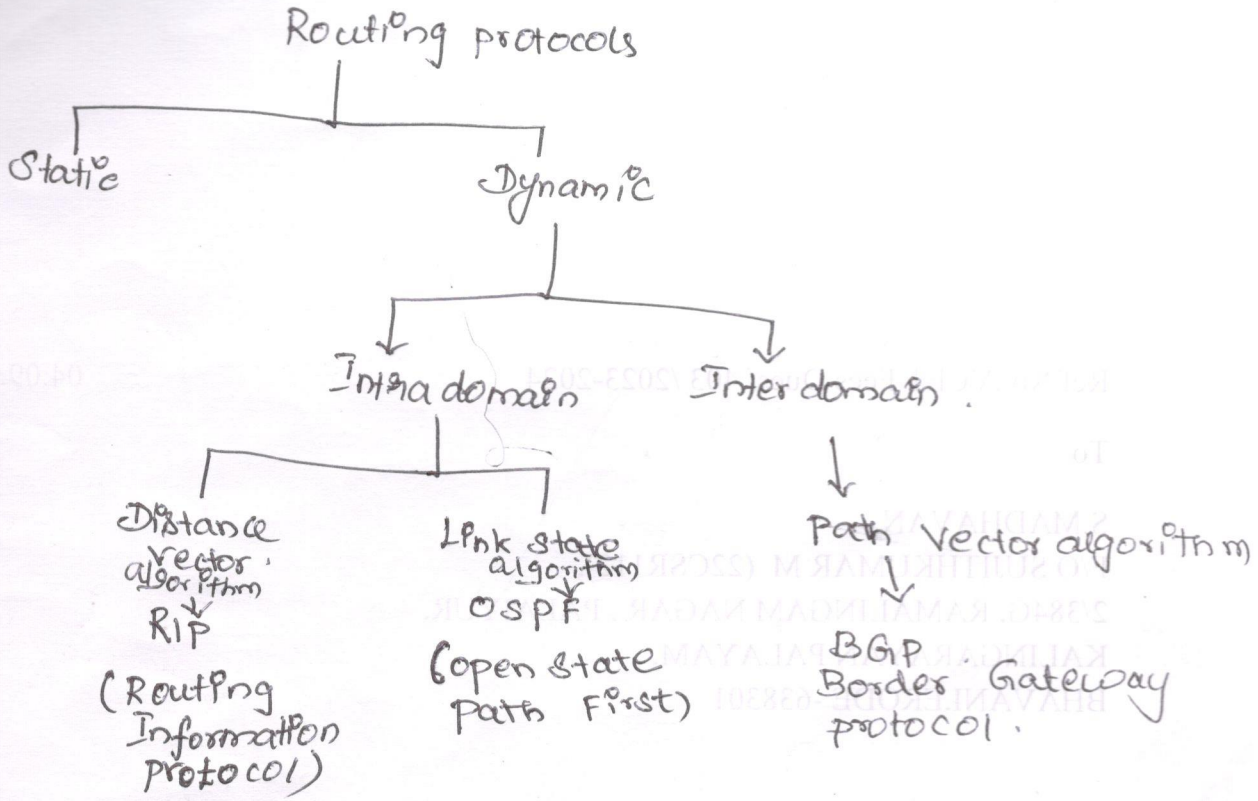
Routing protocols.



Types of routing.

