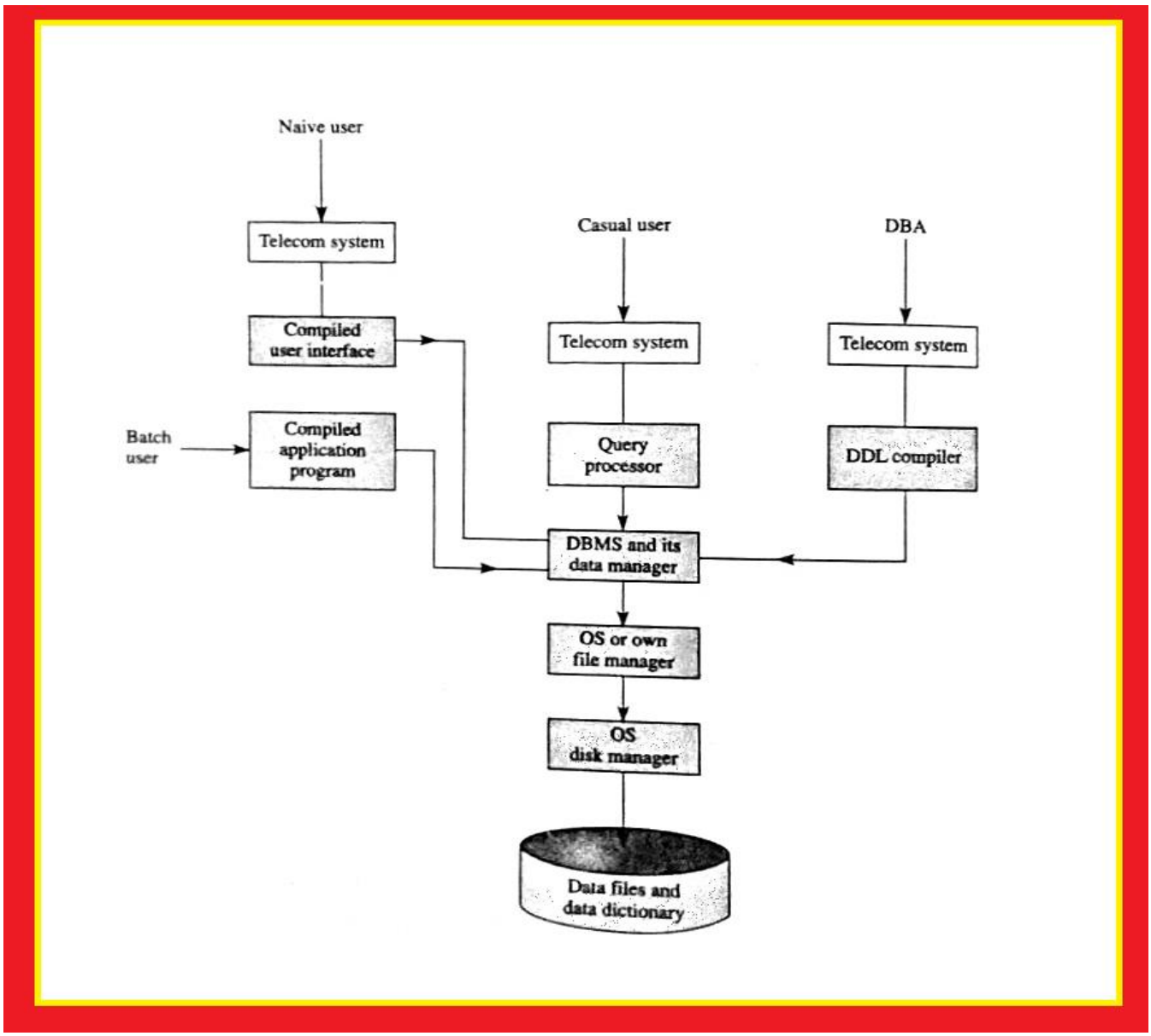
Structure of DBMS

For our purposes, we may assume that the database management system is structured and interfaces with various users as shown in following figure. The major components of this system are described below.



