

## UNIT 5 : COMMUNICATION AND NETWORK CONCEPTS

### Network

- The collection of interconnected computers is called a computer network.
- Two computers are said to be interconnected if they are capable of sharing and exchanging information.

### Need

- Resource Sharing
- Reliability
- Cost Factor
- Communication Medium

**Resource Sharing** means to make all programs, data and peripherals available to anyone on the network irrespective of the physical location of the resources and the user.

**Reliability** means to keep the copy of a file on two or more different machines, so if one of them is unavailable (due to some hardware crash or any other) then its other copy can be used.

**Cost factor** means it greatly reduces the cost since the resources can be shared

**Communication Medium** means one can send messages and whatever the changes at one end are done can be immediately noticed at another.

### Evolution of Networking

1. **ARPANET**: In 1969, The US govt. formed an agency named ARPANET (Advanced Research Projects Agency NETWORK) to connect computers at various universities and defense agencies. The main objective of ARPANET was to develop a network that could continue to function efficiently even in the event of a nuclear attack.
2. **Internet (INTERconnection NETWORK)**: The Internet is a worldwide network of computer networks. It is not owned by anybody.
3. **Interspace**: InterSpace is a *client/server* software program that allows multiple users to communicate online with real - time audio, video and text chat in dynamic 3D environments.

### SWITCHING TECHNIQUES

Switching techniques are used for transmitting data across networks.

**Different types are :**

1. **Circuit Switching**: In the Circuit Switching technique, first, the complete end-to-end transmission path between the *source and the destination* computers is established and then the message is transmitted through the path. The main advantage of this technique is guaranteed delivery of the message. Mostly *used for voice communication*.
2. **Message Switching**: In the Message switching technique, *no physical path* is established *between sender and receiver* in advance. This technique follows the store and forward mechanism.
3. **Packet Switching**: In this switching technique *fixed size of packet* can be transmitted across the network.

Comparison between the Various Switching Techniques: Criteria	Circuit Switching	Message Switching	Packet Switching
Path established in advance	Yes	No	No
Store and forward technique	No	Yes	Yes
Message follows multiple routes	No	Yes	Yes

## DATA COMMUNICATION TERMINOLOGIES

**Data channel :-** The information / data carry from one end to another in the network by channel.

**Baud & bits per second (bps) :-** It's used to measurement for the information carry of a communication channel.

**Measurement Units :- bit**

**1 Byte= 8 bits**

**1 KBPS ( Kilo Byte Per Second)= 1024 Bytes**

**1 Kbps (kilobits Per Second) = 1024 bits**

**1 Mbps ( Mega bits Per Second )=1024 Kbps**

**Bandwidth :-** It is amount of information transmitted or receives per unit time.

### **Transmission media:**

**1. Twisted pair cable:** - It consists of two identical 1 mm thick copper wires insulated and twisted together. The twisted pair cables are twisted in order to reduce crosstalk and electromagnetic induction.

#### **Advantages:**

- (i) It is easy to install and maintain.
- (ii) It is very inexpensive

#### **Disadvantages:**

- (i) It is incapable to carry a signal over long distances without the use of repeaters.
- (ii) Due to low bandwidth, these are unsuitable for broadband applications.

**2. Co-axial Cables:** It consists of a solid wire core surrounded by one or more foil or braided wire shields, each separated from the other by some kind of plastic insulator. It is mostly used in the cable wires.

#### **Advantages:**

- (i) Data transmission rate is better than twisted pair cables.
- (ii) It provides a cheap means of transporting multi-channel television signals around metropolitan areas.

#### **Disadvantages:**

- (i) Expensive than twisted pair cables.
- (ii) Difficult to manage and reconfigure.

**3. Optical fiber:** - An optical fiber consists of thin glass fibers that can carry information in the form of visible light.

#### **Advantages:**

- (i) Transmit data over long distance with high security.
- (ii) Data transmission speed is high
- (iii) Provide better noise immunity (iv) Bandwidth is up to 10 Gbps.

