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Digital Imaging and Communications in Medicine (DICOM)

8 *Supplement 170: Service Capabilities for RESTful Services*

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18 **DICOM Standards Committee, Working Group 27 Web Technology**

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66 **Scope and Field of Application**

This supplement describes a means of discovering DICOM RESTful services, and determining which
68 options are supported, such as:

- — Supported services
70 — Supported Transfer Syntaxes and Media Types
- — Supported Accept header values
72 — Supported query parameters

74 A client makes an HTTP request and receives an object describing the server capabilities as the result.

CONCEPTS:

76 This service would provide a means of exchanging machine-readable information similar to Conformance
Statements for DICOM RESTful services. Terminology should be consistent between Capabilities Service
78 payloads and conventional Conformance Statements as described in PS 3.2.

Other domains have identified the need to provide a standard way of interrogating a web service to
80 determine its supported endpoints and parameters. For WS*-based services, WSDL has become the
standard.

82 Web Application Description Language (WADL) is a machine-readable XML description of HTTP-based
RESTful web applications. It has reasonable acceptance within the REST community though it has not yet
84 become a formal standard.

86

Changes to NEMA Standards Publication PS 3.15

88 ## Digital Imaging and Communications in Medicine (DICOM)

Part 15: Security and System Management Profiles

90 | **Update PS 3.15 Section H.2.3 Referenced Standards as follows** |
|---|

H.2.3   Referenced Standards

92   RFC-2181   Clarifications to the DNS Specification **<http://tools.ietf.org/html/rfc2181>**

RFC-2219   Use of DNS Aliases for Network Services **<http://tools.ietf.org/html/rfc2219>**

94   RFC-2782   A DNS RR for specifying the location of services (DNS SRV) **<http://www.ietf.org/rfc/rfc2782.txt>**

96   RFC 2136   DNS Dynamic Updates <http://www.rfc-editor.org/rfc/rfc2136.txt>

~~RFC 2782   A DNS RR for specifying the location of services (DNS SRV) <http://www.rfc-editor.org/rfc/rfc2136.txt>~~

98

~~DNS SRV (RFC 2782) Service Types <http://www.dns-sd.org/ServiceTypes.html>~~

100   **RFC-6763** DNS-Based Service Discovery <**http://www.rfc-editor.org/rfc/rfc6763.txt**~~http://files.dns-sd.org/draft-cheshire-dnsext-dns-sd.txt~~>

102   DNS Self-Discovery <http://www.dns-sd.org/>

RFC-6762 Multicast DNS <**http://www.ietf.org/rfc/rfc6762.txt**~~http://files.multicastdns.org/draft-~~

104   ~~cheshire-dnsext-multicastdns.txt~~>

~~Multicast DNS <http://www.multicastdns.org/>~~

106

The name to be used in the DNS SRV to advertise DICOM Association Acceptors, regardless of the SOP
108 Class(es) supported, shall be

— "dicom" for unsecured DICOM communication

110   — "dicom-tls" for the Basic TLS Secure Transport Connection Profile

— "dicom-iscl" for ISCL Transport Connection Profile

112   — **"dicomweb" for DICOM web services over unsecured http**

— **"dicomweb-tls" for DICOM web services over https**

114

Note: These choices are consistent with the names registered with IANA to define the mapping of IP ports to
116   services, which is conventional for this usage. The choice "dicom" is used rather than the "acr-nema"
    alternative for clarity. There is no implied port choice by the usage in the DNS SRV Service Type, since
118   the port is explicitly conveyed.

120 The DNS TXT record may contain the following parameters:

— AET=*<application entity title>*, where the value *<application entity title>* is to be used as the Called
122   Application Entity Title when initiating Associations to the device

— PrimaryDeviceType=*<primary device type>*, where the value *<primary device type>* is as defined
124   Table H.1-2 Attributes of Device Object

— **DICOMWebPath=*<service>*, where the value *<service>* is the *path* component of the DICOM**
126   **Web Service root as defined in PS 3.18**

128 In the absence of a DNS TXT record, or the AET parameter of the DNS TXT record, then the Instance
Name preceding the Service Type in the DNS SRV record used for DICOM service discovery shall be the
130 AET.

Note: Further parameters are not specified, for example to indicate the SOP Classes supported or other
132   information, since the size of DNS records encoded as UDP datagrams is strictly limited, and
           furthermore, the envisaged multicast usage encourages the exchange of the minimal information
134   necessary. The existing DICOM association negotiation mechanism can be used to explore the SOP
           Classes offered once the IP address, port number and AET are known. The primary device type is
136   supplied because it is useful to indicate to users the type of device, which is not conveyed during
           association establishment.
138
H.2.4   Examples

140 **Example SRV record:**

— **_dicomweb-tls._tcp. examplehospital.org 86400 IN SRV 10 60 443 dicomweb.**
142   **examplehospital.org.**

144 **Example TXT record:**

— **dicomweb. examplehospital.org   IN   TXT   "DICOMWebPath=apps/dicom-rs"**
146

The above examples would combine to define a DICOM web service root of:

148 **— https://dicomweb. examplehospital.org:443/apps/dicom-rs**

150 *

Changes to NEMA Standards Publication PS 3.17

152 # Digital Imaging and Communications in Medicine (DICOM)

