



SOFTWARE ENGINEERING



DATABASE MANAGEMENT SYSTEMS

**DATABASE AND DATABASE
MANAGEMENT SYSTEMS (DBMS)**

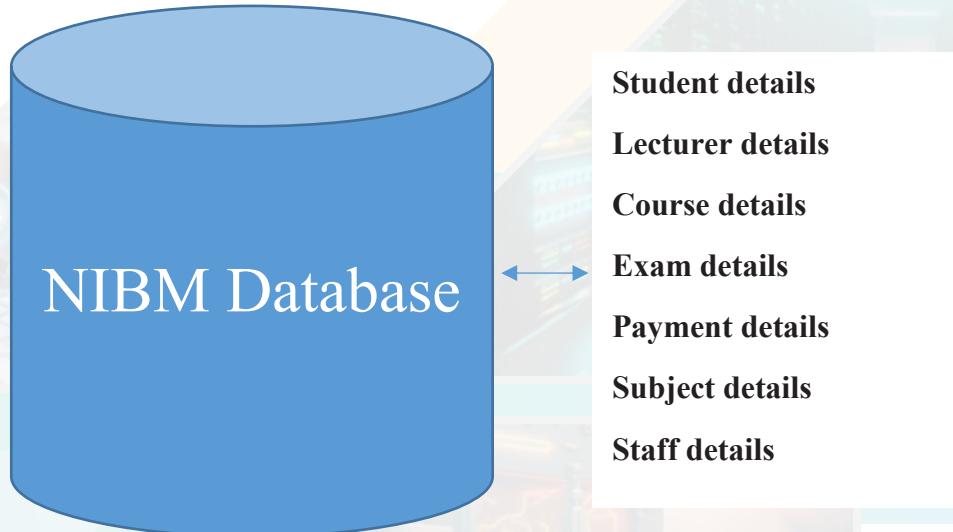
Lesson 01 – Database and Database Management Systems (DBMS)

Introduction

- A **database** is an integrated collection of logically related records and files.
- Every company need to maintain their data inside a repository which called as a Database.
- Without a Database it is difficult to maintain the security of the data.
- **Database management system** is software package that can use to create and maintain a database.

Examples for Database

Ex01: Consider about NIBM. In NIBM various data need to be maintain inside the Database. Student details, Lecturer details, Course details, Exam details, Payment details etc.



Ex02: Consider about BOC Bank. In BOC bank various data need to be maintain inside the Database. Customer details, Branch details, Loan details, Credit Card details, Account details, Staff details etc.



Customer details

Branch details

Loan details

Credit Card details

Account details

Staff details



Ex03: Consider about Food City. In Food City various data need to be maintain inside the Database. Customer details, Branch details, Item details, Supplier details, Staff details etc.



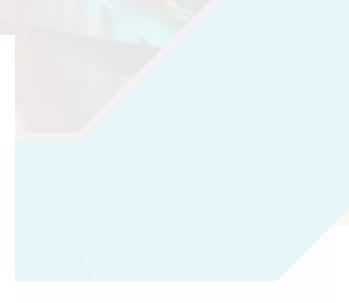
Customer details

Branch details

Item details

Supplier details

Staff details



File Based Data Processing (Traditional way)

