Computer Networking Architecture and Communication Technologies

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ABSTRACT: The evolution of communication media from traditional platforms such as radio and television to the Internet has fundamentally transformed human interaction and enabled the emergence of a globally connected digital society. Cyberspace has reshaped cultural and social practices by redefining how individuals communicate, exchange information, and access digital resources beyond geographical limitations. Computer networks form the backbone of this transformation by enabling efficient data transmission, distributed computing, collaborative work environments, and access to remote services. This paper provides a concise historical overview of computer networking and examines its fundamental components, including network architecture and communication protocols. It further discusses widely adopted networking technologies such as Ethernet and the TCP/IP protocol suite, highlighting their roles and underlying mechanisms in supporting modern digital communication systems.

KEYWORDS: Computer Networks, Network Architecture, Communication Protocols, LAN, TCP/IP, Ethernet.

1. INTRODUCTION

Computer network is the basis of communication in IT. They are used in many ways and may include many different types of networks. A computer network is a digital telecommunications network that allows nodes to share resources. In computer networks, network computing devices exchange data with each other using a data link. Cable media or wireless media are used for connections between nodes. A computer network is made up of a combination of hardware and software.

Figure 1: Computer Networks

Computer networking is a group of computers and other devices for the purpose of communication that are connected to wired (LAN), wireless, or the Internet. Network devices can have a variety of devices such as Printer, Scanner, Server, including switches and routers. To exchange information in the network, protocols and algorithms are used. Each endpoint of the network (sometimes called a host) is a unique identifier that is often an IP address or a Media Access Control (MAC) address. It is used to indicate the source or destination of a transmission. Endpoints may include servers, personal computers, phones, and many types of network hardware. Two or more devices are connected by networking so that all the data and information between them can be shared. A rautor is used to connect to the network. FEATURES FOR MAKING THE NETWORK Firewall to protect the network, IP phone to call over the network and VPN to make secure 10 runs in the network are required. A network is a very complex structure.

2. COMPUTER NETWORKS

When more than one computer is connected through some medium and the information is shared, then this technique is called network. This connection can be wired and also wireless, when talking about Wire Medium, it twisted. Pair cable, coaxial cable and fiber optics cable can be anything. If you talk about Wireless Medium, it can be anything from Radio Wave, Bluetooth, Infrared, Satellite. In computing, a network is a group of two or more devices through which we can communicate.

Figure 2: Computer Networking

In practice, networks consist of many different computer systems connected by physical and wireless connections. A network is a collection of computers, servers, mainframes, network devices or other interconnected devices that allow sharing of data among themselves. An excellent example of a network is the Internet, which connects millions of people all over the world.

3. HARDWARE AND ETHERNET

All the mechanical, electronic and electrical parts used in computer which we can see with eyes and touch with hands are called hardware. Such as - monitors, keyboards, hard-disks, circuits, memory chips, etc. Computer hardware has two types depending on its function and structure -

CPU (Central Processing Unit) - The task of CPU is to process the given data and extract the information from it in the output form. Peacock is also called the brain of the computer. Deccan is mainly divided into three parts –

1. Control Unit - The Control Unit works to control or control the data and instructions given to the computer. The control unit controls the computer's internal functions, controlling them. These actions are then exchanged between ALU and memory.

2. Arithmetic logic unit - Arithmetic logic unit is used to perform arithmetic actions and logical actions on data and instructions given on the computer. ALU sends data and instructions from the control unit to memory as information.

3. Memory - This is the part of the computer in which all data and instructions are stored. If it is not part, then the data and instructions given to the computer will be immediately destroyed. There are mainly two types of memory-

1. Main Memory

2. Auxiliary memory

Peripheral: Input devices, output devices, and secondary storage devices are collectively called peripherals. It is of three types -

1. Input Unit

2. Output Unit

3. Collection Unit

IP address: An Internet Protocol address (IP address) is a numeric label assigned to each device connected to a computer network that uses the Internet protocol for communication. An IP address performs two main functions: host or network interface identification and location addressing.

