COM204 Databases

L02 – Introduction to Databases

Outline

- Definitions
- Types of Data Stored
- Database Management System (DBMS)
- Types of Databases
- Structure of Data
- File Systems
- Database Systems
- Database Design

Databases

- A database is an organized collection of structured end-user data and metadata
- Databases allow computer-based systems to store, manage, and retrieve data very quickly. (Coronel, Morris & Rob)
- Databases are usually controlled by a database management system (DBMS).
- Databases are modeled in rows and columns in a series of tables for efficient data querying.
- Most databases use structured query language (SQL) for writing and querying data.

Types of Data Stored

- End-user Data
  - Raw facts stored by the user
  - Example: employee or customer details
- Metadata
  - Data about data
  - Shows characteristics of end-user data and how they are stored in the database
  - Enables management of the end user data in the database

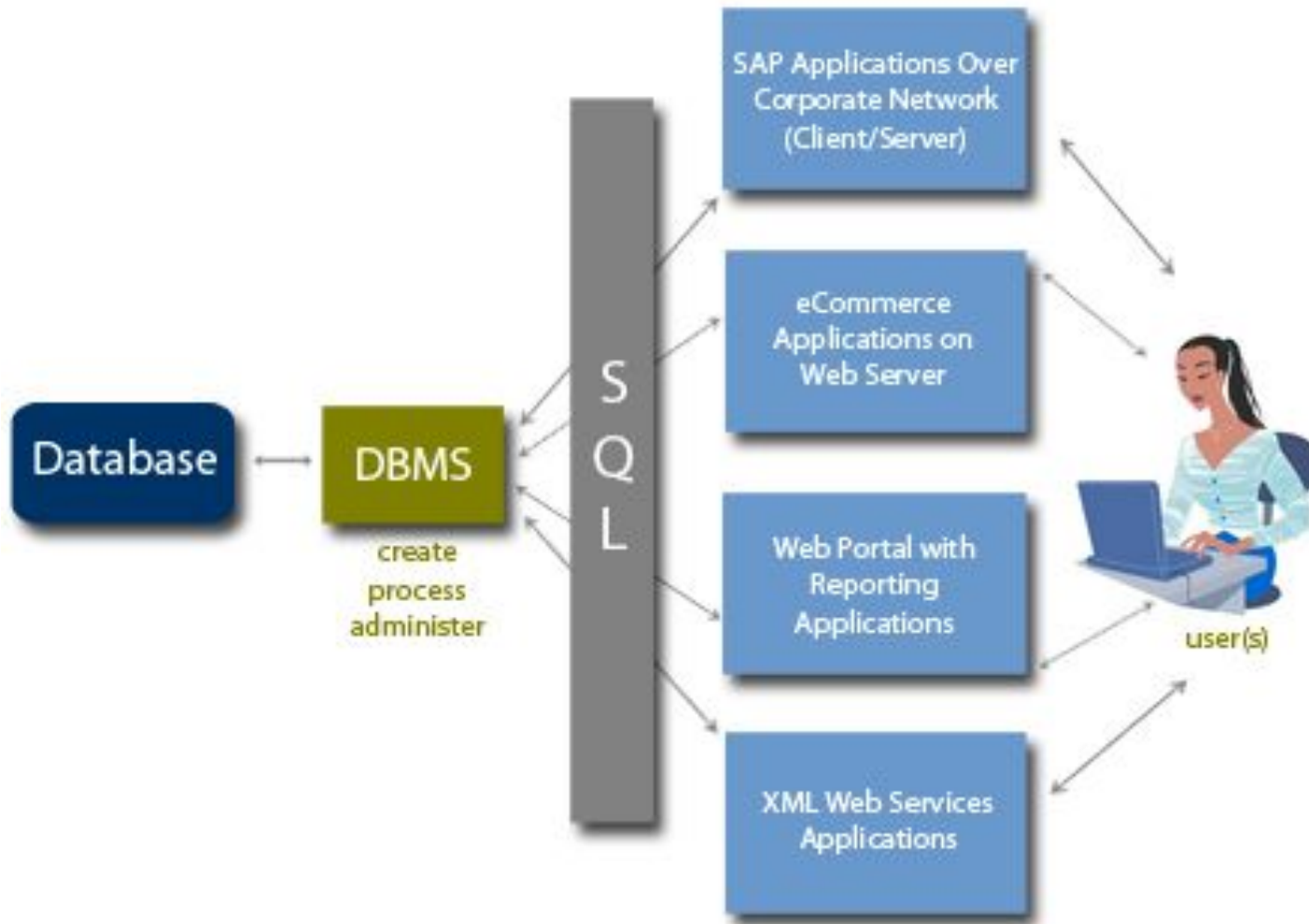# Database Management System (DBMS)

- DBMS is a collection of programs that manages the database structures and controls how the stored data are accessed

- DBMS is the platform used by end-users to access the database

- DBMS are written by programmers using Java, C# or other programming languages

Advantages of DBMS

- Manages interaction between end-users and the database
- Hides complexities of the database internal structure from the end user
- Enables data in the database to be shared by multiple users
- Each user can have their own user view specific to their needs
- Provides improved data security

Role of the DBMS

Functions of DBMS

- Data dictionary management

- Data storage management

- Data transformation and presentation

- Security management

- Multiuser access control

- Backup and recovery management

- Data integrity management

Types of Databases

- Database classification based on number of users:
  - Single-user database : Supports 1 user at a time
  - Multiuser database:
  - Desktop database: Runs on a personal computer
  - Workgroup database : supports number of people
- Classification based on location of data:
  - Centralized database
  - Distributed database

Types of Databases cont.

