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Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Web Map Service Implementation Specification — Part 2: XML for Requests using HTTP POST

Contents

i.   Preface

This document is a partial description of the accomplishments of the Open GIS Consortium (OGC) Web Services Testbed, phase 1 (OWS1).

ii.   Submitting Organizations

The US National Aeronautics and Space Administration (NASA) submits this IPR to the OGC as a component of future revisions of the Web Map Service Implementation Specification.

iii.   Submission Contact Points

All questions regarding this submission should be directed to the Editor or to the WWW Mapping SIG chair:

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iv.   Revision History

Date	Release	Editor	Description
2001-11-02	0.0.1	Jeff de La Beaujardière	Submittal to OGC IP
2002-03-18	0.0.2	Jeff de La Beaujardière	Submittal to OGC TC
2002-04-24	0.0.3	Jeff de La Beaujardière	Public Release as a Discussion Paper, formatting changes for public release.

v.   Changes to the OpenGIS Abstract Specification

No revisions to the OGC Abstract Specification are required.

Foreword

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Introduction

The OGC Web Map Service (WMS) implementation specification version 1.1.0 defines keyword/value encodings for operation requests using HTTP GET. This document describes XML encodings for requests using HTTP POST. This document is advanced as a draft candidate for a new Part 2 of the WMS specification.

Basic GET encodings are directly usable by standard World Wide Web user agents, and may be bookmarked, sent in email, pasted into HTML documents, and so forth. The ease of use of the GET encoding is its primary benefit. However, it does have some disadvantages. Additional semantics must be defined to, for example, associate a list of layers with a list of styles. Styled Layer Descriptor (SLD) WMS requests, which include an XML description of the styling, are difficult to encode directly and require that the request URL make reference to a separate SLD URL. Proposals to add a Filter parameter have been made more complex by the need to associate specific Filter expressions with specific Layers. Length limitations on HTTP URLs may preclude all of the desired parameters from being included in the request.

The optional HTTP POST encodings defined in this document are meant to provide additional structure in the request message and thereby to allow additional functionality without encountering size restrictions and encoding ambiguities. The greatest benefit is felt in the GetMap operation, where the comma-separated list of Layer names in HTTP GET can be replaced by a sequence of XML elements, each of which is either a named or a user-defined Layer, and directly associating Style and Filter information within each Layer. The GetFeatureInfo operation, which includes most of a GetMap request, benefits in a similar way.

Web Map Service Implementation Specification — Part 2: XML for Requests using HTTP POST

1   Scope

This part of the Web Map Service (WMS) specification applies to those clients and servers which allow operation request encodings that are more complex than those permitted by the basic keyword/value encoding defined in WMS Part 1 [17]. Part 2 only describes the encoding of the request messages using Extensible Markup Language (XML); all other aspects of the Web Map Service are fully defined in Part 1.

2   Conformance

An implementation conformant with this Part of the WMS specification must also be conformant with Part 1 [17]. Additional conformance tests for this Part only are listed in Annex D.

The following Sections of Part 1 **shall not** apply to conformance based on Part 2:

- 6.2.1: "Reserved characters in HTTP GET URLs"

- 6.2.2: "HTTP GET"

3   Normative references

The following normative documents contain provisions that, through reference in this text, constitute provisions of this specification. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

Berners-Lee, T., Fielding, N., and Masinter, L., "Uniform Resource Identifiers (URI): Generic Syntax", IETF RFC 2396, August 1998, http://www.ietf.org/rfc/rfc2396.txt.

Bray, T., Paoli, J., Sperberg-McQueen, C.M., and Maler, E., eds., "Extensible Markup Language (XML) 1.0", 2nd edition, October 2000, W3C Recommendation, http://www.w3.org/TR/2000/REC-xml.

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Freed, N. and Borenstein N., "Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies", IETF RFC 2045, November 1996, http://www.ietf.org/rfc/rfc2045.txt.

4   Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1
Operation
Specification of an interaction that can be requested from an object to effect behavior (definition from ISO 19119).

4.2
Interface
An implementation of operations including the syntax of the interaction for a given distributed computing technology (definition from ISO 19119).

4.3
Service
A collection of operations, accessible through an interface, that allows a user to evoke a behavior of value to the user (definition from ISO 19119).

