Tribhuvan University

B.Sc. CSIT

Butwal Multiple Campus

# Database Management System
# CSC260
## Unit 2: Database System – Concepts and Architecture


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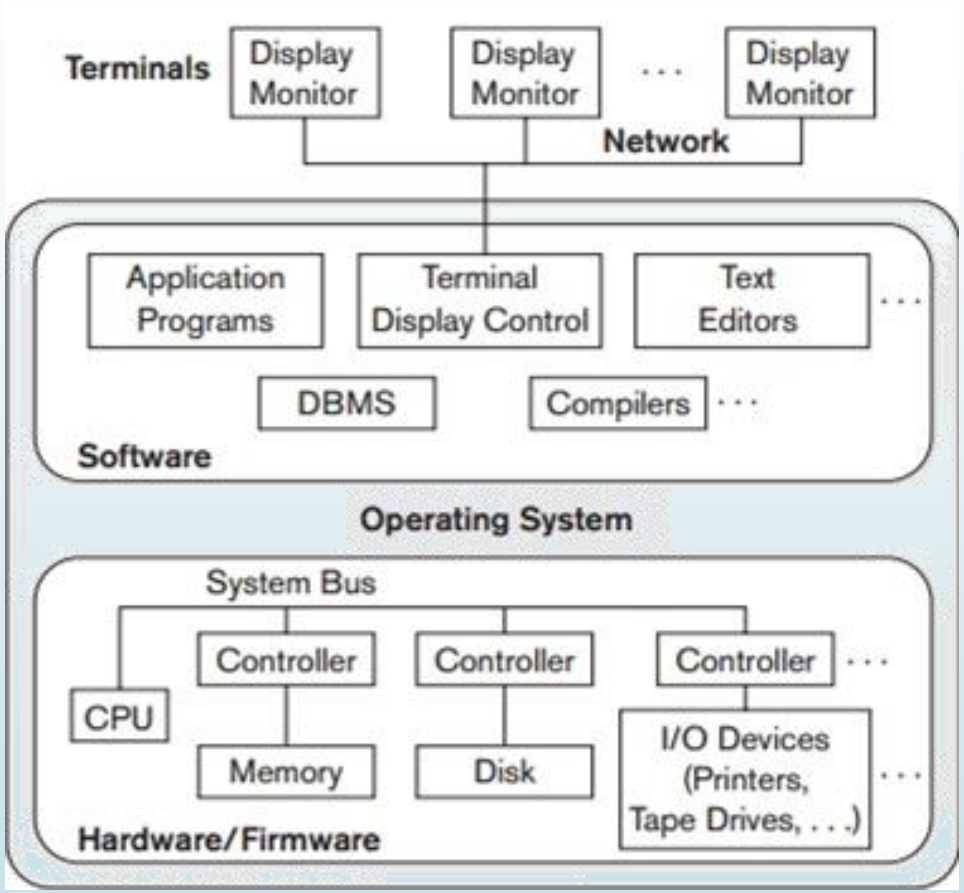
# Centralized Architecture for DBMS

**Centralized DBMS:**

- Earlier architecture used mainframe computers to process all system functions
- Mainframe replaced with terminals and workstations
- Centralized DBMS Combines everything into single system including
  - DBMS software
  - Hardware
  - Application programs
  - User interface processing software
- All DBMS functionality carried out on one machine
- Gradually, DBMS systems started to exploit the available processing power at the user side, which led to Client/Server Architectures

# Centralized Architecture for DBMS

**Centralized DBMS:**



# Basic Client Server Architectures

1. Specialized Servers with Specialized functions
2. Clients
3. DBMS Server

# Specialized Server with Specialized functions

- **Servers** with specific functionalities
  - **File server**
    - Maintains the files of the client machines.
  - **Printer server**
    - Connected to various printers; all print requests by the clients are forwarded to this machine
  - **Web servers** or **e-mail servers**

# Basic Client/Server Architectures

- **Client machines**
  - Provide user with:
    - Appropriate interfaces to utilize these servers
    - Local processing power to run local applications

