Web Services, Mashups & KML

Exploring and Using the GeoWeb & Web 2.0 Technologies

AJ Wortley – UW State Cartographer’s Office
– Overview –

• Introduction to Web 2.0
• Web services & web service clients
• KML -> 3D client publishing
• KML Clients & Tools
• Mashups explained -> web services applied
• Mashup Tools
• Mashup Frameworks
• Local & other examples
The Context

• Globalization
• Shrinking resources
• Information society
• Moving from *Maps* as art and output …

to geospatial as an organizing principle in support of efficiency, economy, knowledge communication and measuring well-being
The GeoWeb

The Geospatial Web or Geoweb is a relatively new term that implies the merging of geographical (location-based) information with the abstract information that currently dominates the Internet. This would create an environment where one could search for things based on location instead of by keyword only – i.e. “What is Here?”.

The interest in a Geoweb has been advanced by new technologies, concepts and products. Virtual globes such as Google Earth and NASA World Wind as well as mapping websites such as Google Maps, Windows Live Local and Yahoo Maps have been major factors in raising awareness towards the importance of geography and location as a means to index information. The increase in advanced web development methods such as Ajax are providing inspiration to move GIS (Geographical Information Systems) into the web.

The concept of a Geospatial Web may have first been introduced by Dr. Charles Herring in his US DoD paper, An Architecture of Cyberspace: Spatialization of the Internet, 1994, U.S. Army Construction Engineering Research Laboratory (40°8′58.9″N 88°16′22.7″W / 40.149694, -88.272972 (U.S. Army Construction Engineering Research Laboratory)). Dr. Herring proposed that the problem of defining the physical domain in a computer or cyber-infrastructure, providing real time and appropriate fidelity, required a cyber-spatial reference or index combining both Internet Addressing and Hierarchical Spatial Addressing. As such, the Geoweb would be characterized by the self synchronization of network addressing, time and location. The Geoweb would allow location to be used to self organize all geospatially referenced data available through the Internet.
What is Web 2.0

Author: Tim O'Reilly

Author: Ludwig Gatke
URL: http://www.railsonwave.it/2007/1/2/web-2-0-map/
What is Web 2.0
What is Web 2.0

Author: Luca Cremonini  
Source: http://www.railsonwave.it/railsonwave/2007/1/2/web-2-0-map
URL: http://www.railsonwave.com/assets/2006/12/25/Web_2.0_Map.svg
Web 2.0

According to Tim O'Reilly:
"Web 2.0 is the business revolution in the computer industry caused by the move to the Internet as platform, and an attempt to understand the rules for success on that new platform."

An IBM social-networking analyst, Dario de Judicibus, has proposed a different definition which focuses more on social interactions and on architectural implementation:
"Web 2.0 is a knowledge-oriented environment where human interactions generate content that is published, managed and used through network applications in a service-oriented architecture."

Web 2.0 can be defined as "the philosophy of mutually maximizing collective intelligence and added value for each participant by formalized and dynamic information sharing and creation."
Web 2.0

... and whether the technologies came first or the words to describe them, they often adhere to said principles like *reusability*, *interactivity*, *user-generated content* ....

Which fits very well in the world of GIS and web publishing of Geographic Information – as if it’s where we were headed all along.
Web 2.0 – in other words

- Internet = platform → connected devices
- Government and corporate data combined with *user-created data* (*UGC, VGI, crowd-sourced*)
- 2-way interaction encouraging interactive participation and collaboration
- Authoring of data as *(re)usable* web services
- Data as a service | s/w as a service (SAAS)
Web 2.0 Content Services

- Blog content
- Web surveys, polls, feedback
- Photo sharing, Video sharing
- Searching, shopping
- Social networking sites
- Location, maps and mappable things

… Enter Web services & Mashups
SOA and Web 2.0: The Top-Level Organizing Principles in Software Continue to Converge and Evolve

Source: http://web2.wsj2.com (CC BY)
Web services

A Web service (also Web Service) is defined by the W3C as "a software system designed to support interoperable Machine to Machine interaction over a network." Web services are frequently just Web APIs that can be accessed over a network, such as the Internet, and executed on a remote system hosting the requested services.

