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Digital Imaging and Communications in Medicine (DICOM)

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Supplement 171: Unified Procedure Step by REpresentational State Transfer (REST) Services (UPS-RS)

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Scope and Field of Application

This Supplement defines a set of REpresentational State Transfer (REST) Services for interfacing with the Unified Procedure Step Services. This could be implemented as a proxy to an existing UPS service or as a web service interacting directly with a worklist manager.

Security is beyond the scope of the RESTful services defined in this supplement. However generic Web security mechanisms are fully compatible. Several security programming recipes are provided for reference.

Changes to NEMA Standards Publication PS 3.4

Digital Imaging and Communications in Medicine (DICOM)

4: Service Class Specifications

Update section CC.1 Overview as follows

CC.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.

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.

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.

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.

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 that manages an internal worklist.

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.

Each of these services has an equivalent HTTP operation defined by the UPS-RS Worklist Service (see PS 3.18 Annex 6.X).

While a Unified Worklist and Procedure Step Service Class SCP is not required to support UPS-RS, an SCP may choose to support one or more of the UPS-RS services as an Origin-Server. In this scenario, an SCP / Origin Server shall follow the same internal behavior for all Workitems irrespective of whether they originated with a DIMSE request or an HTTP request. A DIMSE request and its equivalent HTTP request with the same parameters shall yield the same response.

For example:

- A Workitem instance created via DIMSE N-CREATE can be retrieved via HTTP requests and vice-versa**
- A Workitem instance created via DIMSE N-CREATE can be updated, have its state changed or be cancelled via HTTP requests and vice-versa**
- A C-FIND request and an HTTP SearchForUPS request with the same parameters shall return the same set of results**
- An N-EVERT-REPORT SCU that also supports HTTP subscriptions will record whether a given subscriber uses DIMSE or WebSockets and send the appropriate form of notification to that subscriber**
- A change made to a Workitem instance will result in the same event notifications regardless of whether the change was requested via DIMSE or HTTP**
- A Global Subscription request or a Filtered Global Subscription request will subscribe an SCU (or User-Agent) to instances created both via DIMSE and via HTTP requests**
- A DIMSE event subscriber will receive notifications for relevant changes made via HTTP requests**
- An HTTP event subscriber will receive notifications for relevant changes made via DIMSE requests**

The mapping between UPS DIMSE operations and UPS-RS services is defined in PS 3.18 Annex 6.X.

Update Table CC.2.3-1. Subscribe/Unsubscribe to Receive UPS Event Reports - Action Information as follows

**Table CC.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	3	Receiving AE	(0074,1234)	1/1

Receive UPS Event Reports		Deletion Lock	(0074,1230)	1/1
		Match Keys (see CC.2.3.1)		3/3
Unsubscribe from Receiving UPS Event Reports	4	Receiving AE	(0074,1234)	1/1
Suspend Global Subscription	5	Receiving AE	(0074,1234)	1/1

Update CC.2.1.3 Service Class Provider Behavior (N-ACTION State Change) as follows

CC.2.1.3 Service Class Provider Behavior

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, the N-ACTION Status Code applicable to the associated request as shown in Table CC.2.1-2.

The SCP shall only perform legal state changes as described in Table CC.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 CANCELED if the Final State requirements described in Table CC.2.5-3 have not been met.

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Update CC.2.3.2 Service Class User Behavior (N-ACTION Subscribe) as follows

CC.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 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 CC.3.1 for further details.

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 CC.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 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 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 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 subscribe for events relating to a filtered subset of all current and subsequently created UPS instances (Filtered Global Subscription) managed by the SCP, the SCU shall use Action Type ID 3 (Subscribe to Receive UPS Event Reports) and provide both the well-known UID 1.2.840.10008.5.1.4.xx.x and a set of Matching Keys and values in the N-ACTION primitive request (see CC.2.3.3.1). The SCU shall indicate a need 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: The well-known UID for a Filtered Global Subscription is distinct from the Global Subscription well-known UID

To unsubscribe for events relating to *all current UPS instances* managed by the SCP and also stop being 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.

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 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 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.

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.

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 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.

CC.2.3.3 Service Class Provider Behavior

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 CC.2.3-2 and then return, via the N-ACTION response primitive, the appropriate N-ACTION Response Status Code.

The SCP may optionally allow an Application Entity to subscribe globally to a filtered set of UPS Instances. In this case, the Application Entity will only be subscribed to existing and future UPS Instances that match the search criteria specified by the Matching Keys of the N-ACTION request (see CC.2.3.3.1). If the SCP does not support Filtered Global Subscription it will return a Failure response with a Code of C307 (see Table CC.2.3-3).

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 CC.2.4.3) to AEs that have a UPS Subscription State of “Subscribed with Lock” or “Subscribed w/o Lock”. **If the SCP also supports the HTTP CreateSubscription service as an Origin-Server, the SCP shall also send HTTP SendEventReport messages (see PS 3.18 Section 6.X.11).**

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

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.

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.

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 CC.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.

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.

CC.2.3.3.1 Filtered Global Subscription

An SCP that supports Filtered Global Subscription shall create an instance subscription for each UPS Instance that would match a C-FIND request with the Matching Keys provided in the subscription request.

The SCP shall support the same matching logic used for C-FIND (see C.C.2.8.3).

Update Table CC.2.5-3. UPS SOP Class N-CREATE/N-SET/N-GET/C-FIND Attributes as follows

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
...								

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 Relationship Module								
...								
Referenced Request Sequence	(0040,A370)	2/2	Not allowed	O	3/2	Re	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	
...								

Update CC.2.4.3 Service Class Provider Behavior (N-EVENT-REPORT) as follows

2 CC.2.4.3 Service Class Provider Behavior

The SCP shall specify in the N-EVENT-REPORT Request Primitive the Event Type ID and the UID of the
4 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
6 UID of the UPS Push SOP Class. See Section CC.3.1 for further details. The SCP shall additionally
include Attributes related to the event as defined in Table CC.2.4-1.

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

12 Each time the SCP completes a Subscribe to Receive UPS Event Reports Action (see Section CC.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
14 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
16 (0074,1000) and Input Readiness State (0040,4041) Attributes.

Each time the SCP creates a new UPS instance, the SCP shall send a UPS State Report Event, indicating
18 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"
20 (see Section CC.2.3)

In the following text "Subscribed SCUs" means all AEs where the UPS Subscription State of the UPS
22 Instance in question is "Subscribed with Lock" or "Subscribed w/o Lock" (see Section CC.2.3). **If the SCP
also supports the HTTP CreateSubscription service as an Origin-Server, "Subscribed SCUs" also
24 includes all CreateSubscription User-Agents where the UPS Subscription State of the UPS
Instance in question is "Subscribed with Lock" or "Subscribed w/o Lock" (see PS 3.18 Section
26 6.X.7).**

...

