

OpenGIS, WMS and WFS

The Vision and the Mission

- The **Vision** of the OpenGIS is to have a world in which everyone benefits from geographic information and services made available across any network, application, or platform.
- The **Mission** is to deliver spatial interface specifications that are openly available for global use.

What is the OpenGIS?

- Open GIS Consortium (OGC)
 - Non-profit, international voluntary consensus standards organization
 - Industry, government, and university members
- Over 260 members worldwide – 30 countries & 5 continents
 - 91 European members - 19 countries
 - 35 Asia-Pacific members - Japan, Republic of Korea, Australia, China, and Thailand
- OGC collaborates and works closely with:
 - International Organization for Standardization (ISO)
 - World Wide Web Consortium (W3C)
 - OASIS (Organization for the Advancement of Structured Information Standards)
 - And others...

Brief History

- The OGC was rooted in GRASS and the governing group of GRASS, the OGF (Open GIS Foundation)
- The OGC was formed out of this group in 1994, with eight charter members.
- The first commercial Principal member: Intergraph.
- The first spec, released in 1997: Simple Features Specification.
- Number of approved, publicly available Implementation Specifications now: 11.
- Number of candidate Implementation Specifications in progress: 30+.
- Broad participation with other industry and international standards organizations

Industry Benefits

- OpenGIS links geographic data with mainstream IT...
- Standardization is an essential and growing element in the success of the Information Technology industry. The success of the Internet, the World Wide Web, and e-Commerce, and are all based on successful Standardization.
- Most new Information Technology (IT) industry initiatives center around the concept of interoperability, and over the last 10 years has become a fundamental goal of IT Standardization.
- There are no more 'homogeneous islands of computing' which marked the late 1980s; today's environment is worldwide and fast paced.
- The Internet is a formidable promoter of open standards that actually work.

OpenGIS Specification

<http://www.opengis.org> **Current**

| Title | Rev | Files | Size |
|---|-------|----------------|-------------------------|
| OpenGIS® Simple Features Specification for OLE/COM get the gisldtgis.t file | 1.1 | [.xml] [.pdf] | [3.07kb] [2.17MB] |
| OpenGIS® Simple Features Specification for CORBA | 1.0 | [.xml] | [277 kb] |
| OpenGIS® Simple Features Specification for SQL | 1.1 | [.xml] | [239kb] [1.739kb] |
| OpenGIS® Catalog Services Implementation Specification | 1.1.1 | [.xml] [.doc] | [732kb] [1.53kb] |
| OpenGIS® Grid Coverages Implementation Specification | 1.0 | [.xml] [.pdf] | [142kb] [2.99kb] |
| OpenGIS® Coordinate Transformation Services Implementation Specification | 1.0 | [.xml] [.doc] | [704kb] [2.82kb] |
| OpenGIS® Web Map Service Interfaces Implementation Specification | 1.1.1 | [.xml] [.pdf] | [609kb] [5.93kb] |
| OpenGIS® Geography Markup Language (GML) Implementation Specification | 3.0 | [.xml] [.pdf] | [4.22 kb] [2.11 kb] |
| OpenGIS® Web Feature Service Implementation Specification | 1.0 | [.xml] [.pdf] | [1.4kb] [2.74kb] |
| OpenGIS® Filter Encoding Implementation Specification | 1.0 | [.xml] [.pdf] | [563kb] [1.43kb] |
| OpenGIS® Styled Layer Descriptor Implementation Specification | 1.0 | [.xml] [.pdf] | [70kb] [1.47kb] |

Web Mapping Specifications

GetCapabilities (WMS)

Image Format available for request

Info format available for request

GetCapabilities (WMS)

Projection/Datum of this webmap

Bounding of this webmap in Lat/Long

Bounding in define SRS

Layer Name, SRS of layer

This layer does not defined bounding box, thus extent is equal to entire webmap

GetCapabilities (WMS)

This layer define its own extent and different map projection from webmap.

