Ekonomická fakulta
Faculty of Economics

Jihočeská univerzita v Českých Budějovicích
University of South Bohemia in České Budějovice

Geographic Information Systems 1
Lecture 1:
Introduction

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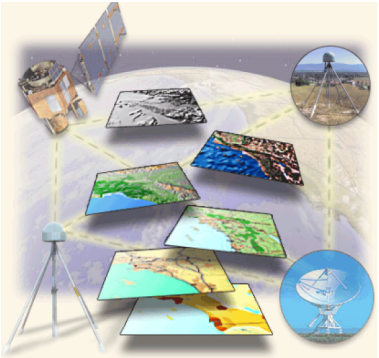
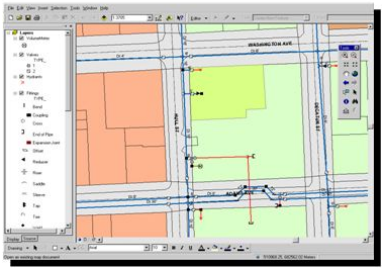
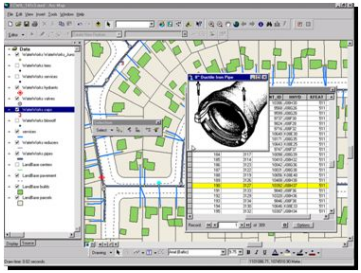
Geoinformation Technologies = specific information technologies aimed to geodata and geoinformation processing - from geodata acquisiton to its visualization.



basic concepts - video

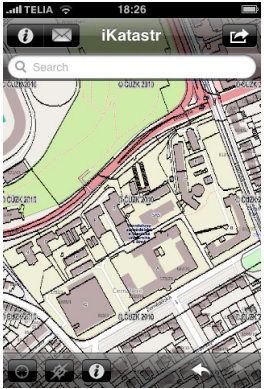
- 7.00 the alarm clock rings ... the energy use by the alarm clock comes from the mains e-on network using for the management GIS - AM/FM (Automated Mapping/Utility Management)





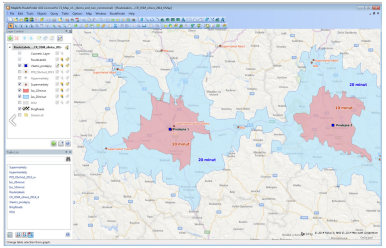
- 7.05 I´m taking a shower ... water flows from the tap thanks to Southbohemian water and sewerage supplies network - using for the management GIS - AM/FM

- 7.35 I´m opening the mail ... a letter from the Cadastral Office, which uses GIS for real estate registration



There are also several flyers in the mail that advertising different kinds of holidays - the travel agency uses GIS for marketing individiual destinations, as well the insurance company uses GIS for risk analysis.

- 8.00 my partner goes to work ...teaches GIS at a local university,
- 8.05 I take the children to the bus stop...our children commute to the school with enlarged sport education, the local office resposible for education uses GIS for generating catchment areas of schools,

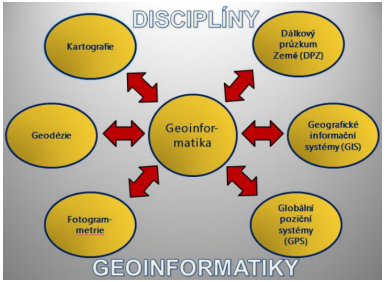


- 8.15 I´m trying to catch a train to work - at the station, trains are displayed on an electronic map that shows their location using real GIS in cooperation with GPS,
- 8.20 I read a newspaper on the train - paper comes from forests managed using GIS. .....

