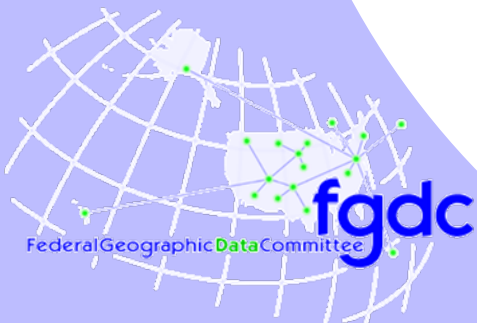


## Geospatial Web Services

# *Introduction to Geospatial Web Services*

An introduction and inventory of geospatial web services and their importance to interoperability in the geospatial domain.

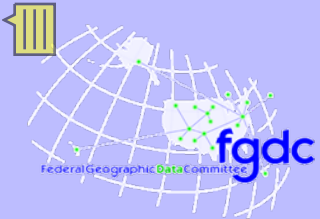




# Learning Objectives

After completing this module the student can:

- ▶ Explain the difference between a website, a web service, and a geospatial web service
- ▶ Differentiate between types of geospatial web services and how they are used
- ▶ Explain the purpose of the Open Geospatial Consortium (OGC)

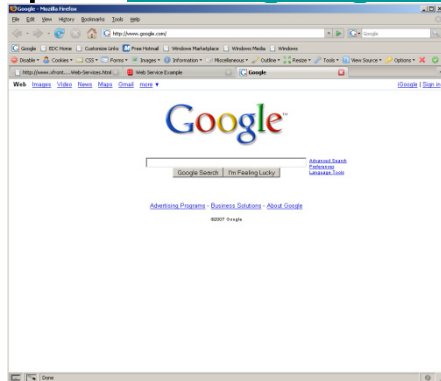


# Differences between a Website & Web Services

## Websites

- ▶ Provide HTML pages and forms for human users to navigate and perform functions
  - Searching, Shopping, Interaction
- ▶ Front end user interfaces through the browser

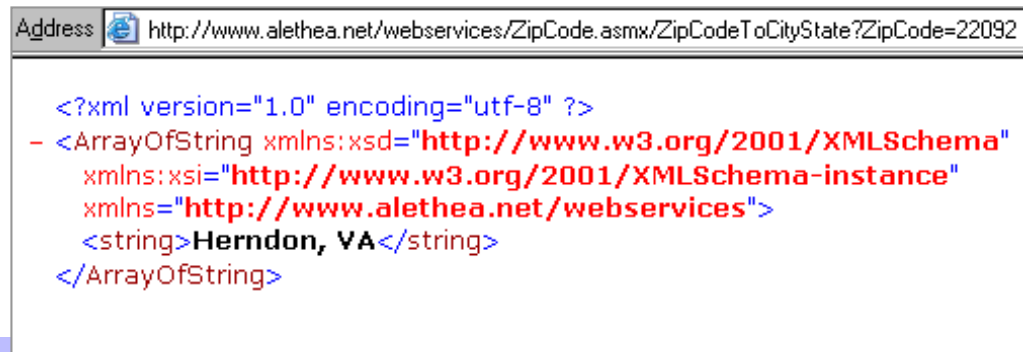
Example: [www.google.com](http://www.google.com)



## Web Services

- ▶ NOT websites
- ▶ Operations that can be called to return information
- ▶ Invoked automatically through a program
- ▶ Publicly available and standardized for use by all programmers

Example:



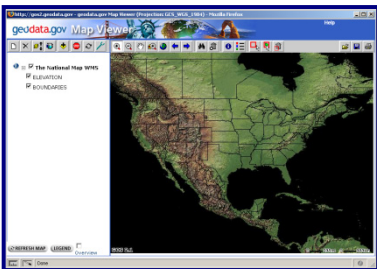


# Types of Geospatial Web Services

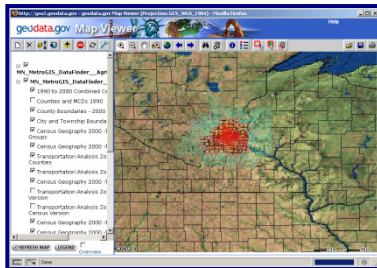
## Web based services with a focus on geospatial information



