UNIT-3

Introduction to Networking

Location	Learning Outcome	Knowledge Evaluation	Performance Evaluation	Teaching and Training Method
• Class room, library or computer laboratory.	• Understanding networking.	• Networking basic. • Concept and definition. • Sharing devices and peripherals. • Sharing data and files.	• Explain networking concept and definition. • Explain sharing of devices and peripherals. • Explain data and file sharing.	• **Interactive lecture:** Basic of networking, concept, definition, sharing devices and peripherals, sharing data & information. • **Activity:** Visit computer laboratory, show students computer network and sharing printer, scanner, etc., and share information from one computer to another.
	• Types of networking and their utility.	• Areas local area network or LAN. • Metropolitan area network or MAN. • Wide area network or WAN. • Personal area network or PAN. • Internet.	• Explain different types of network with examples. • Explain internet and intranet. • Benefit of internet.	• **Interactive lecture:** Explain different types of network & their purposes with examples. • **Activity:** Visit computer laboratory and show students different types of network through images and multimedia, help may be taken from internet.
	• Understanding server.	• Client / server. • Peer-to-peer.	• Explain server and different models, client-server and peer-to-peer.	• **Interactive lecture:** Explain server and different models, client-server and peer-to-peer. • **Activity:** Visit computer laboratory and show students server through images and multimedia, help may be taken from internet.

	a) Switching technique.	• Circuit switching. • Packet switching. • Message switching.	• Explain types of switching techniques.	• **Interactive lecture:** Explain switching techniques with examples. • **Activity:** Visit computer laboratory & show students switching through images and multimedia, help may be taken from internet.
	• Networking and communication protocols.	• OSI reference model. • TCP/IP Model. • CDMA. • GSM. • GPRS.	• Explain reference models and protocols.	• **Interactive lecture:** Explain reference models and communication protocols. • **Activity:** Visit computer laboratory and show students reference models through images and multimedia, help may be taken from internet.
	• Networking topology.	• Linear or Bus. • Star. • Ring. • Mesh. • Tree. • Hybrid.	• Explain networking topology.	• **Interactive lecture:** Discuss networking topologies. • **Activity:** Visit computer laboratory & show students networking topologies through images and multimedia, help may be taken from internet.
	a) Transmission channels and networking.	• Twisted pair cables. • Coaxial pair cable. • Fiber optic cable. • Micro waves. • Radio waves. • Communication satellites. • Bluetooth. • WiFi.	• Explain different transmission channels.	• **Interactive lecture:** Discuss transmission channels with example of day to day life. • **Activity:** Make them transfer data through Bluetooth & WiFi. Visit computer laboratory take help of Internet in

	b) Benefits of networking.	• Resource sharing. • Information exchange. • Cost reduction. • Reliability. • Easy communication. • Flexible working environment.	• Explain resource sharing, cost reduction, flexible working environment, etc.	explaining channels. Interactive lecture: Discuss resource sharing, cost saving, etc. • **Activity:** Transfer file photo through network with the help of email, whatsapp, etc.
	• Practical.	• Connecting computer and peripherals as printer, scanner, etc. • Sharing data and information.	• Able to connect computers and peripherals like printer, scanner, etc. • Able to take print from printer installed at another computer. • Transfer file or data from one computer to another computer.	• **Interactive lecture:** Explain how to connect computers and peripherals & share data from one to another terminal. • **Activity:** Connect computer, printer, etc. and take print.

3.1 Understanding Networking

The modern technological world needs faster communication channels to communicate frequently from one place to another. There is a frequent need of data transmission over varied distances. To share data or to communicate quickly from one place to another, the concept of networking has been introduced. Networking is a mechanism through which two or more independent computers of communication devices communicate with each other to share the data or information.

Networking: Concept and Definition

Networking is a concept, where two or more than two computers are joined together to share information. This sharing can be in the form of files among computers and peripherals such as printers, modems, CD-ROM or DVD-ROM drives. These computers can be within a walking distance or in the same building of the office or in the same city or even across the cities.

There are various definitions given for networking. The Merriam Webster Dictionary defines it as “the establishment or use of a computer network”. A computer network is a collection of two or more connected computers to share the information. So, a network allows the computer to share its equipments, files, data and programs. When networks at multiple locations are connected, people can send messages (SMS), e-mail, can share links to the worldwide Internet, or conduct video conferences in real time with other remote users.

In networking, several computers together allows data to be transmitted from one machine to another in rapid and easily managed data streams. The sharing of data allows many of the

resources that are located on a single machine to effectively become available to all other machines on the network.

The resources can be physically located on one machine e.g., as files on the hard disk, or the devices as printer connected locally to one machine. Such resources as files, printer, located or connected with one machine (computer) remain available over the network to other machines of that network.

An alternate situation would be where access to the Internet is available to all the computers on a network through a special communication devices attached to the network. Access to all external and internal resources are thus made available to the users on the network.

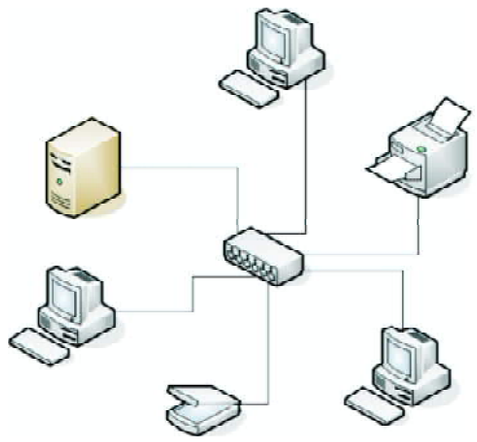

Figure 3.1: Networked Computers

Source: http://www.functionx.com/illustrations/network2a.gif)

A network server provides network services to a user workstation (client) on the network. Services can range from sharing database and files to printers, scanner, and so many other devices and network resources. Thus, the network servers are also called file servers, print servers, communication servers, etc, on the basis of the task it performs.

Need for Networking

Networking is a need of modern technological era. Have you ever found yourself rushing from one computer to another in your school or home, attending to several different joints at various locations to share the information or do you often find yourself moving files that need printing from your computer to the other computer that is connected to the printer? All of these situations can be made easier by allowing two or more computer systems to communicate with each other over a shared network medium. A computer network enhances the reliability of available computer resources and resource sharing between two or more computers.

