

Architecture of DBMS

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SCOPE

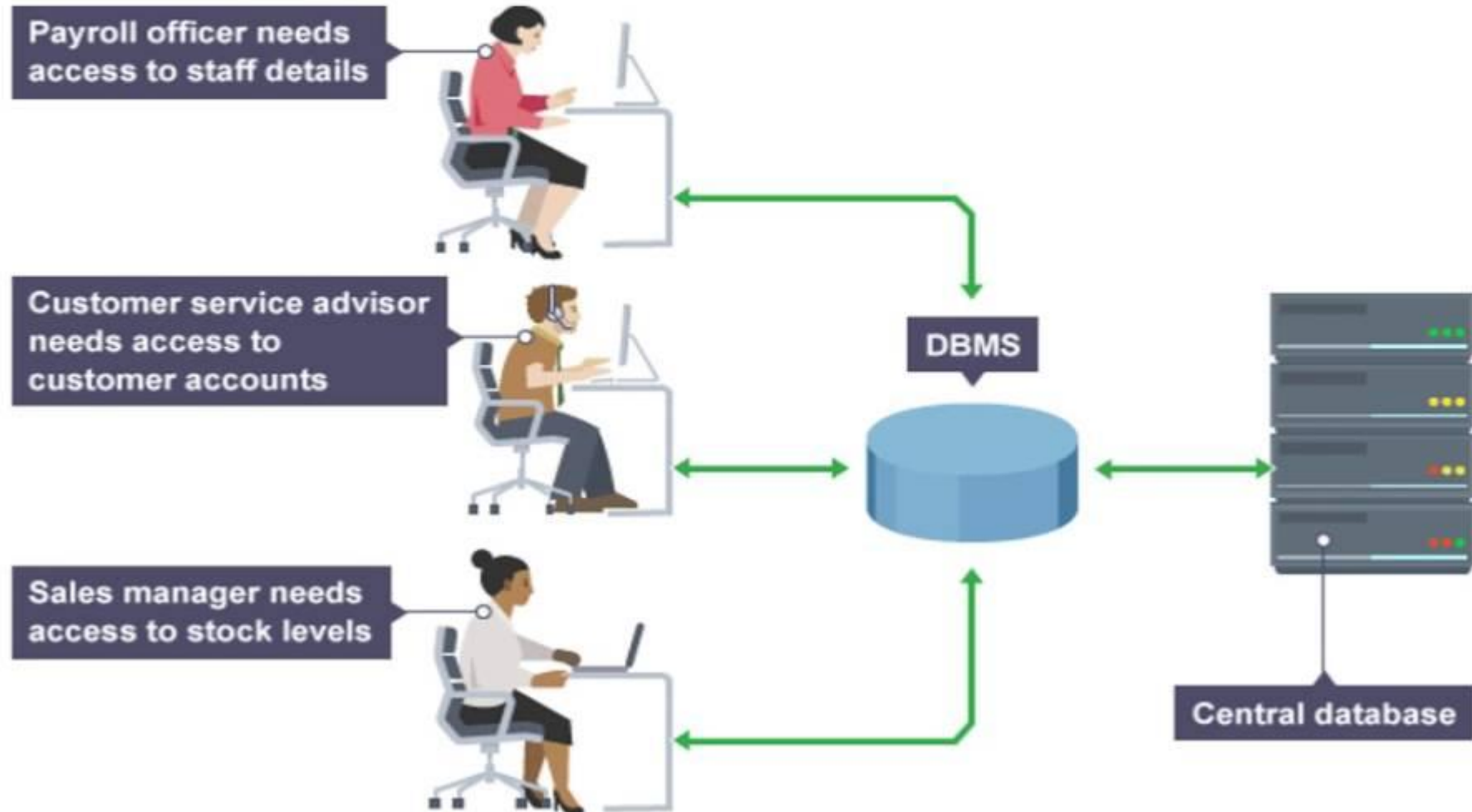
VIT-AP University

Amaravati

Client and Server

- Database systems can be centralized, or client-server, where one server machine executes work on behalf of multiple client machines.
- Most users of a database system today are not present at the site of the database system, but connect to it through a **network**.
- **client** machines, on which remote database users work, and **server** machines, on which the database system runs.
- Google Drive, Codethantra, Facebook, Youtube and VTOP are some examples

