

# UNIT- V

## NETWORK LAYER ROUTING PROTOCOLS

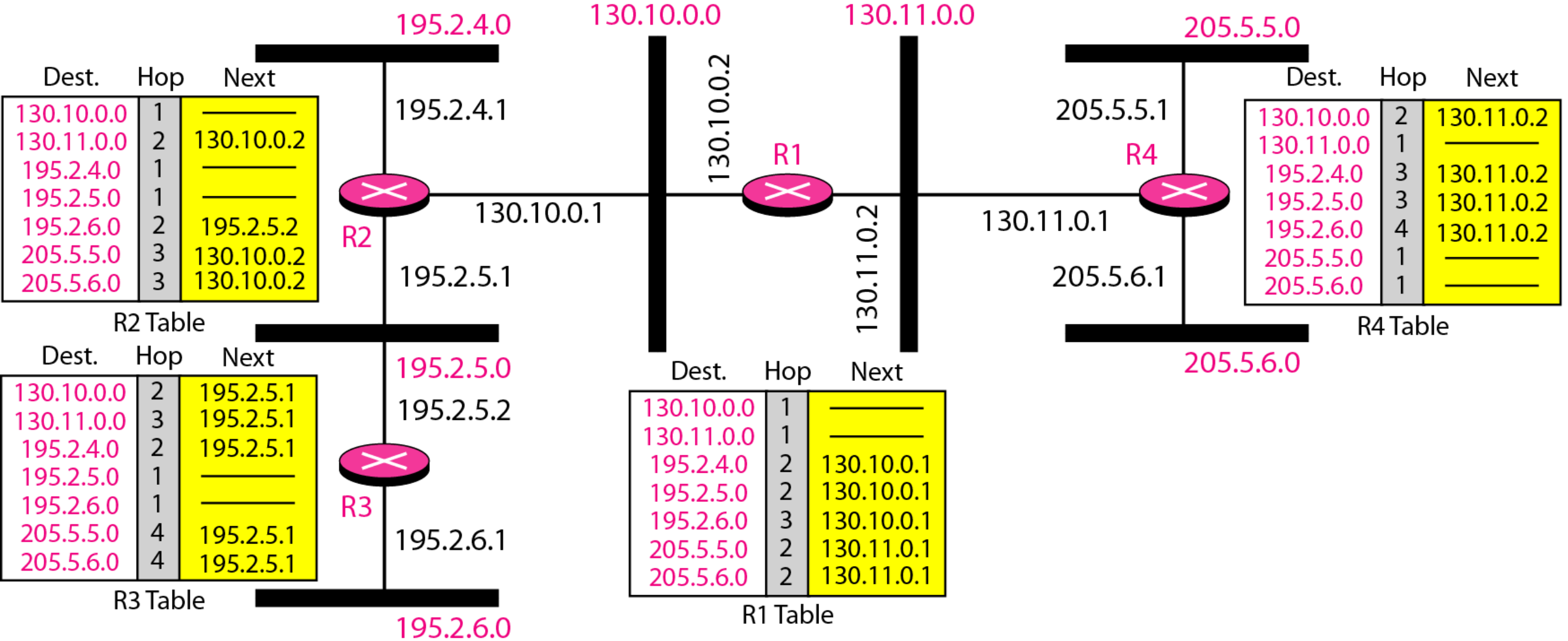
## Routing Information Protocol (RIP)

It is an Intradomain routing protocol used inside an autonomous system. It is a very simple protocol based on distance vector routing.

RIP implements distance vector routing directly with ***some considerations***:

1. In an autonomous system, we are dealing with routers and networks (links). The routers have routing tables; networks do not.
2. The destination in a routing table is a network, which means the first column defines a network address.
3. The metric used by RIP is very simple; the distance is defined as the number of links (networks) to reach the destination. For this reason, the metric in RIP is called a hop count.
4. Infinity is defined as 16, which means that any route in an autonomous system using RIP cannot have more than 15 hops.
5. The next-node column defines the address of the router to which the packet is to be sent to reach its destination.

**Figure** *Example of a domain using RIP*



Which routing protocol has a maximum network diameter (hop count) of 15?

- a) RIPv1
- b) RIPv2
- c) EIGRP
- d) Both RIPv1 and RIPv2

Which command displays RIP routing updates?

- a) Show IP route
- b) Debug IP rip
- c) Show protocols
- d) Debug IP route

Default administrative distance of a static route is \_\_\_\_\_

- a) 0
- b) 90
- c) 100
- d) 1

Distance vector routing algorithm is implemented in Internet as .....

