Univerzitet u Beogradu – Građevinski fakultet www.grf.bg.ac.rs

Studijski program: **GRAĐEVINARSTVO**

Modul: **MASTER STUDIJE**

Godina/Semestar: **1 godina / 1 semestar**

Naziv predmeta (šifra): **Geoinformacioni sistemi u saobraćajnicama (M2S1GI)**

Nastavnik: **Aleksandar Sekulić**

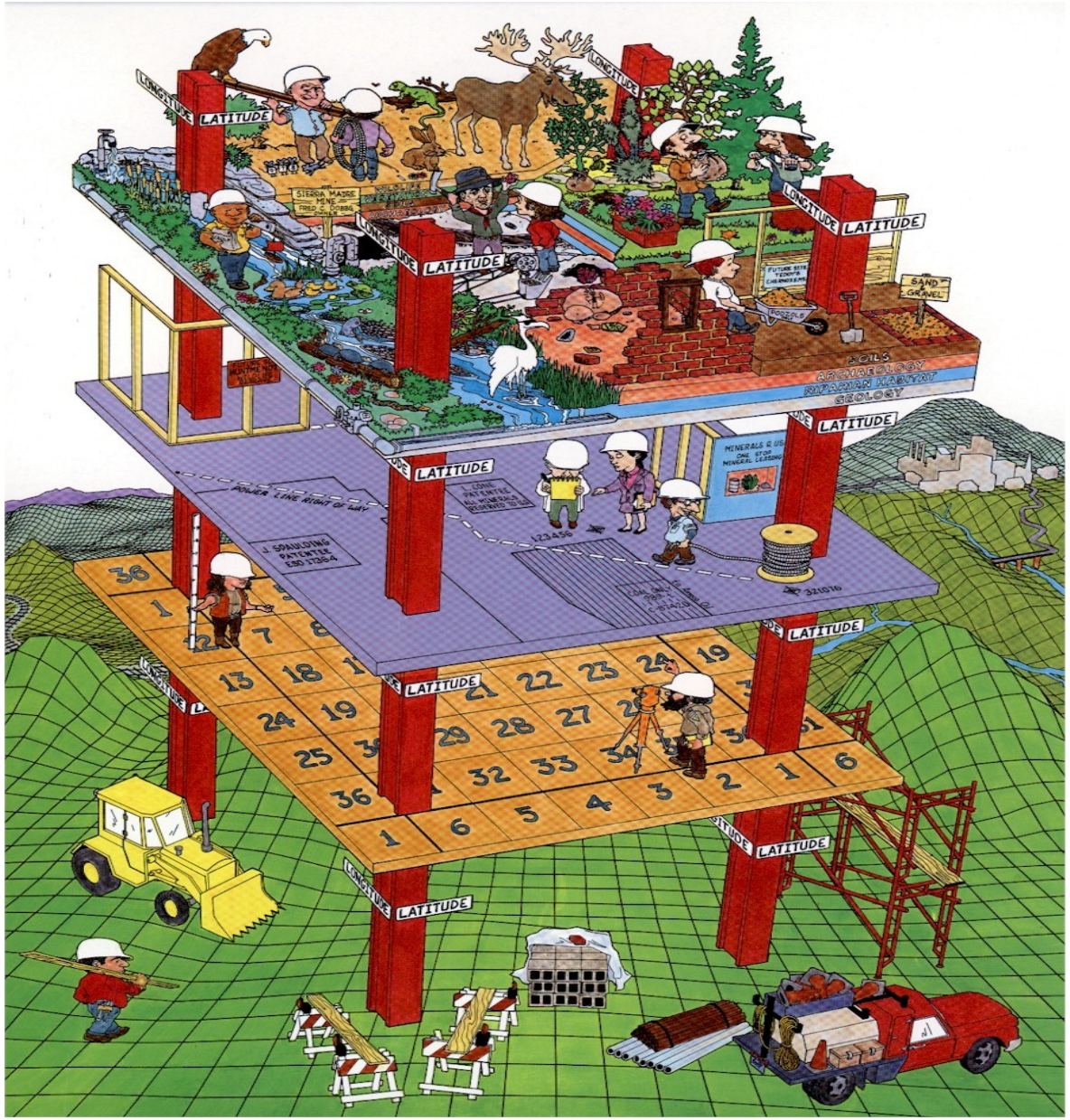
Naslov predavanja: # Tipovi i strukture geobaza podataka

Datum : 08.12.2021.

Beograd, 2021.

Geopodaci

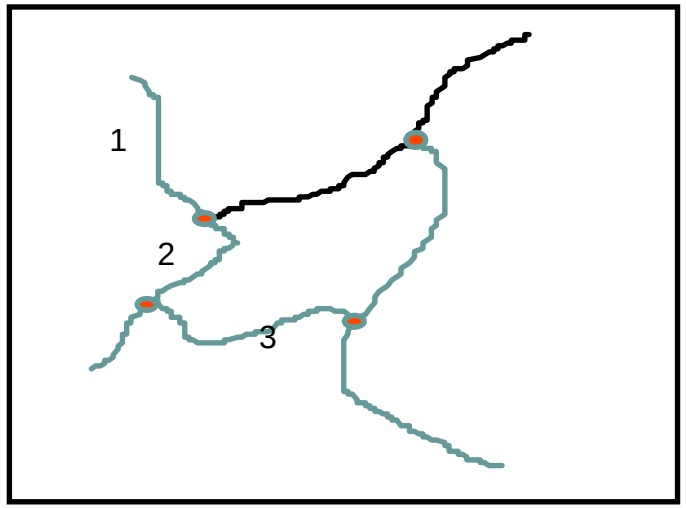
Podaci definisani prostornim koordinatama.



GIS: tehnološki razvoj

GIS tehnologija je razvijena iz:

- Digitalne kartografije i CAD-a
- Sistema za upravljanje bazama podataka (*Data Base Management Systems* (DBMS))



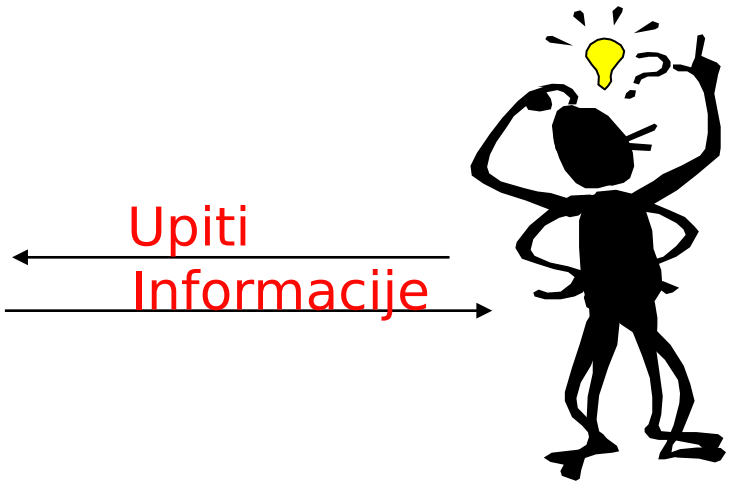
CAD Sistem

ID	X,Y
1	
2	
3	

ID	ATRIBUTI
1	
2	
3	

Sistemi za upravljanje bazama podataka

Šta je to informacioni sistem?

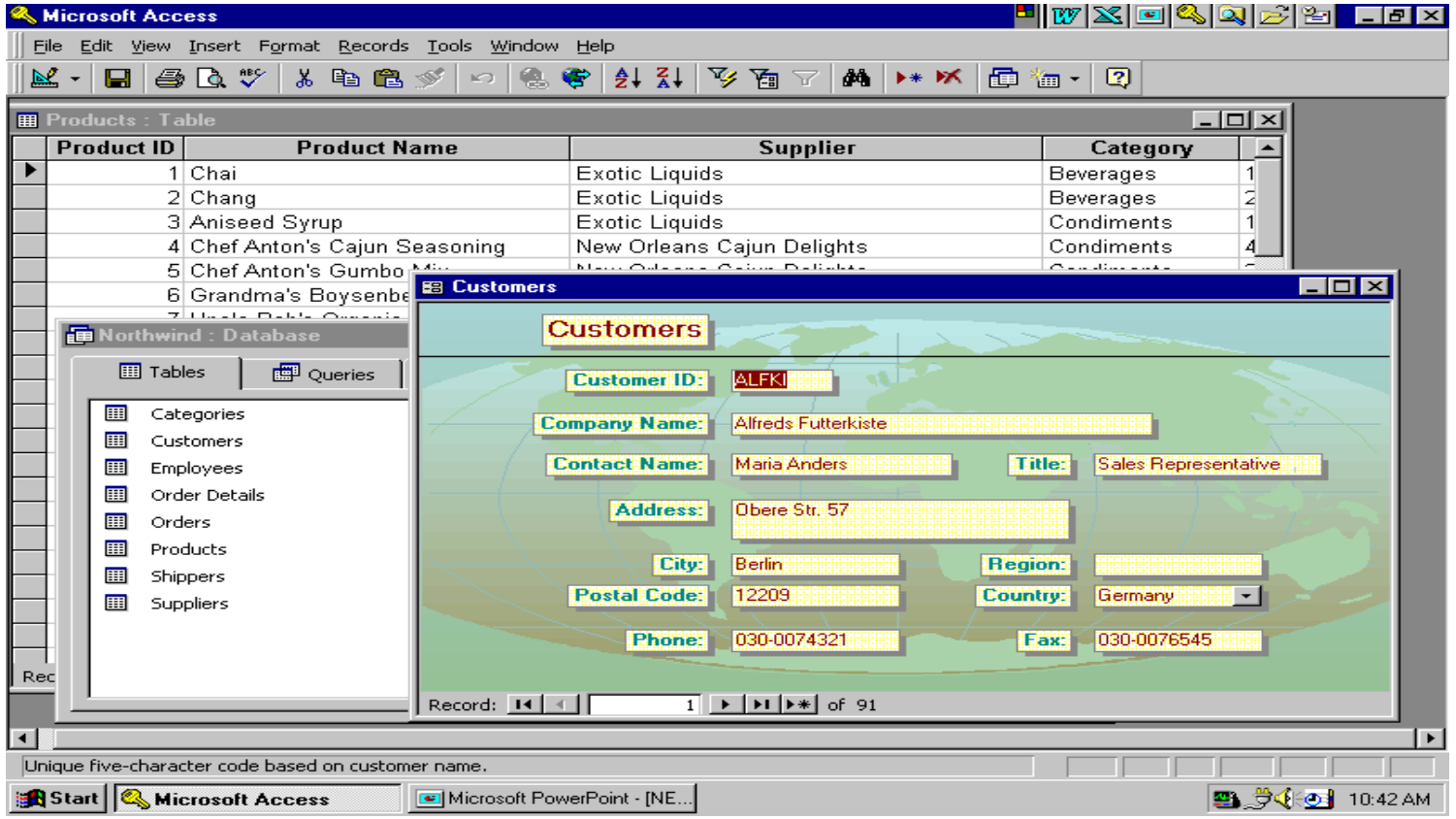


Informacion sistem može biti sasvim jenostavan, kao telefonski imenik.

