

An Overview on Networking

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ABSTRACT: *Currently, Networking plays a significant role in the development of automation technologies as it is the backbone of 5G technology is fiber network. Networking is basically defined as two or more devices grouped together throughout a cable and Wi-Fi is an example of networking. Due to take more knowledge to understand the networking, author decides to write this review paper. In this review paper, author have discussed about networking, types of networks, network topologies, various layers in OSI (Open Systems Interconnection) reference model, various network protocols and difference in IPv4 & IPv6. Author believes that this paper will be helpful to understand networking. Also, there are various job opportunities in the department of networking like system engineer, network administrator etc. Networking makes it easier to share resources and documents from one place to another. The future of networking will be bright as the development of automation technology depends on networking.*

KEYWORDS: *Computer, Data, Networking, Node, Topology.*

1. INTRODUCTION

The electrical connecting of computers for the resolve of distribution data is referred to as "networking". Shared material shared in a networking context includes files, applications, printers, and software. Because it allows users to interact across a variety of platforms, networking benefits may be seen in terms of cost effectiveness, manageability, efficiency, and security [1]. In the field of networking, there are different types of networks, the most prominent of which are Wide Area Network (WAN) and Local Area Network (LAN).

1.1. Terms under networking:

- 1.1.1. *Node:* A node can be defined as the connection where two or more computers meet via a cable or an optical fibre.
- 1.1.2. *Router:* It's a piece of hardware that links two or more system sectors. It offers transmission of data from one location to another.
- 1.1.3. *Firewall:* It is a network mechanism that prevents unwanted access to computer networks. It protects computer network from dangerous outdoor entree. It can also be created to allow outside user restricted entree.
- 1.1.4. *DNS:* In a non-professional language, Domain Name Server (DNS) is an internet mobile volume. The DNS stores all public IP addresses and their hostnames, which it then translates into a matching IP address.
- 1.1.5. *NIC:* A Network Interface Card is a type of add-in pass that is installed on a computer to allow it to connect with a network. It is also known as Ethernet Card or Network Adapter.

1.2. Famous Computer networks:

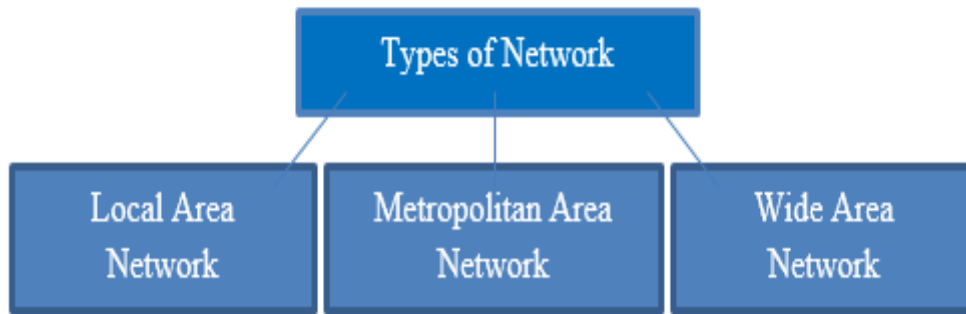


Figure 1: Various computer networks that is used in networking.

Various networks that are used in computer networking are shown in Figure 1. These networks are mentioned below:

1.2.1. Local Area Network (LAN): It connects small groups of computers in a small office or Internet cafe. They are typically used to transmit files or play games via a network.

- Speed of operating is high in LAN.
- It is less expensive to purchase and install.
- It offers wired or wireless facilities.

1.2.2. Metropolitan Area Network (MAN): A city, small town or other regions is covered by MAN. To cover such a vast region for connectivity, a big server is needed. It is a more dominant network category than LAN.

- The cost of MAN module is less as compare to other.
- It offers high data transfer speed as compare to WAN.
- Many users can access to high-speed internet as it offers access to the internet connection.
- It offers high safety to its users.

