

INTRODUCTION TO COMPUTER NETWORK

- Computer Network is a set of computers that are connected together to share information and other resources.

HARDWARE TO SETUP A COMPUTER NETWORK

1. Network Cables
 - Used to connect computers.
 - Most commonly used: **Category 5 cable RJ-45**
2. Distributors
 - To connect many computers to produce network
 - E.g. switches (used to be called hub)
3. Routers
 - Acts as the central point among computers and other devices that are a part of a network.
 - It has holes that are called ports.
 - It can be wireless nowadays.
4. Internal and External Network Cards
 - Necessary component of a computer because a computer cannot be connected to a network without network card.
 - Also known as **Network Adapter**
5. USB (Universal Serial Bus) Card
 - Easy to use and connect via USB port.

TYPES OF COMPUTER NETWORK

- A computer network is a group of computers linked to each other that enable computers to

communicate with another computer.

- Computer network can be categorized by size.

GENERAL TYPES

LAN (Local Area Network)

- Group of computers connected to each other in a small area like buildings, offices.
- Used for connecting two or more personal computers thru a communication medium such as twisted pair, and coaxial cable.
- It is less costly as it is built with inexpensive hardware such as hubs, network adapters, and ethernet cables.

PAN (Personal Area Network)

- Network arranged within an individual person within a range of 10 meters, but it usually covers an area of 30 feet.
- **Thomas Zimmerman** - who brought the idea of PAN.
- **Two types:** Wireless (wifi and bluetooth) and Wired (USB)

MAN (Metropolitan Area Network)

- Network that covers a larger geographical area by interconnecting different LAN
- Gov't agencies uses MAN to connect to the citizens and private industries.
- **USES:** (1) communication between banks in a city. (2) can be used in airline reservations. (3) college within a city and communication for military.

WAN (Wide Area Network)

- Extends over a large geographical area such as countries, and states.
- Bigger network than LAN.
- Not limited to a single location, but spans over a large geographical area thru telephone line, fiber optic cable, or satellite links.
- One of the biggest WAN is the internet.

INTERNETWORK

- Defined as two or more computer network LANs or WAN

OTHER TYPES

HAN (Home Area Network)

Campus Networks

Enterprise Private Networks

BBN (Backbone Networks)

GAN (Global Area Networks)

NETWORK TOPOLOGY

- Way of a network is arranged, including the physical or logical description of how links and nodes are set up to relate to each other.

PHYSICAL

- Refers to the actual connection of how the network is arranged.

LOGICAL

- Higher-level of idea of how the network is set up, including which nodes connect to each other.

TYPES OF NETWORK TOPOLOGY

1. Bus Topology

- Every computer and network device is connected to a single cable.

- When it has two endpoints, it is called Linear Bus Topology.

FEATURES

- Transmits data only in one direction.

ADVANTAGES

- Cost effective
- Cable required is least compared to other network topology
- Used in small networks
- Easy to understand
- Easy to expand

DISADVANTAGES

- Cable fails then the whole network fails
- If there is a network traffic is heavy, then the performance of network decreases
- Cable has a limited length
- Slower than ring topology

2. Ring Topology

- It forms a ring as each computer is connected to another computer.

FEATURES

- The transmission is unidirectional but can be bidirectional by having 2 connections between Network Node, it is called Dual Ring Topology
- In dual ring, 2 ring networks are formed so that there is a backup in case one fails.
- Data is transferred in a sequential manner in bit by bit.

ADVANTAGES

- It is not affected by high traffic or by adding more nodes
- Cheap to install and expand

DISADVANTAGES

- Troubleshooting is difficult
- Adding or deleting the computers disturbs the network activity
- Failure of one computer disturbs the whole network

3. Star Topology

- All the computer are connected thru a single hub thru a cable.

FEATURES

- Every node has its dedicated connection to the hub.
- Hubs acts a repeater for data flow
- Can be used with twisted pair, fiber optic, and coaxial cable

ADVANTAGES

- Fast performance with few and low network traffic
- Hub can be upgraded easily
- Easy to troubleshoot
- Easy to setup and modify
- Other nodes won't be affected if one fails.

DISADVANTAGES

- Cost of installation is high
- Expensive to use
- If the hub fails then the whole network will stop
- Performance is based on the hub

4. MESH Topology

- Point-to-point connection to other nodes or devices.
- All are connected to each other

TYPES OF MESH TOPOLOGY

PARTIAL MESH

- Some systems are connected in the same fashion.

FULL MESH

- Each nodes are connected to each other.

FEATURES

- Fully connected
- Robust
- Not flexible

ADVANTAGES

- Each connection can carry its own data load
- It is robust
- Fault is diagnosed easily
- Provides security and privacy

DISADVANTAGES

- Installation and configuration is difficult
- Cabling is cost more
- Bulk wiring is required

OSI LAYER

NETWORK PROTOCOL

- Protocols are the specific rules and standards that define how data is transmitted and received to each layer of the network model
- There are different protocol and technologies operate at each layer to ensure data is properly encapsulated, routed, and delivered across networks

NETWORK PROTOCOLS

1. HTTP/HTTPS

- Used for web browsing

2. TCP

- Ensures reliable data delivery

3. IP

- Handles addressing and routing

4. SMTP

- Used for email

5. FTP

- Used for file transfers

OSI AND TCP/IP

- OSI (Open Systems Interconnection) and TCP/IP model are both conceptual frameworks that are used to understand network protocols and communication.
- They serve different purposes and are used in different context

DIFFERENCE BETWEEN OSI

1. NUMBER OF LAYERS

- OSI has 7 layers
- TCP/IP has 4 layers

2. DEVELOPMENT HISTORY

- OSI was developed by the International Organization for Standardization (ISO) in the late 1970s and early 1980s.
- TCP/IP predates the OSI model and model was developed by U.S Department of Defense in the 1970s. Was used to create the ARPANET, which later evolved into the modern internet

3. PRACTICAL USE

- OSI gives a more comprehensive and theoretical framework, but it's less commonly used in practice.
- Serves as a reference model for understanding networking concepts and is used for educational purposes.
- TCP/IP is the model that most modern networking protocols and the internet itself are based on.

LAYERS OF OSI (SOFTWARE LAYER: 4-7 AND HARDWARE LAYER: 1-3)

1. PHYSICAL (Bit)

- Deals with the physical medium and transmission of binary raw data

2. DATA LINK (Frame)

- Responsible for error detection

3. NETWORK (Packets)

- Manages routing and addressing

4. TRANSPORT (Segment)

- Ensures end-to-end communication and reliability
- Two of the most common transport layer protocols are Transmission Control Protocol (TCP) for reliable connections and User Datagram Protocol (UDP) for connectionless communication.

5. SESSION

- Manage sessions or connections between devices

6. PRESENTATION

- Handles data translation, encryption, and compression

7. APPLICATION

- Provides user interfaces and network services (HTTP/HTTPS, SMTP)

IMPORTANCE OF STANDARDS

- Standards are crucial in networking to ensure compatibility and interoperability
- IEEE and IETF are organizations that develop and maintain networking standards.