Part 17: Explanatory Information

154 **Update to PS 3.17 Section 4 Symbols and Abbreviations**

4 SYMBOLS AND ABBREVATIONS

156 The following symbols and abbreviations are used in this Part.

WADL   Web Application Description Language

158

Append to PS 3.17 Annex HHH

160 **HHH.X   USES FOR SERVER OPTIONS SERVICES**

Clients would like to be able to discover a list of devices that support DICOM RESTful services and query
162 a DICOM RESTful service to determine which options are supported, such as:

— Supported services and transactions
164 — Supported Transfer Syntaxes and Media Types
— Supported Accept header values
166 — Supported query parameters

168 **HHH.X.1   WADL Example (XML)**

The following WADL XML example contains all the required elements for an origin-server that supports
170 WADO-RS, QIDO-RS and STOW-RS with all required services and parameters.

```
<application xsi:schemaLocation="http://wadl.dev.java.net/2009/02 wadl.xsd"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns="http://wadl.dev.java.net/2009/02">
  <resources base="http://medical.examplehospital.org/dicomweb">
    <resource path="studies">
      <method name="GET" id="SearchForStudies">
        <request>
          <param name="Accept" style="header" default="multipart/related;
          type=application/dicom+xml">
            <option value="multipart/related; type=application/dicom+xml" />
            <option value="application/json" />
          </param>
          <param name="Cache-control" style="header">
```

```
184                <option value="no-cache" />
             </param>
186          <param name="limit" style="query" />
             <param name="offset" style="query" />
188          <param name="StudyDate" style="query" />
             <param name="00080020" style="query" />
190          <param name="StudyTime" style="query" />
             <param name="00080030" style="query" />
192          <param name="AccessionNumber" style="query" />
             <param name="00080050" style="query" />
194          <param name="ModalitiesInStudy" style="query" />
             <param name="00080061" style="query" />
196          <param name="ReferringPhysicianName" style="query" />
             <param name="00080090" style="query" />
198          <param name="PatientName" style="query" />
             <param name="00100010" style="query" />
200          <param name="PatientID" style="query" />
             <param name="00100020" style="query" />
202          <param name="StudyInstanceUID" style="query" repeating="true" />
             <param name="0020000D" style="query" repeating="true" />
204          <param name="StudyID" style="query" />
             <param name="00200010" style="query" />
206          <param name="includefield" style="query" repeating="true">
               <option value="all" />
208          </param>
           </request>
210        <response status="200">
             <param name="Warning" style="header" fixed="299 {SERVICE}: The
212          fuzzymatching parameter is not supported. Only literal matching has
             been performed." />
214          <representation mediaType="multipart/related;
             type=application/dicom+xml" />
216          <representation mediaType="application/json" />
           </response>
218        <response status="400 401 403 413 503" />
         </method>
220      <method name="POST" id="StoreInstances">
           <request>
222          <param name="Accept" style="header" default="application/dicom+xml">
               <option value="application/dicom+xml" />
224          </param>
             <representation mediaType="multipart/related;
226          type=application/dicom" />
             <representation mediaType="multipart/related;
228          type=application/dicom; transfer-syntax=1.2.840.10008.1.2.1" />
             <representation mediaType="multipart/related;
230          type=application/dicom+xml" />
           </request>
232        <response status="202 409">
             <representation mediaType="application/dicom+xml" />
234        </response>
           <response status="400 401 403 503" />
236      </method>
         <resource path="{StudyInstanceUID}">
238        <method name="GET" id="RetrieveStudy">
```

```
                     <request>
240                    <param name="Accept" style="header" default="multipart/related;
                       type=application/dicom">
242                      <option value="multipart/related; type=application/dicom" />
                         <option value="multipart/related; type=application/dicom;
244                      transfer-syntax=1.2.840.10008.1.2.1" />
                         <option value="multipart/related; type=application/octet-stream"
246                      />
                       </param>
248                  </request>
                     <response status="200 206">
250                    <representation mediaType="multipart/related;
                       type=application/dicom" />
252                    <representation mediaType="multipart/related;
                       type=application/dicom; transfer-syntax=1.2.840.10008.1.2.1" />
254                    <representation mediaType="multipart/related;
                       type=application/octet-stream" />
256                  </response>
                     <response status="400 404 406 410 503"></response>
258                </method>
                   <method name="POST" id="StoreStudyInstances">
260                  <request>
                       <param name="Accept" style="header"
262                    default="application/dicom+xml">
                         <option value="application/dicom+xml" />
264                    </param>
                       <representation mediaType="multipart/related;
266                    type=application/dicom" />
                       <representation mediaType="multipart/related;
268                    type=application/dicom; transfer-syntax=1.2.840.10008.1.2.1" />
                       <representation mediaType="multipart/related;
270                    type=application/dicom+xml" />
                     </request>
272                  <response status="202 409">
                       <representation mediaType="application/dicom+xml" />
274                  </response>
                     <response status="400 401 403 503" />
276                </method>
                   <resource path="series">
                     <method name="GET" id="SearchForStudySeries">
278                    <request>
280                      <param name="Accept" style="header" default="multipart/related;
                         type=application/dicom+xml">
282                        <option value="multipart/related; type=application/dicom+xml"
                           />
284                        <option value="application/json" />
                         </param>
286                      <param name="Cache-control" style="header">
                           <option value="no-cache" />
288                      </param>
                         <param name="limit" style="query" />
290                      <param name="offset" style="query" />
                         <param name="Modality" style="query" />
292                      <param name="00080060" style="query" />
```

```
                       <param name="SeriesInstanceUID" style="query" repeating="true"
294                    />
