INTRODUCTION TO ROUTING PROTOCOLS

- why ROUTING PROTOCOLS ?

STATIC ROUTING
- Too much overhead
- Must be configured manually
- Manual configuration on all routers
- No account for link failure
- Not used for large n/w
- Every n/w requires new static route

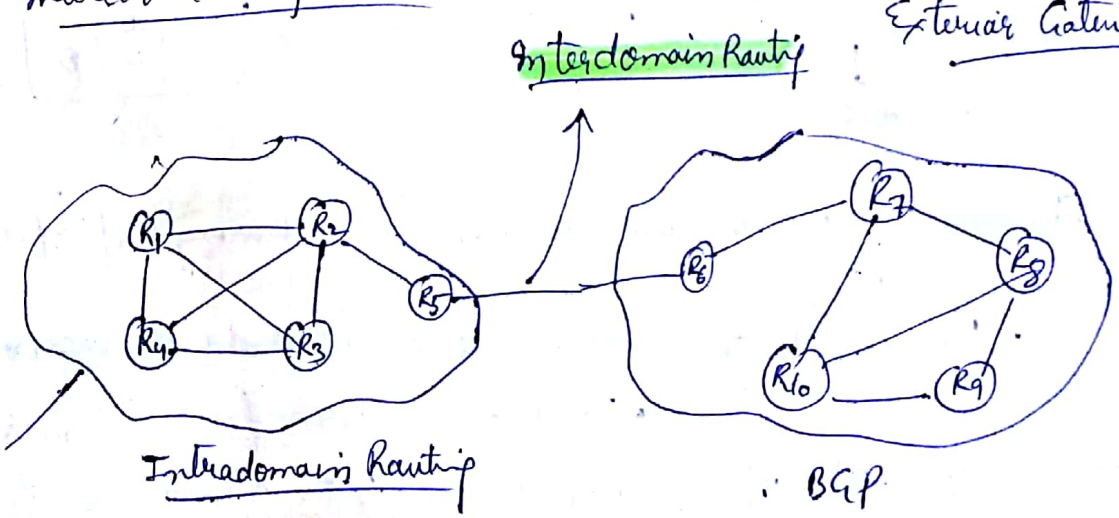
AUTONOMOUS SYSTEM (AS) - is an internetwork under the control of single admn.

- One routing protocol cannot handle the task of updating the routing tables. For this Internet is divided into autonomous systems.

ROUTING PROTOCOLS

INTRA DOMAIN
- Routing inside an AS
- Protocols like RIP, EIGRP, OSPF
- Interior Gateway Protocol

INTER DOMAIN
- Routing b/w A.S
- PROTOCOLS BGP (Border Gateway Protocol)
- Exterior Gateway Protocol



RIP
OSPF
EIGRP
IGRP

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INTRA DOMAIN ROUTING PROTOCOLS

