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

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### *Supplement 170: Service Capabilities for RESTful Services*

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## Scope and Field of Application

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

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

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

### 74 **CONCEPTS:**

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

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

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

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## Changes to NEMA Standards Publication PS 3.15-2012

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

88

#### Part 15: Security and System Management Profiles

Update PS 3.15 Section H.2.3 Referenced Standards as follows

#### 90 H.2.3 Referenced Standards

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

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

RFC-2782 A DNS RR for specifying the location of services (DNS SRV)

94 <<http://www.ietf.org/rfc/rfc2782.txt>>

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

96 ~~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>>~~

~~RFC-6763 DNS-Based Service Discovery <[100 ~~editor.org/rfc/rfc6763.txt~~<http://files.dns-sd.org/draft-cheshire-dnsxt-dns-sd.txt>>](http://www.rfc-</a></del></p></div><div data-bbox=)~~

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

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

104 ~~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 Class(es) supported, shall be

- 108 — “dicom” for unsecured DICOM communication
- “dicom-tls” for the Basic TLS Secure Transport Connection Profile
- 110 — “dicom-iscl” for ISCL Transport Connection Profile
- **“dicomweb” for DICOM web services over unsecured http**
- 112 — **“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.

The DNS TXT record may contain the following parameters:

- 120 — AET=<*application entity title*>, where the value <*application entity title*> is to be used as the Called Application Entity Title when initiating Associations to the device
- 122 — PrimaryDeviceType=<*primary device type*>, where the value <*primary device type*> is as defined Table H.1-2 Attributes of Device Object
- 124 — **DICOMWebPath=<service>, where the value <service> is the path component of the DICOM Web Service root as defined in PS 3.18 Section 6.3.1**

126

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 AET.

