CM1603 - Database Systems

Week 01 | Introduction to DBMS

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Learning Outcomes

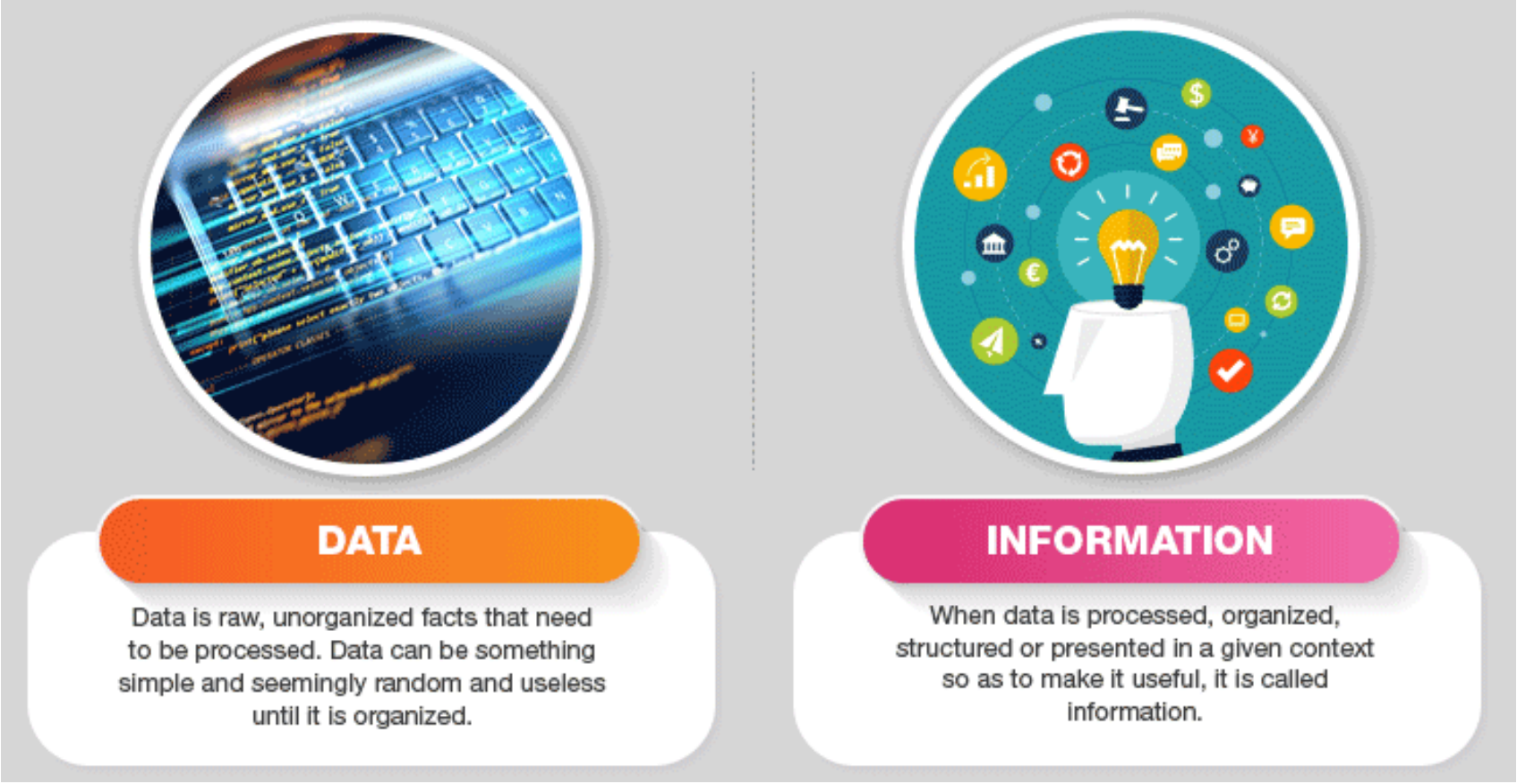
- Preparing for LO1 of Module

- On completion of this lecture, students are expected to be able to:
  - Define data and information
  - Understand different data processing systems
  - Understand the importance of the database system
  - Define a data model and different types of data models
  - Identify and define Relational Data model

Lesson Outline

- Data & Information
- Data Processing Systems
- Introduction to Database and DBMS
- Applications of Databases
- Data Models in DBMS
- Database Architecture
- The Role of a Database
- People who deal with databases

What is Data and Information?



