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Module 4 - Database Architecture

What is DBMS Architecture?

DBMS stands for **Database Management System**. It helps in storing, managing, and using data in an easy and secure way.

DBMS architecture means how the database is built, how users or applications connect to it, and how data is handled inside the system.
There are **three main types** of DBMS architecture:
1. 1-Tier Architecture
2. 2-Tier Architecture
3. 3-Tier Architecture

Types of DBMS Architecture

1. 1-Tier Architecture

What it is:
Everything is on one computer. The user and the database are on the same machine.
How it works:
You open the database directly and use it. No network or server is needed.

Example:
Using MS Access or SQLite on your personal laptop.

Simple idea:
Like writing in your own diary. You do everything by yourself.

2. 2-Tier Architecture

What it is:
There are two layers:
- The client (your computer with an application)
- The database server (where data is stored)

How it works:
You use the app on your computer to send a request. The app sends it directly to the database server, and the server sends back the result.

Example:
A banking app installed on your computer that connects to the bank's central database.

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Data and Database Management System

Simple idea:
Like filling a form and giving it to a bank clerk who checks your data and gives you the result.

3. 3-Tier Architecture
What it is:
There are three layers:
- Client (the user interface, like your browser)
- Application server (handles rules and logic)
- Database server (stores the data)

How it works:
The client sends a request to the application server. The application server checks it, processes it, and then talks to the database to get the data.

Example:
Shopping on Amazon. Your browser is the client, Amazon's software is the application server, and the data is stored in a database server.

Simple idea:
Like calling customer care. The agent checks your request in their system and gives you the answer.

Inside a DBMS - Main Components
A DBMS has important internal parts that do all the processing, storage, and management of data.

1. Query Processor
What it does:
It reads and understands SQL queries. It checks if they are correct and decides the fastest way to run them.

Parts:
- Parser: Checks for mistakes in the query
- Translator: Changes the query into a format the system understands
- Optimizer: Finds the quickest way to run the query

Example:
You write:
SELECT * FROM students WHERE city = 'Delhi';

The query processor works out the best way to get that data from the database.

2. Storage Manager

What it does:
Manages how data is stored and fetched from the disk. It keeps data safe, organized, and accurate.

Parts:
- Buffer Manager: Keeps recently used data in memory
- File Manager: Stores and organizes files on the disk
- Transaction Manager: Makes sure data is correct when many users use it at the same time
- Recovery Manager: Recovers data if something crashes or goes wrong

Example:
If two people try to update the same student record at once, the transaction manager keeps the data safe.

3. Catalog Manager (Metadata Manager)
What it does:
Stores metadata, which means data about the structure of the database. It knows:
- Table names
- Column names
- Data types
- User permissions

Example:
It keeps track of a table called "Employees" and that it has columns like ID, Name, and Salary.

4. Disk Storage
What it does:
This is where all the actual data is stored permanently on hard disks or SSDs.

Example:
When you add a new record, like a student, that data is saved on the disk.

Assignment

Q1: Which DBMS architecture is most commonly used in modern web applications?
A) 1-Tier
B) 2-Tier

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C) 3-Tier
D) 4-Tier

Q2: Which component of a DBMS is responsible for planning the fastest way to run a SQL query?
A) Parser
B) File Manager
C) Optimizer
D) Translator

Q3: If a student accidentally closes the program while entering data, which DBMS component helps restore it?
A) Query Processor
B) Recovery Manager
C) Catalog Manager
D) File Manager

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