LAN: Its full name is Local Area Network. It is a network that is used to connect two or more computers. Local area network is a locally functioning network. It is called Lean in Sanskrit. It is a computer network that covers the local millions of office buildings.
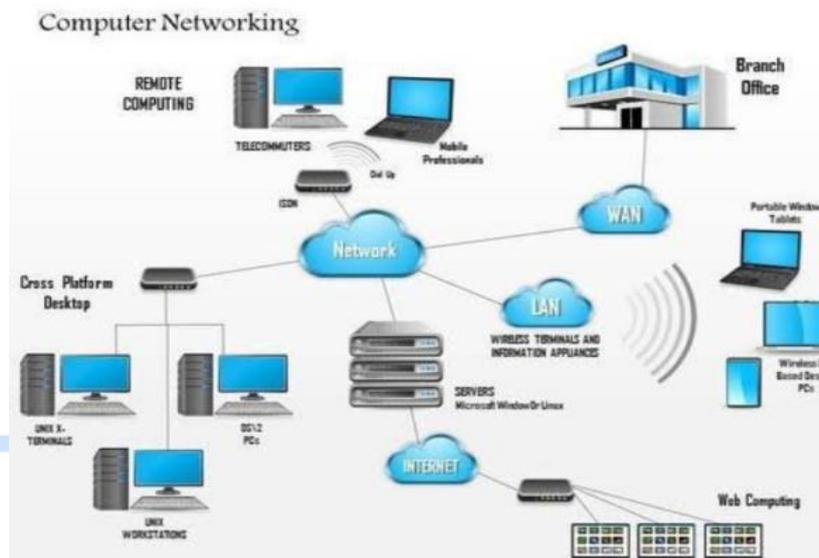

Figure 3: Complete Computer Networking Process

LAN Features:

- It is limited to one room or one building.
- Its data transfer speed is high.
- It does not have to hire external networks.
- Data is safe in this.
- It is easy to organize data.

Different types of LAN:

- Network Adapter
- Network Medium
- Cable Connector
- Power Supply
- Hub/ Switch /Router
- Network Software.

Ethernet

Ethernet is a technology commonly used in wired local area networks (LANs). A LAN is a network of computers and other electronic devices that cover a small area such as a room, office, or building.

It is used in contrast to the Wide Area Network (WAN), which spreads over a very large geographical area.

Figure 4: Ethernet

Ethernet is a network protocol that controls how data is transmitted over a LAN. Technically it is known as the IEEE 802.3 protocol.

Ethernet is a technology used in the Wired Local Area Network. A LAN is a computer network that covers small areas such as home, office, school, college, meaning that LAN works to establish computer network in small area.

It is a network protocol that controls the data being transmitted through the LAN (Local Area Network), that is, it tells how to transmit the data.

WAN: WAN (wild area network) is a telecommunications network or computer network that spans vast geographical distances. Wide area networks are often set up with a leased telecommunications circuit. A wide area network (WAN) is a telecommunications network that is spread over a large geographic area for the primary purpose of computer networking. Wide area networks are often installed with leased telecommunications circuits.
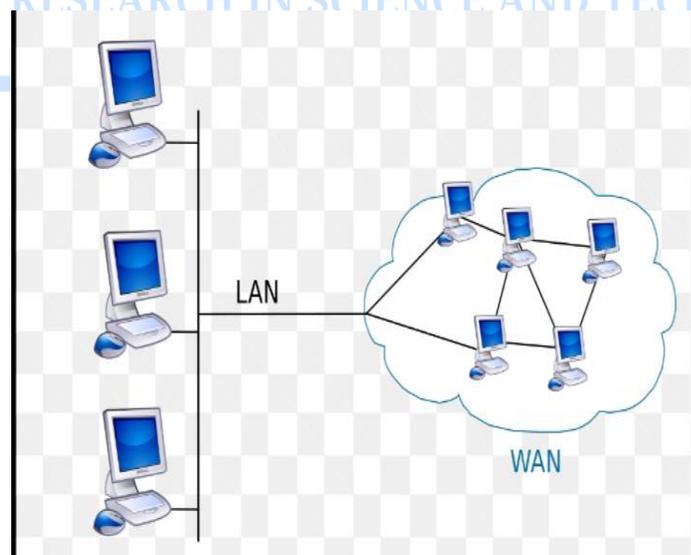

Figure 5: WAN

Businesses, as well as education and governmental entities use extensive field networks to relay data to employees, students, customers, buyers, and suppliers from various locations around the world. In short, this mode of telecommunications allows a business to carry out its daily work effectively regardless of location. Internet can be considered as WAN.