Data vs. Information

- **Data** can be any individual fact like character, text, word, number, picture, sound, or video. Data doesn't carry any significance or purpose on its own.

- **Information** is useful and can be understood by the human. Information enables decision making

Example for Data and Information

Example of Data:

Joe, 34, Smith, Mr., NW65JH, Abbey, London, Road, England

Example of Information:

Mr. Joe Smith,
34 Abbey Road,
London,
NW65JH
England

Data Processing Systems

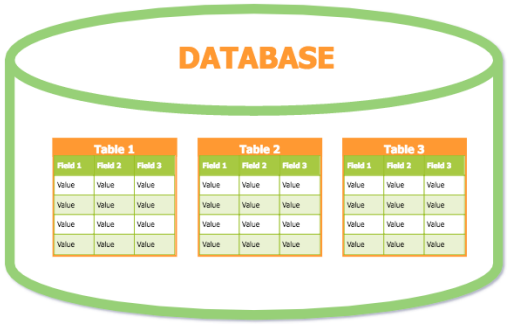
- **Manual Processing**

- **File based Processing**

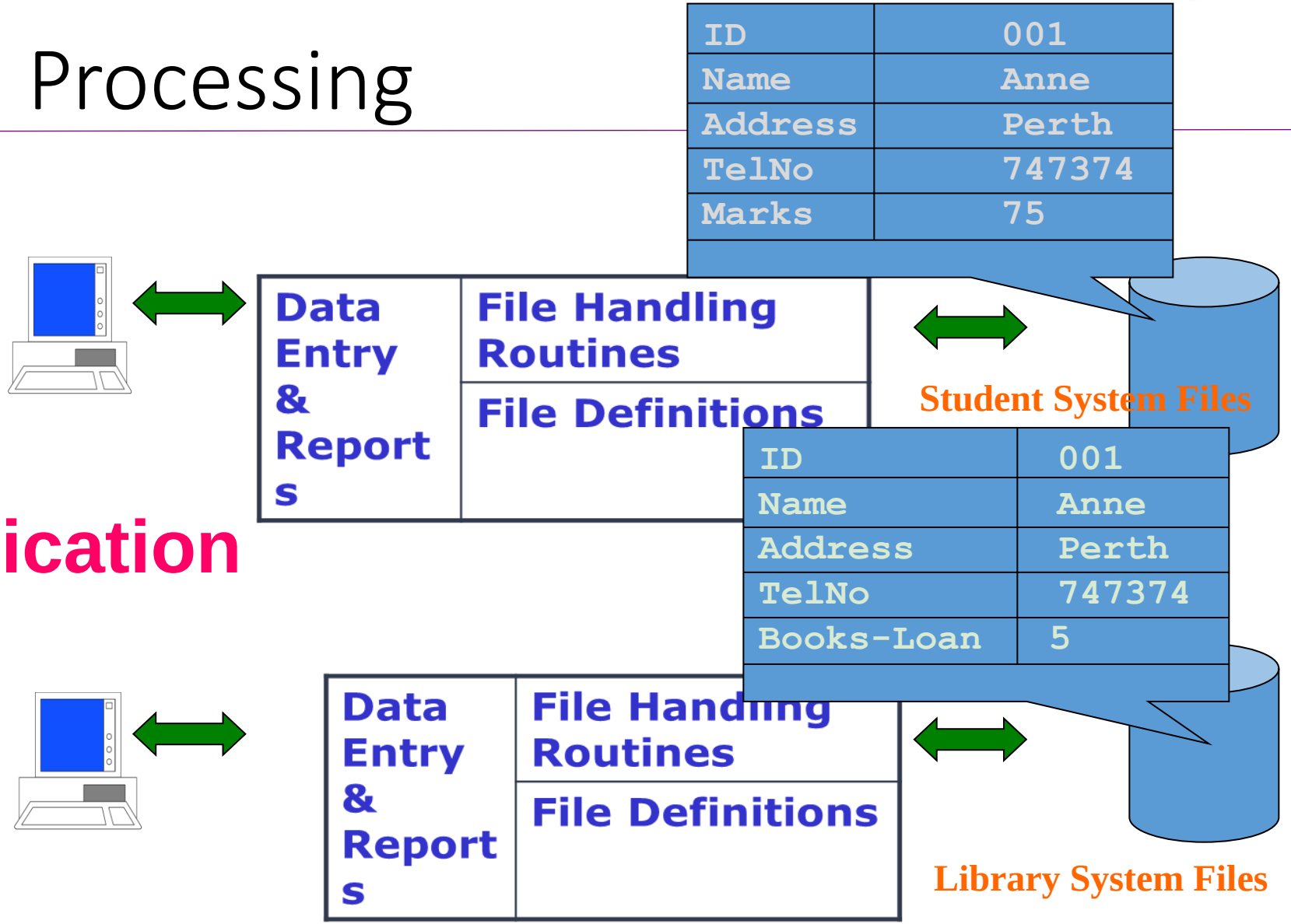
Traditional Computer Files

Patient Id	Name	D.o.B	Gender	Phone	Doctor Id	Doctor	Room
134	Jeff	4-Jul-1993	Male	7876453	01	Dr Hyde	03
178	David	8-Feb-1987	Male	8635467	02	Dr Jekyll	06
198	Lisa	18-Dec-1979	Female	7498735	01	Dr Hyde	03
210	Frank	29-Apr-1983	Male	7943521	01	Dr Hyde	03
258	Rachel	8-Feb-1987	Female	8367242	02	Dr Jekyll	06