Šta je to informacioni sistem?

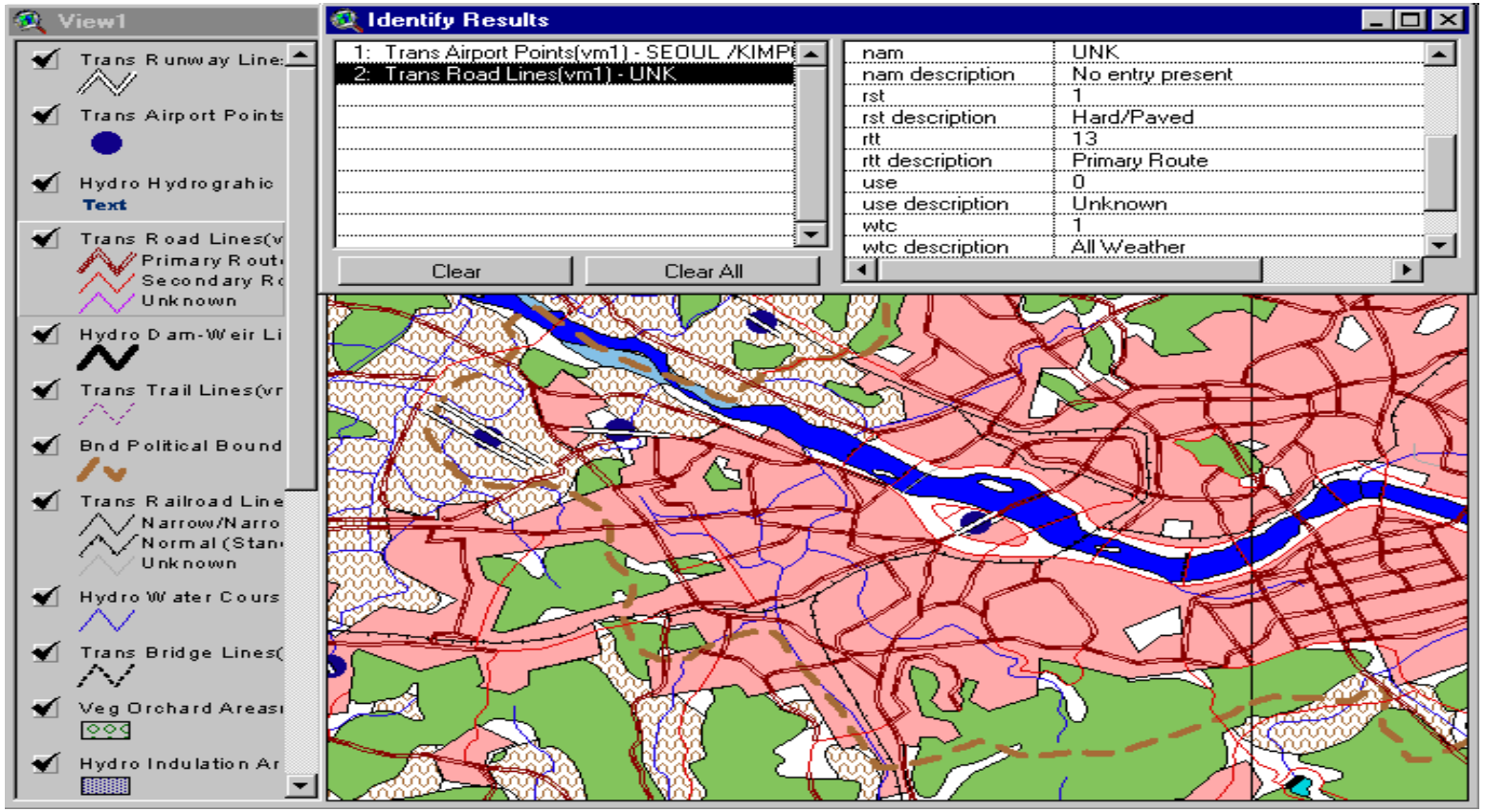
U digitalnom okruženju koristimo softver kako bismo kreirali kompleksne informacione sisteme.

Database Management



Šta je GIS?

GEO Informacioni Sistem

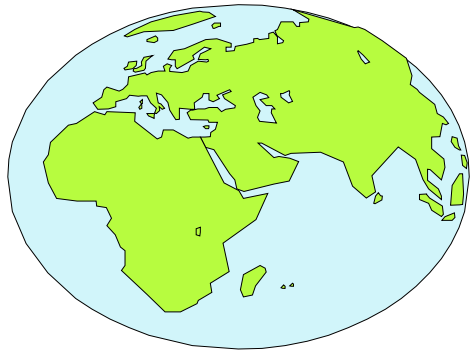


GIS povezuje grafičke prostorne pojave (**entitete**) sa tabelarnim podacima (**atributima**)

K O R I S N I K

PROGRAMI + BAZE PODATAKA

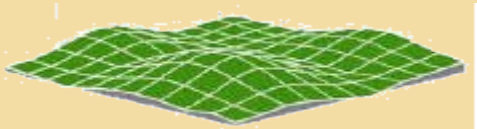
APROKSIMACIJE

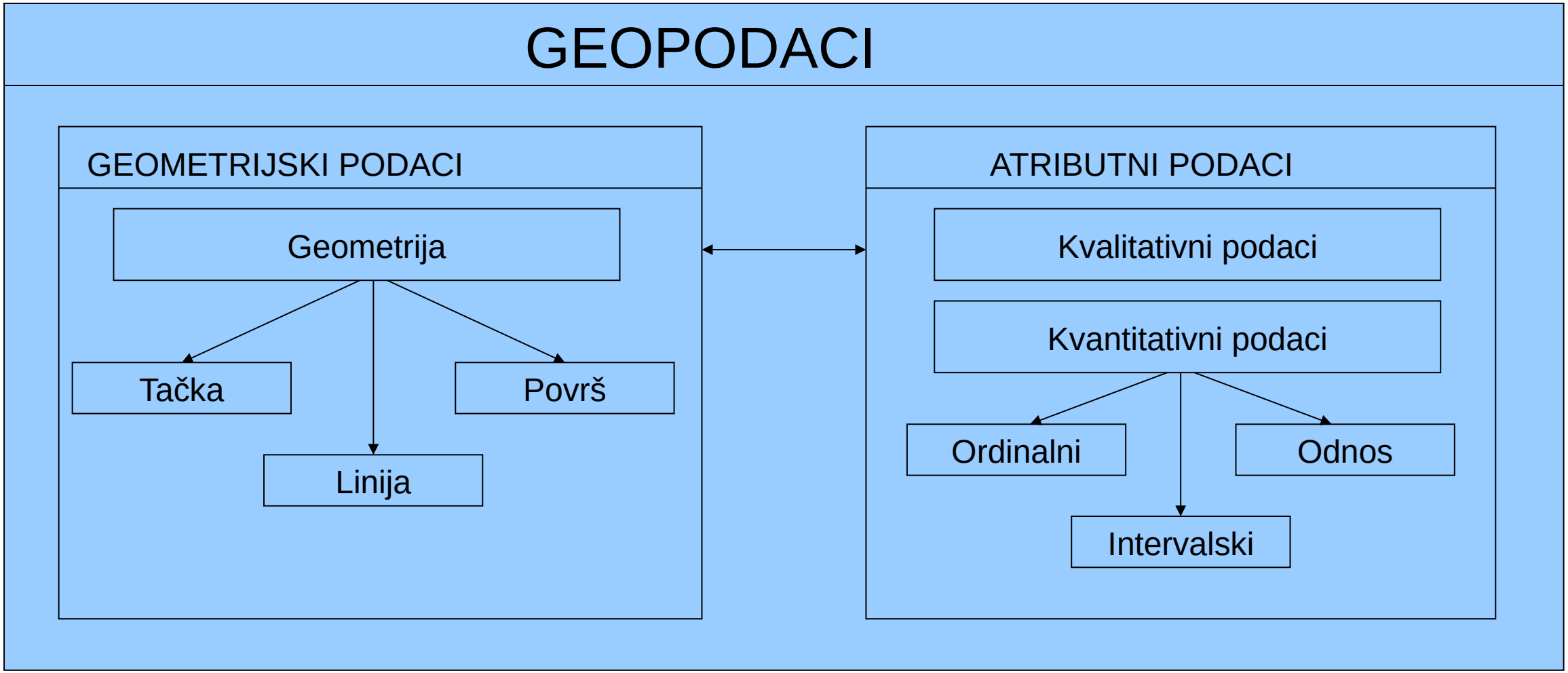


REALNI SVET

REZULTATI

Geopodaci



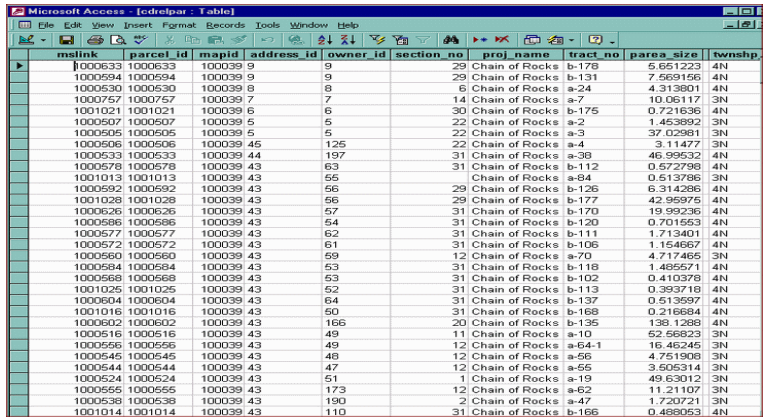

GEOPODACI
GEOMETRIJSKI PODACI
Geometrija
Tačka
Površ
Linija
ATRIBUTNI PODACI
Kvalitativni podaci
Kvantitativni podaci
Ordinalni
Odnos
Intervalski