DISTANCE VECTOR — RIP

LINK STATE ROUTING — OSPF

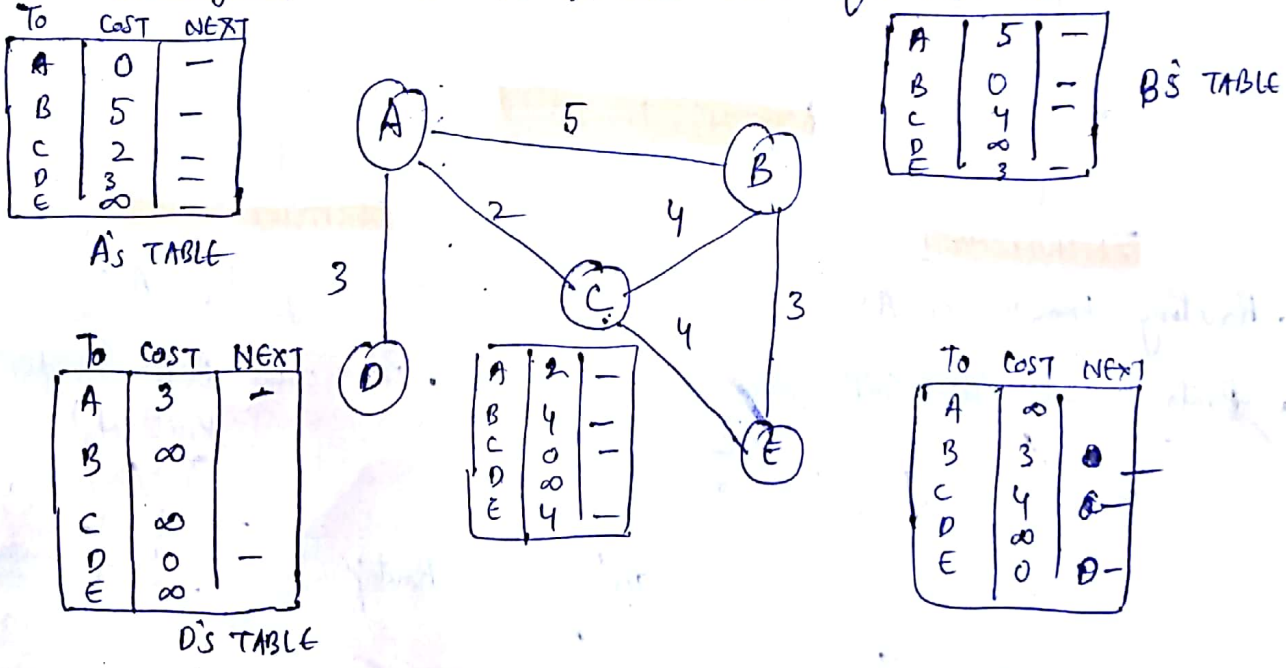
DISTANCE VECTOR ROUTING

- In DVR, the least cost route b/w any two nodes is the route with minimum distance.
- Each node maintains a vector (table) of minimum distances to every node.

DVR works in 3 STEPS

(1) **Initialization** – At the beginning, Each node can know only the distance b/w itself & its immediate neighbours..

BELOW Figure shows the initial table for each node.



A's TABLE

To	COST	NEXT
A	0	—
B	5	—
C	2	—
D	3	—
E	∞	—

B's TABLE

A	5	—
B	0	—
C	4	—
D	∞	
E	3	—

D's TABLE

To	COST	NEXT
A	3	—
B	∞	
C	∞	
D	0	—
E	∞	

A	2	—
B	4	—
C	0	—
D	∞	
E	4	—

To	COST	NEXT
A	∞	
B	3	D
C	4	D
D	∞	
E	0	D

(2) **SHARING** – whole idea of DVR is sharing of infor" b/w neighbours.

- How much of table must be shared with each neighbour?
- The best solution for each node is to send its entire table to the neighbour & let the neighbour decide

