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**Report on**

**Database: history and tools**

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## **Abstract**

The database is one of the main reasons for the development and advancement of information systems. It receives data of the world in databases. The databases feed other systems and reports for different purposes. The different programs that feed the databases and the different objectives make the database take different forms and models. In this report the author wrote his introduction to the database and its definition. Then, explain the history of the database and its importance in the community. There is a rule states that everything is collected without arranging is difficult to access, and databases are no exception to this rule. So, I show in this report some methodologies to organize and arrange databases to ease, speed up searches and access to stored data. The author also wrote about database management systems and their types. In addition, the author discussed database tools, most notably SQL is one of the most important languages used in database programming in terms of creating and retrieving database files.

## Introduction

After the existence of computers, databases have a very significant impact on society. It is fair to say that databases play a crucial and important role in almost all areas of computers, including business, local economics, e-commerce, science, engineering, medicine, information technology, software, law, education, business administration and library science. The database word is so popular that we should start by specifying the database. A database is a set of data arranged in a particular way. The purpose of the database is to collect, use, store and retrieve the data and information we need through an application or program of database.

This report contains different sections including introduction to database where I explain what the meaning of the database is. Also, it discusses how databases began. Moreover, it gives an overview on how database has been improved starting from 1960s to 2000s. Then, it mentions the importance of databases. Moreover, it defines what is Structured Query Language (SQL). Finally, it clarifies Database Management Systems (DBMS).

### Purpose of Report

I implemented this report to benefit the society. Moreover, it is a requirement of the Faculty of Computing at the Islamic University in Madinah.

The databases are of great importance in the various works, and their importance is highlighted in many points. First, the databases help greatly accelerate the process of access to the data they contain. Instead of searching here and there, the data is collected in order to facilitate the process of access to different works in the future. Second, they make it quite easy to modify data in the future. Third, they greatly facilitate the process of making the necessary updates, in addition to facilitating the processes of humping or adding. Finally, they help to format and aggregate large data in a way that is easy to manage and retrieve.

I choose database title because it provides an ability to handle large amount of data and helps to format and aggregate large data hierarchically for easy management and retrieval.

This report is an explanation to what is the database for all people in general and my friends.

This report does not discuss Conceptual Modeling and Database Design, object and Object-Relational Databases, Database Programming Techniques, Distributed database, Database Design Theory and Normalization, Advanced Database Models, Systems, and Applications and Physical Database Design and Tuning. This report concentrates only on history and tools of database.

## **Related Works**

### **Key definitions**

Data is basically information before it gets processed.

Information is data that has been processed by systems or programs.

Technology is the ability given to us using technical processes.

Humans began storing information long time ago in ancient times through simple methods until the emergence of database that changed the course of history. The computerized database began in the 1960s, when computers became more widespread and effective than anything else at the time.

Elmasri (2010) states that the technological revolution that emerged at the end of the last century is one of the main reasons for the increase in the volume of institutional information in all fields of work and the various aspects.

Jukic (2013) notes that any corporation must collect and maintain human resources records for its employees. This information must be available to those who need it only.

Cyran (2013) illustrates that “an information system is a formal system for storing and processing information. An information system could be a set of cardboard boxes containing manila folders along with rules for how to store and retrieve the folders”. However, most companies today use database to automate their information systems.

The manila folder is a powerful folder designed to contain documents that are usually from of large paper and placed without folding.

The increasing number of diverse types of information is a reason for the increasing need for using different information records. Research, classification and keeping pace with the technological development in the field of digital computing require the use of database technology. Database technology has appeared to meet the needs of different processing on data in digital format.

The databases and their applications have become an essential element in controlling everyday's life in the modern society. All the activities carried out by the members of the society need database, such as birth and death registration, study results, travel documents, banking operations, etc. Every organization must store and manage its information to meet its requirements.

All books and reports refer to the advantages of database in particular without mentioning the main reason for the emergence of databases and how the world would be without databases.

This report will be as simple as it can to understand database in general.