Networking is Necessary Due to Following Reasons:

- **To Enable Two or More Computers to Communicate with Each Other:** Through networking, two or more computer can communicate with each other or one another for data storage and sharing resources irrespective of their operating environment. For example, a UNIX based computer can communicate with a Windows or LINUX without any problem.
- **To Share Computer Files, Data and Programs:** Through networking, we can share any file or programs to all connected computers. Such as in schools if one file has to be shared with all departments, this file can be placed on network system.
- **To Share Computer Peripheral and Devices:** One device, connected to a network can be made available for all other computers through networking. For example, a single printer can be used by whole network if it is connected to a network and configured for sharing purpose.
- **Cost Reduction in Terms of Devices and Data Transfer:** Computer devices such as

printers, scanners, large hard disks are very costly. Through networking we can link a single printer to two or more computer systems. The same goes for other devices like Scanner, CD/DVD Drive, etc.

- **To Make Resource Sharing Easier and Faster:** Through networking, computer resources can be shared quickly and accurately irrelevant to their size and travel distance. Hence, it saves the time and efforts involved in sending data from one place to other places.
- **Access Control:** The networking tools and techniques provide mechanism to control the resources available on network. For example, a file available or a device on network can be restricted for the limited users.

Review Questions

A. Fill in the blanks

1. In _____ server provides network services to a user workstation.
2. Networking allows two or more than two computer to _____.
3. Networking tools and techniques provide mechanism to control the _____ available on network.

B. Multiple Choice Questions

Tick the correct answer

1. Networking makes resources sharing _____
   (a) Slow and difficult
   (b) Quick and accurate
   (c) Expensive
   (d) Resistible
2. How can devices and peripheral installed at one computer be shared easily?
   (a) With networking
   (b) Without networking
   (c) Manually
   (d) Impossible

C. Short Answer Questions

1. What is the networking?
2. What is a server?
3. What is a client?
4. What do you mean by access control?

Checklist for Assessment Activity

Use the following checklist to see if you have met all the requirements for assessment activity.

Part-A

1. Defined network.
2. Understood need of networking.

Part-B

1. What is computer network?
2. What is the need of networking?

Part-C

Performance Standards

The performance standards may include, but not limited to:

Performance Standards	Yes	No
Able to explain network.		
Able to identify the need of networking.		

3.2 Types of Networking and Utility

The network can be classified on the basis of it size and applications. On the basis of the two characteristic, the network can be categorized as:

1. Local Area Networks or LAN
2. Wide Area Network or WAN
3. Metropolitan Area Network or MAN
4. Personal Area Network or PAN
5. Internet

3.2.1 Local Area Network

A Local Area Network (LAN) connects computers and devices spread in an area of short distance. It can be a small well-defined area such as a room, building, or group of closely placed buildings. Maximum distance between two computers should be within one kilometer for getting best performance and managing it too. For example, your school campus might have its own LAN for administration and teaching and learning process.

Nowadays, a LANs can operate at the speed of up to 10Gbps whereas, traditional LANs works at a speed of 10Mbps to 100Mbps. In this technological era, Wireless LANs have also introduced which uses wireless transmission technology and gives a new dimension to the traditional wire transmission technology.

LAN has some characteristics which differentiate it from other types of networks. These are:

- Geographic Area: LAN covers relatively short distance which usually ranges from 100m to 1 km.
- Size: LANs are restricted in size.
- Error rates are very low in LAN.
- Generally, owned by a single organization.

Wireless Local Area Network (WLAN)

WLAN is a LAN which is based on wireless transmission technology. This technology is termed

as Wi-Fi. It is the most popular wireless technology that allows an electronic device, (a computer or a tab or mobile phones) to exchange data or connect to the network using radio waves. Various shopping malls and eating hubs are providing Wi-Fi facilities to their customers.

3.2.2 Wide Area Networks or WAN

A Wide Area Network or WAN covers a large geographical area usually a country or a continent. This type of network is usually limited to use by large corporations and government agencies because of the high cost involved in terms of infrastructure and maintenance. It uses a variety of commercial and private communication lines. Telephone exchange system is a good example of WAN.

Characteristics of WAN are:

- It covers a huge geographical area as of a country or continent which can be more than 1000 kms.
- It uses satellite transmission lines and switching elements as its transmission technology.
- It uses different types of serial connections to provide access to bandwidth over a large geographic area.

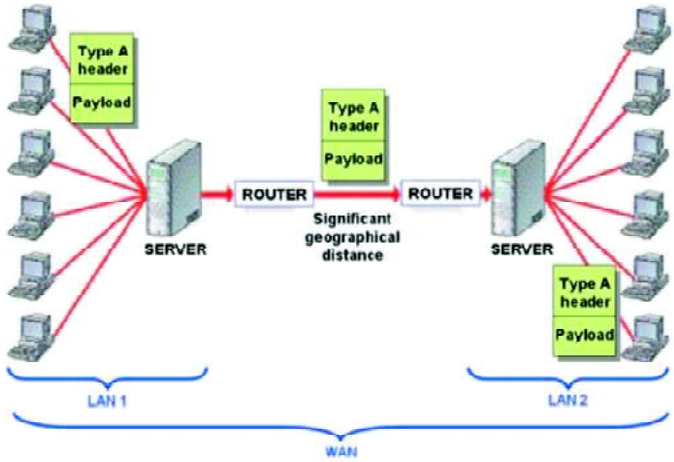

Figure 3.2: Wide Area Network (WAN)

Source: http://computer.atlas4e.com/Project_E1/chapter04/Network.jpg)

Types of Wide Area Networks

There are mainly two types of WAN:

- **Public Networks**

  Public networks are established and run by a group of people under a consortium or by a single owner or telecommunication authorities. They sell their services to any organization or individual who pay for them.

- **Private Networks**

  The private networks are based on private IP addresses which govern on some specified standards. These networks allow the user to access the system by some unique address that cannot be accessible publicly, or in global domain. It provides a private IP address to

a computer.The first WAN was a private network designed and developed by ARPANET in USA.