WMS (Web Map Service)

- GetMap
 - Returns generate graphic image of data according to extent, layer etc. of map data
 - Image, not features, not attributes
 - Key parameter
 - LAYERS : data desired to be draw [road,river,sea,...] First list item is the most bottom of image map
 - BBOX : extent of image map [minx, miny ,maxx ,maxy]
 - SRS : reference system/ projection of bounding box <http://www.epsg.org> such epsg:4326 -> Lat/Long (WGS84)
 - FORMAT : image format return from WMS Server

WMS (Web Map Service)

- Key parameter (GetMap cont)
 - STYLES : (desired portrayal of data)
 - e.g. layers=elevation,roads,railways&styles=default,red,blue
 - Empty list value for non styled layers
 - REQUEST (= GetMap)
 - VERSION
 - SERVICE
 - WIDTH : width of return image
 - HEIGHT : height of return image

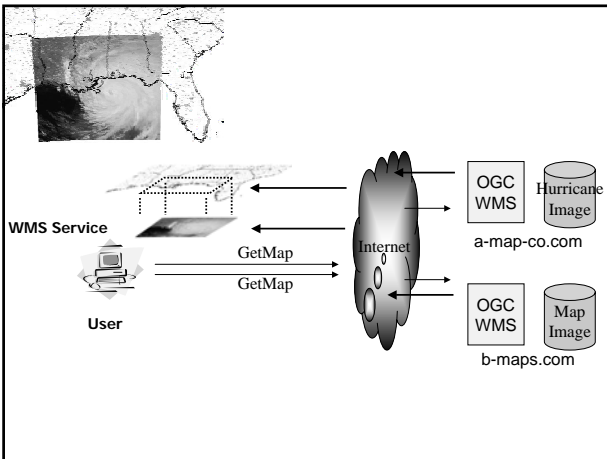
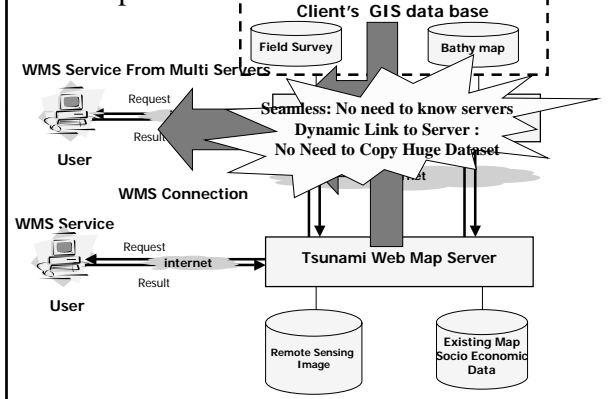
WMS (Web Map Service)

- Key parameter (GetMap cont)
 - TRANSPARENT : Either TRUE or FALSE
 - Useful for layering data from multiple remote WMS services atop eachother for map composition
 - Depends on image format (JPEG is not transparent)
 - Depends on web browser support
 - GIF transparency is supported in all browser but PNG is only Netscape7, etc
 - BGCOLOR : optional background color of image

WMS (Web Map Service)

```
http://server-maps.com/mapserv?map=mapfile.map&VERSION=1.1.0&
REQUEST=GetMap&
SRS=EPSG:4326&
BBOX=-97.105,24.913,78.794,36.358&
WIDTH=560&
HEIGHT=350&
LAYERS=WATER,ROAD,POLBNDI&
STYLES=0xFF8080,0X101040,BLACK&
FORMAT=image/png&
BGCOLOR=0xFFFFFFFF&
TRANSPARENT=TRUE&
SERVICE=WMS&
```

Web Map Service



Web Map Service (WMS)

- Parameters
 - transparent (whether to make non-opaque data pixels transparent)
 - Either TRUE or FALSE
 - Useful for layering data from multiple remote WMS services atop each other for map composition
 - Depends on image format (JPEG is not transparent)
 - Depends on web browser support
 - GIF transparency is supported in all browsers
 - PNG transparency support in newer browsers (NN7, etc.)
 - bgcolor (optional background color of image)

Web Map Service (WMS)

- GetFeatureInfo
 - Asks for information about features display in the map by point-based queries on map data
 - No ability for complex, expression-like queries

