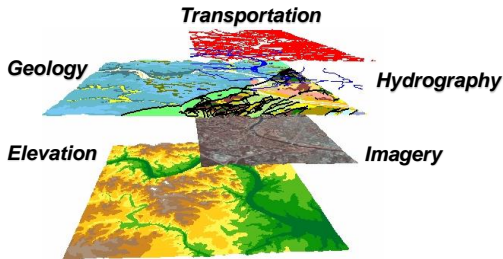


What is GIS?



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Key Questions and Issues

- ⌘ What is GIS?
- ⌘ What are the applications of GIS?
- ⌘ How is the real world represented in GIS?
- ⌘ What analyses can GIS performed?

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GIS = Geographic Information System(s)

- ⌘ Computerized management & analysis of geographic information
- ⌘ Group of tools (and people) for collection, management, storage, analysis, display and distribution of spatial data & information
- ⌘ Computer-based tool for mapping and analyzing things that exist and events that happen
- ⌘ Others, e.g. Bolstad

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GIS is to geographic analysis as:

- ⌘ Typewriter → Word Processor
Automation
- ⌘ Pen & Ink → C.A.D.
Storage, Editing
- ⌘ Almanacs → Climate Models
Prediction, Analysis
- ⌘ Light Table → G.I.S.
Map Overlay Analysis, Pattern Recognition

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Historical Development -GIS timeline

- ⌘ **1963-1977 Innovation**
 - ☒ Canadian Land Inventory system, Harvard Graphics & S.A. Lab, US Census Bureau, ERTS-1 (Landsat 1)
- ⌘ **1981-1999 Commercialization**
 - ☒ ArcInfo, GPS, MapInfo, TIGER, NSDI, MapQuest
- ⌘ **2000-present Exploitation**
 - ☒ >\$7 billion industry, >1 million users

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Components of a GIS

- ⌘ **Network**
- ⌘ **People**
 - ☒ ~50,000 professionals in US, 2005
- ⌘ **Hardware**
- ⌘ **Software**
 - ☒ ~ \$1 billion annual sales in 2000
- ⌘ **Data**
 - ☒ >\$4 billion/yr by gov. agencies

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Demand for GIS Professionals

- ⌘ **In the U.S. in 2005:**
 - ☒ ~500,000 using GIS as part of job; growing at 15% each year.
 - ☒ Job market demand is ~75,000/year
 - ☒ ~50,000 US students/year take a GIS class
 - ☒ 4000 "certified" graduates/year

Source: ESRI:
<http://www.esri.com/news/arcuser/0700/umbrella11.htm>

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Online GIS - e.g. Google Earth

- ⌘ **Haughton Crater geology, Devon Island, Canada**

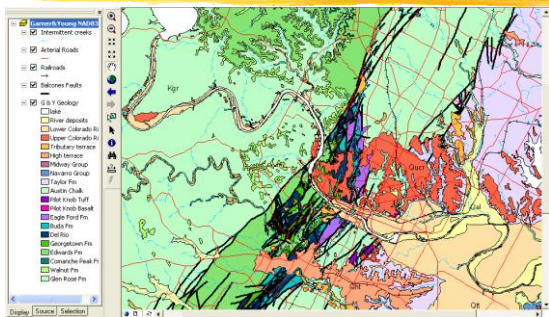


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GIS for Austin Geology - ArcGIS software

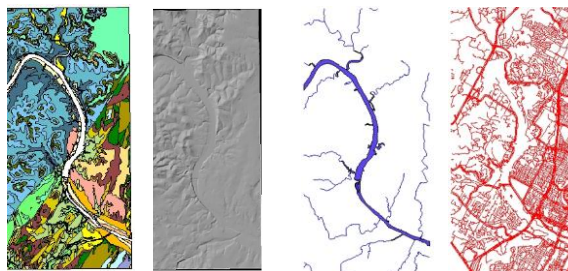


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9

A GIS is Composed of Layers



Geology

D.E.M.

Hydro.

