

Practical Networking & Data

Date _____ 20 _____

Communication

Lecture # 01

→ will not focus on this

- ✓ → whenever network is established, it is between client and server.
- ✓ → To study protocols and requirements.

Protocols:

I am q.

Set of rules that governs data communication

- ✓ Purpose of Networking:-
- Resource sharing
- communication

Communication

data)

Exchange of Data / (digital ↑) which is in the form of 0/1 in binary with the transmission medium → [conversion of data into signals.]

+ deals with signals

Two types data

- 1) Digital (0 1 0 1 ...)
- 2) Analog (Natural communication/ continuous data)

Types of Medium

- 1) Wireless
- 2) Wired

Shot on Y11

- ✓ signals are travelling in medium
- ✓ medium depends on type
- Both signals can transmit through medi.

Types of signal

- 1) Digital signal
- 2) Analog signal

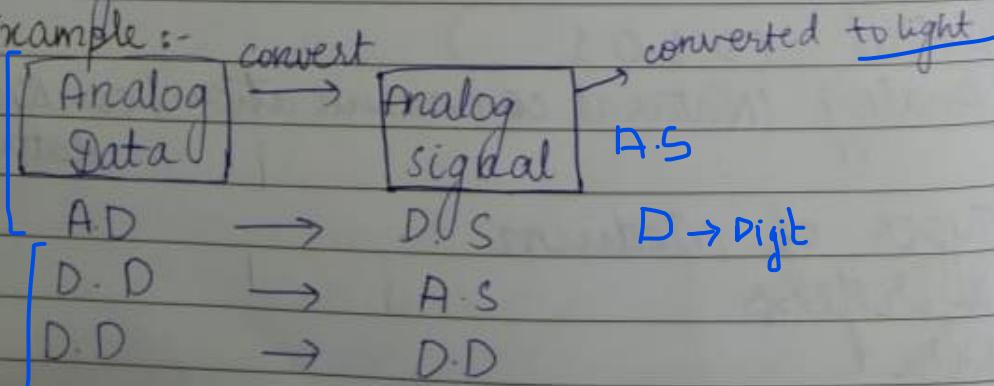
↙ light
fast signal
e.g. optical fibers
because it uses
fibres.

→ whenever we want to travel data then we will use signals.

convert Data → Signal is called natural communication.

Amplifier amplifies the voice, it increases voltage.

Example :-



Coaxial wire → ~~cable~~ cablewire
 Twisted ~~wire~~ pair → internet wire

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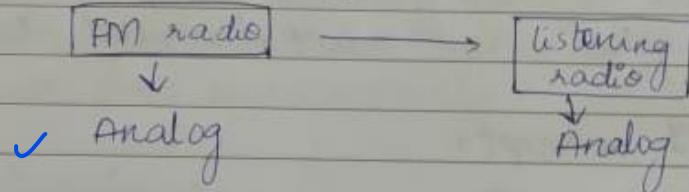


Voice recording on system, this process is called digitized

voice convert computer system is called A S O S

digitization and data is digitized

→ FM channels are Analog channel, it deliver analog signal



⇒ Generations of Mobile:- → Band width of signal / network

- 1) 1G ATMPS (Advance Mobile Phone System) → Analog signals
- 2) 2G GSM (Global Standard for mobile phones) → Mobile phones converted into digital signals
- 3) CDMA (Code Division Multiplexing)
- 4) 4G LTE
- 5) 5G (Not available in Pakistan)

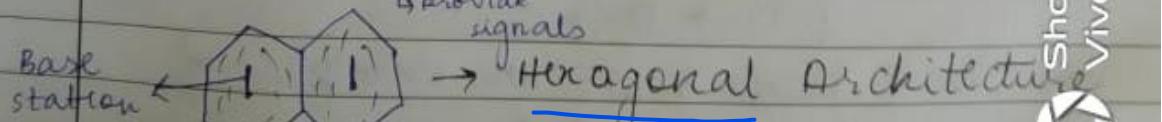


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Vivo AI camera

Network

Towers → Base station → cellular

provide signals



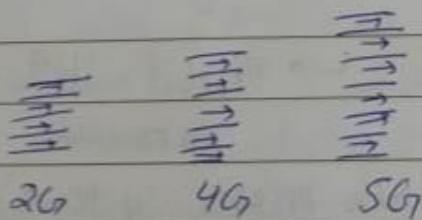
Ek base station pure hexagon ko cover kri thay



- ✓ → 2G k baad sara frequency ka concept hai
- After 2G, frequency is dependent on band width
- More frequency → More users
- 2G is only Voice.
- Example for 2G is A.D → D.S

- Original 2G is GSM and SMS.
- Before 3G we were basically using 2.5G, 2.5G support GSM + GPRS (limited internet)

Bandwidth concept :-

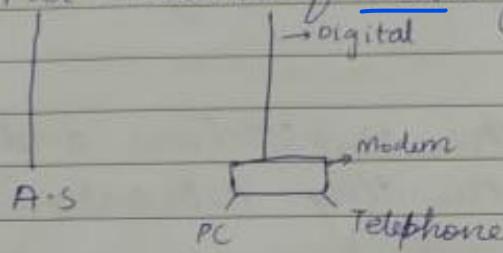


- ⇒ WCD (Wavelength code Division)
- TD (Time Division)
- FD (Frequency \downarrow)
- CD (Code \downarrow)

- ✓ Internet browsing is an example of D.D → D.S
- ✓ Song playing is an example of D.D → A.S

✓ Telephone line is Analog signal

Ptcl → Addition of DSL (Digital Subscriber line)



- ✓ Twisted pair can support digital and analog both signals.
- Before digital, in analog we had only one channel.
- In digital, we have 40 channels and we can use them simultaneously.



⇒ Multiplexing :- One wire ~~travels~~ ^{contains} multiple channels.

