Database Systems

Engr. Madeha Mushtaq

Department of Computer Science

Iqra National University

What is a Database?

- Basically a computerized record keeping system.

- Can be regarded as a kind of electronic filing cabinet, that is, it is a repository for a collection of computerized data.

- Users of the system can perform a variety of operations, for example:

What is a Database?

- Adding new files to the database.

- Inserting data into existing files.

- Retrieving data from existing files.

- Deleting data from existing files.

- Changing data in existing files.
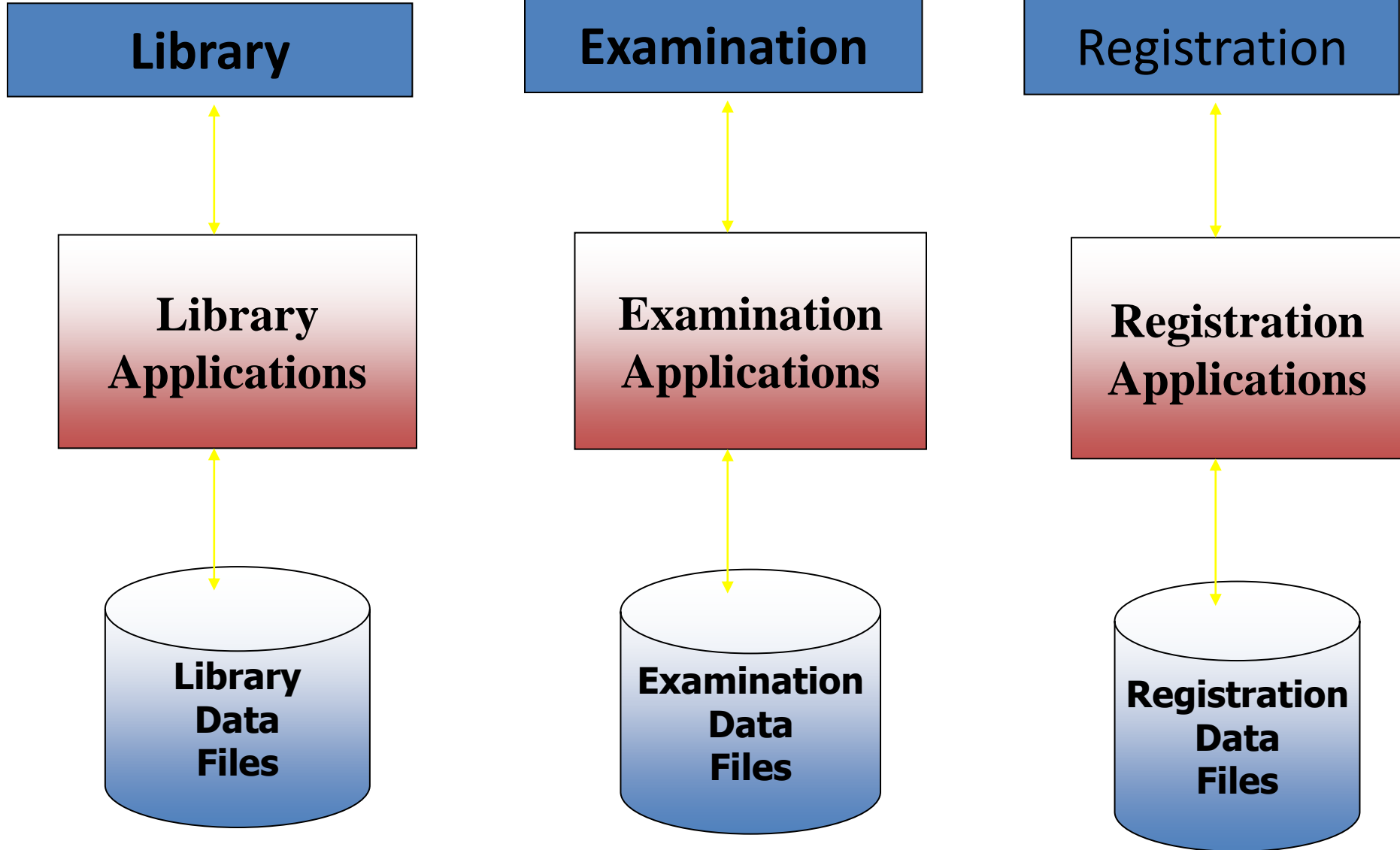
- Removing files from the database.

A bit of History

- Computer initially used for computational/ engineering purposes.
- Commercial applications introduced File Processing System.

File Processing System

- A collection of programs that perform services for the end-users such as production of reports.

- In traditional file processing each user defines and implements the files needed for a specific software application as part of programming the application.

