



Database Management Systems

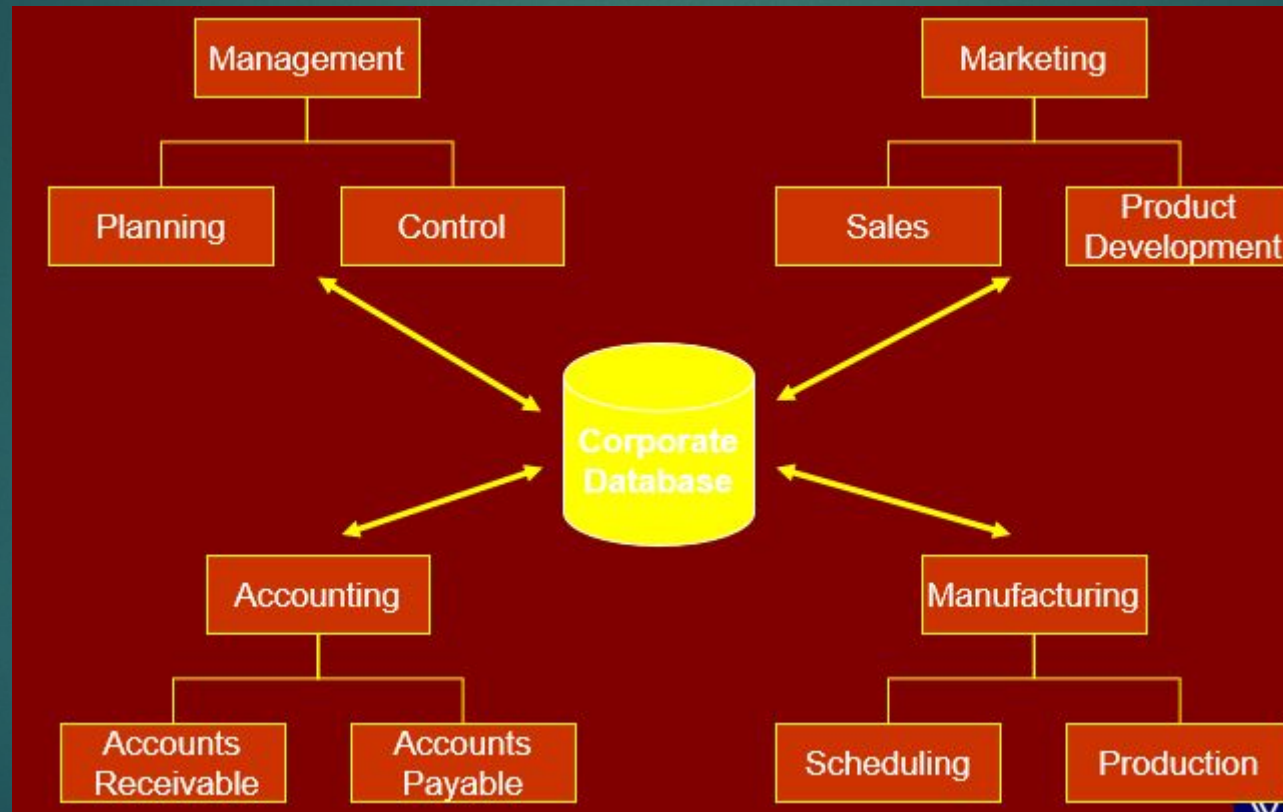
LECTURE - 1

What is a Database

Database Definitions

- ▶ A database is a shared collection of logically related data that is stored to meet the requirements of different users of an organization

The concept of a shared organizational database



Database System Important Terms

- ▶ Schema
- ▶ Database Application
- ▶ Database Management system(DBMS)

Data As Resource

- ▶ **Resource**

Any asset that is of value to an organization and that incurs cost

Levels of Data

- ▶ Real-world data (Entity)
- ▶ Metadata (Record Type)
- ▶ Data Occurrence (Record of an Entity)