- **Database Processing**

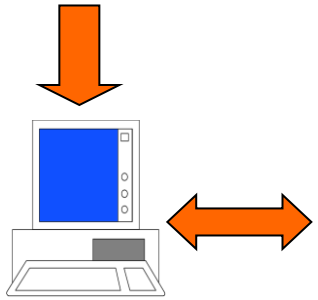


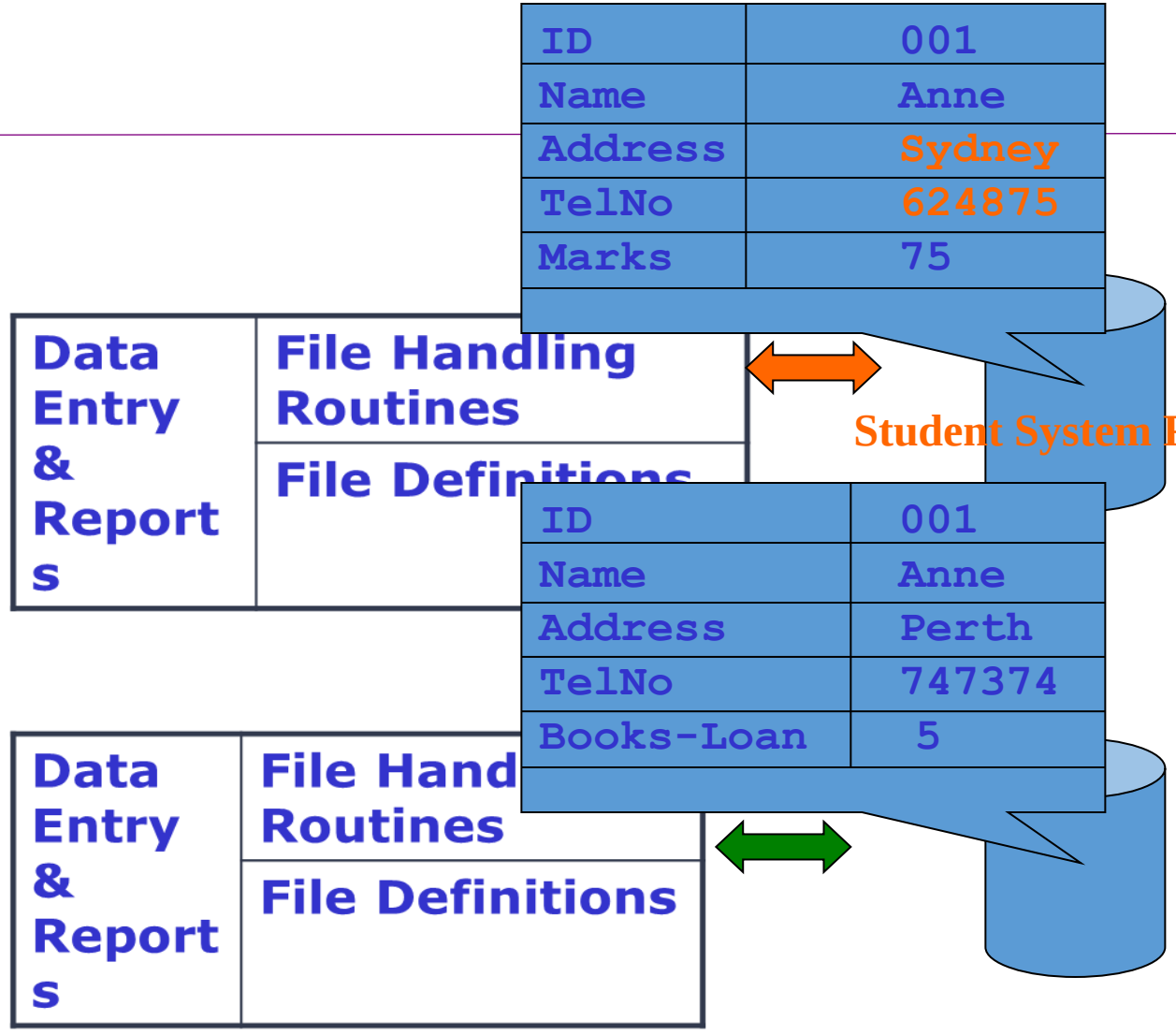
File-based Processing



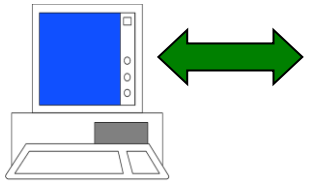
Data Duplication

Change request





Inconsistent Data



Limitations of a file-based system

- Data Inconsistency
- Data Duplication
- Data integrity problems
- Incompatible file format
- Security Issues – Only password security

How do we resolve these problems?

