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Digital Imaging and Communications in Medicine (DICOM)

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

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28

Table of Contents

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

Insert into Section 2 Normative References (in correct order)

IETF RFC7230   Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing

Append to Section 3 Definitions

3.X HTTP DEFINITIONS

This Part of the Standard makes use of the following terms defined in IETF RFC7230:

a. Origin-Server
b. User-Agent

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 Section 6.9).

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**

- Standard -

— **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 Section 6.9.

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 Receive UPS Event Reports	3	Receiving AE	(0074,1234)	1/1
		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.

…

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

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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 1.2.840.10008.5.1.4.34.5.1 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.

> **Note: The UPS-RS User-Agent is responsible for opening the N-EVENT-REPORT communication channel (see PS 3.18 Section 6.9.10). The UPS-RS User-Agent is also responsible for re-establishing the N-EVENT-REPORT communication channel if it is disconnected. This differs from the DIMSE approach where the UPS SCP opens an Association for N-EVENT-REPORT messages as necessary.**

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 6.9.11).**

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.

- Standard -

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
…								
			Unified Procedure Step Relationship Module					
…								
Referenced Request Sequence	(0040,A370)	2/2	Not allowed	O	3/2	RO	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 **6.9.7).**

…

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~~ request**s** ~~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 **set** ~~N-SET~~ request ~~primitive~~ as specified in Table CC.2.5-3.

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

The SCP shall refuse **set** ~~N-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 **request** ~~N-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.

…

54
Changes to NEMA Standards Publication PS 3.6

Digital Imaging and Communications in Medicine (DICOM)

56
6: Data Dictionary

Update Table A-1. UID Values as follows

58
Table A-1
UID Values

UID Value	UID Name	UID Type	Part
…			
1.2.840.10008.5.1.4.34.5	~~Unified Worklist and Procedure Step~~ **UPS Global Subscription** SOP Instance	Well-known SOP Instance	PS3.4
1.2.840.10008.5.1.4.34.5. 1	**UPS Filtered Global Subscription SOP Instance**	**Well-known SOP Instance**	**PS3.4**
…			

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Changes to NEMA Standards Publication PS 3.17

Digital Imaging and Communications in Medicine (DICOM)

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Part 17: Explanatory Information

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Update section GGG.1 as follows

66 **GGG.1   INTRODUCTION**

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

The examples are intended to provide a sense of how the UPS SOP Classes can be used to support a
70 variety of workflow use cases. For the detailed specification of how the underlying DIMSE Services
function, please refer to Annex CC "Unified Procedure Step Service and SOP Classes (Normative)". **For**
72 **the detailed specification of how the RESTful services function, please refer to PS 3.18 Section 6.9.**

The Unified Worklist and Procedure Step Service Class combines the information that is conveyed
74 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
76 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.

78 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
80 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
82 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.

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Changes to NEMA Standards Publication PS 3.18

Digital Imaging and Communications in Medicine (DICOM)

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Part 18: Web Services

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Insert into Section 3 Normative References (in correct order)

88

90	IETF RFC6455	The WebSocket Protocol
	IETF RFC6570	URI Template
92	IETF RFC7231	Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content
	IETF RFC7232	Hypertext Transfer Protocol (HTTP/1.1): Conditional Requests
94	IETF RFC7233	Hypertext Transfer Protocol (HTTP/1.1): Range Requests
	IETF RFC7234	Hypertext Transfer Protocol (HTTP/1.1): Caching
96	IETF RFC7235	Hypertext Transfer Protocol (HTTP/1.1): Authentication
98	IETF RFC7236	Initial Hypertext Transfer Protocol (HTTP) Authentication Scheme Registrations
	IETF RFC7237	Initial Hypertext Transfer Protocol (HTTP) Method Registrations

100

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

102

UPS-RS   Unified Procedure Step by RESTful Services

104

Update Section 6.7 QIDO-RS – Search as follows

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106 **6.7.1   QIDO-RS – Search**

6.7.1.1   Request

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

— Resource

110   — SearchForStudies

            — {**+**SERVICE}/studies**{{**?query***,fuzzymatching,limit,offset}}**

112   — SearchForSeries

            — {**+**SERVICE}/studies/{StudyInstanceUID}/series**{{**?query***,fuzzymatching,limit,offset}}**

114   — {**+**SERVICE}/series**{{**?query***,fuzzymatching,limit,offset}}**

    — SearchForInstances

116   — {**+**SERVICE}/studies/{StudyInstanceUID}/series/{SeriesInstanceUID}/
            instances**{{**?query***,fuzzymatching,limit,offset}}**

118   — {**+**SERVICE}/studies/{StudyInstanceUID}/instances**{{**?query***,fuzzymatching,limit,offset}}**

            — {**+**SERVICE}/instances**{{**?query***,fuzzymatching,limit,offset}}**

120 where

        — {**+**SERVICE} is the base URL for the QIDO RESTful service. This may be a combination of
122   ~~scheme~~ **protocol** (either HTTP or HTTPS), ~~host, port~~ **authority**, and ~~application~~ **path**.

