

SEE

ADBMS - UNIT-5

* Active database concepts & triggers

* Temporal, deductive, spatial Database - Basic concepts.

* Recent Appn: mobile databases, multimedia database

* Graphical info. system, Genome data management.

① mobile database

→ * Recent advances in Portable & wireless technology led to mobile computing, for new dimension & data communication.

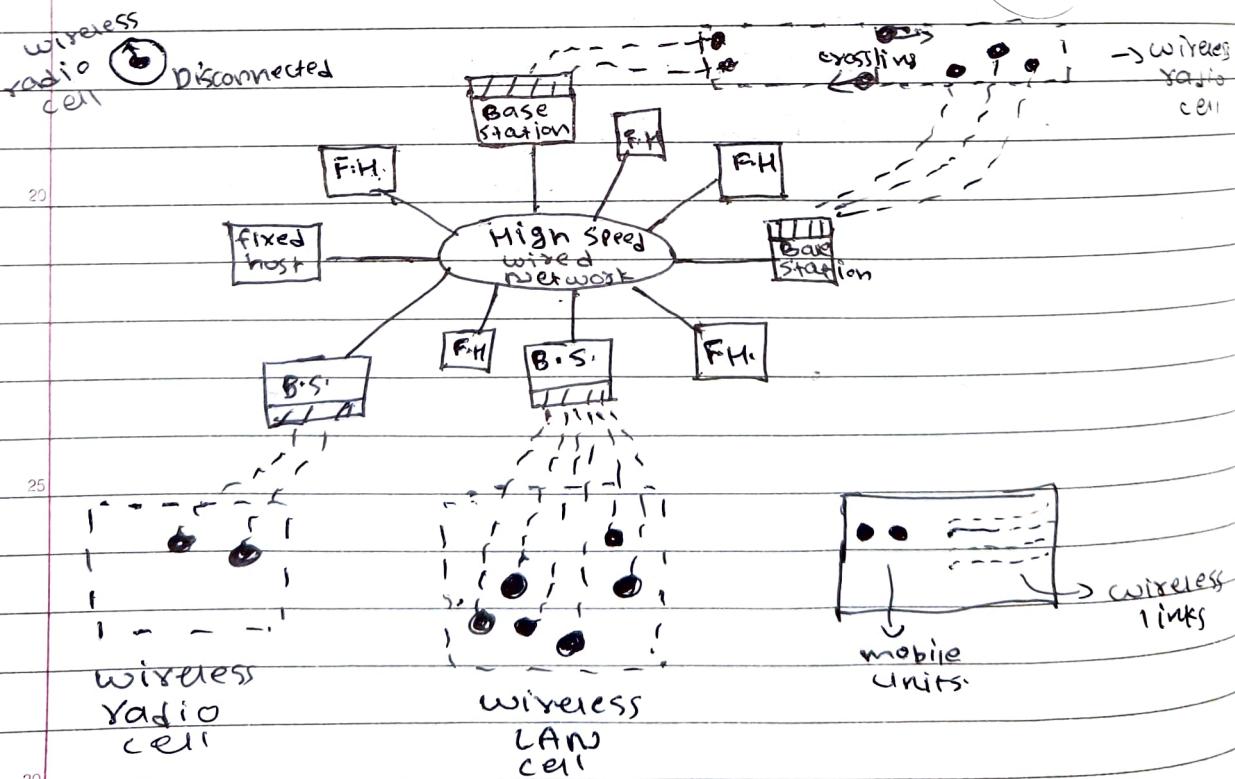
* Portable computing devices coupled with wireless communication, that allow clients to access data virtually.

* In mobile computing the problems are more difficult mainly focused on following:

① The limited life of the power supply (battery)

② The changing Technology of network.

③ The limited connectivity afforded by wireless com.



① It is distributed architecture where a no. of computers generally refers to Fixed host & Base station & interconnected to High speed Wired Network.

- (2) fixed hosts are general purpose computers that configured to manage mobile units
- (3) Base stations function as gateways to fixed network for mobile units
- 5 (4) The current generation of wireless technology has data rates range from tens to hundreds kilobits/sec. to tens of megabits/sec.
- (5) Interference, locality of access, range these factors distinguish wireless connectivity options
- 10 (6) Some modern wireless network such as wi-fi, bluetooth use unlicensed areas frequencies spectrum that cause interference with other appliances.
- (7) mobile units can move freely in geographic mobility domain & to manage mobility domain is divided into one or more smaller domains called cell
- (8) MANET = mobile units are responsible for routing their own data & effectively acting as base station

(2) Characteristics of Mobile env.