DATABASE MANAGEMENT SYSTEM (DBMS)

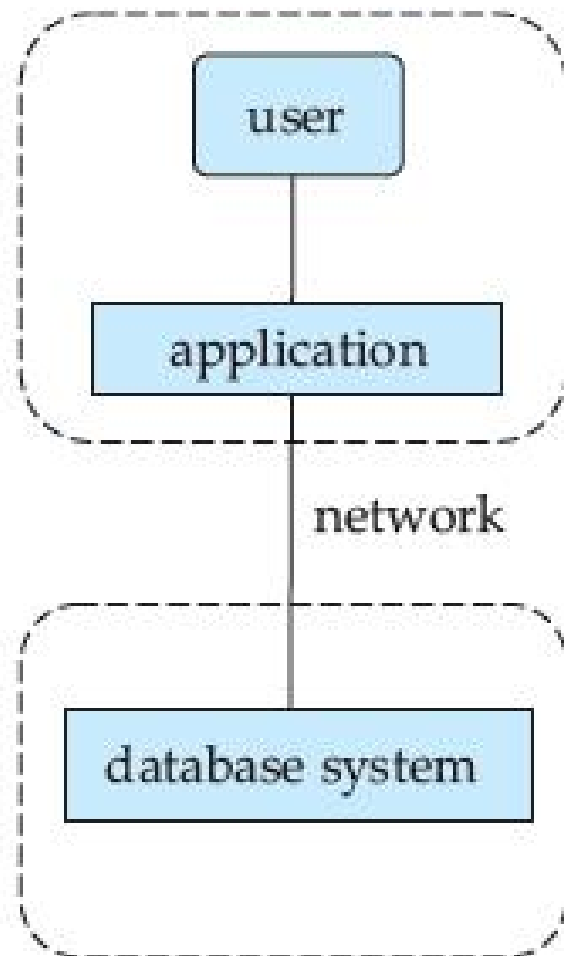


Database Application

- Two tier Architecture
- Three Tier Architecture

Two-Tier Architecture

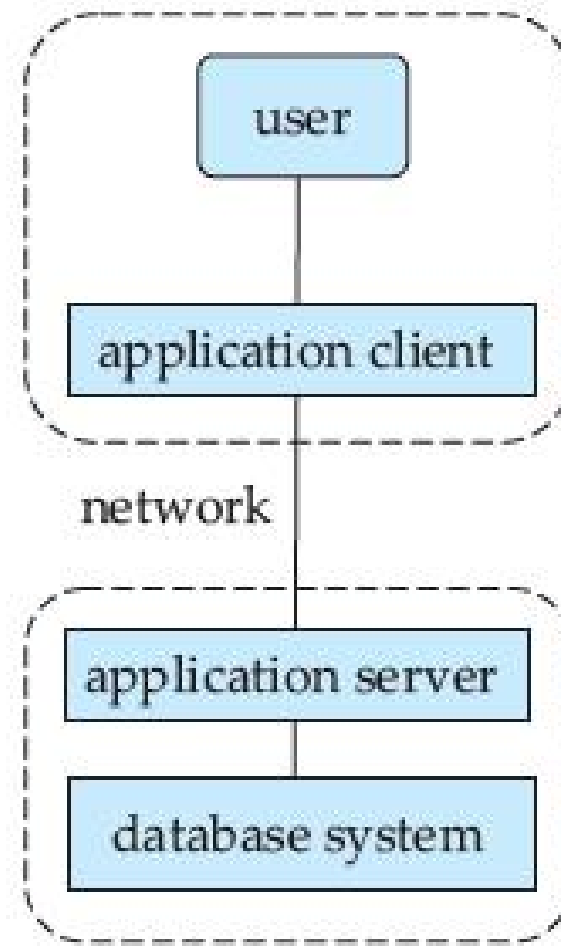
- Client side- Application
- Server Machine – Invoke database system functionality through Query language.
- Application program interface- ODBC/JDBC



