

Lecture:11

Databases Management system

Prepared by :Uttam Acharya

Learning Outcomes

By the end of this lecture you will learn:

- Data and Information
- An introduction to DBMS
- The main components of database
- File system vs DBMS
- Plus - What is SQL and how it is used

Data: Define



See definitions in:

All Computing Philosophy

noun

facts and statistics collected together for reference or analysis.
"there is very little data available"

Similar: facts figures statistics details particulars specifics features

- the quantities, characters, or symbols on which operations are performed by a computer, which may be stored and transmitted in the form of electrical signals and recorded on magnetic, optical, or mechanical recording media.
- PHILOSOPHY**
things known or assumed as facts, making the basis of reasoning or calculation.



See definitions in:

All Law Computing Mathematics

noun

- facts provided or learned about something or someone.
"a vital piece of information"

Similar: details particulars facts figures statistics data

- what is conveyed or represented by a particular arrangement or sequence of things.
"genetically transmitted information"

Define: Data Google Result

Facts concerning things such as people, objects or events

Information is data that have been processed and presented in a form suitable for human understanding

World of Data



WORLD is REPRESENTATION of DATA.

- POPULATION
- AREA
- LANGUAGE
- EDUCATION
- ECONOMY
- TECHNOLOGY USE
- AGE

Of Countries are ALL DATA

Data Representation - Employee

Employee Data

Employee ID: 102 **Birth Date:** 06/05/1962

Manager ID: 501 **Soc. Sec. No.:** 017-34-9033

Emp. First Name: Fran **Salary:** \$45,700.00

Emp. Last Name: Whitney **Start Date:** 02/26/1990

Department ID: 100 **Termination Date:** 00/00/0000

Street: 49 East Washington Street **Status:** ☒ Active

City: Needham ☐ Terminated

State: MA ☐ On Leave

Zip Code: 02192- **Health Insurance:** ☒

Phone: (617) 555-3985 **Life Insurance:** ☒

Sex: ☐ Male **Day Care:** ☐

☒ Female

Employee Data Entry

- ID
- Manager
- Name
- Department
-

ALL DATA

Data Representation - Students

| Student # | First Name | MI | Last Name | DOB | Gender |
|-------------|------------|----|-----------|------------|--------|
| 888-849-402 | Sebastien | B | Porter | 02/12/1993 | Male |
| 286-022-404 | Suzie | D | Hoak | 10/05/1997 | Female |
| 138-248-300 | Antoinette | | Clarck | 04/10/1993 | Female |
| 247-900-002 | Koko | P | Domba | 02/05/1996 | Male |
| 174-302-802 | Janet | O | West | 06/02/1993 | Female |
| 395-484-228 | Catherine | L | Chang | 06/12/1994 | Female |
| 206-022-274 | Nehemiah | | Dean | 12/02/1993 | Male |
| 285-902-004 | Sherryl | B | Ashburn | 10/07/1993 | Female |
| 444-736-466 | Santos | M | Pacheco | 05/05/1994 | Male |
| 512-882-805 | Mohamed | D | Husseini | 01/05/1994 | Male |
| 903-627-414 | Dean | F | Chen | 05/02/1994 | Male |
| 728-599-277 | Ruby | W | DeGaram | 10/11/1995 | Female |
| 802-948-008 | Carole | | Chance | 10/22/1997 | Female |
| 240-048-427 | Justin | G | Vittas | 05/04/1997 | Male |
| 110-472-462 | Ismael | T | Zara | 05/25/1996 | Male |
| 831-822-852 | Anselme | T | Waters | 07/23/1997 | Male |
| 382-866-277 | Brenda | P | Lobo | 10/05/1994 | Female |
| 666-265-905 | Suzanna | | Verde | 03/12/1994 | Female |

STUDENT DATA

STUDENT#
FIRST NAME
LAST NAME
DATE OF BIRTH
GENDER

Are STUDENT DATA

Data vs. Information

- Data:
 - Raw facts (building blocks of information)
 - Collection of unprocessed information
 - Numbers, text, image, audio, video
- Information:
 - Data processed to reveal meaning
 - It is meaningful, useful and organized
- Accurate, relevant, and timely information is key to good decision making
- Good decision making is the key to survival in a global environment

Information - Relevance



What will you do if you see such sign while driving ?



Dilemma because you have no DATA to decide!

Information - Relevance



What will you do if
you see such sign
while driving ?



Slippery Road:
Control Speed and
Drive Slowly

Importance of Information

Let's answer the following:

- ❖ If you had two cans without labels, which would you drink ?