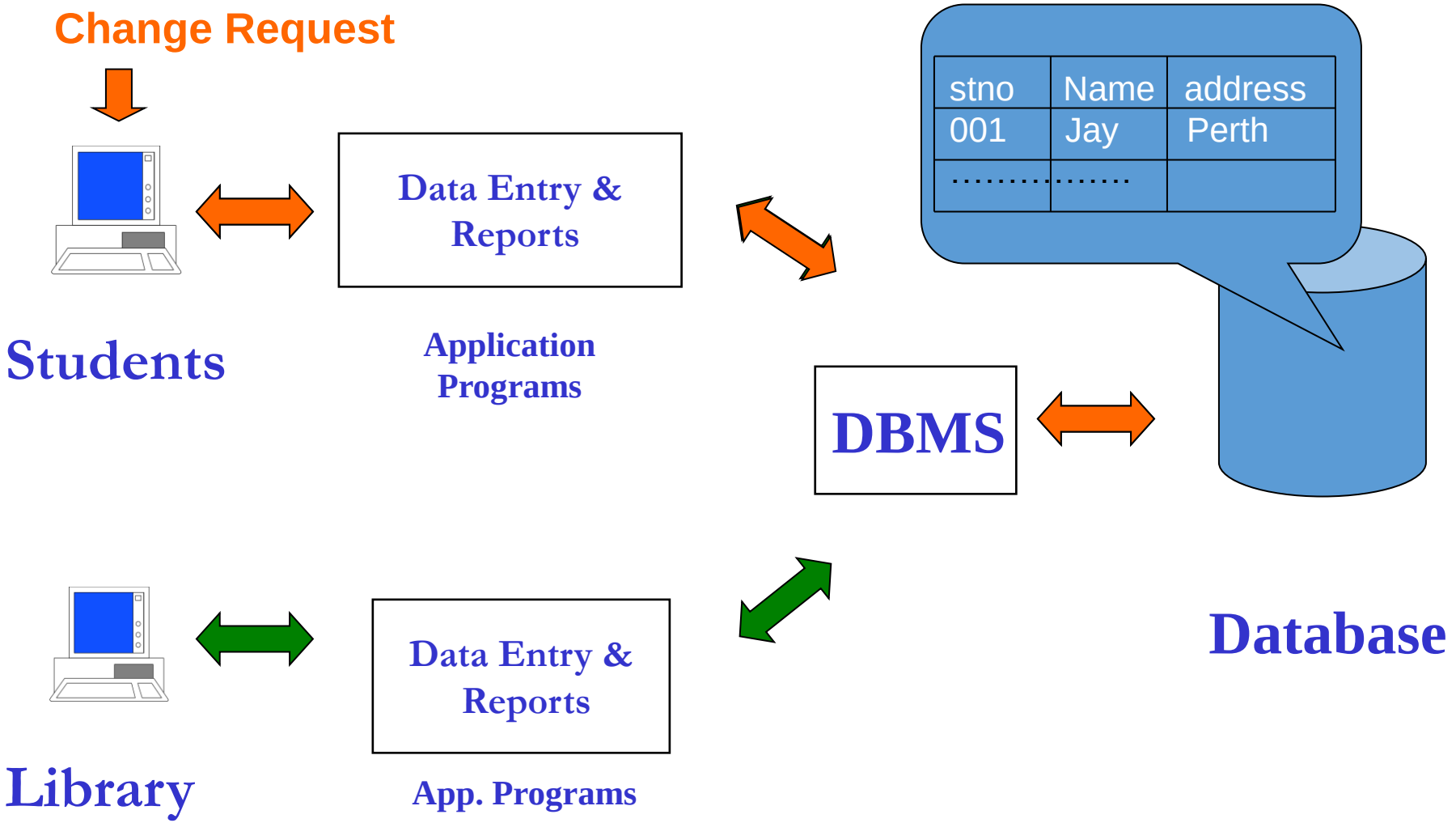
Introduction to Database & DBMS

- **What is a database?**
  - A database is **a collection of logically related data.**