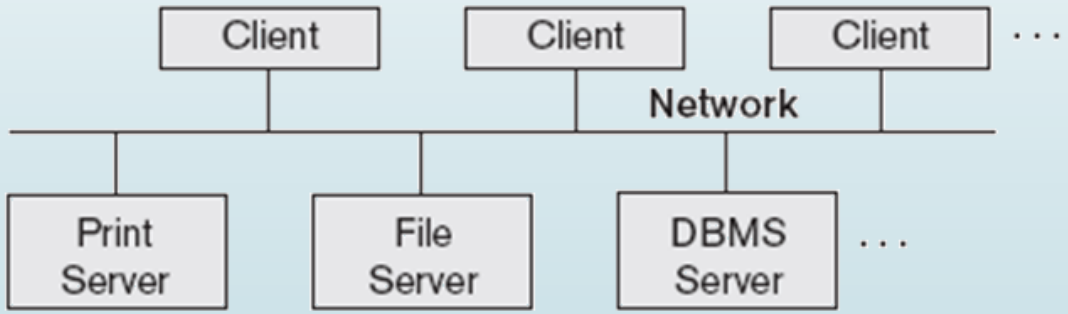



**Figure 2.5**
Logical two-tier client/server architecture.

# Basic Client/Server Architectures

- **Client machines**
  - Clients maybe diskless machines or PCs or Workstations with disks with only the client software installed.
  - Connected to the servers via some form of a network. (LAN: local area network, wireless network, etc.)

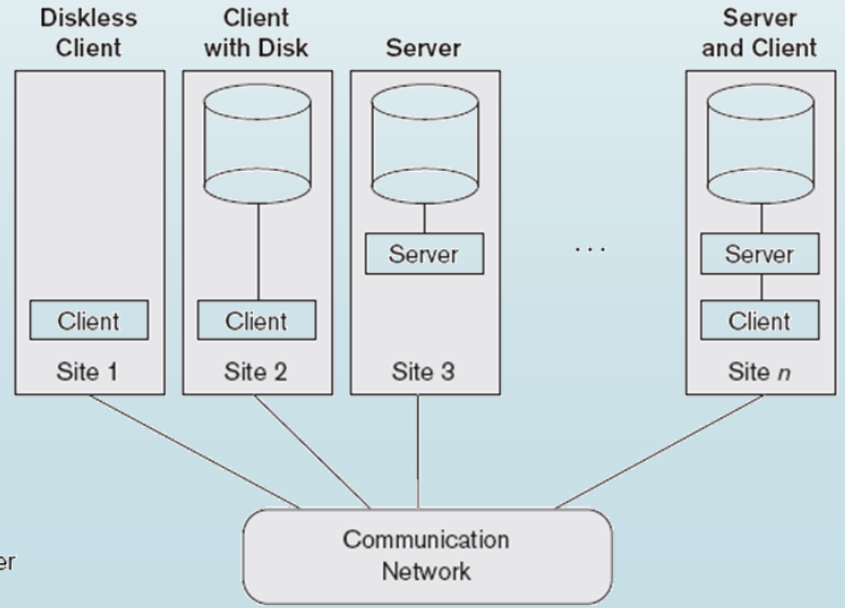



**Figure 2.6**
Physical two-tier client/server architecture.

# Basic Client/Server Architectures

- **Diskless Node**
  - PC without disk drives, which employs network booting to load its operating system from a server.
  - A computer may also be said to act as a diskless node, if its disks are unused and network booting is used
  - Dummy terminal, or dumb terminal
  - It is a networked computer that provides no local hard drive space or floppy disk drive access.
  - They have a monitor, motherboard, network card, keyboard, and mouse.
  - Computer that has a hard drive, but is booting and using applications from the network instead of from the local hard drive
  - Often referred to as a hybrid computer or network computer.

# Basic Client/Server Architectures

- **Client**
  - User machine that provides user interface capabilities and local processing
- **Server**
  - System containing both hardware and software
  - Provides services to the client machines
    - Such as file access, printing, archiving, or database access

# Two-Tier Client/Server Architectures

- Server handles
  - Query and transaction functionality related to SQL processing
- Client handles
  - User interface programs and application programs run on the client side

# Two-Tier Client/Server Architectures

- Open Database Connectivity (ODBC)
  - Provides application programming interface (API) Allows client-side programs to call the DBMS
  - Both client and server machines must have the necessary software installed
  - Most DBMS vendors provide ODBC drivers
- JDBC
  - Allows Java client programs to access one or more DBMSs through a standard interface

