

# Workshop 12-13<sup>th</sup> June

## **Geospatial Data Visualisation Via Web Services :-**

### **An Introduction to the Technologies and Nomenclature.**

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June 12-13th, 2006



- Objectives
  - Introduction to some key Open Geospatial Consortium (OGC) web services technologies:
    - WMS
    - SLD
    - WFS
    - GML
    - WCS
    - SVG
  
- Not Objectives
  - Learn all the relevant technologies in detail !!



# What? - Open Geospatial Consortium Overview

- ❑ The Open Geospatial Consortium (OGC) is a not-for-profit, international consortium whose many members work to make GIS an integral part of information systems of all kinds.
- ❑ Operates a *Specification Development Program* that is similar to other Industry consortia (W3C, OMG, etc.).
- ❑ Also operates an *Interoperability Program* (IP), a partnership-driven engineering and testing program designed to deliver proven specifications into the Specification Development Program.
- ❑ OGC used to talk about “web-enabling GIS”, now they talk about “geo-enabling the web.”



# What? - OGC and Web Services

- ❑ Open Geospatial Consortium was working on developing geospatial Web services before “Web Services”\* (SOAP/WSDL/UDDI/...) existed – focus on modular, reusable components
- ❑ Because of early start OGC is now working to adapt OGC specifications to mainstream Web Services architecture (or vice versa), i.e. making OGC services build on top of standard Web Services frameworks
- ❑ OGC use of HTTP GET & POST for invocations is a constraint on acceptance of OGC specs in Web Services community
- ❑ See OGC Web Services, Phase 2 (OWS-2) & Phase 3 (OWS-3):  
<http://www.opengis.org/initiatives/?iid=7>

\* According to the W3C a **Web Service** is a software system designed to support *interoperable* machine-to-machine interaction over a network.