Web Map Service (WMS)

- GetFeatureInfo
 - Parameters
 - <all GetMap parameters>
 - Use request=GetFeatureInfo instead of GetMap
 - Pass on ALL GetMap keyword-value pairs as if performing a GetMap request
 - x (pixel value in X image coordinates)
 - y (pixel value in Y image coordinates)
 - query_layers (layers to be queried)
 - Can be one or multiple layers
 - This does not substitute passing the layers parameter

Web Map Service (WMS)

- GetFeatureInfo
 - Info_format
 - HTML : Difficult for parser
 - GML.1 :XML-Based
 - Lack of common definition structure between vendor implementation

WFS (Web Feature Service)

- Feature level access to spatial data (vectors)
- Rich query interface
- Returns GML
- Transactional capability
 - A transaction request is composed of operations that modify features; that is create, update, and delete operations on geographic features.
- Security considerations for OGC:WFS-T
 - A web feature service may be able to process a lock request on one or more instances of a feature type for the duration of a transaction.

WFS (Web Feature Service)

- Operations
 - GetCapabilities
 - DescribeFeatureType
 - GetFeature

WFS (Web Feature Service)

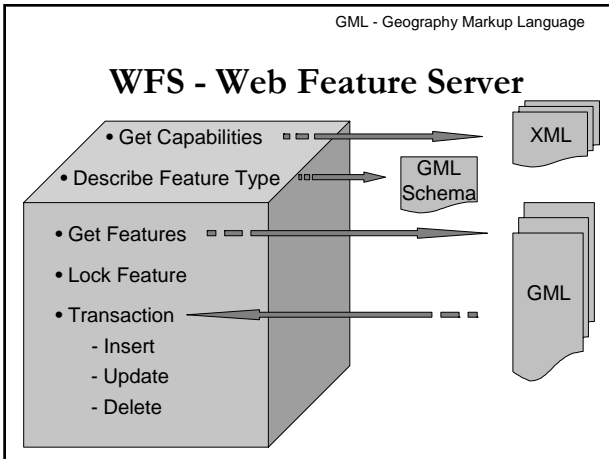
- GetCapabilities
- Same WMS - > GetCapabilities
- Parameters
 - VERSION
 - SERVICE
 - REQUEST

WFS (Web Feature Service)

- DescribeFeatureType
- Provides an outline of the structure of a feature type (fields, etc.) in XML schema
- XML schema document must be a valid GML application schema and defines the schema of the feature types listed in the request.
- Parameters
 - VERSION
 - SERVICE
 - REQUEST
 - TYPENAME

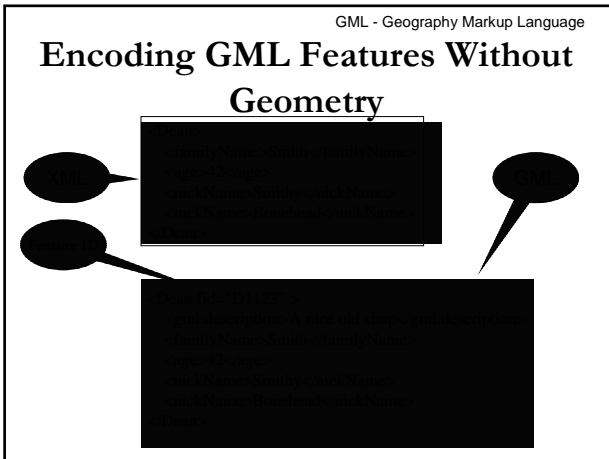
WFS (Web Feature Service)

- GetFeature
 - Parameters
 - VERSION
 - SERVICE
 - REQUEST
 - TYPENAME
 - FILTER (optional)
 - BBOX (can also be done through FILTER)



Basics of GML

- Geography Markup Language (GML) is an XML grammar written in XML Schema for the modeling, transport, and storage of geographic information.
- GML provides a variety of kinds of objects for describing geography including features, coordinate reference systems, geometry, topology, time, units of measure and generalized values.
- GML includes
 - Geometries and Coordinate Reference System (based on EPSG)
 - A temporal reference system (based on ISO 8601)
 - A Units of Measure (UOM) dictionary