1. Data Discovery: Provide search and discovery to geospatial data and services



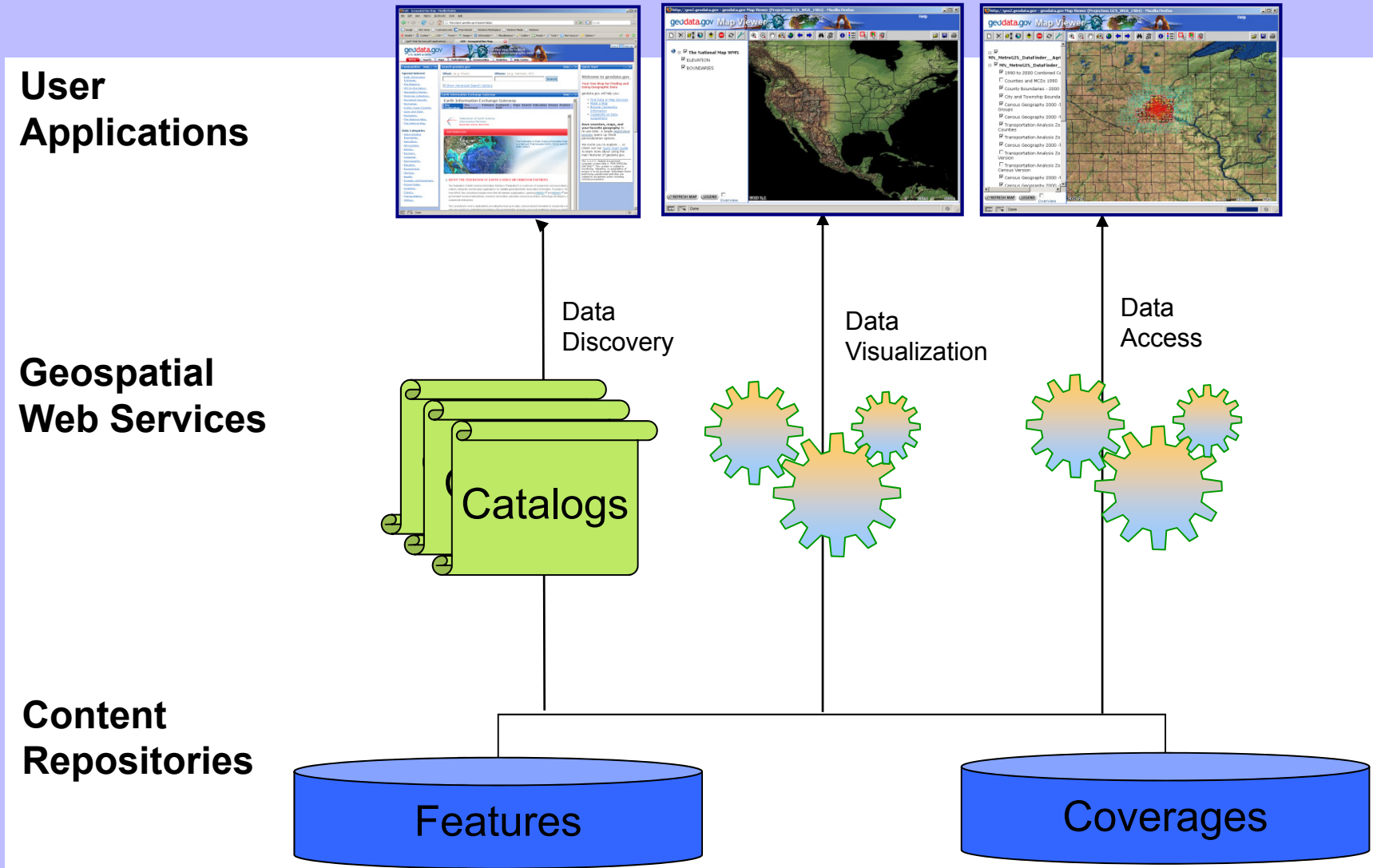
2. Data Visualization – Provide visualization images of the actual geospatial data



3. Data Access – Provides access to the actual geospatial data



# Geospatial Web Service Types

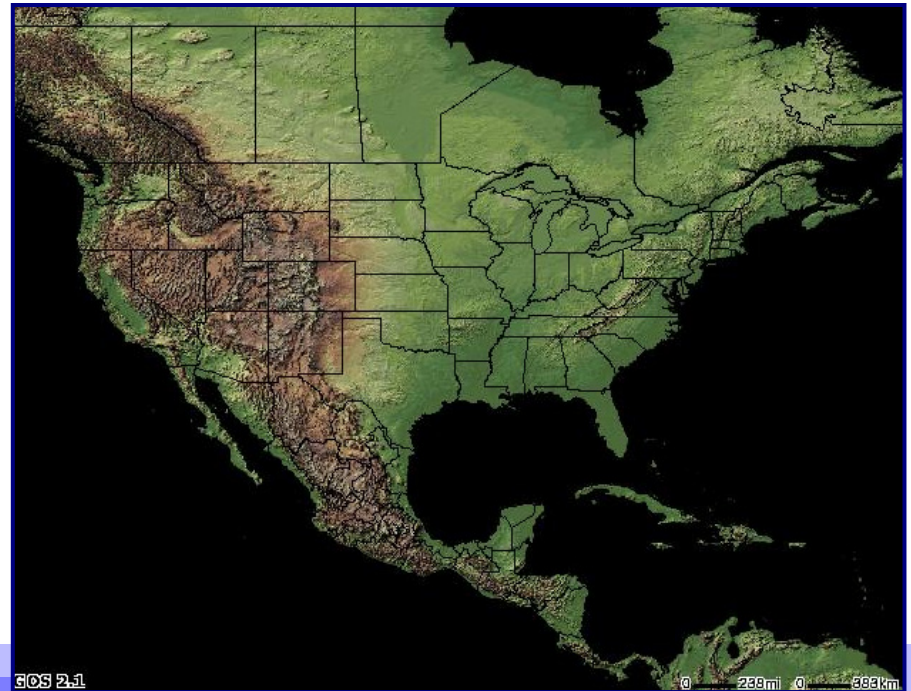


# Geospatial Web Service Example

## Request to a web service for an image of a map

### ► Web Map Service (WMS)

<http://100.200.128.70/wms/process.cgi?REQUEST=GetMap&FORMAT=image/gif&WIDTH=640&HEIGHT=480&LAYERS=relief,bound&SRS=EPSG:4326&BBOX=-137,14,-50.,52&VERSION=1.1.1>