- (1) communication latency
- (2) intermittent connectivity
- (3) limited battery life
- (4) changing client location
 - * clients can be unreachable due to energy saving modes or being out of range.
 - * In client unreachability: neither client nor server can communicate in this state.
 - * Proxies can cache updates intended for the server when the client is unreachable.
 - 30 • wireless communication latency affects server scalability.
 - Increased latency means server can handle fewer client requests.

- Server can broadcast data periodically to reduce load & avoid constant connection.
- * Server needs to track the client location for efficient message routing.
- 5 * Client data should be stored where it minimizes access traffic.
- * Transitioning b/w network cell should be seamless for clients.
- 10 * Mobility enables new-location based applications

(3)

15 Data management issues:

- * Data distribution & replication
- * Transactions models
- * Query Processing
- * Recovery & Fault tolerance
- * Security
- 20 * Mobile database design

- * Ensuring data is appropriately distributed across both wired & wireless network.
- ④ * Developing transaction models that can handle the mobility of users.
- ⑤ * Optimizing query performance in mobile environment & handing queries in mobile & fixed components efficiently.
- ⑥ * Implementing strategies to know recover failure system & maintain data integrity.
- ⑦ * Designing database that can effectively support mobile operation.
- ⑧ * Integrating location data into database operations.

② Distributing data management task b/w base station & mobile devices

③ Application

- ① clients connects to servers to receive updates
- ② clients are mostly disconnected ; server can't always reach
- ③ Environment similar to distributed , client-server & mobile database
- ④ Known as intermittently synchronized database Environment [ISDBE]
- ⑤ Client initiates connection for updates
- ⑥ communication can be unicast (one-on-one) or multicast (one-to-many)

- * Clients get updates from server when they connect, like syncing phone with your computer
- * most of the times, clients are not connected to server, similar to how you might not always have internet access
- * This setup shares challenges with distributed client server & mobile database
- * ISDBE env. is called intermittently synchronized database environment
- * Client decides when to connect to server to get updates, like choosing when to check for new email

(2) multimedia database & types

⇒ * multimedia systems are expected to dominate our daily lives.

- ① our houses will be wired for Bw to handle interactive multimedia appn.
- ② over HD TV computer, workstation will have access to large no. of database
- ③ including digital libraries, image, video database that will distribute vast amounts of multimedia content

Types:

- | | | |
|--------------|--------------------|-----------------|
| ① Text | ⑥ Structured Audio | ⑪ Collaborative |
| ② Graphics | ⑦ Audio | |
| ③ Images | ⑧ Composite | |
| ④ Animations | ⑨ Repository | |
| ⑤ Video | ⑩ Presentation | |

- ① Text may be formatted or unformatted, for ease of parsing structured doc., standards like SGML variations such as HTML
- ② Ex. include drawings, illustrations that are encoded using some descriptive standards [COM, P]
- ③ Includes drawing, photographs, encoded in standard formats such as JPEG, MPEG
- ④ Temporal sequences of images or graphic data is called Animation
- ⑤ A set of temporally sequenced photographic data for presentation at specific rates e.g. 30 f.p.s is video
- ⑥ A sequences of audio components comprising note, tone, duration etc. for ex.
- ⑦ Sample data generated from analog recordings in a string of bits in digitized form is audio & Analog recording converted to

digital before store it

- (8) It is the combination of audio & video multimedia type, which may be physically mixed to yield a new storage format or logically mixed while retaining original format.
- (9) A large amount of multimedia data as well as meta data is stored for retrieval.
- (10) A large amount of app involve delivery of multimedia data subject to temporal constraints.
- (11) This process involves generating new documentation & issuing change notification as part of the design work flow.

* ISSUES IN MULTIMEDIA.

→ ① Multimedia app dealing with lots of img; doc, audio, video segments & free text data depend on.

* Appropriate modelling of the structure & content of data

ISSUES.

- ① Modeling
- ② Complex of objects
- ③ Design
- ④ Storage
- ⑤ Queries & Retrieval
- ⑥ Performance.

- ① Ensuring the data structure accurately reflects the diverse type of multimedia content.
- ② Multimedia data often various forms that require sophisticated method to handle these.
- ③ Object within System.
- ④ Design involve in three stages

* Conceptual design * logical design * Physical Design.