(a) Two-tier architecture

client

server

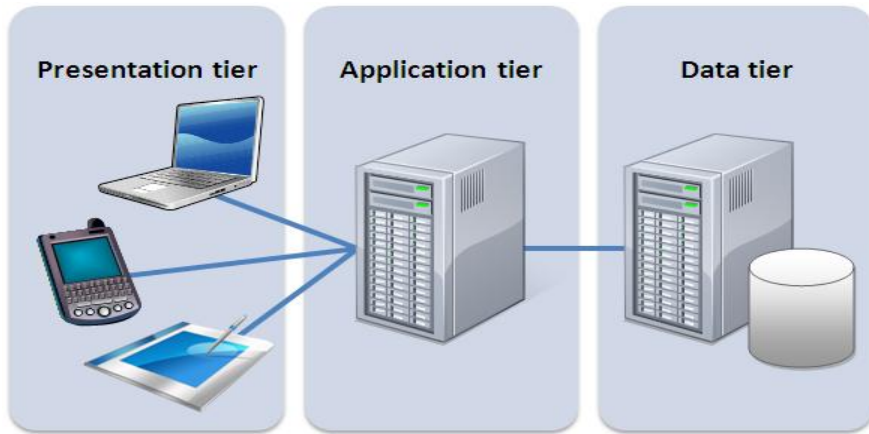


(b) Three-tier architecture

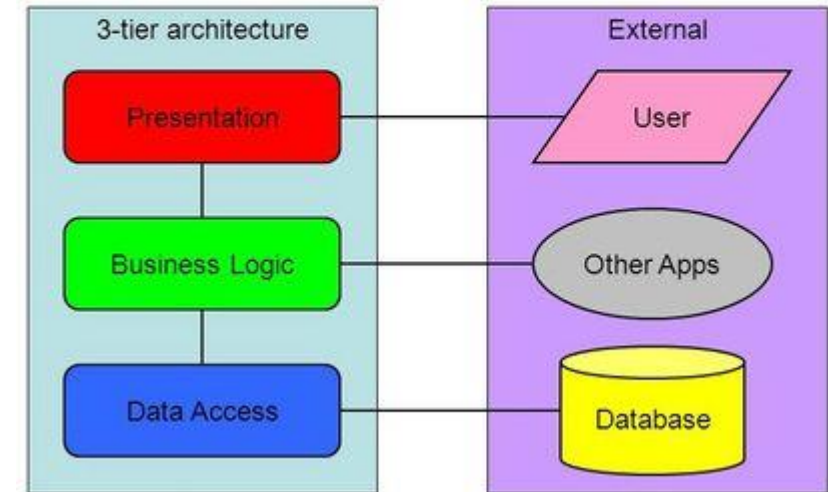
Three-Tier Architecture

- Client machine – Front end does not contain direct database calls.
- Application client- Communicate to Application server through **forms interface**
- Application server - communicates with a database system to access data
- Business logic - which says what actions to carry out under what conditions, is **embedded in the application server**, instead of being distributed across multiple clients.

Three Tier Architecture

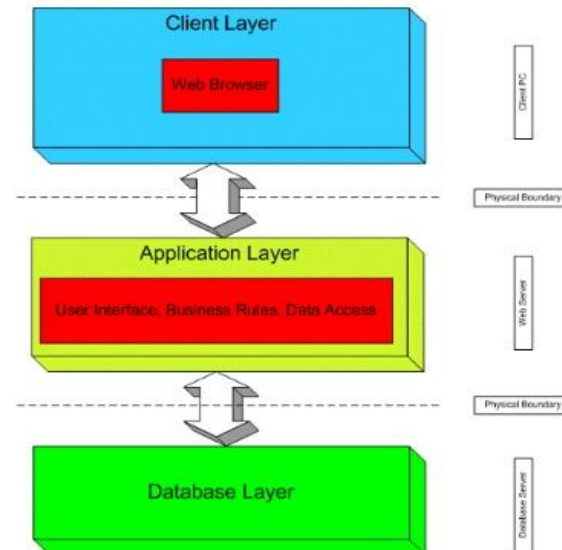


3-tier Application Architecture



3-Tier Architecture (III)

- The client only displays the GUI and data, but has no part in producing results.



3-Tier Architecture

- is a type of software architecture which is composed of three “tiers” or “layers” of logical computing.
- Provides many benefits for production and development environments by modularizing the user interface, business logic, and data storage layers.