(Note: API = Application Programming Interface)
“Open” Web services

• Differentiate … (all location examples)
  – Proprietary services (e.g. ArcWeb Services)
  – Commercial APIs (e.g. Yahoo/Google Maps)
  – Standards-based web services (OGC)
    • Open Geospatial Consortium
    • + ISO, XML …
    • KML, WMS, WFS, WCS
  – Defining Open … not always 100% clear
OGC Web service standards

Of primary interest…

• Web Map Service (WMS) Image
• Web Feature Service (WFS) Feature
• GeoRSS Event
• KML (not really a service, but we’ll come back.)

Of secondary interest …

• Web Coverage Service (WCS) Grid
• Catalog Service for Web (CSW) Catalog
Open Web services

- Open Web Service (WFS) graphic with diagram of Capabilities -> Query
On-line Mapping Applications and Open Geospatial Web Services

Interactive Applications

Web Browser Requirements for Interactive Maps:

Soil Landscapes of Canada

Version 3.0 Interactive Map

Version 2.2 Interactive Map

Ecosystem Framework

Open Web Services:

WMS GetCapabilities
WFS GetCapabilities
Ecozones Context Document

The National Ecological Framework provides a consistent, national spatial context within which ecosystems at various levels of generalization can be described, monitored, and reported on. The use of such a framework of standard ecological units provides for common communication and reporting between different jurisdictions and disciplines, and provides a common ground to report on the state of the environment and the sustainability of ecos.

http://sis.agr.gc.ca/cansis/systems/online_maps.html

Soil Landscapes of Canada (SLCs) describe the major characteristics of soil and land for the whole country. SLCs were compiled at a scale of 1:1 million, and information is organized according to a uniform national set of soil and landscape criteria based on permanent natural attributes. More Info
Map Web Service Authoring Tools

- MapServer
- simpleWMS
- GeoServer
- Featureserver

- Autodesk MapGuide & MapGuide Enterprise

- ArcGIS Server (*ArcIMS, ArcObjects*)
Web Service Clients

• Web clients (Site, application, mashup)
  – E.g. Targeted ads, Coastal Circle Tour, weather
  – Microsoft Virtual Earth = fuzzy line …

• Thin clients (software-lite, service-heavy)
  – E.g. 2D: QGIS, gvSIG, UDig, Gaia
  – E.g. 3D: Worldwind, Google Earth, ArcGIS Explorer

• Thick clients (often traditional software)
  – E.g. ArcGIS, AutoDesk Map, Intergraph
Explore Our Planet
ExploreOurPla.net has a OGC WMS database with +200 public servers and more than 30,000 layers. Most of them are viewable as base map and overlay with Google Maps as framework. You may combine them with transparency to visualize more information.
An OGC Web Map Service (WMS) produces maps of spatially referenced data dynamically from geographic information. Combining different layers and extensions gives you a unique control and you will reach faster want you to achieve.
In any case you can generate a handy geoLink or copy the URL as permalink to come back later or use the information about latitude, longitude, maps, overlays, etc in mails.

The picture above is only a preview of common used layers:
Exchange

• First there was XML …

• Then there was GML …

• Now there is KML …
KML Tools

• MapExcel2KML ....
• KML2SHP, SHP2KML
• Gdal2tiles, GeoServer,
• ESRI-related:
  – Export to KML 2.4.4
  – Arc2Earth
• KML Clients (Google Earth, ArcGIS Explorer, NASA Worldwind)

Welcome to earth.nanaimo.ca

The City of Nanaimo is pleased to provide some of its geographic information for use in Google Earth™ on an experimental basis.

Google Earth™ is a fully featured spatial discovery tool, available free for download at http://earth.google.com/. Using an XML format called KML (Keyhole Markup Language) users are able to create their own features for display in Google Earth™.

Recent G.I.S. software developments have allowed us to begin offering our data in Google Earth™. This includes Safe Software's recently introduced support for the KML format in FME, and a custom KML generation routine running on the recently released MapGuide Open Source.

