Parul® University

Database Management System (303105203)

Unit – 1: Introduction

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Unit 1: Introductory concepts of DBMS

1)Introduction and applications of DBMS

2)Purpose of Database

3)Data Independence

4)Database System Architecture - Levels Mappings Database

5)Users

6)DBA

Data & Information

Data:

- Raw facts which can be manipulated.
- Refers to what is actually stored in the database.

Information:

- Manipulation of data.
- Summarization of data in a presentable form.
- Meaning of the data as understood by some users.
- Data comprises of raw facts, which become information when processed
- Information conveys some meaning to people

Database

- Organized collection of inter related facts.
- Collection of “***persistent***” data.
- Collection of Information arranged and presented to serve an assigned purpose.
  - Definition (C.J. Date):
  - A Database is a collection of persistent data that is used by the application systems of some given enterprise.
  - Ex: Dictionary

What is Database Management System (DBMS)?

- Data - Fact that can be recorded or stored
  - e.g. Person Name, Age, Gender and Weight etc.
- Database - Collection of logically related data
  - e.g. Books Database in Library, Student Database in University etc.
- Management - Manipulation, Searching and Security of data
  - e.g. Viewing result in GTU website, Searching exam papers in GTU website
- System - Programs or tools used to manage database
  - e.g. SQL Server Studio Express, Oracle 11g
- DBMS - A Database Management System is a software for creating and managing databases. It provides a systematic way to create, retrieve, update and manage data.
  - e.g. MS SQL Server 2014, Oracle 11g, My SQL, MS Access, dBase etc.

Applications

The following are examples of database applications:

- Computerized Library Systems
- Automated Teller Machines
- Flight Reservation Systems
- Computerized parts inventory systems
- Enterprise Resource Management (ERP) systems
- Online Banking systems

Write down any five applications of DBMS other than above individually in chats separated by comma.

Disadvantages of File processing system(FPS)

- Earlier database applications were built directly on top of file systems.
- DBMS were developed to handle the difficulties of typical file-processing systems supported by conventional operating systems.
- Database systems offer solutions to all the disadvantages of file processing systems.

Disadvantages of File processing system(FPS)

- Data redundancy and inconsistency.
- Multiple file formats.
- Duplication of information.
- Difficulty in accessing data.
- File system exhibits structural dependency.
- Need to write a new program to carry out each new task.

Disadvantages of File processing system(FPS)

- Data isolation
- Integrity problems
- Hard to add new constraints or change existing ones
- Atomicity of updates
- Failures may leave database in an inconsistent state with partial updates carried out
- Example: Transfer of funds from one account to another should either complete or not happen at all.

Disadvantages of File processing system(FPS)

- Concurrent access by multiple users
  - Concurrent access is needed for performance
  - Uncontrolled concurrent accesses can lead to data inconsistencies
  - Example: Two people reading a balance and updating it at the same time

Disadvantages of File processing system(FPS)

- Security problems.
  - Security features like -
  - effective password protection,
  - locking out parts of files or parts of the system itself.

Advantages of DBMS

- Data can be shared.
- Redundancy can be reduced.
- Inconsistency can be avoided
- Integrity can be maintained.
- Security can be enforced.
- Better Conflicting Management.
- Standards can be enforced.

