

Web Mapping and Analysis

Dr Alex Singleton

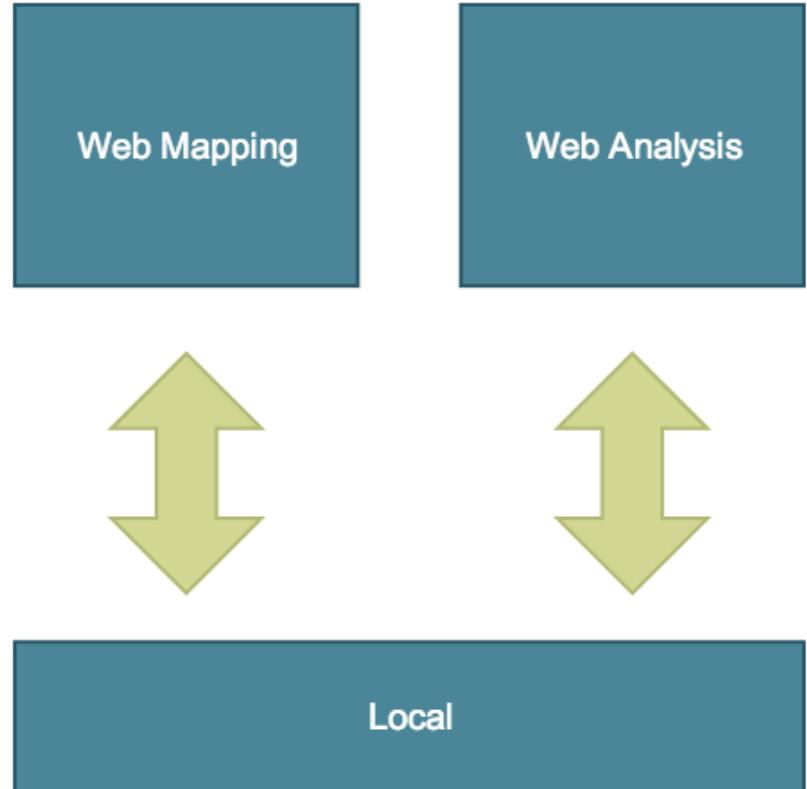
Department of Geography and Planning



UNIVERSITY OF
LIVERPOOL

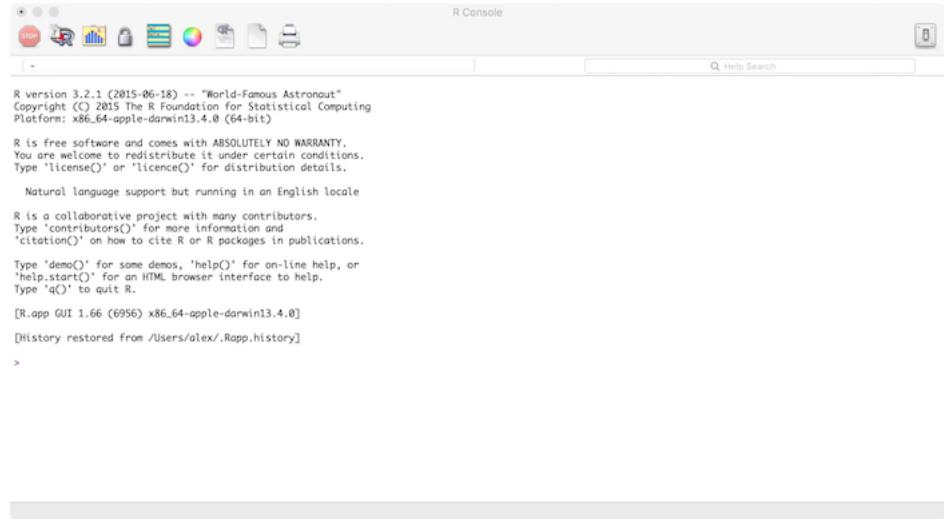
Overview and Structure

- 10 Weeks
 - 10 Lectures - 1hr
 - 10 Labs - 2hr
- Website
 - <http://geographicdatascience.com/WebMapping/>
 - 2 Assignments
 - *Due end week 7*
 - *Due end week 12*



Week 1: An Introduction to Web Mapping and Analysis

- Module Tour
- History of the Geoweb
- Practical
 - An Introduction to the R Language
 - Basics of R & data manipulation



R version 3.2.1 (2015-06-18) -- "World-Famous Astronaut"
Copyright (C) 2015 The R Foundation for Statistical Computing
Platform: x86_64-apple-darwin13.4.0 (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[R.app GUI 1.66 (6956) x86_64-apple-darwin13.4.0]
[History restored from /Users/alex/.Rapp.history]
>