- ✓ Frequency of all channels is mix and travel.
- ✓ TV is deplexer which separates all channels ^{mix} and shows us.
- ✓ Internet is evolved due to multiplexing otherwise 1 wire means one channel.

Calculations.

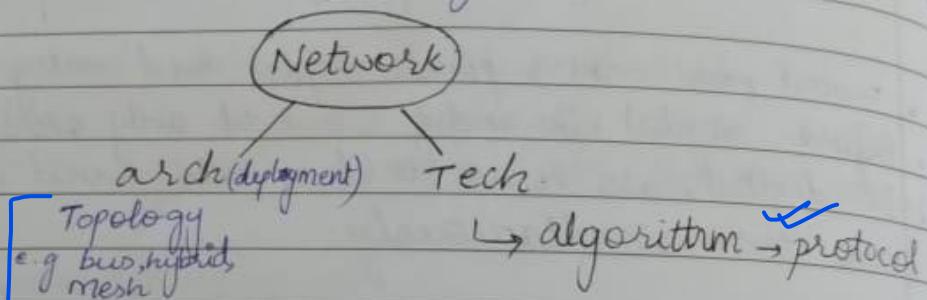
- Frequency Calculation
- Bandwidth calculation
- Bandwidth and data rate relations
- Data into signals conversion

→ Network :-

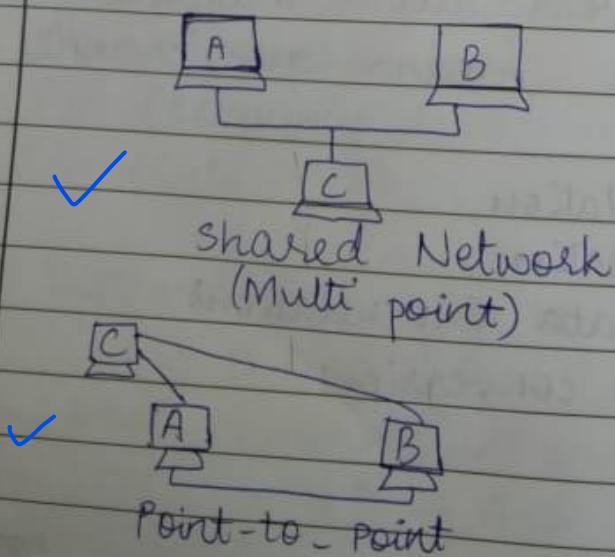
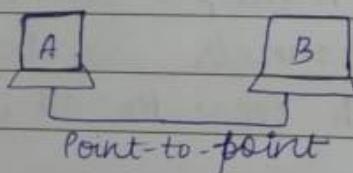
Connection of two devices or more.
E.g. TV and remote (infrared)

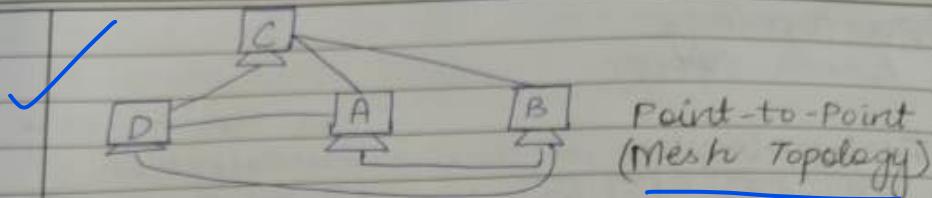
→ Networking :-

Networking is the architecture and technology of the communicating networks.



→ Architecture :-





✓ Mesh Topology:-

Every Device connected to every other device
security is there

✓ point-to-point → secure network

⇒ cable:

devices, $2 \rightarrow 1$

$3 \rightarrow 3$

$4 \rightarrow 6$

$5 \rightarrow 11$

$6 \rightarrow$

$$\frac{1}{2} \times n(n-1)$$

* This is practically impossible because as devices increases number of wires increases very much. Cost and size is too much.

* Jb tk architecture point - to - point hai tb

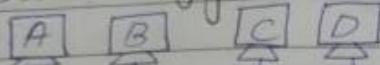
koi marta nhi hai. It is secure.





Bus topology :-
linear topology

Technology :-



Let \rightarrow $A \rightarrow B \rightarrow C \rightarrow D$ \rightarrow Bidirectional Broadcast

shared topology (CSMA/CD)

we have to sense
carrier/medium

If medium is free then
can talk otherwise

- In shared topology, we need technology to have noise free experience

- Technology means algorithm means protocol

Protocol of bus topology is CSMA/CD

Carrier Sense Multiple Access Collision Detection
Medium Avoidance

- Medium breakage will affect the whole connection
 $B \rightarrow C$

mediumfree = no signals in line

Types of casting :-

- 1) Uni casting 1 to 1
- 2) Multi , 1 to group / many
- 3) Broad , 1 to all / creates noise

→ Broad cast creates noise so it is discourage.
It creates extra traffic.

Bidirectional = because by sending data from B to C. B don't know C is on left or right this is called "Broadcast".

→ Types of Address :-

- 1) IP address
- 2) Name address
- 3) Port address
- 4) mac address

- Every parcel has one address written on it
- ✓ security is a problem here

(B → C)

(D → B)

✓ We will carrier sense at first, Both will bring their traffic on network but multiple access is not allowed so collision will occur (signals taken away). [High voltage is given in normal scenario] If carrier is busy then we will have to ~~wait~~ wait and if collision occurs we also have to wait for medium clearance. Jiska medium pehle clear hogya wo pehle caught kerga.]



✓ Only single access is allowed.

⇒ Duplex :-

✓ Mode of transmission
Types of Duplex :-

- 1) Full Duplex (send and receive both)
- 2) simplex (sender is always sender and receiver is always receiver)
- 3) Half Duplex (send or receive → one at a time)
e.g. Walkie Talkie

✓ Problem :-

* Half Duplex is a problem. Network ka size bra krenge tou zyada kRNA parega.
* Broadcasting is problem.

