

hub me mac address sb pc jata jis ke hota wo accept karta baghi

Hub (one to multi ports)

- passive Switch bhi kerte (filtering nahi karte)

A hub is a physical layer networking device which is used to connect multiple devices in a network. They are passive devices. It sends message to all ports.

Repeater (1 to one)

A repeater receives a signal and before it becomes too weak or corrupted, regenerates and

- Repeater have no filtering capability.
- Ye bs power generate karta
- is ko bridge bhi kaha jate

Link-Layer Switches

Active Switch

Switch or hub me frame filtering ka hota.

- A link layer switch operates both the physical and data link layer filtering

It can check the destination link-layer address of a frame and can decide from which outgoing port the frame should be sent.

Repeater

Repeater is also known as bridge. A repeater is a device that regenerates signals as they pass through the networks when it becomes weak or corrupted. Repeater have no filtering capability; it only generates power.

Link Layer Switch

It operates in both physical & data link layer. As a physical-layer device it regenerates signals when it receives and links layer device, the link layer switch can check Mac address.

Transparent Switch

A transparent switch is a switch in which the stations are completely unaware of the switches' existence.

"Looping", When we have more than one route to reach at switch or destination

Switch or destination Jane ka ek se ziyada taste ho. (2 bar ek hi frame agaya).

STP = if you have more than one route in the frame

STP:- Spanning tree protocol.

Q How to solve problem of looping of frame

• STP = use hota looping ki problem ko solve kine ke liye.

Ø Ye looping wali problem q kya?

we cannot change the physical topology of the system because of physical connection between cables and switches.

How we solve it.

logically registration laga lete

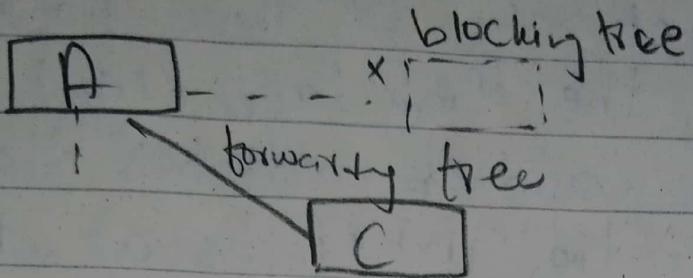
• we can create a logical topology that overlays the physical one

• jb koi switch ek se ziyada raste ho to usse chota route lete or

Last Selection ↑

Kam cost ziyada priority-

Kam cost wala Path Select kerte hain
STP k through
+1 - 1 k through costing dakte.



A se C jana ka ek chota raste to forward bagi sb block.

Advantages of Switches

There is no collision in Switches

Switches have different cables.

Routers (network layer pe kaam kisi).

A router is a three layer device. It operates in the physical layer.

{ network address → IP.

Packet forward switches

{ Switch dakte, koi Mac address us pe hai kahi

you can see Secondary destination address

to change kise

link layer physical k
baard wali layer

Router

A router has a link layer and network-layer address for each of its interfaces

2 A router acts only on those packets in which the link layer (mac) destination address matches the address of the interfaces at which the packet arrives.

3) A router changes the link-layer address of the packet (both sources and destination when it forwards the packet).

Virtual LANS (V LANS).

→ 2 networks (create kise 0-120).

V LANS = grouping

V LAN we physical configuration ko change nhi karte balkay logical configuration ko change karte

How to create VLAN in Switch

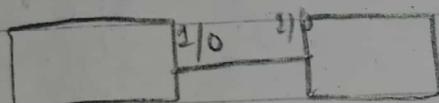
Switch(config)# VLAN 10 Junk
Switch(config)# VLAN 20 Junk

(Config)# int 1/0

Switch(config-if)# VLAN 10.

Trunk

Trunk (inter Switch) a switch k zaiya
ek connection hote



2 switch ko apne
connect kerna hota to trunk switch.

late

switchport trunk.