1.2.3. Wide Area Network (WAN): It is extra complicated than a LAN. It generally shields a broad region with a considerable physical distance. The Internet is the world's biggest wide-area network (WAN). The WAN is not controlled by a single company, but rather by a group of companies.

- It offers long range of networks.
- It offers companies a platform to reorganized data and files.
- It also offers distribution of workload as one can share their work to other.

1.3.Topologies in networking[2]:

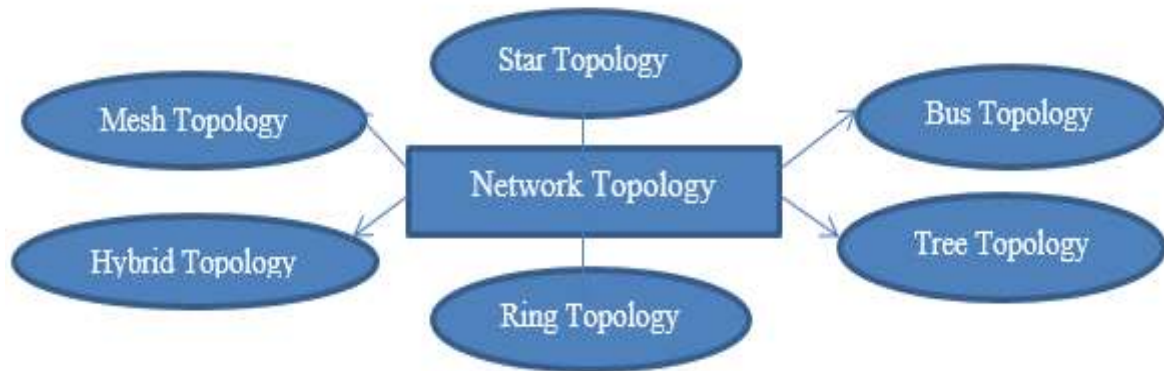


Figure 2: Various topologies used in networking.

1.3.1 *Bus Topology*: It is a system where every node is attached to a solo rope acknowledged as a chief cable or bus as shown in Figure 3. In this, if cable gets damaged then the complete system flops. It is mainly used for a minor no. of devices.

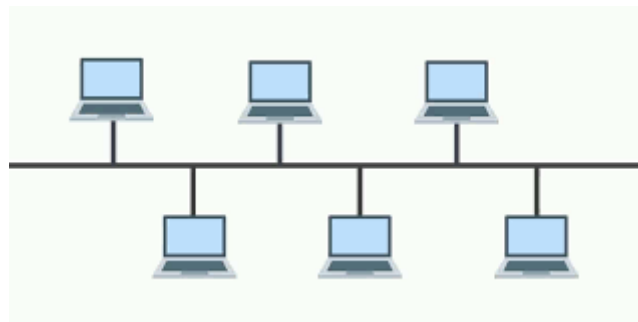


Figure 3: The representation of bus topology connected with central cable[3].

1.3.2 *Star Topology*: It is a network in which all the nodes are linked with a solo device known as a central device as shown in Figure 4. In business and residential networks, the star topology is frequently employed. Installing, managing, and troubleshooting a star topology is a breeze. In comparison to other topologies, the star topology requires more wire.

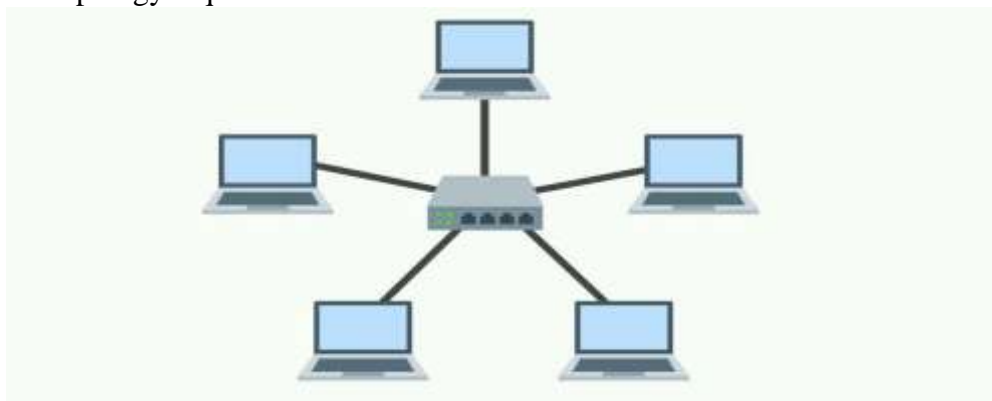


Figure 4: The representation of star topology with a central device[4].

