| Unit V | Computer Networks, Internet and Email | CHAPTER | 14 |

Computer Network

Learning Objectives

By the end of this chapter, the students will be able

- To explain the evolution of Networking
- Types of Network Topologies
- To explain the types of Network
- To compare the types of Networks
- To identify the types of network in the lab
- To identify computers and users over a network
- To explain wireless mobile communication
- To explain internet applications
- To know Network security concepts
- To use a DNS server to connect it to a network   resource/server

Computer Network

A computer network is an interconnection of various computers to share software, hardware, resources and data through a communication medium between them.

The computers on a computer network may be linked through cables, telephone lines, radio waves, satellites, or infrared light beams.

14.1. Evolution of Networking

Computers exchange data in automatic mode, is, essentially, the basic mechanism of any computer network. Developers of the first networks implemented services for file exchange, database synchronization, e-mail and other network services.

14.1.1. ARPANET

ARPANET was established by the Advanced Research Projects Agency (ARPA) in 1969 for two main reasons:

- To allow the transfer of data between various research institutes.

- To answer the call of the U.S. Department of Defence for a technology to provide messaging capabilities to the government in the event of nuclear war.

14.1.2 World Wide Web(WWW)

The World-Wide Web is a collection of documents and services. It is distributed across the Internet and linked together by hypertext links. The web is therefore a subset of the Internet.

World Wide Web was created by **Timothy Berners Lee** in 1989 at **CERN** in **Geneva**.

Web page is a document available on World Wide Web.   A web page can contain

information including text, graphics, audio, video and hyper links. These hyper links are the link to other web pages.

Web Browser is an application software that allows us to view and explore information on the web.

Following are the most common web browser available today:

Table 14.1

Browser	Vendor
Internet Explorer	Microsoft
Google Chrome	Google
Mozilla Firefox	Mozilla
Netscape Navigator	Netscape Communications Corp.
Opera	Opera Software
Safari	Apple
Sea Monkey	Mozilla Foundation
K-meleon	K-meleon

WWW Operation

WWW works on client- server approach. Following steps explain how the web works:

1. The User enters the URL (say http:// www.tngovernmentjobs.in/) of the web page in the address bar of web browser.

2. The browser then requests the Domain Name Server for the IP address corresponding to www. tngovernmentjobs.in.

3. After receiving the IP address, the browser sends a request to the web page and web server using HTTP protocol.

4. The web server receives request using HTTP protocol and checks for the requested web page. If found returns back to the web browser and closes the HTTP connection.

5. Now the web browser receives the web page, it interprets and displays the contents of web page in web browser's window.
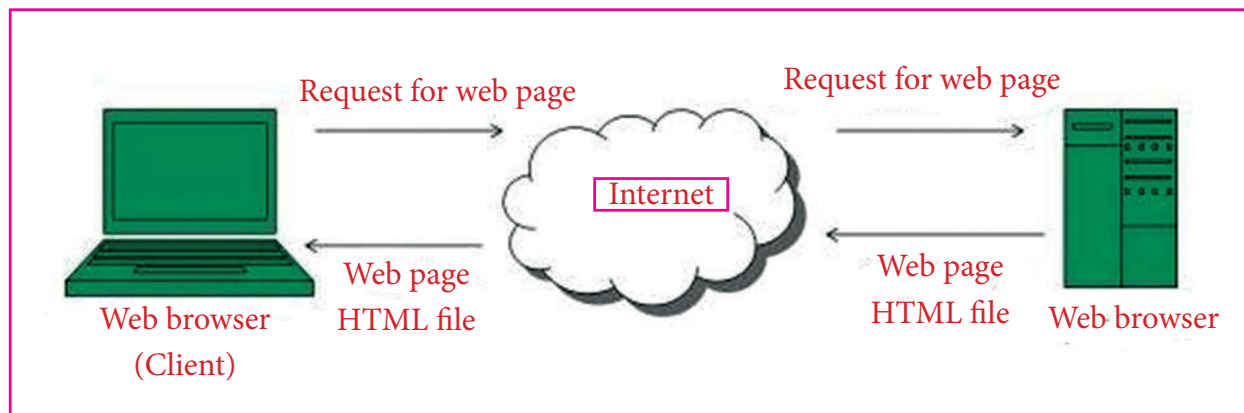

Figure 14.1 WWW Operation

Web server is a computer where the web content is stored. Basically web server is used to host the web sites.

Internet

- Internet is a world-wide global system of interconnected computer networks.

- Internet uses the standard Internet Protocol (TCP/IP).

- Every computer in internet is identified by a unique IP address.

- IP Address is a unique set of numbers (such as 110.22.33.114) which identifies a computer location.

- A special computer DNS (Domain Name Server) is used to give name to the IP Address so that the user can locate a computer by a name.

- Internet is accessible to every user all over the world.

Evolution

- The origin of Internet is devised from the concept of **Advanced Research Project Agency Network (ARPANET).**

Advantages

- Internet allows us to communicate with the people sitting at remote locations. There are various apps available on the web that uses Internet as a medium for communication. One can find various social networking sites such as:

  - Facebook

  - Twitter

  - Yahoo

- Google+

- Flickr

- Orkut

- One can surf for any kind of information over the internet with the help of a search engine.

- Apart from communication and source of information, internet also serves as a medium for entertainment. Following are the various modes for entertainment over internet.

  - Online Television

  - Online Games

  - Songs

  - Videos

  - Social Networking Apps

- Internet allows us to use many services like:

  - Internet Banking

  - Online Educational Services

  - Online Shopping

  - Online Ticket Booking

  - Online Bill Payment

  - Data Sharing

  - E-mail

- Internet provides concept of electronic commerce, that allows the business deals to be conducted on electronic systems

Topology:

Topology describes the physical cabling layout and the logical way of moving data between components.

14.2. Network Topologies

Network Topology is the schematic description of a network arrangement, connecting various nodes (sender and receiver) through lines of connection.
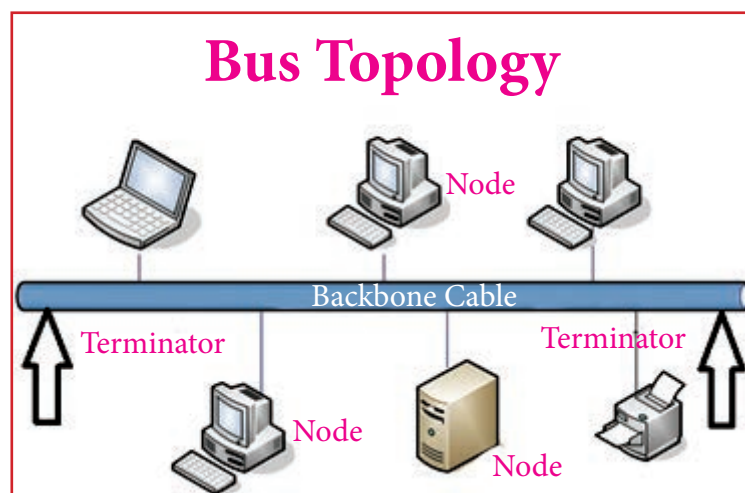
14.2.1. BUS Topology

Bus topology is a network type in which every computer and network device is connected to a single cable. All devices are connected to a common backbone. Maximum nodes that can be attached are 30.

