

OSI Model Layer (Open System Interconnection)

उपर वाली layer का packet piggyback, नीचे वाली layer का सक पलाई है।
अंत में फिरिकल लेयर इस पैकेट को इसी end होर पर ले जाता है।

D.

functions provided.

OSI layer

Physical

Transmission of binary data of a medium.
मीडिया वालों द्वारा दास्तावेश करता है।

Data link

Transfer of Unit of Information
framing & Error Checking.
Fiber Optics, UTP, COAX, STP, DLL unit of info. को दास्तावेश करता है,

Network

Delivery of Packets of Information, which includes routing.
जहाँ IP info. के packets की delivery के लिए है, जिसमें Routing शामिल है।

Transport

Provision for end-to-end reliable & unreliable delivery.
End to End Reliable/ Unreliable delivery करता है।

Session

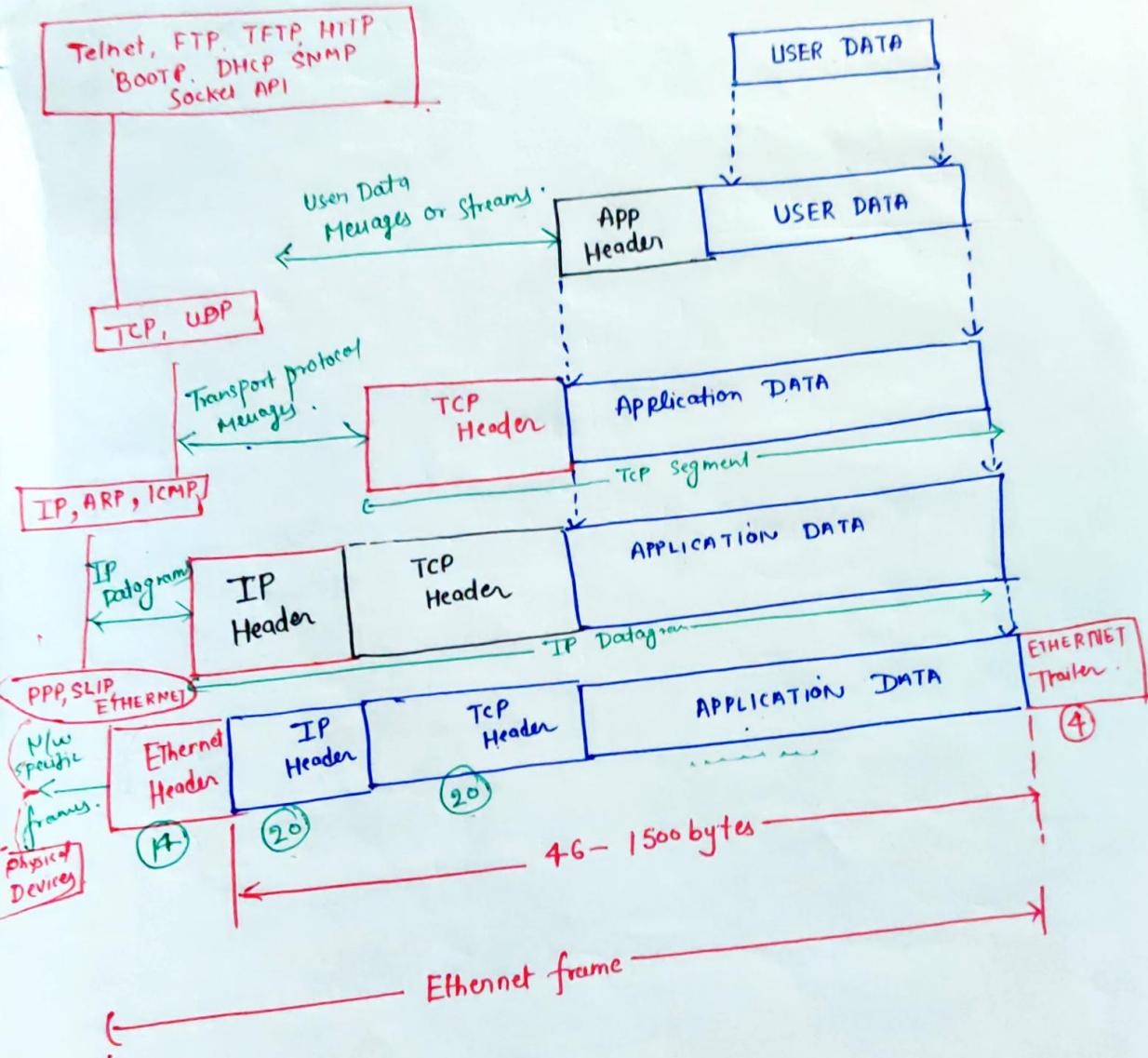
Establishment & maintenance of Sessions.

Presentation

Data formatting & Encryption.

Application — N/w applications such as file transfer & terminal emulation.

Ping, DNS, Telnet, TFTP, FTP, BOOTP, RIP, OSPF, SNMP, SMTP, POP3, IMAP4



(2)

TCP / IP - Packet Encapsulation

typical component of an N/w

Client
Server

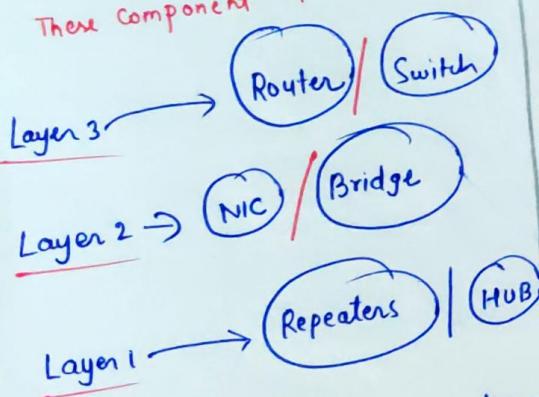
FTP - Server.
FTP - Client.



web Browser.
पृष्ठ जो उपयोग करते हैं वह Server है,
जैसे gpk.ac.in की access कर
रहा है - यह एक HTTP सर्वर है
वहाँ से HTTP Client है, जैसे
Browser HTTP Client है।

Browsers HTTP Client है।

These component operates at -



NIC (L1) N/w Interface Card, यह भी layer 2 device है।
यह MAC address यह ऑफिस-लेवल N/w address
जैसे कंपनी के विहार का address होता है।

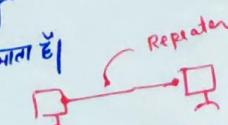
MAC - Media access control

NIC provides hosts with access to media by
using MAC address.

→ यह एक Unique address है जिसका OEM नाम भी होता है।

amplify & Retime Signals.

Repeaters (L1)



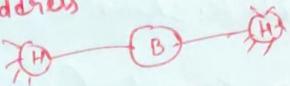
Repeater.
If we want to
connect more
than two
systems over
a n/w.

HUB (L1)

"A multi Port Repeater"
is called Hub -

can not filter traffic.

