

COMPUTER NETWORKS

A network is a set of devices (Often referred to as nodes) connected by communication links. A node can be a computer, printer, or any other device capable of sending and / or receiving data generated by other nodes on the network

⇒ DATA COMMUNICATIONS :

- ❖ Data Communications are the exchange of data between two devices via some form of transmission medium such as a wire cable.
- ❖ The effectiveness of a data communications system depends on four fundamental characteristics
 - 1) Delivery
 - 2) Accuracy
 - 3) Timeliness
 - 4) Jitter

⇒ COMPONENTS

- ❖ A data communications system has 5 components

- | | | |
|------------------------|-----------|-------------|
| 1) Message | 2) Sender | 3) Receiver |
| 4) Transmission Medium | | 5) Protocol |

⇒ DATA FLOW :

- ❖ Communication between two devices can be simplex, half-duplex or full-duplex
- ❖ **SIMPLEX :** In simplex mode, the communication is unidirectional. Only one of the two devices on a link can transmit ; the other can only receive
Eg : Keyboard and traditional monitors
The keyboard can only introduce input ; the monitor can only accept output.
The simplex mode can use the entire capacity of the channel to send data in one direction.
- ❖ **HALF-DUPLEX :** In half-duplex mode, each station can both transmit and receive, but not at the same time. The entire capacity of the channel can be utilized for each direction.
- ❖ **FULL DUPLEX :** In full-duplex mode (also called duplex), both stations can transmit and receive simultaneously. The capacity of the channel, however, must be divided between the two directions.

⇒ PHYSICAL STRUCTURES :

❖ TYPE OF CONNECTION :

- ❖ A network is two or more devices connected through links. A link is a communication pathway that transfers data from one device to another.

There are two possible types of connections :

Point - to - point and multipoint.

- ❖ **Point - to - point :** A point - to - point connection provides a dedicated link between two devices. The entire capacity of the link is reserved for transmission between those two devices. Most point-to-point connections use an actual length of wire or cable to connect two ends.

Even microwaves or satellite links are also possible.

- ❖ **Multi point :** A multipoint (also called multidrop) connection is one in which more than two specific devices share a single link.
 - The capacity of the channel is shared, either spatially or temporally.

- If several devices are use the link simultaneously, it is spatially shared connection.
- If users must take turns, it is a time-shared connection.

COMPONENTS OF A COMPUTER NETWORK : The communication between the two nodes is implemented and controlled by using many hardware (Physical) and Software (Logical or Programs) components in a Computer networks

HARDWARE COMPONENTS :

- ❖ Computer hardware
- ❖ Front End Processor (FEP)
- ❖ Terminals
- ❖ Modems, Connectors, Multiplexers
- ❖ Transmission media
- ❖ Data Switching equipment (Switches or routers) etc

SOFTWARE COMPONENTS :

- ❖ Operating system protocols
- ❖ File management systems
- ❖ Communication software
- ❖ Application software etc.

All the components of a computer network are coordinated to realize the functional of a meaningful communication between the nodes.

TOPOLOGIES : Physical or logical arrangement of the nodes in the network is called network topology.

BASIC TOPOLOGIES :

- ❖ **BUS TOPOLOGY :** All devices are connected to a central cable, called the bus or backbone.
- ❖ Bus topology is a multipoint one long cable acts as a backbone to link all the devices in a network.
- ❖ It becomes weaker and weaker as it travels farther and farther.
- ❖ Can be used for 10BASE5 (thick net), 10BASE2 (thin net) or 10BROAD36 (broad band) co-axial bus standards.
- ❖ Any small break in the medium the signal will reflect back and cause errors. When one device fails the rest of the LAN fails.

- ❖ It is easy to install
- ❖ Backbone cable can be laid along the most efficient path.
- ❖ Bus uses less cabling than mesh or star topologies.

RING TOPOLOGY :

- ❖ All devices are connected to one another in the shape of a closed loop, so that each device is connected directly to two other devices, one on either side of it.
- ❖ Ring topology sometimes called as a loop
- ❖ Transmissions are uni-directional
- ❖ In this topology signal degeneration is low ; only the device that holds the token can transmit which reduces collisions.
- ❖ It is difficult to locate a problem cable segment ; expensive hardware

- ❖ Commonly used for 10BASE5, 10BASE-T or 100BASE-TX types.

- ❖ Easy to install and easy to configure

- ❖ To add or delete a device requires changing only two connections.

⇒ **STAR TOPOLOGY**

- ❖ In star topology, each device has a dedicated point-to-point link only to a central controller, usually called a hub

- ❖ The devices are not directly linked to one another

- ❖ If one device wants to send data to another, it sends the data to the controller, which then relays the data to the other connected device.

- ❖ It is less expensive than a mesh topology

- ❖ In a star, each device needs only one link and one I/O port to connect it to any number of others.

- ❖ It is easy to install and configure.

⇒ **MESH TOPOLOGY :**

- ❖ In a mesh, every device has a dedicated point - to - point link to every other device

- ❖ In a mesh topology, we need $n(n-1)/2$ duplex - mode links

- ❖ It helps to find the quickest route on network ; provide redundancy

- ❖ Mesh topology is robust & Eliminates traffic problem

- ❖ Point - to - point links make fault identification and fault isolation easy

- ❖ Advantage of privacy or security

⇒ **HYBRID TOPOLOGY :** A hybrid is a combination of two or more basic network topologies, such as star-bus, star-ring, or tiered topology

- ❖ In a hybrid topology, central and distributed topologies are combined to meet the needs of an organization

- ❖ It is also sometimes called as Mixed topology

⇒ **PROTOCOLS :** A protocol is a set of rules or agreements between the communicating parties, to indicate what is communicated, how it is communicated and when it is communicated.

- ❖ The key elements of a protocol are syntax, semantics and timing

- ❖ **SYNTAX :** The term syntax refers to the structure or format of the data, meaning the order in which they are presented.

- ❖ **SEMANTICS :** The word semantics refers to the meaning of each section of bits.

- ❖ **TIMING :** The term timing refers to two characteristics :

- I When data should be sent and I how fast they can be sent

⇒ **STANDARDS :**

- ❖ Standards and protocols are required to govern the physical and logical connections between terminals computers and other equipment

- ❖ They are vital for data communications and computer networking

- ❖ Typically standards fall into two groups official standards (from national standards bodies) and defacto standards established by common usage.
- ❖ An early official standard was the EIA RS - 232 - C for data transfer over wires (Electronic Industries Association Recommended Standard)

⇒ **OSI MODEL :**

- ❖ The ISO (International Standards Organization) was established in 1947
- ❖ The OSI (Open systems interconnection) was developed in 1983
- ❖ An open system is a set of protocols that allows any two different systems to communicate regardless of their underlying architecture.
- ❖ The purpose of OSI model is to show how to facilitate communication between different systems without requiring changes to the logic of the underlying hardware & software
- ❖ The OSI model is not a protocol ; it is a model for understanding and designing a network architecture that is flexible, robust and inter operable.
- ❖ OSI model consists of 7 separate layers but related layers each of which defines a segment of process of moving information across network

- ❖ The seven layer's are divided into 3 subgroups They are :
 - Network support Layers (1, 2, 3)
 - User Support Layers (5,6,7)
 - Intermediate Layer (4)

- ❖ Layer's 1,2,3 are network support layers as they deal with physical aspects of transmission of data between one device and another.
- ❖ Layer's 5,6,7 are user support layer's as they allow interpretability among unrelated software system's

- ❖ Layer's 4 ensures end to end reliable data transmission
- ❖ The upper layer's are implemented in software and lower layers are combination of hardware & software but physical layer is mostly hardware

INTERFACE : An interface defines what information and services a layer must provide for the adjacent layer. Between every pair of adjacent layer's at the sender side and receiver side interface passes that the data and information.

Each layer in the sending machine adds its own information to the message it receives from the layer above it and passes the whole packaged to the layer below it. This information is added in the form of header and trailers.

Headers are added at layers 6,5,4,3,2.

A trailer is added at only layer 2

At layer 1 the entire package is converted to a form that can be transferred to the receiving machine. At the receiving machine the message is unwrapped layer by layer with each process receiving and removing data meant for it i.e., layer 3 removes the data meant for it and passes the rest to layer 4 and so on.

⇒ **PEER - TO - PEER PROCESSES :** Between machines layer on one machine communicates with layer on another machine.

This communication is governed by protocol.

- Routing

TRANSPORT LAYER : The transport layer is responsible for process-to-process delivery of the entire message. A process is an application program running on a host. The transport layer ensures that the whole message arrives intact and in order, overseeing both error control and flow control at the source - to - destination level.

SERVICES : TCP - to ensure error free delivery
UDP - connectionless communications and does not guarantee packet delivery between transfer points

RESPONSIBILITIES :

- Service - Point addressing
- Segmentation and reassembly
- Connection control
- Flow control
- Error control

SESSION LAYER : The session layer is the network dialog controller. It establishes, maintains and synchronizes the interaction among communicating systems.

NOTE : The session layer is responsible for dialog control and synchronization.

SERVICES : Various Port numbers are POP (25), USENET (532), HTTP (80), FTP (20/21), TELNET (23), DNS (53), SNMP (161/162) etc.

RESPONSIBILITIES :

- Dialog control
- Synchronization

PRESENTATION LAYER : The presentation layer is concerned with the syntax and semantics of the information exchanged between two systems.

NOTE : The presentation layer is responsible for translation, compression and encryption.

SERVICES : POP, SMTP, HTTP, FTP, TFTP, TELNET, DNS, SNMP

APPLICATION LAYER : It enables the user to access the network. It provides user interfaces and support for services such as electronic mail, remote file access and transfer, shared database management.

NOTE : The application layer is responsible for providing services to the user.

SERVICES : email, news groups, web applications, file transfer, remote host, directory services, network management file services

RESPONSIBILITIES :

- Network virtual terminal.
- File transfer, access and management
- Mail services
- Directory services

DATA TERMINOLOGY : At each layer in the OSI model, the data is treated with specific term.

Layer

Application Layer

Data Item

data

Presentation Layer	data
Session Layer	session
Transport Layer	segments
Network Layer	Packets
Datalink Layer	Frames
Physical Layer	Bits

TCP / IP PROTOCOL SUITE :

- ❖ It is a protocol suite used in the internet. It was developed pre to OSI model.
- ❖ TCP / IP protocol suite is made of "5" layers.
- ❖ The first three layers provide physical standards, network interface, inter networking and transport functions that correspond to the first four layers of the OSI model.
- ❖ The three top most layers in the OSI model are represented in TCP/IP by a single layer called the application layer.
- ❖ TCP/IP is a hierarchical protocol made of interactive modules each of which provides a specific functionality.
- ❖ Unlike OSI model the layers of TCP/IP model contain relatively independent protocols that can be mixed and matched depending on the needs of the system.

TCP / IP AND OSI MODEL

Physical and Data link layers :

- ❖ The physical and the data link layer of OSI model is merged and form host-to-network layer in TCP/IP
- ❖ It does not define any specific protocol.
- ❖ It supports all the standards and proprietary protocols
- ❖ It supports the device drivers of OS.

Network Layer

Also called internetwork (or) internet layer

TCP/IP supports Internetworking protocols.

It supports the protocols such as :

❖ Internetworking Protocol (IP) :

- i) The Internetworking Protocol (IP) is the transmission mechanism used by the TCP/IP protocols
- ii) It is an unreliable and connectionless protocol
- iii) It provides best - effort delivery service
- iv) IP is responsible for creating network layer packets called IP datagrams.
- v) IP allows for maximum efficiency.

❖ Address Resolution Protocol (ARP) :

- i) It is used to associate a logical address with a physical address.
- ii) ARP is used to find the physical address of the node when its internet address is known.

❖ Reverse Address Resolution Protocol (RARP) :

- i) It allows a host to discover its internet address when it knows only its physical address.
- ii) It is used when a computer is connected to a network for the first time or when a diskless computer is booted.

❖ **Internet Control Message Protocol (ICMP) :**

- i) It is a mechanism used by hosts and gateways to send notification of datagram problems back to the sender.

❖ **Internet Group Message Protocol (IGMP) :**

- i) It is used to facilitate the simultaneous transmission of a message to a group of receipts.

⇒ **Transport Layer :** Transport layer was represented in TCP/IP by two protocols : TCP and UDP.

❖ IP is a host-to-host protocol, i.e., it can deliver a packet from one physical device to another.

❖ UDP and TCP are transport level protocols responsible for delivery of a message from a process to another process.

❖ **User Datagram Protocol (UDP) :**

- i) It is a process-to-process protocol that adds only port addresses, checksum error control, and length information to the data from the upper layer

❖ **Transmission Control Protocol (TCP) :**

- i) It provides full transport - layer services to applications.

- ii) TCP is a reliable stream transport protocol

- iii) In TCP, a connection must be established between both ends of a transmission before either can transmit data.

- iv) At the sending end of each transmission, TCP divides a stream of data into smaller units called segments.

❖ **Stream Control Transmission Protocol (STCP) :**

- i) It provides support for newer application such as voice over the internet.

- ii) It is a transport layer protocol that combines the best features of UDP and TCP

⇒ **Application Layer :** The application layer in TCP/IP is equivalent to the combined session, presentation and application layers in the OSI model. Many protocols are defined at this layer.

⇒ **Data Transmission :** There is a maximum limit to the amount of data that can be transmitted using any transmission medium (Shannon's Law). Each medium has its own maximum.

❖ Data is transmitted as signals. The number of signals per second is the frequency of the signal. This is measured in Hertz (Hz). One cycle per second is 1 Hz. One million cycles per second is 1 MHz.

⇒ **Digital Transmission :** Digital transmission takes place in the form of pulses representing bits (1's and 0's).

❖ The high speed trunks linking central phone exchanges use digital transmission. It has a lower error rate than analog transmission

❖ A device called a Codec (coder / decoder) does the conversion of analog to digital and vice versa. It samples the analog signal 8000 times per second and encodes the signal digitally by representing each sample as a binary number. The technique used is called Pulse Coded Modulation or PCM.

⇒ **Modems :**

- ❖ Phone lines deal with frequencies of 300 to 3000 Hz. A computer outputs a serial stream of bits (1's, 0's).
- ❖ A modem is a device that accepts such a bit stream and converts it to an analog signal, using modulation.
- ❖ It also performs the inverse conversion. Thus two computers can be connected using two modems and phone line.
- ❖ Using the modem a continuous signal (tone) is sent in the range 1000 to 2000 Hz.
- ❖ To transmit information this carrier signal is modulated. Its amplitude, frequency phase or a combination can be modulated.
- ❖ This diagram illustrates the carrier signal always present between two modems.
- ⇒ One common form of modulation Frequency Modulation (FM)

Multiplexing

- ❖ With high bandwidth channels it is possible to share the channel so that a number of users can use the channel at the same time. This is called multiplexing.
- ❖ Multiplexing is also used for voice transmission where optic fibers and microwave cable can handle from 8000 to 16000 simultaneous conversations.
- ❖ There are a number of types of multiplexing.
- ❖ Two common ones are Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM)

TRANSMISSION MEDIA :

- ❖ A transmission medium can be broadly defined as any thing that carries information from a source to a destination.
- ❖ In telecommunications, transmission media can be divided as :
- ❖ Media is a physical path between sender and Receiver
- ❖ Bandwidth, Noise, Radiation and Attenuation are consider while using the transmission media
- ❖ Bandwidth determines the maximum amount of data that can be transmitted.
- ❖ Higher band width transmission media supports higher data rate
- ❖ Due to attenuation it limits the distance of the data can travel on the media.