Features of Bus Topology

1.   It transmits data only in one direction.

2.   Every device is connected to a single cable.
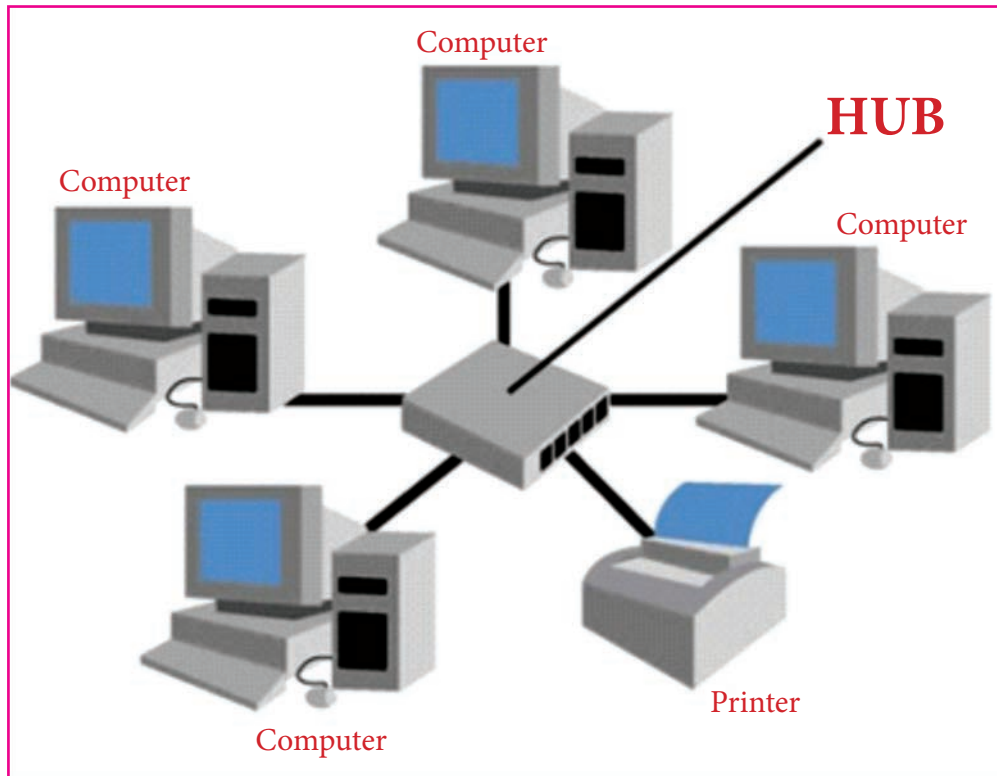

Figure 14.2 Bus Topology

Advantages of Bus Topology

1.   It is cost effective.

2.   Installation of device is easy.

3.   Cable required is less compared to other network topology.

4.   Used in small networks.

STAR Topology

Figure 14.3 STAR Topology

In this type of topology all the computers are connected to a single hub/switch through cables. This hub is the central node and all others nodes are connected to the central node.

Features of Star Topology

1. In this type, every node has its own dedicated connection to the hub.

2. The hub acts as a repeater for data flow.

Advantages of Star Topology

1. The performance is fast with few nodes and low network traffic.

2. The hub can be upgraded easily.

3. It is easy to troubleshoot, to setup and modify.

4. Only the failed node will get affected, and the rest will work smoothly.

TREE Topology

This type of topology is arranged in the form of a tree like structure in which top level contains **parent node** (root node), which is connected with the child nodes in the second level of hierarchy. The second level nodes are connected to the third level nodes, which in turn are connected to the fourth level nodes and so on. Except the top-level nodes, each level node has a parent node. It is also called **hierarchical topology**.
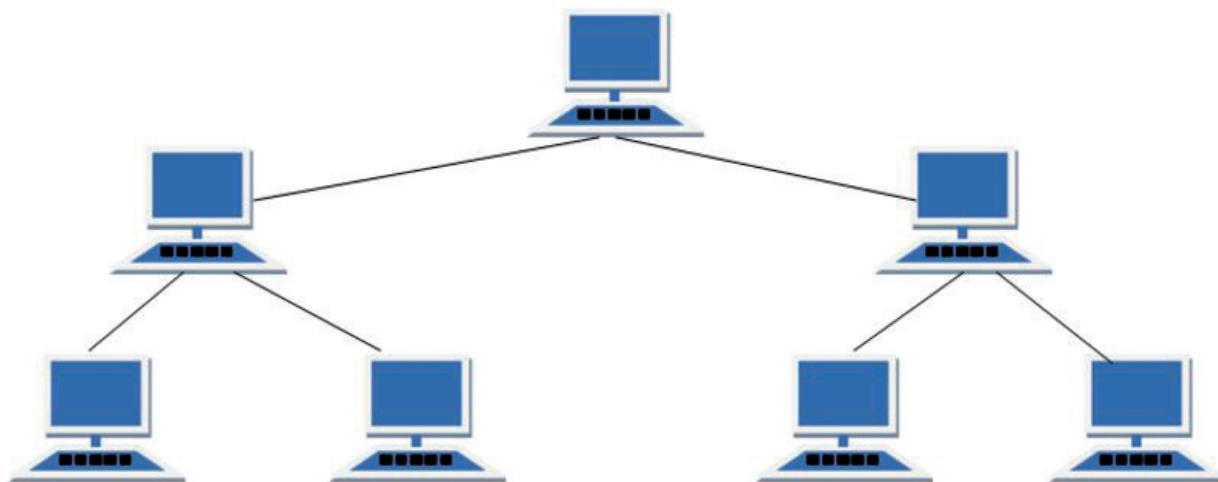

Figure 14.4 Tree Topology

Features of Tree Topology

1.   It is ideal if workstations or nodes are located in groups.

2.   It can be used in Wide Area Network.

Advantages of Tree Topology

1. The expansion of nodes is possible in this type.

2. It can be easily managed and maintained.

3. The error detection can be done easily.

Workshop-1

Go to your Computer laboratory and identify the type of topology followed there. Seek help from your teacher.

14.3. Types of Network

14.3.1. Computer Networks are classified into four types based on the size, distance and the structure namely: **LAN** (Local Area Network), **MAN** (Metropolitan Area Network), **WAN** (Wide Area Network) and **PAN** (Personal Area Network).

Personal area network

- A personal area network, or PAN, is a computer network that enables communication between computer devices.

- PANs can be wired, such as USB or FireWire, or they can be wireless, such as infrared, ZigBee, Bluetooth and ultra wide band (UWB).

- The range of a PAN typically is a few meters. Examples of wireless PAN (WPAN) are devices include cell phone

,headsets, wireless keyboards, wireless mice, printers, bar code scanners and game consoles.

LAN (Local Area Network)

- A **Local Area Network** is a privately owned computer **network** covering a **small Network geographical area**, like a home, office, or groups of buildings e.g. a school Network.

- We can use different types of topologies through LAN.

- LAN networks are also widely used to share resources like printers, shared hard-drive etc.

- The size of LAN is usually small. The various devices in LAN are connected to central devices called **Hub** or **Switch** using a cable.

- Now-a-days LANs are being installed using wireless technologies.