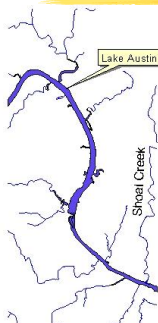
Roads

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Layers contain *Features* or *Surfaces*



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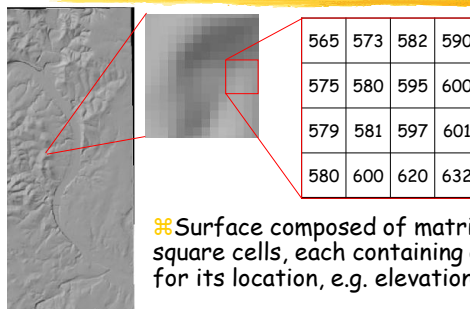
⚡ Features are geographic objects represented by a point, line or polygon

- ☐ Polygons (filled or unfilled) for things large enough to have boundaries
- ☐ Lines for things too narrow to be polygons
- ☐ Points for things too small to be polygons

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Layers contain *Features* or *Surfaces*



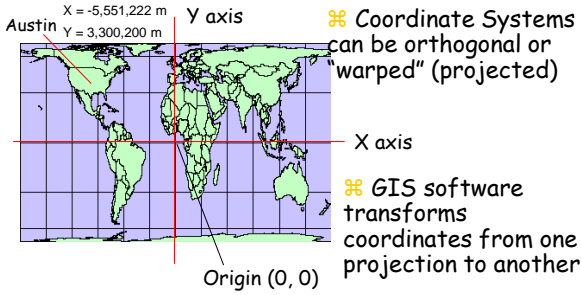
⚡ Surface composed of matrix of square cells, each containing a value for its location, e.g. elevation.

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Features have locations

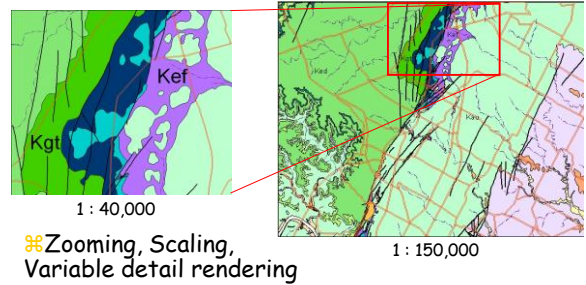


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Features can be displayed at different scales

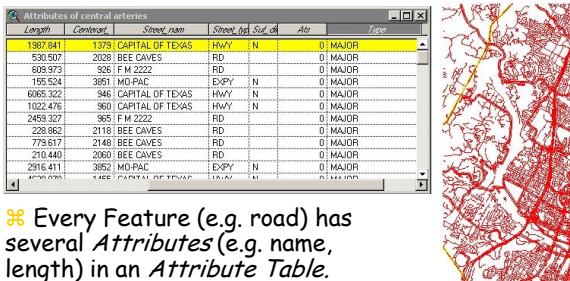


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Features are linked to information



Every Feature (e.g. road) has several Attributes (e.g. name, length) in an Attribute Table.

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Spatial relationships can be queried

- What crosses what?
- Proximity - What is within a certain distance of what?
- Containment - What's inside of what?
- Which features share common attributes?
- Many others

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Applications

- ⌘ **What is where?**
 - ☒ Query and info. retrieval - e.g. MapQuest, Google Maps
- ⌘ **What geographic patterns exist?**
 - ☒ E.g. Geostatistics; e.g. prediction of ore grades from limited data
- ⌘ **Where have temporal changes occurred?**
 - ☒ E.g. LULC change, water table levels, morphologic studies
- ⌘ **Where do certain conditions apply?**
 - ☒ E.g. suitability analyses - "where is the best place for..."
- ⌘ **"What if" forward modeling; what are spatial implications for certain actions?**
 - ☒ E.g. mine reclamation

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The Five M's

- ⌘ **Mapping**
 - ☒ Accuracy, Reproducibility, Portability, Customization
- ⌘ **Measuring**
 - ☒ Automation, Accuracy
- ⌘ **Modeling**
 - ☒ Scaling, Verifiability, Analytical Tools
- ⌘ **Monitoring**
 - ☒ Automation, Flexibility
- ⌘ **Management**
 - ☒ Storage, Updating, Data Integrity, Security

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GIS Advantages:

- ⌘ **Manage & organize vast amounts of geospatial data**
 - ☒ Rapid updating, info. dispersal
- ⌘ **VERIFIABLE methods**
- ⌘ **Modeling, hypothesis-testing, PREDICTION**
- ⌘ **Automate & customize map production**

