



جامعة المستقبل
AL MUSTAQBAL UNIVERSITY

كلية العلوم
قسم الانظمة الطبية الذكية
Lecture: (1)

Subject: **Introduction to GIS**

Level: Second

Lecturer: MSc. Mustafa Yousif

What is

GIS

Refer to :

Geographic Information System



What is Geography ?

- ▶ **Geography** is a science that deals with the earth and life on the earth and provide the position data (**Spatial Data**)

What is an Information System?

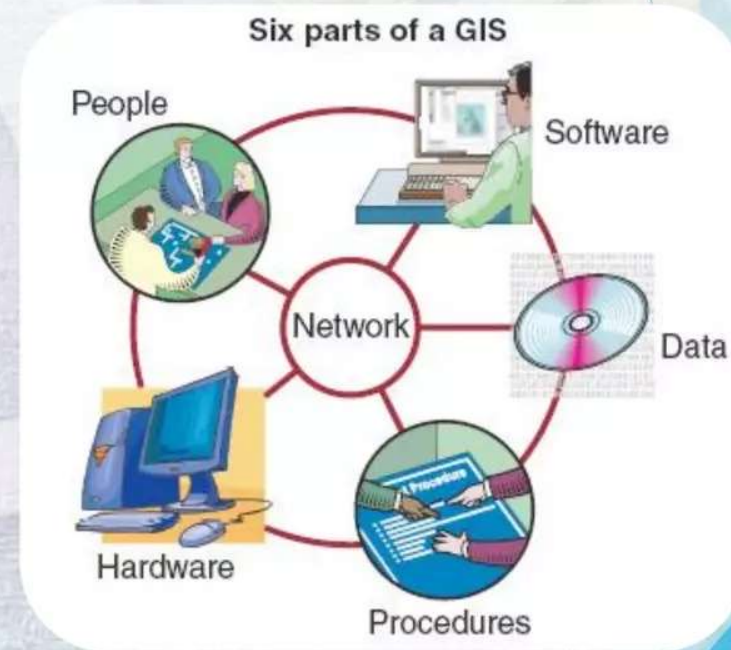
- ▶ Its System used for:
Gathering, Storing, Updating,
Manipulating, Analyzing
Data

Then GIS is

- ▶ A geographic information system (GIS) is a system designed to Gathering, Storing, Updating, Manipulating, Analyzing and present all types of spatial or geographical data.
- ▶ A geographic information system (GIS) is a computer-based tool that analyzes, stores, manipulates and visualizes geographic information on a map.
- ▶ GIS allows you to view, understand, question, interpret and visualize data in many ways in form of maps, reports and charts.
- ▶ A GIS helps you answer questions and solve problems by looking at your data in a way that is quickly understood and easily shared.
- ▶ Briefly GIS mean Making Smart Maps can Talk to You 😊

GIS Not Software only!

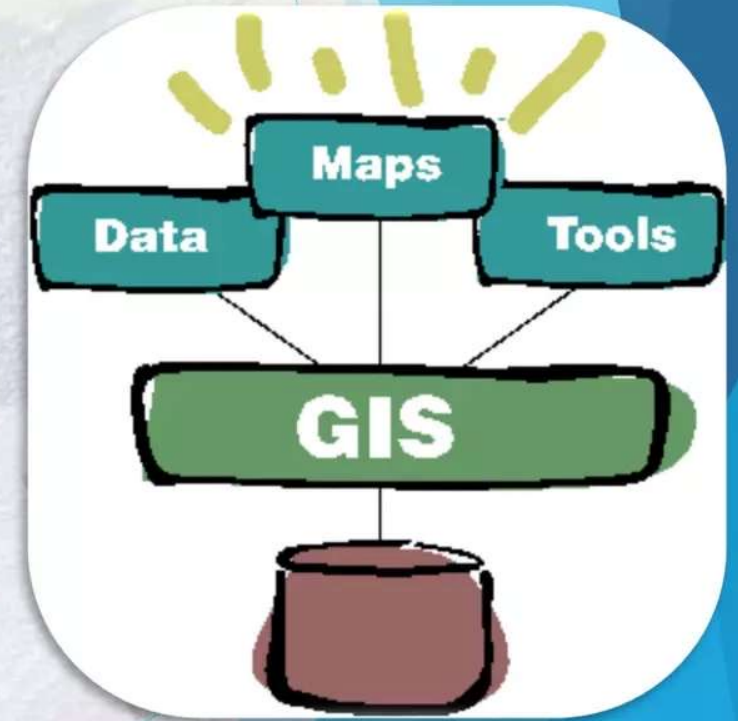
- ▶ A Geographic Information System is not only about computers, software and electronic data.
- ▶ A GIS is an organized collection of :
 - ▶ Hardware
 - ▶ Software
 - ▶ Network
 - ▶ Data
 - ▶ Procedures
 - ▶ And people!