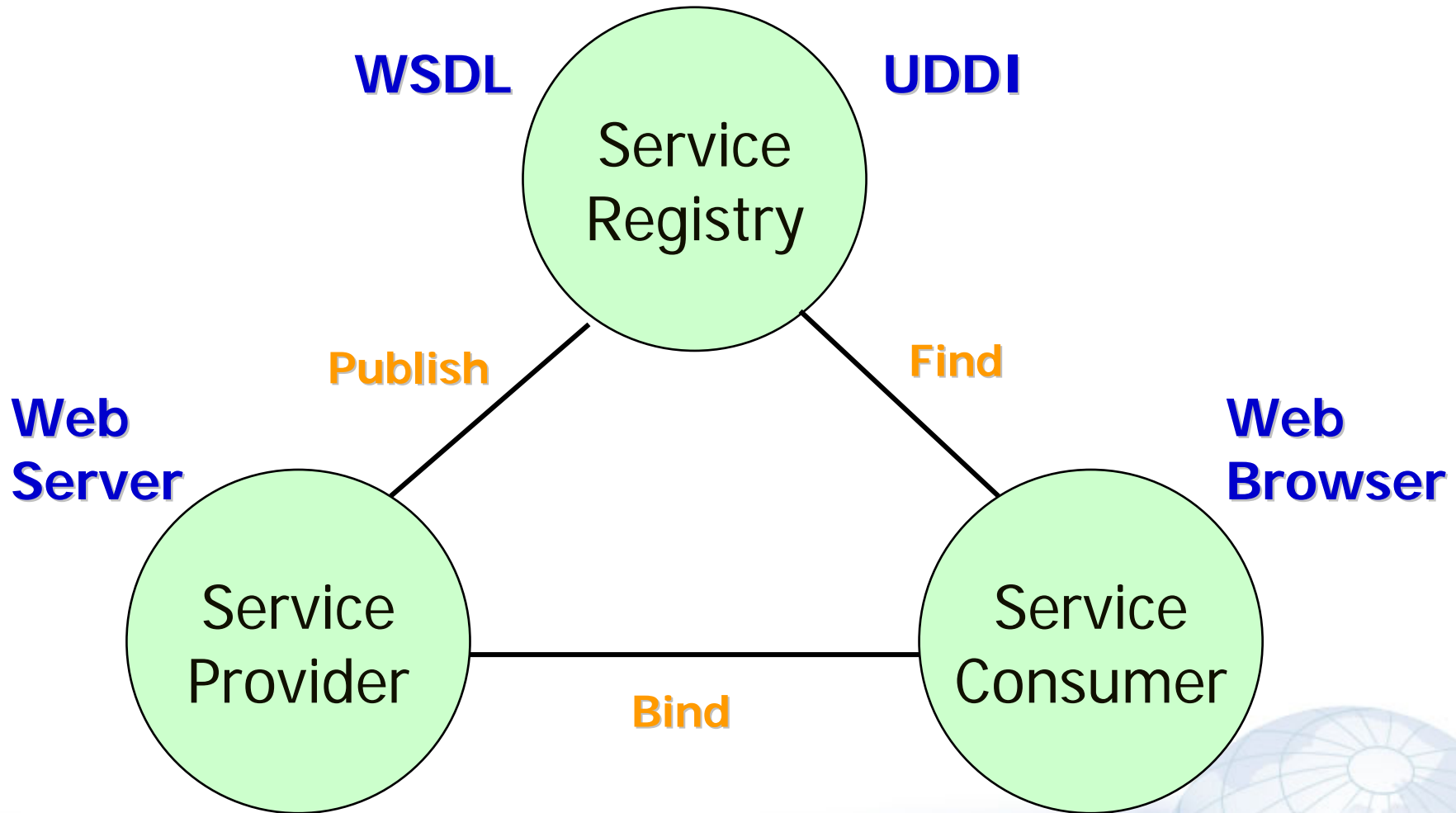


# Why? - The benefits of Interoperability

- ❑ Non OGC-compliant map servers are data islands
  - ❑ Data from different servers cannot be combined
- ❑ Data available in many vendor or non-proprietary formats
  - ❑ Conversion time consuming, confusing
- ❑ Data available in different coordinate systems
  - ❑ Conversion time consuming, confusing
- ❑ Service chaining
  - ❑ Make services that add value to other services



# How? - Web Services Architecture



# OGC Specifications (some!!)

- ❑ Web Map Service (WMS) - ISO 19128
  - ❑ Specifies the behavior of services that return georeferenced maps
- ❑ Web Feature Service (WFS) -
  - ❑ Interface that supports query level access to vector data repositories
- ❑ Web Coverage Service (WCS)
  - ❑ Supports networked interchange of geospatial data as 'coverages' containing values or properties of geographic locations
- ❑ Styled Layer Descriptor (SLD)
  - ❑ Styling language for WMS map servers, allow for pre-defined and user defined styles
- ❑ Geography Markup Language (GML) – ISO 19136
  - ❑ GML is an XML grammar for the modelling, transport, and storage of geographic information
- ❑ Scalable Vector Graphics (SVG)
  - ❑ an XML markup language for describing two-dimensional vector graphics, both static and animated (either declarative or scripted).



# WMS - Web Map Server Specification

Specification defines syntax for URLs to invoke map operations. XML encoding defined for service level metadata.

- ❑ *GetCapabilities*

Returns server-level metadata, description of services and content, acceptable request parameters