3.2.3 Metropolitan Area Network or MAN

A metropolitan Area Network or MAN covers larger area than LAN but smaller than WAN. It usually covers a city which can be more than 10 kms in its geographic area. One of the best well-known examples of MAN is the cable TV network of a city. The main characteristics of MAN are as follows:

- MANs coverage area is larger than LAN and smaller than WAN.
- It usually covers a city within the range of 10 kms or few more.
- It is generally owned by a consortium or a single owner or service provider who sells their services.

3.2.4 Personal Area Network

PAN is a computer network created around an individual. A cell phone, tablet or any hand held computer device comes under this network. It creates a network which provides interconnection of the devices within an environment of an individual person. PANs transmitted data by using cable wires and it can go wireless as well. USBs and Fire Wire technologies mostly connected through wires, whereas Bluetooth goes wireless. Connection through USBs, Pen drives, and Bluetooth are some fine examples of Personal Area Network.

3.2.5 Internet

Internet is a global network defined as the network of networks. It is spread globally over countries and continents and is the largest communication network throughout the world. It allows all types of networks from all over the world to get connected and share or exchange data with any other system or network faster than any other communication system. Internet follows TCP/IP (Transmission Control Protocol / Internet Protocol which provides end-to-end connectivity. The salient feature of Internet is that due to its global coverage, it is not in control of a single body or organization. Hence, anyone can get connected or disconnected on their own or as and when required.

Figure 3.3: www.internet.org

History of Internet

In 1960s a project was undertaken by the U.S. Defense Advance Research Projects Agency (DARPA). It was in fact looking for some technology that could enable it to maintain its strategic military-based communication worldwide in case of a nuclear attack. This can be said as the main conception of the Internet.

Later, these developments led to the establishment of the Advanced Research Projects Agency Net (ARPA Net). The main interest of this was looking for a technology that could link computers in various locations by using a new technology called Packet Switching Technology. This new technology enabled several users to simultaneously share a single communication line. This technology was then used by U. S. National Science Foundation (NFS) to create its own network and called it NSFNET. The project met with a large success in achieving its objectives.

Since, the users were mostly scientists and researchers, the demand went on increasing endlessly. The NSF found it unable to cope with the demand. In 1990, a non-profit organization Advance Networks and Service (ANS) created by MERIT, MCI and IBM took over the NSFNET, upgraded it to the speed of 45 MBPS and formed ANSNET. Now the network become commercial and opened to the public. The ANSNET worked for five years and later sold to America Online. By the time, several companies started to offer IP services. Today in fact, anybody with a number of devices as computer, tablet, smart phone, etc. can access Internet with the help of some service provider.

Some Salient Features of Internet are:

- It is a network of networks, that can be called as Internetworks.
- It is the largest communication network in the world.
- It uses TCP/IP protocols to communicate with other systems.
- It is a collection of LANs connected by a WAN.
- It can transmit data from one part of world to another part in real time.
- Anyone with individual device or any network can get connected or disconnected at any time.

Internet and Intranet

Internet should not be confused with Intranet. Intranet is a private network within a company or an organization using internet technology within the network. It can be understood as private network using all the protocols used on internet for the operation of organization. It uses the same kinds of software that you may find on the Internet. Internet essentially used to exchange confidential information between the officials at certain levels, information that is not meant to share with others in the rest of that organization's overall network. Such network is created for security reasons. For example, within the organization Microsoft Outlook can be used for e-mail and messaging among the staff.

Review Questions

A. Fill in the blanks

1. LAN connects computers and devices spread in an area of _____ distance.
2. WLAN is based on _____ transmission technology.
3. WAN is spread in _____ area, usually a country or a continent.

B. Multiple Choice Questions

Tick the correct answer

1. Global network is known as:
   - (a) Internet
   - (b) MAN
   - (c) WLAN
   - (d) Intranet
2. With the help of which protocol systems communicate with each other on Intenet?
   - (a) TCP/IP
   - (b) Personal protocol
   - (c) Wire protocol
   - (d) Twisted protocol

C. Short Answer Questions

1. What is a LAN?
2. What is a WAN?
3. What do you mean by Internet?
4. What do you mean by Intranet?
5. What is a public network?
6. What is a private network?

Checklist for Assessment Activity

Use the following checklist to see if you have met all the requirements for assessment activity.

Part-A

1. Understood different types of network.
2. Differentiated internet and intranet.
3. Explained evolution of internet.
4. Indentified features of internet.

Part-B

1. What are different kinds of network?
2. Explain the evolution of internet.
3. Identify the feature of internet.

Part-C

Performance Standards

The performance standards may include, but not limited to:

Performance Standards	Yes	No
Able to explain different types of network.		
Able to explain the evolution of internet.		

3.3 Understanding Server

A server is a system that refers to the combination of both hardware and software applications or program, which manages access to centralized resources or services in a network. Depending upon its functionalities, servers are of different types, some important of them are such as; **web server, proxy server, application or database server, dedicated server** and **cloud server.** All these above servers are working on following two models of architectures namely **Client-Server based model** and **Peer-to-peer based system.** The client server model is based on a computer network architecture in which each computer on the network is either a client or a server. The server computer system is managing all applications such as disk drives, printer, traffic, etc., to run the various applications within any workstation (or client) computer over a network. Where as peer to peer model is decentralized in nature, which enables each computer works as client and server both, mean all computers have equivalent capabilities and responsibilities. Today, both models are in wide use depending upon their business requirements.

3.3.1 Networking Switching Techniques

The switching technique provides path for data movement on network from source to destination as well as fragments the message before passing to the network. It is an essential component of all types of network whether computer, telephone, or any other network. There are three types of switching techniques which have been given below:

(i) Circuit Switching

(ii) Message Switching

(iii) Packet Switching

(i) Circuit Switching

The circuit switching is a transmission system of a network in which a physical path from source to destination is established and it remains dedicated till the transmission gets completed. For example, when you talk on a telephone then the telephone network establish path (circuit) from your phone to destination phone. It remains dedicated till you finish the talk.

(ii) Message Switching

The message switching is a transmission technique in which whole message is being made a block of data, bundled with destination address and forwarded to the first switching office (i.e. router) and then forwarded towards the destination. The block remained stored in the buffer, available with the router and when the router finds the vacant path towards the destination, it forwards the block. The block of data get stored and forwarded at different routers in the network till it reaches the destination. Hence, a network using this technique of switching is called a Store-and-Forward Network.