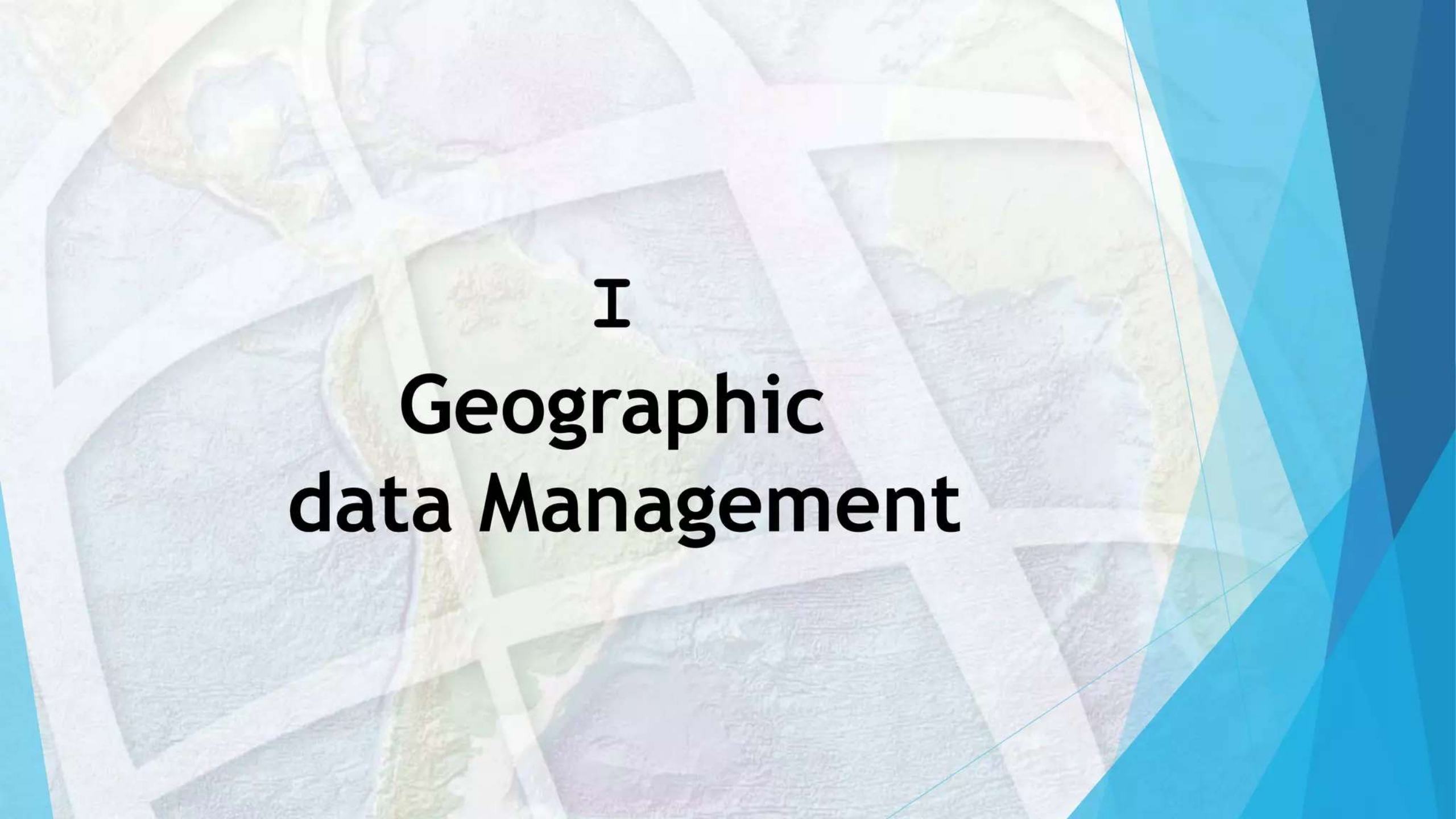


GIS functions

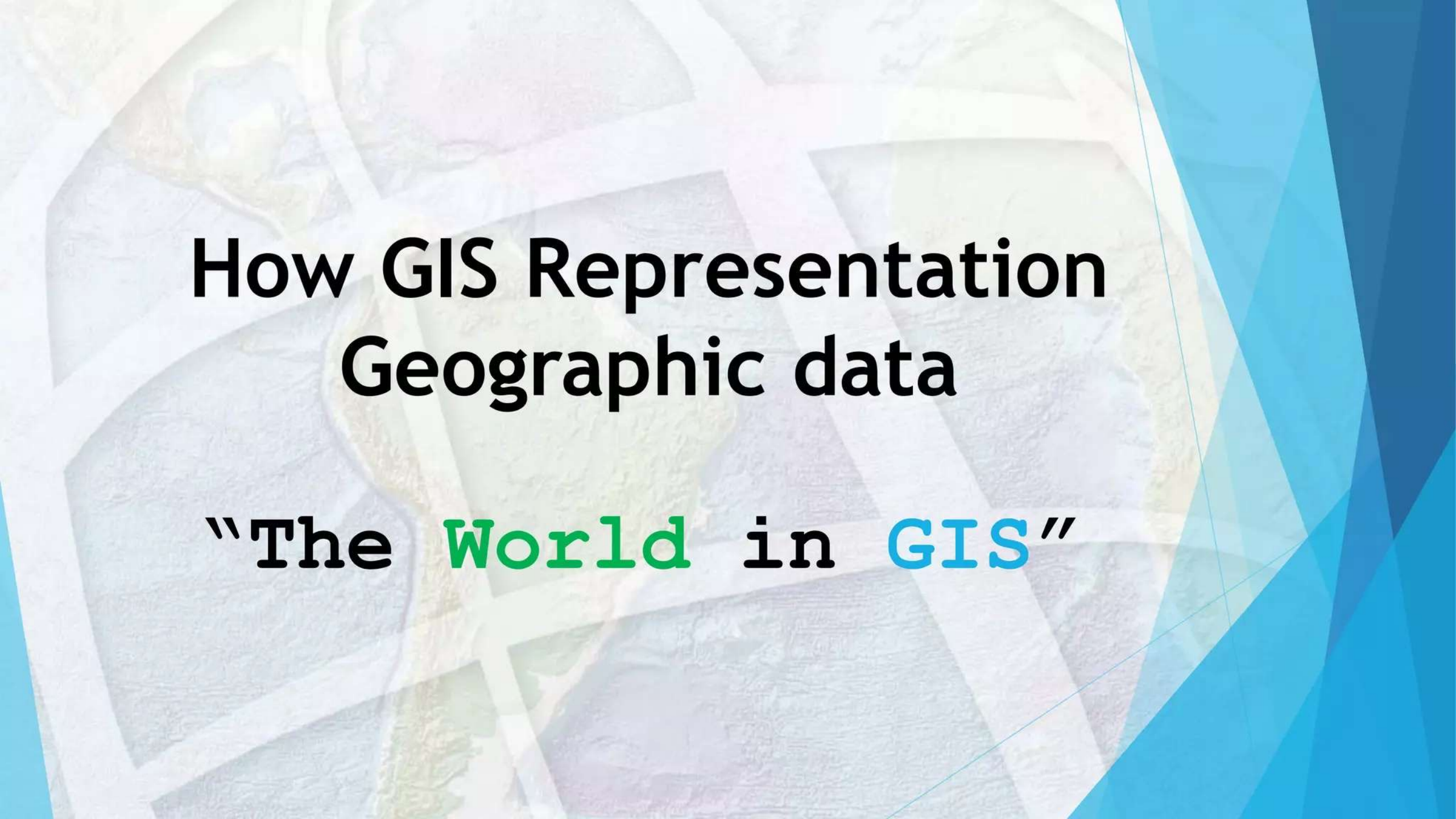
There are three main functions of GIS :

- 🌐 Geographic data Management
- 🌐 Mapping and Visualization
- 🌐 Spatial Analysis





I Geographic data Management



How GIS Representation Geographic data

“The **World** in **GIS**”

Geographic Data

- ▶ Two components of geographic data
 - ▶ ***Spatial Data***: representation of geographic features associated with real-world locations
 - ▶ Says **where** the feature is
 - ▶ Co-ordinate based