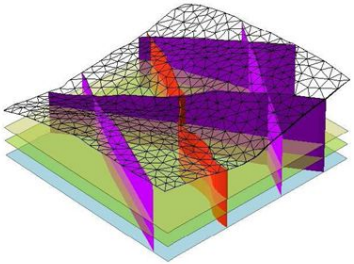
Geoinformatics

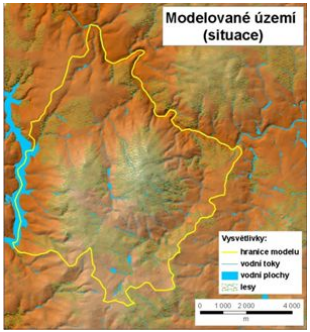
(geographic information science, geomatics - in Canada)

- „new“ discipline within geosciences - seeks to develop and apply methods for solving specific problems in geoscinces - with special emphasis on geographical location of the objects,
- typical problem of geosciences - spatial component of information.

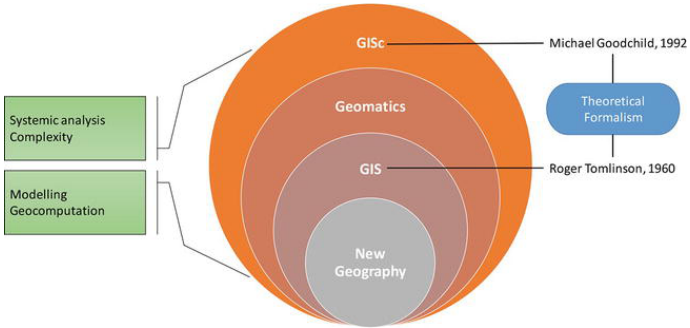


- specialized discipline on the border of Informatics and Sciences or technical disciplines,
- discipline that focuses on the development and application of methods for solving problems of geosciences with special emphasis on „geogrphic position of objects“ (Streit, 2000)

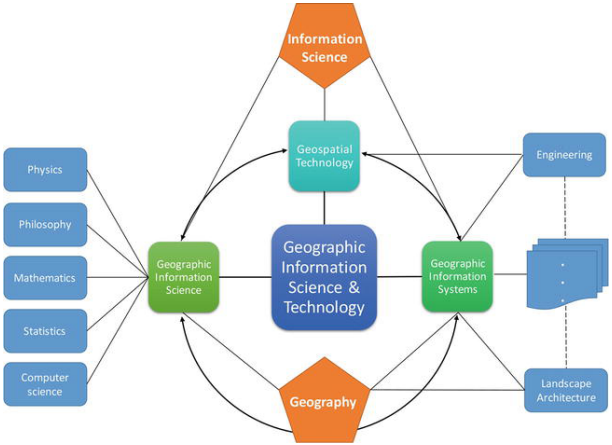




- = science and technology that deals with character and structure of spatial information, collection methods, organization, classification, analysis, data representation and dissemination, as well as the infrastructure necessary for optimal use of spatial information (Federal Geomatics Bulletin, 1991).



- Informatics,
- Geosciences.



Each scientific discipline develops its own unique vocabulary and language, enabling the description of one´s own work and experience and further communication among co-workers.

The central concepts are:

- **geospace**,
- **geoobject (geo-feature)** and its characteristics,
- **geodata**,
- **geoinformation**.

GIS (Geograhpic Information System[1]) is an Information System.

Information System = system for collection, maintenance, processing and providing information and data.

= a set of HW and SW for information acquistion, storage, connection and evaluation. It consits of a data processing device, a database system and evaluation programs.

There exist various GIS definitons.

What is GIS? - video 1

What is GIS? - video 2

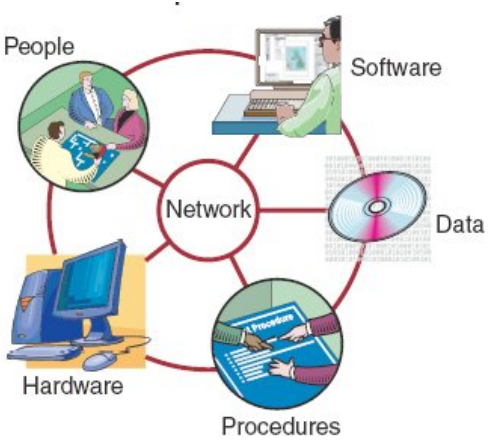
[1] It is gaining more and more popularity designation Geospatial Information System