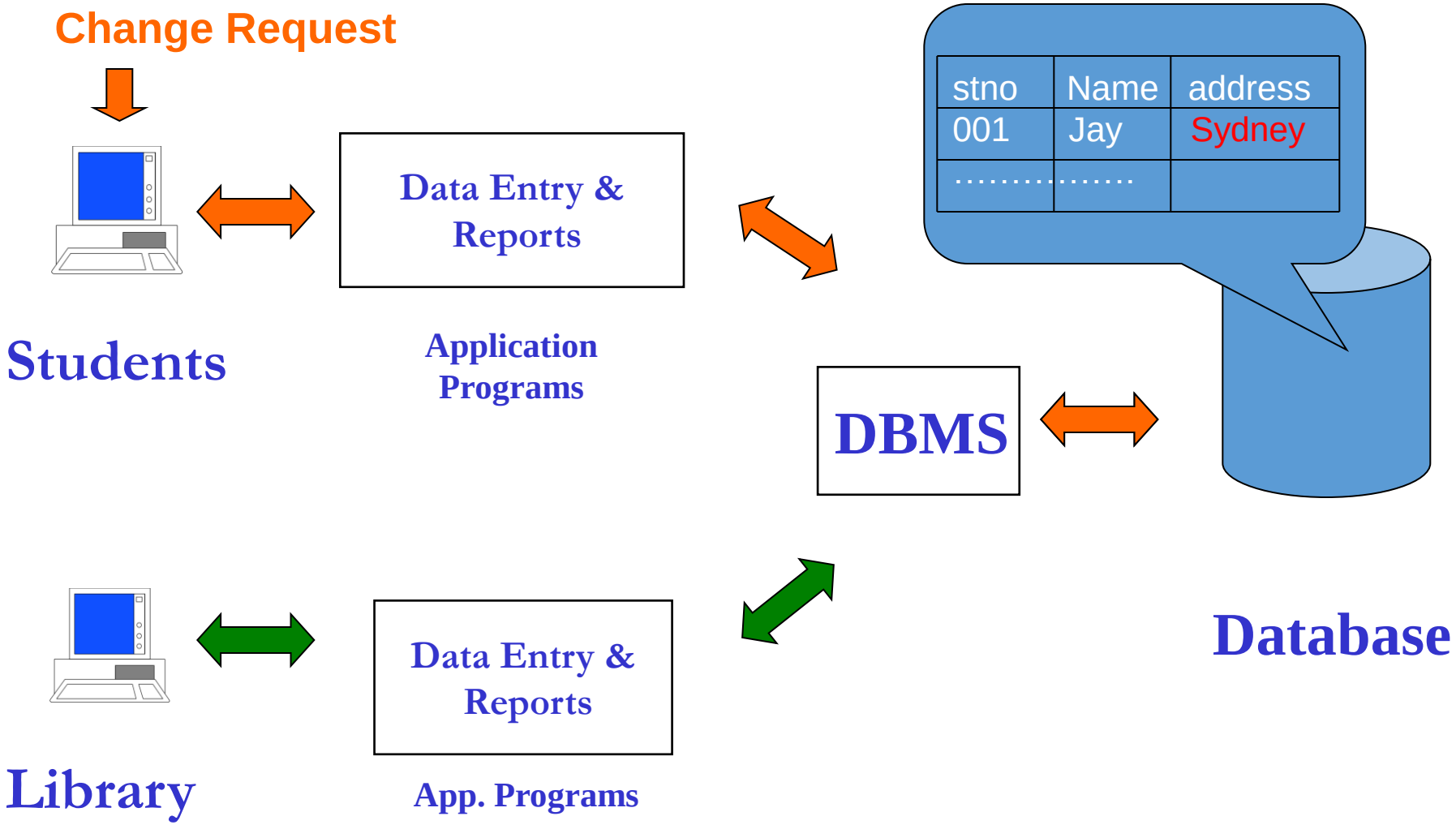
- **What is a DBMS (Database Management System)**
  - Set of programs to access the data.
  - A software package designed to create and maintain databases.