✓ Assignment :-

→ Collision Avoidance in mobile netw
4/5 steps

Hand written , single page

To Download for Lab :-

Cisco Packet Tracer (latest version)
Create account

LAB :-

- 1) Internet
- 2) Intranet
- 3) Extranet

To search

→ one way
communication
e.g. Radio

LAB 1

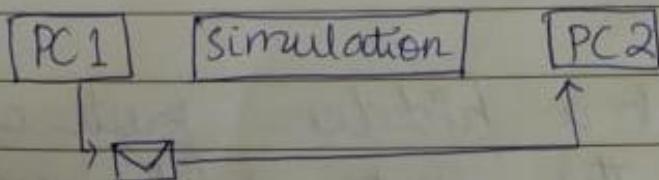
- * Topologies
- * Ethernet differences
- * WAN, PAN

LAB 2

- * IP addresses

LAB 3

- * simulations in Packet Tracer



- ✓ Upload lab on google classroom (CSV file)

Collision Avoidance in Mobile Networks

- i) We can avoid collision by using multiple access with collision avoidance (CSMA/CA). It is a multiple access method in which sensing is used, but nodes attempt to avoid collision.
- ii) Collision is avoided by beginning transmission only after the channel is sensed to be 'idle'.
- iii) When they do transmit, nodes transmit their packet data in its entirety.
- iv) It is particularly important for wireless networks, where the collision detection of the alternative CSMA/CD is not possible due to wireless transmitting their receivers during packet transmission.
- v) CSMA/CA is a hidden protocol that operates in the Data Link Layer of the OSI model.

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✓ Flowchart for CSMA/CA :-

Wire Networks
Date 26
using Carrier
Collision
a network
which carries
attempt to

ring
channel

transmit

for
collision
A/CD
transmitter
packet

that
of

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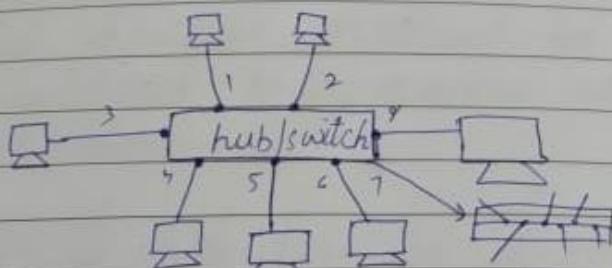
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Page

⇒ STAR Topology :-

- One central device to which all systems will be connected which is known as server.



✓ Internal Bus topology

- Medium breakage will not affect flow of data / connection

- Multiple devices can be connected

- Hub will manage data transmission

- This is internal bus topology where chances of medium breakage is minimum

- The issues are same as bus topology except medium breakage.

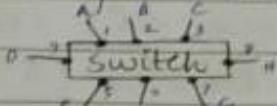
- We are only changing structure of bus.
- Hub is non-intelligent.

- It will broadcast data to all systems without any sense and exceptions.
It will broadcast on every point.

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topology, i.e. star and bus is constructed in a container.

⇒ If it is a switch: switch brings complete technology. Technology shifts where 'switch' is applied.



Device will use learning mechanism

1) Switch is an intelligent device]

2) The one who is intelligent will learn

3) Switch is an internal mesh topology i.e. in full duplexity. It is connected from two road on every port.

[Internal Bus Topology + Switch → Internal Mesh Topology]

[Non- Intelligent → Intelligent
Half Duplex → Full duplex]

Learning mechanism :

- 1) It becomes more intelligent/efficient after learning.
- 2) We will do decision making

- ✓ 3) It will learn port numbers
- ✓ 4) It will learn on what port which device is connected.
- ✓ 5) Learning of switch is based on MAC address (Media Access Control)
- ✗ 6) It is also called physical address and hardware address.
- * 6) Every device that needs to communicate over the network will use Mac address.
- ✓ E.g. Mobile, computer system, printer.
- 7) When you are going to access wifi then you'll require Mac address to connect.
- ✗ 8) Mac address can be changed. It travel with network in the form of bits.
- 9) Size of Mac address 48 bits
 - 24 bit - Manufacturer Id
 - 24 bit - Random/unique number
- ✓ 10) Data deliverance is always based on Mac address. Mac address must be

unique

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- 1) IP config will show IP and Mac Address which is written Hexa-decimal number

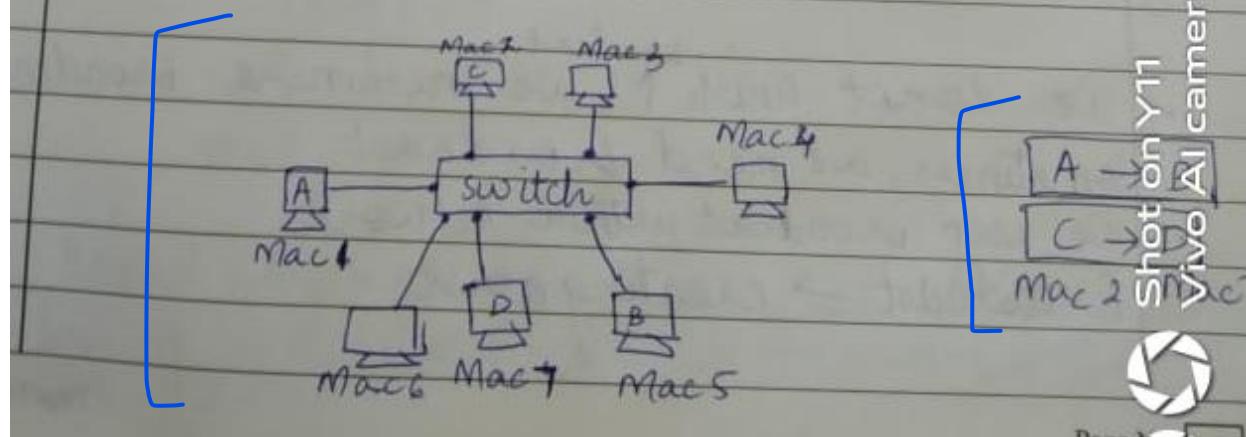
(A) B 19 75 CF → Total 12 bits
↓
4 bits

- ✓ 12) 1 digit of Mac address is of 4 bits.

