

# Overview of Web Services

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# What are web services?

- Web services provide a standard means of interoperating between different software applications, running on a variety of platforms and/or frameworks -W3C Org
- So a web service is a mechanism that provides some kind of data and/or functionality over the Web

# So what's a GIS web service?

- Provides access to GIS data or functionality over the internet in a standardized way
- GIS web service is NOT an internet mapping application
  - A service can be *consumed by*, or integrated into, a web application
  - A web service can be thought of as an Interface, by which your application accesses the data or functionality

# What's a GIS web service, cont'd

- GIS services can provide geographic data
- Can also provide geoprocessing tasks, such as address matching, routing, or geocoding
- Provided through standard internet protocols

# Advantages of using GIS web services

- Data does not need to be housed locally- can come from many sources, and maintained by the hosting entity
- Functionality is already provided, doesn't need to be built by the app developer
- Developers can use multiple services in their applications

# Advantages of using GIS web services

- Services use standard formats regarding how they are accessed and what capabilities they have
- Interoperability- can work across different platforms and applications and over networks

# Types of GIS web services

- OGC Standard services:
  - WMS- Web Map Service
  - WFS- Web Feature Service
  - WCS- Web Coverage Service
  - WPS- Web Processing Service
  - WS-Common- Web Services Common
- Proprietary services

# WMS- Web Map Service

- Provides a “simple HTTP interface for requesting georeferenced map images” (OGC)
- The request defines the spatial extent and layers to be returned
- A “map” is a digital image of geographic information
  - A map is *not* the data itself
- Usually rendered in PNG, JPEG, or GIF format, sometimes SVG
- Both vector and raster data supported

# Web Map Service

- There are two subclasses of WMS
- Basic WMS supports two operations:
  - GetCapabilities
  - GetMap
- Queryable WMS- same as Basic, also supports the optional GetFeatureInfo operation

# GetCapabilities operation

- Purpose: request the service's metadata
- Returns an XML document containing information on the service's holdings and abilities
- The resultant information includes (but not limited to) the WMS version, what data layers are available, layer properties, supported spatial reference systems, and which operations are supported

# GetCapabilities example

<http://localhost/cgi-bin/mapserv.exe?MAP=C:/ms4w/apps/ka-map-1.0/htdocs/megug/WFStest.map&SERVICE=wms&VERSION=1.1.1&REQUEST=GetCapabilities>

# GetMap operation

- Returns a map image
- Client will specify bounding box, spatial reference system, layers, size and format of returned map
- If request is successful, returns a map. If not, an Exception is returned in an XML document.

# GetMap example

```
http://localhost/cgi-  
bin/mapserv.exe?MAP=C:/ms4w/apps/ka-map-  
1.0/htdocs/megug/WFStest.map&SERVICE=wms  
&VERSION=1.1.1&LAYERS=Counties,towns100&  
REQUEST=GetMap&SRS=EPSG:26919&BBOX=33  
6615,4759552,662100,5256295&FORMAT=image  
/png&WIDTH=800&HEIGHT=800
```

# GetFeatureInfo operation

- Only supported by layers with attribute `<queryable="1">` (as found in a GetCapabilities request)
- Returns information about a feature-similar to an Identify in ArcGIS
- Format is similar to a GetMap request, but includes an XY location of the pixel to be queried

# GetFeatureInfo example

```
http://localhost/cgi-bin/mapserv.exe?MAP=C:/ms4w/apps/ka-map-1.0/htdocs/megug/WFStest.map&SERVICE=wms&VERSION=1.1.1&LAYERS=Counties,towns100&REQUEST=GetFeatureInfo&SRS=EPSG:26919&BBOX=336615,4759552,662100,5256295&FORMAT=image/png&WIDTH=800&HEIGHT=800&X=200&Y=200&query_layers=Counties
```

# Web Feature Service (WFS)

- The WFS standard defines interfaces and operations for data access and manipulation on a set of geographic features, including:
  - Get or Query features based on spatial and non-spatial constraints
  - Create a new feature instance
  - Get a description of the properties of features
  - Delete a feature instance
  - Update a feature instance
  - Lock a feature instance

(Source: OGC)

# Web Feature Service

- While a WMS returns an image of a map, WFS returns the *actual features*
- Use with vector data
- Allows analysis and editing
- Ability to filter and query data
- Features are transported in GML format
- Data may come from multiple sources

# Required WFS Operations

- GetCapabilities- similar to GetCapabilities in WMS. Returns an XML document describing what services and feature types the service supports
- DescribeFeatureType- describes the structure/schema of any feature in the service
- GetFeature- allows a client to request and retrieve actual features.