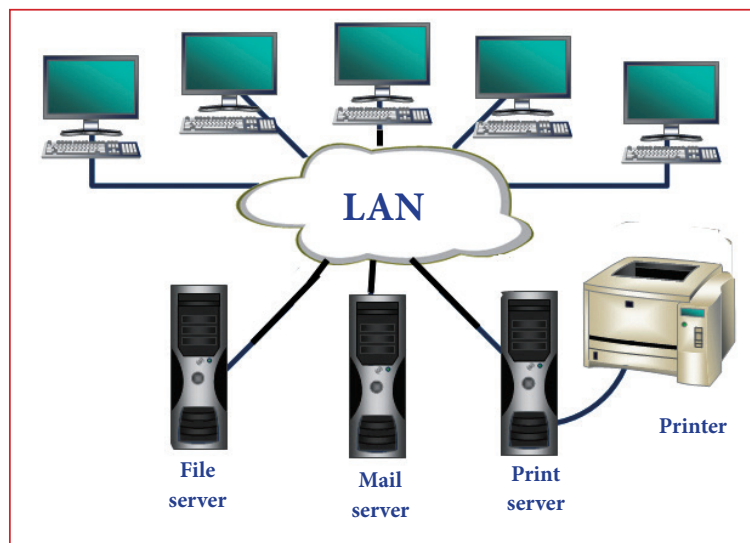- LAN offers high speed communication of data rates between 4 to 16 megabits per second (Mbps).

Figure 14.5 Local Area Network

Advantages of LAN

- In this network one can become a server serving all the remaining computers called **clients**. A Software can be stored on the server and it can be used by the remaining clients.

- Without internet access, it is possible to connect all the workstations in a building with each other locally.

- It is easy to share common resources like printers with LAN.

Metropolitan Area Network (MAN)

It is basically a bigger version of LAN. It is designed to extend over the entire city. MANs extend beyond 100 KM. MANs are usually owned by large organizations to interconnect its various branches across a city. MAN comprises combination of different hardware and transmission media. It can be single network such as a cable TV network, or it is a means of connecting a number of LANs into a larger network so that resources can be shared through LAN to LAN as well as device to device.
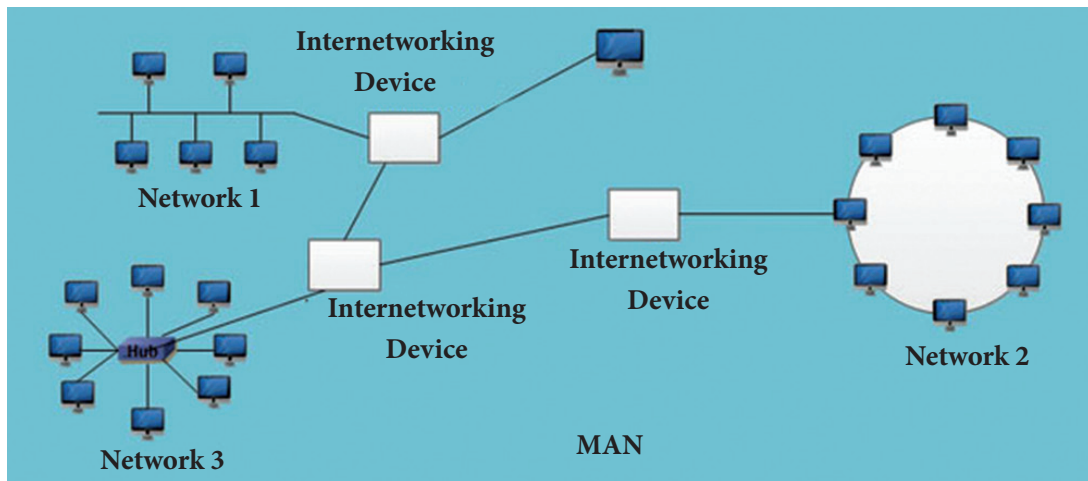
Figure 14.6 Metropolitan Area Network (MAN)

Advantages of MAN

- It is extremely efficient and provides fast communication via high-speed carriers, such as fibre optic cables.

- It provides a good back bone for large network and provides greater access to WANs.

- The dual bus used in MAN helps the transmission of data in both directions simultaneously.

- A MAN usually encompasses several blocks of a city or an entire city.

Wide area network (WAN)

A wide area network (WAN) is a telecommunication network. WANs connect LANs that may be on opposite sides of a building, across the country or around the world. Computers connected to a Wide Area Network are often connected through public networks, such as the telephone system. They can also be connected through leased lines or satellites. The largest WAN in existence is the Internet.
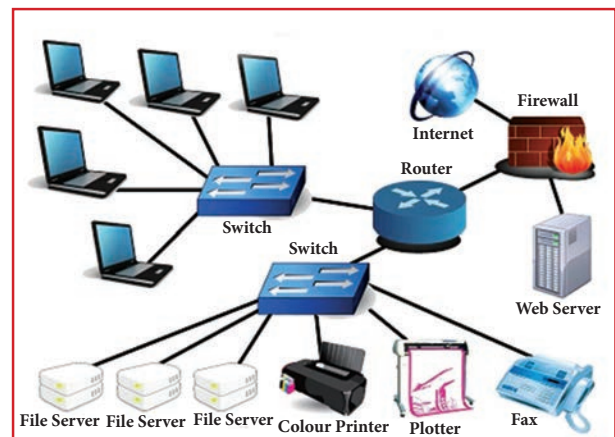

Figure 14.7 Wide area network

Advantages of WAN

- It covers a large geographical area.

- It shares software and resources with connecting workstations.

- Messages can be sent very quickly to anyone else on the network. These messages can have picture, sounds or data included with them (called attachments).

- Everyone on the network can use the same data. This avoids problems where some users may have older information than others.

280

14.4. Wired Technologies

The means through which data is transferred from one place to another is called transmission or communication media. There are two categories of transmission media used in computer communications.

- Wired/Bounded/Guided media

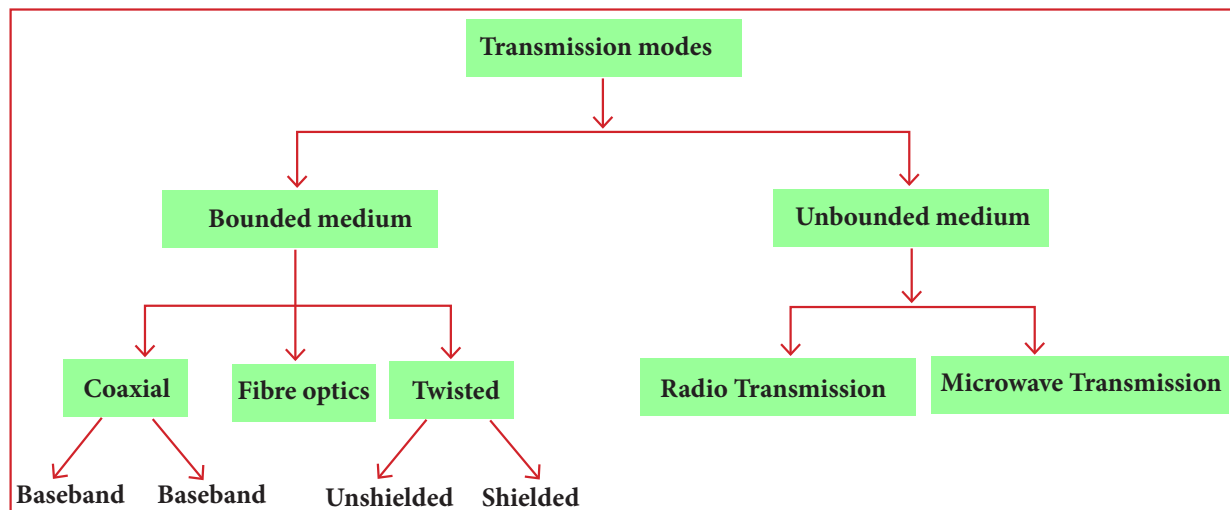- Wireless/Unbounded/Unguided media

Figure 14.8 Wired Technologies

Bounded/Guided Media

There are three common types of bounded media in the data transmission. They are

- Twisted-Pair Cable,

- Coaxial Cable, and

- Fibre-Optic Cable.