File Processing Systems

Library	Examination	Registration

Library Applications	Examination Applications	Registration Applications

Library Data Files	Examination Data Files	Registration Data Files

Program and Data Interdependence

File Processing Systems

Library
Reg_Number
Name
Father Name
Books Issued
Fine

Examination
Reg_Number
Name
Address
Class
Semester
Grade

| Registration |
| --- |
| Reg_Number |
| Name |
| Father Name |
| Phone |
| Address |
| Class |

Database Approach
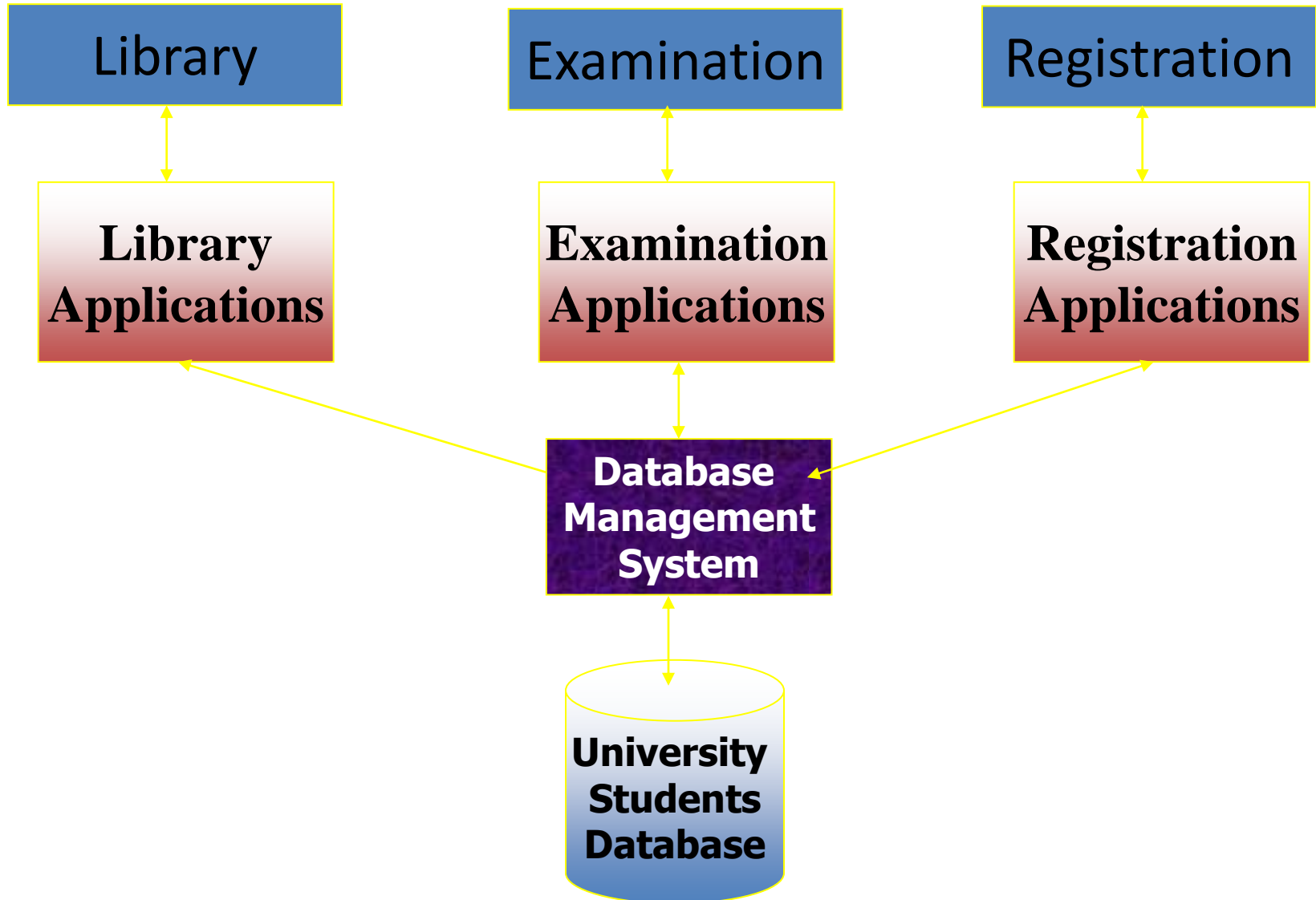
Database Approach

- In the database approach, a single repository maintains data that is defined once and then accessed by various users.

- In file systems, each application is free to name data elements independently.

- In contrast, in a database, the names or labels of data are defined once, and used repeatedly by queries, transactions, and applications.

