Why GIS & Why Internet GIS?

- The Internet bandwagon
- Internet mapping (e.g., MapQuest)
- Location-based services
- Real-time navigation (e.g., traffic)
- Real-time service dispatch
- Business Intelligence
- Spatial data dissemination
  - Accessibility
  - Timeliness
  - Linkages of databases

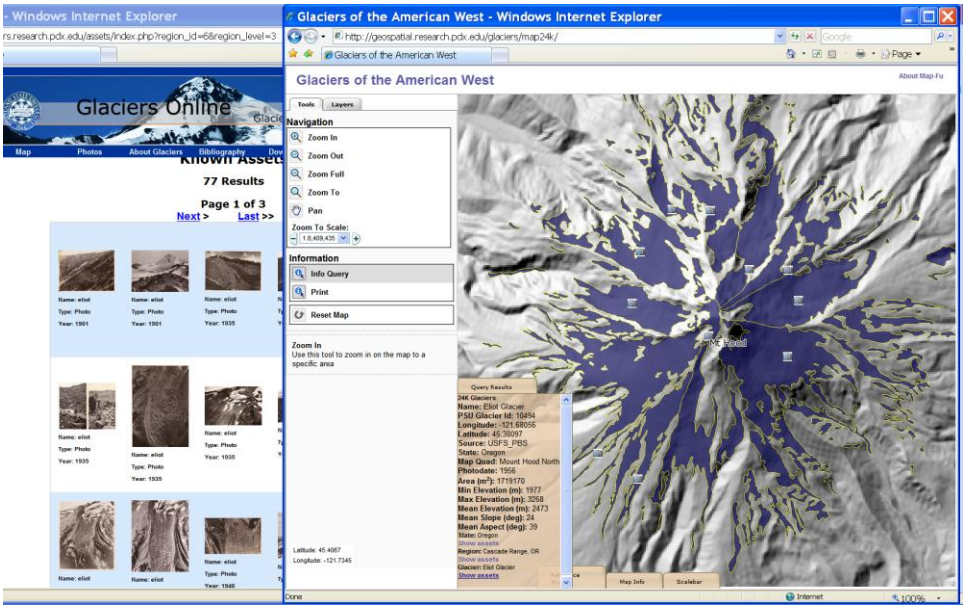
Maclachlan, J. C, Jerrett, M., Abernathy, T. et al. 2007. Mapping health on the Internet: A new tool for environmental justice and public health research. Health & Place 13: 72–86.

Criteria tested	% Fit criteria	Criteria tested	% Fit criteria
Metadata		*Cartographic*	
Authorship attribution	97%	Graphing	3%
Disclosure of funding	70%	Colour scheme availability	7%
Currency of data	73%	Scale capabilities	63%
Attribution of sources	67%		
Technical aspects		*Data analysis*	
Speed of site startup	50%	Boolean queries	23%
Ease of navigation	63%	Interactive overlays	30%
Map upload time	50%	Pattern recognition	0%
Query process time	43%	Reclassing data	7%
Site accessibility	97%	Advanced regression	0
Data			
Down loadable data	20%		
Confidentiality explicit	20%		
Interactive search	50%		
Links to other sites	87%		

Survey result based on 30 existing web-GIS sites.

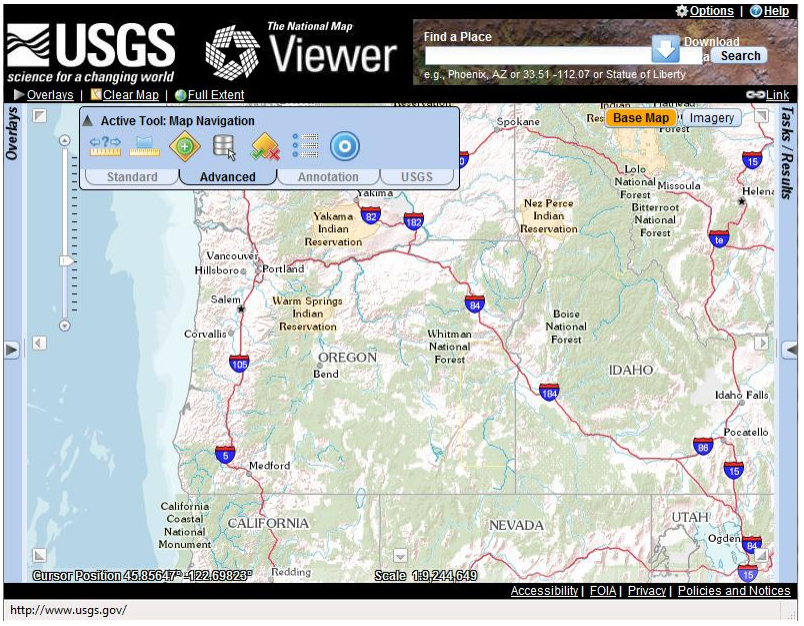
PSU Glaciers Database (Mapserver)