4.4
Service Instance
An actual implementation of a Service. Service Instance is synonymous with Server.

4.5
Client
A software component that can invoke an Operation from a Server.

4.6
Request
An invocation by Client of an Operation.

4.7
Response
The result of an Operation returned from a Server to a Client.

4.8
Capabilities XML
Service-level metadata describing the operations and content available at a Service Instance.

5 Conventions

5.1 Normative verbs

In the sections labeled as normative, the key words **"must"**, **"must not"**, **"required"**, **"shall"**, **"shall not"**, **"should"**, **"should not"**, **"recommended"**, **"may"**, and **"optional"** in this document are to be interpreted as described in Internet RFC 2119 [15].

5.2 Abbreviated Terms

DTD	Document Type Definition
HTTP	Hypertext Transfer Protocol
MIME	Multipurpose Internet Mail Extensions
OGC	Open GIS Consortium
OWS	OGC Web Service
RFC	Request for Comments
SLD	Styled Layer Descriptor
SOAP	Simple Object Access Protocol
URL	Uniform Resource Locator
WMS	Web Map Service
XML	Extensible Markup Language

6 WMS Operation with HTTP POST

[Debate about whether to use SOAP[19] has not been completely settled by tests on actual implementations, so two alternatives are temporarily described here.]

WMS requests using HTTP POST are made as follows:

(1) The OnlineResource URL of the request message is determined from the Capabilities XML of the service instance according to this XPath [21] expression:

```
/WMT_MS_Capabilities/Capability/Request/(operation)/DCPType/
HTTP/Post/OnlineResource/@xlink:href
```

where `(operation)` refers to `GetCapabilities`, `GetMap`, or another operation name. A line break has been added for clarity.

If this XPath expression is not resolvable for the desired operation, then the service instance does not support HTTP POST and the Client **must not** attempt communication using that protocol. This specification does not apply to such service instances.

(2) An XML document conformant with the XML Schema in Annex A for the desired operation is constructed.

(2a) (with SOAP) The message document from step 2 is enclosed in a SOAP envelope as follows:

```
<env:Envelope
 xmlns:env="http://www.w3.org/2001/09/soap-envelope">
  <env:Body>
    request document here
  </env:Body>
</env:Envelope>
```

[The request document in (2) uses SOAP value encoding (which is based on XML Schema) and therefore could legally be used alone or in a SOAP envelope.]

(3) The request message is sent to the OnlineResource in (1) according to the HTTP POST rules defined in [8]. The following HTTP request headers **must** be used (along with any others mandated by [8]).

(3a) (without SOAP)

```
Content-Type: text/xml; charset="utf-8"
-or?-
Content-Type: application/vnd.ogc.request+xml
```
The text/xml content type is mandated by SOAP [19] and is generically applicable to the document constructed in step (2). However, it might be useful to define operation-specific MIME [11] types as in the second alternative (where request is one of the defined operation names).

```
Content-Length: nnnn
```
The content length is the number of bytes in the document created in (2).

(3b) (with SOAP)

```
Content-Type: text/xml; charset="utf-8"
```
The text/xml content type is mandated by SOAP.

```
Content-Length: nnnn
```
The content length is the number of bytes in the document created in (2), including the SOAP envelope.

```
SOAPAction:
```

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A SOAPAction header is required by SOAP, and may have a null value. *[It is not clear when it should be non-null; its value is a URL, and need not be that of the OnlineResource to which the request is sent.]*

(4) A response in received from the server.

(4a) (without SOAP): the response is one of the operation responses defined in WMS Part 1 [17]. That is, for GetCapabilities the results is Capabilities XML with MIME type application/vnd.ogc.wms+xml; for GetMap the result is a map image with the correct MIME [11] type; if an error has occurred the response is a Service Exception; etc.

(4b) (with SOAP): the response is a multipart-MIME document formatted according to the SOAP Messages with Attachments [20] note from W3C. The first part is a SOAP message and the second contains the actual WMS response object as in (4a).

(4c) (alternative with SOAP): the response is a SOAP message that includes the URL of the actual WMS response object as in (4a).

7   Description of Request Messages

The format of the request messages is normatively specified by Annex A. This section points out several features of those messages.

All requests include a `service` attribute. For Web Map Service requests, a value of "`WMS`" **must** be used.