                       <param name="0020000E" style="query" repeating="true" />
296                    <param name="SeriesNumber" style="query" />
                       <param name="00200011" style="query" />
298                    <param name="PerformedProcedureStepStartDate" style="query" />
                       <param name="00400244" style="query" />
300                    <param name="PerformedProcedureStepStartTime" style="query" />
                       <param name="00400245" style="query" />
302                    <param name="RequestAttributeSequence" style="query" />
                       <param name="00400275" style="query" />
304                    <param name="RequestAttributeSequence.ScheduledProcedureStepID"
                       style="query" />
306                    <param name="00400275.00400009" style="query" />
                       <param name="RequestAttributeSequence.RequestedProcedureID"
308                    style="query" />
                       <param name="00400275.00401001" style="query" />
310                    <param name="includefield" style="query" repeating="true">
                         <option value="all" />
312                    </param>
                  </request>
314             <response status="200">
                  <param name="Warning" style="header" fixed="299 {SERVICE}: The
316                fuzzymatching parameter is not supported. Only literal matching
                   has been performed." />
318                <representation mediaType="multipart/related;
                   type=application/dicom+xml" />
320                <representation mediaType="application/json" />
                </response>
322             <response status="400 401 403 413 503" />
              </method>
324           <resource path="{SeriesInstanceUID}">
                <method name="GET" id="RetrieveSeries">
326               <request>
                    <param name="Accept" style="header"
328                 default="multipart/related; type=application/dicom">
                      <option value="multipart/related; type=application/dicom" />
330                   <option value="multipart/related; type=application/dicom;
                      transfer-syntax=1.2.840.10008.1.2.1" />
332                   <option value="multipart/related; type=application/octet-
                      stream" />
334                 </param>
                  </request>
336               <response status="200 206">
                    <representation mediaType="multipart/related;
338                 type=application/dicom" />
                    <representation mediaType="multipart/related;
340                 type=application/dicom; transfer-syntax=1.2.840.10008.1.2.1"
                    />
342                 <representation mediaType="multipart/related;
                    type=application/octet-stream" />
344               </response>
                  <response status="400 404 406 410 503"></response>
346             </method>
                <resource path="instances">
```

```
348              <method name="GET" id="SearchForStudySeriesInstances">
                   <request>
350                  <param name="Accept" style="header"
                     default="multipart/related; type=application/dicom+xml">
352                    <option value="multipart/related;
                       type=application/dicom+xml" />
354                    <option value="application/json" />
                     </param>
356                  <param name="Cache-control" style="header">
                       <option value="no-cache" />
358                  </param>
                     <param name="limit" style="query" />
360                  <param name="offset" style="query" />
                     <param name="SOPClassUID" style="query" repeating="true" />
362                  <param name="00080016" style="query" repeating="true" />
                     <param name="SOPInstanceUID" style="query" repeating="true"
364                  />
                     <param name="00080018" style="query" repeating="true" />
366                  <param name="InstanceNumber" style="query" />
                     <param name="00200013" style="query" />
368                  <param name="includefield" style="query" repeating="true">
                       <option value="all" />
370                  </param>
                   </request>
372                <response status="200">
                     <param name="Warning" style="header" fixed="299 {SERVICE}:
374                  The fuzzymatching parameter is not supported. Only literal
                     matching has been performed." />
376                  <representation mediaType="multipart/related;
                     type=application/dicom+xml" />
378                  <representation mediaType="application/json" />
                   </response>
380                <response status="400 401 403 413 503" />
                 </method>
382              <resource path="{SOPInstanceUID}">
                   <method name="GET" id="RetrieveInstance">
384                  <request>
                       <param name="Accept" style="header"
386                    default="multipart/related; type=application/dicom">
                         <option value="multipart/related;
388                      type=application/dicom" />
                         <option value="multipart/related;
390                      type=application/dicom; transfer-
                         syntax=1.2.840.10008.1.2.1" />
392                      <option value="multipart/related;
                         type=application/octet-stream" />
394                    </param>
                     </request>
396                  <response status="200 206">
                       <representation mediaType="multipart/related;
398                    type=application/dicom" />
                       <representation mediaType="multipart/related;
400                    type=application/dicom; transfer-
                       syntax=1.2.840.10008.1.2.1" />
```

```
402                     <representation mediaType="multipart/related;
                        type=application/octet-stream" />
404                   </response>
                      <response status="400 404 406 410 503"></response>
406                 </method>
                    <resource path="frames">
408                   <resource path="{framelist}">
                        <method name="GET" id="RetrieveFrames">
410                       <request>
                            <param name="Accept" style="header"
412                         default="multipart/related; type=application/octet-
                            stream">
414                           <option value="multipart/related;
                              type=application/octet-stream" />
416                         </param>
                          </request>
418                       <response status="200">
                            <representation mediaType="multipart/related;
420                         type=application/octet-stream" />
                          </response>
422                       <response status="400 404 406 410 503"></response>
                        </method>
424                   </resource>
                    </resource>
426                 <resource path="metadata">
                      <method name="GET" id="RetrieveInstanceMetadata">
428                     <request>