In this techniques, dedicated path from source to destination does not get established in advance rather uses the available path in the network in segments. But, once a router starts transmitting a particular block to the next router, it occupies the channel between the two routers till it transmit whole block. If the data size of a particular block is very large, in that case it capture the channel for longer period. Because of this that segment of channel remains unavailable for other transmissions and creates obstacles in interactive traffic.

(iii) Packet Switching

The packet switching is transmission techniques in which message get broken into packets of a certain size depending upon the upper limit of the size of the packet set by the network and then these packets are forwarded towards the destination. Since the whole block of message broken into packets hence the network put the packet number and destination address on each packet. When these packets reach the destination, there they get assembled according to packet number and whole message become available to the user. The transmission of packets, follow the same process for transmission as follows by message switching. But as the size of the blocks is limited here hence, the channels between two routers get free after sending one packet. Hence, this technique overcome the problem faced by store-and-forward network and becomes suitable for interactive traffic of data. All most all the computer networks use this technique for transmission of data over the network.

Review Questions

A. Fill in the blanks

1. There are two types of web server models namely, client-server and _____.
2. Switching techniques provides path for _____ movement from source to destination.

B. Multiple Choice Questions

Tick the correct answer

1. Which kind of path gets established in circuit switching?
   (a) Fragmented physical path
   (b) Dedicated physical path

(c) Store and forward path

(d) All of the above

2. How does packet switching works?

(a) Message is broken into packets

(b) Whole message gets bundled in one packet

(c) Sounds and text are sent in separate packets

(d) None of the above

C. Short Answer Questions

1. What do you mean by Client-Server Model?
2. What do you mean by Peer to Peer system?
3. What is a circuit switching?
4. What is a store-and-forward network?
5. What do you mean by packet switching?

Checklist for Assessment Activity

Use the following checklist to see if you have met all the requirements for assessment activity.

Part-A

1. Understood different models of web server.
2. Understood different switching techniques.

Part-B

1. What are different models of web server?
2. What are different switching techniques?

Part-C

Performance Standards

The performance standards may include, but not limited to:

Performance Standards	Yes	No
Able to explain different web server models.		
Able to explain different switching techniques.		

3.4 Networking and Communication Protocols

Protocol is a set of rules, used by the computers to communicate with each other under a shared network. It is an agreement between two or more communicating parties as on which principles communication will proceed. It provides a common language for the computer

networking to maintain consistency in the network system. Depending upon the structure of the network, different types of protocols are being used at different layers. To understand different layers of the network, we will have to understand the reference models of networking under which different layers are defined. There are two networking reference models, on which all the networks run.

1. The OSI Reference Model
2. The TCP/IP reference Model

3.4.1 OSI Reference Model

The OSI stands for Open System interconnection. It is a step towards the international standardization of protocols in networking system which mainly deals with connecting open systems of networking. This model is designed and developed by International Standard Organization (ISO).

The OSI reference model has seven working layers. Each layer has its well-defined function to perform. These seven layers are as follows:

1. The Physical Layer
2. The Data Link Layer
3. The Network Layer
4. The Transport Layer
5. The Session Layer
6. The Presentation Layer
7. The Application Layer

We can understand these layers with the help of the following diagram:

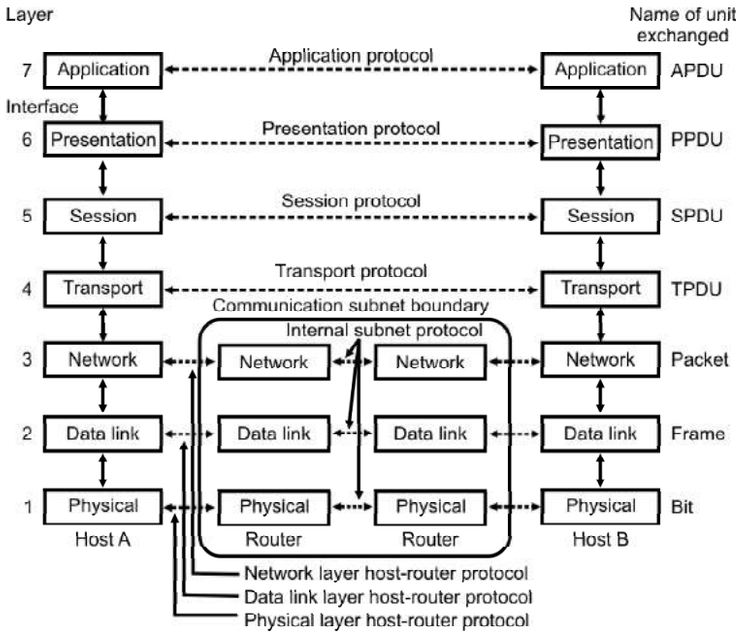

Figure 3.4: An OSI Reference Model

(Source: https://fmfi-uk.hq.sk/Informatika/Distribuovane%20Systemy/knihy/ICN/ch1s4.htm)

The Physical Layer : It is concerned with the transmission of raw bits over a communication channel. This first layer concentrates on proper transmission of bits to its destination.

The Data Link Layer : It is a higher layer concerned on error free data transmission. It transmits the raw bits to the network layer into a frame line. It transforms bits into a frame. It also works to control access to the shared channel.

The Network Layer : It controls the flow and operation of subnet. Subnet is the collection of communication lines and routers. It transforms frame lines into large or small packets and determines proper routing of these packets (free from all kinds of errors and congestion) from their source to destination.

Above three layers comes under Communication Subnet Boundary Line.

Transport Layer accepts data from network layer and split it into small units and ensures the complete and accurate data transmission. It exchanges Transport Protocol Data Unit and provides an error free and point- to- point services to the session layer.

Session Layer exchanges Session Protocol Data Unit (SPDU) and allows establishing sessions between different computers. It provides several services such as synchronization, dialog control and token management.

The Presentation Layer is a lower layer deals with the syntax and semantics of data transmission. It exchanges Presentation Protocol Data Units (PPDU) and maintains the actual required format of exchanged data.