    - Eg: MS Access, MySQL, Microsoft SQL Server, Oracle, etc.

Database Processing



Database Processing



Advantages of database systems

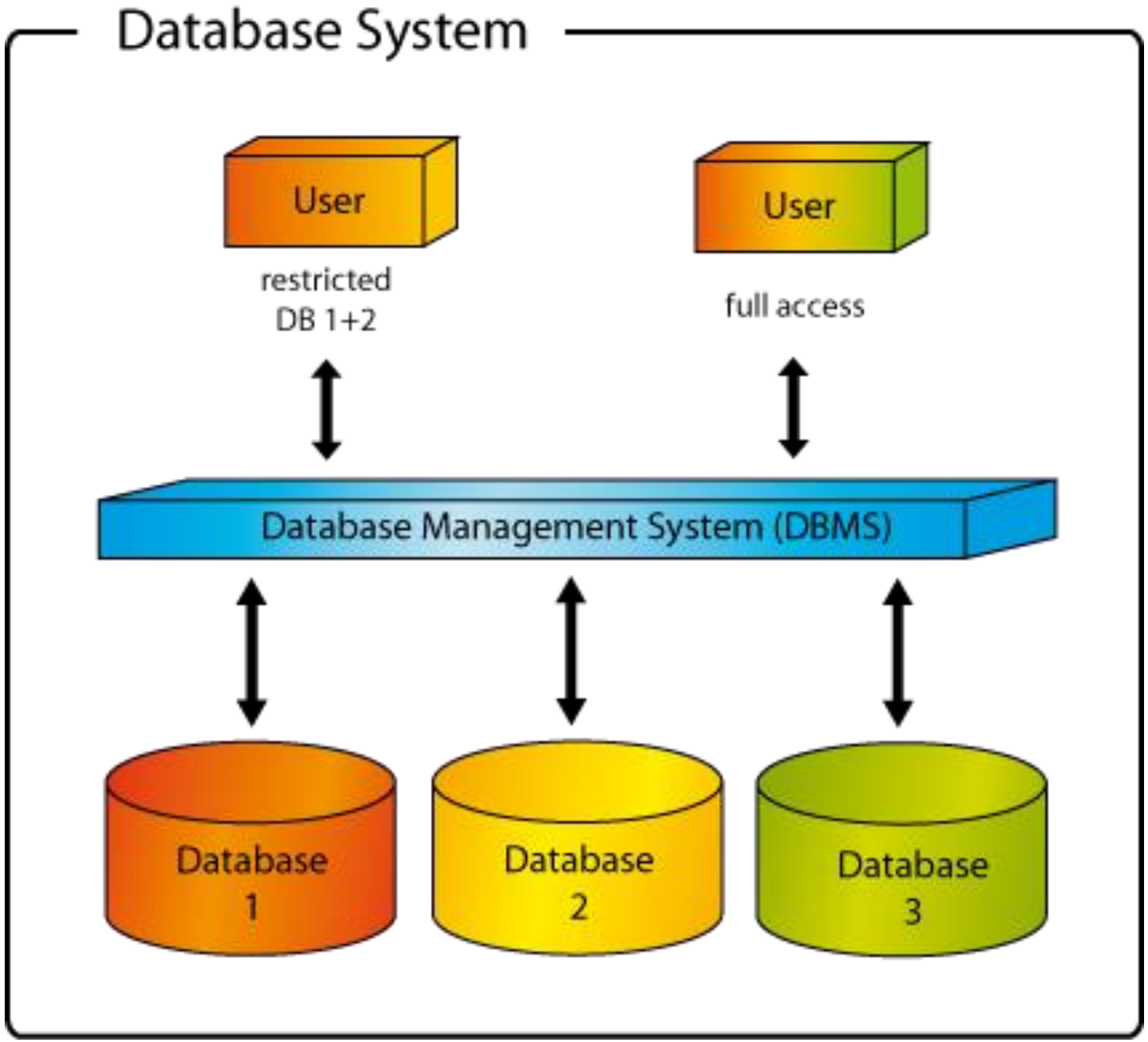
- Minimize data redundancy
- Data independence
- Efficient access to data
- Data integrity is high
- High security
- Improve data quality and accuracy
- Easy data administration
- Provide concurrent access
- Easy data sharing

Applications of Databases

Data Models in DBMS

- Defines the logical design and structure of a database and defines how data will be stored, accessed and updated in a DBMS.

