



Database Fundamentals

Lecture 1 – Introduction

Course Outline



Grading System

- » **Lecture Assignment & Quizzes**
- » **Lab Work**
- » **Final Exam**



Lecture 1 - Outline

1 – Database Development Phases

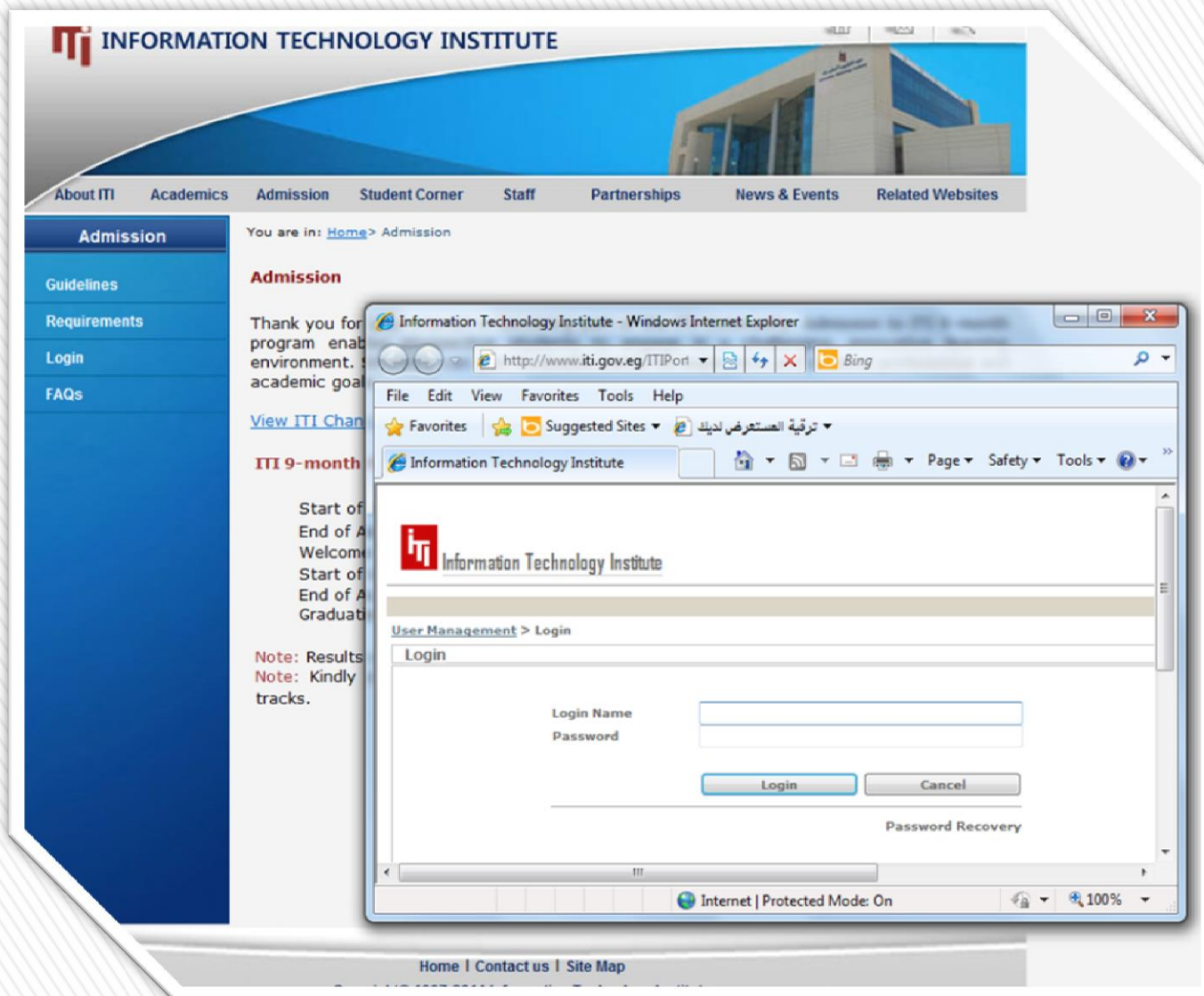
2- Database processing history

2 - Definitions

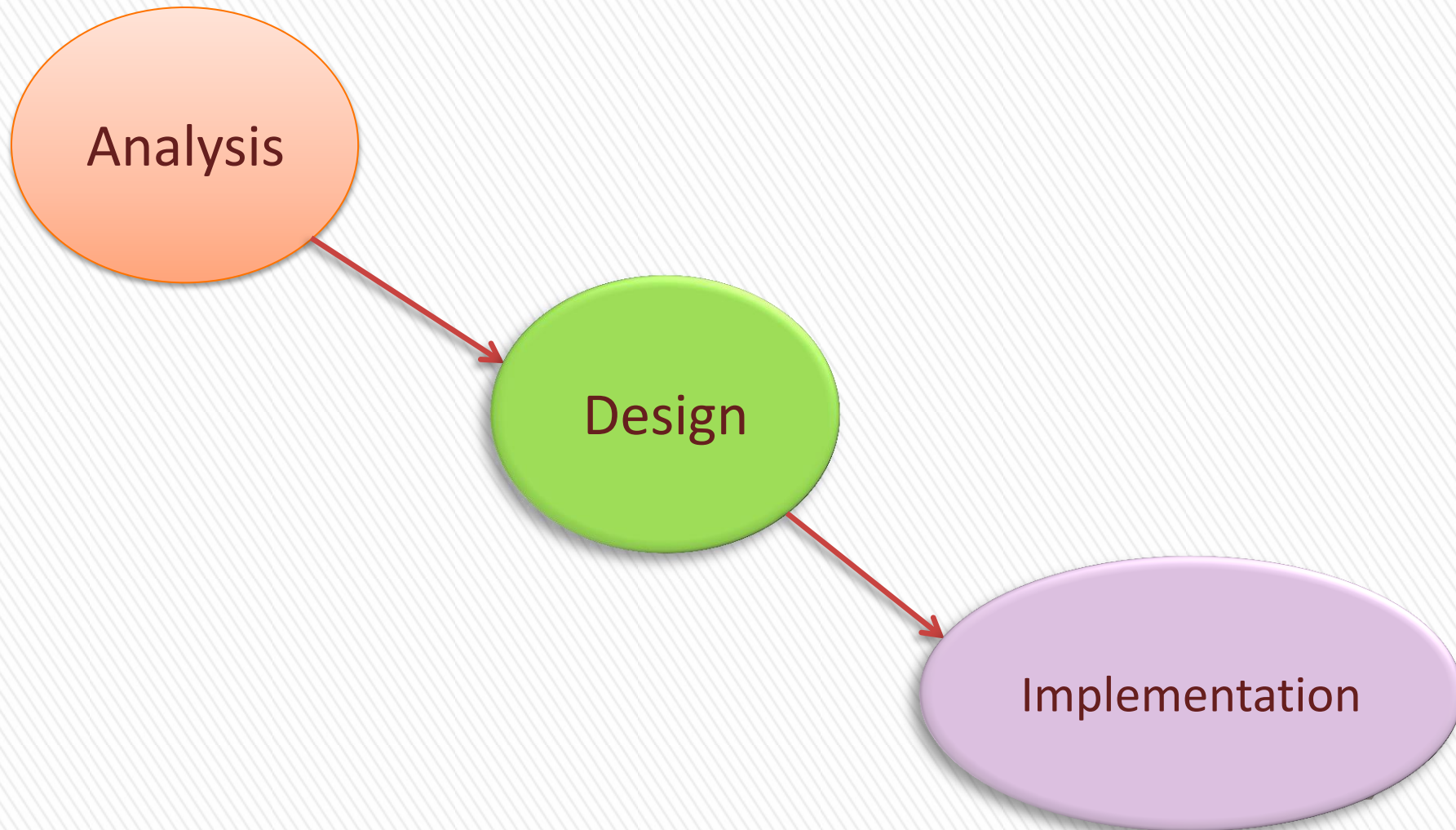
- Database
- Database Management System (DBMS)
- Database System
- Database Users
- Database Environment
- DBMS Architecture
- Data Model



Example



Database Development Phases



Database Processing History

1- File Based System

- It is a collection of programs that perform services for the end user.
- Each Program defines and manages its own data

Limitations

- Separation & Isolation Of data
- Duplication Of data
- Program Data Dependence
- Incompatible File Formats



Database Processing History

2- Hierarchical & network model

Data is organized into a tree-like structure. The structure allows repeating information using parent/child relationships: each parent can have many children but each child only has one parent.

3- Relational Database

A data structure through which data is stored in tables that are related to one another in some way. The way the tables are related is described through a relationship.



Database Processing History

4- Object Oriented Database

A database system that incorporates all the important object-oriented concepts with some additional features, Unique Object identifiers & Persistent object handling



Database Processing History

5- Document Oriented Database

The massive growth of web applications and cloud computing, however, presents new scalability challenges for which a new breed of databases referred to as NoSQL, or Not only SQL, have emerged.

Data is stored in the form of documents that are organized into collections. A document is equivalent to a row in a SQL database. Collections are used to group together similar documents and are thus equivalent to tables in SQL.



Definitions



Database

» **Database:** Logical collection of Non-Redundant, shareable data that is used by different application systems of some given enterprise, this data represents some aspects of the real world.

» **Properties:**

- » Redundancy can be reduced.
- » Allow data sharing by concurrent users.
- » Security restrictions can be applied.
- » Data integrity can be maintained.