Skup Geoprostornih podataka

Entitet/ Atributi/ Vrednosti

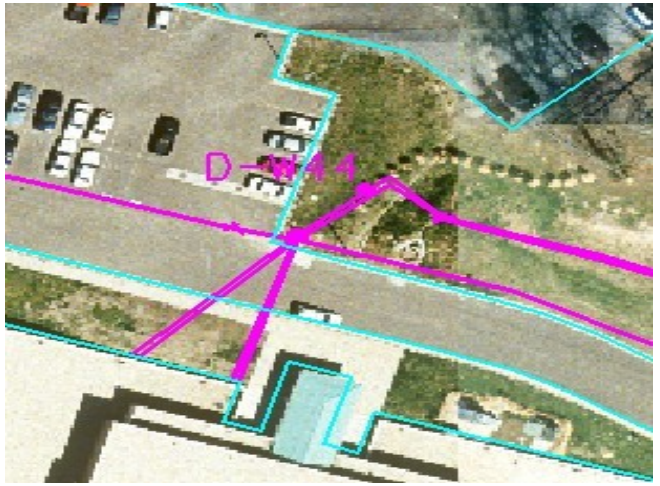
Prostorna geometrija

Geoprostorni entitet



mslink	parcel_id	mapid	address_id	owner_id	section_no	proj_name	tract_no	parea_size	twnshp
1000633	1000633	100039	9	9	29	Chain of Rocks	b-178	5.651223	4N
1000594	1000594	100039	9	9	29	Chain of Rocks	b-131	7.569156	4N
1000530	1000530	100039	8	8	6	Chain of Rocks	a-24	4.313801	4N
1000757	1000757	100039	7	7	14	Chain of Rocks	a-7	10.06117	3N
1001021	1001021	100039	6	6	30	Chain of Rocks	b-175	0.721636	4N
1000507	1000507	100039	5	5	22	Chain of Rocks	a-2	1.453892	3N
1000505	1000505	100039	5	5	22	Chain of Rocks	a-3	37.02981	3N
1000506	1000506	100039	46	125	22	Chain of Rocks	a-4	3.11477	3N
1000533	1000533	100039	44	197	31	Chain of Rocks	a-38	46.99532	4N
1000578	1000578	100039	43	63	31	Chain of Rocks	b-112	0.572798	4N
1001013	1001013	100039	43	56		Chain of Rocks	a-84	0.513786	3N
1000592	1000592	100039	43	56	29	Chain of Rocks	b-126	6.314286	4N
1001028	1001028	100039	43	56	29	Chain of Rocks	b-177	42.96975	4N
1000626	1000626	100039	43	57	31	Chain of Rocks	b-170	19.99236	4N
1000586	1000586	100039	43	54	31	Chain of Rocks	b-120	0.701553	4N
1000577	1000577	100039	43	62	31	Chain of Rocks	b-111	1.713401	4N
1000572	1000572	100039	43	61	31	Chain of Rocks	b-106	1.154667	4N
1000560	1000560	100039	43	59	12	Chain of Rocks	a-70	4.717465	3N
1000584	1000584	100039	43	53	31	Chain of Rocks	b-118	1.485571	4N
1000568	1000568	100039	43	53	31	Chain of Rocks	b-102	0.410378	4N
1001025	1001025	100039	43	52	31	Chain of Rocks	b-113	0.393718	4N
1000604	1000604	100039	43	64	31	Chain of Rocks	b-137	0.513597	4N
1001016	1001016	100039	43	50	31	Chain of Rocks	b-168	0.216684	4N
1000602	1000602	100039	43	166	20	Chain of Rocks	b-135	138.1288	4N
1000516	1000516	100039	43	49	11	Chain of Rocks	a-10	52.56823	3N
1000556	1000556	100039	43	49	12	Chain of Rocks	a-64-1	16.46245	3N
1000545	1000545	100039	43	48	12	Chain of Rocks	a-56	4.751908	3N
1000544	1000544	100039	43	47	12	Chain of Rocks	a-55	3.605314	3N
1000524	1000524	100039	43	51	1	Chain of Rocks	a-19	49.63012	3N
1000555	1000555	100039	43	173	12	Chain of Rocks	a-62	11.21107	3N
1000538	1000538	100039	43	190	2	Chain of Rocks	a-47	1.720721	3N
1001014	1001014	100039	43	110	31	Chain of Rocks	b-166	0.488053	4N

+



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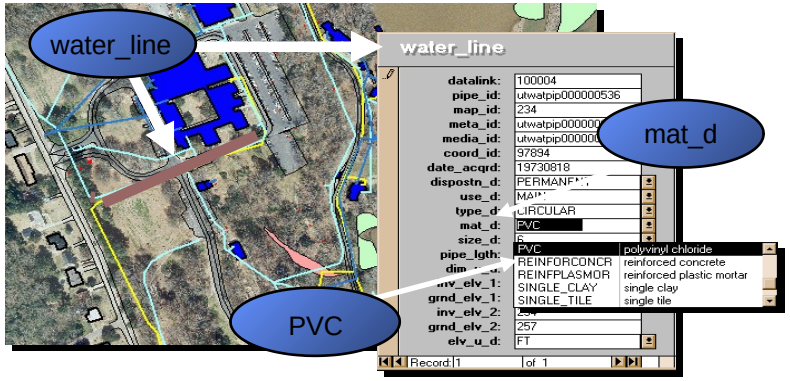
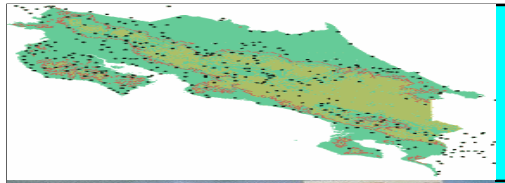
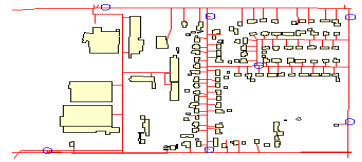
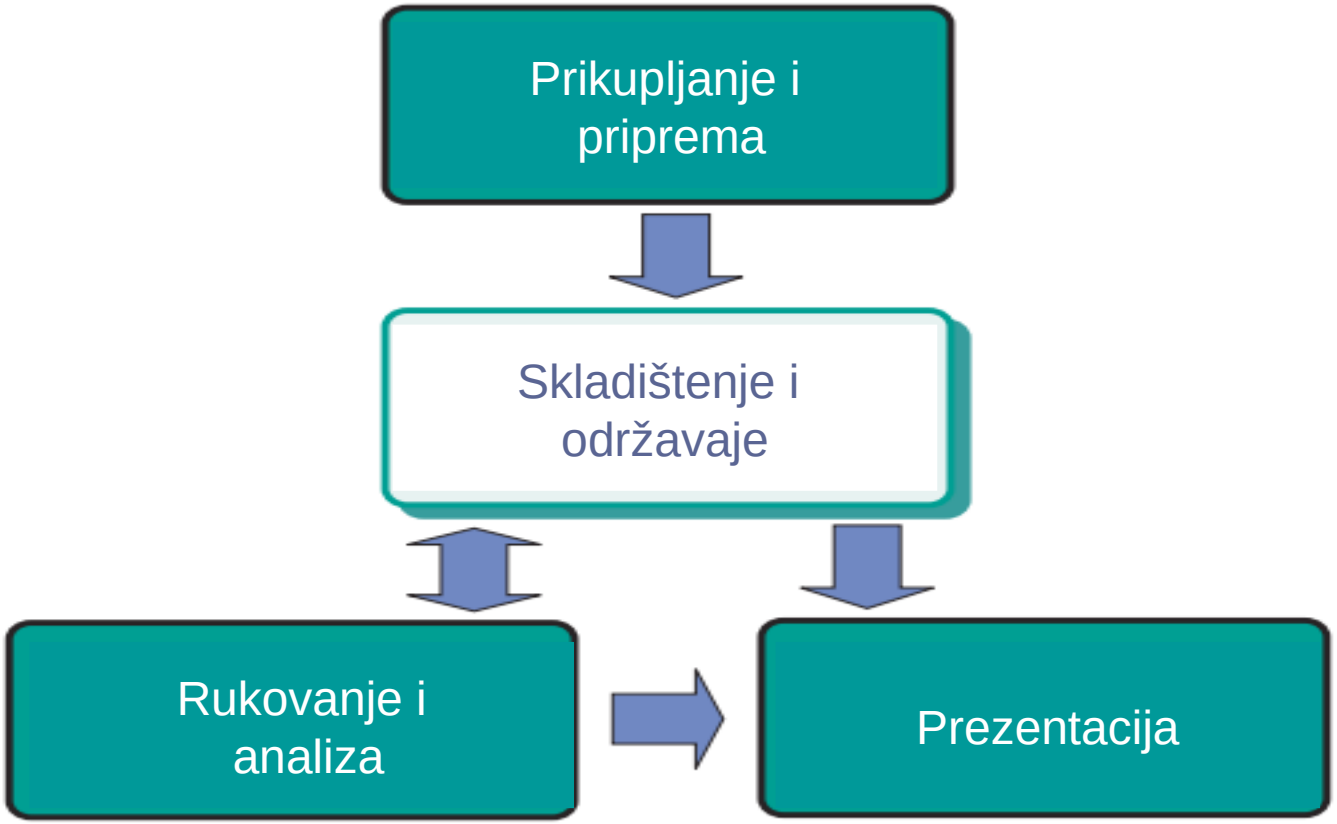


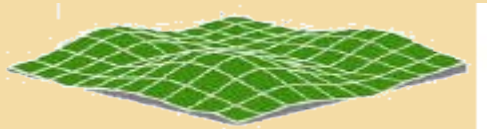
Tipovi podataka

	Prostorni	Ne-prostorni
	Karte	Shematski diagrami 
	Slike	Snimci 
	Videografija	Filmovi
KT1 2EE RH8 9AA SW1P 3AD	Adrese	Finansijski obračuni £12,000 23.45 56789 £23,456 12.45 23456 £45,987 29.57 87634