- Each application has data files that correspond to only that application

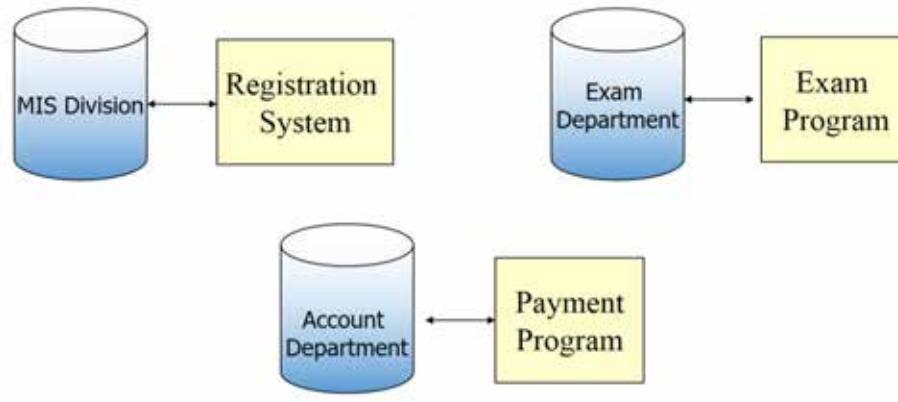


Figure 1.0.1 File Based Data Processing

- Each department maintain different file (can be a manual file as well) to keep the data. As an example if the student register in the MIS division his/her data record in the MIS division file. Then in Exam department and Account department his/her data need to record separately. Therefore, same data duplicate in many different files. Also later if the student's name or any other detail changed it will only update in MIS division file only. Therefore, data is inconsistency problem occur.

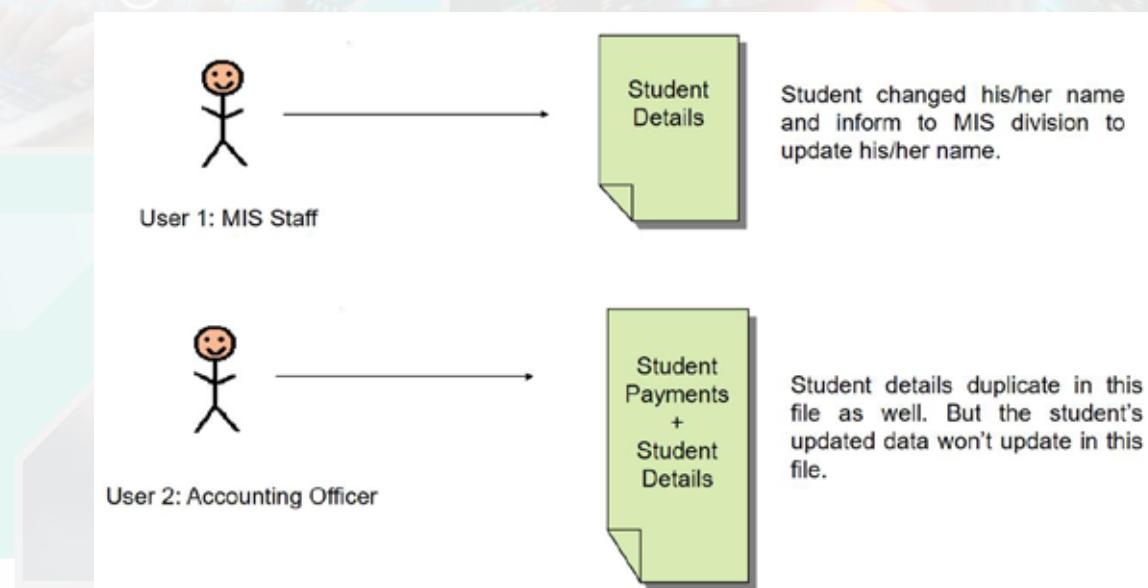


Figure 1.0.2 Example for File Based Data Processing

Problems with File Based Data Processing

- Data redundancy and inconsistency
 - The same data may be duplicated in each application's file
- Data inconsistency
 - The various copies of the same data may no longer agree
- Difficulty in accessing data
- Data isolation