#### **Disadvantages:**

- (i) Expensive as compared to other guided media.
- (ii) Need special care while installation?

**4. Infrared:** - The infrared light transmits data through the air and can propagate throughout a room, but will not penetrate walls. It is a secure medium of signal transmission. The infrared transmission has become common in TV remotes, automotive garage doors, wireless speakers etc.

**5. Radio Wave:** - Radio Wave an electromagnetic wave with a wavelength between 0.5 cm and 30,000m. The transmission making use of radio frequencies is termed as radio-wave transmission

**Advantages:**

- (i) Radio wave transmission offers mobility.
- (ii) It is cheaper than laying cables and fibers.
- (iii) It offers ease of communication over difficult terrain.

**Disadvantages:**

- (i) Radio wave communication is insecure communication.
- (ii) Radio wave propagation is susceptible to weather effects like rains, thunder storms etc.

**6. Microwave Wave:** - The Microwave transmission is a line of sight transmission. Microwave signals travel at a higher frequency than radio waves and are popularly used for transmitting data over long distances.

**Advantages:**

- (i) It is cheaper than laying cable or fiber.
- (ii) It has the ability to communicate over oceans.

**Disadvantages:**

- (i) Microwave communication is an insecure communication.
- (ii) Signals from antenna may split up and transmitted in different way to different antenna which leads to reduce to signal strength.
- (iii) Microwave propagation is susceptible to weather effects like rains, thunder storms etc. (iv) Bandwidth allocation is extremely limited in case of microwaves.

**7. Satellite link:** - The satellite transmission is also a kind of line of sight transmission that is used to transmit signals throughout the world.

**Advantages:**

- (i) Area covered is quite large.
- (ii) No line of sight restrictions such as natural mountains, tall building, towers etc.
- (iii) Earth station which receives the signals can be fixed position or relatively mobile.

**Disadvantages:-**

- (i) Very expensive as compared to other transmission mediums.
- (ii) Installation is extremely complex.
- (iii) Signals sent to the stations can be tampered by external interference.

**Network devices:**

**Modem:** A MODEM (MODulator DEModulator) is an electronic device that enables a computer to transmit data over telephone lines. There are two types of modems, namely, internal modem and external modem.

**RJ45 connector:** - The RJ-45(Registered Jack) connectors are the plug-in devices used in the networking and telecommunications applications. They are used primarily for connecting LANs, particularly Ethernet. **Ethernet Card:** - It is a hardware device that helps in connection of nodes within a network.

**Hub:** A hub is a hardware device used to connect several computers together. Hubs can be either active or passive. Hubs usually can support 8, 12 or 24 RJ45 ports.

**Switch:** A switch (switching hub) is a network device which is used to interconnect computers or devices on a network. It *filters and forwards* data packets across a network. The main difference between hub and switch is that hub replicates what it receives on one port onto all the other ports while switch keeps a record of the MAC addresses of the devices attached to it.

**Gateway:** A gateway is a device that *connects dissimilar* networks.

**Repeater:** A repeater is a network device that *amplifies and restores signals* for long distance transmission.

## Network Topologies and Types

### **Topology :**

□ Topology refers to the way in which the workstations attached to the network are interconnected in Local Area Network .

**The BUS Topology:** - The bus topology uses a common single cable to connect all the workstations. Each computer performs its task of sending messages without the help of the central server. However, only one workstation can transmit a message at a particular time in the bus topology.

#### **Advantages:**

- (i) Easy to connect and install.
- (ii) Involves a low cost of installation time.
- (iii) Can be easily extended.

#### **Disadvantages:-**

- (i) The entire network shuts down if there is a failure in the central cable.
- (ii) Only a single message can travel at a particular time.
- (iii) Difficult to troubleshoot an error.

**The STAR Topology:** - A STAR topology is based on a central node which acts as a hub. A STAR topology is common in homes networks where all the computers connect to the single central computer using it as a hub.