Twisted-pair and coaxial cable use metallic (copper) conductors that accept and transport signals in the form of electric current. Optical fibre is a cable that accepts and transports signals in the form of light.

14.4.1. Twisted Pair Cable

A twisted pair consists of two conductors (normally copper), each with its own plastic insulation, twisted together. One of these wires is used to carry signals to the receiver, and the other is used only as ground reference. In addition to the signal sent by the sender on one of the wires, interference (noise) and crosstalk may affect both wires and create unwanted signals.

Twisted Pair is of two types:

- Unshielded Twisted Pair (UTP)

- Shielded Twisted Pair (STP)

Unshielded Twisted Pair Cable
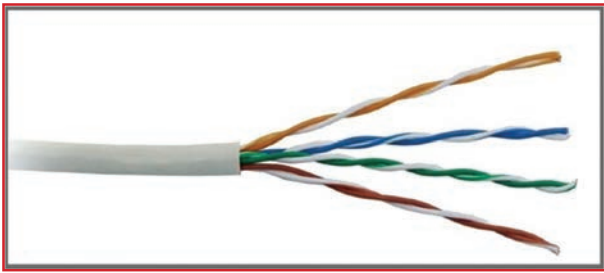
Figure 14.9 Unshielded Twisted Pair Cable

It consists of two insulating copper wires (1mm thick). The wires are twisted together in a helical form to reduce electrical interference from similar pair.

Advantages

- It has high speed capacity.
- Higher grades of UTP are used in LAN technologies like Ethernet.

Shielded Twisted Pair Cable

This cable has a metal foil or braided-mesh. Electromagnetic noise penetration is prevented by metal casing. Shielding also eliminates crosstalk. It is faster than unshielded and coaxial cable.
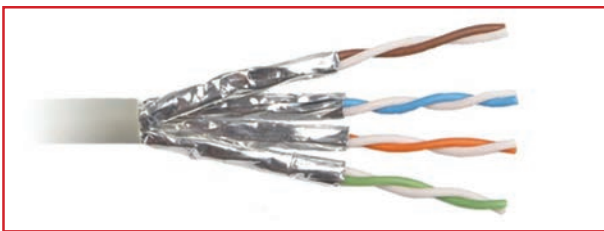

Figure 14.10 Shielded Twisted Pair

Advantages

- It can be used for Analog or Digital transmission
- It increases the signalling rate.
- It eliminates crosstalk.

Coaxial Cable

- Coaxial is called by this name because it contains two conductors that are parallel to each other.
- Copper is used in this as a central conductor. It is surrounded by PVC installation.
- Outer metallic wrapping is used as a shield against noise and as a second conductor which completes the circuit.
- The outer conductor is also encased in an insulating sheath. The outermost part is the plastic cover which protects the whole cable.
- The most common coaxial standards are:
  - 50-Ohm RG-7 or RG-11 : used with thick Ethernet.
  - 50-Ohm RG-58 : used with thin Ethernet
  - 75-Ohm RG-59 : used with cable television
  - 93-Ohm RG-62 : used with ARCNET.
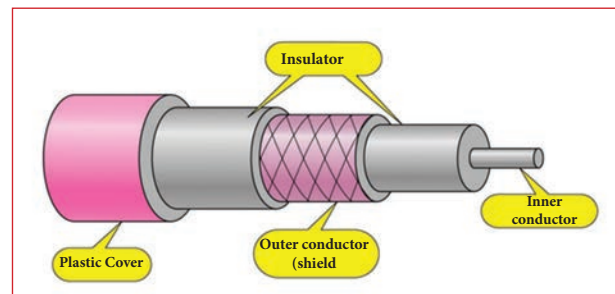
Figure 14.11 Coaxial Cable

Advantages

- It is used in long distance telephone lines.
- It transmits digital signals at a very high rate of 10Mbps.
- It has higher noise immunity.
- It transmits data without distortion.

- This can span longer distance at higher speeds as they have better shielding when compared to twisted pair cable.

Fiber Optical Cable

A fibre-optical cable is made of glass or plastic and transmits signals in the form of light. In fibre optical cable, light moves only in one direction. For two way communication to take place a second communication must be made between the two devices. Optical fibres use reflection to guide light through a channel. A glass or plastic core is surrounded by a cladding of less dense glass or plastic. The difference in density of the two materials must be such that a beam of light moving through the core is reflected off the cladding instead of being refracted into it.
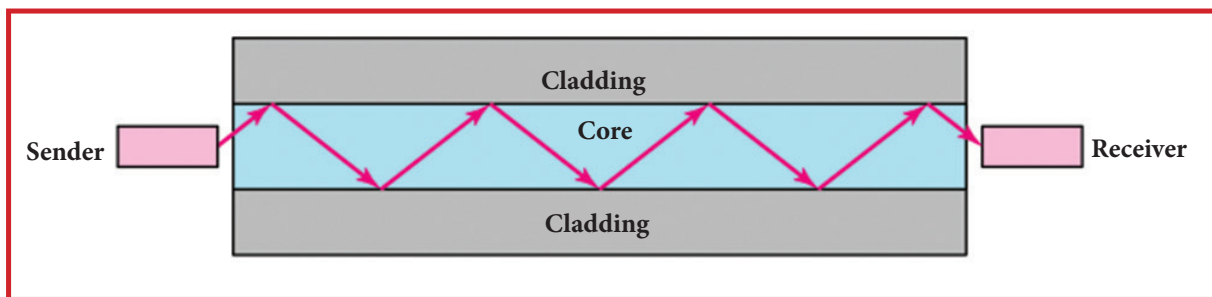

Figure 14.12 Fibre-Optical Cable

Fibre-Optic Cable Connectors

There are three types of connectors for fibre-optic cables, as shown in the figure below.
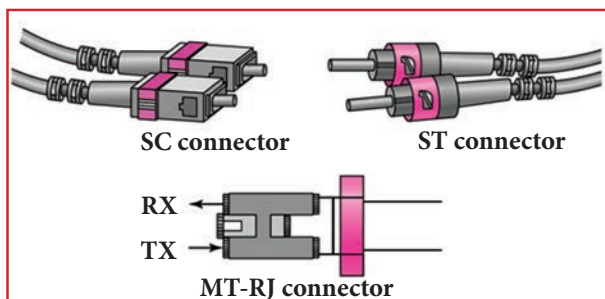
Figure 14.13 Fibre-Optical Cable Connectors

The Subscriber Channel (SC) connector is used for cable TV. It uses push/pull locking system. The Straight-Tip (ST) connector is used for connecting cable to the networking devices. The MT-RJ connector utilizes two fibres and integrates them into a single design that looks similar to an RJ45 modular connector.

Advantages

Fibre optic has several advantages over metallic cable:

- It is resistant to corrosion.
- It shows greater immunity to tapping.

Workshop-3

Go to your Computer laboratory. Identify the type of wired technology applicable there. Write a report on using the same.

14.5. Wireless Technologies

Wireless communication plays a significant role in day to day life. The term wireless refers to the communication or transmission of information over a distance without requiring wires, cables or any other electrical conductors.

The Communication is set and the information is transmitted through

electromagnetic waves like radio frequencies, infrared, satellite, etc., in a wireless communication technology network.

Types of Wireless Communication Technologies

The devices used for wireless communication are cordless telephones, mobiles, GPS units, wireless computer parts, and satellite television.

14.5.1.Bluetooth

It is named after a Danish king named Harald Bluetooth. Bluetooth is used to connect different electronic devices wirelessly to a system for transferring and sharing data. Cell phones are connected to hands-free earpieces, wireless keyboard, mouse and mike to laptops with the help of Bluetooth as it transmits information from one device to other device.