Database Processing using DBMS

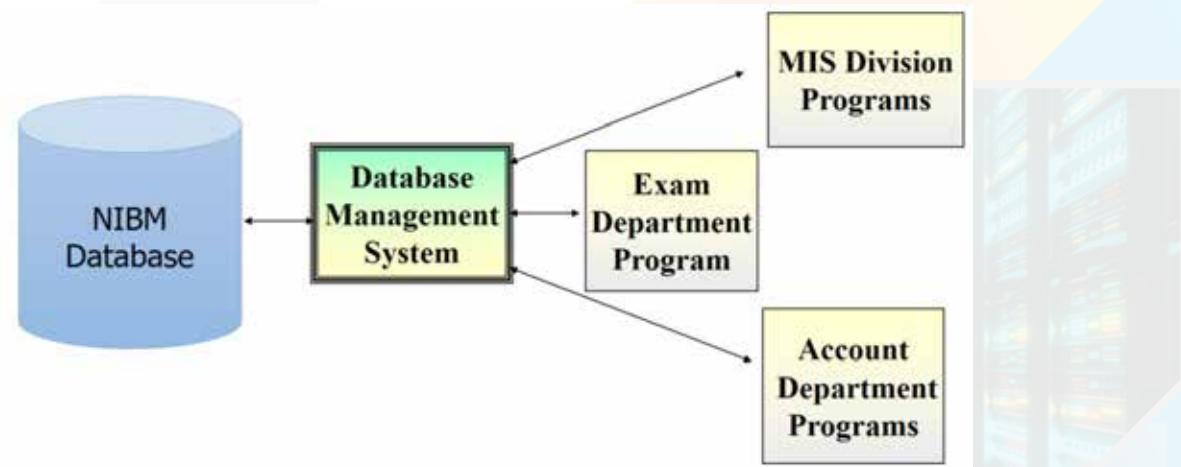


Figure 1.0.3 Database Processing

Database Management System (DBMS)

A DBMS is a Software program that can be used to create and maintain a database.

Examples for DBMS

- MS Access
- MySQL
- SQL Server
- Oracle
- IBM DB2
- Mongo DB
- H2

Advantages of Database Processing using DBMS

1. Sharing of data: No duplicate data
2. Controlling of Redundancy: A multi-user DBMS allows multiple users to access the database at the same time.
3. Security restrictions: User access to the Database is restricted by account numbers and passwords.
4. Backup and recovery: A DBMS must provide facilities for recovering from hardware and software failures.
5. Flexibility: Allows changes to the structure of the database without effecting most of the application programs.
6. Enforcing integrity constraints (accuracy of data): There are different ways to maintain the accuracy of data such as Primary Key and Foreign Key.

Disadvantages of Database Processing using DBMS

1. High initial investment in hardware, software and training and greater impact on system failure.
2. Unnecessary overhead costs in providing security, concurrent control and recovery as compared to traditional file processing systems.
3. A DBMS is a large program which requires more disk space and a more powerful computer than for a traditional file system.