 - ▶ Stored in files and managed by the GIS software
 - ▶ ***Attribute Data (non Spatial)*** : descriptive information
 - ▶ Says **what** a feature is .
 - ▶ like : statistics, text, images, sound, etc.
 - ▶ Stored in tables and managed by an RDBMS (relational database management system)

Geographic data models

- ▶ Two main models for geographic data

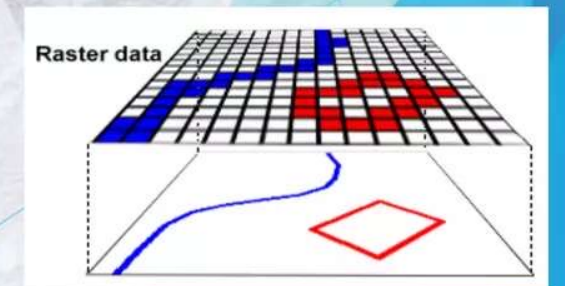
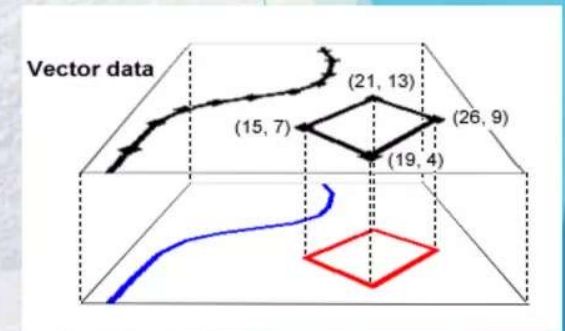
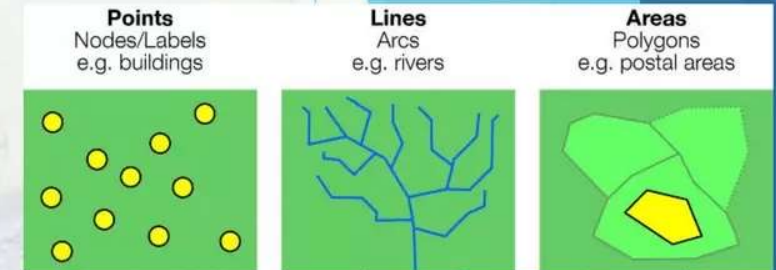
- ▶ **Vector data: Discrete features**