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

#### 138 **H.2.4 Examples**

##### **Example SRV record:**

140 — **dicomweb-tls. tcp.nema.org 86400 IN SRV 10 60 443 dicomweb.nema.org.**

##### 142 **Example TXT record:**

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

144

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

146 — **https://dicomweb.nema.org:443/apps/dicom-rs**

148 \*

## Changes to NEMA Standards Publication PS 3.17-2012

150

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

#### Part 17: Explanatory Information

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

### 4 SYMBOLS AND ABBREVIATIONS

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

**WADL      Web Application Description Language**

156

**Append below PS 3.17 Annex HHH.4**

158 **HHH.5            USES FOR SERVER OPTIONS SERVICES**

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

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

166 **HHH.5.1          WADL Example (XML)**

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

```
170 <application xsi:schemaLocation="http://wadl.dev.java.net/2009/02 wadl.xsd"
171 xmlns:xsd="http://www.w3.org/2001/XMLSchema">
172   <resources base="http://medical.nema.org/dicomweb">
173     <resource path="studies">
174       <method name="GET" id="SearchForStudies">
175         <request>
176           <param name="Accept" style="header" default="multipart/related;
177             type=application/dicom+xml">
178             <option value="multipart/related; type=application/dicom+xml" />
179             <option value="application/json" />
180           </param>
181           <param name="Cache-control" style="header">
182             <option value="no-cache" />
183           </param>
184         </request>
185       </method>
186     </resource>
187   </resources>
188 </application>
```

```
182     </param>
183     <param name="limit" style="query" />
184     <param name="offset" style="query" />
185     <param name="StudyDate" style="query" />
186     <param name="00080020" style="query" />
187     <param name="StudyTime" style="query" />
188     <param name="00080030" style="query" />
189     <param name="AccessionNumber" style="query" />
190     <param name="00080050" style="query" />
191     <param name="ModalitiesInStudy" style="query" />
192     <param name="00080061" style="query" />
193     <param name="ReferringPhysicianName" style="query" />
194     <param name="00080090" style="query" />
195     <param name="PatientName" style="query" />
196     <param name="00100010" style="query" />
197     <param name="PatientID" style="query" />
198     <param name="00100020" style="query" />
199     <param name="StudyInstanceUID" style="query" repeating="true" />
200     <param name="0020000D" style="query" repeating="true" />
201     <param name="StudyID" style="query" />
202     <param name="00200010" style="query" />
203     <param name="includefield" style="query" repeating="true">
204         <option value="all" />
205     </param>
206 </request>
207 <response status="200">
208     <representation mediaType="multipart/related;
209     type=application/dicom+xml" />
210     <representation mediaType="application/json" />
211     <param name="Warning" style="header" fixed="299 {SERVICE}: The
212     fuzzymatching parameter is not supported. Only literal matching has
213     been performed." />
214 </response>
215 <response status="400,401,403,413,503" />
216 </method>
217 <method name="POST" id="StoreInstances">
218     <request>
219         <param name="Accept" style="header" default="application/dicom+xml">
220             <option value="application/dicom+xml" />
221         </param>
222         <representation mediaType="multipart/related;
223         type=application/dicom" />
224         <representation mediaType="multipart/related;
225         type=application/dicom; transfer-syntax=1.2.840.10008.1.2.1" />
226         <representation mediaType="multipart/related;
227         type=application/dicom+xml" />
228     </request>
229     <response status="202,409">
230         <representation mediaType="application/dicom+xml" />
231     </response>
232     <response status="400,401,403,503" />
233 </method>
234 <resource path="{StudyInstanceUID}">
235     <method name="GET" id="RetrieveStudy">
236         <request>
```

```
238     <param name="Accept" style="header" default="multipart/related;
type=application/dicom">
240         <option value="multipart/related; type=application/dicom" />
242         <option value="multipart/related; type=application/dicom;
transfer-syntax=1.2.840.10008.1.2.1" />
244         <option value="multipart/related; type=application/octet-stream"
/>
246     </param>
</request>
248 <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" />
</response>
256 <response status="400,404,406,410,503"></response>
</method>
258 <method name="POST" id="StoreInstances">
260     <request>
262         <param name="Accept" style="header"
default="application/dicom+xml">
264             <option value="application/dicom+xml" />
266         </param>
268         <representation mediaType="multipart/related;
type=application/dicom" />
270         <representation mediaType="multipart/related;
type=application/dicom; transfer-syntax=1.2.840.10008.1.2.1" />
272         <representation mediaType="multipart/related;
type=application/dicom+xml" />
274     </request>
276     <response status="202,409">
278         <representation mediaType="application/dicom+xml" />
280     </response>
282     <response status="400,401,403,503" />
</method>
284 <resource path="series">
286     <method name="GET" id="SearchForSeries">
288         <request>
290             <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">
                <option value="no-cache" />
            </param>
            <param name="limit" style="query" />
            <param name="offset" style="query" />
            <param name="Modality" style="query" />
            <param name="00080060" style="query" />
            <param name="SeriesInstanceUID" style="query" repeating="true"
/>
        </request>
    </method>
</resource>
</service>
</capabilities>
```



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

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

```
402         <response status="400,404,406,410,503"></response>
403     </method>
404 <resource path="frames">
405     <resource path="{framelist}">
406         <method name="GET" id="RetrieveFrames">
407             <request>
408                 <param name="Accept" style="header"
409                     default="multipart/related; type=application/octet-
410 stream">
411                 <option value="multipart/related;
412                     type=application/octet-stream" />
413                 </param>
414             </request>
415             <response status="200">
416                 <representation mediaType="multipart/related;
417                     type=application/octet-stream" />
418             </response>
419             <response status="400,404,406,410,503"></response>
420         </method>
421     </resource>
422 </resource>
423 <resource path="metadata">
424     <method name="GET" id="RetrieveMetadata">
425         <request>
426             <param name="Accept" style="header"
427                 default="multipart/related; type=application/dicom+xml">
428             <option value="multipart/related;
429                 type=application/dicom+xml;" />
430             <option value="application/json" />
431             </param>
432         </request>
433         <response status="200">
434             <representation mediaType=" multipart/related;
435                 type=application/dicom+xml" />
436         </response>
437         <response status="400,404,406,410,503"></response>
438     </method>
439 </resource>
440 </resource>
441 </resource>
442 <resource path="metadata">
443     <method name="GET" id="RetrieveMetadata">
444         <request>
445             <param name="Accept" style="header"
446                 default="multipart/related; type=application/dicom+xml">
447             <option value="multipart/related;
448                 type=application/dicom+xml;" />
449             <option value="application/json" />
450             </param>
451         </request>
452         <response status="200">
453             <representation mediaType="multipart/related;
454                 type=application/dicom+xml" />
455         </response>
456         <response status="400,404,406,410,503"></response>
```

```

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

