UNIVERSITY of RWANDA

COLLEGE OF SCIENCE AND TECHNOLOGY

SCHOOL OF ICT

DEPARTMENT OF INFORMATION SYSTEMS

YEAR II

DATABASE DESIGN AND MANAGEMENT (ISY2161)

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Course Information

- Prerequisites : None
- Credits: 10
- Assessments: 100%
  - Quizzes: 10%
  - Assignments : 10%
  - Continuous Assessment Tests(2): 30%
  - Final Exam: 50%
- Office Hours: Working days (8:00am-5:00pm)

Indicative Contents

Unit One: Database Management System and Design Concepts

Chapter 1: Database overview

- Information
- Database
- Why Databases?

Chapter 2:File-Based systems

- Features
- File-based processing
- Limitations of File based systems approach

Chapter 3:Database Management System (DBMS)

- Components of DBMS
- Functions, Advantages and disadvantages of a DBMS
- Database approach
- Database views
- Roles in Database environment

Chapter 4: Database Architecture

- Why three-Level architecture (Objectives)
- Three levels of ANSI-SPARC architecture.
- Data dependency
- Database languages

Chapter 5: Data Modeling Concepts

- Categories of data modeling
- Conceptual modeling
- Relational model
- Data modeling concepts
- Relational keys
- Relational Integrity
- Entity relationship symbols, types and relational cardinality

Chapter 6: Normalization

- First Normal Form (1st NF)
- Second Normal Form (2nd NF)
- Third Normal Form (3rd NF)
- Boyce-Codd Normal Form (BCNF)

Chapter 7: Data and Database Security

- Computer and Non-Computer-based measures and controls
- Security in various DBMSs
- DBMS and web Security

Unit Two: Implementation and Administration of Databases

Chapter 8: Database Modeling

- Design of Data Flows Diagram (DFD)
- Design of Entity Relationship Diagram(ERD)
- Design of Logical Data Model (LDM)

Chapter 9:Database Implementation

- Implement the LDM in the database to have the Physical Data Model
- Creation of tables and relationships following referential constraints
- Creation of views**, cursors, sequences, triggers and stored procedures**

Chapter 10: Administering the Database

- Users creation and management
- Granting and revoking privileges
- Database security
- Recovery management

Unit One:

Database Management System and Design Concepts

Chapter 1:
Overview of Database

- ✓ A **Database** is a collection of related data organized in a way that data can be **easily accessed**, **managed** and **updated**.
- ✓ Any piece of information can be a **data**, for example name of your District.
- ✓ Database is actually a **place where related piece of information** is **stored and various operations** can be **performed** on it.

Properties of Database (DB)

- It is a **representation of some aspect of the real world** or a **collection of data elements (facts)** representing real **world information.**
- A database is **logical, coherent and internally consistent**.
- A database is designed, built and populated with data for a specific purpose.
- Each data item is stored in a field.
- A combination of fields makes up a **table.**

Example of a Database

Student

StudName	StudNo	Class	Dept
Smith	17	1	CS
Brown	8	2	CS

Course

CourseName	CourseNo	Credits	Dept
Introduction to CS	CS1310	4	CS
Data Structures	CS3320	4	CS
Discrete Mathematics	MA2410	3	MA
Database Management	CS3380	3	CS

Prerequisite

CourseNo	PrereqNo
CS3380	CS3320
CS3380	MA2410
CS3320	CS1310

Session

SessIdent	CourseNo	Semester	Year	Professor
85	MA2410	Fall	96	King
92	CS1310	Fall	96	Anderson
102	CS3320	Spring	97	Knuth
112	MA2410	Fall	97	Chang
119	CS1310	Fall	97	Anderson