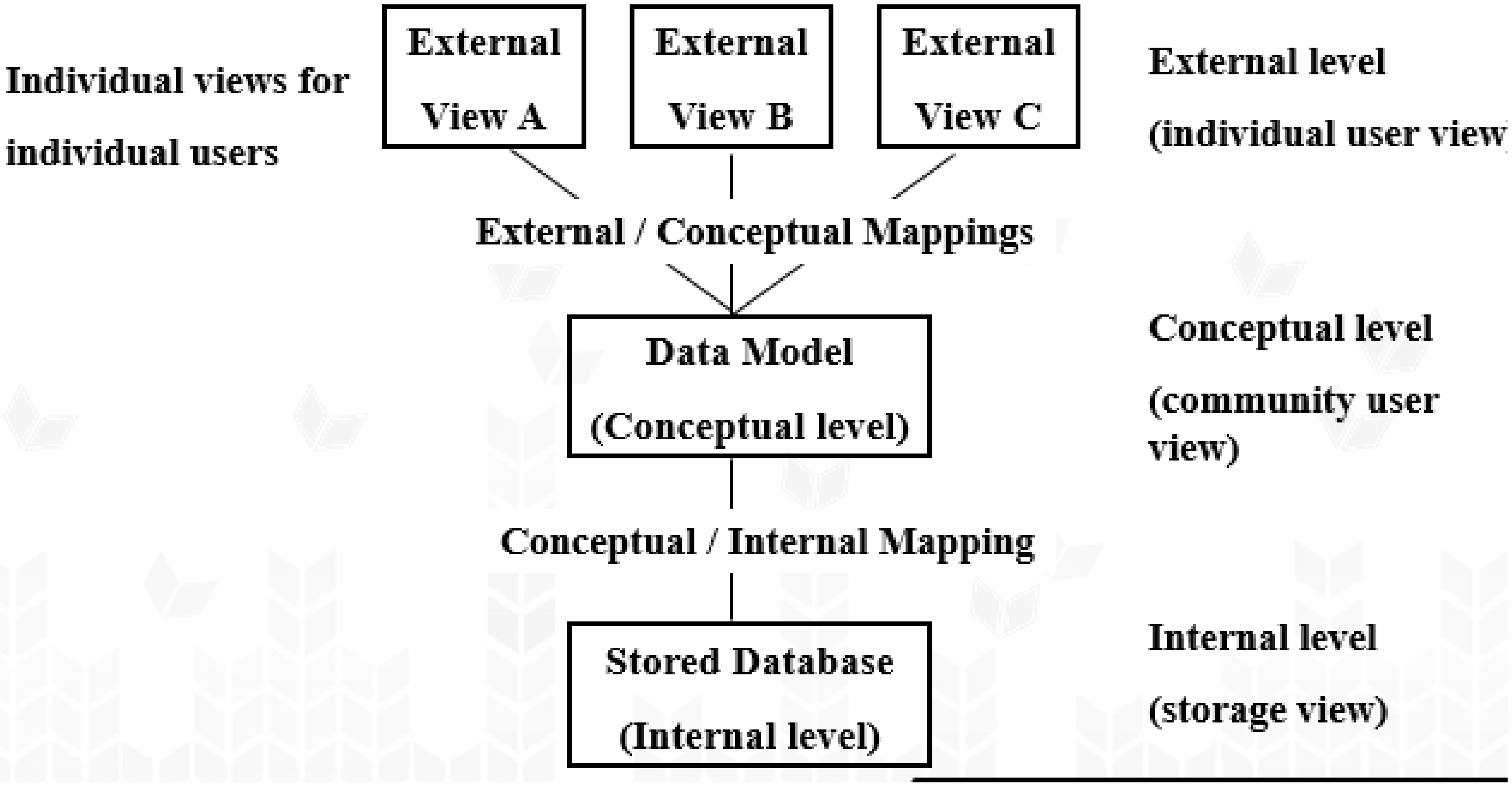
ANSI/SPARC THREE LEVEL ARCHITECTURE

- This is in agreement with the ANSI/SPARC study group on DBMS. ANSI/SPARC is the American National Standards Institute/Standard Planning and Requirement Committee).