```

```
512         <response status="400,401,403,413,503" />
513     </method>
514 </resource>
515 <resource path="metadata">
516     <method name="GET" id="RetrieveMetadata">
517         <request>
518             <param name="Accept" style="header" default="multipart/related;
519                 type=application/dicom+xml">
520                 <option value="multipart/related; type=application/dicom+xml;"
521                     />
522                 <option value="application/json" />
523             </param>
524         </request>
525         <response status="200">
526             <representation mediaType="multipart/related;
527                 type=application/dicom+xml" />
528         </response>
529         <response status="400,404,406,410,503"></response>
530     </method>
531 </resource>
532 </resource>
533 </resource>
534 <resource path="series">
535     <method name="GET" id="SearchForSeries">
536         <request>
537             <param name="Accept" style="header" default="multipart/related;
538                 type=application/dicom+xml">
539                 <option value="multipart/related; type=application/dicom+xml" />
540                 <option value="application/json" />
541             </param>
542             <param name="Cache-control" style="header">
543                 <option value="no-cache" />
544             </param>
545             <param name="limit" style="query" />
546             <param name="offset" style="query" />
547             <param name="StudyDate" style="query" />
548             <param name="00080020" style="query" />
549             <param name="StudyTime" style="query" />
550             <param name="00080030" style="query" />
551             <param name="AccessionNumber" style="query" />
552             <param name="00080050" style="query" />
553             <param name="Modality" style="query" />
554             <param name="00080060" style="query" />
555             <param name="ModalitiesInStudy" style="query" />
556             <param name="00080061" style="query" />
557             <param name="ReferringPhysicianName" style="query" />
558             <param name="00080090" style="query" />
559             <param name="PatientName" style="query" />
560             <param name="00100010" style="query" />
561             <param name="PatientID" style="query" />
562             <param name="00100020" style="query" />
563             <param name="StudyInstanceUID" style="query" repeating="true" />
564             <param name="0020000D" style="query" repeating="true" />
565             <param name="SeriesInstanceUID" style="query" />
566             <param name="0020000E" style="query" />
```