Bridges filters n/w traffic based on
MAC address

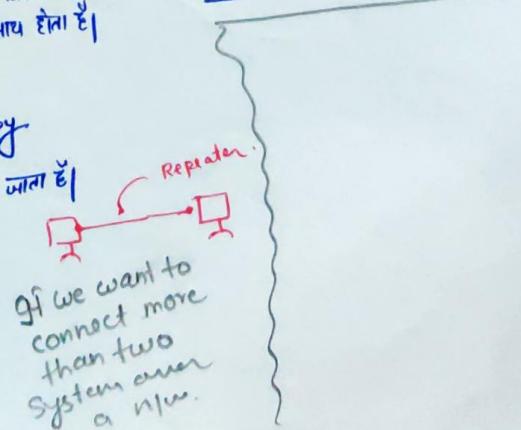
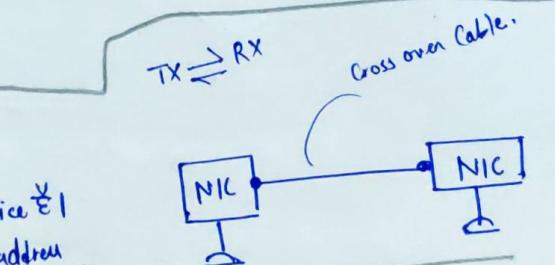


- ① ,

Switch - यह एक multi port Bridge
each LAN gets dedicated Bandwidth.

ROUTER

Router filter traffic based on
IP address.
The IP address tells the router which
LAN segment the ping belongs to.



192.168.1.1

C:\Windows\system32\cmd\ipconfig /all

Cisco Packet Tracer

Cisco - leader company in networking.

It is networking simulation tool for practice, discovery and troubleshooting.

Helps to understand n/w practically

Download Cisco Packet Tracer

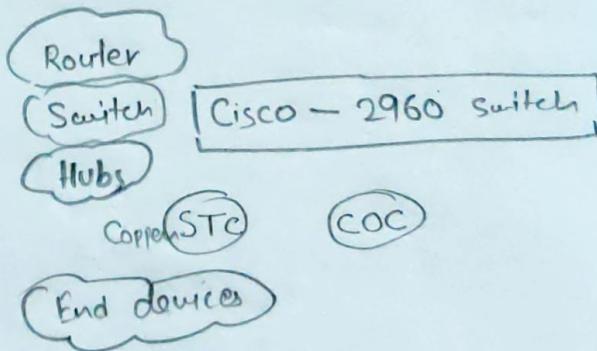
netacad.com

Scroll to find packet tracer.

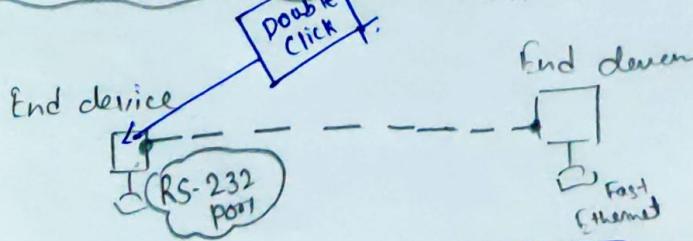
Download it
install it.

it is free of Cost

CPT 6.2



Peer to Peer N/w Connections



cisco user
• Separation

diff. device → E String through Cable

Same → E Cross Over Cable

Assign IP Address
click to End device > desktop Tab > IP Configuration
click on 192.168.1.1

cmd ipconfig /all

Cisco Packet Tracer

(Hub)

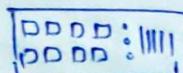
Part - ②

basics of CPT

Know about (Hub)Simulate LAN using HUB.HUB N/w HUB

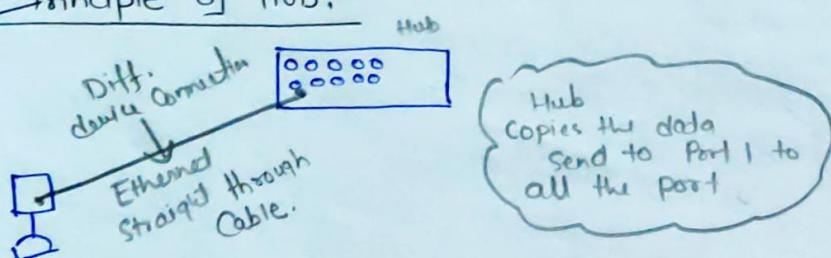
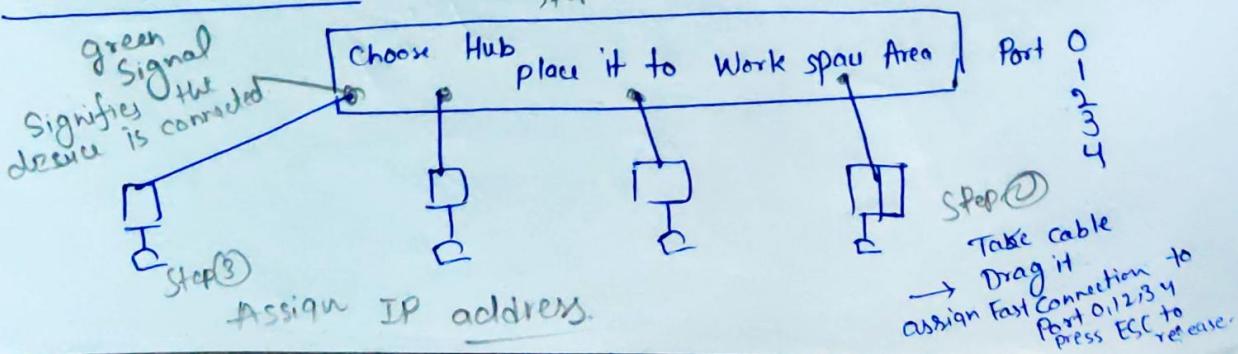
It is work at Physical layer of the OSI Model.
 Used to set up LAN.
 Hub has multiple ports.

Drawback



* Hub comes under Star Topology.

when a Packet arrives at one port, it is copied to the other ports so that all segments of the LAN can see all packets.

Working Principle of HUBWorking Via CPT

ELFCTN.

HUB

Pros — cheaper than switches
Works good for smaller nw.

Cons —
* Issues with broadcast
* No memory
* Normally runs in half duplex mode

Send data
Receive data
but not at same
Time

We are moving from Hubs to Switches

CISCO PACKET TRACER (PART-3) [SWITCH]

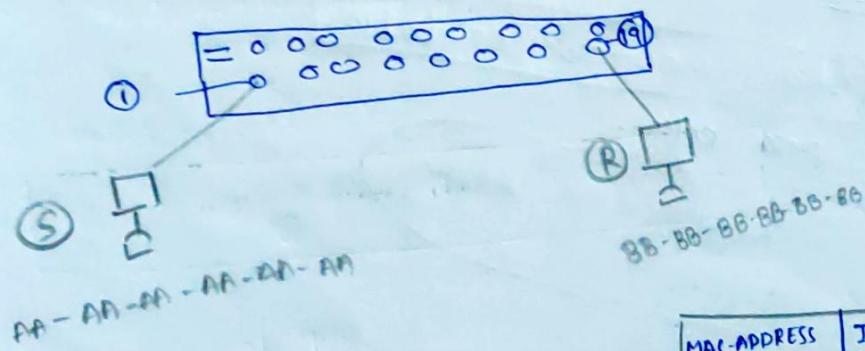
✓ A switch is a networking hardware that connects device on a computer network to establish local area network.

Unlike Hub, Switch has memory

Switch stores the MAC ADDRESS via MAC ADDRESS Table

✓ Hub is Layer 1 device

✓ Switch is Layer 2 device for setting up LAN



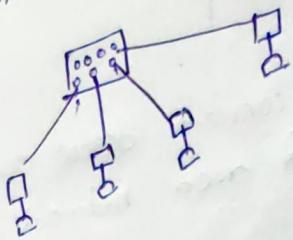
✓ Switch can do Unicast/Multicast/Broadcast

MAC-ADDRESS	INTERFACE/PORT
AA-AA-AA-AA-AA-AA	1
BB-BB-BB-BB-BB-BB	19

Fast Ethernet Port
Gigabit Ethernet Port.