(1) If a datagram is destined for only one destination. (one to one delivery) then call it as unicast routing

(2) If a datagram is destined for several destinations (one to many delivery), we call it as multicast routing

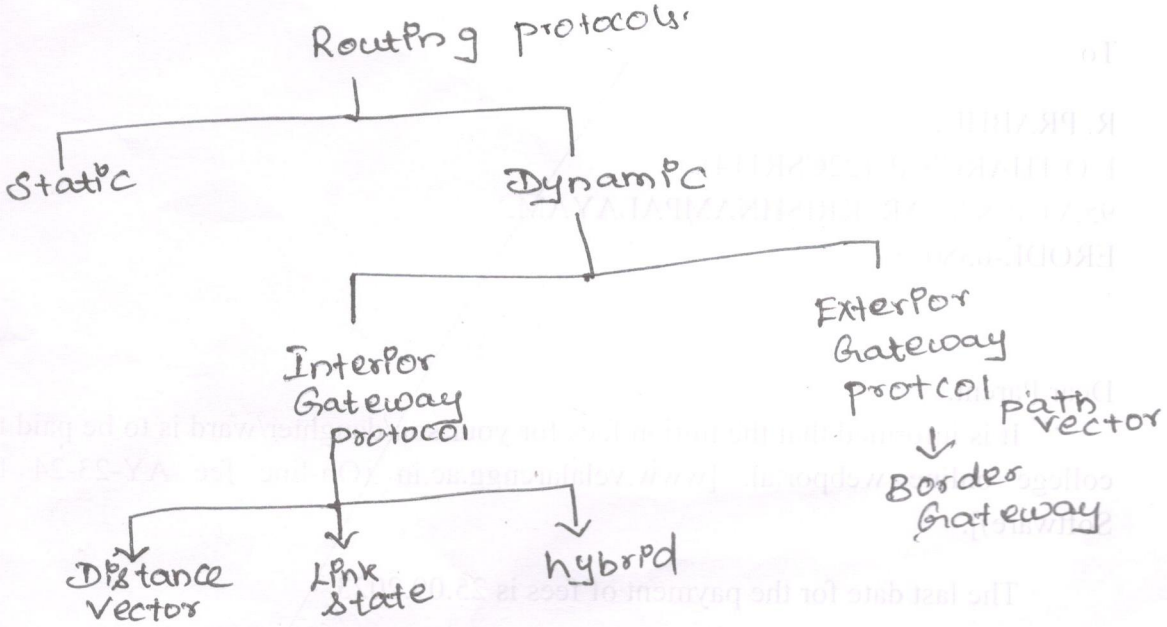
(3) If a packet is supposed to be delivered to all hosts in the Internet, (one to all), then we call it as broadcast routing.

A protocol needs to define its domain of operation, the messages exchanged, communication between routers, and interaction with protocols in other domains.

Routing

A Routing is a process of selecting path along which the data can be transferred from source to the destination.

Types of routing protocols



Autonomous system → group of routers under authority of a single administration.

Interior Gateway protocol → works within an autonomous system

Exterior Gateway protocol → Works Between one autonomous system to another autonomous system.

Router is a networking device that forwards the packet based on the information available in the packet header and routing table.

Routing table.

A routing table is a table maintained by a host or a router with an entry for each destination or a combination of destinations to route IP packets.

Types of routing table.

(1) Static routing table
(2) Dynamic routing table.

Static routing table

↳ The entries are created or updated manually by an administrator

Dynamic routing table

↳ The entries are updated automatically by dynamic routing protocols such as RIP, OSPF, BGP.

Command to view routing table.

netstat -rn.

Distance Vector routing (DVR)

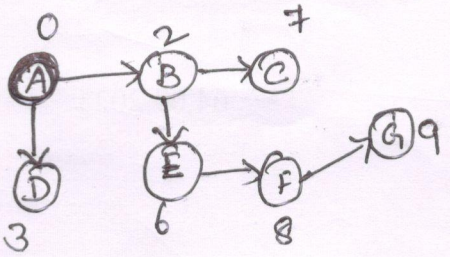
In distance Vector routing, each router periodically shares its knowledge about the entire network with its neighbors.

Distance vector routing (DVR) protocol requires that a router inform its neighbors of topology changes periodically.

It uses Bellman-Ford algorithm.

↳ Distance vector does not give the path to the destinations as the least cost tree does, it gives only the least cost to the destinations.