GUIDED MEDIA :

Guided media is the one that provides a

physical conduct from one device to another.

It is sub classified into :

- 1) Twisted Pair cable
- 2) Co-axial Cable
- 3) Optical Fiber Cable

TWISTED PAIR CABLE :

- ❖ It is least expensive and most widely used
- ❖ It is used for both analog and digital signals
- ❖ For analog signals amplifiers are required about every 5-6 km
- ❖ For digital signals repeaters are required every 2 or 3 km
- ❖ Twisted pair is more commonly used in telephone networks.
- ❖ Twisted pair is limited in distance, bandwidth and data rate.

- ❖ Twisted pair in the copper wire reduces the cross talk and electro magnetic induction.
- ❖ A tp consists of two insulated copperwires (1 mm diameter) twisted to reduce electrical interference.
- ❖ Capacity : dependent on the distances involved but can be up to several Mbps over a few kms.
- ❖ The communications standard used in this case is called 10/100 -Base - T.
- ❖ CAT-6 cable operates at 100/1000 Mbps (Gigabit Ethernet) and is typically used to interconnect hubs. It is more expensive than CAT-5 cable.
- ❖ The purpose of twisted pair is to avoid electrical interference between the cables.
- ❖ It comes in two forms
 - i) Unshielded twisted pair cable (UTP)
 - ii) Shielded twisted pair cable (STP)

⇒ **UTP** : UTP is mostly connected to network devices via a type of connectors.

- Each wire in a cable is attached to one conductor in the connector.
- UTP is mostly used in LAN.
- UTP can transfer data 10-100 Mbps over a distance of 100 m.
- The frequently used connector is RJ45
- UTP is cheap, flexible and easy to install

⇒ **EIA** : Electronic Industries Association has developed 5 categories of UTP cables. There are :

Category 1 : It is the base cable that can transparent data at 1 Mbps

Category 2 : It is suitable for voice and data transmission upto 4 Mbps

Category 3 : This is the cable mostly used in telephone systems that support data transmission speed upto 10 Mbps.

Category 4 : The speed is 16 Mbps and three twist for foot.

Category 5 : Used for data transmission upto 100 Mbps

❖ The difference between CAT 3 and CAT 5 cable is number of twist for unit distance.

⇒ **STP** : STP offers a protective shielding around the copper wire.

- This prevents the penetration of electro magnetic noise
- It can also eliminate on phenomenon called cross talk which is undesired affect of one channel on another channel.
- Its cost is very expensive.

⇒ **Co-Axial Cable :**

- ❖ It carries signals of high frequency ranges than twisted pair cable
- ❖ It is used to transmit both analog and digital signals.
- ❖ The original Ethernet standard was based on 10 Mbps coaxial cable.
- ❖ Ethernet is the mostpopular LAN standard and was developed at Rank Xerod. Who also developed the mouse, laserprinter and Graphical User Interface (GUI) software. Ethernet LANs can be used on Twister Pair, coaxial cable, or optic fibre.
- ❖ A coaxial cable might have a bandwidth of 10 to 100 MHz.
- ❖ Following are the co axial cable commonly used in networks.
 - 50 Ohm, RG (Government Rating) - 8 and RG - 11 for thick Ethernet.
 - 50 Ohm, RG - 58 used for their Ethernet

- 750 Ohm, RG - 59 used for cable TV
- 93 Ohm, RG - 62 used for ARC Net
- Data Rate is 10 Mbps

⇒ **There are two forms of coaxial :**

- Thick Coaxial : operates over distances up to 500m based on 10-Base-5 standard.
- Thin Coaxial : operates over distances of up to 200m based on 10-Base-3-standard
- Capacity : 10 to 100 Mbps for distances of up to 1 km. Frequently used in LANs but is being replaced by UTP / STP in most LANAS
- It is less expensive than fiber optic cable but more expensive than twisted pair cable
- Good resistance to electrical interference

⇒ **APPLICATIONS :**

- Used in telephone networks
- Used in ethernet LAN's
- Used in cable television networks.

❖ The connectors that can be used with co-axial cable are

- BNC (Bayone-Neill-Concelman) (Bayonet Network Connector)
- T-connector
- Terminator

⇒ **FIBRE OPTIC CABLE :**

- ❖ FOC is a light pipe which is used to carry a light beam from one place to another
- ❖ Light is an electromagnetic signal and can be modulated by information
- ❖ It is made of glass or plastic that transmits data in the form of light
- ❖ The fiber is covered by a buffer layer's that protects its from moisture.
- ❖ An Optic fiber has a bandwidth of up to 108 MHz.
- ❖ The light source for an optical fiber cable is light emitting device (LDE) or Laser Diode (LD)
- ❖ Higher the data rate can be achieved with excellent reliability
- ❖ For transmission to occur the sending device must be equipped either LDE or LD and the receiving device with a photo diode that can receive light optical fiber cables can connect with several connectors that are presized and easy to use. Capacity of 1000 Mbps over 1 km is feasible
- ❖ Not effected by electrical interference.
- ❖ It commonly used in back bone between the buildings and token ring networks.
- ❖ It is having higher Band width, less signal attenuation and noise resistance
- ❖ It is very cost, installation & maintenance is difficult

⇒ **UNGUIDED MEDIA (OR) WIRELESS TRANSMISSION :**

Unguided media transport electromagnetic waves using a physical conductor in the form of waves or signals through air or water or obstacles.

These are classified into 3 types

❖ **Radio Waves :**

- Cannot transmit data at faster rates but they can transmit for longer distances.
- Radio waves does not need line of sight (Transmitter and Receiver focussing each other).

- The band width of radio signals or waves ranges from 3 KHz - 300 GHz

❖ **Micro Waves :**

- Micro waves have the frequency ranging from 30 GHz - 300 GHz
- It requires line of sight transmission and reception equipment.
- Microwave transmission is weather and frequency dependent.
- Microwave system permit data transmission rates of about 16 Gbps (at such high frequencies microwave system can carry 2 lakh 50 thousand voice channel at the same time)
- For 100m high towers, repeaters can be spaced 80 Kms apart.

❖ **APPLICATIONS :**

- 1) Mobile telephone network uses microwave communication
- 2) Wireless LAN
- 3) Point-to-Point Communication System
- 4) Line-to-Side Communication

❖ **Infrared Waves :**

- It also require line of sight and transmit the data in short time but for short distances

An IP datagram consists of a header part and a text part.

- The header has a 20-byte fixed part and a variable length optional part
- Internet Protocol (IP) consists of various parameters
- Package in the IP layer are called datagrams

⇒ **VERSION :**

- The version field keeps track of which version of the protocol the datagram belongs to
- The size of the version is 4 bits.

⇒ **IHL :**

- IHL is provided to tell how long the header is in 32-bit words.
- The minimum value is 5, which applies when no options are present
- The size of IHL block is 4 bits

The maximum value of this 4-bit field is 15, which limits the header to 60 bytes, and thus options field to 40 bytes.

⇒ **TYPE OF SERVICE :**

- This field contains information about service and Host uses this field.
- Using this field Host to tell the subnet what kind of service it wants.
- Various combinations of reliability and speed are possible.
- Size of type of service is 8 bits in IP

⇒ **TOTAL LENGTH :**

- The total length includes both header and data in the datagram
- The maximum length is 65,535 bytes
- The size of total length is 16 bits

⇒ **IDENTIFICATION :**

- The Identification field is needed to allow the destination host to determine which datagram a newly arrived fragment belongs to

ECET(CSE-I)

- All the fragments of a datagram contain the same identification value
- ❖ Next comes an unused bit and then two 1-bit fields.

⇒ DF :

- DF stands for Don't fragment
- It is an order to the routers not to fragment the datagram because the destination is incapable of putting the pieces back together again.
- Size of DF is 1 bit field.

⇒ MF :

- MF stands for More Fragments.
- All fragments except the last one have this bit set.
- It is needed to know when all fragments of a datagram have arrived.
- The fragment offset tells where in the current datagram this fragment belongs.
- Size of MF field is 1 bit
- There is a maximum of 8192 fragments per datagram
- Maximum datagram length is 65 536 bytes.

⇒ TIME TO LIVE :

- The time to live field is a counter used to limit packet lifetimes.
- The maximum lifetime is 255 sec.
- It must be decremented on each hop and is supposed to be decremented multiple times when queued for a long time in a router.
- When counter becomes zero, the packet is discarded and a warning packet is sent back to the source host.
- Size of time to live is 8 bits.

⇒ PROTOCOL :

- The protocol field tells it which transport process to give it to. TCP, UDP and other protocols are examples of the field.
- Size of protocol block is 8 bits.

⇒ HEADER CHECK SUM :

- It verifies the header only
- Checksum is useful for detecting errors generated by bad memory words inside a router.
- Header checksum must be recomputed at each hop because at least one field always changes.
- The size of it is 16 bits.

⇒ SOURCE ADDRESS AND DESTINATION ADDRESS :

- Source address and Destination address indicate the network number and Host number
- Every host and router on the Internet has an IP address which encodes its network number & host number
- The IP address is unique i.e., no two machines on the Internet have the same IP address.
- 1 All IP addresses are 32 bits long and are used in the source address and Destination address fields of IP packets.

Class Network	Format	Maximum Networks	Maximum Nodes for
A	Node	127	16,777,214
B	Node	16,384	65534
C	Node	2097152	254

- An IP address is a numeric Identifier. Assigning to each machine on an IP network.
- IP address is a software address, not a hardware address which is hard coded in a machine or NIC
- An IP address is made up of 32 bit information
- This bits are divided into 4 parts containing 8 bits each.

- There are 3 methods to represent an IP address

❖ **Doted decimal**

Eg : 127. 255. 255. 255

❖ **Binary**

Eg : 1000 1100 . 11001100. 11111 000. 00001111

❖ **Hexa decimal**

Eg : 8B. 32. C9. 40

- The 32 bit IP address is a structural or hierarchical.
- The network address is uniquely identifies each network
- Every machine on the same network shares that network address as part of its IP address.
- The first two parts of IP address is called as network.
- Rest of the address is called as Node address
- The Node address is assigned to & uniquely identifies each machine on a network.
- The max number of networks of class C is 254.

⇒ **CLASSIFICATION OF NETWORKS :**

Based on the data rate, transmission and distance of the transmission the network is classified as

⇒ **LAN (LOCAL AREA NETWORK) :**

- ❖ A LAN is usually private owned and links the devices in a single office, building, campus.
- ❖ LAN'S are designed to allow the resources to be shared between the personal computers.
- ❖ The resources should be shared can include hardware, software over all data.
- ❖ LAN will use only one type of transmission medium.
- ❖ LAN support common topologies : BUS, RING and STAR
- ❖ The transmission rate of LAN is 1 Mbps speed.
- ❖ Bandwidth of LAN is 10 Mbps
- ❖ Distance covered by LAN is 1-2 km
- ❖ The common standard LAN'S are

* IEEE 802.3, 802.4, 802.5

- ❖ LAN's are distinguished from other kinds of network by 3 characteristics :
 - 1) their size
 - 2) transmission technology
 - 3) their topology
- ❖ LANs usually use broadcast subnets

⇒ **MAN (Metropolitan Area Network) :**

- ❖ A MAN is designed to extends over a entire city.
- ❖ It may be a single network such as cable television network
- ❖ Many telephone provides a popular MAN service called Switched Multi Mega bit data service [SMDS]
- ❖ MAN is designed with two uni-directional bus topologies
 - 1) Open Bus
 - 2) Closed Bus
- ❖ MAN's are based on the fiber optic transmission technology
- ❖ The standard IEEE 802.6 is considered as MAN.
- ❖ The data transmission rate of MAN is 1.5 Mbps to 10 Mbps over 5 miles
- ❖ MAN is owned by few organizations
- ❖ The best known example of a MAN is the cable television network available in many cities.
- ❖ MAN is easy to install than WAN. Data transmission speed is moderately high

⇒ **WAN [WIDE AREA NETWORK] :**

- ❖ WAN provides a long distance of transmission of data, voice, image and information over a large geographical area that may comprise a country, continent even whole world.
- ❖ Transmission or Communication medium of WAN is PSTN (Public Switch Telephone Network), telephone lines or Wireless technology such as satellites.
- ❖ The data transmission rate of WAN is 1.5 Mbps to 2.4 Gbps over 100-1000 miles.
- ❖ WAN is difficult to install and data transmission rate is low compare to LAN and WAN
- ❖ The world's most popular WAN is the Internet.
- ❖ WAN suffers from propagation delay.

⇒ **BLUE TOOTH**

- ❖ Bluetooth is a wireless network
- ❖ Range of Bluetooth is 10m
- ❖ IEEE standard for Bluetooth is 802.15
- ❖ Operating frequency of Bluetooth is 2.4 GHz, in ISM band.
- ❖ A piconet is a collection of Bluetooth devices which are synchronized to the same hopping sequence.
- ❖ Piconet has seven slaves all are connected to one master node.
- ❖ Maximum active nodes at a time in piconet is 8 [1 master and seven slaves]
- ❖ The devices which are not in active mode in piconet are called parking nodes.
- ❖ If any piconet has less than seven active nodes then parking nodes comes to active mode.
- ❖ The collection of two or more piconets is called "Scatternet".
- ❖ In Scatternet one slave is common for both two masters of piconets.
- ❖ Common slave is called scatter bridge
- ❖ Slave of the one piconet is can change to slave of other piconet

- ❖ Master of one piconet can change to slave of other piconet
- ❖ Master of one piconet can change into master of the other piconet is possible when tooth piconets having same hopping sequence otherwise it is not possible
- ❖ Bluetooth consist of maximum & active devices because it has 3-bit address lines.
- ❖ Maximum parking nodes in bluetooth is 200.
- ❖ Blue tooth technology discussed here aims at so called ad-hoc piconets
- ❖ Blue tooth invented by Bisikian in 1998

⇒ **SWITCHING :**

- ❖ A network is a set of connected devices.
- ❖ A switched network consists of a series of interlinked nodes called switches. Switches are devices capable of creating temporary connections between two or more devices linked to the switch. In a switched network some of these nodes are connected to the end systems (computers or telephones).
- ❖ Virtual-circuit networks have some common characteristics with circuit switching and datagram networks.
- ❖ Packet switching is to combine to datagram networks and virtual circuit networks. Networks route the first packet based on the datagram addressing idea, but then create a virtual-circuit network for the rest of the packets coming from the same source and going to the same destination.
- ❖ In message switching each switch stores the whole message and forwards it to the next switch.
It is used in electronic mail (e-mail).