ELECTRONICS

After establish connection



- ① Click on the Switch
- ② Window will open
- ③ Open **CLI** Tab.

Press **ENTER**
type **[en]** to enable

type **show mac-address-table**

press enter.

It will show you MAC Address
table

HUB

✓ Layer 1 device

✓ Works at Physical Layer

✓ Has No Memory

✓ Not an intelligent device

✓ floods the network due to broadcasting

✓ Security Risks are high

✓ less efficient

✓ Half duplex

Switch

✓ Layer 2 device

✓ Works at Data Link Layer.

✓ Has memory and stores MAC Address Table

✓ Intelligent device.

✓ Can do unicasting, multicasting & broadcasting

✓ Security risks are low

✓ More efficient.

Half ✓ Full duplex.

Cisco Packet Tracer (Router)

Basics of Router.

How to connect two different LAN using Router

Difference between Switch & Router.

A router is a networking device that forwards data packets between computer networks. (they may be two different LAN)

Switches connect devices that are belonging to same network.

Router can connect two LAN's WAN's to the internet / ISP's n/w.

For Internet connectivity to our Local network, we need the help of Internet Service provider

A Router is connected to atleast two networks, commonly two LAN's or WAN's or LAN and its ISP's network

It is Layer 3 device.

It works at network layer.

Router Stores Routing Table in the Memory.

Cisco Packet Tracer (Router)

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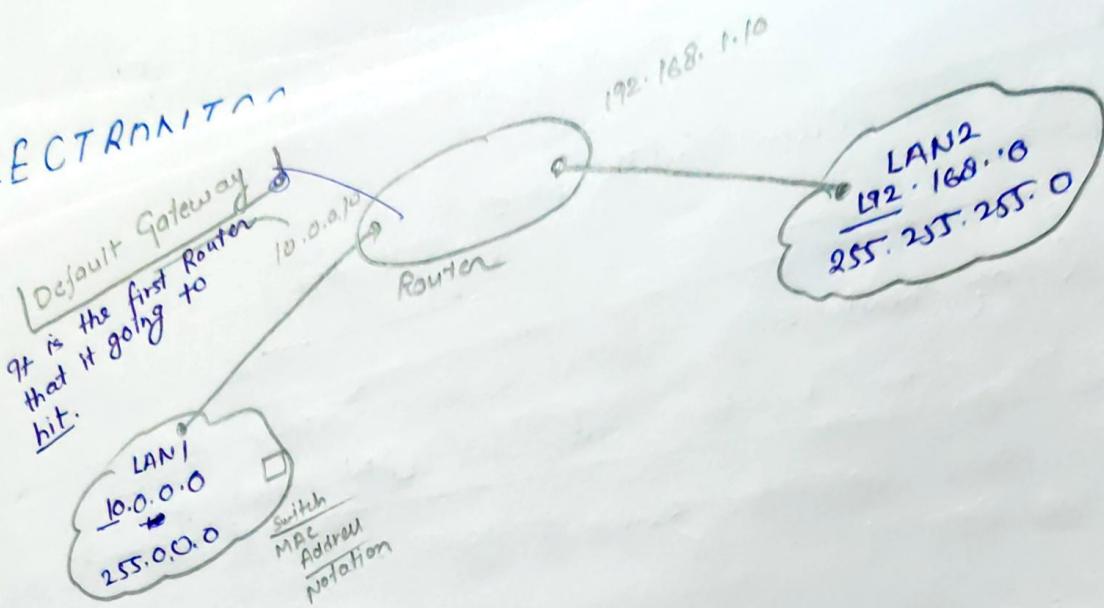
A Router is connected to atleast two networks, commonly two LAN's or WAN's or LAN and its ISP's network

It is Layer 3 device.

It works at network layer.

Router Stores Routing Table in the Memory.

ELECTRONICS



Switch Vs Router

Switch

Router

- ✓ A network switch is a computer networking device that is used to connect many devices together on a computer network.

✓ Operates at Data Link layer

✓ Has memory & stores MAC Address Table

✓ Decisions are taken based on MAC Address

✓ Half Duplex | full

✓ LAN

- ✓ A router is a networking device that connects a local network to other local networks

✓ Operates at network layer

✓ Has Memory & Stores Routing Table.

✓ Decisions are taken based on IP address

✓ Full Duplex

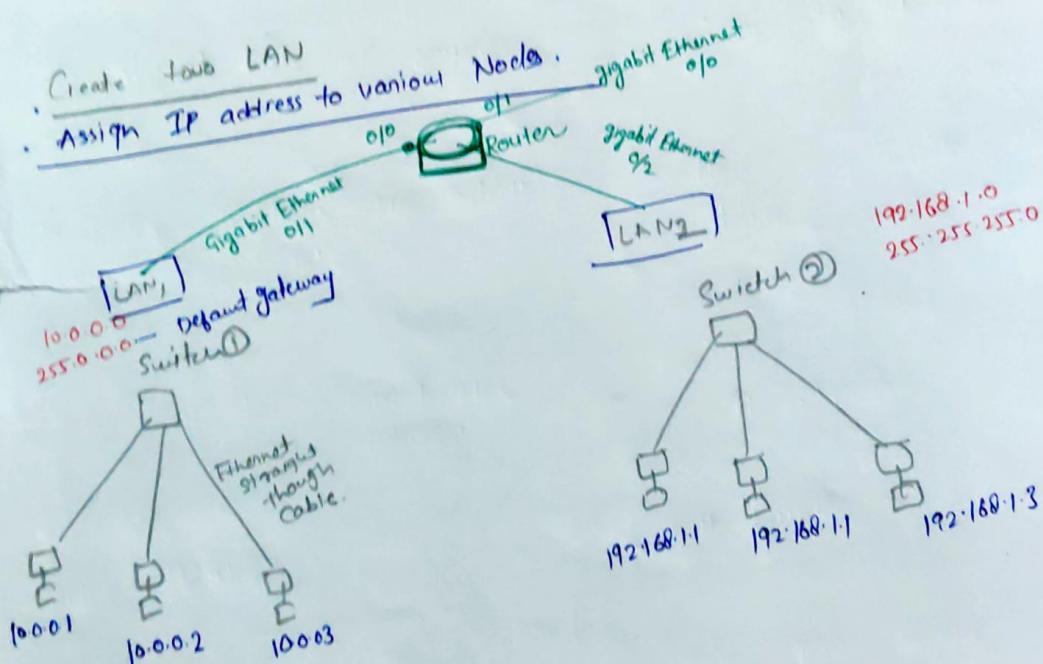
✓ LAN / MAN / WAN

Physical Layer & Media

Understand fundamental principles ..

How to Connect two diff LAN using Router

Router - connects two or more different LAN.
It is Layer 3 device.
Stores Routing Table.