The Application Layer is the last and most important layer of this model. It contains various application protocols which are in use throughout the world. FTP, HTTP are two most commonly used protocols.

3.4.2 The TCP / IP Reference Model

TCP / IP stands for Transmission Control Protocol / Internet Protocol is an international standard of internetworks. It is a commonly used protocol in IP networks to transport data and information. This model is set by a computer research network ARPANET.

Besides OSI reference model, this model consists only the most important and useful layers in its structure. These are:

1. Host to Network Layer
2. The Internet Layer
3. The Transport Layer
4. The Application Layer

Through this model anyone can create their own network servers and clients. We may compare

and easily understands the TCP/IP concept through the following diagram:

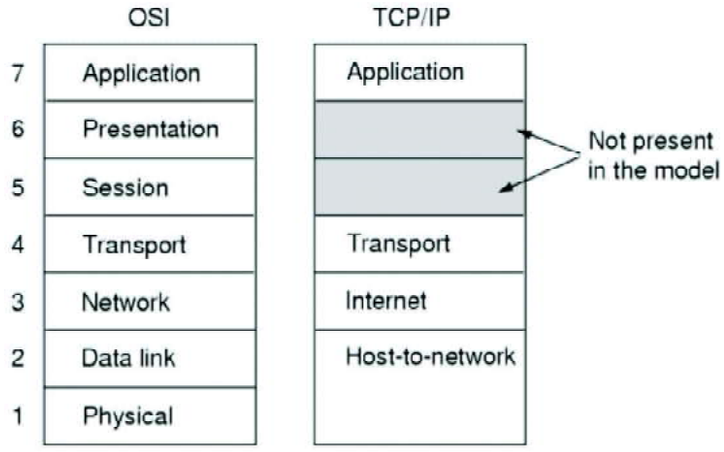

Figure 3.5: A TCP / IP Reference Model Comparing to OSI Reference Model

(Source: *Tanenbaum, Andrew S. Computer networking. 4th edition*)

Here, the Host-to-Network layer has not any defined protocol. It may vary from host to host and networks to networks.

The Internet Layer defines a protocol called Internet Protocol (IP) and an official packet format. This mainly deals with delivering of IP packets to their proper destination. It works almost similar to OSI network layer.

The Transport Layer in TCP/IP models works same as of OSI model. It transmits data accurately, avoiding all congestion and errors and handles flow of data in a faster speed. This layer contains two end-to-end transport protocols i.e. TCP and UCP (User Datagram Protocol).

Application Layer is the topmost layer of TCP/IP model. It includes all higher level protocols such as HTTP (Hyper Text Transfer Protocol), FTP (File Transfer Protocol), NNTP (Network News Transfer Protocol), DNS (Domain Name System), SMTP (for e-mail), SLIP (Serial Line Internet Protocol) now superseded by PPP (Point-to-Point Protocol).

Protocols

WWW

WWW stands for World Wide Web. It was invented by Tim Berners – Lee, a physicist of CERN Laboratory. It uses three technologies namely (i) HTML, (ii) HTTP and (iii) Web Server and Web Browser which governs whole resources on Internet. The data of any kind as text, audio, video, etc, are converted into web resources with the help of HTML and stored at the Web Server. The HTTP provides transfer of data and the browser provides access to the users. With the help of HTML or its next generation as XHTML, XML, etc, web resources are created which are known as websites. The websites are the collection of web pages organized in logical manner. These web pages are supported with the embedded links within the resource or outside the resource. The embedded links make the web resources non-sequential in nature. With the help of these embedded links, a user can directly go to another web resource (webpage or applications) just by clicking on them. With the help of WWW the internet become the technology of common

man for communication and resources sharing. WWW brings a boom in the field of information technology with the establishment of new rules in the world of Internet.

HTTP

HTTP stands for Hypertext Transfer Protocol. It is the protocol to exchange or transfer hypertext between two or more computers. Hypertext is text in a code language called as HTML (Hypertext Multimedia Language). All the websites and web resources are created using this language and made available through HTTP and web server and browser.

FTP

FTP stands for File Transfer Protocol. It is a part of TCP/IP protocol. It allows easy and accurate transfer of files from one computer to another irrelevant of its type and structure.

PPP

PPP stands for Point-to-Point Protocol which allows a computer to work with TCP/IP protocol to get directly connected with internet. It uses telephone line or a modem device to transmit the information. Earlier, SLIP (Serial Line Internet Protocol) was in use which has been superseded by PPP.

NNTP

Network News Transfer Protocol (NNTP) is a protocol for news groups networking which provides a set of rules as how to get a public forum or news group over on internet.

TELNET

Telnet is a protocol which provides remote login. By using TELNET, one can login from one computer on the Internet to another computer. It provides network connection at a remote station, through remote log in.

SMTP

Simple Mail Transfer Protocol is an e-mail protocol which allows easy and error free transfer of e-mails and messages over the internet.

POP

POP is an abbreviation for post office protocol. It is a protocol used to retrieve an e-mail from the server.

IMAP

Internet Mail Access Protocol is a protocol used where multiple computers are in use to access information. It works as a repository that can be accessed from anywhere and from any computer. Such as in offices from office computer at home from laptop or PC, while travelling access from tablets or mobile phones.

3.4.3 Wireless Communication Protocols

In this modern era of advanced communication, wireless communication protocols have also emerged which set up the rules for wireless transmission of information. Wireless communication protocol allows one mobile network to transmit information to another network with their

permanent IP address. Global System for Mobile (GSM), Code Division Multiple Access (CDMA), General Packet Radio Services (GPRs), 3G, 4G, all is the wireless communication protocol.

Review Questions

A. Fill in the blanks

1. There are _____ layers in the OSI Reference model.
2. There are _____ layers in the TCP/IP Reference model.

B. Multiple Choice Questions

Tick the correct answer

1. What is the function of session layer?
   - (a) Using application protocol
   - (b) Establishing session between two computers
   - (c) Establishing physical connectivity using channels
   - (d) None of the above
2. HTTP stands for:
   - (a) Hypertension and Treatment Protocol
   - (b) Hypertext Transfer Protocol
   - (c) Hyperlink and Text Transfer Protocol
   - (d) All of the Above

C. Short Answer Questions

1. How many layers are in OSI Reference model?
2. How many layers are in TCP/IP Reference Model?
3. What does the physical layer do in OSI Reference Model?
4. What are different components of WWW?
5. Define HTTP.