⇒ **Circuit switched network**

- ❖ A circuit switched network is made of a set of switches connected by a physical links, in which each link is divided into n channels.
- ❖ If any system needs to request a connection to other send system that must be accepted by all switches as well as by end system itself, this is called setup phase.
- ❖ Circuit switching takes place at the physical layers.
- ❖ Before starting the communication, the stations must make reservation for the resources to be used during the communication, and it must dedicated during the entire duration of data transfer until the teardown phase.
- ❖ Data transferred between the two stations are not packetized.
- ❖ There is no addressing involved during data transfer.
- ❖ Efficiency in this type of network is low, and delay is minimum
- ❖ Switching at the physical layers in the traditional telephone networks uses the circuit-switching approach.

⇒ **Data gram Network**

- ❖ In data communications, we need to send messages from one end system to another.
- ❖ It needs to be divided into packets of fixed or variable size.
- ❖ The size of the packet is determined by the network and governing protocols.
- ❖ In a packet switched network, there is no resource reservation resources are allotted on demand.
- ❖ In packet switching networks no reservations of bandwidth on the links and there.

- ❖ The allocation is done on a first come, first served basis.
- ❖ In datagram network, each packet is treated independently of all others.
- ❖ Datagram switching is normally done at the network layer
- ❖ Datagram do not have the necessary bandwidth available to carry all the packets from source to end point node.
- ❖ Upper layer protocols is responsible to reorder the datagrams or ask for the datagrams before passing them on to the application.
- ❖ The datagram networks sometimes referred as connectionless networks. The term connectionless means that the switch does not keep information about the connection state.
- ❖ A switch in a datagram network uses a routing table that is based on the destination address
- ❖ The destination address in the header of a packet in a datagram network remains the same during the entire journey of the packet
- ❖ There may be greater delay in a datagram network than in a virtual circuit network.
- ❖ There are no setup and tear down phases, each packet may experience a wait at a switch before it is forwarded.
- ❖ Efficiency of a datagram network is better than that of a circuit switched network.
- ❖ Total delay = $3T + P + W_1 + W_2$
Where $3T$ = Three transmission times
= Three propagation delays
 $W_1 + W_2$ = two waiting times
- ❖ Switching in the internet is done by the using the datagram approach to packet switching at the network layers

⇒ **Virtual Circuit Networks** : It is a cross section a circuit switched network and a datagram network

⇒ **Jurisdiction :**

- ❖ It defines what should be the next switch and the channel on which the packet is being carried
- ❖ The address in the header has local jurisdiction, not end-to-end jurisdiction
- ❖ It is normally implemented in datalink layer

❖ **It has two types of addressing :**

- 1) global addressing
 - 2) local (virtual - circuit - identifier)
- ❖ Global address in virtual - circuit networks is used only to create a virtual circuit identifier.
 - ❖ The identifier that is actually used for data transfer is called the virtual - circuit identifier. It is unlike global address, is a small number that has only switch scope.
 - ❖ To transfer a frame from a source to its destination, all switches need to have a table entry for this virtual circuit.
 - ❖ The data transfer phase is active until the source sends all its frames to the destination.
 - ❖ Virtual circuit is not a real circuit between the source and destination
 - ❖ To create virtual circuit between source to destination two steps are required. The setup request and the acknowledgment
 - ❖ In virtual circuit switching all packets belonging to the same source and destination travel the same path ; but the same packets may arrive at the destination with different delays it resource allocation is on demand.

- ❖ Delay in a virtual - circuit network.
 - ❖ Total delay = $3T + \dots +$ Setup delay + tear down delay
 - ❖ Switching the data link layer in a switched WAN is normally implemented by using virtual-circuit techniques.
- ⇒ **ETHERNET :**
- IEEE 802.3 Ethernet
 - IEEE 802.11 Wireless LAN
 - IEEE 802.15 Bluetooth
 - IEEE 802.16 Wireless WAN
 - ❖ Ethernet and IEEE 802.3 are identical
 - ❖ Ethernet and IEEE 802.3 are used interchangeably.
 - ❖ The name ethernet refers to the cable (the ether).
 - ❖ 10 Base 5 abling, popularly called thick Ethernet 62) Thicknet
 - ❖ 10 Base F Fiber Ethernet
 - ❖ 10 Base 2 is called as thin ethernet
 - ❖ 10 Base T Twisted pair ethernet
 - ❖ Ethernet is operated as two layer physical layer, data link layer.
 - ❖ Standard ethernet 10 Mbps
 - ❖ Fast ethernet 100 Mbps
 - ❖ Giga bit ethernet 1 Gbps
 - ❖ Ten- Gigabit Ethernet 10 Gbps
 - ❖ Ethernet is the most widely used LAN protocol

KEY TERMS

1000Base - CX	Fast Ethernet
1000Base-Lx	frame bursting
1000Base-SX	full-duplex switched Ethernet
1000Base-T	Gigabit Ethernet
100Base-FX	hexadecimal notation
100Base-T4	logical link control (LLC)
100Base-TX	media access control (MAC)
10Base2	network interface card (NIC)
10Base5	preamble
10Base-F	Project 802
10Base-T	source service access point (SSAP)
10GBase-E	Standard Ethernet
10GBase-L	switch
10GBase-S	switched Ethernet
autonegotiation	Ten-Gigabit Ethernet
bridge	thick Ethernet
carrier extension	Thicknet
Cheapernet	thin Ethernet
collision domain	transceiver
destination service access point (DSAP)	twisted - pair Ethernet

Number	Topic
802.1	Overview and architecture of LANs
802.2	Logical link control
802.3 *	Ethernet
802.4	Token bus (was briefly used in manufacturing plants)
802.5	Token ring (IBM's entry into the LAN world)
802.6	Dual queue dual bus (early metropolitan area network)
802.7	Technical advisory group on broadband technologies
802.8	Technical advisory group on fiber optic technologies
802.9	Isochronous LANs (for real-time applications)
802.10	Virtual LANs and security
802.11 *	Wireless LAN's
802.12	Demand priority (Hewlett-Packard's AnyLAN)
802.13	Unlucky number. Nobody wanted it
802.14	Cable modems (defunct : an industry consortium got there first)
802.15*	Personal area networks (Bluetooth)
802.16 *	Broadband wireless
802.17	Resilient packet ring

⇒ **Points To Remember :**

- ❖ Those which operate below the physical layer such as passive hub.
- ❖ Those which operate at the physical layer (a repeater or an active hub).
- ❖ Those which operate at the physical and data link layers (a bridge or a two-layer switch)
- ❖ Those which operate at the physical, data link, and network layers (a router or a three-layer switch).
- ❖ Those which can operate at all five layers (a gateway).
- ❖ Anything that interferes with the message is technically called Noise.
- ❖ The connection between two exchanges is called a trunk and trunk switches in each exchange route calls. The connection between a subscriber and the local exchange is called the local loop.
- ❖ RS 232 is the name of the standard that defines the interface
- ❖ The serial interface between the modem and the computer is governed by the RS 232 standard (also known as the CCITTV 24 standard)

⇒ **PASSIVE HUBS :**

- ❖ A passive hub is just a connector. It connects the wires coming from different branches.
- ❖ In a star-topology Ethernet LAN, a passive hub is just a point where the signals coming from different stations collide, the hub is the collision point.
- ❖ This type of a hub is part of the media ; its location in the Internet model is below the physical layer.

⇒ **Repeaters :**

- A repeater is a device that operates only in the physical layer.
- Signals that carry information within a network can travel a fixed distance before attenuation endangers the integrity of the data.

- A repeater receives a signal and, before it becomes too weak or corrupted, regenerates the original bit pattern.
- The repeater then sends the refreshed signal.
- A repeater can extend the physical length of a LAN
- A repeater connects segments of a LAN
- A repeater forwards every frame ; it has no filtering capability.
- A repeater is a regenerator, not an amplifier.

⇒ **Active Hubs :**

- An active hub is actually a multiport repeater.
- It is normally used to create connections between stations in a physical star topology
- We have seen examples of hubs in some Ethernet implementations (10 Base - T)
- A bridge operates in both the physical and the data link layer.
- As a physical layer device, it regenerates the signal it receives.
- As a datalink layer device, the bridge can check the physical (MAC) addresses (Source and destination) contained in the frame.
- A bridge has filtering capability. It can check the destination address of a frame and decide if the frame should be forwarded or dropped.
- If the frame is to be forwarded, the decision must specify the port.
- A bridge has a table that maps addresses to ports.
- A bridge has a table used in filtering decisions.
- A bridge does not change the physical (MAC) addresses in a frame

❖ **Transparent Bridge :**

- A transparent bridge is a bridge in which the stations are completely unaware of the bridge's existence.
- If a bridge is added or deleted from the system, reconfiguration of the stations is unnecessary.
- A spanning Tree is a graph in which there is no loop.

❖ **Source Routing Bridges :** Prevent loops in a system with redundant bridges is to use source routing bridges. A transparent bridge's duties include filtering frames, forwarding and blocking.

❖ **Routers :**

- A router is a three-layer device that routes packets based on their logical addresses (host-to-host addressing)
- A router normally connects LANs and WANs in the Internet and has a routing table that is used for making decisions about the route.
- The routing tables are normally dynamic and are updated using routing protocols.

⇒ **GATEWAY :**

- A gateway is normally a computer that operates in all five layers of the Internet or seven layers of OSI model.
- A gateway takes an application message, reads it and interprets it.
- Without Gateways computers will never be able to understand and communicate with each other.
- Gateways perform protocol translation between networks
- Gateways make a connection between two totally different networks

- 1) Transform the packet format
- 2) Transform the address format
- 3) Transform the protocol

⇒ **Network interface Cards (NIC):**

- This is called network cards and network adapters include a cable socket allowing computers to be connected to the network.
- All NICs have a unique address (sometimes called a MAC address), placed in them by their manufacturer.
 - Before sending data onto the network, the network card also organize data into frames and then sends them out on the network.
 - Note book computers often use NICs that are plugged into the PCMCIA port.
 - Wireless LAN adapters are needed for WLANs.

⇒ **NIC card functions :**

- ❖ LAN adapters have their own onboard architectures and they carry NIC
- ❖ Functions out several important functions including
 - Monitoring activity on the communication medium
 - Providing each work station / server with a unique identification address (MAC)
 - Recognizing and receiving data transmitted to the computer
 - Creating (building) the frames needed to transmit data on the communication medium
 - Controlling LAN transmission speed
 - Transmission error detection and recovery

⇒ **SWITCH**

- A concentrator is a device that provides a central connection point for cables from workstations, servers, and peripherals.
- In a star topology, twisted-pair wire is run from each workstation to a central switch / hub. Most switches are active, which means they electrically amplify the signal as it moves from one device to another.
- Switches no longer broadcast network packets as hubs did in the past. They memorize addressing of computers and send the information to the correct location directly.

Switches are

- 1) Usually configured with 8, 12, or 24 RJ-45 ports
- 2) Often used in a star or star-wired ring topology
- 3) Sold with specialized software for port management
- 4) Also called hubs
- 5) Usually installed in a standardized metal rack that also may store net modems, bridges, or routers.

- ❖ In a bus backbone, the topology of the backbone is a bus.
- ❖ In a star backbone, the topology of the backbone is a star; the backbone is just one switch.
- ❖ A point-to-point link acts as a LAN in a remote backbone connected by remote bridges.
- ❖ VLANs (Virtual Local Area Network) create broadcast domains.
- ❖ A repeater is a connecting device that operates in the physical layer of the Internet model.
- ❖ A repeater regenerates a signal, connects segments of a LAN, and has no filtering capability.

- ❖ A bridge is a connecting device that operates in the physical and datalink layers of Internet model.
- ❖ A transparent bridge can forward and filter frames and automatically build its forwarding table.
- ❖ A bridge can use the spanning tree algorithm to create a loopless topology
- ❖ A backbone LAN allows several LANs to be connected
- ❖ A backbone is usually a bus or a star.
- ❖ A virtual local area network (VLAN) is configured by software, not by physical wiring.
- ❖ Membership in a VLAN can be based on port numbers, MAC addresses, IP addresses, IP multicast addresses, or a combination of these features.
- ❖ VLANs are cost-and time-efficient, can reduce network traffic, and provide an extra measure of security.

⇒ **HYPertext Transfer Protocol (HTTP):**

- ❖ It is the main protocol used to access data on the World Wide Web (WWW).
- ❖ HTTP uses a TCP connection to transfer files.
- ❖ HTTP functions like a combination of FTP and SMTP

⇒ **HTTP uses the services of TCP on well known port 80.**

- ❖ An HTTP message (request or response) consists of a request or status line, headers and a body.
- ❖ The request line consists of a request type, a URL and the HTTP version number.
- ❖ The Uniform Resource Locator (URL) consists of a method, host computer, optional port number, and the pathname to locate information on the WWW.
- ❖ The request type or method is the actual command or request issued by the client to the server.
- ❖ The status line consists of the HTTP version number, a status code, and a status phrase.
- ❖ The status code relays general information.
- ❖ The header relays additional information between the client and server.
- ❖ A header consists of a header name and a header value
- ❖ A general header gives general information about the request or response message.
- ❖ A request header specifies a client's configuration and preferred document format.
- ❖ A response header specifies a server's configuration and special information about the request.
- ❖ An entity header provides information about the body of a document.
- ❖ A unit of hypertext or hypermedia available on the Web is called a page.
- ❖ The main page for an organization or an individual is known as homepage.
- ❖ Each browser usually consists of 3 parts :
- 1) controller 2) client program 3) interpreters
- ❖ Common Gateway Interface (CGI) is a technology that creates and handles dynamic documents.
- ❖ For many applications, we need a program to be run at the client side. These are called active document.
- ❖ A web document can be classified as static, dynamic or active.

⇒ **TELENT**

- ❖ TELNET is an abbreviation for Terminal Network.
- ❖ TELNET is a client - server application that allows a user to logon to a remote machine, giving the user access to the remote system.
- ❖ TELNET uses the Network Virtual Terminal (NVT) system to encode characters on the local system. On the server machine, NVT decodes the characters to a form acceptable to the remote machine.
- ❖ NVT uses a set of characters for data and a set of characters for remote control.
- ❖ TELNET allows negotiation to set transfer conditions between the client and server before and during the use of the service
- ❖ A TELNET implementation operates in the default, characters or line mode.
- ❖ TELNET is usually not accessed directly by the user. User friendly software acts as an interface between TELNET and the user.
- ❖ Rlogin is a BSD UNIX product that provides a simple remote login service.
- ❖ The characters are sent to the TELNET client, which transforms the characters to a universal character set called Network Virtual Terminal characters.
- ❖ Pseudoterminal driver is a piece of software which pretends that the character's are coming from a terminal
- ❖ **Rlogin uses the TCP port 513**
- ❖ Rlogin allows either local or remote flow control
- ❖ Rlogin allows the server to send commands to the client and vice versa
- ❖ Rlogin supports local tasking and local program interruption.
- ❖ Security is an issue with both TELNET and Rlogin, although the former does allow an authentication option.

