International Journal of Advanced Research in Commerce, Management & Social Science (IJARCMSS)
ISSN : ……, Volume 01, No. 01, October - December, 2017, pp. 64-74

DATA BASE MANAGEMENT SYSTEM : A NEW WAY OF INFORMANTION MANAGEMENT

Sunita Tailor *

Abstract

In most organisations, data files and data systems develop independently without based on a company's plan. Each field such as marketing, accounting, etc. developed their own systems traditionally. Each department and application needed its own computer and files and as the result of this an organisation used to be saddled with hundreds of files. To manage them was a tedious and complicated task. The resulting problems from this were inflexibility, data redundancy and inconsistency, poor data security, poor data integrity, programme data dependence and inability to share data among applications. Therefore a new approach named DBMS was evolved and used to overcome all these problems. In this article some concept and techniques of database management system is explained in a simple language so that a layman may understand this typical term easily.

Keywords: *DBMS, Data Files, Data Systems, Inflexibility, Electronic Forms, Database.*

Introduction

In the traditional information systems, a great amount of information is created in an organisation and data are stored in the form of paper files. To manage these files is a tedious and time-consuming task. Drawbacks of this system gave rise to file management systems where files were stored in electronic forms but the data of one application could not be used for another application. In the organisations, managers are responsible for decision-making and therefore they need only accurate and reliable data for decision-making. For limitations of traditional information systems and file management systems demanded a new system and it resulted in the name of DBMS. This system enabled managers to query data using easy non-procedural languages for their decision-making. In competitive business environment no enterprise can survive without data integration and data quality. Therefore data management is being considered essential.

According to—Lorents, Alden and **James Morgan,** "With each online mouse click, either a fresh bit of data is created or already-stored data are retrieved from all those business websites. All that's on top of the heavy demand for industrial-strength data

* Assistant Director, Drashti Research Center, Jaipur, Rajasthan.

storage already in use by scores of big corporations. What's driving the growth is a crushing imperative for corporations to analyze every bit of information they can extract from their huge data warehouse for competitive advantage. That has turned the data storage and management function into a key strategic role of the information age."

What is a Database

An effective information system provides accurate, reliable, relevant and timely information to its users. It is known that many business organisations do not have this type of information which results in increasing inefficiency. Therefore, data management is necessary in all organisations. How an organisation stores, organises and manages its data exercises great influence the organisational effectiveness. Traditionally, different types of information's are stored in different places. To compile and update information from these sources is very tiring job. A database is defined as a collection of data organised to serve many applications efficiently by centralizing the data and controlling redundant data. Data are stored close to the users in only one location. In database collection of records is in a structured format because in structured format, data are easily retrievable for analyses and calculations. A database enables a manager to make decisions by providing information on his computer.

Using a database tracking information can be managed from a single database file. In an organisation the database can be one or more than one relying on the needs and the operations of the organisation.

Problems with the Traditional File Environment

In most organisations, data files and data systems develop independently without based on a company's plan. Each field such as marketing, accounting, etc. developed their own systems traditionally. Each department and application needed its own computer and files and as the result of this an organisation used to be saddled with hundreds of files. To manage them was a tedious and complicated task. The resulting problems from this were inflexibility, data redundancy and inconsistency, poor data security, poor data integrity, programme data dependence and inability to share data among applications. Therefore a new approach named DBMS was evolved and used to overcome all these problems.

Database Management System Concepts

To understand the Database Management Concepts concepts clearly some terms are needed to be explained: They are—entity, attributes, data value, record, fields and relationships.

- **Entity**: Entity is the basic unit which is an object of concern for an organisation and about which the information is recorded. For example, the employee, the customer or the bank account.
- **Attributes**: An attribute is also termed as data element, element, item or object property. The attributes describe the entities features. If an employee is an entity then its attributes are the age, height, education, etc.
- **Data Value**: We record an entity with its value. Each entity has its value which is called as data value. Data value can be descriptive or quantitative.

- **Key Attributes**: Some attributes are used as key attributes of an entity. This key attribute can help us in finding the value of the other attributes. For example, the employee number is an attribute of an entity 'employee'.
- **Record**: The record is a set of the attribute values.
- **Table**: A table is an object that is used to store data in a record and fields.
- **Fields**: The columns which represent the attributes are called fields. For example, product name, product ID is fields in the product table.

