Lecture 18: How to Pick a GIS II

(chapter 9)

Rui Zhu
What functions should a GIS have?

Six critical perspectives:

- Data capture
- Storage
- Management
- Retrieval
- Analysis
- Display / Visualization

Additional tools covered: Dissolving, Mosaicing, Rubber sheeting, Generalization, Masking, Identify, Buffer, Map algebra
Some other considerations

- Does this GIS provide
  - good documentations for users to seek helps?
  - an easy-to-use GUI?
  - “batching” commands?
  - a “language” for users to communicate with or program the system’s functions?
The more the better?

● Is a GIS with more functions always better for you? → Not necessarily!
  ○ More functions might confuse the end users → like ArcMap
  ○ GIS with more functions are often more expensive
    ■ Many GISs are sold by modules
      ● [https://developers.arcgis.com/pricing/](https://developers.arcgis.com/pricing/)

● Choose a GIS based on the needs of your project / organization!
Recall: choosing a GIS

- The first decision for a GIS analyst is often “Which GIS?”
  - What functions should this GIS have?
  - **Commercial or Open Source GIS?**
  - Do you need to develop your own GIS applications?
Commercial GIS or Open-Source GIS

- Advantages of commercial GIS
  - Stable and robust
  - Good documentations
  - Good training and tutorials
  - Maintenance support

- Disadvantages of commercial GIS
  - Purchasing the software is expensive
  - Maintenance is expensive
  - Even a support call can charge your organization’s money
  - Not flexible!
Commercial GIS or Open-Source GIS

- Advantages of open-source GIS
  - Low cost (might not be free!)
  - Flexible: can be combined to a project in your way
  - High extensibility: you can extend its existing functionality by modifying its codes

- Disadvantages of open-source GIS
  - May not be robust
  - May not have well-organized documentations
  - You have to do maintenance yourself
## Commercial GIS

<table>
<thead>
<tr>
<th>Software</th>
<th>About</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autodesk</td>
<td>Map 3D, Topobase, MapGuide and other products that interface with its AutoCAD CAD package.</td>
<td>usa.autodesk.com/</td>
</tr>
<tr>
<td>Bentley Systems</td>
<td>Products include Bentley Map, Bentley PowerMap, and other products that interface with its MicroStation software.</td>
<td><a href="http://www.bentley.com/en-US/">www.bentley.com/en-US/</a></td>
</tr>
<tr>
<td>Intergraph</td>
<td>GeoMedia, GeoMedia Professional, GeoMedia WebMap, and add-on products for industry sectors, as well as photogrammetry.</td>
<td><a href="http://www.intergraph.com/">www.intergraph.com/</a></td>
</tr>
<tr>
<td>ERDAS</td>
<td>Leica Geosystems subunit encompassing GIS, Photogrammetry, and Remote Sensing. Main software is Imagine.</td>
<td><a href="http://www.erdas.com">www.erdas.com</a></td>
</tr>
<tr>
<td>ESRI</td>
<td>ArcView 3.x, ArcGIS, ArcSDE, ArcIMS, ArcWeb services, and ArcServer.</td>
<td><a href="http://www.esri.com">www.esri.com</a></td>
</tr>
<tr>
<td>MapInfo</td>
<td>From Pitney Bowes. Includes MapInfo Professional and MapXtreme. Integrates GIS software, data and services.</td>
<td><a href="http://www.mapinfo.com">www.mapinfo.com</a></td>
</tr>
<tr>
<td>Manifold</td>
<td>Full capability GIS software package.</td>
<td><a href="http://www.manifold.net">www.manifold.net</a></td>
</tr>
</tbody>
</table>
## Commercial GIS (cont.)

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadcorp</td>
<td>Cadcorp SIS (desktop), GeognoSIS (web), mSIS (mobile), and developer kits.</td>
<td><a href="http://www.cadcorp.com">www.cadcorp.com</a></td>
</tr>
<tr>
<td>Caliper</td>
<td>Maptitude, TransCAD, and TransModeler. Develops GIS and the only GIS for transportation.</td>
<td><a href="http://www.caliper.com">www.caliper.com</a></td>
</tr>
<tr>
<td>IDRISI</td>
<td>Taiga GIS product developed by Clark Labs.</td>
<td><a href="http://www.idrisi.com">www.idrisi.com</a></td>
</tr>
<tr>
<td>TatukGIS</td>
<td>TatukGIS Developer Kernel (SDK), GIS Internet Server, GIS Editor, and free GIS Viewer software products.</td>
<td><a href="http://www.tatukgis.com">www.tatukgis.com</a></td>
</tr>
</tbody>
</table>
Open Source GIS

QGIS
Quantum GIS (QGIS) is a user-friendly Open Source GIS that runs on Linux, Unix, Mac OS X, and Windows. http://www.qgis.org/

MapWindow GIS
Free, open source GIS desktop application and programming component. http://www.mapwindow.org/

ILWIS

uDig
uDig is an open source desktop application framework, built with Eclipse Rich Client technology. http://udig.refractions.net/

JUMP GIS / OpenJUMP-J0

Capaware rc1 0.1
General purpose virtual worlds 3D viewer. A free software project started in 2007 to promote the development of free 3D. http://www.capaware.org/