Data Definition Language [DDL] Compiler:- The DDL compiler converts the data definition statements into a set of tables. These tables contain the metadata [**Metadata** is "data that provides information about other data". In other words it is

data about data.] Concerning the database and are in a form that can be used by other components of the DBMS.

Data Manager :- The data manager is the central software component of the DBMS. It is sometimes referred to as the database control system. One of the functions of the data manager is to convert operations in the user's queries coming directly via the query processor or indirectly via an application program form the user's logical view to a physical file system. The data manager is responsible for interfacing with the file system. In addition, the tasks of enforcing constraints to maintain the consistency and integrity of the data, as well as its security, are also performed by the data manager. It is also entrusted with backup and recovery operations.

File Manager:- Responsibility for the structure of the files and managing the file space rests with the file manager. It is also responsible for locating the block containing the required record, requesting this block from the disk manager and transmitting the required record to the data manager.

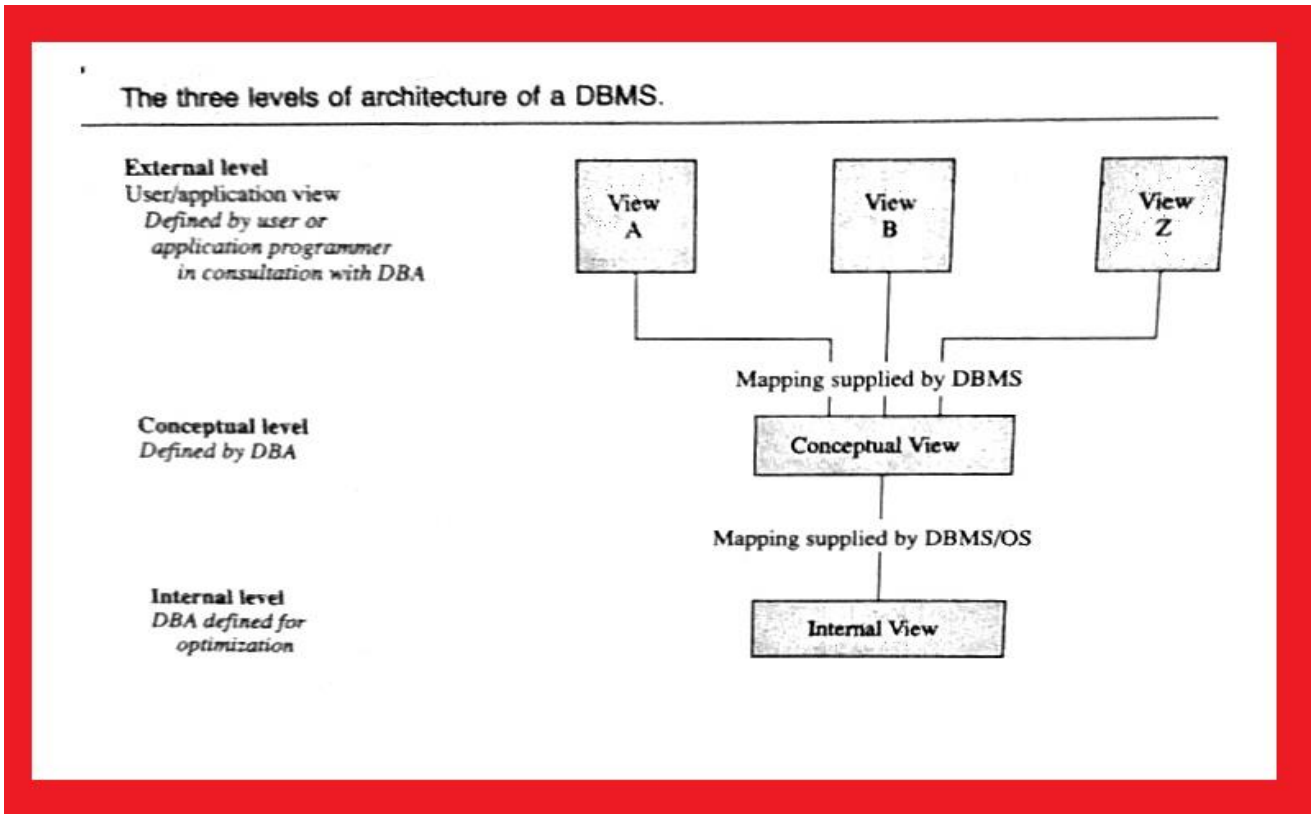
Disk Manger:- The disk manager is a part of the operating system of the host computer and all physical input and output operations are performed by it.