#### **Advantages:**

- (i) Easy to troubleshoot
- (ii) A single node failure does not affect the entire network.
- (iii) Fault detection and removal of faulty parts is easier.
- (iv) In case a workstation fails, the network is not affected.

#### **Disadvantages:-**

- (i) Difficult to expand.
- (ii) Longer cable is required.
- (iii) The cost of the hub and the longer cables makes it expensive over others.
- (iv) In case hub fails, the entire network fails.

**The RING : - In this each node is connected with two of its neighbouring nodes**

#### **Advantages:**

- (i) Eliminates network congestion (Traffic).
- (ii) cable length is minimum

#### **Disadvantages:**

- (ii) Requires a large amount of hardware components and hence is expensive.
- (iii) Installation and reconfiguration is very difficult.

### **Types of Networks:**

**LAN (Local Area Network):** A Local Area Network (LAN) is a network that is confined to a relatively small area. It is generally limited to a geographic area such as writing lab, school or building. It is generally privately owned networks over a distance not more than 5 Km.

**MAN (Metropolitan Area Network):** MAN is the networks cover a group of nearby corporate offices or a city and might be either private or public.

**WAN (Wide Area Network):** These are the networks spread over large distances, say across countries or even continents through cabling or satellite uplinks are called WAN.

**PAN (Personal Area Network):** A Personal Area Network is computer network organized around an individual person. It generally covers a range of less than 10 meters. Personal Area Networks can be constructed with cables or wirelessly.

## COMMUNICATION PROTOCOLS

Protocol: A protocol is a description of message formats and the rules that two or more machines must follow to exchange those messages. It provide standardized format for data packets, techniques for detecting and correcting errors and so on.

**Types of protocols are:**

1. **HTTP (Hypertext Transfer Protocol)** is the set of rules for transferring hypertext (i.e., text, graphic, image, sound, video, etc.) on WWW (World Wide Web). HTTP is a request/response standard between a client and a server. A client is the end-user; the server is the web site

2. **FTP (File Transfer Protocol)** is the standard for the exchange of files over the Internet. The objectives of FTP are:

To promote sharing of files (computer programs and/or data).

To encourage indirect or implicit use of remote computers

3. **TCP/IP (Transmission Control Protocol / Internet Protocol)**

**TCP** part is responsible for dividing the file or message into packets on the source computer. TCP is also responsible for reassembling the received packets at the destination computer.

**IP** part is responsible for handling the address of destination computer so that each packet is routed (sent) to its proper destination.

4. **SLIP/PPP: Serial Line Internet Protocol (SLIP)** is used for delivering IP packets over dial-up lines, and (PPP) Point to Point Protocol is used for transmitting the IP packets over serial lines.

**PPP** is the Internet Standard for transmission of IP packets over serial lines. The Point-to-Point Protocol (PPP) is currently the best solution for dial-up Internet connections

## WIRELESS/MOBILE COMPUTING

**Wireless communication** is simply data Mobile computing essentially refers to a communication without the use of landlines.

**Mobile computing** means that computing device is not continuously connected to the base or central network.

Wireless Vs.	Mobile	Examples
×	×	Stationary Computer
×	√	Notebook in a hotel
√	×	Wireless LANs in historic buildings
√	√	Smart phones, pagers

1. **GSM(Global System for Mobile communication):** it is leading digital cellular system. It has become the international standard in Europe, Australia and in many other countries. GSM users simply switch **subscriber identification module (SIM)** cards.SIM cards are small removable disks that slip in and out of GSM cell phones. GSM uses narrowband **TDMA** (Time Division Multiple Access), which allows eight simultaneous calls on the same radio frequency. It divides a radio frequency into time slots and then allocating slots to multiple calls. In this way, a single frequency can support multiple, simultaneous data channels.

**The SIM- Subscriber Identity Module-** is a chip card, the size of a first class postage stamp. It is a tiny computer chip that gives a cellular device its unique phone number.