28 Update CC.2.5.3 Service Class Provider Behavior (N-CREATE) as follows

CC.2.5.3 Service Class Provider Behavior

30 The SCP shall create and maintain UPS instances as instructed by ~~creation~~**N-CREATE** requests and as
specified by Table CC.2.5-3.

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

34 The SCP shall accept ~~creation~~**N-CREATE** requests ~~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
36 SCP shall fail the ~~request~~**N-CREATE**.

...

38 Update CC.2.6.3 Service Class Provider Behavior (N-SET) as follows

CC.2.6.3 Service Class Provider Behavior

- 40 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 Section CC.3.1 for further details.
- 42 The SCP shall support the Attribute changes to the UPS instance specified by the SCU in the ~~setN-SET~~ request **primitive** as specified in Table CC.2.5-3.
- 44 The SCP shall refuse ~~setN-SET~~ requests on an IN PROGRESS UPS and not modify the UPS if the ~~setN-SET~~ request does not include the Transaction UID (0008,1195) Attribute with the same value as currently recorded in the UPS instance.
- 46

The SCP shall refuse ~~setN-SET~~ requests on a COMPLETED or CANCELED UPS.

- 48 The SCP shall use the Specific Character Set (0008,0005) value to appropriately modify its internal representation so that subsequent operations reflect the combination of the character sets in use by the
- 50 Attributes in this ~~requestN-SET~~ and those used by Attributes that have not been modified.

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

52 the associated request as specified in Section CC.2.6.4.

...

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Changes to NEMA Standards Publication PS 3.17

56

Digital Imaging and Communications in Medicine (DICOM)

Part 17: Explanatory Information

58 **Update section GGG.1 as follows**

GGG.1 INTRODUCTION

60 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).

62 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

64 function, please refer to Annex CC “Unified Procedure Step Service and SOP Classes (Normative)”. **For the detailed specification of how the RESTful services function, please refer to PS 3.18 Part 6.X.**

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

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

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

78

Changes to NEMA Standards Publication PS 3.18

Digital Imaging and Communications in Medicine (DICOM)

80

Part 18: Web Services

Insert into Section 3 Normative References (in correct order)

82

IETF RFC6455 The WebSocket Protocol

84

Insert into Section 5.2 Symbols and Abbreviated Terms (in correct alphabetical order)

86

UPS-RS Unified Procedure Step by RESTful Services

88

Update Section 6.7 QIDO-RS – Search as follows

90 **6.7.1 QIDO-RS – Search**

6.7.1.1 Request

92 The specific resources to be used for the search actions shall be as follows:

— Resource

94 — SearchForStudies

— {SERVICE}/studies[?query]

96 — SearchForSeries

— {SERVICE}/studies/{StudyInstanceUID}/series[?query]

98 — {SERVICE}/series[?query]

— SearchForInstances

100 — {SERVICE}/studies/{StudyInstanceUID}/series/{SeriesInstanceUID}/instances[?query]

— {SERVICE}/studies/{StudyInstanceUID}/instances[?query]

102 — {SERVICE}/instances[?query]

where

104 — {SERVICE} is the base URL for the QIDO RESTful service. This may be a combination of
scheme (http or https), authority and path.

106 — {StudyInstanceUID} is the unique Study Instance UID for a single study.

— {SeriesInstanceUID} is the unique Series Instance UID for a single series.

108

— Method

- 110 — GET
- 112 — Headers
 - Accept – The Media Type of the query results. The types allowed for this request header are:
 - 114 — multipart/related; type=application/dicom+xml (default)
Specifies that the results should be DICOM PS3.19 XML (one part per result)
 - 116 — application/json
Specifies that the results should be DICOM JSON
 - 118 A QIDO-RS provider shall support both Accept header values
 - Cache-control: no-cache (recommended)
 - 120 If included, specifies that search results returned should be current and not cached.
 - 122 — Query key=value pairs
 - {attributeID}={value}
 - 124 0-n / {attributeID}={value} pairs allowed
 - includefield={attributeID} | all
 - 126 0-n includefield / {attributeID} pairs allowed, where “all” indicates that all available attributes should be included for each response.
 - 128
 - Each {attributeID} must refer to one of:
 - 130 — Patient IE attributes
 - Study IE attributes
 - 132 — Series IE attributes (SearchForSeries or SearchForInstances requests only)
 - Composite Instance IE attributes (SearchForInstances requests only)
 - 134 — Additional Query / Retrieve Attributes (DICOM PS 3.4 C.3.4)
 - Timezone Offset From UTC (0008,0201)
 - 136 **See Section 6.7.1.1.1 for {attributeID} and {value} encoding rules**
 - 138 **~~Each {attributeID} query value must be unique unless the associated DICOM Attribute allows UID List matching (see DICOM PS3.4 C.2.2.2.2), in which case each {value} will be interpreted to be an element of the UID List.~~**
 - 142 **~~The acceptable values for {value} are determined by the types of matching allowed by C-FIND for its associated {attributeID} (see PS3.4 C.2.2.2). All characters in {value} that are disallowed for URLs must be URL encoded. See IETF RFC 1738 for details.~~**
 - 144
 - 146 **~~If an {attributeID} is passed as the value of an “includefield” query key this is equivalent to C-FIND Universal matching for the specified attribute (see DICOM PS3.4 C.2.2.2.3).~~**
 - 148
 - fuzzymatching=true | false
 - 150 — limit={maximumResults}
 - offset={skippedResults}
 - 152

6.7.1.1.1 {attributelD} encoding rules

154 **Each {attributelD} query key shall be unique unless the associated DICOM Attribute allows UID List**
156 **matching (see DICOM PS3.4 C.2.2.2.2), in which case each {value} will be interpreted to be an**
element of the UID List.

158 **The acceptable values for {value} are determined by the types of matching allowed by C-FIND for**
its associated {attributelD} (see PS3.4 C.2.2.2). All characters in {value} that are disallowed for URIs
shall be percent-encoded. See IETF RFC 3986 for details.

160 **If an {attributelD} is passed as the value of an “includefield” query key this is equivalent to C-FIND**
Universal matching for the specified attribute (see DICOM PS3.4 C.2.2.2.3).

162 {attributelD} can be one of the following:

- {dicomTag}
- 164 — {dicomKeyword}
- {dicomTag}.{attributelD}, where {attributelD} is an element of the sequence specified by {dicomTag}
- 166 — {dicomKeyword}.{attributelD}, where {attributelD} is an element of the sequence specified
by {dicomKeyword}

168

{dicomTag} is the eight character hexadecimal string corresponding to the Tag of a DICOM Attribute (see
170 PS3.6 Section 6).

