1. Introduction to Database Management System

PAGE NO.:

1] Data :
Data is the information which has been translated into a form that is more ~~convient~~ convinient to process or move.

2] Database :
A Database is an organised collection of data so that it can be easily accessed and managed.

3] Database management System (DBMS) :
DBMS is a system software which manages the data. It can perform various tasks like creation, retrivable, insersation, modification and Deletion of Data. to manage it in a systamatic way as per requirement.

* File System vs DBMS

	Basis	DBMS approach	File System approach
1]	Meaning	Collection of Data. In DBMS the user is not required to write the procedure	In file system the user has to write the procedure for managing Database
2]	Sharing of Data	Due to centralised approach Data Sharing is easy	Data is Distributed in many files & it may be of different formats so it is not easy to share Data.
3]	Data Abstraction	DBMS gives an abstract view of Data that hides the Details	File system provide details of Data representation & Storage of data.
4]	Security and protection	DBMS provides a good Protection Mechanism.	It is not easy to protect a file under a file system

5]	Recovery mechanism	DBMS provides the crash recovery mechanism that is DBMS protect the user from system failur.	The File system doesn't have a recovery mechanism that is if the system crash while entering some data the content of the file will be lost.
6]	Concurrency problem	DBMS taks care of concurrent access of data using some form of locking.	In the file system concurrent access has many problem

⇒ Applications of DBMS :

1] Industry
2] Banking
3] Airlines
4] Railway Reservation system.
5] Hospital management.
6] E - Commerse website.
7] Education system.
8] Social media.
9] Library management system.
10] Telecom.

⇒ Data Abstraction :
To make the user interaction easy with database, the internal irrelevent details can be hidden from users. this process of hiding irrelevent details from user is called data abstraction.

⇒ Schema :
The Design of a Database is called as Schema.

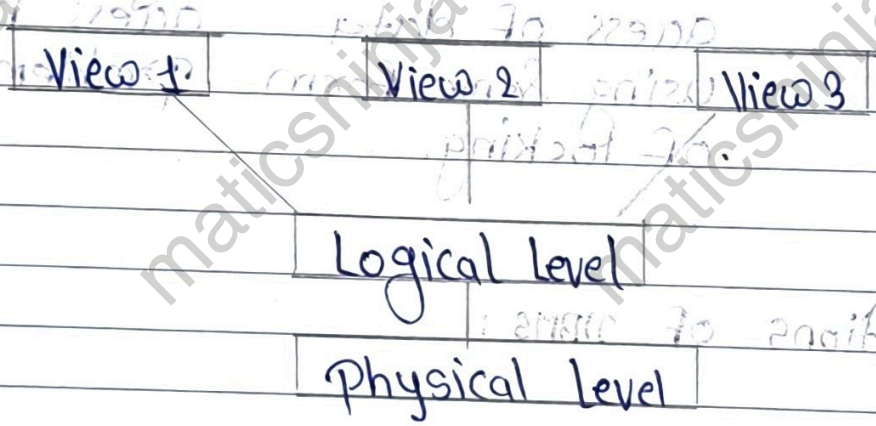


Fig. Levels of Data Abstraction

→ Layers of Database
→ Architecture of DBMS

1] Physical Level / Internal Schema :

In Data Abstraction Physical level is the lowest level this level describes how the data Actually stored in Physical Memory

2) Logical Level / Conceptual Schema:

This is the next higher level of Abstraction which is used to describe what data the database stores and what relationships exits in between the data items.

(DBA) Database Admistrator:
use the logical level of Abstraction to decides what information to keep in database

3) View level or external Schema:

It is the highest level of Data Abstraction this level describes the user interaction with database System. End user interacts with System with the help of GUI and Inters the details at the screen at the View level.

⇒ Data independance:

The Ability to modify Schema defination in one level without affecting Schema defination in the next higher level is called data independance.

Types of Independance:
① Physical level.
② logical level.

1] Physical Data Independance:
It means # we change the physical storage or level without affecting the conceptual or external view of data.

2] Logical Data Independance:
It is the ability to modify the logical schema without causing application program to be return.

⇒ Structure of DBMS

The structure of DBMS content following components

1] DPL compiler:
The DDL compiler converts DDL commands into set of tables containing meta data store in a Data Dictionary.

2] DML compiler and query optimizer:
The DML command such as retrieve, insert, update, delete etc from the application program are send to the DML compiler for compilation. It converts this commands into object code

for understanding of database.

3] Data manager:
The Data manager is the central software component of the dbms also known as Data base control system.