Database Approach

- The main characteristics of the database approach versus the file-processing approach are the following:
  - Self-describing nature of a database system
  - Insulation between programs and data, and data abstraction
  - Support of multiple views of the data
  - Sharing of data and multiuser transaction processing

Characteristics of Database System
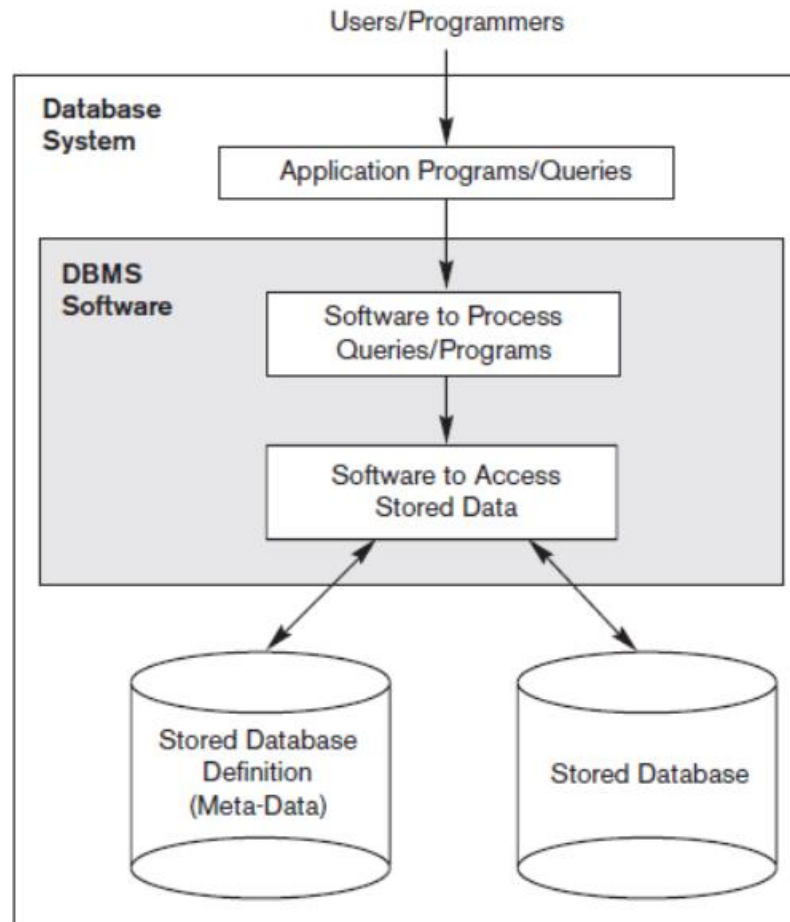
Self-Describing Nature of a Database System

- A fundamental characteristic of the database approach is that the database system contains not only the database itself but also a complete definition or description of the database structure and constraints.

- This definition is stored in the DBMS catalog.

- The information stored in the catalog is called **meta-data**, and it describes the structure of the primary database.

Insulation between Programs and Data/Data Abstraction

- In traditional file processing, the structure of data files is embedded in the application programs, so any changes to the structure of a file may require changing all programs that access that file.

- By contrast, DBMS access programs do not require such changes in most cases.

- The structure of data files is stored in the DBMS catalog separately from the access programs.

Insulation between Programs and Data/Data Abstraction

- This property is called program-data independence.

- The characteristic that allows program-data independence and program-operation independence is called data abstraction.

- A DBMS provides users with a conceptual representation of data that does not include many of the details of how the data is stored or how the operations are implemented.

Support for Multiple Views of Data

- Database typically has many users, each of whom may require a different perspective or view of the database.

- A view may be a subset of the database or it may contain virtual data that is derived from the database files but is not explicitly stored.

Sharing of Data and Multiuser Transaction Processing

- A multiuser DBMS, as its name implies, must allow multiple users to access the database at the same time.

- The DBMS must include concurrency control software to ensure that several users trying to update the same data do so in a controlled manner so that the result of the updates is correct.

Advantages of Database Approach

- Data consistency

- Better data security

- Improved data standards

- Database approach also provides Balancing of conflicting requirements

- Faster development of new applications

- Better data accessibility

Advantages of Database Approach

- Economy of scale

- Better control concurrency

- Better backup and recovery procedures.

Database Users

- Application Programmers
  - System analysts determine the requirements of end users, especially naive and parametric end users.
  - Application programmers implement these specifications as programs; then they test, debug, document, and maintain these canned transactions.
  - Application programmers should be familiar with the full range of capabilities provided by the DBMS to accomplish their tasks.

Database Users

- Database Designers
  - Database designers are responsible for identifying the data to be stored in the database and for choosing appropriate structures to represent and store this data.
  - These tasks are mostly undertaken before the database is actually implemented and populated with data.

Database Users

- End Users
    - End users are the people whose jobs require access to the database for querying, updating, and generating reports; the database primarily exists for their use.

Database Users

- Database Administrator (DBA)
  - A person who has central control over data and programs that access this data.
  - The DBA is responsible for authorizing access to the database, coordinating and monitoring its use, and acquiring software and hardware resources as needed.
  - The DBA is accountable for problems such as security breaches and poor system response time.

