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COMPUTER NETWORKING: A REVIEW

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ABSTRACT

The primary purpose of a computer network is to share resources A computer network can also be mentioned as a client-server if at least one of the nodes is used to serve other nodes called clients. Besides the nodes, other types of devices are also included in the network. In the early days of networking, there will be one central server that contains the data and all the clients can access this data through a Network Interface Card. Later on, Client-server architecture came into existence, where still the burden is there on the server machine. This paper describes how the concept of distributed computing came into existence based on the advantages and disadvantages that rose in earlier networking concepts. The idea of distributed computing is based on the concept that once the data is available in the server, it can be accessed and processed from any client device.

Keywords: Computer Networking, Communication Channels, Distributed Processing, LAN, WAN, MAN, WLAN, Topology.

I. INTRODUCTION

A network is a set of devices (often referred to as nodes). A node can be a computer, printer, or any other device that is able to send and/or receive data from other nodes on the network. Networking enhances communication among two or more programs operating on physically remote machines. The links that connect the devices are referred to as communication channels. Network use Distributed Processing. A group of computers exchanging information by common etiquette is known as protocols in the communication medium. A computer network is merely computers connected together through wires that permit them to share data or devices like hard drives, CD-ROMs, fax modems, printers, etc. Fig 1 provides an example of a network in a school consisting of a local area network or computers connected through LAN [1].

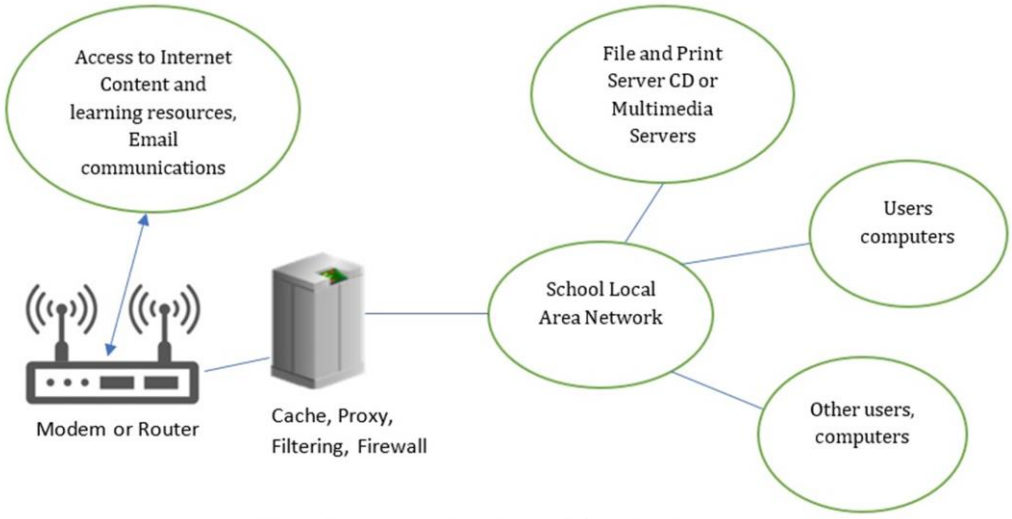

Figure 1: Representation of network in a school

In general, there are two types of network architecture, peer-to-peer networks and client/server networks.

A. Peer-to-Peer networks

Peer-to-peer networks are more frequently applied where less than ten computers are present and where stringent security is not essential. All computers have identical status and they perform transmission on an identical footing. Files can be shared over the network and all the computers on the network can share devices such as printers or scanners, which are connected to any one computer. Fig 2 depicts how the computers are interconnected in a peer-to-peer networks [2].