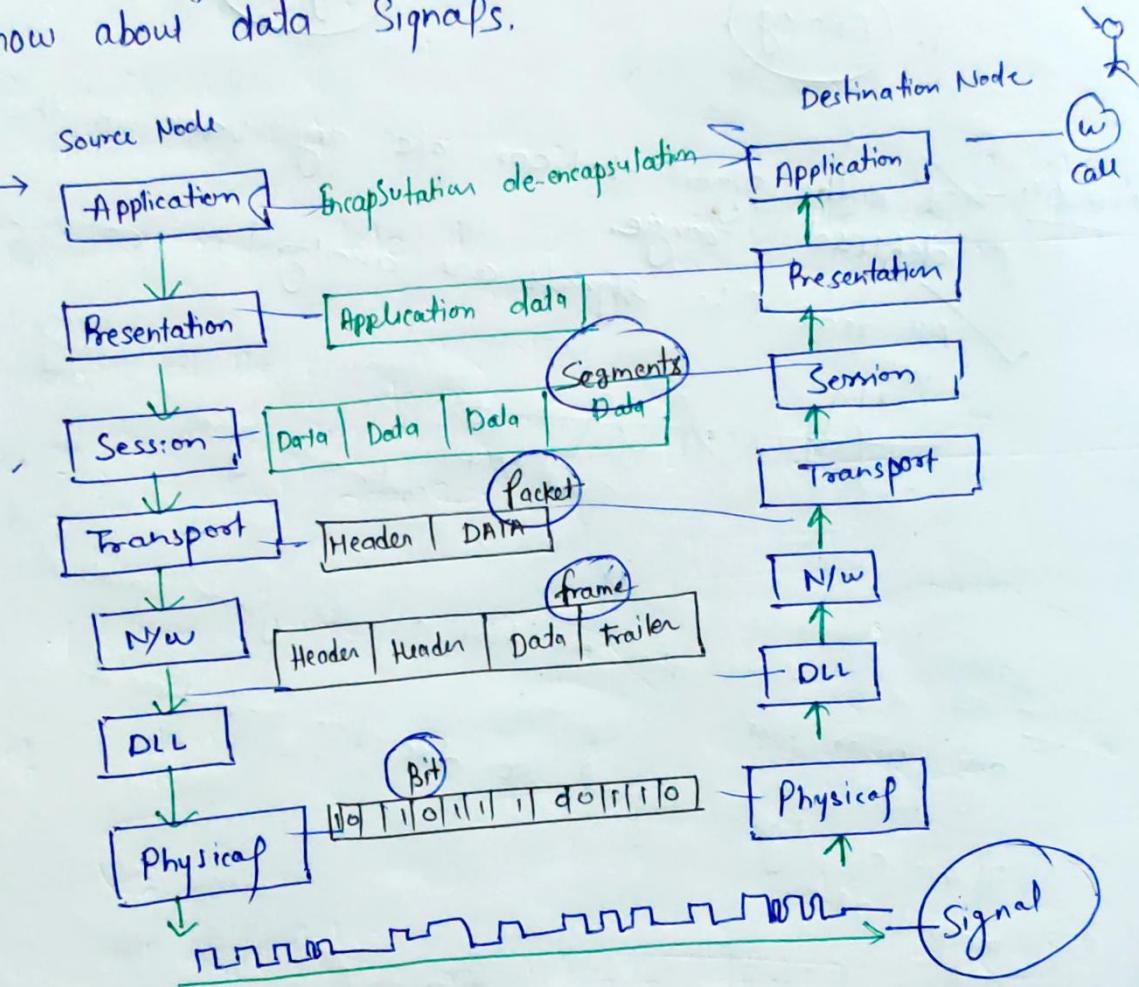


- ① Click on Router
- ② Click on **Config** Tab

Physical Layer & Media

Understand fundamental principles of P.L.
Know about data Signals.

Q



✓ One of the major function of P.L. is to move data in the form of electromagnetic signals across a transmission medium.

✓ The data usable to a person or an application are not in a form that can be transmitted over a network

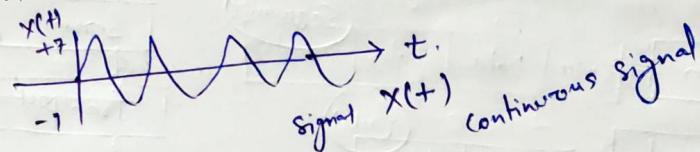
Signal — $x(t)$ is a function that represents the variation of a physical quantity with respect to time.

Digital

1. Analog

ANALOG — $x(t)$ is the signal that can take any value in the defined range.

✓ All real life signals are analog in nature



colour
sound
heat

Digital — $x(t)$ is the signal that can take on the finite values at any given time.

✓ In case of digital signal, we discretize both time & magnitude.

3/22

Cisco Packet tracer (Repeater)

more

- ✓ Understand Basics of Repeater
- ✓ Working of Repeater using CPT.

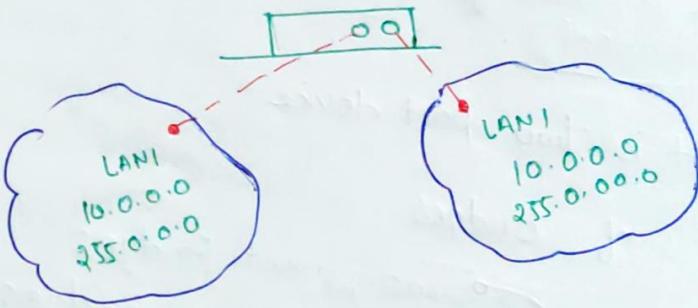
The data Signals generally become too weak or corrupted if they tend travel a long distance.

- ✓ Repeater regenerate the signal over the same network. data

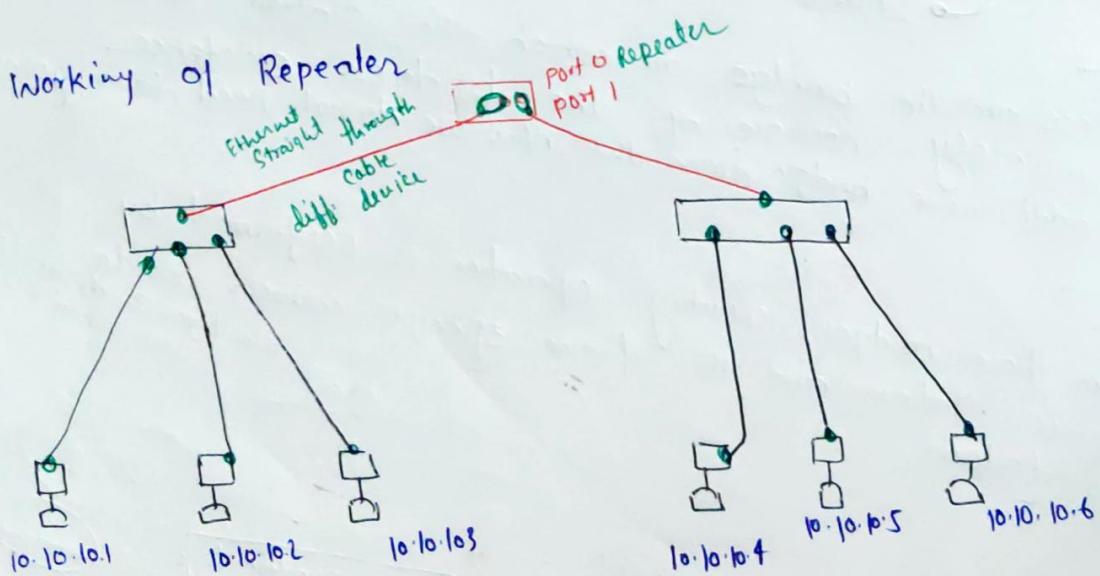
It operates at the physical layer.

They do not amplify the signal.

it is a two port device.



Working of Repeater



ELECT

- ① Smriti
- ② priyo

Basics of Bridge

Understand the basics of Bridge.

Types of bridge.

Working of bridge.

Difference between Router & bridge.

Bridge = Repeater + Some Additional functionality of reading MAC Address.

It is layer 2 device

It is used for interconnecting two LAN's on the same network (protocol).