Components of a DBMS

The major components of a DBMS are as follows:

- **Data Definition Language Compiler**: The data definition language complier is used to convert the data definition statements into a set of tables. The compiled form of the database is known as data dictionary. These tables contain the data in a form that these may be used by the other components of the database management system.
- **File Manager**: File manager has the responsibility for managing the file space and for file structure. He locates the block containing the required record and transmits the required record to the data manager.
- **Data Manager**: The data manager is the key software component of the database management system. He is responsible for converting operations in the user's queries coming either directly via the query processor or indirectly through an application programme from the users logical view to a physical file system. He also interfaces with the file system. In addition, he has to perform some other tasks such as to maintain the consistency and integrity of the data, to maintain data security and to control concurrency.
- **Disk Manager**: All physical input and output operations are performed by it. He transfers the block or page requested by the file manager.
- **Query Processor**: The query processer explains the online user's query and convert it into an effective series of operations in order to send it to the file manager for execution. He uses the data dictionary to find out the structure of the database and he uses this information to modify the query and paves a way to access the database.
- **Telecommunication System**: Online users send and receive messages over communication lines. These messages are routed through an independent software system which is called telecommunication system. Some of the examples of these systems are CICS. Talkmaster, Iercomm and IDMS-Dc. It should be noted that it is not a part of DBMS but we consider it because the DBMS works this system. Messages are sent through this system and responses are also sent back.
- **Data Dictionary**: Information regarding the structure and usage of data is maintained in a **data dictionary or system catalogue**. The data dictionary documents the data. The users can consult this dictionary in order to get information about the nature of data. It stores the information of the external, internal and conceptual levels of the database. The data dictionary contains the

source of each data-field value, the frequency of its use and an audit trail concerning update information.

Functions of the Data Administration Group

To manage data effectively, data administration plays an important role. Generally, this group reports to the IS Director. Each organisation specifies its policy that outlines the role of the data administration. Data administrators are given both operational and planning responsibilities. Data administration has to perform following function:

- **Promoting and Controlling Data Sharing**: The group should work to promote and control the data sharing. This group encourages all business units to increase the use of common sources of data in different application systems.
- **Reducing Redundant Data and Processing**: This group encourages reducing redundant data and processing. It also synchronises useful redundant copies and controls data distributed across the various computer systems.
- **Maintaining the Data Dictionary**: Data dictionary leads to achieving the goals of data management. Data administration group adds new definitions and new data to it. They are responsible to updata DD/D.
- **Reducing Costs**: Data administration makes best efforts to minimise system maintenance costs. Therefore database, systems must be easy to use and using effective database technologies resulting in cost reduction.
- **Improving Systems Productivity**: Data administration should work to improve system development productivity by selecting effective and easy techniques. It should train database analysts and programmers to improve productivity and maintenance of the application systems.
- **Improving Quality and Security of Data**: The group should constantly work to ensure quality and security of data. It can be done by helping managers to define data quality and set security clearances.
- **Analysing the Impact of Changes**: The group should analyse the impact of changes to application systems when changes in data definitions occur. The group should consider the needs of all database users and this group should modify the database programmes when necessary.

Database Management Systems

A database management is supportive software that permits an organisation to create, manage and protect organisational data. It provides access to the stored data by application programmes. It acts as an interface between application programmes and the physical data files. A DBMS aims at significant data management capabilities. Selecting data through a computer programmer makes programming easier and more productive. It also enables systems professionals to recognise the physical organisation of data without affecting their logical programmes. The DBMS provides access to data based on content and by association. The DBMS makes the physical database available for different logical views needed by the users. Databases created by the DBMS are used for decision-making. These data are used to create reports, documents and analyse using a DBMS.

Advantages and Disadvantages of DatabaseManagement System

Advantages of Database Management System

Organisations rely on the use of DBMS for following advantages:

- **Organisational Flexibility**

Traditional data structures were not able to provide organisational flexibility and they were designed to support only a particular application. Traditionally, information receiver is regarded as the designated decision-making authority. Now traditional data structure or file management systems have been replaced by DBMS which provides more organisational flexibility.