Looping :- When you have more than one route to reach at destination and switches. There is a chances of overlapping of frame. To solve looping problem STP Spanning tree protocol is used in which we can create a logical topology that overlays the physical one and select the shortest and least cost path through STP.

transport layer → (network layer)
Packet band

Chapter # 07

Packetizing (encapsulation) encapsulating the payload (data received from the upper layer) in a network-layer packet at the source and destination

Routing

A network layer is responsible for routing a network-layer packet from its source to the destination.

Error control

Flow Control.

Congestion Control

Routing k protocol k andr hota.
Routing hot 2 tya ki (distance base
routing, time base rout.
channel k characteristic pr routing

best route

* 5 (Cheezin hain jin k basis pr
hum router select)

- delay
- Redundancy - (reliability).
- congestion control (load balancing).
- Bandwidth
- MTU (Maximum transmission unit)

Quality of Services. (QoS).

Routing k upper QoS bhi hota..

Packet Switching.

Packet Switching is used in router or network layer. Layer stream of packet data is send in smaller chunks.

- layer stream of data is converted into smaller pac
- * dedicated logical link use here circuit switching.
- the packet is sent one by one through the network.

The destination waits for all the packets to arrive before sending to the upper network layer are rearranged it.

Delay::

Transmission Delay

$$t_2 - t_1$$

$$\checkmark \text{ Delay}_{\text{tx}} = (\text{Packet length}) / (\text{transmission rate}).$$

Propagation Delay (channel ka delay).

Propagation delay is the time it takes for a bit to travel from point A to B in the transmission media.

$$\text{Delay}_{\text{pg}} = (\text{distance}) / \text{propagation Speed}.$$

Processing Delay.

The processing delay is the time required to process a packet in a router or a destination host.

$$\text{Delay}_{\text{pr}}$$

1Mbit

Queuing Delay

Delay_{qu} = time a packet waits in input and output queues in a router.

Total Delay.

n = number of routers

Total delay = $(n+1)(\text{delay}_{\text{tr}} + \text{delay}_{\text{pg}} + \text{delay}_{\text{pri}}) + (n)(\text{delay}_{\text{qu}})$.

Throughput

Minimum bandwidth is the last bandwidth of the router.

Criterias of Selection of Routing

→ Highest value of the lowest bandwidth
btw the routes

Sb route ki lowest

$2^{16} = 65,536$. TCP Transmission Control

Maximum Transfer Unit (MTU).
final length

(ICMPv4).

The internet Control Message Protocol
Version 4 (ICMPv4)

TTL = time to live.

ICMP → support IP

ICMP - is itself a network layer protocol.
ICMP ye sb bataa.
Destination Unreachable - routing git.

Source Quench = which informs the Sender
that the network has encountered congestion &
Redirection Message:- datagram has been dropped
Redirection message is used when the Source
uses a wrong router to send out its
message

Parameter Problem = it can be sent when
either there is a problem in header
& datagram.

Query Message.

ICMP: Networking device use the ICMP protocol to send echo message.

echo-reply = is a datagram jo apko batata k
data is khaas tha se jay ga.

→ ping =

→ traceroute = step by step reply (k konse
node pr konsi
IP hai)

IPv6 ::

An IPv6 address is 128 bits and
16 bytes (Octets long, 4 time
the address length of IPv4)

16 se mil k ek column bn

8 octets me 16 bytes hoti

$$4 \times 4 + 4 \times 4 = 16$$

Abbreviation

FDECO:0:0:0:BBFF:0:FFFF →

FDE::BBFF:0:FFFF,

Chapter # 08

Least-Cost Trees

(each node we update)

Costing calculate

Kate

This Shortest route.

N routers

Count. $(N-1)$. \rightarrow Least count path

① Routing

Rip me distance-vector routing use for
distance vector me

* Vector = any route to directional ho likin
chota ho.

Vector \leftarrow null - ye

* distance ho likin chota route. likin
route change ho skte.

* Shortest distance hai jb hi distance
vector hai

In distance vector - each nodes create
its own least cost tree with the
rudimentary information it has
about its immediate neighbors.