# Geospatial Web Service Example

## Request to a web service for attribute information for a specific point

### ► Web Feature Service (WFS)

[http://100.200.128.70/geoserver/wfs?request=GetFeature&version=1.0.0&typeName=massgis:GISDATA.TOLLBOOTHES\\_POLY](http://100.200.128.70/geoserver/wfs?request=GetFeature&version=1.0.0&typeName=massgis:GISDATA.TOLLBOOTHES_POLY)

```

<?xml version="1.0" encoding="UTF-8"?>
<wfs:FeatureCollection xmlns:wfs="http://www.opengis.net/wfs" xmlns:gml="http://www.opengis.net/gml" xmlns:massgis="http://massgis.state.ma.us/featuretype" xmlns:xsi="
  <gml:boundedBy>
    <gml:Box srsName="http://www.opengis.net/gml/srs/epsg.xml#26986">
      <gml:coordinates xmlns:gml="http://www.opengis.net/gml" decimal="." cs="," ts=" " >46372.21687076,875108.58939714 239087.47029824,903573.651823
    </gml:Box>
  </gml:boundedBy>
  <gml:featureMember>
    <massgis:GISDATA.TOLLBOOTHES_PT fid="GISDATA.TOLLBOOTHES_PT.1">
      <massgis:OBJECTID>1</massgis:OBJECTID>
      <massgis:ID>0</massgis:ID>
      <massgis:OWNER>Massachusetts Turnpike Authority</massgis:OWNER>
      <massgis:DISTRICT>1</massgis:DISTRICT>
      <massgis:LOCATION>MassPike Exit 1</massgis:LOCATION>
      <massgis:TOWN>West Stockbridge</massgis:TOWN>
      <massgis:ROUTES>90/41</massgis:ROUTES>
      <massgis:MPO>Berkshire</massgis:MPO>
      <massgis:SHAPE>
        <gml:Point srsName="http://www.opengis.net/gml/srs/epsg.xml#26986">
          <gml:coordinates xmlns:gml="http://www.opengis.net/gml" decimal="." cs="," ts=" " >46372.21687076,899010.9202994</gml:coordinates>
        </gml:Point>
      </massgis:SHAPE>
    </massgis:GISDATA.TOLLBOOTHES_PT>
  </gml:featureMember>
  <gml:featureMember>
    <massgis:GISDATA.TOLLBOOTHES_PT fid="GISDATA.TOLLBOOTHES_PT.2">
      <massgis:OBJECTID>2</massgis:OBJECTID>
      <massgis:ID>0</massgis:ID>
      <massgis:OWNER>Massachusetts Turnpike Authority</massgis:OWNER>
      <massgis:DISTRICT>1</massgis:DISTRICT>
      <massgis:LOCATION>MassPike Exit 2</massgis:LOCATION>
      <massgis:TOWN>Lee</massgis:TOWN>
      <massgis:ROUTES>90/20</massgis:ROUTES>
      <massgis:MPO>Berkshire</massgis:MPO>
      <massgis:SHAPE>

```

# Geospatial Interoperability

- ▶ Ability for different systems to exchange/use geospatial information
  - Web services provide interoperability
- ▶ Interoperability drives costs down and productivity up
  - How many hours does it take to transform, translate and understand “free” data you download from the web?
  - Are you even certain it is “fresh” after all that processing?
- ▶ Spatial Data Infrastructures (SDI's) use web services to access and publish data, services and metadata
  - Need to be interoperable with other SDI systems world wide

