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**Database Management System**

**Theory Assignment (#3)**

**SUBMITTED BY**

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1. **ADDITIONAL ADVANTAGES OF DATABASE APPROACH**

We have different types of additional advantages of the database. Some of the additional advantages are described below.

1. **Expandability/flexibility :**
2. **Reduce application development time**

The cost and time for developing new applications is also reduced. The DBMS provides tools that can be used to develop application programs. For example, some wizards are available to generate Forms and Reports. Stored procedures (stored on server side) also reduce the size of application programs.

1. **Economy of scale**

It is much easier to respond to unanticipated requests when data is centralized in a database than when it is stored in a conventional file system. Although the initial cost of setting up of a database can be large, but the cost of developing and maintaining application programs to be far lower than for similar service using conventional systems. The productivity of programmers can be higher in using non-procedural languages that have been developed with DBMS than using procedural languages.

1. **Centralized control by the DBA**

A centralized database consists of a single data server into which all data are stored and from which all data are retrieved. All the data reside at a single location and all applications must retrieve all data from that location.The centralized approach consists of a central server into which all forecast data are stored. At some predefined time, software on this central server requests data from each of the local data servers scattered throughout the country. These data are received, processed and stored, possibly at lower spatial and temporal resolution than the data from which it was derived.

1. **Database system components:**

A database management system (DBMS) consists of several components. Each component plays very important role in the database management system environment. The major components of database management system are:

* **Data**

Data is the most important component of the DBMS. The main purpose of DBMS is to process the data. In DBMS, databases are defined, constructed and then data is stored, updated and retrieved to and from the databases. The database contains both the actual (or operational) data and the metadata (data about data or description about data).

* **Hardware**

Hardware consists of a set of physical electronic devices such as computers (together with associated I/O devices like disk drives), storage devices, I/O channels, electromechanical devices that make interface between computers and the real world systems etc, and so on. It is impossible to implement the DBMS without the hardware devices, In a network, a powerful computer with high data processing speed and a storage device with large storage capacity is required as database server.

* **Software**

The main component of a DBMS is the software. It is the set of programs used to handle the database and to control and manage the overall computerized database

1. DBMS software itself, is the most important software component in the overall system
2. Operating system including network software being used in network, to share the data of database among multiple users.
3. Application programs developed in programming languages such as C++, Visual Basic that are used to to access database in database management system. Each program contains statements that request the DBMS to perform operation on database. The operations may include retrieving, updating, deleting data etc . The application program may be conventional or online  workstations or terminals.

* **Users**

The users are the people who manage the databases and perform different operations on the databases in the database system.There are three kinds of people who play different roles in database system

1. Application Programmers
2. Database Administrators
3. End-Users

**Application Programmers**

The people who write application programs in programming languages (such as Visual Basic, Java, or C++) to interact with databases are called Application Programmer.

**Database Administrators**

A person who is responsible for managing the overall database management system is called database administrator or simply DBA.

**End-Users**

The end-users are the people who interact with database management system to perform different operations on database such as retrieving, updating, inserting, deleting data et**c.**

1. **Data communication manager:**

(DC manager) is a software component that manages all message transmissions between the user and the DBMS (more accurately, between the user and some application running on top of the DBMS).

1. **Data system utilities:**

* **Loading :** A loading utility is used to load existing data files-such as text files or sequential files-into the database. Usually, the current (source) format of the data file and the desired (target) database file structure are specified to the utility, which then automatically reformats the data and stores it in the database. With the proliferation of DBMSs, transferring data from one DBMS to another is becoming common in many organizations. Some vendors are offering products that generate the appropriate loading programs, given the existing source and target database storage descriptions (internal schemas). Such tools are also called conversion tools.
* **Backup:** A backup utility creates a backup copy of the database, usually by dumping the entire database onto tape. The backup copy can be used to restore the database in case of catastrophic failure. Incremental backups are also often used, where only changes since the previous backup are recorded. Incremental backup is more complex but saves space.
* **File Reorganization:** This utility can be used to reorganize a database file into a different file organization to improve performance.
* **Performance Monitoring:** Such a utility monitors database usage and provides statistics to the DBA. The DBA uses the statistics in making decisions such as whether or not to reorganize files to improve performance.

1. **Classification of DBMS**

Database management systems can be classified based on several criteria, such as the data model, user numbers and database distribution, all described below.

**CLASSIFICATION BASED ON DATA MODEL**

The most popular data model in use today is the relational data model. Well-known DBMSs like Oracle, MS SQL Server, DB2 and MySQL support this model. Other traditional models, such as hierarchical data models and network data models, are still used in industry mainly on mainframe platforms. However, they are not commonly used due to their complexity. These are all referred to astraditional models because they preceded the relational model.

In recent years, the newer object-oriented data models were introduced. This model is a database management system in which information is represented in the form of objects as used in object-oriented programming. Object-oriented databases are different from relational databases, which are table-oriented. Object-oriented database management systems (OODBMS) combine database capabilities with object-oriented programming language capabilities.

The object-oriented models have not caught on as expected so are not in widespread use. Some examples of object-oriented DBMSs are O2, ObjectStore and Jasmine.

**CLASSIFICATION BASED ON USER NUMBERS**

A DBMS can be classification based on the number of users it supports. It can be a single-user database system, which supports one user at a time, or a multiuser database system, which supports multiple users concurrently.

**CLASSIFICATION BASED ON DATABASE DISTRIBUTION**

There are four main distribution systems for database systems and these, in turn, can be used to classify the DBMS.