Checklist for Assessment Activity

Use the following checklist to see if you have met all the requirements for assessment activities.

Part-A

1. Understood the OSI Reference model.
2. Understood the TCP/IP Reference model.
3. Understood different protocols.

Part-B

1. Differentiated OSI and TCP/IP Reference models.
2. Identified functions of different layers of TCP/IP Reference models.
3. Identified functions of different protocols.

Part-C

Performance Standards

The performance standards may include, but not limited to:

Performance Standards	Yes	No
Able to differentiate OSI and TCP/IP Reference models.		
Able to identify functions of differentiate layers of OSI and TCP/IP reference models.		
Able to explain functions of different protocol.		

3.5 Networking Topology

Networking Topology is a layout of interconnection of nodes and their workflow in a network. It defines both the physical and logical structure of a network and gives a blue print of how the nodes are interconnected with each other and how they communicate with each other. There are various types of network topologies. Topology decides the structure of a network, so it must be chosen carefully.

Various types of network topologies are Linear, Star, Ring, Tree, Mesh and Hybrid Topology. Let us discuss them in brief:

(a) Linear or Bus Topology

Linear is one of the most common types of topology. It is also called as bus topology. It consist of a series of nodes that work on a common path at a single length in which each node is directly attached to a segment which connects all the computers in a network. This segment is known as backbone cable. It is an easiest and most reliable topology, which best deals with a smaller network. It works well in a network of 10-15 computers.

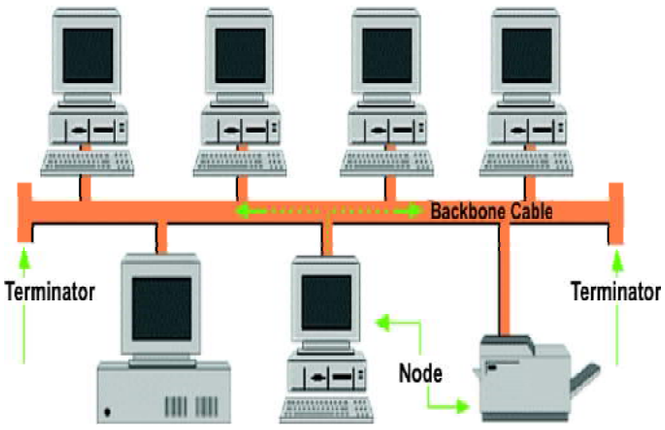

Fig 3.6: Diagram of Bus Topology

(Source: http://www.lahitech.com/images/lin_bus.gif)

Merits of Linear Topology

1. It requires short cable wire.
2. Installation and setup is very easy.
3. It is the most cost-reducing topology as comparable to other topologies.
4. Flexibility is high. It is easy to enlarge or to add computers in this topology.

Demerits of Linear Topology

1. Error detection is quiet difficult.
2. Needs re-configuration.
3. If any fault arises in central cable, that will disconnect the whole network.

(b) Star Topology

It is the most common topology used for Local Area Network (LANs). It is also known as radial topology. In this topology, all the computers are connected to a central hub through a dedicated link or a common path. A central hub is the router or switches which routes the information to its destination. All connected computers have their own functionality.

Merits of Star Topology

1. Error detection is very easy.
2. Set up is very simple and provides easy re-configuration of the network.
3. Fault can be isolate separately for each device. It did not disturb the whole network.
4. More reliable than bus topology and ideal for LANs.

Demerit of Star Topology

1. It requires long cable length as for each computer to connect them to central hub.
2. All the computers are dependent on central hub.
3. Expansion or to add computers is quiet difficult.
4. High cost as comparable to bus or linear topology.

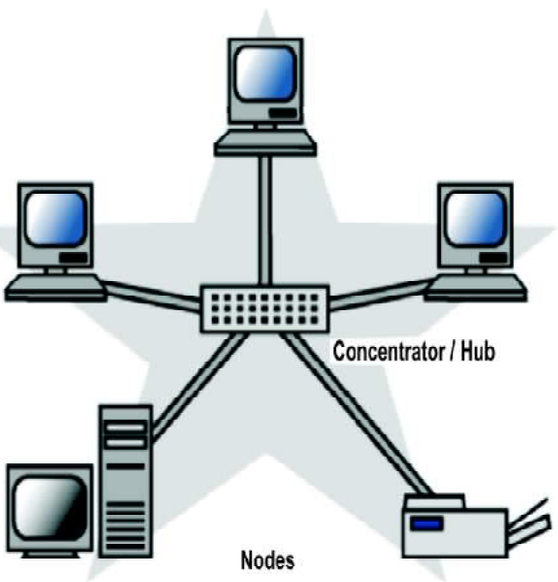

Fig 3.7: Diagram of Star Topology
(Source: http://fcit.usf.edu/network/chap5/chap5.htm)

(c) Ring Topology

It is also known as circular or loop topology. In this topology, every node gets connected to its neighbouring nodes on both the sides. The information flows in a circular form whether clock-wise or anti-clock wise. From the sources node the information flows to the next node and so on until it reaches to the destination. This topology is very simple for operation and maintenance but is prone to break down as fault in any node can disrupts the whole network.

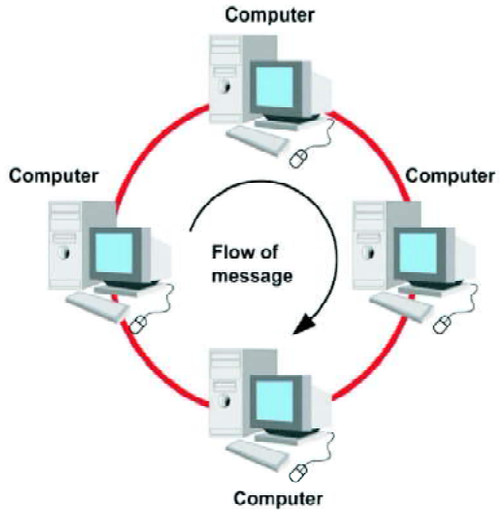

Fig 3.8: Diagram of Ring Topology

(Source: http://www.techiwarehouse.com/engine/e96bb2f2/Understanding-Ring-Topology)

Merits of Ring Topology

1. It requires less cable wire than star topology.
2. It requires less space for wiring closets.

Demerits of Ring Topology

1. Error detection is highly difficult.
2. Re-configuration of network is quiet difficult.
3. An error in any node can cause disruption of the whole network.
4. Isolation of fault is also very difficult.