Hierarchical Structure of Database

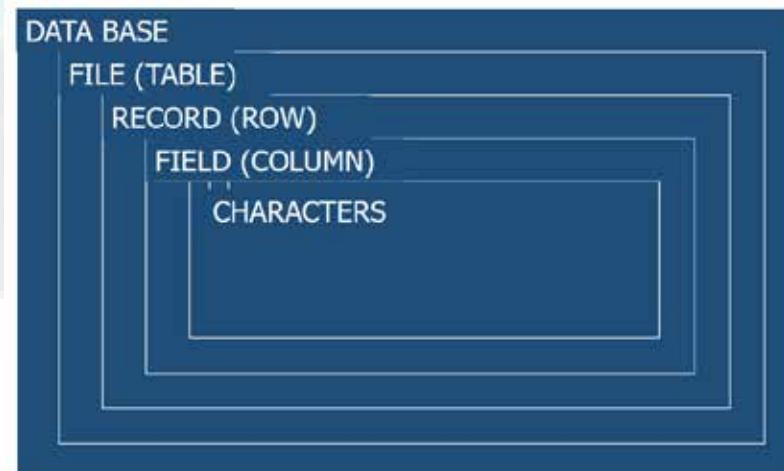


Figure 1.0.4 Hierarchical Structure of Database

Database Management System

3 Schema Architecture for Database Development

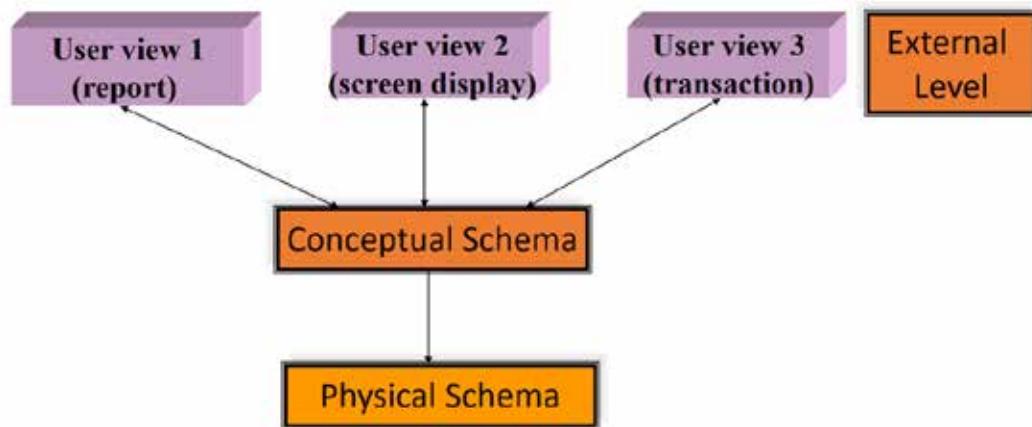


Figure 1.0.5 Schema Architecture for Database Development

External level (View):

Front end of the Software. Each view describes the part of the database that a particular user group is interested.

Physical level:

Describes the physical storage structure of the database and access paths for the database.

Conceptual level:

Describes the structure of the database. (Entities, Data types, Relationships and Constraints).

A conceptual schema can represent as an ER diagram.

Data Independence

Logical Data Independence

Capacity to change the logical structure (conceptual schema) without having to change the external schema or application programs. That is adding, deleting of fields or tables should not affect the existing data.

Physical Data Independence

Having to change the internal schema (physical storage or access method) without having to change the application programs. That is insulation against the physical structure.

- Eg: Using new storage devices
Switching from one access method to another
Modifying indexes

Data Models

A data model is a collection of concepts and rules for the description of the structure of the database. Structure of the databases means the data types, the constraints and the relationships for the description or storage of data respectively.

Classification of Database Management Systems

1. According to Data model

- Flat File System
- Relational model
- Network model
- Hierarchical model
- Object data model
- Object-Relational model

2. According to no of users

- Single user systems
- Multi user systems

3. According to no of sites the database is distributed

- Centralized DBMS: The DBMS is stored at a single computer
- Distributed DBMS: DBMS is among many computers on a network

Flat File System

A relatively simple database system in which each data item is stored in a single table.

Flat-File (one table)

Patient Id	Name	D.o.B	Gender	Phone	Doctor Id	Doctor	Room
134	Jeff	4-Jul-1993	Male	7876453	01	Dr Hyde	03
178	David	8-Feb-1987	Male	8635467	02	Dr Jekyll	06
198	Lisa	18-Dec-1979	Female	7498735	01	Dr Hyde	03
210	Frank	29-Apr-1983	Male	7943521	01	Dr Hyde	03
258	Rachel	8-Feb-1987	Female	8367242	02	Dr Jekyll	06

Figure 1.0.6 Flat File System

Hierarchical Data Model

This model represents a tree structure. There are two main data structuring concepts.

Record: Gives information about an entity.