Figure 14.14 Bluetooth Technology

Infrared

Infrared technology is a type of wireless communication technology to transfer data between two infrared enabled

devices through infrared radiation. This technology plays a very important role in wireless data communication. Infrared is used in devices such as the mouse, wireless keyboard and printers.

Unlike Wi-Fi and Bluetooth technologies, infrared network signals cannot penetrate walls or other obstructions and work only with a direct line of sight.

Due to its short-range communication system, the use of an infrared communication system in one room will not be affected by the use of another system in the next room. This is why using an infrared TV remote control in our home will not interfere with the use of our neighbour's infrared TV remote control.

DO YOU KNOW? They also operate in diffuse mode, also called scatter mode. This means that the source and destination are not directly visible to each other. An example is a television remote-control box. The box does not have to be pointed directly at the set, although the box must be in the same room as the set, or just outside the room with the door open.

DO YOU KNOW? Line-of-sight transmission is a characteristic of electro magnetic radiation which means waves will travel in a direct path from the source to the receiver.
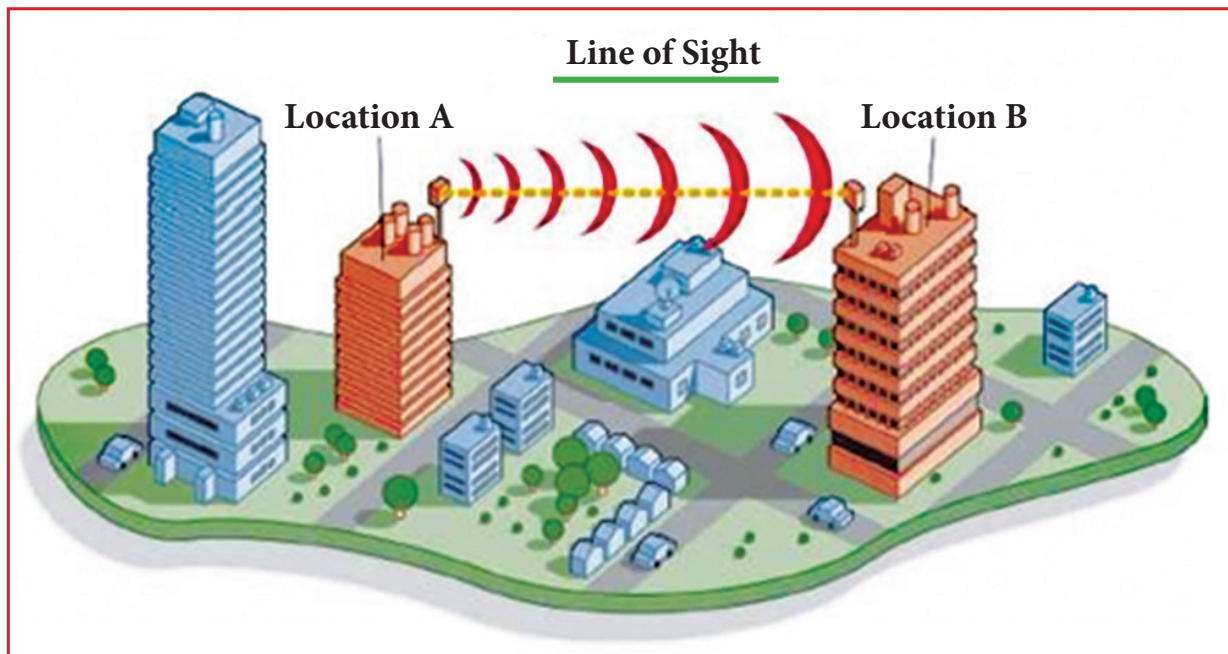
Figure 14.15 Line of Sight

Wi-Fi

Wi-Fi is a low-cost wireless communication technology. A WiFi setup consists of a wireless router which serves a communication hub, linking portable device with an internet connection. This network facilitates connection of many devices depending on the router configuration. These networks are limited in range due to the low power transmission, allowing the user to connect only in the close proximity.

Figure 14.16 wifi

DO YOU KNOW? Bluetooth is designed to connect two devices directly together by pairing them so they can communicate, usually for the purposes of relaying information (like sound or instructions) from one device to the other. The distance to which they will be able to connect is only short, usually several feet, while the range of Wi-Fi is greater.

Wi-Fi is generally used to connect many devices to one central device, typically a Wi-Fi enabled router, most often for the purposes of accessing the Internet. Wi-Fi is considered more stable and performs better when connecting for longer periods of time and transferring larger amounts of data.

Radio link

- A radio link is a wireless connection (also called wireless Point-to-Point connection) between two nodes, or

radio units, in a data network.

- Each radio unit consists of a transceiver (a device that can both send and receive communication) and a highly directive antenna. The antenna only emits or receives power in the direction it is pointing.

- The two radio units are mounted and are directed towards each other with no obstacles, such as buildings, in between them that can hinder or disturb the transmission.

- As the connection is very directive it enables very high signal to noise ratio and thereby high data rates.

- The primary downside is that radio links require direct so called line-of-sight for optimum performance. Compared to fibre the connection is less stable as bad weather can interrupt the connection, in particular at higher frequencies.

Microwave Link

- Microwave is a line-of-sight wireless communication technology that uses high frequency beams of radio waves to provide high speed wireless connections that can send and receive voice, video and data information.

- One of the reasons microwave links are so adaptable is that they are broadband.

- They require no equipment or facilities between the two terminal points, so installing a microwave link is often faster and less costly than a cable connection.

- Microwaves are also able to penetrate rain, fog and snow, which means bad weather doesn't disrupt transmission.

Satellite link

- Satellite communication is one of the wireless technologies, used to transfer the signals from the transmitter to a receiver with the help of satellites.

- It is widely spread all over the world allowing users to stay connected virtually anywhere on the Earth.

- The Satellites used in this mode of communication, communicate directly with the orbiting satellites via radio signals.

- The process of satellite communication begins at an earth station. Here an installation is designed to transmit and receive signals from a satellite in orbit around the earth.

- The transmission system from the earth station to the satellite through a channel is called the **uplink**. The system from the satellite to the earth station through the channel is called the **downlink**.

Workshop-4
Identify the ways of pairing a mobile phone with other one using Bluetooth technology.

14.6. Network devices

Network devices are components used to connect computers or other electronic devices together so that they can share files or resources.

14.6.1. Hub

It is a common connection point for devices in a network. It joins together the workstations, printers, and servers on a network to communicate with each other. Each hub has a number of ports that connect it to the other devices via a network cable. A hub connects all the devices on its ports together. When data arrives at one port, it is sent to the other ports so that all the devices can see all the information, commonly called **packets**.
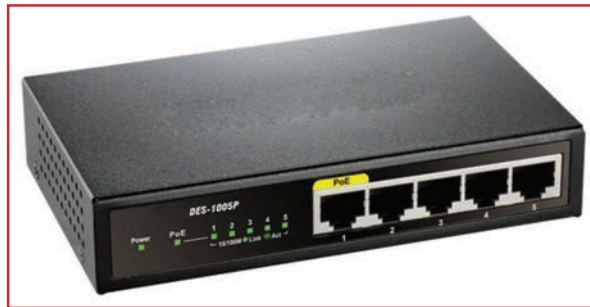
Figure 14.17 Hub

Switch

A **switch** is a hardware device that filters and forwards network packets. A network switch also connects computers to each other, like a hub. When a switch receives a packet of data, it determines what computer or device the packet is intended for and sends it to that computer only. It does not broadcast the packet to all computers as a hub. For this reason alone, switches are usually preferred over a hub.