                          <param name="Accept" style="header"
430                       default="multipart/related; type=application/dicom+xml">
                            <option value="multipart/related;
432                         type=application/dicom+xm;" />
                            <option value="application/json" />
434                       </param>
                        </request>
436                     <response status="200">
                          <representation mediaType=" multipart/related;
438                       type=application/dicom+xml" />
                        </response>
440                     <response status="400 404 406 410 503"></response>
                      </method>
442                 </resource>
                  </resource>
444             </resource>
                <resource path="metadata">
446               <method name="GET" id="RetrieveSeriesMetadata">
                    <request>
448                   <param name="Accept" style="header"
                      default="multipart/related; type=application/dicom+xml">
450                     <option value="multipart/related;
                        type=application/dicom+xm;" />
452                     <option value="application/json" />
                      </param>
454                 </request>
                    <response status="200">
```

```
456              <representation mediaType="multipart/related;
                 type=application/dicom+xml" />
458            </response>
               <response status="400 404 406 410 503"></response>
460          </method>
           </resource>
462        </resource>
         </resource>
464      <resource path="instances">
           <method name="GET" id="SearchForStudyInstances">
466          <request>
               <param name="Accept" style="header" default="multipart/related;
468            type=application/dicom+xml">
                 <option value="multipart/related; type=application/dicom+xml"
470              />
                 <option value="application/json" />
472            </param>
               <param name="Cache-control" style="header">
474              <option value="no-cache" />
               </param>
476            <param name="limit" style="query" />
               <param name="offset" style="query" />
478            <param name="SOPClassUID" style="query" />
               <param name="00080016" style="query" />
480            <param name="SOPInstanceUID" style="query" repeating="true" />
               <param name="00080018" style="query" repeating="true" />
482            <param name="Modality" style="query" />
               <param name="00080060" style="query" />
484            <param name="SeriesInstanceUID" style="query" repeating="true"
               />
486            <param name="0020000E" style="query" repeating="true" />
               <param name="SeriesNumber" style="query" />
488            <param name="00200011" style="query" />
               <param name="InstanceNumber" style="query" />
490            <param name="00200013" style="query" />
               <param name="PerformedProcedureStepStartDate" style="query" />
492            <param name="00400244" style="query" />
               <param name="PerformedProcedureStepStartTime" style="query" />
494            <param name="00400245" style="query" />
               <param name="RequestAttributeSequence" style="query" />
496            <param name="00400275" style="query" />
               <param name="RequestAttributeSequence.ScheduledProcedureStepID"
498            style="query" />
               <param name="00400275.00400009" style="query" />
500            <param name="RequestAttributeSequence.RequestedProcedureID"
               style="query" />
502            <param name="00400275.00401001" style="query" />
               <param name="includefield" style="query" repeating="true">
504              <option value="all" />
               </param>
506          </request>
             <response status="200">
508            <param name="Warning" style="header" fixed="299 {SERVICE}: The
               fuzzymatching parameter is not supported. Only literal matching
510            has been performed." />
```

```
                        <representation mediaType="multipart/related;
512                     type=application/dicom+xml" />
                        <representation mediaType="application/json" />
514                  </response>
                     <response status="400 401 403 413 503" />
516              </method>
             </resource>
518          <resource path="metadata">
                <method name="GET" id="RetrieveStudyMetadata">
520                <request>
                     <param name="Accept" style="header" default="multipart/related;
522                  type=application/dicom+xml">
                        <option value="multipart/related; type=application/dicom+xm;"
524                     />
                        <option value="application/json" />
526                  </param>
                  </request>
528                <response status="200">
                     <representation mediaType="multipart/related;
530                  type=application/dicom+xml" />
                  </response>
532                <response status="400 404 406 410 503"></response>
                </method>
534          </resource>
          </resource>
536      </resource>
       <resource path="series">
538      <method name="GET" id="SearchForSeries">
           <request>
540          <param name="Accept" style="header" default="multipart/related;
             type=application/dicom+xml">
542            <option value="multipart/related; type=application/dicom+xml" />
               <option value="application/json" />
544          </param>
             <param name="Cache-control" style="header">
546            <option value="no-cache" />
             </param>
548          <param name="limit" style="query" />
             <param name="offset" style="query" />
550          <param name="StudyDate" style="query" />
             <param name="00080020" style="query" />
552          <param name="StudyTime" style="query" />
             <param name="00080030" style="query" />
554          <param name="AccessionNumber" style="query" />
             <param name="00080050" style="query" />
556          <param name="Modality" style="query" />
             <param name="00080060" style="query" />
558          <param name="ModalitiesInStudy" style="query" />
             <param name="00080061" style="query" />
560          <param name="ReferringPhysicianName" style="query" />
             <param name="00080090" style="query" />
562          <param name="PatientName" style="query" />
             <param name="00100010" style="query" />
564          <param name="PatientID" style="query" />
             <param name="00100020" style="query" />
```

```
566            <param name="StudyInstanceUID" style="query" repeating="true" />
               <param name="0020000D" style="query" repeating="true" />
568            <param name="SeriesInstanceUID" style="query" />
               <param name="0020000E" style="query" />
570            <param name="StudyID" style="query" />
               <param name="00200010" style="query" />
572            <param name="SeriesNumber" style="query" />
               <param name="00200011" style="query" />
574            <param name="PerformedProcedureStepStartDate" style="query" />
