What is GIS?

G stands for geographic, so we know that GIS has something to do with geography.

I stands for information, so we know that GIS has something to do with information, namely geographic information.

S stands for system, so we know that GIS is an integrated system of geography and information tied together.

- Most people agree that over 80% of the information related to government operations have a geographic component. Therefore, a system that integrates this information together is quite valuable. We shall see how a geographic information system tied geography and information together....
What is GIS?

- A computer system for
  - collecting,
  - storing,
  - manipulating,
  - analyzing,
  - displaying, and
  - querying geographically related information.
In general, GIS cover 3 components:

- **Computer system**
  - Hardware
    - Computer, plotter, printer, digitizer
  - Software and appropriate procedures
- **Spatially referenced or geographic data**
- **People to carry out various management and analysis tasks**
Well-designed GIS should provide

- Quick and easy access to large volumes of data
- The ability to:
  - Select detail by area or theme
  - Link or merge one dataset with another
  - Analyze spatial characteristics of data
  - Search for particular characteristics or features in an area
  - Update data quickly and cheaply
  - Model data and assess alternatives
- Output capabilities tailored to meet particular needs
What can you do with ArcGIS?

A tax assessor's office produces land use maps for appraisers and planners.

An engineering department monitors the condition of roads and bridges and produces planning maps for natural disasters.

A water department finds the valves to isolate a ruptured water main.

A transit department produces maps of bicycle paths for commuters.

A police department studies crime patterns to intelligently deploy its personnel and to monitor the effectiveness of neighborhood watch programs.

A wastewater department prioritizes areas for repairs after an earthquake.
A telecommunication company studies the terrain to find locations for new cell phone antennae.

A hydrologist monitors water quality to protect public health.

A pipeline company finds the least-cost path for a new pipeline.

A biologist studies the impact of construction plans on a watershed.

An electric utility models its circuits to minimize power loss and to plan the placement of new devices.

A meteorologist issues warnings for counties in the path of a severe storm.
A business evaluates locations for new retail outlets by considering nearby concentrations of customers.

A police dispatcher finds the fastest route to an emergency.

An emergency management agency plans relief facilities by modeling demand and accessibility.

A water resource manager traces upstream to find the possible sources of a contaminant.

A fire fighting team predicts the spread of a forest fire using terrain and weather data.
Geographic Data

- **Geospatial data** tells you where it is and **attribute data** tells you what it is.
- **Metadata** describes both geospatial and attribute data.

In GIS, we call geographic data as GIS data or spatial data.
Traditional method

- To represent the geographic data is paper-based maps
  - Geology map
  - Topographic map
  - City street map (we still use it a lot)
  - ...

In GIS: new fashion

**Raster:**
- is a grid consisting of individual cells or pixels. Each cell holds a value (elevation, radiance, reflectance, rainfall, or land use type,…). The resolution of the data is the size on the ground by each cell.

**Vector:**
- points, lines, and polygons
Ways for Collecting GIS Data

And many more such as weather station observations, water meter readings, sampler analysis results, daily sale amounts, census results, ....
Power of GIS - integration
Why GIS?

- Provides powerful tools for
  - data process, analysis, and visualization
  - data management and retrieval

- One of the fastest growing high-tech career fields
GIS growing very fast

- 1981, 1st ESRI user conference only 18 people

- 2003, 23rd ... 12,000 people, the theme of the year is “serving our world with GIS”
Historical Development of GIS

- “Pioneer” research period (late 1950’s to early 1970’s) -- advances in computer technology
- Gov’t. Agency research and development (1970’s to early ‘80’s)
- Commercial development period (1980’s to present)
- desktop, which supports enhanced professional productivity;
- multipurpose and database systems with many clients accessing, updating, and using them; and
- distributed and shared Web services
Stand Alone GIS

Networked GIS (Local)

Networked GIS (Global)

Figure © ESRI
Geographic Information Will Be Increasingly Available and Interrelated
## Product families of main GIS software providers

<table>
<thead>
<tr>
<th></th>
<th>Autodesk</th>
<th>ESRI</th>
<th>Intergraph</th>
<th>MapInfo</th>
<th>GE Smallworld</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Professional</strong></td>
<td>AutoCAD/World</td>
<td>ArcInfo</td>
<td>GeoMedia Pro</td>
<td>Mapinfo Professional</td>
<td>Smallworld GIS</td>
</tr>
<tr>
<td><strong>Desktop</strong></td>
<td>World</td>
<td>ArcView, ArcGIS</td>
<td>GeoMedia</td>
<td>MapInfo Professional</td>
<td>Spatial intelligence</td>
</tr>
<tr>
<td><strong>Viewer</strong></td>
<td>AutoCAD LT</td>
<td>ArcExplorer</td>
<td>GeoMedia Viewer</td>
<td>ProViewer</td>
<td>Custom</td>
</tr>
<tr>
<td><strong>CAD</strong></td>
<td>AutoCAD MAP</td>
<td>ArcCAD</td>
<td>*</td>
<td>*</td>
<td>Part of Smallworld GIS</td>
</tr>
<tr>
<td><strong>Hand-held</strong></td>
<td>OnSite</td>
<td>ArcPad</td>
<td>In development</td>
<td>MapXtend</td>
<td>Scount</td>
</tr>
<tr>
<td><strong>Component</strong></td>
<td>*</td>
<td>MapObjects</td>
<td>Part of GeoMedia</td>
<td>MapX, MapJ</td>
<td>Part of Smallworld GIS</td>
</tr>
<tr>
<td><strong>DB server</strong></td>
<td>Vision</td>
<td>ArcSDE</td>
<td>Uses Oracle Spatial</td>
<td>SpatialWare</td>
<td>Part of Smallworld GIS</td>
</tr>
<tr>
<td><strong>Internet</strong></td>
<td>MapGuide</td>
<td>ArcIMS</td>
<td>GeoMedia Web Map</td>
<td>MapXtreme and</td>
<td>Smallworld internet</td>
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<td></td>
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<td></td>
<td>and Web Enterprise</td>
<td>Web Enterprise</td>
<td>application server</td>
</tr>
</tbody>
</table>

* Featured in several products

Modified from: p171 of Longley el al. 2001
GIS Market Share - 2000

2000 EST GIS Worldwide Core Business Software Only

Total Revenue 2000 EST
$939 Million

- ESRI 36%
- Intergraph 16%
- GE Smallworld 7%
- SICAD/Siemens 6%
- Autodesk 6%
- Mapinfo 6%
- Logica 3%
- GeoGraphix 3%
- Erdas 2%
- IBM 2%
- Enghouse 2%
- Other 11%

Data from GIS Monitor
Family of ArcGIS Desktop

- ArcView 8.x
- ArcEditor 8.x
- ArcInfo 8.x

1. These products have the same interface and share much of their functionality. **ArcEditor** does everything **ArcView** does and goes beyond it; **ArcInfo** does everything **ArcEditor** does and goes beyond it.

2. **ArcEditor** can create and edit certain spatial data formats, but **ArcView** can not.

3. **ArcInfo** can edit more spatial data formats, with a **ArcInfo workstation** together.
Source: http://www.esri.com/news/arcnews/fall03articles/arcgis9-is-the.html
GIS Applications

- Agriculture
- Archaeology
- Business
- Environment
- Geology
- Health
- Hydrology
- Land Information System
- Military
- Natural Hazard Management
- Natural Resource Management
- Urban Planning
- Many more …..

http://www.gisdevelopment.net/application/index.htm
ESRI, http://www.esri.com
GIS development, http://www.gisdevelopment.net/application/index.htm