Database

» **Database:** Logical collection of Non-Redundant, shareable data that is used by different application systems of some given enterprise, this data represents some aspects of the real world.

Advantages:

- + Reduce Redundancy
- + Avoid inconsistency.
- + Share data
- + Security Restrictions
- + Integrity maintained.

»
»

Disadvantages:

- + Expensive due to it needs expertise , and the cost of DBMS



Database Management System

» **Database Management System (DBMS):** A software package/ system to facilitate the creation and maintenance of a computerized database.

It is an intermediate layer between database and the program that access the data. It enables users to create and maintain database and handle all requests from users to access the database.

ORACLE®



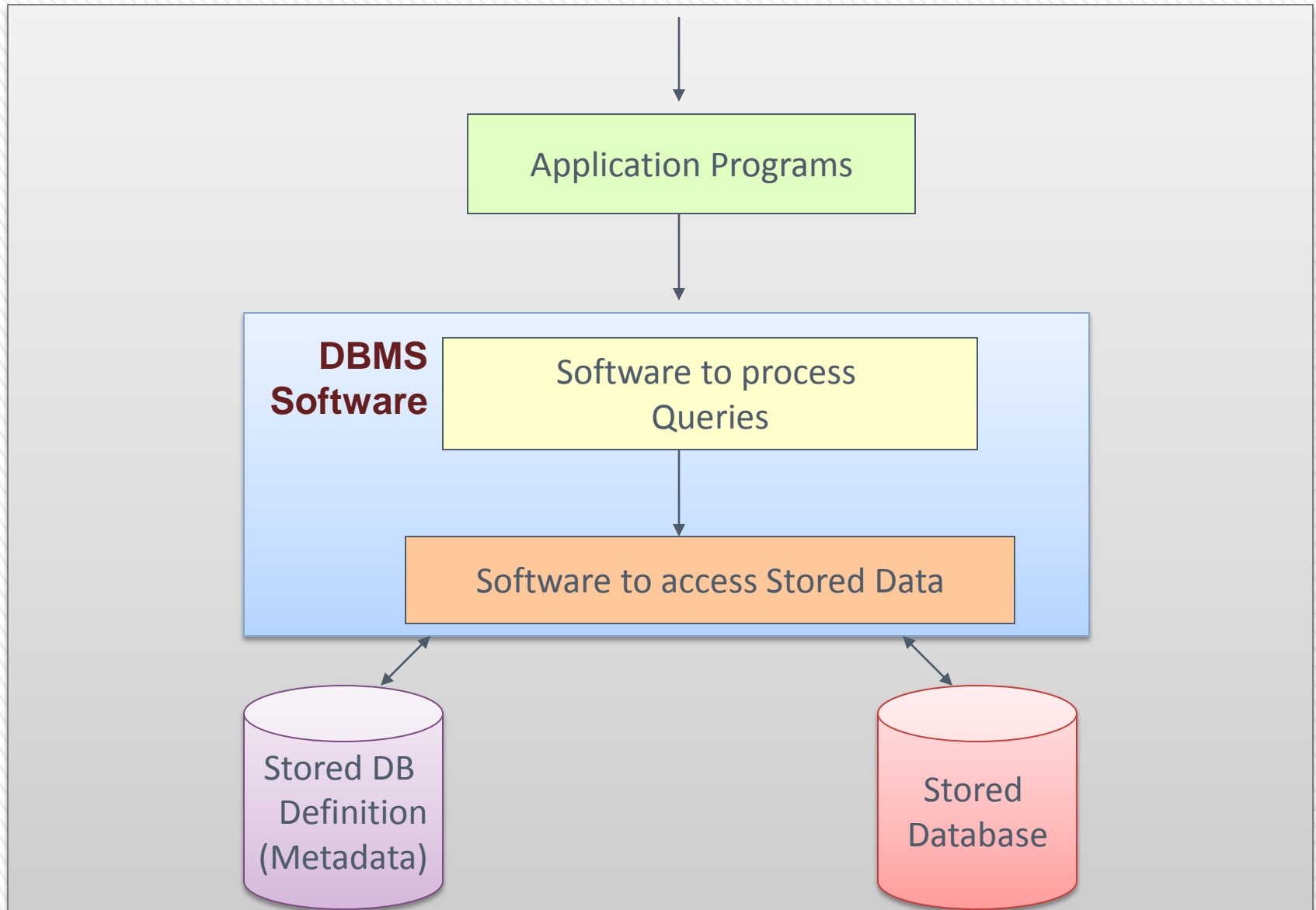
DBMS Functions

- Defining & constructing the database
- Manipulating the database.
- Data security & integrity
- Concurrency
- Recovery
- Data Dictionary
- Performance