               <param name="00400244" style="query" />
576            <param name="PerformedProcedureStepStartTime" style="query" />
               <param name="00400245" style="query" />
578            <param name="RequestAttributeSequence" style="query" />
               <param name="00400275" style="query" />
580            <param name="RequestAttributeSequence.ScheduledProcedureStepID"
               style="query" />
582            <param name="00400275.00400009" style="query" />
               <param name="RequestAttributeSequence.RequestedProcedureID"
584            style="query" />
               <param name="00400275.00401001" style="query" />
586            <param name="includefield" style="query" repeating="true">
                 <option value="all" />
588            </param>
          </request>
590        <response status="200">
             <param name="Warning" style="header" fixed="299 {SERVICE}: The
592          fuzzymatching parameter is not supported. Only literal matching has
             been performed." />
594          <representation mediaType="multipart/related;
             type=application/dicom+xml" />
596          <representation mediaType="application/json" />
           </response>
598        <response status="400 401 403 413 503" />
         </method>
600      <resource path="{SeriesInstanceUID}">
           <resource path="instances">
602          <method name="GET" id="SearchForSeriesInstances">
               <request>
604              <param name="Accept" style="header" default="multipart/related;
                 type=application/dicom+xml">
606                <option value="multipart/related; type=application/dicom+xml"
                   />
608                <option value="application/json" />
                 </param>
610              <param name="Cache-control" style="header">
                   <option value="no-cache" />
612              </param>
                 <param name="limit" style="query" />
614              <param name="offset" style="query" />
                 <param name="SOPClassUID" style="query" repeating="true" />
616              <param name="00080016" style="query" repeating="true" />
                 <param name="SOPInstanceUID" style="query" repeating="true" />
618              <param name="00080018" style="query" repeating="true" />
                 <param name="InstanceNumber" style="query" />
620              <param name="00200013" style="query" />
```

```
               <param name="includefield" style="query" repeating="true">
622              <option value="all" />
               </param>
624          </request>
            <response status="200">
626            <param name="Warning" style="header" fixed="299 {SERVICE}: The
               fuzzymatching parameter is not supported. Only literal matching
628            has been performed." />
               <representation mediaType="application/json" />
630            <representation mediaType="multipart/related;
               type=application/dicom+xml" />
632          </response>
            <response status="400 401 403 413 503" />
634        </method>
         </resource>
636    </resource>
     </resource>
638   <resource path="instances">
       <method name="GET" id="SearchForInstances">
640        <request>
           <param name="Accept" style="header" default="multipart/related;
642        type=application/dicom+xml">
             <option value="multipart/related; type=application/dicom+xml" />
644          <option value="application/json" />
           </param>
646        <param name="Cache-control" style="header">
             <option value="no-cache" />
648        </param>
           <param name="limit" style="query" />
650        <param name="offset" style="query" />
           <param name="SOPClassUID" style="query" repeating="true" />
652        <param name="00080016" style="query" repeating="true" />
           <param name="SOPInstanceUID" style="query" repeating="true" />
654        <param name="00080018" style="query" repeating="true" />
           <param name="StudyDate" style="query" />
656        <param name="00080020" style="query" />
           <param name="StudyTime" style="query" />
658        <param name="00080030" style="query" />
           <param name="AccessionNumber" style="query" />
660        <param name="00080050" style="query" />
           <param name="Modality" style="query" />
662        <param name="00080060" style="query" />
           <param name="ModalitiesInStudy" style="query" />
664        <param name="00080061" style="query" />
           <param name="ReferringPhysicianName" style="query" />
666        <param name="00080090" style="query" />
           <param name="PatientName" style="query" />
668        <param name="00100010" style="query" />
           <param name="PatientID" style="query" />
670        <param name="00100020" style="query" />
           <param name="StudyInstanceUID" style="query" repeating="true" />
672        <param name="0020000D" style="query" repeating="true" />
           <param name="SeriesInstanceUID" style="query" repeating="true" />
674        <param name="0020000E" style="query" repeating="true" />
           <param name="SeriesNumber" style="query" />
```

```
676          <param name="00200011" style="query" />
             <param name="InstanceNumber" style="query" />
678          <param name="00200013" style="query" />
             <param name="PerformedProcedureStepStartDate" style="query" />
680          <param name="00400244" style="query" />
             <param name="PerformedProcedureStepStartTime" style="query" />
682          <param name="00400245" style="query" />
             <param name="RequestAttributeSequence" style="query" />
684          <param name="00400275" style="query" />
             <param name="RequestAttributeSequence.ScheduledProcedureStepID"
686          style="query" />
             <param name="00400275.00400009" style="query" />
688          <param name="RequestAttributeSequence.RequestedProcedureID"
             style="query" />
690          <param name="00400275.00401001" style="query" />
             <param name="includefield" style="query" repeating="true">
692            <option value="all" />
             </param>
694        </request>
           <response status="200">
696          <param name="Warning" style="header" fixed="299 {SERVICE}: The
             fuzzymatching parameter is not supported. Only literal matching has
698          been performed." />
             <representation mediaType="multipart/related;
700          type=application/dicom+xml" />
             <representation mediaType="application/json" />
702        </response>
           <response status="400 401 403 413 503" />
704      </method>
       </resource>
706    <resource path="{BulkDataURL}">
         <method name="GET" id="RetrieveBulkData">
708        <request>
             <param name="Accept" style="header" default="multipart/related;
710          type=application/octet-stream">
               <option value="multipart/related; type=application/octet-stream"
712            />
             </param>
714        </request>
           <response status="200">
716          <representation mediaType="multipart/related;
             type=application/octet-stream" />
718        </response>
           <response status="400 404 406 410 503"></response>
720      </method>
       </resource>
722   </resources>
    </application>

724
```