4] Data Dictionary:
Data Dictionary is a repository of discription of data in the database.

5] Data File:
It contents the data porstion of the data base that is it has the real data stored in it.
It can be stored as magnetic disks, magnetic tapes, or optical disks

6] Compiled DML:
The DML compiler converts the high level querys into low level file access commands known as compiled DML.

7] End users:
They are the real users of the database. they can be developers, disiginer, Admistrator, or the Actual users of the database.

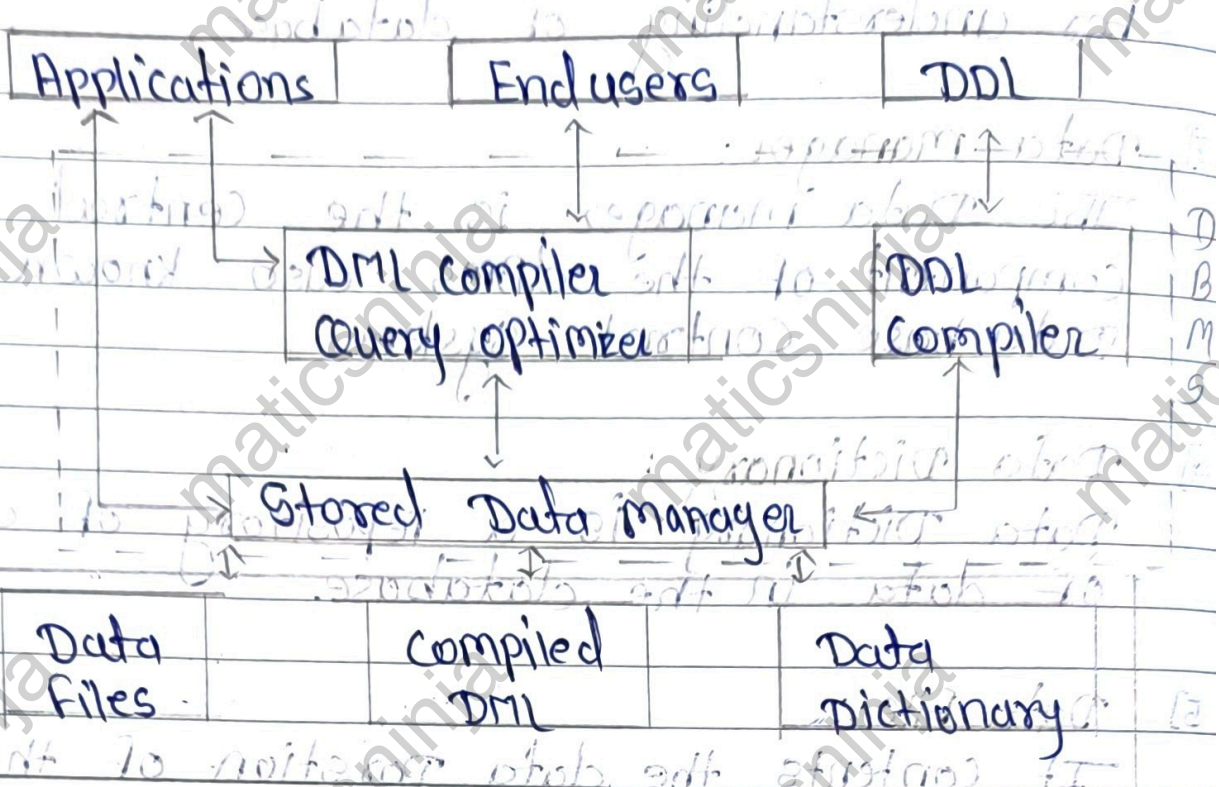


Fig. Overall structure of DBMS

① DDL : Data Defination Language
② DML : Data Manupulation Language

- Types of Data Models :

Data Models

Relational Model	Network Database-Model	object oriented Data model
Hierarchical Model	Entity Relationship Model	Physical Data model

1] Relational Model or Record based Logical Model
Relational Database is an attempt to simplify the data structure by making use of table. Tables are used to represent the data and there relationship. Table is a collection of Rows and columns.

- Records are knowns as Tuples and fields are known as attributes.

- In the Relational Model, every record must have a unique identification or key based on Data

- Let's consider a college database it contents information About

① Student table : Contains information of all students

② Faculty table : Faculty is nothing but staff Contains information of all faculty

(III) Account table :
Contains information about all fee transtion that happen in college, Salary records for Faculties and all other account details.

(IV) Class Table:
Maintains information about various classes available in college.