Database System

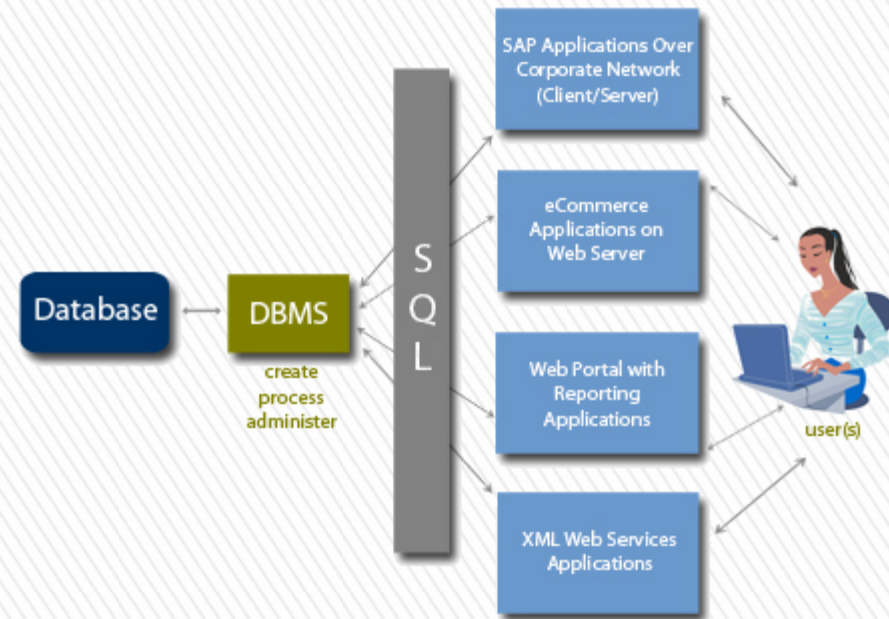
Users



Database Management System

» DBMS Advantages:

- Controlling Redundancy.
- Restricting Unauthorized Access.
- Sharing data.
- Enforcing Integrity Constraints
- Inconsistency can be avoided.
- Providing Backup and Recovery.



» DBMS Advantages:

- It needs expertise to use (which is expensive)
- DBMS itself is expensive



Database System

The DBMS software together with the data itself.

Sometimes, the applications are also included.

(Software + Database)



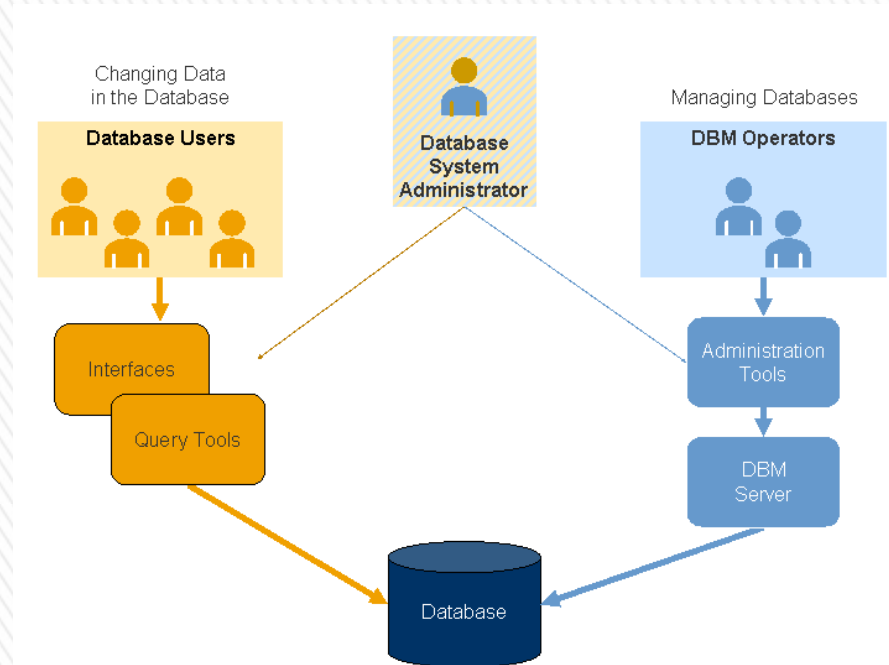
Database Users

» Database Administrator (DBA)

- Put and implement suitable strategy & policy of the whole database
- Define internal schema
- Define security & integrity checks
- Define backup & recovery procedure
- Monitor performance