726 ## Changes to NEMA Standards Publication PS 3.18

Digital Imaging and Communications in Medicine (DICOM)

728 ## Part 18: Web Services

Insert into PS 3.18 Section 3 Normative References (in correct alphabetical order)

730 **SUBM-wadl-20090831**   **Web Application Description Language (WADL),**
W3C Member Submission 31 August 2009
732 **http://www.w3.org/Submission/wadl/)**

---

734 **Insert into PS 3.18 Section 4 Terms and Definitions (in correct alphabetical order)**

Origin-Server   See IETF RFC-7230 Section 2.1 Client / Server Messaging
736 **User-Agent   See IETF RFC-7230 Section 2.1 Client / Server Messaging**

---

738 **Insert into PS 3.18 Section 5 Symbols and abbreviated terms (in correct alphabetical order)**

5 Symbols and abbreviated terms

740 **WADL   Web Application Description Language**

---

742 **Update PS 3.18 Section 6   Data Communication Requirements**

6 Data Communication Requirements

744 **6.1   INTERACTION**

The interaction shall be as shown in Figure 6-1.

746 Multiple communications modes are possible:

— URI based mechanism using HTTP Get: WADO-URI Type request

748

— Web Services (WS*) using HTTP Post: WADO-WS, either:
750 a. DICOM Requester (Retrieve Imaging Document Set)
   b. Rendered Requester (Retrieve Rendered Imaging Document Set)
752 c. Metadata Requester (Retrieve Imaging Document Set Metadata)

754 — RESTful Services (RS) using HTTP Get: WADO-RS, either:

    a. DICOM Requester (Retrieve Study, Series, or Instance DICOM Objects)

756   b. Pixel Data Requester (Retrieve Instance Frame Pixel Data)

    c. Bulk Data Requester (Retrieve Study, Series, Instance bulk data)

758   d. Metadata Requester (Retrieve Study Metadata)

760 — RESTful Services (RS) using HTTP Get: QIDO-RS:

    a. Query Requester (Search for Study, Series or Instance DICOM Objects)

762

— RESTful Services (RS) using HTTP Post: STOW-RS, either:

764   a. DICOM Creator (Store Instances)

    b. Metadata and Bulk Data Creator (Store Instances)

766

— RESTful Services (RS) using HTTP Options: RS Capabilities:

768   **a. Provided information about the capabilities of a DICOM RESTful web service provider)**

770 | **Append to PS 3.18 Section 6 Data Communication Requirements** |
| --- |

6.X   RS CAPABILITIES SERVICE

772 DICOM RS Capabilities Service defines a single transaction type which shall be supported by all implementations:

774   1. RetrieveCapabilities

    This transaction retrieves the parameters for services supported by the server.

776

6.X.1   Retrieve Capabilities

778 **6.X.1.1   Request Message**

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

780 — {SERVICE}[/{InformationEntity}]

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

    — where {InformationEntity} is the path to a defined DICOM RESTful service resource, such as:

784   — 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)

786   — QIDO-RS (see 6.7.1)

788 **6.X.1.1.1   Method = OPTIONS**

The Retrieve Server Options Service request messages use the OPTIONS method.

790 **6.X.1.1.2   Header Fields**

The Retrieve Server Options Service request messages can include the following header fields:

792 Accept:

    — application/vnd.sun.wadl+xml

794 — application/json

6.X.1.2 Response message

All responses are http single part messages. A successful response will return a Web Application
798 Description Language (WADL) document encoded in a Media Type consistent with the Accept header of
the request.

800 The WADL document shall contain one top-level "application" element.

The "application" element shall contain one "resources" element whose "base" attribute value is
802 {SERVICE}, where {SERVICE} is the base URL for the service. This may be a combination of protocol
(either http or https), host, port, and application.

804 Additionally, the WADL content shall include a "resource" element for the resource specified in the request
(see 6.X.1.1) describing all methods (see 6.X.1.2.1.2 for description and examples) and child resources
806 (see 6.X.1.2.1.1 for description and examples) for the specified resource and each of its children.