1.3.3 *Ring Topology*: It is an architecture in which nodes are precisely linked to two or more nodes producing a distinct uninterrupted communication channel as shown in Figure 5. There is no requirement for a central server to manage the communication

between the nodes. The entire network will fail, if one node fails. SONET networks, SDH networks are the examples.

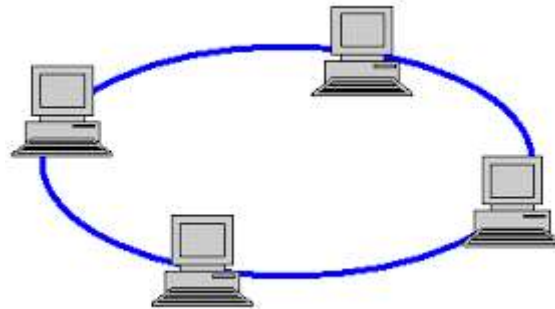


Figure 5: The above diagram shows the representation of ring topology in ring form.

1.3.4 Mesh Topology: It is an architecture in which each node is linked to other nodes independently as shown in Figure 6. It is a robust system because if one of the cables fails, it will only disconnect the computer that is linked to that connection. Mesh topology is rarely utilised since it is difficult to set up and configure. The star and bus topologies are combined in tree topology. The extended star topology is another name for it.

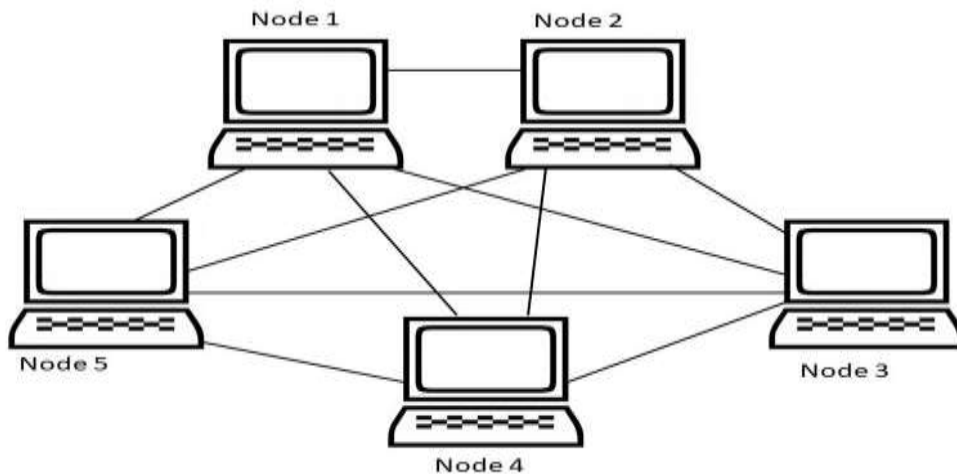


Figure 6: The above diagram shows the representation of mesh topology[5].

1.3.5 Tree Topology: All the networks in a tree topology are connected to a single bus as shown in Figure 7. In this architecture, the Ethernet protocol is utilised. The entire network is split into pieces called star networks, which are easy to manage. If one section is destroyed, but the other segments are unaffected. The "main bus" is critical to tree topology, and if it fails, the entire network is harmed. When it comes to connecting people, due to the requirement of wholesale wire, the price of the cable is high.