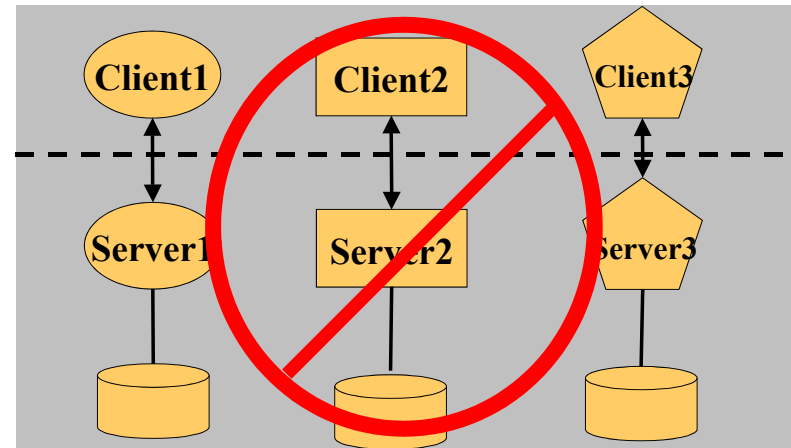


Figure 1: “Stove Pipe” Systems

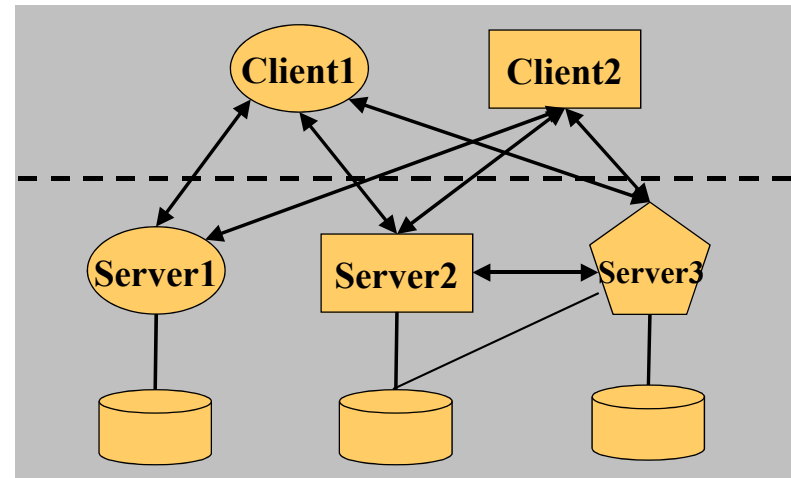
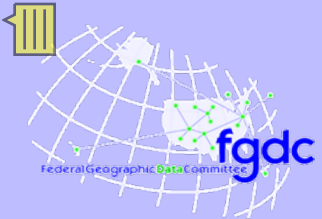


Figure 2: Network of Systems





# The Open Geospatial Consortium

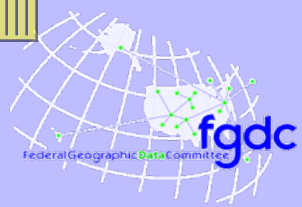
## Vision:

*Develops standards for geospatial web services*

## Mission:

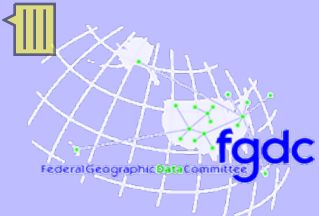
*A world in which everyone benefits from geographic information and services made available across any network, application, or platform*





# OGC Provides Interoperability

- ▶ OGC Specifications are agreed upon by a broad constituency of the geospatial community and are supported by many software vendors
- ▶ OGC links geographic data with mainstream Information Technology (IT)
- ▶ Vendor implementation in products enables the direct access and use of data produced by programs from many vendors



# Example Members

## Integrators

- ▶ Lockheed Martin, QuenitQ, SAIC, BAE Systems, Boeing, General Dynamics, Computer Sciences Corporation, Schlumberger Information Solutions ...



## Major Hardware and Software Companies

- ▶ Sun Microsystems, Oracle, HP, Microsoft...



## Developers of GeoSpatial Technologies and Services

- ▶ Intergraph, AutoDesk, ESRI, LaserScan, MapInfo, SICAD, GE Network Solutions, PCI Geomatics, Leica Geosystems,



## Government agencies that depend on geoprocessing

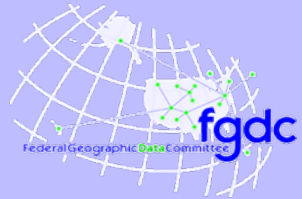
- ▶ United Nations, National Government Agencies from: United States, Canada, United Kingdom, France, Germany, Australia, Japan, Republic of Korea; Sub-National Governments: California, Consellería de Medio Ambiente (Spain), NRW....



## Others

- ▶ Content Providers, Power, Universities, Consultants, Startups...

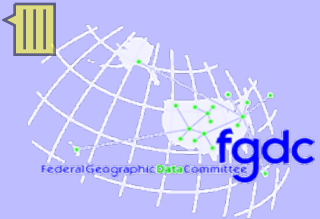




# OGC and Standards Organizations

OGC collaborates and work closely with:

- ▶ International Organization for Standardization (ISO)  
TC 211 and 204
- ▶ World Wide Web Consortium (W3C)
- ▶ Internet Engineering Task Force (IETF)
- ▶ OASIS
- ▶ Automotive Mobile Information Consortium
- ▶ Open Mobile Alliance
- ▶ And others...