GradeReport

StudNo	SessIdent	Grade
17	112	14
17	119	12
8	85	16
8	92	16
8	102	14

Database System Environment

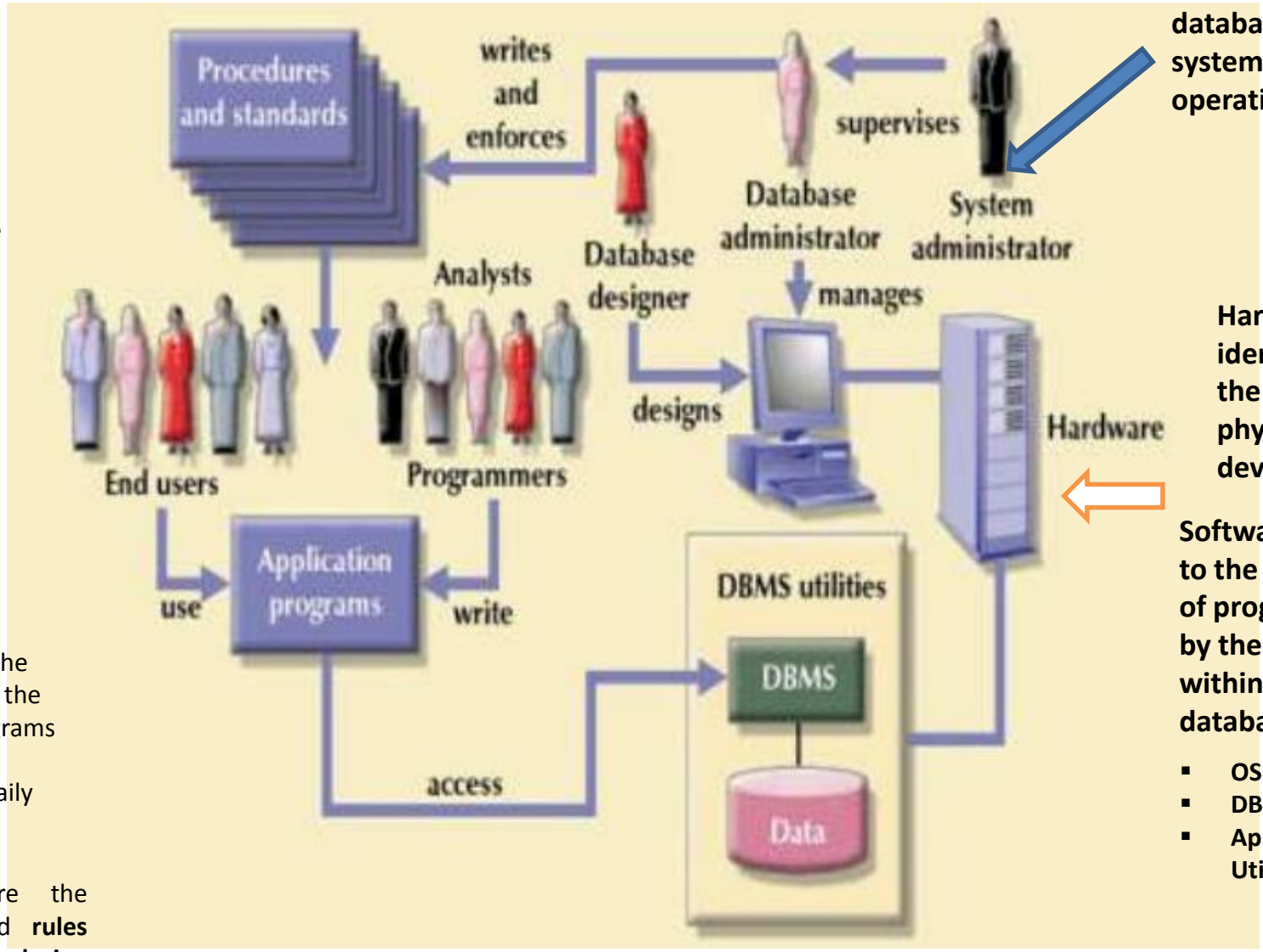
DA: Ensure that the database is functioning properly.

D.D: Design the database structure. They are, in effect , the database architects.

SA & Programmers: Design and implement the application programs.

End-users: Are the people who use the application programs to run the organization's daily operations.

Procedures: Are the **instructions** and **rules that govern the design and use of the database system.**



Oversee the database system's general operations

Hardware identifies all the system's physical devises.

Software refers to the collection of programs used by the computers within the database system.

- **OS**
- **DBMS Software**
- **App.programs & Utilities**

Figure 1:Database System Environment

Why Database?