Database Users

- ▶ Application Programmers
- ▶ End Users
 - ❖ Naïve
 - ❖ Sophisticated

Database Users

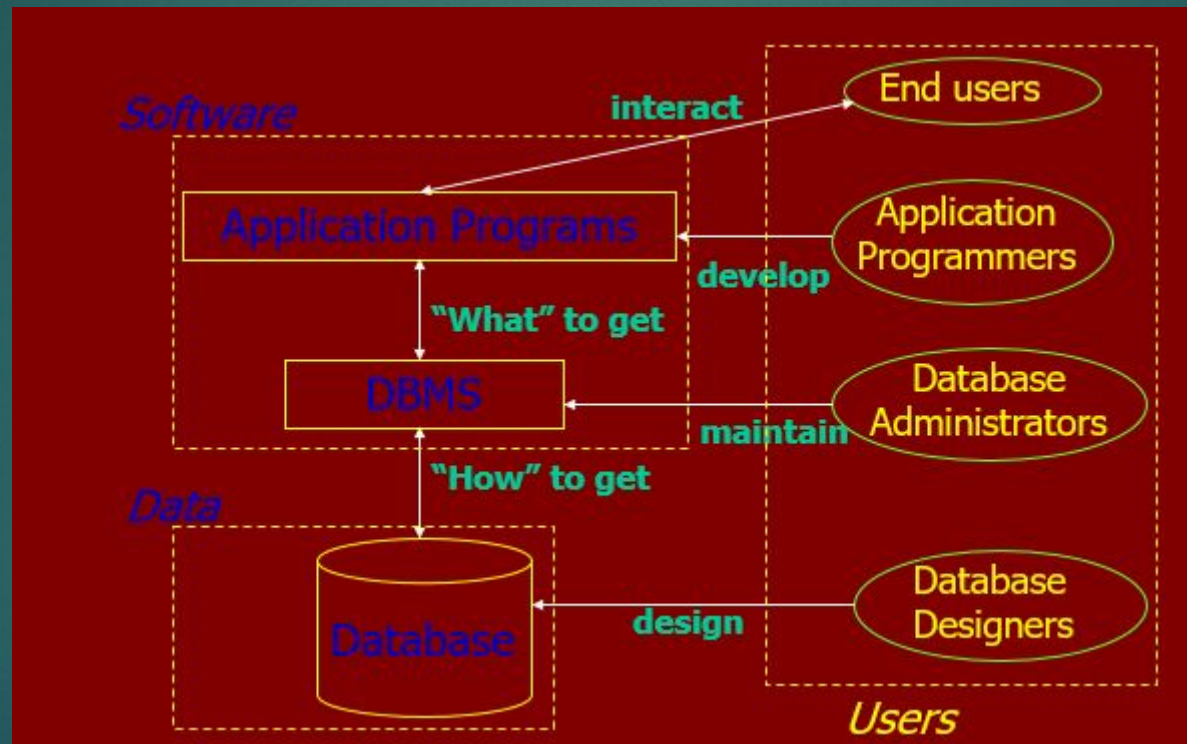
- ▶ Database Administrator (DBA)