Importance of Information

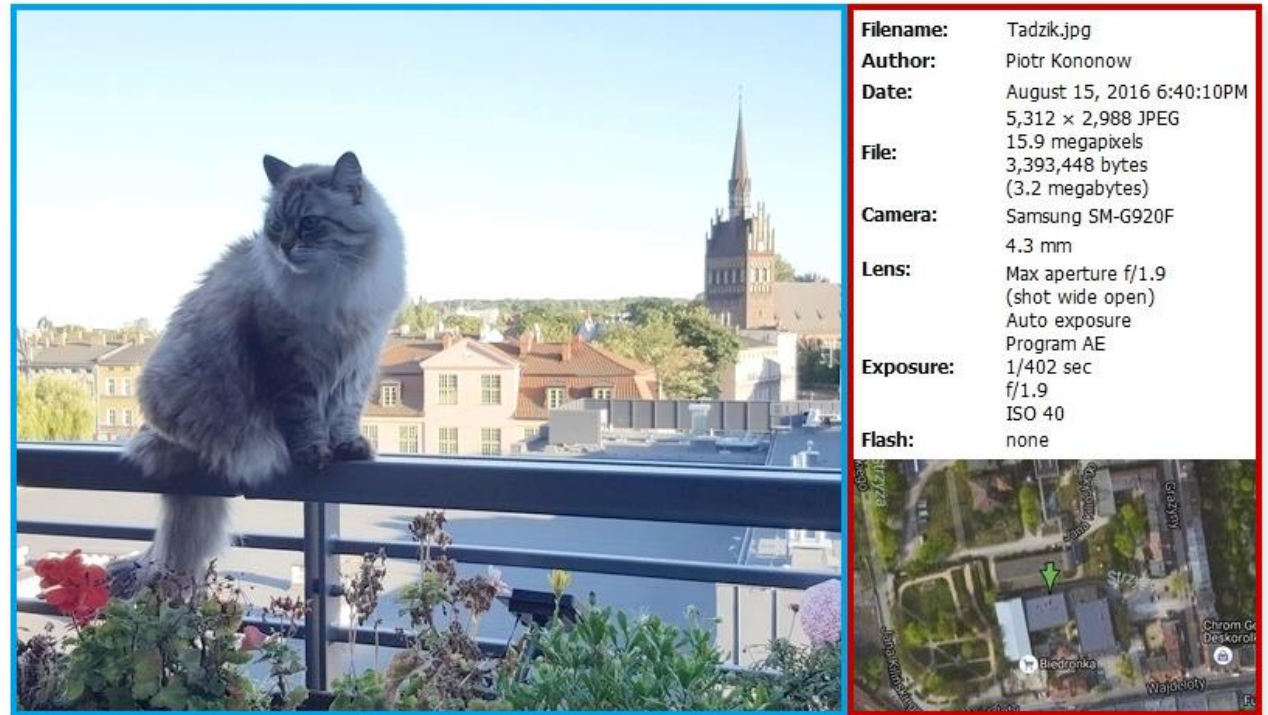
- It's the label which defines the content/data inside the can, hence label is Metadata



Metadata

Metadata is simply **data about data**. It means it is a description and context of the data. It helps to organize, find and understand data.

- Title and description
- Tags and categories
- Who created and when



Data

Metadata

MetaData in Microsoft Access

[illegible]

