18CSC303J -Database Management Systems

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S-1 SLO-1 : What is Database Management System ?

Data : It is a RAW FACT (It won't give any meaning)

Ex: 10, RAM, etc.

Information : Which gives meaning for Data

Ex: id = 10 , name = 'RAM' Distance in miles = 200, etc.

Database : Collection of meaningful interrelated information

Ex: DB2,ORACLE, SQL Server, MySQL, etc.

Database Management System (DBMS) :

- Database Management Systems (DBMS) are software systems used to store, retrieve, and run queries on data which is stored in a database.
- A DBMS serves as an interface between an end-user and a database, allowing users to create, read, update, and delete data in the database.
- DBMS manage the data, the database engine, and the database schema, allowing for data to be manipulated or extracted by users and other programs.
- This helps provide data security, data integrity, concurrency, and uniform data administration procedures.

S-1 SLO-2 : Advantage of DBMS over File Processing System

What is File Processing / Management System?

A File Processing / Management system is a DBMS that allows access to single files or tables at a time. In a File System, data is directly stored in set of files.

It contains flat files that have no relation to other files (when only one table is stored in single file, then this file is known as flat file).

Limitations of File Processing System

- ✓ Data redundancy
- ✓ Data inconsistency
- ✓ Data Isolation
- ✓ Data Dependency on application programs
- ✓ Atomicity
- ✓ Data Security

S-1 SLO-2 : Advantage of DBMS over File Processing System

Advantage of DBMS over file system

- ✓ No redundant data
- ✓ Data Consistency and Integrity
- ✓ Data Concurrency
- ✓ Data Security
- ✓ Data Privacy
- ✓ Easy access to data
- ✓ Data Recovery
- ✓ Flexible

S-2 SLO-1 :Introduction and applications of DBMS

DBMS stands for Database Management System.

- ✓Database is collection of meaningful interrelated information.
- ✓DBMS is a collection of set of programs to store and access data in an easy and effective manner from a database.

Need for DBMS:

- ✓Database systems are developed to deal huge amount of data.
- ✓Data to be stored and retrieved for data processing in an effective manner.

S-2 SLO-1 :Introduction and applications of DBMS

Why use DBMS

- To develop software applications In less time.
- Data independence and efficient use of data.
- For uniform data administration.
- For data integrity and security.
- For concurrent access to data, and data recovery from crashes.
- To use user-friendly declarative query language

S-2 SLO-1 :Introduction and applications of DBMS

Applications of DBMS

Domain	Usage of DBMS
Banking	Managing customer information, account activities, payments, deposits, loans, etc.
Transportation	Maintain and Manage the Passenger Manifesto, reservations and schedule information.
Universities	Student information, course registrations, colleges and grades.
Telecommunication	It helps to keep call records, monthly bills, maintaining balances, etc.
Finance	For storing information about stock, sales, and purchases of financial instruments like stocks and bonds.
Sales	To store customer details , product details & sales information.
Manufacturing	It is used for the management of supply chain and for tracking production of items. Inventories status in warehouses.
Social Media	Manage the user accounts, Security, Data access

S-2 SLO-2 :Purpose of database system

Purpose of DBMS:

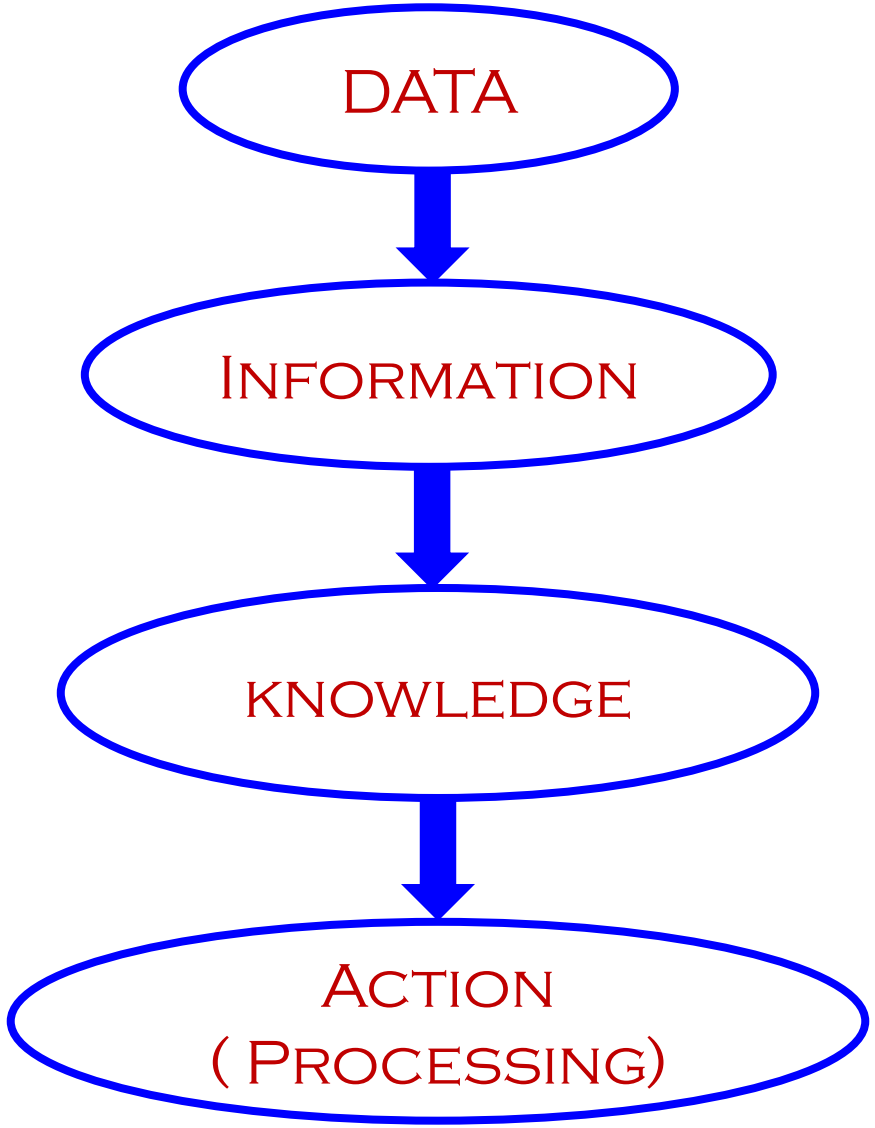
The purpose of DBMS is to transform the following –

- ✓ Data into information.
  - Raw fact is converted into Meaningful information
  - For Example:
    - The data ‘1000’ is converted into INR = ‘1000’
- ✓ Information into knowledge.
  - Using the information or comparing the information , can easily develop knowledge
  - For Example:
    - INR 75 = 1 USD
    - INR100 = 1.17 EURO
- ✓ Knowledge to the action.
  - Can predict the USD , EURO value in the mere future from history of information
  - In 1900 what is the equivalent of INR for USD
  - In 1950, 2000, etc.,
    - What will be the equivalent value in 2030?

