



## Preamble Analysis of Computer Networking and Management

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**Abstract:** A network is a connected collection of devices and end systems, such as computers and servers that can communicate with each other. A computer network interconnect is the glue which links devices together. Interconnect come in many forms and support several different kinds of networking. To understand how network functions by introducing fundamental computer and network concepts and the characteristics, functions, benefits, metrics, and attributes are used to describe network features and performance. An efficient and easy use of communication network management system is of great advantage.

**Keywords:** protocols, topology, data compression, networks, management.

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### I. INTRODUCTION

A computer Network is the infrastructure that allows two or more computers to communicate with each others. A computer network consists of two or more computers that are linked together in order to share resources such as printers, files, or electronic communication. The network achieves this by providing a set of rules for communication, called protocols. A network management system (NMS) is a set of hardware and/or software tools that allow an IT professional to supervise the individual components of a network within a larger network management framework.

### II. NETWORK TOPOLOGIES

Distributed computing systems have become the essential aspect of growing information technology. Autonomous computers are connected by means of a communication network in a distributed computing environment which is arranged in a geometrical shape called network topology. Network Topology is the schematic description of a network arrangement, connecting various nodes (sender and receiver) through lines of connection.

#### Types of Network Topologies:

**A. Bus Topology:** Bus topology is a network type in which every computer and network device is connected to single cable. It carries the transmitted message along the cable. As the message arrives at each device (node), the nodes checks the destination address contained in the message to see if it matches its own. If the address does not match, the node does nothing more.

**Advantages:** It is cost effective; cable required is less as compared to other network Topologies, Easy to expand joining two cables together.

**Disadvantages:** If cable fails then whole network fails, If network traffic is heavy or nodes are more the performance of the network decreases, cable has limited length, it is slower than ring topology.

**B. Ring Topology:** It is called ring topology because it forms a ring as each computer is connected to another computer, with the last one connected to the first. Exactly two neighbors for each device. In a ring topology all of the nodes or devices are connected to one another in a circle. The data passes from one device to the next one and all the way around the ring layout until it reaches the destination node.

**Advantages:** Transmitting network is not affected by high traffic or by adding more nodes, as only the nodes having token can transmit data. 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.

**C. Star Topology:** Star topology is one of the most common network setups where each of the devices or nodes on a network connects to a central hub. In star topology all the computers are connected to a single hub through a cable. This hub is the central node and all other nodes are connected to the central node.

**Advantages:** Fast performance with few nodes and low network traffic. Easy to troubleshoot. Only the node is affected which has failed; rest of the nodes can work smoothly.

**Disadvantages:** Cost of installation is high. If the hub is affected then the whole network is stopped because all the nodes depends on the hub.

**D. Mesh Topology:** In this type of topology each device is interconnected with one another, allowing for more transmission to be distributed even if one of the connections goes down. It is a point to point connection to other nodes or devices.

**Advantages:** Each connection can carry its own data load. It is robust. Fault can be diagnosed easily, provides security

and privacy.

**Disadvantages:** Installation and configuration is difficult, cabling cost is more and bulk wiring is required.

**E. Tree Topology:** Tree Structure suits best when the network is widely spread and vastly divided into many branches.

Tree topology is a combination of two or more bus and the Star Topology connected.

**Advantages:** Extension of bus and star topologies, expansion of nodes is possible and easy, easily managed and maintained, error detection is easily done.

**Disadvantages:** Heavily cabled, costly, if more nodes are added maintenance is difficult. If central hub fails, network fails.

**F. Hybrid Topology:** It is two different types of topologies which is a mixture of two or more topologies. Hybrid topology is a network topology that is composed of one or more interconnections of two or more networks that are based upon different physical topologies or a type of network topology that is composed of one or more interconnections of two or more networks that are based upon the same physical topology, but where the physical topology of the network resulting from such an interconnection does not meet the definition of the original physical topology of the interconnected networks.

**Advantages:** Reliable as troubleshooting and error finding is easy, effective, scalable as size can be increased easily.