Module Tour

- **Week 1:**
 - Lecture: An Introduction to Web Mapping and Analysis
 - Practical: An Introduction to the R Language
- **Week 2:**
 - Lecture: R for Mapping
 - Practical: Using R for Mapping and Visualization
- **Week 3:**
 - Lecture: The Anatomy and Social Science of the Internet
 - Practical: Linking R to the Web (Mapping and Analysis)
- **Week 4:**
 - Lecture: The Internet as a Geographic Data Source
 - Practical: Linking R to the Web (Data)

Module Tour

- **Week 5:**
 - Lecture: Shiny Web Applications
 - Practical: Interactive Mapping in R Pt 1
- **Week 6:**
 - Lecture: Coding Basic Web Pages
 - Practical: Interactive Mapping in R Pt 2
- **Week 7:**
 - Lecture: The Web Mapping Stack (Interfaces)
 - Practical: Assignment 1 Clinic
- **EASTER**

Module Tour

- **Week 8:**
 - Lecture: The Web Mapping Stack (Tile Servers)
 - Practical: An Introduction to Cartodb
- **Week 9:**
 - Lecture: Lecture: Cartography and Web Mapping
 - Practical: An Introduction to Mapbox Studio
- **Week 10:**
 - Lecture: A Gallery of Web Mapping and Analysis Applications
 - Practical: Assignment 2 Clinic

Assignment

Assignment 1:

Using R and the Police.UK API, create maps for Liverpool that illustrate how the geography of crime has changed over a 12 month period. For this assignment you will need to submit your R code and created outputs created using Rmarkdown. Additional credit will be given if an interactive map is created using Shiny. Due end Week 7

Assignments

Assignment 2:

Using either CartoDB or Mapbox Studio, create an Index of Multiple Deprivation Map for Liverpool. This should graphically illustrate the overall IMD decile that each Lower Layer Super Output Area is assigned, and provide additional information about the LSOA using a rollover. *Due end Week 12*

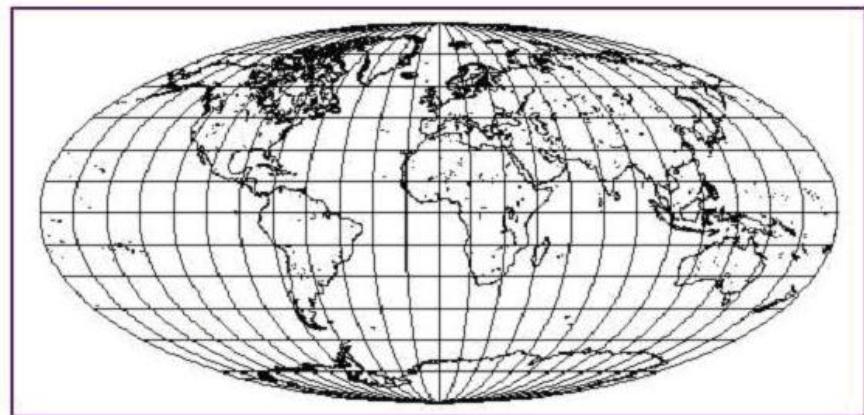
History of the Geoweb

- For an overview of the history and development of the geoweb:
- Haklay, M., Singleton, A., and Parker, C. (2008). Web Mapping 2.0: The Neogeography of the GeoWeb. *Geography Compass*, 2(6):2011–2039.

1990s

1. Clicking on the links sends a request to the server - inc. coordinates
2. Server receives request
3. Common Gateway Interface Script (CGI)
4. Server creates an image and associated HTML page
5. Web browser client receives HTML content

Xerox PARC Map Viewer: world 0.00N 0.00E (1.0X)



Select a point on the map to zoom in (by 2), or select an option below. Please read [About the Map Viewer](#), [FAQ](#) and [Details](#). To find a U.S. location by name, see the [Geographic Name Server](#).

Options:

- Zoom In: [\(2\)](#), [\(5\)](#), [\(10\)](#), [\(25\)](#); Zoom Out: [\(1/2\)](#), [\(1/5\)](#), [\(1/10\)](#), [\(1/25\)](#)
- Features: [Default](#), [All](#); [+borders](#), [+rivers](#)
- Display: [color](#); Projection: [elliptical](#), [rectangular](#), [sinusoidal](#); [Narrow](#), [Square](#)
- Change Database to [USA](#) only ([more detail](#))
- [Hide Map Image](#), [Retrieve Map Image Only](#), [No Zoom on Select](#),
- [Place mark at \(0.00N 0.00E\)](#), [Reset All Options](#)

1993 - Xerox Corporation's Palo Alto Research Center (no longer online)