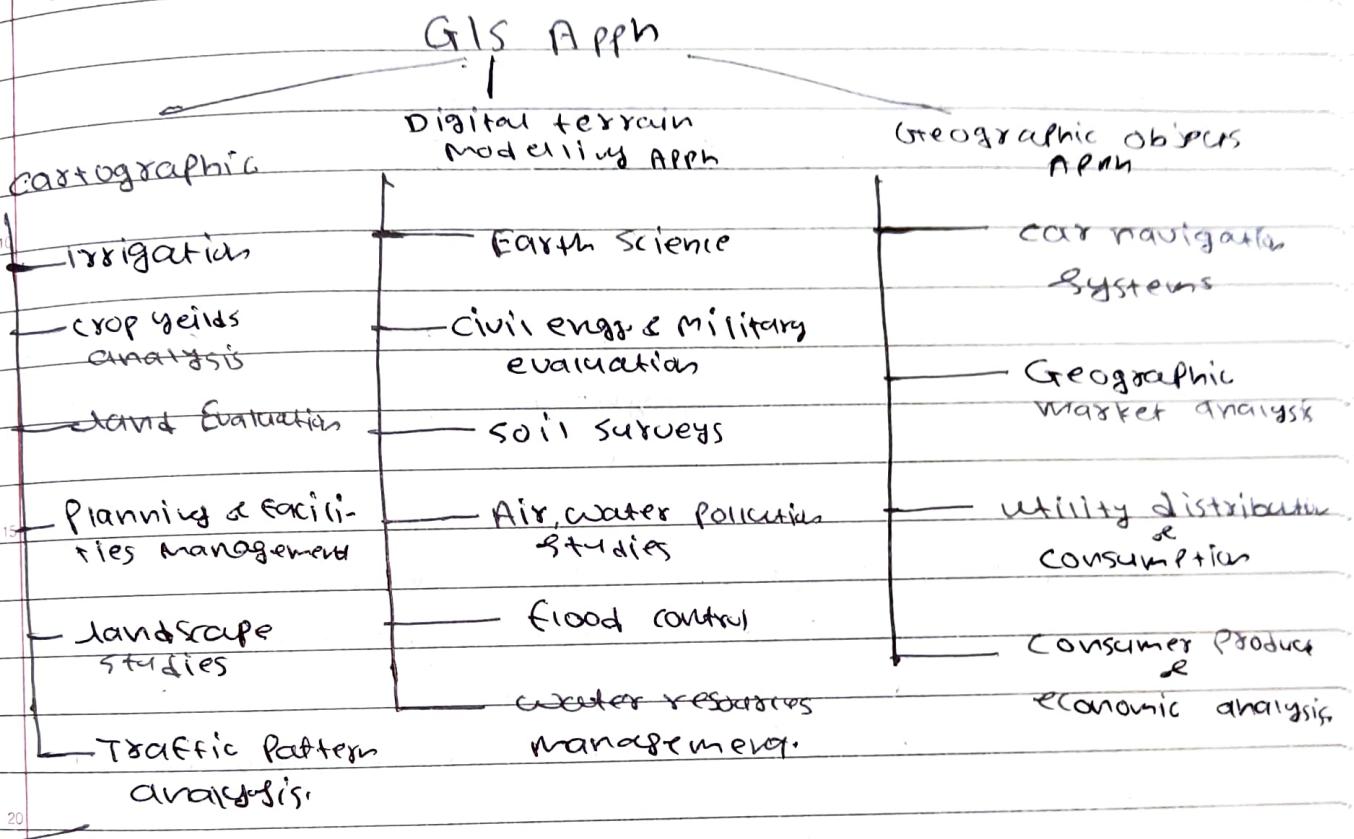
* So creating a broad framework & understand it

- how it works is difficult.
- ④ Finding efficient ways to represent & compress data & ensuring long term preservation. Unique challenges are present in multimedia.
 - ⑤ Database way of retrieving info. is based on query lang. & internal index structures are not easy.
 - ⑥ It have varying performance requirements for doc., & text, video, audio
- ~~10~~
- * Appn
- ① Documents & record management
 - ② Knowledge dissemination
 - ③ Education & training
 - ④ Marketing, advertising, retailing, entertainment & travel
 - ⑤ Real time control & monitoring
- ~~15~~

- ③ 20 Geographic information System [GIS]
- * GIS are used to collect model & analyze information & describing physical properties of geographical world.
- The scope of GIS encompasses two types
 - ① Spatial data
 - ② Non-Spatial data.
- ① Spatial = data originating from maps, digitized img, administrative & political boundaries, roads transportation, Physical data, such as rivers, soil characteristics, climate & land elevation
- ② Non-Spatial = data such as social-economic data, economic data, sales or marketing info. GIS is rapidly developing domain that offers highly innovative approaches.
- ~~25~~
- ~~30~~

* GIS Appn

- ① Cartographic appn
- ② Digital terrain modeling appn
- ③ Geographic Objects appn



* Data management requirements of GIS.