Kalypso
An Open Source GIS (Java, GML3) that focuses on water management. Supports modeling and simulation. http://www.ohloh.net/p/kalypso

TerraView
Desktop GIS that handles vector and raster data stored in a relational or geo-relational database, a frontend for TerraLib. http://www.dpi.inpe.br/terraview/index.php

GeoServer
GeoServer is an open-source software server written in Java that allows users to share and edit geospatial data. Design http://geoserver.org/display/GEOS/Welcome

WebMap Server

MapGuide Open Source
Web-based platform that enables users to quickly develop and deploy web mapping applications and geospatial web services. http://mapguide.osgeo.org/

MapServer
Web-based mapping server, developed by the University of Minnesota. http://mapserver.org/

PostGIS
Spatial extensions for the open source PostgreSQL database, allowing geospatial queries. http://postgis.refractions.net/

H2Spatial for

Spatialite for SQLite
Spatialite extension enables SQLite to support spatial data in a way conformant to OpenGis specifications. http://www.gaia-gis.it/spatialite-2.0/index.html
Quantum GIS (QGIS)


GET INVOLVED!
GRASS

- First UNIX GIS
- Developed by the army

https://grass.osgeo.org/

Human factors in selecting a GIS

- Can people in your organization learn new technologies quickly?
- How much are people in your organization familiar with GIS?
- Is there any GIS that has been previously used in your organization?
- ...

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Recall: choosing a GIS

- The first decision for a GIS analyst is often “Which GIS?”
  - What functions should this GIS have?
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GIS development

● What if you want to develop your own GIS for a particular application?
● GIS development components
  ○ Commercial software: ArcGIS Engine, ArcGIS Server, ArcGIS Javascript API, ….
  ○ Open source: Open Layers, Leaflet, cgal, JTS, OpenCV, ….
GIS development

- ArcGIS Engine: for developing custom GIS applications on desktop GIS
- Support C++, Java, .Net, …
GIS development

- ArcGIS Server: for developing GIS application running on servers
- Support multiple programming languages
GIS development

- ArcGIS Javascript API: for developing lightweight **web-based GIS**
GIS development

- OpenLayers 3: an open source JavaScript library for developing web-based GIS

A high-performance, feature-packed library for all your mapping needs.

Features:
- Tiled Layers
  - Pull tiles from OSM, Bing, MapBox, Stamen, MapQuest, and any other XYZ source you can find. OGC mapping services and unlimited layers also supported.
- Vector Layers
  - Render vector data from GeoJSON, TopoJSON, KML, XML, and a growing number of other formats.
- Fast & Mobile Ready
  - Mobile support out of the box, build lightweight custom profiles with just the components you need.
- Cutting Edge & Easy to Customize
  - Map rendering leverages WebGL, Canvas 2D, and all the latest greatness from HTML5. Style your map controls with straightforward CSS.
GIS development

- Leaflet: an open source Javascript library for mobile-friendly interactive maps

Leaflet is the leading open-source JavaScript library for mobile-friendly interactive maps. Weighing just about 33 KB of JS, it has all the mapping features most developers ever need.

Leaflet is designed with simplicity, performance and usability in mind. It works efficiently across all major desktop and mobile platforms, can be extended with lots of plugins, has a beautiful, easy to use and well-documented API and a simple, readable source code that is a joy to contribute to.
GIS development

Cgal: an open source project based on C++ to provide easy access to efficient and reliable geometric algorithms
GIS development

- JTS: an open source java library for **geometry algorithms**
GIS development

- OpenCV: an open source image processing library based on C++
Algorithms v.s. Applications

- Algorithm development: inventing **new methods** to improve the efficiency of existing GIS functions or creating **new GIS functions**.
  - Requires good backgrounds in computer science (CS 130A, CS 130B, GEOG 178)
  - Competitions: ACM GIS Cups
    - Spatial Networks
    - Spatial Data Structures and Algorithms
    - Indexing and Retrieval in Spatial Computing
    - ...
Algorithms v.s. Applications

- Applications development: integrating existing GIS components and APIs
- API: Application Programming Interface
  - Interfaces from existing software that allow a third-party application to access the data and function
  - E.g., Twitter API, Foursquare API, Google Maps API, …
- A lot of GIS developments are application developments
  - Requires brilliant ideas
  - Requires less on programming
  - Requires the capabilities to learn new technologies
- Examples:
  - Using twitters to predict disasters (e.g., tornados)
  - Suggesting places based on Foursquares
  - ……
Outline

- Episode 1: Positioning, technology, public inputs
- Episode 2: GIS and our daily lives, planning, business and many other issues
- Episode 3: GIS in military actions, safety, and privacy issues
- Episode 4: Climate, hunger, and disease
Episode 1: Positioning, technology, public inputs

http://geospatialrevolution.psu.edu/episode1
Episode 1: Positioning, technology, public inputs

- **GPS and navigation**
  - 3 satellites can give you some locations, but not so accurate; to get more accurate locations, you need **at least 4 satellites!** (an error in the video!)

- **Location-based services**
  - GIS changed the way we live today!
  - Examples: navigation + find nearby restaurants

- **Disaster responses**
  - Volunteered geographic information
  - Mapping task was outsourced to thousands of online volunteers
  - GIS’s definition in terms of society!