- **Integrity**

DBMS also ensures that integrity is secured through adequate checks incorporated in DBMS. Data integrity emphasises on accuracy and consistency of data. They must fall within a specific range and are of the correct format. Companies need integrity in their system. For example, Cavin Care, a personal care products company, has felt the need for integrity due to delays experienced in tabulating.

- **Better Operational Coordination**

The database is under the control of the DBA, the user or manager must resolve the conflicting situations of the users and applications. Conflict resolution is not possible without a seamless flow of data and information between these organisational units. The DBMS provides the best file structure and access method to establish coordination. Computer-based tracking system can enable the packages to be tracked anywhere around the world.

- **Improved Information for Managers**

A well-designed DBMS helps the managers to analyse and understand the changing market trends and to monitor consumer behaviour. Data collected and stored by DBMS can be used in planning and decision-making. For example, ICICI bank in India uses a consumer database to understand its customers better and to be able to identify why they are not satisfied.

- **Shared Data**

A database allows sharing data under its control by application programmes or users. The requirements of the data can be integrated by the person who is responsible for centralised control.

- **Reduction of Redundancies**

A good DBMS avoids duplication of data and simultaneously reduces the total amount of data storage required. It eliminates the inconsistencies that are present in redundant data files. DBMS controls any redundancies that can exist.

- **Security**

Data are useful if only they are confidential. These data must not be accessed by unauthorised persons. The DBA is responsible for this. He ensures that proper access procedures are being followed. Various security measures are implemented. The enforcement of security could be both data value dependent and data type dependent.

Disadvantages of the Database Management System

Database management system suffers from following drawbacks:

- Database management system is costlier.

- Sharing of data may cause a degradation of the response and through –put times.
- Back up and recovery are complex.
- Problems related to centralization.

Steps in Data Access

Step-1— Receiving of data requests by the data manager and determination of physical record.

Step-2— Sending the request by the data manager to the file manager for a specific physical record.

Step-3— Determination of physical block of secondary storage by the file manager and sending the request for the proper block to the disk manages.

Step-4— The disk manager retrieves the block and sends it to the file manager which in return sends the proper record to the data manager.

Classification of DBMS users

Classification of DBMS users depend on the degree of expertise or the mode of users interactions with the DBMS:

- **Online Users**

Online users are those who communicate with the database either via an online terminal or via a user interface and application programme. These users have some knowledge about database and computer networks. Some users use a data manipulation language (DML) in order to manipulate the database. These users may also be naïve users when they need additional help.

- **Naïve Users**

The users who need not to be aware about the presence of the database system are called naïve users. A naïve user is directed through each step of procedure. This class of users are very limited in number. Some other users of this category are the end users of the database who work via a menu-oriented application programme.

- **Application Programmers**

Application programmers are the persons who develop application programmes or user interfaces which are utilised by the naïve and online users. These programmes can be written in general programming language such as in C, COBOL, FORTRAN, PASCAL or PL/I, etc.

- **Database Administrator DBA**

DBA is responsible to exercise centralised control of the database. DBA may be a person or a group of persons. These are the most familiar with the database. They control the data structure. The DBA is responsible to create, modify and to maintain the three levels of DBMS. The DBA specifies the external view of the various users and applications. Definition and implementation of the internal level is under control of the DBA. Any changes in three levels of DBMS are controlled by the DBA. The DBA grants permission to the users of the database and stores the profile of each user in the database. The DBA is also responsible to come over the database failure reasons.

Database Design

Database design is regarded an iterative process for which various methodologies have been developed. Here, common steps of database design are discussed. First diagram given on next page shows these steps and further these are discussed in detail.

- **Defining the Problem**

First step taken in database design is to define the problem for which database design is made. One alternative among the available alternatives is selected for a feasibility study. All types of costs are estimated and the risks versus the profits are examined. Besides these time scales for the next stages are also projected. When top management approves all these, the design of the database system begins.

- **Analysing the Existing System and Procedures**

The second stage involves performing a feasibility study of the proposed solutions. This stage also involves analysis of the existing system and procedures and the impact of the proposed system on the organisation. Analysis of existing system helps in determining information requirements. Analysis of the existing system reveals inefficiencies, duplications and desired changes in procedures and the impact of the database system on the existing system and procedures. While analysing the existing system levels of management, types of activities and nature of functions must be given attention. In this step information requirements and processing requirements are also defined.