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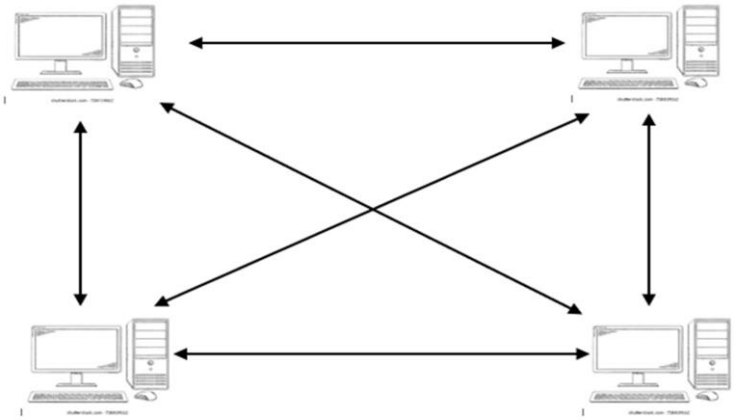

Figure 2: Peer to Peer Networking

B. Client/server networks

Client/server networks are more appropriate for extensive networks. A central computer or server serves as the storage location for files and applications shared on the network. Generally, the server is higher than an average-performance computer. The server also regulates the network access of the other computers which are known as the client computers. The access rights of the server are only with the network administrator. Other users can only work on the client computers. Fig 3 depicts how the computers are connected in a client/server network [3].

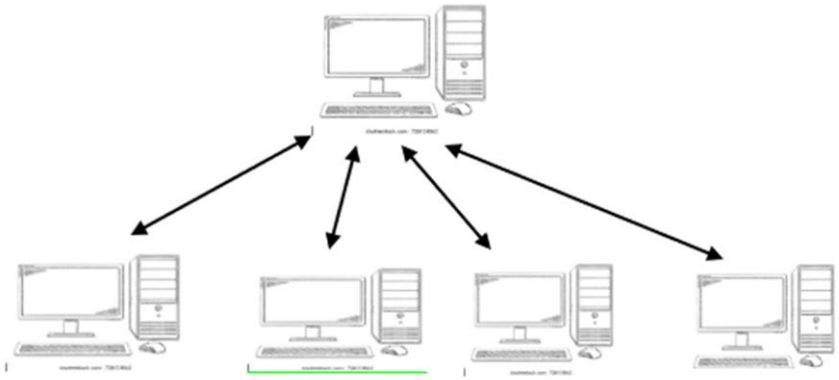

Figure 3: Client Server Networking

II. COMPONENTS OF A NETWORK

A computer network consists of the following constituents [4]:

- A minimum of at least two computers.
- Cables that interconnect the computers, although wireless communication is becoming more popular.
- A network interface device or network interface card (NIC)on every computer
- A switch is used to switch the data from one point to another. Hubs are obsolete.
- Network operating system software

III. TYPES OF NETWORKS

The network can be divided into geographical regions and fall into these broad categories [5].

- Local Area Network (LANs).
- Wide Area Network (WANs).
- Metropolitan Area Network (MANs). Wireless networks.

A. Local Area Network

A LAN is normally restricted to a specific location, such as a floor, building, or some other small region. By being restricted it is feasible in the majority of cases to employ only one transmission medium (cabling). This

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technology is cost-effective to implement than WAN because of small area coverage, and generally higher speed is obtained. They are widely used to interconnect personal computers and workstations in offices and factories for resource sharing. Traditional LANs run at a speed of 10 to 100 Mbps have a low delay and make very few errors. Newer LANs may operate at a higher speed up to 100 Mbps [6].

1) Common Physical Topologies

Physical and logical topologies can take various forms [7]. The most frequently used and the most important for understanding the Ethernet and Token Ring topologies are

- Bus topology.
- Ring topology.
- Star topology.
- Mesh topology.
- Cellular topology

a) Bus Topology

A bus topology is one in which all the devices are connected to a commonly shared cable. In this topology, one long cable is known as backbone computers (workstation and servers) are attached directly to the backbone by the usage of terrestrial microwave connectors. After the signal is passed from all the devices the backbone is terminated at both ends.it is one of the oldest types of topologies. This is a failure model [8]. Most bus topologies permit electric or electro-magnetic signals to travel in both directions. A LAN with bus topology is depicted in Fig 4.