S-2 SLO-2 :Purpose of database system

Purpose of DBMS:

The diagram given explains the process as to how the transformation of data to information to knowledge to action happens respectively in the DBMS



S-3 SLO-1 & SLO2 :Views of data

Data Abstraction

- ✓Data Abstraction is a process of hiding unwanted or irrelevant details from the end user.
- ✓Data abstraction has different views and support in attaining data independence which is used to enhance the security of data.
- ✓The database systems consist of complicated data structures and relations.

  - To make the easy access of data by the users the complications are kept hidden and the remaining part of the database is accessible to the them through data abstraction

S-3 SLO-1 & SLO2 :Views of data

Levels of Abstraction

Physical level: describes how a record (e.g., student) is stored.

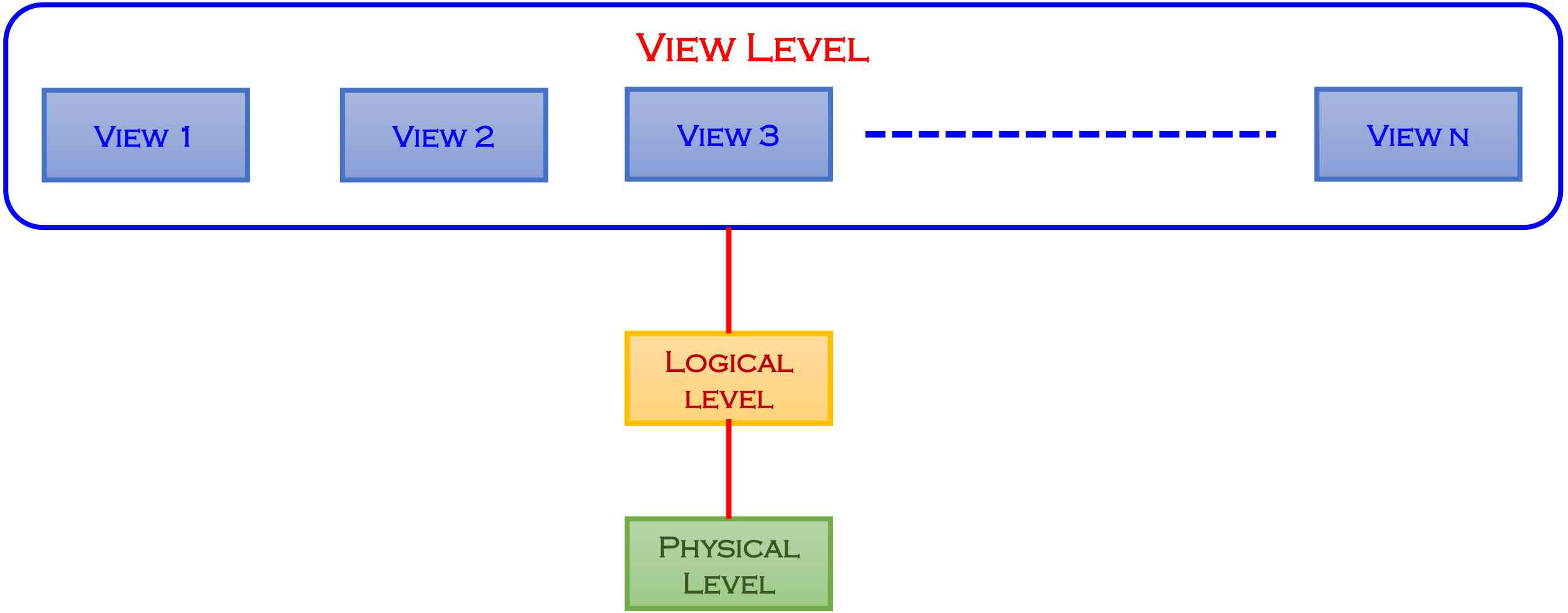
Logical level: describes data stored in database, and the relationships among the data.

```
type student = record
        student_reg_number : integer;
        student_name : string;
        student_degree : string;
        customer_mobile : integer;
        student_email : string
end;
```

View level: application programs hide details of data types. Views can also hide information (such as an student's mobile number /email) for security purposes.

S-3 SLO-1 & SLO2 :Views of data

View of Data



S-3 SLO-1 & SLO2 :Views of data

Instances and Schemas

Schema – the logical structure of the database

Example: The database consists of information about a set of students and departments and the relationship between them

There are two types of schemas are available in database

1. Physical Schema (Database design at physical level and relates with physical structure)

   Datafiles, Control file, Redolog files, Tablespaces, Datablocks, Segments, Extents

2. Logical Schema (Database design at logical level and relates with logical structures)

   Tables, Views, Synonyms, Indexes, Clusters, Sequences

S-3 SLO-1 & SLO2 :Views of data

Instances and Schemas

Instance – The actual content of the database at a particular point in time

Physical Data Independence – The ability to modify the physical schema without changing the logical schema

- Applications depend on the logical schema
- In general, the interfaces between the various levels and components should be well defined so that changes in some parts do not seriously influence others.

S-3 SLO-1 & SLO2 :Views of data

Data Models

- Data models is , a collection of tools for describing Data and its relationships, Semantics and Constraints
- There are different types of data models are available in DBMS
  - Relational model
  - Entity-Relationship data model (mainly for database design)
  - Object-based data models (Object-oriented and Object-relational)
  - Semi structured data model (XML)
  - Other older models:
    - Network model
    - Hierarchical model

S 4-5 SLO-1 & SLO-2 : Lab 1: SQL Data Definition Language Commands on sample exercise

Structured Query Language (SQL)

- ✓SQL became a standard of the American National Standards Institute (ANSI) in 1986, and of the International Organization for Standardization (ISO) in 1987
- ✓Common language for all Databases
- ✓Fourth generation Language
- ✓Non procedural Language
- ✓Commands like an normal English statements
- ✓SQL is not a case sensitive language
- ✓All SQL statements should ended with terminator , the default terminator is semi-colon (;)
- ✓Based on the operation SQL divided into three categories
  - DDL (Data Definition Language)
  - DML (Data Manipulation Language)
  - DCL (Data Control Language)

S 4-5 SLO-1 & SLO-2 : Lab 1: SQL Data Definition Language Commands on sample exercise

Data types in SQL (ORACLE)

- ✓CHAR
- ✓VARCHAR2
- ✓NUMBER
- ✓DATE
- ✓RAW
- ✓LONG
- ✓CLOB
- ✓BLOB , etc.,

S 4-5 SLO-1 & SLO-2 : Lab 1: SQL Data Definition Language Commands on sample exercise

Data Definition Language (DDL)