Student table			
Stud_id	Stud-Name	Age	Contact No:

Faculty Table		
Faculty-Id	Name	Salary

Account Table		
Account_Id	Transaction Date	Amount

Class Table			
Class_ID	Year	Branch	Room

Ex: Most popular commertial dbms products such as Oracle, MySQL, Sybase are based on a relational model

- Advantages

1] Relational Algebra
A relational Database supports and various operations of the set theory (Like: union, intersection etc)

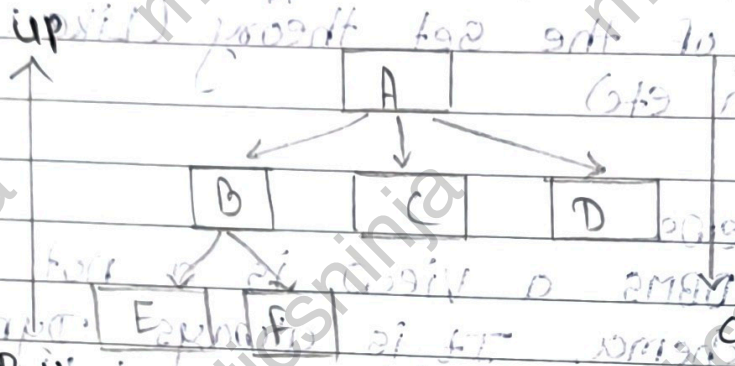
2] Dynamic Views
In an RDBMS a View is a not part of physical Schema. It is always Dynamic. Hence changing the data in a table also changes the data present in View

3] Excellent data Security.
Every user is assigned some database permissions called as user - rights.

2] Hierarchical Model

It was the first DBMS model. the data either is sorted Hierarchicaly by a top-down or bottom-up approch to design.

This model represents data as a Hierarchical tree



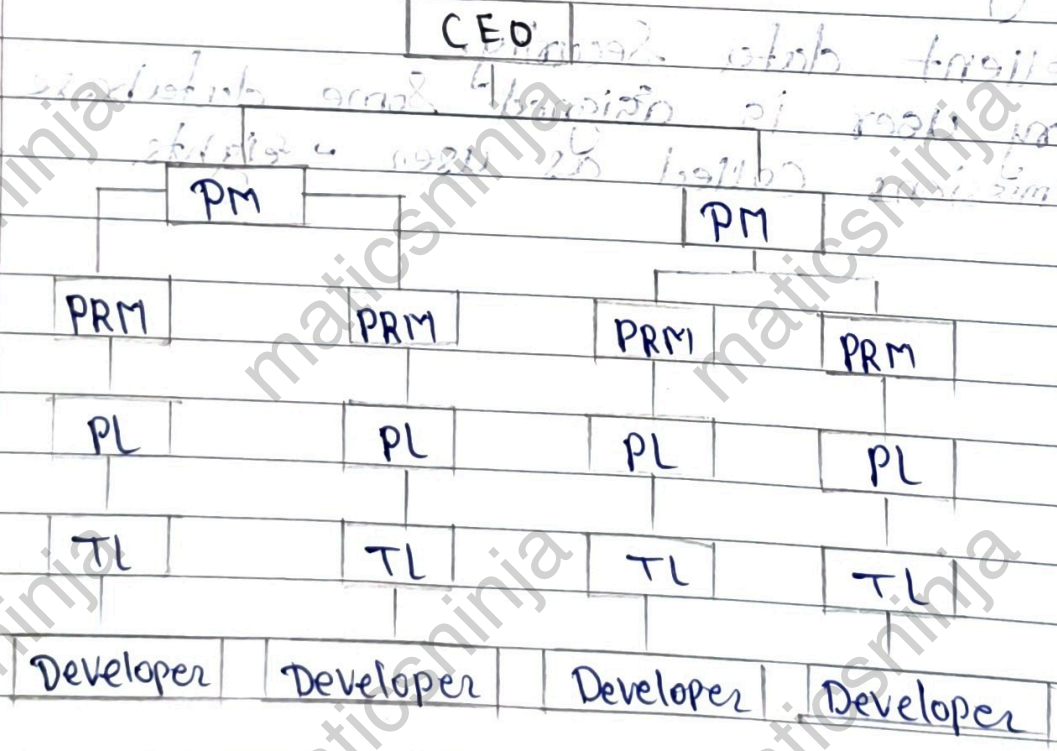


Fig. Organizational Hierarchy

CEO → Program Manager
PM → People Manager
PRM → Project Manager
PL → Project Leader
TL → Team Leader
Developer →

- CEO
is the root node having many DU heads below that managers who manage multiple project leaders who organised developers.