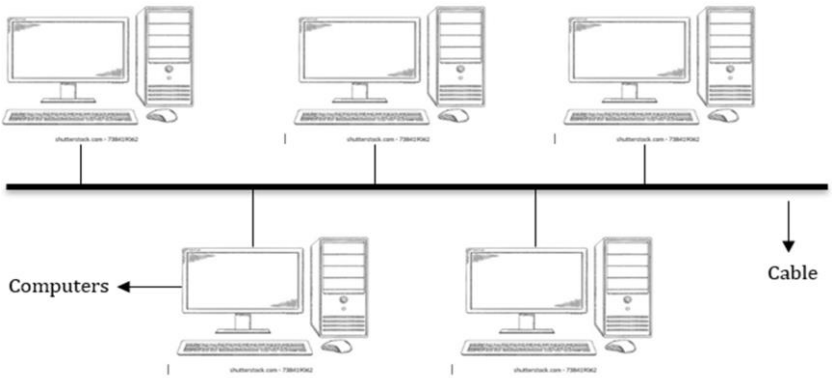

Figure 4: LAN with Bus Topology

b) Ring Topology

Ring topologies are wired in a circle Each device includes a receiver and a transmitter and acts as a repeater that sends the signal to the next device in the ring. Since the signal is regenerated at each device, there is less signal degeneration. The ring topology came into existence after some time span. The disadvantages of bus topology is removed in ring topology. But this is also a failure model. Ring topologies are ideally suited for token passing access techniques. The token is passed in the ring and node that holds the token can transmit data. Ring topologies are quite rare [9]. A LAN with ring topology is depicted in Fig 5.

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Figure 5: LAN with Ring Topology

c) Star Topology

In star topology a central device is used with cables expanding in all directions. Each networked device is connected via a point-to-point link to the central device known as a hub or multiport repeater or switch. Moreover, star topologies can be nested within other stars to form tree or hierarchical network topologies. In star topology, electrical or electromagnetic signals travel from the networked device, up to its drop cable, to the switch, from there the signal is sent to other networks. The disadvantages of the bus topology and ring topology are removed in star topology. It is a commonly used and accepted model [10]. A LAN with star topology is depicted in Fig 6.

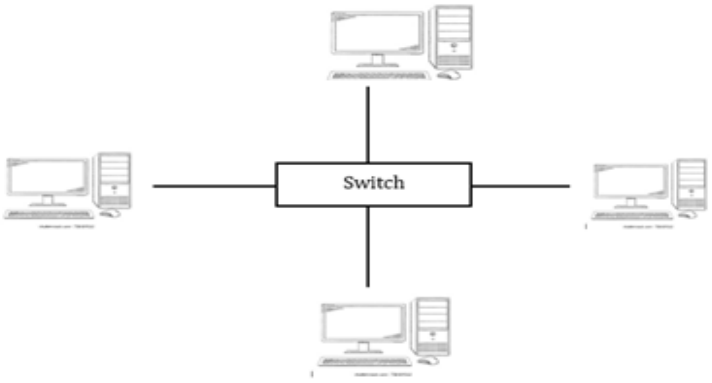

Figure 6: LAN with Star Topology

d) Mesh Topology

A mesh network has a point-to-point connection between each device in the network. Because each device needs an interface for every other device on the network, mesh topologies are not usually considered practical. However, mesh networks extremely fault-tolerant and each link provides guaranteed capacity [8].

e) Cellular Technology

A cellular topology blends wireless point-to-point and multipoint strategies for dividing a geographic area into cells. Each cell portrays the part of the entire network area in which a specified connection operates. Devices inside a cell intercommunicate with a central station or switch. Switches are interconnected for routing data in the network and providing the entire network infrastructure. For example, devices may roam from cell to cell while maintaining the connection to the network.

B. Wide Area Network

A wide area network connects a large geographical area, usually a country or continent. It connects numerous connected LANs that can be isolated by geographical distance. In majority of WANs, the network consists of various cables or telephone lines, each one connecting a pair of routers. If two routers do not share a cable and wish to communicate, they must do it indirectly. On personal computers, modems are used to communicate indirectly with other computers. WAN connecting two different networks is depicted in Fig 7.