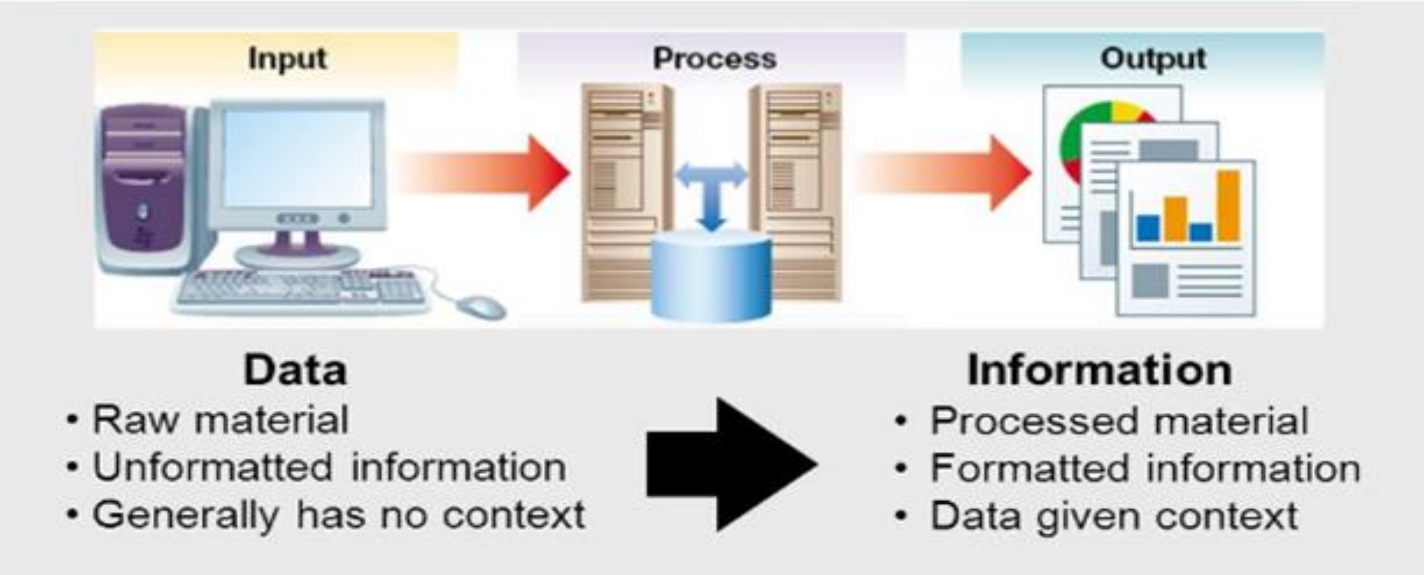
- Redundancy can be reduced
- Inconsistency(instability) can be avoided
- The data can be shared
- Standards can be enforced
- Security restrictions can be applied
- Integrity can be maintained
- Provision of data independence

  - **Integrity:** Is the assurance that the information is trustworthy and accurate (protecting information from being modified by unauthorized parties)

The Essence (Quality of) of a Database

- Organization of data
- Efficient retrieval of data
- Reliable storage of data
- Maintaining the consistency of the data
- Sharing data
- Structuring the data