SIMPLE MAIL TRANSFER PROTOCOL (SMTP) :

- ❖ The TCP/IP protocol that supports electronic mail on the Internet is called Simple Mail Transfer Protocol (SMTP).
- ❖ SMTP provides for mail exchange between users on the same or different computers.
- ❖ SMTP supports :
 - Sending a single message to one or more recipients.
 - Sending messages that include text, voice, video or graphics
 - Sending messages to users on networks outside the Internet.
- ❖ **The SMTP server uses the TCP well-known port 25.**
- ❖ Both SMTP client and server requires a user agent (UA) and a mail transfer agent (MTA).
- ❖ The UA prepares the message, creates the envelope, and puts the message in hte envelope.
- ❖ The mail address consists of two parts : a local address (User mailbox) and a domain name. The form is local name @ domain name.
- ❖ A mail gateway translates mail formats.
- ❖ Delivery of SMTP messages can be delayed at the sender site. The receiver site, or at intermediate servers.
- ❖ An alias allows one user to have multiple e-mail addresses or many users to share the same e-mail address.
- ❖ The MTA transfers the mail across the Internet.
- ❖ SMTP uses commands and responses to transfer messages between on MTA client and an MTA server.
- ❖ The steps in transferring a mail message are :

1) Connection establishment

3) Connection Terminating

❖ **Multipurpose Internet Mail Extension (MIME)** is an extension of SMTP that allows the transfer of multimedia messages.

❖ **Post Office Protocol (POP)** is a protocol used by a mail server in conjunction with SMTP to receive and hold mail for hosts.

⇒ **FILE TRANSFER PROTOCOL (FTP) :**

❖ File transfer protocol (FTP) is a TCP / IP client - server application for copying files from one host to another.

❖ FTP requires two connections for data transfer : a control connection and a data connection.

❖ FTP employs NVT ASCII for communication between dissimilar systems.

❖ Prior to the actual transfer of files, the file type, data structure, and transmission mode are defined by the client through the control connection.

There are 6 classes of commands sent by the client to establish communication with the server. They are :

1) access commands 2) file management commands

3) data formating commands

4) port defining commands

5) file transferring commands

6) miscellenious commands

❖ Responses are sent from the server to the client during connection establishment.

❖ **There are 3 types of File transfer :**

a) a file is copied from the server to the client

b) a file is copied from the client to the server

c) a list of directories or filename is sent from the server to the client.

❖ MOST OS provide a user - friendly interface between FTP & the user.

❖ Anonymous FTP provides a method for the general public to access files on remote sites.

❖ FTP uses two well known TCP ports : Port 21 is used for control connection, and port 20 is used for the data connection.

X. 25

❖ X. 25, an ITU - T protocol for WAN communications, is a packet switched data network protocol which defines the exchange of data as well as control information between a user device, called **Data Terminal Equipment (DTE)** and a network node, called **Data Circuit Terminating Equipment (DCE)**.

❖ X.25 is designed to operate effectively regardless of type of systems connected to the network.

❖ X.25 is typically used in the packet - switched networks (PSNs) of common carriers, such as the telephone companies.

❖ X.25 utilises a connection - Oriented Service that insures that packets are transmitted in order.

❖ X. 25 was deployed in the 1970's

❖ In the 1980's the X. 25 networks were largely replaced by a new kind of network called frame relay.

⇒ **FRAME RELAY :**

- ❖ Frame relay is a high performance WAN protocol that operates at the physical and data link layers of the OSI model.
- ❖ The essence of frame relay is that it is a connection oriented network with no error control and no flow control.
- ❖ Frame relay originally was designed for use across ISDN interfaces.
- ❖ Frame relay offers an attractive alternative to both dedicated lines and X.25 networks for connecting LANs to bridges and routers.

⇒ **ASYNCHRONOUS TRANSFER MODE (ATM) :**

- ❖ Asynchronous transfer mode (ATM) is a high performance cell-oriented switching and multiplexing technology that utilizes fixed-length packets to carry different types of traffic.
- ❖ ATM is a technology that will enable carriers to capitalize on a number of revenue opportunities through multiple ATM classes of services.

⇒ **BENEFITS :**

- High performance via hardware, switching
- Dynamic bandwidth for bursty traffic
- Class - of - Service support for multimedia
- Scalability in speed and network size.
- Common LAN/ WAN architecture
- International standards compliance

⇒ **DOMAIN NAME SYSTEM (DNS) :**

- ❖ DNS is a distributed database that is used by TCP / IP applications to map between hostnames and IP addresses and to provide e-mail routing information.
- ❖ DNS provides the protocol that allows clients and servers to communicate with each other.
- ❖ The standard allows the DNS to identify the types of applications that are available on a particular machine, to identify gateways to networks.
- ❖ The domain name of any node in the tree is the list of labels, starting at the node, working up to the root, using a period ("dot") to separate the labels.
- ❖ Every node in the tree must have a unique domain name, but the same label can be used at different points in the tree.

⇒ **SUBNETTING**

- ❖ Subnetting divides one large network into several smaller one's
- ❖ Subnetting adds an intermediate level of hierarchy in IP addressing
- ❖ Class A, B and C addresses can be subnetted.
- ❖ The subnet id defines the physical network.
- ❖ Masking is a process that extracts the network address from an IP address.
- ❖ Subnet masking is a process that extracts the subnetwork address from an IP address.
- ❖ A network or subnet address is obtained from applying the bit-wise AND operation on the IP address and the mask.
- ❖ The concept of special addresses in IP addressing carries over to subnetting.
- ❖ A contiguous mask (a string of 1s followed by a string of 0s) is highly recommended.
- ❖ In variable length subnetting, more than one subnet mask is applied by the router.
- ❖ Supernetting combines several networks into one large one.

- ❖ Classless interdomain routing (CIDR) reduces the number of entries in a routing table by using a supernet mask and the lowest network address of a supernet to represent the member networks.

⇒ **ISDN :**

- ❖ Integrated Services Digital Network (ISDN) is a high speed, fully digital telephone service.
- ❖ It is an ITU-T (CCITT) standard for an end-to-end global digital communication system providing fully integrated digital services.
- ❖ The principles of ISDN from the point of ITU-T (International Telecommunication Union-Telecommunications) Standardisation Sector). CCITT (Consultive Committee for International Telegraphy and Telephony) are :
 - Support of Voice and a non-voice applications
 - Support for switched and non-switched applications
 - Reliance for 64-kbps connections
 - Intelligence in the network
 - Layered protocol architecture.

⇒ **ISDN Services are :**

- Bearer Services
- Tele Services
- Supplementary Services.

⇒ **CSMA :**

- ❖ If a station senses the carrier on the medium before starting its own transmission, collision can be avoided. such protocols are called "carrier - sense multiple access (CSMA)" protocols
- ❖ The term "Carrier sense" indicates the "listening before transmitting" behaviour.
- ❖ In CSMA, an algorithm is needed to specify when a station can transmit once the channel is found busy.

⇒ **CSMA protocols are :**

- Non- Persistent CSMA
- persistent CSMA
- P - persistent CSMA

⇒ **WEB SERVER :**

- ❖ A web server is a program running on a server computer
- ❖ It consists of the web site containing a number of web pages.
- ❖ A web page constitutes simply a special type of computer file written in a specially designed language called as Hyper Text Markup Language (HTML).
- ❖ The request - response model is governed by a protocol called Hyper Text Transfer Protocol (HTTP)

ADDRESSES :

- ❖ An IP₄ address is 32 bits long.
- ❖ IP₄ addresses are unique and universal
- ❖ The address space of IP₄ is 2^{32} or 4, 294, 967, 296

- ❖ There are two prevalent notations to show an IP_{v4} address : binary notation and dotted decimal notation.
- ❖ There are 5 classes in IP_{v4} addresses classes A, B, and C differ in the number of hosts allowed per network.
- ❖ Class D is for multicasting and class E is reserved.
- ❖ Classes A,B, or C are mostly used for unicast communication.
- ❖ In IP_{v4} addressing, a block of addresses can be defined as x.y.z.t/n
- ❖ In which x.y.z.t defines one of the address and the /n defines the mask.
- ❖ The first address in the block can be found by setting the rightmost 32-n bits to 0s
- ❖ The last address in the block can be found by setting the rightmost 32-n bits to 1s.
- ❖ The number of addresses in the block can be found by using the formula 2^{32-n}
- ❖ The first address in a block is normally not assigned to any device ; it is used as the network address that represents the organization to the rest of the world.
- ❖ Each address in the block can be considered as a two-level hierarchical structure ; the left most n bits (prefix) define the network ; the right most 32-n bits define the host.

⇒ **IP_{v6} ADDRESSES :**

- ❖ An IP_{v6} address is 128 bits long.
- ❖ The address space of IP_{v6} is 2^{128}
- ❖ A unicast address defines a single computer.
- ❖ IP_{v6} defines two types of unicast address geographically based and provider - based.
- ❖ The provider - based address is generally used by a normal host as a unicast address.
- ❖ IP_{v6} also defines anycast addresses which defines a group of nodes
- ❖ An unspecified address is used when a host does not know its own address and sends an inquiry to find its address.
- ❖ A loop back address is used by a host to test itself without going into the network.
- ❖ A compatible address is used during the transition from IP_{v4} to IP_{v6}
- ❖ IP_{v6} addresses use hexadecimal colon notation with abbreviation methods available.
- ❖ There are three types of addresses in IP_{v6} : unicast, anycast and multicast
- ❖ In an IP_{v6} addresses, the variable type prefix field defines the address type or purpose.

⇒ **WORLD WIDE WEB (WWW) :**

- ❖ The WWW is a repository of information spread all over the world and linked together.
- ❖ The WWW has a unique combination of flexibility portability and user- friendly features.
- ❖ The WWW today is a distributed client - server service, in which client using a browser can access a service using a server.
- ❖ The service provided is distributed over many locations called Web Sites.
- ❖ The WWW uses the concept of hypertext and hypermedia. In a hypertext environment, information is stored in a set of documents that are linked together using the concept of pointers.

⇒ **PROXY SERVER :**

- ❖ Proxy servers sit between a client program (typically a Web browser) and an external server (typically another server on the Web) to filter requests, improve performance, and share connections.

- ❖ A Proxy server is similar to a gateway that speaks HTTP to the browser, but FTP, Gopher or an older protocol to the Web server.
- ❖ It acts as an interpreter between the web browser and the web server for transforming a non-HTTP protocol to HTTP and vice versa.
- ❖ This means that the browser does not have to understand and / or interpret any additional protocols.

⇒ Hubs / Switches

- ❖ Hubs act as junction boxes, linking cables from several computers on a network. Hubs are usually solid with 4,8,16 or 24 ports.
- ❖ Some hubs allow connection of more than one kind of cabling, such as UTP and coax.
- ❖ Hubs also repeat (reconstruct and strengthen) incoming signals. This is important since all signals become weaker with distance.
- ❖ The maximum LAN segment distance for a cable can therefore be extended using hubs.
- ❖ In general use Hub can be referred to any connecting device and can be considered as multipoint repeater
- ❖ Technically it is bus topology
- ❖ Network point of view it is a logical device and does not have an address.
- ❖ The added benefit of using Hub is it removes the length restriction 100 meters in 10 Base T.
- ❖ A switch is more sophisticated than hub and can remember and checknode addresses. In fact this phenomenon can affect logical topology of the network.
- ❖ While a hub broadcasts data frames to all ports, the switch reads the destination address of the data frame and only sends it to the corresponding port. The effect is to turn the network into a group of point-to-point circuits and thus changes the logical topology of the network from a bus to a star.
- ❖ Switched Ethernet still uses CSMA/CD media access control, but collisions are less likely as each network segment operates independently.
- ❖ Switched Ethernet can dramatically improve network performance
- ❖ Shared Ethernet 10BaseT networks are only capable of using about 50% of capacity before collisions area problem.
- ❖ Switched Ethernet, runs at up to 95% capacity on 10BaseT. Using a 10/100 switch that uses a 100BaseT connection for the server(s) and/or routers, i.e., the network segments experiencing the highest volume of LAN traffic, can make another performance improvement.

⇒ Web Browsers

Simply putting, a browser is a program that reads HTML (Hyper Text Markup Language, the programming language of the web) and displaylist of the viewer.

While there is currently one recognized standard language used to write web pages (HTML 4), there are a myriad of browsers available to view it with. Choosing the right one for your individual needs can help maximize your web experience, which will also cut down on installations and un installations.

Currently the two most popular browsers are Microsoft Internet explorer, and Netscape Navigator. Microsoft Internet Explorer is by far more widespread in use and is one of the most powerful browser available. NCSA's Mosaic was one of the first popular browsers to gain

Wide use and supports most HTML functions but not the newest attributes like frames or animated images.

- ⇒ **FTP Servers** : One of the oldest of the Internet services, File Transfer Protocol makes it possible to move one or more files securely between computers while providing file security and organization as well as transfer control
- ⇒ **Mail Servers** : Almost as ubiquitous and crucial as Web servers, mail servers move and store mail over corporate networks (via LANs and WANs) and across the Internet.
- ⇒ **Telnet Servers** : A Telnet server enables users to log on to a host computer and perform tasks as if they're working on the remote computer itself.

POINTS TO REMEMBER

01. The transport layer links the network support layers and the user support layer
02. The physical layer coordinates the functions required to transmit a bit stream over a physical medium.
03. The data link layer is responsible for delivering data units from one station to the next without efforts
04. The network layer is responsible for the source - to - destination delivery of a packet across multiple network links.
05. The transport layer is responsible for the process - to - process delivery of the entire message.
06. Data must be transformed into electromagnetic signals prior to transmission across a network
07. Data and signals can be either analog or digital
08. A signal is periodic if it consists of a continuously repeating pattern.
09. Each sine wave can be characterized by its amplitude, frequency, and phase
10. Frequency and period are inverse of each other
11. A time-domain graph plots amplitude as a function of time
12. A frequency-domain graph plots each sine wave's peak amplitude against its frequency.
13. By using Fourier analysis, any composite signal can be represented as a combination of simple sine waves
14. The spectrum of a signal consists of the sine waves that make up the signal.
15. The bandwidth of a signal is the range of frequencies the signal occupies. Bandwidth is determined by finding the difference between the highest and lowest frequency components.
16. Bit rate (number of bits per second) and bit interval (duration of 1 bit) are terms used to describe digital signals
17. A digital signal is a composite with an infinite bandwidth
18. Bit rate and bandwidth are proportional to each other
19. The Shannon capacity determines the theoretical data rate for a noisy channel.
20. Attenuation is the loss of a signal's energy due to the resistance of the medium
21. The decibel measures the relative strength of two signals or a signal at two different points.