(d) Mesh Topology

It is a variation of linear topology. In this topology, all the computers are directly connected to each other instead of a central segment or backbone and each of them can work as a router or switches to flow the information until the destination. This topology is mainly used on Wide Area Network (WAN).

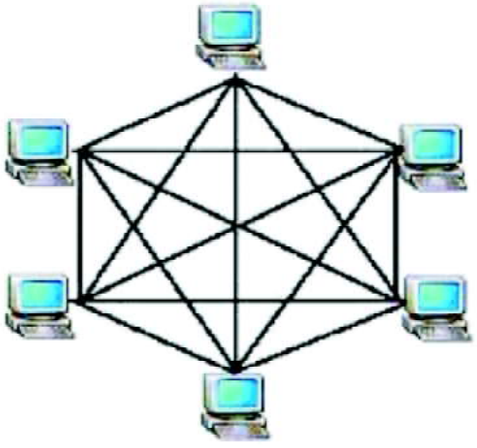

Fig 3.9: Diagram of Mesh topology

(Source: http://brebru.com/aplusstudyguides/mesh.gif)

Merits of Mesh Topology

1. Error detection and isolation is very easy.
2. Network disruption is negligible due to interconnection of each computer.
3. Much secure and reliable.
4. It is ideal for WANs.

Demerits Mesh Topology

1. Architectural structure is more complex and requires lots of space.
2. Re-configuration is quiet difficult.

e) Tree Topology

Tree topology comprised multiple star topologies on a linear or bus network. It comprises the features of star topology and a modified form of linear or bus topology. In this topology, the central hub of each star topology is directly connected to the central backbone of bus and every individual hubworks as a root of tree for all computers.

Television cable networks can be a good example of tree topology.

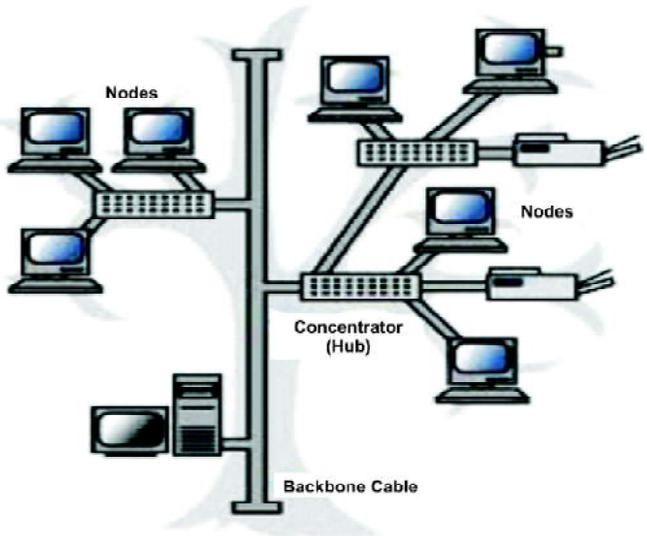

Fig 3.10: Diagram of Tree Topology
(Source: http://vceit.com/networks/tree.gif)

Merits of Tree Topology

1. Expansion is very smooth and easy.
2. Fault detection and isolation is very easy.
3. It provides linear connection to its nodes.

Demerits of Tree Topology

1. Maintenance cost is very high.
2. Failure of backbone can cause total disruption of network.
3. Depends upon the root of trees.

f) Hybrid Topology

This topology is a combination of two or more topologies. It works together comprising the characteristics of multiple topologies. Hybrid topology usually combines bus, star and ring topologies together. Two major examples of hybrid topology are:

(a) Star Ring Topology: It comprises two or more star topologies connected through a centralized hub using a multi-station access unit.

(b) Star Bus Topology: It comprises two or more star topologies connected through linear or bus servers as the network's backbone.

3.5.1 Transmission Channels and Networking

Transmission channels are the media through which the data get transmitted from one point of network to another point of network. They can be categorized as:

1. Wire Technology
2. Wireless Technology

Wire Technology

Wire technology is the traditional transmission technology comprises a network of wires where data transmits through cable wiring. Its various types are as follows:

1. **Twisted Pair Cables:** This cable wiring mostly used for telephone lines. It consists of two identical wires having same features which maintain the balance.
2. **Coaxial Cables:** It consists of a hollow cylindrical conductor made up of copper tube or wire, and an insulator of long diameter made up of copper tubes.
3. **Fiber Optical Cables:** These cables are made up of thin strands of glass arranged in bundles called optical cables.

Wireless Technology

Wireless technology is the technology in which data travels or transmits through the rays or waves. It uses radio or microwaves as transmission channel. This technology is cost benefitting rather than wireless technologies in terms of space and structure.

1. **Microwaves:** This wireless technology is mainly used for long distance networking. It uses micro rays to send signals. It is commonly used in broadband system. Television network, dish TV, Tata sky all works on this technology.
2. **Radio Waves:** These rays travels in a vacuum same as infrared rays, ultraviolet rays etc. These transmit the audio, music, pictures, and other data through the invisible air. Radio stations, FM, mobile phones use this technology.
3. **Communication Satellites:** This technology is used in television network which used satellites to broadcast the information. Cable TV network, dish TV, Tata sky all are using this technique. It can cover an extra large area easily, and provide access even to remote areas. It requires a high cost and feasible for extra large network areas.

4. **Bluetooth:** It is a very short range wireless technology commonly used in mobile phones. It connects and transmits the data from one device to other within the short range and limited time period. Mobile phones, android phones, laptops, digital cameras are using this technology.

5. **Wi-Fi:** It stands for Wireless Fidelity. It is a kind of wireless LAN which covers a small area such as a home, a school rooms or a public hotspot. This technology is very much famous nowadays and this facility is now available in various public hotspots, libraries and eating hubs, etc.