— It is two port device

Types of Bridges

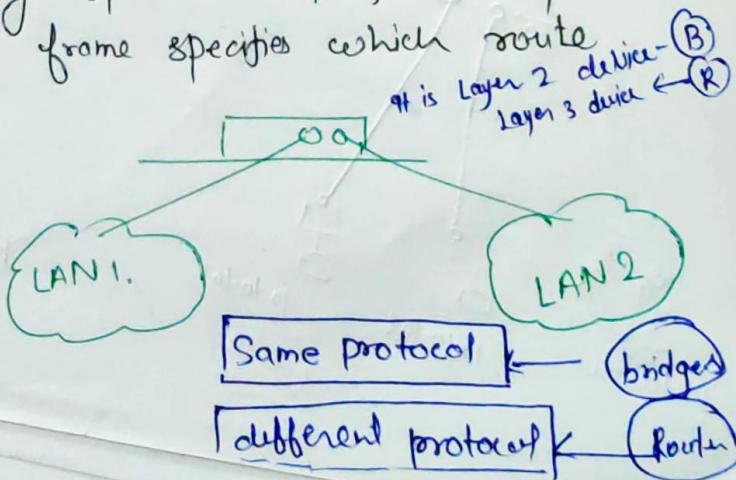
- Transparent Bridges
- Source Routing Bridges

T.B. →

These are the bridge in which the stations(nodes) are completely unaware of the bridge's existence.
if we add/remove bridge from the n/w, we do not need Reconfiguration.

S.R.B. →

In these bridges, routing operation is performed by Source Station and the frame specifies which route to follow.



link to each other?

98/feb/22
CN.

Shell

layering :-

layering means decomposing the problem into more manageable components (layers). ①

Advantage -

It provides more modular design.

Easy to troubleshoot.

The Protocols in each layer governs the activities of the data communication.

LAYERED ARCHITECTURES

The OSI Reference model.

The TCP/IP Model.

The OSI Model

✓ OSI Stands for Open System Interconnection.

✓ It is a model for understanding & designing a hardware architecture that is flexible, robust and interoperable.

Developed by the International Standards Organization (ISO).

✓ The OSI model is not a protocol.

✓ It is only a guideline and hence it is referred as OSI reference model

✓ The purpose of the OSI model is to show how to facilitate communication between different systems without requiring changes to the logic of the underlying H/w & S/w.

✓ The OSI Model was never fully implemented.

✓ The OSI Model was never fully implemented.

TCP/IP Model

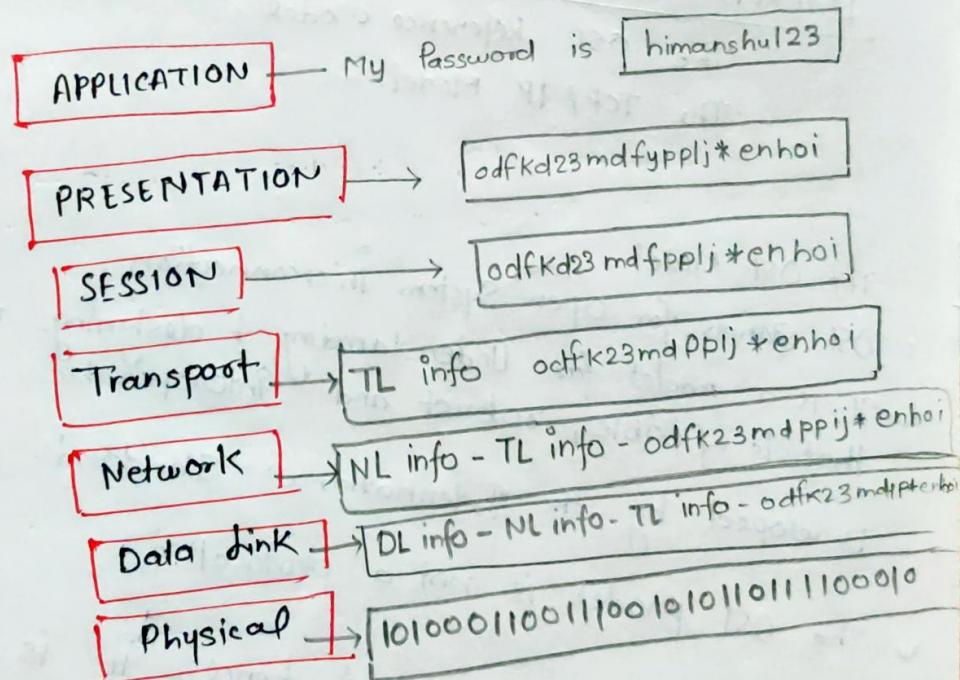
②

TCP/IP = Transmission Control Protocol / Internet Protocol.

TCP/IP protocol suite was developed prior to the OSI model.

Therefore, the layers in the TCP/IP protocol suite do not exactly match those in the OSI Model.

TCP/IP is a hierarchical protocol made up of interactive modules, each of which provides a specific functionality.



APPLICATION LAYER — It enables the user to access the n/w resources.

Services provided by APPLICATION LAYER

- * File Transfer & Access Management (FTAM)
- * Mail Services
- * Directory Services

Presentation layer — It is concerned with the syntax and semantics of the information exchanged between two systems.

Services provided by presentation layer

- * Translation .
- * Encryption
- * Compression .

Session layer — It establishes, maintains, and synchronizes the interaction among communicating devices

Services provided By Session layer

- * Dialog Control
- * Synchronization

ELECT
① Smriti
② Priya

Transport layer :-

(9)
It is responsible for process to process delivery of the entire message.

Services Provided by Transport layer

Port Addressing.

Segmentation & Reassembly.

Connection Control

End to End flow Control.

Error Control.

Network layer :-

It is responsible for delivery of moving data (frames) from the original source to the destination n/w.

Services Provided by N/w layer

• Logical addressing

• Routing

DATA link layer

It is responsible for moving data (frames) from one node to another node.

Services Provided by DLL

Framing

Physical Addressing

Flow Control

Error Control

Access Control.

COMPUTER

Physical fai

inhal

Apfelkern

0/0

Physical layer :- It is responsible for transmitting bits over a medium.
It also provides electrical & mechanical specification.

Services Provided by Physical Layer

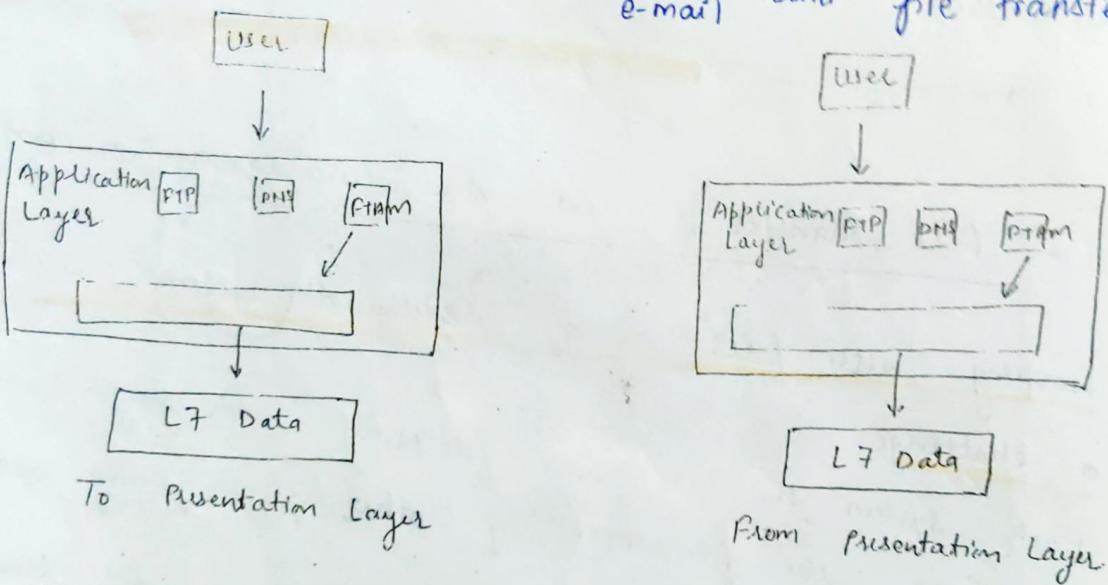
- * Physical Characteristics of the Media.
- * Representation of bits
- * Data Rate.
- * Synchronization of bits..
- * Line Configuration.
- * Physical topology .