To summarise following sub steps are taken in the second step:

  - Study of the existing system and procedures.
  - Asking or interviewing the user groups.
  - Analysis of information flow.
  - Necessary modification for improvement.
  - Preparing the initial proposal and requirement specifications.
  - Definition of user interface.

- **Preliminary Design**

Preliminary design is assessed against the initial requirements. Before getting a good preliminary design the first and the second steps are repeated. Two approaches to the design of the conceptual schema are used

  - **Centralised Schema Design**: Requirement specifications are merged into a single set of specifications.
  - **View Integration Approach**: Requirement specifications are integrated into conceptual schema for the database.

- **Computing System Decision**

When the database is implemented on an existing computer system, the choice becomes limited for the DBMS. For this the existing system must fulfil the storage and processing requirements of the proposed DBMS. DBMS model also plays important role in computing system design. A hierarchical DBMS is appropriate in case of hierarchical data. The network or relational model must be used if the data reveals a large number of interrelationships. Some other factors which affect the choice of a DBMS are availability of services from the vendor, reputation of the vendor, experience of the personnel, capital

costs, conversion and initial training costs and maintenance of the software and hardware.

- **Final Design**

This step involves converting the conceptual and external schemes in the model of the database. The main models of DBMS have also been discussed in this chapter also. Following models are used:

- Relational DBMS
- Network DBMS
- Hierarchical DBMS
- Physical DBMS

In the hierarchical database, the choice of root record type determines the performance of the system. In the physical design various strategies are used to improve performance. In a network system the performance can be improving by storing the members close to the owner record type and in a relational database performance can be improved by using a serial file.

- **Implementation and Testing**

In the sixth stage, the design is implemented and tested. The code for the conceptual and external schemes in the DDL of the DDBMS is compiled. The application programmes and transactions are written in high-level languages. The system is tested through various procedures. If it is found adequate it must be installed for daily operations.

- **Operation and Tuning**

In this stage the design is installed. The users are guided and errors are removed. If the performance of the system seems to be unsatisfactory, fine tuning should be called for.

Database Models

Database models are classified as:

- Relational DBMS model
- Hierarchical DBMS model
- Networks DBMS model

- **Relational DBMS**

Relational DBMS is widely used and most popular model of DBMS for PCs as well as for larger computers and mainframes. In the Relational DBMS, two dimensional tables or relations are used. Each table shows data on an entity and its attributes. My SQL is widely used open-source DBMS, and Oracle Database Lite is used for small handheld computing devices.

- **Hierarchical Database Model (HDBM)**

A hierarchical DBMS model one-to-many relation. It must be applied when the data can be put down in the hierarchical levels. The data model seems to be like a tree. This model is less flexible than RDBMS and does not support ad hoc, natural language. The relationship between the entities in HDBM is shown by the structure of the resulting ordered tree. This model restricts each record type to only one parent record type.

- **Network Database Model (NDBM)**

The network data model represents data for an entity set by a logical record type. It is also not generally used like RDBMS and is less flexible than RDBMS. This model was formalised in the late 1960s by the Database Task Group. This model is also known as DBTG data model. It uses two different data structures to show the database entities and relationship between record type and set type entities.

Data Warehouse

A data warehouse is a database type used to store current and past data for decision-making. Lauden and Lauden write, "The data warehouse consolidates and standardises information from different operational databases so that the information can be used across the enterprise for management analysis and decision-making." The data warehouse provides data anyone who needs it. For an efficient data warehouse, the data must be accurate and current. There must be easy-to-use data access and data tools. In data warehouse three software tools are necessary: warehouse construction software, warehouse operation software and warehouse access and analysis software. Data warehouse is capable to let companies utilise the data that they have already collected.

Components of a Data Warehouse

A data warehouse uses current and historical data from external and internal sources and reorganises them into a central database designed.