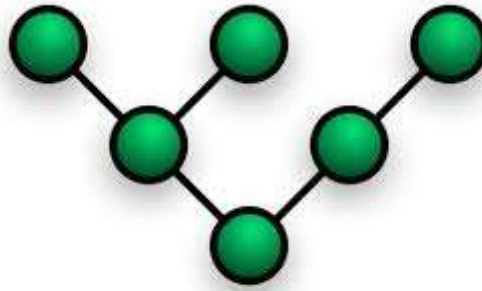


Figure 7: The above diagram shows the representation of tree topology.

1.3.6 *Hybrid Topology:* It is an architecture that is created by combining multiple topologies as shown in Figure 8. If one topology is linked to another similar topology, it is still considered same topology. When a one topology is combined with another topology, the result is a hybrid topology. It offers rigidity as it can be fulfilled in altered network atmosphere.

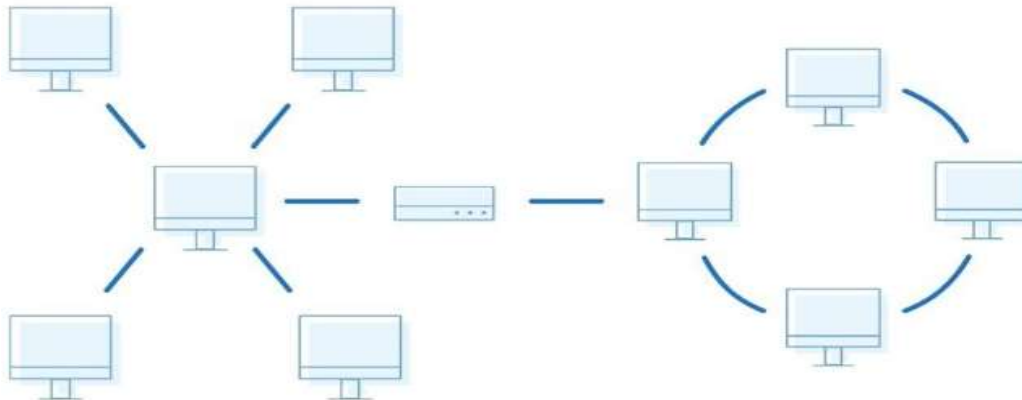


Figure 8: The representation of hybrid topology involving star and ring topology[6].

1.4. OSI Reference Model[7]:

The term indicates that Open System Interconnection (OSI) is a reference model that describes how programmes may interconnect with one another across an interacting system[8]. It also aids in the comprehension of network relationships and describes the connection procedure in a network.

Seven model of OSI reference is shown in Figure 9[9].

- 1.4.1 *Application layer:* The application layer and the end-user communicate with software applications in this layer. File transfer and e-mail are the following facilities offered by this layer. It is the seventh layer in this model.
- 1.4.2 *Presentation layer:* It is called as “Syntax Layer”. It changes records into a format that the application layer can understand. This is the sixth layer in this model.
- 1.4.3 *Session layer:* The connections between computers are managed and controlled by this layer. It connects local and distant applications by establishing, coordinating, exchanging, and terminating connections.
- 1.4.4 *Transport layer:* It sends and receives information between nodes as well as providing confirmation of positive information program. It maintains record of the program and resends the sections if first one flops.

- 1.4.5 *Network layer:* This layer transmits variable-length information sequences from first network node to the next. Datagrams are another name for this variable-length data stream. This is the third layer of OSI model.
- 1.4.6 *Data link layer:* This is the second layer of this model. In this, files packs are encrypted and decrypted into bits. It offers nodes to nodes data relocation. It finds errors and faults that happened at layer 1.
- 1.4.7 *Physical layer:* It is the initial layer in this model. It transforms data bits into radio signal or electrical impulses. Ethernet is the example of this layer.