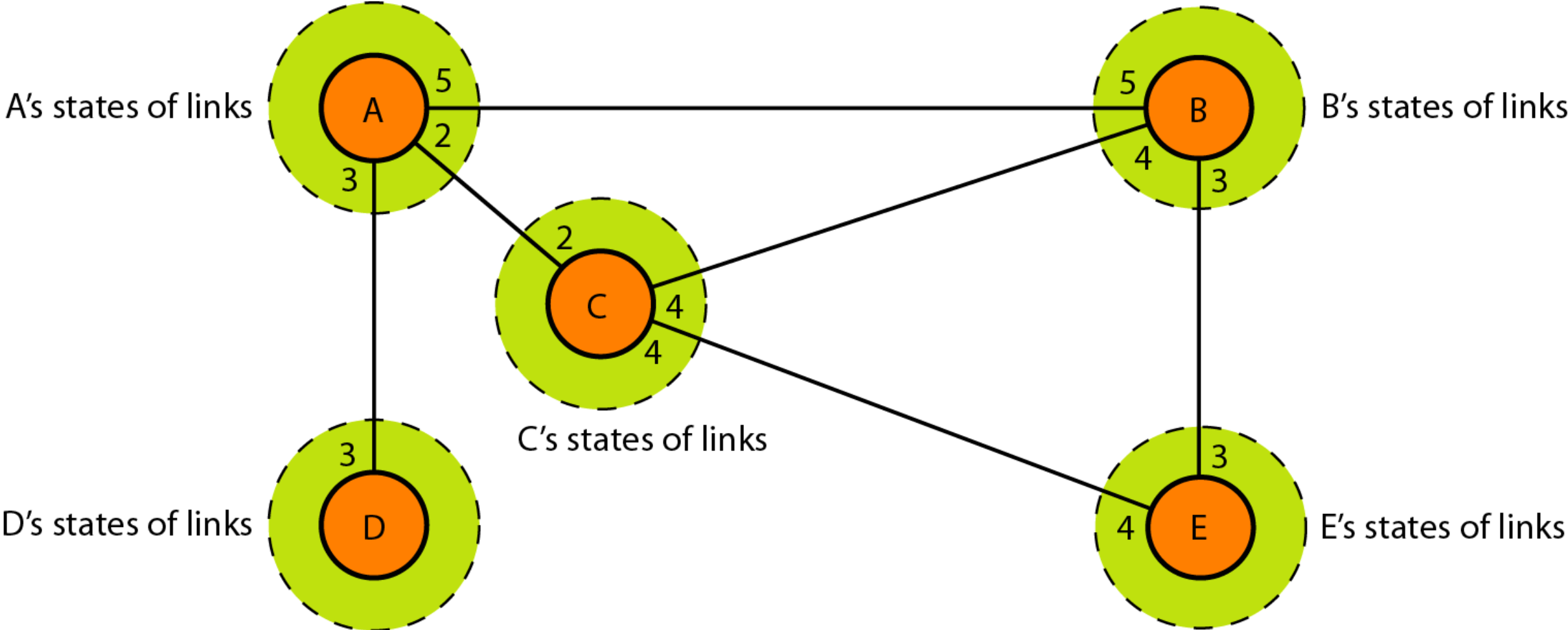
- (A) OSPF
- (B) RIP
- (C) ARP
- (D) APR

# Link state routing

- In link state routing, each node in the domain has the entire topology of the domain
- List of nodes and links, how they are connected including cost (metric), and condition of the links (up or down)



# *Link state knowledge*



# BUILD ROUTING TABLE

**In link state routing, four sets of actions are required to ensure that each node has the** routing table showing the least-cost node to every other node.

1. Creation of the states of the links by each node, called the link state packet (LSP).
2. Dissemination of LSPs to every other router, called **flooding, in an efficient and**  
reliable way.
3. Formation of a shortest path tree for each node.
4. Calculation of a routing table based on the shortest path tree.

## **Creation of Link State Packet (LSP) -**

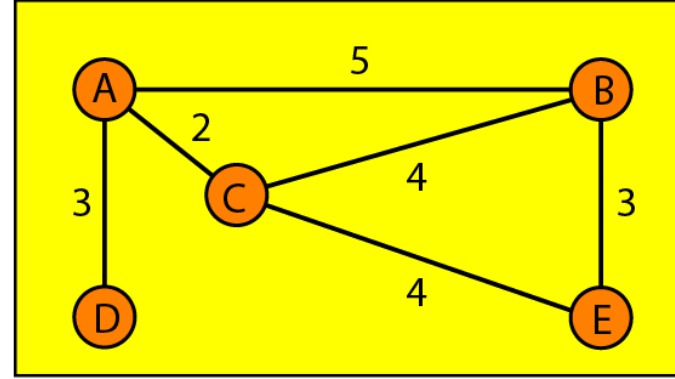
- A link state packet can carry a large amount of information.