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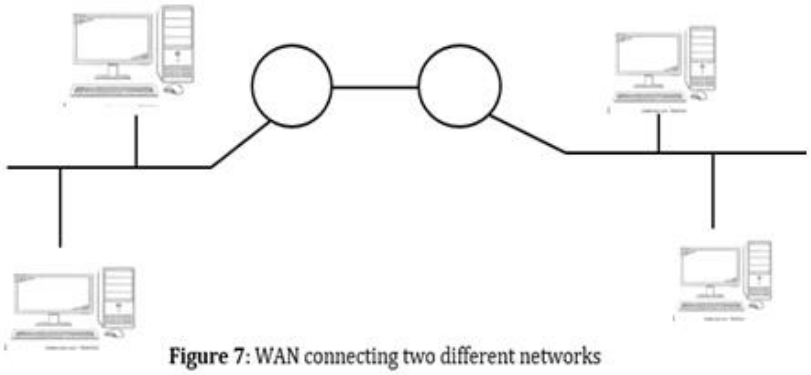

Figure 7: WAN connecting two different networks

C. Metropolitan Area Network

Metropolitan Area Network is basically a major version of LAN and is based om the same technology. It can include a group of nearby corporate offices or a city and maybe either private or public. On the other hand, MAN is a network running throughout a metropolitan area such as a backbone for a phone service carrier. A MAN just has one or two cables and does not contain switching elements [7].

D. Wireless Networks

Mobile computers like notebook, laptops ,iPad are the rapidly growing sector of computer industry. Users want to connect this machine to their office LANs to see the data when they are out from the office, since the wired connection is not possible, we have to use wireless networks. For e.g., on aircraft single router will retain a radio link with some other router on ground, changing routers as it flies along this configuration is just a conventional LAN, except that its connection to the outside world happens to be a radio link instead of a wired line [11].

IV. COMMUNICATION LINKS

Various types and forms of communication mediums are []

- Fiber-optic cable.
- Twisted-pair copper wire.
- Coaxial cable.
- Wireless local-area links. (e.g., 802.11, Bluetooth)
- Satellite channel

V. INTERNET PROTOCOL

The internet protocol was developed for solving the problem of scaling with Ethernet and for supporting other types of LANs and point-to-point linksIP provides a universal technique for addressing and routing in order that packets can be delivered from one host to another host. IP addresses (for the most common version 4, which we denote IPv4) are of 4 bytes (32 bits) and are part of the IP header that generally follows the Ethernet header. The Ethernet header is attached with a packet for one hop; the IP header is attached with the packet for its entire journey across the Internet. A vital characteristic of IPv4 addresses is that they can be separated into a network part and a host part [13]. There are various forms of classes in IPv4 and their ranges are shown in Table 1.

Table 1. Types and Range of classes

Class	Address Range
Class A	0 to 126
Class B	128 to 191
Class C	192 to 223
Class D	224 to 239
Class E	240 to 254

VI. OPEN SYSTEM INTERCONNECTION (OSI) MODEL

In 1977 the International Organization for Standardization, or ISO, founded the Open Systems Interconnection model, or OSI, a process for the creation of new network standards. OSI described an endeavor for the creation of networking standards independent of any individual government. The OSI model is today perhaps best known for its seven-layer networking model. The seven layers of OSI model and their functions are specified Table 2. As a result, troubleshooting is easier. The IP is similar to CLNP, the Connection Less Network Protocol, although OSI also establishes a connection-oriented protocol CMNS. [14]. The purpose of the classification of layers in OSI model is to define specific protocol, function, independent design, and testing of components for a particular class of a problem.

The model uses layers for visual representation of the working in a networking system. This can help network managers narrow down problems. It is a universal model and serves as a guidance tool for development of any network model. It distinctly separates services, interfaces, and protocols. Hence, it is flexible in nature. Based on the type of network, protocols in each layer can be interchanged very comfortably. Connection-oriented services, as well as connectionless services, are supported. It is a layered model Modifications in one layer don't influence other layers, given that the interfaces between the layers do not change significantly.

Table 2. Layers of OSI model and their purpose

Layer	Purpose
Physical	Physical connection between devices
Data Link	Error control, multiplexing data streams, communication and cards
Network	Controls subnet operations, Addressing, traffic, switching.
Transport	Flow control, segmentation, error control
Session	Session checkpointing and recovery
Presentation	Translator between application and network layer
Application	Provides services directly for the application process

VII. CONCLUSION

Computer communication, will become a much far beneficial networking tool when large numbers of people with similar interests acquire access to the technology. Though it can accelerate the formation of new interpersonal networks by overcoming the space and time barriers faced by traditional networking techniques, it still needs a fair amount of collaborative effort and resources to make the people use it. As technological advancement interpenetrates in society, this problem should become diminished rapidly over the years to come.

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