- ✓ DDL is the subset of SQL and part of DBMS
- ✓ DDL relates only with base tables structure and it is no where relates with the information stored in the table.
- ✓ **Note : All the DDL command statements are AUTO COMMIT Statements**
- ✓ DDL consists of the following commands
  - CREATE
  - ALTER
  - DROP
  - TRUNCATE

S 4-5 SLO-1 & SLO-2 : Lab 1: SQL Data Definition Language Commands on sample exercise

CREATE COMMAND

Used to create a new object / schema with a defined structure

Syntax :

```
CREATE TABLE table_name (
    column1 datatype,
    column2 datatype,
    column3 datatype,
   ....
);
```

Example :

```
CREATE TABLE EMP
      (EMPNO NUMBER(4) NOT NULL,  ENAME VARCHAR2(10),  JOB VARCHAR2(9),
       MGR NUMBER(4), HIREDATE DATE, SAL NUMBER(7, 2), COMM NUMBER(7, 2),
       DEPTNO NUMBER(2));
```

S 4-5 SLO-1 & SLO-2 : Lab 1: SQL Data Definition Language Commands on sample exercise

ALTER COMMAND

✓Alter command used to modify the base table structure

✓Using this command

- a new column can be added with restrictions
- column data width can be increased / decreased with restrictions
- a column can be dropped

✓Two key words are using in this command

- ADD
- MODIFY

S 4-5 SLO-1 & SLO-2 : Lab 1: SQL Data Definition Language Commands on sample exercise

ALTER COMMAND

SYNTAX

ALTER TABLE table_name ADD / MODIFY column_name datatype;

EXAMPLE 1: To add a new column in a table

ALTER TABLE emp ADD phone_no number(10);

EXAMPLE 2 : TO modify the existing column data width

ALTER TABLE emp MODIFY phone_no number(13);

S 4-5 SLO-1 & SLO-2 : Lab 1: SQL Data Definition Language Commands on sample exercise

ALTER COMMAND

Syntax to DROP a column

ALTER TABLE table_name DROP column column_name;

Example :

ALTER TABLE emp DROP column phone_no;

S 4-5 SLO-1 & SLO-2 : Lab 1: SQL Data Definition Language Commands on sample exercise

DROP COMMAND

It is used to remove the base table with records (information) from database permanently.

Syntax:

DROP TABLE table_name ;

Example:

DROP TABLE emp;

TRUNCATE COMMAND

Truncate command used to delete the records (information) from the base table permanently and keeps the structure of the base table alone

Syntax:

```
TRUNCATE TABLE table_name;
```

Example:

```
TRUNCATE TABLE emp;
```

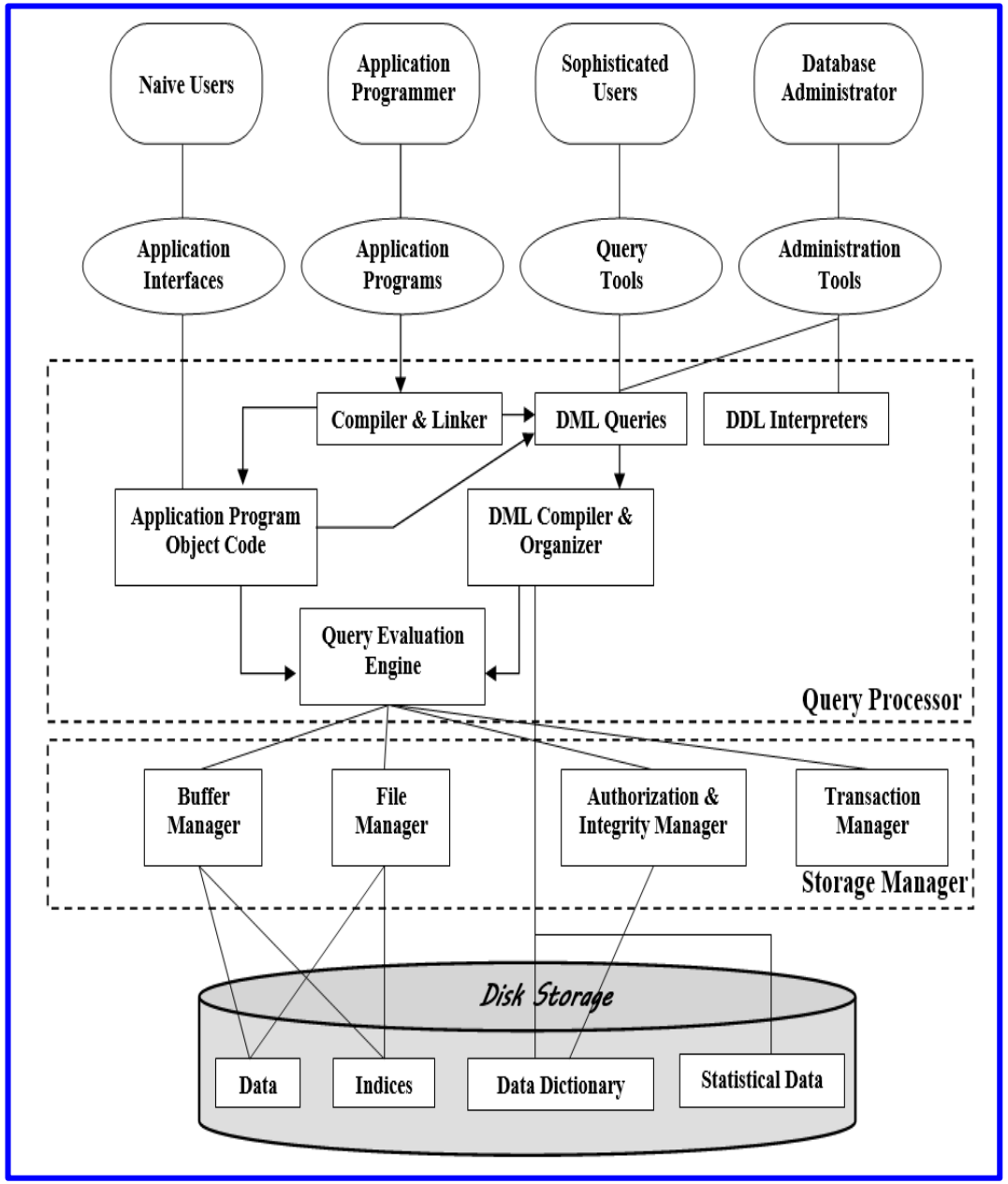
S-6 SLO-1 & SLO-2 : DATABASE SYSTEM ARCHITECTURE

There are four types users accessing / managing the database

- ✓ Naïve Users
- ✓ Application Programmers
- ✓ Sophisticated Users
- ✓ Database Administrators

The database system is divided into three components:

- ✓ Query Processor
- ✓ Storage Manager
- ✓ Disk Storage.