# Approved OGC Specifications

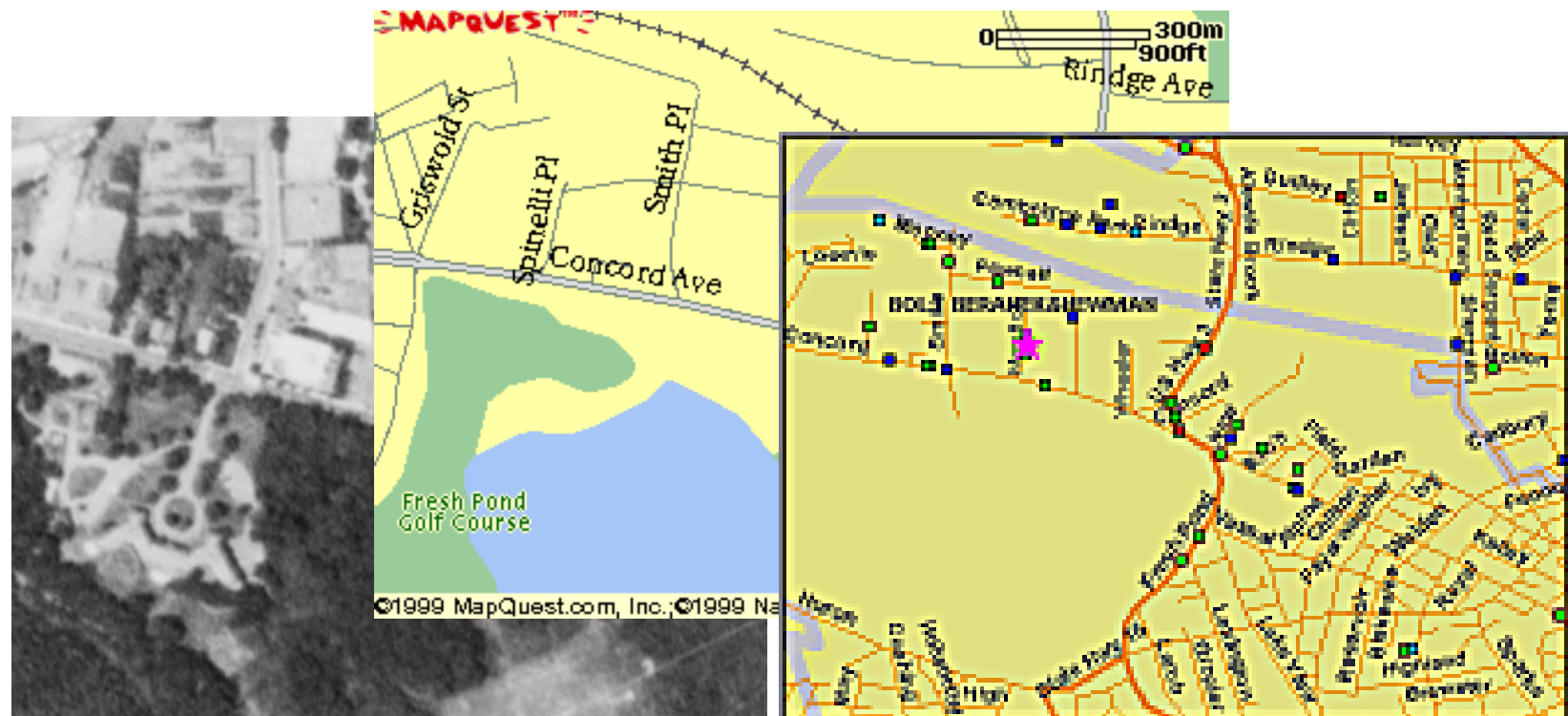
Service Type	Name	SDI Suite 1.0
<i>Data Discovery</i>	Catalog Service with CSDGM Metadata	Version 2.0 Z39.50 Protocol
<i>Data Visualization</i>	Web Map Service	Version 1.1.1
	Style Layer Descriptor	
	Web Map Context	
<i>Data Access</i>	Web Feature Service	Version 1.0
	Web Coverage Service	Version 1.1
	Geographic Markup Language	Version 2.1.2
	Filter Encoding	Version 1.1

# A Concrete Example on Non-Interoperability

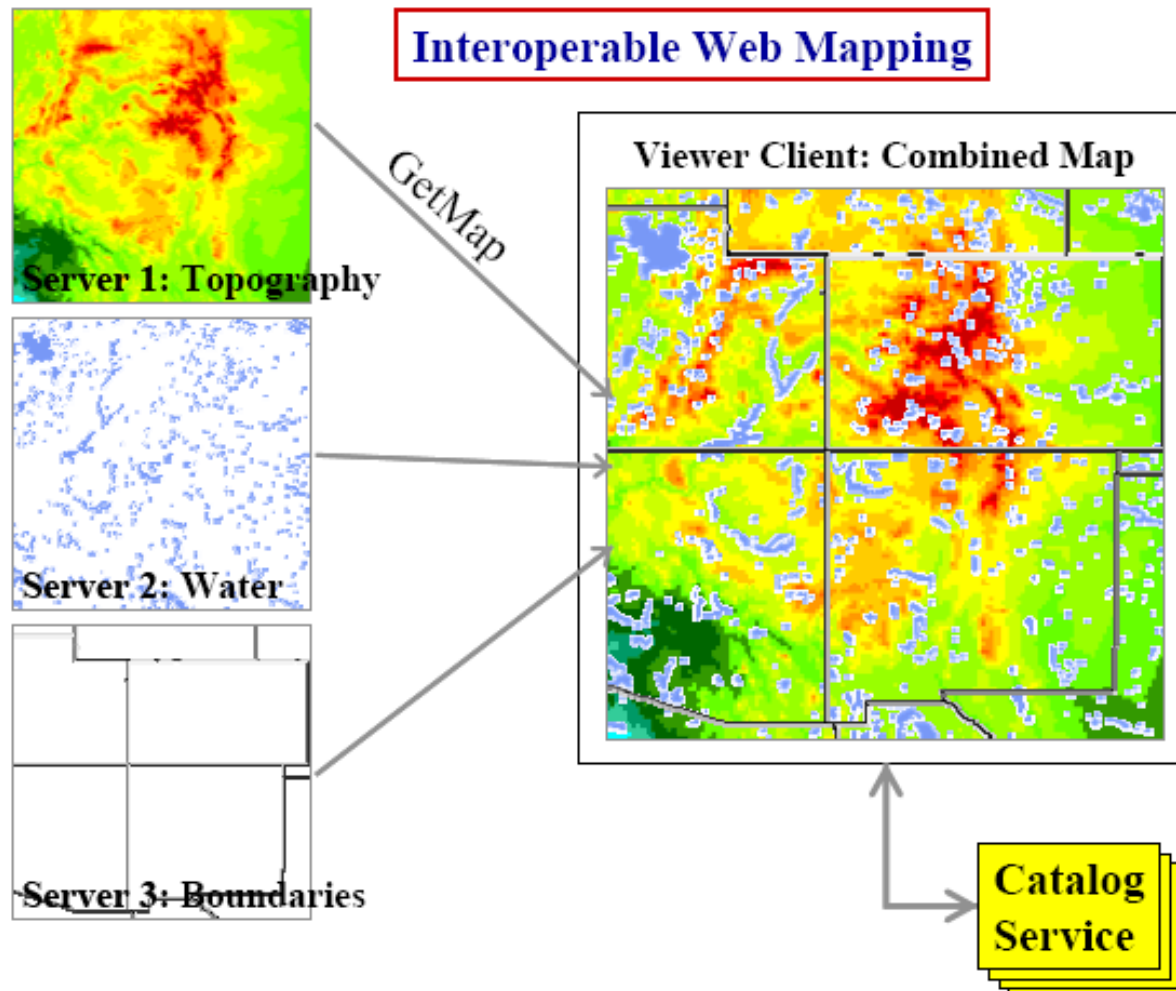
**TerraServer - <http://terraserver.microsoft.com>**