http://glaciers.research.pdx.edu/

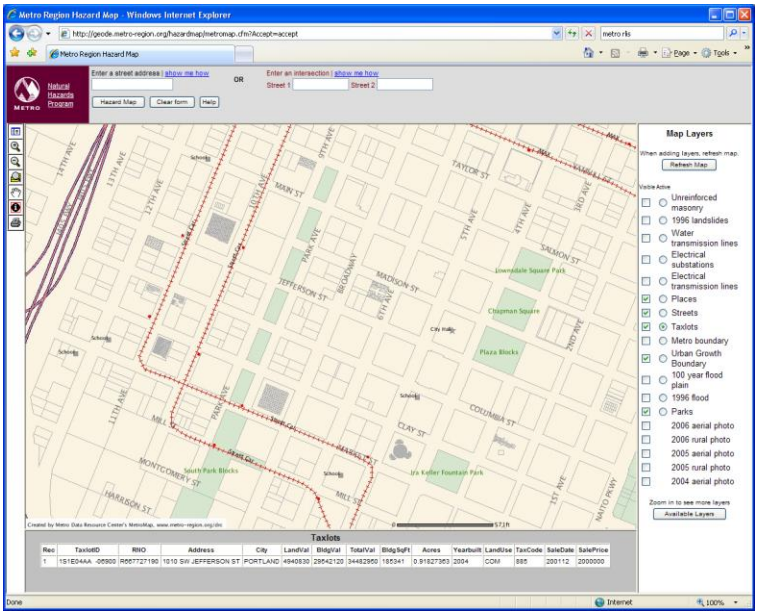


The USGS National Map Viewer (USGS)

http://nationalmap.gov/viewers.html



MetroMap
http://www.metro-region.org/index.cfm/go/by.web/id=1055



Example Internet GIS Websites

- Metro RLIS (ArcIMS)
  http://www.metro-region.org/index.cfm/go/by.web/id=1055
- PSU Glaciers Database (Mapserver)
  http://glaciers.research.pdx.edu/
- The USGS National Map Viewer (USGS)
  http://nationalmap.gov/viewers.html

Internet Applications
Client – Server Architecture

Considerations:

- Web performance (Network connection speed)
- Data complexity (image - WMS vs. map features - WFS)
- Extent of user/data interaction

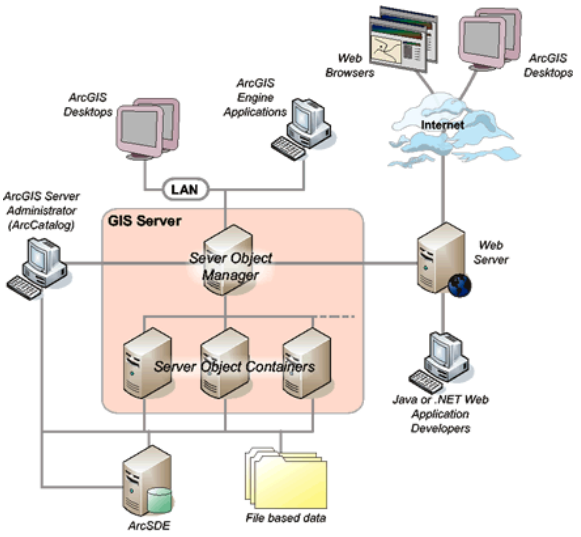
Major Components:

- Client viewer
- Data/map server

Ways of Accessing Data

- Direct disk access – OS file access
  - Shapefiles on the C: drive
- Network file system – OS file access
  - Shapefiles on the I: drive
- Database engine – SQL
  - Personal geodatabase on C: or I: drive
  - SDE geodatabase on C: or I: drive
- (Network) database server – RPC SOAP or image
  - DEM on http://maps.geog.pdx.edu/arcgis/services
- Network web applications – HTTP SOAP or image
  - Google map

ArcGIS Server Architecture



ArcGIS Server Functionality

	Editions		
Functionality	**Basic**	**Standard**	**Advanced**
Geodatabase Management	Included	Included	Included
Geodatabase Replication	Included	Included	Included
GIS Web Services	Geodata Service Only	Included	Included
Web Mapping Applications	Not Available	Included	Included
Web Editing	Not Available	Included	Included
Geoprocessing	Not Available	Included	Included
Advanced Geoprocessing	Not Available	With Extensions	Included
ArcGIS Mobile Application/SDK	Not Available	Not Available	Included (.NET only) (Enterprise only)