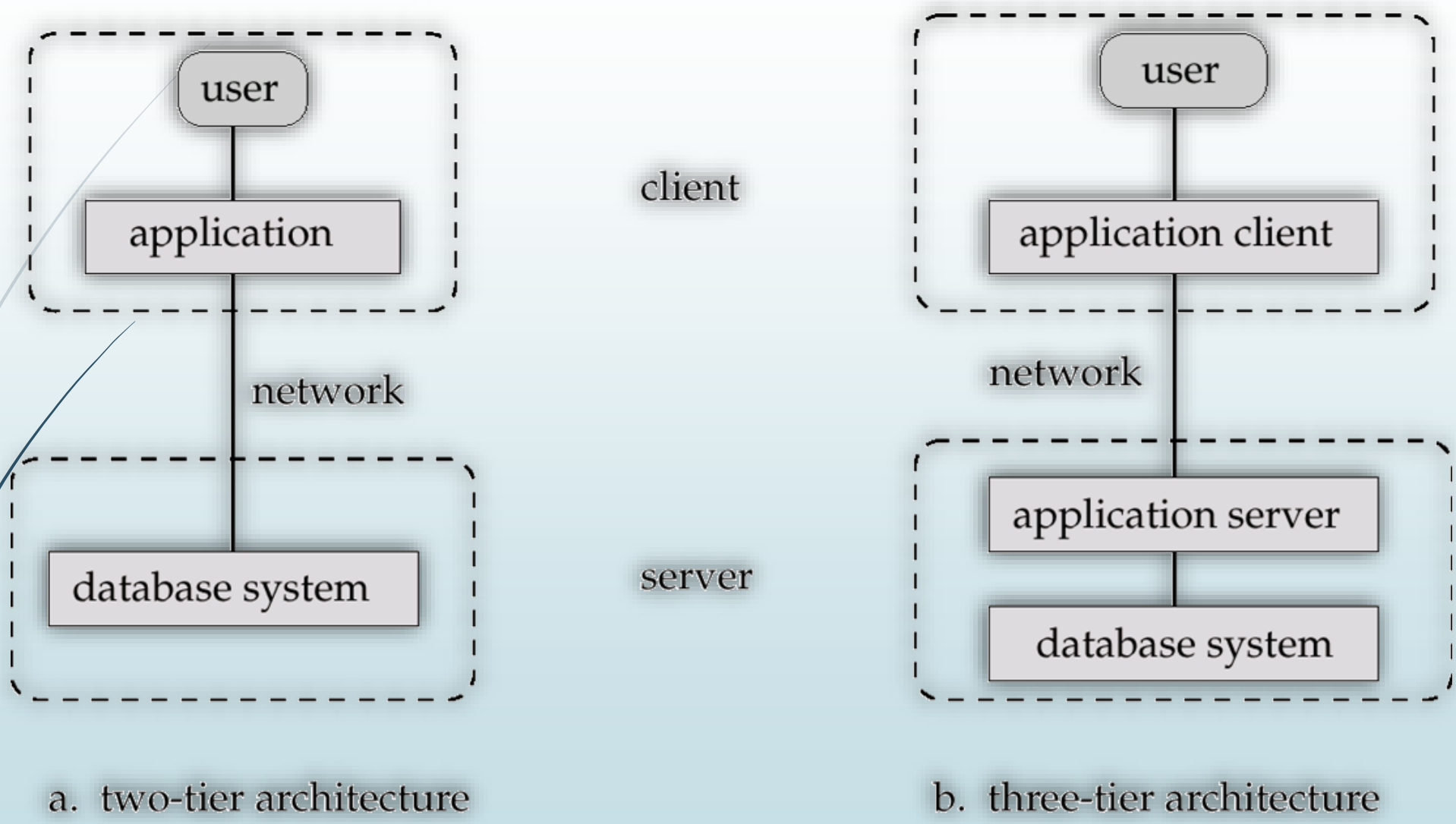
# Two-Tier Client/Server Architectures

- A client program may connect to several DBMSs.
- Other variations of clients are possible:
- In some DBMSs, more functionality is transferred to clients including:
  - Data dictionary functions
  - Optimization
  - Recovery across multiple servers, etc.
- In such situations the server may be called the **Data Server**.

# Three-Tier and n-Tier Architectures

- Common for **Web applications**
- Intermediate Layer called **Application Server** or **Web Server:**
  - Stores the web connectivity software and **the rules and business logic (constraints)**
  - Runs application programs and stores business rules
  - Part of the application used to access the right amount of data from the database server
  - Acts like a conduit for sending partially processed data between the database server and the client.
- **Additional Features- Security:**
  - encrypt the data at the server before transmission
  - decrypt data at the client
- **N-tier**
  - Divide the layers between the user and the stored data further into finer components