Database

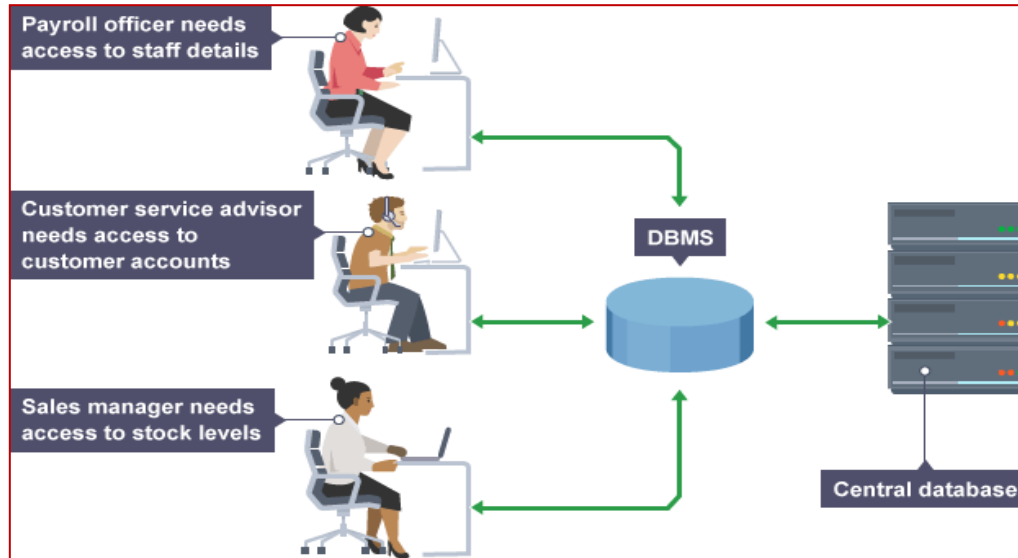


A structured set of data held in computer memory.

Is a collection of information that is organized so that it can be easily accessed, managed and updated.

A collection of tables, queries, reports, views and other objects

Database Management System



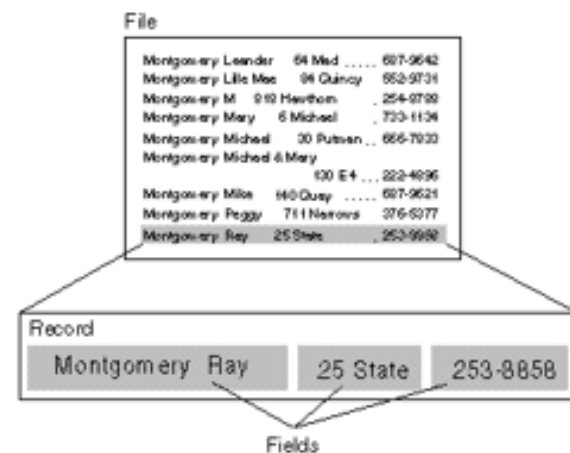
is a system software for creating and managing databases. DBMS provides users and programmers with a systematic way to create, retrieve, update and manage data.



Historical Roots of database:

Files and File Systems

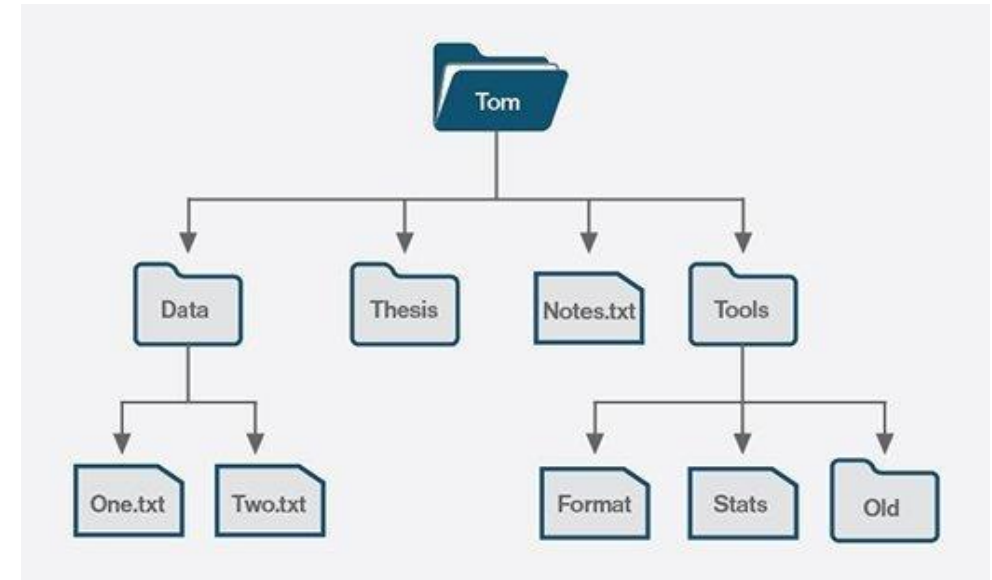
- Data – “Raw” facts, such as telephone number, customer name. This has little meaning unless they have been organized in some logical manner.
 - e.g. input data from the user
- Field – Used to define and store data.
 - e.g. “student name” field
- Record/Tuple – logically connected set of fields
 - e.g. student name, student phone number
- File – Collection of related records
 - e.g. all student’s details
- Database
 - Collection of related files