- ❑ *GetMap*

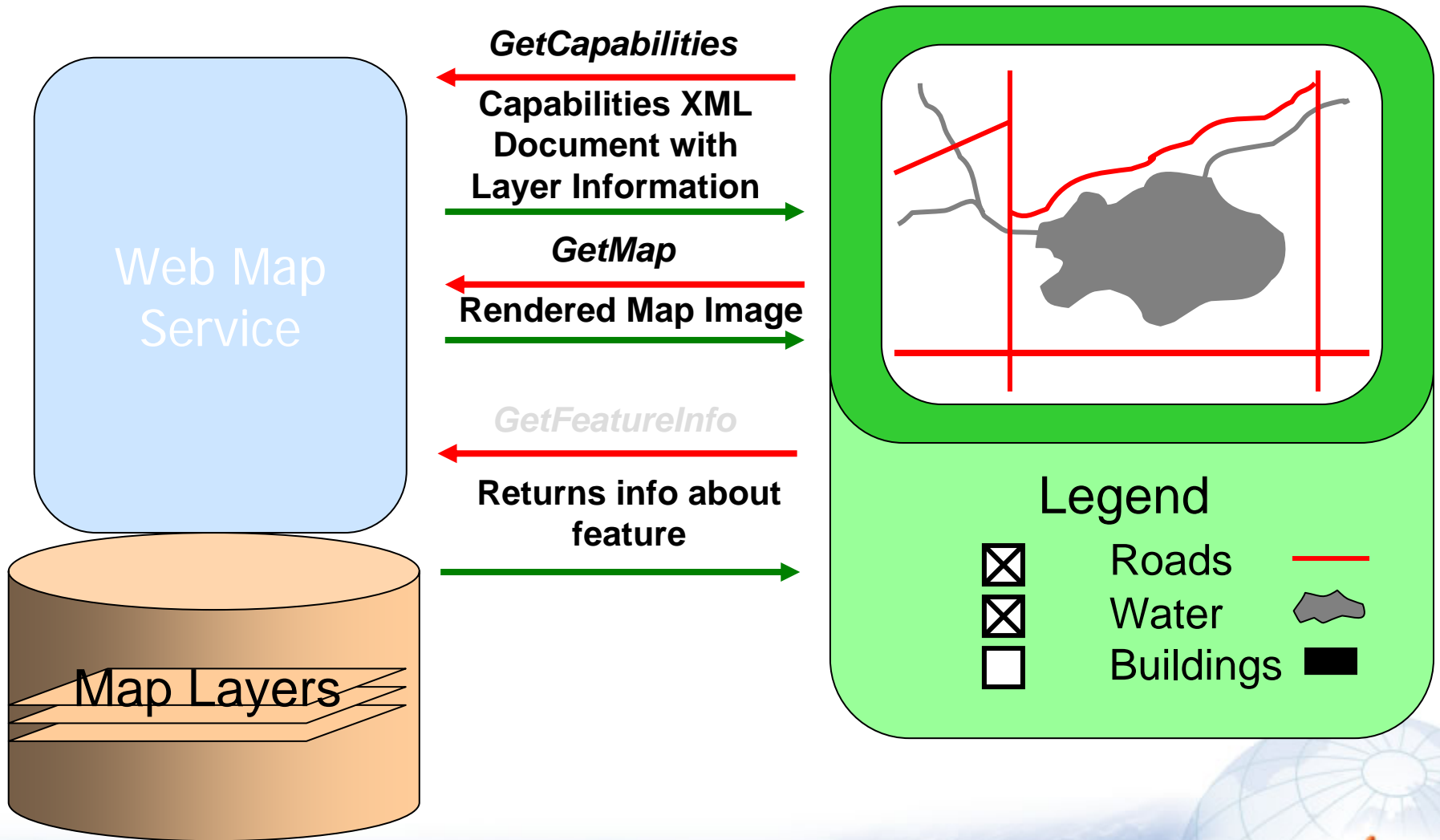
Returns map image whose geospatial and dimensional parameters are well-defined

- ❑ *GetFeatureInfo*

Returns information about particular features shown on map (*optional*)



# WMS Interface: Operation

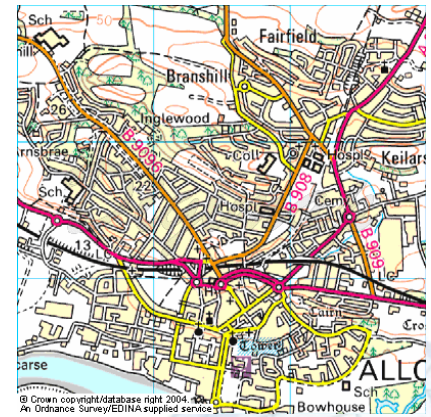


# Anatomy of WMS Map Requests

- ❑ A WMS request (e.g., "GetMap") is based on the HTTP Common Gateway Interface (CGI) form request, represented by a URL with a question mark
- ❑ Everything after the question mark is a list of key/value pairs in the format: *key = value &*

<b>VERSION=version</b>	<b>Request version (e.g., VERSION=1.1.1)</b>
<b>REQUEST=GetMap</b>	<b>NOTE: some faulty WMS servers only accept "REQUEST=map"</b>
<b>LAYERS=layer_list</b>	<b>Comma-separated list of one or more map layers. Optional if SLD parameter is present</b>
<b>STYLES=style_list</b>	<b>Comma-separated list of one rendering style per requested layer. Optional if SLD parameter is present</b>
<b>SRS=namespace:identifier</b>	<b>Spatial Reference System</b>
<b>BBOX=minx,miny,maxx,maxy</b>	<b>Bounding box corners (lower left, upper right) in SRS units</b>
<b>WIDTH=output_width</b>	<b>Width in pixels of map picture</b>
<b>HEIGHT=output_height</b>	<b>Height in pixels of map picture</b>
<b>FORMAT=output_format</b>	<b>Output format of map</b>

```
http://anyoldserver.com/WebMapService?  
version=1.1.0&  
layers=Raster50K&  
styles=default&  
srs=EPSG%3A4277&  
bbox=287000,692001,290000,695001&  
width=400&  
height=400&  
format=image%2Fgif&  
request=GetMap
```