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19

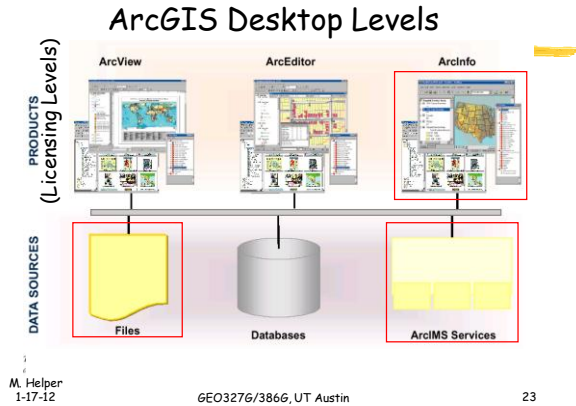
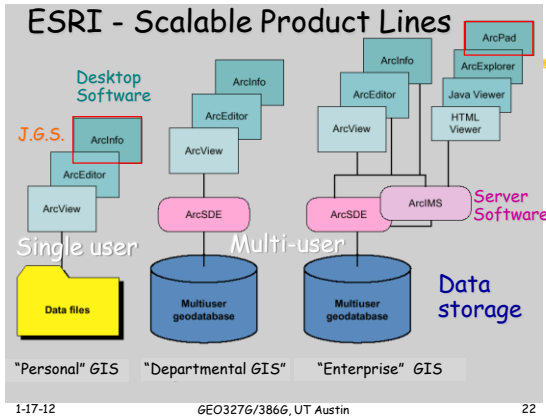
GIS Drawbacks

- ⌘ **Errors play significant role in queried results - not always apparent**
- ⌘ **Abstract concepts difficult to implement - different approaches may yield different answers**
- ⌘ **Pretty pictures can obscure uncertainties - promotes uncritical thinking, black-box approach**

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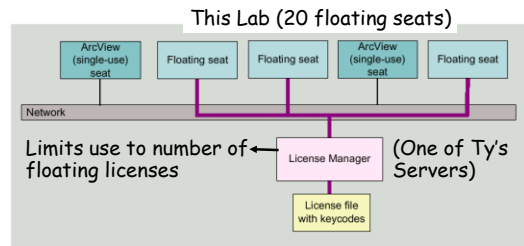
20



ArcGIS Licensing Levels

- ⌘ **ArcView** - Make maps, do queries, some spatial analysis, some editing (shapefiles, personal geodatabases) - included with GTK ArcGIS Desktop
- ⌘ **ArcEditor** - plus edit multi-user geodatabases; more tools in toolbox
- ⌘ **ArcInfo** - full functionality; comes with ArcInfo Workstation (i.e. legacy version ArcInfo v. 7). *UT D.G.S. licenses.*
- ⌘ Current ArcGIS = v. 9.3

Licensing and "Floating Seats"



ArcGIS Extensions

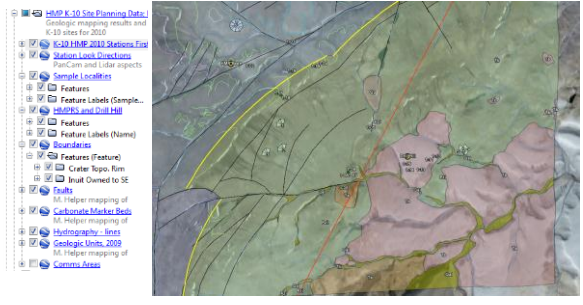
	ArcView, ArcEditor, and ArcInfo	ArcInfo only
ArcGIS Spatial Analyst	<ul style="list-style-type: none"> Advanced raster modeling ARC GRID calculator with ARC GRID algebra VBA for raster analysis 	<ul style="list-style-type: none"> ARC GRID program in ArcInfo Workstation ARC GRID commands in Arc program
ArcGIS 3D Analyst	<ul style="list-style-type: none"> ArcScene™—real-time interactive three-dimensional scenes Scene views in ArcCatalog Three-dimensional modeling tools ARC TIN tools 	<ul style="list-style-type: none"> ARC TIN™ commands in Arc program Surfacescene command
Geostatistical Analyst	<ul style="list-style-type: none"> Advanced kriging and surface modeling Exploratory spatial data analysis tools Probability, threshold, and error mapping 	

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Online GIS -e.g. Google Earth



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27