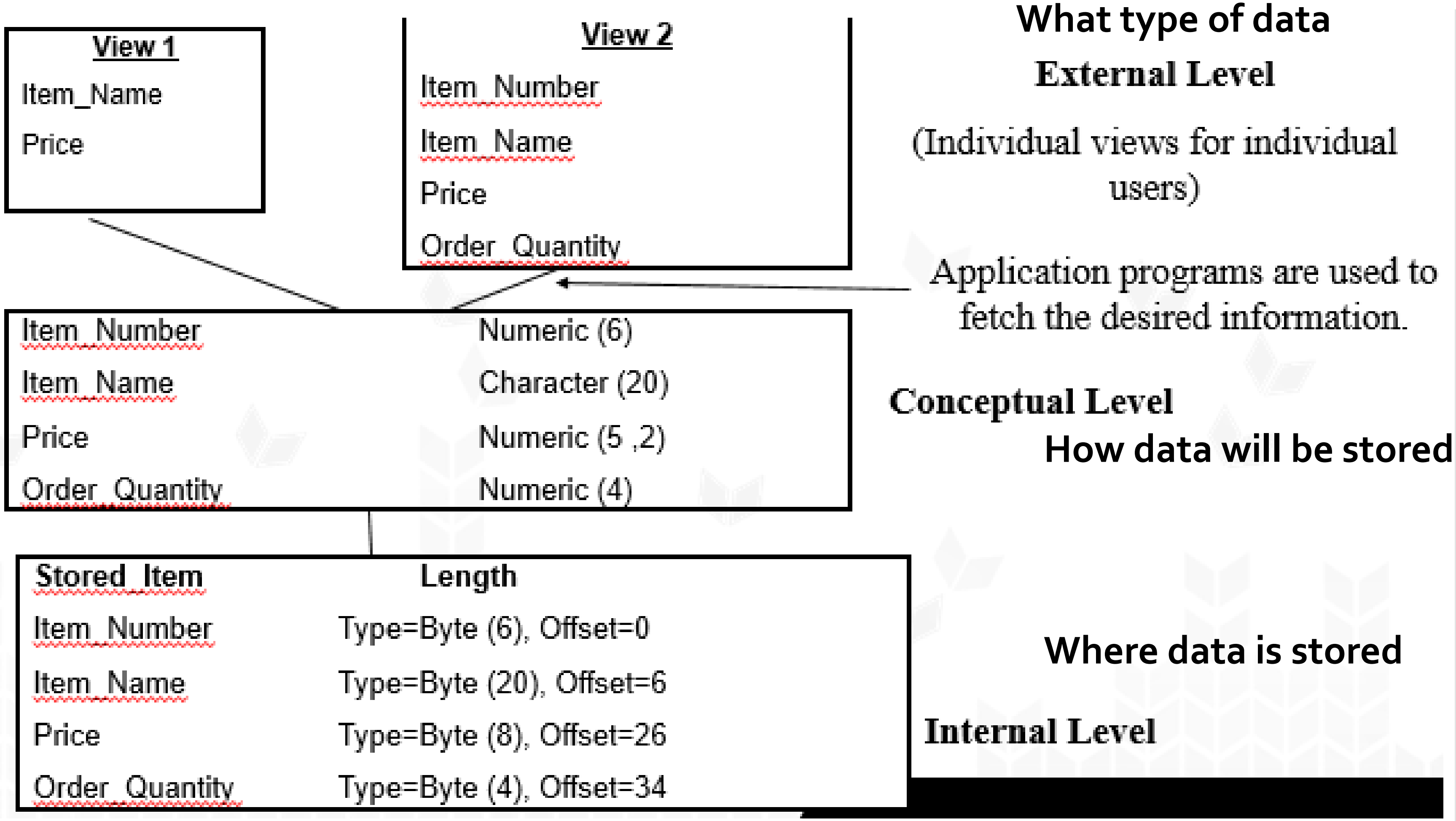
ANSI/SPARC THREE LEVEL ARCHITECTURE

- The Architecture for DBMS is divided into three general levels:
  - **External level**: concerned with the way individual users see the data.
  - **Conceptual level**: can be regarded as a community user view - a formal description of data of interest to the organization, independent of any storage considerations.
  - **Internal level**: concerned with the way in which the data is actually stored.

ANSI/SPARC THREE LEVEL ARCHITECTURE



ANSI/SPARC THREE LEVEL ARCHITECTURE



What type of data

External Level

(Individual views for individual users)

View 1

Item_Name

Price

View 2

Item_Number

Item_Name

Price

Order_Quantity

Application programs are used to fetch the desired information.