# Temporal support

- ❑ A WMS server can provide support to temporal requests. This is done by providing a TIME parameter with a time value in the request.
- ❑ NASA Scientific Visualization Studio (formerly Animated Earth Server) uses temporal WMS
- ❑ Imagery of Hurricane Katrina from August 23, 2005 to August 30, 2005 from the Imager instrument on GOES-12 using temporal WMS



# Image Services vs. Feature Services



# Image Services vs. Feature Services

- ❑ Image Services
  - ❑ Deliver image only (snapshot of the data), not actual feature (vector) data
  - ❑ More limited functionality—can't export locally; changing symbology more limited
  - ❑ Lower bandwidth requirement
  
- ❑ Feature Services (WFS & WCS + SLDs)
  - ❑ Streams actual feature data over the Internet, available as individual feature classes
  - ❑ Allows extra functionality of changing symbology or exporting the data locally; cleaner maps
  - ❑ Higher bandwidth requirement
  - ❑ Filtering; more sophisticated linking



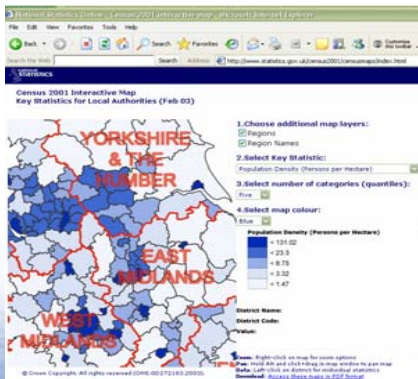
# Geography Markup Language 2.x-3.x

- ❑ XML encoding for transport and storage of geographic information, including spatial and non-spatial properties of features
- ❑ Defines the XML schema syntax, mechanisms, and conventions that provide open, vendor-neutral framework for the definition of geospatial application schemas and objects
- ❑ Allows profiles that support proper subsets of GML framework descriptive capabilities
- ❑ Support schemas for specialized domains
- ❑ Support storage and transport of application schemas and datasets
- ❑ Increase ability to share schemas and information
- ❑ 3.0 latest; 2.1.2 used with WFS (and in OSMM)



# Transforming GML to SVG

- ❑ GML can be transformed (e.g. via XSLT) into SVG:  
OSMM GML + Stylesheet = SVG
- ❑ Graphical objects can be grouped, styled, transformed and composited into previously rendered objects. The feature set includes nested transformations, clipping paths, alpha masks, filter effects, template objects and extensibility.
- ❑ SVG drawings can be dynamic and interactive. The Document Object Model (DOM) for SVG, which includes the full XML DOM, allows straightforward and efficient vector graphics animation via Javascript or SMIL. A rich set of event handlers such as *onmouseover* and *onclick* can be assigned to any SVG graphical object.



# Data Services Opportunities – Consuming Services



# Problem: Numeric Data Integration

- ❑ Early OGC specifications and services are relatively map- and feature-centric—service content relatively “dumb” from the point of view of attribute/tabular data integration
- ❑ How can geospatial web services be integrated with numeric data stores in a web services environment?
- ❑ Discussion docs:
  - ❑ Geo-linked Data Access Service (GDAS)  
([http://portal.opengis.org/files/?artifact\\_id=5858](http://portal.opengis.org/files/?artifact_id=5858))
  - ❑ & associated Geo-Linking Service (GLS)  
([http://portal.opengis.org/files/?artifact\\_id=5859](http://portal.opengis.org/files/?artifact_id=5859))
  - ❑ Demo implementation at:  
<http://wms1.agr.gc.ca/gdas/gdas.phtml>



# A Web Processing Example Using GDAS

([http://wms1.agr.gc.ca/GeoPS/gdas\\_GeoPS\\_4\\_client.php](http://wms1.agr.gc.ca/GeoPS/gdas_GeoPS_4_client.php))



