PDHonline Course L153G (5 PDH)

Geographic Information Systems (GIS)–Hardware and software in GIS

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Slide 1

Lecture 3 Content

- **Geographic Information Systems (GIS)**

  -- **GIS Hardware and Software considerations –**

  (Continued)

We are going to continue with our talk on hardware and software as defined on the course description.

Slide 2

- **Hardware Considerations**
  - **all GIS are not alike**
  - **GIS is not “turnkey” system**
  - **Building DB is the largest initial expense**
  - **Building DB is an on going process**
  - **DB is the most valuable asset**
- **How are Information Systems created?**
- **System Architectures**
  - **Independent Functional Processes**
  - **Mainframe or Central approach**
  - **Network Distributed Processing Environment**

This is the content of the lecture. Each one of these bullet points will be discussed further.

Slide 3

Hardware considerations

- A GIS your friend is using may not be best one for you:
  - Some are PC based while others require networks
  - Less expensive GIS may produce only map diagrams while the full capacity systems can support a multitude of analytical operations and high quality graphics
  - Right decisions are required to choose right GIS software based on money available, application requirements and resource available

Not all GIS applications are the same. A GIS system for a specific application may not be suitable for another GIS application. Usually, a GIS from one application require the collection of new data set, and sometimes different processing procedures. The choice of a suitable GIS application depends upon the specifications given by the client, and the budget of the project.

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- **GIS is not "turnkey" system**
  - **Any GIS requires to be tailored to the specific requirements of the agency**
  - **Basic issues need to be addressed before implementation are:**
    - » **Number of application packages**
    - » **Data transfer protocols**
    - » **Database structure and content**
    - » **Organizational management**
- **Building database (DB) is an on going process**
  - **Updating DB**
  - **New applications require new data**

The GIS software bought off the shelf cannot be expected to answer the application question(s) at hand after installing the software because data need to be collected, processed and stored into formats that the GIS software can use. Other issues need to be considered such as the ability to transfer data between various systems, the ability of other third party application packages to provide compatible data used in the GIS software. The organizational management is another issue that will also influence the architecture of the GIS within a given organization. For example, a department within an organization may be required to share their data sets and as such, will influence the type of GIS system within the organization. Another consideration is that the database building is an on going process. The database is a snapshot in time and will require updating. New application programs will require new data.

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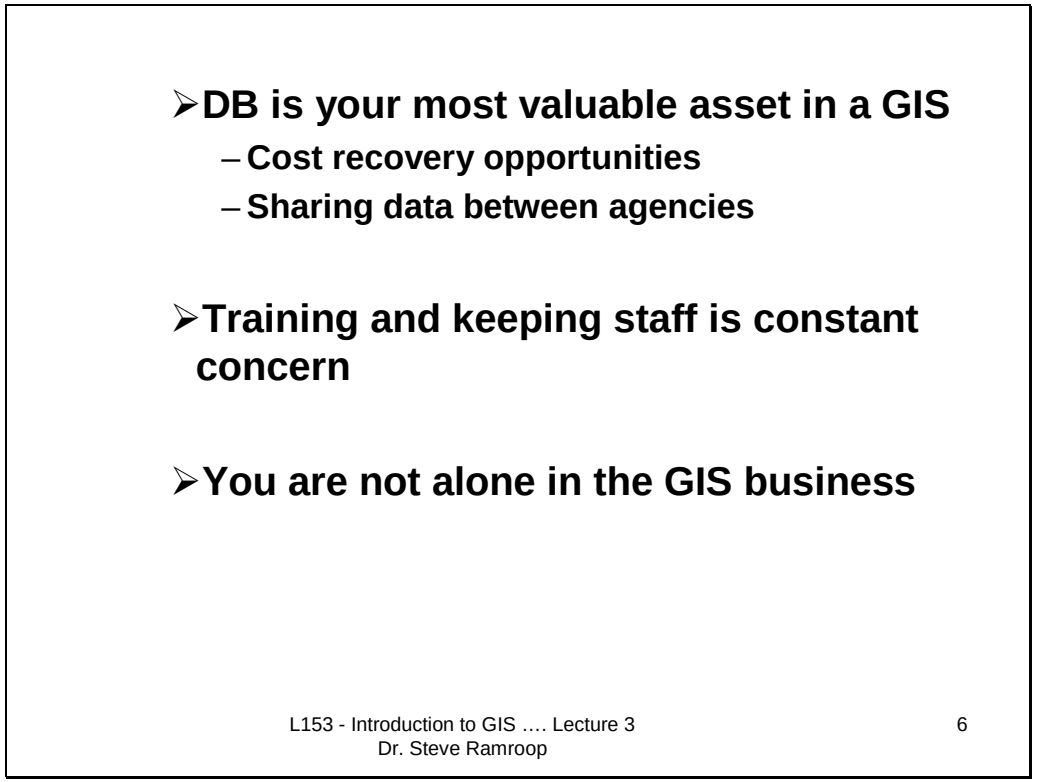
– Sample of questions addressed by GIS:

- **Where are particular features found?**
- **What geographical patterns exist?**
- **Where have changes occurred over a given time period?**
- **Where do certain conditions apply?**
- **What will the spatial implications be if an organization takes action?**
- **etc…**

This slide shows a sample of some of the questions addressed by GIS application systems. This list is not exhaustive…..You can add many more questions and such questions will be influenced by the intended GIS application.