S-6 SLO-1 & SLO-2 : DATABASE SYSTEM ARCHITECTURE

Query Processor :

It interprets the requests (queries) from user(s) via an application program /interface into instructions.

It also executes the user request which is received from the DML compiler.

Query Processor contains the following components

Name of the Component	Purpose of the component
DML Compiler	It processes the DML statements into low level instruction
DDL Interpreter	It processes the DDL statements into a set of table containing meta data
Embedded DML Pre-compiler	It processes DML statements embedded in an application program into procedural calls.
Query Optimizer	It executes the instruction generated by DML Compiler.

S-6 SLO-1 & SLO-2 : DATABASE SYSTEM ARCHITECTURE

Storage Manager :

- ✓It is an interface between the information stored in the database an and the requests (queries)
- ✓It is also known as Database Control System
- ✓It maintains the consistency and Integrity
- ✓The main responsibility is managing the data manipulation such as addition deletion, modification , etc.,

S-6 SLO-1 & SLO-2 : DATABASE SYSTEM ARCHITECTURE

Storage Manager contains the following components

COMPONENTS	PURPOSE OF THE COMPONENTS
Authorization Manager	It ensures role-based access control, i.e,. checks whether the particular person is privileged to perform the requested operation or not.
Integrity Manager	It checks the integrity constraints when the database is modified.
Transaction Manager	It controls concurrent access by performing the operations in a scheduled way that it receives the transaction. Thus, it ensures that the database remains in the consistent state before and after the execution of a transaction.
File Manager	It manages the file space and the data structure used to represent information in the database.
Buffer Manager	It is responsible for cache memory and the transfer of data between the secondary storage and main memory.

Disk Storage

- ✓Used to store all the information
- ✓It contains the following components

Components	Purpose of the Components
Data Files	It stores the data.
Data Dictionary	It contains the information about the structure of any database object. It is the repository of information that governs the metadata.
Indices	It provides faster retrieval of data item.
Statistical Data	Contains the statistics of all information

S-7 SLO-1 & SLO-2 : Data Independence

✓Data Independence is an important property of DBMS and also an advantage.

✓There are three levels in database:

1. Physical level / Low level (Disk storage)
2. Conceptual level (query / procedure / logics / etc.,)
3. Logical level / View level (User Interface)

✓Data Independence is used to achieve the changes in physical level without affecting logical level and vice versa.

✓There are two types of Data Independence in DBMS:

1. Physical Data Independence
2. Logical Data Independence

S-7 SLO-1 & SLO-2 : Data Independence

Need of Data Independence

- ✓To improve the quality of data
- ✓Easy maintenance of DBMS
- ✓To achieve database security
- ✓Developer need not be worry about internal structure
- ✓Easily making the changes in physical level to improve the performance

S-7 SLO-1 & SLO-2 : Data Independence

Physical Data Independence

It is defined as to make the changes in the structure of the physical level /low level of DBMS without affecting the logical level / view level.

Some of the changes in Physical level

- ✓Changing the storage devices
- ✓Changing the file organization techniques
- ✓Changing the data structures
- ✓Changing the data access method
- ✓Modifying indexes
- ✓Migrating the Database from one drive to another

S-7 SLO-1 & SLO-2 : Data Independence

Logical Data Independence

It is defined as to make the changes in the structure of the logical level / view level of DBMS without affecting the physical / low level.

Some of the changes in Logical level

- ✓ Add a new attribute in an entity set
- ✓ Modify / Delete an attribute
- ✓ Merging records
- ✓ Splitting records

S-7 SLO-1 & SLO-2 : Data Independence

Difference between physical data independence and logical data independence

PHYSICAL DATA INDEPENDENCE	LOGICAL DATA INDEPENDENCE
Concerned with the storage of the data.	Concerned with the structure of data definition.
Easy to retrieve	Difficult to retrieve because of dependent on logical structure
Easy to achieve, compare with logical data independence	Difficult to achieve, compare with physical data independence
Concerned with physical schema	Concerned with logical schema

S-8 SLO-1 & SLO-2 : The evolution of Data Models

To come across the limitations of file systems, there are lot of researchers and software developers designed and developed various data models.

The important and widely accepted models are:

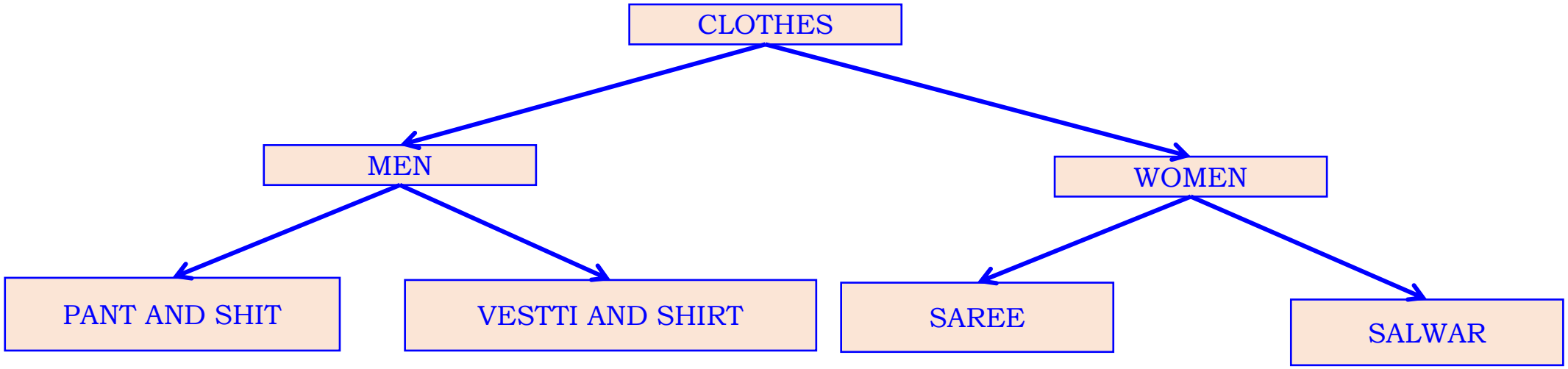
- ✓Hierarchical
- ✓Network
- ✓Entity relationship
- ✓Relational
- ✓Object oriented

S-8 SLO-1 & SLO-2 : The evolution of Data Models

Hierarchical Model

- ✓ The first and fore most model of the DBMS.
- ✓ This model organizes the data in the hierarchical tree structure.
- ✓ This model is easy to understand with real time examples site map of a website

Example : For example the following is the representation of relationships present on online clothes shopping



S-8 SLO-1 & SLO-2 : The evolution of Data Models

Features of a Hierarchical Model

- ✓ One-to-many relationship:
- ✓ Parent-Child Relationship
- ✓ Deletion Problem:
- ✓ Pointers

Advantages of Hierarchical Model

- ✓ Simple and fast traversal because of using tree structure
- ✓ Changes in parent node automatically reflected in child node