Funkcionalne komponente GIS-a

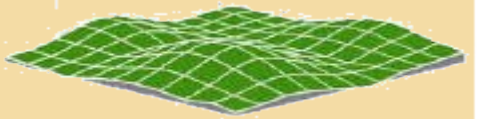


Strukture baza podataka



- Flat fajlovi (spreadsheets)
- Hijerarhijski fajlovi
- Umreženi fajlovi
- Relacione baze podataka
- Objektne strukture

Flat fajlovi (spreadsheets)

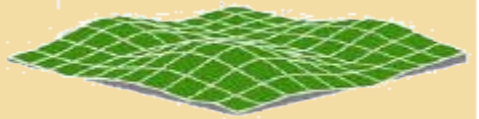


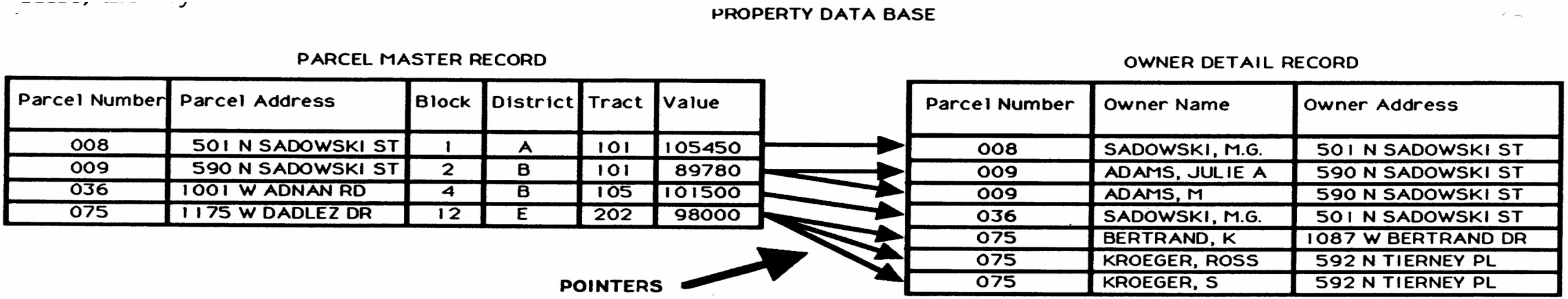
Property file

Parcel Number	Parcel Address	Block	District	Tract	Owner #1 Name	Owner #1 Address	Owner #2 Name	Owner #2 Address	Value
008	501 N SADOWSKI ST	1	A	101	SADOWSKI, M.G.	501 N SADOWSKI ST			105450
009	590 N SADOWSKI ST	2	B	101	ADAMS, JULIE A	590 N SADOWSKI ST	ADAMS, M	590 N SADOWSKI ST	89780
036	1001 W ADNAN RD	4	B	105	SADOWSKI, M.G.	501 N SADOWSKI ST			101500
075	1175 W DADLEZ DR	12	E	202	KROEGER, ROSS	592 N TIERNEY PL	BERTRAND, K	1087 W BERTRAND DR	98000

KEY FIELD

Hijerarhijski fajlovi

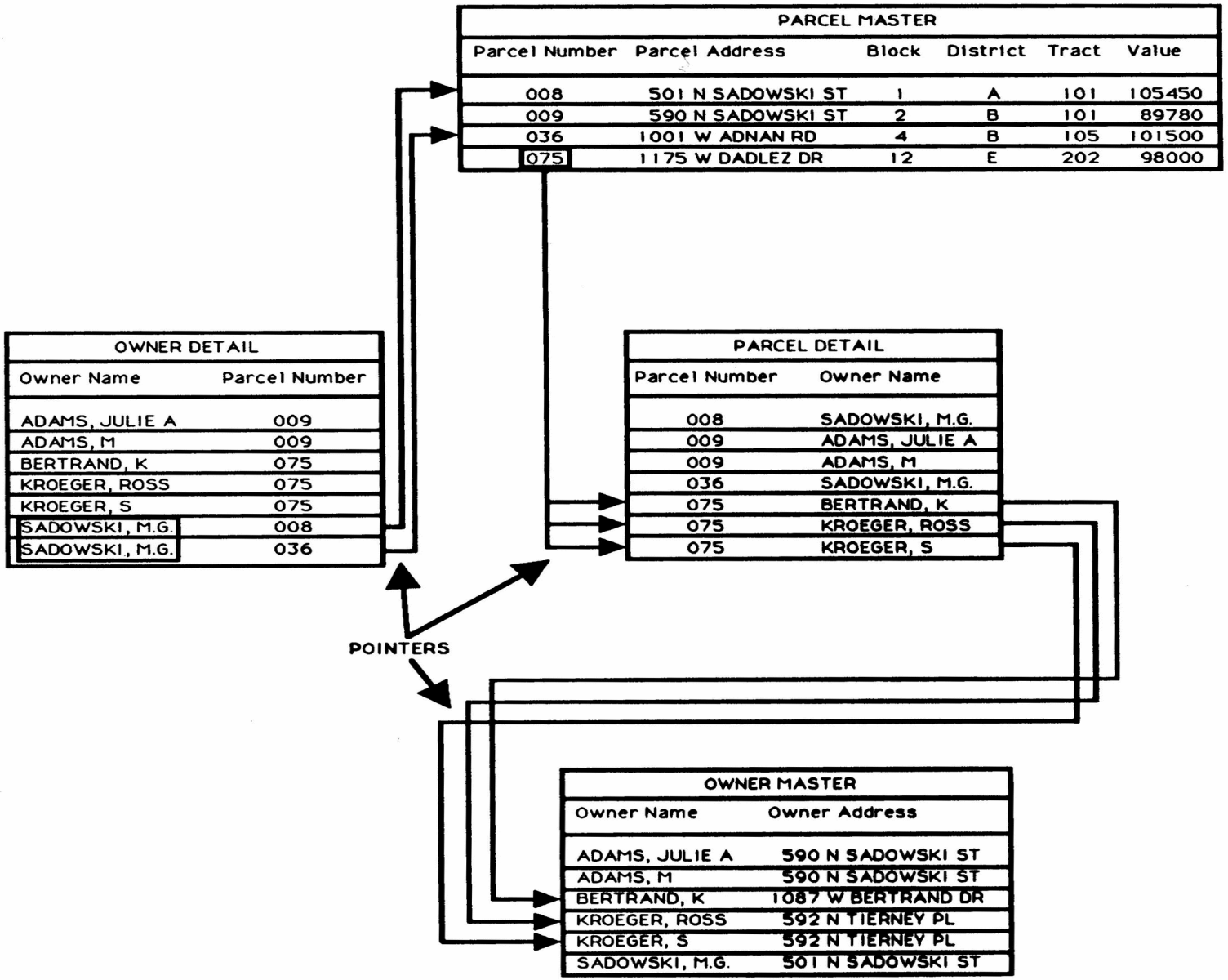




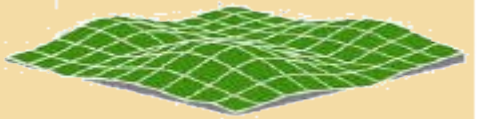
Parcel Number	Parcel Address	Block	District	Tract	Value
008	501 N SADOWSKI ST	1	A	101	105450
009	590 N SADOWSKI ST	2	B	101	89780
036	1001 W ADNAN RD	4	B	105	101500
075	1175 W DADLEZ DR	12	E	202	98000

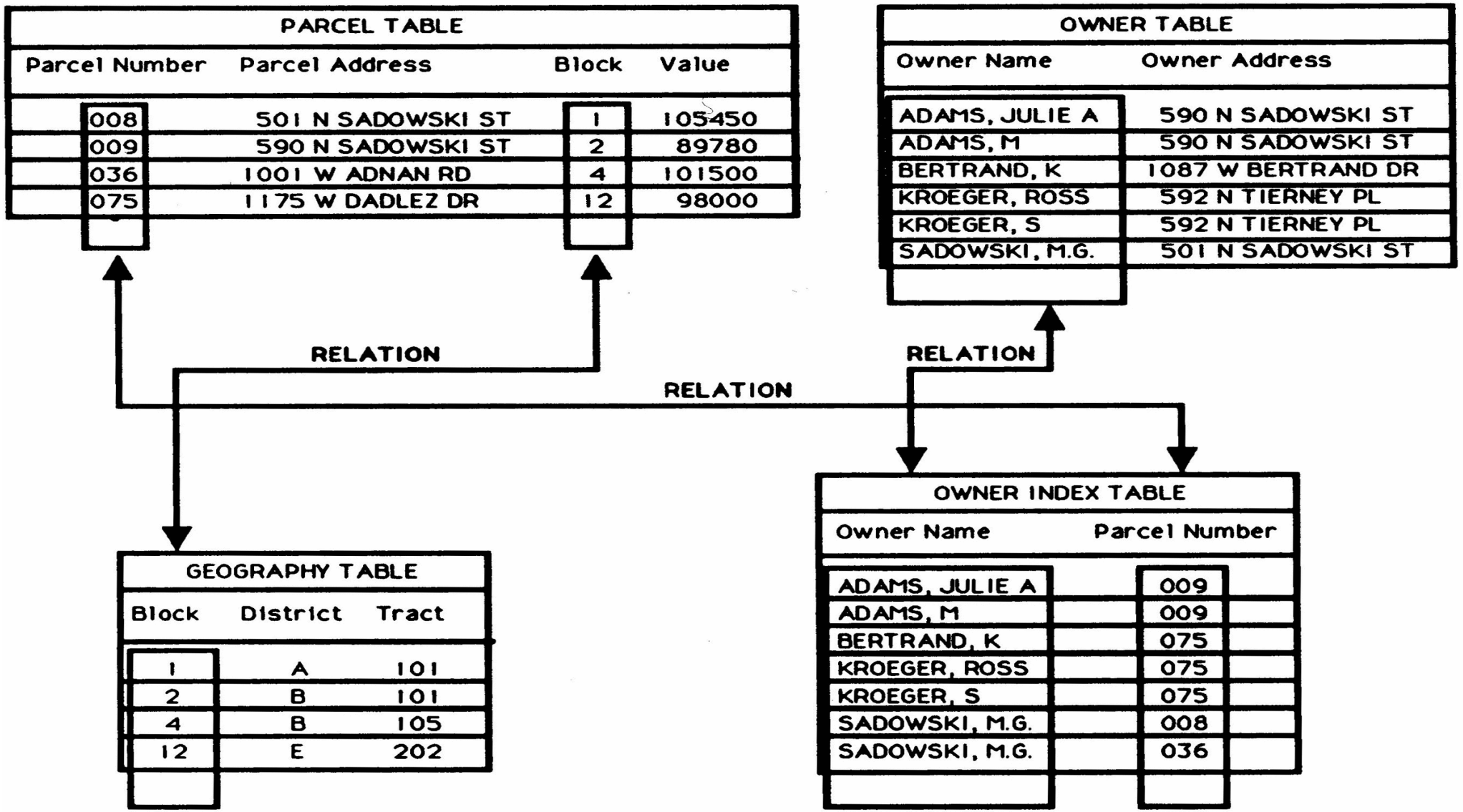
Parcel Number	Owner Name	Owner Address
008	SADOWSKI, M.G.	501 N SADOWSKI ST
009	ADAMS, JULIE A	590 N SADOWSKI ST
009	ADAMS, M	590 N SADOWSKI ST
036	SADOWSKI, M.G.	501 N SADOWSKI ST
075	BERTRAND, K	1087 W BERTRAND DR
075	KROEGER, ROSS	592 N TIERNEY PL
075	KROEGER, S	592 N TIERNEY PL