A person who has central control over data and programs that access this data

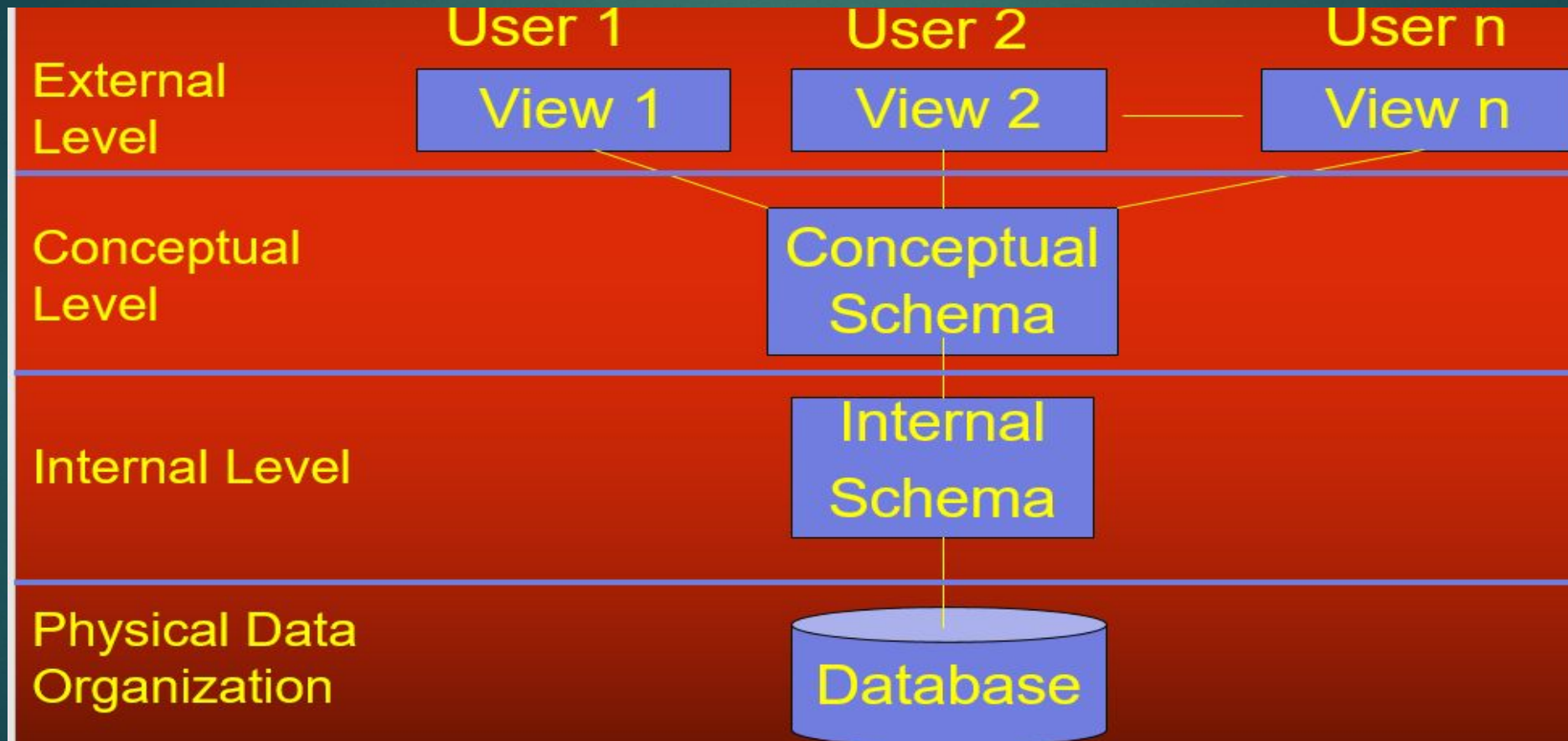
Functions of DBA

- ♦ Schema definition
- ♦ Granting data access
- ♦ Routine Maintenance
 - Backups
 - Monitoring disk space
 - Monitoring jobs running

Data, Database, Data Model and DBMS



The Three-Level Architecture



First Name: Rana
Last Name: Aslam
Date of Birth:
12 Sep, 1970

Saleema



Name: R. Aslam
Age: 24y, 10d
Dept: Sales

Saleem

<u>Name</u>	<u>DoB</u>	<u>Deps</u>	<u>DepId</u>
<u>Rana Aslam</u>	12/09/70	5	D001
Marya Wasti	29/02/80	0	D005

BH RH Rana Aslam 120970 5 D001 RH Marya Wasti..