Data vs. Information



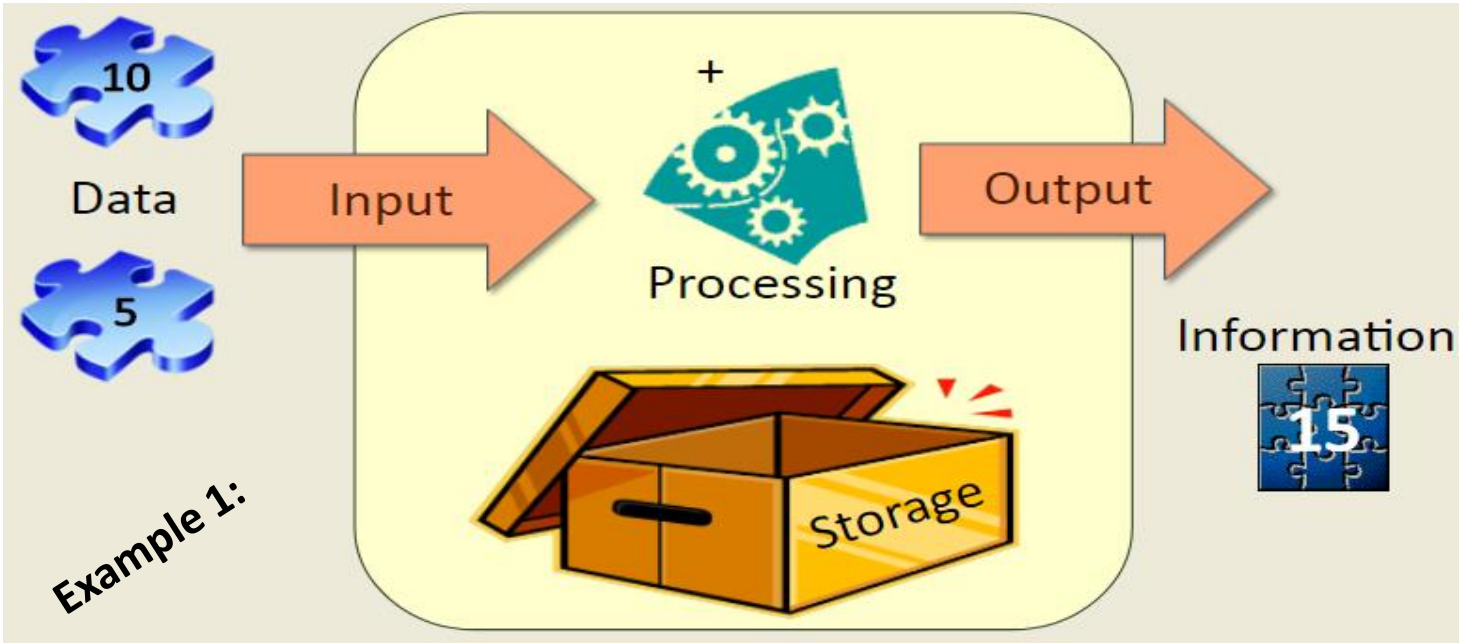


Figure 2: Data vs. Information

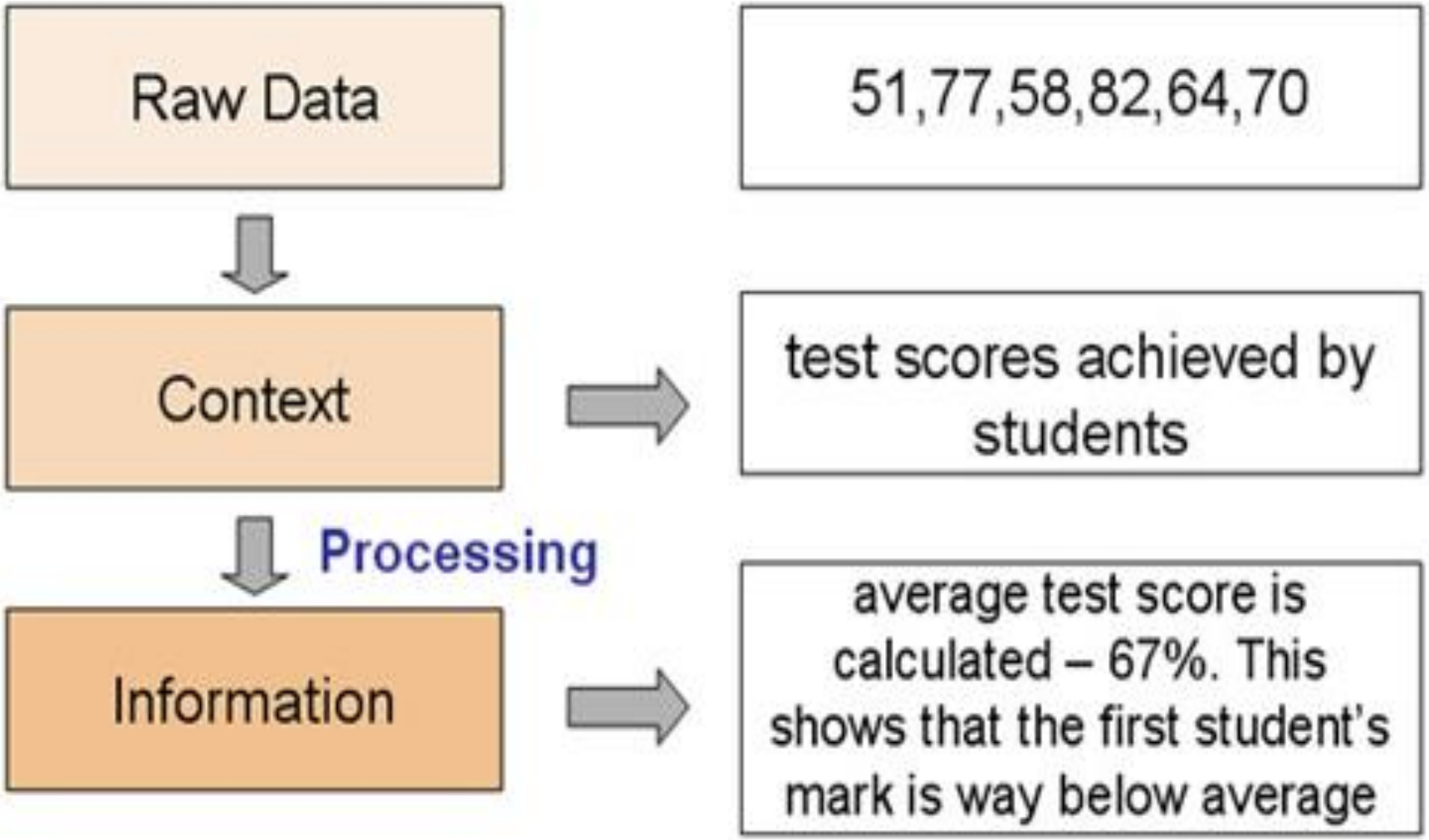


Figure 3: Example 2 of Data & Information

Chapter 2:
File-Based Systems

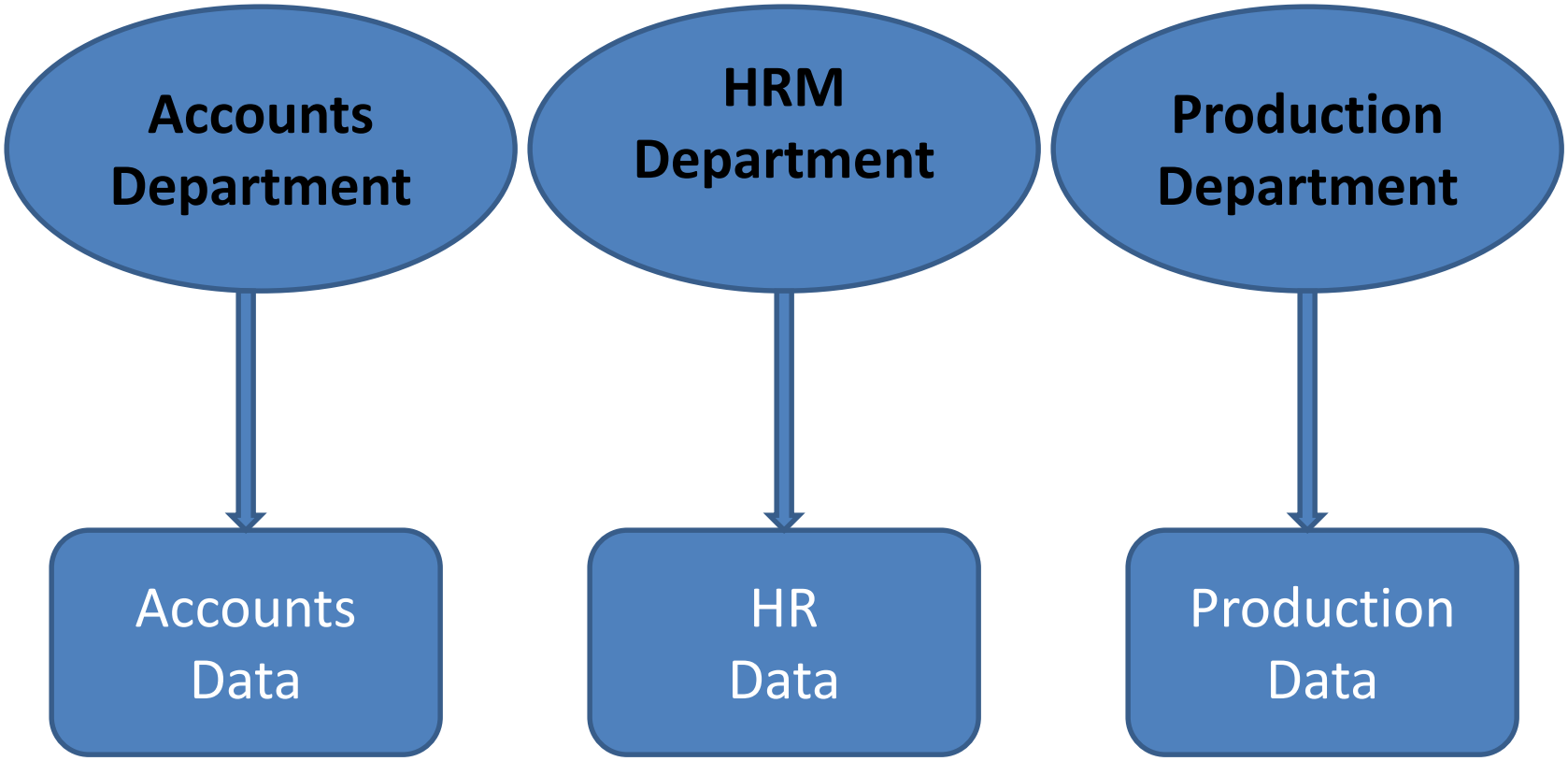
Outline

- ✓ Introduction about File based system
  - What is file based system?
  - How it works?
- ✓ Advantages & disadvantages in file based system
- ✓ Solution for those problems

What is file based system?

- A file based system is a collection of **application programs** that **perform services for the user.**
- **Each program** within a file based system **defines and manages** its own data.

How it works?



- **Each department maintains their own set of data.**
- **There is no link between those data pools.**

Advantages of file based system

- No need of external storage
- No need of highly technical person to handle the database.
- Processing speed is high as compare to DBMS
- Low cost (ex: Equipments)

Disadvantages of File based system

- Provide less security.
- High complexity in updating of database
- Data separation and isolation
- Data dependence
- Data duplication
- Incompatible data (different file formats)
- Lack of flexibility in organizing and querying the data