- ✓ 13) Switch creates a table

- 14) So ~ 90 secs mai initially jb switch on hota hai toh sb keeza extra hal (depending on size of system)

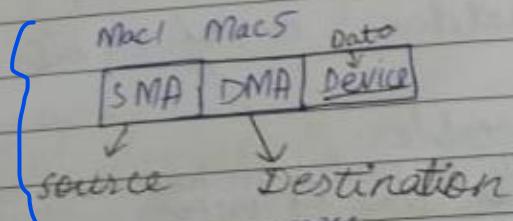
Port address	Hardware Address
6	Mac 1
5	Mac 2
3	Mac 4
2	Mac 5
1	Mac 6
4	Mac 3
7	Mac 7



⇒ Data Packet:-

In which data is stored. It constitutes source Mac address and destination Mac.

- ✓ • And we will hand over this parcel to switch.
- ✓ • Switch will read this parcel.



- 50-60 sec mai data learn kرنے k baad sb chezen stable hojati hain
- ✓ • Mac address will be checked of all devices by switch when required address is found then the data will be transferred.
- ✓ • After completion of learning, everything will be done on unicasting.
- ✓ • Here collision is not possible on switch.
- ✓ We do not finish ↑, we minimize broadcast Sometimes, we need broadcast
- ✓ We keep broadcast within network.
Broadcast → creating noise.

• If we want broadcasting then switch will perform otherwise it will minimize broadcast.

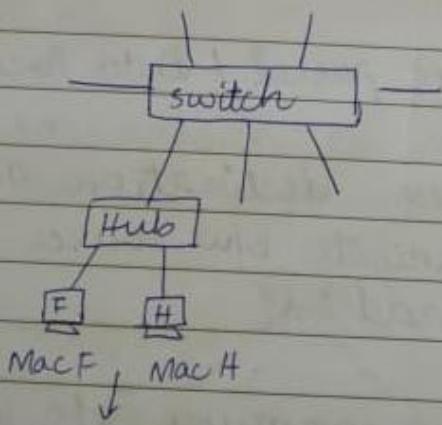
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~~Advantage of switch~~

- ✓) Full Duplex
- 2) No collision
- 3) Minimum broadcasting
- ✓) Unicasting
- ✓) Increased efficiency

Example :- Networks that we use nowadays.

- If there is no collision, then there is no wait so data rate will increase.
- ✓) Learning of switch is constant.
- ✓) If we reflect a port then the entry against it will also be removed, it will be removed from switch table.



✓) Broadcasting will occur on whole device but it will reflect it due to unmatched mac address.

Port	Hardware Address Mac F, Mac H	Date	Mac ad

✓ Ek port pe multiple mac address connected hokte hain magar shaft ye hai k port connected to switch se.

✓ If collision occur on hub connected multiple mac address, the port on switch will block this collision. It will filter the collision out.

✓ Switch ki har port collision domain hai. It will block collision. Port will filter the collision.

✓ Switch and Hub will create their own table / entries.

✓ system will create parcel / Data Packet

How can I access destination mac address to communicate b/w source and destination mac address?
 → using DNS

If you want to communicate with a device then you will need its mac address otherwise data delivery is not

Mac address is of 6 bytes (12 Hex / 48 bits)

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possible.

Two ways to communicate -

- 1) Name address.
- 2) IP address

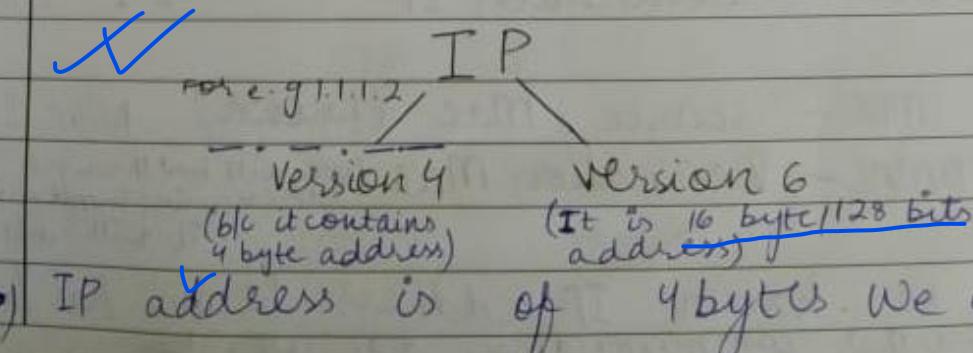
Ex: kisi bhi website ko kholek liye jo URL dalte hain wo name kehata hai jo IP address mai change hota hai.

DNS - Domain Name system

DNS converts name to IP address.

Example: contact list on mobile phone is based on DNS.

Ex: Agar hum website ka direct IP address dalden tou DNS ki zaroorat nahi



IP address is of 4 bytes. We use

DIRECT / INDIRECT SPEECH.

1. He told me that he was ready.
2. Sonia said that I helped her sister.
3. They told that they can not live without one another.
4. The Indian express tells that they will issue a astrology section in their Thursdays paper.
5. John says that he will go there.
6. Robert will tell me that he is my classmate.
7. Reema told Ali that he would not fight with him.
8. My father told me that it might rain there.
9. He said that he had gone to Disneyland there.

✓ communication occurs through IP and data is delivered through Mac address

✓ Version 1, 2, 3 nhi hai ~~so~~ kyun k address 4 bytes ka hota hai.