- It has memory, processor.
- Capable to interact to interact with user.
- Have 16 to 64 kb of memory.
- Can store phone numbers, text messages and other data

2. **CDMA(Code Division Multiple Access):** it is a digital cellular technology that uses spread-spectrum techniques. CDMA does not assign a specific frequency to each user. Instead, every channel uses the full available spectrum. It uses a spread- spectrum technique where data is sent in small pieces over a number of distinct frequencies available for use. Each user's signal is spread over the entire bandwidth by unique spreading code. At the receiver end, the same unique code is used to recover the signal.

3. **WLL(Wireless in Local Loop) :** WLL is a system that connects subscribers to the public switched telephone network (PSTN) using radio signals as a substitute for other connecting media.

4. **GPRS (General Packet Radio Service):** is a technology for radio transmission of small packets of data especially between mobile devices and Internet.

1G, 2G, 2.5G, 3G, 4G networks, G refers to the "Generation" of wireless network Technology.

4G network is all about faster internet speed it offers no improvement in making calls or sending texts but very fast web-experience compared to 3G. Its downloadlink rates are over 100Mbps, low latency, very efficient spectrum use and low cost implementations.4G is also referred to by "**MAGIC**" which stands for Mobile multimedia, Any-where, Global mobility solutions over, integrated wireless and customized services.

5. **SMS : (Short Message Service)** SMS is the transmission of short text messages to and from a mobile phone, fax machine and IP address. Messages must be not longer than some fixed number of alpha-numeric characters and contain no images or graphics.

6. **Chat:** Online textual talk in real time, is called Chatting.

7. **Video Conferencing:** a two way videophone conversation among multiple participants is called video conferencing.

## 8. Protocols for chat and video conferencing:

Chat Protocol:

**IRC (Internet Relay Chat):** protocol is a simple, text based conferencing protocol, involving a number of users spread across a number of international servers. These users may chat with other individual users, or may chat with groups of users.

**Video-conferencing Protocol:**

1. **H.323:** H.323 is a standard that specifies the components, protocols and procedures that provide multimedia communication services - real-time audio, video, and data communications over packet-based networks.

2. **SIP (Session Initiation Protocol) :** is used to establish modify and terminate VOIP telephone calls. SIP works with both IPv4 and IPv6.

9. **VOIP (Voice over Internet Protocol) :** is a technology that enables voice communications over the Internet through the compression of voice into data packets that can be efficiently transmitted over data networks and then converted back into voice at the other end.

10. **Wi-Fi:** refers to Wireless Fidelity, which lets you connect to the internet without a direct line from your PC to the ISP.

**Wi-Fi Hotspots:** A hotspot is a venue that offers Wi-Fi access. The public can use laptop, Wi-Fi phone, or other suitable portable device to access the internet through a Wi-Fi Hotspot.

**EDGE(Enhanced Data rates for Global Evolution )** is a radio based high speed mobile data standard

## Internetworking Terms & Concepts

1. **WWW (World Wide Web):** is a set of protocol that allows you to access any document on the Internet. It specifies a way – HTTP (Hypertext Transfer Protocol) -to request and send a document over the Internet.

2. **Telnet:** Telnet is an Internet utility that lets you log onto remote computer system.

3. **Web Browser & Web Server:** A **Web Browser** is a WWW client that navigates through the World Wide Web and displays web pages. A **Web Server** is a WWW server that responds to the requests made by web browser.

4. **URL and Domain Names:** Uniform Resource Locator. URL specifies the distinct address for each resource(Page) on the Internet, - address is a address of the server. - path is a location of the file on the server. Eg: <http://kvsangathan.nic.in/ContactUs.aspx>

5. **Domain Name :** It is the address of a web site :

www. Kvsangathan.nic.in

6.

**Domain Name System:** The characters based naming system by which servers are identified is known as DNS (Domain Name System) instead of IP address.

An Internet address which is character based is called a **Domain Name**, such as com, org etc.