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

```
622     <response status="200">
623         <representation mediaType="multipart/related;
624             type=application/dicom+xml" />
625         <representation mediaType="application/json" />
626         <param name="Warning" style="header" fixed="299 {SERVICE}: The
627             fuzzymatching parameter is not supported. Only literal matching
628             has been performed." />
629     </response>
630     <response status="400,401,403,413,503" />
631 </method>
632 </resource>
633 </resource>
634 </resource>
635 <resource path="instances">
636     <method name="GET" id="SearchForInstances">
637         <request>
638             <param name="Accept" style="header" default="multipart/related;
639                 type=application/dicom+xml">
640                 <option value="multipart/related; type=application/dicom+xml" />
641                 <option value="application/json" />
642             </param>
643             <param name="Cache-control" style="header">
644                 <option value="no-cache" />
645             </param>
646             <param name="limit" style="query" />
647             <param name="offset" style="query" />
648             <param name="SOPClassUID" style="query" repeating="true" />
649             <param name="00080016" style="query" repeating="true" />
650             <param name="SOPInstanceUID" style="query" repeating="true" />
651             <param name="00080018" style="query" repeating="true" />
652             <param name="StudyDate" style="query" />
653             <param name="00080020" style="query" />
654             <param name="StudyTime" style="query" />
655             <param name="00080030" style="query" />
656             <param name="AccessionNumber" style="query" />
657             <param name="00080050" style="query" />
658             <param name="Modality" style="query" />
659             <param name="00080060" style="query" />
660             <param name="ModalitiesInStudy" style="query" />
661             <param name="00080061" style="query" />
662             <param name="ReferringPhysicianName" style="query" />
663             <param name="00080090" style="query" />
664             <param name="PatientName" style="query" />
665             <param name="00100010" style="query" />
666             <param name="PatientID" style="query" />
667             <param name="00100020" style="query" />
668             <param name="StudyInstanceUID" style="query" repeating="true" />
669             <param name="0020000D" style="query" repeating="true" />
670             <param name="SeriesInstanceUID" style="query" repeating="true" />
671             <param name="0020000E" style="query" repeating="true" />
672             <param name="SeriesNumber" style="query" />
673             <param name="00200011" style="query" />
674             <param name="InstanceNumber" style="query" />
675             <param name="00200013" style="query" />
676             <param name="PerformedProcedureStepStartDate" style="query" />
```

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

722
```



## Changes to NEMA Standards Publication PS 3.18-2012

724

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

#### Part 18: Web Services

726

Insert into PS 3.18 Section 4 Normative References (in correct alphabetical order)

728

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

730

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

732

#### 5 Symbols and abbreviated terms

734

WADL      Web Application Description Language

Update PS 3.18 Section 9 RS Protocol as indicated.

736

#### 9 RS Protocol

The RS Protocol specifies RESTful Web Services. The following services have been defined:

738

**Retrieve Service**      Retrieves study, series, instance, or frame objects in various media types.

**Store Service**      Stores or updates study information in various formats.

740

**Query Service**      Searches for studies, series, or instances that match a specified search criteria.

742

**Capabilities Service**      **Provides information about the capabilities of a DICOM RESTful web service provider**

744

Append to PS 3.18 Section 6 RS Protocol

746

#### 6.X      RS CAPABILITIES SERVICE

748

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

1. RetrieveCapabilities

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

## 752 **6.X.1 Retrieve Capabilities**

### **6.X.1.1 Request Message**

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

— {SERVICE}/{InformationEntity}

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

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

— WADO-RS (see 6.5.1, 6.5.2, 6.5.3, 6.5.4, 6.5.5, 6.5.6)

760 — STOW-RS (see 6.6.1)

— QIDO-RS (see 6.7.1)

762

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

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

#### **6.X.1.1.2 Header Fields**

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

Accept:

768 — application/vnd.sun.wadl+xml

— application/json

770

#### **6.X.1.2 Response messages**

772 All responses shall be http single part messages. A successful response will return a Web Application Description Language (WADL) document.

774 The WADL document shall contain one top-level “application” element.

The “application” element shall contain one “resources” element whose “base” attribute value is

776 {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.

778 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

780 (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**

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

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

786

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

| <b>Resource</b> | <b>Methods supported<br/>(excluding RetrieveCapabilities)</b> | <b>Reference</b> |
|-----------------|---|------------------|
| {SERVICE}       | N/A   | N/A              |

|                       |   |                            |
|-----------------------|---|----------------------------|
| — studies             | SearchForStudies<br>StoreInstances                | 6.X.1.2.2.3<br>6.X.1.2.2.2 |
| — {StudyInstanceUID}  | RetrieveStudy<br>StoreInstances – specified Study | 6.X.1.2.2.1<br>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                |

788

**6.X.1.2.2 Methods**790 **6.X.1.2.2.1 Retrieve Methods**

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

792 The Retrieve methods shall contain the following attributes:

- A “name” attribute with a value of “GET”
- 794 — An “id” attribute with a value of “RetrieveStudy”, “RetrieveSeries”, “RetrieveInstance”,  
“RetrieveBulkData”, “RetrieveFrames” or “RetrieveMetadata” depending on the full resource path
- 796

The Retrieve methods shall contain a “request” element with “param” elements documenting the following:

- 798 — supported Accept header values
- 800 — 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

802 The Retrieve methods shall contain one or more “response” elements documenting the following:

- supported Status Codes
- 804 — Media Types returned for each Status Code (if applicable)
- 806 — 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

808 Note: More than one Status Code can be described by a single “response” element

810 Example:

```

810 <method name="GET" id="RetrieveStudies">
812   <request>
813     <param name="Accept" style="header" default="multipart/related;
814       type=application/dicom">
815       <option value="multipart/related; type=application/dicom" />
816       <option value="multipart/related; type=application/dicom"; transfer-
817         syntax=1.2.840.10008.1.2 />
818       <option value="multipart/related; type=application/dicom"; transfer-
819         syntax=1.2.840.10008.1.2.1 />
820       <option value="multipart/related; type=application/octet-stream" />
821       <option value="multipart/related; type=image/dicom+jpx" />
822       <option value="multipart/related; type=image/dicom+jpx; transfer-
823         syntax=1.2.840.10008.1.2.4.92" />
824       <option value="multipart/related; type= video/mpeg; transfer-
825         syntax=1.2.840.10008.1.2.4.100" />
826     </param>
827   </request>
828   <response status="200,206">
829     <representation mediaType="multipart/related; type=application/dicom";
830       transfer-syntax=1.2.840.10008.1.2 />
831     <representation mediaType="multipart/related; type=application/dicom";
832       transfer-syntax=1.2.840.10008.1.2.1 />
833     <representation mediaType="multipart/related; type=application/octet-
834       stream" />
835     <representation mediaType="multipart/related; type= image/dicom+jpx" />
836     <representation mediaType="multipart/related; type= image/dicom+jpx;
837       transfer-syntax=1.2.840.10008.1.2.4.92" />
838     <representation mediaType="multipart/related; type= video/mpeg; transfer-
839       syntax=1.2.840.10008.1.2.4.100" />
840   </response>
841   <response status="400,404,406,410,503" />
842 </method>

```

#### 844 6.X.1.2.2.2 Store Methods

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

846 The Store methods shall contain the following attributes:

- A “name” attribute with a value of “POST”
- 848 — An “id” attribute with a value of “StoreInstances”

850 The Store methods shall contain a “request” element with “param” elements documenting the following:

- supported Accept header values
- 852 — supported Representations
  - if the same Media Type is supported with multiple Transfer Syntaxes there should be one
  - 854 entry for each combination of Media Type and Transfer Syntax

856 The Store methods shall contain one or more “response” elements documenting the following:

- supported Status Codes
- 858 — Media Types returned for each Status Code (if applicable)

— Headers returned for each Status Code

860

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

862

Example:

```

864 <method name="GET" id="StoreInstances">
    <request>
866     <param name="Accept" style="header" default="application/dicom+xml">
868       <option value="application/dicom+xml" />
868     </param>
870     <representation mediaType="multipart/related; type=application/dicom" />
870     <representation mediaType="multipart/related; type=application/dicom";
872     transfer-syntax=1.2.840.10008.1.2 />
872     <representation mediaType="multipart/related; type=application/dicom";
874     transfer-syntax=1.2.840.10008.1.2.1 />
874     <representation mediaType="multipart/related;
876     type=application/dicom+xml" />
876     <representation mediaType="multipart/related;
878     type=application/dicom+xml; transfer-syntax=1.2.840.10008.1.2" />
878     <representation mediaType="multipart/related;
880     type=application/dicom+xml; transfer-syntax=1.2.840.10008.1.2.1" />
880     <representation mediaType="multipart/related;
882     type=application/dicom+xml; transfer-syntax=1.2.840.10008.1.2.4.92" />
882     <representation mediaType="multipart/related;
884     type=application/dicom+xml; transfer-syntax=1.2.840.10008.1.2.4.100" />
884   </request>
886   <response status="200" />
886   <response status="202,409">
888     <representation mediaType="application/dicom+xml" />
888   </response>
890   <response status="400,401,403,503" />
</method>

```

### 892 6.X.1.2.2.3 Search Methods

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

894 The Search methods shall contain the following attributes:

- A “name” attribute with a value of “GET”
- 896 — An “id” attribute with a value of “SearchForStudies”, “SearchForSeries” or “SearchForInstances”  
depending on the level of the parent resource

898

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

- 900 — supported Accept header values
- support for the Cache-control header
- 902 — support of “limit”, “offset” and “fuzzymatching” query parameters
- supported search parameters (both tag and keyword variants shall be listed)
- 904 — supported options for the “includefield” parameter (both tag and keyword variants shall be listed)

906 The Search methods shall contain one or more “response” elements documenting the following:

- supported Status Codes

- 908 — returned “header” parameters, including use of “warning headers”
- Media Types returned for each Status Code (if applicable)

910

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

912

Example:

```

914 <method name="GET" id="SearchForStudies">
    <request>
916     <param name="Accept" style="header" default="multipart/related;
        type=application/dicom+xml">
918         <option value="multipart/related; type=application/dicom+xml" />
        <option value="application/json" />
920     </param>
    <param name="Cache-control" style="header">
922     <option value="no-cache" />
    </param>
924     <param name="limit" style="query" />
    <param name="offset" style="query" />
926     <param name="fuzzymatching" style="query" />
    <param name="StudyDate" style="query" />
928     <param name="00080020" style="query" />
    <param name="StudyTime" style="query" />
930     <param name="00080030" style="query" />
    ...
932     <param name="includefield" style="query" repeating="true" />
        <option value="all" />
934         <option value="00081049" />
        <option value="PhysiciansOfRecordIdentificationSequence" />
936         <option value="00081060" />
        <option value="NameOfPhysiciansReadingStudy" />
938     ...
    </param>
940 </request>
    <response status="200">
942     <representation mediaType="multipart/related;
        type=application/dicom+xml" />
944     <representation mediaType="application/json" />
    </response>
946     <response status="400,401,403,413,503" />
</method>

```

948

### 6.X.1.3 Status Codes

950 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.

952

**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.   |

954

956

**Append to PS 3.18**

## Annex X WADL JSON Representation

958

### X.1 INTRODUCTION

960

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

962

### X.2 XML ELEMENTS

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

964

- a “doc” element
- an element that is unique within a particular parent element (e.g. “request”)
- an element that can be repeated within a particular parent element (e.g. “param”)

968

#### X.2.1 Doc Elements

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

970

- a “@xml:lang” string
- a “@title” string
- a “value” string

974

e.g.

976

```
"doc": [  
  {  
    "@xml:lang": "en",  
    "value": "Wang^XiaoDong"
```

978

```
980     },  
981     {  
982         "@xml:lang": "cn",  
983         "value": "王^小東"  
984     }  
985 ]
```

### 986 **X.2.2 Unique Elements**

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

- a "@{attribute}" string for each XML attribute of the name {attribute}
- 990 — a child object for each child element that must be unique
- a child array for each child element that may not be unique

992

e.g.

```
994 "request": {  
995     "param": [ ... ],  
996     "representation": [ ... ]  
997 }  
998
```

### 1000 **X.2.3 Repeatable Elements**

1001 All repeatable WADL XML elements are represented as an array of objects whose name is the name of  
1002 the XML element and where each may contain:

- a "@{attribute}" string for each XML attribute of the name {attribute}
- 1004 — a child object for each child element that must be unique
- a child array for each child element that may not be unique

1006

e.g.

```
1008 "param": [  
1009     {  
1010         "@name": "Accept",  
1011         "@style": "header"  
1012     },  
1013     {  
1014         "@name": "Cache-control",  
1015         "@style": "header"  
1016     }  
1017 ]
```