Presentation Tier

- The presentation tier is the front end layer in the 3-tier system
- consists of the user interface
- The user interface(UI) is often a graphical one accessible through a **web browser or web-based application**
- UI displays **content and information** useful to an end user
- UI is built on web technologies such as **HTML5, JavaScript, CSS, or through other popular web development frameworks**, and communicates with others layers through **API** (Application Programme Interface) calls.
- presentation tier deployed to a desktop, laptop, tablet or mobile device either via a web browser or a web-based application utilizing a web server.

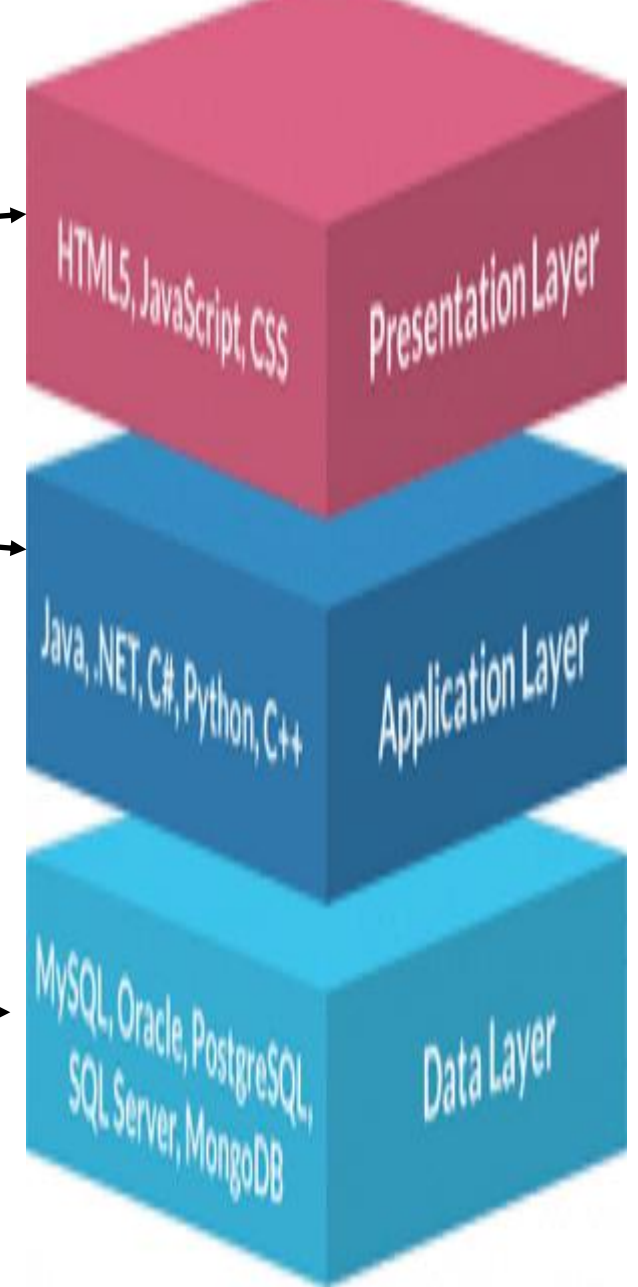
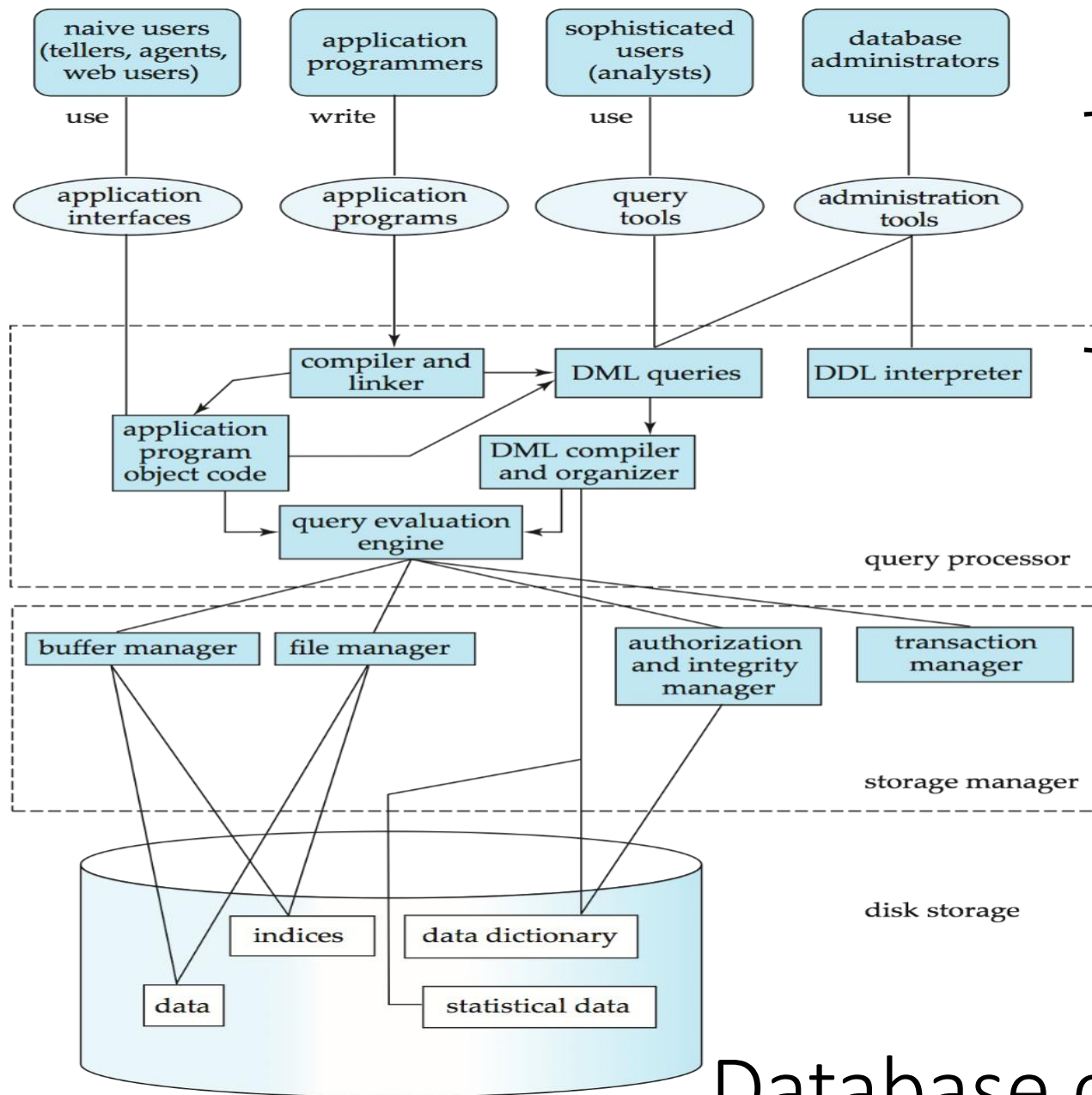
- The standard user and application programming interface ([API](#)) of a **relational database** is the Structured Query Language ([SQL](#)).
- SQL statements are used both for interactive queries for information from a relational database and for gathering data for reports.