Figure 14.18 Switch

Repeater

Repeaters remove the unwanted noise in an incoming signal. It increases a signal's strength, so it can be transmitted and received over a greater distance without loss in quality. Network repeaters receive and retransmit incoming electrical, wireless or optical signals.

Whenever a repeater receives a signal through one of its ports, it repeats or sends the incoming signal onto the other port. Its main use is to amplify and regenerate signals.
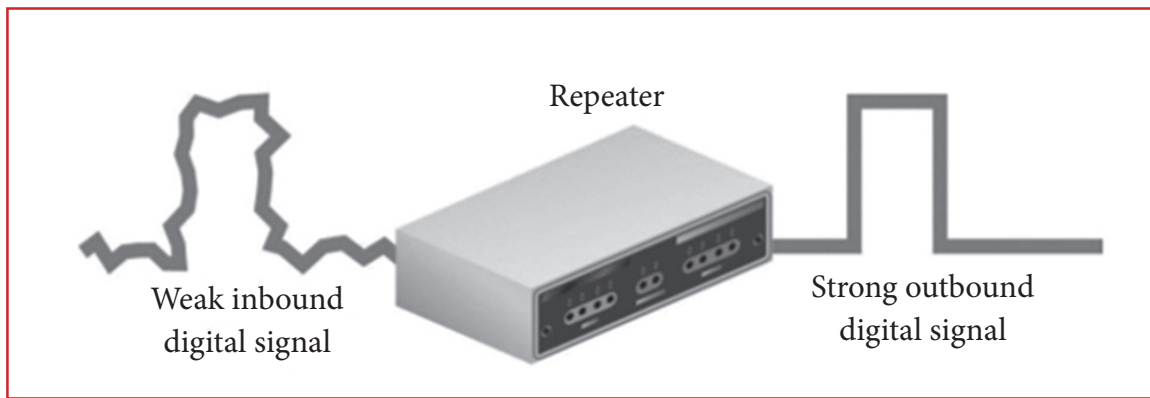
Figure 14.19 Repeater

Gateway

A network gateway joins two networks so the devices on one network can communicate with the devices on another network. Gateways serve as the entry and exit point of a network. For basic Internet connections at home, the gateway is the Internet Service Provider that gives you access to the entire Internet.

A gateway is often associated with a router. Routers can be gateways because a router can control the path through which information is sent in and out.

The default gateway is the machine IP number that you need to access to get to the rest of the network or the Internet.

Figure 14.20 Gateway

14.7. Identifying computers and users over a network

14.7.1. Basic concept of domain name

- A domain name is a unique name that identifies a website. Each website has a domain name that serves as an address, which is used to access the website. For example, "google. com" is a domain name.

- Whenever you visit a website, the domain name appears in the address bar of the web browser. Some domain names are preceded by "www" (which is not part of the domain name), while others omit the "www" prefix.

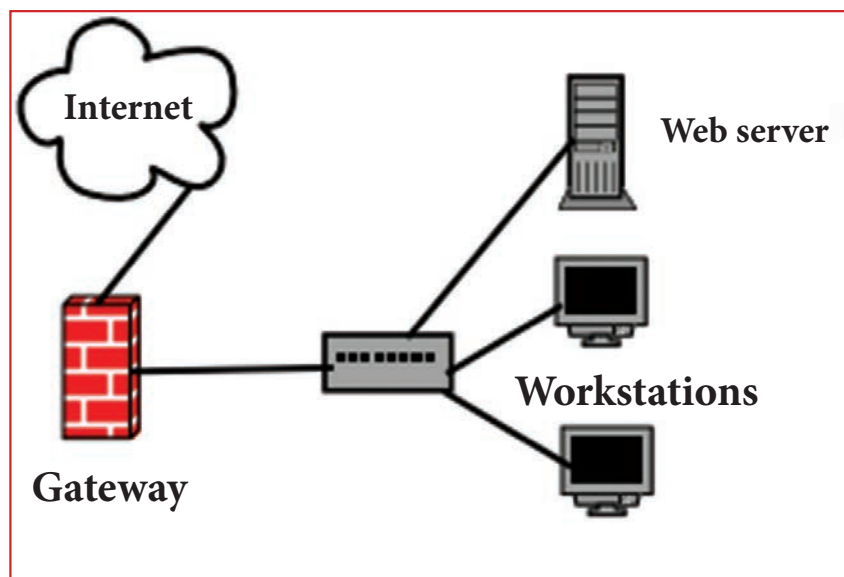- All domain names have a domain suffix, such as .com, .net, or .org. The domain suffix helps identify the type of website the domain name represents. There are only a limited number of such domains. For example:

  - gov - Government agencies

  - edu - Educational institutions

  - org - Organizations (nonprofit)

  - mil - Military

  - com - commercial business

  - net - Network organizations

  - ca - Canada

  - th - Thailand

Domain names are relatively cheap to register, though they must be renewed every year or every few years. Anyone can register a domain name, so you can purchase a unique domain name for your blog or website.

> **DO YOU KNOW?** When you access a website, the domain name is actually translated to an IP address, which defines the server where the website is located. This translation is performed dynamically by a service called DNS.

MAC Address

- MAC stands for "Media Access Control".

- A MAC address is a hardware identification number that uniquely identifies each device on a network.

IP address

- IP stands for "Internet Protocol." An IP address, is a unique address that identifies a device on the Internet or a local network.

> **DO YOU KNOW?** A valid IP address must be in the form of xxx.xxx.xxx.xxx, where xxx is a number from 0-255. IPv6 is the sixth revision to the Internet Protocol and the successor to IPv4. It functions similarly to IPv4 in that it provides the unique, numerical IP addresses necessary for Internet-enabled devices to communicate. it utilizes 128-bit addresses. IPv4 uses 32 bits for its Internet addresses.

> **Workshop-5**
> Write down the IP address of the PCs used in your computer laboratory.

14.8. Wireless/Mobile Communication

Wireless communications is a type of data communication that is performed and delivered wirelessly. This is a broad term that incorporates all procedures and forms of connecting and communicating between two or more devices using a wireless signal through wireless communication technologies and devices.

14.8.1. GSM (Global System for Mobile Communication)

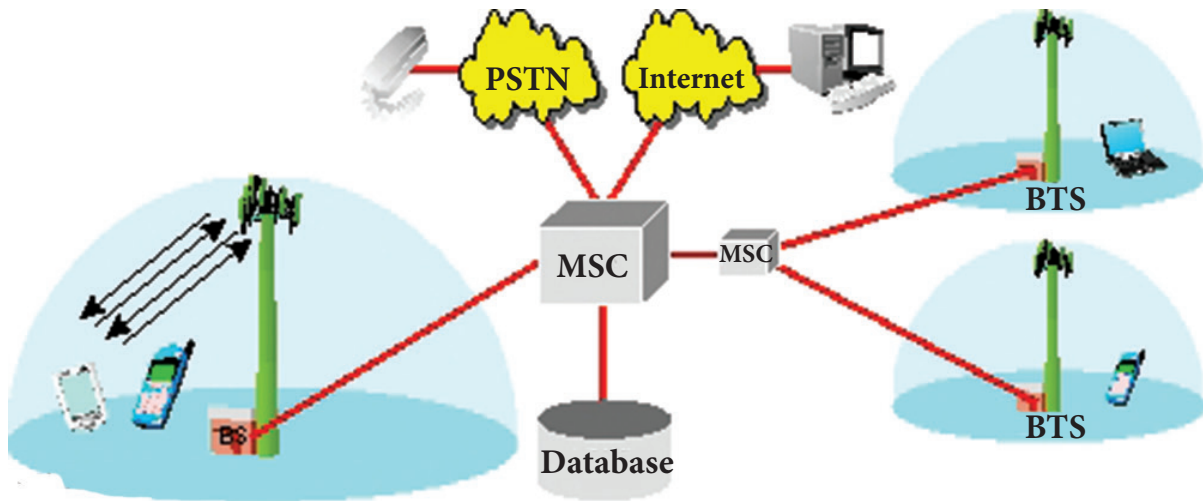The Global System for Mobile Communications (GSM) is a second generation (2G) standard for mobile networks.