22. Distortion is the alteration of a signal due to the differing propagation speeds of the frequencies that make up a signal.
23. Transmission media can be evaluated by throughput, propagation speeds of each of the frequencies that make up of a signal
24. Transmission media can be evaluated by throughput, propagation speed, and propagation time.
25. The wavelength of frequency is defined as the propagation speed divided by the frequency
26. Line coding is the process of converting binary data to a digital signal
27. The number of different values allowed in a signal is the signal level. The number of symbols that represent data is the data level.
28. Bit rate is a function of the pulse rate and data level
29. Line coding methods must eliminate the dc component and provide a means of synchronization between the sender and the receiver.
30. Line coding methods can be classified as unipolar, polar, or bipolar
32. NRZ, RZ, Manchester, and differential Manchester encoding are the most popular polar encoding methods
33. Analog-to-digital conversion relies on PCM (pulse code modulation).
34. PCM involves sampling, quantizing, and line coding
35. Digital transmission can be either parallel or serial in mode
36. In parallel transmission, a group of bits is sent simultaneously, with each bit on a separate line.
37. In serial transmission, there is only line and the bits are sent sequentially
38. Serial transmission can be either synchronous or asynchronous
39. In asynchronous serial transmission, bits are sent in a continuous stream without start and stop bits and without gaps between bytes is the responsibility of the receiver
40. Digital-to-analog modulation can be accomplished using the following : Amplitude shift keying (ASK) - the amplitude of the carrier signal varies. Frequency shift keying (FSK) the frequency of the carrier signal varies. Quadrature amplitude modulation (QAM) both the phase and amplitude of the carrier signal vary.
41. QAM enables a higher data transmission rate than other digital - to-analog methods
42. Baud rate and bit rate are not synchronous. Bit rate is the number of bits transmitted second. Baud rate is the number of signal units transmitted per second. One signal unit can represent one or more bits
43. The minimum required bandwidth for ASK and PSK is the baud rate
44. The minimum required bandwidth (BW) for FSK modulation is $BW = F_{c1} - f_{c0} + N_{baud}$, where f_{c1} is the frequency representing a 1 bit, f_{c0} is the frequency representing a 0 bit, and N baud rate.
45. A regular telephone line uses frequencies between 600 and 3000 Hz for data communication
46. ASK modulation is especially susceptible to noise.
47. Each signal change can represent more than one bit.
48. Analog - to - analog modulation can be implemented by using the following
Amplitude modulation (AM)
Frequency modulation (FM)

ECET(CSE-II)

49. Phase modulation (PM) In AM radio, the bandwidth of the modulated signal must be twice the bandwidth of the modulating signal.
50. In FM radio, the bandwidth of the modulated signal must be 10 times the bandwidth of the modulating signal.
51. Errors can be categorized as a single - bit error or a burst error. A single-bit error has one bit errors per data unit.
52. Errors are corrected through retransmission and by forward error correction.
53. The Hamming code is an error correction method using redundant bits. The number of bits is a function of the length of the data bits.
54. By rearranging the order of bit transmission of the data units, the Hamming code can correct burst errors.
55. Flow control is the regulation of the sender's data rate so that the receiver buffer does not become overwhelmed.
56. Error control is both error detection and error correction.
57. In stop-and-wait ARQ, multiple frames can be in transit at the same time. If there is an error, only the unacknowledged frame is retransmitted.
58. Flow control mechanisms with sliding windows have control variables at both sender and receiver sites.
59. HDLC is a protocol that implements ARQ mechanisms. It supports communication over point-to-point or multipoint links.
60. HDLC protocol defines three types of frames; the information frame (I-frame), the supervisory frame (S-frame), and the unnumbered frame (U-frame).
61. Multiplexing is the simultaneous transmission of multiple signal across a single data link.
62. Frequency-division multiplexing (FDM) and wave-division multiplexing (WDM) are techniques for analog signal, while time-division multiplexing (TDM) is for digital signals.
63. In FDM, each signal modulates a different carrier frequency. The modulated carriers are combined to form a new signal that is then sent across the link.
64. In FDM, multiplexers modulate and combine signals while demultiplexers decompose and demodulate.
65. In FDM, guard bands keep the modulated signals from overlapping and interfering with one another.
66. Telephone companies use FDM to combine voice channels into successively larger groups for more efficient transmission.
67. Wave-division multiplexing is similar in concept to FDM. The signals being multiplexed, are light waves.
68. In TDM, digital signals from n devices are interleaved with one another, forming a frame of data (bits, bytes or any other data unit).
69. Framing bits allow the TDM multiplexer to synchronize properly.
70. Digital signal (DS) is a hierarchy of TDM signals.
71. Inverse multiplexing splits a data stream from one high-speed line onto multiple lower-speed lines.
72. Switching is a method in which communication devices are connected to one another efficiently.
73. A switch is intermediary hardware or software that links devices together temporarily.

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74. There are three fundamental switching methods : circuit switching, packet switching, and message switching
75. In circuit switching, a direct physical connection between two devices is created by space-division switches, time-division switches, or both.
76. In a space-division switch, the path from one device to another is spatially separate from other result
77. Multistage switches can reduce the number of crosspoints needed, but blocking may result.
78. Blocking occurs when not every input has its own unique path to every output
79. In a time-division switch, the inputs are divided in time, using TDM. A control unit sends the input to the correct output device
80. The time-slot interchange and the TDM bus are two types of time-division switches
81. Space and time-division switches may be combined
82. A telephone network is an example of a circuit-switched network
83. Ethernet is the most widely used local area network protocol
84. The IEEE 802.3 standard defines 1-persistent CSMA/CD as the access method for first generation 10-Mbps Ethernet
85. The data link layer of Ethernet consists of the LLC sublayer and the MAC sublayer.
86. The MAC sublayer is responsible for the operation of the CSMA/CD access method
87. The common baseband implementation of 10-Mbps Ethernet are 10 base 5 (thick Ethernet), 10Base2 (thin Ethernet), 10Base-T(Twisted -pair Ethernet), and 10 Base-FL (fiber Ethernet)
88. The 10Base 5 implementation of Ethernet uses thick coaxial cable. The 10 Base 2 implementation of Ethernet uses thin coaxial cable. The 10Base T implementation of Ethernet uses twisted-pair cable that connects each station to a port in a hub. The 10Base-FL implementation of Ethernet uses fiber optic cable.
89. A bridge can raise the bandwidth and separate the collision domains on an Ethernet LAN
90. A switch allows each station on an Ethernet LAN to have the entire capacity of the network to itself
91. Full-duplex mode doubles the capacity of each domain and deletes the need for the CSMA/CD method.
92. Fast Ethernet has a data rate of 100 Mbps
93. In Fast Ethernet, auto negotiation allows two devices to negotiate the mode or data rate of operation.
94. The fast Ethernet reconciliation sublayer is responsible for the passing of data in 4-bit format to the MII.
95. The fast Ethernet MII is an interface that can be used with both a 10- and a 100-Mbps interface.
96. The fast Ethernet PHY sublayer is responsible for encoding and decoding
97. The common Fast Ethernet implementation are 100 Base - TX (two pairs of twisted-pair cable), 100 Base-FX (two fiber - optic cables), and 100 Base-T4 (four pairs of voice - grade, or higher, twisted-pair cable).
98. Gigabit Ethernet has a data rate of 1000 Mbps
99. Gigabit Ethernet access methods include half-duplex using traditional CSMA/CD (not common) and full duplex (most popular method).

100. The Gigabit Ethernet reconciliation sublayer is responsible for sending 8-bit parallel data to the PHY sublayer via a GMII interface
101. The Gigabit Ethernet GMII defines how the reconciliation sublayer is to be connected to the PHY sublayer
102. The Gigabit Ethernet PHY sublayer is responsible for encoding and decoding
103. The common Gigabit Ethernet implementations are 1000 Base - SX (two optical fibers and a software laser source), 100 Base-LX (two optical fibers and a long-wave laser source), and 100 Base - T (four pairs of voice-grade, or higher, twisted-pair cable).
104. Gigabit Ethernet has a data rate of 1000 Mbps
105. Gigabit Ethernet methods include half-duplex using traditional CSMA/ CD (not common) and full duplex (most popular method).
106. The Gigabit Ethernet reconciliation sublayer is responsible for sending 8-bit parallel data to the PHY sublayer via a GMII interface.
107. The Gigabit Ethernet GMII defines how the reconciliation sublayer is to be connected to the PHY sublayer.
108. The Gigabit Ethernet PHY sublayer is responsible for encoding and decoding
109. The common Gigabit Ethernet Implementations are 1000Base-SX (two optical fibers and a shortwave laser source), 100Base-LX (two optical fibers and a long-wave laser source), and 100 Base-T (four twisted pairs)
110. The IEEE 802.11 standard for wireless LAN's defines two services; basic service set (BSS) and extended service set (ESS). An ESS consists of two or more BSSs ; each BSS must have in access point (A.P)
111. The wireless LAN access method is CSMA/CA
112. The MAC layer frame has nine fields. The addressing mechanism can include up to four addresses.
113. Wireless LANs use management frames, control frames, and data frames.
114. There are two popular approaches to packet switching; the datagram approach and the virtual circuit approach
115. In the datagram approach, each packet is treated independently of all other packets.
116. At the network layer, a global addressing system that uniquely identifies every host and router is necessary for delivery of a packet from network to network.
117. The IP protocol is a connectionless protocol. Every packet is independent and has no relationship to any other packet.
118. Every host or router has a routing table to route IP packets.
119. The telephone system will be digital from end to end new system known as ISDN, will be introduced in the future. Narrow band ISDN is a circuit-switched digital system that is an incremental improvement over the current system. In contrast, broadband ISDN represents a paradigm shift, since it is based on cell switching ATM technology. Various kinds of ATM switches exist, including the knockout switch and the Batcherbanyan switch.
120. For mobile applications, the hard-wired telephone system is not suitable. Alternatives to the telephone system include cellular radio and communication satellites. Cellular radio is now widely used for portable telephones but will soon be common for data traffic as well. The current generation of cellular systems (e.g., AMPS) are analog, but the next (e.g. PCS/PCN) will be fully digital. Traditional communication satellites are geosynchronous, but there is now much interest in low-orbit satellite systems such as Iridium.

121. Computer networks are inherently insecure. To keep information secret, it must be encrypted. Encryption protocols fall into two general classes : secret key (e.g. DES, IDEA), and public key (e.g. RSA). Using these protocols is straight forward ; the hard part is key management.
122. In addition to providing secrecy, cryptographic protocols can also provide authentication. Cryptography can also be used to follow messages to be signed in such a way that the sender cannot repudiate them have been sent.
123. Naming in the internet uses a distributed database system DNS, DNS holds records with IP addresses mail exchanges, and other information. By querying a DNS server, a process onto the IP address used to communicate with that domain.
124. As networks grow larger, they become harder to manage. For this reason special network management systems and protocols have been devised, the most popular of which is SNMP. This protocol allows managers to communicate with agents inside devices to read out their status and issue commands to them.
125. Four major network applications are electronic mail, USENET news, the World Wide Web, and multimedia (video on demand and Mbone). Most email systems use the mail system defined in RFCs 821 and 822. Message sent in this system use system ASCII headers to define message properties. These messages are sent using SMTP. Two systems of securing email exist, PGP and PEM.
126. USENET new consists of thousands of news groups on all manner of topics. People can join newsgroups locally, and can then post message all over the world using the NNTP protocol, which has some resemblance to SMTP.
127. The World Wide Web is a system for linking up hypertext documents. Each document is a page written in HTML, possible with hyperlinks to other documents. A browser can display a document by establishing a TCP connection to its server, asking for the document, and then closing the connection. When a hyper link is selected by the user, that document can also fetched in the same way. In this manner, documents all over the world are linked together in a giant web.

DTE	-	“Data Terminal Equipment”
DCE	-	“Data Circuit Terminating Equipment”
CGI	-	“Common Gateway Interface”
FTP	-	“File Transfer Protocol”
TELNET	-	“Terminal Network”
SMTP	-	“Simple Mail Transfer Protocol”
HTTP	-	“Hyper Text Transfer Protocol”
HTML	-	“Hyper Text Markup Language”
ATM	-	“Asynchronous Transfer Mode”
LAN	-	“Local Area Network”
WAN	-	“Wide Area Network”
MAN	-	“Metropolitan Area Network”
DNS	-	“Domain Name System”
CIDR	-	“Classless Interdomain routing”
APRANET	-	“(Advanced Research Project Agency Network”
ISP	-	“Internet Service Provider”

ISDN	-	"Integrated Services Digital Network"
ITU-T	-	"International Telecommunication Union standardisation"
Telecommunications Sector"	-	
CCITT	-	"Consecutive Committee for International Telegraphy and Telephony"
CDMA	-	"Code division Multiple Access"
FDDI	-	"Fibre distributed data interface"
MAC	-	"Media access control"
POP	-	"Post Office Protocol"
DHCP	-	"Dynamic Host Configuration Protocol."
RARP	-	"Reverse address resolution Protocol"
IGMP	-	"Internet Group Management Protocol"
HDLC	-	"High Level Data link control"
SNMP	-	"Simple Network Management Protocol"
LLC	-	"Logical Link Control"
UDP	-	"User Datagram Protocol"
TCP	-	"Transmission Control Protocol"
ISO	-	"International Standards Organization"
ITU - T	-	"International Telecommunications Union"
Telecommunication Standards	-	"Sector"
ANSI	-	"American National Standards Institute"
IEEE	-	"Institute of Electrical and Electronics Engineers"
EIA	-	"Electronic Industries Association"

PREVIOUS ECET BITS

2009

01. Which layer of OSI model provides connectivity and path selection between two end systems?
 - 1) Physical layer
 - 2) Data link layer
 - 3) Network layer
 - 4) Transport layer
02. Which of the following is not a packet switching characteristic?
 - 1) Shared bandwidth
 - 2) Queuing at routers
 - 3) Different parts possible
 - 4) store and forward
03. What is the max data capacity for optical fiber cable?
 - 1) 10 mbps
 - 2) 100 mbps
 - 3) 1000 mbps
 - 4) 10000 mbps
04. Ring topology is
 - 1) Active topology
 - 2) static topology
 - 3) Passive topology
 - 4) Dynamic topology
05. Which of the following TCP/IP protocol is used for transferring files from one machine to another
 - 1) RARP
 - 2) ARP
 - 3) TCP
 - 4) FTP
06. The default mode of HTPP1.1 is
 - 1) Persistent connections without pipelining
 - 2) Persistent connections with pipelining