Functions of DBA

- Schema definition
- Granting data access
- Routine Maintenance
    - Backups
    - Monitoring disk space
    - Monitoring jobs running

Data, Database, Data Model and DBMS
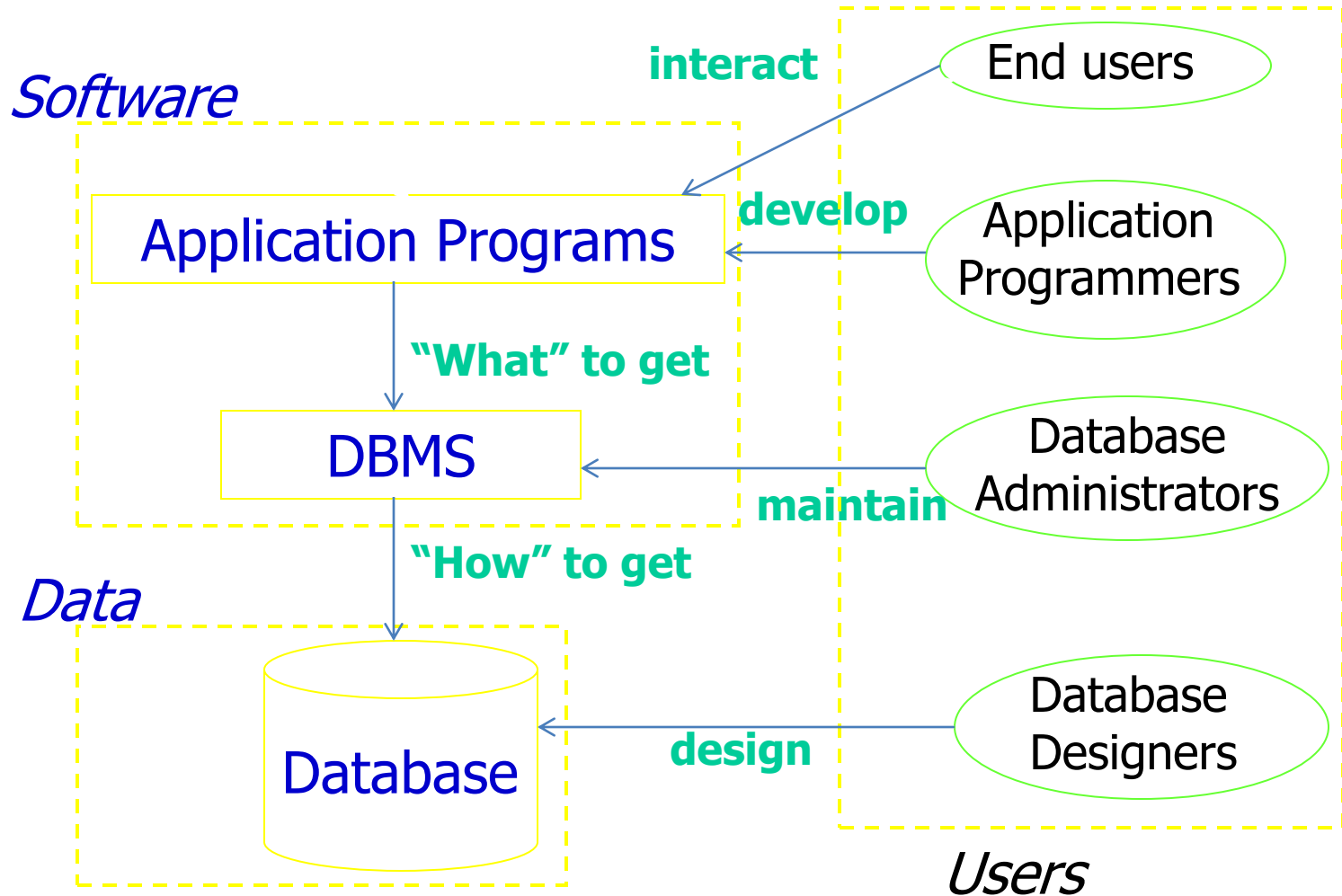
Common Terms

- Data
- Information
- Database Management system (DBMS)

Common Terms

- Data: Facts concerning things, such as people, objects, or events

- Information: Data that have been processed and presented in a form suitable for human interpretation.

Common Terms

DBMS:

- A database management system (DBMS) is a software package designed to define, manipulate, retrieve and manage data in a database.

- A DBMS generally manipulates the data itself, the data format, field names, record structure and file structure.

Common Terms

DBMS:

- It also defines rules to validate and manipulate this data.
- DBMS examples include:
  - MySQL
  - SQL Server
  - Oracle
  - dBASE
  - FoxPro

End of Slides