- Increased number of different application programs

Data Redundancy

- Redundancy means having multiple copies of the same data.
- In computer file-based processing system, each application program has its own data files.
- The same data may be duplicated in more than one file. The duplication of data may create many problems such as:

- To update a specific data/record, the same data must be updated in all files, otherwise different file may have different information about a specific item.
- A valuable storage space is wasted.

Data Inconsistency

- Data inconsistency means that different files may contain different information of a particular object or person.
- Actually redundancy leads to inconsistency.
- When the same data is stored in multiple locations, the inconsistency may occur.

Data Isolation and Separation

- In computer file-based system, data is isolated in separate files.
- It is difficult to update and to access particular information from data files.

Data Dependence

- In computer file-based processing systems, the data stored in file depends upon the application program through which the file was created.
- It means that the structure of data files is coupled with application program.

Data Dependence Cont’

- The physical structure of data files and records are defined in the application program code.
- It is difficult to change the structure of data files or records.
- If you want to change the structure of data file (or format of file), then you have to modify the application program.

Program Maintenance

- In computer file-based processing system, the structure of data file is coupled with the individual application programs.
- Therefore, any modification to a data file such as size of a data field, its type etc. requires the modification of the application program also.
- This process of modifying the program is referred to as **program maintenance**.

Data Sharing

- In computer file-based processing systems, each application program uses its own private data files.
- The computer file-based processing systems do not provide the facility to share data of a data file among multiple users on the network.

Data Security

- The computer file-based processing system do not provide the proper security system against illegal access of data.
- Anyone can easily change or delete valuable data stored in the data file.
- It is the most complicated problem of file-processing system.