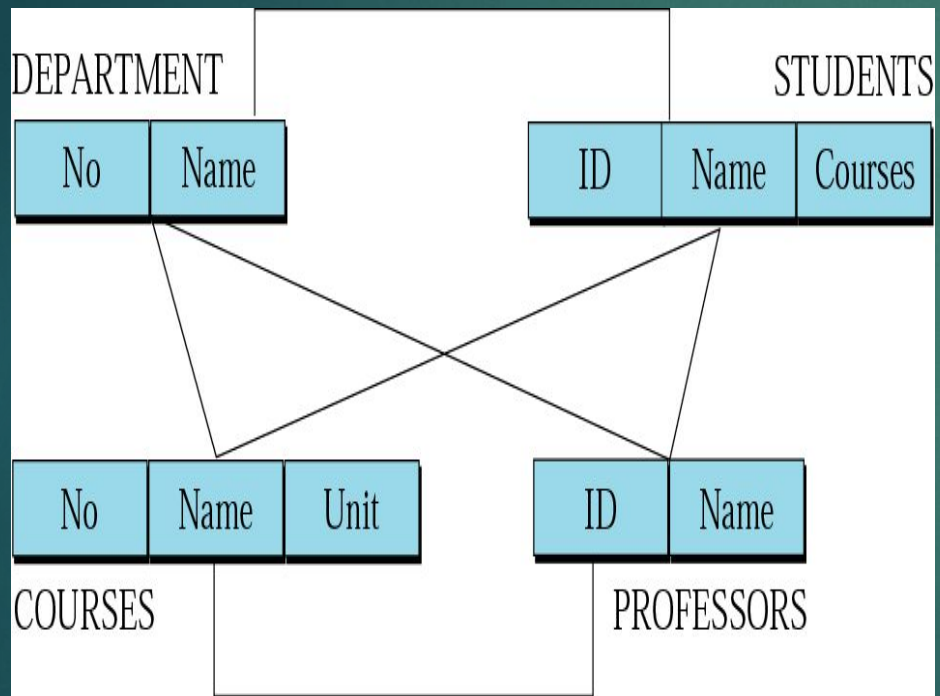
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Database Model

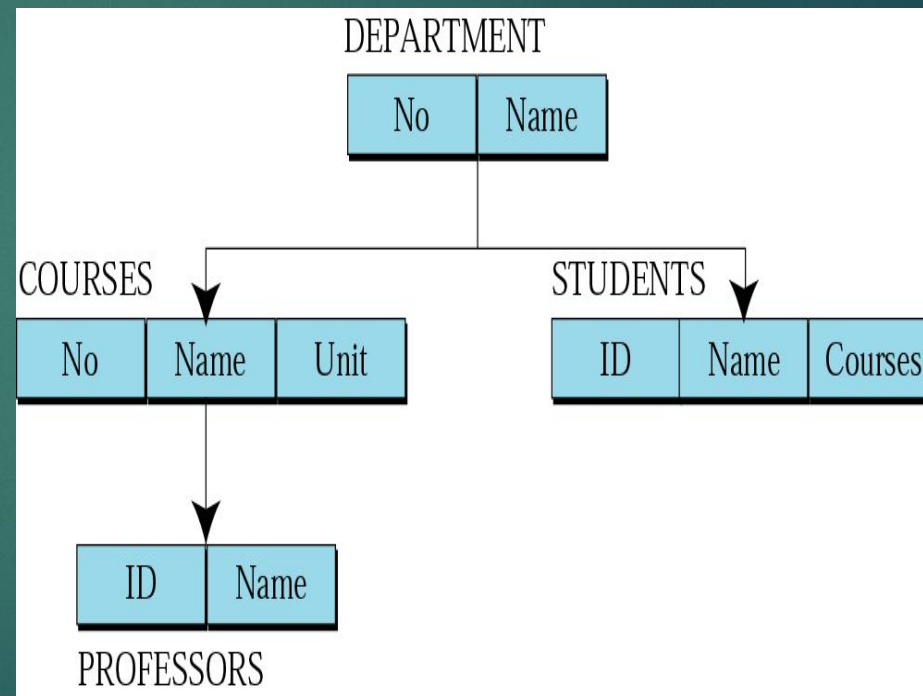
- Database model defines the logical design of data.
- Database model describes the relation between different parts of data.
- There are three database models:
 1. Hierarchical Model
 2. Network Model
 3. Relational Model

