# UNIT- V

NETWORK LAYER
ROUTING PROTOCOLS

A routing table *can be either static or dynamic.*

A static table is one with manual entries.

A dynamic table is one that is updated automatically when there is a change somewhere in the Internet.

A routing protocol is a combination of rules and procedures that lets routers in the Internet inform each other of changes.

Figure *Autonomous systems*

Autonomous system

Autonomous system

R1

R2

R3

R4

Autonomous system

Autonomous system
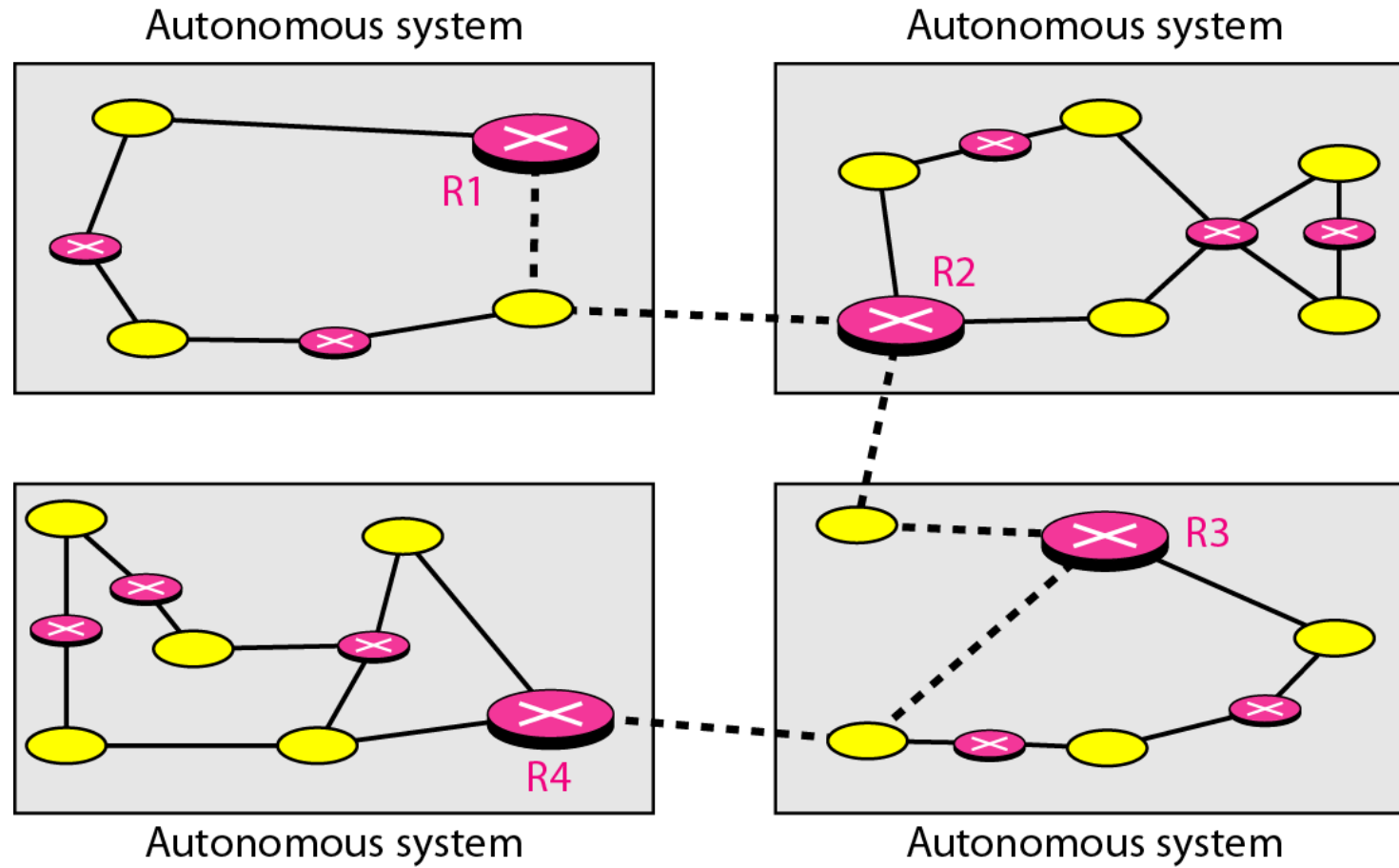
- When it receives a packet, to which network should it pass the packet?
- The decision is based on optimization: Which of the available pathways is the optimum pathway?

