

A **database-management system** (DBMS) is a collection of interrelated data and a set of programs to access those data. The collection of data, usually referred to as the **database**, contains information relevant to an enterprise. The primary goal of a DBMS is to provide a way to store and retrieve database information that is both *convenient* and *efficient*.

Database systems are designed to manage large bodies of information. Management of data involves both defining structures for storage of information and providing mechanisms for the manipulation of information. In addition, the database system must ensure the safety of the information stored, despite system crashes or attempts at unauthorized access. If data are to be shared among several users, the system must avoid possible anomalous results.

Because information is so important in most organizations, computer scientists have developed a large body of concepts and techniques for managing data. These concepts and technique form the focus of this book. This chapter briefly introduces the principles of database systems.

1.1 Database System Applications

Databases are widely used. Here are some representative applications:

- *Banking*: For customer information, accounts, and loans, and banking transactions.
- *Airlines*: For reservations and schedule information. Airlines were among the first to use databases in a geographically distributed manner—terminals situated around the world accessed the central database system through phone lines and other data networks.
- *Universities*: For student information, course registrations, and grades.

Credit card transactions: For purchases on credit cards and generation of monthly statements.

- *Telecommunication*: For keeping records of calls made, generating monthly bills, maintaining balances on prepaid calling cards, and storing information about the communication networks.
- *Finance*: For storing information about holdings, sales, and purchases of financial instruments such as stocks and bonds.
- *Sales*: For customer, product, and purchase information.
- *Manufacturing*: For management of supply chain and for tracking production of items in factories, inventories of items in warehouses/stores, and orders for items.
- *Human resources*: For information about employees, salaries, payroll taxes and benefits, and for generation of paychecks.

As the list illustrates, databases form an essential part of almost all enterprises today. Over the course of the last four decades of the twentieth century, use of databases grew in all enterprises. In the early days, very few people interacted directly with database systems, although without realizing it they interacted with databases indirectly—through printed reports such as credit card statements, or through agents such as bank tellers and airline reservation agents. Then automated teller machines came along and let users interact directly with databases. Phone interfaces to computers (interactive voice response systems) also allowed users to deal directly with databases—a caller could dial a number, and press phone keys to enter information or to select alternative options, to find flight arrival/departure times, for example, or to register for courses in a university.

The internet revolution of the late 1990s sharply increased direct user access to databases. Organizations converted many of their phone interfaces to databases into Web interfaces, and made a variety of services and information available online. For instance, when you access an online bookstore and browse a book or music collection, you are accessing data stored in a database. When you enter an order online, your order is stored in a database. When you access a bank Web site and retrieve your bank balance and transaction information, the information is retrieved from the bank's database system. When you access a Web site, information about you may be retrieved from a database, to select which advertisements should be shown to you.

Furthermore, data about your Web accesses may be stored in a database.

Thus, although user interfaces hide details of access to a database, and most people are not even aware they are dealing with a database, accessing databases forms an essential part of almost everyone's life today.

The importance of database systems can be judged in another way—today, database system vendors like Oracle are among the largest software companies in the world, and database systems form an important part of the product line of more diversified companies like Microsoft and IBM.