3.5.2 Benefits of Networking

Networking is essential and required in all the sectors. Networks are facilitating colleges, schools, universities, libraries or research centers, banking and business sector, government organizations and many other organizations and take them in a new dimension. It applies to facilitate as follows:

- Resource sharing of data and information in between two or more computers and also to share their peripheral devices.
- To reduce cost in terms of infrastructure, assets and maintenance. A single device can be used for several computers under networking.
- To exchange data and information in between two different types of systems irrelevant of their processing system.
- Communication becomes easy and smooth. One can connect even in remote area.
- Increased reliability in data transmission as there is hardly any scope of loss of data while transmitting.
- Time saving- It saves the time in transmitting data as with the help of network the data can travel one part of world to another part within a few second.
- Real time access worldwide- one part of world can access real time events of another part of world. The video conferencing is an example of this characteristic.
- Provides flexible working environment. A system in network can be accessed from anywhere and at any time.

Review Questions

A. Fill in the blanks

1. Network topology is a layout of _____ of nodes and their workflow in a network.

2. Transmission channels are the _____ through which data gets transmitted.

B. Multiple Choice Questions

Tick the correct answer

1. What is the name of the cable which connects all nodes in bus topology?
   (a) Backbone cable
   (b) Electric wire
   (c) Front cable
   (d) None of the above
2. WiFi stands for:
   (a) Wireless frequency
   (b) Wireless fidelity
   (c) Wire and filter
   (d) Wire and filler

C. Short Answer Questions

1. What do you mean by topology?
2. What is a star topology?
3. What is a tree topology?
4. Define a hybrid topology.
5. What is a transmission channel?
6. What are the different categories of transmission channels?

Checklist for Assessment Activity

Use the following checklist to see if you have met all the requirements for assessment activity.

Part-A

1. Understood different types of topology, their advantages and disadvantages.
2. Understood different transmission channels and their utility.
3. Explained benefits of networking.

Part-B

1. Explain different topology.
2. Explain different transmission channels.
3. Identify benefits of networking.

Part-C

Performance Standards

The performance standards may include, but not limited to:

Performance Standards	Yes	No
Able to explain different topology, their advantages and disadvantages.		
Able to explain different transmission channels and their utility.		
Able to identify benefits of networking.		

3.6 Summary

In this chapter we have studied networking in depth beginning from its introduction, need and purpose till networking benefits and application. Networking is a concept, where two or more than two computers are joined together to share information. This sharing can be in the form of data and files and peripherals such as printers, modems, CD-ROM or DVD-ROM drives. Nowadays, networking become essential and needed for resource sharing, cost reduction and to exchange information and devices.

There are various types of networks based on their geographical coverage area. These are LAN, MAN, WAN, PAN and internet. Internet is a global network defined as network of networks. Network Web Servers are Client / server and peer-to peer. In networking, circuit, packet and message switching techniques are used to transmit data. There are a few set of rules or agreements between two or more communicating parties as on which principles communication will proceed called as network protocols. These provide a common language for the computer networking to maintain consistency in the network system. There are two networking reference models i.e., OSI reference model and TCP / IP model available on which all the networks run. Nowadays, few wireless communication protocols are also in used for wireless networks. Network Topology is a layout of interconnection of nodes and their workflow in a network. It defines both the physical and logical structure of a network and gives a blue print of how the nodes are interconnected with each other and how they communicate with each other.

3.7 Exercise

1. What are the needs of Networking?
2. Write a note on HTTP, FTP, TELENET and SMTP.
3. Write a short note on each types of Network.
4. Discuss the evolution of internet (history of internet).
5. Write a short note www.
6. What are the functions of each layer of OSI Reference Model?
7. What are the functions of TCP/IP Reference Model?

8. Write a short note on each topology.

9. What are the merits and demerits of star topology?

10. Write down the benefits of networking.

3.8 Practical

1. Configure a printer on network and take print of a page from a computer other than the computer attached with the printer.

3.9 Glossary

- 1 G and 2G: 1G refers to the first generation of mobile telecommunications which an analogue telecommunication standard which provides data speed between 28kbps to 56kbps. The 2G refers to the second generation of mobile telecommunications which is a digital telecommunication standard which provides speed up to 153.6 kbps.
- 3G and 4G: 3G and 4G refers to 3rd and 4th generation mobile telecommunications standards which are digital telecommunication standard and provides maximum data speed up to 2 mbps and 1 gbps respectively.
- Bandwidth: Bandwidth in computer networking refers to the transmission capacity of a channel in bit per second which is proportional to the bandwidth in hertz (Hz).
- GPRS: General Packet Radio Service.
- IBM: International Business Machine Corporation, an American company.
- MCI: MCI Communication Corp (1963-1998) was an American Telecommunication company.
- MERIT: A non-profit organization of USA, pioneer of networking in the initial phase of development of Internet.
- Switching Elements: Special computer or device which connect three or more transmission lines, responsible for data transmission across the network router and handle the congestion.

Resource Material

(i) Harinarayana, N.S., (1991). Concept of Library Automation. Herald of Library Science, 30, 174-183.

(ii) Arora, Sumita (2007). Computer science with C++, New Delhi: Dhanpat Rai & Co. (P) Ltd.

(iii) Bansal, S.K. (2002). Fundamentals of Information technology, New Delhi: APH Publishing.

(iv) Kaul, H.K., (1999). Library Resource Sharing and Networking, New Delhi: Virgo Publication.38.

(v) Manjunath, G.K., (2006). Library Automation: Why and How.

(vi) Pandey, S.K. Sharma., (1995). Fundamentals of Library Automation. New Delhi: EssEss Publications. 131.

(vii) Riaz, Muhammed. (1992). Library Automation. Atlantic Publication and Distributions Ltd.

(viii) Development Library Network, New Delhi. http://www.delnet.nic.in/objectives.htm accessed on 07/01/2013.

(ix) Satyanarayana, N.R., (2003). A Manual of Library Automation and Networking Lucknow: New Royal Book co. 148.

(x) Tanenbaum, Andrew S.(2008), Computer networks, 4th ed. New Delhi, Prentice Hall.