Umreženi fajlovi

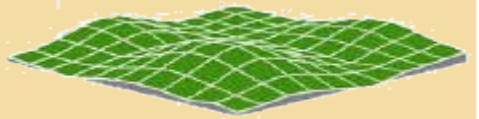


Relacione baze podataka



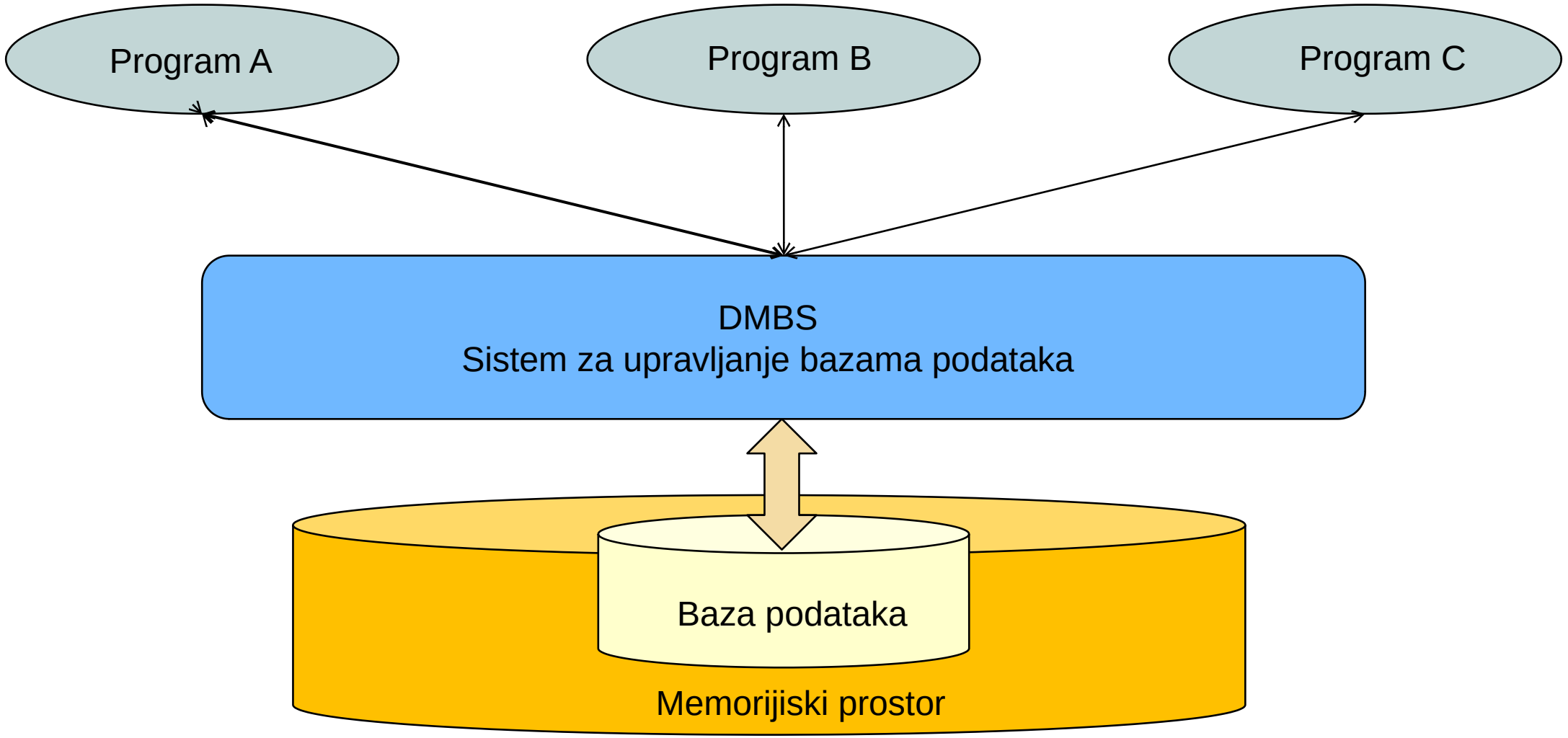


Objektni model

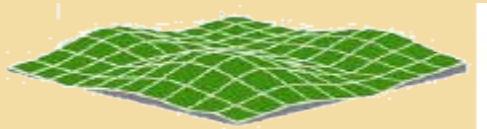


- Baziran je na konceptu objekata koji predstavljaju skup podataka i operacija koji se nad njima mogu izvršiti.
- U objektno orijentisanom modelu entiteti su predstavljeni klasom, koja obuhvata i atribute i moguće operacije nad podacima.
- U njima se informacija čuva kao stalni objekat, a ne kao red u tabeli.

DMBS

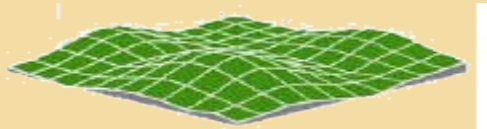

Program A
Program B
Program C
DMBS
Sistem za upravljanje bazama podataka
Baza podataka
Memorijiski prostor

Osnovni koncepti DBMS



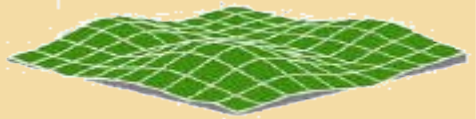
- Podaci su organizovani u tabelama.
- Tabele sadrže redove.
- Svi redovi u tabeli imaju isti broj kolona.
- Svaka kolona je definisana tipom podataka kao što su celi broj, decimalni, tekstualni, datum itd...
- Relacije se koriste za pridruživanje redova iz jedne tabele sa redovima iz druge tabele. To je bazirano na zajedničkoj koloni za obe tabele, koja se obično zove primarni ključ i strani ključ.

Osnovni koncepti DBMS



- Pravila relacionog integriteta postoje kod tabelarnih skupova podataka. Na primer,svaki red uvek deli iste kolone, domene itd.
- Niz funkcija i operatora poznatih kao SQL (Structured Query Language) su dostupni za operacije na tabelama i njihovim podacima.
- SQL operatori su napravljeni za rad nad opštim tipovima podataka relacionih baza kao što su celi brojevi, decimalni , karakteri itd.

SQL (**Structured Query Language**)



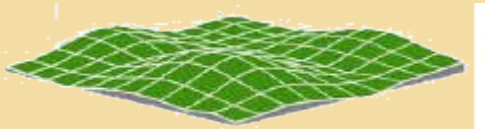
PrivatePerson	TaxId	Surname	BirthDate
	101-367	Garcia	10/05/1952
	134-788	Chen	26/01/1964
	101-490	Fakolo	14/09/1931

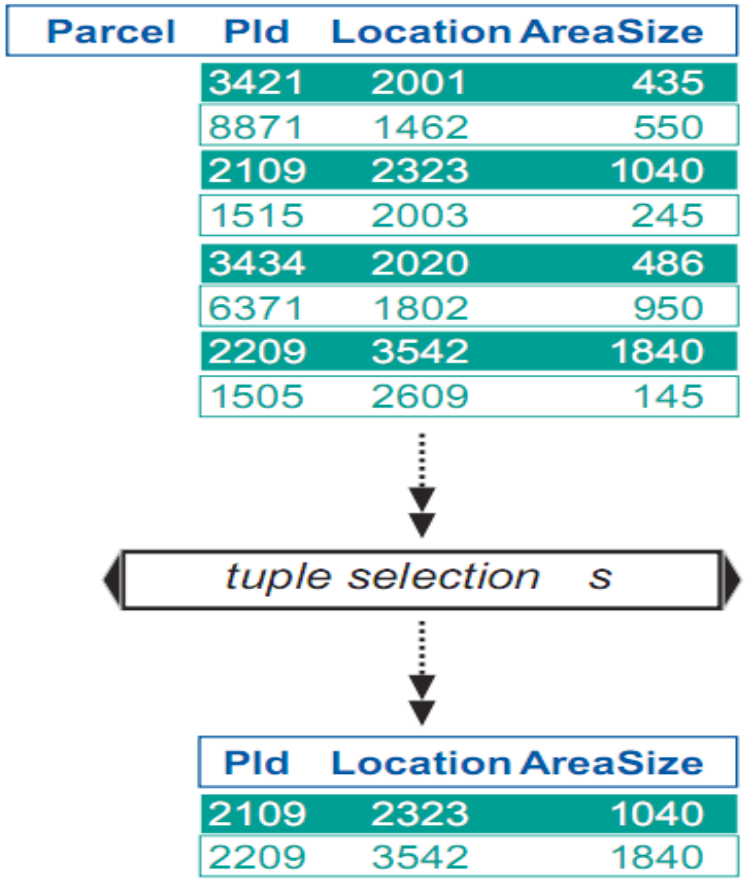
Parcel	PId	Location	AreaSize
	3421	2001	435
	8871	1462	550
	2109	2323	1040
	1515	2003	245