- One approach is to assign a cost for passing through a network. We call this cost a metric.

- However, the metric assigned to each network depends on the type of protocol.

- Some simple protocols, such as the Routing Information Protocol (RIP), treat all networks as equals. The cost of passing through a network is the same; it is one hop count.

- So if a packet passes through 10 networks to reach the destination, the total cost is 10 hop counts

- Another method can be type of service

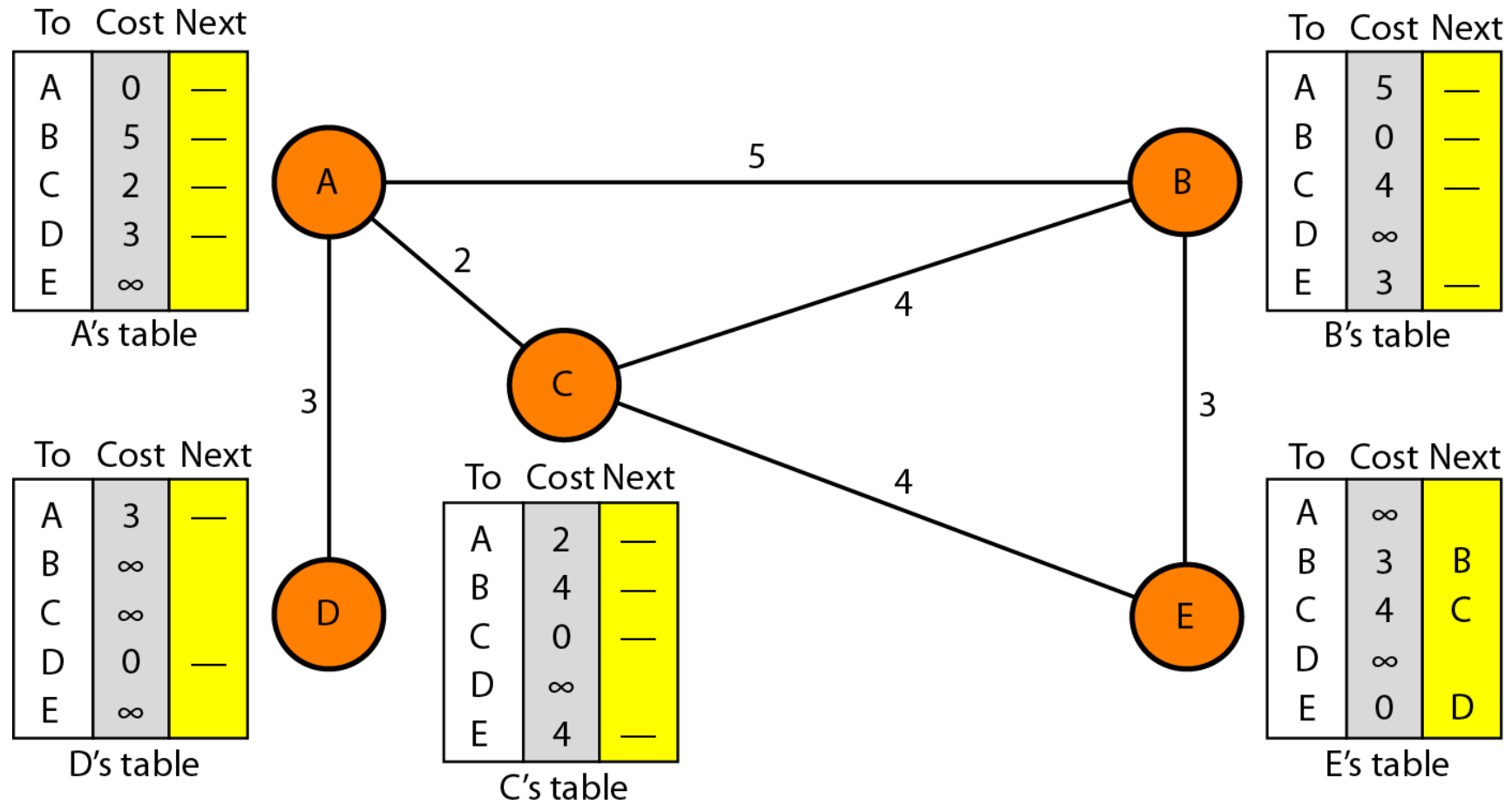**Figure** *Popular routing protocols*
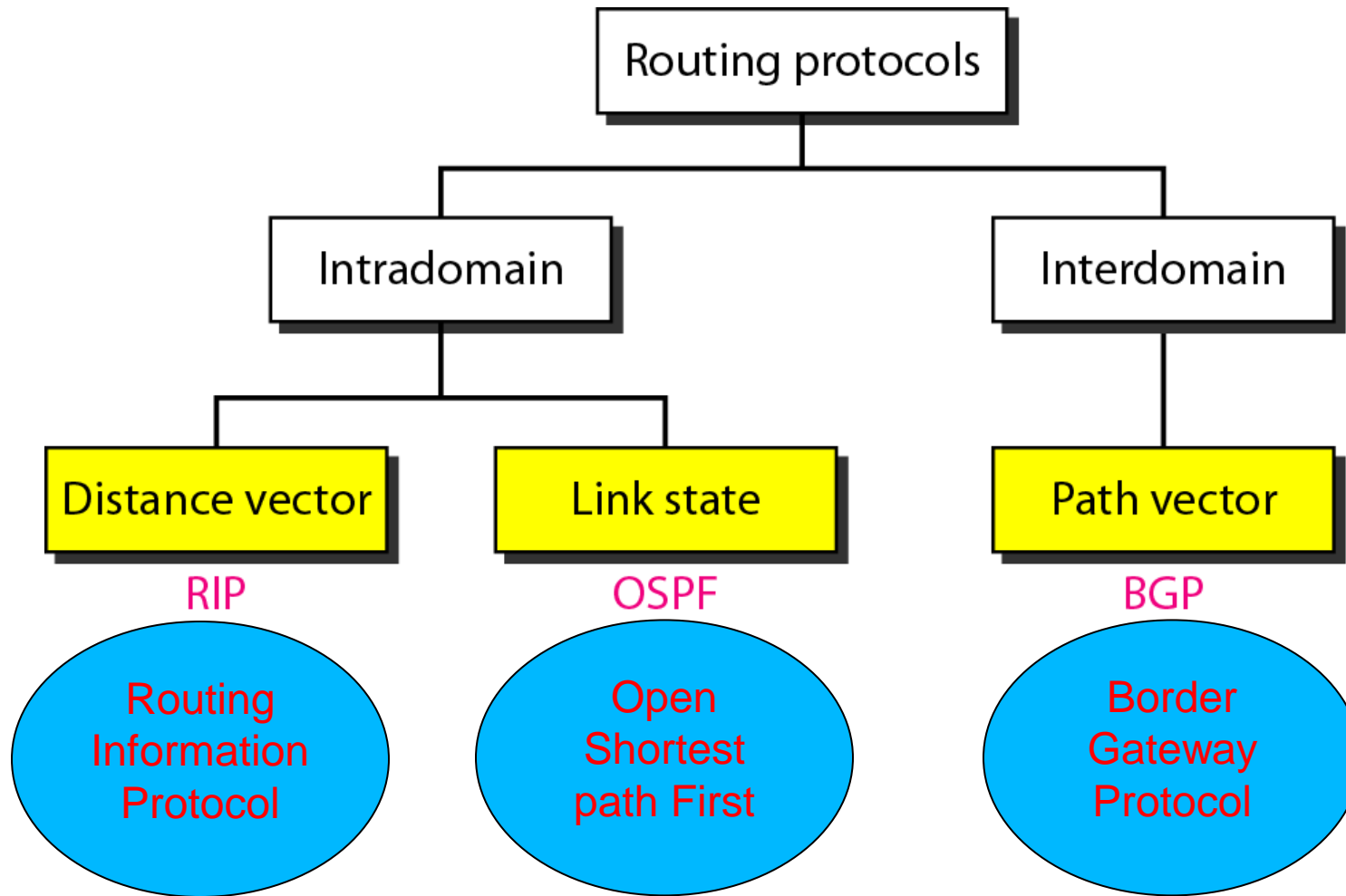
Let us see the differences between Intradomain and Interdomain:

S.No	Intradomain Routing	Interdomain Routing
1.	Routing algorithm works only within domains.	Routing algorithm works within and between domains.
2.	It need to know only about other routers within their domain.	It need to know only about other routers within and between their domain.
3.	Protocols used in intradomain routing are known as **Interior-gateway protocols**.	Protocols used in interdomain routing are known as **Exterior-gateway protocols**.
4.	In this Routing, routing takes place within an autonomous network.	In this Routing, routing takes place between the autonomous networks.
5.	Intradomain routing protocols ignores the internet outside the AS(autonomous system).	Interdomain routing protocol assumes that the internet contains the collection of interconnected AS(autonomous systems).
6.	Some Popular Protocols of this routing are RIP(resource information protocol) and OSPF(open shortest path first).	Popular Protocols of this routing is BGP(Border Gateway Protocol) used to connect two or more AS(autonomous system).

- In distance vector routing, the least-cost route between any two nodes is the route with minimum distance.

- In this protocol, as the name implies, each node maintains a vector (table) of minimum distances to every node.

- The table at each node also guides the packets to the desired node by showing the next stop in the route (next-hop routing).

Figure : *Initialization of tables in distance vector routing*

A's table

To	Cost	Next
A	0	—
B	5	—
C	2	—
D	3	—
E	∞	

B's table

To	Cost	Next
A	5	—
B	0	—
C	4	—
D	∞	
E	3	—

D's table

To	Cost	Next
A	3	—
B	∞	
C	∞	
D	0	—
E	∞	

C's table

To	Cost	Next
A	2	—
B	4	—
C	0	—
D	∞	
E	4	—

E's table

To	Cost	Next
A	∞	
B	3	B
C	4	C
D	∞	
E	0	D

Note

In distance vector routing, each node shares its routing table with its immediate neighbors periodically and when there is a change.
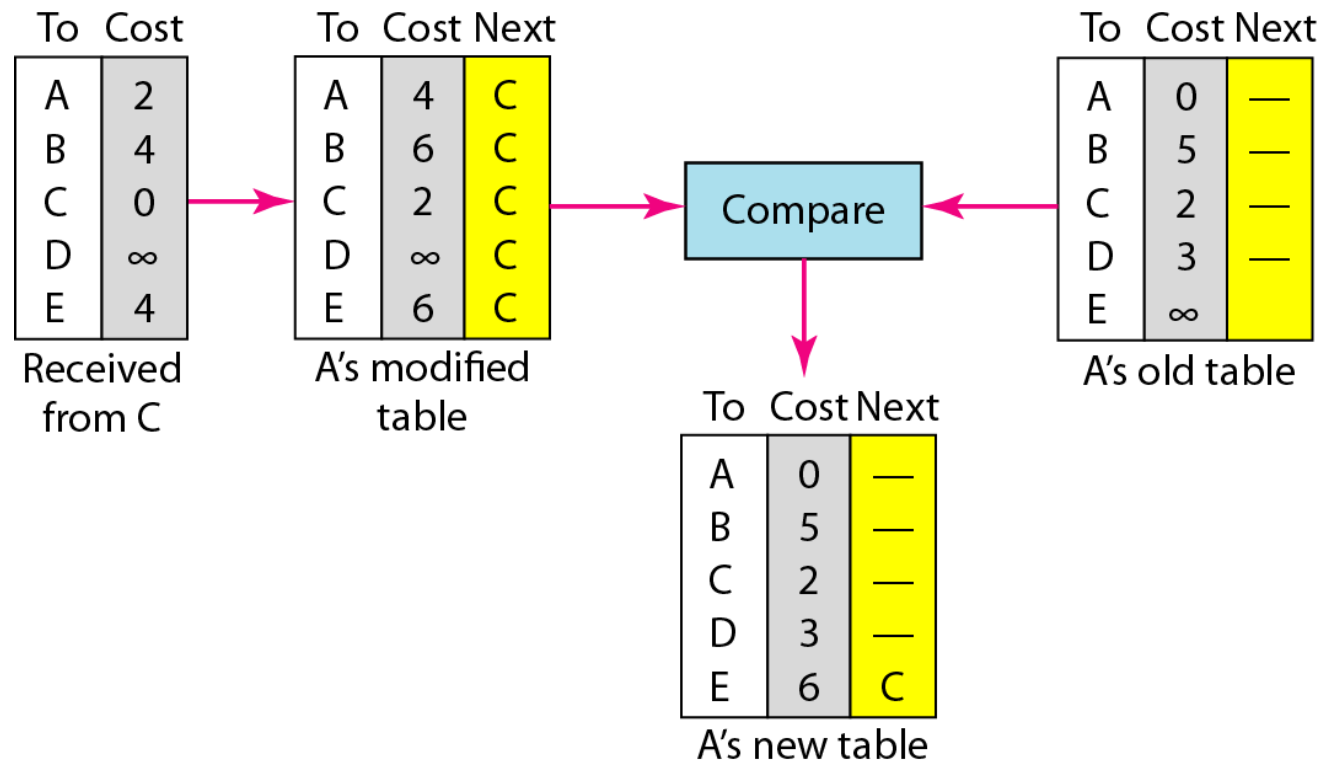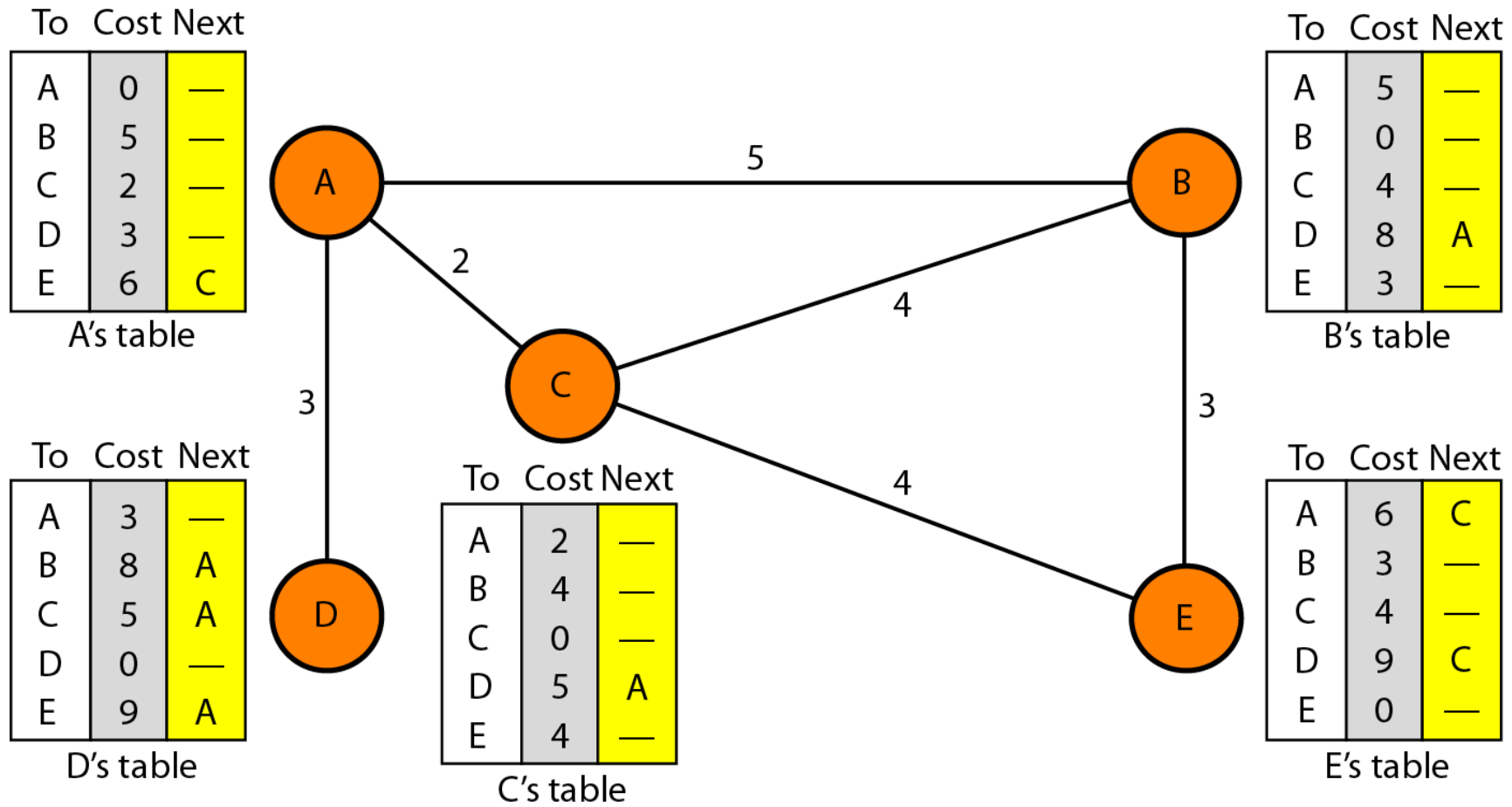
Figure *Updating in distance vector routing*