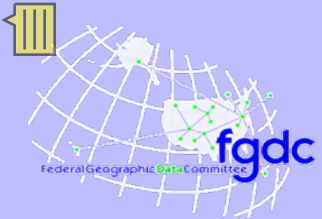
**MapQuest - <http://www.mapquest.com>**

**EPA - <http://www.epa.gov/enviro/enviromapper.html>**



# A Concrete Example of Interoperability





# Web Mapping Interoperability Example

**Central America demonstration developed for Global Spatial Data Infrastructure (GSDI) meeting in Cartagena, Colombia 2001 to demonstrate capabilities of WMS servers and client**

## Data Servers Established:

- ▶ **FGDC – Reston**
  - DCW Boundaries
  - Roads
  - Cities
  - Shaded Relief
- ▶ **EROS Data Center – South Dakota**
  - El Salvador Roads1 & 2
  - Cities
  - Departments
- ▶ **UNITEC – Honduras**
  - Rivers
  - Lakes
  - Land Use
  - Base Map







Bookmarks Location: <http://grid/multiviewer/viewer2.htm>

Instant Message WebMail Contact People Yellow Pages Download Channels

# OpenGIS Multi-Server Web Mapping

## Layers:

- DCW Boundaries [Reston]
- DCW Roads [Reston]
- DCW Cities [Reston]
- El Salvador Roads [EDC]
- El Salvador Cities [EDC]
- El Salvador Departments [EDC]
- Mitch Rivers [UNITEC]
- Mitch Lakes [UNITEC]
- Mitch Landuse [UNITEC]
- Mitch Base Map [UNITEC]
- WSI Shaded Relief [Reston]

Redraw Map

Map: No currently visible layers...