Figure 14.21 GSM Block Diagram

In the early 1980s, a group was formed by the European Telecommunications Standards Institute (ETSI) to develop a digital mobile communication system. Aptly named Groupe Speciale Mobile (GSM), its main task was to develop a single, consistent network for all of Europe and come up with a better and more efficient technical solution for wireless communication.

> **DO YOU KNOW?** The GSM standard operates on three different carrier frequencies: the 900 MHz band, which was used by the original GSM system; the 1800 MHz band, which was added to support the swelling number of subscribers and the 1900 MHz frequency, which is used mainly in the U.S

CDMA (Code Division Multiple Access)

CDMA (Code-Division Multiple Access) refers to a protocol used in second-generation (2G) and third-generation (3G) wireless communications. Code Division Multiple Access (CDMA) is a sort of multiplexing that facilitates various signals to occupy a single transmission channel. It optimizes the use of available bandwidth. This technology is commonly used in ultra-high-frequency (UHF) cellular telephone systems, bands ranging between the 800-MHz and 1.9-GHz.

GPRS (General Packet Radio Service)

General Packet Radio Service (GPRS) is a packet-switching communications protocol for cellular networks. Mobile phones that have the GPRS technology can be used to receive data and information, such as web pages and email. GPRS is an "always on" technology which means that the mobile phone is always ready to receive data.

Other features supported by GPRS include:

- Short Message Service (SMS) – It is a special-purpose communication protocol designed for text messaging

- Multimedia Messaging Service (MMS) – It is an extension to SMS to enable transmission of videos in addition to text

- Wireless Application Protocol (WAP) – It is a specialized communication protocol for mobile browsers.

WLL (Wireless Local Loop)

WLL is a system that connects subscribers to the local telephone station wirelessly. Wireless local loop is used for wireless communication links which deliver plain old telephone services or broadband services to customers. This is an ideal application which provides telephone services remotely and is mostly used in developing countries where cable infrastructure is either expensive or speed is not fast. This wireless link can be a part of the connection between the subscribers and switch.

This system is based on radio networks which provide services like telephone in remote areas. Different types of wireless local loop include Broadband Wireless Access, Radio in the Loop, Fixed Radio Access and Fixed Wireless Access.

14.9. Internet Applications

14.9.1. SMS

SMS stands for Short Message Service. It is commonly referred to as "text messaging,". It is a service for sending short messages of up to 160 characters (224 characters if using a 5-bit mode) to mobile devices, including cellular phones, smartphones and PDAs.

Voice Mail System (VMS) and answering Machine

Voice mail system can be thought as a message box for phone user to store voice messages and retrieve it through telephone. User can divert all his calls to his voice mail system when he wishes so.

Figure 14.22 Voice Mail System

Main difference between answer machine and voice mail system is that voice

mail system is a centralized system where voice mail boxes are managed for many users, while answering machine is an independent individual system connected to a telephone line. Many telephone instrument comes with built-in answering machine.

Messages stored in answering machine is played back on the answering machine equipment, cannot be accessed remotely. But voice mail messages can be accessed, listened and managed from anywhere in the world through telephone line.

Answering machine is usually suitable for home use for single line, while voice mail system is more suitable for office use where there are multiple telephone connections as well as extensions through EPABX.

E-Mail

E-mail (electronic mail) is the exchange of computer-stored messages by telecommunication. E-mail messages are usually encoded in ASCII text. However, you can also send non-text files, such as graphic images and sound files, as attachments sent in binary streams. E-mail is one of the first uses of the Internet and is still the most popular one. A large percentage of the total traffic over the Internet is e-mail. E-mail can also be exchanged between online service provider users and in networks other than the Internet, both public and private.

Chat

Chat is a text-based communication that is live or in real-time. For example, when talking to someone in chat any typed text is received by other participants immediately.

Video Conferencing

A video conference is a live, visual connection between two or more people residing in separate locations for the purpose of communication. At its simplest, video conferencing provides transmission of static images and text between two locations. It provides transmission of full-motion video images and high-quality audio between multiple locations.

For example, a point-to-point (two-person) video conferencing system works much like a video telephone. Each participant has a video camera, microphone and speakers mounted on his or her computer. As the two participants speak to one another, their voices are carried over the network and delivered to the other's speakers and whatever images appear in front of the video camera appear in a window on the other participant's monitor.

Multipoint videoconferencing allows three or more participants to sit in a virtual conference room and communicate as if they were sitting right next to each other.

14.10. Network Security Concepts

14.10.1.Cyber Law

Cyber law is the part of the overall legal system that deals with the Internet, cyberspace, and their respective legal issues. Cyber law covers a fairly broad area including freedom of expression, access to and usage of the Internet and online privacy. Cyber law has been referred to as the Law of the Internet.

Figure 14.23 Cisco Hardware Firewall

A firewall is a network security system, either hardware- or software-based, that uses rules to control incoming and outgoing network traffic. A firewall acts as a barrier between a trusted network and an untrusted network.

Cookies

Cookies are small files which are stored on a user's computer. They are designed to hold a modest amount of data specific to a particular client and website, and can be accessed either by the web server or the client computer.

Hacking

Computer hacking refers to the practice of modifying or altering computer software and hardware to accomplish a goal that is considered to be outside of the creator's original objective. Those individuals who engage in computer hacking activities are typically referred to as "hackers."

Crackers

A cracker is someone who breaks into someone else's computer system, often on a network; bypasses passwords or licenses in computer programs; or in other ways intentionally breaches computer security.

Points to Remember:

- A computer network is an interconnection of various computers
- ARPANET was established by the Advanced Research Projects Agency (ARPA) in 1969
- World Wide Web was created by Timothy Berners Lee in 1989 at CERN in Geneva.
- Web page is a document available on World Wide Web
- Web Browser is an application software that allows us to view and explore information on the web
- Web server is a computer where the web content is stored. Basically web server is used to host the web sites
- Internet is a world-wide global system of interconnected computer networks.