TitleDeed	Plot	Owner	DeedDate
	2109	101-367	18/12/1996
	8871	101-490	10/01/1984
	1515	134-788	01/09/1991
	3421	101-367	25/09/1996

PrivatePerson	(TaxId : string, Surname : string, Birthdate : date)
Parcel	(Pid : number, Location : polygon, AreaSize : number)
TitleDeed	(Plot : number, Owner : string, DeedDate : date)

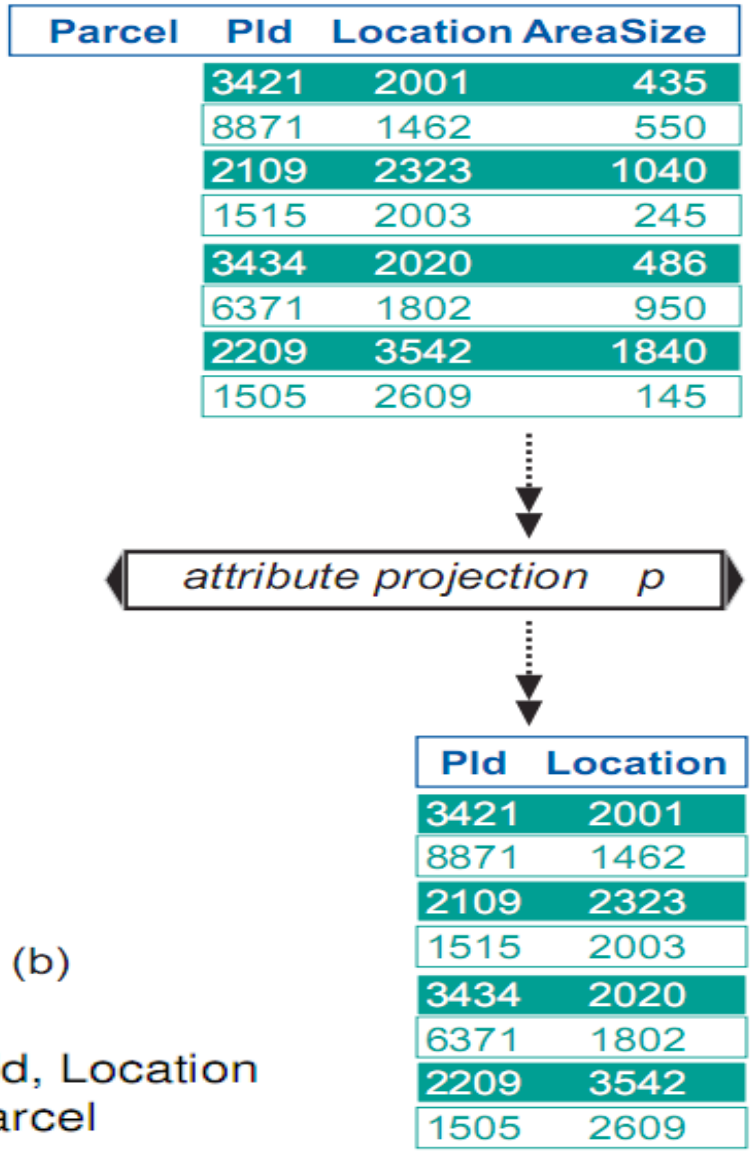
SQL (selekcija)





(a)

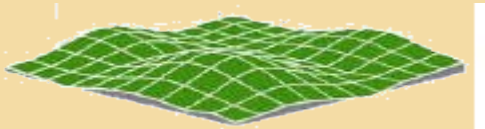
```
SELECT   *
FROM     Parcel
WHERE    AreaSize > 1000
```



(b)

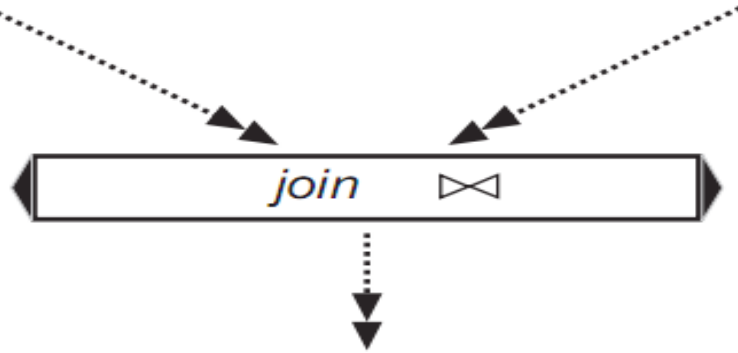
```
SELECT   PId, Location
FROM     Parcel
```

SQL-join



TitleDeed	Plot	Owner	DeedDate
2109	101-367	18/12/1996
8871	101-490	10/01/1984
1515	134-788	01/09/1991
3421	101-367	25/09/1996

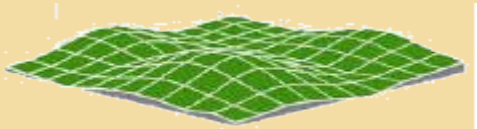
Parcel	PId	Location	AreaSize
3421	2001	435
8871	1462	550
2109	2323	1040
1515	2003	245



Plot	Owner	DeedDate	PId	Location	AreaSize
2109	101-367	18/12/1996	2109	2323	1040
8871	101-490	10/01/1984	8871	1462	550
1515	134-788	01/09/1991	1515	2003	245
3421	101-367	25/09/1996	3421	2001	435

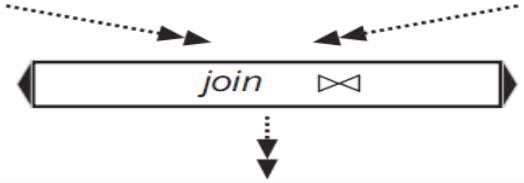
```
SELECT   *
FROM     TitleDeed, Parcel
WHERE    TitleDeed.Plot = Parcel.PId
```

SQL



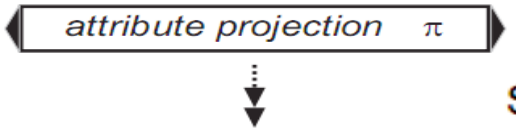
TitleDeed	Plot	Owner	DeedDate
	2109	101-367	18/12/1996
	8871	101-490	10/01/1984
	1515	134-788	01/09/1991
	3421	101-367	25/09/1996

Parcel	Pld	Location	AreaSize
	3421	2001	435
	8871	1462	550
	2109	2323	1040
	1515	2003	245



Plot	Owner	DeedDate	Pld	Location	AreaSize
2109	101-367	18/12/1996	2109	2323	1040
8871	101-490	10/01/1984	8871	1462	550
1515	134-788	01/09/1991	1515	2003	245
3421	101-367	25/09/1996	3421	2001	435

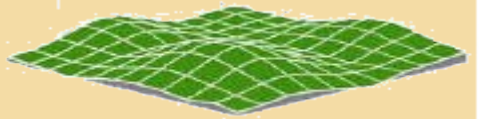
Plot	Owner	DeedDate	Pld	Location	AreaSize
2109	101-367	18/12/1996	2109	2323	1040



Owner	DeedDate
101-367	18/12/1996

```
SELECT   Owner, DeedDate
FROM     TitleDeed, Parcel
WHERE    TitleDeed.Plot = Parcel.Pld AND AreaSize > 1000
```

Vrste baza podataka



Baze podataka se klasifikuju prema broju korisnika, lokaciji baze i prema načinu i obimu korišćenja.

Broj korisnika:

- Jedno-korisničke (*single-user*)
- Višekorisničke (*multi-user*)
- Baza podataka firmi (*enterprise database*)

Lokacija:

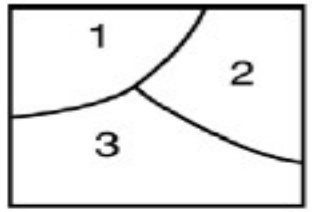
- Centralizovane
- Distribuirane

Obim:

- Transakcione (operational, production database)
- Skladištene (datawerhouse)

Modeli podataka u u GIS-u

- Georelacioni- skladišti geometriju i atribute odvojeno.



Graphic Files

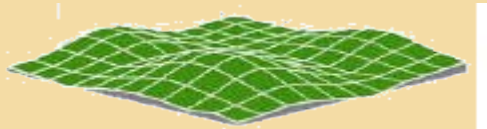
Polygon/arc list
Arc-coordinate list
Left/right list
:
:
:

INFO File

Polygon-ID	Field 1	. . .
1		
2		
3		

Coverage (topološki) & shape (netopološki)

Modeli podataka u u GIS-u



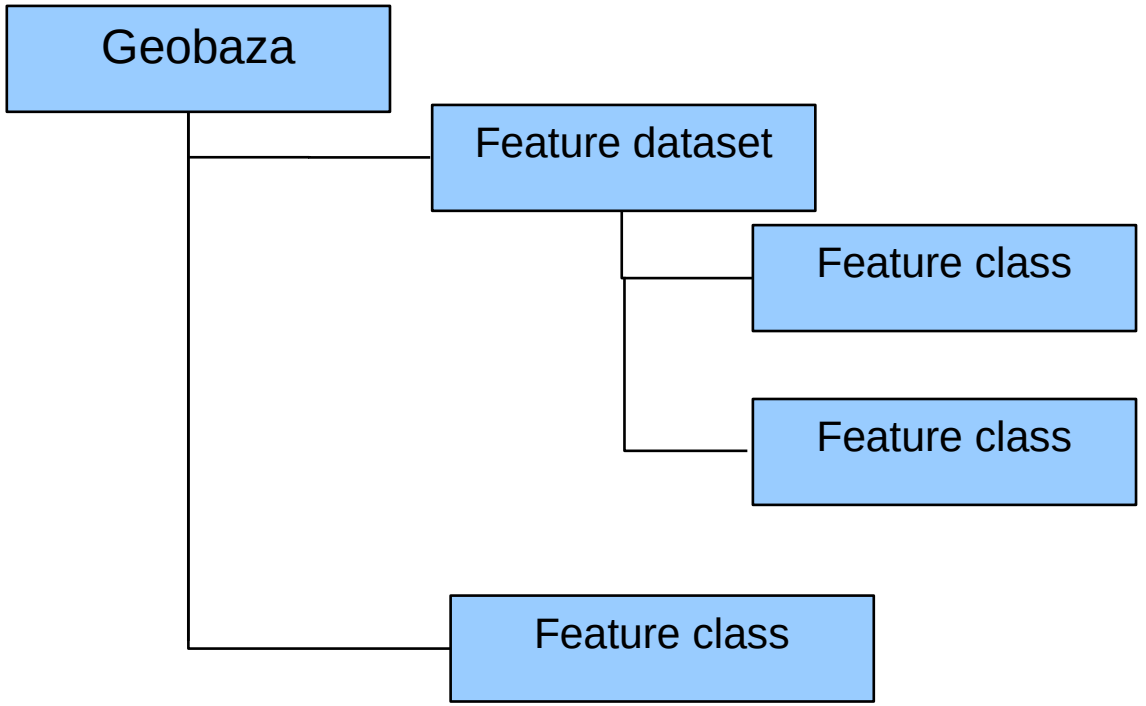
Objektno orijentisani- tretira geopodatke kao objekte.