## Internet Servers and What they provide

Server	Protocol	Information It Provides
Mail	Post Office Protocol(POP) Version 3 and Simple Mail Transfer Protocol (SMTP)	Messages sent via electronic mail.
News	Network News Transfer Protocol (NNTP)	Newsgroups that are organized in a hierarchical structure.

## Some Most Common Domains

Domain ID	Affiliation	Remarks
com	Commercial	For commercial Firms
edu	Education	For education firms
gov	Government	For governmental organizations
org	Usually non-profit organizations	For NGOs and other no-profit

Some countries abbreviations are listed as:

Australia	au
Canada	ca
India	in
New Zealand	nz

**Web Page:** A location on a net server is called a **Web Site**. A document that uses HTTP is called a **Web Page**.

7. **Web Hosting:** Web Hosting is a means of hosting web-server application on a computer system through which electronic content on the Internet is readily available to any web browser client

8. **Web 2.0:** web 2.0 refers to added features and applications that make more interactive, support easy online-information exchange and interoperability. Some of features are blogs, wikis, video sharing websites, social networking sites, RSS etc.

**Example:** Facebook, Wordpress, Myspace, Twitter, Youtube, Flickr, etc.

9. **HTML(Hyper Text Markup Language):** Used to design the layout of a document and to specify the hyperlinks. It tells the browser how to display text, pictures and other support media. It supports multimedia and new page layout features. It provides may tags for control the presentation of information on the web pages, such as <body>, <li>, <hr> etc.

10. **XML (eXtensible Markup Language):** A markup language is a mechanism to identify structure in a document. XML defines a standard way to add markup to documents. It provides an ability to define tags and the structural relationship between them.

11. **DHTML (Dynamic HTML):** DHTML refers to web content that changes each time it is viewed. For example,

- Geographic location of the reader.
- Time of day
- Previous pages viewed by the reader
- Profile of the reader

It enables a web page to react to user input without sending request to web server. :

12. **Web Scripting:** The process of creating and embedding scripts in a web page is known as web-scripting.

A **script** is a list of commands embedded in web-page. Scripts are interpreted and executed by certain program.

Types of Scripts:-

(i) **Client Side Scripts:** - Client side scripts supports interaction within a webpage. E.g. VB Script, Java Script, PHP (PHP'S Hypertext Preprocessor).

(ii) **Server Side Scripts:** - Server side scripting supports execution at server - end. E.g. ASP, JSP, PHP

### Network Security Concepts:

#### **Protection Methods:**

For network security following protection methods are used :

1. **Authorization** : Determines whether the service provider has granted access to the web service to the requestor. Performed by asking the user a legal login-id.

2. **Authentication** : Ensures that each entity involved in using a web service is what it actually claims to be. Performed by asking the user to provide a valid password.

3. **Biometric systems** : Involve some unique aspect of a person's body such as finger-prints, retinal patterns etc. to establish user identity.

4. **Firewall** : System designed to prevent unauthorized access to or from a private network. Can be implemented in hardware, software or combination of both.

**Cookies:** A cookie is a message given to a web browser by a web server transmits to a Web browser so that the web server and keep track of the user's activity on a specific web site.

**Hackers and Crackers:** **Crackers** are the malicious programmers who break into secure systems whereas **Hackers** are more interested in gaining knowledge about computer systems and possibly using this knowledge for playful pranks.

**Cyber Law:** Cyber Law is a generic term, which refers to all the legal and regulatory aspects of Internet and World Wide Web.

**India's IT Act :** In India the cyber laws are contained in the Information Technology Act,2000 which was notified on 17 October 2000. The IT Act aims to provide the legal infrastructure for e-commerce in India by governing the transactions through the Internet and other electronic medium.

The Act was later amended in December 2008 through the IT Act. 2008. It provided additional focus on Information Security. It has added several new sections on offences including Cyber Terrorism and Data Protection.

**Cyber Crime:** is understood as an unlawful act where in the computer is either a tool or a target or both.

#### **Classification of Cyber Crime:**

1. Corrupt computer source documents.
2. Hacking.
3. Publishing of information, which is obscene in electronic form.
4. Accessing protected system.