By Alka

such

UNIT - 5Application Layer

- It provides services that directly support user application such as database access, e-mail and file transfer.



- The application layer is concerned with the semantics of data i.e. what the data means to applications.
- The application layer provides standards for supporting a variety of application independent entities. Examples include -
 - Virtual terminal standards to allow applications to communicate with different types of terminals in a device independent manner.
 - Message handling system standards used for electronic mail.

for exchanging files in distributed system.

- (iv) Allow different computers with different systems to access each other's on the database (mapping, and reservation).
- (v) standards for exchanging formatted documents

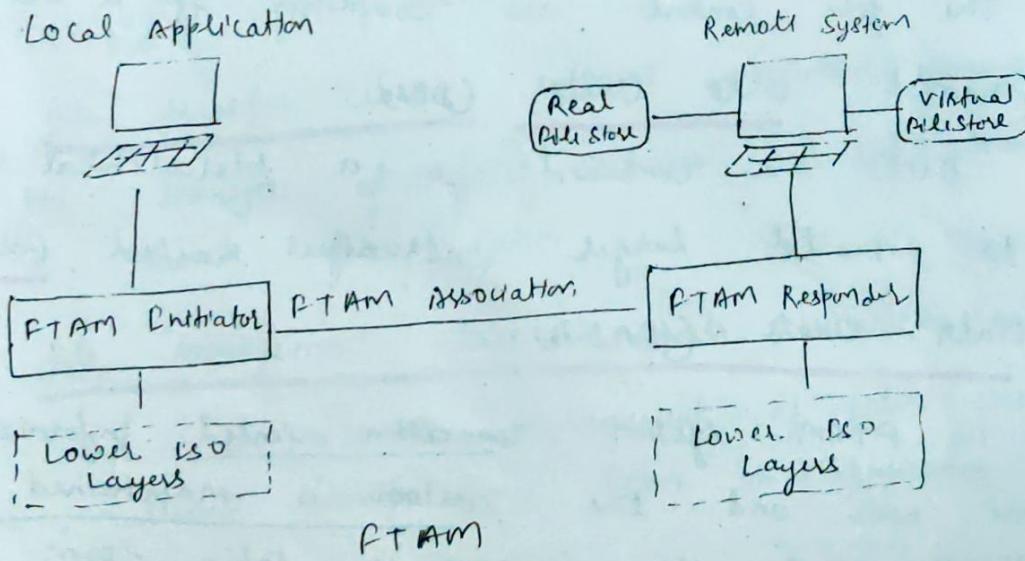
File Transfer, Access And Management (FTAM)

- Working with files in a distributed system presents a challenge.
- Each system has its own file store which may be different from the file stores of other participating systems.
- The ISO 8571 series of standards for file transfer, access, and management (FTAM) provide useful services for addressing this problem.
- FTAM provides file service uniformity by having each real file store represented by a virtual file store.
- Although the real file stores are system dependent and potentially different, the virtual file stores all adhere to the same format and protocol.

The mapping b/w a virtual filestore and its corresponding real file store is beyond the scope of PTAM; it is the responsibility of the system which own the real file store.

Operation of PTAM

- PTAM provides the necessary services for application to establish associations with remote file systems to transfer files, access and manipulate file contents, manage files (create, delete, copy, move) and manipulate file attributes (name, access permissions, date, etc).



- According to diagram a local application accesses the file store of a remote system.

- FTAM process provides an association b/w an initiator and a responder which make the FTAM service accessible to the local and remote systems.
- FTAM classifies attributes off a file into four groups.

(i) Kernel	file name, file structure ...
(ii) storage	file size, creator ID, Read Date, write date ...
(iii) security	Access permission, Encryption
(iv) private	user defined

- The file contents are comprised of a set of named Data Units (DUs).
- DUs are combined in a hierarchical manner to build larger structures called File Aggregate Data Units (PADUs).
- In FTAM system, connection oriented information about the user and the session is maintained by a server until the session is taken down.
- The FTAM client contacts the FTAM server and requests a session.

COMPUTER NETWORKS

(18.2.22)

talk to each other?

- * Since the two hosts can communicate, they can talk to each other.
- * Représenter
- * Assign location
- * Can change location
- * It is L

172.15.150.
172.15.150.
172.15.150.

Host A

once the session is established, file transfer

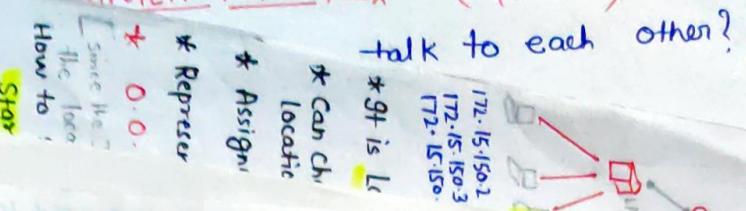
can take place:

- FTAM provides the concept of a virtual file store which provides a common system view of files.
- The FTAM file system hides the differences between vendor systems.

FTAM services -

- FTAM services are also organized into related groups so that their selection can be negotiated when an association is being established.
- FTAM defines five service classes:
 - i) The file transfer class supports association management and the transfer of files between an application and a remote file system.
 - ii) The file management class supports association management and the local management of files (creation, deletion, attribute manipulation) from an application.
 - iii) The file access class supports association management and the remote manipulation of file contents from an application.

COMPUTER NETWORKS (18.2.22)



mail destination and deal with errors including transmission errors and disk space capacity.

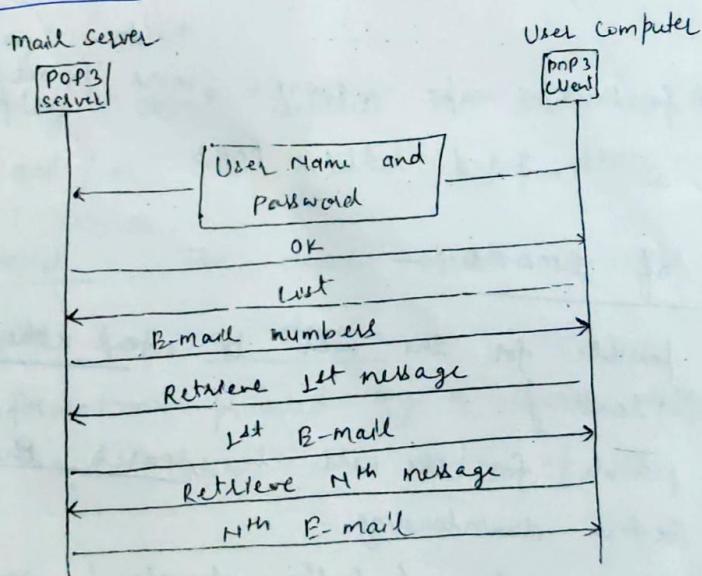
Mail Access Protocol:

- (i) Post office Protocol (POP) Version 3, i.e. POP3.
- (ii) Internet mail Access Protocol Version 4 i.e. IMAP4.