GML - Geography Markup Language

Defining, Encoding GML Geometry

- Point
- LineString
- LinearRing
- Polygon
- MultiPoint
- MultiLineString
- MultiPolygon
- MultiGeometry

```

<element name="coord" type="gml:CoordType" />
<complexType name="CoordType">
  <sequence>
    <element name="X" type="decimal"/>
    <element name="Y" type="decimal" minOccurs="0"/>
    <element name="Z" type="decimal" minOccurs="0"/>
  </sequence>
</complexType>

```

```

<Point srsName="http://www.opengis.net/gml/srs/epsg.xml#4326">
  <coord><X>5.0</X><Y>40.0</Y></coord>
</Point>

```

GML - Geography Markup Language

Defining Geometry Properties in GML/Schema

```

<element name="_geometryProperty" type="gml:GeometryPropertyType"
  abstract="true"/>
<complexType name="GeometryPropertyType">
  <annotation>
    <documentation>A simple geometry property encapsulates a geometry element.
      Alternatively, it can function as a pointer (simple-type link) that refers to a
      remote geometry element. </documentation>
    </annotation>
    <sequence minOccurs="0">
      <element ref="gml:_Geometry"/>
    </sequence>
    <attributeGroup ref="gml:AssociationAttributeGroup"/>
  </complexType>

```

GML - Geography Markup Language

Defining Geometry Properties in GML/Schema

```

<element name="pointProperty" type="gml:PointPropertyType"
  substitutionGroup="gml:_geometryProperty"/>
<complexType name="PointPropertyType">
  <annotation>
    <documentation>Encapsulates a single point to represent position,
      location, or centerOf properties.</documentation>
    </annotation>
    <complexContent>
      <restriction base="gml:GeometryPropertyType">
        <sequence minOccurs="0">
          <element ref="gml:Point"/>
        </sequence>
        <attributeGroup ref="gml:AssociationAttributeGroup"/>
      </restriction>
    </complexContent>
  </complexType>

```

GML - Geography Markup Language

Defining Features with Geometry in GML/Schema

```
<element name="Dean" type="ex:DeanType" substitutionGroup="gml:_Feature"/>
<element name="deanLocation" type="gml:PointPropertyType"
  substitutionGroup="gml:pointProperty"/>

<complexType name="DeanType">
  <complexContent>
    <extension base="gml:AbstractFeatureType">
      <sequence>
        <element name="familyName" type="string"/>
        <element name="age" type="integer"/>
        <element name="nickName" type="string"
          minOccurs="0" maxOccurs="unbounded"/>
        <element ref="ex:deanLocation" />
      </sequence>
    </extension>
  </complexContent>
</complexType>
```

GML - Geography Markup Language

Encoding GML Features with Geometry

```
<Dean fid="D1123" >
  <gml:description>A nice old chap</gml:description>
  <familyName>Smith</familyName>
  <age>42</age>
  <nickName>Smithy</nickName>
  <nickName>Bonehead</nickName>
  <deanLocation>
    <Point srsName="http://www.opengis.net/gml/srs/epsg.xml#4326">
      <coord><X>5.0</X><Y>40.0</Y></coord>
    </Point>
  </deanLocation>
</Dean>
```

<http://www.opengeospatial.org/specs/>

More & More

- OGC : SLD (Styled Layer Description)
 - "Add-on" specification to OGC:WMS
 - Enables custom styling
- OGC : Filter
 - "Add on" specification to OGC:WFS
 - Custom XML query language such as draw only "Capital City" point.
- OGC :WMC (WEB MAP CONTEXT)
 - Save Web Mapping Application State
 - Like "save project"
- OGC : WCS (WEB COVERAGE SERVICE)
 - More Advanced of WMS and WFS
 - Multidimensional : returns representations of space-varying phenomena that relate a spatio-temporal domain to a range of properties.

More & More

- OGC Web Site
 - <http://www.opengeospatial.org/specs/?page=specs>