Query Processor:- The query processor is used to interpret the online user's query and convert it into an efficient series of operations in a form capable of being sent to data manager for execution. The query processor uses the data dictionary [Data dictionary defined in the *IBM Dictionary of Computing*, is a "centralized repository of information about data such as meaning, relationships to other data, origin, usage, and format"] to find the structure of the relevant portion of the database and uses this information in modifying the query and preparing an optimal plan to access the database.

The Three Level Architecture for a DBMS

A database management system that provides three levels of data is said to follow three-level architecture. These three levels are the **external level, the conceptual level and the internal level** which are shown in following figures.

The Three Levels of Architecture of a DBMS



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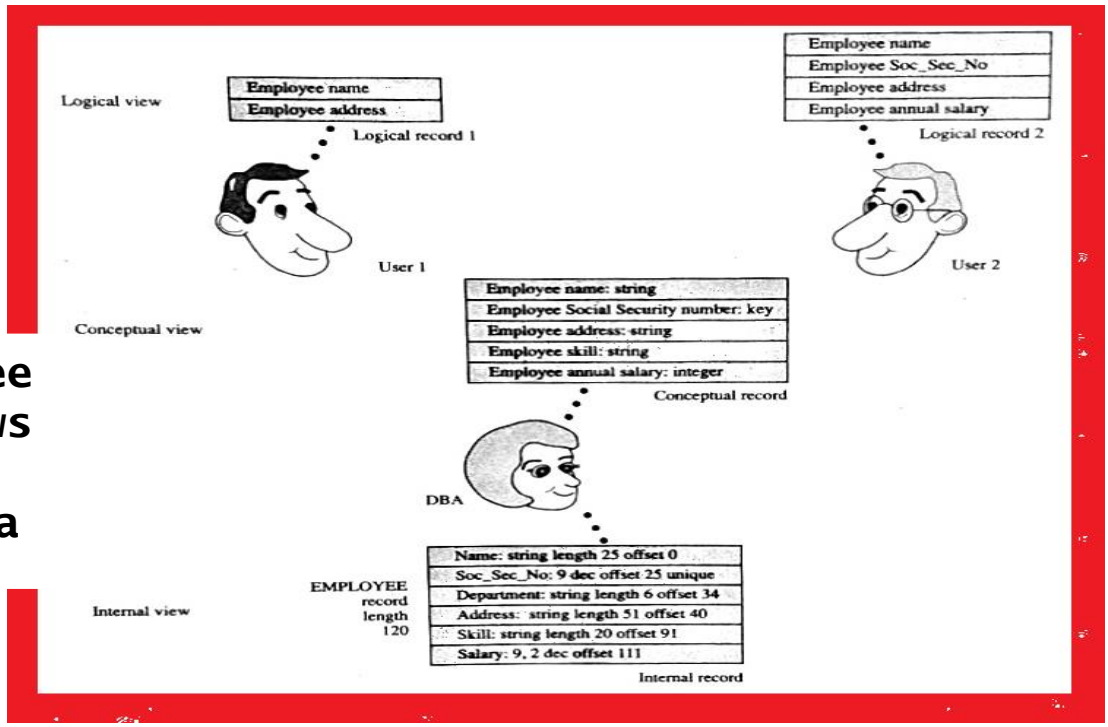
Data Models

