

Open GIS Consortium - Web Map Service Primer

In the past few years since web mapping was first introduced and implemented, many online mapping applications have been developed on top of vendor software that requires the application to access data on a local system and in the format(s) supported by a particular vendor. This has resulted in thousands of spatially-enabled applications being published to the Internet, applications that can only leverage those datasets that are specifically prepared for them. As a consequence, there has been tremendous redundancies in efforts around the world to prepare and integrate identical datasets in various locations and formats. The overall effect has been to greatly slow down the progress of Web-based mapping and create isolated islands of mapping functionality.

The Open GIS Consortium, Inc. (OGC) was established to solve this problem, by providing a non-proprietary framework for communication of spatial information over the Internet – a straightforward, standardized method for data providers to make their data accessible, and for client applications to access and merge georeferenced data. Data are shared through Web services that deliver only the precise information required from disparate servers, which potentially use completely different data structures, formats, and software products. So long as those servers *publish* in accordance with the OGC communication protocols, their data can be accessed seamlessly by Web clients. As more and more “data vendors” make their offerings accessible through OGC standards, the capabilities of the Web mapping universe increase exponentially.

This primer presents a very high-level overview of how the most mature and widely-adopted of these standards – the Web Map Service - works. A wealth of additional detail (both historic and technical) can be found in the documents referenced at the end of this document.

Web Map Services

The OGC specification for the Web Map Service (WMS) defines the language through which clients communicate with a server publishing to WMS. By configuring a map server to comply with the WMS specification, data owners can publish their spatial information and allow Web application developers to access it in a predictable and known manner. When publishing to WMS, the data that are being published or accessed are communicated as a “picture” (raster) of the actual geospatial data, not the source data itself. (Remember that the source data may be compiled and stored in a myriad of different formats and projections.) The data are transferred in a well-known image format (i.e., GIF, JPEG, or PNG) that both the client and server can work with.

Accessing WMS Data

Web clients (e.g., a map viewing application on a Website) can request georeferenced data from a WMS through a simple, URL-based protocol. The types of information that potentially can be accessed from any WMS include (multiple) map layers, layer styles, geographic areas of interest, specific data about map features, and general information about what data is available through

that server. (In fact, some Web map servers also act as clearinghouses for other WMSs – but this is transparent to the client.)

The following is a quick overview of the three types of WMS requests that can come from client applications.

GetCapabilities (required)

The GetCapabilities request returns an XML-based document describing all the data (i.e., maps, layers, etc.) that are available through the requested server. Because OGC sets out strict guidelines for how the capabilities document is to be formatted, this data can, for example, be automatically manipulated by the client to provide users choices of which data they'd like displayed. An example of a URL to request capabilities is:

```
http://www2.dmsolutions.ca/cgi-bin/mswms_gmap?REQUEST=GetCapabilities&VERSION=1.1.1
```

GetMap (required)

The GetMap request returns a well-defined map **image**. Because the geospatial and dimensional parameters of the map can be specified by the requesting client, multiple map layers (from potentially multiple WMSs) can be easily overlaid to display a single map. A simple example of a URL to request a map is:

```
http://www2.dmsolutions.ca/cgi-bin/mswms_gmap?REQUEST=GetMap&VERSION=1.1.1
```

GetFeatureInfo (optional)

The GetFeatureInfo request returns information about particular features displayed on a map. GetFeatureInfo is optional in that data providers do not currently need to support such requests to be deemed a valid WMS. Because a feature must be queried from a particular map layer, the GetFeatureInfo request is quite similar to the GetMap request. An example of a GetFeatureInfo URL is:

```
http://www2.dmsolutions.ca/cgi-bin/mswms_gmap?REQUEST=GetFeatureInfo&VERSION=1.1.1&QUERY_LAYERS=park&X=121&Y=232
```

The Query_Layers parameter defines which data layer to request. The X and Y parameters represent the point to query on the given map layer.

Publishing WMS Data

While accessing data from a WMS is a relatively straightforward task, publishing OGC-compliant data is a little more involved. However, the minimum basic requirement for a WMS is to be able to have your server accept the URL-based GetCapabilities and GetMap requests detailed above. Most WMS installations do this through the use of a CGI script, but other methods are also possible. In many cases, your scripts will have to parse the OGC request and use the in-house mapping software to create the appropriate outputs to be returned to the client. How this is done relies, of course, on what GIS system(s) are being used to store/manipulate the data.

As the popularity of open standards such as OGC/WMS has grown, the need for reliable and cost-effective tools to display geospatial data within those standards has also grown. MapServer,

an Open Source collaboration started at the University of Minnesota, has benefited from a consistent R&D effort to support WMS and many other OGC specifications and, because of this, is one product that is being widely adopted for conforming to the WMS specification. By having the capability to publish to WMS embedded in the technology, the process of publishing data to the WMS specification becomes a relatively simple process.

Where to Go for More Information

The following documents contain a wealth of information about OGC/WMS:

- OpenGIS Web Map Server Cookbook
<http://www.ogcnetwork.org/docs/03-050r1.pdf>
- Web Map Service Implementation Specification (Version 1.1.1)
<http://www.opengis.org/docs/01-068r3.pdf>
- Web Map Context Document Specification (Version 1.0.0)
<http://www.opengis.org/docs/03-036r2.pdf>
- Styled Layer Descriptor Implementation Specification (Version 1.0.0)
<http://www.opengis.org/docs/02-070.pdf>
- HOWTO for Setting Up a WMS Server with MapServer
<http://mapserver.gis.umn.edu/doc42/wms-server-howto.html>
- HOWTO for Setting Up a WMS Client with MapServer
<http://mapserver.gis.umn.edu/doc42/wms-client-howto.html>
- Guide to Distributing Your Data Products Via WMS 1.1.1: *A Tutorial For Data Providers*
<http://oceanesip.jpl.nasa.gov/esipde/guide.html>