GIS Definition by Different Authors

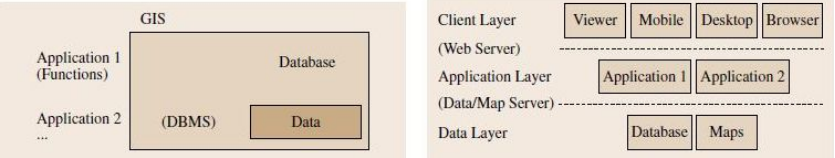
1. The U.S. Geological Survey in 1992, defined Geographic Information System (GIS) as a computer system (s) capable of assembling, storing, manipulating and displaying geographically reference information. Such systems, in fact, have power, utility ad importance far beyond this definition, both within and beyond the field of geography. Their most valuable potential capability which sets them apart from computer mapping systems, is the ability to perform spatial analyses to address research and application questions.
2. GIS is defined as the computer system build to capture, store, manipulate, analyze, manage and display all kinds of spatial or geographical data.
3. GIS is a powerful set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world this definition was given by Burrough in 1987.
4. GIS is a computer assisted system for capture, storage, retrieval, analysis and display of spatial data, within a particular organization (Clarke, 1986).
5. GIS is an information technology which stores, analyzes and display both spatial and non-spatial data (Parker, 1988).
6. GIS is defined as a decision support system involving the integration of spatial referenced data in a problem solving environment (Cowen, 1988)
7. GIS is seen as a system with advanced geo-modeling capabilities (Koshkariov, Tikunov and Trofimov, 1989).
8. GIS is an organized collection of computer Hardware, Software, Data and Analyst to effectively capture, store, manipulate, analyze and retrieve all types of spatial and non-spatial information. It is ageographic information system. Like any information system, a GIS is an organized accumulation of data and procedures that help people make decisions about what to do with things.

However, Geographical Information is information about where something is or what is at a certain location. For example, we may collect data from a forest on where some of the few remaining spotted eagles live which is geographical information. What trees grow in the areas inhabited by these eagles is also a geographical information, because it has a spatial component. Spatial data are any data that have a location that can be geocoded.

GIS is uniquely integrative. Where spatial data are available, GIS can offer a range of functionality. Whereas other technologies might be used only to analyse aerial photographs and satellite images, to create statistical models or to draft maps, these capabilities are all offered together within a comprehensive GIS.


People
Software
Network
Data
Hardware
Procedures

- **traditional GIS** - the core of the system consists of a database controlled by a database management system (DBMS) + tools for data manipulation and analysis - the beginnings of GIS: standard relational database,
- **modern GIS** - object-related data management system (ORDBMS), Internet ⇒ web services, mobile technologies



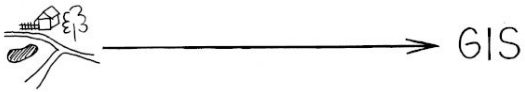
source: Springer Handbook of Geographic Information

an image resembling a map

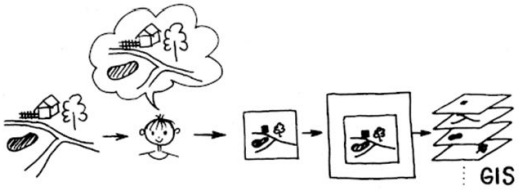
- electronic map,
- www.mapy.cz,
- maps.google.com

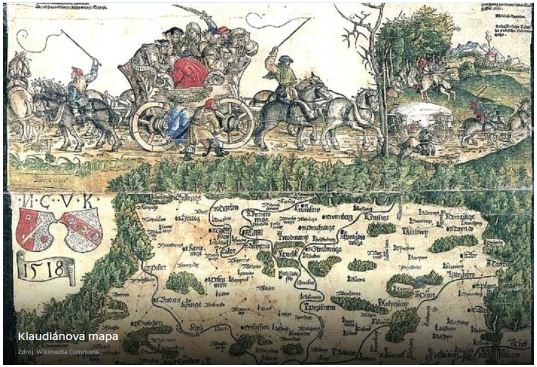
How do I know GIS?

it enables **geodata editing, geoprocessing** - due to **topology**



1. The real world observed by the user and the creation of his mental image.
2. Conversion into a distributable (interpretive) form - map.
3. GIS (GIT) modelling tools.