{dicomKeyword} is the Keyword of a DICOM Attribute (see PS3.6 Section 6).

172 Note: Examples of valid values for {attributelD}:

- 0020000D
- 174 — StudyInstanceUID
- 00101002.00100020
- 176 — OtherPatientIDsSequence.PatientID
- 00101002.00100024.00400032
- 178 — OtherPatientIDsSequence.IssuerOfPatientIDQualifiersSequence.UniversalEntityID

180 Note: Examples of valid QIDO-RS URLs:

- http://dicomrs/studies?PatientID=11235813
- 182 — http://dicomrs/studies?PatientID=11235813&StudyDate=20130509
- http://dicomrs/studies?00100010=SMITH*&00101002.00100020=11235813&limit=25
- 184 — http://dicomrs/studies?00100010=SMITH*&OtherPatientIDsSequence.00100020=11235813
- http://dicomrs/studies?PatientID=11235813&includefield=00081048&includefield=00081049
- 186 &includefield=00081060
- http://dicomrs/studies?PatientID=11235813&StudyDate=20130509-20130510
- 188 — http://dicomrs/studies?StudyInstanceUID=1.2.392.200036.9116.2.2.2.2162893313.
- 1029997326.94587%2c1.2.392.200036.9116.2.2.2.2162893313.1029997326.94583

190

Add Section 6.X UPS-RS WORKLIST SERVICE
--

192 **6.X UPS-RS WORKLIST SERVICE**

194 This DICOM Web Service defines a RESTful interface to the UPS SOP Classes (See PS 3.3 & PS 3.4). It consists of the following action types:

- 196 1. CreateUPS
This action requests the creation of a UPS Instance on the Origin-Server. It corresponds to the UPS DIMSE N-CREATE operation.
- 198 2. UpdateUPS
200 This action sets the attributes of a UPS Instance managed by the Origin-Server. It corresponds to the UPS DIMSE N-SET operation.
- 202 3. SearchForUPS
This action searches for UPS Instances known to the Origin-Server. It corresponds to the UPS DIMSE C-FIND operation.
- 204 4. RetrieveUPS
This action retrieves a UPS Instances. It corresponds to the UPS DIMSE N-GET operation.
- 206 5. ChangeUPState
208 This action sets the state of a UPS Instance managed by the Origin-Server. It corresponds to the UPS DIMSE N-ACTION operation "Change UPS State".
- 210 6. RequestUPSCancellation
This action requests the cancellation of a UPS Instance managed by the Origin-Server. It corresponds to the UPS DIMSE N-ACTION operation "Request UPS Cancel".
- 212 7. CreateSubscription
214 This action subscribes to a UPS Instance or the Global Worklist managed by the Origin-Server. It corresponds to the UPS DIMSE N-ACTION operation "Subscribe to Receive UPS Event Reports".
- 216 8. SuspendGlobalSubscription
This action suspends an existing subscription to the Global Worklist managed by the Origin-Server. It corresponds to the UPS DIMSE N-ACTION operation "Suspend Global Subscription".
- 218 9. DeleteSubscription
220 This action cancels an existing subscription to a UPS Instance or the Global Worklist managed by the Origin-Server. It corresponds to the UPS DIMSE N-ACTION operation "Unsubscribe from Receiving UPS Event Reports".
- 222 10. OpenEventChannel
224 This action initiates a WebSocket connection to allow the User-Agent to start receiving Event Report messages.
- 226 11. SendEventReport
228 This action sends an Event Report using an open WebSocket connection. It corresponds to the UPS DIMSE N-EVENT-REPORT operation.

An Origin-Server shall support all of the above action types.

230 The requirements for a UPS-RS Origin-Server that is also a Unified Worklist and Procedure Step SCP are described in PS 3.4 Section CC.1.

232 **Table 6.X-1
 UPS Interface Mapping**

Action Type	Section	Method & Resource
-------------	---------	-------------------

Action Type	Section	Method & Resource
CreateUPS	6.X.1	POST {SERVICE}/workitems
UpdateUPS	6.X.2	POST {SERVICE}/workitems/{UPSInstanceUID}{?transaction }
SearchForUPS	6.X.3	GET {SERVICE}/workitems{?query*}
RetrieveUPS	6.X.4	GET {SERVICE}/workitems/{UPSInstanceUID}
ChangeUPSState	6.X.5	PUT {SERVICE}/workitems/{UPSInstanceUID}/state
RequestUPSCancellation	6.X.6	POST {SERVICE}/workitems/{UPSInstanceUID}/cancelrequest
CreateSubscription	6.X.7	POST {SERVICE}/workitems/{UPSInstanceUID}/subscribers/{AETitle}{?deletionlock} POST {SERVICE}/workitems/1.2.840.10008.5.1.4.34.5/subscribers/{AETitle}{?deletionlock} POST {SERVICE}/workitems/1.2.840.10008.5.1.4.XX.X/subscribers/{AETitle}{?deletionlock,query*}
SuspendGlobalSubscription	6.X.8	POST {SERVICE}/workitems/1.2.840.10008.5.1.4.34.5/subscribers/{AETitle}/suspend POST {SERVICE}/workitems/1.2.840.10008.5.1.4.XX.X/subscribers/{AETitle}/suspend
DeleteSubscription	6.X.9	DELETE {SERVICE}/workitems/{UPSInstanceUID}/subscribers/{AETitle}
OpenEventChannel	6.X.10	GET {WSSERVICE}/subscribers/{AETitle}
SendEventReport	6.X.11	N/A

234

236 The Origin-Server shall comply with all requirements placed on the SCP for the corresponding services in PS 3.4 Annex CC (Unified Procedure Step Service and SOP Classes).

238 **6.X.1 CreateUPS**

This resource allows a User-Agent to instruct an Origin-Server to create a UPS instance.

240 **6.X.1.1 Request**

The request message shall be formed as follows:

242 — Resource

— {SERVICE}/workitems

244 where

— {SERVICE} is the base URL for the service. This may be a combination of protocol (either HTTP or HTTPS), authority and path.

248 — Method

- POST
- 250
- Headers
- 252 — Content-Type – The representation scheme being posted to the RESTful service. The types allowed for this request header are as follows:
- 254 — application/dicom+xml
 Specifies that the post is PS 3.19 XML metadata. See 6.X.1.1.1
- 256 — application/json
 Specifies that the post is PS 3.18 JSON metadata. See 6.X.1.1.1
- 258
- The request body shall convey a single Unified Procedure Step Instance. The instance shall comply with all requirements in the Req. Type N-CREATE column of PS 3.4 Table CC.2.5-3.
- 260

262 **6.X.1.1.1 Metadata Request Message**

The Metadata Request Message has a single part body.