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

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

126 — Method

        — GET

128

— Headers

130   — Accept – The Media Type of the query results. The types allowed for this request header are:

    — multipart/related; type=application/dicom+xml (default)

132   Specifies that the results should be DICOM PS3.19 XML (one part per result)

    — application/json

134   Specifies that the results should be DICOM JSON

    A QIDO-RS provider shall support both Accept header values

136   — Cache-control: no-cache (recommended)

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

138

— **~~Query key=value pairs~~ {query}**

140   — {attributeID}={value}

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

142   — includefield={attributeID} | all

    0-n includefield / {attributeID} pairs allowed, where "all" indicates that all available attributes should
144   be included for each response.

146   Each {attributeID} must refer to one of:

    — Patient IE attributes

148   — Study IE attributes

    — Series IE attributes (SearchForSeries or SearchForInstances requests only)

150   — Composite Instance IE attributes (SearchForInstances requests only)

    — Additional Query / Retrieve Attributes (**see ~~DICOM~~** PS 3.4 **Section** C.3.4)

152   — Timezone Offset From UTC (0008,0201)

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

154

    ~~Each {attributeID} query value must be unique unless the associated DICOM Attribute~~
156   **~~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.~~

158

    ~~The acceptable values for {value} are determined by the types of matching allowed by C-~~
160   **~~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.~~

162

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

166 **— fuzzymatching=true | false**

  — limit={maximumResults}

168 **— offset={skippedResults}**

    ~~— fuzzymatching=true | false~~

170   **~~— limit={maximumResults}~~**

172
 — offset={skippedResults}

6.7.1.1.1   {attributeID} encoding rules

174 **Each {attributeID} query key shall 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**
176 **element of the UID List.**

The acceptable values for {value} are determined by the types of matching allowed by C-FIND for
178 **its associated {attributeID} (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.**

180 **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).**

182 {attributeID} can be one of the following:

 — {dicomTag}
184 — {dicomKeyword}
 — {dicomTag}.{attributeID}, where {attributeID} is an element of the sequence specified by {dicomTag}
186 — {dicomKeyword}.{attributeID}, where {attributeID} is an element of the sequence specified
  by {dicomKeyword}
188

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

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

192 Note: Examples of valid values for {attributeID}:
 — 0020000D
194 — StudyInstanceUID
 — 00101002.00100020
196 — OtherPatientIDsSequence.PatientID
 — 00101002.00100024.00400032
198 — OtherPatientIDsSequence.IssuerOfPatientIDQualifiersSequence.UniversalEntityID

200 Note: Examples of valid QIDO-RS URLs:
 — http://dicomrs/studies?PatientID=11235813
202 — http://dicomrs/studies?PatientID=11235813&StudyDate=20130509
 — http://dicomrs/studies?00100010=SMITH*&00101002.00100020=11235813&limit=25
204 — http://dicomrs/studies?00100010=SMITH*&OtherPatientIDsSequence.00100020=11235813
 — http://dicomrs/studies?PatientID=11235813&includefield=00081048&includefield=00081049
206   &includefield=00081060
 — http://dicomrs/studies?PatientID=11235813&StudyDate=20130509-20130510
208 — http://dicomrs/studies?StudyInstance~~er~~UID=1.2.392.200036.9116.2.2.2.2162893313.
  1029997326.94587%2c1.2.392.200036.9116.2.2.2.2162893313.1029997326.94583
210

Update Section 6.8.1.1 Request Message as follows

---

212 **6.8.1.1 Request Message**

The Retrieve Server Options transaction can be requested for the following resources:

214 — {**+**SERVICE}**[**{**/**InformationEntity*****}**]**

— where {**+**SERVICE} is the base URL for the service. This may be a combination of protocol
216 (either http or https), host, port, and application.

— where {InformationEntity} is the path to a defined DICOM RESTful service resource, such as:
218 — WADO-RS (see 6.5.1, 6.5.2, 6.5.3, 6.5.4, 6.5.5, 6.5.6)

— STOW-RS (see 6.6.1)
220 — QIDO-RS (see 6.7.1)

— **UPS-RS (see 6.9.1, 6.9.2, 6.9.3, 6.9.4, 6.9.5, 6.9.6, 6.9.7, 6.9.8, 6.9.9)**

222

> **Update Section 6.8.1.2.1 Resources as follows**

224 **6.8.1.2.1 Resources**

The full WADL resource tree follows directly and unambiguously from the RESTful resource endpoints
226 defined in 6.5, 6.6**, and** 6.7 **and 6.9**.