- There are several data models:
  - Hierarchical Model
  - Network Model
  - Entity-relationship Model
  - **Relational Model** (Most widely used database model)
  - Object Oriented Model


Database System
User
restricted
DB 1+2
User
full access
Database Management System (DBMS)
Database
1
Database
2
Database
3

Database Architecture

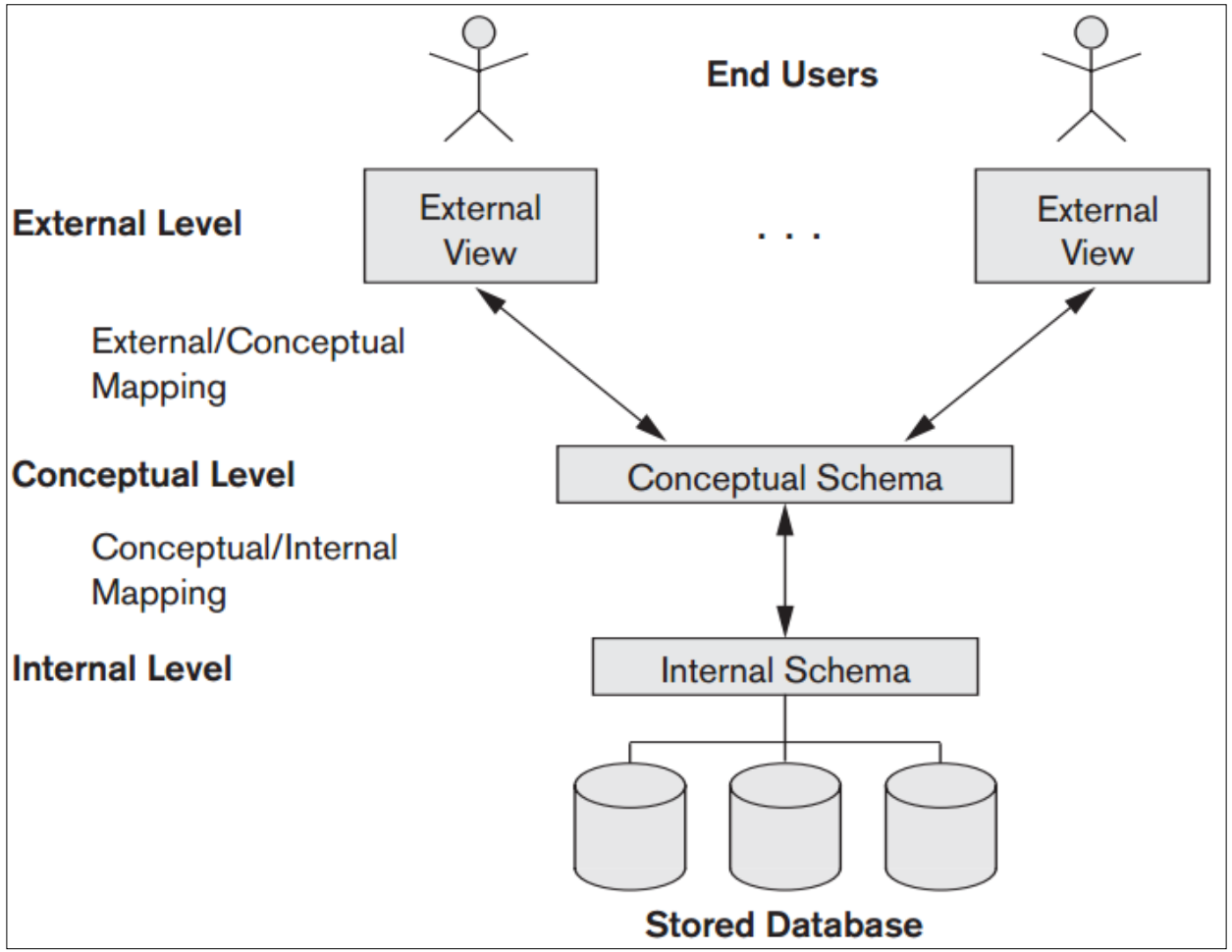
3 Level ANSI-SPARC Architecture

3 Schema (3 Tier) Architecture

- It contains 3 levels/views/schemas
  - External Schema (View Level)
  - Conceptual Schema (Logical Level)
  - Physical Schema (Internal Level)

- These 3 levels are defined as **levels of data abstraction.**
- Information about the schemas is stored in the system catalog

Database Architecture



Note: any given database has exactly one conceptual schema and one physical schema because it has just one set of stored relations, but it may have several external schemas

External Schema

- The users' view of the database.
- Describes the part of the database that is relevant to each user.
- Describe how users or programs see the data.
- Application programs hide details of data types.
- Can hide some information (eg: Salary) for security purposes.
- Different external views can be provided to different categories of users.