- Classification based on how data is intended to be used
  - Operational database or Online transaction processing (OLTP) : used to manage dynamic data in real-time
  - Analytical database: Handles Large volume of Historical data collected a long period.
    - Data warehouse
    - Online analytical processing (OLAP)

Structure of data

- Databases can be classified based on the degree to which the data are structured
  - Structured data : Fits nicely into a relational database. It's highly organized and formatted: easily searchable
  - Unstructured data: not as easily searchable, having no fixed format: includes formats like audio, video, and etc
  - Semi-structured data

Some Popular DBMS

- MS Access

- MS SQL Server

- IBM DB2

- MySQL

- Oracle RDBMS

- OpenOffice Base

File System

- Provides hierarchical storage and organization of files

- Basic file system terminologies
  - Files: sequence of bytes stored on a computer
  - Directory/folder: a file which contains information about other files and directories
  - Disk: where information is stored when the power is turned off

- The database evolved from the file system, owing to the limitations of the file system
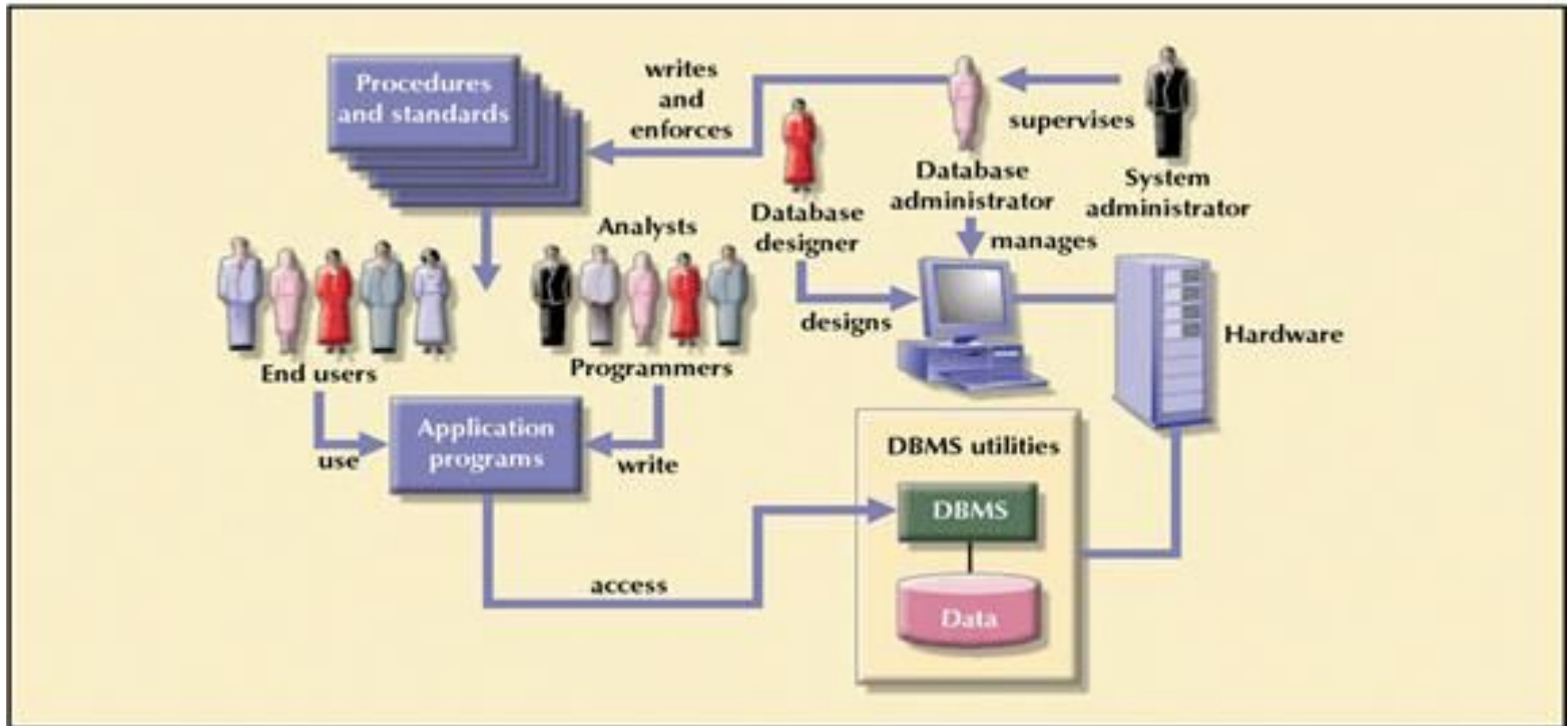
Limitations of the File System

- Prolonged development time/too much programming
- Slow response to reports request
- Difficult systems administration
- Poor data security
- Limited data sharing
- Structural dependency
- Data redundancy

Database Systems

- The database system is a collection of components that allows the collection, storage, management, and use of data within a database environment.