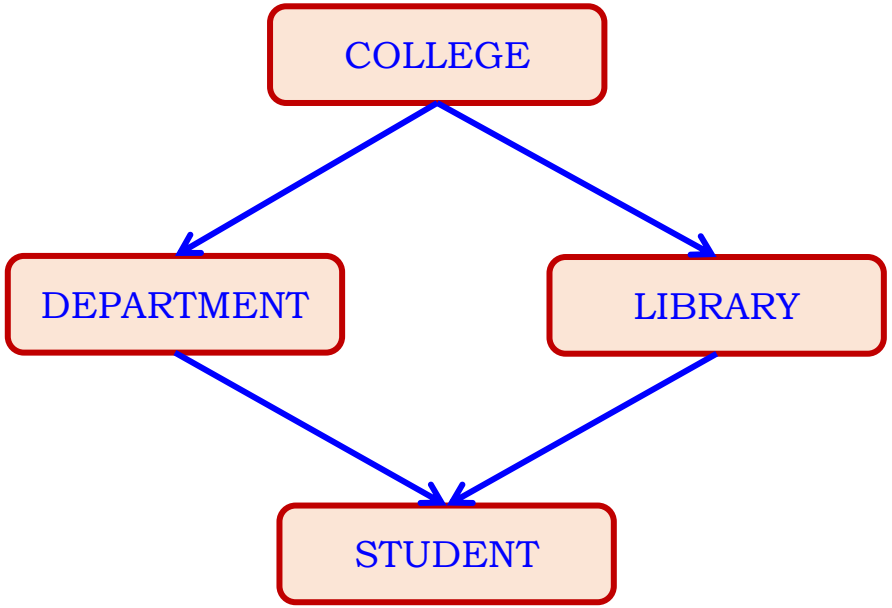
Disadvantages of Hierarchical Model

- ✓ Complexity
- ✓ Parent mode deleted automatically child node will be deleted

S-8 SLO-1 & SLO-2 : The evolution of Data Models

Network Model

- ✓ Network model is an extension of hierarchical model.
- ✓ This model was recommended as the best before relationship model.
- ✓ Same like hierarchical model, the only difference between these two models are a record can have more than one parent
- ✓ For Example consider the following diagram a student entity has more than one parent



S-8 SLO-1 & SLO-2 : The evolution of Data Models

Features of a Network Model

- ✓ Manage to Merge more Relationships
- ✓ More paths
- ✓ Circular Linked List

Advantages of Network Model

- ✓ Data access is faster
- ✓ Because of parent child relationship , the changes in parent reflect in child

Disadvantages of Network Model

- ✓ More complex because of more and more relations

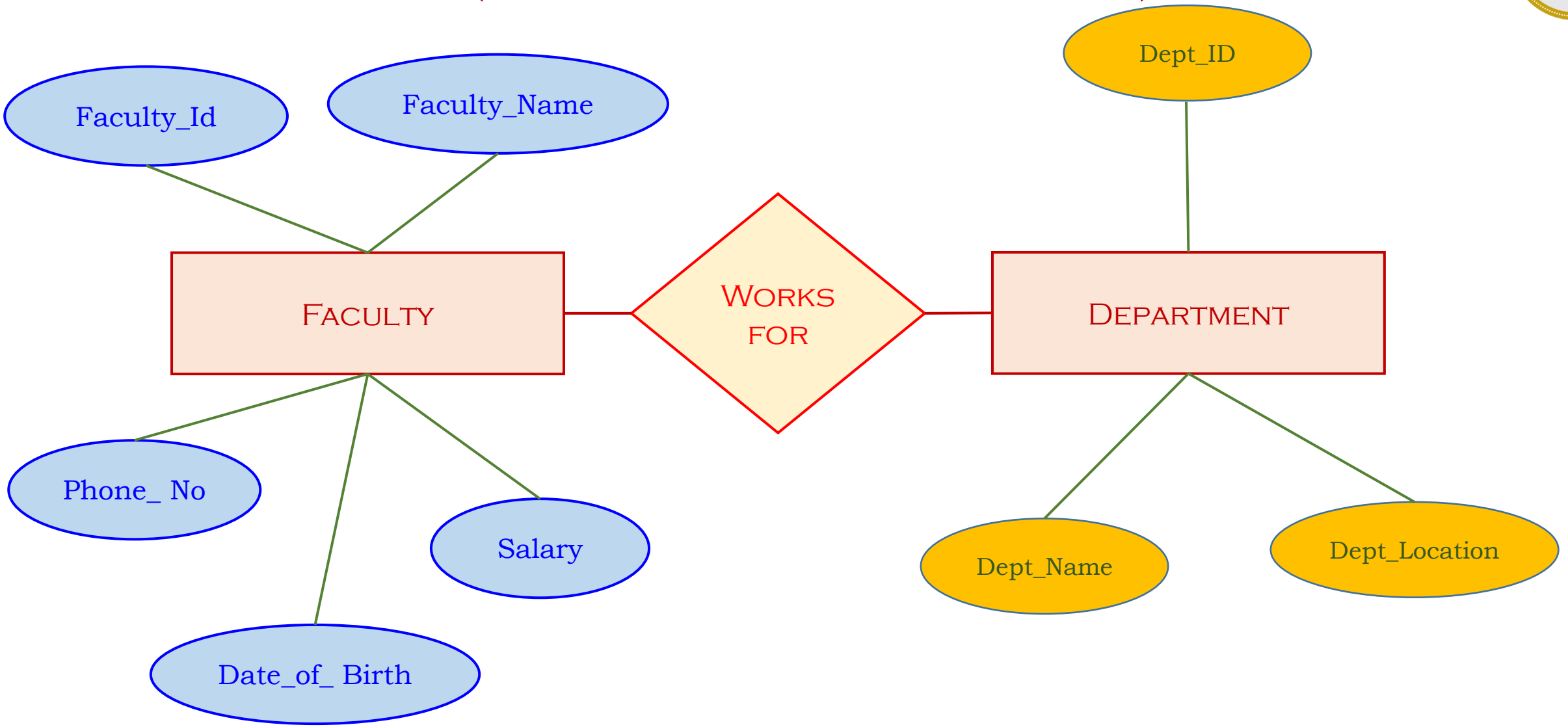
S-8 SLO-1 & SLO-2 : The evolution of Data Models

Entity-Relationship Model (ER Model)

- ✓ This model is a high level data model
- ✓ Represents the real – world problem as a pictorial representation
- ✓ Easy to understand by the developers about the specification
- ✓ It is like a visualization tool to represent a specific database
- ✓ It contains three components
  1. Entities
  2. Attributes
  3. Relationships

S-8 SLO-1 & SLO-2 : The evolution of Data Models

Example for ER Diagram (Faculty and Department entity set)