(a) Tree for node A



(b) Distance vector for node A

A	0
B	2
C	7
D	3
E	6
F	8
G	9

Metric.

↳ cost assigned for passing through a networks

Router chooses the route with least cost

RIP treat all networks as equal. The cost of passing through each network is same. It is one hop count.

Ex: If a packet passes through 10 network to reach destination, the total cost is 10 hop counts.

Distance Vector Routing

↳ periodically shares its knowledge about the entire Internet with its neighbours.

Points to be considered in DVR working

1. Sharing knowledge about the entire autonomous system
2. Sharing only with neighbours
3. Sharing at regular intervals.

↳ Distance vector routing protocols measure the distance by the number of routers a packet has to pass

↳ In distance vector routing, a router continuously tells all of its neighbors about what it knows about the whole Internet.

Distance vector routing is based on Bellman-Ford equation.

This equation is used to find the least cost (shortest distance) between a source node x and destination node y, through some intermediary nodes (a, b, c)

The cost between the source and the intermediary nodes and the least costs between the intermediary nodes and destinations are given.

$$D_{xy} = \min\{(C_{xa} + D_{ay}), (C_{xb} + D_{by}), (C_{xc} + D_{cy}), \ldots\}$$

In distance vector routing, an existing least cost is updated with a least cost through an intermediary node such as z

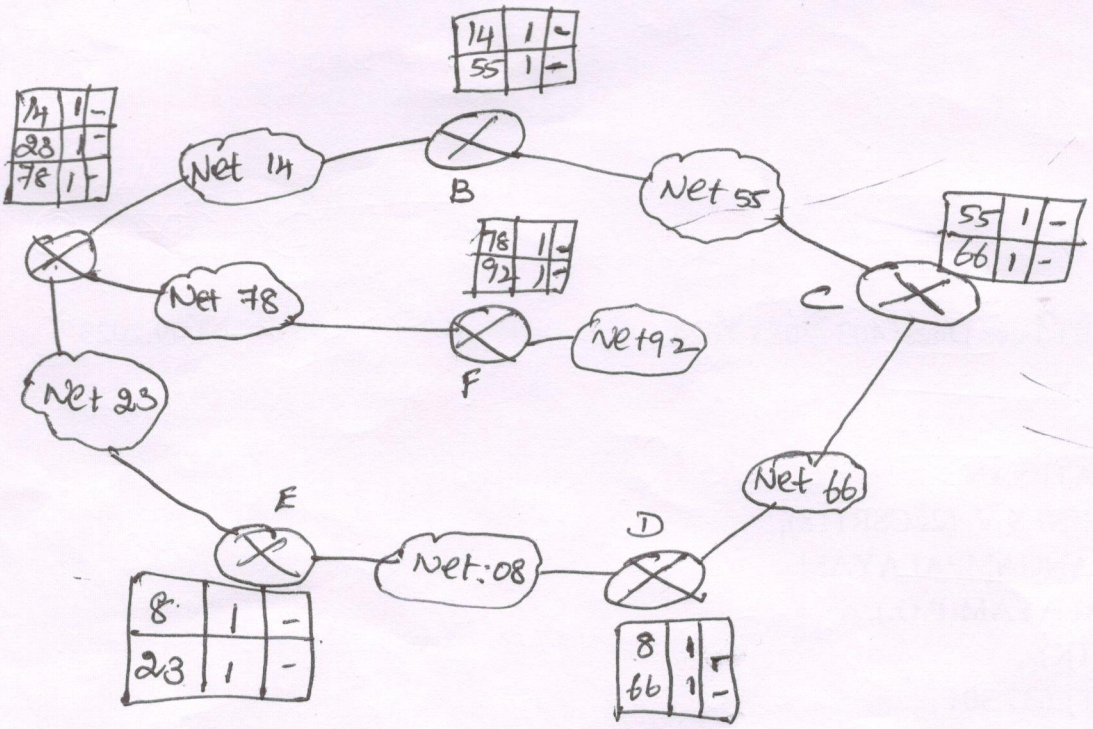
$$D_{xy} = \min\{D_{xy}, (C_{xz} + D_{zy})\}$$

Distance Vector

↳ Distance vector is a least cost path in a least cost tree.