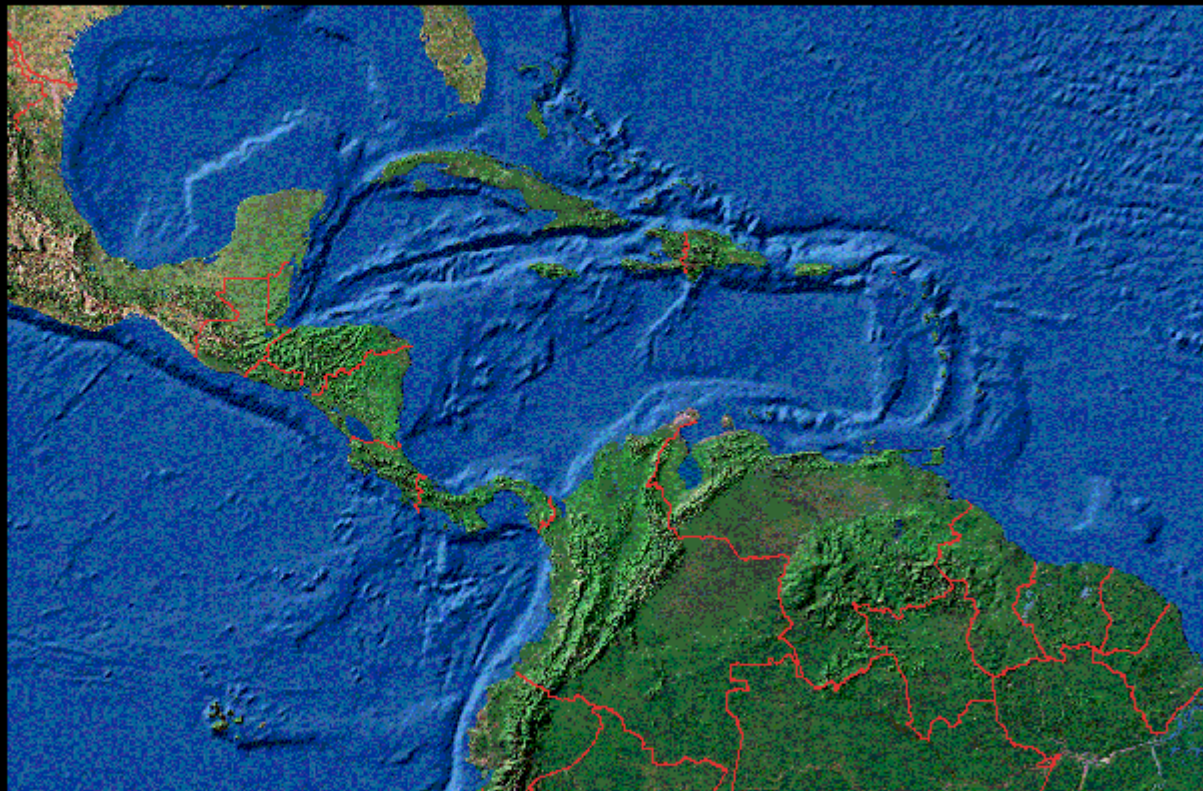
Zoom In Zoom Out Re-Center

# OpenGIS Multi-Server Web Mapping

## Layers:

- DCW Boundaries [Reston]
- DCW Roads [Reston]
- DCW Cities [Reston]
- El Salvador Roads [EDC]
- El Salvador Cities [EDC]
- El Salvador Departments [EDC]
- Mitch Rivers [UNITEC]
- Mitch Lakes [UNITEC]
- Mitch Landuse [UNITEC]
- Mitch Base Map [UNITEC]
- WSI Shaded Relief [Reston]

Redraw Map



Zoom In Zoom Out Re-Center

# OpenGIS Multi-Server Web Mapping

## Layers:

- DCW Boundaries [Reston]
- DCW Roads [Reston]
- DCW Cities [Reston]
- El Salvador Roads [EDC]
- El Salvador Cities [EDC]
- El Salvador Departments [EDC]
- Mitch Rivers [UNITEC]
- Mitch Lakes [UNITEC]
- Mitch Landuse [UNITEC]
- Mitch Base Map [UNITEC]
- WSI Shaded Relief [Reston]

Redraw Map



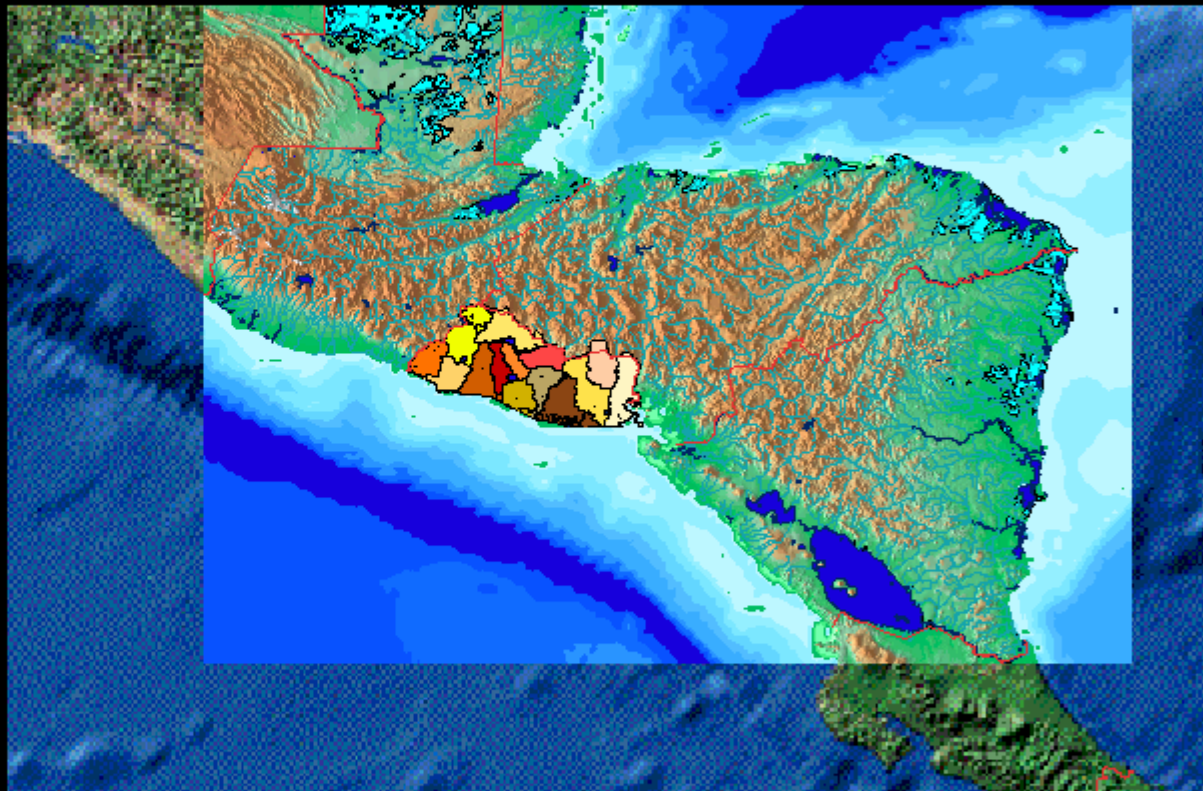
Zoom In Zoom Out Re-Center

# OpenGIS Multi-Server Web Mapping

## Layers:

- DCW Boundaries [Reston]
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- El Salvador Departments [EDC]
- Mitch Rivers [UNITEC]
- Mitch Lakes [UNITEC]
- Mitch Landuse [UNITEC]
- Mitch Base Map [UNITEC]
- WSI Shaded Relief [Reston]