## 1.0 Introduction

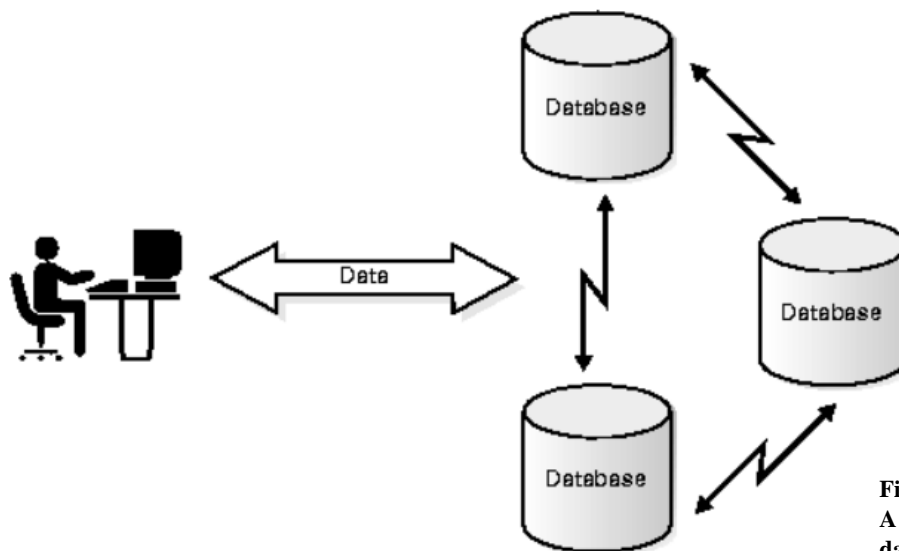
Computers are now a prominent sign of the civilized development of mankind as a distinctive feature of our present age. It has entered into various scientific, industrial, economic and military fields, since it provides human beings with super-fast speed and accuracy in accomplishing many calculations and routine actions and their ability to save and retrieve information in time. The databases are the most important computer sciences that deal with the completeness of information systems. The database enters in all fields of life from the local small library to the large public libraries through the organization of works. Management in companies and other businesses require special databases.

### 1.1 Definition

A database is a collection of relevant data or information. Information is exchanged and stored in a typical manner without any unnecessary repetition. The most important characteristic of it is storing in a manner that achieves independence and immunity against any change from the programs are used in the present or future. The databases are created and stored with the possibility of deleting, adding, updating, etc., using a DBMS.

Database management systems is a program or group of programs through which databases can be accessed and then conducted Operations needed.

Elmasri (2010) explains that database is a collection of related data. He means known facts that can be recorded and that have implicit meaning. For example, consider the names, telephone numbers, and addresses of the people you know. You may have recorded this data in an indexed address book or you may have stored it on a hard drive, using a personal computer and software such as Microsoft Access or Excel. This collection of related data with an implicit meaning is a database. The preceding definition of database is quite general; for example, we may consider the collection of words that make up this page of text to be related data and hence to constitute a database. However, the common use of the term database is usually more restricted. A database is a logically coherent collection of data with some inherent meaning. A random assortment of data cannot correctly be referred to as a database. A database is designed, built, and populated with data for a specific purpose. It has an intended group of users and some preconceived applications in which these users are interested. In other words, a database has some source from which data is derived, some degree of interaction with events in the real world, and an audience that is actively interested in its contents. The end users of a database may perform business transactions for example, a customer buys a car or events may happen for example, an employee has a baby that cause the information in the database to change. In order for a database to be accurate and reliable at all times, it must be a true reflection of the world that it represents. Therefore, changes to the database must be reflected continuously.



**Figure 1:**  
A simplified example of a database.

Singh (2017)

Obeidi(2008) emphasizes that the databases are of great importance to the progress of any society planning to build its future on sound scientific frameworks, especially as we live in an age dominated by many variables based on data of importance whether economic, social or otherwise. The development of development plans, whether short-term or long-term, cannot be carried out without a fundamental pillar on which to build, and here we mean sound databases. So how do we know the database or databases of Database. To simplify the matter on the reader, we say that it is a set of logical data elements, whether numbers, letters or symbols linked to each other with mathematical relationships. Each database consists of at least one or more tables. These tables contain one or more records. Finally, these records are eventually made up of a field or fields.