-
- ① Data modeling & Representation
 - ② Data Analysis
 - ③ Data integration
 - ④ Data capture

①

* Vector Data = Represents geometric objects like Points, lines, & Polygons

* Raster Data = consists of an array of pixels where each point represents value for a specific location

* TIN (Triangular Irregular Network) = It is vector based approach that models surfaces with triangles

Connecting sample points.

* DTM = It uses models to represent attribute such as population density or air temperature

(2)

5 * GIS data undergoes various types of analysis such as
 • soil erosion studies, Fnuu impact studies, Hydrological studies.

* Geometrical analysis involves in following measures
 • slope values, Gradients, Plan convexity, Profile convexity [rate of change of gradient]

(3)

* GIS integrates vector & raster data from various sources
 • edges & region might be inferred from rastering to vector models

(4)

15 * capturing geographical info. in digital form is the first step in creating spatial database

* spatial data can also capture from remote sensors on satellite like landsat, MODIS, AVHRR, SPOT HRV [High resolution visible range]

* GIS Data operations

→ ① Interpolation

② Interpretation

③ Proximity analysis

④ Raster image processing

⑤ Analysis of networks

* The functionality of GIS is also subjected to other considerations

30 ① Extensibility

② Data quality control

③ visualization

* Such requirements clearly illustrate that standard RDBMS or ODBMS do not meet specific needs of G+I

(4) Genome Data Management

① Biological Science & Genetics

* Environmental science gives us a view of how species lives & interact in a world.

* Anatomy focuses on the overall structure of an organism, & documenting physical aspects of individual bodies.

* Genetics has emerged as an ideal field for appn of information technology.

* Genes can be defined as units of heredity.

② The study of genetics can be divided into three branches

i) Mendelian genetics = It is the study of transmission of traits b/w generation

ii) Molecular genetics = It is the study of chemical structure & function of genes at molecular level.

iii) Population genetics = It is the study of how info. varies across populations.

③ Origin of Molecular genetics

* 1869 = Friedrich discovered a substance he called nuclein which is known as DNA.

* 1944 = oswald demonstration = DNA is the molecule responsible for carrying genetic info.

* 1953 crick & watson discovered that DNA is shaped like double helix

① Genome data manage & list biological database
biological characteristics

* 5 list biological database

→ ① GenBank

② The Genome Database (GDB)

③ OMIM (online mendelian inheritance in man)

④ Eco Cyc

10 ⑤ ACE DB

⑥ HGMDB

⑦ Gene ontology.

① GenBank:

15 * It is Premier DNA sequence database, that is established in the year of 1978 & maintained by NCBI

* It contains DNA sequences, Protein sequences, 3D-Protein structures, taxonomy that link to Medical literature.

* It contains 31 billion nucleotide bases & 24 million sequences collaborative with European & Japanese databases

② GDB:

25 * It is catalog of human gene mapping data established in 1989.

* It contains map info., PCR Probe data, mutations linked to genetic loci & DNA Probe libraries

* It build using Sybase DBMS with data modeled using ER technique

* It focuses on high-level view for searching rather than exploratory, ad hoc search

(3) OMIM

- * It is electronic compendium of info. on the genetic basis of human diseases
- * It is established in the year of 1987-1989 & it contains info. on over 14,000 entries that covering genetic disease
- * Initially created by Victor in 1966 & Administrated by NDCB1 since 1991 & integrated with Gen Bank

(4) EcoCyc:

- * Database on the genome & metabolism & established in 1996.
 - * It contains the information about E.coli genes & metabolic pathways.
 - * It uses an OO data model with data stored in a knowledge representation system called Ocelot.
- ### (5) Gene Ontology (GO):
- * It describes the structured vocabulary for gene roles across organisms & established in the year of 1998.
 - * It contains molecular function, biological process & cellular components

* Characteristics

→ * High complexity

* Variability

* Rapid schema changes

* Diverse representation

* Read only access

* Limited schema knowledge

* Contextual meaning

* Complex querying

* Access to historical data

Unit - 6

Active database concepts & triggers ; Temporal database.