Database Model

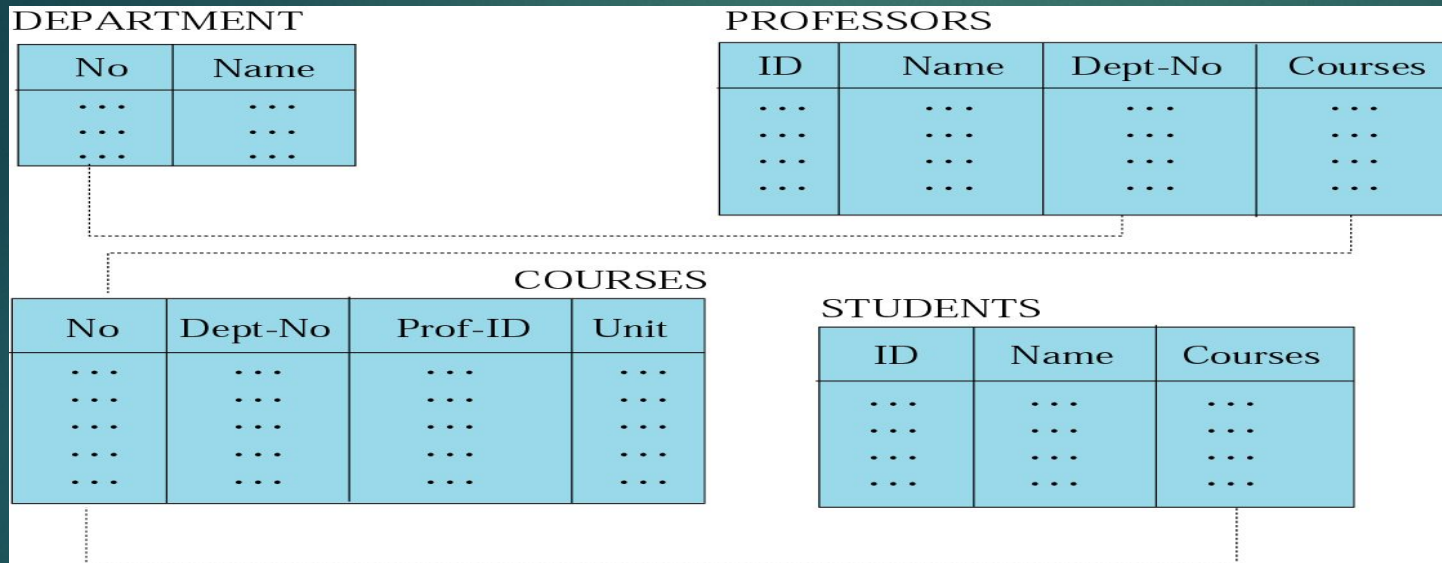
Network Model



Hierarchical Model



Relational Model



- Data are organized in two dimensional tables (relations)
- Tables related to each other
- Relational Database Management System (RDBMS) are more common model used today

Basics of RDM

- Relations physically represented as tables
- Table is a two dimensional representation of a relation
- Consists of rows and columns
- Columns represent attributes and rows represent records
- Rows, records and tuples all these terms are used interchangeably

Basic Properties of a Table

- Each cell of a table contains atomic/single value
- Each column has a distinct name; the name of the attribute it represents
- The values of the attributes come from the same domain
- The order of the columns is immaterial
- The order of the rows is immaterial