~2005

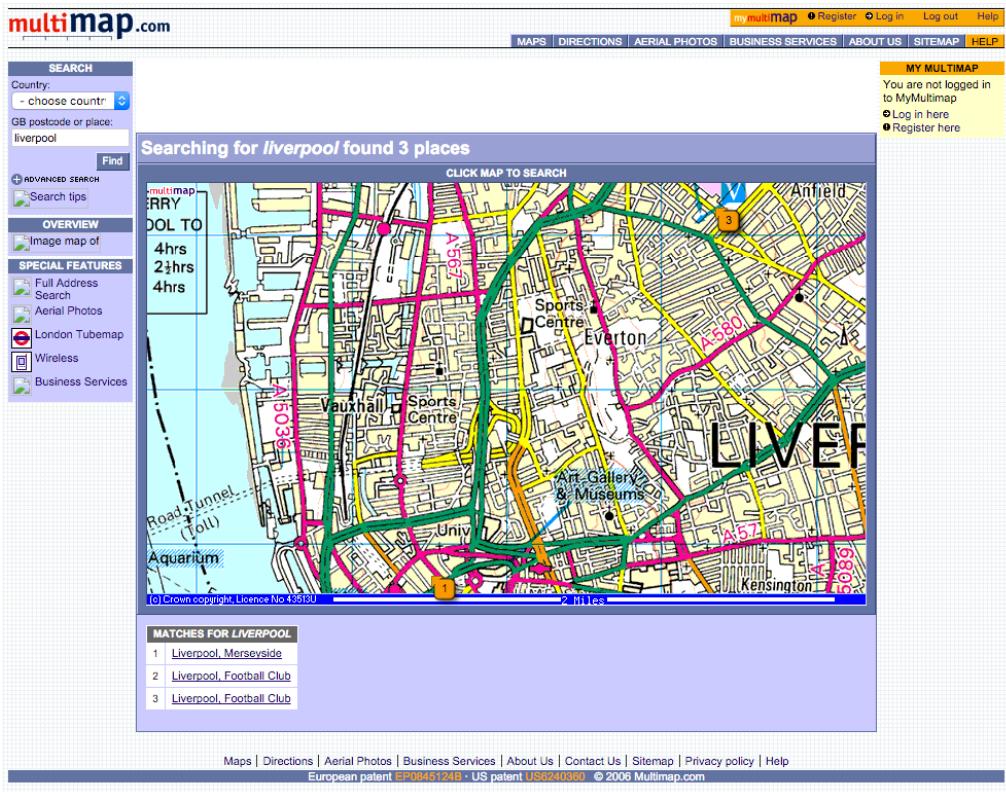
- Users accessed web mapping by three main methods
 - Public mapping
 - Web (or Internet) Mapping Servers
 - Geographic Web Services.

Public Mapping

The screenshot shows the homepage of multimap.com. At the top, there's a navigation bar with links for MAPS, DIRECTIONS, AERIAL PHOTOS, BUSINESS SERVICES, ABOUT US, SITEMAP, and HELP. Below the navigation is a search bar with a dropdown menu set to 'Great Britain' and a 'Find' button. To the right of the search bar are icons for zooming in and out, a location pin, and a three-dot menu. The main content area features a map of Great Britain with major cities like Edinburgh, Belfast, Dublin, and London marked. A world map is also visible. A sidebar on the left lists 'QUICKSEARCH' (Great Britain, GB postcode or place), 'ADVANCED SEARCH', 'SEARCHTIPS', 'SPECIAL FEATURES' (Full Address Search Service, Traffic information, Aerial Photos, London Tubemap, Wireless, Business Services, Text Weather Service), 'THINGS TO DO' (Book Flights, Hotelfinder, Book Holiday Cottages, Book A Restaurant, Buy Train Tickets, Historic Photos, Buy Business Reports, Buy A-Z Maps), and a 'FIRST TIME USER?' link. On the right, there are sections for 'NEWS' (Hotels, Developer Program, Business Services), 'Cheapflights.com' (links to Cheap Flights, Cheap Short Breaks, Cheap Holidays), and 'BOOK NOW' (link to 2004 FOSTER'S BRITISH GRAND PRIX). A 'Multimap.com wins!' section highlights awards from THE SUNDAY TIMES TECH TRACK 100 (2003 ARM) and Webuser AWARDS 2003 (WINNER). At the bottom, there's a footer with links to PSINet Europe, Privacy policy, European patent EP0845124B, US patent US6240360, and copyright information for 2003 Multimap.com.

- Multimap - main UK mapping site - 7.3 million visitors (~2005)

Public Mapping



- Interactivity
 - Click to pan / zoom
 - Refreshed page
- Map is not the main feature of the page
 - Constrained bandwidths
 - Cartography very similar to print