- For the moment, we assume that it carries a minimum amount of data:
  - node identity
  - list of links
  - sequence number,
  - age.
- The first two, node identity and the list of links, are needed to make the topology.
- The third, sequence number, facilitates flooding and distinguishes new LSPs from old ones.
- The fourth, age, prevents old LSPs from remaining in the domain for a long time.
- **LSPs are generated on two occasions:**
  - *When there is a change in the topology of the domain*
  - On a periodic basis

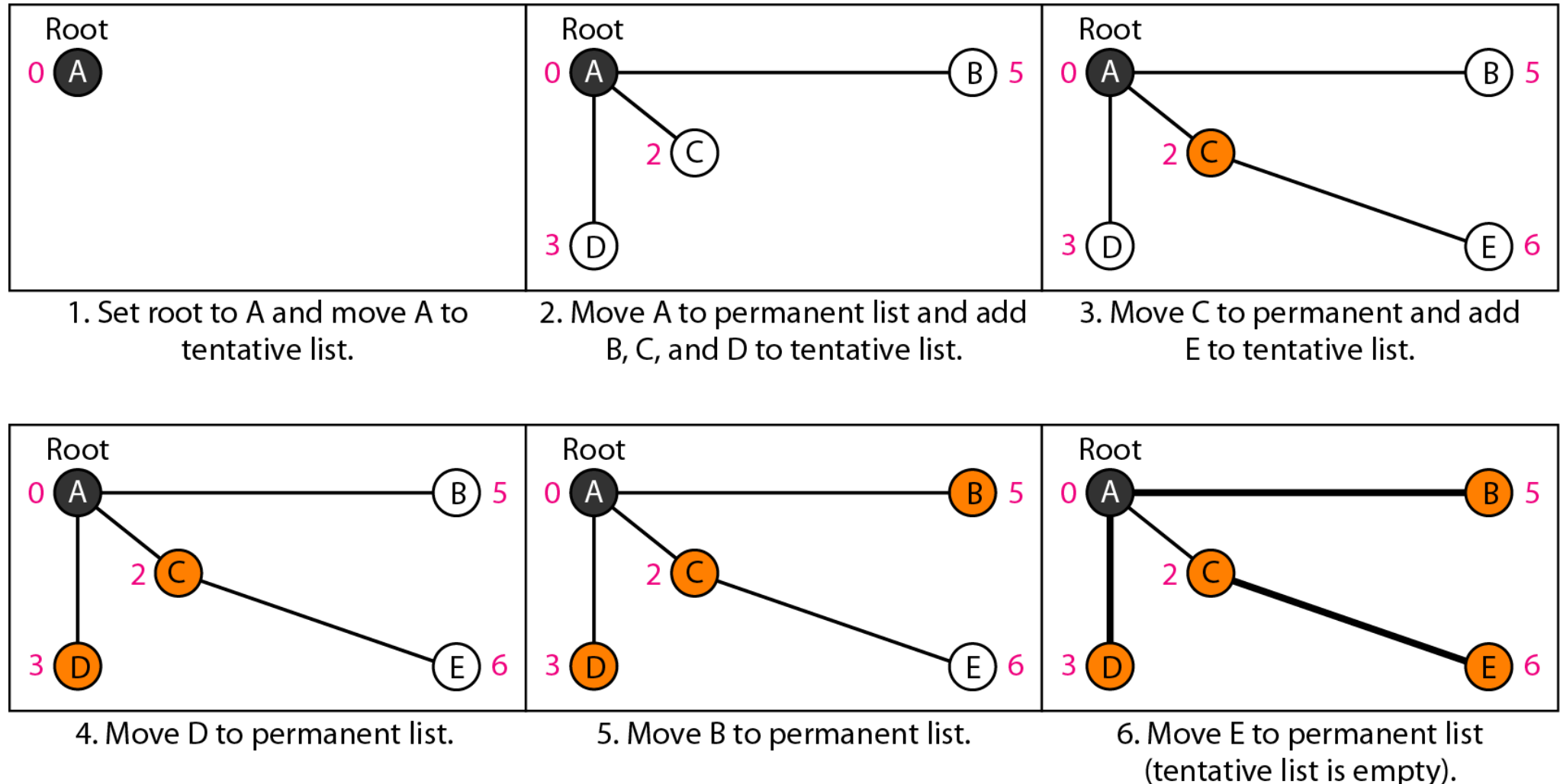
## Flooding of LSPs-

- The creating node sends a copy of the LSP out of each interface.
- A node that receives an LSP compares it with the copy it may already have.
- If the newly arrived LSP is older than the one it has, it discards the LSP. If it is newer, the node does the following:
  - a. It discards the old LSP and keeps the new one.
  - b. It sends a copy of it out of each interface except the one from which the packet arrived.