- ❑ **OGC Interoperability Add-on for ArcGIS**

<http://www.esri.com/software/standards/interopdownload.html>

- ❑ **Cubewerx Extensions for ArcGIS and MapInfo**

[http://www.cubewerx.com/main/about\\_us/news/WMS\\_ext.html](http://www.cubewerx.com/main/about_us/news/WMS_ext.html)

- ❑ **ARC3WMS (ArcView 3.x WMS Client)**

<http://www.refractions.net/arc3wms/>

[Demo EDINA adapter ☺](#)

- ❑ **ArcExplorer Web**

<http://www.esri.com/software/standards/interopdownload.html#aeweb>



# OGC Client Software – *some others*

- ❑ **CadCorp MapBrowser**

[http://www.cadcorp.com/products\\_geographical\\_information\\_systems/map\\_browser.htm](http://www.cadcorp.com/products_geographical_information_systems/map_browser.htm)

- ❑ **UDIG (User-friendly Desktop Internet GIS)**

<http://udig.refractions.net/downloads/udig1.0.RC4.exe>

- ❑ **Gaia**

<http://www.thecarbonproject.com/products/gaia.html>

- ❑ **MapInfo (7.8)**

<http://extranet.mapinfo.com/products/Overview.cfm?productid=1044>

- ❑ **AutoCAD**

<http://www.ime.co.uk/WMS/>



- ❑ Red Spider Catalog2 (Ionic)  
[http://www.ionicsoft.com/products/main\\_catalog.jsp](http://www.ionicsoft.com/products/main_catalog.jsp)
- ❑ deegree (open source)  
<http://deegree.sourceforge.net/>
- ❑ terraCatalog (Con terra)  
[http://www.conterra.de/software/terraCatalog/index\\_engl.shtm](http://www.conterra.de/software/terraCatalog/index_engl.shtm)
- ❑ Indicio (Galdos)  
<Http://www.galdosinc.com/index.html>



# Cascading Map Servers: Examples

- ❑ USGS National Map  
<http://nationalmap.usgs.gov>
- ❑ NC OneMap  
<http://www.nconemap.com>
- ❑ FEMA Hazardmaps.gov  
<http://hazardmaps.gov>



# OGC Server Software -- Commercial

- ❑ **Cubeserve WMS Cascading Map Server (Cubewerx)**  
[http://www.cubewerx.com/main/products/CubeSERV\\_WMS.html](http://www.cubewerx.com/main/products/CubeSERV_WMS.html)
- ❑ **Cartalinea (Galdos)**  
<http://www.galdosinc.com/index.html>
- ❑ **Red Spider (Ionic)**  
<http://www.ionicsoft.com/products/specRedSpiderEnterprise.jsp>
- ❑ **Moximedia Internet Mapping Framework**  
<http://www.moximedia.com/ows.html>
- ❑ **Cadcorp SIS**  
<http://www.cadcorp.com/index.htm>
- ❑ **Intergraph WMS Client**  
[www.wmsviewer.com](http://www.wmsviewer.com)



# OGC Server Software -- Connectors

- ❑ WMS Bridge – ArcIMS WMS Connector (Compusult)

[http://www.compusult.net/cslt\\_prod\\_dm\\_wmsb.html](http://www.compusult.net/cslt_prod_dm_wmsb.html)

- ❑ ArcIMS WMS and WFS Connectors (ESRI)

<http://www.esri.com/software/standards/product-support.html>



- ❑ Minnesota Map Server

<http://mapserver.gis.umn.edu>

- ❑ Geoserver

<http://geoserver.sourceforge.net/html/index.php>

- ❑ deegree

<http://deegree.sourceforge.net/index.html>

For a list of products compliant to or implementing  
OGC specs or interfaces see:

<http://www.opengis.org/resources/?page=products>



# Example Server Implementations

## ❑ Federal

- National Map <http://www.nconemap.com>
- FEMA HazardMaps <http://hazardmaps.gov>

## ❑ State and Local

- NC OneMap <http://www.nconemap.com>
- NCMapNet <http://www.ncmapnet.com>
- Louisiana Atlas  
<http://atlas.lsu.edu/central/displayOGCWFSFAQ.htm>

## ❑ University

- Harvard University WMS (Distributed) Servers  
[http://portal.opengis.org/files/files/?artifact\\_id=5908](http://portal.opengis.org/files/files/?artifact_id=5908)