S-8 SLO-1 & SLO-2 : The evolution of Data Models

In the above example:

- ✓There are two entities , Faculty and Department
- ✓The attributes of Faculty entities are
  - Faculty_Id
  - Faculty_Name
  - Phone_No
  - Date_of_birth
  - Salary
- ✓The attributes of Department entities are
  - Dept_ID
  - Dept_Name
  - Dept_Location
- ✓Relationship : Faculty works for a department

S-8 SLO-1 & SLO-2 : The evolution of Data Models

Features of ER Model

- ✓ Graphical representation
- ✓ Visualization
- ✓ Good Database design (Widely used)

Advantages of ER Model

- ✓ Very Simple
- ✓ Better communication
- ✓ Easy to convert to any model

Disadvantage of ER Model

- ✓ No industry standard
- ✓ Hidden information

S-8 SLO-1 & SLO-2 : The evolution of Data Models

Relational Model

- ✓ Widely used model
- ✓ Data are represented as row-wise and column-wise (2 Dimensional Array)

Example : EMP (Employee) Table

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800	-	20
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7566	JONES	MANAGER	7839	02-APR-81	2975	-	20
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850	-	30
7782	CLARK	MANAGER	7839	09-JUN-81	2450	-	10
7788	SCOTT	ANALYST	7566	09-DEC-82	3000	-	20
7839	KING	PRESIDENT	-	17-NOV-81	5000	-	10
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7876	ADAMS	CLERK	7788	12-JAN-83	1100	-	20
7900	JAMES	CLERK	7698	03-DEC-81	950	-	30
7902	FORD	ANALYST	7566	03-DEC-81	3000	-	20
7934	MILLER	CLERK	7782	23-JAN-82	1300	-	10

S-8 SLO-1 & SLO-2 : The evolution of Data Models

Relational Model

- ✓ Each row is known as RECORD or TUPLE
- ✓ Each Column is known as ATTRIBUTE or FILED
- ✓ The collection of attributes are called as record – An Entity
- ✓ The collection of records are called as Table – Entity Set
- ✓ In the above example:

  Table – EMP

  Attributes – Empno, Ename, Sal,….

S-8 SLO-1 & SLO-2 : The evolution of Data Models

Features of Relational Model

- ✓ Records
- ✓ Attributes

Advantages of Relational Model

- ✓ Simple
- ✓ Scalable
- ✓ Structured format
- ✓ Isolation

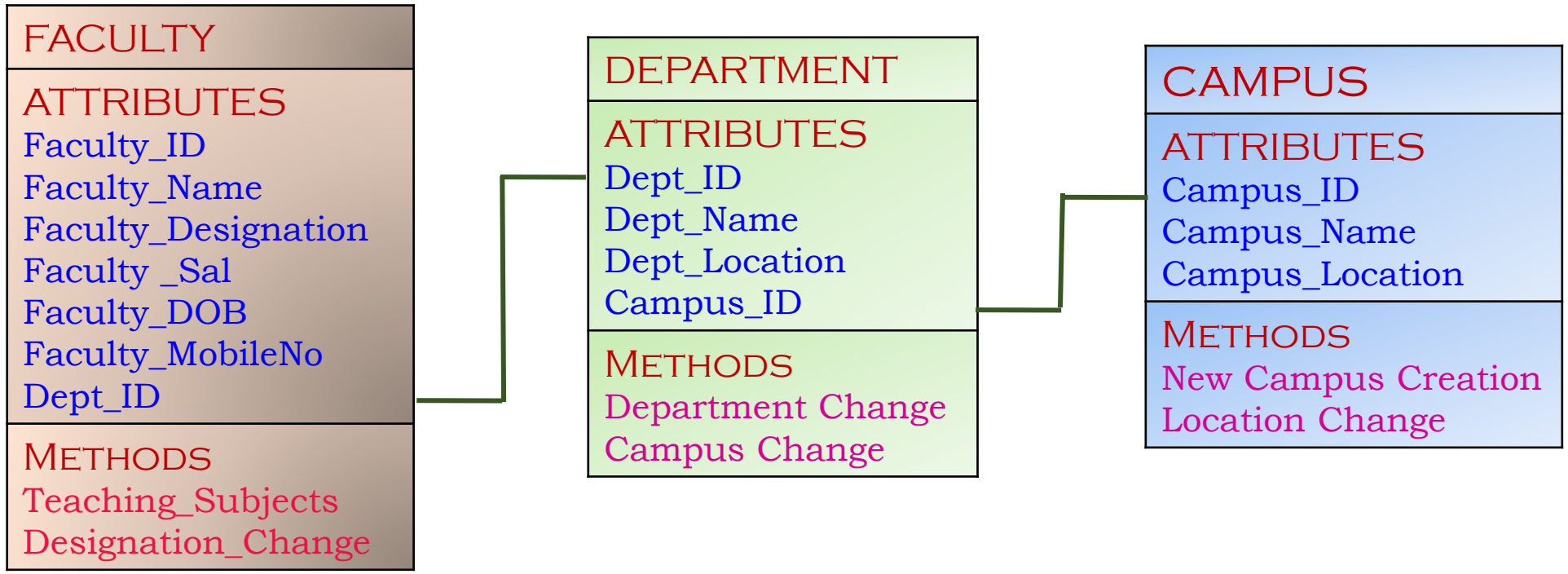
Disadvantages of Relational Model

- ✓ Hardware overheads

S-8 SLO-1 & SLO-2 : The evolution of Data Models

Object Oriented Model

- ✓ The real- time problems are easily represented through object-oriented data model which is an OBJECT.
- ✓ In this Model, the data and its relationship present in the single structure
- ✓ Complex data like images, audio, videos can be stored easily
- ✓ Objects connected through links using common attribute(s)
- ✓ Example : Three Objects Faculty, Department and Campus linked using common attribute



S-9-10 SLO-1 & SLO-2 :

Lab 2: SQL Data Manipulation Language Commands

Consider EMP table for DML operations

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPT NO
7369	SMITH	CLERK	7902	17-DEC-80	800	-	20
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7566	JONES	MANAGER	7839	02-APR-81	2975	-	20
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850	-	30
7782	CLARK	MANAGER	7839	09-JUN-81	2450	-	10
7788	SCOTT	ANALYST	7566	09-DEC-82	3000	-	20
7839	KING	PRESIDENT	-	17-NOV-81	5000	-	10
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7876	ADAMS	CLERK	7788	12-JAN-83	1100	-	20
7900	JAMES	CLERK	7698	03-DEC-81	950	-	30
7902	FORD	ANALYST	7566	03-DEC-81	3000	-	20
7934	MILLER	CLERK	7782	23-JAN-82	1300	-	10

S-9-10 SLO-1 & SLO-2 : Lab 2: SQL Data Manipulation Language Commands

DML Commands are relates only with base table information (value in an attribute)