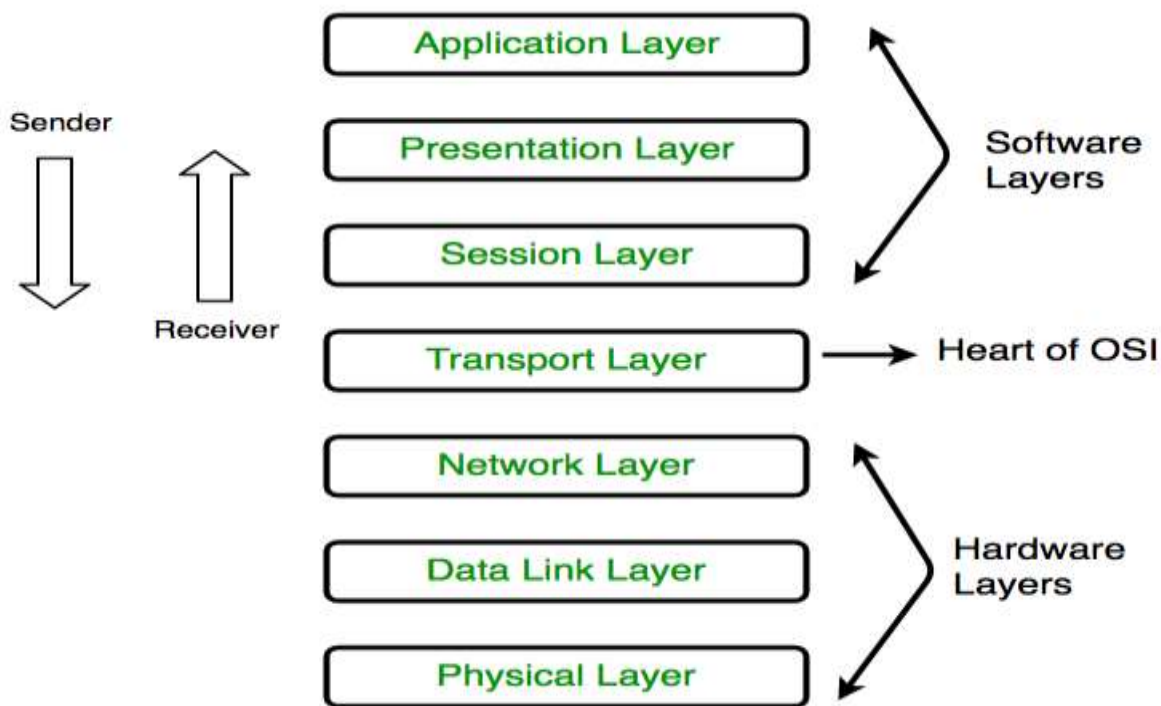


Figure 9: The above diagram shows the different layers of OSI reference model in networking[10].

1.5. Network Protocols:

There are several protocols that play an important role in connecting with varied devices throughout the network as shown in Figure 10.

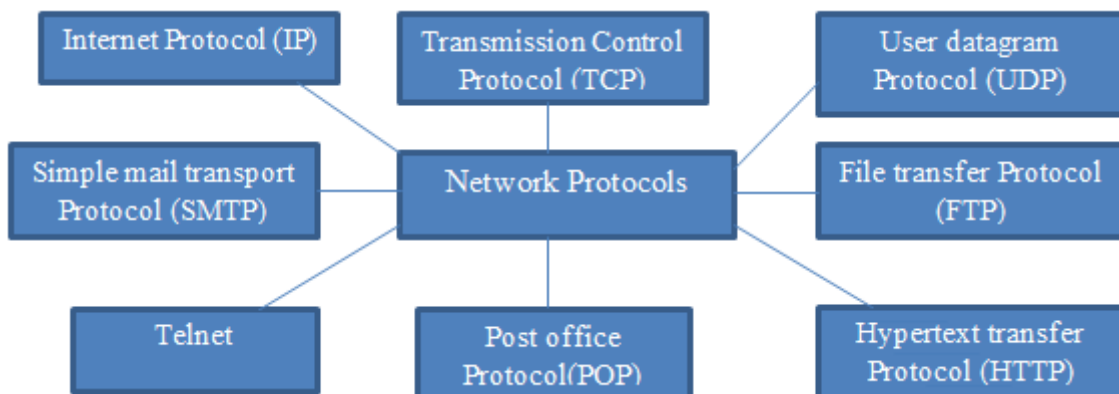


Figure 10: Various protocols that offers communication with devices across a network