- objects are difficult to find,
- demanding work with multiple maps of different scales,
- what is shown is all I can get (static information).

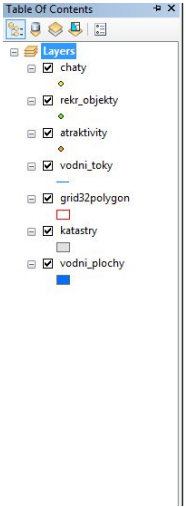


Table Of Contents
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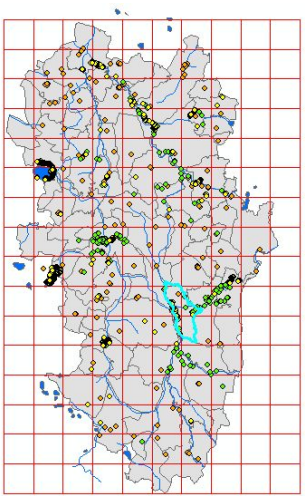

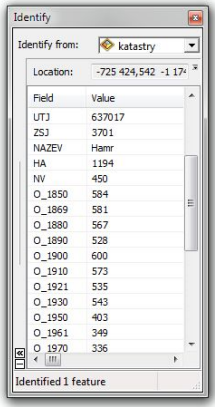
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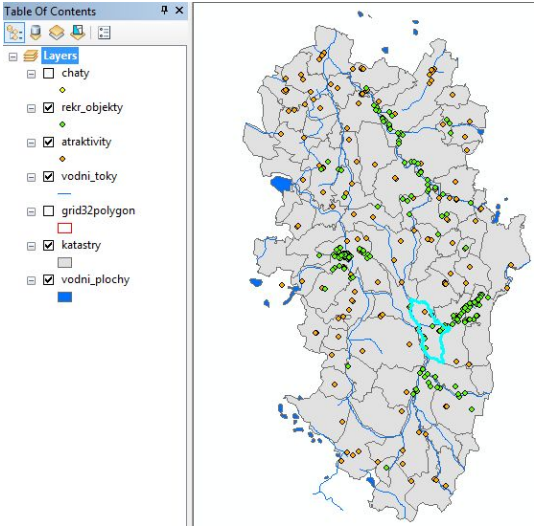
O_1880 567
O_1890 528
O_1900 600
O_1910 573
O_1921 535
O_1930 543
O_1950 403
O_1961 349
O_1970 336
Identified 1 feature

GIS changes static maps to dynamic ones

displays data in layers



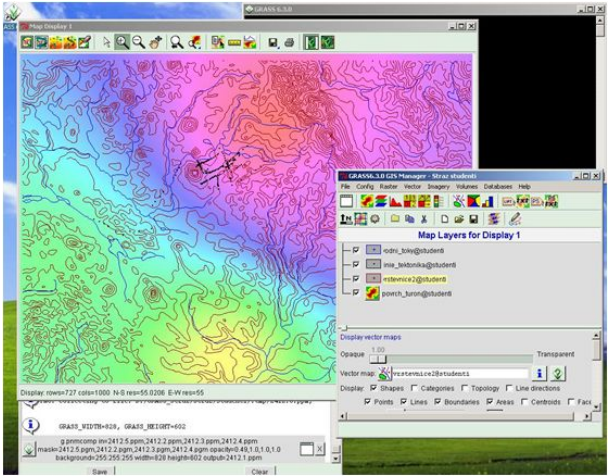
GIS not only changes static maps to dynamic ones

That´s not all - in addition, it can

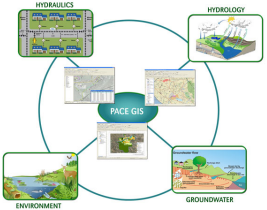
get answers to these type of questions:

- What is located or is close to a certain location?
- Which territories meet the given criteria?
- What has changed in a certain time period?
- What are the spatial arrangements of objects?
- What if?