The inco
imme di
trees
and

Bel

\rightarrow The
is

$D_{xy} = m$

$x \leq q$

c. cost

cost

basis

Static

\rightarrow When

6

The incomplete tree are exchanged btw immediate neighbours to make the trees more and more complete and to represent whole internet.

Bellman Ford Equation

→ The heart of distance-vector routing is the famous Bellman-Ford equation.

$$D_{xy} = \min_{x \in y} \{ C_x^{\text{costing}} + D_{ay}^{\text{distance}}, (C_{xb} + D_{by}), (C_{xc} + D_{cy}), \dots \}$$

C=Costing , D= Distance

Cost is the number that assign on the other basis. (cost ka number alg alg hotska).

Static route se Laga hua to mtlb uska cost '1' hai

→ When we update an existing node(route).

$$D_{xy} = \min \{ D_{xy}, (C_{xz} + D_{zy}) \}$$

6 route Select hote.

Count of infinity.

link broken to it take a bit of time

Decrease in cost is good news and increase in cost is bad news. Will propagate slowly. For a routing protocol to work properly, if a link broken (cost become infinity).

Two node instability

320

False update,
link ki cost 1

routing looping is problem Split
Horizon aka Solution.

jis Source se ap k pa ek data
update agai ap usko dubao update
nhi let skte

Split Horizon: One direction update
direction should be split.

Yip chalane k baad No split Horizon
lagate

distance me sir tip routing ho

Poisoned Reversed.

discount se phase 3 timer hole
timer expired (hold on timer).

to Make Sure that a path does not turn
back into the same node if a Cost has changed
Link-State-Routing. LSDB within network

Link State - routing is derived from

5 thing
bandwidth
MTU
Delay
Redundancy

LSDB congestion (load balancing).
The collection of states for all
link is called link-state routing.
data base. There is only one
LSDB for an internel. The LSDB
can be represented as two
dimensional array (matrix) in
which the value of each cell
defines the cost of corresponding
link.

How can each create this LSDB that
contain information about the whole internel
This can be done by a process
called flooding.

Flooding:-
is a node that send greeting message to all its immediate neighbour. Those nodes ask identity of the node and cost of the link from the neighbour.

neighbour table

- identify the node
- cost of the link.

The combination of these two pieces of information is called LS (packet)

LS packet \rightarrow database banks

Formation of Least-Cost Tree

To create a Least-cost tree for itself using the Shared LSDB, each node need to run the famous Dijkstra's algorithm.

Steps:-

- The node choose itself as the root of the tree, creating a tree with a single node, & set total cost of each node based on LSDB
- The node select one node among all nodes in the which is closest to the root and add this to tree. After added, the cost of all other nodes not in the tree needs to be update because path changed
- Repeat Step 2 until all nodes added

^{(3) Drawing} Path Vector routing

both link state and distance vector routing are based on Least Cost goal.
Largest route to prioritize in shortest.

path vector routing is a computer network routing which maintains the path information that get updated dynamically. update which have looped through the network and returned to same node easily detected & discharge

Spanning Tree

In Path vector routing, the path from a source to all destination is also determined by the best Spanning tree.

The Spanning tree determined by the source. it and it imposes its own policy. If there is more than one route to destination. The source choose the route that meet its policy best. One common policy is the minimum number of node to be visited