» System Analysts

- Determine the user requirements



Database Users

» Database Designer

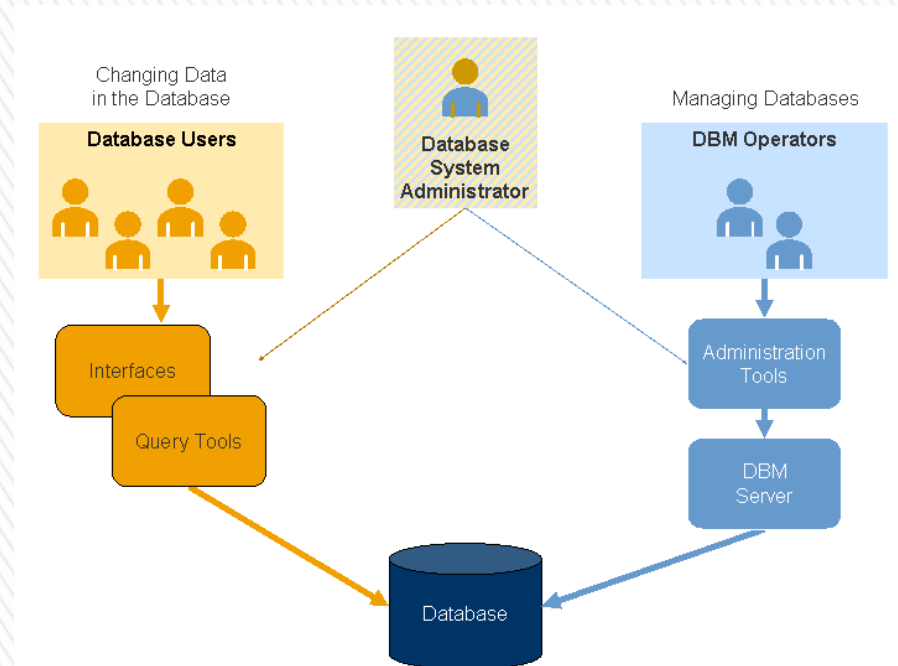
- Choose the appropriate structure to represent data

» Application programmers

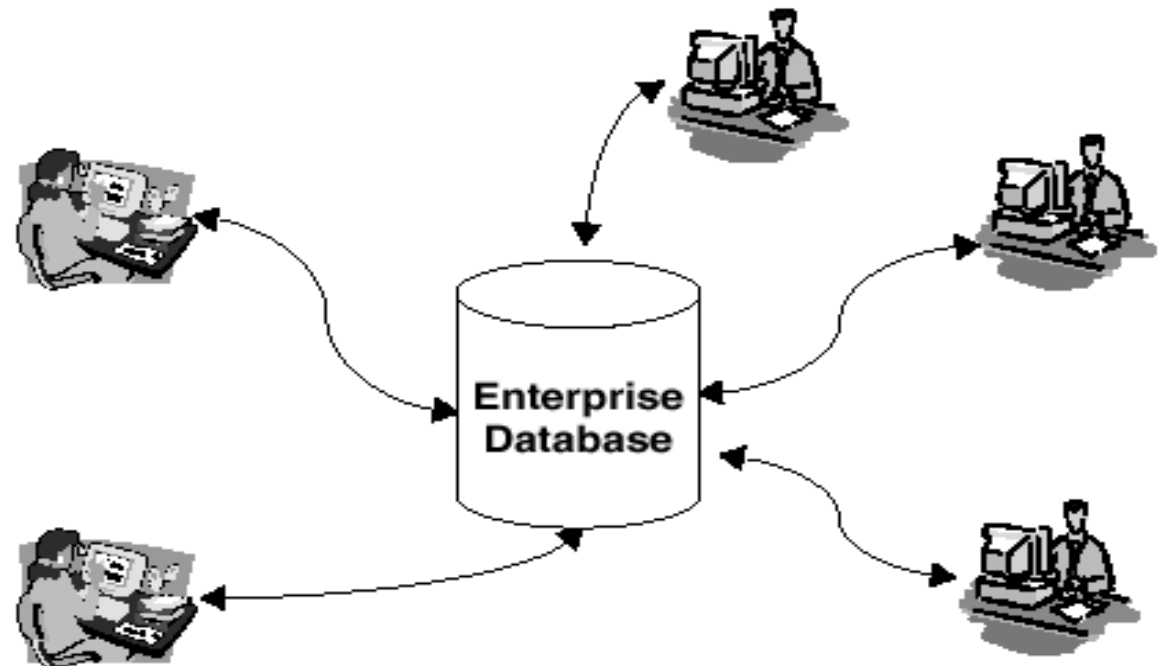
- Implement the specifications as programs with high level language
- Testing, Debugging, Documenting & maintaining transactions

» End users

- Casual
- Naïve
- Sophisticated



Centralized Database Environment



All data at a single site.

**Data access from remote sites
through communication links.**

Easy to administer.

Uncertain data availability.