For informative purposes, the full resource tree and the methods defined for each resource are described
228 in Table 6.8-1:

Table 6.8-1
230 **Resources and Methods**

Resource	Methods supported (excluding RetrieveCapabilities)	Reference
{**+**SERVICE}	N/A	N/A
— studies	SearchForStudies	6.8.1.2.2.3
	StoreInstances	6.8.1.2.2.2
— {StudyInstanceUID}	RetrieveStudy	6.8.1.2.2.1
	Store**Study**Instances **– specified Study**	6.8.1.2.2.3
— metadata	Retrieve**Study**Metadata **– Study**	6.8.1.2.2.1
— series	SearchFor**Study**Series	6.8.1.2.2.3
— {SeriesInstanceUID}	RetrieveSeries	6.8.1.2.2.1
— metadata	Retrieve**Series**Metadata **– Series**	6.8.1.2.2.1
— instances	SearchFor**StudySeries**Instances	6.8.1.2.2.3
— {SOPInstanceUID}	RetrieveInstance	6.8.1.2.2.1
— metadata	Retrieve**Instance**Metadata **– Instance**	6.8.1.2.2.1
— frames	N/A	N/A
— {framelist}	RetrieveFrames	6.8.1.2.2.1
— instances	SearchFor**Study**Instances **– no specified Series**	6.8.1.2.2.3
— series	SearchForSeries **– no specified Study**	6.8.1.2.2.3
— {SeriesInstanceUID}	N/A	N/A
— instances	SearchFor**Series**Instances **– no specified Study**	6.8.1.2.2.3

— instances	SearchForInstances — no specified Study or Series	6.8.1.2.2.3
— {BulkDataURL}	RetrieveBulkData	6.8.1.2.2.1
— workitems	**SearchForUPS** **CreateUPS**	**6.8.1.2.2.3** **6.8.1.2.2.2**
— {UPSInstanceUID}	**RetrieveUPS** **UpdateUPS**	**6.8.1.2.2.1** **6.8.1.2.2.4**
— state	**ChangeUPSState**	**6.8.1.2.2.4**
— cancelrequest	**RequestUPSCancel**	**6.8.1.2.2.4**
— subscribers	**N/A**	**N/A**
— {AETitle}	**CreateSubscription** **DeleteSubscription**	**6.8.1.2.2.5** **6.8.1.2.2.5**
— 1.2.840.10008.5.1.4.34.5	**N/A**	**N/A**
— subscribers	**N/A**	**N/A**
— {AETitle}	**CreateSubscription** **DeleteSubscription**	**6.8.1.2.2.5** **6.8.1.2.2.5**
— suspend	**SuspendGlobalSubscription**	**6.8.1.2.2.5**
— 1.2.840.10008.5.1.4.34.5.1	**N/A**	**N/A**
— subscribers	**N/A**	**N/A**
— {AETitle}	**CreateSubscription** **DeleteSubscription**	**6.8.1.2.2.5** **6.8.1.2.2.5**
— suspend	**SuspendGlobalSubscription**	**6.8.1.2.2.5**

232 **Update 6.8.1.2.2.1 Retrieve Methods as follows**

6.9.1.2.2.1   Retrieve Methods

234 The Retrieve methods define the capabilities of a WADO-RS resource (see 6.5) **or a RetrieveUPS resource (see 6.9.4)**.

236 The Retrieve methods shall contain the following attributes:

— A "name" attribute with a value of "GET"

238 — An "id" attribute with a value of "RetrieveStudy", "RetrieveSeries", "RetrieveInstance", "RetrieveBulkData", "RetrieveFrames", "RetrieveStudyMetadata", "RetrieveSeriesMetadata", or

240 "RetrieveInstanceMetadata" **or "RetrieveUPS"** depending on the full resource path

…

242 **Update 6.8.1.2.2.2 Store Methods as follows**

6.8.1.2.2.2   Store Methods

244 The Store methods define the capabilities of a STOW-RS resource (see 6.6) **or a CreateUPS resource (see 6.9.1)**.

246 The Store methods shall contain the following attributes:

— A "name" attribute with a value of "POST"

248 — An "id" attribute with a value of "StoreInstances"**,** ~~or~~ "StoreStudyInstances" or "CreateUPS"

…

250

Update 6.8.1.2.2.3 Search Methods as follows

---

252 **6.8.1.2.2.3   Search Methods**

The Search methods define the capabilities of a QIDO-RS resource (see 6.7) **or a SearchForUPS**
254 **resource (see 6.9.3)**.

The Search methods shall contain the following attributes:

256 — A "name" attribute with a value of "GET"

— An "id" attribute with a value of "SearchForStudies", "SearchForStudySeries", "SearchForSeries",
258 "SearchForStudySeriesInstances", "SearchForStudyInstances", "SearchForSeriesInstances"**,** ~~or~~
"SearchForInstances" **or "SearchForUPS"** ~~depending on the level of the parent resource~~

260 …

---

262 **Append to 6.8.1.2.2 Methods**

6.8.1.2.2.4   Update Methods

264 The Update methods define the capabilities of an UpdateUPS, a ChangeUPSState or a
RequestUPSCancellation resource (see 6.9.2).