Incompatible File Format

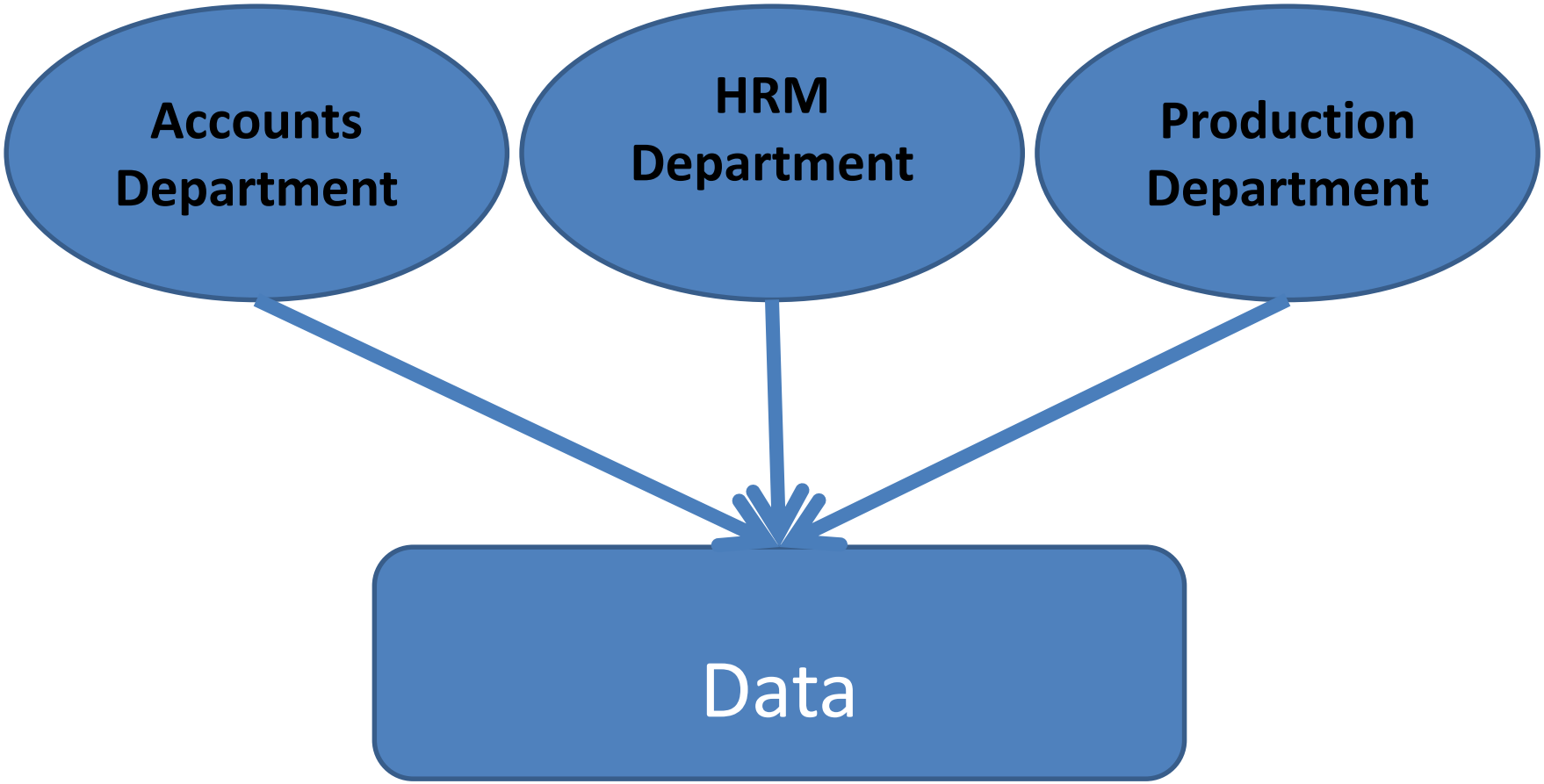
- In computer file-based processing systems, the structure of data file is coupled with the application program and the structure of data file is dependent on the programming languages in which the application program was developed.

