Introduction to Database and DBMS

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Outline

◦ Introduction to **Database** and **Database Systems**

◦ **Databases** in Real World

◦ **Purpose** of Database Systems

◦ **Roles** in the Integrated Database Environment

◦ **File-Processing Systems** vs. **Database Systems**

◦ **Advantages** of Integrated Database Approach

What is a Database?

◦ **Database** is a shared collection of logically **related data** and its description, designed to meet the information needs of an organization.

◦ And each database has a target group of users and applications.

◦ It is usually controlled by a database management system (**DBMS**).

Database Management System (DBMS)

◦ **DBMS (Database Management System)** is a software system that enables users to define, create, maintain, and control access to the database.

◦ The **DBMS** interacts with the users' application programs and the database.

End Users

Database Applications

Database Management System
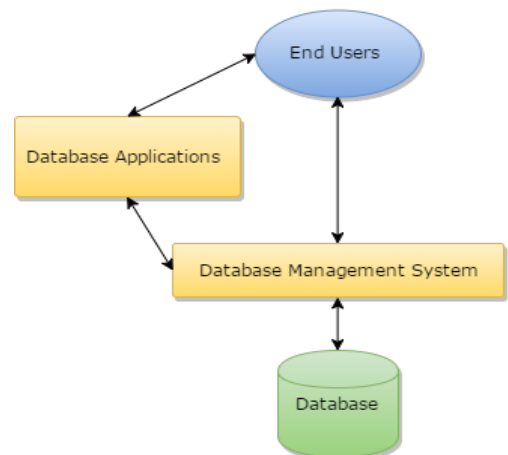
Database

Uses of Databases

◦ Database can be used in different industries:

- **Banking:** transactions
- **Travel Agencies and Airlines:** reservations, schedules
- **Universities:** registration, grades
- **Retailing:** products, purchases
- **Manufacturing:** production, orders
- **Health Care Centers and Hospitals:** prescription
- …

Database Example

◦ **Shopping market database platform**

- Adding new items to the store
- Calculation of the receipt on the cashier
- Deduction of sold items from the system
- Reporting of the needed items
- Filling the place of the sold items with the ones from the store.
- Reporting of the sold items and calculation of the amount of profit within a period.
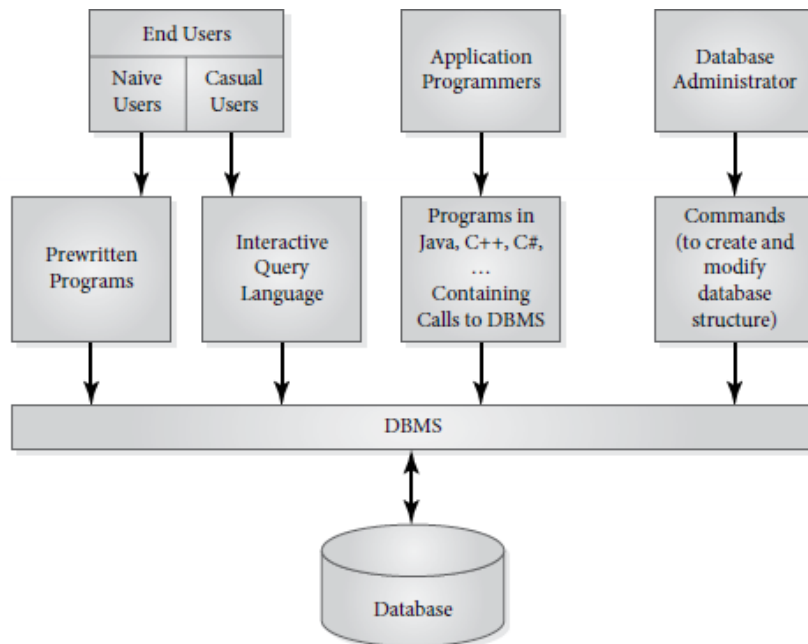
Roles in the Integrated Database Environment

◦ **End-Users**

- The database is designed, created, and maintained to serve the information needs of **end users**, people who use the data to perform their jobs.

◦ **Application Developers (Application Programmers)**

- This group includes **programmers** who write applications for other users.