266 The Update methods shall contain the following attributes:

— A "name" attribute with a value of "POST" for UpdateUPS and RequestUPSCancel
268 — A "name" attribute with a value of "PUT" for ChangeUPSState
— An "id" attribute with a value of "UpdateUPS", "ChangeUPSState" or "RequestUPSCancellation"
270

The Update methods shall contain a "request" element with "param" elements documenting the following:

272 — supported Representations

274 The Update methods shall contain one or more "response" elements documenting the following:

— supported Status Codes
276 — Headers returned for each Status Code

278   Note: More than one Status Code can be described by a single "response" element

280   Example:
```
<method name="POST" id="UpdateUPS">
```
282
```
 <request>
   <representation mediaType="application/dicom+xml" />
```
284
```
   <representation mediaType="application/json />
 </request>
```
286
```
 <response status="200">
   <param name="Warning" style="header" fixed="299 {+SERVICE}: The UPS was
```
288
```
   created with modifications." />
   <param name="Warning" style="header" fixed="299 {+SERVICE}: Requested
```
290
```
   optional Attributes are not supported." />
 </response>
```
292
```
 <response status="409">
   <param name="Warning" style="header" fixed="299 {+SERVICE}: The
```
294
```
   Transaction UID is missing." />
   <param name="Warning" style="header" fixed="299 {+SERVICE}: The
```
296
```
   Transaction UID is incorrect." />
   <param name="Warning" style="header" fixed="299 {+SERVICE}: The
```
298
```
   submitted request is inconsistent with the current state of the UPS
   Instance." />
```
300
```
 </response>
 <response status="400 401 403 404 503" />
```
302
```
</method>
```

304 **6.8.1.2.2.5   Subscribe Methods**

The Subscribe methods define the capabilities of a CreateSubscription, a SuspendGlobalSubscription or a
306 DeleteSubscription resource (see 6.9.7, 6.9.8 and 6.9.9).

The Subscribe methods shall contain the following attributes:

308   — A "name" attribute with a value of "POST" for CreateSubscription and SuspendGlobalSubscription
        — A "name" attribute with a value of "DELETE" for DeleteSubscription
310   — An "id" attribute with a value of "CreateSubscription", "SuspendGlobalSubscription" or
        "DeleteSubscription"
312

The Update methods shall contain a "request" element with "param" elements documenting the following:

314   — supported parameters

316 The Update methods shall contain one or more "response" elements documenting the following:

        — supported Status Codes
318   — Headers returned for each Status Code

320   Note: More than one Status Code can be described by a single "response" element

322   Example:
```
<method name="POST" id="CreateSubscription">
```
324
```
 <request>
```

```
          <param name="deletionlock" style="query" default="false">
326         <option value="true" />
            <option value="false" />
328       </param>
        </request>
330     <response status="201">
          <param name="Warning" style="header" fixed="299 {+SERVICE}: Deletion
332       Lock not granted." />
        </response>
334     <response status="403">
          <param name="Warning" style="header" fixed="299 {+SERVICE}: The Origin-
336       Server does not support Global Subscription Filtering." />
        </response>
338     <response status="400 401 404 409 503" />
      </method>
340
```

Add Section 6.9 UPS-RS WORKLIST SERVICE

---

342 **6.9   UPS-RS WORKLIST SERVICE**

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

1. CreateUPS
346   This action requests the creation of a UPS Instance on the Origin-Server. It corresponds to the
        UPS DIMSE N-CREATE operation.

348 2. UpdateUPS
        This action sets the attributes of a UPS Instance managed by the Origin-Server. It corresponds to
350   the UPS DIMSE N-SET operation.

3. SearchForUPS
352   This action searches for UPS Instances known to the Origin-Server. It corresponds to the UPS
        DIMSE C-FIND operation.

354 4. RetrieveUPS
        This action retrieves a UPS Instances. It corresponds to the UPS DIMSE N-GET operation.

356 5. ChangeUPSState
        This action sets the state of a UPS Instance managed by the Origin-Server. It corresponds to the
358   UPS DIMSE N-ACTION operation "Change UPS State".

6. RequestUPSCancellation
360   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".

362 7. CreateSubscription
        This action subscribes to a UPS Instance or the Global Worklist managed by the Origin-Server. It
364   corresponds to the UPS DIMSE N-ACTION operation "Subscribe to Receive UPS Event Reports".

8. SuspendGlobalSubscription
366   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".

368 9. DeleteSubscription

₃₇₀   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".

₃₇₂   10. OpenEventChannel

      This action initiates a WebSocket connection to allow the User-Agent to start receiving Event
₃₇₄   Report messages.

     11. SendEventReport

₃₇₆   This action sends an Event Report using an open WebSocket connection. It corresponds to the UPS DIMSE N-EVENT-REPORT operation.