Parent-Child Relationship

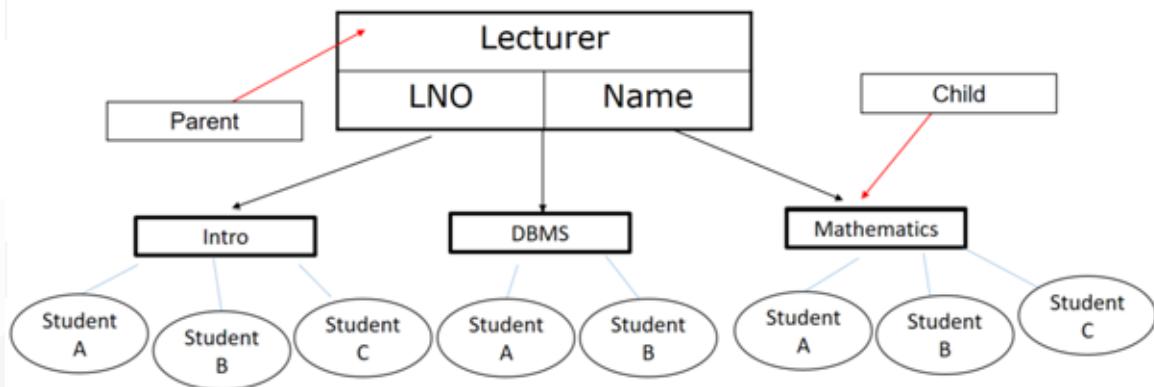


Figure 1.0.7 Hierarchical Data Model

Network Model

The network model allows each record to have multiple parent and child records, forming a generalized graph structure.

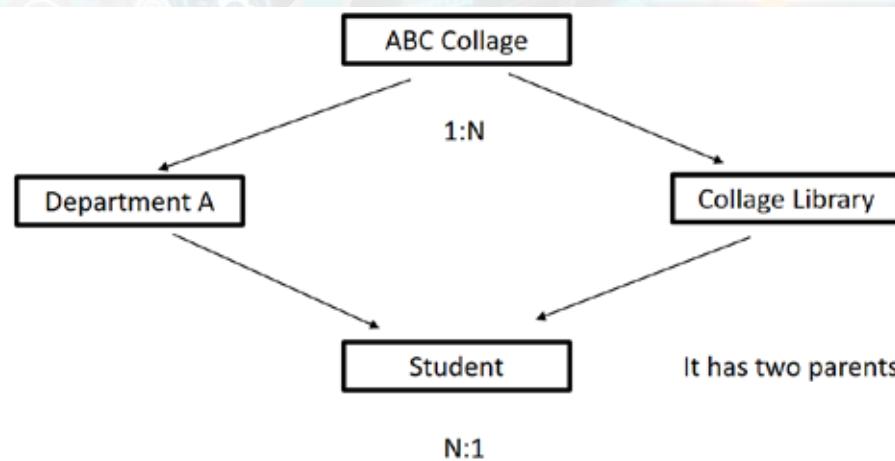


Figure 1.0.8 Network Model

Relational Model

The relational model represents the database as a collection of relations. Each relation resembles a table.

Customer Master					
Customer No	F-Name	L-Name	DOB	Phone	Registration Fee
0001	Mala	De Silva	79/03/21	0773657675	150.00
0002	Nimal	Mendis	80/04/08	0112667769	175.80
0003	Sunimal	Ratnayake	72/05/20	0715349240	150.00
0004	Kamala	Amaratunga	85/10/12	0759876092	120.00

Figure 1.0.9 Relational Model

Phases of Data Base Design

Phase 1: Requirement analysis

This is done by conducting interviews with the prospective database users.

Phase 2: Conceptual design

Designing the database structure

Make use of: a) ER Modelling and b) Normalization

Phase 3: Logical design or data model mapping

Transforms the output of phase 2 into a particular DBMS. Use SQL statements to create the database.

Eg: Oracle, Access, Informix

Phase 4: Physical Database design

Transforms the Schema into physical database. Use SQL statements to create the database and it is a process of choosing specific storage structure and access paths for the Data base files.