✓ IP address is same as home address
it will constitute home and block number
→ found through DNS

SIP — Source IP (known)	1.1.11
DIP — Destination IP	1.1.12

SMAC — Source Mac (known) Mac 1

DMAC — Destination Mac (we will find through IP address using broadcast)
X it will unicast

✓ DNS ka kaam IP address btana hai bs.
the further communication mai uska koi kaam nhi



Shot on Y11

Vivo AI camera

→ system generate broadcast and switch will forward it.

✓ ARP — Address Resolution Protocol
broadcast

- ARP will look for required mac address of destination
- If we want to broadcast then in destination mac address, it will turn all 'F' then the system is requesting broadcast to receive broadcast traffic then IP address will be matched.

DMAC → F F F F F F

- When IP address is matched / unicast then system will create reply which will be unicasted.
- When unicasting will occur source will convert into destination.

SIP	1.1.1.2
DIP	1.1.1.1
SMAC	Mac 5
DMAC	Mac 1

when required
system will reply
that I am the
one you are looking
for.

- Once Mac address is received, system will store into cache.
- Table tb tk exist krega jb tk system or hai
- Jb mac and IP address mil jata hai tb communication starts. a^p-a
- For Next class:-
Why not one Address?

There are five^{classes} of IP V4.

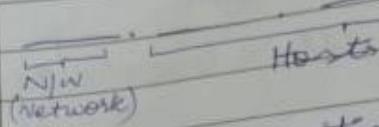
- A 1 - 126] These three are address to access the network
- B 128 - 191] [0.127] Internet
- C 192 - 223] → missing
- D 224 - 239 → Multicast IP is used
- E 240 - 255

200, 5 . 5 , 93

- * It will be considered as home address, we can use just this to access internet.
- * We use IP of D to Multicast
- * Either unicast or broadcast.
✓ If it is unicast then it will occur within it
- * After accessing a network by using a class IP then we can communicate in group through class D IP
✓
- * 1st octet pe 240 i.e. class E kahi nahi milogi
- * E class internet/network pe nazr nahi ayegi.



A



- 2 categorization

What is the concept of Network & Hosts.

* Network tells the location of yours.

E.g
Bulshan-e-Iqbal Block 4 is a network
And Houses are the ~~the~~ hosts.

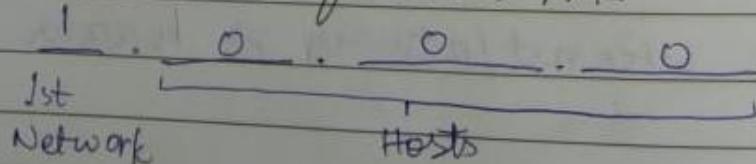
* Network is an environment and
the host exist within it.

* Network is a location and holds
many hosts.

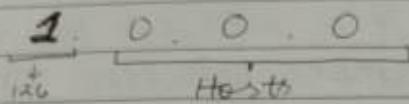
* Hosts need IP address to access Netwo

IP address → logical address

1st Network of class A:-



* Hosts are not known.



$$\begin{aligned} \text{3 bytes} &= 255 \times 3 \\ 1 \text{ byte } 255 &= 2^8 = 16M \end{aligned}$$

- * 1 byte is 255 so for 3 bytes, it is 255×3
- * 16M devices are possible in 1st network of class A

1.0.0.1

1.0.0.2

1.0.0.3

:

1.0.0.255

1.0.1.0

then 1.0.1.255 so on

:

- * Last address of 1st Network of Class A.

1. 255. 255. 255, all 1s in binary

- * We do not assign 1st and last address to any host.

- * We do not assign 1st address because it is all zero.

* Host & portion mai all 0 means network address It is address for all hosts It is the shared number between all hosts

* last address is called all 1s in binary.

* It is also not assigned to any host. It is known as broadcast address.

✓ [111 _____. _____. _____. _____. _____. _____.] is different from
✓ [1 _____. _____. _____. _____. _____. _____.]

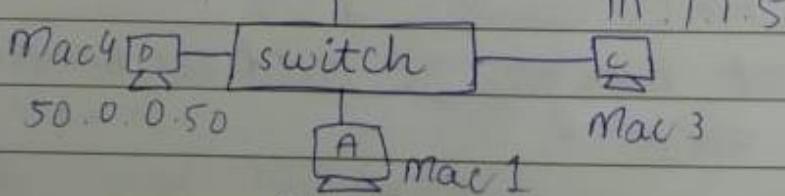
* broadcast means we want to send a message to everyone.

* We navigate through path using Network address. If we want to find network and then identify address then we will use Network address.

* When there is multiple network then in order to find address, we need network address.

111.0.0.2
B Mac 2

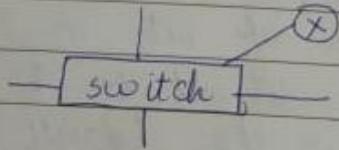
1 - 126



- * If this system creates a broadcast then it will remain inside the network. It will not reach devices outside the network.
- * Switch does not control broadcast, it minimizes it.
- * Router filters the broadcast, it will not go outside. It can connect it into another and then it can go outside.
- * If we are in a same network then the address should be same to access a device.
- * True hi IP address change hogta, switch main krdga connection i.e.
- * Switch same network mai connection krueda hai.

Router:

- (i) Router connects two dissimilar networks or two different networks.
- * It identifies networks.
- * Dissimilar respect to topology.
- * Topology is same but network number is different then we will introduce router.
- * Shortest path to reach a network symbol of router: 



- * Switch will request router to connect with ~~similar~~ dissimilar network.
- * We search path through network address.
- * There are some router protocols inside router. Identification of network is done through routers.

To check route =
Traceroute google.com
trace root google.com
+ It will tell after accessing how many paths we have reached to google

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- * If there is a traffic jam in one path then router will change the path switch will work inside network & router will work outside the network.
- * ✓ 1G has least cost because you will reach fast.
- * ✓ Jis ka factor km hogा uski quality high hogी

✓ [IP Address] These two [Subnet Mask] come together

Subnet Mask :-

It is used to identify the number of bits in a network portion.