7.1   GetCapabilities

The GetCapabilities request includes an optional <Section> element to retrieve only one of the sections of a complete Capabilities XML document. *[It is intended that this document include a WSDL section as defined by OWS1 testbed.]* If the Section element is missing, the server **must** return the entire Capabilities XML document. The Section element includes an XPath [21] expression stating which part to retrieve. At present, only a limited number of predefined XPath expressions are enumerated in the Schema; this specification uses the XPath syntax for compatibility but does not require that service instances support complete XPath parsing. However, a service instance which accepts POST requests **must** understand the predefined XPath expressions and correctly return only the desired section of the document upon request. The expression "/" refers to the entire document. An expression of the form "`/OGC_Capabilities/element_name`" refers to the child called <element_name> in the <OGC_Capabilities> parent, including the <element_name> start tag, the </element_name> closing tag, and everything in between.

7.2 GetMap

The GetMap request includes exactly one <StyledLayerDescriptor> element that defines the map layers which are to appear in the returned map. Layers **shall** be drawn in the order that they appear in the XML, with the first one drawn at the bottom.

When accessing a basic WMS as defined in Part 1 [17], the StyledLayerDescriptor element simply contains named Layer(s) and possibly named Style(s). When accessing an SLD-enabled WMS as defined in [10], more complex expressions specifying user-defined layer contents and styling are permitted.

Annex A
(normative)

XML Schema

A.1 GetCapabilities Request Schema

[Copy of http://www2.digitalearth.gov/ows/GetCapabilities002.xsd]

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema targetNamespace="http://www.opengis.net/ows"
        xmlns:ogc="http://www.opengis.net/ows"
        xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:annotation>
    <xs:documentation xml:lang="en">
      XML Schema for OGC Web Service GetCapabilities request.
    </xs:documentation>
  </xs:annotation>

  <!-- Type Declarations -->
  <xs:simpleType name="ogc:OWSType">
    <xs:restriction base="xs:string">
      <xs:enumeration value="WMS" />
      <xs:enumeration value="WFS" />
      <xs:enumeration value="WCS" />
    </xs:restriction>
  </xs:simpleType>
  <xs:simpleType name="ogc:CapabilitiesSectionType">
    <xs:restriction base="xs:string">
      <xs:enumeration value="/" />
      <xs:enumeration value="/OGC_Capabilities/ServiceMetadata" />
      <xs:enumeration value="/OGC_Capabilities/OperationSignatures" />
      <xs:enumeration value="/OGC_Capabilities/ContentMetadata" />
      <xs:enumeration value="/OGC_Capabilities/Common" />
    </xs:restriction>
  </xs:simpleType>

  <!-- Root Element -->
  <xs:element name="GetCapabilities">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="Section" type="ogc:CapabilitiesSectionType"
                    minOccurs="0" maxOccurs="1" default="/" />
      </xs:sequence>
      <xs:attribute name="version" type="xs:string" use="required"
                    fixed="1.2.0" />
      <xs:attribute name="service" type="ogc:OWSType" use="required" />
      <xs:attribute name="updateSequence" type="xs:string" use="optional" />
    </xs:complexType>
  </xs:element>