Elmasri (2010) proposes that let us consider a simple example that most readers may be familiar with a university database for maintaining information concerning students, courses and grades in a university environment. Figure 2 shows the database structure and a few sample data for such a database. The database is organized as five files each of which stores data records of the same type. Student file stores data on each student. Course file stores data on each course. Section file stores data on each section of a course. Grade report file stores the grades that students receive in the various sections they have completed. Prerequisite file stores the prerequisites of each course. To define this database, we must specify the structure of the records of each file by specifying the different types of data elements to be stored in each record. In figure 2, each student record includes data to represent the student's name, student number, Class, and major such as mathematics or 'MATH' and computer science or 'CS'. Each course record includes data to represent the course name, course number, credit hours, and Department that offers the course.

We must also specify a data type for each data element within a record. For example, we can specify that Name of student is a string of alphabetic characters, Student number is an integer and Grade is a single character from the set {'A', 'B', 'C', 'D', 'F'}. To construct the university database, we store data to represent each student, course, section, grade report, and prerequisite as a record in the appropriate file. Note that the records in the various files may be relevant as is evident in the figure 2. Most medium-size and large databases include many types of records and have many relationships among the records.



**STUDENT**

Name	Student_number	Class	Major
Smith	17	1	CS
Brown	8	2	CS

**COURSE**

Course_name	Course_number	Credit_hours	Department
Intro to Computer Science	CS1310	4	CS
Data Structures	CS3320	4	CS
Discrete Mathematics	MATH2410	3	MATH
Database	CS3380	3	CS

**SECTION**

Section_identifier	Course_number	Semester	Year	Instructor
85	MATH2410	Fall	07	King
92	CS1310	Fall	07	Anderson
102	CS3320	Spring	08	Knuth
112	MATH2410	Fall	08	Chang
119	CS1310	Fall	08	Anderson
135	CS3380	Fall	08	Stone

**GRADE\_REPORT**

Student_number	Section_identifier	Grade
17	112	B
17	119	C
8	85	A
8	92	A
8	102	B
8	135	A

**PREREQUISITE**

Course_number	Prerequisite_number
CS3380	CS3320
CS3380	MATH2410
CS3320	CS1310

**Figure 2:**  
A database that stores student  
and course information.

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Hall (2013)

In conclusion, the database can be defined as an organized way to store a set of data that can be used to extract the information you want. and thus. The database term refers to how the information is placed in a coordinated format that is easy to deal with. However, there is a wrong concept that some may imagine that the databases exist on the computer only!

The concept above is completely wrong. The need for databases is not limited to the computer, but it is in our hands. Databases may not be felt, for example the phone book is a database because it contains data contact of a certain number of individuals in an organized structural way through which at any time the details of each individual can be found quickly and easily.

## 2.0 History of the database

### Introduction

computer has entered in the areas of life and has shown its effect in solving many of the problems experienced by peoples and individuals. Among these problems is the ability to store a large amount of data and the consequent method of saving, retrieving and indexing those data, which requires effort and cost and long time. Time is the main factor and the difference for all works in this present age and therefore database was created.

### 2.1 The chronology of the database

A timeline of databases history (2018) shows that human beings began to store information very long ago in the ancient times, elaborate database systems were developed by government offices, libraries, hospitals and some of the basic principles of these systems are still being used today.

**1960s** Computerized database started when the use of computers became a more cost-effective option for private organizations. There were two popular data models in this decade: a network model called Codasyl and a hierarchical model called IMS.

**1970 to 1972** Dr. Edgar Frank Codd published an important paper to propose the use of a relational database model and his ideas changed the way people thought about databases. In his model, the database's schema, or logical organization, is disconnected from physical information storage, and this became the standard principle for database systems.

**1974 to 1977** Two main models of the relational database system were created are Ingres and System R.

Ingres used a query language known as Quel, and it led to the creation of systems such as Ingres Corp., Sybase, and other. On the other hand, System R used the Sequel query language, and it contributed to the development of SQL/DS, Oracle, and other.

**1980s** SQL, became the standard query language.

Relational database systems became a commercial success as the rapid increase in computer sales boosted the database market, and this caused a major decline in the popularity of network and hierarchical database models.