#### **IRP Issues:**

The **Intellectual Property** may be defined as a product of the individual that has commercial value, including copyrighted property such as artistic works, and ideational property.

#### **Viruses:**

**Computer virus** is a malicious program which replicate and attach to other programs in order to corrupt the executable codes. Virus enters the computer system through an external source and become destructive

#### **Damage that Viruses Cause:**

- Can corrupt entire file system. , Create bad sector on a disk. , Decrease the space on hard disk by duplicating files.
- Can format the entire disk. , Cause the system to hang.

**Trojan Horses:** A Trojan horse is a code hidden in program such as a game or spreadsheet that looks safe to run but has hidden side effects. Such a program can also enter into the computer through an e- mail or free programs downloaded through the Internet.

A **worm** is self- replicating programs that do not create multiple copies of itself on one computer but propagate through the computer network. Worms log on to computer systems using the username and passwords and exploit the system

**Spam** refers to electronic junk mail or junk newsgroup postings. Unwanted e-mail

### **Virus Protection:**

- Write protect your disks. Use licensed software. Protect your PC with password. Make regular backups.
- Install and use antivirus software and keep it up to date.

### **OPEN SOURCE TERMINOLOGIES**

- Free Software:** The S/W's is freely accessible and can be freely used changed improved copied and distributed by all and no payments is needed to make for free.
- Open Source Software:** S/w whose source code is available to the customer and it can be modified and redistributed without any limitation .OSS may come free of cost but nominal charges has to pay nominal charges (Support of S/W and development of S/W).
- FLOSS (Free Libre and Open Source Software) :** S/w which is free as well as open source S/W. ( Free S/W + Open Source S/W).
- GNU (GNU's Not Unix) :** GNU project emphasize on the freedom and its objective is to create a system compatible to UNIX but not identical with it.
- FSF (Free Software Foundation) :** FSF is a non -profit organization created for the purpose of the free s/w movement. Organization funded many s/w developers to write free software.
- OSI (Open Source Initiative) :** Open source software organization dedicated to cause of promoting open source software it specified the criteria of OSS and its source code is not freely available.
- W3C(World Wide Web Consortium) :** W3C is responsible for producing the software standards for World Wide Web.
- Proprietary Software:** Proprietary Software is the s/w that is neither open nor freely available, normally the source code of the Proprietary Software is not available but further distribution and modification is possible by special permission by the supplier. . - Windows -10, Photoshop, Ms-Office, Tally ,
- Freeware:** Freeware are the software freely available , which permit redistribution but not modification (and their source code is not available). Freeware is distributed in *Binary Form(Machine Language)* (ready to run) without any licensing fees.
- Shareware:** Software for which license fee is payable after some time limit, its source code is not available and modification to the software are not allowed. (Demo Version)

### **OPEN SOURCE / FREE SOFTWARE**

- Linux :** Linux is a famous computer operating system . popular Linux server set of program - LAMP(Linux, Apache, MySQL, PHP) . . It is . free and open source software
- Mozilla :** Mozilla is a free internet software that includes
  - a web browser
  - an email client
  - an HTML editor
  - IRC client
- Apache server:** Apache web server is an open source web server available for many platforms such as Linux, and Microsoft Windows etc.

### **PHP**

- PHP stands for PHP:- Hypertext Preprocessor.
- No source code available It is used as server side program and developing dynamic web applications.

### **Cloud Computing**

The use network of remote servers hosted on the Internet to store, manage, and process data, rather than a local server or a personal computer.

#### **Benefits of cloud computing**

##### 1. Cost

Cloud computing eliminates the expense of buying hardware and software and setting up and running on-site Computer.

##### 2. Speed

Most cloud computing services are provided self service and on demand, so here amounts of computing resources can be provisioned in minutes, just a few mouse clicks.

##### 3. Global scale

The benefits of cloud computing services include the ability to scale elastically around the globe.