Three views of data



Hierarchical Model:-

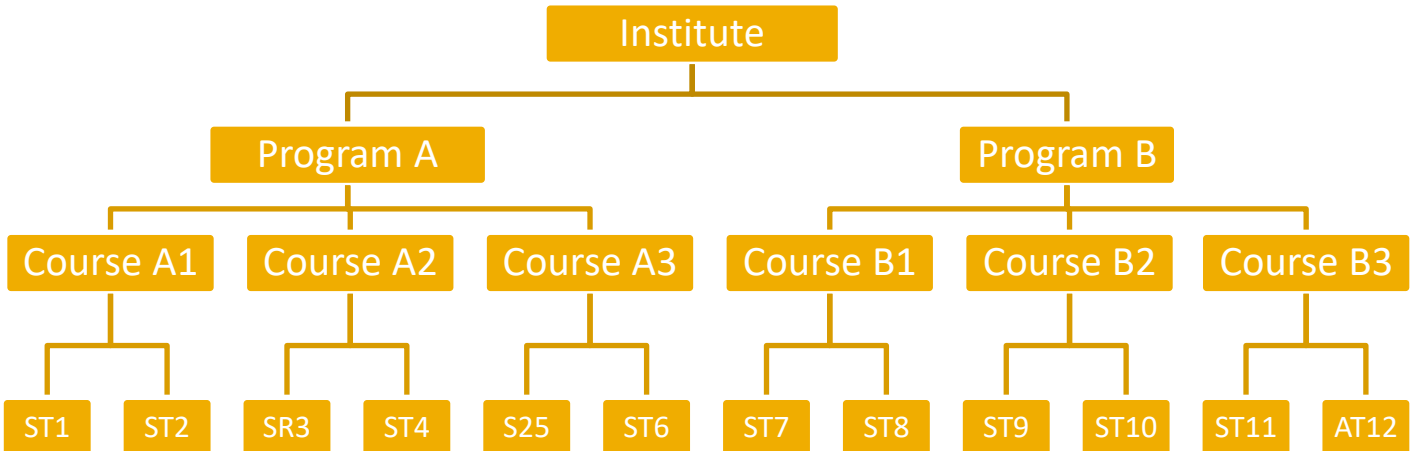
A DMBS belonging to the hierarchical data model uses tree structure to represent relationship among records. A hierarchical consist of a collection of records which are connected with each other through links. Each record is a collection of fields [attributes], each of which contains one data value. A link is an association between two records.

Features of Hierarchical model:-

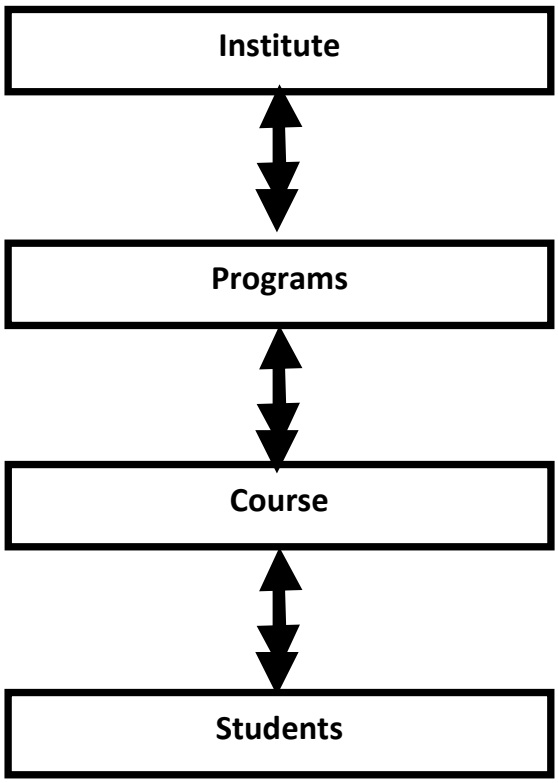
1. Each hierarchical tree can have only one root record type and this record type does not have a parent record type.
2. The root can have any number of child record type and each of which can itself be a root of a hierarchical sub tree.
3. Each child record type can have only one parent record type, thus a M:N relationship cannot be directly expressed between two record types.

4. Data in parent record applies to all its child records.
5. A child record occurrence must have a parent record occurrence, deleting a parent record occurrence requires deleting its entire children record occurrence.

Following figure shows typical database occurrence of a hierarchical structure [tree structure].



The tree structure occur naturally in many data organization because some entities have an intrinsic hierarchical order. For Example, an institute has a number of programs to offer. Each program has a number of courses. Each course has a number of students registered in it. Following figure depicts the four entities types Institute, Program, Course and Student make up the four different levels of hierarchical structure.



Currently hierarchical databases are still widely used especially in applications that require very high performance and availability such as banking and telecommunications. One of the most widely used commercial hierarchical databases is IMS [Information Management System].