- ▶ *three feature types*

- ▶ points/nodes (single x,y locations)
 - ▶ lines/arcs (linear string of x,y locations)
 - ▶ areas/polygons (closed string of x,y locations)
zones or areas

- ▶ **Raster data : A continuous surface**

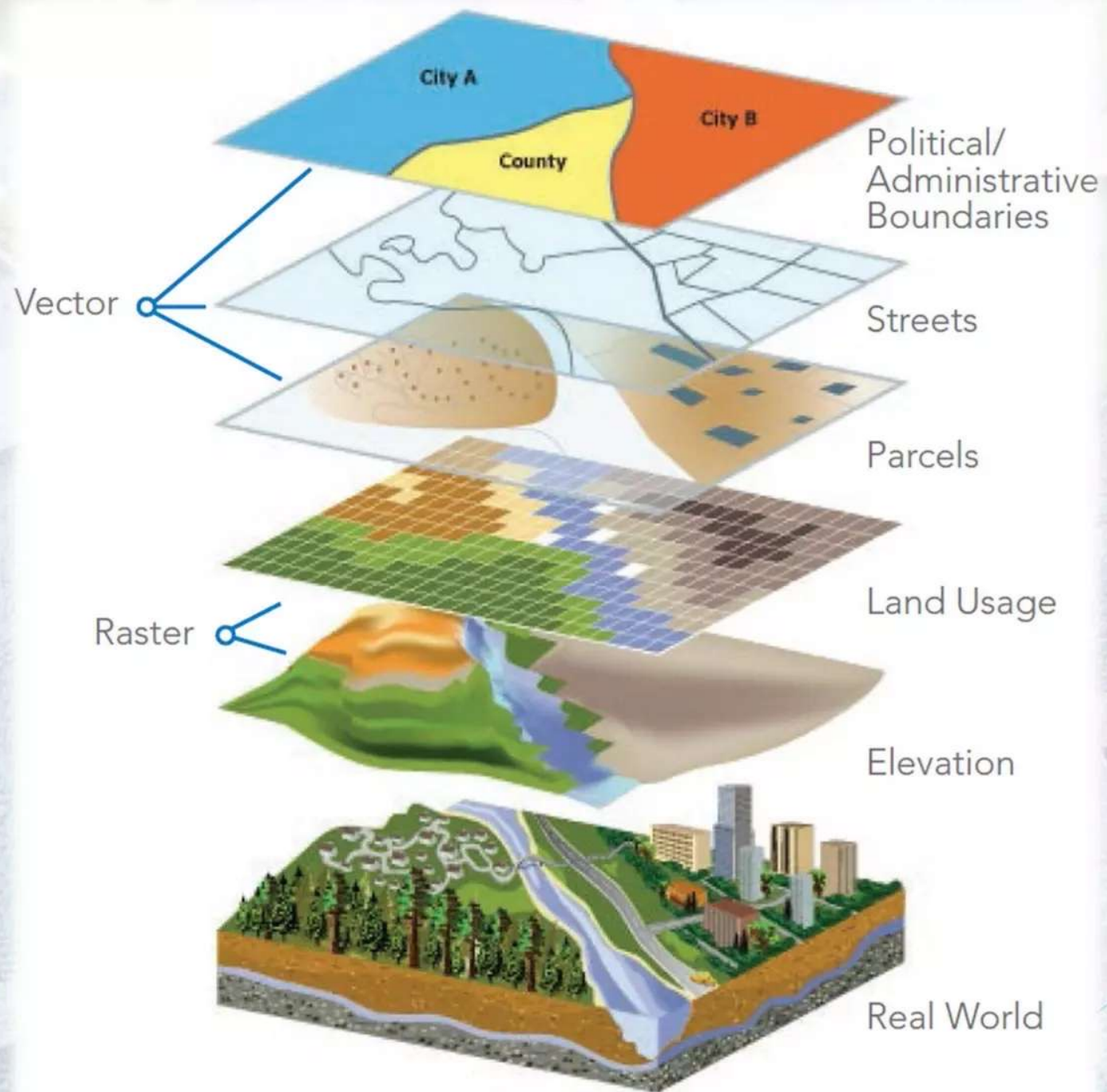
- ▶ Rectangular array of cells or pixel



Geographic data models

- ▶ Other models :
 - ▶ *Surfaces for 3D visualization*
 - ▶ *Networks (geometric, transportation)*



