Types of Database Management Systems

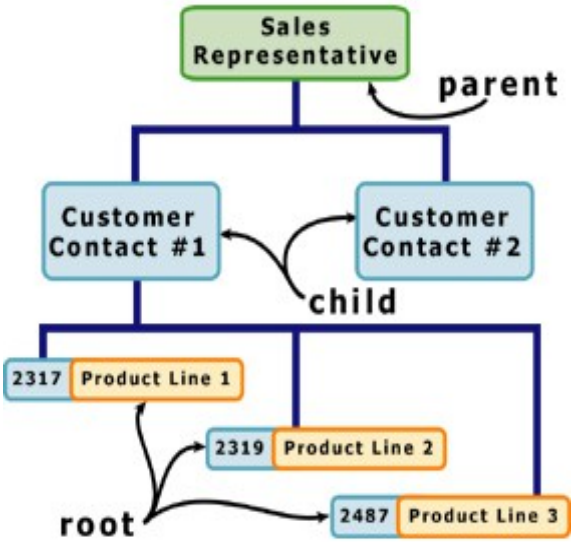
DBMSs come in many shapes and sizes. For a few hundred dollars, you can purchase a DBMS for your desktop computer. For larger computer systems, much more expensive DBMSs are required. Many mainframe-based DBMSs are leased by organizations. DBMSs of this scale are highly sophisticated and would be extremely expensive to develop from scratch. Therefore, it is cheaper for an organization to lease such a DBMS program than to develop it. Since there are a variety of DBMSs available, you should know some of the basic features, as well as strengths and weaknesses, of the major types.

After reading this lesson, you should be able to:

- Compare and contrast the structure of different database management systems.
- Define hierarchical databases.
- Define network databases.
- Define relational databases.
- Define object-oriented databases.

Types of DBMS: Hierarchical Databases

There are four structural types of database management systems: hierarchical, network, relational, and object-oriented.



Hierarchical Databases (DBMS), commonly used on mainframe computers, have been around for a long time. It is one of the oldest methods of organizing and storing data, and it is still used by some organizations for making travel reservations. A hierarchical database is organized in pyramid fashion, like the branches of a tree extending downwards. Related fields or records are grouped together so that

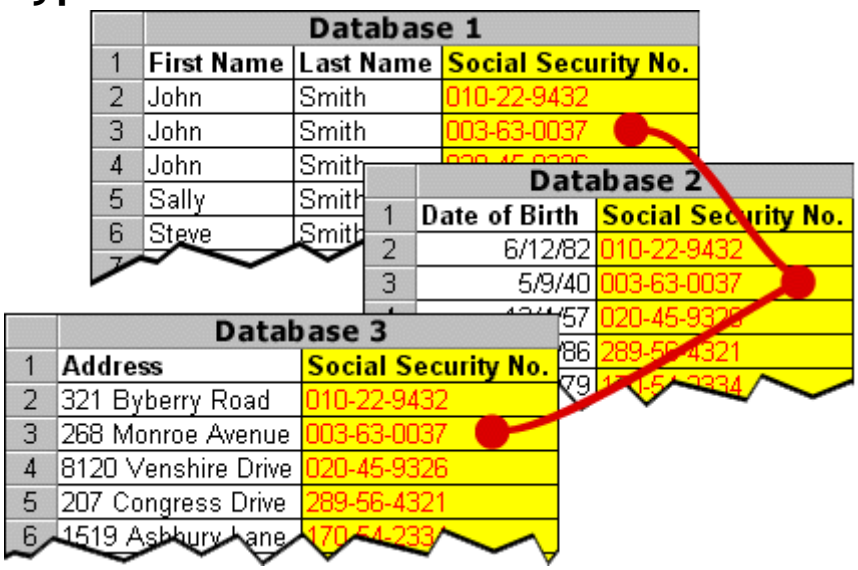
there are higher-level records and lower-level records, just like the parents in a family tree sit above the subordinated children.
Based on this analogy, the parent record at the top of the pyramid is called the **root record**. A child record always has only one parent record to which it is linked, just like in a normal family tree. In contrast, a parent record may have more than one child record linked to it. Hierarchical databases work by moving from the top down. A record search is conducted by starting at the top of the pyramid and working down through the tree from parent to child until the appropriate child record is found. Furthermore, each child can also be a parent with children underneath it.
The advantage of hierarchical databases is that they can be accessed and updated rapidly because the tree-like structure and the relationships between records are defined in advance. However, this feature is a two-edged sword. The disadvantage of this type of database structure is that each child in the tree may have only one parent, and relationships or linkages between children are not permitted, even if they make sense from a logical standpoint. Hierarchical databases are so rigid in their design that adding a new field or record requires that the entire database be redefined.