Redraw Map



Zoom In Zoom Out Re-Center

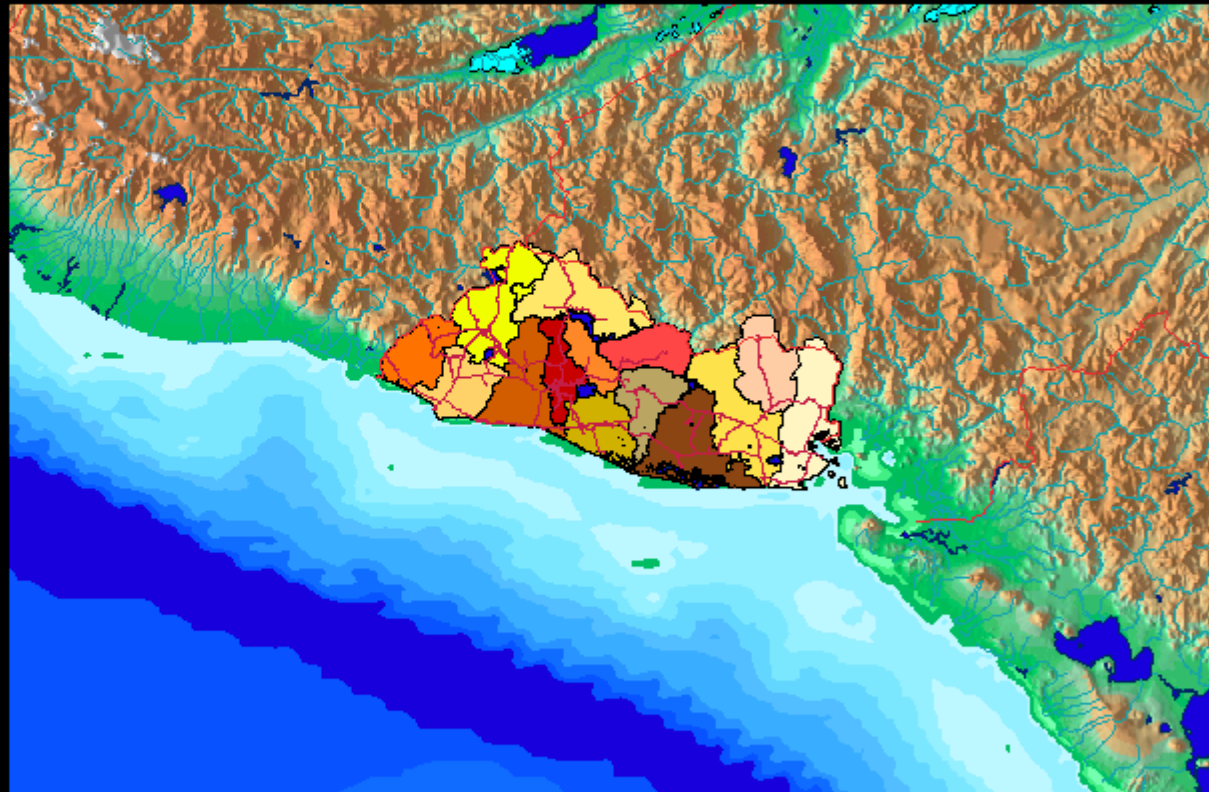


# OpenGIS Multi-Server Web Mapping

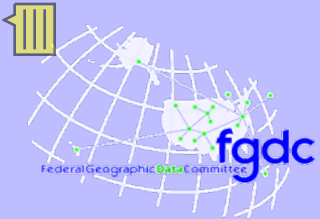
## Layers:

- DCW Boundaries [Reston]
- DCW Roads [Reston]
- DCW Cities [Reston]
- El Salvador Roads [EDC]
- El Salvador Cities [EDC]
- El Salvador Departments [EDC]
- Mitch Rivers [UNITEC]
- Mitch Lakes [UNITEC]
- Mitch Landuse [UNITEC]
- Mitch Base Map [UNITEC]
- WSI Shaded Relief [Reston]

Redraw Map



Zoom In Zoom Out Re-Center



# What Does All This Do for You?

## ‘Near instant’ data interoperability

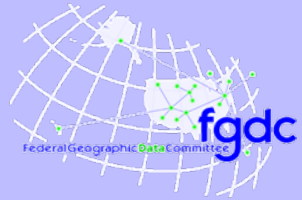
- ▶ Access and exploit a wide variety of spatial data on-demand
- ▶ No more time spent translating files to your format or projection

## Supports web based services architecture

- ▶ Get your GIS over the web. Choice of web-based tools
- ▶ Locate information across a distributed environment using different vendor applications, different projections

## No more data configuration management

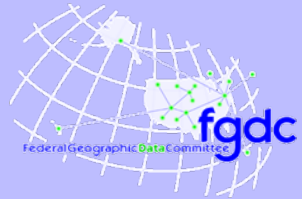
- ▶ Get your answer from the latest data when you need it
- ▶ Reduce data maintenance costs. Access and maintain only the data you care about



This is the conclusion of: Introduction to Geospatial Web Services.

You should be able to:

- ▶ Explain the difference between a website, a web service, and a geospatial web service
- ▶ Differentiate between types of geospatial web services and how they are used
- ▶ Explain the purpose of the Open Geospatial Consortium (OGC)



# Additional Lessons

**The FGDC invites you to visit**

**<http://www.fgdc.gov/training/nsdi-training-program/online-lessons>**

**for additional lessons.**