Application Tier

- contains the functional business logic which drives an application's core capabilities.
- often written in Java, .NET, C#, Python, C++, etc.

Database Tier

- The data tier comprises of the database/data storage system and data access layer.
- Examples of such systems are MySQL, Oracle, PostgreSQL, Microsoft SQL Server, MongoDB, etc.
- Data is accessed by the application layer via **API calls**.



Database components architecture

Database Users and Administrators

- A primary goal of a database system is to retrieve information from and store new information into the database.
- People who work with a database can be categorized as database **users or database administrators**.
- Users - differentiated by the way they expect to interact with the system

- **Naive users** are unsophisticated users who interact with the system by invoking one of the **application programs** that have been written previously.
- **Application programmers** are computer professionals who write application programs. Application programmers can choose from many tools to develop user interfaces.
- **Sophisticated users** interact with the system without writing programs. Instead, they form their requests either using a **database query language or data analysis software**

Sophisticated users Application

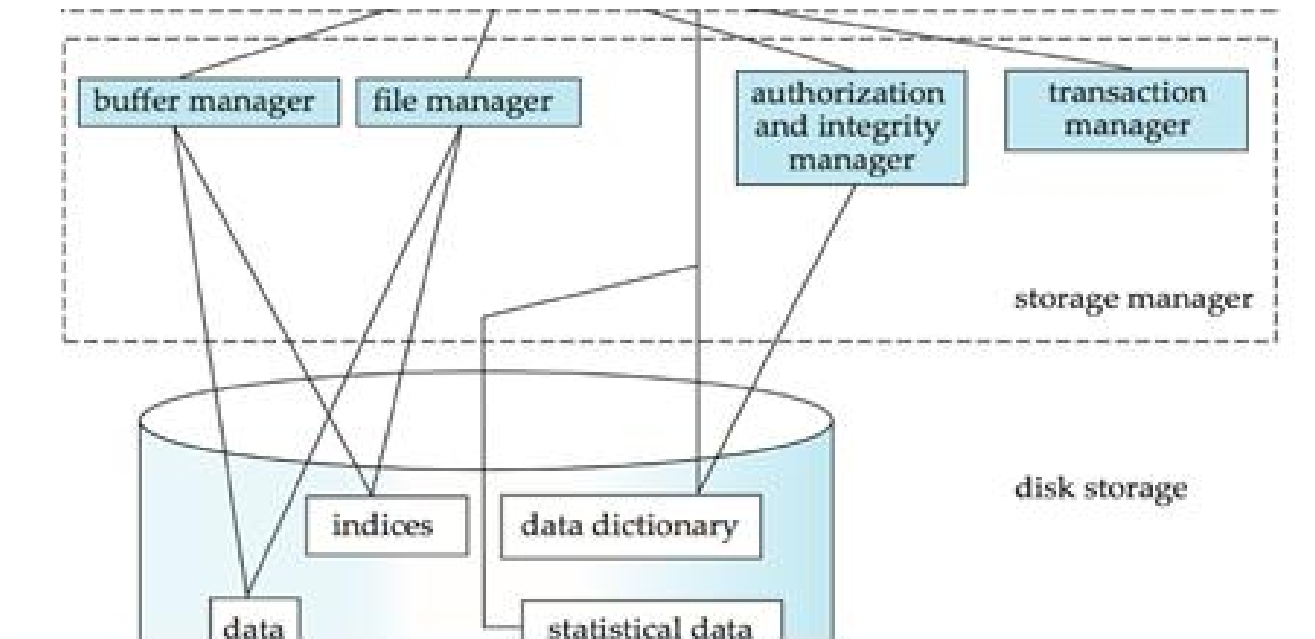
- Chat with counselors
- Speech recognition
- Gamified learning
- Mood tracking
- AI-assisted Q&A
- Interactive whiteboard
- Mentor connect
- Skill assessments
- Internship/job match
- Real-time experiments
- Smart reminders
- Analytics
- Live quiz sessions

Database Administrator

- A person who has such central control over the system is called a **database administrator (DBA)**.
- **Schema definition.** The DBA creates the original database schema by executing a set of data definition statements in the DDL.
- **Storage structure and access-method definition.**
- Alter the **physical organization** to improve performance.
- **Granting of authorization for data access.**
- **Routine maintenance.**
 - Periodically backing up the database, either onto tapes or onto remote servers, to prevent loss of data in case of disasters such as flooding.
 - Ensuring that enough free disk space is available for normal operations,
 - and upgrading disk space as required.
 - Monitoring jobs running on the database and ensuring that performance
 - is not degraded by very expensive tasks submitted by some users.

Storage manager

- The storage manager is the component of a database layer
- provides the interface between the low-level data stored in the database and the application programs and queries submitted to the system.
- The storage manager is responsible for the interaction with the file manager
- The raw data are stored on the disk using the file system provided by the operating system.
- Storage manager is responsible for storing, retrieving, and updating data in the database.



storage manager components

- **Authorization and integrity manager**

Tests for the satisfaction of integrity constraints and checks the authority of users to access data.

- **Transaction manager,**

Ensures that the database remains in a consistent (correct) state despite system failures, and that concurrent transaction executions proceed without conflicting.

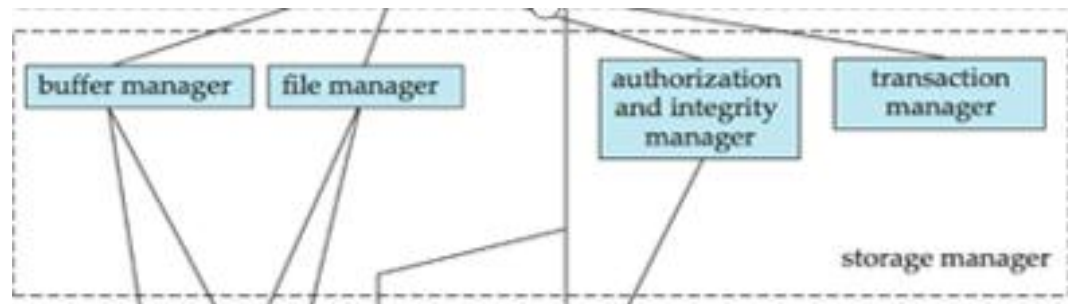
- **File manager**

Manages the allocation of space on disk storage and the data structures used to represent information stored on disk.