- * ✓ It identifies number of bits in IP address.
- * ✓ It tells to convert 1st bit to 1 and others to 0. It is the default subnet mask of class A.

IP add 126.1.1.5

✓ [Subnet mask] 255.0.0.0

11111111 → /8 → 8 bits in network portion

- * ✓ It will only find network, not host that's why other bits will become 0



Shot on Y11

Conditions for class A:-

- * 1 - 126 ki range ho
- * /8 ho.

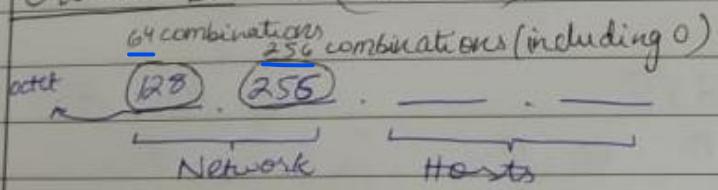
- * If it fulfills this definition then it is called class full address

19

- * If ~~is~~ 19 krdya tou isse class less address kahege. Jhn definition nahi fulfil horahi.

To restrict broadcast, we break networks or increase number of networks

→ Class B : (128 - 191)



- * First octet will represent the class. Lekn network address. dono octet ko mila k brega.

$$\begin{array}{l} \boxed{64} \times \boxed{256} = \text{Total combinations } 2^{14} \\ \text{Range} \qquad \qquad \qquad 16,384 \text{ Networks} \end{array}$$

- * Class A mai 126 networks the is mai 2^{16} networks hain.

$$\checkmark \text{ Hosts} = \underbrace{2^{16}}_{\text{including}} - 2 = 2^{14}$$

including
network
address
↳ broadcast
address

Hosts in class B:

2 16 - 2

(-2 because 1st or last address not
karte)

1st Network of class

128 0.00 → 128 0.0.0

128 . 1 . 0 . 0 0 . 1

0 . 2

6

128 - 255

255°. 255

129.0.0.0

Last address of class B is

~~4-1-~~ 191 255 . . .

Network Address \rightarrow 129.1.1.0

IP / 16
Subnet Mask → 16 bits → classful
because of 2 octets of network portion.

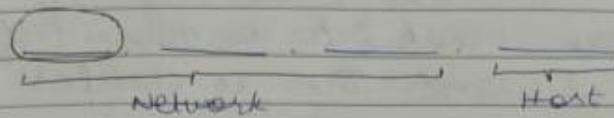


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⇒ class C. (192 - 223)



~~Total Networks:-~~

$$\cancel{2^8} = 2^7 \text{ networks}$$

Total Hosts :-

$$2^8 - 2 = 254$$

1st Network of Class C

192.	0.	0.	0 } Host
192.	0.	1.	0 }

255.255.255.0

Subnet Mask :- /24

255.255.255.0

How to avoid wastage of Networks?

* 16M users of a network is not possible.

Long run solution → IPV6

Short-term solution → Apni requirements

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1.0.0.0

we can break into my requirements.
I can break into as many networks
as I want. This is classless concept.



LAB #02

- MAC address → Physical address ✓
 - cannot be changed ✓
 - works on DLL
- IP address → logical address ✓
 - can be changed ✓
 - work on Network layer ✓
- ✓ DLL → Data Link Layer → Mac Address

- we need IP address to access a network of outside Domain.

- * Class A is used in govt. sector
- * Class B is used in medium size organization
- * Class C " " " small companies.

A	0			
B	10			
C	110			
D	1110			
E	1111			

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* These are fixed and will never change.

✓ Private IP address → cannot be used through internet

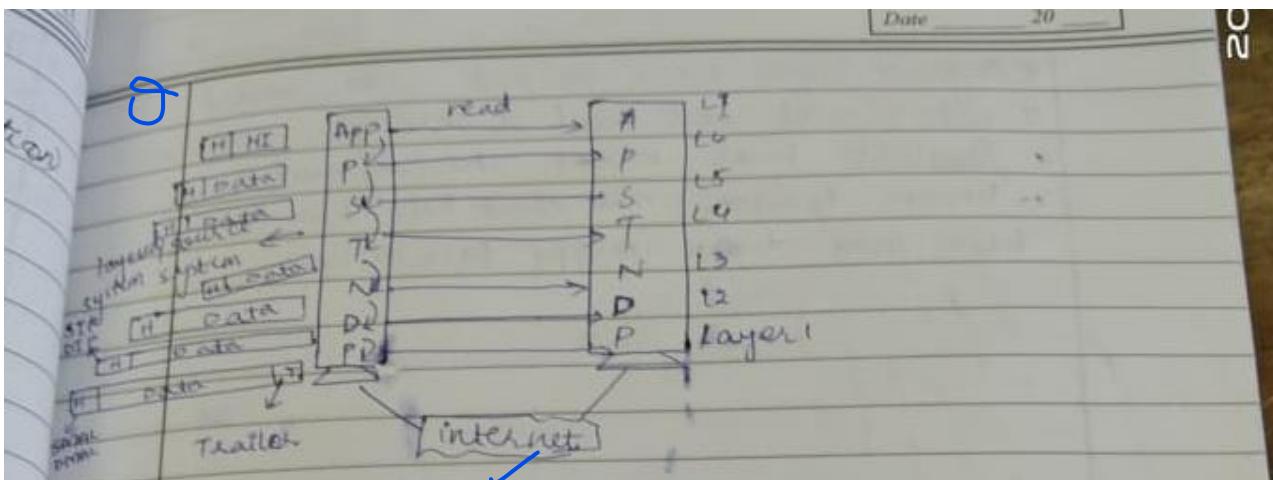
Lecture # 04

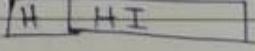
OSI Model :- open system Interconnect

7 Layers of OSI Model

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





- ✓ * Neighbour layer will only communicate to its neighbour
- * Extra layer / information that will travel with data
- ✓ * Data is variable and Header will be attached information 

* Har layer apni information/header attach krdga jo se data ka size barhta jaega

* Data Link layer pl trailer bhi attach hota hai data k sth

* Header mai addresses k elawa bhi information store hoti hai jo hmne is course mai parkna hai

* Data ka size bht ziada hogा chahiye data kyun naa ho kyun k IP address or Mac address attach hote hain.