- 264 — Content-Type:
 - application/dicom+xml
 - 266 — application/json
- 268 — The request body contains all the metadata to be stored in either DICOM PS 3.19 XML metadata or DICOM PS 3.18 JSON metadata. Any binary data contained in the message shall be inline.
- 270

6.X.1.2 Behavior

- 272 The Origin-Server shall create and maintain UPS instances as instructed by CreateUPS requests and as specified by the SCP behavior in PS 3.4 Section CC.2.5.3.
- 274 The Origin-Server shall return the HTTP/1.1 Status Line applicable to the associated request.

6.X.1.3 Response

- 276 The Origin-Server shall return an HTTP/1.1 response message.

6.X.1.3.1 Response Status Line

- 278 If the Create request is successful, the Origin-Server shall return an HTTP/1.1 “201 - Created” response code.
- 280 If the request fails, the Origin-Server shall return an appropriate failure status line with a response code from Table 6.X.1-1.

282

**Table 6.X.1-1
 STATUS CODES**

HTTP/1.1 Code	Reason Phrase	Description
201	Created	The UPS instance was created and the new resource can be retrieved at the Content-Location specified in the response
400	Bad Request	The UPS-RS Origin-Server was unable to understand the

		request
401	Unauthorized	The UPS-RS Origin-Server refused to accept the request because the client is not authenticated.
403	Forbidden	The UPS-RS Origin-Server understood the request, but is refusing to perform the query (e.g. an authenticated user with insufficient privileges).
409	Conflict	The UID of the posted UPS Instance corresponds to an existing UPS Instance.
503	Busy	Service is unavailable.

284

6.X.1.3.2 Response Headers

286 If the request is successful, the HTTP/1.1 response message shall include the following HTTP/1.1 header:

— Content-Location: {WorkitemURL}

288 Where {WorkitemURL} is the URL from which the created UPS Instance can be retrieved (see 6.X.4)

290 If the UPS instance was created with modifications, the response message shall include the following HTTP/1.1 header:

292 — Warning: 299 {SERVICE}: The UPS was created with modifications.

294 6.X.1.3.3 Response Message Body

The response message body shall be empty.

296

6.X.2 UpdateUPS

298 This resource supports the modification of attribute values of an existing UPS Instance.

6.X.2.1 Request

300 The request message shall be formed as follows:

— Resource

302 — {SERVICE}/workitems/{UPSInstanceUID}{?transaction}

where

304 — {SERVICE} is the base URL for the service. This may be a combination of protocol (either HTTP or HTTPS), authority and path.

306 — {UPSInstanceUID} is the UID of the Unified Procedure Step Instance

308 — {transaction} specifies the Transaction UID / Locking UID for the specified Unified Procedure Step Instance

If the UPS instance is currently in the SCHEDULED state, {transaction} shall not be specified.

- 310 If the UPS instance is currently in the IN PROGRESS state, {transaction} shall be specified.
- 312 — Method
- 314 — POST
- 314 — Headers
- 316 — Content-Type – The representation scheme being posted to the RESTful service. The types allowed for this request header are as follows:
- 318 — application/dicom+xml
Specifies that the post is PS 3.19 XML metadata. See 6.X.2.1.1
- 320 — application/json
Specifies that the post is PS 3.18 JSON metadata. See 6.X.2.1.1
- 322
- 324 — The request body describes changes to a single Unified Procedure Step Instance. It shall include all Attributes for which Attribute Values are to be set. The changes shall comply with all requirements described in PS 3.4 Section CC.2.6.2.
- 326
- 328 — Because the request will be treated as atomic (indivisible) and idempotent (repeat executions have no additional effect), all changes contained in the request shall leave the UPS instance in an internally consistent state.

330 **6.X.2.1.1 Metadata Request Message**

- 332 The Metadata Request Message has a single part body.
- Content-Type:
- 334 — application/dicom+xml
- 336 — application/json
- 338 — The request body contains all the metadata to be updated in either DICOM PS 3.19 XML metadata, DICOM PS 3.18 JSON metadata. Any binary data contained in the message shall be inline.

340 **6.X.2.2 Behavior**

342 The Origin-Server shall support the Attribute changes to the UPS instance specified by the User-Agent in the UpdateUPS request and as specified by the SCP behavior in PS 3.4 Section CC.2.6.3.

The Origin-Server shall return the HTTP/1.1 Status applicable to the associated request.

344 **6.X.2.3 Response**

The Origin-Server shall return an HTTP/1.1 response message.

346 **6.X.2.3.1 Response Status Line**

- 348 If the Set request is successful, the Origin-Server shall return an HTTP/1.1 “200 - OK” response code.
- 348 If the request fails, the Origin-Server shall return an appropriate failure status line with a response code from Table 6.X.2-1.

350 **Table 6.X.2-1**

STATUS CODES

HTTP/1.1 Code	Reason Phrase	Description
200	OK	The UPS instance was updated
400	Bad Request	The UPS-RS Origin-Server was unable to understand the request
401	Unauthorized	The UPS-RS Origin-Server refused to accept the request because the client is not authenticated.
403	Forbidden	The UPS-RS Origin-Server understood the request, but is refusing to perform the query (e.g. an authenticated user with insufficient privileges).
404	Not found	The specified UPS Instance does not exist or is not managed by this Origin-Server.
409	Conflict	The request cannot be performed for one of the following reasons: <ul style="list-style-type: none">— the submitted request is inconsistent with the current state of the UPS Instance— the Transaction UID is missing— the Transaction UID is incorrect
503	Busy	Service is unavailable.

352

6.X.2.3.2 Response Headers

354 If the UPS instance was updated but with modifications made by the Origin-Server, the response message shall include the following HTTP/1.1 header:

356 — Warning: 299 {SERVICE}: The UPS was created with modifications.

358 If optional attributes were rejected, the response message shall include the following HTTP/1.1 header:

— Warning: 299 {SERVICE}: Requested optional Attributes are not supported.

360

362 If the request was rejected with an HTTP/1.1 409 status code, the response message shall include one of following HTTP/1.1 headers describing the nature of the conflict:

— Warning: 299 {SERVICE}: the Transaction UID is missing.

364 — Warning: 299 {SERVICE}: the Transaction UID is incorrect.

366 — Warning: 299 {SERVICE}: the submitted request is inconsistent with the current state of the UPS Instance.

368 6.X.2.3.3 Response Message Body

The response message body shall be empty.

370

6.X.3 SearchForUPS

372 This resource returns a list of UPS Instances that match specified search query parameters along with requested attributes for each Instance.