- The database system's components are hardware, software, people, procedures and data

Components of the Database System

Basic Database Terminologies

- Data: raw facts such as student name, age, date of birth

- Field(Column or attribute) : Used to store data

- Record(Row): Logically connected fields/column describing an entity.

- File (Table): collection of related records

Draw backs of the Database Systems

- – Increased costs

- – Management complexity

- – Keeping it up to date
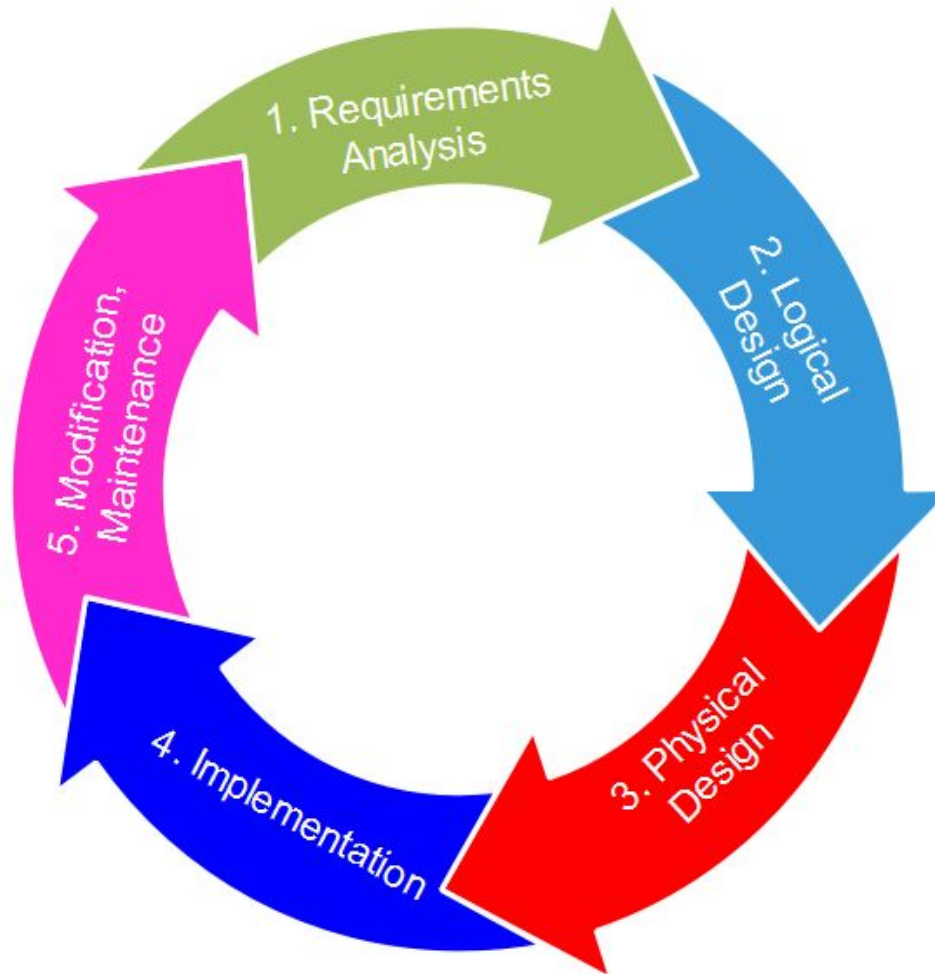
- – Vendor dependency

Importance of Database Design

- Database design consists of a set of activities that are carried out to create the database structures used to store end-user data

- Data is a very valuable asset to every organization, this makes it important to carefully design where the data will be stored

Database Development Process

- Database design must conform to the design of the information systems within which it exists

- The framework for database development, evaluation and revision is known as the Database Life Cycle (DBLC)

Database Life Cycle

DBLC

- Establish requirements
  - Database initial study
- Analysis
  - Situation analysis
  - Problem definition
  - Define objectives
  - Define scope and boundaries
- Design
  - Create the conceptual design
  - Select the DBMS software
  - Create logical design
  - Create physical design

DBLC

- Implementation
  - Install DBMS
  - Create the database(s)
  - Load data
- Testing
  - Run tests
  - Fine-tuning
  - Evaluate the database and application programs
- Maintenance
  - Make changes and updates
  - Make enhancements

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