GIS is a tool of Geoinformatics



- GIS **as a technology** - resources necessary for operation and implementation - HW, SW equipment;
- GIS **as an application** - particular information system of geographical type that serves an organization - eg. GIS Canada,



- An individiual or group understand GIS as a scientific discipline, they usually solve a specific spatial problem.

Data = a string of charactes - has no meaning itself - obtained by measurement, observaton.

Data, which is assigned a meaning given by their context and relationship to other data becomes **information**.

example: „Joseph“ is an element of data and the fact that Joseph is a name of particular person is information.

The information does not always have to be in the form of facts only, but can be presented in the form of rules (more general):

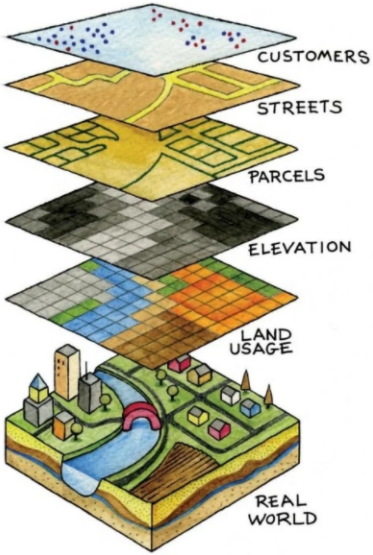
example: „all districts in the Czech Republic are contiguous area“

knowledge $\Leftarrow$ drawing conclusions form information.
kowledge of reality: data + context + experinece

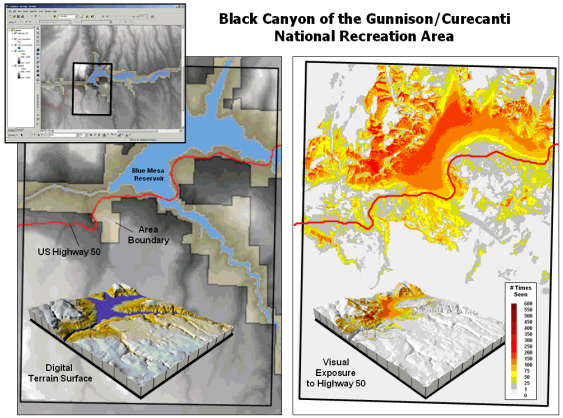
= data related to localization on the earth´s surface - **spatial data** (geo-objects, geo-elements)

contain multiple types of information:

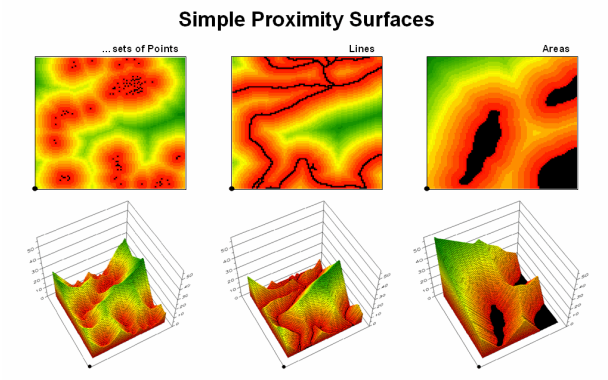
- absolute **position** is described by the geometry of geoobjects,
- **topology** describes spatial relationships among geoobjects ("geometry of relative position"),
- the special thematic area of geoobjects is described by **attributes** = descriptive infomation,
- **dynamics** of geoobjects is expressed by a change in geometry, topology or attributes.