- * active rules = The rules can be automatically triggered by events that occur, such as database updates or certain times being reached. & can initiate certain action that specified in rule.
- * temporal database = which permit database to store history of changes, & allow users to query both current or past state of database.
- * spatial database = diff. kinds of spatial analysis operation on spatial data, types of spatial querying, spatial data indexing, spatial data mining.
- * multimedia database = It provide feature that allows users to store query & diff. types of multimedia info. such as image, video clips, audio clip & documents.
- * deductive database system = It include capabilities to define rules, which can deduce additional facts from facts that stored in a database.

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① Active Database Concept & Triggers:

- * Database System implement rules that specify actions automatically triggered by certain events.
- * Triggers = Tech. for specifying certain type of active rules.
- * Commercial RDBMS have various versions of triggers available.

Generalized Model for Active Database

- 30) * Event-condition-action [ECA] Model

① Event triggers a rule

- * usually database update operations

② Cond'n determines whether rule action

Should be completed.

* Action will complete only if condⁿ evaluates to true.

(ii) Action to be taken.

* Sequence of SQL statements, transaction or external program.

Appn for active database

- ① Allow notification of certain condⁿ that occur
- ② Maintain consistency of Materialized views
- ③ Enable consistency of replicated tables.
- ④ Enforce integrity constraints.
- ⑤ Automatically maintain derived data

ISSUES:

- ⑥ Deactivated rules will not be triggered by the triggering event = this feature allow user to deactivate certain rules for period of time.
- ⑦ Active command - makes the rule active again
- ⑧ Drop command - deletes rule from the system
- ⑨ Group rules into rule sets approach.
- ⑩ Timing of action:
 - Before trigger executes, trigger before executing event that caused the trigger.
 - After trigger executes, trigger after executing the event.
- ⑪ Action can be considered separate transaction
- ⑫ Row-level rule = rule considered separately for each rule
- ⑬ Statement rule level = rule considered once for entire statements.
- ⑭ Condⁿ evaluated at the end of the transaction
- ⑮ Condⁿ evaluated as a separate transaction
- ⑯ Condⁿ evaluated as part of same transaction

* Temporal Database.

- (i) It is database that needs some aspect of time organization of information.
- (ii) In temporal database each tuple relation is associated with time.
- 5 (iii) It stores info about past states, it only stores info about current states.
- (iv) whenever the state of database changes, info in database gets updated.

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Terminology in Temporal database.

- (i) Valid Time = It is a time in which the facts are true with real world.
- (ii) Transaction Time = It is time at which fact is currently present in the database.
- (iii) Decision Time = decision time is time at which decision is made about the fact.

More :- This database uses support of RDBMS but
20 not provide support for complex operations

Appn.

- (i) It is used to maintain the stock price history.
- (ii) It is used in factory monitoring system = for storing info. about current & past readings of sensors.
- (iii) Healthcare = To maintained histories of patients to give right treatment.
- (iv) Banking = for maintaining credit history of user.

30 ex:- A employee table consists of Dept table that the employee is assigned to if employee is transferred to another dept. at some time

③ Query Processing: Processing query in this is slower than processing non-temporal database due to additional complexity.

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Types

① Uni-temporal Relation ② Bi-temporal ③ Tri-temporal.

* The relation which is associated with transaction time is called Uni-temporal.

* It is suitable for where historical data is not required such as real-time monitoring system.

* It records current state of data without tracking past changes.

② * The relation which is associated with both valid time or transaction time is called.

* Valid time has two parts start time and end time similar in the case for transaction time.

* Allows querying data as it was at a specific point in time or tracks when made a change.

③ * The relation which is associated with three aspects of time namely valid time, transaction time, decision time.

④ Decision time represent the time when a decision was made to record.

⑤ It supports querying data based on any combination of three temporal dim.

Features:

① Temporal database provide built in support for time dimension.

② It stores data related to the time aspects.

③ It contains Historical data instead of current data.

④ It provides a uniform way to deal with historical data.

Challenges:

① Data storage = each version of data needs to be stored separately, so storing data it require more storage.

② Schema design = the schema must accommodate the time dimension, creating schema is difficult.