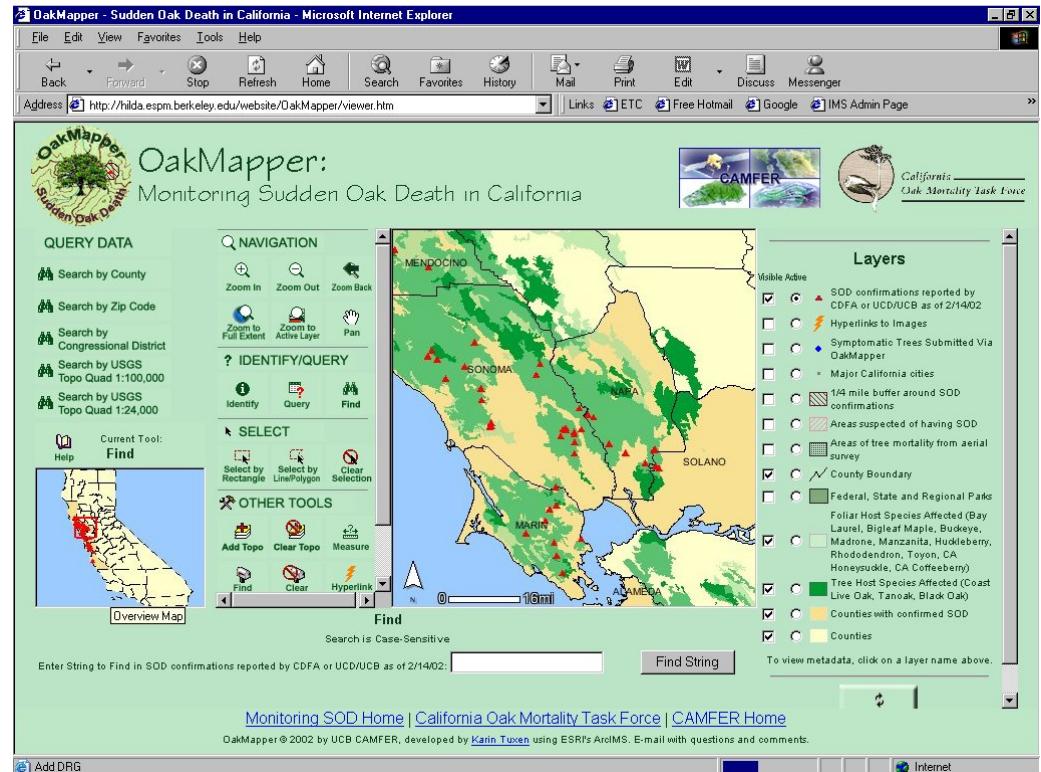
Web (or Internet) Mapping Servers



- Web Mapping Server (WMS) software offered by many GIS vendors
 - Work in conjunction with web mapping server
- Browsing, searching, downloading and rudimentary editing capabilities
 - Borrows terminology from GIS (data layers, query layer, zoom in, zoom out)

Geographic Web Services

- Similar to WMS
 - More advanced functionality
 - End user interfaces were still complex



Open Geospatial Consortium

- <http://www.opengeospatial.org/Working> on web mapping standards since 2000
 - Web Mapping Service (WMS) specifications
 - <http://www.opengeospatial.org/standards/wms>
- Many compatible productsMainly in the technical domain

WMS Specification Version: 1.1.0

OGC 01-047r2

Open GIS Consortium Inc.

Date: 2001-06-21

Reference number of this OpenGIS® project document: OGC 01-047r2

Version: 1.1.0

Category: OpenGIS® Implementation Specification

Status: Adopted Specification

Editor: Jeff de La Beaujardière

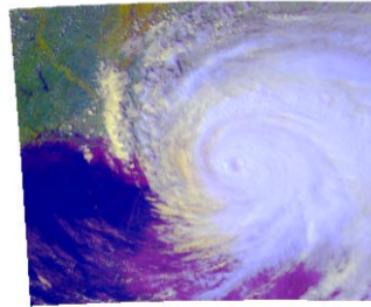
Web Map Service Implementation Specification

Document type: OpenGIS® Publicly Available Standard
Document stage: Adopted Specification
Document language: English

WARNING: The Open GIS Consortium (OGC) releases this specification to the public without warranty. It is subject to change without notice. This specification is currently under active revision by the OGC Technical Committee

Requests for clarification and/or revision can be made by contacting the OGC at revisions@opengis.org.

Figure 2 — NOAA Hurricane Image of the Gulf of Mexico



Example 2: One Server, Three Layers

The following hypothetical URL requests three layers--built-up areas, coastlines, and political boundaries -- to produce the map shown in Figure 3:

```
http://b-maps.com/map.cgi?VERSION=1.1.0&REQUEST=GetMap&
SRS=EPSG%3A4326&BBOX=-97.105,24.913,78.794,36.358&
WIDTH=560&HEIGHT=350&LAYERS=BUILTUP_1M,COASTL_1M,POLBNDL_1M&
STYLES=0xFFFF8080,0X101040,BLACK&FORMAT=image/png&BGCOLOR=0xFFFFFFFF&
TRANSPARENT=TRUE&EXCEPTIONS=application/vnd.ogc.se_inimage
```