- Skladišti prostorne i atributske podatke prostornih pojava zajedno
- Omogućava da se entitetima (objektima) pridružuje niz svojstava i metoda (operacija) koje se mogu izvršavati nad njima

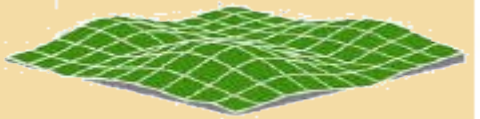
Objekt ID	Shape	Način korišćenj-ID	Klasa zemljišta	Shape_Length	Shape_Area
1	Polygon	2	6	15099.7	60024326
2	Polygon	3	7	17001.3	61543297
3	Polygon	1	5	44709.4	204543395

Geobaza podataka

- Geobaza podataka je skup različitih tipova geografskih podataka smeštenih u običnim datotekma na disku (*Microsoft Access*) ili u višekorisničkim relacionim bazama podatka (poput *Oracle, Microsoft SQL Server, ili IBM DB2*)



Geobaza podataka



File-based datasets
Coverages
Shapefiles
Grids
TINs
Images (numerous formats)
Vector Product Format (VPF) files
CAD files (numerous formats)
Tables (numerous formats)

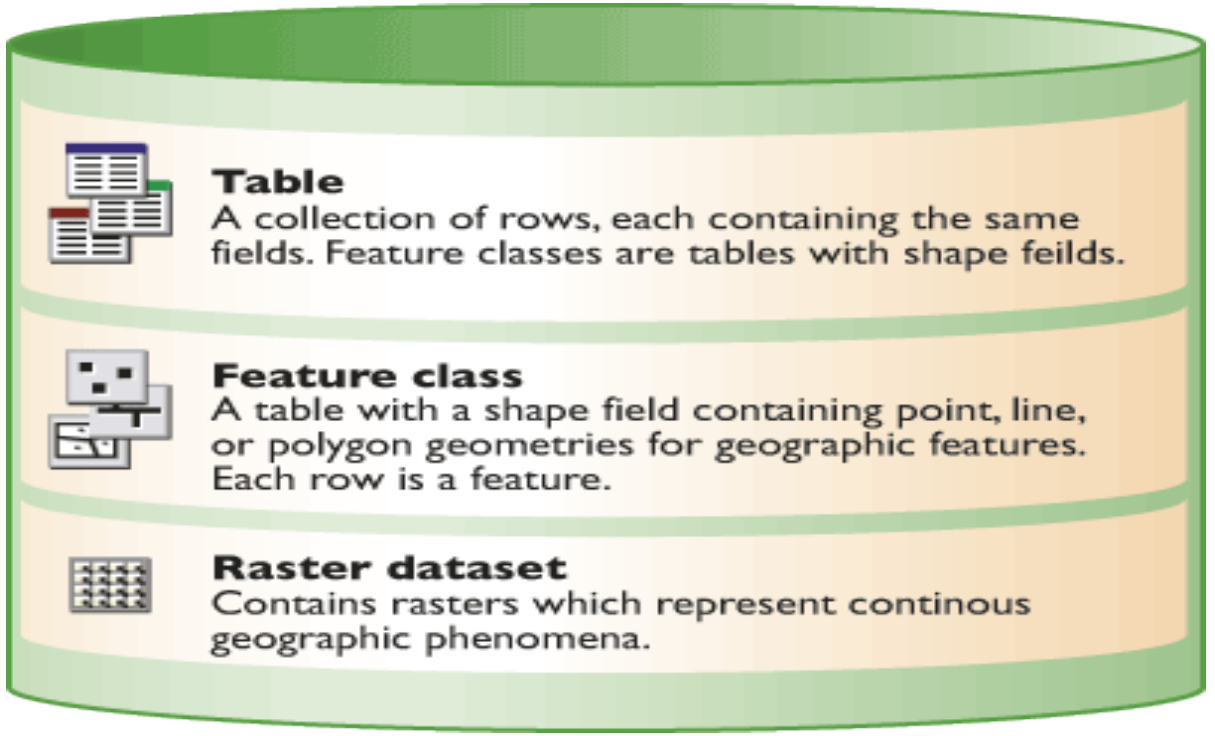
Geodatabases
Oracle
Oracle with Spatial or Locator
DB2 with its Spatial Type
Informix with its Spatial Type
SQL Server
Personal Geodatabases (Microsoft Access)

Geobaza podataka je model podataka za prikazivanje geografskih informacija primenom standardne tehnologije relacionih baza podataka.

Geobaza podataka podržava memorisanje i upravljanje geografskih informacija u okviru standardnih sistemskih tabela za upravljanje podacima.

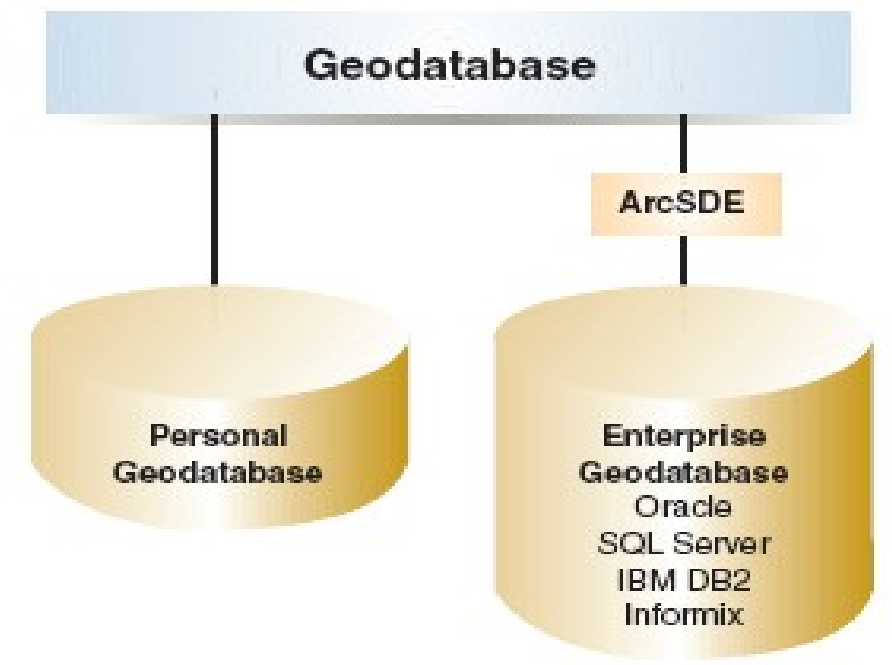
Tipovi geopodataka

1. Klase entiteta (Feature classes)
2. Rasteri (Raster datasets)
3. Tabele (Tables)



Vrste Geobaza podataka

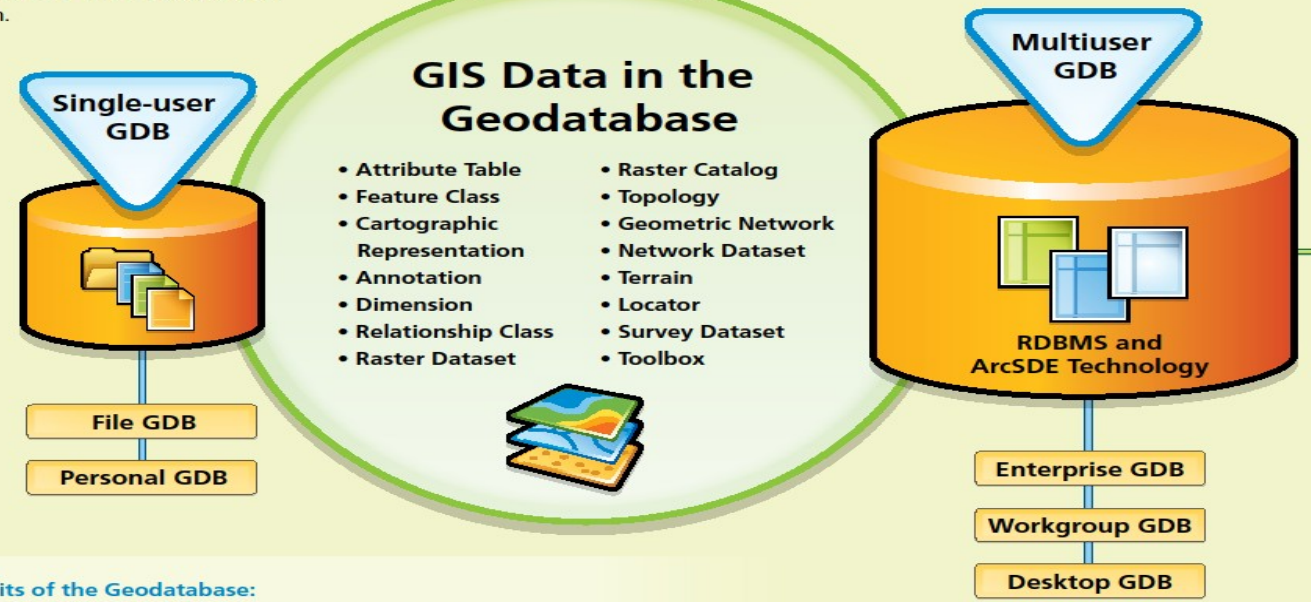
Geodatabase type	DBMS	Notes
Personal geodatabase	Microsoft Jet Engine (Access)	· Single-user editing · 2 GB size limit · No versioning support
Multiuser, versioned geodatabase	· Oracle · Oracle with Spatial or Locator · IBM DB2 · IBM Informix · Microsoft SQL Server	· Requires ArcSDE Gateway · Multiuser editing · Version-based work flows · Database size and number of users up to RDBMS limits