Metropolitan Area Network/MAN

MAN connects two or more local area networks. It is a network of computers located within the city limits. Routers, switches, and hubs together form a MAN.

Similar networks are individual area networks (PANs), local area networks (LANs), campus area networks (CANs) or metropolitan area networks (MANs), which are usually limited to a room, building, campus, or specific metropolitan area.
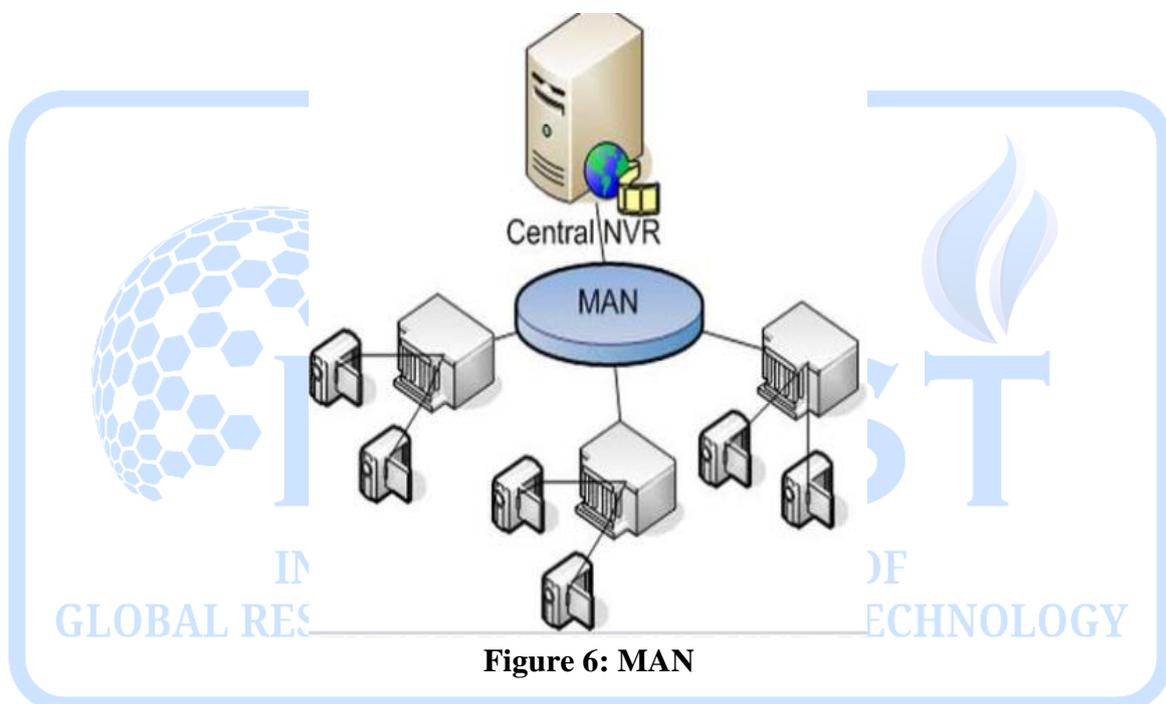

Figure 6: MAN

4. CONCLUSION

A network is a collection of many computers that are connected with each other, these computers share information with each other. However, this system works independently. As a result, a combination of computer and network provides a system in which data and information are transmitted in all forms. There are differences in data communication and data processing. Similarly, there is no distinct difference between data, voice and video communication. Major networking technologies are designed and designed to achieve a certain objective. For example, many organizations run their own network, which connects many departments and employees of that organization to that system. Therefore each organization selects the appropriate hardware technology for communication needs and budget. In addition, it is not possible to create a network technology that allows a network technology to provide its service to many types of networks. Because some applications require a high-speed network to connect their computers to a building. Many expensive

technologies cannot extend geographic distances and low-speed network link machines to meet its requirement. Basically, there are three types of networks - LAN, MAN and WAN.

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