**CENTRALIZED SYSTEMS**

With a centralized database system, the DBMS and database are stored at a single site that is used by several other systems too. This is illustrated in Figure 6.1.

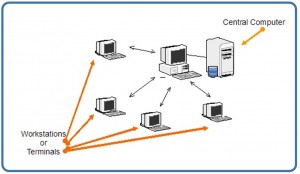
[](http://opentextbc.ca/dbdesign01/wp-content/uploads/sites/11/2013/12/Record-300x177.jpg)

Figure 6.1. Example of a centralized database system.

In the early 1980s, many Canadian libraries used the GEAC 8000 to convert their manual card catalogues to machine-readable centralized catalogue systems. Each book catalogue had a barcode field similar to those on supermarket products.

1. **Variation of distributed environment**

**DISTRIBUTED DATABASE SYSTEM**

In a distributed database system, the actual database and the DBMS software are distributed from various sites that are connected by a computer network, as shown in Figure 6.2.

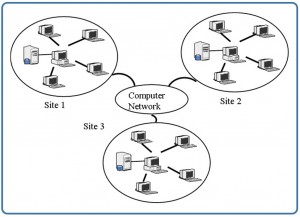
[](http://opentextbc.ca/dbdesign01/wp-content/uploads/sites/11/2013/12/EntitySet-300x86.jpg)

Figure 6.2. Example of a distributed database system.

**HOMOGENEOUS DISTRIBUTED DATABASE SYSTEMS**

Homogeneous distributed database systems use the same DBMS software from multiple sites. Data exchange between these various sites can be handled easily. For example, library information systems by the same vendor, such as Geac Computer Corporation, use the same DBMS software which allows easy data exchange between the various Geac library sites.

**HETEROGENEOUS DISTRIBUTED DATABASE SYSTEMS**

In a heterogeneous distributed database system, different sites might use different DBMS software, but there is additional common software to support data exchange between these sites. For example, the various library database systems use the same machine-readable cataloguing (MARC) format to support library record data exchange.

1. **Database system life cycle**

A database is usually a fundamental component of the information system, especially in business oriented systems. Thus database design is part of system development. The following picture shows how database design is involved in the system development lifecycle.

There are various methods of how the different phases of information system design, analysis and implementation can be done. Here the main tasks or goals are described but no method is introduced.

**Database Planning**

The database planning includes the activities that allow the stages of the database system development lifecycle to be realized as efficiently and effectively as possible. This phase must be integrated with the overall Information System strategy of the organization.  
  
The very first step in database planning is to define the mission statement and objectives for the database system. That is the definition of:  
- the major aims of the database system  
- the purpose of the database system  
- the supported tasks of the database system  
- the resources of the database system

**Systems Definition**

In the systems definition phase, the scope and boundaries of the database application are described. This description includes:  
- links with the other information systems of the organization  
- what the planned system is going to do now and in the future  
- who the users are now and in the future.  
  
The major user views are also described. i.e. what is required of a database system from the perspectives of particular job roles or enterprise application areas.

**Requirements Collection and Analysis**

During the requirements collection and analysis phase, the collection and analysis of the information about the part of the enterprise to be served by the database are completed. The results may include eg:  
- the description of the data used or generated  
- the details how the data is to be used or generated  
- any additional requirements for the new database system

**Database Design**

The database design phase is divided into three steps:  
- conceptual database design  
- logical database design  
- physical database design  
  
In the conceptual database design phase, the model of the data to be used independent of all physical considerations is to be constructed. The model is based on the requirements specification of the system.  
  
In the logical database design phase, the model of the data to be used is based on a specific data model, but independent of a particular database management system is constructed. This is based on the target data model for the database e.g. relational data model.  
  
In the physical database design phase, the description of the implementation of the database on secondary storage is created. The base relations, indexes, integrity constraints, security, etc. are defined using the SQL language.

**Database Management System Selection**

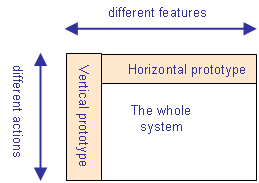
This in an optional phase. When there is a need for a new database management system (DBMS), this phase is done. DBMS means a database system like Access, SQL Server, MySQL, Oracle.  
  
In this phase the criteria for the new DBMS are defined. Then several products are evaluated according to the criteria. Finally the  
recommendation for the selection is decided.

**Application Design**

In the application design phase, the design of the user interface and the application programs that use and process the database are defined and designed.

**Protyping**

The purpose of a prototype is to allow the users to use the prototype to identify the features of the system using the computer.  
  
There are horizontal and vertical prototypes. A horizontal prototype has many features (e.g. user interfaces) but they are not working. A vertical prototype has very few features but they are working. See the following picture.



**Implementation**

During the implementation phase, the physical realization of the database and application designs are to be done. This is the programming phase of the systems development.

**Data Conversion and Loading**

This phase is needed when a new database is replacing an old system. During this phase the existing data will be transferred into the new database.

**Testing**

Before the new system is going to live, it should be thoroughly tested. The goal of testing is to find errors! The goal is not to prove the software is working well.

**Operational Maintenance**

The operational maintenance is the process of monitoring and maintaining the database system.  
  
Monitoring means that the performance of the system is observed. If the performance of the system falls below an acceptable level, tuning or reorganization of the database may be required.  
  
Maintaining and upgrading the database system means that, when new requirements arise, the new development lifecycle will be done. Source: Connolly, Begg. 2005. Database Systems. A Practical Approach to Design, Implementation, and Management. Addison Wesley. Chapter 9. Database Planning, Design and Administration.