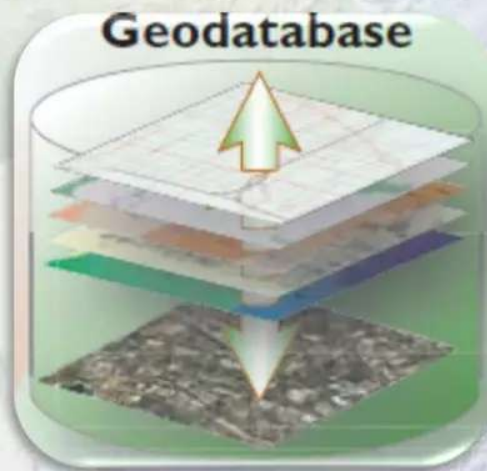


How data are stored in ArcGIS

“Data Management”

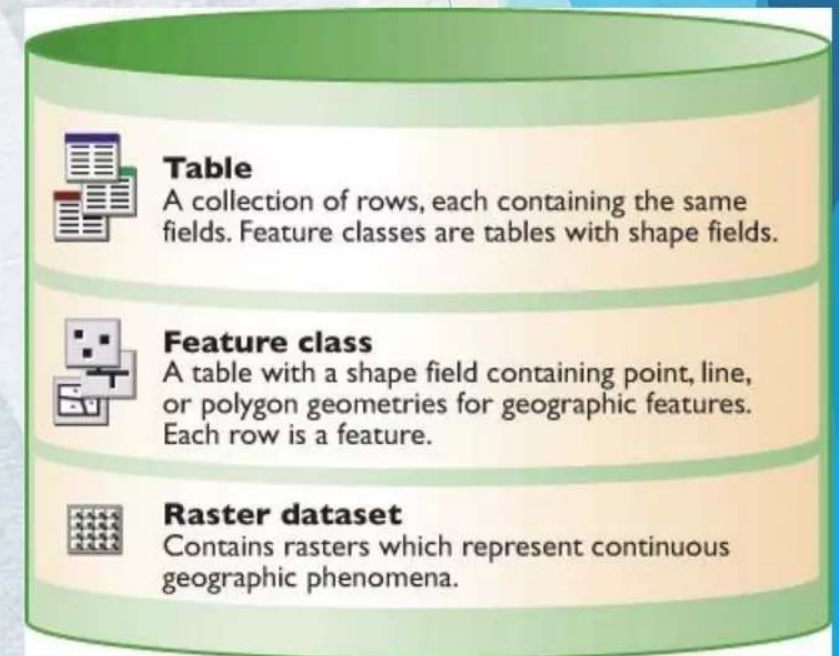
All data store in the genius GIS Container

“Geo-Database”



What is a geodatabase?

- ▶ **ArcGIS geodatabase** is a collection of geographic datasets of various types held in a common file system folder, a Microsoft Access database, or a multiuser relational DBMS
- ▶ The geodatabase contains three primary dataset types:
 - ▶ Feature classes
 - ▶ Raster datasets
 - ▶ Tables



Types of geodatabases

- ▶ There are three types of GDB:
 - ▶ **Personal Geodatabase**
 - ▶ Single user editing / multiple readers
 - ▶ Stored in MS Access
 - ▶ Size limit of 2 GB
 - ▶ **File Geodatabase**
 - ▶ Single user editing / multiple readers
 - ▶ 1 TB per table
 - ▶ Reduced storage requirements
 - ▶ **ArcSDE Geodatabase**
 - ▶ Stored in an Enterprise DBMS
 - ▶ Supports multiuser editing via versioning
 - ▶ Requires ArcEditor or ArcInfo to edit



An overview of geodatabase design

- ▶ How the geographic features are to be represented for each theme (for example, as points, lines, polygons, or rasters) along with their tabular attributes
- ▶ How the data will be organized into datasets, such as feature classes, attributes, raster datasets, and so forth
- ▶ What additional spatial and database elements will be needed for integrity rules, for implementing rich GIS behavior (such as topologies, networks, subtypes and raster catalogs), and defining spatial and attribute relationships between datasets

Geodatabase Workflow

- ▶ Create Schema
- ▶ Import / Load data
- ▶ Pre-process data to store geodatabase behaviors
- ▶ Create geodatabase behaviors (subtypes, domain,...)
- ▶ Apply behaviors
- ▶ Create topology or geometric network
- ▶ Create connectivity rules for networks
- ▶ Use and edit in ArcMap
- ▶ Feature and attribute validation
- ▶ Backtrack to create needed schemas if necessary