374 6.X.3.1 Request

The request message shall be formed as follows:

376 — Resource

— {SERVICE}/workitems/{?query*}

378 where

380 — {SERVICE} is the base URL for the service. This may be a combination of protocol (either HTTP or HTTPS), authority and path.

382 — Method

— GET

384

— Headers

386 — Accept – The representation scheme in which the RESTful service is requested to return the results. The types allowed for this request header are as follows:

388 — multipart/related; type=application/dicom+xml; boundary={messageBoundary}

Specifies that the results should be PS 3.19 XML metadata.

390 — application/json

392 Specifies that the results should be PS 3.18 JSON metadata.— Cache-control: no-cache (recommended)

If included, specifies that search results returned should be current and not cached.

394

— {query}

396 — {attributeID}={value}

0-n / {attributeID}={value} pairs allowed

398 — includefield={attributeID} | all

400 0-n includefield / {attributeID} pairs allowed, where “all” indicates that all attributes with values should be included for each response.

402 Each {attributeID} shall refer to an attribute of the Unified Procedure Step IOD (see PS 3.3 B.26.2).

404 See Section 6.7.1.1.1 for {attributeID} and {value} encoding rules

406 — fuzzymatching=true | false

— limit={maximumResults}

408 — offset={skippedResults}

410 **6.X.3.2 Behavior**

The Origin-Server shall perform a search according the requirements for the QIDO-RS services (see 412 6.7.1.2).

6.X.3.2.1 Matching

414 An Origin-Server shall support matching against all Unified Procedure Step Instance Attributes in PS 3.4 Table CC.2.5-3 with a Match Key Type value of U, R or *.

416 See 6.7.1.2.1 for matching behavior.

6.X.3.3 Response

418 The Origin-Server shall return an HTTP/1.1 response message.

6.X.3.3.1 Response Status Line

420 If the SearchForUPS request is successful, the Origin-Server shall return an HTTP/1.1 “200 – OK” response code.

422 If the request fails, the Origin-Server shall return an appropriate failure status line with a response code from Table 6.X.3-3.

424

**Table 6.X.3-1
STATUS CODES**

HTTP/1.1 Code	Reason Phrase	Description
200	OK	The query completed and any matching results are returned in the message body.
206	Partial Content	Only some of the query results were returned and the rest can be requested through the appropriate UPS-RS request.
400	Bad Request	The UPS-RS Origin-Server was unable to perform the query because the Service Provider cannot understand the query component.
401	Unauthorized	The UPS-RS Origin-Server refused to perform the query because the client is not authenticated.
403	Forbidden	The UPS-RS Origin-Server understood the request, but is refusing to perform the query (e.g. an authenticated user with insufficient privileges).
413	Request entity too large	The query was too broad and a narrower query or paging should

		be requested.
503	Busy	Service is unavailable.

426

6.X.3.3.2 Query Result Attribute

428 For each matching UPS Instance, the Origin-Server shall return:

- 430 — All Unified Procedure Step Instance Attributes in PS 3.4 Table CC.2.5-3 with a Return Key value of 1 and 2.
- 432 — All Unified Procedure Step Instance Attributes in PS 3.4 Table CC.2.5-3 with a Return Key value of 1C for which the conditional requirements are met.
- 434 — All other Unified Procedure Step Instance Attributes passed as {attributeID} query keys that are supported by the Origin-Server as matching or return attributes
- 436 — All other Unified Procedure Step Instance Attributes passed as “includefield” query values that are supported by the Origin-Server as return attributes.

438 6.X.3.3.3 Response Message

The response message body contains the results.

440 The format of the response message body shall contain one of the Media Types specified by the request Accept header field. An Origin-Server shall support all Media-Types allowed in the request.

442 6.X.3.3.3.1 XML Response Message

- Content-Type:
 - 444 — multipart/related; type=application/dicom+xml
- The response is a multipart message body where each part is a DICOM PS 3.19 XML DicomNativeModel element containing the attributes for one matching UPS Instance (see DICOM PS 3.19 Annex A.1).
- 448 — If there are no matching results, the message body shall be empty.
- Each part in the multipart body includes the following HTTP/1.1 headers:
 - 450 — Content-Type: application/dicom+xml

452 6.X.3.3.3.2 JSON Response Message

- Content-Type:
 - 454 — application/json
- The response is a DICOM JSON message containing a DICOM JSON property for each matching UPS Instance containing sub-properties describing the matching attributes for each UPS Instance (see F.2).
- 458 — If there are no matching results, the JSON message shall be empty.

460

6.X.4 RetrieveUPS

462 This resource supports the retrieval of a UPS Instance.

6.X.4.1 Request

464 The request message shall be formed as follows:

- Resource

- 466 — {SERVICE}/workitems/{UPSInstanceUID}
 where
 468 — {SERVICE} is the base URL for the service. This may be a combination of protocol (either
 HTTP or HTTPS), authority and path.
 470 — {UPSInstanceUID} is the UID of the Unified Procedure Step Instance
- 472 — Method
 — GET
- 474 — Headers
- 476 — Accept – The representation scheme in which the RESTful service is requested to return the
 result. The types allowed for this request header are as follows:
 478 — application/dicom+xml
 Specifies that the result should be PS 3.19 XML metadata.
 480 — application/json
 Specifies that the result should be PS 3.18 JSON metadata.
 482 — Cache-control: no-cache (recommended)
 If included, specifies that results returned should be current and not cached.

484 **6.X.4.2 Behavior**

486 The Origin-Server shall return, via the HTTP/1.1 response, the indicated Unified Procedure Step Instance to the User-Agent.

488 Note: The requirement for the Origin-Server to respond to GET requests for UPS Instances that have moved to
 the COMPLETED or CANCELED state is limited. See PS 3.4 Section CC.2.1.3 Service Class Provider
 490 Behavior.

492 The User-Agent shall not return the Transaction UID (0008,1195) Attribute. This is necessary to preserve this Attribute's role as an access lock.

494 The User-Agent shall return the HTTP/1.1 Response Status Code applicable to the associated request. A Failure Code shall indicate that the Origin-Server has not returned the SOP Instance.

496 **6.X.4.3 Response**

The Origin-Server shall return an HTTP/1.1 response message.

498 **6.X.4.3.1 Response Status Line**

500 If the Retrieve request is successful, the Origin-Server shall return an HTTP/1.1 “200 – OK” response code.

502 If the request fails, the Origin-Server shall return an appropriate failure status line with a response code from Table 6.X.4-1.

504 **Table 6.X.4-1
STATUS CODES**

HTTP/1.1 Code	Reason Phrase	Description
200	OK	The requested instance is returned.