◦ **Database Administrator (DBA)**

- The **database administrator** is the individual or group responsible for designing, creating the structure of, and maintaining the database.

Data as a Resource

◦ **Resource** ➔ any asset that is of value to an organization and has costs.

◦ Resources include:
- Capital Equipment
- Financial Assets
- Personnel
- Data

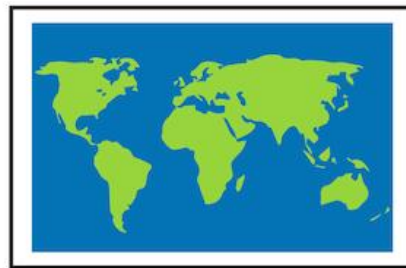◦ **Database is a resource. It has value and it has cost.**

Data vs. Information

◦ **Data** ➔ The facts recorded in the database.

◦ **Information** ➔ Processed Data that is useful for making decisions.
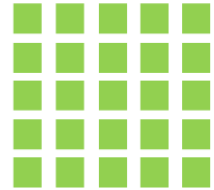

DATA

INFORMATION

Structured Data vs. Unstructured Data

◦ **Structured data** is data that fits neatly into data tables and includes discrete data types such as numbers, short text, and dates.

◦ **Unstructured data** doesn't fit neatly into a data table because of its size or nature: for example, audio and video files and large text documents.

Structured Data

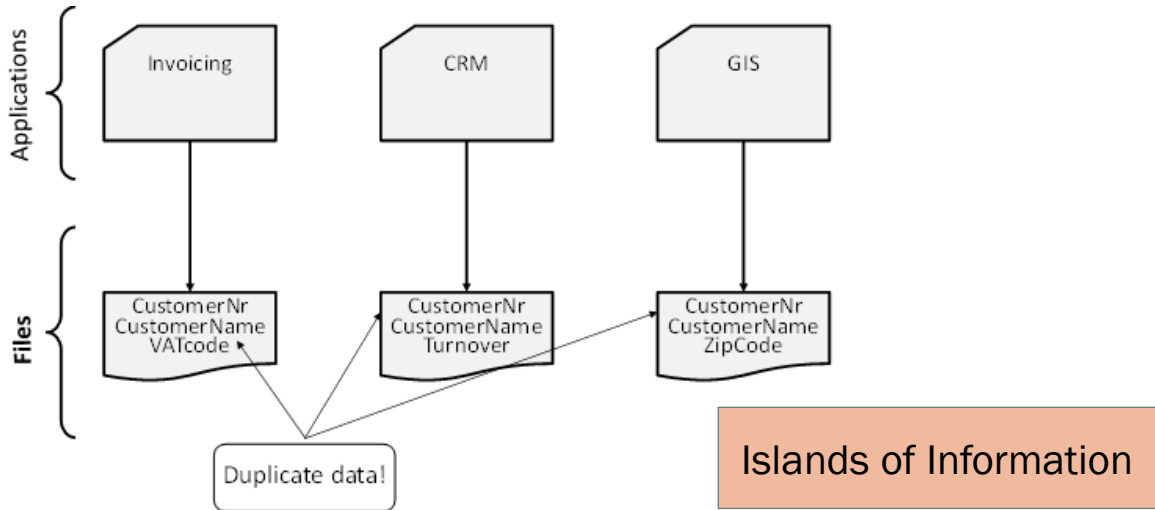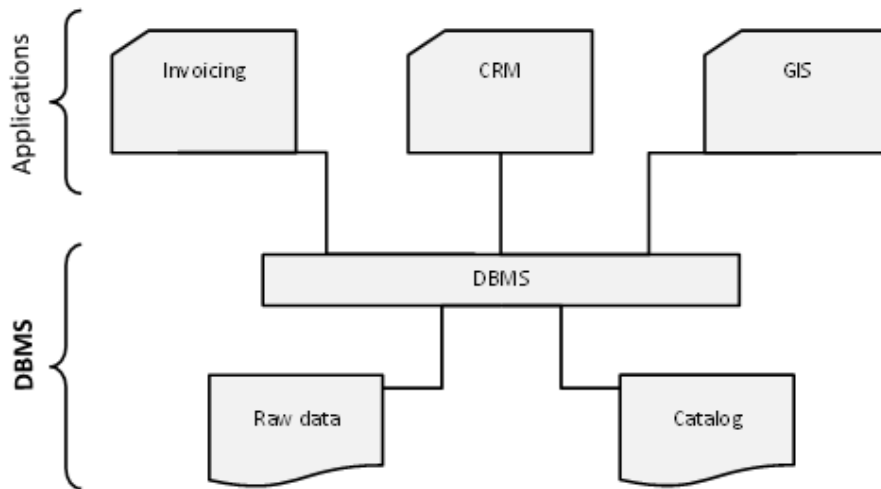Unstructured Data
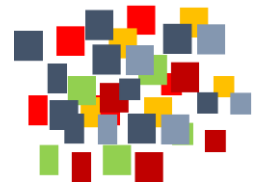
File-Processing System