Figure 3 — Political, Coastline, and Populated Areas, Southeastern United States

Elsewhere – Web 2.0

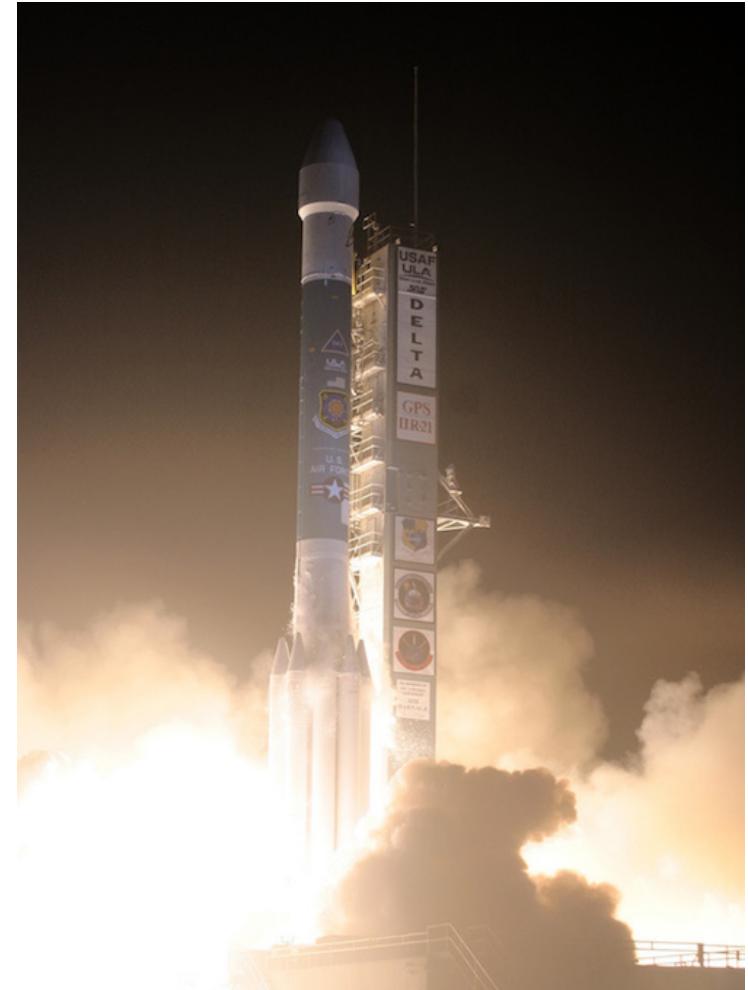
- **O'Reilly 2006**
 - Web 2.0 is the business revolution in the computer industry caused by the move to the **Internet as platform**, and an attempt to understand the rules for success on that new platform.

Elsewhere – Web 2.0

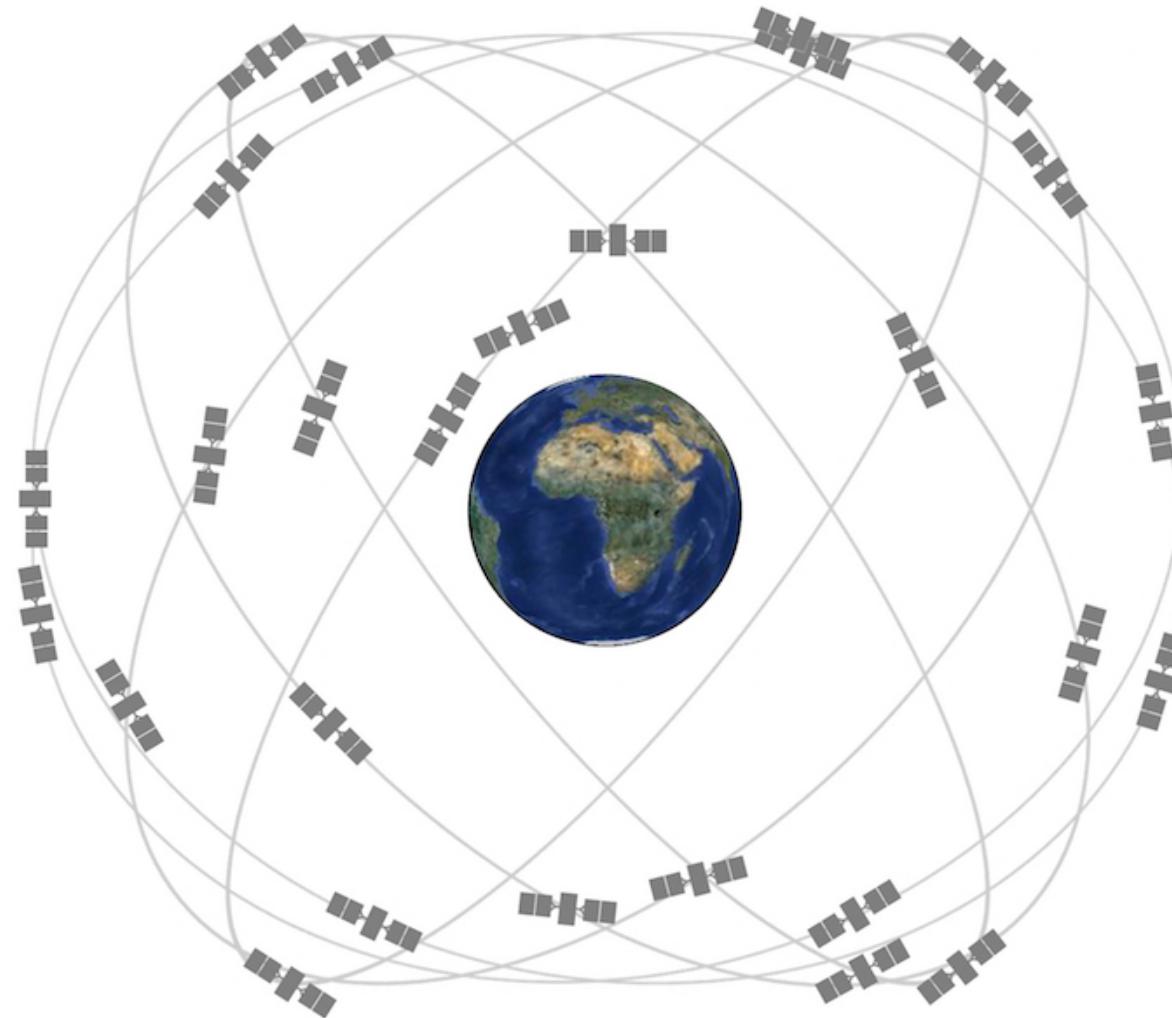
- **Goodchild (2007)**
 - [T]he early Web was primarily one-directional, allowing a large number of users to view the contents of a comparatively small number of sites, the new Web 2.0 is a **bi-directional collaboration** in which users are able to interact with and provide information to central sites, and to see that information collated and made available to others.

