**Introduction to Databases**

***Database is*** a collection of related data.

***Database Management System***(DBMS) is the software that manages and controls access to the database.

A ***database application*** is simply a program that interacts with the database at some point in its execution.

***Database system***to be a collection of application programs that interact with the database along with the DBMS and database itself.

**APLLICATION AREAS OF DATABASES**

Purchases from the supermarket

When you purchase goods from your local supermarket, it is likely that a database is

accessed. The checkout assistant uses a bar code reader to scan each of your purchases.

This is linked to an application program that uses the bar code to find out the price of the

item from a product database. The program then reduces the number of such items in stock

and displays the price on the cash register. If the reorder level falls below a specified

threshold, the database system may automatically place an order to obtain more stocks

of that item. If a customer telephones the supermarket, an assistant can check whether an

item is in stock by running an application program that determines availability from the

database.

Purchases using your credit card

When you purchase goods using your credit card, the assistant normally checks that you

have sufficient credit left to make the purchase. This check may be carried out by telephone

or it may be carried out automatically by a card reader linked to a computer system.

In either case, there is a database somewhere that contains information about the purchases

that you have made using your credit card. To check your credit, there is a database application

program that uses your credit card number to check that the price of the goods you

wish to buy together with the sum of the purchases you have already made this month is

within your credit limit. When the purchase is confirmed, the details of the purchase are

added to this database. The application program also accesses the database to check that

the credit card is not on the list of stolen or lost cards before authorizing the purchase.

There are other application programs to send out monthly statements to each cardholder

and to credit accounts when payment is received.

Booking a holiday at the travel agents

When you make inquiries about a holiday, the travel agent may access several databases

containing holiday and flight details. When you book your holiday, the database system

has to make all the necessary booking arrangements. In this case, the system has to ensure

that two different agents do not book the same holiday or overbook the seats on the flight.

For example, if there is only one seat left on the flight from London to New York and two

agents try to reserve the last seat at the same time, the system has to recognize this situation,

allow one booking to proceed, and inform the other agent that there are now no seats

available. The travel agent may have another, usually separate, database for invoicing.

Using the local library

Your local library probably has a database containing details of the books in the library,

details of the readers, reservations, and so on. There will be a computerized index that

allows readers to find a book based on its title, or its authors, or its subject area. The database

system handles reservations to allow a reader to reserve a book and to be informed

by mail when the book is available. The system also sends reminders to borrowers who

have failed to return books by the due date. Typically, the system will have a bar code

reader, similar to that used by the supermarket described earlier, which is used to keep

track of books coming in and going out of the library.

Taking out insurance

Whenever you wish to take out insurance, for example personal insurance, building, and

contents insurance for your house, or car insurance, your broker may access several

databases containing figures for various insurance organizations. The personal details that

you supply, such as name, address, age, and whether you drink or smoke, are used by the

database system to determine the cost of the insurance. The broker can search several

databases to find the organization that gives you the best deal.

Renting a video

When you wish to rent a video from a video rental company, you will probably find that

the company maintains a database consisting of the video titles that it stocks, details on the

copies it has for each title, whether the copy is available for rent or whether it is currently

on loan, details of its members (the renters), and which videos they are currently renting

and date they are returned. The database may even store more detailed information on each

video, such as its director and its actors. The company can use this information to monitor

stock usage and predict future buying trends based on historic rental data.

Using the Internet

Many of the sites on the Internet are driven by database applications. For example,

you may visit an online bookstore that allows you to browse and buy books, such as

Amazon.com. The bookstore allows you to browse books in different categories, such as

computing or management, or it may allow you to browse books by author name. In either

case, there is a database on the organization’s Web server that consists of book details,

availability, shipping information, stock levels, and on-order information. Book details

include book titles, ISBNs, authors, prices, sales histories, publishers, reviews, and detailed

descriptions. The database allows books to be cross-referenced: for example, a book may

be listed under several categories, such as computing, programming languages, bestsellers,

and recommended titles. The cross-referencing also allows Amazon to give you information

on other books that are typically ordered along with the title you are interested in.

As with an earlier example, you can provide your credit card details to purchase one or

more books online. Amazon.com personalizes its service for customers who return to its

site by keeping a record of all previous transactions, including items purchased, shipping,

and credit card details. When you return to the site, you can now be greeted by name and

you can be presented with a list of recommended titles based on previous purchases.

Studying at university

If you are at university, there will be a database system containing information about yourself,

the course you are enrolled in, details about your grant, the modules you have taken

in previous years or are taking this year, and details of all your examination results. There

**File-Based Approach**

**File-based System -** A collection of application programs that perform services for the

end-users such as the production of reports. Each program defines and manages its own data.

**Limitations of the File-Based Approach**

**1**. **Separation and isolation of data**- When data is isolated in separate files, it is more difficult to access data that should be available. For example, if we want to produce a list of all houses that match the requirements of clients, we first need to create a temporary file of those clients who have ‘house’

as the preferred type.

**2. Duplication of data -** Owing to the decentralized approach taken by each department, the file-based approach encouraged, if not necessitated, the uncontrolled duplication of data.

3. **Data dependence-** the physical structure and storage of the data files and

records are defined in the application code. This means that changes to an existing structure

are difficult to make.

**4. Incompatible file formats**

Because the structure of files is embedded in the application programs, the structures are

dependent on the application programming language.

**5.** **Fixed queries/proliferation of application programs-** From the end-user’s point of view, file-based systems proved to be a great improvement over manual systems. Consequently, the requirement for new or modified queries grew.

However, file-based systems are very dependent upon the application developer, who has

to write any queries or reports that are required. As a result, two things happened. In some

organizations, the type of query or report that could be produced was fixed. There was no

facility for asking unplanned (that is, spur-of-the-moment or *ad hoc*) queries either about

the data itself or about which types of data were available.

**Database Approach**

All the above limitations of the file-based approach can be attributed to two factors:

(1) the definition of the data is embedded in the application programs, rather than being stored separately and independently;

(2) there is no control over the access and manipulation of data beyond that imposed by the application programs.

**The Database**

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

**The Database Management System (DBMS)**

**DBMS** A software system that enables users to define, create, maintain, and control access to the database.

**DBMS provides the following facilities**

* It allows users to define the database, usually through a **Data Definition Language** (DDL). The DDL allows users to specify the data types and structures and the constraintson the data to be stored in the database.
* It allows users to insert, update, delete, and retrieve data from the database, usually through a **Data Manipulation Language** (DML). Having a central repository for all data and data descriptions allows the DML to provide a general inquiry facility to this data, called a **query language**. The provision of a query language alleviates the problems with file-based systems where the user has to work with a fixed set of queries or there is a proliferation of programs, giving major software management problems. The most common query language is the **Structured Query Language** (SQL, pronounced ‘S-Q-L’, or sometimes ‘See-Quel’), which is now both the formal and *de facto* standard language for relational DBMSs. For example, it may provide:
* a security system, which prevents unauthorized users accessing the database;
  + an integrity system, which maintains the consistency of stored data;
  + a concurrency control system, which allows shared access of the database;
  + a recovery control system, which restores the database to a previous consistent state
* following a hardware or software failure;

a user-accessible catalog, which contains descriptions of the data in the database.

**(Database) Application Programs**

**Application program** - A computer program that interacts with the database by issuing an appropriate request (typically an SQL statement) to the DBMS.

**Views**

With this functionality, the DBMS is an extremely powerful and useful tool.

**BENEFITS OF VIEWS**

* *Views provide a level of security*.
* *Views provide a mechanism to customize the appearance of the database.*
* *A view can present a consistent, unchanging picture of the structure of the database*