There are four commands in DML:

1. INSERT
2. UPDATE
3. DELETE
4. SELECT
   - ✓ Where clause (Conditional retrieval)
   - ✓ Order by clause (Retrieval in Ascending or Descending Order)
   - ✓ Group by clause (Retrieval of distinct values by considering groups)
   - ✓ Having clause (Followed by Group by clause with COUNT function)

SLO-1 & SLO-2 :
Lab 2: SQL Data Manipulation Language Commands

INSERT COMMAND

- ✓ It relates only with new records.
- ✓ Only one row can be inserted at a time
- ✓ Multiple rows can be inserted using “&” symbol one by one
- ✓ Can insert to entire table
- ✓ Can insert in selected columns with some restrictions
- ✓ Must follow the order of the column specified in the query statement

SLO-1 & SLO-2 : Lab 2: SQL Data Manipulation Language Commands

INSERT COMMAND

Syntax:

```
INSERT INTO <table_name> (column_name1 <datatype>,
                          column_name2 <datatype>,
                          . . . ,
                          column_name_n <datatype>)
                VALUES
                          (value1,
                           value2,
                           . . . ,
                          value n);
```

Note :

- Number values can be inserted as integer or float
- Char and Date values must be in single quote

SLO-1 & SLO-2 :
Lab 2: SQL Data Manipulation Language Commands

INSERT COMMAND

Example 1: To insert a record using all fields in EMP table

```
INSERT INTO EMP VALUES (7369, 'SMITH',  'CLERK', 7902, '17-12-1980', 800, NULL, 20);
                              (OR)
INSERT INTO EMP (EMPNO,ENAME,JOB,MGR,HIREDATE,SAL,COMM,DEPTNO)
VALUES (7369, 'SMITH',  'CLERK', 7902, '17-12-1980',  800, NULL, 20);
```

Example 2: To insert a record using selected fields in EMP table

```
INSERT INTO EMP (EMPNO, ENAME) VALUES (7499, 'ALLEN);
```

NOTE : When a record is inserted using selected fields, it must include NOT NULL and Primary key fields.

SLO-1 & SLO-2 :
Lab 2: SQL Data Manipulation Language Commands

Example 3: To insert multiple records using all fields in EMP table

```
INSERT INTO EMP values
(&EMPNO,'&ENAME','&JOB',&MGR,'&HIREDATE',&SAL,&COMM,&DEPTNO) ;
```

NOTE : '&' (Ampersand) symbol used to ask
Enter value for followed by the string during runtime.

The input value will be store in the appropriate field using bind variable (:OLD and :NEW)

S-9-10 SLO-1 & SLO-2 : Lab 2: SQL Data Manipulation Language Commands

Update command

- ✓ It works with only existing records
- ✓ It works only column wise
- ✓ It is used to modify the column values (increase / decrease / change)

Syntax

UPDATE <table_name> set <field_name> = value [where <condition>];

Note : Update command without where condition will update all the records.

Update command with where condition will update the records which are satisfy the condition

Example 1:

UPDATE emp set comm = 2000 ; (Update all the records in EMP table)

Example 2 :

Update emp set comm = 1000 where empno = 7369;

(Update the records having the empno as 7369)

SLO-1 & SLO-2 : Lab 2: SQL Data Manipulation Language Commands

Delete command

- ✓ It works only with existing records
- ✓ It works only with row wise
- ✓ It not possible to delete a single column in a row

Syntax

DELETE from <table_name> [where <condition>];

Note : Delete command with out where condition will delete all the records in the table.

Delete command with where condition will delete the selected records which are satisfy the condition.

Example 1: DELETE from emp; (All records will be deleted from emp)

Example 2: DELETE from emp where empno = 7369;

(Those records holding the value in the field empno as 7369 will be deleted)

SLO-1 & SLO-2 :
Lab 2: SQL Data Manipulation Language Commands

SELECT COMMAND

- ✓Works with existing records
- ✓Works with row wise and column wise
- ✓Works with multiple tables
- ✓Never affect / change / update / modification in the data base
- ✓Using this command , we can select a column , multiple columns, all columns, single row, multiple row, all rows
- ✓Specially called as “QUERY STATEMENT”

SLO-1 & SLO-2 :
Lab 2: SQL Data Manipulation Language Commands

SELECT COMMAND

Syntax

```
SELECT column_list FROM table-name
                        [WHERE Clause]
                        [GROUP BY clause]
                        [HAVING clause]
                        [ORDER BY clause];
```

NOTE : To retrieve all the column from the table ‘ * ’ symbol can be used instead of specifying the column_list.

S-9-10 SLO-1 & SLO-2 : Lab 2: SQL Data Manipulation Language Commands

SELECT COMMAND

Example 1: To retrieve all the columns and rows from emp table

SELECT * from emp; ('*' stands from all columns and rows)

Example 2: To select retrieve the specific columns from all rows

SELECT empno,ename from emp;

Select command with where clause

Example 3: To retrieve the records from emp table which record holds the salary value greater than 1000;

SELECT * from emp WHERE sal> 1000;

Example 4: To retrieve the columns empno and ename from emp table which records holds the value as CLERK in job column.

SELECT empno, ename from emp WHERE job = 'CLERK'

SLO-1 & SLO-2 :
Lab 2: SQL Data Manipulation Language Commands

SELECT COMMAND

Select command with order by clause

Example 5 : To retrieve the records from emp table in ascending order using empno

SELECT * from emp order by empno asc;

(OR)

SELECT * from emp order by empno;

Example 6: To retrieve the records from emp table in ascending order using job and empno

SELECT * from emp order by job,empno asc;

(OR)

SELECT * from emp order by job,empno;

NOTE : Ascending order is default condition, no need to specify

SELECT COMMAND

SELECT COMMAND WITH ORDER BY CLAUSE

EXAMPLE 7 : To retrieve the records from emp table in descending order using empno.

```
SELECT * from emp order by empno desc;
```

EXAMPLE 8: To retrieve the records from emp table in descending order using job and empno

```
SELECT * from emp order by job desc,empno desc;
```

EXAMPLE 8: To retrieve the records from emp table in ascending order using job and descending order empno

```
SELECT * from emp order by job asc,empno desc;
```

SELECT COMMAND

SELECT COMMAND WITH GROUP BY CLAUSE

EXAMPLE 9: To retrieve the different jobs from emp table

SELECT job from emp group by job;

EXAMPLE 10: To retrieve the different jobs and its average salary from emp table

SELECT job, avg(sal) from emp group by job;

SELECT COMMAND WITH GROUP BY AND HAVING CLAUSE

EXAMPLE 11: To retrieve the different jobs from emp table where the total numbers in a group is greater than 2;

SELECT job from emp group by job having count(job) >2;

NOTE : Count is built-in group function

S-11 SLO-1 & SLO-2 : Degrees of Data Abstraction

- ✓Data abstraction is the idea that a database design begins with a high level view and as it approaches implementation level, the level of detail increases.
- ✓In 1970, the American National Standards Institute (ANSI) Standards Planning and Requirements Committee (SPARC) established a framework for database design based on the degrees of abstraction.
- ✓The ANSI/SPARC architecture is composed of four levels of data abstraction; these levels are external, conceptual, internal, and physical

Reference : https://databasemanagement.fandom.com/wiki/Degrees_of_Abstraction

S-11 SLO-1 & SLO-2 : Degrees of Data Abstraction

- ✓The External Model is the end users' view of the data. The end users view of data usually applies to their specific business needs and those of their organizational unit.