Data Quality

Data for any company must be accurate, reliable and easily available to ensure data quality, the company should adopt an information policy and measures of database administration. Besides these, additional steps and cautions must be taken up to ensure data quality. Inaccurate, untimely or inconsistent data result only in incorrect decisions and business losses. According to Forrester Research, 20 per cent of U.S. mail and commercial package deliveries were returned because of incorrect names or addresses. The Gartner Group consultants reported that more than 25 per cent of the critical data in large fortune 1000 companies' databases is inaccurate or incomplete, including bad product codes and product descriptions, faulty inventory descriptions, erroneous financial data, incorrect supplier information, and incorrect employee data. **Gartner** believes that customer data degrades at a rate of 2 per cent per month, making poor data quality a major obstacle to successful customer relationship management. Organisations should identify data errors and establish better routines to edit data. Data quality audit must be used to increase the accuracy, reliability and completeness of the data. Data quality audit involves surveying samples from data files, surveying all files or surveying end users. Data cleansing is used to correct and detect data in a database to avoid redundancy, incompleteness and improper formation of data. Some data cleansing softwares are available for data cleansing. Those softwares add integration and consistency to data. Centralised data warehouse, data quality management software, data quality software tools are also used for ensuring data quality.

Database Security

An access to up-to-date and reliable information has vital importance for every organisation. Therefore, it is necessary that databases must be secured from manipulations. To ensure security, the DBMS must have mechanisms to restrict users to only required

data. Database security is defined as the protection of the information contained in the database against manipulations, destruction and unwanted modifications.

Forms of Security Threats

- Hardware failures
- Improper authorisation
- Errors in system
- Concurrent usage anomalies
- Getting Access to the computer system by unauthorised persons
- Personal gain of authorised users
- Malicious intention of system programmer.

Measures to Data Security

- Mechanisms to support concurrency
- Audit and recovery data logging
- Mechanism for defining the authorisations
- Providing semantic integrity constraints
- Control policies and administrative controls
- Transaction management
- Effective operating systems
- Adequate physical protection
- Ciphered communication channels
- Mandatory controls.

Current Database Systems

- **Distributed Database**

A distributed database is stored in more than one physical location. The components of a distributed database are located at various places interconnected through a communication network. In a centralised database system the DBMS and the data are located at a single location and to control over this location is limited. But now companies have operations at various locations and to access data from a centralised database creates many problems. Besides this, the control site has to suffer from excessive load. Therefore, distributed database system is an alternative to the central database approach.

Advantages of the DDBMS

These systems are used in networks of libraries, networks of banks, networks of insurance companies, transaction of credit and so on. These systems provide following benefits:

- These systems can handle local as well as global transactions.
- The system is available even in case of a portion of a system is down.
- This system can hide the complexity of the underlying differences in the various local systems.
- These are useful when organisation tend to grow constantly.
- This system provides benefits of increasing availability, reliability and incremental growth.

- **Object-oriented Databases**

The concept of object-oriented system was developed by the smalltalk programming system. An object is denoted by a name and has a private memory. In the object-oriented DBMS, data are stored retrieved and shared automatically as objects. These systems are becoming popular rapidly because managers can use them to manage the various multimedia components. Those systems can store and retrieve images, drawings, photographs, voice and full-motion video. These systems can be effective to overcome the limitations of relational database management system. IRIS is an object-oriented research DBMS under development at Hewlett-Packard.

- **Expert Database Systems**

An Expert database system is an integration of expert system with the DBMS. This type of system is used to perform the traditional DBMS functions and use the inference system in terms of inductive, adductive and deductive reasoning. It can interprete the responses to queries and enhances the integrity and security in the system.

References

- Alexander Totok and Vijay Karamcheti. Improving performance of internet services through reward-driven request prioritization. In *Proc. IEEE International Workshop on Quality of Service (IWQoS'06)*, June 2006.
- D. Kalmuk. DB2 10.1: Leveraging new capabilities within the WLM best practices. IDUG DB2 Tech Conference presentation, November 2012.
- Dushyanth Narayanan, Eno Thereska, and Anastassia Ailamaki. Continuous resource monitoring for self-predicting DBMS. In *International Symposium on Modeling, Analysis, and Simulation of Computer and Telecommunication Systems (MASCOTS'05)*, pages 239-248, 2005.
- Nicolas Bruno and Surajit Chaudhuri. An online approach to physical design tuning. In *Proc. International Conference on Data Engineering (ICDE'07)*, pages 826-835, April 2007.
- Surajit Chaudhuri and Vivek Narasayya. Automating statistics management for query optimizers. *IEEE Transactions on Knowledge and Data Engineering*, 13(1):7-20, 2001.

❖❖❖