# Optional WFS Operations

- GetGMLObject
- Transaction
- LockFeature
- GetFeatureWithLock

# Three types of WFS

- Basic WFS- supports GetCapabilities, DescribeFeatureType and GetFeature
  - Can be considered a “read-only” service
- XLink WFS- supports all basic operations, and also supports GetGMLObject
- Transaction WFS- supports all basic operations. Also implements Transaction, and optionally, LockFeature.

# WFS GetCapabilities example

`http://localhost/cgi-bin/mapserv.exe?MAP=C:/ms4w/apps/ka-map-1.0/htdocs/megug/WFStest.map&SERVICE=wfs&VERSION=1.1.0&REQUEST=GetCapabilities`

# WFS DescribeFeature example

```
http://localhost/cgi-  
bin/mapserv.exe?MAP=C:/ms4w/app  
s/ka-map-  
1.0/htdocs/megug/WFStest.map&SE  
RVICE=wfs&VERSION=1.1.0&REQUE  
ST=DescribeFeatureType
```

# WFS GetFeature example

```
http://localhost/cgi-  
bin/mapserv.exe?MAP=C:/ms4w/apps/ka-  
map-  
1.0/htdocs/megug/WFStest.map&SERVICE  
=wfs&VERSION=1.1.0&REQUEST=GetFeat  
ure&TYPENAME=Counties
```

# Web Coverage Service (WCS)

- “The Web Coverage Service (WCS) supports electronic retrieval of geospatial data as “coverages”- that is, digital geospatial information representing space-varying phenomena” –OGC
- Not to be confused with an ArcGIS Coverage

# Web Coverage Service (WCS)

- Used to deliver raster data over internet
- Coverages may be used for spatial analysis (whereas a WMS only returns a static image)

# WCS Operations

- GetCapabilities
- DescribeCoverage
- GetCoverage

# GetCapabilities

- Returns an XML document, describing the service and coverages within
  - Similar to GetCapabilities for WMS and WFS

# DescribeCoverage

- Returns an XML document, containing a full description of one or more coverages within a WCS
- Provides information such as spatial extent, spatial resolution, cell size, spatial reference system

# GetCoverage

- Returns a requested coverage in a known coverage format (e.g. GeoTIFF)
- Similar to WMS GetMap and WFS GetFeature requests

# Web Processing Service (WPS)

- Intended to be a standardized means of performing geoprocessing tasks over the internet
- Current WPS version is targeted at both vector and raster data
- Standardizes how inputs/outputs are described, how to request execution, how to handle output

# WPS Operations

- GetCapabilites
- DescribeProcess
- Execute

# GetCapabilities

- Returns service-level metadata
- Provides names and descriptions of each process in a WPS instance, as well as specification version
- Response is delivered as an XML document

# GetCapabilities example

- <http://www.bobGIS.com/wps?REQUEST=GetCapabilities&VERSION=1.0.0>

# DescribeProcess

- Returns detailed information about the service's available processes
  - Required input data
  - Allowable input formats
  - Description of the output data, such as type and format
  - Describe mandatory, optional and default parameters

# DescribeProcess example

- <http://www.bobGIS.com/wps?SERVICE=WPS&REQUEST=DescribeProcess&VERSION=1.0.0&Identifier=Intersect>

# Execute

- Run the process specified by the client, return the outputs to the client
- Outputs can be returned as an XML response document, or stored as a web accessible resource

# Proprietary services

- Non-standard (not “open”) services
- ArcGIS and ArcIMS
  - ArcGIS Server services can include:
    - Map
    - Globe
    - Geoprocessing
    - Address Geocoding
    - Geodata
    - Image

# Proprietary services

- ArcIMS services
  - Feature
  - Image
  - Metadata
- MapQuest, Google Maps, Virtual Earth, Yahoo Maps, etc
- Advantages and limitations of proprietary services