Conceptual Level

How data will be stored

Item_Number	Numeric (6)
Item_Name	Character (20)
Price	Numeric (5 ,2)
Order_Quantity	Numeric (4)

Where data is stored

Internal Level

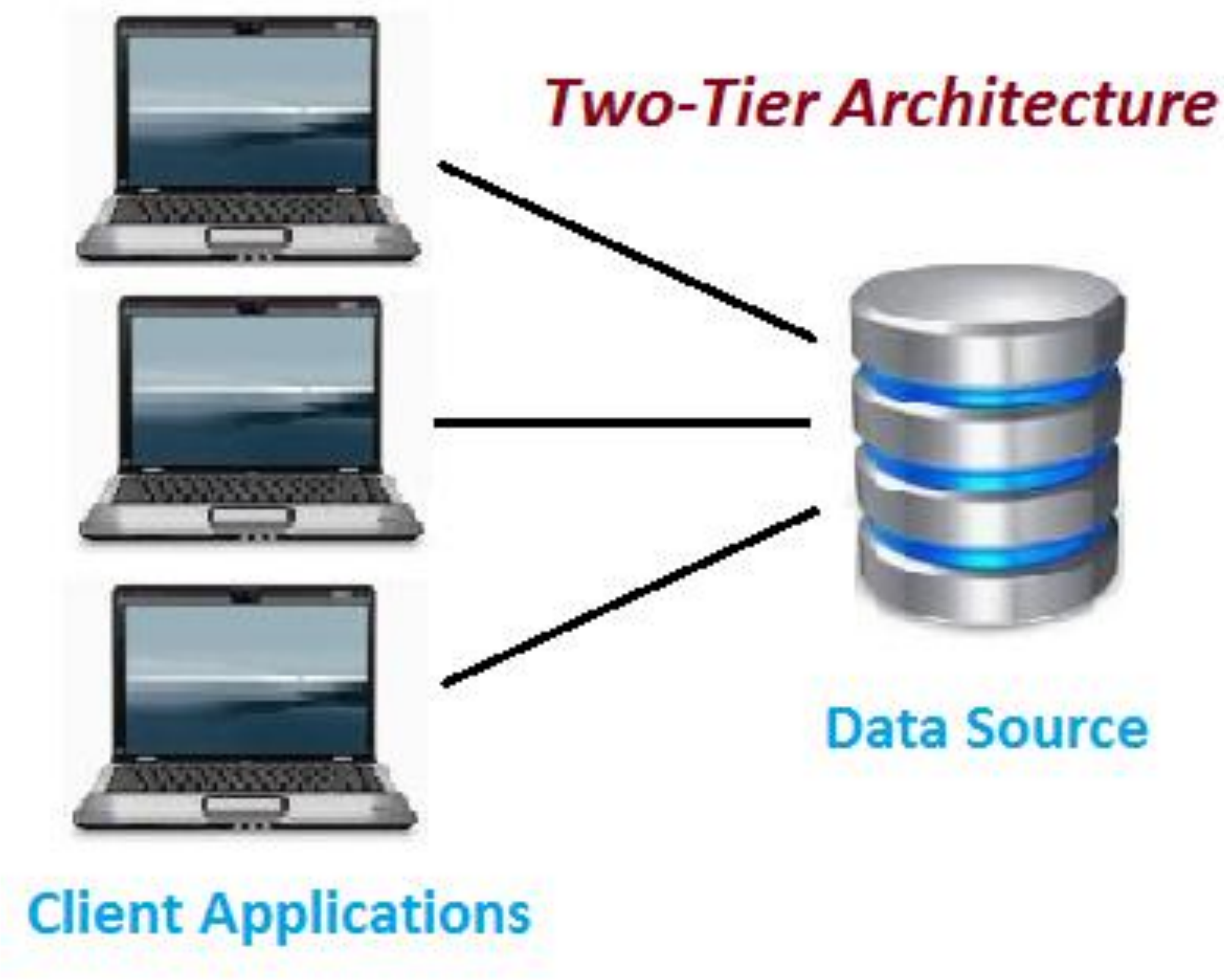
Stored_Item	Length
Item_Number	Type=Byte (6), Offset=0
Item_Name	Type=Byte (20), Offset=6
Price	Type=Byte (8), Offset=26
Order_Quantity	Type=Byte (4), Offset=34