400	Bad Request	The UPS-RS Origin-Server was unable to perform the query because the Service Provider cannot understand the query component.
401	Unauthorized	The UPS-RS Origin-Server refused to perform the query because the client is not authenticated.
403	Forbidden	The UPS-RS Origin-Server understood the request, but is refusing to perform the query (e.g. an authenticated user with insufficient privileges).
404	Not found	The specified UPS Instance does not exist or is not managed by this Origin-Server.
503	Busy	Service is unavailable.

506 **6.X.4.3.2 Response Message**

The response message body contains the results.

508 The format of the response message body shall contain one of the Media Types specified by the request Accept header field. An Origin-Server shall support all Media-Types allowed in the request.

510 **6.X.4.3.2.1 XML Response Message**

— Content-Type:

512 — application/dicom+xml

— The response contains a DICOM PS 3.19 XML DicomNativeModel element containing the attributes for the requested UPS Instance (see DICOM PS 3.19 Annex A.1).

516 **6.X.4.3.2.2 JSON Response Message**

— Content-Type:

518 — application/json

— The response is a DICOM JSON array containing a DICOM JSON representation of the requested UPS Instance (see F.2).

522 **6.X.5 ChangeUPSState**

This resource supports the modification of the state of an existing UPS Instance.

524 **6.X.5.1 Request**

The request message shall be formed as follows:

526 — Resource

— {SERVICE}/workitems/{UPSInstanceUID}/state

- 528 where:
- 530 — {SERVICE} is the base URL for the service. This may be a combination of protocol (either HTTP or HTTPS), authority and path.
 - {UPSInstanceUID} is the UID of the Unified Procedure Step Instance

532

— Method

534 — PUT

536 — Headers

— Content-Type – The representation scheme being posted to the RESTful service. The types allowed for this request header are as follows:

538

— application/dicom+xml

540

Specifies that the post is PS 3.19 XML metadata. See 6.X.5.1.1

— application/json

542

Specifies that the post is PS 3.18 JSON metadata. See 6.X.5.1.1

544 — The request body describes a state change to a single Unified Procedure Step Instance. It shall include all Attributes required for an SCU in PS 3.4 Table CC.2.1-1.

546

6.X.5.1.1 Metadata and Bulk Data Request Message

548 The Metadata and Bulk Data Request Message has a single part body.

— Content-Type:

550

— application/dicom+xml

— application/json

552

— The request body contains DICOM PS 3.19 XML metadata or DICOM PS 3.18 JSON metadata. Any binary data contained in the message shall be inline.

554

6.X.5.2 Behavior

556 The Origin-Server shall support the state changes to the UPS instance specified in the request as described by the SCP behavior in PS 3.4 Section CC.2.1.3.

560 After completing the ChangeUPSSState request, the Origin-Server shall return the HTTP/1.1 Response Line applicable to the associated request.

6.X.5.3 Response

562 The Origin-Server shall return an HTTP/1.1 response message.

6.X.5.3.1 Response Status Line

564 If the State Change was successful, the Service shall return an HTTP/1.1 “200 - OK” response code.

566 If the State Change fails, the Service shall return an appropriate failure status line with a response code from Table 6.X.5-1.

568

Table 6.X.5-1 STATUS CODES

HTTP/1.1 Code	Reason Phrase	Description
200	OK	The UPS instance was updated
400	Bad Request	The UPS-RS Origin-Server was unable to understand the request
401	Unauthorized	The UPS-RS Origin-Server refused to accept the request because the client is not authenticated.
403	Forbidden	The UPS-RS Origin-Server understood the request, but is refusing to perform the query (e.g. an authenticated user with insufficient privileges).
404	Not found	The specified UPS Instance does not exist or is not managed by this Origin-Server.
409	Conflict	The request cannot be performed for one of the following reasons: — the submitted request is inconsistent with the current state of the UPS Instance — the Transaction UID is missing — the Transaction UID is incorrect
503	Busy	Service is unavailable.

570 **6.X.5.3.2 Response Headers**

572 If the User-Agent passes a “state=CANCELED” parameter and the UPS Instance is already in that state, the response message shall include the following HTTP/1.1 Warning header field:

- 574 — Warning: 299 {SERVICE}: The UPS is already in the requested state of CANCELED.

576 If the User-Agent passes a “state=COMPLETED” parameter and the UPS Instance is already in that state, the response message shall include the following HTTP/1.1 Warning header field:

- 578 — Warning: 299 {SERVICE}: The UPS is already in the requested state of COMPLETED.

580 If the request was rejected with an HTTP/1.1 409 status code, the response message shall include one of the following messages in the HTTP/1.1 Warning header field describing the nature of the conflict:

- 582 — Warning: 299 {SERVICE}: the Transaction UID is missing.
- Warning: 299 {SERVICE}: the Transaction UID is incorrect.

584 — Warning: 299 {SERVICE}: the submitted request is inconsistent with the current state of the UPS Instance.

586 **6.X.5.3.3 Response Message Body**

The response message body shall be empty.
588

6.X.6 RequestUPSCancellation

590 This resource records a request that the specified UPS Instance be canceled.

6.X.6.1 Request

592 — Resource

— {SERVICE}/workitems/{UPSInstanceUID}/cancelrequest

594 where:

596 — {SERVICE} is the base URL for the service. This may be a combination of protocol (either HTTP or HTTPS), authority and path.

— {UPSInstanceUID} is the UID of the Unified Procedure Step Instance

598

— Method

600 — POST

602 — Headers

— Content-Type – The representation scheme being posted to the RESTful service. The types allowed for this request header are as follows:

— application/dicom+xml

606 Specifies that the post is PS 3.19 XML metadata. See 6.X.6.1.1

— application/json

608 Specifies that the post is PS 3.18 JSON metadata. See 6.X.6.1.1

610 — The request body describes a request to cancel a single Unified Procedure Step Instance. The request body shall comply with all attribute requirements described in PS 3.4 Table CC.2.2-1.

612

6.X.6.1.1 Metadata and Bulk Data Request Message

614 The Metadata and Bulk Data Request Message has a single part body.

— Content-Type:

616 — application/dicom+xml

— application/json

618

620 — The request body contains DICOM PS 3.19 XML metadata or DICOM PS 3.18 JSON metadata. Any binary data contained in the message shall be inline.

622 **6.X.6.2 Behavior**

624 RequestUPSCancellation is used to request to the Origin-Server that the state of a UPS Instance be changed to CANCELED as shown in PS 3.4 Figure CC.1.1-1. The Origin-Server shall process the request as described by the SCP behavior in PS 3.4 Section CC.2.2.3.