Foundations for Change (GPS)

- 2000 Bill Clinton, announced the removal of selective availability of the GPS signal
 - Enabled accuracy of 6–10 m (from 100m)



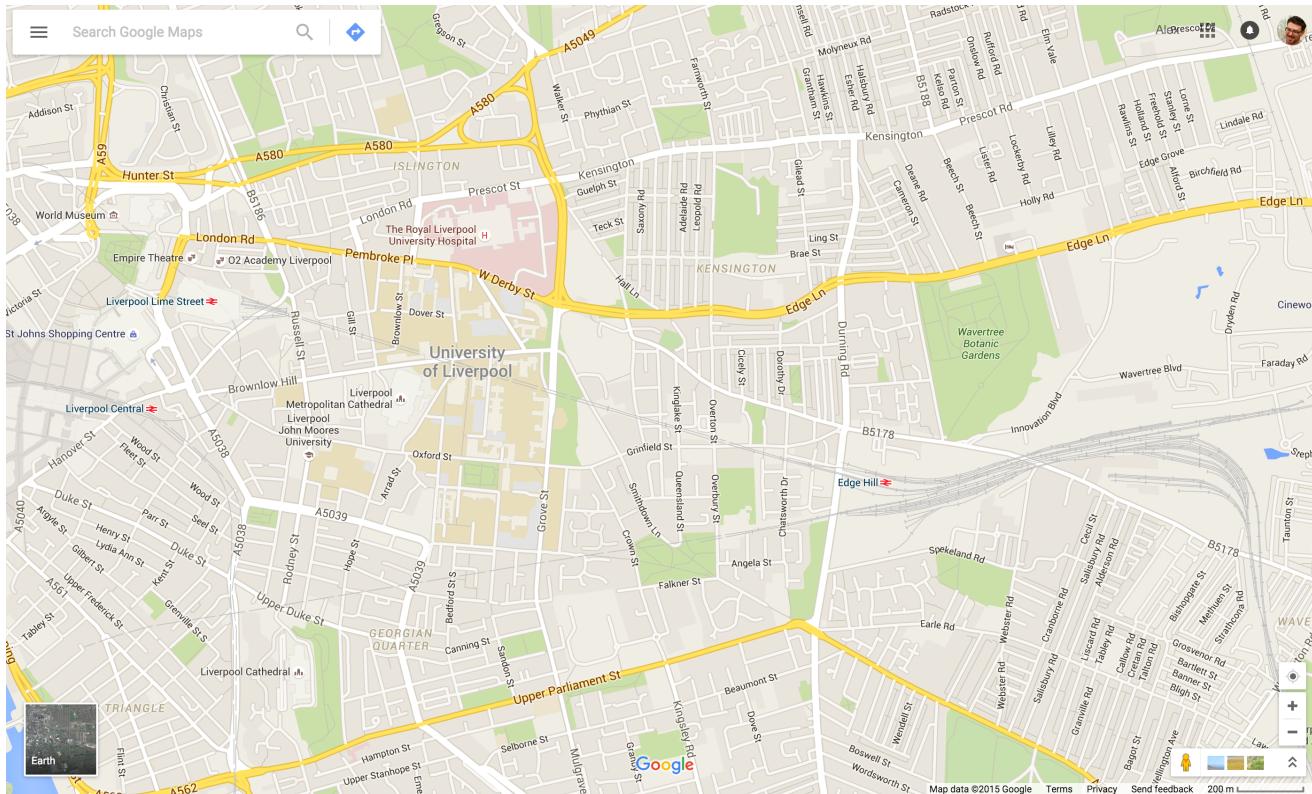
Foundations for Change (GPS)