Warning: These are currently experimental data sets and subject to change without notice. They may be inaccurate or out of date.
Mashup Concepts

• Mashups – The merging of services and content from multiple web sites in an integrated, coherent way is called a *mashup*.

• Most mashups do more than simply integrate services and content. Sites that do mashups typically add value. They benefit users in a way that's different and better than the individual services they leverage.

Source:
http://java.sun.com/developer/technicalArticles/J2EE/mashup_1/
The Mashup Ecosystem: Flourishing In An Increasingly Nurturing Environment

Source: http://web2.wsj2.com
(Location) Map Mashups

Mashups are appearing on the web at an extremely fast rate. Three new mashups typically appear on the web each day. You can see some of the newest ones on the ProgrammableWeb site. The bulk of the mashups on the web involve the use of maps. Many of these sites use mapping services such as those provided by Yahoo Maps and Google Maps.

Source:
http://java.sun.com/developer/technicalArticles/J2EE/mashup_1/
GeoWeb Relationships

(Geo)Web services = content/process

KML = sharing, publishing, exchange

Mashups = web service app's
March 27th, 2007

400 Web APIs

The rate of new web APIs continues apace with our API directory now hitting an even 400 entries. If you View by Category you can see there are just over 50 categories of APIs now listed. Top 3 categories? Mapping, Reference and Internet.

The 400th entry is the Multimap API. The latest version of this JavaScript API for European and global mapping was just announced and includes new features like a geocoding API, search by radius, routing with ‘traveling salesman’ optimization and route animation, and local points of interest. POI, like schools, transportation, restaurants and bars, ATMs, and car parks.

February 18th, 2007

Thanks to Our Sponsors
February 5th, 2007

1,500 Mashups

Last week the ProgrammableWeb database of mashups crossed the 1,500 mashups threshold. That’s an average of just over 100 a month with a fairly steady climb (and as always, this is a sample of all the thousands of mashups out there). Beyond the base numbers it’s generally more interesting to look at any trends or differences over time. If you compare the distribution by tag to back at the 1001 mashup level you can see that, with one exception, not a lot has changed. Mapping then was at 46% versus now at 44%, essentially the same. As are most of the other common mashup subjects: photo 9%, search 9%, and shopping 9%.

Probably the biggest change of note is that you can see video is now in the top 10, with 90 video mashups listed.

On the API side there are now 374 APIs listed. 11 more added in the past 7 days. Google Maps is still king here, with Flickr, Amazon and YouTube next. Again, due to the rise of video mashups, YouTube’s gained a bigger slice of the mashup pie.
Map-based Web Services

- Map image
- 3D image, photo image
- Geocoding, reverse geo-coding
- Gazetteer, place name search
- Analytical processing services
- Geo-tagged content services
- Geosocial networks
Wisconsin County Web Mapping Sites

http://coastal.lic.wisc.edu/
Putting it all together- Case Study

- GIS Cert. Student Project – S. Johnson
- WI Land Economic Inventory Maps
  ~ Bordner Survey
    – Scan historical raster maps & process
    – Gdal2tiles – w/ mashup and/or kml output
    – Develop associated metadata (and in this case web presence.)
    – http://sco.wisc.edu/maps/bordner_main.php
The Wisconsin Land Economic Inventory, commonly referred to as the Bordner Survey, is a data collection effort carried out statewide under the auspices of the Department of Industry, Trade and Commerce between 1937 and 1941 by the State Planning Board. Its mission was to inventory land resources in all parts of the state so that the resources could be used in the most productive manner possible. Although the survey was conducted by Geo-Stat maps, most of the data remain in the archives of the State Cartographer's Office. Small areas of the inventory data have been vectorized and automated for use in specific GIS project analyses. However, the Bordner Survey maps have only been available in static form and only at the above-named centralized repositories until their relatively recent addition to the UW Digital Collections. They nonetheless remain flat files in archived analog or digital form, having never been georeferenced and systematically manipulated and made available and distributable via a modern web interface.