07. Which of the following is not specified by 10 Base T?
 1) Twisted pair cable 2) Base band transmission
 3) 10 megabits per second data rate 4) T-style connectors
08. The length of IPVA addresses is
 1) 4 bytes 2) 6 bytes 3) 8 bytes 4) 16 bytes
09. Which of the following IP network address is a reserved address
 1) 197.65.10.0 2) 255.255.255.255 3) 127.0.0.0 4) 255.0.0.0
10. A company is converting a cabled LAN to a wireless Ethernet LAN. What must be changed on every host on the network
 1) No changes required 2) Each host requires new IP address
 3) Each host requires NIC or adapter upgraded 4) Each host requires operating system to be changed in the TCP/IP protocol suite, connectionless report is provided by
11. In the TCP/IP protocol suite, connectionless report is provided by
 1) TCP 2) IP 3) UDP 4) ICMP
- 2010**
12. The layer in which encryption and decryption is done is known as
 1) Application layer 2) Network layer 3) Transport layer 4) Presentation layer
13. Ethernet corresponds to the following OSI layers
 1) Presentation, application 2) Physical, data link
 3) Network, data link 4) Network, transport
14. Identity which of the network components given below is associated with OSI layer 3
 1) Router 2) Amplifier 3) Switch 4) Transmitter
15. The services like SNMP, SMTP are provided in the following OSI layer
 1) Application layer 2) Session layer 3) Transport layer 4) Network layer
16. Token bus is a LAN technology which
 1) Uses coaxial cable 2) Uses wireless communication channel
 3) Uses fiber optic cables for communication 4) permits easy adding more stations to the bus
17. Most web-enabled devices follow a wireless technology known as
 1) fire wire 2) Bluetooth 3) TCP/IP 4) Wi-Fi
18. Protocol used by internet is
 1) IPX/SPX 2) NetBIOS 3) TCP/IP 4) NetBEUI
19. The telnet server listens to the port numbered
 1) 21 2) 80 3) 25 4) 23
20. The number of bits in the internet protocol version 6 address is
 1) 32 2) 64 3) 128 4) 256
21. The number of hosts that can be assigned address with class C type of IP addressing is
 1) 2350 2) 250 3) 500 4) 1000
22. Frame is the data item that is formed in the _____ of OSI
 1) Layer 1 2) Layer 2 3) Layer 3 4) Layer 4
23. The FTP listens to the port numbered
 1) 21 2) 23 3) 25 4) 80
- 2011**

- 24.** In OSI network architecture, the dialogue control and token management are responsibility of _____
 1) Session layer 2) network layer 3) transport layer 4) data link layer
- 25.** How many OSI layers are covered in the X.25 standard
 1) two 2) three 3) seven 4) six
- 26.** Which of the following statement is incorrect
 1) the difference between synchronous and asynchronous transmissions the clocking derived from the data in synchronous transmission
 2) Half duplex line is a communication line in which data can move in two directions, but not at the same time
 3) Teleprocessing combines telecommunications and DP techniques in online activities
 4) Batch processing is the preferred processing mode for telecommunication operation
- 27.** Which of the following statement is incorrect?
 1) Multiplexers are designed to accept data from several I/O devices and transmit unified stream of data on one communication line
 2) HDLC is a standard synchronous communication protocol
 3) RTS/CTS is the way the DTE indicates that it is ready to transmit data and the way the DCW indicates that it is ready to accept data
 4) RTS/CTS is the way the terminal indicates ringing
- 28.** The transmission signal coding method of TI carrier is called
 1) Bipolar 2) NRZ 3) Manchester 4) Binary
- 29.** A standard program that has been modified to work on a LAN by including concurrency controls such as file and record locking is an example of _____
 1) LAN intrinsic software 2) LAN aware software
 3) Groupware 4) LAN ignorant software
- 30.** What is the central device in star topology?
 1) STP server 2) HUB/switch 3) PDC 4) Router
- 31.** Which of the following signal is not standard RS-232-C signal
 1) VDR 2) RTS 3) CTS 4) DSR
- 32.** To which class the computer belongs if its IP address is 192.5.5.0
 1) A 2) B 3) C 4) D
- 33.** What is the main difference between DDCMP and SDLC
 1) DDCMP does not need special hardware to final the beginning of a message
 2) DDCMP has a message header 3) SDLC has a IP address 4) SDLC does not use
- 2012**
- 34.** _____ layer is not present in the TCP / IP reference model
 1) Transport 2) Session 3) Internet 4) Application
- 35.** _____ is the Protocol Data Unit (PDU) used at the network layer of the OSI model
 1) Segment 2) Frame 3) Packet 4) Bits
- 36.** Which layer in the OSI reference model takes the responsibility of flow control ?
 1) Application layer 2) Transport layer 3) Network layer 4) Session layer
- 37.** _____ are the devices that operate at the network layer of the OSI model for forwarding the packets over WAN
 1) Hubs 2) Bridges 3) Switches 4) Routers

38. What does SMTP stand for ?
 1) Standard message transfer protocol
 2) Standard mail transfer protocol
 3) Simple mail transfer protocol
 4) Simple message transfer protocol
39. Identify the class of the IP address given in the binary representation below :
 11000110. 01110000. 00011100. 11111100
 1) A 2) b 3) C 4) D
40. Which of the following statement is typically FALSE about Ethernets ?
 1) Ethernets use circuit switching to send messages
 2) Ethernets are used in providing physical address
 3) Ethernet protocols use a collision - detection method to ensure that messages are transmitted properly
 4) Networks connected by Ethernets are limited in length to a few hundred meters.
41. _____ acts as security buffer between a company's private network and all external networks.
 1) Firewall 2) Password 3) Disaster recovery plan 4) Virus checker
42. How many bytes are used by the Class 'B' IP addresses to represent the Host and Network IDs ?
 1) 1,3 2) 2,3 3) 2,2 4) 3,1
43. _____ protocol is used for remote login purpose
 1) Telnet 2) HTTP 3) FTP 4) SMTP

PREVIOUS ECET BITS KEY

01) 1	02) 2	03) 2	04) 3	05) 4	06) 4	07) 1	08) 1	09) 2	10) 1
11) 3	12) 3	13) 4	14) 1	15) 4	16) 4	17) 4	18) 4	19) 4	20) 2
21) 3	22) 3	23) 4	24) 1	25) 4	26) 4	27) 4	28) 1	29) 2	30) 2
31) 1	32) 3	33) 1	34) 2	35) 3	36) 2	37) 4	38) 3	39) 3	40) 4
		41) 1	42) 3	43) 1					

PRACTISE SET-1

01. Which agency developed standards for electrical connections and the physical transfer of data between devices
 1) EIA 2) ITU-T 3) ANSI 4) ISO
02. In the original ARPANET, _____ were directly connected together.
 1) IMPs 2) host computers 3) networks 4) routers
03. This was the first network
 1) CSNET 2) NFSNET 3) ANSNET 4) ARPANET
04. _____ is the protocol suite for the current Internet

ECET(CSE-I)

05. 1) TCP / IP 2) NCP 3) UNIX 4) ACM
 A version of the _____ operating system included TCP / IP
06. 1) DARPA 2) NCP 3) UNIX 4) ACM
 Transmission media are usually categorized as _____
07. 1) fixed or unfixed 2) guided or unguided
 3) determinate or indeterminate 4) metallic or nonmetallic
 _____ cable consists of an inner copper core and a second conducting outer sheath
08. 1) Twisted - pair 2) Coaxial 3) Fiber - optic 4) Shielded twisted - pair
 In fiber optics, the signal source is _____ waves
09. 1) light 2) radio 3) infrared 4) very low frequency
10. Which of the following primarily uses guided media ?
 1) cellular telephone system 2) local telephone system
 3) satellite communications 4) radio broadcasting
11. Which of the following is not a guided medium?
 1) twisted - pair cable 2) coaxial cable 3) fiber - optic cable 4) atmosphere
12. In which type of switching uses the entire capacity of a dedicated link ?
 1) circuit switching 2) datagram approach to packet switching
 3) virtual circuit approach to packet switching 4) message switching
 In which type of packet switching do all the datagrams of a message follow the same channels of a path
13. In _____ each packet of a message need not follow the same path from source to destination
 1) circuit switching 2) message switching 3) both 1 and 2 4) none of the above
14. X.25 protocol uses _____ for end-to-end transmission
 1) message switching 2) circuit switching
 3) the datagram approach to packet switching 4) the virtual circuit approach to packet switching
15. The physical layer protocol directly specified for the X.25 protocol is _____
 1) RS - 232 2) X.21 3) DB - 15 4) DB 37
16. Which of the following is not a connecting device ?
 1) bridge 2) transceiver 3) router 4) repeater
17. A bridge forwards or filters a packet by comparing the information in its address table to the packet's _____
 1) layer 2 source address 2) source node's physical address
 3) layer 2 destination address 4) layer 3 destination address
18. Gateway function in which OSI layer ?
 1) lower 3 2) upper 4 3) all 7 4) all but the physical layer

19. A packet from an Ethernet network requires a _____ before it can be routed to an FDDI network
 1) repeater 2) bridge 3) router 4) gateway
20. Using the direct broadcast address, a _____ sends a packet to _____ on the network
 1) host ; all other hosts 2) router ; all other hosts
 3) host ; a specific host 4) host ; itself
21. In _____ delivery, packets of a message are logically connected to one another.
 1) a connectionless 2) a connection-oriented
 3) a direct 4) an indirect
22. In _____ delivery, a packet is not connected to any other packet.
 1) a connectionless 2) a connection-oriented 3) a direct 4) an indirect
23. In _____ routing, the routing table holds the address of just the next hop instead a complete route information
 1) next - hop 2) network - specific 3) host-specific 4) default
 1) 65, 535 bytes 2) 65, 515 bytes 3) 65, 475 bytes 4) 65, 460 bytes
25. A best - effort delivery service such as IP does not include
 1) error checking 2) error correction
 3) datagram acknowledgement 4) all of the above
26. A datagram is fragmented into three smaller datagrams. Which of the following is true ?
 1) The do not fragment bit is set to 1 for all three datagrams
 2) The more fragment bit is set to 0 for all three datagrams
 3) The identification field is the same for all three datagrams
 4) The offset field is the same for all three datagrams
27. In _____ a protocol associates a logical address with a physical address
 1) static mapping 2) dynamic mapping 3) physical mapping 4) 1 and 2
28. In _____ a table associating a logical address with a physical address is maintained on all devices on a network
 1) static mapping 2) dynamic mapping 3) physical mapping 4) 1 and 2
29. The _____ is a dynamic mapping protocol in which a logical address is found for a given physical address.
 1) ARP 2) RARP 3) ICMP 4) none of the above
30. The _____ is dynamic mapping protocol in which a physical address is found for a given logical address
 1) ARP 2) RARP 3) ICMP 4) none of the above
31. If a host needs to synchronize its clock with another host, it sends a _____ message
 1) timestamp-request 2) source-quench 3) router-advertisement 4) time-exceeded
32. Which of the following types of ICMP messages needs to be encapsulated into an IP datagram ?
 1) time exceeded 2) multicasting 3) echo reply 4) all of the above
33. Who can send ICMP error-reporting messages ?
 1) routers 2) destination hosts 3) source hosts 4) 1 and 2

34. The purpose of the IGMP query is to _____
 1) solicit membership in a group
 2) monitor membership of a group
 3) continue membership in a group
 4) all of the above
35. An IGMP query is sent from a _____ to a _____
 1) host ; host 2) host ; router 3) router ; router 4) router ; host
36. A group table entry is in the _____ state if there is no corresponding timer running
 1) FREE 2) DELAYING 3) IDLE 4) none of the above
37. UDP is an acronym for _____
 1) User Delivery Protocol
 2) User Datagram Procedure
 3) User Datagram Protocol
 4) Unreliable Datagram Protocol
38. In the sending computer, UDP receives a data from the _____ layer
 1) application 2) transport 3) IP 4) data link
39. The definition of reliable delivery includes
 1) error - free delivery
 2) receipt of the complete message
 3) in-order delivery
 4) all of the above
40. Which of the following does UDP guarantee ?
 1) nonduplication of data
 2) in-order delivery
 3) error-free delivery
 4) 1 and 2
41. Which components in our UDP package send user datagrams to the IP layer ?
 1) control-block module
 2) control-block table
 3) input module
 4) output module
42. IP is responsible for _____ communication while TCP is responsible for _____ communication
 1) host-to-host ; process - to - process
 2) process-to-process ; host-to-host
 3) process-to-process ; network -to-network
 4) network-to-network ; process - to -process
43. A host can be identified by _____ while a program running on the host can be identified by
 1) an IP address ; a port number
 2) a port number ; an IP address
 3) an IP address ; a host address
 4) an IP address ; a well - known port
44. The _____ address uniquely identifies a running application program.
 1) IP address 2) host 3) NIC 4) socket
45. In _____ data is sent or processed at a very inefficient rate, such as one byte at a time.
 1) Nagle's syndrome
 2) silly window syndrome
 3) sliding window syndrome
 4) delayed acknowledgement
46. To prevent silly window syndrome created by a receiver that processes data at a very slow rate, _____ can be used
 1) Clark's solution
 2) Nagle's algorithm
 3) delayed acknowledgment
 4) 1 or 3
47. The _____ timer keeps track of the time between the sending of a segment and the receipt of an acknowledgment
 1) retransmission 2) persistence 3) keepalive 4) time-waited
48. Which type of network using the OSPF protocol can have five routers attached to it ?
 1) point-to-point 2) transient 3) stub
 4) all of the above
49. _____ can request a service

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50. _____ can provide a service
 1) A socket interface 2) A port 3) A client 4) A server
51. _____ processes requests one at a time
 1) An iterative server 2) A concurrent server 3) A client 4) 1 and 2
52. _____
 1) An iterative client 2) An iterative server 3) A concurrent client 4) A concurrent server
53. The DHCP client may not send a _____
 1) DHCPDISCOVER 2) DHCPOFFER 3) DHCPREQUEST 4) DHCPRELEASE
54. A computer booted for the first time has its _____ stored on ROM
 1) IP address 2) subnet mask 3) IP address of a name server 4) none of the above
55. In the domain name chal. atc. fhda. edu _____ is the least specific label.
 1) chal 2) atc 3) fhda 4) edu
56. A DNS response is classified as _____ if the information comes from a cache memory
 1) authoritative 2) unauthoritative 3) iterative 4) recursive
57. A DNS _____ server gets its data from another DNS server,
 1) primary 2) secondary 3) root 4) all of the above
58. In a timesharing environment _____
 1) each user can access only his own computer 2) one computer supports multiple users
 3) each user has a dedicated computer 4) all of the above
59. In the local operating system always correctly interrupts the keystrokes accepted by
 the local terminal driver
 1) dedicated login 2) remote login 3) local login 4) 2 and 3
60. What is needed in option negotiation ?
 1) an option 2) an IAC control character 3) an option control character (WILL, WONT, DO, or DON'T) 4) all of the above
61. In the TELNET _____ mode, no GA character is sent.
 1) default 2) character 3) line 4) 2 and 3
62. Which of the following is not common to both local and remote login ?
 1) terminal driver 2) local operating system 3) application programs 4) pseudoterminal
63. Which of the following is true ?
 1) FTP allows systems with different directory structures to transfer files.
 2) FTP allows a system using ASCII and a system using EBCDIC to transfer files.
 3) FTP allows a PC and a SUN workstation to transfer files.
 4) all of the above
64. During an FTP session the control connection is opened
 1) exactly once 2) exactly twice 3) as many times as necessary 4) all of the above
65. When you _____ it is copied from the server to the client
 1) retrieve a file 2) store a file 3) retrieve a list 4) 1 and 3
66. A band is always equivalent to a
 1) a byte 2) a bit 3) 100 bits 4) none of above

