The Components of GIS

A Geographic Information System is a system of computer software, hardware and data, and the personnel that make it possible to enter, manipulate, analyze, and present information that is tied to a location on the earth’s surface.

The components of a GIS fall into three main categories.

Computer Hardware and Software
Spatial Data from the “Real World”
Trained Personnel

Hardware/Software: Hardware is the computer on which a GIS operates. The software runs on a wide range of hardware types, from centralized computer servers to desktop computers used in stand-alone or networked configurations. GIS software provides functions and tools needed to input and store geographic information. It also provides query tools, performs analysis, and displays geographic information in the form of maps or reports. All GIS software packages rely on an underlying database management system (DBMS) for storage and management of the geographic and attribute data. The GIS communicates with the DBMS to perform queries specified by the user.

Data: Data is one of the most important, and often most expensive, components of a GIS. Geographic data, which is comprised of geographic features and their corresponding attribute information, is entered into a GIS using a technique called digitizing. This process involves digitally encoding geographic features, such as buildings, roads or county boundaries. Digitizing is done by tracing the location, path or boundary of geographic features either on a computer screen using a scanned map in the background, or a paper map that is attached to a digitizing tablet. The digitizing process can be very tedious and time consuming, especially when capturing large datasets such as soil polygons, streams or topographic contours. Fortunately, much of the data GIS users need has been created by government agencies or commercial operations, and is available for free or for purchase from the data provider or from a spatial data clearinghouse.

People: The real power of a GIS comes from the people who use them. Over the past decade, computers have become much easier for people to use and more affordable for companies, schools and organizations to purchase. Given this fact, the number of GIS users has increased rapidly, and no longer includes only GIS specialists. Today GIS is being used by people, in many different fields, as a tool that enables them to perform their jobs more effectively. Police use GIS to solve crimes, Emergency 911 operators use GIS to send emergency personnel to a person in distress, biologists use GIS to protect plant and animal species, teachers use GIS to teach lessons in geography, history or engineering. The list of GIS users in the 21st century goes on and on. Whatever the application, the user is the key to a successful GIS.

How GIS Works - Visualizing Your Data

GIS databases are often large and complex collections of geographic features, and their corresponding attribute data. For example, the table below contains county-level population statistics for the United States. This particular database contains over 3,000 records (one for each county) and numerous columns of attributes, which include population, income, crime, etc.
Like, standard database management systems, a GIS provides tools that enable a user to query, manipulate and summarize large quantities of data. Additionally, a GIS enables you to link the tabular attribute data with the mapped features so that you can visualize patterns in the data across space. The graphic below shows all counties that have more than 1000 farms. The mapping capabilities of a GIS make it easier to see patterns in the data.

It is not just the visualization of a database that makes a GIS so powerful but its ability to combine multiple thematic layers for the purpose of answering complex questions. Examples of thematic layers are roads, rivers or buildings to name a few. The ability to combine these layers in a GIS allows us to answer questions like: “Where are all of the rivers that are within 25 meters of a road?” We will show an example of this in the next section.

**How GIS Works:** **Combining Data**

One of the greatest advantages of using GIS is its capacity to combine layers of data into a single map. The following graphics illustrate how multiple individual layers (or themes) can be combined for the purpose of performing complex queries.
How GIS Works:  The Query

A query is the same thing as a search. When you do a query, you are asking a database to find all of the data that is related to the terms, phrases, or features that you choose. This is similar to how an internet search engine finds specific web pages when you type in the phrase "mountain bikes", or a computerized library system finds specific books, magazines, or authors related to "bluejays". With GIS, you query the system by asking a question, or series of questions, to the database system. It then displays the data that relates to your query as a new theme.

GIS Data Types:  Raster

In a GIS, raster data is a cell-based representation of map features. Satellite images, aerial photography and scanned images are all stored in raster format. This is Digital Ortho Quarter Quadrangle (DOQQ). Orthophotos combine the image characteristics of a photograph with the geometric qualities of a map. DOQQ's serve a variety of purposes, from interim maps to field references for earth science investigations and analysis. DOQQ is also useful as a layer of a geographic information system and as a tool for digitizing and revising new and existing vector data.

GIS Data Types:  Vectors

Vectors can be classified into three primary feature types: points, lines and polygons. Vector data is entered into a GIS by digitizing these features from a base map. All vector data is stored as an x,y coordinate, or a series of x,y coordinates.
**What can GIS be Used For?**

GIS can be used to:

- Explain events
- Planning Strategies
- Integrate Information
- Solve complicated problems
- Predict outcomes
- Create “smart” maps
- Visualize scenarios
- Present powerful ideas

**Who Uses GIS?**

- Police and Law Enforcement Agencies
- Planning Strategies
- Foresters
- Industry
- Environmental Engineers
- Real Estate Professionals
- Telecommunications Professionals
- Emergency Response Organizations
- Local and Federal Government
- Health
- Transportation
- Geographers
- Market Developers

**Courtesy of:**

[Image]

http://www.pasda.psu.edu/tutorials/gisbasics/

**For more information on GIS please visit:**

https://njgin.state.nj.us/NJ_NJGINEplorer/index.jsp

https://njgin.state.nj.us/OIT_NJGF/index.jsp