POPS:

- The POPS consists of client POPS software and server POPS software.
- ✓ when the user wants to download email from the mailbox on the e-mail server, the events take place in the following sequence

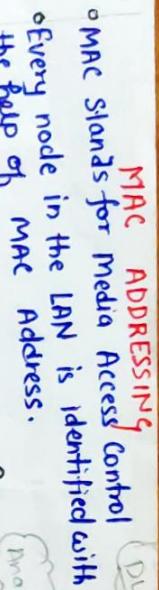
- (a) The client (user) opens a connection with the server on TCP port 110.



Downloading in POP3.

IP ADDRESSING

- IP stands for Internet Protocol.
- Every node in the computer network is identified with the help of IP address.



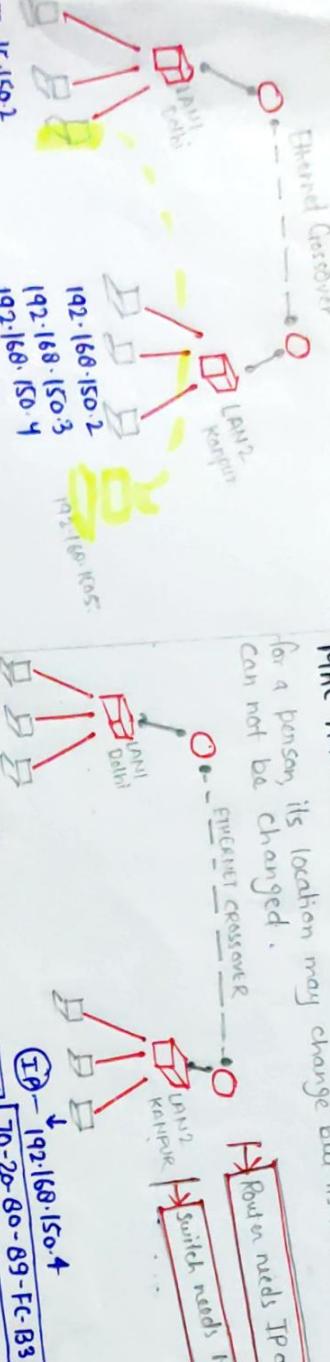
MAC Address = Name of the Person.

Reaching our Apartment = Reaching our MAC address.

Reaching our City = Reaching our IP address
Reaching the Right Person = Reaching the right process in the Host.

Router needs IP address
Switch needs MAC Address

= (Port Address)



* It is logical Address.

* Can change based on location of the device.

* Assigned by manually or dynamically.

* Represented in decimal & it has 4 octets (xx.xx.x)

(32 bits)

When the Router receives the data packet, it takes the forwarding decision based on IP address.

Once the data is received by the Switch, it is responsibility of the Switch to deliver the data to right MAC address.

Every Switch will maintain a MAC address

* Represented in decimal & it has 4 octets (xx.xx.x)

(48 bits)

Since the IP addresses can be changed based on the logic or location we call IP address in Read Device

How to see IP Address in Read Device

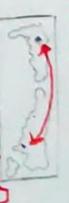
Start → cmd → type ipconfig

Fixed Port number - 25,80
Dynamic Port number - 62414

How to see MAC Address in read device

Start → cmd → type ipconfig/all

PORT ADDRESSING



→ Host

Reaching our City = Reaching our IP address

Reaching our Apartment = Reaching our MAC address

Reaching the Right Person = Reaching the right process in the Host.

= (Port Address)

○ Port number.
○ Every process in a node is uniquely identified using port numbers.

○ In a node, many processes will be running.
○ Data which are sent/received must reach the right process.

○ Port = Communication End Point.
○ Port numbers and dynamic port numbers

○ Fixed port numbers and dynamic port numbers
○ Fixed Port number - 25,80
Dynamic Port number - 62414

Fixed Port number - 25,80
Dynamic Port number - 62414

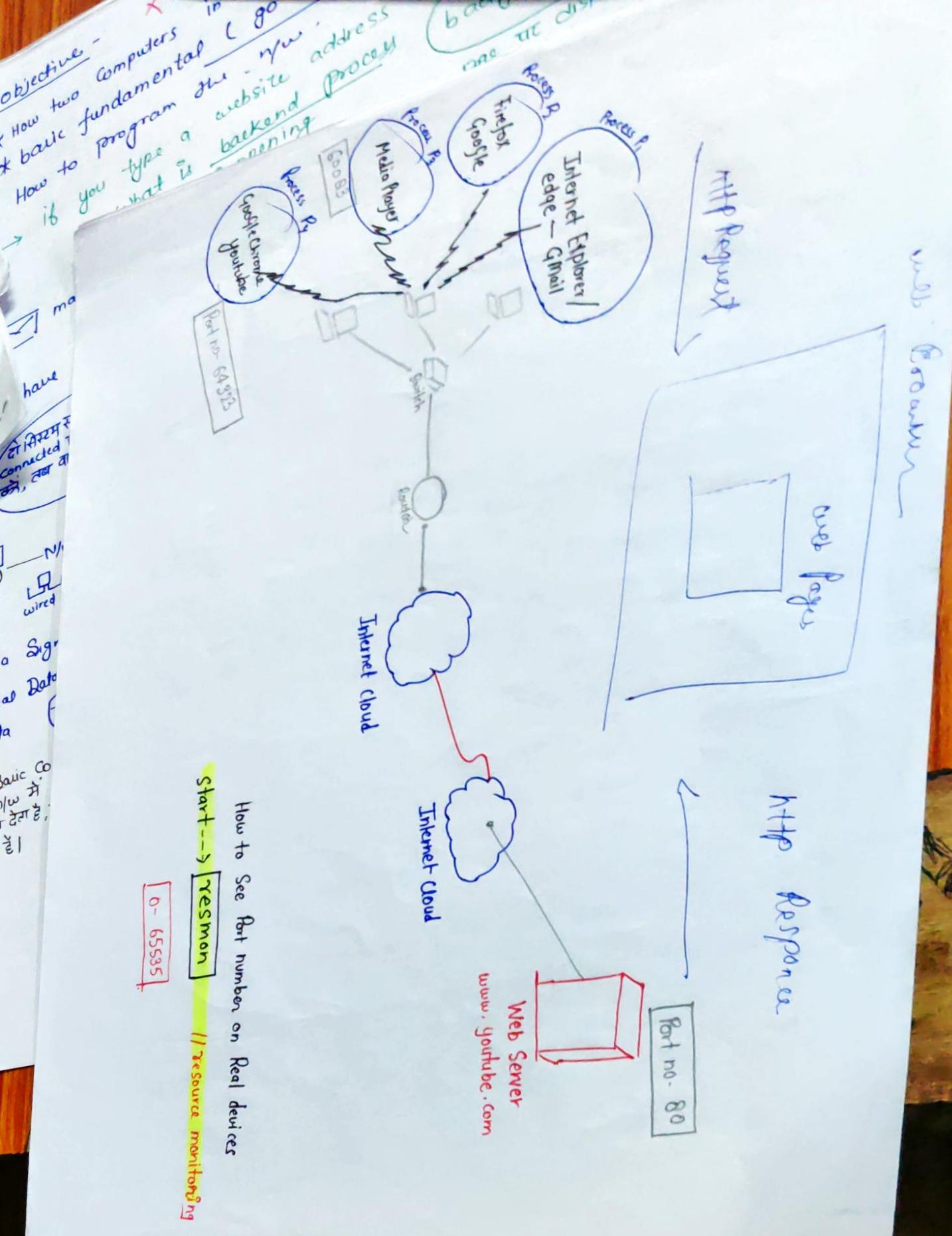
Example - hyphen(-), period(.) , colon(:).