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66. The loss in signal power as light travels down the fiber is called
 1) attenuation 2) propagation 3) scattering 4) interruption
67. Avalanche photodiode receivers can detect bits of transmitted data by receiving
 1) 100 photons 2) 200 photons 3) 2000 photons 4) 300 photons
68. Communication circuits that transmit data in both directions but not at the same time are operating in
 1) a simplex mode 2) a half duplex mode
 3) a full duplex mode 4) a asynchronous mode
69. An example of a medium speed, switched communications service is
 1) series 1000 2) data phone 50 3) CDD
 above 4) All of the
70. In communication satellite, multiple repeaters are known as
 1) detector 2) modulator 3) stations 4) transponders
71. The options field of the TCP header ranges from 0 to ___ bytes
 1) 10 2) 20 3) 40 4) 2^{32}
72. The ___ timer prevents a long the idle connection between two TCP's
 1) retransmission 2) persistence 3) keepalive 4) time-waited
73. The ___ timer is needed to handle the zero window-size advertisement.
 1) retransmission 2) persistence 3) keepalive 4) time-waited
74. Connection establishment involves a ___ handshake ; connection termination involves a ___ handshake
 1) one-way ; two - way 2) two - way ; three - way
 3) three - way ; three-way 4) three-way ; four-way
75. The TCP / IP application layer corresponds to the OSI model's ___ layer
 1) physical, data link, and network 2) transport and network
 3) session and transport 4) session, presentation, and application
76. Machine A requests service X from machine B. Machine B requests service Y from machine A. What is the total number of application programs required ?
 1) 1 2) 2 3) 3 4) 4
77. In a connection - oriented concurrent server, the ___ is used for connection only
 1) infinite port 2) ephemeral port 3) well-known port 4) 2 and 3
78. The ___ message offers the client an IP address
 1) DHCPOFFER 2) DHCPREQUEST 3) DHCPNACK 4) DHCPRELEASE
79. Which of the following domain names would most likely use a country domain to resolve its IP address ?
 1) chal.atac. fhda.edu 2) gsfc.nasa.gov
 3) kenz.acct.sony.jp 4) mac.eng.sony.com
80. In address-to-name resolution the ___ domain is used
 1) inverse 2) reverse 3) generic 4) country
81. Question records are round in the ___ record section
 1) question 2) answer 3) authoritative 4) additional information
82. A TELNET control character
 1) has its high-order bit set to 0 2) has its high - order bit set to 1

83. 3) is the same as a command 4) 2 and 3
 The ____ option allows the server to echo data received from the client
 1) binary 2) echo 3) repeat 4) 2 and 3
84. To interrupt the TELNET client, type ____ 2) Ctrl +] followed by Ctrl + c
 1) Ctrl + c 4) Ctrl +z
 3) Ctrl +]
85. In Rlogin, a command from the client to the server logs in with ____ 4) Ctrl +c
 1) the tilde 2) the use of 3) Ctrl + z
 2) the use of 3) Ctrl + z
86. There are three types of ____ : stream, block, and compressed 4) all of the above
 1) file types 2) data structures 3) transmission modes
87. ASCII, EBCDIC, and image define an attribute called ____ 4) all of the above
 1) file type 2) data structure 3) transmission mode
88. Which category of commands is used to store and retrieve files ?
 1) file transfer commands 2) access commands
 3) file management commands 4) data formatting commands
89. In anonymous FTP, the user can usually 2) navigate through directories
 1) retrieve files 4) all of the above
 3) store files
90. In a synchronous modem, the receive equalizer is known as
 1) adaptive equalizer 2) impairment equalizer
 3) statistical equalized 4) compromise equalizer
91. The channel in the data communication model can be 4) Any of the
 1) postal mail services 2) telephone lines 3) radio lines above
92. A data terminal serves as an
 1) Effector 2) Sensor 3) both 1 and 2 4) neither 1 nor 2
93. Which of the following transmission systems provide the highest data rate to individual device
 1) computer bus 2) telephone lines 3) voice and mode 4) lease lines
94. A protocol is a set of rules governing a time sequence of events that must take place
 1) between peers 2) between an interface 3) between modems 4) across an interface
95. A remote batch-processing operation in which data is solely input to a central computer would require
 1) telegraph line 2) simplex lines 3) mixed bad channel 4) all of above
96. While transmitting odd-parity coded symbols, the number of zeros in each symbol is
 1) odd 2) even 3) 1 and 2 both 4) unknown
97. Data communications monitors available on the software market include
 1) ENVIRON/1 2) TOTAL 3) BPL 4) Telnet
98. An example of an analog communication method is
 1) laser beam 2) microwave 3) voice grade telephone line 4) all of the above
99. Which data communication method is used to transmit the data over a serial communication link ?

- 1) simplex 2) half-duplex 3) full-duplex 4) 2 and 3
 100. What is the minimum number of wires needed to send data over a serial communication link layer ?
 1) 1 2) 2 3) 4 4) none of above

PRACTICE SET - I KEY

01) 1	02) 1	03) 4	04) 1	05) 3	06) 2	07) 2	08) 1	9) 2	10) 4
11) 1	12) 2	13) 3	14) 4	15) 2	16) 2	17) 3	18) 3	19) 4	20) 2
21) 2	22) 1	23) 1	24) 2	25) 4	26) 3	27) 4	28) 1	29) 2	30) 1
31) 4	32) 4	33) 2	34) 4	35) 4	36) 3	37) 3	38) 1	39) 4	40) 3
41) 4	42) 1	43) 1	44) 4	45) 2	46) 4	47) 1	48) 2	49) 3	50) 4
51) 2	52) 2	53) 4	54) 4	55) 2	56) 2	57) 2	58) 3	59) 4	60) 4
61) 4	62) 4	63) 1	64) 4	65) 4	66) 4	67) 2	68) 2	69) 3	70) 4
71) 3	72) 3	73) 2	74) 4	75) 4	76) 4	77) 3	78) 1	79) 3	80) 1
81) 1	82) 4	83) 2	84) 2	85) 2	86) 3	87) 1	88) 1	89) 1	90) 1
91) 4	92) 3	93) 1	94) 1	95) 2	96) 4	97) 1	98) 4	99) 3	100)
2									

PRACTICE SET - II

01. Why was the OSI model developed ?
 1) manufacturers disliked the TCP / IP protocol suite
 2) the rate of data transfer was increasing exponentially
 3) standards were needed to allow any two systems to communicate
 4) none of the above
02. The _____ model shows how the network functions of a computer ought to be organized
 1) CCITT 2) OSI 3) ISO 4) ANSI
03. The physical layer is concerned with the transmission of _____ over the physical medium
 1) programs 2) dialogs 3) protocols 4) bits
04. The OSI model consists of _____ layers
 1) three 2) five 3) seven 4) eight
05. As a data packet moves from the lower to the upper layers, headers are _____
 1) added 2) subtracted 3) rearranged 4) modified
06. In a noisy environment, the best transmission medium would be _____
 1) twisted - pair cable 2) coaxial fiber 3) optical fiber 4) the atmosphere
07. What protects the coaxial cable from noise ?
 1) inner conductor 2) diameter of cable 3) outer conductor material 4) insulating
08. In an optical fiber the inner core is _____ the cladding ?
 1) more dense than 2) less dense than

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09. 3) the same density as
 09. The inner core of an optical fiber is ____ in composition.
 1) glass or plastic 2) copper 3) bimetallic 4) liquid
10. Radio communication frequencies range from ____
 1) 3 KHz to 300 KHz 2) 300 KHz to 3 GHz
11. X.25 protocol requires error checking at the ____ layer
 1) physical 2) data link 3) network 4) 2 and 3
12. Frame relay requires error checking at the ____ layer
 1) physical 2) data link 3) network 4) none of the above
13. Why is so much error checking required for the X.25 standard ?
 1) X.25 requires a large bandwidth
 2) When X.25 was first introduced, the transmission medium was unreliable
 3) When X.25 was first introduced, the switching was unreliable
 4) When X.25 was first introduced, no multiplexing was available.
14. In frame relay, which bit in the address field is set to one to signify the last address byte ?
 1) DE (discard eligibility) 2) EA (extended address)
 3) C/R (command / response) 4) FECN (forward explicit congestion notification)
15. Which of the following can be handled by a gateway ?
 1) protocol conversion 2) packet re-sizing 3) data rate adjustment 4) all of the above
16. Bridges function in the ____ layer
 1) physical 2) data link 3) network 4) 1 and 2
17. A device has two IP addresses. This device could be ____
 1) a computer 2) a router 3) a gateway 4) any of the above
18. A host can get its IP address from its server by using ____ as the source address and ____ as the destination address.
 1) 127.127.127.127 ; 0.0.0.0 2) 255.255.255.255 ; 0.0.0.0
 3) 127.0.0.0; 255.255.255.255 4) 0.0.0.0; 255.255.255.255
19. In ____ delivery, both the deliver of the IP packet and the destination are in the same network
 1) a connectionless 2) a connection-oriented 3) a direct 4) an indirect
20. In ____ delivery, the deliver of the IP packet and the destination are on different networks
 1) a connectionless 2) a connection-oriented 3) a direct 4) an indirect
21. For a direct delivery, the ____ flag is on.
 1) up 2) gateway 3) host-specific 4) added by redirection
22. What is needed to determine the number of the last byte of a fragment ?
 1) identification number 2) offset number 3) total length 4) 2 and 3
23. The IP header size ____
 1) is 20 to 60 bytes long 2) is 20 bytes long 3) is 60 bytes long 4) depends on the MTU

24. Which IP option is used if exactly four specific routers are to handle the datagram ?
 1) record route 2) strict source route 3) loose source route 4) timestamp
25. A router reads the _____ address on a packet to determine the next hop
 1) logical 2) physical 3) source 4) ARP
26. An ARP reply is _____ to _____
 1) broadcast ; all hosts 2) multicast ; one host 3) unicast ; one hosts 4) unicast ; one host
27. An ARP request is _____ to _____
 1) broadcast ; all hosts 2) multicast ; one host 3) unicast ; one hosts 4) unicast ; one host
28. The purpose of echo request and echo reply is to _____
 1) report errors 2) check node-to-node communication
 3) check packet lifetime 4) find IP addresses
29. In error reporting the encapsulated ICMP packet goes to _____
 1) the sender 2) the receiver 3) the router 4) any of the above
30. One method to alert a source host of congestion is the _____ message
 1) redirection 2) echo-request 3) source-quench 4) destination - unreachable
31. How does a host respond when no processes in a group with a continue membership?
 1) The host sends a report 2) The host sends a query
 3) The host sends a NAK 4) The host does not respond
32. The least significant 23 bits in a 48-bit Ethernet address unambiguously _____
 1) identify a multicast router 2) identify a host
 3) identify a multicast group 4) none of the above
33. The _____ module receives an IGMP report or query.
 1) input 2) output 3) group-joining 4) group-leaving
34. In the sending computer, UDP sends a data unit to the _____ layer
 1) application 2) transport 3) IP 4) data link
35. UDP and TCP are both _____ layer protocols.
 1) physical 2) data link 3) network 4) transport
36. Which of the following does UDP guarantee ?
 1) sequence numbers on each user datagram 2) acknowledgements to the sender
 3) flow control 4) none of the above
37. Because there is no _____ UDP is considered a connectionless transport protocol
 1) acknowledgment 2) virtual circuit 3) reliability 4) data flow control
38. Which column in the control-block table contains information from the UDP header ?
 1) state 2) process D 3) port number 4) queue number
39. In a segment carries data along with an acknowledgment, this is called _____
 1) backpacking 2) piggybacking 3) piggypacking 4) mother's helper
40. The _____ field is used to order packets of a message

- 1) urgent pointer number 2) checksum 3) sequence number 4) acknowledgment
41. The _____ field is used for error detection
 1) urgent pointer 2) checksum
 3) sequence number 4) acknowledgment number
42. To prevent silly window syndrome created by a sender that sends data at a very slow rate, _____ can be used
 1) Clark's solution 2) Nagle's algorithm 3) delayed acknowledgment 4) 1 and 3
43. TCP uses _____ for error detection
 1) checksum 2) acknowledgment 3) time-out 4) all of the above
44. A server issues _____ open while a client causes _____ open
 1) an active ; an active 2) a passive ; an active
 3) an ephemeral ; a well-known 4) a well-known ; an ephemeral
45. An Ethernet LAN using the OSPF protocol with five attached routers can be called a _____ network
 1) point-to-point 2) transient 3) stub 4) virtual
46. Which layer produces the OSPF message ?
 1) data link 2) network 3) transport 4) application
47. A connection-oriented concurrent server uses _____ ports
 1) ephemeral 2) well-known 3) active 4) 1 and 2
48. A connectionless iterative server uses _____ ports
 1) ephemeral 2) well-known 3) active 4) 1 and 2
49. _____ processes many requests simultaneously
 1) An iterative client 2) An iterative server 3) A concurrent client 4) A concurrent server
50. The DHCP server may not send a _____
 1) DHCPOFFER 2) DHCPACK 3) DHCPNACK 4) DHCPRELEASE
51. _____ can supply a diskless computer with its IP address
 1) RARP 2) ARP 3) BOOTP 4) 1 and 3
52. In the domain name chal.atc.fhda.edu _____ is the most specified label
 1) chal 2) atc 3) fhda 4) edu
53. In _____ resolution the client is in direct contact with at most one server.
 1) a recursive 2) an iterative 3) a cache 4) all of the above
54. A resolver is the _____
 1) DNS client 2) DNS server 3) host machine 4) root server
55. Remote login can involve _____
 1) NVT 2) TELNET 3) TCP/IP 4) all of the above
56. The _____ at the remote site sends received characters to the operating system.
 1) terminal driver 2) pseudoterminal driver 3) TELNET client 4) TELNET server
57. To interrupt an application running at the remote site, type _____
 1) Ctrl + c 2) Ctrl +] followed by Ctrl + c 3) Ctrl +] 4) Ctrl + z
58. In Rlogin, a command from the server to the client is accomplished through _____