- **Buffer manager**

Responsible for fetching data from disk storage into main memory, and deciding what data to cache in main memory.

The buffer manager is a critical part of the database system, since it enables the database to handle data sizes that are much larger than the size of main memory.



Example:

ID	NAME	SEMENSTER	AGE
1000	Tom	1 st	17
1001	Johnson	2 nd	24
1002	Leonardo	5 th	21
1003	Kate	3 rd	19
1004	Morgan	8 th	A ,

Example:

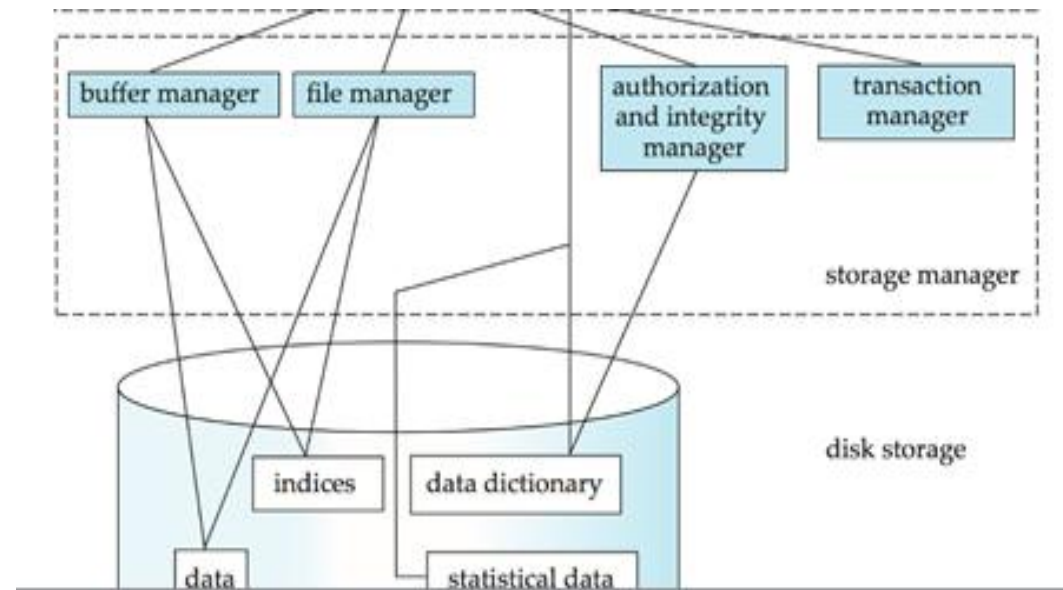
ID	NAME	SEMENSTER	AGE
1000	Tom	1 st	17
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Not allowed. Because AGE is an integer attribute

Data structures

The storage manager implements several data structures as part of the physical system implementation:

- Data files, which store the database itself.
- Data dictionary, which stores metadata about the structure of the database, in particular the schema of the database.
- Indices, which can provide fast access to data items. Like the index in this textbook, a database index provides pointers to those data items that hold a particular value.



table

Tablename	Columncount	Rowcount
Department	3	3
Employee	4	3

Column

tablename	columnname
department	Deptno
department	Deptname
department	Budget
Employee	Empno
Employee	Empname
Employee	Deptno
Employee	Salary

The query processor components

- **DDL interpreter**

- Interprets DDL statements and records the definitions in the data dictionary.

- **DML compiler**

- Translates DML statements in a query language into an **evaluation plan** consisting of low-level instructions that the query **evaluation engine understands**.
- A query can usually be translated into **any of a number** of alternative evaluation plans that all give the same result.
- The DML compiler also performs query optimization; that is, it picks the **lowest cost evaluation plan** from among the alternatives.
- **Query evaluation engine**,
executes low-level instructions generated by the DML compiler