# Three-Tier and n-Tier Architectures



# Three-Tier and n-Tier Architectures

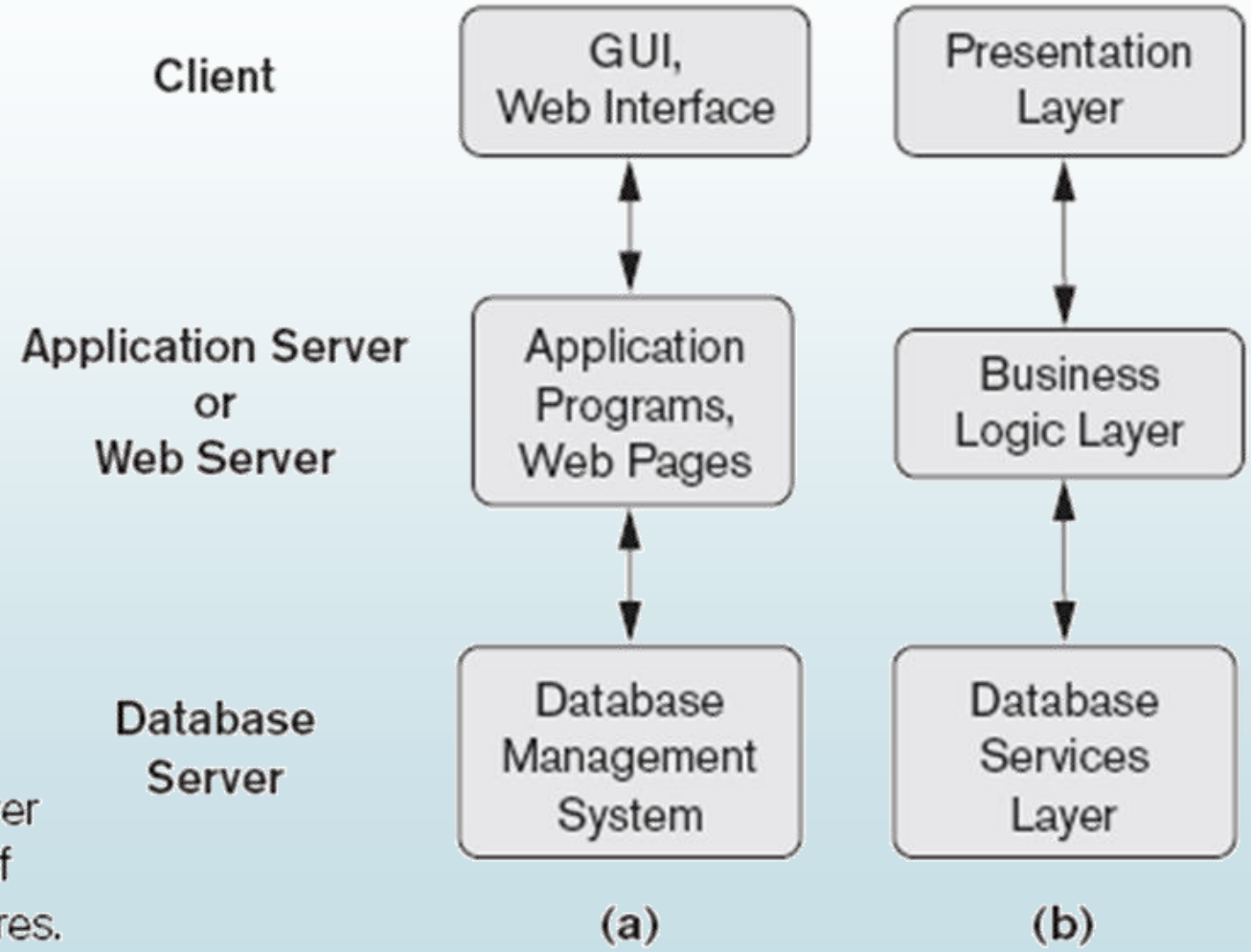



**Figure 2.7**
Logical three-tier client/server architecture, with a couple of commonly used nomenclatures.

# Classification of DBMSs

- **Based on the data model used**:
  - Traditional: Relational, Network, Hierarchical.
  - Emerging: Object-oriented, Object-relational.
- **Number of Users:**
  - Single-user (typically used with microcomputers) vs. multi-user (most DBMSs).
  - Multi- user
- **Number of Sites**
  - Centralized (uses a single computer with one database)
  - Distributed (uses multiple computers, multiple databases)

# Classification of DBMSs

- **Distributed Database Systems** have now come to be known as **client server based database systems**
- Because they do not support a totally distributed environment, but rather a set of database servers supporting a set of clients.
- Variations of Distributed Environments
  - Homogeneous DDBMS
  - Heterogeneous DDBMS
  - Federated or Multidatabase Systems

# Classification of DBMSs

- **Cost**
  - Open source (**MYSQL, PostgreSQL, MongoDB**)
  - Different types of licensing (**Oracle, IBM DB2, Microsoft SQL**)
- Types of access path options
- General or special-purpose