Types of DBMS: Network Databases

Network databases are similar to hierarchical databases by also having a hierarchical structure. There are a few key differences, however. Instead of looking like an upside-down tree, a network database looks more like a cobweb or interconnected network of records. In network databases, children are called **members**and parents are called **owners**. The most important difference is that each child or member can have more than one parent (or owner).
Like hierarchical databases, network databases are principally used on mainframe computers. Since more connections can be made

between different types of data, network databases are considered more flexible. However, two limitations must be considered when using this kind of database. Similar to hierarchical databases, network databases must be defined in advance. There is also a limit to the number of connections that can be made between records.

Types of DBMS: Relational Databases



	Database 1		
1	First Name	Last Name	Social Security No.
2	John	Smith	010-22-9432
3	John	Smith	003-63-0037
4	John	Smith	
5	Sally	Smith	
6	Steve	Smith	

	Database 2	
1	Date of Birth	Social Security No.
2	6/12/82	010-22-9432
3	5/9/40	003-63-0037

	Database 3	
1	Address	Social Security No.
2	321 Byberry Road	010-22-9432
3	268 Monroe Avenue	003-63-0037
4	8120 Venshire Drive	020-45-9326
5	207 Congress Drive	289-56-4321
6	1519 Ashbury Lane	

In **relational databases**, the relationship between data files is relational, not hierarchical. Hierarchical and network databases require the user to pass down through a hierarchy in order to access needed data. Relational databases connect data in different files by using common data elements or a key field. Data in relational databases is stored in different tables, each having a key field that uniquely identifies each row. Relational databases are more flexible than either the hierarchical or network database structures. In relational databases, tables or files filled with data are called **relations**, **tuples** designates a row or record, and columns are referred to as **attributes** or fields.

Relational databases work on the principle that each table has a key field that uniquely identifies each row, and that these key fields can be used to connect one table of data to another. Thus, one table might have a row consisting of a customer account number as the key field along with address and telephone number. The customer account number in this table could be linked to another table of data that also includes customer account number (a key field), but in this case, contains information about product returns, including an item number (another key field). This key field can be linked to another table that contains item numbers and other product information such as production location, color, quality control person, and other data. Therefore, using this database, customer information can be linked to specific product information.

The relational database has become quite popular for two major reasons. First, relational databases can be used with little or no training. Second, database entries can be modified without redefining the entire structure. The downside of using a relational database is that searching for data can take more time than if other methods are used.

Types of DBMS: Object-oriented Databases (OODBMS)

Able to handle many new data types, including graphics, photographs, audio, and video, **object-oriented databases** represent a significant advance over their other database cousins. Hierarchical and network databases are all designed to handle structured data; that is, data that fits nicely into fields, rows, and columns. They are useful for handling small snippets of information such as names, addresses, zip codes, product numbers, and any kind of statistic or number you can think of. On the other hand, an object-oriented database can be used to store data from a variety of media sources, such as photographs and text, and produce work, as output, in a multimedia format.

Object-oriented databases use small, reusable chunks of software called objects. The objects themselves are stored in the object-oriented database. Each object consists of two elements: 1) a piece of data (e.g., sound, video, text, or graphics), and 2) the instructions, or software programs called methods, for what to do with the data. Part two of this definition requires a little more explanation. The instructions contained within the object are used to do something with the data in the object. For example, test scores would be within the object as would the instructions for calculating average test score.

Object-oriented databases have two disadvantages. First, they are more costly to develop. Second, most organizations are reluctant to abandon or convert from those databases that they have already invested money in developing and implementing. However, the benefits to object-oriented databases are compelling. The ability to mix and match reusable objects provides incredible multimedia capability. Healthcare organizations, for example, can store, track, and recall CAT scans, X-rays, electrocardiograms and many other forms of crucial data.