59. 1) the urgent mode 2) the use of 3) Ctrl + z 4) Ctrl + c
 During an FTP session the data connection is opened
 1) exactly once 2) exactly twice 3) as many as necessary 4) all of the above
60. What attributes must be defined by the client prior to transmission ?
 1) data type 2) file structure 3) transmission mode 4) all of the above
61. A file can be organized into records, pages, or a stream of bytes. These are types of an attribute called
 1) file types 2) data structures 3) transmission modes 4) all of the above
62. The transmission signal coding method of TI carrier is called
 1) Bipolar 2) NRZ 3) Manchester 4) Binar
63. In OSI network architecture, the dialogue control and token management are responsibility of
 1) session layer 2) network layer 3) transport layer 4) data link layer
64. In OSI network architecture, the routing is performed by
 1) network layer 2) data link layer 3) transport layer 4) session layer
65. Which of the following performs modulation and demodulation ?
 1) fiber optics 2) satellite 3) coaxial cable 4) modem
66. The process of converting analog signals into digital signals so they can be processed by a receiving computer is referred to as :
 1) modulation 2) demodulation 3) synchronizing 4) digitising
67. How many OSI layers are covered in the X.25 standard ?
 1) 4 2) 3 3) 2 4) 5
68. Layer one of the OSI model is
 1) physical layer 2) link layer 3) transport layer 4) network layer
69. The x.25 standard specifies a
 1) technique for start-stop data 2) technique for dial access
 3) DTE/DCE interface 4) data bit rate
70. Which of the following communication modes support two-way traffic but in only one direction at a time ?
 1) simplex 2) half duplex 3) three-quarters duplex 4) all of the above
71. A communications device that combines transmissions from several I/O devices into one line is a
 1) concentrator 2) Modifier 3) Multiplexer 4) full-duplex line
72. How much power (roughly) a light emitting diode can couple into an optical fiber ?
 1) 100 microwatts 2) 440 microwatts 3) 100 picowatts 4) 10 milliwatts
73. The synchronous modems are more costly than the asynchronous modems because
 1) they produce large volume of data 2) they contain clock recovery circuits
 3) they transmit the data with stop and start bits
 4) they operate with a larger bandwidth
74. Which of the following statement is correct ?
 1) terminal section of a synchronous modem contains the scrambler
 2) receiver section of synchronous modem contains the scrambler
 3) transmission section of a synchronous modem contains the scrambler
 4) control section of a synchronous modem contains the scrambler

75. In a synchronous modem, the digital-to-analog converter transmits signal to the
 1) equalizer 2) modulator 3) demodulator 4) terminal

PRACTICE SET - II KEY

01) 3	02) 2	03) 4	04) 3	05) 2	06) 3	07) 3	08) 1	09) 1	10) 3
11) 2	12) 4	13) 2	14) 2	15) 4	16) 4	17) 4	18) 4	19) 3	20) 4
21) 3	22) 4	23) 1	24) 2	25) 1	26) 4	27) 1	28) 2	29) 1	30) 3
31) 4	32) 4	33) 1	34) 3	35) 1	36) 4	37) 2	38) 3	39) 2	40) 3
41) 2	42) 2	43) 1	44) 2	45) 2	46) 2	47) 4	48) 2	49) 4	50) 4
51) 1	52) 1	53) 1	54) 1	55) 4	56) 2	57) 1	58) 1	59) 4	60) 2
61) 1	62) 1	63) 1	64) 1	65) 4	66) 4	67) 3	68) 1	69) 3	70) 2
71) 3	72) 1	73) 2	74) 3	75) 1					

PRACTISE SET-III

01. When data is transmitted from device A to device B, the header from A's layer 5 is read by B's _____ layer
 1) physical 2) transport 3) session 4) presentation
02. Which layer functions as a liaison between user support layers and network support layers ?
 1) network layer 2) physical layer 3) transport layer 4) session layer
03. What is the main function of the transport layer?
 1) node-to-node delivery 2) process-to-process message delivery
 3) synchronization 4) updating and maintenance of routing tables
04. Session layer checkpoints _____
 1) allow just a portion of a file to be resent 2) detect and recover errors
 3) control the addition of headers 4) are involved in dialog control
05. Encryption and decryption are functions of the _____ layer
 1) transport 2) session 3) presentation 4) application
06. The radio communication spectrum is divided into bands based on _____
 1) amplitude 2) frequency
 3) cost and hard ware 4) transmission media
07. When a beam of light travels through media of two different densities, if the angle of incidence is greater than the critical angle, _____ occurs
 1) reflection 2) refraction 3) incidence 4) criticism
08. When a light beam moves to a less dense medium, the angle of refraction is _____ the angle of incidence.
 1) greater than 2) less than 3) equal to 4) none of the above
09. When we talk about unguided media, usually we are referring to _____

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- 1) metallic wires 2) nonmetallic wires 3) the atmosphere 4) none of the above
10. Which field contains the permanent virtual circuit address ?
 1) EA 2) FECN / BECN 3) DE 4) DLCI
11. The most efficient medium for ATM is _____.
 1) twisted pair 2) coaxial cable
 3) fiber - optic cable 4) shielded coaxial cable
12. In data communications, ATM is an acronym for _____.
 1) automatic, teller machine 2) automatic transmission model
 3) asynchronous telecommunication method 4) Asynchronous telecommunication method
13. Because ATM is _____ cells do not usually arrive out of order because the cells follow the same path.
 1) asynchronous 2) multiplexed 3) a network 4) a connection - oriented
14. Which ATM layer specifies how user data should be packaged into cells ?
 1) physical 2) ATM
 3) application adaptation 4) data adaptation
15. Repeaters function in the _____ layer
 1) physical 2) data link 3) network 4) 1 and 2
16. A repeater takes a weakened or corrupted signal and _____ it
 1) amplifies 2) regenerates 3) resamples 4) reroutes
17. Which of the following is a source IP address ?
 1) this host on this network 2) limited broadcast address
 3) loopback address 4) specific host on this network
18. When a direct delivery is made, both the deliver and receiver have the same _____.
 1) routing table 2) IP address 3) hostid 4) netid
19. When an indirect delivery is made, the deliverer and receiver have _____.
 1) the same IP address 2) different netids
 3) the same netid 4) none of the above
20. The _____ flag indicates the availability of a router.
 1) up 2) gateway 3) host-specific 4) added by redirection
21. The _____ flag indicates that already existing information in the routing table has been modified by a redirection message.
 1) gateway 2) host-specific 3) modified by redirection 4) added by redirection
22. Which IP option always lists all routers visited ?
 1) record route 2) strict source route 3) loose source route 4) 1 and 2
23. The checksum in the IP packet covers _____.
 1) just the header 2) just the data
 3) the header and the data 4) just the source and destination addresses
24. The _____ module takes fragments of a message and puts them back in order.
 1) Processing 2) routing 3) fragmentation 4) reassembly
25. The ARP component that sends an ARP reply to the data link layer is the

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26. 1) cache controller 2) input module 3) output module
The ARP component that sends an IP packet to a queue is the _____
4) 1 and 2
27. 1) cache controller 2) input module 3) output module
ARP packets are sent to the data link layer by the _____
4) 1 and 2
28. 1) cache-control module 2) input module
3) output module 4) all of the above
Which field is always present in an ICMP packet ?
4) all of the above
29. A _____ can learn about network _____ by sending out a router - solicitation packet
1) router, routers 2) router, hosts 3) checksum
4) host, routers
30. ICMP packets are the output of _____
1) only the input module 2) code
3) both the input and the output module 3) host, hosts
4) neither the input nor the output module 4) all of the above
31. The _____ field of the IGMP message is all zeros in a query message ?
1) version 2) type 3) checksum
4) group address
32. The _____ field of the IGMP message is one for a query message
1) version 2) type 3) checksum
4) 1 and 2
33. The _____ module can create a new entry in the group table and start a timer.
1) input 2) output 3) group-joining 4) group-leaving
34. Which of the following functions does UDP perform ?
1) process - to - process communication 2) host-to-host communication
3) end-to-end reliable data delivery 4) all of the above
35. When the IP layer of a receiving host receives a datagram,
1) delivery is complete 2) a transport layer protocol takes over
3) a header is added 4) 2 and 3
36. Which of the following is not part of the UDP user datagram header ?
1) length of header 2) source port address 3) checksum 4) destination port address
37. The _____ defines the client program
1) ephemeral port number 2) IP address
3) well-known port number 4) physical address
38. TCP lies between the _____ and the _____ layers of the TCP/ IP protocol suite
1) application ; UDP 2) application ; transport
3) application ; network 4) network ; data link
39. Multiply the header length field by _____ to find the total number of bytes in the TCP header
1) 2 2) 4 3) 6 4) 8
40. Which field indicates the length of the TCP header ?
1) window 2) acknowledgment 3) header length 4) control
41. In _____ routing, the destination address is a network address in the routing table.
1) next - hop 2) network - specific 3) host-specific 4) default
42. The _____ flag indicates that the entry in the destination column is a host specific address.
1) gateway 2) host-specific
3) modified by redirection 4) added by redirection

43. The _____ module sends out an IP packet, the next-hop address, and interface information
 1) processing 2) routing 3) fragmentation 4) reassembly
44. The _____ module discards datagrams with a TTL value of zero.
 1) processing 2) routing 3) fragmentation 4) reassembly
45. The output of the _____ module is an IP packet destined for an upper layer protocol.
 1) processing 2) routing 3) fragmentation 4) reassembly
46. Which module can send an ICMP error message ?
 1) processing 2) routing 3) fragmentation -
47. An ARP packet from the data link layer goes to the _____
 1) cache - control module 2) input module 3) fragmentation 4) all of the above
48. An IP packet goes directly from the _____ to the data link layer if the state of the entry is RESOLVED
 1) cache - control module 2) input module
 3) output module 4) 1 and 3
49. The _____ packet contains information about a router
 1) router - solicitation 2) router - information
 3) router - advertisement 4) router - reply
50. ICMP functions include :
 1) error correction 2) detection of all unreachable datagrams
 3) reporting of some types of errors 4) all of the above

PRACTICE SET - III KEY

01) 3	02) 3	03) 2	04) 1	05) 3	06) 4	07) 2	08) 4	09) 4	10) 3
11) 2	12) 4	13) 4	14) 3	15) 1	16) 2	17) 1	18) 4	19) 2	20) 1
21) 3	22) 4	23) 1	24) 4	25) 2	26) 3	27) 4	28) 4	29) 4	30) 3
31) 4	32) 4	33) 3	34) 1	35) 2	36) 1	37) 1	38) 3	39) 2	40) 3
41) 2	42) 2	43) 2	44) 1	45) 4	46) 4	47) 2	48) 3	49) 3	50) 3

SELF TEST

01. Which of the following is an application layer service ?
 1) network virtual terminal 2) file transfer, access, and management
 3) mail service 4) all of the above
02. When a host on network A sends a message to a host on network B, which address does not router look at ?
 1) port 2) IP 3) physical 4) none of the above
03. To deliver a message to the correct application program running on a host, the _____ address must be consulted
 1) port 2) IP 3) physical 4) none of the above

04. IPv6 has _____ bit addresses
 1) 32 2) 64 3) 128 4) variable
05. ICMPv6 includes _____
 1) IGMP 2) ARP 3) RARP 4) 1 and 2
06. 10BASE2 uses _____ cable while 10BASE5 uses _____
 1) thick coaxial, thin coaxial 2) twisted pair, thick coaxial
 3) thin coaxial, thick coaxial 4) fiber optic, thin coaxial
07. 10BASE2 and 10BASE5 have different _____
 1) signal band types 2) fields on the frame
 3) maximum segment lengths 4) maximum data rates
08. _____ specifies a star topology featuring a central hub and unshielded twisted pair wire as the medium
 1) 10BASE5 2) 10BASE2 3) 10Baset 4) none of the above
09. The _____ houses the switches in token ring
 1) NIC 2) MAU 3) 9-pin connector 4) transceiver
10. What can happen at a token ring station ?
 1) examination of the destination address 2) regeneration of the frame
 3) passing of the frame to the next station 4) all of the above
11. FDDI is more efficient than a regular token ring because _____
 1) no timers are required 2) the node that has the token can send more than one frame
 3) the AC field is eliminated 4) of the added priority and reservation option
12. Which ATM layer has a 53-byte cell as an end product ?
 1) physical 2) ATM 3) application adaptation 4) cell transformation
13. Which application adaptation layer type can process a data stream having a non constant bit rate ?
 1) AAL 1 2) AAL 2 3) AAL3/4 4) AALS
14. Which AAL type is designed to support a data stream that has a constant bit rate ?
 1) AAL 1 2) AAL 2 3) AAL3/4 4) AALS
15. The end product of the AALS SAR is a data packet that is _____
 1) variable in length 2) 48 bytes long
 3) 44 to 48 bytes long 4) greater than 48 bytes long
16. A _____ field on a cell header in the ATM layer determines weather a cell can be dropped
 1) VPI (Virtual path identifier) 2) VCI (Virtual channel identifier)
 3) CLP (Cell loss priority) 4) GFC (generic flow constant)
17. A bridge has access to the _____ address of a station on the same network
 1) physical 2) network 3) service across point 4) all of the above
18. Routers function in the _____ layers
 1) physical and data link 2) physical, and network
 3) data link and network 4) network and transport
19. Using the limited broadcast address, a _____ sends a packet to _____ on the network
 1) host ; all other hosts 2) router ; all other hosts

ECET(CSE-I)

20. In _____ routing, the full IP address of a destination is given in the routing table.
 1) next - hop 2) network - specific 3) host-specific 4) host ; itself
21. ICMP packets are the input to _____.
 1) only the input module 2) only the output module
 3) both the input and the output module 4) neither the input nor the output module
22. A multicast message is sent from _____ to _____.
 1) one source ; one destination 2) one source ; multiple destination
 3) multiple sources ; one destination 4) multiple sources ; multiple destination
23. In networks that do not support physical multicast addressing, multicasting can be accomplished through _____.
 1) mapping 2) unicasting 3) queries 4) tunneling
24. The _____ module can decrement the reference count in the group table.
 1) input 2) output 3) group-joining 4) group-leaving
25. UDP needs the _____ address to deliver the user datagram to the correct application program.
 1) port 2) application 3) internet 4) physical
26. Which is a legal port address ?
 1) 0 2) 513 3) 65, 535 4) all of the above
27. The _____ defines the server program.
 1) ephemeral port number 2) IP address
 3) well-known port number 4) physical address
28. Which component in our UDP package communicates with the ICMP software package ?
 1) control-block module 2) control-block table
 3) input module 4) output module
29. What is the maximum number of no-operation options in one 32-bit word ?
 1) one 2) two 3) three 4) four
30. What is the maximum number of the end-of-options in the entire TCP header ?
 1) 30 2) 10 3) 9 4) 1

SELF TEST KEY

01) 4	02) 2	03) 1	04) 3	05) 4	06) 3	07) 3	08) 3	09) 2	10) 4
11) 2	12) 2	13) 2	14) 1	15) 2	16) 3	17) 1	18) 2	19) 1	20) 3
21) 1	22) 2	23) 4	24) 3	25) 4	26) 1	27) 4	28) 3	29) 3	30) 1