To	Cost
A	2
B	4
C	0
D	∞
E	4

Received from C

To	Cost	Next
A	4	C
B	6	C
C	2	C
D	∞	C
E	6	C

A's modified table

Compare

To	Cost	Next
A	0	—
B	5	—
C	2	—
D	3	—
E	∞	

A's old table

To	Cost	Next
A	0	—
B	5	—
C	2	—
D	3	—
E	6	C

A's new table

Figure *Distance vector routing tables*

3. In distance vector routing, a router sends its updating packet _____.

    A. only to its neighbors

    B. to every other router in the internetwork (through flooding)

    C. either a or b

    D. neither a nor b

When does a node send its partial routing table (only two columns) to all its immediate neighbors?

Periodic Update: A node sends its routing table, normally every 30 s, in a periodic update. The period depends on the protocol that is using distance vector routing.

Triggered Update: A node sends its two-column routing table to its neighbors anytime there is a change in its routing table. This is called a triggered update.

The change can result from the following:

1. A node receives a table from a neighbor, resulting in changes in its own table after updating.

2. A node detects some failure in the neighboring links which results in a distance change to infinity.

Consider-

- There is a network consisting of 4 routers.
- The weights are mentioned on the edges.
- Weights could be distances or costs or delays.
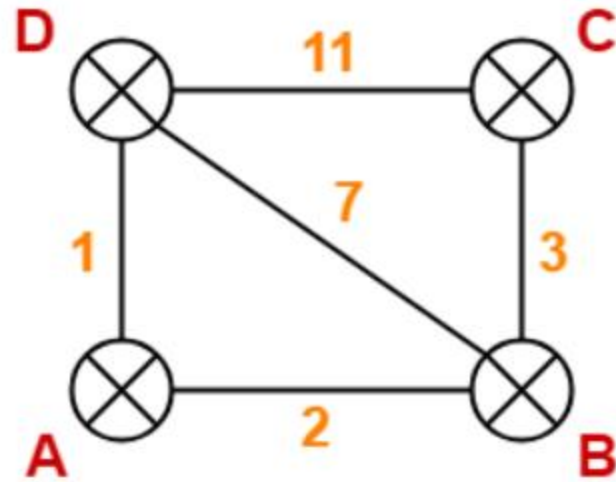
Step-01:

Each router prepares its routing table. By their local knowledge. each router knows about-

- All the routers present in the network
- Distance to its neighboring routers

Step-02:

- Each router exchanges its distance vector with its neighboring routers.
- Each router prepares a new routing table using the distance vectors it has obtained from its neighbors.
- This step is repeated for (n-2) times if there are n routers in the network.
- After this, routing tables converge / become stable.