□ Ex

<u>stID</u>	<u>stName</u>	<u>clName</u>	<u>doB</u>	sex
S001	M. Suhail	MCS	12/6/84	M
S002	M. Shahid	BCS	3/9/86	M
S003	Naila S.	MCS	7/8/85	F
S004	Rubab A.	MBA	23/4/86	F
S005	Ehsan M.	BBA	22/7/88	M

A Table

Table also called Relation

Primary Key

Domain
Ex: NOT NULL

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CustomerID	CustomerName	Status
1	Google	Active
2	Amazon	Active
3	Apple	Inactive

Tuple OR Row

Total # of rows is **Cardinality**

Column OR Attributes

Total # of column is **Degree**

RM Concept in DBMS

Attribute: Each column in a Table. Attributes are the properties which define a relation. e.g., Student_Rollno, NAME, etc

Tables – In the Relational model the, relations are saved in the table format. It is stored along with its entities. A table has two properties rows and columns. Rows represent records and columns represent attributes.

Tuple – It is nothing but a single row of a table, which contains a single record.

Relation Schema: A relation schema represents the name of the relation with its attributes.

Degree: The total number of attributes which in the relation is called the degree of the relation.

Cardinality: Total number of rows present in the Table.

Column: The column represents the set of values for a specific attribute.

Relation instance – Relation instance is a finite set of tuples in the RDBMS system. Relation instances never have duplicate tuples

RM Concept in DBMS

Relation key – Every row has one, two or multiple attributes, which is called relation key.

Attribute domain – Every attribute has some pre-defined value and scope which is known as attribute domain

Relational database schema – A set of relation schemas ,each with a distinct name.

Example: If $R_1, R_2, R_3, \dots, R_n$ are set of relations, then we can write RDBMS as

$R = \{ R_1, R_2, R_3, \dots, R_n \}$

Relational Integrity Constraints

- Relational Integrity constraints in DBMS are referred to conditions which must be present for a valid relation. These Relational constraints in DBMS are derived from the rules in the mini-world that the database represents.
- There are many types of Integrity Constraints in DBMS. Constraints on the Relational database management system is mostly divided into three main categories are:
 1. Domain Constraints
 2. Key Constraints
 3. Referential Integrity Constraints

Domain Constraints

- Domain constraints can be violated if an attribute value is not appearing in the corresponding domain or it is not of the appropriate data type.
- Domain constraints specify that within each tuple, and the value of each attribute must be unique. This is specified as data types which include standard data types integers, real numbers, characters, Booleans, variable length strings, etc.

Example:

```
create DOMAIN CustomerName  
check( value not null)
```


Key Constraints

- An attribute that can uniquely identify a tuple in a relation is called the key of the table. The value of the attribute for different tuples in the relation has to be unique.

Example: In the given table, CustomerID is a key attribute of Customer Table. It is most likely to have a single key for one customer, CustomerID =1 is only for the CustomerName = "Google".

CustomerID	CustomerName	Status
1	Google	Active
2	Amazon	Active
3	Apple	Inactive

Referential Integrity Constraints

- Referential Integrity constraints in DBMS are based on the concept of Foreign Keys. A foreign key is an important attribute of a relation which should be referred to in other relationships. Referential integrity constraint state happens where relation refers to a key attribute of a different or same relation. However, that key element must exist in the table.

- Example :

CustomerID	CustomerName	Status
1	Google	Active
2	Amazon	Active
3	Apple	Inactive

Customer

InvoiceNo	CustomerID	Amount
1	1	\$100
2	1	\$200
3	2	\$150

Billing

- In the above example, we have 2 relations, Customer and Billing.
- Tuple for CustomerID =1 is referenced twice in the relation Billing. So we know CustomerName=Google has billing amount \$300

Advantages of Relational Database Model

- **Simplicity:** A Relational data model in DBMS is simpler than the hierarchical and network model.
- **Easy to use:** The Relational model in DBMS is easy as tables consisting of rows and columns are quite natural and simple to understand
- **Data independence:** The Structure of Relational database can be changed without having to change any application



Database Management Systems

LECTURE -1

END