ArcGIS Server Web Services

Resources on the server that are available over the internet

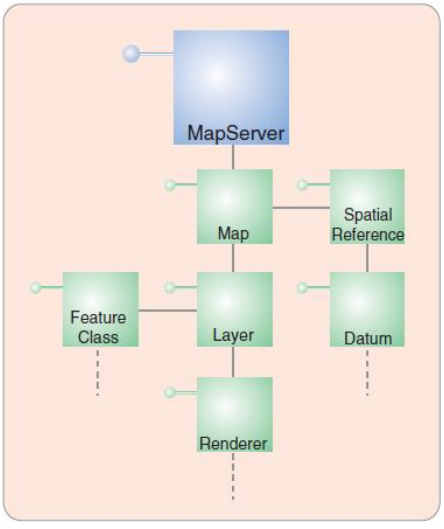
- Data
  - Feature (for Web editing)
  - Geometry (for geometric calculations such as calculating areas and lengths)
  - Globe (for 3D and globe rendering)
  - Image (for serving raster data and providing control over imagery delivery)
  - Keyhole Markup Language (KML)
  - Map (for cached and optimized map services)
- Functionality
  - Geocode (for finding and displaying addresses/locations on a map)
  - Geoprocessing (for modeling and analysis of spatial data)
  - Mobile (for running services on field devices)
  - Network Analyst (for routing, closest facility location, or service area analysis)
  - Search (for enterprise search of GIS assets)
- Internet services
  - Web Coverage Service (WCS)
  - Web Feature Service (WFS) and Transactional Web Feature Service (WFS-T)
  - Web Map Service (WMS)

Web Mapping Applications

Packages web services that are developed for client-side applications, such as:

- Web browsers
- ArcGIS.com Viewer
- ArcGIS Explorer Online
- ArcGIS Viewer for Flex™
- ArcGIS Mobile Applications (with ArcGIS Server Advanced Enterprise)
- ArcGIS Server Web Mapping Application
- ArcGIS for iOS® (for iPhone and iPad)
- ArcGIS Mapping for SharePoint®

An Example of a Server Object



ArcGIS & ArcGIS Server

- ArcCatalog
  - GIS Server connection and administration
- ArcGIS Toolbars for server administration
  - Image Service Definition Editor
    - .ISDef and .ISCDef (compiled)
    - .ISCDef is used by the server to provide image services
  - Map Service Publishing
    - .msd (map service definition file)
    - Both .msd and .mxd can be used by the server
- All data defined in the definition files must be accessible by the server.

ESRI vs. Open Source Internet GIS

- Client Applications
  - ArcGIS Desktop, internet browsers or applets.
- Server Applications
  - ArcGIS Server / PostGIS
- DBMS
  - ArcSDE + RDBMS / MySQL, PostgreSQL, …
- Data format
  - Raster: Geodatabase / GDAL - Geospatial Data Abstraction Library
  - Vector: Geodatabase / OGL - OpenGIS Simple Features Reference Implementation
  - ArcGIS SDE supports PostgreSQL
- Development environments
  - ArcGIS Desktop (Author, Designer), Java, Javascript, SilverLight, Flex, php, ColdFusion, .NET,…

Take-home Messages

- Database design is an art. You need to consider:
  - System efficiency
  - Query/analysis efficiency
  - Management efficiency
  - Interoperability considerations
- You could base your DB design on:
  - existing DB functionality of GIS software, or
  - customized DB tools for specific applications.
- Everything is in a steady state before the next driver acts…, that is, don't expect the existing DBMS/GIS features will be the same down the road.
- The goals and theories of representing reality in a digital world are more or less constant.

Guidelines for GIS Projects

- Creating 1st-hand data is expensive (use existing data when possible)
- Conform project data (projected coordinate systems, attribute data type, file structure, file naming convention)
- Check the output of each geoprocessing step
- Keep a backup copy of your data
- Check hardware's capacity (disk space, R/W access privilege, network bandwidth,…)
- Know the software limitations/features (no space for in your file path and file name, 2GB size limit for personal GDB, info goes with coverage, layer files vs feature classes, file lock, …)
- Know that software can never be bug-free (so what?)
- Be resourceful in solving problems (online help, user forum, your peers…)
- Know when to ask for help
- Learn new things on your own
- …

What's next?

- Large GIS databases (e.g., National Information Infrastructure, Alexandria Digital Spatial Library)
- Goal- vs. Application-Oriented System Design
- Data-Oriented System Design
  - Data capture and post production
  - Data storage
  - Data searching and reporting
  - Data retrieval and distribution
  - Data maintenance