₃₇₈

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

₃₈₀ 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.

₃₈₂

Table 6.9-1
UPS Interface Mapping

Action Type	Section	Method & Resource
CreateUPS	6.9.1	POST {+SERVICE}/workitems{?AffectedSOPInstanceUID}
UpdateUPS	6.9.2	POST {+SERVICE}/workitems/{UPSInstanceUID}{?transaction}
SearchForUPS	6.9.3	GET {+SERVICE}/workitems{?query*}
RetrieveUPS	6.9.4	GET {+SERVICE}/workitems/{UPSInstanceUID}
ChangeUPSState	6.9.5	PUT {+SERVICE}/workitems/{UPSInstanceUID}/state
RequestUPSCancellation	6.9.6	POST {+SERVICE}/workitems/{UPSInstanceUID}/cancelrequest
CreateSubscription	6.9.7	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/1.2.840.10008.5.1.4.34.5.1/ subscribers/{AETitle}{?deletionlock,query*}
SuspendGlobalSubscription	6.9.8	POST {+SERVICE}/workitems/1.2.840.10008.5.1.4.34.5/ subscribers/{AETitle}/suspend POST {+SERVICE}/workitems/1.2.840.10008.5.1.4.34.5.1/ subscribers/{AETitle}/suspend
DeleteSubscription	6.9.9	DELETE {+SERVICE}/workitems/{UPSInstanceUID}/ subscribers/{AETitle}
OpenEventChannel	6.9.10	GET {+WSSERVICE}/subscribers/{AETitle}
SendEventReport	6.9.11	N/A

₃₈₄

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

388 **6.9.1   CreateUPS**

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

390 **6.9.1.1   Request**

The request message shall be formed as follows:

392 — Resource
   — {+SERVICE}/workitems{?AffectedSOPInstanceUID}
394   where
      — {+SERVICE} is the base URL for the service. This may be a combination of protocol (either
396   HTTP or HTTPS), authority and path.
      — {AffectedSOPInstanceUID} specifies the SOP Instance UID of the UPS Instance to be created
398
— Method
400   — POST

402 — Headers
   — Content-Type – The representation scheme being posted to the RESTful service. The types
404   allowed for this request header are as follows:
      — application/dicom+xml
406   Specifies that the post is PS 3.19 XML metadata. See 6.9.1.1.1
      — application/json
408   Specifies that the post is PS 3.18 JSON metadata. See 6.9.1.1.1

410 — 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.
412

6.9.1.1.1 Request Message
414 The Request Message has a single part body.

— Content-Type:
416   — application/dicom+xml
   — application/json
418
— The request body contains all attributes to be stored in either DICOM PS 3.19 XML or DICOM PS 3.18
420   JSON. Any binary data contained in the message shall be inline.

422 **6.9.1.2   Behavior**

The Origin-Server shall create and maintain UPS instances as instructed by CreateUPS requests and as
424 specified by the SCP behavior in PS 3.4 Section CC.2.5.3.

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

426 **6.9.1.3   Response**

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

428 **6.9.1.3.1   Response Status Line**

If the Create request is successful, the Origin-Server shall return an HTTP/1.1 "201 - Created" response
430 code.

If the request fails, the Origin-Server shall return an appropriate failure status line with a response code
432 from Table 6.9.1-1.

Table 6.9.1-1
434   **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.

436 **6.9.1.3.2   Response Headers**

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

438 — Content-Location: {+WorkitemURL}

Where {+WorkitemURL} is the URL from which the created UPS Instance can be retrieved (see 6.9.4)
440

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

— Warning: 299 {+SERVICE}: The UPS was created with modifications.
444

6.9.1.3.3   Response Message Body

446 The response message body shall be empty.

- Standard -

448 **6.9.2   UpdateUPS**

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

450 **6.9.2.1   Request**

The request message shall be formed as follows:

452 — Resource
  — {+SERVICE}/workitems/{UPSInstanceUID}{?transaction}
454   where
    — {+SERVICE} is the base URL for the service. This may be a combination of protocol (either
456   HTTP or HTTPS), authority and path.
    — {UPSInstanceUID} is the UID of the Unified Procedure Step Instance
458   — {transaction} specifies the Transaction UID / Locking UID for the specified Unified Procedure
      Step Instance
460   If the UPS instance is currently in the SCHEDULED state, {transaction} shall not be specified.
      If the UPS instance is currently in the IN PROGRESS state, {transaction} shall be specified.
462

— Method
464   — POST

466 — Headers
  — Content-Type – The representation scheme being posted to the RESTful service. The types
468   allowed for this request header are as follows:
    — application/dicom+xml
470   Specifies that the post is PS 3.19 XML metadata. See 6.9.2.1.1
    — application/json
472   Specifies that the post is PS 3.18 JSON metadata. See 6.9.2.1.1

474 — 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
476   described in PS 3.4 Section CC.2.6.2.