- 1.5.1 *Telnet*: It's an Internet protocol that links two methods. The term "remote login" is used to define the procedure of linking. The connection requests is initiated by the local PC and the connection is received by the remote computer.
- 1.5.2 *Hypertext Transfer Protocol (HTTP)*: It is a protocol that allows two or more patterns to exchange hypertext. HTML tags are used to create links. These ties can take many different forms, including manuscripts and photographs. HTTP is built on client-server principles, which allows a client's system to connect to a server computer to submit a request. The server understands the requests from the client and responds appropriately.
- 1.5.3 *Simple Mail Transport Protocol (SMTP)*: Distribution and transfer outgoing e-mail is done in SMTP.
- 1.5.4 *Post Office Protocol (POP)*: This protocol is aimed for getting incoming E-mails.
- 1.5.5 *Internet Protocol (IP)*: IP/TCP is the most frequently used networking protocol. IP was designed specifically to be used as an addressing protocol. It's mostly often linked to TCP. IP-addressed packages are directed through numerous node in a networks until they reach their destination system.
- 1.5.6 *File Transfer Protocol (FTP)*: In this, users can move records from one system to another. Documents, text files, multimedia records and Program collections are the examples of file types.
- 1.5.7 *User Datagram Protocol (UDP)*: It was established as a replacement for Transmission Control Protocol which has low-latency statement and loss-tolerant.
- 1.5.8 *Transmission Control Protocol (TCP)*: It's a renowned data-transfer protocol for transmitting and getting information across a network. Any communication is broken down into a series of packets that are sent from home to endpoint and reassembled.

1.6. *IPv6 VS IPv4*[11]:

The difference of IPv6 and IPv4[12] is shown in Table 1.

Table 1: The difference between IPv6 and IPv4

	IPv6	IPv4
Length of address	128 bit is the address in IPv6.	32 bit is the address in IPv4.
IP address classes	It doesn't hold classes of IP addresses.	There are five different types of IP addresses: Class E, Class D, Class C, Class B and Class A.
Configuration of addresses	It holds renumbering, auto-configuration, and DHCP.	It holds physical and DHCP configuration.
Fragmentation	Only the transmitter is responsible for fragmentation.	Transmitter and advancing routers are responsible for fragmentation.
Authentication and Encryption	It offers Authentication and encryption.	It doesn't offer authentication and encryption.

Generation of space address	It produces 3.4×10^{38} address space	It produces 4.29×10^9 address space.
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2. DISCUSSION

As discussed above, Networking is a collection of devices that are combined together through a cable. Networking plays an important role in the growth of a career. Networking which is sometimes confused with selling, is truly about forming long-term connections and a positive status over time. It entails meeting and getting to know individuals who can help you and who might be able to aid you in return. Networking also offers availability of information and resources. In this review paper, author have discussed about networking, types of networks and their benefits, network topologies, various layers in OSI reference models, various network protocols and difference in IPv4 & IPv6. The author decides to write this paper to enhance the understanding of people about networking. The department of networking also offers job opportunities such as network administrator, system engineer etc. So, the future of networking is bright as the development of automation depends on networking.

3. CONCLUSION

Currently, Networking plays a vital role in the growth of career. It is a platform which enhances availability of information and resources and boosts storage capacity. A network is made up of two or more computers that are linked together via a telecommunications system in order to communicate and share resources. It has been seen that people don't have understanding of networking. To solve this problem, author decides to write this paper. In this review paper, author have discussed about networking, types of networks, network topologies, various layers in OSI reference model, various network protocols and difference in IPv4 & IPv6. Companies would not be able to share resources and boost production as efficiently if they did not have a network. Nowadays, automation technology is ongoing and the 5G network is coming and the demand will grow in future. So, the future of networking will be bright.

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