Router

8.3 Unicast Routing Protocol

internet me ab different backbones hoti hain

RIP

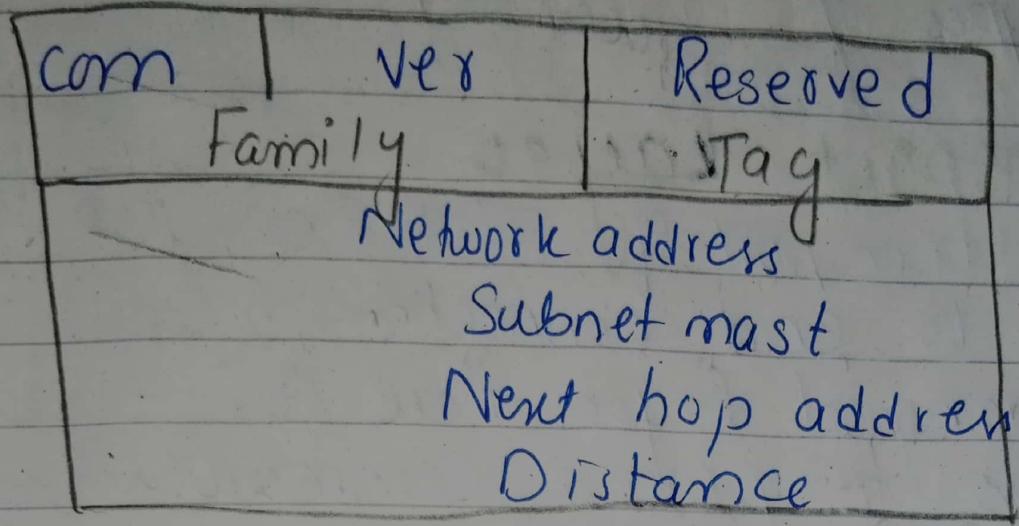
In RIP 15 is maximum cost of a path which means 16 is considered as infinity (no way to route open shortest)

RIP is only used in autonomous systems in which the diameter of AS is not more than 15 hops

Forwarding IP

IP - Autonomous System

Rip message format



Com: Command request(1), response(2)

ver, Version, Current version is 2

family Family of Protocol for TCP/IP
value is 2

OSPF (s message or s advertisement)

it is intradomain routing protocol like RIP, but it is based on the link state routing protocol. It uses Dijkstra algorithm.

cost value me different area.
OSPF me area holca

host to host communication = network layer
deliver

User end ko find kota network layer
area generalize ho k data jata

Five types of process to process

Transport Layer

Enable transport of data TCP/UDP
End to end connection.

In transport layer there is
process to process communication.

OSI Model

Application
Presentation

Session

Transport

Network

Data link

Physical

L

Transport layer

Packetizing

connection

flow control Control

Addressing

Reliability

Congestion

Control

Receive Services from
Network layer

Transport Protocol

In transport protocol there is end to end connection. It is important that it has reliable connection. If any one connection is lost than again send the packet. And it has greater complexity. Transport Layer is a logical channel.

2¹⁶

Client-Server Computing.

Servers

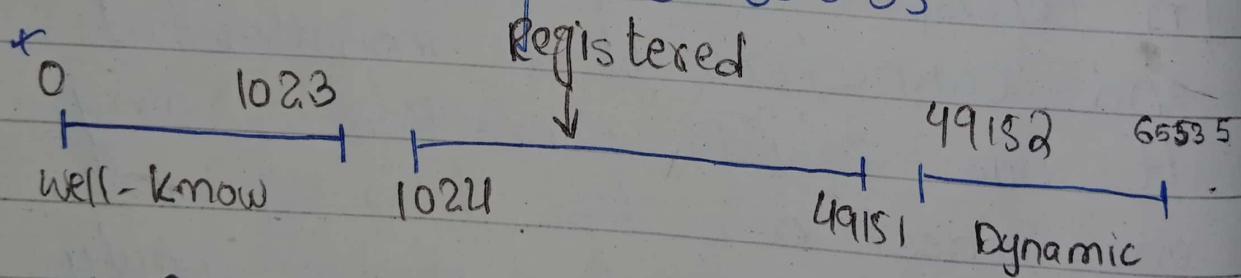
Store and protect data
process requests from clients

Clients

Make request
format data on the desktop

Port Numbers

- 16 bit field
- * Number range : 0 - 65535



Socket address

IP + port number → consists of service
has no batch

It is in transport Layer header

A pair of IP address & port number
uniquely identifies a process
the pair is called socket address

DCLP = Dynamic host

trival = 0 \Rightarrow value

UDP = Universal datagram protocol

bootstrap = initial stage, code.