478 — 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
480   consistent state.

482 **6.9.2.1.1 Request Message**

The Request Message has a single part body.

484 — Content-Type:
  — application/dicom+xml
486   — application/json

488 — The request body contains all the attributes to be updated in either DICOM PS 3.19 XML or DICOM
PS 3.18 JSON. Any binary data contained in the message shall be inline.

490

6.9.2.2   Behavior

492 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.

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

6.9.2.3   Response

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

6.9.2.3.1   Response Status Line

498 If the Set request is successful, the Origin-Server shall return an HTTP/1.1 "200 - OK" response code.

If the request fails, the Origin-Server shall return an appropriate failure status line with a response code
500 from Table 6.9.2-1.

Table 6.9.2-1
502   **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.

504 **6.9.2.3.2   Response Headers**

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

— Warning: 299 {+SERVICE}: The UPS was created with modifications.
508

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

— Warning: 299 {+SERVICE}: Requested optional Attributes are not supported.
512

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

— Warning: 299 {+SERVICE}: The Transaction UID is missing.
516 — Warning: 299 {+SERVICE}: The Transaction UID is incorrect.
— Warning: 299 {+SERVICE}: The submitted request is inconsistent with the current state of the UPS
518   Instance.

520 **6.9.2.3.3   Response Message Body**

The response message body shall be empty.

522

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

526 **6.9.3.1   Request**

The request message shall be formed as follows:

528 — Resource
    — {+SERVICE}/workitems/{?query*}
530   where
        — {+SERVICE} is the base URL for the service. This may be a combination of protocol (either
532   HTTP or HTTPS), authority and path.

534 — Method
    — GET
536
— Headers
538   — 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:
540   — multipart/related; type=application/dicom+xml; boundary={messageBoundary}
          Specifies that the results should be PS 3.19 XML metadata.
542   — application/json

Specifies that the results should be PS 3.18 JSON metadata.

544 — Cache-control: no-cache (recommended)

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

546

— {query}

548 — {attributeID}={value}

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

550 — includefield={attributeID} | all

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

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

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

558 — fuzzymatching=true | false

— limit={maximumResults}

560 — offset={skippedResults}

562 **6.9.3.2 Behavior**

The Origin-Server shall perform a search according the requirements for the QIDO-RS services (see
564 6.7.1.2).

6.9.3.2.1 Matching

566 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 *.

568 See 6.7.1.2.1 for matching behavior.

6.9.3.3 Response

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

6.9.3.3.1 Response Status Line

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

574 If the request fails, the Origin-Server shall return an appropriate failure status line with a response code
from Table 6.9.3-3.

576 **Table 6.9.3-1**
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.

578

6.9.3.3.2   Query Result Attribute

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

— All Unified Procedure Step Instance Attributes in PS 3.4 Table CC.2.5-3 with a Return Key value of
582   1 and 2.

— All Unified Procedure Step Instance Attributes in PS 3.4 Table CC.2.5-3 with a Return Key value of
584   1C for which the conditional requirements are met.

— All other Unified Procedure Step Instance Attributes passed as {attributeID} query keys that are
586   supported by the Origin-Server as matching or return attributes

— All other Unified Procedure Step Instance Attributes passed as "includefield" query values that are
588   supported by the Origin-Server as return attributes.

590 **6.9.3.3.3   Response Message**

The response message body contains the results.

592 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.

594 **6.9.3.3.3.1   XML Response Message**

— Content-Type:

596   — multipart/related; type=application/dicom+xml

— The response is a multipart message body where each part is a DICOM PS 3.19 XML
598   DicomNativeModel element containing the attributes for one matching UPS Instance (see PS 3.19
Section A.1).

600 — 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:

- Standard -

602 — Content-Type: application/dicom+xml

604 **6.9.3.3.3.2   JSON Response Message**

— Content-Type:

606 — application/json

— The response is a DICOM JSON message containing a DICOM JSON property for each matching
608 UPS Instance containing sub-properties describing the matching attributes for each UPS Instance (see
F.2).

610 — If there are no matching results, the JSON message shall be empty.

612

6.9.4   RetrieveUPS

614 This resource supports the retrieval of a UPS Instance.

6.9.4.1   Request

616 The request message shall be formed as follows:

— Resource

618 — {+SERVICE}/workitems/{UPSInstanceUID}

where

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

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

624 — Method

— GET

626

— Headers

628 — 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:

630 — application/dicom+xml

Specifies that the result should be PS 3.19 XML metadata.

632 — application/json

Specifies that the result should be PS 3.18 JSON metadata.

634 — Cache-control: no-cache (recommended)

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

636

6.9.4.2   Behavior

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

640   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
642   Behavior.

644 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.

646 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.

648 **6.9.4.3   Response**

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

650 **6.9.4.3.1   Response Status Line**

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

If the request fails, the Origin-Server shall return an appropriate failure status line with a response code
654 from Table 6.9.4-1.