**Disadvantages:** Its designing is quite complex and is inexpensive.

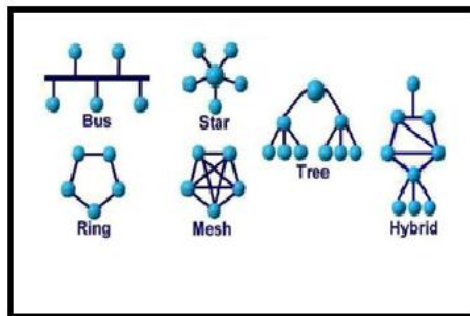


Fig 1: Types of Topologies

### III. TYPES OF NETWORK

**A. Local Area Network (LAN):** A LAN is a network that is used for communicating among computer devices, usually within an office building or home. LAN's enable the sharing of resources such as files or hardware devices that may be needed by multiple users. It is limited in size, typically spanning a few hundred meters, and not more than a mile. It is fast, with speed from 10Mbps to 10 Gbps. It requires little wiring, typically a single cable connecting to each device.

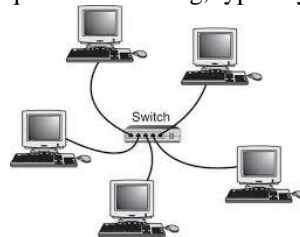


Fig 2: Local Area Network

**B. Metropolitan Area Network (MAN):** A metropolitan area network (MAN) is a large computer network that usually spans a city or a large campus. A MAN is optimized for a larger geographical area than a LAN, ranging from several blocks of buildings to entire cities. A MAN often acts as a high speed network to allow sharing of regional resources. A MAN typically covers an area of between 5 km and 50 km diameter.

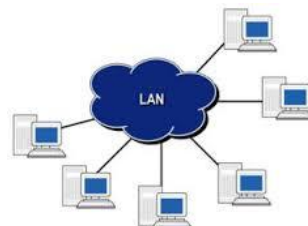


Fig 3: Metropolitan Area Network

**C. Wide Area Network (WAN):** WAN covers a large geographic area such as country, continent or even whole of the world. A WAN is two or more LANs connected together. The LANs can be many miles apart. To cover great distances, WANs may transmit data over leased high-speed phone lines or wireless links such as satellites. Multiple LANs can be connected together using devices such as bridges, routers, or gateways, which enable them to share data. The world's most popular WAN is the Internet.

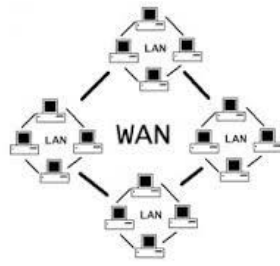


Fig 4: Wide Area Network

**D. Personal Area Network (PAN):** A PAN is a network that is used for communicating among computers and computer devices (including telephones) in close proximity of around a few meters within a room. It can be used for communicating between the devices themselves, or for connecting to a larger network such as the internet. PAN's can be wired or wireless.



Fig 5: Personal Area Network

**The OSI Model:** OSI is an acronym of Open system interconnection. The OSI model depicts how data communication should take place. It splits the functions or processes into seven groups that are described as layers. The purpose of the OSI reference model is to guide vendors and developers so the digital communication products and software programs they create will interoperate, and to facilitate clear comparisons among communication tools. The OSI model is made up of seven layers which are presented as a stack. Each of the layers of the OSI model has a numerical level or layer, and a plain text descriptor. Data which is passed over the network moves through each layer.