Date

- ✓ ~~Ques~~
- * Physical layer have to pick data, convert it into signal and send it through a medium.
 - * Trailor have error checking codes.
 - ↳ Error trailor mai check hote hain jink basis mai data verify karwate hain.

- * Data will be verified by Trailer. If data is verified then trailer will be dropped otherwise it won't.
- * ab data network layer pe ayaega jhn IP or Mac address check krenge Agr match kryaega tou drop kiderge.
- * Header layer pe ~~information~~ information ki verification
- * Data Link layer of one system can only be read by data link layer of other system, other layers cannot read it.
- * communication is occurring in pairs.
- * Jo link hai wohi link dusre system ki information ko read karskti hai
- * Every layer is multiple fields.
- * Physical layer mostly perform the tasks that we discussed in 1st class (signal, medium, topology)
- * Physical layer is layer 1 because it is closer to the medium.
- * Physical layer is related to Electrical Engn.



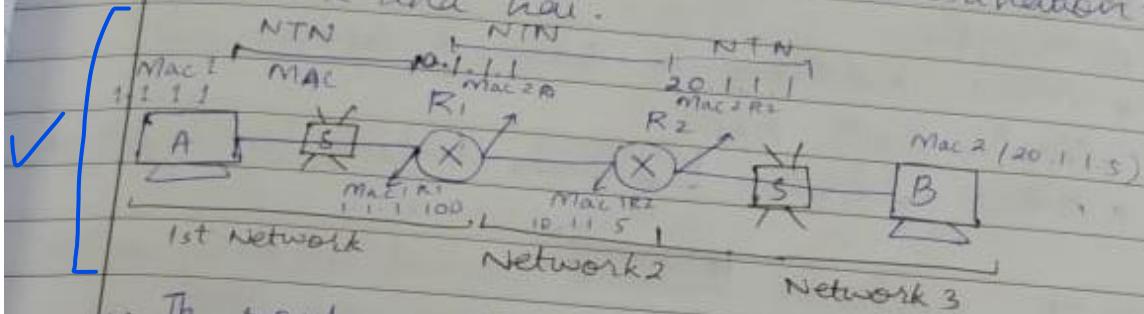
Delivery of data

Date

20

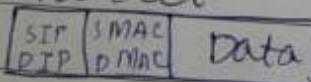
- ✓ Data Link \Rightarrow Node to Node
- ✓ N/W \Rightarrow Source to Destination
- Transport \Rightarrow End to End

* Parcel ko utthana hai or destination tk chod k ana hai.



- ✓ Jb router lg gya iss ka mtlb hai ek se zyada network agae
- ✓ Networks can be more than 3 as well.
- ✓ You can make system a router
- ✓ Haar interface ek address generate kr ke le ke acha hota hai.

Parcel



SIP 1.1.1.1
DIP 2.0.1.1.5
SMAC Mac1
ARP \neq DMAC

Shot on Y11

- * Router will drop broadcast packet.
- * wo system jo network se baki ho uska MAC Address nahi find karta.
- * Data delivery is always based MAC address.
- * APP ki broadcast to successful hogi, ^{to} wo mere network pe mit hon.
- * MAC address cannot go outside network.
- * MAC address ki base k. upar bhi attacks hote hain.
- * MAC address boundary Local (locally unique)
- * IP address boundary Global (globally unique)
- * kisi bhi outside system ka MAC address findout kiske

IP
 SB (Subnet Mask)
 DG (Default Gateway) ← A

Default gateway (DG) :-
 visa to go out of network.

* Iss system ka gateway router hai.

Gateway:

Next point is k through exit kr ske ha



- ✓ * Normally, there is only one exit.
- ✓ * Data delivery is based on Mac address.
- ✓ * To packet reader k pe pachch jaega to mac address ho raha dega.
- ✓ * Router have routing table, it is formed by observing networks.
- ✓ * MAC address change hota jata hain, IP address same hota hain.
- ✓ * IP address remain same.
- ✓ * Communication takes place through IP address.
- ✓ * This is called Node to Node delivery.

⇒ Transport:-

It ensures the delivery from end to the other end.

Assignment:-

Q. When we are already at the destination through network layer or IP address then why we need transport layered delivery of data which delivers end to end?
(working of transport layer)



Lab # 04

Point-to-Point Network creation

- * Jis komare ps 2 devices hongi same tou hm crossover cable use krnge for connection.

- * Agr green Δ hai tou connection chahi

- * Agr red Δ hai tou connection inc. hahi

.) static → manual IP address assign define kte hain

.) DHCP → assign IP address automatically. (we need DHCP server for this)

* we are using static

PC1 :-

IP Address : 10.0.0.1

Subnet Mask : Automatically Appear

Q2 :

IP Address : 10.0.0.2

Subnet Mask : Automatically appear

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Page No.

ping (2ways)

- ① Command Prompt
- ② Graphical

meaning → small unit of data sender & receiver
 kps jae or phir receiver se sender
 kps jae

Steps :-

select PC1 → Desktop → command prompt →
 command (ping 10.0.0.2)

✓ PDU (Protocol Data Unit)

select closed envelope (Add simple PDU)

PDU :-

- i) Graphical method to ping between two devices that have at least one interface within IP address

* Quiz in next class
* Topics done till today

Date 29.03.2021

Lecture #05

→ Transport layer \Rightarrow End to End
Process to Process
App to App

Requirement of Transport layer:-
When your data delivers at destination, but we are using multiple applications at a time, transport layer guide that to which application a data should be delivered.

✓ It specifies where to deliver data.

* we use another approach for this purpose i.e. port address.