◦ A **file processing system** is a collection of programs that store and manage files in a storage medium like hard-disk.

◦ **File processing systems** consist of different files which are grouped into directories. The directories further contain other folders and files.

File-Processing System Example

Islands of Information

Database Approach

File Processing Approach vs. Database Approach to Data Management: Example

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File approach

```
Procedure FindCustomer;
begin
    open file Customer.txt;
    Read(Customer)
    While not EOF(Customer)
            If Customer.name='Bart' then
                    display(Customer);
            EndIf
    Read(Customer);
    EndWhile;
End;
```

Database approach (SQL)

```
SELECT *
FROM Customer
WHERE
name = 'Bart'
```

Advantages of Integrated Database Approach

○ Some Advantages of Database Management Systems:

- Sharing of Data
- Control of **Data Redundancy**
- **Data Consistency**
- Better **Data Security**
- Improved **Data Integrity**
- Better **Data Accessibility**
- **...**

Advantage #1 – Sharing of Data

◦ The database belongs to the entire organization.

◦ Many users can be authorized to access the same piece of information.

◦ **Data concurrency** means that many users can access data at the same time.

Advantage #2 – Control of Data Redundancy

◦ **Data Redundancy** → Means having multiple copies of the same data.

◦ The database approach attempts to <u>eliminate the redundancy</u> by integrating the files so that <u>multiple copies of the same data are not stored</u>, unless necessary.

Advantage #3 – Data Consistency

◦ Meaning of **Consistency** in Dictionary ➔ something that stays the same, is done in the same way or looks the same.

◦ **Data consistency** in database systems, means that each user sees a consistent view of the data, including visible changes made by the user's own transactions and transactions of other users.

Advantage #4 – Better Data Security

◦ **Data Security** ➔ protection of the database from unauthorized access by persons or programs that might misuse or damage the data.

◦ **Data security** can be improved by defining and applying security rules and restrictions.

Advantage #5 – Improved Data Integrity

- **Data Integrity** refers to the validity and consistency of stored data.

- **Data Integrity** is usually expressed in terms of constraints, which are **consistency rules** that the database is not permitted to violate.

- A record insertion, deletion, or update that violates an integrity constraint is not allowed.

Example of Data Integrity Constraints

Department Table

dept_name	building	budget
Biology	Watson	90000
Comp. Sci.	Taylor	100000
Elec. Eng.	Taylor	85000
Finance	Painter	120000
History	Painter	50000
Music	Packard	80000
Physics	Watson	70000

Student Table

ID	name	dept_name	tot_cred
00128	Zhang	Comp. Sci.	102
12345	Shankar	Comp. Sci.	32
19991	Brandt	History	80
23121	Chavez	Finance	110
44553	Peltier	Physics	56
45678	Levy	Physics	46
54321	Williams	Comp. Sci.	54
55739	Sanchez	Music	38
70557	Snow	Physics	0
76543	Brown	Comp. Sci.	58
76653	Aoi	Elec. Eng.	60
98765	Bourikas	Elec. Eng.	98
98988	Tanaka	Biology	120

| 99117 | Sarah | Translation | 76 |

In a well-structured database adding this new record is not allowed (against data integrity constraints), because dept_name of this student is not among name of departments in department table.

Advantage #6 – Better Data Accessibility

○ In addition to providing data for programs, <u>database management systems allow interactive access by users through query languages</u>.