Conceptual Schema

- Defines the logical structure of the entire database.
- Describes what and how data is stored in the database and the relationships among the data.
- Describes all relations that are stored in the database.
- Defines the data types, field sizes, primary keys, foreign keys etc.

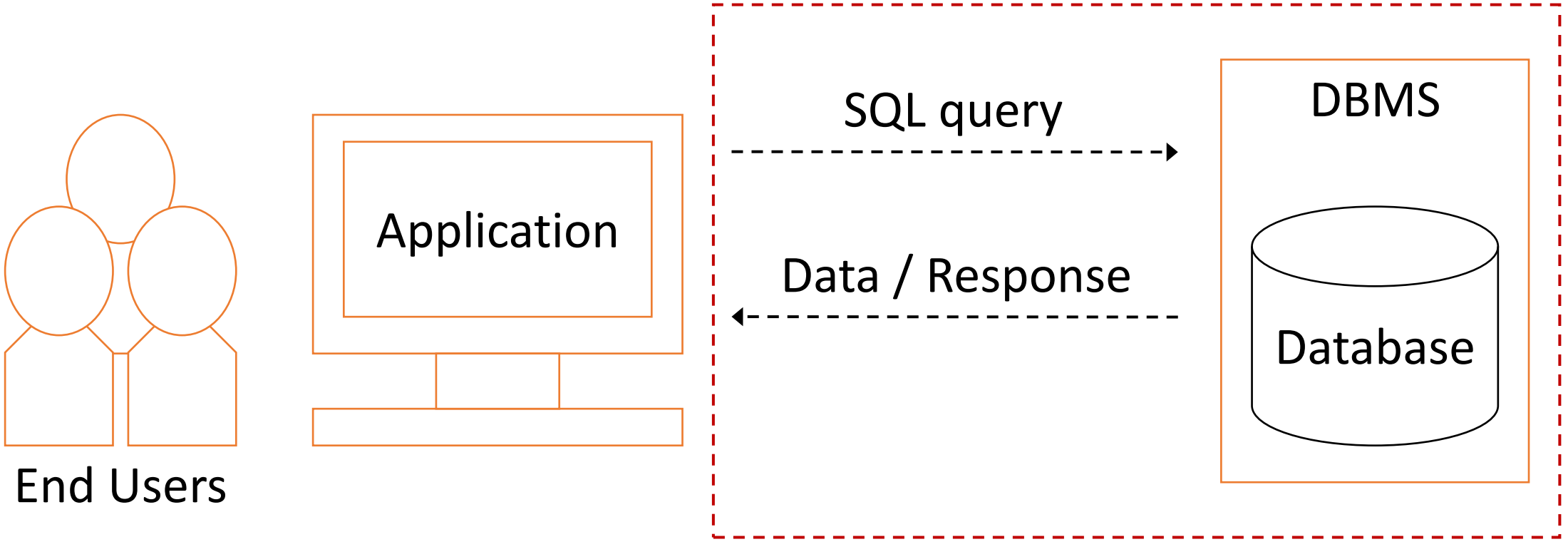
Physical Schema

- The physical representation of the database on the computer.
- Describes how the data is stored in the database in terms of record formats, file structures, indexes etc.
- Describes how the files and indexes are used.
- Describes how a record is stored.
- Provides the disk drives and physical addresses.
- Physical database design is the responsibility of the database administrator(DBA).

The Role of a Database

- The database is typically not accessed directly by users.
  - It is first designed.
  - Then implemented in a DBMS.
  - The DBMS hosts the database, making it available for applications to interact with as needed.
  - Applications interact with the database; requesting data from it, inserting data into it, updating data in it, and deleting data from it.
  - Users interact with the application, not directly with the database.
  - This controls access to the database, allowing policies and procedures to be enforced.

The Role of a Database



- The DBMS may contain multiple databases
- Multiple different applications may interact with a DBMS/database

People who deal with databases

End users- uses applications written by database application programmers

Application Programmers – develop packages that facilitates data access for end users.

Database Administrators – undertake the task of designing and maintaining the database.

Thank you

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