With the advent of popular, free Web 2.0 web mapping and visualization offerings like Google Earth, NASA World Wind, and ESRI's ArcExplorer, and the example of renowned map collectors such as David Rumsey, the potential for giving these maps new life has never been more obvious. This effort, through the State Cartographer's Office, in cooperation with the Wisconsin Historical Society and the iCenter and with the cooperation of the Wisconsin Historical Society, aims to make these maps available and distributable via a modern web interface.
Great Lakes Circle Tour

The Circle Tour site on GLIN has lots of info, but only schematic maps.

The 6,500-mile Great Lakes Circle Tour is a scenic, international road system connecting the five Great Lakes and the St. Lawrence River. It now has its own section on the Great Lakes Information Network.

The Circle Tour signage system was established in the late 1980s as a cooperative, regional effort between the Great Lakes Commission and the eight U.S. states and two Canadian provinces that comprise the Great Lakes-St. Lawrence system.
Wisconsin Coastal Guide – Map Features

• Land
  – Circle Tour route
  – Parks

• Shore
  – Beaches
  – Lighthouses

• Water
  – Shipwrecks

• Viewing
  – Panorama photos
  – Webcams

Use the map as a means to link to existing web content
Map Viewer Interfaces

Web Mapping Interface
- OpenLayers
- MapServer/Chameleon
- GeoServer
- ESRI ArcIMS

Virtual Globe
- Google Earth
- NASA World Wind

Map Search/Directions
- Google Map API
- Yahoo Maps/Pipes
Wisconsin Coastal Guide

Get Down to the Water!

The Great Lakes Circle Tour leads you around the largest freshwater system on the planet — but the main route often takes you far from the water’s edge. This site shows you where to pull off the highway for a quiet beach, a hidden lighthouse, or a secluded park.

360° Panoramas

Have a look around. More than two hundred 360° photo panoramas show you what things look like at many public places where you can drive or walk down to the water. The links below share the views from beaches, parks, and boat ramps — even lonely fire lines where there’s nothing to do but admire the view. Accompanying maps show what direction you are looking as you “turn around.”
Other Map Tools

Google Earth
Google Earth is a free program from Google that puts a planet’s worth of imagery and other geographic information right on your desktop. View exotic locales as well as points of interest such as local restaurants, hospitals, schools, and more.

Download Google Earth (for both Mac and PC)

Download the Google Earth Version of the Maps on this Website
After you’ve downloaded and installed Google Earth, you can take advantage of some of its advanced features to view the maps on this site.

- 360° Panoramas
- Beaches
- Lighthouses
- Parks (State)
- Parks (County)
- Parks (Local)
- Shipwrecks
- Webcams
- Circle Tour Route
- Oblique Photos

All maps in one file
(These links will launch Google Earth. If Google Earth does not launch automatically, try downloading the file to your computer then double-click on it to launch Google Earth. The files contain the links and information for the 360° panoramas, beaches, lighthouses, shipwrecks and parks displayed on this site.)

OpenLayers
OpenLayers is an open-source web mapping software. It is a project that includes the participation of software developers from around the world.

OpenLayers web mapping application including panoramas, parks, lighthouses, shipwrecks, beaches, parks, webcams, and NEXRAD radar (works in Mozilla Firefox).
Mashups in Planning

- Project communication
- Relevant regulations
- Participatory mapping
- Combining multiple map services for visual interpretation

http://www.burbankca.org/planning/projectsmap.html
Enterprise Support for Mashups
What it all means …

• Lower skills threshold and lower cost of ownership
• Faster development and rollout often soliciting iterative feedback
• Useful mid-project as well as for communication of results
• Map mashups are a good entry point
Mashup Tools

• Yahoo! *Pipes*, Yahoo! *GeoPlanet*
• Google Maps, StreetView, GE APIs
• Google & Yahoo! Geocoding services
• .NET/Microsoft Virtual Earth
• Custom coding
• Mashup code “framework” (e.g. OpenLayers, MapFish)
• Online mashup frameworks (ExploreOurPla.net, GeoCommons Maker/Finder)

… and the list is growing.
Mashup Frameworks

- OpenLayers/ MapFish (Javascript)
- Modest Maps (Flash)
- SpatialKey (Flex)
- SpatialWiki (.NET/Virtual Earth)
- GeoCommons – Finder! & Maker! (Online)

… and the list is growing.