↳ Representation of least cost paths in a least cost tree

Initial routing tables in a small autonomous system



Example of updating a routing table.

RIP message from C

Net 2	4
Net 3	8
Net 6	4
Net 8	3
Net 9	5

RIP message from C after increment

Net2	5
Net 3	9
Net 6	5
Net 8	4
Net 9	6

Old routing table

Net1	7	A
Net 2	2	C
Net 6	8	F
Net 8	4	E
Net 9	4	F

Updating algorithm

New routing table

Net1	7	A
Net 2	5	C
Net 3	9	C
Net 6	5	C
Net 8	4	E
Net 9	4	F

Net1 : No news, do not change
Net2 : Same next hop, replace
Net3 : A new router, add
Net6 : Different next hop, new hop count smaller, replace
Net8 : Different next hop, new hop count the same, do not change
Net9 : Different next hop, new hop count larger, do not change.

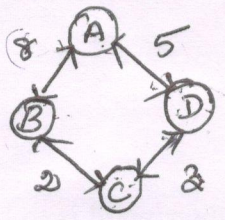
Routing table.

Each router keeps a routing table that has one entry for each destination network of which the router is aware.

Distance vector routing table.

Destination	Hop count	Next Router.
190.5.0.0.	7	156.2.15.4.
175.4.32.1	2	170.3.17.2.

Example of Distance vector Routing.



Step 1:

Routers in the network start sharing their information with the neighboring router in the network.

Routing table of A

Destination	Hop count	Next Router
A	0	A
B	8	B
C	2	-
D	5	D

Routing table of B

Destination	Hopcount	Next Router
A	8	A
B	0	B
C	2	C
D	2	-

Routing table of C

Destination	Hop count	Next Router
A	2	B
B	2	B
C	0	C
D	3	D

Routing table of D

Destination	Hop count	Next Router
A	5	A
B	2	-
C	3	C
D	0	D

Step 2:

After creating the seperate local table, this information is shared with the neighboring node having a direct link.

For router A

The distance to reach a destination B from router A

$A = \min\{(A \to B + B \to B), (A \to D + D \to B)\} = \min\{8, 5 + \text{infinity}\}$

$= 8.$

The distance to reach a destination C from router A

$A = \min\{(A \to B + B \to C), (A \to D + D \to C)\} = \min((8+2), (5+3))$

$= \min\{10, 8\} = 8$

Distance to reach destination D from A

$A = \min\{(A \to B + B \to D), (A \to D + D \to D)\} = \min\{8+0, 5+0\}$

$= 5$

Routing table of A

Destination	Hopcount	Next Router
A	0	A
B	8	B
C	8	D
D	5	D

In the similar way, new routing table for B, C, D can be calculated.

For B

Destination	Hopcount	Next Router
A	8	A
B	0	B
C	2	C
D	5	C

For C

Destination	Hop count	Next Router
A	8	D
B	2	B
C	0	C
D	3	D

For D

Destination	Hop count	Next Router
A	5	A
B	5	C
C	3	C
D	0	D

Steps:

Subsequently, sharing of routing information takes place.

and updation of routing table has been done periodically.

RIP Updating algorithm

Receive a response RIP message.

1. Add one hop to the hop count for each advertised destination.
2. Repeat the following steps for each advertised destination.
    1. If (destination not in routing table)
        1. Add the advertised information to the table.
    2. Else
        1. If (next-hop field is same)
            1. Replace entry in the table with the advertised one.
        2. Else
            1. If (advertised hop count smaller than one in the table)
                1. Replace entry in the routing table.
3. Return.