6.X.1.2.1 Resources

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

810 For informative purposes, the full resource tree and the methods defined for each resource are described
in Table 6.X-1:

812 **Table 6.X-1**
Resources and Methods

Resource	Methods supported (excluding RetrieveCapabilities)	Reference
{SERVICE}	N/A	N/A
— studies	SearchForStudies	6.X.1.2.2.3
	StoreInstances	6.X.1.2.2.2
— {StudyInstanceUID}	RetrieveStudy	6.X.1.2.2.1
	StoreInstances – specified Study	6.X.1.2.2.3
— metadata	RetrieveMetadata – Study	6.X.1.2.2.1
— series	SearchForSeries	6.X.1.2.2.3
— {SeriesInstanceUID}	RetrieveSeries	6.X.1.2.2.1
— metadata	RetrieveMetadata – Series	6.X.1.2.2.1
— instances	SearchForInstances	6.X.1.2.2.3
— {SOPInstanceUID}	RetrieveInstance	6.X.1.2.2.1
— metadata	RetrieveMetadata – Instance	6.X.1.2.2.1
— frames	N/A	N/A
— {framelist}	RetrieveFrames	6.X.1.2.2.1
— instances	SearchForInstances – no specified Series	6.X.1.2.2.3
— series	SearchForSeries – no specified Study	6.X.1.2.2.3
— {SeriesInstanceUID}	N/A	N/A
— instances	SearchForInstances – no specified Study	6.X.1.2.2.3
— instances	SearchForInstances – no specified Study or Series	6.X.1.2.2.3

| — {BulkDataURL} | RetrieveBulkData | 6.X.1.2.2.1 |

814

6.X.1.2.2 Methods

816 ### 6.X.1.2.2.1 Retrieve Methods

The Retrieve methods define the capabilities of a WADO-RS resource (see 6.5).

818 The Retrieve methods shall contain the following attributes:

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

820 — An "id" attribute with a value of "RetrieveStudy", "RetrieveSeries", "RetrieveInstance",
"RetrieveBulkData", "RetrieveFrames", "RetrieveStudyMetadata", "RetrieveSeriesMetadata" or
822 "RetrieveInstanceMetadata" depending on the full resource path

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

— supported Accept header values

826 — if the same Media Type is supported with multiple Transfer Syntaxes there should be one
entry for each combination of Media Type and Transfer Syntax

828

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

830 — supported Status Codes

— Media Types returned for each Status Code (if applicable)

832 — if the same Media Type is supported with multiple Transfer Syntaxes there should be one
entry for each combination of Media Type and Transfer Syntax

834

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

836

Example:

838
```
<method name="GET" id="RetrieveStudies">
 <request>
840   <param name="Accept" style="header" default="multipart/related;
      type=application/dicom">
842     <option value="multipart/related; type=application/dicom" />
        <option value="multipart/related; type=application/dicom"; transfer-
844     syntax=1.2.840.10008.1.2 />
        <option value="multipart/related; type=application/dicom"; transfer-
846     syntax=1.2.840.10008.1.2.1 />
        <option value="multipart/related; type=application/octet-stream" />
848     <option value="multipart/related; type=image/dicom+jpx" />
        <option value="multipart/related; type=image/dicom+jpx; transfer-
850     syntax=1.2.840.10008.1.2.4.92" />
        <option value="multipart/related; type= video/mpeg; transfer-
852     syntax=1.2.840.10008.1.2.4.100" />
      </param>
854   </request>
    <response status="200,206">
856     <representation mediaType="multipart/related; type=application/dicom";
      transfer-syntax=1.2.840.10008.1.2 />
858     <representation mediaType="multipart/related; type=application/dicom";
      transfer-syntax=1.2.840.10008.1.2.1 />
```

```
860        <representation mediaType="multipart/related; type=application/octet-
           stream" />
862        <representation mediaType="multipart/related; type= image/dicom+jpx" />
           <representation mediaType="multipart/related; type= image/dicom+jpx;
864        transfer-syntax=1.2.840.10008.1.2.4.92" />
           <representation mediaType="multipart/related; type= video/mpeg; transfer-
866        syntax=1.2.840.10008.1.2.4.100" />
         </response>
868      <response status="400 404 406 410 503" />
       </method>
870
```

6.X.1.2.2.2   Store Methods

872 The Store methods define the capabilities of a STOW-RS resource (see 6.6).

The Store methods shall contain the following attributes:

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

— An "id" attribute with a value of "StoreInstances" or "StoreStudyInstances"

876

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

878 — supported Accept header values

— supported Representations

880 — if the same Media Type is supported with multiple Transfer Syntaxes there should be one
entry for each combination of Media Type and Transfer Syntax

882

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

884 — supported Status Codes

— Media Types returned for each Status Code (if applicable)

886 — Headers returned for each Status Code

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

890 Example:

```
<method name="GET" id="StoreInstances">
892  <request>
       <param name="Accept" style="header" default="application/dicom+xml">
894      <option value="application/dicom+xml" />
       </param>
896    <representation mediaType="multipart/related; type=application/dicom" />
       <representation mediaType="multipart/related; type=application/dicom";
898    transfer-syntax=1.2.840.10008.1.2 />
       <representation mediaType="multipart/related; type=application/dicom";
900    transfer-syntax=1.2.840.10008.1.2.1 />
       <representation mediaType="multipart/related;
902    type=application/dicom+xml" />
       <representation mediaType="multipart/related;
904    type=application/dicom+xml; transfer-syntax=1.2.840.10008.1.2" />
       <representation mediaType="multipart/related;
906    type=application/dicom+xml; transfer-syntax=1.2.840.10008.1.2.1" />
       <representation mediaType="multipart/related;
908    type=application/dicom+xml; transfer-syntax=1.2.840.10008.1.2.4.92" />
```

```
            <representation mediaType="multipart/related;
910         type=application/dicom+xml; transfer-syntax=1.2.840.10008.1.2.4.100" />
          </request>
912       <response status="200" />
          <response status="202,409">
914         <representation mediaType="application/dicom+xml" />
          </response>
916       <response status="400,401,403,503" />
        </method>
918
```