##### 4. Productivity

On-site data centers typically require a lot of “racking and stacking”—hardware set up, software and other time-consuming IT management. Cloud computing removes the need for many of these tasks.



## ABBREVIATIONS

- 1) PC → Personal computer
- 2) ARPANET → Advanced research projects agency Network
- 3) NSFnet → National science foundation (internet)
- 4) TCP/IP → Transmission control protocol/internet Protocol
- 5) NIU → Network interface unit
- 6) TAP → Terminal access point
- 7) NIC → Network interface card
- 8) bps → bits per second
- 9) kbps → kilo bytes per second
- 10) MHz → megahertz
- 11) LAN → Local area network
- 12) VGM → Voice grade medium
- 13) DGM → Data grade medium
- 14) UTP → Unshielded twisted Pair
- 15) STP → Shielded twisted cable
- 16) LED → Light emitting diode
- 17) PDAs → personal digital assistants
- 18) MANs → Metropolitan area networks
- 19) WANs → Wide area networks
- 20) PAN → Personal area network
- 21) WS → Workstations
- 22) A/F → Audio frequency
- 23) AM → Amplitude modulation
- 24) FM → Frequency modulation
- 25) PM → Phase modulation
- 26) RTS → Request to send
- 27) DSR → Data set ready
- 28) DTR → Data terminal ready
- 29) CTS → Clear to send
- 30) DTE → Data terminal equipment
- 31) DCE → Data communication equipment
- 32) CD → Carrier detect
- 33) RJ-45 → Registered jack-45
- 34) BNC → Bayonet-neill-concelman
- 35) AUI → Attachment unit interface
- 36) SNA → Systems network architecture
- 37) VFIR → very fast infrared
- 38) NFS → Network file system
- 39) HTTP → Hypertext transfer protocol
- 40) URI → Uniform resource identifier
- 41) URL → Uniform resource locator
- 42) URN → Uniform resource name
- 43) MIME → Multipurpose internet mail extensions
- 44) WWW → World wide web
- 45) FTP → File transfer protocol
- 46) SLIP → Serial line internet protocol
- 47) PPP → Point to point protocols
- 48) NCPs → network control protocols
- 49) LCP → Link control protocol
- 50) GUI → Graphical user interface
- 51) ISP → Internet service provider
- 52) GSM → Global system for mobiles
- 53) SIM → Subscriber identification module
- 54) TDMA → Time division multiple access
- 55) TDM → Time-division multiplexing
- 56) IDEN → Integrated digital enhanced network
- 57) CDMA → Code-division multiple access
- 58) WLL → Wireless in local loop (WiLL)
- 59) PSTN → Public switched telephone network
- 60) GPRS → General packet radio service
- 61) G → Generation (1G,2G,3G,4G)
- 62) CSD → Circuit-switched data
- 63) HDTV → High definition television
- 64) LTE → Long term evolution
- 65) SMS → Short message service
- 66) SMSC → Short message service CENTER
- 67) HLR → Home location register
- 68) IRC → Internet relay chat
- 69) SIP → Session initiation protocol
- 70) ITU → International telecommunications union
- 71) Wi-Fi → Wireless fidelity
- 72) BWA → Broadband wireless access
- 73) HTML → Hypertext markup language
- 74) DNS → Domain name system
- 75) POP → Post office protocol
- 76) SMTP → Simple mail transfer protocol
- 77) NNTP → Network news transfer protocol
- 78) XML → eXtensible markup language
- 79) DHTML → Dynamic HTML
- 80) PHP → Hypertext preprocessor
- 81) ASP → Active server pages
- 82) JSP → Java server pages
- 83) IE → Internet explorer
- 84) IT → Information technology
- 85) IP → Intellectual property
- 86) FAT → File allocation tables
- 87) UNCITRAL → United nation's commission for international trade related laws
- 88) MAGIC → Mobile multimedia, Any-where, Global mobility solutions over, integrated wireless and customized services
- 89) VoIP → Voice over Internet protocol
- 90) MODEM → MODulator DEModulator