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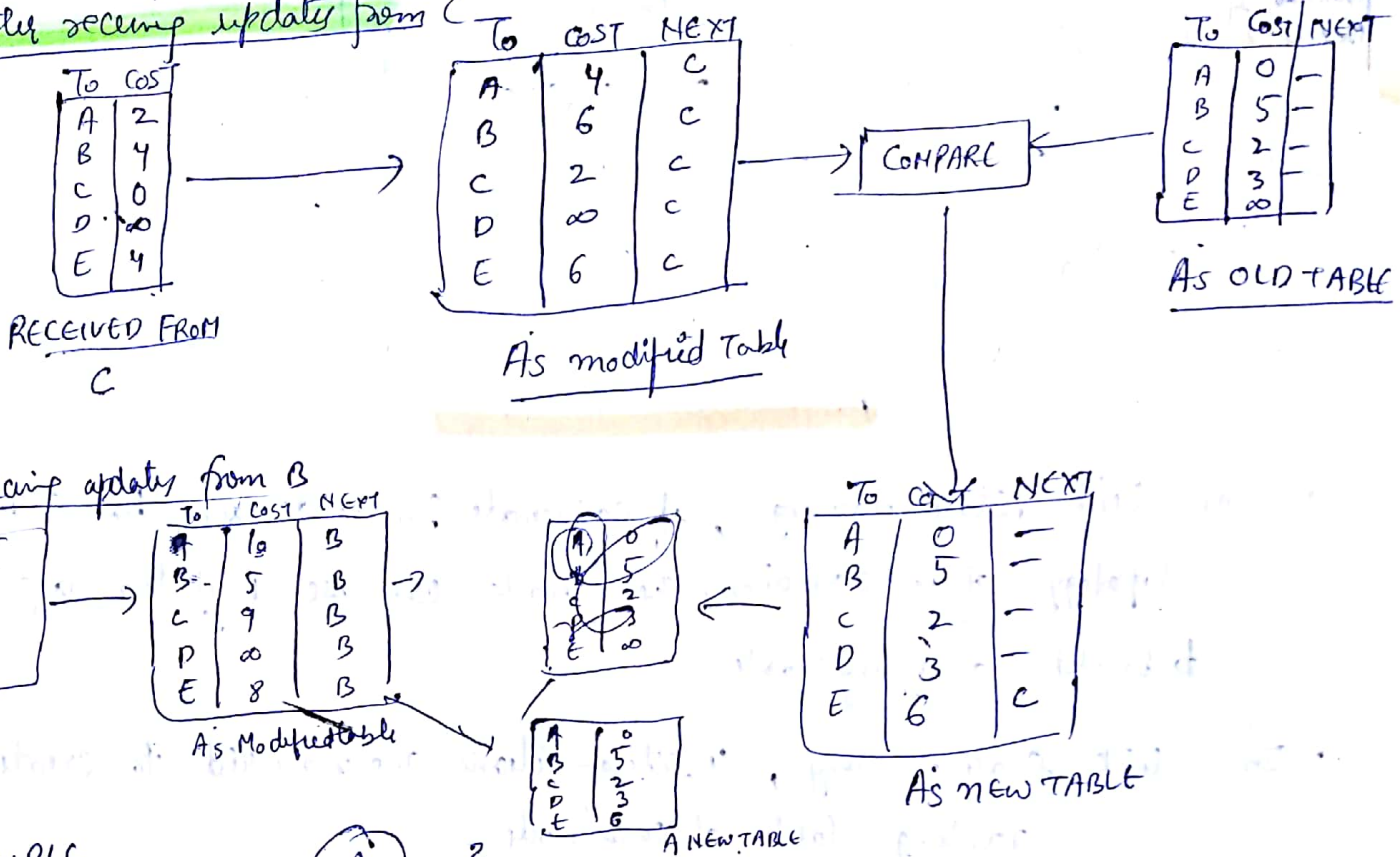
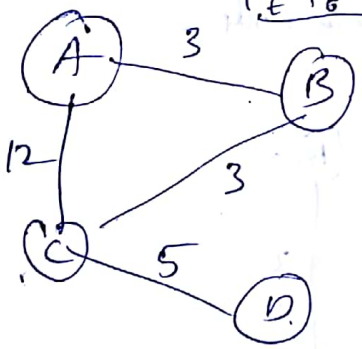
Updating – when a node receives a routing table from a neighbour, it needs to update its routing table.