- Bussiness Rule :
one parent node may have many child nodes but one child can not have more than one parent node.

Ex:
one of the popular DBMS based on a Hierarchical model is (IMS) information Management System from IBM

- Advantages

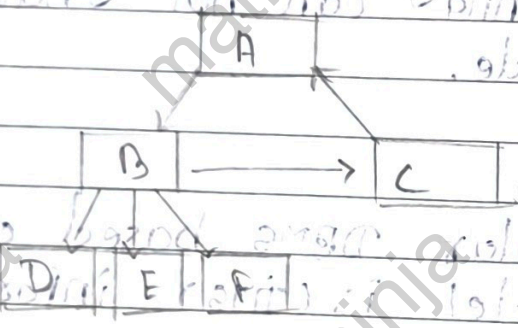
1] Conceptual Simplicity
2] Database Security
3] Simple creation, updation and Access.
4] ~~Effien~~ Efficiency.
5] Database integrity and Data Independance

- Disadvantages.

i) Complex implementation.
ii) Difficult to manage
iii) Complex application programming.
iv) Limitations in implementations.

3) Network Model

Like the Hierarchical model this model also uses pointers towards data but there is no need for parent to child association so it does not necessarily used a downward tree structure.



there are some concepts in involved in the network model as follows.

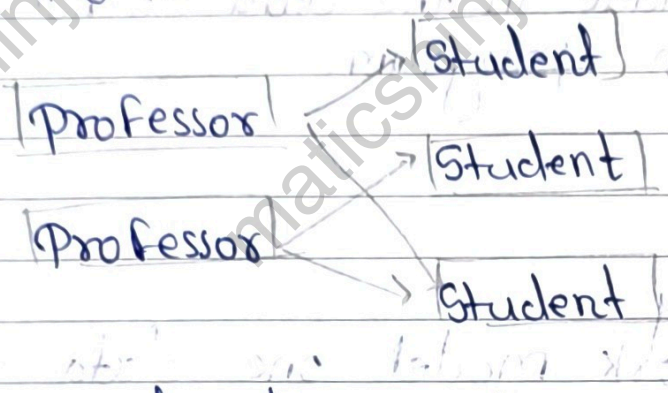
① Set
A relationship between any two record type is called as set.

② Record
The owner record is like a parent record in the Hierarchical model.

Parent Record is like child record in network model.

ex:

many prof. in college teach too many students



A relationship can be 1:N or in this model we can show M:N relationship M:N

- Advantages

1) Simple Design
2) Ability to Handle many types of relationship
3) - the network model can handel one to many, many to many or other relationships Hence the network model manages the multiusers enviroment.

3) Ease of Data access.
- In a network model an application can access a root (Parent) record a root or Parent and all the member records within a set. (child)

4] Data Independance
- In network model applications, programs work independantly of the data.
- Any changes made in the data do not affect the application program.

⇒ Disadvantages

1] System complexity
- In a network model one data record is accessed at a time.

2] Lack of structual independance
- Any changes made to the data base structure require the application program to be modified before they can access data

- Database Architecture :

1] Single tier Architecture. (centralized architecture)

An application running on a single computer and performing all the required tasks. the application running on such a desktop computer is known as one-tier application

The single tier architecture consist of the presentation, Bussiness rules and Data access layers in a single computing layer.

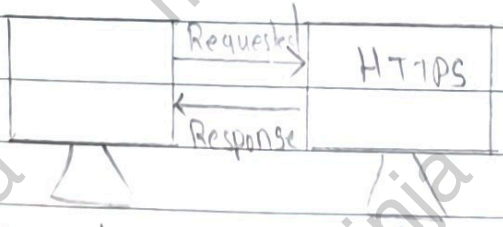
⇒ Advantages.

1] consistance data.
2] Enhanced security.
3] Efficient management.
4] Scalability
5] Collaboration

Disadvantages

1] multiprocessing not possible.

2] Two-tier Architecture.



Two-tier architecture is a client server architecture. in this architecture, the terminal is the client and powerful computer hosting application files, Database, transection management feature and overall logic is the server.

⇒ This architecture has certain limitations

① when the no of users increases performance decreases.