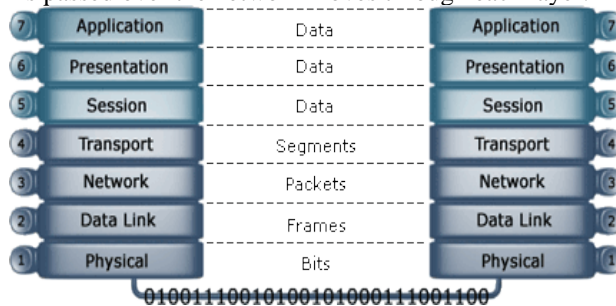


Fig 6: Layers of OSI Model

**A. Layer 1- Physical Layer:** The first layer in the OSI model is the Physical layer which transmits raw bit streams over a physical medium. The Physical layer deals with establishing a physical connection between computers to enable communication. The physical layer is hardware specific and deals with the actual physical connection between the computer and the network medium. All devices that function at the Physical layer handle signaling. Data handled at the layer are in bits (1s and 0s). The 1s and 0s are represented by pulses of light or electricity .E.g. DSL, USB.

**B. Layer 2- Data Link Layer:** The Data Link Layer is primarily responsible for communication between adjacent network nodes. Network switches and hubs operate at this layer which may also correct errors generated in the Physical Layer. The Data link layer of the OSI model enables the movement of data over a link from one device to another, by defining the interface between the network medium and the software on the computer. The Data link layer maintains the data link between two computers to enable communication. E.g. PPP, IEEE 802.2, L2TP.

**C. Layer 3- Network Layer:** The Network Layer is primarily responsible for establishing the paths used for transfer of data packets between devices on the network. Network routers operate at this layer which can commonly be divided into three sub-layers: Sub network access, Sub network dependent convergence, and Sub network-independent convergence. E.g. IPv4, IPv6, IP sec, Apple Talk.

**D. Layer 4- Transport Layer:** The Transport Layer is responsible for the delivery of messages between two or more networked hosts. It handles fragmentation and reassembly of messages and controls the reliability of a given link. It also includes segmentation, acknowledgement and multiplexing. The Transport layer at each computer verifies that the application transmitting the data is actually allowed to access the network. E.g. TCP, UDP.

**E. Layer 5- Session Layer:** The Session Layer establishes process to process communications between two or more networked hosts. Under OSI, this layer is responsible for gracefully closing sessions (a property of TCP) and for session

check pointing and recovery (not used in IP). It is used in applications that make use of remote procedure calls. The Session layer utilizes the virtual circuits created by the Transport layer to establish communication sessions.

E.g. HTTP, FTP, PAP.

**F. Layer 6- Presentation Layer:** The Presentation Layer's primary responsibility is to define the syntax that network hosts use to communicate. Compression and encryption fall in the functions of this layer. It is sometimes referred to as the "syntax" layer and is responsible for transforming information or data into format(s) the application layer can use. It performs protocol conversion, data translation, data encryption and decryption, data compression, character set conversion, interpretation of graphics commands. E.g. ASCII, EBCDIC, JPEG.

**G. Layer 7- Application Layer:** The Application layer is the highest layer of the OSI model, and it provides the interface between the network protocol and the software running on the computer. The Application layer provides the necessary services that support applications. It provides the interface for e-mail, Telnet and File Transfer Protocol (FTP) applications, and files transfers. This is the location where applications interrelate with the network. E.g. mail, internet explorer, Firefox, Google chrome.

#### IV. NETWORK MANAGEMENT

A Network Management System (NMS) is used to design, organize, analyze and administer computer and telecommunication networks, in order to maintain a desired level of service at all times. The functional areas of network management are Fault management, performance management, configuration management, security management. It is necessary to manage these aspects for services, networks and network elements. If these areas are not managed, commercial offering of network services is very difficult. Management or operations systems must be flexible and have a distributed, modular architecture that allows service providers to adapt to future customer needs. These needs may include, for example, rapid service deployment and activation, enhanced billing, and end-user online feature access.

#### V. CONCLUSION

While the age-old concept of the network is foundational in virtually all areas of society, Computer Networks and Protocols have forever changed the way humans will work, play and communicate. Forging powerfully into areas of our lives that no one had expected, digital networking is further empowering us for the future. Depending on the characteristics of the network you are developing, you have a wide range of architectural solutions, from a simple single-platform system with preconfigured monitoring and management capabilities to a distributed, hierarchical system in which you determine and configure its monitoring and management capabilities.

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