Table 6.9.4-1
656   **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.

658 **6.9.4.3.2   Response Message**

The response message body contains the results.

660 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.

662 **6.9.4.3.2.1   XML Response Message**

— Content-Type:

- Standard -

664   — application/dicom+xml

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

668 **6.9.4.3.2.2**   **JSON Response Message**

— Content-Type:
670   — application/json

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

674 **6.9.5**   **ChangeUPSState**

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

676 **6.9.5.1**   **Request**

The request message shall be formed as follows:

678 — Resource

    — {+SERVICE}/workitems/{UPSInstanceUID}/state
680   where:

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

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

684

— Method
686   — PUT

688 — Headers

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

        — application/dicom+xml
692   Specifies that the post is PS 3.19 XML metadata. See 6.9.5.1.1

        — application/json
694   Specifies that the post is PS 3.18 JSON metadata. See 6.9.5.1.1

696 — 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.
698

6.9.5.1.1 Request Message
700 The Request Message has a single part body.

    — Content-Type:
702   — application/dicom+xml

    — application/json
704

706 — The request body contains attributes in either DICOM PS 3.19 XML or DICOM PS 3.18 JSON format.

6.9.5.2 Behavior

708 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.

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

712 ### 6.9.5.3 Response

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

714 ### 6.9.5.3.1 Response Status Line

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

716 If the State Change fails, the Service shall return an appropriate failure status line with a response code from Table 6.9.5-1.

718
Table 6.9.5-1
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.

720

6.9.5.3.2 Response Headers

722 If the User-Agent specifies a Procedure Step State (0074,1000) attribute with a value of "CANCELED" and the UPS Instance is already in that state, the response message shall include the following HTTP/1.1
724 Warning header field:

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

726

If the User-Agent specifies a Procedure Step State (0074,1000) attribute with a value of "COMPLETED"
728 and the UPS Instance is already in that state, the response message shall include the following HTTP/1.1 Warning header field:

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

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

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

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

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

738

6.9.5.3.3 Response Message Body

740 The response message body shall be empty.

742 ### 6.9.6 RequestUPSCancellation

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

744 ### 6.9.6.1 Request

— Resource

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

where:

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

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

752 — Method

— POST

754

— Headers

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

758 — application/dicom+xml

Specifies that the post is PS 3.19 XML metadata. See 6.9.6.1.1

760 — application/json

Specifies that the post is PS 3.18 JSON metadata. See 6.9.6.1.1

762

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

766 **6.9.6.1.1 Request Message**

The Request Message has a single part body.

768 — Content-Type:
    — application/dicom+xml
770 — application/json

772 — The request body contains attributes in either DICOM PS 3.19 XML or DICOM PS 3.18 JSON format.

774 **6.9.6.2   Behavior**

RequestUPSCancellation is used to request to the Origin-Server that the state of a UPS Instance be
776 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.

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

780 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.

782   Note: An HTTP/1.1 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
784   some scenarios, may not even receive notification of the request. See Section PS 3.4 CC.2.4.

786 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 6.9.5.

788 **6.9.6.3   Response**

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

790 **6.9.6.2.1   Response Status Line**

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

792 If the cancel request was rejected, the Service shall return an appropriate failure status line with a
response code from Table 6.9.6-1.

794   **Table 6.9.6-1**
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.

796

6.9.2.5.2 Response Headers

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

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

6.9.5.2.3 Response Message Body

802

The response message body shall be empty.

804

6.9.7 CreateSubscription

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

6.9.7.1 Request

808

The request message shall be formed as follows:

810 — Resource
   — {+SERVICE}/workitems/{UPSInstanceUID}/subscribers/{AETitle}}{?deletionlock}
812   — {+SERVICE}/workitems/1.2.840.10008.5.1.4.34.5/subscribers/{AETitle}{?deletionlock}
   — {+SERVICE}/workitems/1.2.840.10008.5.1.4.34.5.1/subscribers/{AETitle}{?deletionlock,query*}
814   where
   — {+SERVICE} is the base URL for the service. This may be a combination of protocol (either
816   HTTP or HTTPS), authority and path.
   — {UPSInstanceUID} is the UID of the Unified Procedure Step Instance or a well-known UID
818   — {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
820   — {deletionlock}, if present, shall have a value of either "true" or "false", indicating whether or not
     the User-Agent is requesting a Deletion Lock

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

824 —   Method
       —   POST

826

—   Headers
828   —   Content-Length: 0

830 —   {query}
       —   deletionlock=true | false
832   —   {attributeID}={value}
          0-n / {attributeID}={value} pairs allowed

834

          Each {attributeID} shall refer to an attribute of the Unified Procedure Step IOD (see PS 3.3 Section
836   B.26.2).
          See Section 6.7.1.1.1 for {attributeID} and {value} encoding rules

838

—   The request body shall be empty.
840

6.9.7.2   Behavior

842 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.