**Early 1990s** after a database industry shakeout, most of the surviving companies sold complex database products at high prices. Around this time, new client tools for application development were released, and these included the Oracle Developer, PowerBuilder, VB, and others. A number of tools for personal productivity, such as Excel, Access, and others.

**Mid 1990s** the advent of the Internet led to exponential growth of the database industry.

**Late 1990s** Increased investment in online businesses resulted in a rise in demand for Internet database connectors, such as Front Page, Active Server Pages, Java Servlets and Oracle Developer The use of MySQL, Apache

**2000s** Although the Internet industry experienced a decline in the early 2000s, database applications continue to grow. Presently, the three leading database companies in the western world are Microsoft, IBM, and Oracle.

In conclusion, the databases have gone through three basic stages throughout history

The first stage is the theoretical bases of relational databases were developed by research conducted by Dr. Edgar Coda. IBM was published in 1969 this research entitled the method of working relational databases. This research opened the field to either many researchers who developed the theoretical foundations for database building Relational. Thanks to the construction of the first system built on this research for Oracle, where it was the first companies that Penetrated the database area and developed it.

The second stage is after Oracle built the first relational database system and tried to develop it into other companies Oracle competes at the forefront, such as IBM, and other. It is one of the largest companies. Now in this field it has a database management system that does not play its own, and last but not least entered a giant domain Microsoft IT to the domain management rules but after a considerable delay for the subject important as database management systems but it has corrected the situation and try to reduce the difference in level and experience between them and other companies that had been proven in this field while Microsoft is considered In this field, it purchased Sybase technology and Microsoft entered into this successful transaction Relational database management is the most widely available based on Sybase technology.

The third stage is at this stage there was an especially important transfer in the field of database management where database design has become in line with the requirements of the Internet world as an example rules Data designed to work with the web.

## 3.0 Importance of databases

### Introduction

The importance of information at present is of the importance of database systems for organizing information. Which we need and provide for use in the appropriate and timely manner. Thus, the science of systems management developed databases from a subtopic in computer applications to a basic subject and a major component of modern computer science, thus making database systems a major part of the science curriculum the computer.

### 3.1 Advantages of databases

There are several advantages of databases.

- First, they all data in all activities in one way in an integrated and accurate ways and to classify and organize such data so that it can be retrieved in the future.
- Second, follow up changes in the stored data and make the necessary adjustments to them, so that they are always in the appropriate picture to be used immediately upon request.
- Third, the storage of a large amount of data beyond the human potential to recall the details and then perform some processes and treatments that cannot be implemented manually.
- Fourthly, helps to store data in an integrated way, in the sense of linking the different types of data reflecting all activities.
- Fifth, help ensure the complete confidentiality of the data stored so that no information is available to anyone who has no right to access it.

Many computing applications deal with very large amounts of information, so database systems provide a set of tools to store, search and manage this information. For this reason, databases are a central subject in computer science.

### 3.2 Disadvantages of databases

There are many cons in databases with the spread of the Internet, enterprises have begun to make available specific parts of their information systems over the Internet in order to expand their services. And here the breakthroughs began to take a new turn and began to play what was available and what was not available. And thus, the possibility of using what is available to access what is not available.

In conclusion, from my point of view the main reason for the emergence of databases is the search for a logical way and scientific from to produce ideas of the possibility of recovery of specific information easily and quickly. The emergence was a result of the weakness of the traditional way of collecting, using, storing, and retrieving the data. That traditional way caused several problems. The most important causes are

- Difficulty of retrieving information on time.
- The inability to exchange work between users simultaneously.
- Weakness or lack of secret aspects.
- Inefficiency and lack of interaction.
- Reducing the presence of talented users.

## 4.0 Structured Query Language (SQL)

### Introduction

Database software is one of the most widely used computer programs and can be used in both commercial and industrial fields, for example accounting, finance, personnel and procurement. Structured SQL is one of the most important languages used in database programming in terms of creating database files and retrieval. Data from them in different and multiple ways fits most of the needs of programmers and are easily installed and easy to understand for everyone.