Thus, the new routing table at router A is-

| Destination	Distance	Next Hop
A	0	A
B	2	B
C	5	B
D	1	D

Thus, the new routing table at router B is-

Destination	Distance	Next Hop
A	2	A
B	0	B
C	3	C
D	3	A

Thus, the new routing table at router C is-

Destination	Distance	Next Hop
A	5	B
B	3	B
C	0	C
D	10	B

Thus, the new routing table at router D is-

Destination	Distance	Next Hop
A	1	A
B	3	A
C	10	B
D	0	D

2. In distance vector routing, the updating packet conveys the knowledge of the router about

_____.

    A. the whole internetwork

    B. the neighborhood

    C. either a or b

    D. neither a nor b

Figure *Two-node instability*
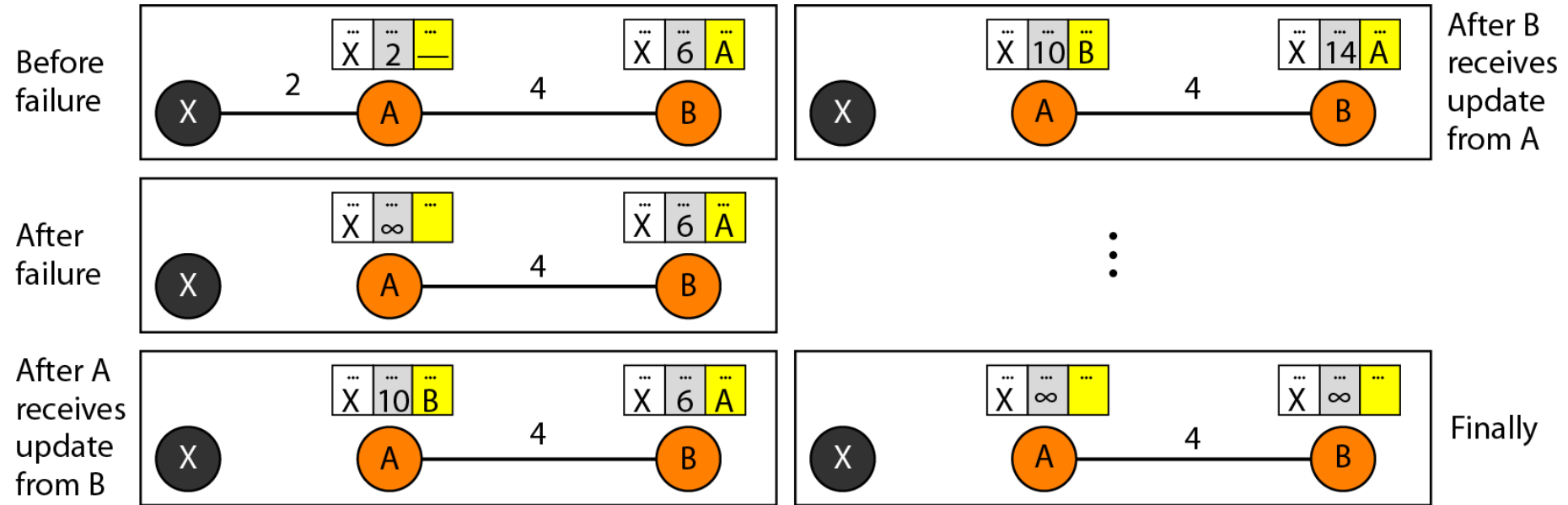
Defining Infinity

- The first obvious solution is to redefine infinity to a smaller number, such as 100.

- For our previous scenario, the system will be stable in less than 20 updates. As a matter of fact, most implementations of the distance vector protocol define the distance between each node to be I and define 16 as infinity.

- However, this means that the distance vector routing cannot be used in large systems.

- The size of the network, in each direction, can not exceed 15 hops.

Q3. A 4 byte IP address consists of _____

a) only network address
b) only host address
c) network address & host address
d) network address & MAC address

Q4. Which of the following routing algorithms can be used for network layer design?
a) shortest path algorithm
b) distance vector routing
c) link state routing
d) all of the mentioned

Q5. A subset of a network that includes all the routers but contains no loops is called _____
a) spanning tree
b) spider structure
c) spider tree
d) special tree

Q6. Which one of the following algorithm is not used for congestion control?
a) traffic aware routing
b) admission control
c) load shedding
d) routing information protocol

Q7. The network layer protocol for internet is _____
a) ethernet
b) internet protocol
c) hypertext transfer protocol
d) file transfer protocol

Q8. Transport layer aggregates data from different applications into a single stream before passing it to _____

a) network layer
b) data link layer
c) application layer
d) physical layer

Q9. Which of the following are transport layer protocols used in networking?
a) TCP and FTP
b) UDP and HTTP
c) TCP and UDP
d) HTTP and FTP

Q10. User datagram protocol is called connectionless because
_____
a) all UDP packets are treated independently by transport layer
b) it sends data as a stream of related packets
c) it is received in the same order as sent order
d) it sends data very quickly

Thank you !!!

Do more practice of MCQ and relevant theory questions!!!