② implementation of two tier architecture provides limited flexibility in moving program functionality from one server to another without manually regenerating procedural code

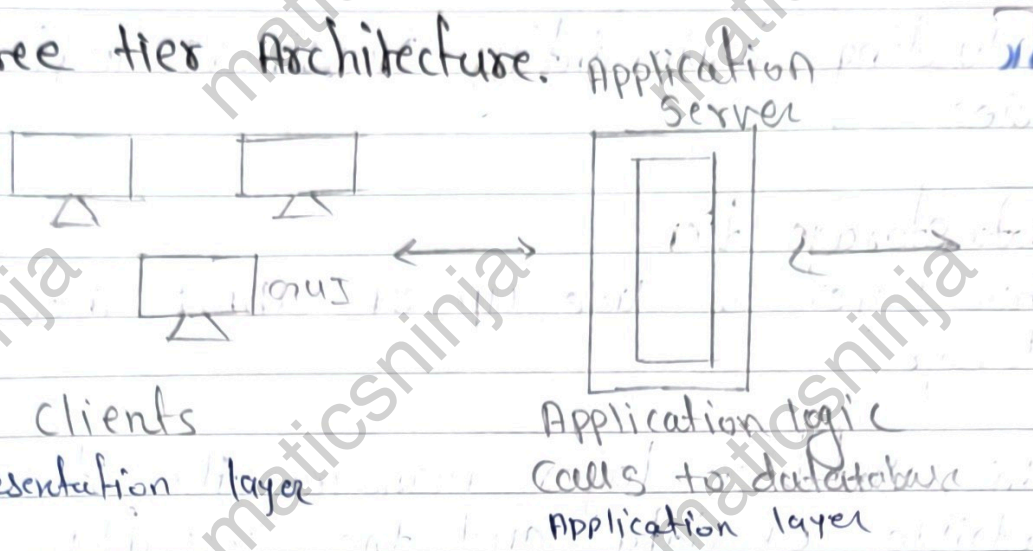
⇒ Advantages

① Simplified design and implementation

② Cost effective

③ Easier troubleshooting.

3] Three tier Architecture.



Three tier architecture any system which enforces a general separation between the following three parts

1] client tier.
2] middle tier or Bussiness logic or Bussiness tier.
3] ~~Data~~ Storage tier or Database tier.

The goal of three schema Architecture is to separate the front end and the backend

1] Client tier
Contains all things that are visible to the user such as screen layout and Navigation

2] The middle tier or Bussiness tier
Consist of application logic the middle tier is also called as application Server

The middle tier executes process management.

including implemenating Bussiness logic and Rules

3] Data storage tier
This layer is made up of dbms and data storage

This Database layer manages the storage and retrible of data and the security and the integrity of an application

Advantages :

1] Enhanced Scalability
A three tier architecture allows for better scalability, as it separates the presentation application and data storage layers, making it easier to handle increase coork load and the growth

2] Flexibility & Modulauity
Each tier can be updated or replaced independantly allowing for easier integration of new technologies. To chainging bussiness requirement.

3] Improved Security
With a clear Separation of consones Parts it beome easier to implement Sequirety measure at each tier ensuring better protection of sensitive data and resources

4] Better maintainability and code Reusability.
The modular design of three tier architecture promotes easier maintainance and code Reusability, Reducing development time & cost

⇒ E.F Codds Rule for DBMS

1] Dr. EF codd was the creater of the relational Data model

This model was publish as a two part artical in Computer World. (1985)

It contains a list of 12 rules that determine whether a dBms is Relational and to want extents it is Relational.

this Rules are very useful measures for evaluating a relational system.

Rules	Discription
1. Information Rule	All available data in system should be represented as a relations or tables. information needs to be store as values in tables.
2. Guranty access Rule	Each data item must be accessible without ambiguity by providing

		table name and it's primary key of the raw also include it's column name to be accessed.
3.	Systematic trement Rule of Null Values	Null values are not equal to blank space or zero they are unknown, unassigned values which should be treated properly
4.	Self Describing Database	There should be dynamic online catalog based dictionary on Relational model which keep Information about tables, data, In Database.
5.	Comprehensive	Comprehensive Data sub language: The Data access language sql must be the only means of accessing data stored in the database
6.	View updating Rule	All views of data are theoritically updatable can be updated using System also
7.	High level Insert, update, Delete.	This Rule states that in a RDBMS the query language must be capable of performing manupulation such as inserting, updating or Deleting Data on sets of Rows in the table

8.	Physical data independance	Any changes made in the way data is physically stored must not affect applications that access data.
9.	Logical data Independance	This Rule states that changes to the data base design should be done in a way without the users being aware of it
10.	Integrity Independance	Data Integrity constraints which are definable in the query language must be stored in the Database as Data in tables that is in the catalog and not in the application programs.