Separator

Hyphen (-) , Period(.) , Colon(:).

How to see MAC Address in read device

Start → cmd → type ipconfig/all



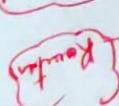
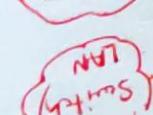
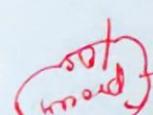
Before sending the data, any node must

3 key points to ponder

* Attach source IP address & destination IP address.

* Attach source MAC address & destination MAC address.

* Attach source port number & destination port number.



Objectives -

- * How two computers in the network talk to each other?
- * basic fundamental (go through).

How to program the n/w.

→ if you type a website address then what is backend process i.e. happening

background process
page or display हो रही है।

mail functionalities
How devices communicate to each other?

→ we have a SET OF FUNCTIONALITIES & SET OF PROTOCOLS.

सियां का स्केम
जो कुछ execute करने में
दृम अनुमति देता है

दो सिस्टम सक इससे से
Connected हो और Communicate
करें, तब वह Network है।



Data Signals के form में जाता है

Digital Data → Analog Data.

Data → transmitt हो रहा है

वह Basic Communication path,
जो n/w में Communicate करने में
अनुमति देता है, उसे हम physical layer
कहते हैं।

Amplifier.

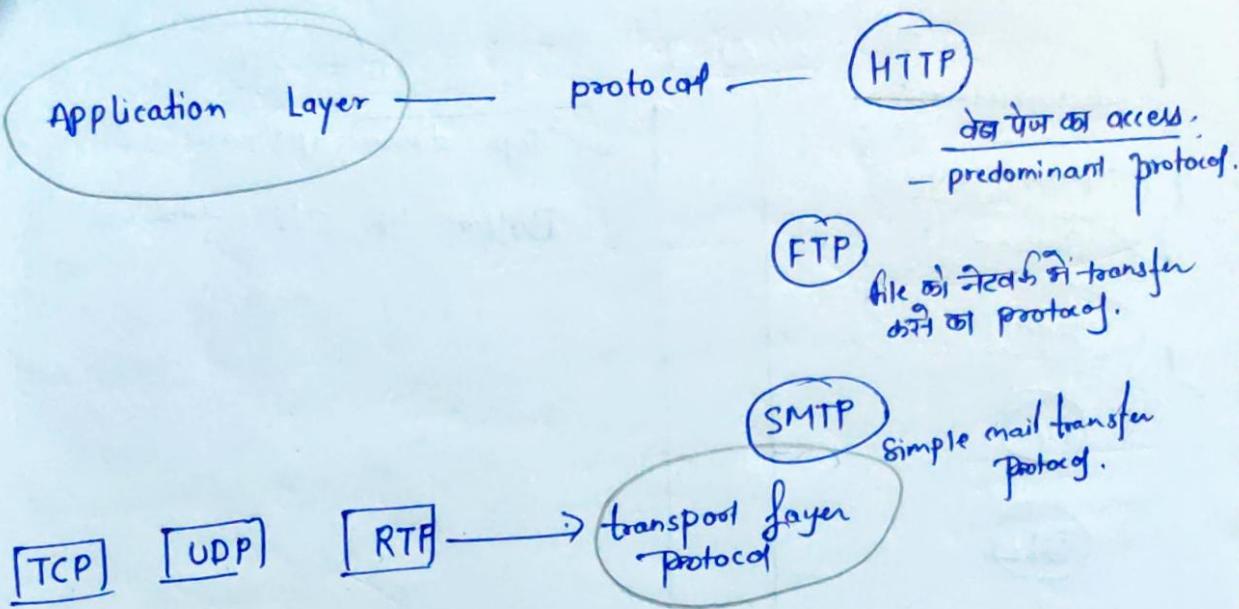
physical layer पर (HUB) Repeater

Signal को repeat करना (Energize करना)

physical layer पर media access के
लिये proper scheduling.

A - B } communication हो रहा है।
B - C } ↓
A - C } (collision होगा।)
↓
(media Access Protocol) — scheduling

यदि आप Data link layer को देखते हैं
तो हम, उस collision domain से बह
लौंगें।



- ✓ Connection Oriented protocol.
- ✓ Connection less protocol.
- ✓ Real time protocol

IPV4

IPV6

MPLS

Network layer protocols.

→ IP layer.

* Ethernet / Wifi / Bluetooth / UMTS

LTE

Data link layer
जहाँ protocols के साथ होते हैं।

Application layer
DNS & transport layer
होते हैं।

CROSS LAYER PROTOCOL

SNMP
transport & Network layer होती है।

ARP

DHCP

Network layer Protocol.

Books

proliferation - ~~उत्पत्ति~~

1.

Kurose
& Ross

2.

टेनलोग्य

IBM Red Book

Internet Resources

IETF

Internet Engineering Task force.
— 1986.

Current — Devops

A to Z publications

Notes

History of Internet

1836 — Telegraph [- cooke & Wheatstone]
- यह सब morse code dots dash की एक Series है।
communication के लिये इसे आज दो [0] [1] से relate कर सकते हैं।

1858-1866 — transatlantic cable.

1876 — Telephone [Alexander Graham Bell]

1957 — Advanced Research Project Agency
- 1962.

APPANET

1962-1968 — Packet Switching N/w developed. Internet relies on Packets to transfer data.
+1977 (Host 1000+)

1971 — E-mail program Ray Tomlinson invents.

1973 — Global n/w becomes reality.

University of London

Norway

1974 — Packets become mode of transfer.

UESNET

1979 → News groups formed.

1982 → TCP & IP are proposed, as protocol suite

future n/w communication.

1983 — Name Server developed.

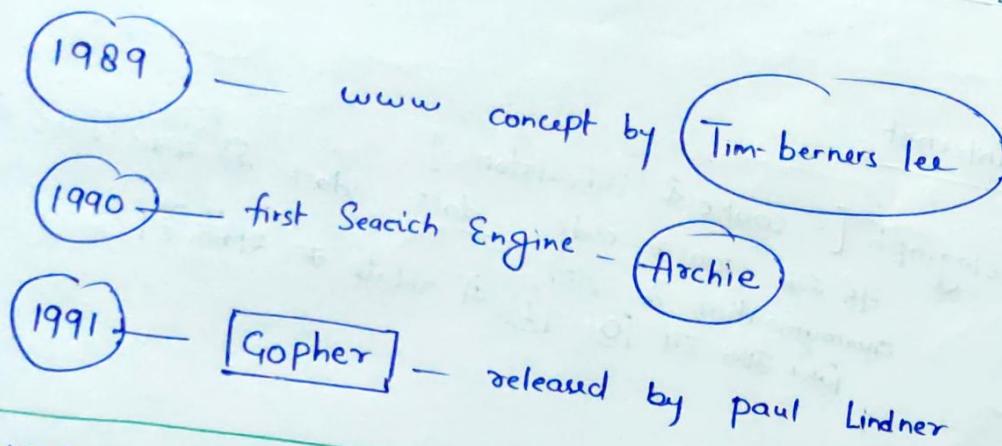
DNS introduced.

Commercialization of Internet

1987

255.255.255.0
can be changed based on the logic.
IP address as logical address.
dress in Read Device

→ type ipconfig



1992 → Multimedia changes the face of Internet

1993 → www revolution begins

Surfing the Internet
— Armstrong Polley

Mosaic Web browser introduced

Now Web Exploded

Some Facts

W3C - world wide web Consortium founded. → 1994

Google is founded → 1998