Data Abstraction

- Hide irrelevant details from the users.
- Three levels of data abstraction:
- **Physical**: Lowest Level of data abstraction. It tells us where the data actually stored in memory.
- **Logical**: Describes how the data is stored in the Database. In short, it represents SCHEMA
- **View**: Highest level of data abstraction. It contains what type of data is to be stored in the database.

Level	***Description***	***Visible To***
Physical	Storage details	DBA
Logical	Structure & schema	Developers
View	User-specific view of data	End Users

Database Application Architectures



Database Application Architectures

Advantages:

1)Easy to maintain

2)Modification is bit easy

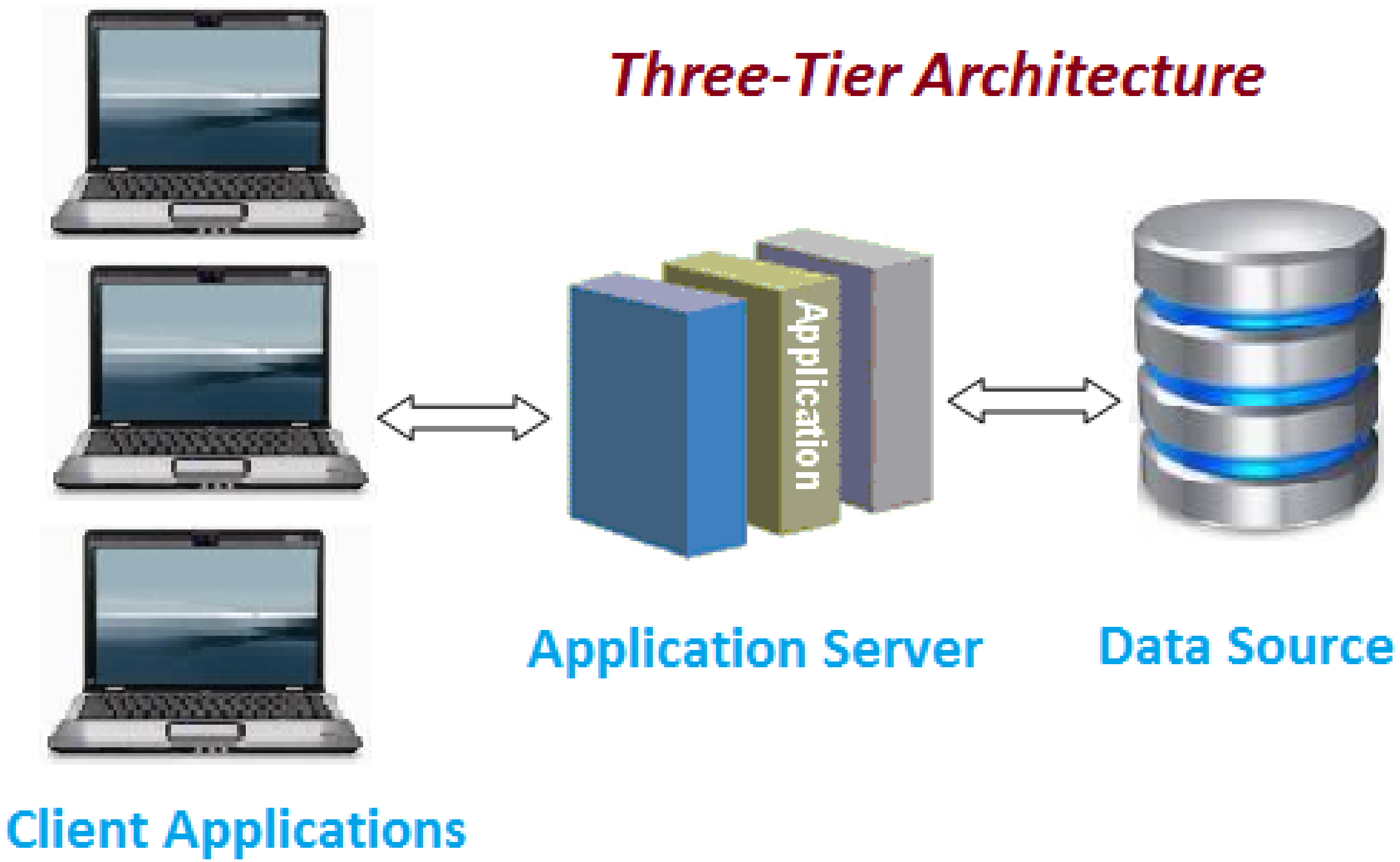
3)Communication is faster

Disadvantages :

1)Performance degrades when number of users increase

2)Cost-ineffective

Database Application Architectures



Three-Tier Architecture

Client Applications

Application Server

Data Source

Database Application Architectures

- Advantages
  1) High performance
  2) Improve Data Integrity
  3) Improved Security – Client has not direct access to database.
  4) In three tier architecture application performance is good.
- Disadvantages
  1) Increase Complexity/Effort

Data Independence

- Ability to modify a data or a structure of the database without disturbing an entire application.

Data Independence

Two levels of data independence:

Physical data independence

A user is allowed to enter any type of data in relevance to Database Requirement.

Logical data independence

A user can change the internal schema of the database without considering the type of data already exists in Database.

Users

- **Application programmer:** writes programs in some high-level language such as Java, etc.
- **Specialized users:** write specialized database applications that do not fit into the traditional data processing framework.
- **Database Administrator (DBA):** controls all operations on the database.
- **Naive users**: invoke one of the permanent application programs that have been written previously E.g. people accessing database over the web, bank tellers, clerical staff. In short, General Users (End Users).

Role of DBA

1. Schema Definition
   - defines the logical schema of the database.
2. Storage Structure and Access Method Definition
   - decides how the data is to be represented in the database & how to access it.
3. Defining Security and Integrity Constraints
   - decides various security and integrity constraints.
4. Granting of Authorization for Data Access
   - determines which user needs access to which part of the database.

Role of DBA

5. Liaison with Users
   - provide necessary data to user.

6. Assisting Application Programmer
   - provides assistance to application programmers to develop application programs.

7. Monitoring Performance
   - ensures that better performance is maintained by making change in physical or logical schema if required.

8. Backup and Recovery
   - backing up the database on some storage devices such as DVD, CD or Magnetic Tape or remote servers and recover system in case of failures, such as flood or virus attack from this backup.

Overall Database Architecture and Components

It comprises of 4 components:

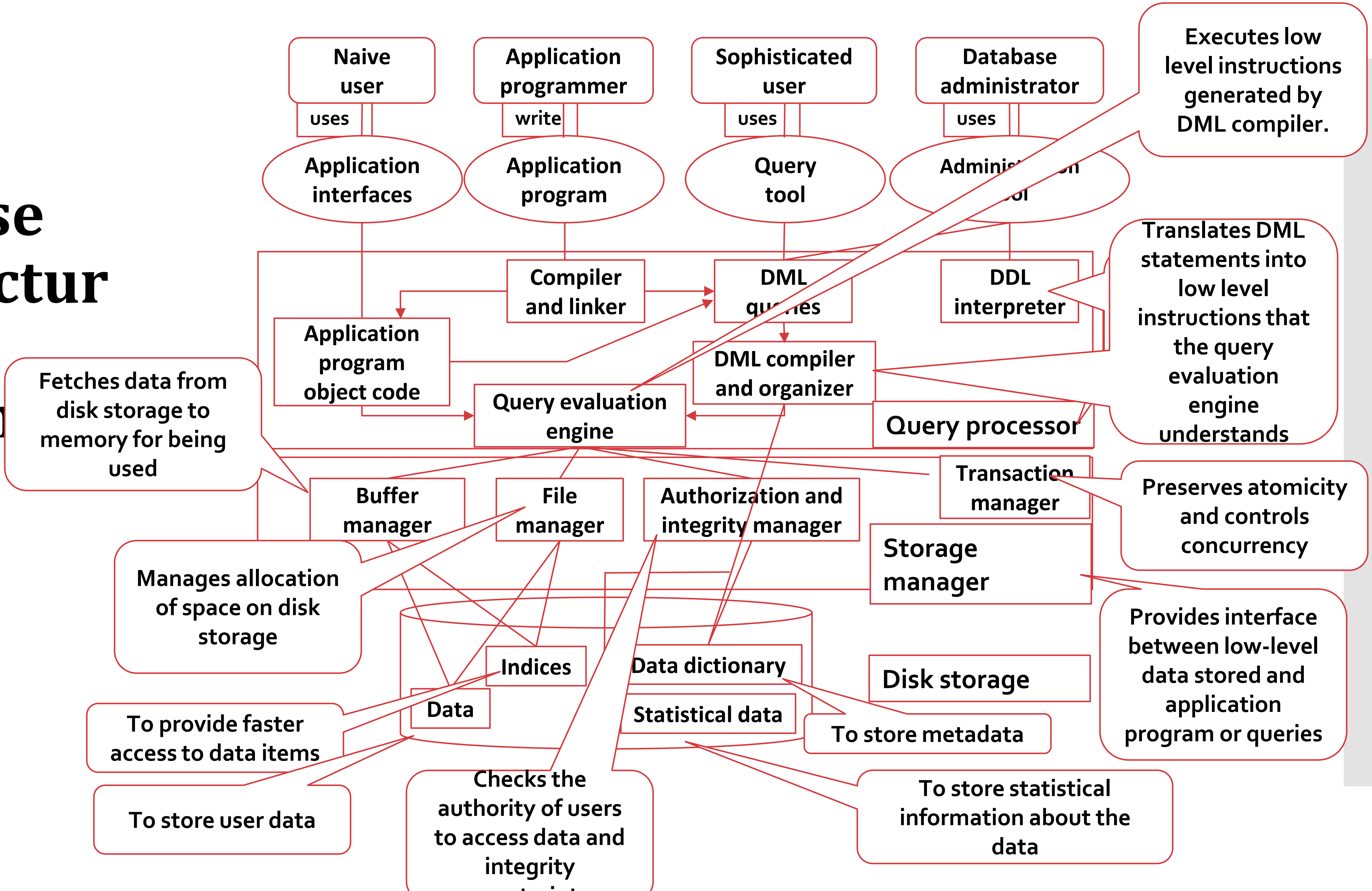
1) Users

2)Query Processor

3)Storage Manager

4)Disk Storage

Overall Database Architecture and Compon s



Naive user

uses

Application interfaces

Application programmer

write

Application program

Sophisticated user

uses

Query tool

Database administrator

uses

Administration tool

Compiler and linker

DML queries

DDL interpreter

Application program object code

DML compiler and organizer

Query evaluation engine

Query processor

Buffer manager

File manager

Authorization and integrity manager

Transaction manager

Storage manager

Indices

Data

Data dictionary

Statistical data

Disk storage

Executes low level instructions generated by DML compiler.

Translates DML statements into low level instructions that the query evaluation engine understands

Fetches data from disk storage to memory for being used

Preserves atomicity and controls concurrency

Manages allocation of space on disk storage

Provides interface between low-level data stored and application program or queries

To provide faster access to data items

To store metadata

To store user data

Checks the authority of users to access data and integrity

To store statistical information about the data

References

1) Silberschatz A, Korth HF, Sudarshan S. Database system concepts. New York: McGraw-Hill; 1997 Apr.

2) Date CJ. An introduction to database systems. Pearson Education India; 1975.

3) PL/SQL Programming by Ivan Bayross.

Thanks