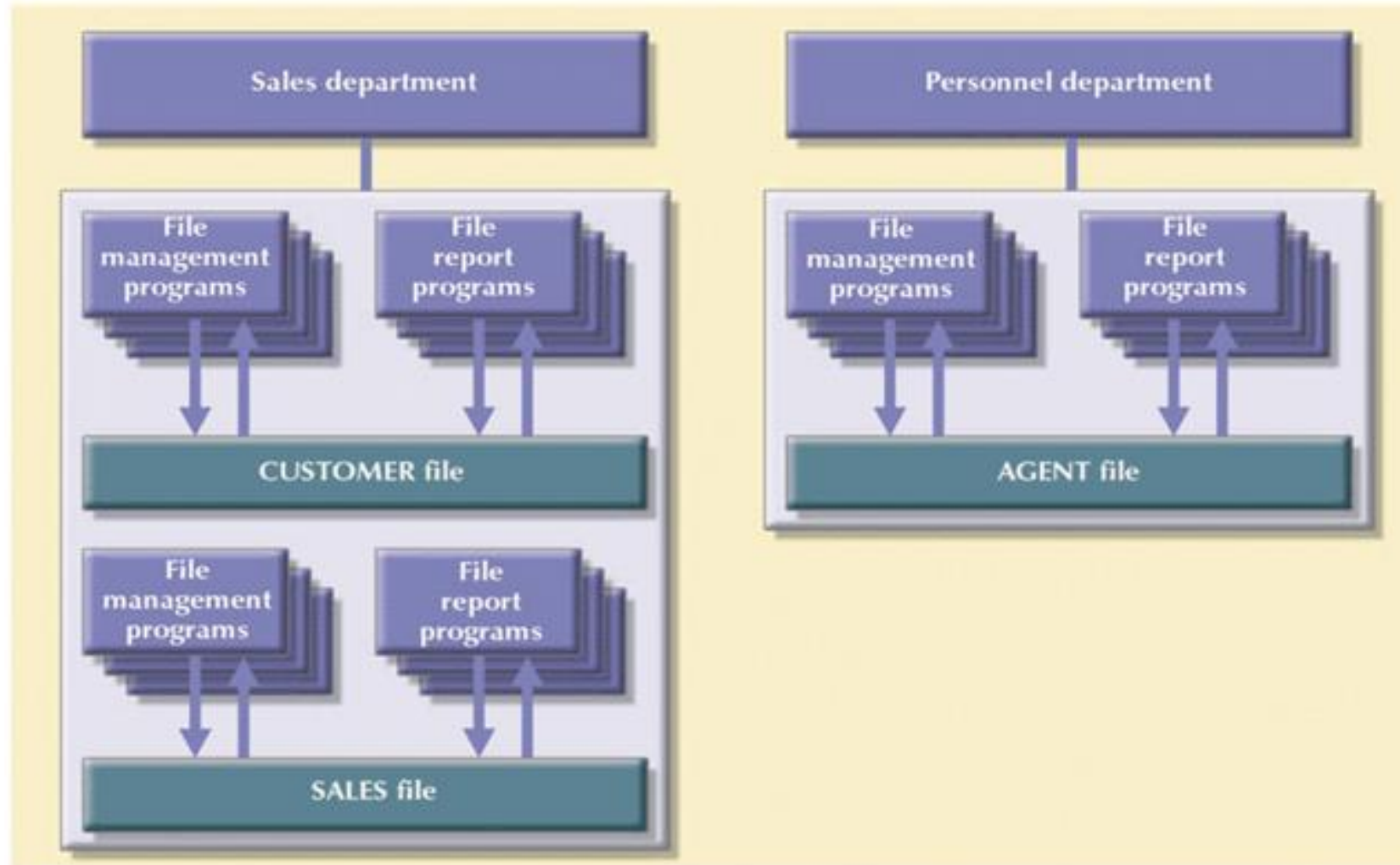
| Hierarchy | Example | | | | | | | | | | | | |
|-----------|---|------|---------|-----|-------|---|------|-------|---|------|-------|---|------|
| Database | <div>Student Database</div> <div>Basic info file</div> <div>Tuition fees file</div> <div>Result file</div> | | | | | | | | | | | | |
| File | <div>Student info files</div> <table><thead><tr><th>Name</th><th>Section</th><th>GPA</th></tr></thead><tbody><tr><td>Monir</td><td>A</td><td>4:50</td></tr><tr><td>Kobir</td><td>B</td><td>4:60</td></tr><tr><td>Rahat</td><td>C</td><td>5:00</td></tr></tbody></table> | Name | Section | GPA | Monir | A | 4:50 | Kobir | B | 4:60 | Rahat | C | 5:00 |
| Name | Section | GPA | | | | | | | | | | | |
| Monir | A | 4:50 | | | | | | | | | | | |
| Kobir | B | 4:60 | | | | | | | | | | | |
| Rahat | C | 5:00 | | | | | | | | | | | |
| Record | <div>Student Record</div> <table><thead><tr><th>Name</th><th>Section</th><th>GPA</th></tr></thead><tbody><tr><td>Monir</td><td>A</td><td>5:00</td></tr></tbody></table> | Name | Section | GPA | Monir | A | 5:00 | | | | | | |
| Name | Section | GPA | | | | | | | | | | | |
| Monir | A | 5:00 | | | | | | | | | | | |
| Field | <div>Student Name field</div> <div>Monir</div> | | | | | | | | | | | | |