Common Examples:

Personal Database

Central Computer Database

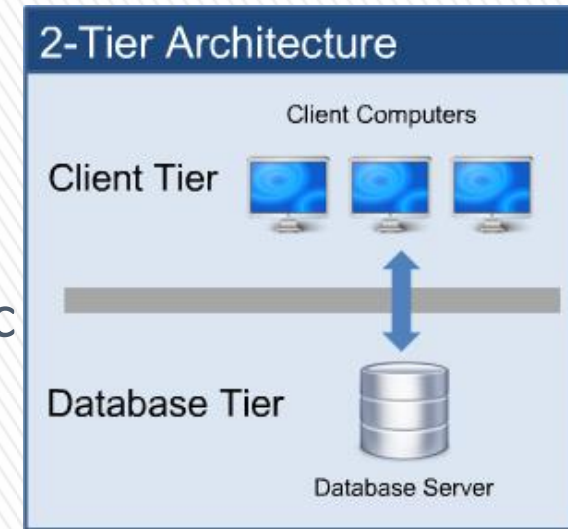
Client/Server Database

Centralized database.

Client – Server Architecture

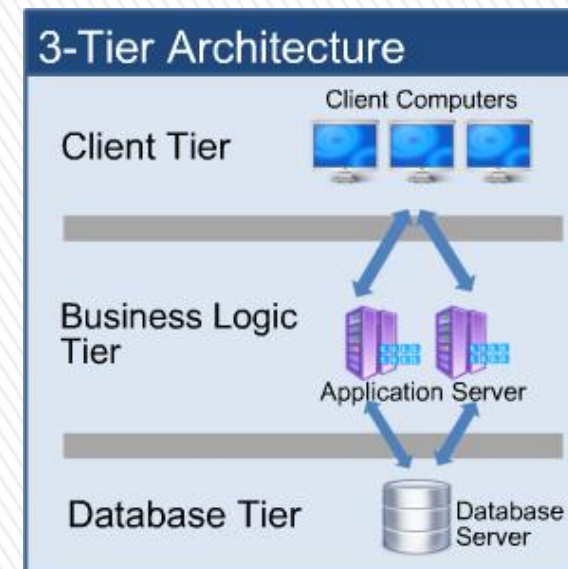
» 2- tier:

1 tier for database, and the other for Logic & interface **OR** 1 tier for database and logic and the other for interface