844 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
846 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.

848 ### 6.9.7.3   Response

6.9.7.3.1   Response Status Line

850 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"
852 response code. The response shall contain a "Content-Location" header of the following format:

—   Content-Location: {WSSERVICE}
854   where:
       —   {WSSERVICE} is the base URL for the WebSocket service. This shall include the WebSocket
856   protocol (either WS or WSS) and may include a combination of authority and path.

858 If the subscription fails, the Service shall return an appropriate failure status line with a response code from Table 6.9.7-2.

860 **Table 6.9.7-2**
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.

862

6.9.7.3.2   Response Headers

864 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:

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

868 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:

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

872 **6.9.7.3.3   Response Message Body**

The response message body shall be empty.
874

6.9.8   SuspendGlobalSubscription

876 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
878 delete any existing subscriptions to specific UPS Instances.

6.9.8.1   Request

880 The request message shall be formed as follows:

— Resource

- Standard -

882 — {+SERVICE}/workitems/1.2.840.10008.5.1.4.34.5/subscribers/{AETitle}/suspend

— {+SERVICE}/workitems/1.2.840.10008.5.1.4.34.5.1/subscribers/{AETitle}/suspend

884 where

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

— {AETitle} identifies the subscribed Application Entity.

888

— Method
890 — POST

892 — The request body shall be empty.

6.9.8.2 Behavior

The SuspendGlobalSubscription Origin-Server shall behave as described in 6.9.7.2.

6.9.8.3 Response

6.9.8.3.1 Response Status Line

898 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 –
900 OK" response code.

If the subscription change fails, the Service shall return an appropriate failure status line with a response
902 code from Table 6.9.8-1.

Table 6.9.7-1
904 **STATUS CODES**

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.

906 **6.9.8.2.2**   **Response Message Body**

The response message body shall be empty.

908

6.9.9   **DeleteSubscription**

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

6.9.9.1   **Request**

912 The request message shall be formed as follows:

— Resource

914   — {+SERVICE}/workitems/{UPSInstanceUID}/subscribers/{AETitle}

where

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

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

     — {AETitle} identifies the subscribed Application Entity.

920

— Method

922   — DELETE

924 — The request body shall be empty.

926 **6.9.9.2**   **Behavior**

The DeleteSubscription Origin-Server shall behave as described in 6.9.7.2.

928 **6.9.9.3**   **Response**

6.9.9.3.1   **Response Status Line**

930 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"
932 response code.

If the subscription fails, the Service shall return an appropriate failure status line with a response code from
934 Table 6.9.9-1.

Table 6.9.7-1
936 **STATUS CODES**

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

- Standard -

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.

938 **6.9.9.3.2 Response Message Body**

The response message body shall be empty.

940

6.9.10 OpenEventChannel

942 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.

944 **6.9.10.1 Request**

The request message shall be formed as follows:

946 — Resource

    — {+WSSERVICE}/subscribers/{AETitle}

948   where

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

        — {AETitle} identifies the subscribed Application Entity.

952

— Method

954   — GET

956 **6.9.10.2 Behavior**

The Origin-Server maintains the active WebSocket connection and uses it to send Event Report messages
958 for UPS Instances which have subscriptions association with {AETitle} (see 6.9.7.2).

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

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

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

966 **6.9.10.3   Response**

6.9.10.3.1   Response Status Line

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

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

If the request fails, the Service shall return an appropriate failure status line with a response code from
972 Table 6.9.10-1.

Table 6.9.10-1
974 **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.

976 **6.9.10.3.2   Response Message Body**

The response message body shall be empty.

978 The connection remains open and may be used by the server to send Event messages (see 6.9.11).

980 **6.9.11   SendEventReport**

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

982 **6.9.11.1   Request**

The request message shall be formed as follows:

984 — Resource

— N/A

- Standard -

986

— Method

988 — WebSocket Data Frame transmission

990 — 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.

992

6.9.11.1.1 Request Message Body

994 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.

996 Note: Example WebSocket payload:

```
{
 "00000002": [ "1.2.840.10008.5.1.4.34.6.4" ],
 "00000100": [ 256 ],
 "00000110": [ 23 ],
 "00001000": [ "1.2.840.10008.5.1.4.34.6.4.2.3.44.22231" ],
 "00001001": [ 1 ],
 "00741238": [ "SCHEDULED" ],
 "00744041": [ "READY" ]
}
```
998
1000
1002
1004

1006

Note: The WebSocket protocol does not allow content negotiation so it is not possible to support both XML and
1008 JSON encoding of Event Report messages without extending the protocol.

1010 **6.9.11.2 Behavior**

PS 3.4 Section CC.2.4.3 describes the scenarios in which an Origin-Server sends Event Reports to a
1012 subscriber and the content of the Event Report messages.

6.9.11.3 Response

1014 None.