File system

- The file system is basically a way of arranging the files in a storage medium like a hard disk.
- The file system organizes the files and helps in the retrieval of files when they are required.
- The file system performs basic operations like management, file naming, giving access rules, etc.



A simple File System

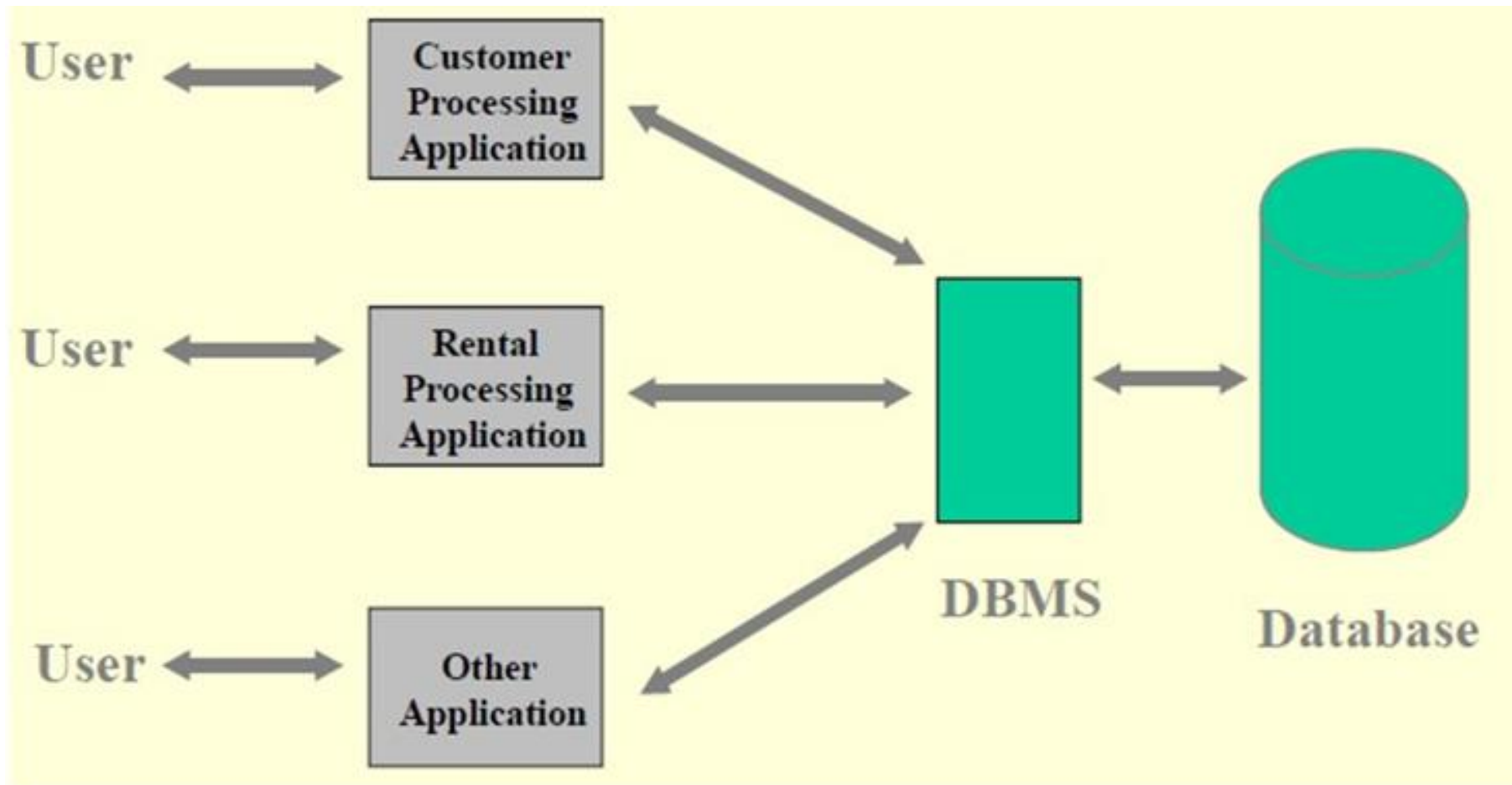


Problems resulting from the traditional file environment:

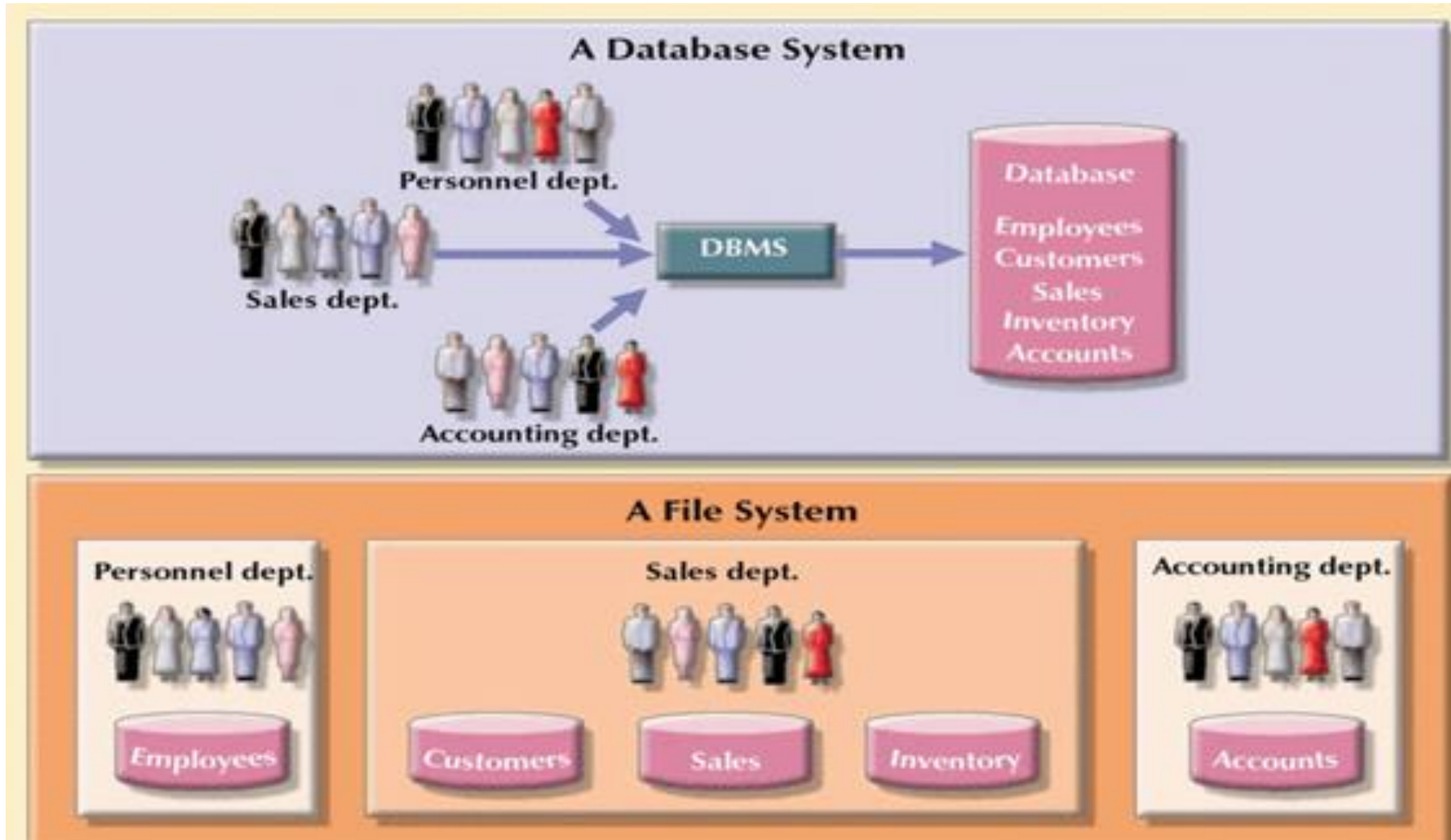
- **Data redundancy:** duplicate data in multiple files
leading to **data inconsistency**, different values used for the same attribute
- **Program-data dependency:** Changes in programs requiring changes to the data
- Poor security
- Limited data sharing