### 4.1 Definition

SQL is the standard language for handling relational databases.

The way SQL works is as follows

- Create a table.
- Enter the fields.
- Enter the information.
- Edit the organization of information.
- Create a database.
- Edit the database.
- Save the database then use it.

This does not mean that SQL cannot do things beyond that in fact can do a lot of things including, improving and maintaining databases.

Rouse. M. (2006) indicates that databases have evolved since their inception in the 1960s, beginning with hierarchical and network databases. Databases are sometimes classified according to their organizational approach. such as relational database, distributed database, cloud database and NoSQL database. These four types are the most common.

In general, to understand SQL more, further explanation of database types will be given.

### 4.2 Types of databases

#### 1- Relational database

A relational database is a database in which data is selected, written, organized and arranged as desired and can be returned at any time. Relational database is the simplest types of databases is not complex compared to other types, because it is easy to add and change at any time especially for beginners in dealing with the computer.

SQL is the user interface and standard application program for relational database.

## **2- Distributed database**

A distributed database is distributed in different and diverse places with each other. Distributed databases can be homogeneous or heterogeneous.

## **3- Cloud database**

A cloud database is a database that has been perfected or built for a virtualized environment. Cloud databases give many benefits such as the ability to pay for storage capacity, they provide scalability on demand and gives enterprises the opportunity to support business applications and share it.

## **4- NoSQL databases**

NoSQL databases are databases that deal with large data that cannot be parsed by relational databases. They are most effective when an organization must analyze large chunks of unstructured data or data that is stored across multiple virtual servers in the cloud.

## **4.3 SQL language sections**

It consists of three sections, each of which gives you the ability to perform a specific order as follows

### **1- Data Manipulation Language**

It is often abbreviated as DML, which handles performing basic functions such as querying, adding, modifying, and deleting data.

### **2- Data Definition Language**

DDL is the department responsible for defining the data structure e.g. creating new databases, creating tables, deleting databases for the installation of databases and tables.

### **3- Control Language Data Control Language**

Abbreviated to DCL, which handles controlling the database management system such as security system control, control of the data query account.

In conclusion, query language is used with many applications, originally designed to use other programming languages. SQL has been able to achieve the ambitions of most database system developers as it is a standard and effective language for building and processing databases. First, learn SQL. Oracle is one of the best relational database systems. It has the ability to manage relational databases. It has the ability to manage very large databases of information, which can reach up to a terabyte of information and the possibility of dealing with too many Damien simultaneously in addition to the very high reliability and security features.

## 5.0 Database Management Systems (DBMS)

### Introduction

The data world is constantly changing and evolving every second, so data must be recorded accurately and continuously updated. Companies and institutions use their database management systems to achieve their objectives.

### 5.1 Definition

DBMS is a set of ready-made programs that perform all the functions and tasks needed from the database like enable creation and maintenance of a database. For example, after entering employee data into the employee database, you may need to arrange the names of employees alphabetically. The database management system consists of a set of programs and files that are intertwined to solve a problem or transform a manual system into a computer-based system such as transferring warehouse accounts from systems and notebooks to a system and files used by the computer.

Elmasri (2010) explains that “a DBMS is a collection of programs that enables users to create and maintain a database. The DBMS is a general-purpose software system that facilitates the processes of defining, constructing, manipulating, and sharing databases among various users and applications.”