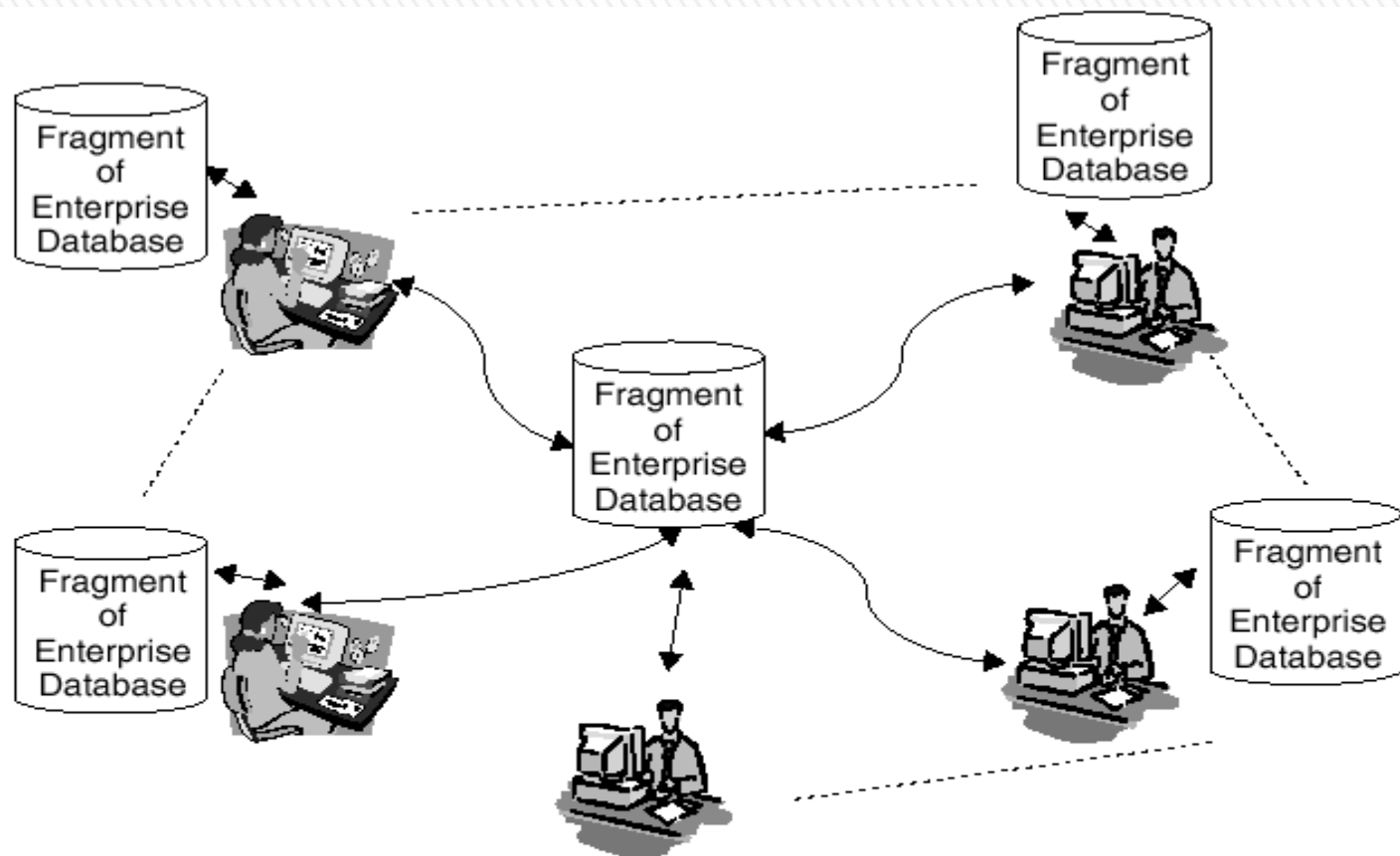


» 3- tier:

1 tier for database, and 1 tier for Logic and the last tier for interface



Distributed Database Environment



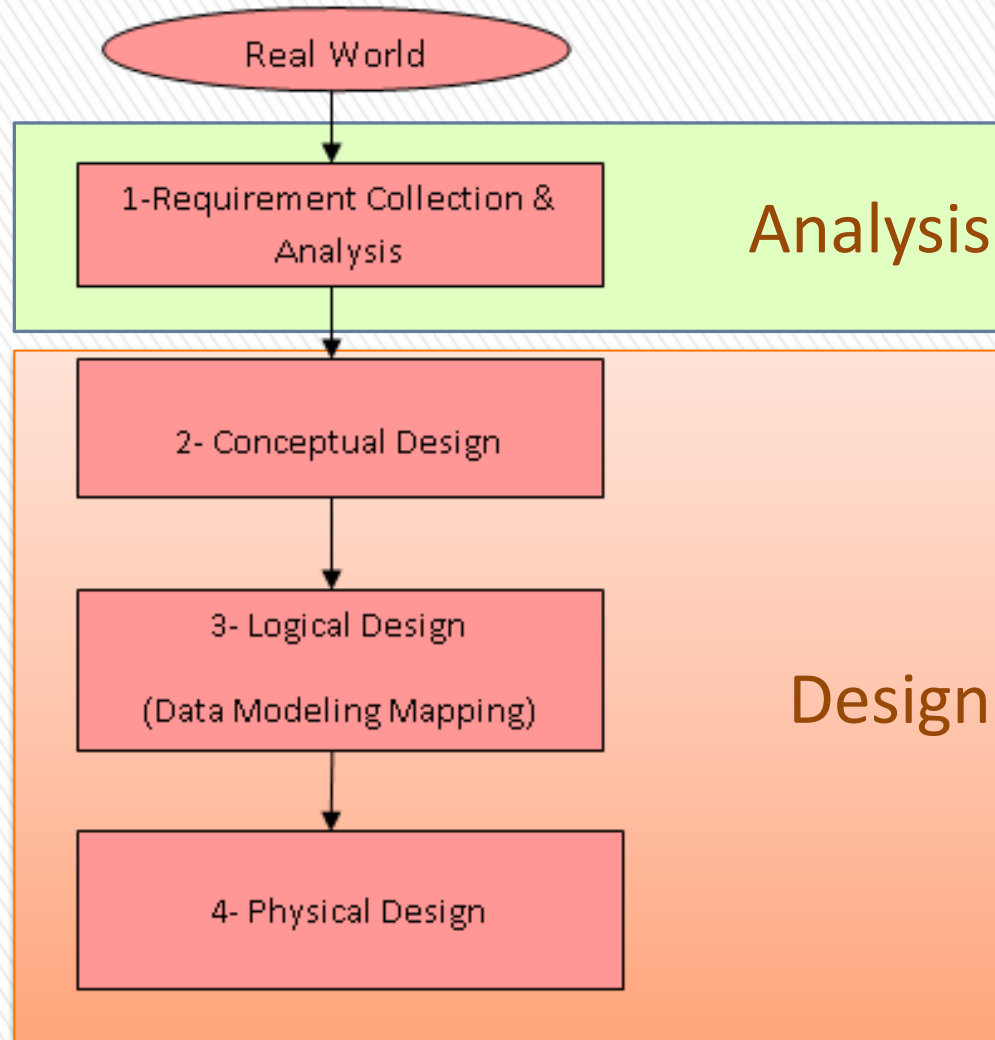
For global and spread-out organizations, centralized databases not economical. Enterprise data distributed across multiple computer systems.