II

Mapping and Visualization

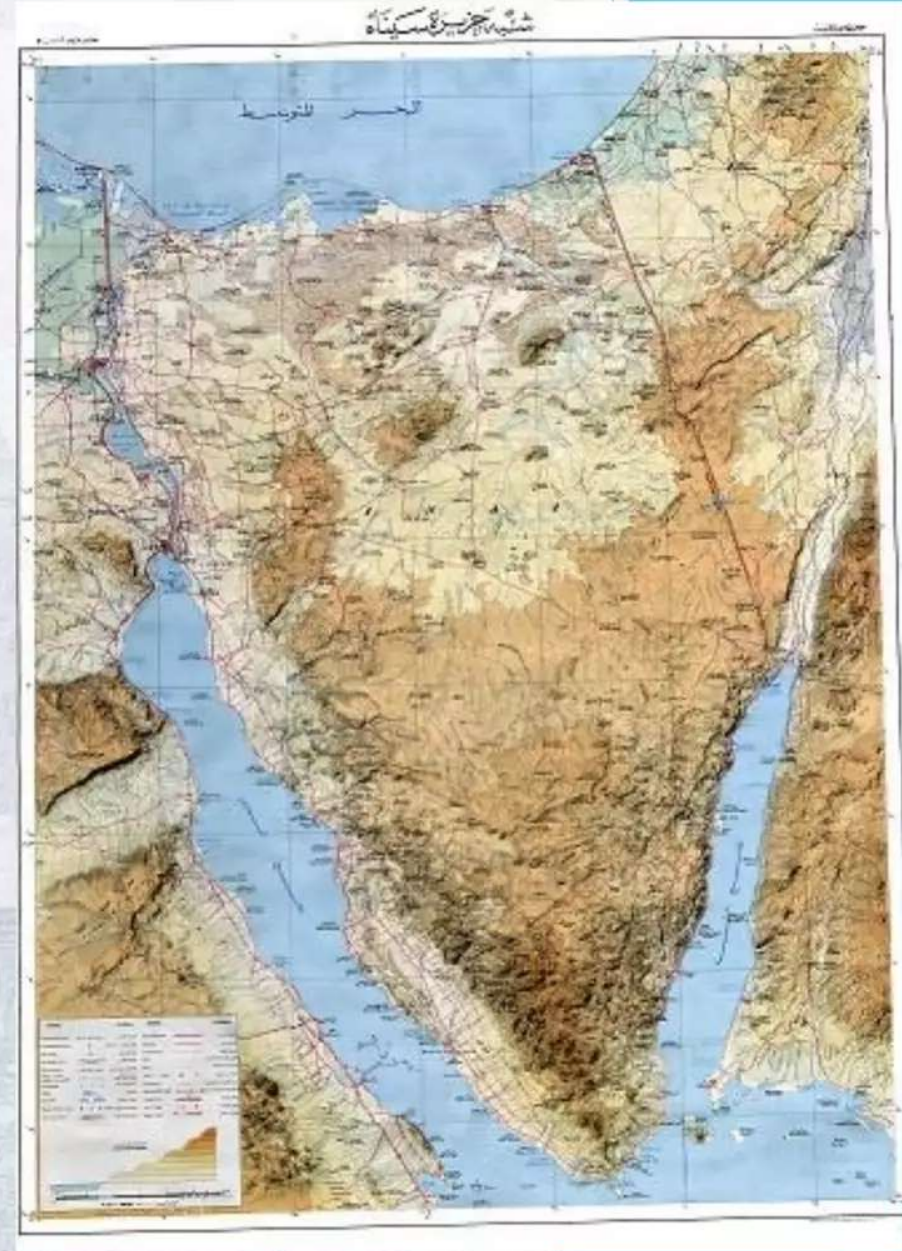
“GIS Maps”

Wisdom (GIS Power “The data behind the map”)



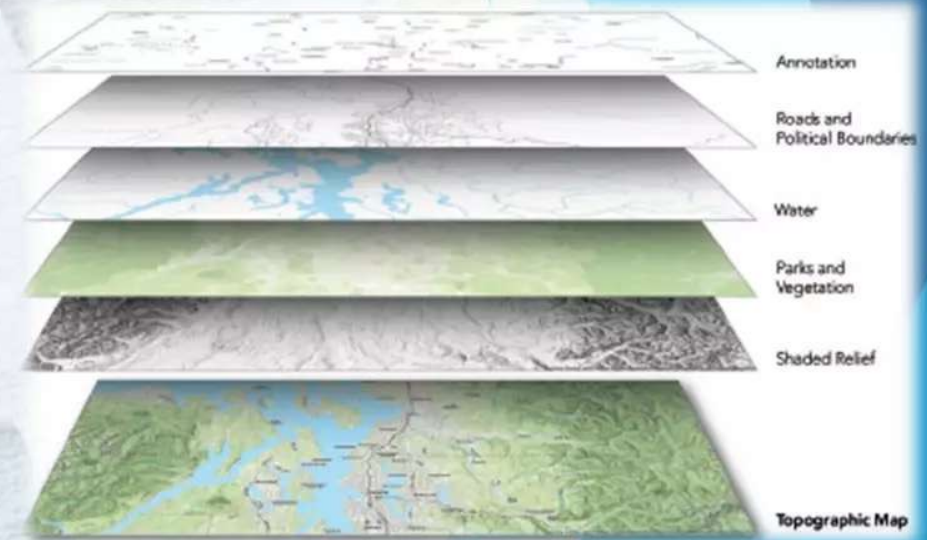
Ordinary Maps

- ▶ A geological map is a **Unique Values Map** based on categorical data representing different formations, or other geological units
- ▶ These maps have **fixed scale**