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

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

630 Note: An HTTP/1.1 Status Code indicating success means that the Request was accepted, not that the UPS
632 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 Section PS 3.4 CC.2.4.

634 To cancel an IN PROGRESS UPS that the User-Agent is itself performing, the User-Agent shall instead use the ChangeUPSState action as described in Section 6.X.5.

636 **6.X.6.3 Response**

The Origin-Server shall return an HTTP/1.1 response message.

638 **6.X.6.2.1 Response Status Line**

If the cancel request was accepted, the Service shall return an HTTP/1.1 “202 - Accepted” response code.

640 If the cancel request was rejected, the Service shall return an appropriate failure status line with a response code from Table 6.X.6-1.

642

**Table 6.X.6-1
STATUS CODES**

HTTP/1.1 Code	Reason Phrase	Description
202	Accepted	The cancel request was accepted
400	Bad Request	The UPS-RS Origin-Server was unable to understand the request
401	Unauthorized	The UPS-RS Origin-Server refused to accept the request because the client is not authenticated.
403	Forbidden	The UPS-RS Origin-Server understood the request, but is refusing to perform the query (e.g. an authenticated user with insufficient privileges).
404	Not found	The specified UPS Instance does not exist or is not managed by this Origin-Server.
409	Conflict	The cancellation request is inconsistent with the current state of the UPS Instance

503	Busy	Service is unavailable.
-----	------	-------------------------

644

6.X.2.5.2 Response Headers

646 If the UPS Instance is already in a canceled state, the response message shall include the following HTTP/1.1 Warning header field:

648 — Warning: 299 {SERVICE}: The UPS is already in the requested state of CANCELED.

6.X.5.2.3 Response Message Body

The response message body shall be empty.

652

6.X.7 CreateSubscription

654 This resource records subscribers to whom future events associated with the specified UPS Instances will be reported.

6.X.7.1 Request

The request message shall be formed as follows:

658 — Resource

— {SERVICE}/workitems/{UPSInstanceUID}/subscribers/{AETitle}{?deletionlock}

660 — {SERVICE}/workitems/1.2.840.10008.5.1.4.34.5/subscribers/{AETitle}{?deletionlock}

— {SERVICE}/workitems/1.2.840.10008.5.1.4.XX.X/subscribers/{AETitle}{?deletionlock,query*}

662 where

— {SERVICE} is the base URL for the service. This may be a combination of protocol (either HTTP or HTTPS), authority and path.

664 — {UPSInstanceUID} is the UID of the Unified Procedure Step Instance or a well-known UID

666 — {AETitle} is an Application Entity Title that conforms to the “AE” Value Representation (see PS 3.5 Table 6.2-1) and identifies the Application Entity to be subscribed

668 — {deletionlock}, if present, shall have a value of either “true” or “false”, indicating whether or not the User-Agent is requesting a Deletion Lock

670 — {query} specifies the query key/value pairs describing the filter parameters

672 — Method

— POST

674

— Headers

676 — Content-Length: 0

678 — {query}

— deletionlock=true | false

680 — {attributeID}={value}

0-n / {attributeID}={value} pairs allowed

682

684 Each {attributeID} shall refer to an attribute of the Unified Procedure Step IOD (see PS 3.3
 B.26.2).

See Section 6.7.1.1.1 for {attributeID} and {value} encoding rules

686

— The request body shall be empty.

688

6.X.7.2 Behavior

690 The Origin-Server shall support the management of UPS instance subscriptions as specified by the SCP
 behavior in PS 3.4 Section CC.2.3.3.

692 Upon receipt of the CreateSubscription, SuspendGlobalSubscription or DeleteSubscription request, the
 Origin-Server shall attempt to update the Global Subscription State, Filtered Global Subscription and/or
 694 UPS Subscription State of the specified Application Entity with respect to the specified SOP Instance UID
 as described in PS 3.4 Table CC.2.3-2 and then return the appropriate HTTP/1.1 response.

696 **6.X.7.3 Response**

6.X.7.3.1 Response Status Line

698 The Service shall return an HTTP/1.1 status line, including a status code and associated reason phrase.

If the CreateSubscription request was successful, the Service shall return an “HTTP/1.1 201 - Created”
 700 response code. The response shall contain a “Content-Location” header of the following format:

— Content-Location: {WSSERVICE}

702 where:

— {WSSERVICE} is the base URL for the WebSocket service. This shall include the WebSocket
 704 protocol (either WS or WSS) and may include a combination of authority and path.

706 If the subscription fails, the Service shall return an appropriate failure status line with a response code from
 Table 6.X.7-2.

708

**Table 6.X.7-2
 STATUS CODES**

HTTP/1.1 Code	Reason Phrase	Description
201	Created	The subscription was created.
400	Bad Request	The UPS-RS Origin-Server was unable to understand the request
401	Unauthorized	The UPS-RS Origin-Server refused to accept the request because the client is not authenticated.
403	Forbidden	The UPS-RS Origin-Server understood the request, but is refusing to perform the query (e.g. the Origin-Server does not support global subscription filtering or an authenticated user has insufficient privileges).

404	Not found	The specified UPS Instance or well-known UID does not exist or is not managed by this Origin-Server.
409	Conflict	Specified action not appropriate for specified instance.
503	Busy	Service is unavailable.

710

6.X.7.3.2 Response Headers

712 If the CreateSubscription request was accepted but the deletion lock was not, the response message shall include the following HTTP/1.1 Warning header field:

714 — Warning: 299 {SERVICE}: Deletion Lock not granted.

716 If the request was rejected with an HTTP/1.1 403 status code because Filtered Global Subscription is not supported, the response message shall include the following HTTP/1.1 Warning header field:

718 — Warning: 299 {SERVICE}: The Origin-Server does not support Global Subscription Filtering

720 6.X.7.3.3 Response Message Body

The response message body shall be empty.

722

6.X.8 SuspendGlobalSubscription

724 This resource suspends an existing Global Subscription or Filtered Global Subscription. The Origin-Server will no longer automatically subscribe the User-Agent to newly-created UPS Instances. This does not delete any existing subscriptions to specific UPS Instances.

6.X.8.1 Request

728 The request message shall be formed as follows:

— Resource

730 — {SERVICE}/workitems/1.2.840.10008.5.1.4.34.5/subscribers/{AETitle}/suspend
— {SERVICE}/workitems/1.2.840.10008.5.1.4.XX.X/subscribers/{AETitle}/suspend

732 where

— {SERVICE} is the base URL for the service. This may be a combination of protocol (either HTTP or HTTPS), authority and path.
— {AETitle} identifies the subscribed Application Entity.

736

— Method

738 — POST

740 — The request body shall be empty.