Advantages of DBMS system

- Removes data redundancy and inconsistency
- Improves data security
- **Backup:** It creates a backup subsystem to restore the data if required.
- **Easy Maintenance:** It is easily maintainable due to its centralized nature
- DBMS maintains data **integrity** by enforcing user-defined constraints on data by itself



DBMS vs File System

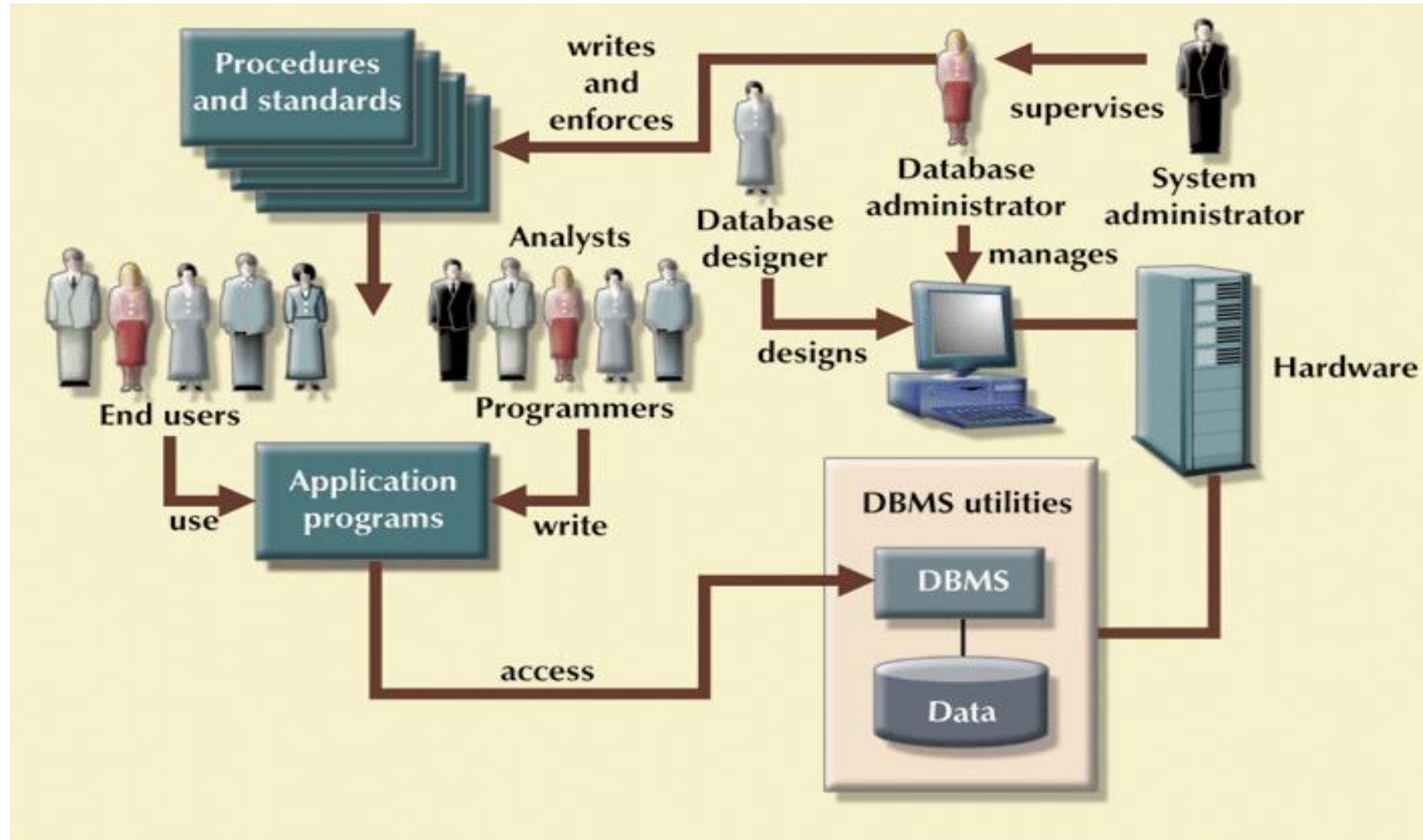


The Database System Environment

Database system is composed of five main component parts:

- Hardware
- Software
 - Operating system software
 - DBMS software
 - Application programs and utility software
- People
- Procedures/SQL queries
- Data

The Database System Environment (continued)



Database models

- Hierarchical database model.
- Relational model.
- Network model
- Object-oriented database model.
- Entity-relationship model

Relational database model

- It stores data in two-dimensional inter-related tables, also known as relations in which each row represents an entity and each column represents the properties of the entity.
- Relational databases and their management systems almost always use SQL as their underlying query language

What is SQL?