GIS Maps

- ▶ GIS organizes the world into ‘**layers**’ of geographic objects that are alike.
- ▶ **Each map** Composed of a series of layers drawn in a particular order.
- ▶ **Each layer** is used to display and work with a **specific** GIS dataset.
- ▶ Layer **references** the data stored in geodatabases
- ▶ Layer defines how a GIS dataset is **symbolized** and **labeled** in your map views



GIS Maps

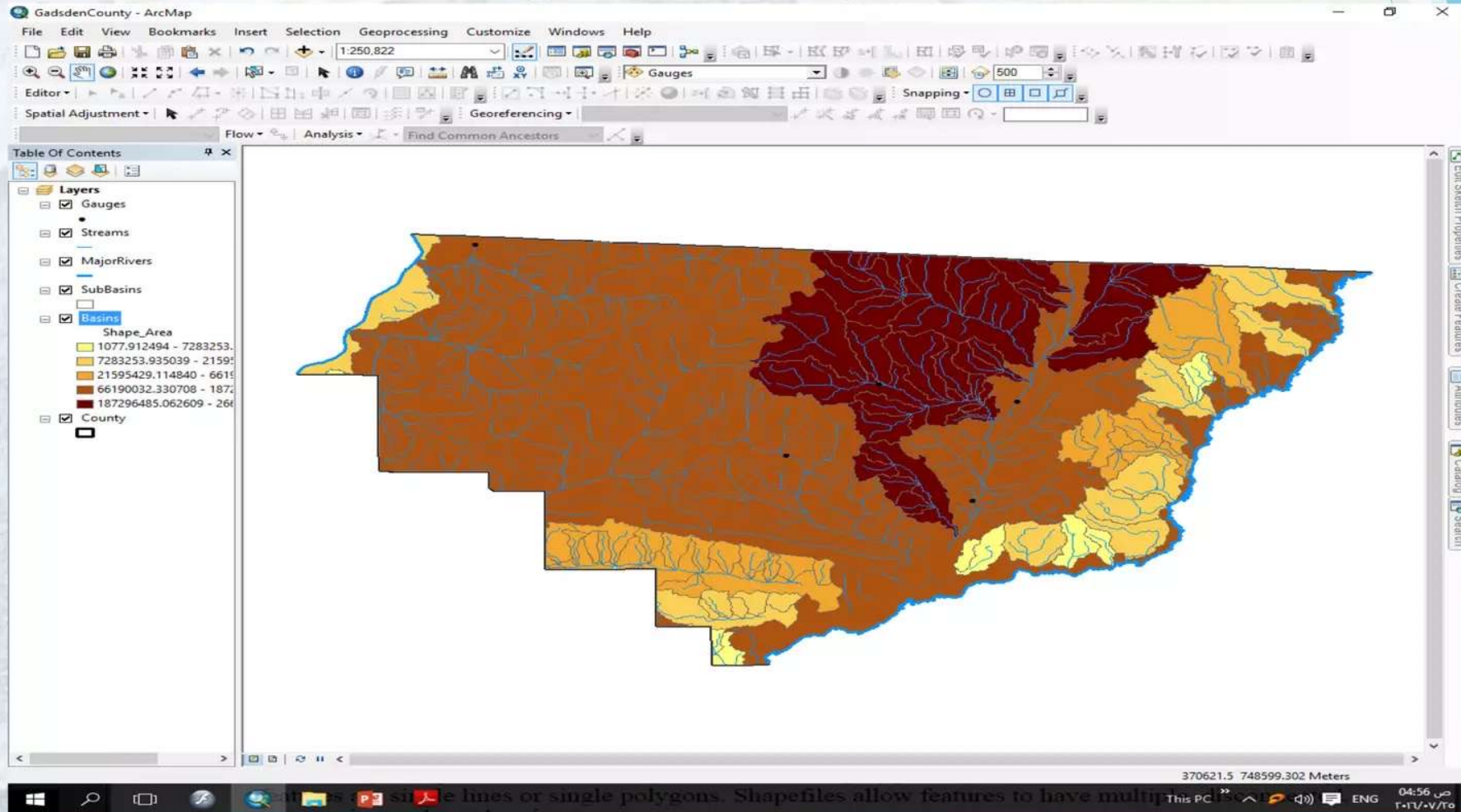
- ▶ Advantage of GIS maps:
 - ▶ Composed of a series of layers.
 - ▶ Dynamic Scale
 - ▶ Dynamic Labels, Annotations
 - ▶ Symbols associated with Data
 - ▶ Variable not fixed