6.X.1.2.2.3   Search Methods

920 The Search methods define the capabilities of a QIDO-RS resource (see 6.7).

The Search methods shall contain the following attributes:

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

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

926

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

928   — supported Accept header values

    — support for the Cache-control header

930   — support of "limit", "offset" and "fuzzymatching" query parameters

    — supported search parameters (both tag and keyword variants shall be listed)

932   — supported options for the "includefield" parameter (both tag and keyword variants shall be listed)

934 The Search methods shall contain one or more "response" elements documenting the following:

    — supported Status Codes

936   — returned "header" parameters, including use of "warning headers"

    — Media Types returned for each Status Code (if applicable)

938

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

940

Example:

```
942  <method name="GET" id="SearchForStudies">
      <request>
944      <param name="Accept" style="header" default="multipart/related;
         type=application/dicom+xml">
946        <option value="multipart/related; type=application/dicom+xml" />
           <option value="application/json" />
948      </param>
         <param name="Cache-control" style="header">
950        <option value="no-cache" />
         </param>
952      <param name="limit" style="query" />
         <param name="offset" style="query" />
954      <param name="fuzzymatching" style="query" />
         <param name="StudyDate" style="query" />
956      <param name="00080020" style="query" />
```

```
         <param name="StudyTime" style="query" />
958      <param name="00080030" style="query" />
         …
960      <param name="includefield" style="query" repeating="true" />
           <option value="all" />
962        <option value="00081049" />
           <option value="PhysiciansOfRecordIdentificationSequence" />
964        <option value="00081060" />
           <option value="NameOfPhysiciansReadingStudy" />
966        …
         </param>
968    </request>
       <response status="200">
970      <representation mediaType="multipart/related;
         type=application/dicom+xml" />
972      <representation mediaType="application/json" />
       </response>
974    <response status="400 401 403 413 503" />
     </method>
```
976

6.X.1.3   Status Codes

978 Table 6.X-2 lists the HTTP/1.1 status codes that shall be used to report any of the associated error and warning situations. Other error codes may be present for other error and warning situations.

980

Table 6.X-2
SERVER OPTIONS HTTP/1.1 STATUS CODES

Code	Name	Description
Success		
200	OK	The query completed and any matching results are returned in the message body.
Failure		
400	Bad Request	The Server Options Provider was unable to perform the query because the Service Provider cannot understand the query component.
401	Unauthorized	The Server Options Provider refused to perform the query because the client is not authenticated.
403	Forbidden	The Server Options Provider understood the request, but is refusing to perform the query (e.g. an authenticated user with insufficient privileges).
503	Busy	Service is unavailable.

982

Append to PS 3.18
984

Annex X WADL JSON Representation

986 **X.1   INTRODUCTION**

While the WADL specification only specifies an XML encoding for the WADL payload, the data structure
988 can easily be represented using JSON. Additionally, conversion from XML to JSON and vice-versa can be
done in a lossless manner.

990 **X.2   XML ELEMENTS**

The JSON encoding of WADL XML elements depends on whether the element is:

992   — a "doc" element

    — an element that is unique within a particular parent element (e.g. "request")

994   — an element that can be repeated within a particular parent element (e.g. "param")

996 **X.2.1   Doc Elements**

A "doc" element is represented as an array of objects, where each object may contain:

998   — a "@xml:lang" string

    — a "@title" string

1000   — a "value" string

```
1002    e.g.
      "doc": [
1004       {
            "@xml:lang": "en",
1006         "value": "Granular cell tumor"
          },
1008       {
            "@xml:lang": "ja",
1010         "value": "顆粒細胞腫"
          },
1012       {
            "@xml:lang": "fr",
1014         "value": "Tumeur à cellules granuleuses"
          }
1016    ]
```

1018 **X.2.2   Unique Elements**

All unique WADL XML elements are represented as an object whose name is the name of the XML
1020 element and where each member may contain:

    — a "@{attribute}" string for each XML attribute of the name {attribute}
1022   — a child object for each child element that must be unique

    — a child array for each child element that may not be unique
1024

```
    e.g.
1026  "request": {
          "param": [ ... ],
```

```
1028              "representation": [ ... ]
          }
1030
```

X.2.3   Repeatable Elements

1032

All repeatable WADL XML elements are represented as an array of objects whose name is the name of
1034 the XML element and where each may contain:

— a "@{attribute}" string for each XML attribute of the name {attribute}
1036 — a child object for each child element that must be unique

— a child array for each child element that may not be unique

1038

```
        e.g.
1040  "param": [
            {
1042          "@name": "Accept",
              "@style": "header"
1044        },
            {
1046          "@name": "Cache-control",
              "@style": "header"
1048        }
          ]
```