- SQL stands for **Structured Query Language**
- SQL is the commonly **programming language** used with database systems
- SQL can be used to monitor and **manipulate large amounts of data**
- SQL can be used to **create and populate** a database system
- SQL has many **pre-defined commands** for inserting, deleting and modifying tables and data

Some Basic SQL Commands

- **Create table**
 - used to create tables within the database
- **Select**
 - returns a set of data depending on the constraint
- **Insert**
 - input data into specified table
- **Delete**
 - removes rows of data depending on the constraints
- **Drop**
 - completely removes a table
- **Count**
 - returns the total number of rows found depending on the constraint

Basic Data Types in SQL

- **Varchar**
 - string (Must specify length of field)
- **Int**
 - whole number (integer)
- **Float**
 - decimal number
- **Boolean**
 - true or false
- **Date**
 - Can be written in many formats

NB// Most variable types can be set to different lengths, precisions and formats.

Formatting Variables in SQL

- In SQL, variable types usually have an attribute associated with it.
 - Varchar (length) →
 - Length is the number of chars
 - Float(size,d) →
 - Size is max digits before the decimal point and “d” is the amount of digits after the decimal place.

Create table example

```
create table Vehicle(
```

```
    V_Name varchar(200), - will hold a character length of 200
```

```
    V_Mileage int(3) – will hold a max digit length of 3. [ 0-999 is  
accepted ]
```

```
);
```


Insert data into a table

Insert into Vehicle(V_Name, V_Mileage) values (“Ferrari”, 20);

This query stores **one row** within the table. In this case, V_Name = “Ferrari” and V_Mileage = 20

Insert into Vehicle(V_Name, V_Mileage) values (“Ferrari”, 20), (“Mercedes”, 35);

The query above stores two rows within the table.

Using **Select** command

```
Select * from Vehicle;
```

This query will retrieve all the rows and columns of data from the **Vehicle table** (using the wildcard “*”)

```
Select * from Vehicle where V_Name = “Ferrari”;
```

This query will only retrieve vehicles that are named as “Ferrari” (It uses generic variables - replace attribute and attribute names as required)

Using **Logic** in SQL

```
SELECT * FROM Vehicle  
WHERE V_name='Ferrari' OR  
V_name='Mercedes';
```

The above query extracts all entries from the Vehicle table when the vehicle name is “Ferrari” or “Mercedes”

- The logical operators that can be used –
 - **OR** (at least one of the conditions must be true)
 - **AND** (all the specified conditions must be true)
 - **NOT** (the specified condition must be false)
- Using a value to be matched (example)

```
Select V_name FROM Vehicle  
WHERE V_mileage < 30;
```

Deleting a table: **drop**

The syntax:

```
drop table table_name;
```

In this next example the table called Vehicle would be removed from the database system.

```
Drop table Vehicle;
```

Further Reading: More Advanced SQL links

More advanced SQL statements (tutorials and video links) –

- <https://www.coursera.org/lecture/data-driven-astronomy/more-advanced-sql-GDmo5> (video)
- https://www.w3schools.com/sqL/trysql.asp?filename=trysql_select_orderby (orderby)
- <https://study.com/academy/lesson/advanced-sql-subqueries-use-examples.html> (joins)
- <http://www.sqlcourse2.com/intro2.html> (many)

MySQL (linux server)

- University of Wolverhampton operate a linux based **MySQL** server (free database software)
- It is accessible by all students (assuming you have a valid account)
- The workshop material will provide you with the instructions to use the system
- It can be used for practice or with your own web-based script (when you require online database access and storage)

Summary

- Data are raw facts → Information is the result of processing data to reveal its meaning (**data with context**)
- To implement and manage a **database efficiently**, use a **DBMS**.
- DBMS's were developed to address file systems' inherent weaknesses
- A well-designed database facilitates data management and generates **accurate and valuable information**.
- A poorly designed database can lead to bad decision making, and bad decision making can lead to the **failure of an organization**.
- **SQL is used to programmatically manipulate database systems**
- Very powerful scripting language that is employed on **huge database systems globally**