CUSTOMERS
STREETS
PARCELS
ELEVATION
LAND USAGE
REAL WORLD

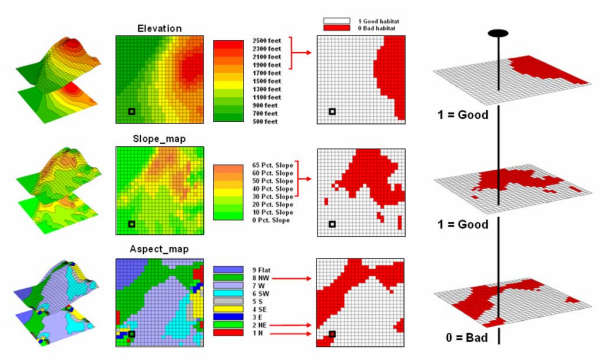
3D modelling - digital terrain model, visibility from the ongoing highway



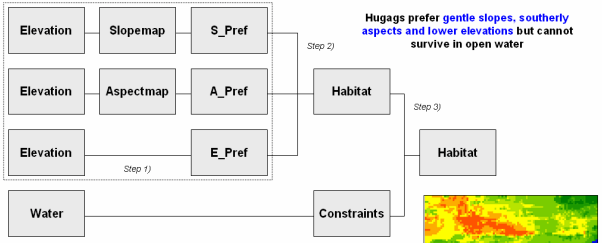
raster analysis - distance surfaces



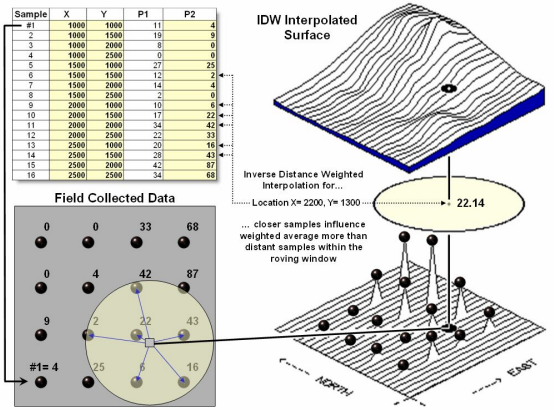
raster analysis - reclassification, map algebra



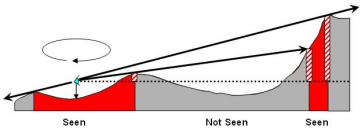
overlays - searching for a suitable site that meets the given conditions (location analysis)

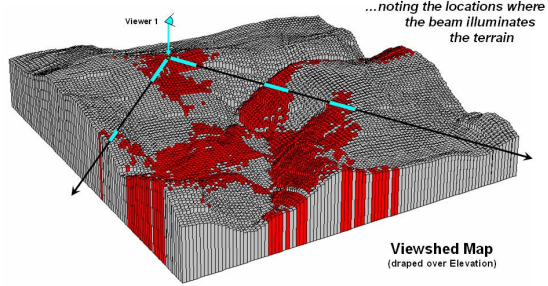


spatial interpolation

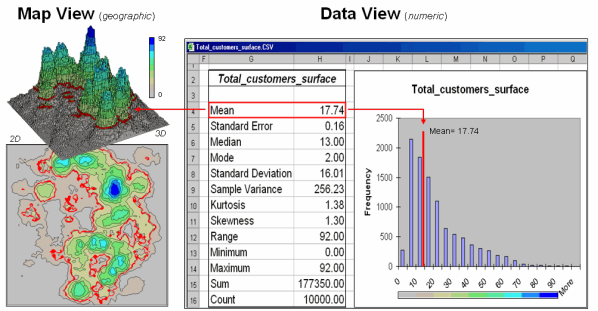


visibility analysis





spatial data statistical analysis



- typical advantages of automation - cost reduction,
- better data organization (unified, accessible and up-to-date),
- faster access to data,
- easier communication,
- new functional possibilites - geoprocessing, visualization.

Thank you for your attention.