(a) After receiving update from C



After receiving update from B

EXAMPLE –



Draw routing table of node A

(1) after receiving update from node C

(2) after receiving update from B

(3) Final routing table of A

RIP

- is an intradomain routing protocol based on DVR.
- CONSIDERATIONS to keep while implementing DVR in RIP
  - a) Metric used in RIP is hop count i.e no. of links to reach the destination.
  - b) Any route in an AS using RIP cannot have more than 15 hops
  - c) The next node column defines address of the router to which packet is to be sent to reach its destination

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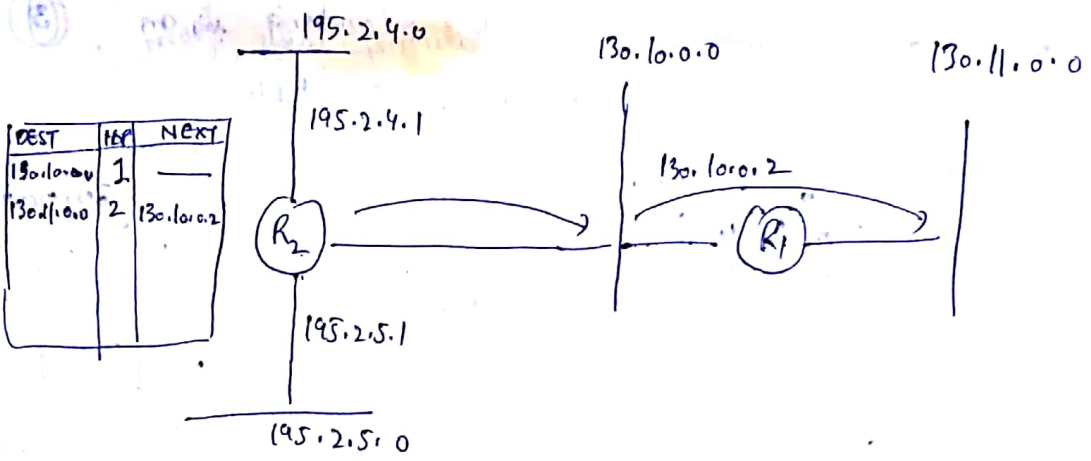
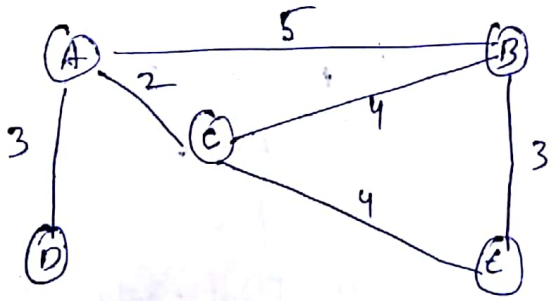


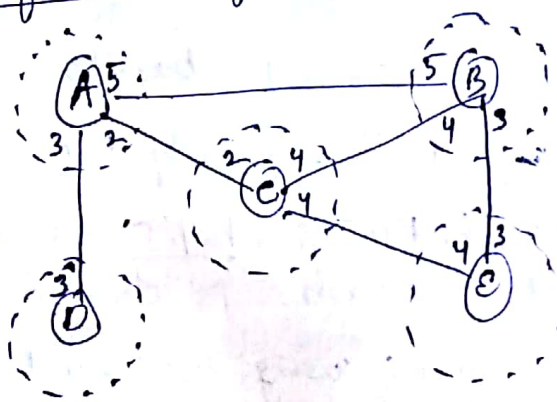
LINK STATE ROUTING

- In link state routing, if each node in the domain has entire topology of the domain, the node can use Dijkstra's algorithm to build a routing table
- In link state routing, 4 sets of actions are required to create routing table at each node.



① Creation of states of the links by each node, called link state Packet (LSP)

A's state of links



B's state of links

E's state of links

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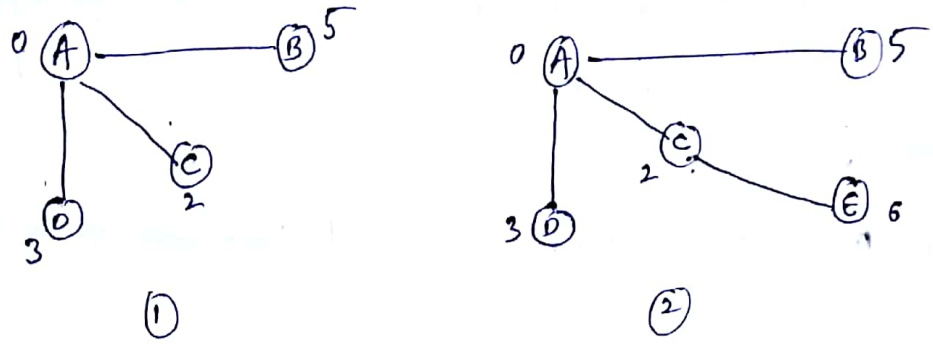
dissemination of LSP's to every other router called Flooding in an efficient & reliable way (3)