→ Port address:-

It makes sure that the data is delivered to its correct location

Sport \rightarrow Random number

2^{16}
D port

32
SIP

DIP

48 SMAC, DMAC

- Source port is not a problem because we know their address
- Destination port number is a well-known protocol number.

✓ Port address is 16 bit number

$2^{16} \rightarrow 65536$

* Every application that needs to communicate with network



over the internet then it needs port number to do that.

- * We have attached destination port number with the protocol. Now we don't need to tell explicitly everytime. These numbers are fixed (default).

~~x~~ [HTTP (port no 80)
HTTPS (" , 443)
DNS (port no 53)
FTP (" , 21)
Telnet (" , 23)

↳ Remote addressing

[To send email or outlook
SMTP (port no. 25)
POP 3 (" , 119)
↳ email get on outlook]

- * These port no. are standard / default

[0 - 1023]

- This number is reserved for port number. If we are creating our own application then it is recommended to use port number from this range.



445 (Port no. for redirection)

- If we use this then the system won't connect with the by-default webserver, it will connect with the application that has port number that is written before colon (:). → 445
- Attack occurs on the basis of port no

For example :-

http://www.google.com:445

- Port scanning - kon kon se port available hain

To search,

SQL Rejection.

- * All the three addresses are very important. They work together to ensure the correct delivery of application.

Other responsibilities of layers.

- I) Data link layer:
 - i) Error control
 - / \
 - Error detection
 - Error correction
 - ii) Node to Node



case
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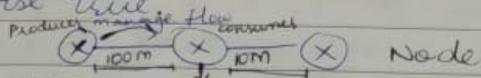
Date 20

Error Detection:

- ✓ It checks if the data has changed during travelling or not.

① Error detection Algo

- * Error detection algorithms state true or false i.e they check whether the data that has reached is authentic / correct or not If data is correct then error detection will state false otherwise true



Error Correction: buffer management

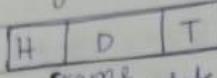
- ✓ If error is detected then we send it to error correction. Identifying the position is the problem. We use Hamming algorithm for this purpose.
- * Agar data sahi hogaya (0 ko 1 kardiya, 1 ko 0 through algorithm then the time for resubmission will be saved.

② Error correction Algo

(ii) Flow Control :-

- Buffer : Jhn data store hota hai / process hota hai
- ✓ → Buffer Management
- ✓ → Buffer ki capacity k mutabiq data bhejna
 - size or capacity to handle data.
- * Data flow control is the responsibility of consumer and will ask the producer to slow down otherwise there will be data loss due to buffer overflow.

- ① Flow control Algo
 - * Data is called frames
- w) Framming :-



Frame
is complete data

Har a node pe frame bn rhe hot.
hain agli node tk k liye

- * Data wapis IP ki base pe ayega
- * b/c T pe error control & numbers hote hain together with source and destination addresses that is why it changes on every node.

2) Network Layer:-

i) STD

- * Source to destination delivery of data with the help of IP address

ii)

Routing :- (Most important)

Telling route to data address (data packet)

① Routing algo.

- * Most important feature of network layer.

iii) Fragmentation.



Switch It is data link layer device

Firewall :-

- ✓ It will determine who will come and go from the network.
 - * It is used for security.
 - * It checks who will enter or leave the network.
 - ✓ It is done on packets.
 - ✓ Packet level filtering - Packet ko dekh k decide kina by seeing the IP's k agey bhejna hai ya drop kina hai.
 - [* Data is called packets.
- Router - It is layer 3 device (Network layer)

4) Transport Layer

- ✓ i) Application-to-Application
- ✓ ii) Error Control / Flow Control - It is happening from Application-to-Application

Buffering - flow control

Transport layer:-

Buffering from Application-to Application

D.L.L:-

Buffering from node-to-node

- ✓ * Data is called segment.

○ Same Algo as D.L.L but implementation is different
Segment:- Managable chunks.

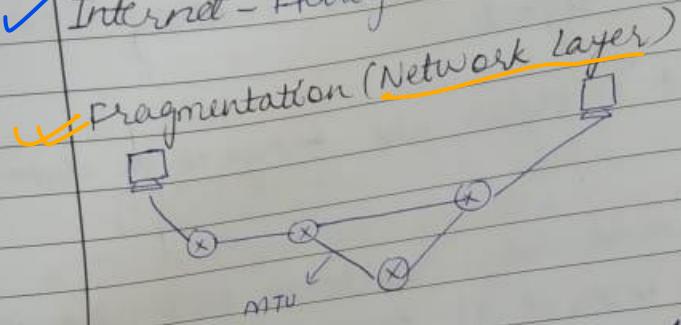


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Vivo AI camera

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✓ Internet - Heterogeneous network.



✓ By default its size is 1800 (MTU size)

- * Data bytes ki form main barabar hai tou we ~~data~~ divide it. This is called fragmentation.
- ✓ Router divide packets on the basis of MTU size. It occurs while travelling of data
- * optional.
- * It is done by router.
- * It can be done multiple time if needed.
- ✓ Re-assembling of packets is done by network layer itself

⇒ Multiplexing

Every port number will communicate through a single IP address. We use socket for uniqueness. We communicate through sockets.

✓ Network programming.



Combination of IP and Port number.

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•) Session Layer

✓ Create, Maintain, disconnect.

✓ Responsibility of session layer is creating a session and encrypting that session. No one can read that session.

Session :-

The communication with Google or Facebook and other application.

[http → insecure] If we enter
[https → secure] a password.

2) Multiprocessing - It creates session of process to increase the speed of processing

•) Presentation Layer

- 1) Encoding / Decoding → codes mai convert karna
- 2) Encryption / Decryption → security
- 3) Compression / deCompression.

•) Application Layer

Applications that we are using
Assignment :-

* Differentiate b/w TCP/IP and OSI model.

* Quiz (Reasoning and MCQ's)

10 Marks