NETWORK MODEL:-

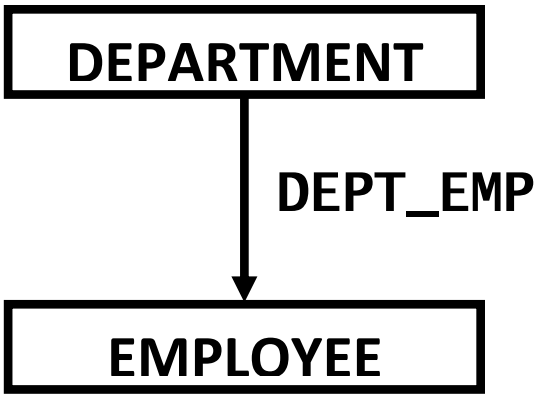
The network data model was formalized in the late 1960s by the **D**ata**b**ase **T**ask **G**roup of the **Co**nference on **Da**ta **S**ystem **L**anguage [DBTG/CODASYL]. A network data model is also known as DBTG data model. The DBTG model uses two different structures to represent the database entities and relationships between the entities namely record type and set type.

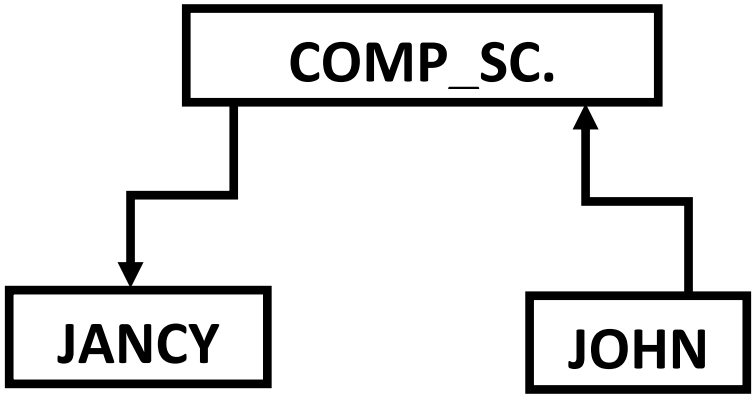
A record type is used to represent an entity type. It is made up of a number of items that represents the attributes of the entity.

A set type is used to represent a directed relationship between two record types, so called owner record type and member record type.

The set type, like the record type, is named and specifies that there is a one-to-many relationship between the owner and member record types. The set type can have more than one record type as its member, but only one record type is allowed to be the owner in given set type.

Bachman introduced a graphical means called a data structure diagram to denote logical relationship implied by the set here a labeled rectangle represents the corresponding entity or record type. An arrow that connects two labeled rectangles represents a set type. The arrow direction is from owner record type to member record type. Given figure shows two record types DEPARTMETN AND EMPLOYEE and the set type DEPT_EMP with DEPARTMENT as the owner record type and EMPLOYEE as the member record type.





Relational Model:-

In relational model data is arranged in tables i.e. entities and attributes are expressed in rows and columns indicate the structure, relationship and integrity in the following manner.

1. In any given column of a table, all items are of the same kind.
2. Each item is a simple number or character string.
3. All rows of a table are distinct. In other words, no two rows are identical in every column.
4. Ordering of rows within a table is immaterial.
5. The column of a table are assigned distinct names and the ordering of these column is immaterial.
6. If a tables has N columns, it is said to be of degree N. This is sometimes also referred to as the cardinality of the tables.

Advantage of Relational Approach:-

- Ease of use:- The revision of any information as table consisting of rows and columns quite natural and therefore even first time users find it attractive.
- Flexibility:- Different tables from which information has to be linked and extracted can be easily manipulated by operators such as projection and join to give information in the form in which it is desired.
- Security:- Security control and authorization can also be implemented more easily by moving sensitive attributes in a given table into a separate relation with its own authorization control.
- Data independence:- Data independence is achieved more easily with normalization structure used in a relational database.

Disadvantage of Relational Approach:-

A major disadvantage in the use of relational database is machine performance. If the number of tables between which relationships to be established are large and the tables themselves are voluminous the performance in responding to queries is degraded.