Virtual globe and open source GIS clients are a good staging/prototype environment for mashup development.
Beyond tools - considerations

• Audience/ Use Case Scenario

• Data access

• Resources and skills to get it done.
Who’s Your Audience?
Data Access

• Geospatial One Stop [www.geodata.gov](http://www.geodata.gov)

• Regional and Local Clearinghouses

• Agency-specific Outlets

• Ad-hoc collections
Sources of Google Earth Files

• “How Google Earth Ate Our Town” - Nanaimo, BC

• Space Science and Engineering, UW-Madison
• Wisconsin Coastal Guide
• Great Lakes Environmental Research Lab
• Great Lakes GIS
• NOAA (NWS, NOHRSC), NASA, USGS
• Google gallery, ad-hoc compilations
Learning more:

• Blogs
• Books
• On-line Training
• Trial and error
• The Planning Report: ‘Mash-Ups’ Will Revolutionize How Planners and Citizens View City Planning

http://www.planningreport.com/tpr/?module=displaystory&story_id=1190&format=html
Re-cap

• Web services as pipe feeds …
• Open web services and web service standards
• Plethora of web service clients
• KML as exchange and web service output
• Mashup concepts & examples
• Message/Audience, Data access & resources
What it all means …

• Lower skills threshold and lower cost of ownership
• Faster development and rollout often soliciting iterative feedback
• Useful mid-project as well as for communication of results
• Focus on user and value-added content
• Networked for connectivity to other tools
Case Study example
– ControlFinder Overview –

• Audience – Wisconsin+ surveying community
• Data access – NGS, SCO/USGS, Counties
• Tools – Mapserver, PostGIS, PHP, Javascript
• Resources – Grants + office/student talent
• Mashup potential – Favorable
• Potential benefits – Reduced maintenance, focus on content, future enhancements
• Next step – Functional application analysis
What is Web 2.0

Author: Luca Cremonini Source: http://www.railsonwave.it/railsonwave/2007/1/2/web-2-0-map
URL: http://www.railsonwave.com/assets/2006/12/25/Web_2.0_Map.svg
Goals of ControlFinder Mashup

- Usability
- Remixability
- Standardization
- Convergence
- Flexible output
- Participation/feedback from users
Use Case Scenario
Know your audience

Use Case Scenario & KML Opportunity
Sometimes, knowing your audience is not by accident

This page was visited 511 times via 12 regions

This page was viewed 456 times

This page was visited 511 times via 79 network locations
Data Access

NGS – Bulk download, granular query… aiming for web services and change alert.

The rest (via SCO)= Web Map Service (WMS)
Data Delivery - Clients
Potential Tools & choices

• PostGIS & flat files: data storage
• Mapserver -> GeoServer: web service authoring
• OpenLayers/MapFish: mapping framework
• GoogleMaps API?: basemap
• Upgraded scripts: specific functions
  – E.g. Saved results
• New scripts: enhanced feedback reporting
KML Exchange

• KML is a transport format
• Can be discreetly published or…
• Can be output by a web service
KML Tools

• MapExcel2KML ....
• KML2SHP, SHP2KML
• Gdal2tiles, GeoServer,
• ESRI-related:
  – Export to KML 2.4.4
  – Arc2Earth
• KML Clients (Google Earth, ArcGIS Explorer, NASA Worldwind)
KML Tool Compilations

http://www.zonums.com/

3 March 09

URPL 590 – Week 2
KML Generators
KML Generators
KML Clients

• Google Earth
• ESRI ArcGIS Explorer
• Microsoft Virtual Earth
• NASA WorldWind
• ERDAS Titan Client
• KML-consuming websites
Mashup Tools

- Google Maps, StreetView, GE APIs
- Yahoo! Pipes, Yahoo! GeoPlanet
- Google & Yahoo! Geocoding services
- .NET/Microsoft Virtual Earth, GeoLife
- Custom coding
- Mashup code “framework” (e.g. OpenLayers, MapFish)
- Online mashup frameworks (ExploreOurPla.net, GeoCommons Maker/Finder)
Mashup Frameworks

- OpenLayers/ MapFish (Javascript)
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