Web 2.0 Technologies and AJAX

- Asynchronous JavaScript and XML (AJAX)
 - Web applications can send data to and retrieve from a server in the background
 - No need to refresh webpages
- Interaction more akin to a desktop application
 - Interfaces changed - maps now larger
 - New forms of interactivity
 - Google Maps launches 2005

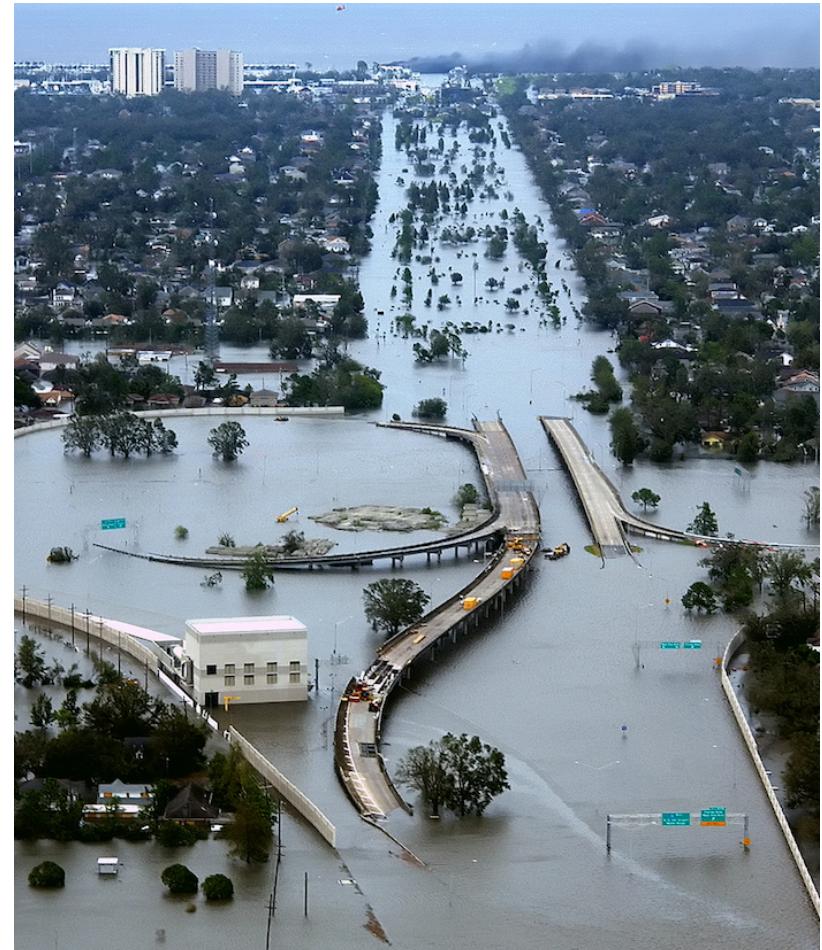
Google Maps



- Google Maps - 71.5 million visitors (by 2007)
- 50,000 new websites that are based on Google Maps (by 2007)

