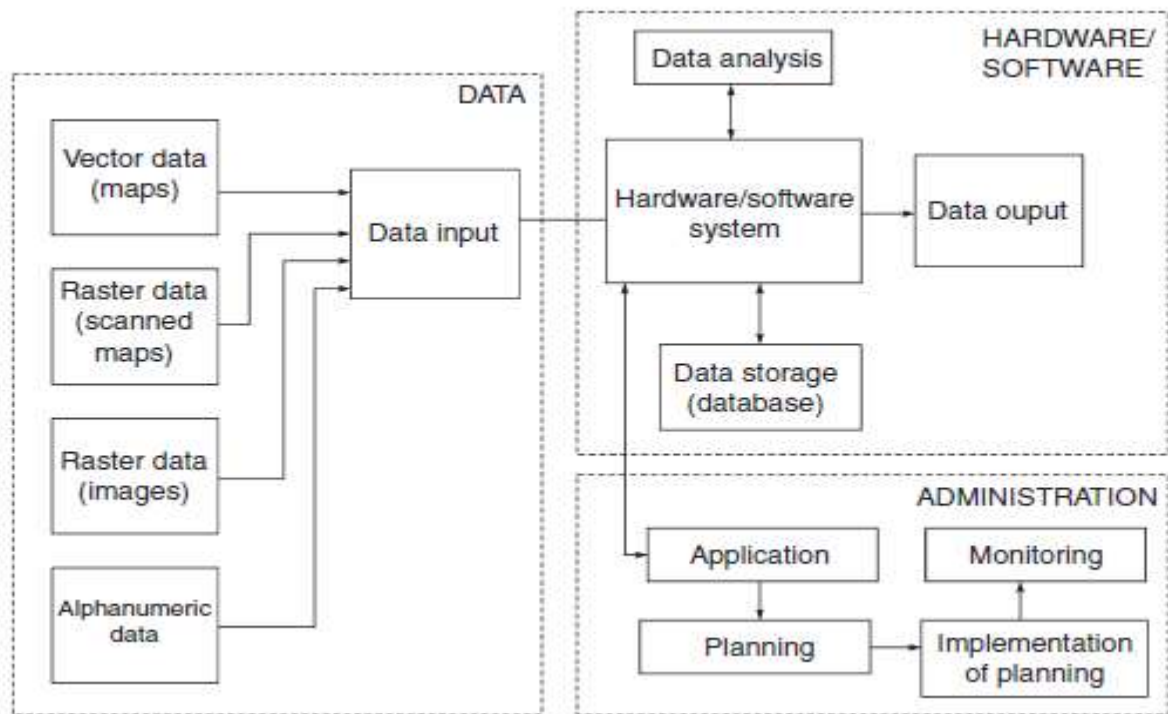


Geographic information systems (GIS)

Introduction

A geographic information system (GIS), in a narrow definition, is a computer system for the input, manipulation, storage and output of digital spatial data. In a more broad definition it is a digital system for the acquisition, management, analysis and visualization of spatial data for the purposes of planning, administering and monitoring the natural and socioeconomic environment. It represents a digital model of geography in its widest sense (see Figure below).



Concept of a geographic information system

In the narrow sense, a GIS consists of a system for data input in vector form, in raster form and in alphanumeric form, a CPU containing the programs for data processing, data storage and data analysis and of facilities for visualization and hard copy output of the data. In a broad sense, a GIS includes the data, which are managed by an administration or a unit conducting a project for the purposes of data inventory, data analysis and data presentation for administrative support or for decision support.

The information system is based on data which are available in various forms:

- **Spatial objects** are represented by identifiers. They can relate to points, lines or areas administered in vector form. The identification and organization of these objects in coordinate and vector form is subdivided into feature or object classes. This includes their spatial or topological relations in two or three dimensions.
- **Data in raster** form are also included. A pixel may be assigned an object code, or it may simply consist of grey levels of an image or a digital elevation model.
- **The vector** or the raster data are also linked to non-graphic information specifying place names and object numbers, which in databases may further be linked to a great variety of coded or alphanumerical attributes.

General and specialized GIS systems have been designed for a variety of purposes:

- For environmental management and conservation.
- For defiance and intelligence purposes.
- For governmental administration.
- For resource management in agriculture and forestry.
- For geophysical exploration.
- For cadastral management.
- For telecommunications.
- For utility management.
- For business applications.
- For construction projects.

Many of these applications require common base data. It is the purpose of an administrative authority to create a spatial data infrastructure by which the base data may easily be exchanged. The main preoccupation in this context is the creation of a topographic database onto which thematic data of specific interest may be added (see Figure below).

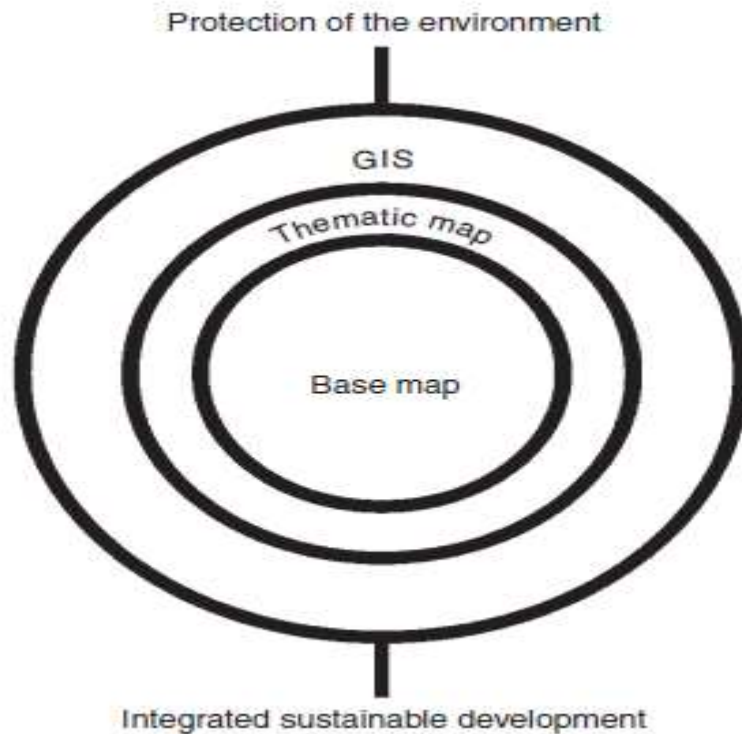


Figure illustrate the relationship between base data and thematic data.

Throughout the development of GIS systems, the hardware costs steadily went down. After a rise in the 1980s, the software cost has likewise taken a downward turn. With increased hardware and software power, GIS and data management likewise get more efficient and cheaper.

What remains high in cost is the provision of data, particularly if these are to be kept up-to-date to reflect a model of the actual geographic and socioeconomic environment.

The GIS pyramid of Figure 4.5 reflects the need for three types of users involved with GIS.