742 6.X.8.2 Behavior

The SuspendGlobalSubscription Origin-Server shall behave as described in 6.X.7.2.

744 **6.X.8.3 Response**

6.X.8.3.1 Response Status Line

746 The Service shall return an HTTP/1.1 status line, including a status code and associated reason phrase.

If the SuspendGlobalSubscription request was successful, the Service shall return an HTTP/1.1 “200 – OK” response code.
 748

If the subscription change fails, the Service shall return an appropriate failure status line with a response
 750 code from Table 6.X.8-1.

**Table 6.X.7-1
 STATUS CODES**

752

HTTP/1.1 Code	Reason Phrase	Description
200	OK	The subscription was suspended.
400	Bad Request	The UPS-RS Origin-Server was unable to understand the request
401	Unauthorized	The UPS-RS Origin-Server refused to accept the request because the client is not authenticated.
403	Forbidden	The UPS-RS Origin-Server understood the request, but is refusing to perform the query (e.g. an authenticated user with insufficient privileges).
404	Not found	The specified UPS Instance or well-known UID does not exist or is not managed by this Origin-Server.
409	Conflict	Specified action not appropriate for specified instance.
503	Busy	Service is unavailable.

754 **6.X.8.2.2 Response Message Body**

The response message body shall be empty.

756

6.X.9 DeleteSubscription

758 This resource removes existing subscriptions from the specified UPS Instances.

6.X.9.1 Request

760 The request message shall be formed as follows:

— Resource

762 — {SERVICE}/workitems/{UPSInstanceUID}/subscribers/{AETitle}

where

- 764 — {SERVICE} is the base URL for the service. This may be a combination of protocol (either HTTP or HTTPS), authority and path.
- 766 — {UPSInstanceUID} is the UID of the Unified Procedure Step Instance or a well-known UID.
- {AETitle} identifies the subscribed Application Entity.

768

— Method

770 — DELETE

772 — The request body shall be empty.

774 **6.X.9.2 Behavior**

The DeleteSubscription Origin-Server shall behave as described in 6.X.7.2.

776 **6.X.9.3 Response**

6.X.9.3.1 Response Status Line

778 The Service shall return an HTTP/1.1 status line, including a status code and associated reason phrase.

If the DeleteSubscription request was successful, the Service shall return an HTTP/1.1 “200 – OK”
780 response code.

If the subscription fails, the Service shall return an appropriate failure status line with a response code from
782 Table 6.X.9-1.

**Table 6.X.7-1
STATUS CODES**

784

HTTP/1.1 Code	Reason Phrase	Description
200	OK	The subscription was removed.
400	Bad Request	The UPS-RS Origin-Server was unable to understand the request
401	Unauthorized	The UPS-RS Origin-Server refused to accept the request because the client is not authenticated.
403	Forbidden	The UPS-RS Origin-Server understood the request, but is refusing to perform the query (e.g. an authenticated user with insufficient privileges).
404	Not found	The specified UPS Instance or well-known UID does not exist or is not managed by this Origin-Server.
409	Conflict	Specified action not appropriate for specified instance.
503	Busy	Service is unavailable.

786 **6.X.9.2.2 Response Message Body**

The response message body shall be empty.

788

6.X.10 OpenEventChannel

790 This resource opens a WebSocket channel that will be used to send Event Reports to the client.

See RFC-6455 for details on the WebSocket protocol.

792 **6.X.10.1 Request**

The request message shall be formed as follows:

794 — Resource

— {WSSERVICE}/subscribers/{AETitle}

796 where

798 — {WSSERVICE} is the base URL for the WebSocket service. This shall include the WebSocket protocol (either WS or WSS) and may include a combination of authority and path

— {AETitle} identifies the subscribed Application Entity.

800

— Method

802 — GET

804 **6.X.10.2 Behavior**

806 The Origin-Server maintains the active WebSocket connection and uses it to send Event Report messages for UPS Instances which have subscriptions association with {AETitle} (see 6.X.7.2).

808 If the WebSocket connection is lost at any point the User-Agent can re-establish it by repeating the request.

810 The state of a WebSocket connection does not affect subscriptions and an Origin-Server is not required to queue messages when the connection is down.

812 Note: A User-Agent will only receive the initial state of a newly-subscribed UPS Instance if the WebSocket connection was initiated before creating the subscription

814 **6.X.10.3 Response**

6.X.10.3.1 Response Status Line

816 The Service shall return an HTTP/1.1 status line, including a status code and associated reason phrase.

818 If the request was successful, the Service shall return an HTTP/1.1 “101 - Switching Protocols” response code.

820 If the request fails, the Service shall return an appropriate failure status line with a response code from Table 6.X.10-1.

822

**Table 6.X.10-1
STATUS CODES**

HTTP/1.1 Code	Reason Phrase	Description
---------------	---------------	-------------

101	Switching Protocols	The WebSocket connection was established.
400	Bad Request	The UPS-RS Origin-Server was unable to understand the request
401	Unauthorized	The UPS-RS Origin-Server refused to accept the request because the client is not authenticated.
403	Forbidden	The UPS-RS Origin-Server understood the request, but is refusing to perform the query (e.g. an authenticated user with insufficient privileges).
503	Busy	Service is unavailable.

824 **6.X.10.2.2 Response Message Body**

The response message body shall be empty.

826 The connection remains open and may be used by the server to send Event messages (see 6.X.11).

828 **6.X.11 SendEventReport**

This operation sends an Event Report over an established WebSocket connection.

830 **6.X.11.1 Request**

The request message shall be formed as follows:

832 — Resource

— N/A

834

— Method

836 — WebSocket Data Frame transmission

838 — The Event Report shall contain all mandatory attributes described in described in PS 3.4 Table CC.2.4-1 and PS 3.7 Table 10.3-1 for the event type.

840

6.X.11.1.1 Request Message Body

842 WebSocket Events are encoded as WebSocket data frames with an opcode of “%x1” (text).

The frame payload data shall be a DICOM JSON dataset containing the attributes of the Event Report.

844 Note: Example WebSocket payload:

```
846 {
847   "00000002": [ "1.2.840.10008.5.1.4.34.6.4" ],
848   "00000100": [ 256 ],
849   "00000110": [ 23 ],
```



```
850     "00001000": [ "1.2.840.10008.5.1.4.34.6.4.2.3.44.22231" ],  
      "00001001": [ 1 ],  
852     "00741238": [ "SCHEDULED" ],  
      "00744041": [ "READY" ]  
854   }
```

6.X.11.2 Behavior

856 PS 3.4 CC.2.4.3 describes the scenarios in which an Origin-Server sends Event Reports to a subscriber and the content of the Event Report messages.

6.X.11.3 Response

None.