(3) Formation of Shortest Path tree : Dijkstra's algorithm



(1) (2)

(4) Calculation of Routing Table Based on the Shortest Path tree

Each node uses the shortest Path tree Protocol to construct its routing table

Routing table for node A

NODE	COST	NEXT ROUTER
A	0	—
B	5	—
C	2	—
D	3	—
E	6	C

OSPF - is an intradomain routing Protocol based on link state routing.

Area - OSPF divided an autonomous system into areas. An area is a collection of n/w, hosts & routers all within an autonomous system.

- An autonomous system can be divided into diffent areas

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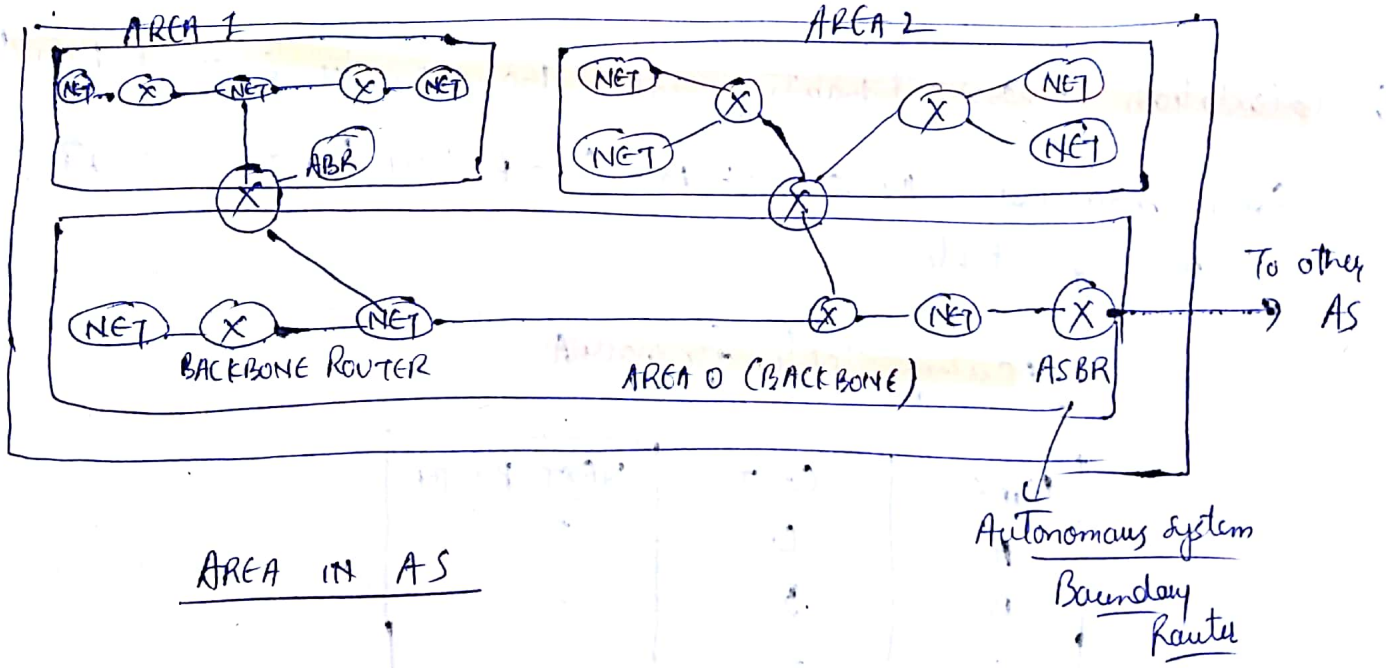
- Routers inside an area flood area with routing infor^n.
- At the Border of an area, special routers called area border routers disseminate infor^n to other areas.
- Among the areas inside AS is a special area called backbone. Backbone serves as a Primary area & other areas called Secondary areas.
- Routers inside the backbone area are called Backbone routers.