- Network Topology is the schematic description of a network arrangement, connecting various nodes (sender and receiver) through lines of connection.
- A personal area network, or PAN, is a computer network that enables communication between computer devices
- A Local Area Network is a privately owned computer network covering a small Networks geographical area, like a home, office, or groups of buildings e.g. a school Network
- MANs are usually owned by large organizations to interconnect its various branches across a city.
- Computers connected to a Wide Area Networks are often connected through public networks
- A fibre-optic cable is made of glass or plastic and transmits signals in the form of light.
- The term wireless refers to the communication or transmission of information over a distance without requiring wires, cables or any other electrical conductors.
- Bluetooth is used to connect different electronic devices wirelessly to a system for transferring and sharing data.
- Infrared technology is a type of wireless communication technology to transfer data between two infrared enabled devices through infrared radiation.
- A WiFi setup consists of a wireless router which serves a communication hub, linking portable device with an internet connection.
- Hub is a common connection point for devices in a network.
- A switch is a hardware device that filters and forwards network packets.
- Repeaters remove the unwanted noise in an incoming signal.
- Gateways serve as the entry and exit point of a network.
- A domain name is a unique name that identifies a website.
- MAC stands for "Media Access Control" Address.
- IP stands for "Internet Protocol." An IP address, is a unique address that identifies a device on the Internet or a local network.
- Wireless communications is a type of data communication that is performed and delivered wirelessly.
- The Global System for Mobile Communications (GSM) is a second generation (2G) standard for mobile networks.
- CDMA (Code-Division Multiple Access) refers to a protocol used in second-generation (2G) and third-generation (3G) wireless communications.
- General Packet Radio Service (GPRS) is a packet-switching communications protocol for cellular networks.
- WLL is a system that connects subscribers to the local telephone station wirelessly.
- Voice mail system can be thought as a message box for phone user to store voice

messages and retrieve it through telephone.
- A video conference is a live, visual connection between two or more people residing in separate locations for the purpose of communication.
- Cyber law is the part of the overall legal system that deals with the Internet, cyberspace, and their respective legal issues.
- A firewall is a network security system, either hardware- or software-based, that uses rules to control incoming and outgoing network traffic.
- Cookies are small files which are stored on a user's computer.
- A cracker is someone who breaks into someone else's computer system

Activity

Student Activity

1. Identify the type of network in your computer lab.

2. Analyse the type of wired technologies in the computer lab.

3. Prepare a report on the types of cables used in your school. (Include the image of the cables in the report)

4. How will you change your computer's IPv4 address? Write the steps.

5. Identify 10 domain names of famous educational websites.

Activity

Teacher Activity

1. The teacher should make the students to go to the lab for explaining the following concepts:

    a. Network Topologies

    b. Types of Networks

    c. Wired Technologies

    d. Wireless Technologies

    e. Network devices

2. The teacher can prepare a PPT for the same and explain the concepts.

3. The teacher can make use of real objects like types of cables, network devices to explain those concepts.

4. The teacher should demonstrate how to set/change the IPv4 address.

Evaluation

Answer the correct answer

1. Which one of the following is not used in media access control?
    A) ethernet   B) digital subscriber line
    C) fiber distributed data interface D) none of the mentioned

2. Which is the first network used to exchange information?
    A) CNNET   B) NSFNET   C) ASAPNET   D) ARPANET

3. Which of the following type of network contains Bluetooth as its example?
    A) personal area network   B) local area network
    C) virtual private network   D) none of the mentioned

4. Identify the device that forwards packets between networks by processing the routing information included in the packet.
    A) bridge   B) firewall   C) router   D) all of the mentioned

5. Your company has a LAN in its downtown office and has now set up a LAN in the manufacturing plant in the suburbs. To enable everyone to share data and resources between the two LANs, what type of device(s) are needed to connect them? Choose the most correct answer.
    A) Modem   B) Cable   C) Hub   D) Router

6. Identify the data communication system within a building or campus.
    A) LAN   B) WAN   C) MAN   D) None of the mentioned

7. Identify the twisted pair cable in which metal casing improves penetration of noise or crosstalk.
    A) insulated twisted pair cable   B) Shielded twisted pair cable
    C) Unshielded twisted pair cable   D) Both A & B

8. ASCII stands for ------------------------------
    A) American Standard Code for Information Interchange
    B) American Scientific Code for International Interchange
    C) American Standard Code for Intelligence Interchange
    D) American Scientific Code for Information Interchange

9. Read the statements and identify the correct option.
    Statement A: Voice mail system is a centralized system where voice mail boxes are managed for many users.
    Statement B: voice mail messages can be accessed, listened and managed from anywhere in the world through telephone line.
    A) Statement A is correct   B) Statement B is correct
    C) Both the statements are correct   D) None of them

10. Identify the network security system that uses rules to control incoming and outgoing network traffic.

    A) Firewall   B) Cookies   C) Hacking   D) Crackers

Part II

Answer to all the questions (2 Marks)

1. Define Computer network.
2. What is electronic commerce?
3. What is spamming?
4. What do you understand by the term node in computer networks?
5. Differentiate 3G and 4G communication.

Part III

Answer to all the questions (3 Marks)

1. Differentiate Web page, Web browser and a Web Server.
2. Switches are usually preferred over a hub. Why?
3. Write short notes on the following: a) Hub b) Switch c) Gateway
4. Draw an outline for the following: a) Coaxial Cable   b) Fiber Optic Cable
5. Write the specific functions of a) Subscriber Channel (SC)   b) Straight-Tip (ST) c) MT-RJ   connector

Part IV

Answer to all the questions (5 Marks)

1. Define Topology. Explain different topologies using schematic diagram.
2. Explain the types of computer networks based on its size, distance and the structure.
3. Define wired technology. Explain the common types of bounded media in the data transmission.
4. Mention the types of wireless technologies we are using. Write in brief on each of them.
5. Explain the applications of internet.

References:

Web links

1. http://www.studytonight.com/computer-networks/types-of-networks
2. http://ecomputernotes.com/computernetworkingnotes/computer-network/how-many-type-of-computer-networking
3. https://www.tutorialspoint.com/internet_technologies/web_pages.htm
4. https://edurev.in/studytube/Chapter-8-COMMUNICATION-AND-ETWORK-CONCEPTS--Chapter-Notes--Class-12--Computer-Science/7e0d2043-f861-4e90-9a9c-5f5b800fb2c0_t
5. https://www.kv1armapur.org/admin/downloads/778624158xii-computer-networking-sumita-arora-solved-assignment-informatics-practices_(1).pdf.
6. https://www.lifewire.com/what-is-3g-service-577592
7. https://www.lifewire.com/what-is-4g-wireless-577577

Routers	Routers are small electronic devices that join multiple computer networks together via wired or wireless connections.
World Wide Web (www)	The World Wide Web is an information space where documents and other web resources are identified by Uniform Resource Locators (URLs).
MILNET	Military network was the name given to a network that split off from ARPANET in 1983 to create an internetwork designated for use by the U.S. Department of Defense. MILNET later became part of the DoD Defense Network (DDN).
NSFNET	The National Science Foundation Network (NSFNET) was a program of coordinated, evolving projects sponsored by the National Science Foundation (NSF).
HTTP	HTTP (Hypertext Transfer Protocol) is the set of rules for transferring files (text, graphic images, sound, video, and other multimedia files) on the World Wide Web.
MTRJ Connector	MT-RJ stands for Mechanical Transfer Registered Jack. MT-RJ is a fiber-optic Cable Connector that is very popular for small form factor devices due to its small size.
RJ 45 Connector	A registered jack (RJ) is a standardized physical network interface for connecting telecommunications or data equipment. RJ 45 is an 8-pin/8-position plug or jack and is commonly used to connect computers onto Ethernet-based local area networks (LAN).
GSM (Global System for Mobile Communication)	GSM (Global System for Mobile Communications) is a standard developed by the European Telecommunications Standards Institute (ETSI)
wireless communication.	Wireless communication, is the transfer of information or power between two or more points that are not connected by an electrical conductor. The most common wireless technologies use radio waves.
CDMA (Code Division Multiple Access)	Code-division multiple access (CDMA) is a channel access method used by various radio communication technologies.
GPRS (General Packet Radio Service)	General Packet Radio Service (GPRS) is a packet oriented mobile data service on the 2G and 3G cellular communication system's global system for mobile communications(GSM).