Two categories:

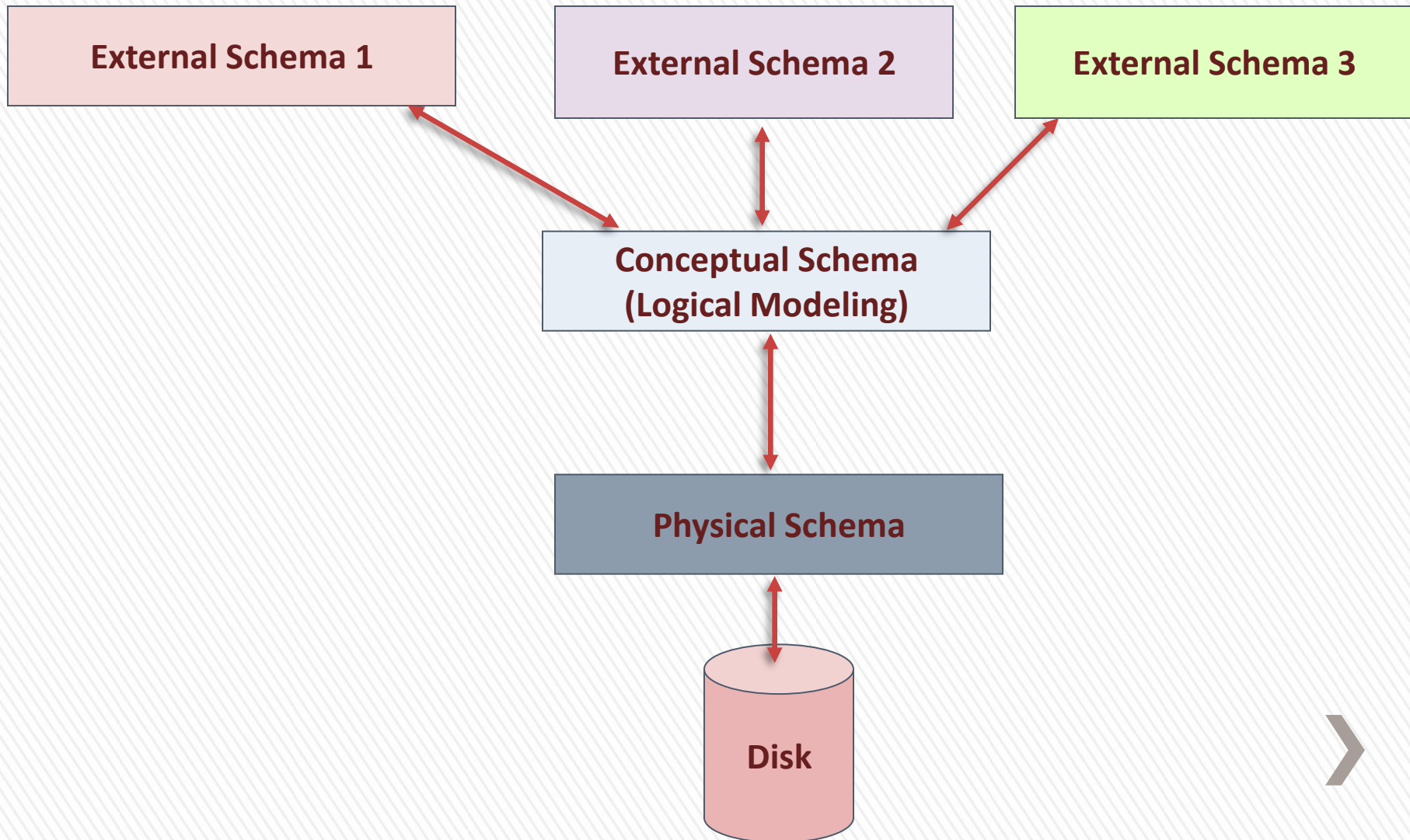
Homogeneous databases

Heterogeneous databases

Database Design Phases



DBMS Architecture



Three Level/Schema Architecture

» External


concerned with what data the user will see and how the data will be presented to the user.

» Conceptual (The logical model)

concerned with *what* is represented rather than *how* it is represented.(define database structures such as tables and constraints)

» Internal (The physical model)

emphasis on *how* the data are represented in the database or on *how* the data structures are implemented.



Data Independence

The capacity to change the schema at one level without having to change the schema at the next higher level



Data Models

- » High Level or Conceptual data models provide concepts that are close to the way many users perceive data, entities, attributes and relationships.
(Ex. ERD)
- » Physical data models describes how data is stored in the computer and the access path needed to access and search for data.



Questions ?