AREA IN AS

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How LINK STATE ROUTING IS BETTER THAN DISTANCE VECTOR ROUTING

Distance vector Routing - designed to run on small n/w (usually fewer than 100 routers).

Example RIP & IGRP

Disadvantage - • DVP do not scale well because they require higher CPU & bandwidth utilization

• They also take longer to converge than do link state Protocols

convergence time is amount of time it takes to propagate changes in n/w topology

• Distance vector routing Protocol are great for small environment but when it comes to enterprise n/w, you must deploy link state Protocols

Link state Routing - designed to operate in large enterprise

example - OSPF

• This algorithm takes into account bandwidth as well as other factors when calculating the best Path for a Packet to traverse a n/w.

• Additionally link state convergence occurs faster than distance vector convergence.

In DVR Protocol - uses hop count as a metric to select the best Path

In Link State Routy Protocol - uses bandwith as a metric & develope a calculate matrix to ~~route the~~ do routing decisions

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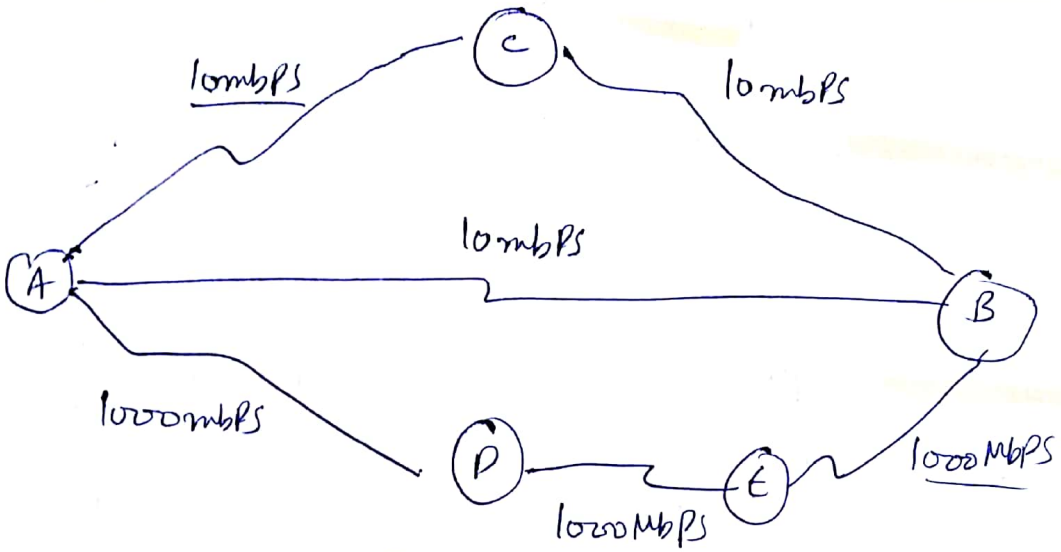

In the above topology, if we follow

a) Distance Vector Routing algorithm -

Then optimal Path is A $\xrightarrow{10\,mbPS}$ B because of less hop counts, but if we follow

b) Link State routing (OSPF) - Then optimal Path is

A $\xrightarrow{1000\,mbPS}$ D $\xrightarrow{1000\,mbPS}$ E $\xrightarrow{1000\,mbPS}$ B

because link state routing uses bandwidth as a metric to take routing decisions.

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