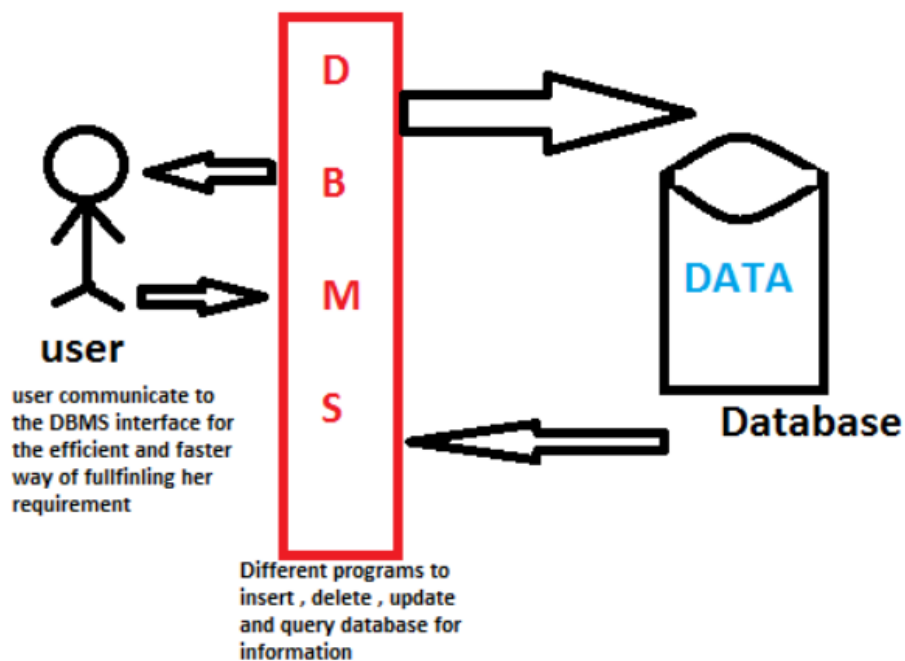


Figure 3:  
A simplified example  
of a DBMS.

## 5.2 Types of DBMS

### 1- Relational database management system

Relational database management system is more widespread than any other system because it is easy to use and simple. It relies on linking tables and information more easily in order to quickly access the required information. These systems are normalized using data stored in tables. Data in the system can be linked to data in any of the tables, whether identical or different.

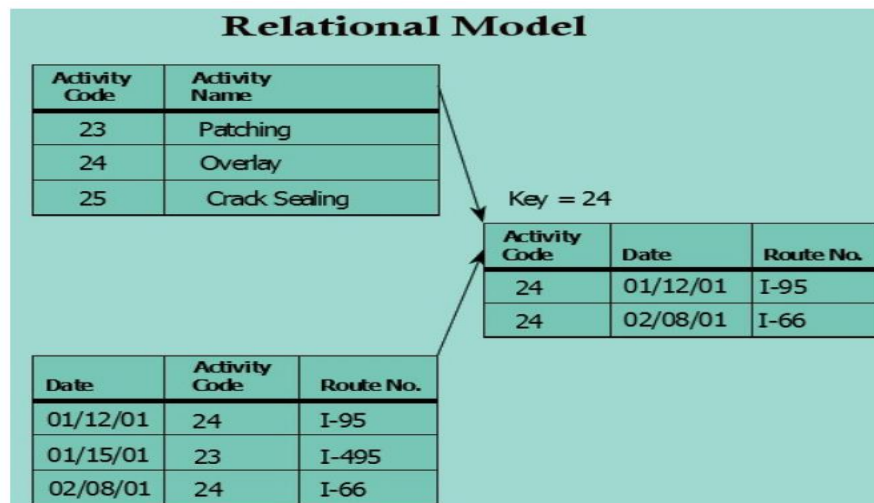


Figure 4:  
A simplified example  
of Relational  
database  
management system.

Jimmy (2003)

### 2- Hierarchical database management system

Hierarchical database management system hierarchically arranges data and is similar to paper organization in tree branches. It is based on the principle of hierarchy in work, because it creates a series of origin, or root, where the system begins to branch in the form of partitions. Its principle is to access the branching data from the chain, either from the bottom up or from the top down.