</xs:schema>
```

A.2 GetMap Request Schema

[Copy of http://www2.digitalearth.gov/ows/GetMap002.xsd]

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema targetNamespace="http://www.opengis.net/ows"
          xmlns:ogc="http://www.opengis.net/ows"
```

```
            xmlns:sld="http://www.opengis.net/sld"
            xmlns:gml="http://www.opengis.net/gml"
            xmlns:xs="http://www.w3.org/2001/XMLSchema"
            elementFormDefault="qualified">
  <xs:annotation>
    <xs:documentation xml:lang="en">
      XML Schema for OGC Web Map Service GetMap request.
    </xs:documentation>
  </xs:annotation>
  <xs:import namespace="http://www.opengis.net/gml"
   schemaLocation="http://www.opengis.net/namespaces/gml/core/geometry.xsd"/>
  <xs:import namespace="http://www.opengis.net/sld"
   schemaLocation="http://www2.digitalearth.gov/ows/sld.xsd"/>
  <xs:element name="GetMap">
    <xs:complexType>
      <xs:sequence>
        <xs:element ref="sld:StyledLayerDescriptor" />
        <xs:element name="BoundingBox" type="gml:BoxType"/>
        <xs:element name="Output">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="Format" type="ogc:FormatType"/>
              <xs:element name="Transparent" type="xs:boolean" minOccurs="0"/>
              <xs:element name="BGcolor" type="xs:string" minOccurs="0"/>
              <xs:element name="Size">
                <xs:complexType>
                  <xs:sequence>
                    <xs:element name="Width" type="xs:positiveInteger"/>
                    <xs:element name="Height" type="xs:positiveInteger"/>
                  </xs:sequence>
                </xs:complexType>
              </xs:element><!--Size-->
            </xs:sequence>
          </xs:complexType>
        </xs:element><!--Output-->
        <xs:element name="Exceptions" type="ogc:ExceptionsType" minOccurs="0"/>
        <xs:element name="Vendor" type="ogc:VendorType" minOccurs="0"/>
      </xs:sequence>
      <xs:attribute name="version" type="xs:string" use="required"/>
      <xs:attribute name="service" type="ogc:OWSType" use="required"/>
    </xs:complexType>
  </xs:element><!--GetMap-->
  <!--Type definitions-->
  <xs:simpleType name="ExceptionsType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="application/vnd.ogc.se+inimage"/>
    <xs:enumeration value="application/vnd.ogc.se+xml"/>
  </xs:restriction>
  </xs:simpleType>
  <xs:simpleType name="FormatType">
    <xs:restriction base="xs:string">
      <xs:enumeration value="image/gif"/>
      <xs:enumeration value="image/jpg"/>
      <xs:enumeration value="image/png"/>
    </xs:restriction>
  </xs:simpleType>
  <xs:simpleType name="OWSType">
    <xs:restriction base="xs:string">
      <xs:enumeration value="WMS"/>
    </xs:restriction>
  </xs:simpleType>
  <xs:complexType name="VendorType"/>
  <!--not sure how to define vendor-specific area in open manner-->
</xs:schema>
```

A.3 GetFeatureInfo Request Schema

[Copy of http://www2.digitalearth.gov/ows/GetFeatureInfo002.xsd]

```
<?xml version="1.0" encoding="UTF-8"?>
```

```
<xs:schema targetNamespace="http://www.opengis.net/ows"
        xmlns:xs="http://www.w3.org/2001/XMLSchema"
        xmlns:ogc="http://www.opengis.net/ows"
        xmlns:sld="http://www.opengis.net/sld"
        xmlns:xlink="http://www.w3.org/1999/xlink">
  <xs:annotation>
    <xs:documentation xml:lang="en">
      XML Schema for OGC Web Map Service GetFeatureInfo request.
    </xs:documentation>
  </xs:annotation>

  <!-- External references -->
  <xs:include schemaLocation="http://www2.digitalearth.gov/ows/GetMap002.xsd" />
  <xs:import namespace="http://www.opengis.net/sld"
   schemaLocation="http://www2.digitalearth.gov/ows/sld.xsd"/>

  <!-- Root Element -->
  <xs:element name="ogc:GetFeatureInfo"
             xmlns:xs="http://www.w3.org/2001/XMLSchema">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="ogc:GetMap" />
        <xs:element name="QueryLayer" type="xs:string"
                   minOccurs="1" maxOccurs="unbounded" />
        <xs:element name="X" type="xs:nonNegativeInteger" />
        <xs:element name="Y" type="xs:nonNegativeInteger" />
        <xs:element name="Output">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="Format" type="xs:string" />
              <xs:element name="Size">
                <xs:complexType>
                  <xs:sequence>
                    <xs:element name="FeatureCount" type="xs:PositiveInteger" />
                  </xs:sequence>
                </xs:complexType>
              </xs:element>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element name="Exceptions" type="xs:string" minOccurs="0" />
        <xs:element name="Vendor" minOccurs="0">
          <!--not sure how to define vendor-specific area in open manner-->
        </xs:element>
      </xs:sequence>
      <xs:attribute name="version" type="xs:string" use="required" />
      <xs:attribute name="service" type="ogc:OWSType" use="required" />
    </xs:complexType>
  </xs:element>
</xs:schema>
```

Annex D
(normative)

Conformance Tests

Minimal conformance with this specification requires the following:

1. The Extensible Markup Language (XML) document sent as an operation request **must** be valid against the appropriate XML Schema in Annex A. Such validation may be performed using commonly available XML validating tools.

2. All clauses in the normative sections of this specification that use the keywords "must", "must not", "required", "shall", and "shall not" have been satisfied.

Bibliography

[numbering will be fixed before final draft]

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[21] Clark, J. and DeRose, S., eds., "XML Path Language (XPath) Version 1.0," November 1999, W3C Recommendation, <http://www.w3.org/TR/xpath>.