- ✓The Conceptual Model is the database as seen by the specific DBMS. What sets the internal model apart from the external and conceptual is its reliance on its software platform.

- ✓The goal in designing the internal model is to achieve logical independence, where the internal model can be changed without affecting conceptual model.

Reference : https://databasemanagement.fandom.com/wiki/Degrees_of_Abstraction

S-11 SLO-1 & SLO-2 : Degrees of Data Abstraction

✓ The Physical Model is the final and lowest level of abstraction. This is the model which describe such implementation level design as how the data is stored on media and what media to use. This level of abstraction is reliant on software and hardware.

Note:

- If the rules established by the ANSI/SPARC are followed, the database is easily scalable and upgradeable.
- A common need is for the ease of upgradability in the physical model.
- As technology improves and as the database grows and needs more processing power and space it is important to be able to upgrade the hardware without worrying about needing to redesign parts or the entire database.

Reference : https://databasemanagement.fandom.com/wiki/Degrees_of_Abstraction

S-12 SLO-1 & SLO-2 : Database Users and DBA

Database Users

- ✓Naive Users
- ✓Application Programmers
- ✓Sophisticated Users
- ✓Native Users
- ✓Specialized Users
- ✓Stand-alone Users

S-12 SLO-1 & SLO-2 : Database Users and DBA

Naive Users

- ✓ Those who don't have any knowledge about DBMS
- ✓ Use DBMS applications frequently
- ✓ Mostly using the internet browser as an interface to access the database
- ✓ They don't have any privileges to modify the database, simply use the application
- ✓ Example : Railway booking users, Clerks in bank accessing database

Application Programmers

- ✓ Users who develop DBMS applications.
- ✓ They are backend programmers
- ✓ Programs can be written in any programming languages like C++, JAVA, Python, PHP

S-12 SLO-1 & SLO-2 : Database Users and DBA

Sophisticated Users

- ✓ Having knowledge about database and DBMS
- ✓ They can create their own applications based on requirements
- ✓ They don't write codes in any programming languages, but able to manage using queries
- ✓ Example : Business Analyst, Researchers

Native Users

- ✓ These are the users, who use the existing database applications
- ✓ They don't write any codes or queries
- ✓ Example: Library Management Systems, Inventory Control Systems

S-12 SLO-1 & SLO-2 : Database Users and DBA

Specialized Users

- ✓ These are also sophisticated users, but they write special database application programs.
- ✓ They are the developers who develop the complex programs to the requirement.

Stand-alone Users

- ✓ These users will have a stand-alone database for their personal use.
- ✓ These kinds of the database will have readymade database packages which will have menus and graphical interfaces.

S-12 SLO-1 & SLO-2 : Database Users and DBA

Database Administrator (DBA)

- ✓ DBA is a person or a group who define and manage the database in all three levels.
- ✓ DBA can create / modify /remove the users based on the requirements.
- ✓ DBA is the super user having all the privileges of DBMS

Responsibilities of DBA

- ✓ Install the Database
- ✓ Upgrade the Database
- ✓ Design and Implementation
- ✓ Database tuning
- ✓ Migrating the Database
- ✓ User Management
- ✓ Backup and Recovery
- ✓ Security of the Database in all access points
- ✓ Documentation

S-13 SLO-1 & SLO-2 : Database Languages

The common language is Structured Query Language

It is categorized into three types based on operations

- ✓Data Definition Language (DDL) – To specify the database schema
- ✓Data Manipulation Language (DML) – To express the database queries and updates.
- ✓Data Control Language (DCL) - To manage the database operations

S-13 SLO-1 & SLO-2 : Database Languages

Data Definition Language (DDL)

- ✓ Can specify the storage structure and access methods used by the database system by a set of statements in a special type of DDL called a data storage and definition language.

- ✓ The values stored in a database must satisfy certain constraints to maintain consistency and reliability

S-13 SLO-1 & SLO-2 : Database Languages

Data Definition Language (DDL)

Different types of constraints

- ✓ Domain Constraints
  - Data types , Not Null, Check ,Unique, Primary key
- ✓ Referential Integrity constraints
  - Foreign key
- ✓ Assertions
  - Any condition that the database must satisfy.
  - Domain and Referential Integrity constraints are special forms of assertion.
- ✓ Authorization
  - User Authorization
  - Read Authorization
  - Insert Authorization
  - Update Authorization
  - Delete Authorization

Note : The output of the DDL will be stored in Data Dictionary which contains all the details about the data, like meta-data

S-13 SLO-1 & SLO-2 : Database Languages

Data Manipulation Language

✓Enables users to access or manipulate data as organized by the appropriate data model.

✓The followings are the different types of access

- Retrieval of information stored in the database (SELECT)
- Insertion of new information into the database (INSERT)
- Deletion of information from the database (DELETE)
- Modification of information stored in the database (UPDATE)

✓There are basically two types:

- Procedural DMLs require a user to specify what data are needed and how to get those data.
- Declarative DMLs (also referred to as nonprocedural DMLs) require a user to specify what data are needed without specifying how to get those data.

S-14-15SLO-1 & SLO-2 : Lab 3: SQL Data Control Language commands and Transaction control commands to the sample exercises

Data Control Languages

✓Used to give / get back / control the privileges of an object by the owner

GRANT : To give access privileges of an object to other user by the owner

Syntax : GRANT [ALL / INSERT /UPDATE /DELETE /SELECT]

on <OBJECT_NAME> to <USER_NAME>;

Example: GRANT all on emp to scott;

REVOKE : To get back all the privileges from the user who has been granted

Syntax : REVOKE [ALL / INSERT /UPDATE /DELETE /SELECT]

on <OBJECT_NAME> from <USER_NAME>;

Example: REVOKE all on emp from scott;

S-14-15SLO-1 & SLO-2 : Lab 3: SQL Data Control Language commands and Transaction control commands to the sample exercises

Transaction Control Language

✓To control the database operation

- COMMIT: Commits a Transaction. Save the changes permanently , can't rollback
- ROLLBACK: Rollbacks a transaction in case of any error occurs.
- SAVEPOINT: Sets a savepoint within a transaction. Rolled back from the specified savepoint