Connection Oriented Vs Connectionless

Connection Oriented	Connection less
connection is established before the actual communication	No connection needed first to send the data
reliable	Unreliable
comparatively slow	fast protocol
TCP, FTP, Telnet, web etc	UDP { DTC P, online games etc }

User Datagram protocol (UDP)

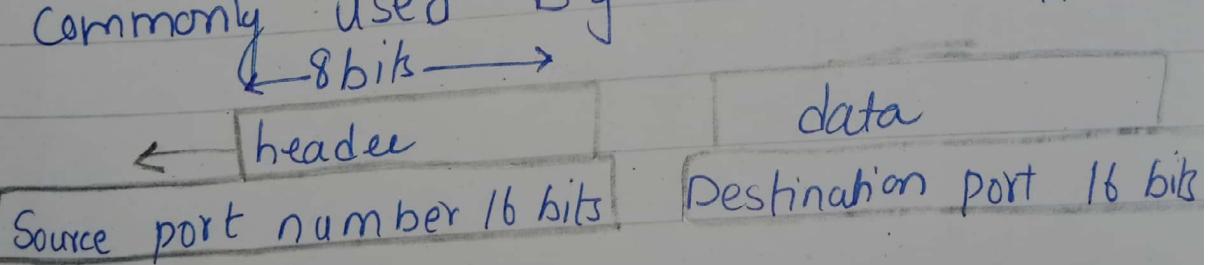
connection less and unreliable protocol.

SNMP RIP UDP there is no services of

transport layer. There is not flow and error control.

A convenient layer 4 protocol for applications that provide their own flow and error control

Commonly used by multimedia application



Total length 16 bits

Checksum 16 bit

Transmission Control protocol (TCP)

btw sender & receiv

It manage Connection of Communication

Connection Oriented protol

Most widely used transport protocol
web, FTP.

A two way reliable, connection-oriented Protocol. It ~~can~~ create virtual connection btw two TCP's to send data It include flow and congestion control Closely tied to Internet protocol (IP).

FSM finik State machine.

different state but finik State ..

Applications layer

uses

Client Servers

Addressing

Electronic protocol (Email).

Simple mail transfer protocol (SMTP)

Post office protocol (POP)

internet mail access protocol (IMAP)

Sending email

Email - To send mail, the user creates mail that looks very similar to postal mail.

I has envelope & a message-

Receiving email.

The email system periodically checks the mailboxes.

If a user has a email, it informs the user with a notice.

Email address

An email has two part

Local Part

Define the name of the user

Domain Name

Name of mail exchanger

local @ domain.

User Agent

UA is a Software that provides Service to the user to make Process of Sending & receiving a message

Types

Command Driven.

e.g mail, pine, and elm

GUI Based

Eudora, outlook and netscape

Mail Transfer Agent (MTA)

The actual mail transfer is done through message transfer agent (MTA)

- To send mail we need Client (SMTP) Simple mail transfer protocol
- To receive mail we need receiver (SMTP) receiver

Mail Access Protocol

POP 3

post office protocol version 3
Simpler in function

In Web-based Mail.

- Mail transfer from sender's browser to mail Server is done through HTTP.
- The transfer of the msg from the sending mail server to the receiving mail server is still through SMTP.
Finally the msg from the receiver browser is done through HTTP.

File Transfer (FTP)

Uses file transfer protocol (FTP)
FTP uses the services of TCP.

it needs two TCP connections

- The well known port 21 is used for the control connection
- The well-known port 20 is used for data connection.

www. Domain name

IP Address \rightarrow Name

TCP / IP protocols use IP addresses to uniquely identify connection of a host to the internet.

However, people prefer to use names instead of numeric addresses.

Therefore we need a system that can map / resolve a name to an address or an address to a name.

When the internet was small, mapping was done by using host file.
had 2 columns: name & address.

Now internet has grown so host file should be large.