Slide 6



The database in your GIS system is more expensive than the cost of the GIS software. As a result, departments within an organization usually share their database. There is also the need to establish a cost recovery strategy should the database become inaccessible due to failure of the computer server.

There is also need for training and keeping the staff within the organization up-to-date with the GIS technology and the other supporting third party database software. Also, it is noteworthy that GIS users are numerous and this reassures new GIS users that they have various levels of support. Therefore, any problem which they encounter can be adequately addressed.

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- **How are Information Systems created?**
  - **Using:**
    - **People, hardware**
    - **UNIX, DOS, or Windows: Graphical interface**
    - **GIS software, data sets, database systems**
    - **Statistical packages**
    - **Text processing software**
    - **…etc.**

GIS is an Information System. It is formed using the listed items on the slide. “People” is an important consideration because the information system is designed to satisfy a particular group of people. If their interests are not addressed then the information system will be ineffective. The other considerations are self-explanatory as they relate to the creation of information systems.

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- **The GIS developer creates:**
  - **Cadastral systems**
  - **Forest Management Systems**
  - **Site Analysis Systems**
  - **Taxation Systems**
  - **Watershed Management Systems**
  - **Environmental Monitoring Systems**
  - **Archaeological Information Systems**
  - **…. etc….**

This is small list of what the GIS developer creates. This list is not exhaustive. The developer uses his knowledge to use GIS to answer various questions related to each of the listed application.

Information System Architectures

Three systems architectures can be seen:

- Independent Functional Processes
- Mainframe or Central approach
- Networked Distributed Processing Environment

This slide shows the three basic GIS Information System Architectures. Each of these systems is discussed in the following slides.

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➢Independent Functional Processes

Description:

- » **Independent processors**
- » **Decentralized operation and management**
- » **Decentralized Application Development**
- » **Departmental financed**

Advantages:

- » **Potential for integrated graphic and DB applications**
- » **Acquisition of hardware and software to meet specific functional requirements**
- » **Moderate cost**

This is a stand alone GIS system. Each PC has its own GIS application and independent CPUs as processors. There is decentralized operation and management and the same can be said for its application development. Usually, in such an information system the stand alone system is departmentally financed.

The advantage of such a system is that the data can be integrated into other application programs that are on the stand alone GIS system. Another advantage is that there is moderate cost and the acquisition of hardware and software is readily available because changes or upgrades are applied to single independent processors.

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Disadvantages:

- Limited data sharing
- Limited coordination
- Extreme difficulty in maintaining data standards
- Limited hardware capacity
- Difficulty in data communications
- Complexity of operation and management

This slide identifies the disadvantages of the Independent Functional Processes architecture. These disadvantages are due to the fact that such architecture is stand alone and not connected to other stand alone processors (or PCs). This will mean that there is limited coordination with other departments, and there is little coordination in terms of the standards to follow in collecting and processing data sets.

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➢Mainframe or Central approach

Description:

- » **Centralized processing**
- » **Central operation and management**
- » **Central application development**
- » **Joint financing**

Advantages:

- » **Data sharing**
- » **Ability to maintain data standards**
- » **Flexible hardware capacity**
- » **Access to a range of system software**
- » **Uncomplicated data communication**
- » **Good technical support staff**
- » **Less difficult operation and management**

This is the second information system architecture. It is a centralized approach where the data sets and the processes are done centrally by a single computer server. All departments within an organization will work together in establishing data standards, share the cost of improvements on the server, administer the accessibility to the data sets and processes, and facilitate the sharing of the data sets and the processes. This is a better approach than the stand alone processing architecture, however, storing all the data and processing capabilities on a single server implies that a lot of dependability is place on the server.

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Disadvantages:

- **Limited ability to integrate graphic and database requirement**
- **Independent graphic processors required**
- **Low level of departmental control**
- **High level of inter-governmental cooperation required**
- **High cost**
- **Tendency to purchase too much excess capacity**

Because the server is critical in this architecture, one of the main disadvantages is the dependability of the single server to be always up and running. Downtime of the server is very costly. In addition there is need to have coordination of the departments within the organization. Sometimes one department is using a low level GIS however they are expected to contribute to for unnecessary upgrades by other departments who are using a high level GIS. Also there is a need to have independent graphic processors on the server and will increase the overall cost to the organization.

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➢Networked Distributed Processing Environment

Description:

- Independent processors in a tightly coupled network
- Coordinated operation and management
- Coordinated application development
- Technical support
- Joint and departmental financing

This is the third GIS information system architecture. It involves the existence of independent processors on a common computer network. There is a high level of coordination and wide range of technical support. The financing is divided between the departments. Should one processor be down then there will be other processors that can be accessed and used.

Slide 15

Advantages:

- Data sharing
- Ability to maintain data standards
- Potential for integrated graphic and attribute applications
- Moderate to high level departmental control
- Flexible hardware capacity
- Access to a range of system software
- Access to good technical support staff
- Moderate cost
- Phase growth

This slide shows the advantages of the network distributed processing architecture. Each point is self explanatory.

… The End …