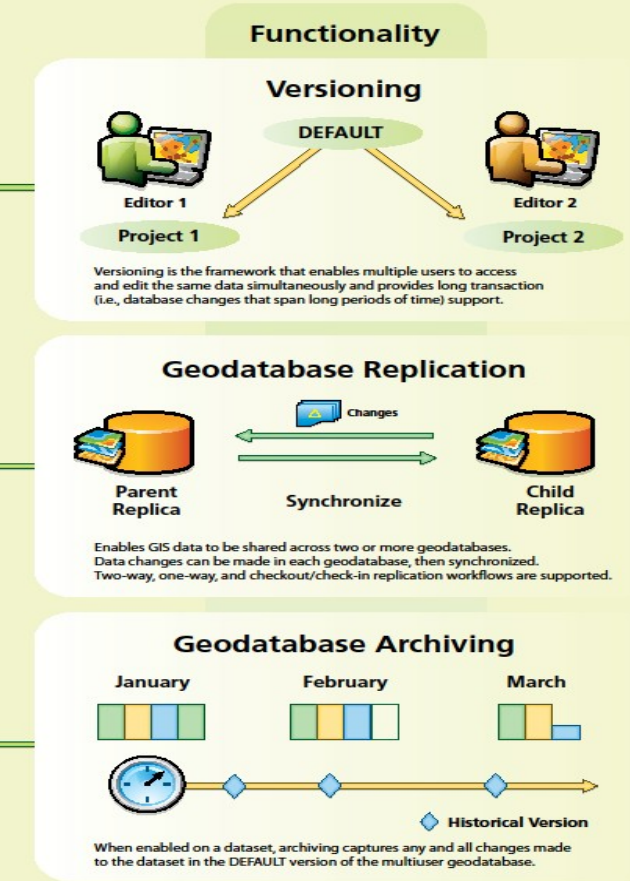


(SDE) Spatial Database Engine

The Geodatabase Offers A Comprehensive Approach to Modeling and Managing Spatial Data

With the geodatabase, all of an individual user's or organization's GIS data can be stored in a uniform format, in one central location, for easy access and management. The geodatabase (GDB) is designed to make full use of the capabilities of ArcGIS Desktop and ArcGIS Server. It is not just another spatial data format that can be used by ArcGIS - it is an integral part of the ArcGIS system.



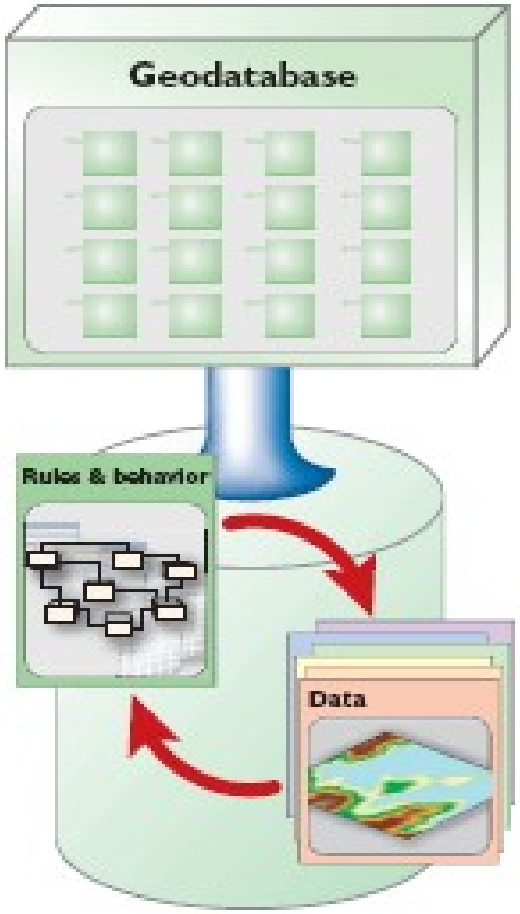


Key Benefits of the Geodatabase:

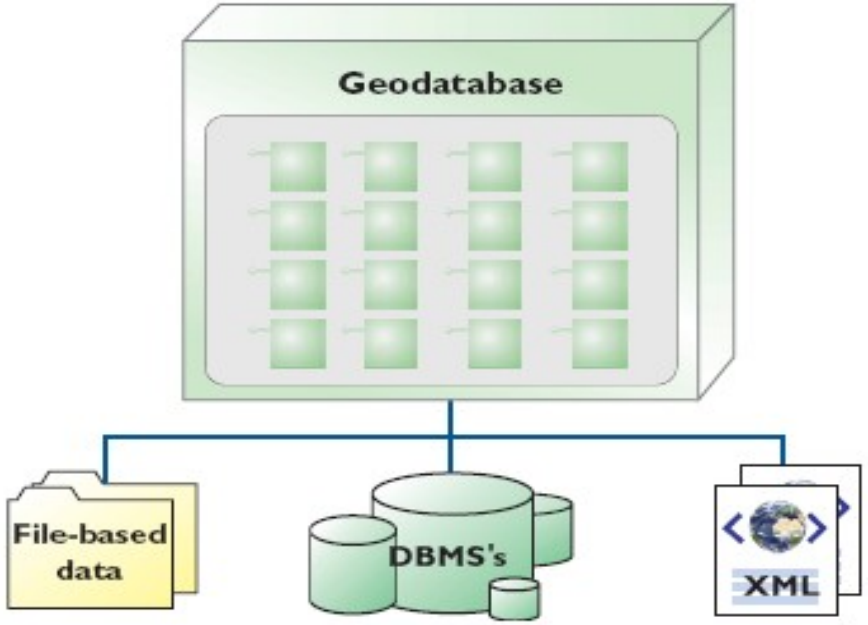
- Store a rich collection of data types in a centralized location.
- Apply sophisticated rules and relationships to the data.
- Define advanced geospatial relational models (e.g., topologies, terrains, networks).
- Maintain integrity of spatial data.
- Work within a multi-user access and editing environment.
- Integrate spatial data with other IT databases.
- Easily scale your storage solution.
- Support custom features and behavior.

www.esri.com/geodatabase

Arhitektura Geobaza

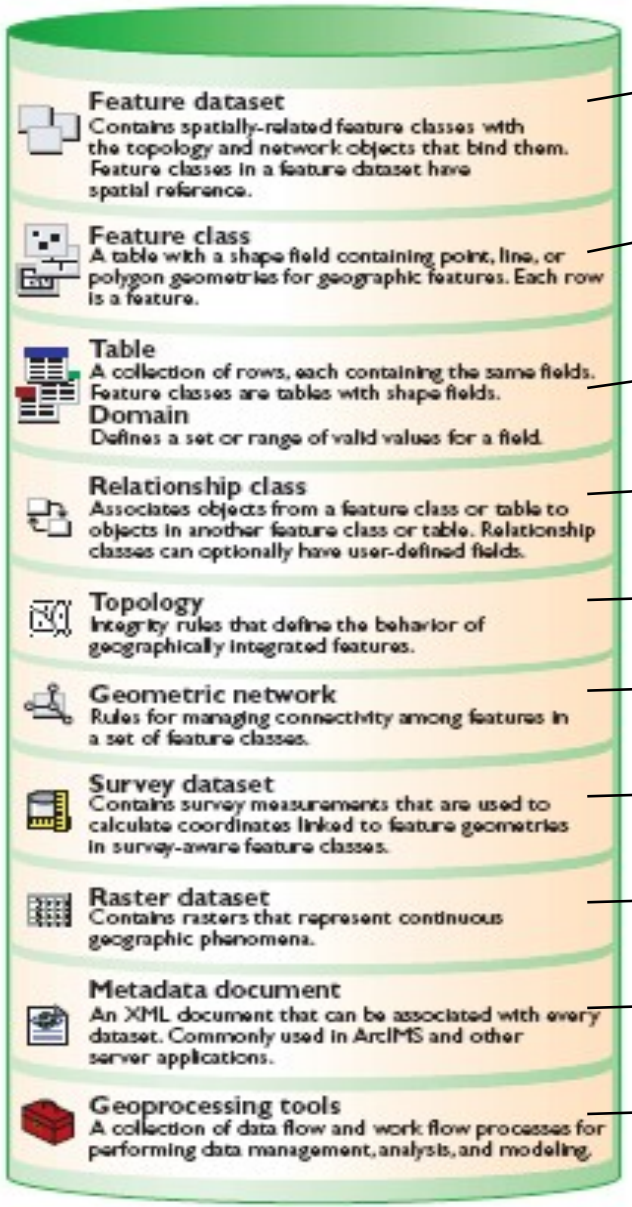


Arhitektura je bazirana na jednostavnim relacionim odnosima



The separation of geodatabase logic from storage enables support for numerous file types, DBMSs, and XML.

Arhitektura Geobaza



SKUP ENTITETA
Sadrži prostorno povezane klase entieta sa topogijom i mrežnim objektima koji ih povezuju. Klase eniteta su prostorno definisane.

KLASE ENTITETA
Tabele sa *shape* poljima koje sadrže tačkastu, linijisku ili poligonsku geometriju prostornih entiteta. Svaki red je jedan entitet.

TABELE
Skup redova koji sadrže ista polja. Klase entiteta su tabele sa *shape* poljima.

DOMEN
Definiše skup ili opseg dozvoljenih vrednosti u polju.

KLASA RELACIJA
Pridružuje objekte iz klase entiteta ili tabele sa objektima u dugoj klasi entiteta ili tabelom. One opciono mogu imati polja koje je definisao korisnik.

TOPOLOGIJA
Pravila integriteta koja definišu ponašanje geografski integrisanih entietata.

GEOMETRIJSKA MREŽA
Pravila za upravljanje vezama među entitetima u skupu klasa entiteta.

PODACI PREMERA
Sadrže geodetska merenja koja su korišćena za računanje koordinata koja su povezana sa geometrijom entiteta.

BAZA RASTERA
Sadrži rastere koji predstavljaju kontinualne prirodne pojave.

METADATA DOKUMENTACIJA
XML dokument koji je pridružen sa svakim skupom podataka.

ALATKE ZA GEOPROCESIRANJE
Skup postupaka za upravljanje, anlalize i modelovanje podataka.

Geobaza u GIS okruženju