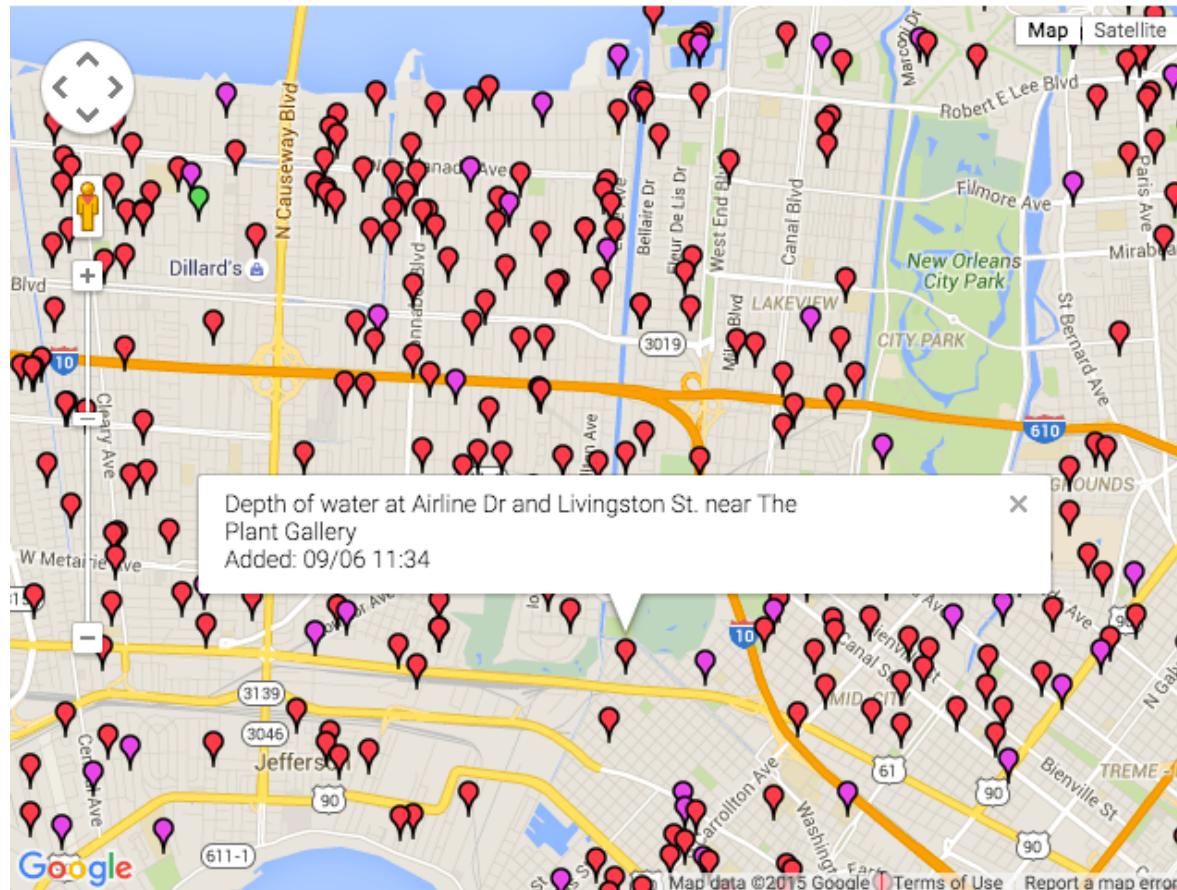
Application Programming Interfaces (API)

- Enables the building of applications
- “Mashups” - adding data to maps
- Wider engagement - non-professionals



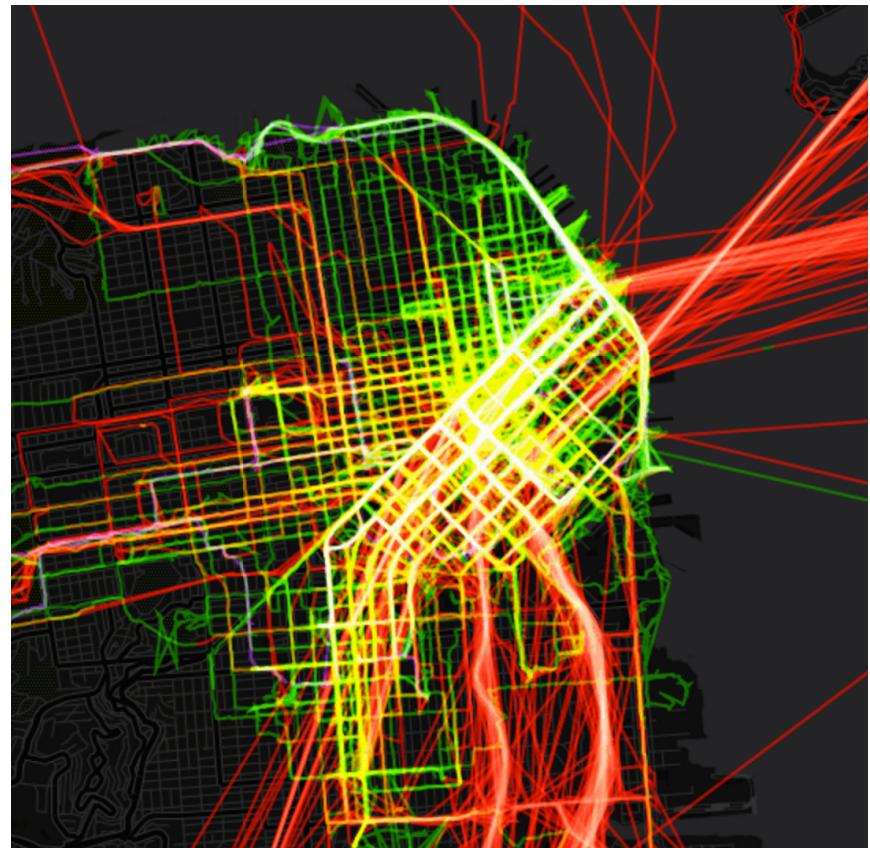
Source: wikipedia

Application Programming Interfaces (API)



Source: Website was developed by Jonathan Mendez and Greg Stoll and is available online (<http://gregstoll.dyndns.org/scipionus>)

Current



Many thanks...