GIS Maps

Not Easy to Understand

Table												
SubBasins												
OBJECTID *	Shape *	AREA	PERIMETER	BASINS_	BASINS_ID	HUC	EXTHUC	BASIN	FEATURE	PK_BASIN	Shape_Length	Shape_Area
1	Polygon	3904.494512	297.435608	2	151	03130004	99000000	DIR RUNOFF TO STREAM	RUNOFF	60	297.435675	3904.498949
2	Polygon	18553596.36375	38575.23986	3	504	03130011	99000000	APALACHICOLA RIVER	STREAM	375	38575.24019	18553596.517232
3	Polygon	11726701.465	18022.828001	4	506	03130011	05990000	MOSQUITO CREEK	STREAM	376	18022.789933	11724639.854452
4	Polygon	3385478.26572	12282.717145	5	507	03130011	05750000	BOYKIN BRANCH	STREAM	378	12282.716827	3385478.362411
5	Polygon	4007207.760296	9215.776389	6	513	03130011	05500000	UNNAMED BRANCH	STREAM	381	9230.166811	4126784.208024
6	Polygon	603667.875028	4511.125985	7	516	03130011	05990000	NORTH MOSQUITO CREEK	STREAM	384	4511.125826	603667.80513
7	Polygon	3124693.633544	7234.790968	8	517	03130011	05450000	OAK GROVE BRANCH	STREAM	385	7234.791056	3124693.623766
8	Polygon	24072309.11246	31286.956385	9	518	03130011	05990000	NORTH MOSQUITO CREEK	STREAM	386	31286.956601	24072309.168972
9	Polygon	3482755.963189	9446.610143	10	523	03130011	05857500	UNNAMED BRANCH	STREAM	390	9446.610251	3482755.92783
10	Polygon	27568901.68951	54550.521557	11	527	03130011	15859900	SOUTH MOSQUITO CREEK	STREAM	393	54550.522033	27568901.660972
11	Polygon	9743815.687205	16918.548008	12	531	03120003	32706060	UNNAMED RUN	STREAM	397	16918.548177	9743815.760241
12	Polygon	8558238.511832	24260.962203	13	532	03120003	32706099	CAMEL CREEK	STREAM	398	24260.962005	8558238.473339
13	Polygon	1135424.428833	4378.695809	14	533	03120003	32706040	UNNAMED RUN	STREAM	400	4378.696085	1135424.455593
14	Polygon	3210287.770906	9603.909894	15	536	03120003	32706088	UNNAMED RUN	STREAM	402	9603.909856	3210287.752852
15	Polygon	6120695.549107	11098.229235	16	540	03130011	05300000	UNNAMED BRANCH	STREAM	406	11098.229302	6120695.498498
16	Polygon	40923003.22514	42420.178715	17	542	03120003	32709900	WILLACOOCHIEE CREEK	STREAM	410	42420.178965	40923003.200044
17	Polygon	3505062.056694	9793.830611	18	545	03130011	05854600	UNNAMED BRANCH	STREAM	411	9793.830539	3505062.095618
18	Polygon	6974330.950797	13375.402274	19	546	03130011	05854600	UNNAMED BRANCH	STREAM	412	13375.4022	6974330.938134
19	Polygon	8598779.483082	13617.586449	20	551	03120003	32707000	UNNAMED BRANCH	STREAM	417	13617.586536	8598779.582081
20	Polygon	6966592.706537	14067.722086	21	554	03120003	32550000	UNNAMED BRANCH	STREAM	419	14067.722061	6966592.691022
21	Polygon	5587675.009184	12106.765194	22	556	03130011	05859700	UNNAMED BRANCH	STREAM	421	12106.765063	5587674.968689
22	Polygon	222857.183821	2596.797427	23	557	03120003	32500000	ATTAPULGUS CREEK	STREAM	422	2596.79738	222857.220253
23	Polygon	68373721.92754	104116.304586	24	560	03120003	72990000	LITTLE RIVER	STREAM	424	104116.305398	68373721.893728
24	Polygon	18693133.9296	25096.30202	25	563	03120003	32659900	SWAMP CREEK	STREAM	427	25096.30284	18693134.024783
25	Polygon	10592240.93909	16306.90851	26	564	03120003	32657500	MILL CREEK	STREAM	428	16306.90843	10592240.880042
26	Polygon	15671954.03392	24378.306394	27	565	03120003	07000000	SHAW CREEK	STREAM	430	24378.306151	15671954.163086
27	Polygon	10994690.39772	15753.712947	28	571	03130011	05200000	UNNAMED BRANCH	STREAM	433	15753.713091	10994690.46505
28	Polygon	92784841.76124	198943.577522	29	570	03120003	99000000	OCHLOCKONEE RIVER	STREAM	1297	198943.578657	92784842.072316
29	Polygon	3814865.708855	10065.308202	30	572	03130011	05970000	HARDIN HEIGHTS BRANCH	STREAM	434	10065.308201	3814865.685532
30	Polygon	1809142.936443	6191.288327	31	576	03130011	05851200	UNNAMED BRANCH	STREAM	437	6191.288269	1809142.925783
31	Polygon	33298287.05537	34093.638976	32	579	03120003	12000000	UNNAMED STREAM	STREAM	440	34093.638195	33298286.967883
32	Polygon	3749438.343375	9723.627598	33	586	03120003	32600000	UNNAMED BRANCH	STREAM	447	9723.627407	3749438.293348
33	Polygon	7100773.235171	12119.245889	34	584	03130011	05856000	UNNAMED BRANCH	STREAM	454	12119.245933	7100773.281378

Changeable Maps



Thank You

Do you have any question?