Solutions

- Using Database Management System (DBMS)
- Because

  - Sharing of data
  - Consistency of data
  - Integrity of data
  - Security of data
  - Potentially increased productivity
  - Improved data backups and recovery Data independence

How DBMS works



Database vs. File Systems

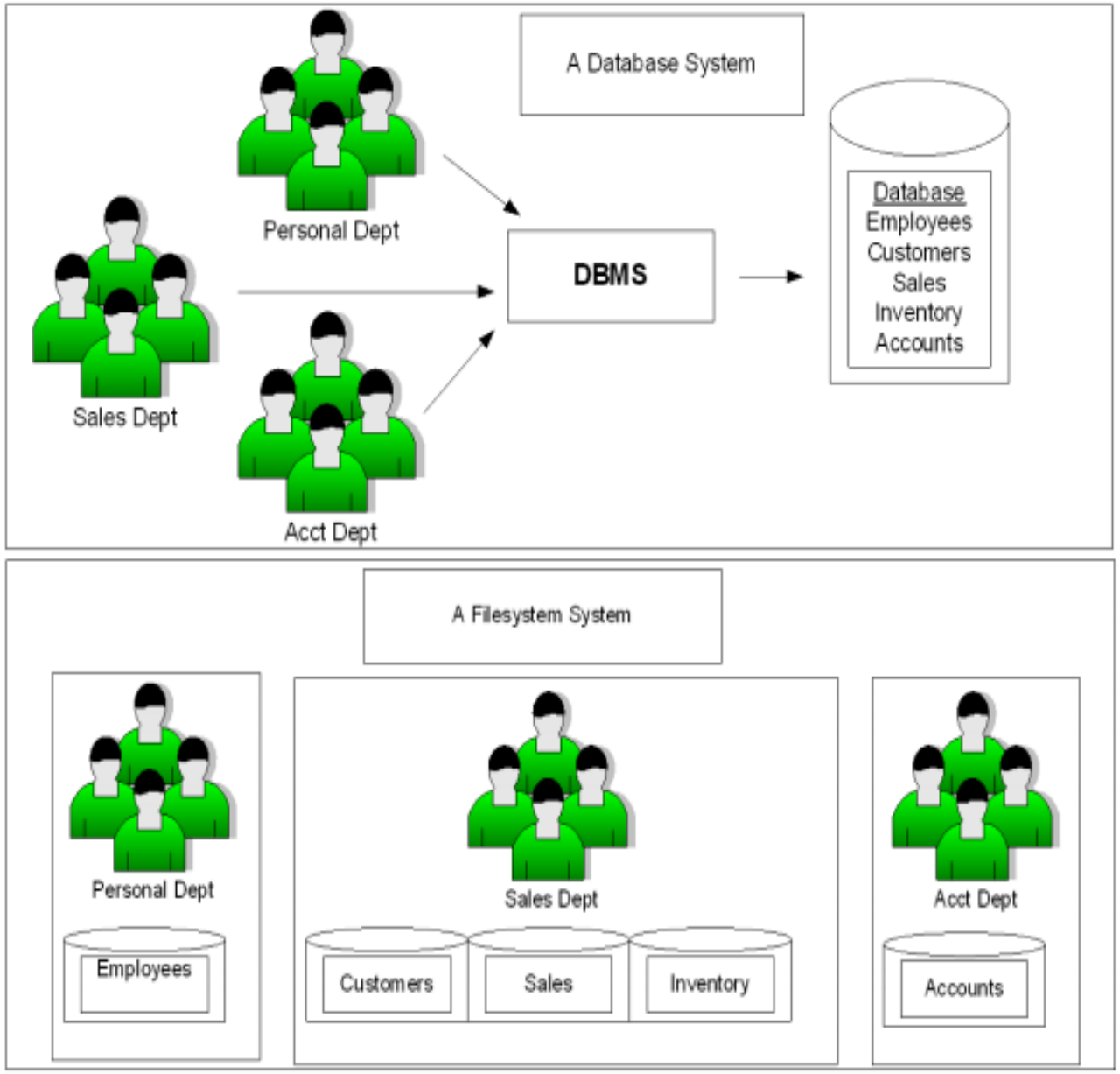


Figure 6: Database vs. File System