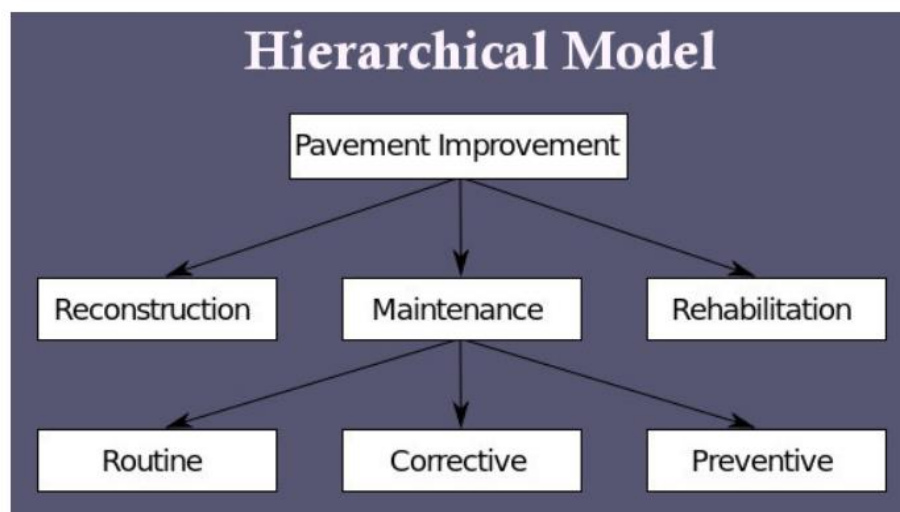


Figure 5:  
A simplified example  
of hierarchical  
database  
management system.

Jimmy (2003)



### 3- Network database management system

Like hierarchical database management system, this system has multiple parent to many relational models. The network model structure uses SQL for manipulation of data that can in turn be used to gain valuable insights and learnings.

Currently, there are at least 200 database management systems, half of the database systems are using SQL.

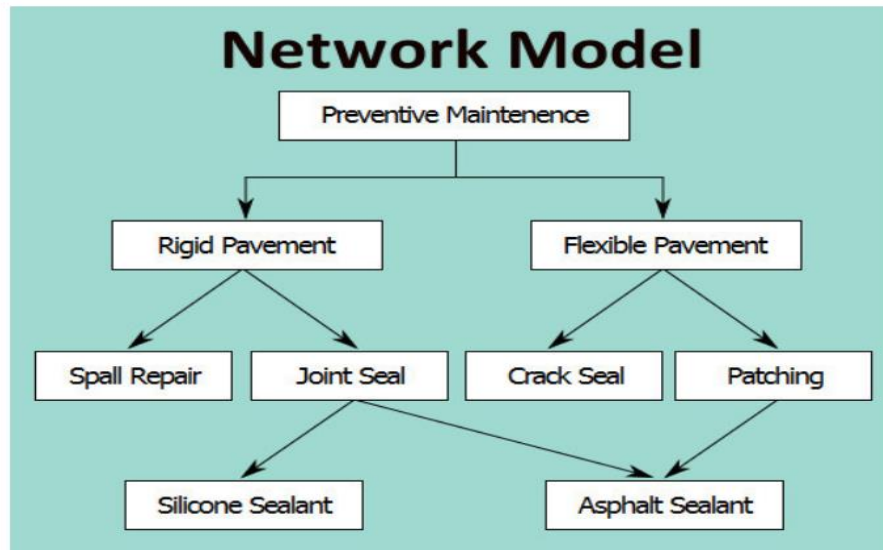


Figure 6:  
A simplified example  
of network database  
management system.

Jimmy (2003)

In conclusion, the days have confirmed the validity of the common saying that the simplest is the most beautiful. The simpler your home and the simpler you live, the fewer problems you have, and the simpler the machine, the easier it will be to manage and support. This was confirmed by dealing with the hierarchical and network databases that were complex in dealing with their files and management methods to the degree that they lead them whenever new applications or new requirements are added that need new indicators, making them huge and complex.

These problems were the basis for the search for solutions that achieve a few goals, including

- The database can be understood for those who did not study computer science.
- Can change, add and delete data without changing the logical layout of the rule.
- Provides the user with the highest degree of flexibility in handling data.

The relational systems were based on relational theories in mathematics and were applied to large computers first, such as ORACLE and SQL. Then several relational systems appeared on the personal computers.

## **Conclusion**

The concept of databases appeared to solve the problem of files with huge numbers and repetition. These files contain a lot of information which is difficult to access, modify and search. The databases make data less accurate and occupies more space in the memory of the computer. This is the concept of databases which is a system that enables the arrangement of data sequentially and coherently, without duplication, with the possibility of modifying, adding, deleting. Moreover, setting conditions and limitations to protect to information confidentiality. Then, database can select the people who can access or modify them. This makes databases a fundamental pillar in computer science and learning.

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