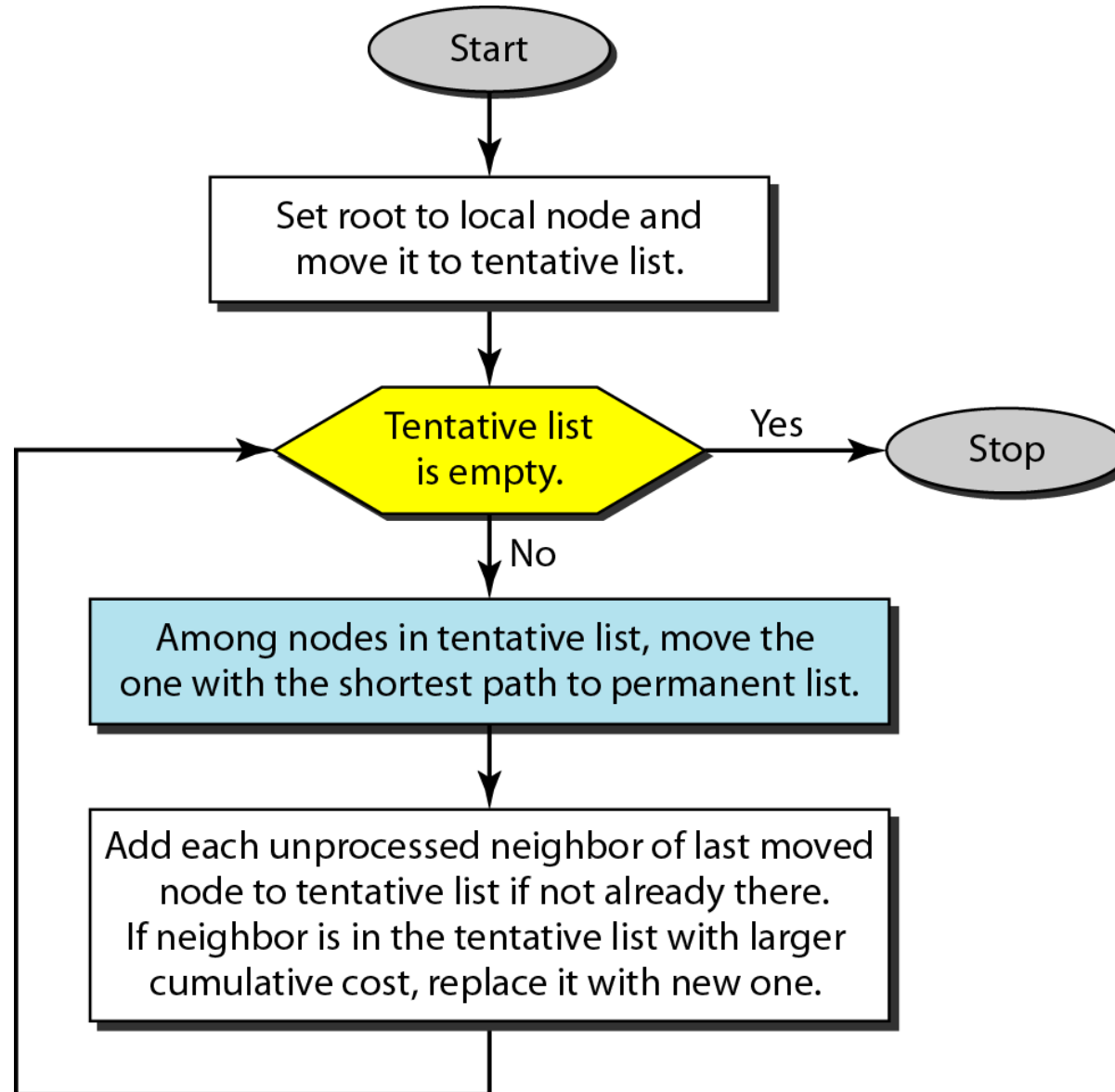
Figure Example of formation of shortest path tree



Topology



## *Dijkstra algorithm*



**Table** *Routing table for node A*

<i>Node</i>	<i>Cost</i>	<i>Next Router</i>
A	0	—
B	5	—
C	2	—
D	3	—
E	6	C

In link state routing, after the construction of link state packets new routes are computed using .....

- (A) Bellman Ford algorithm
- (B) DES algorithm
- (C) Dijkstra's algorithm
- (D) Leaky bucket algorithm



Count-to-Infinity problem occurs in

.....

- (A) distance vector routing
- (B) short path first
- (C) link state routing
- (D) hierarchical routing

In distance vector routing algorithm, each router maintains a separate routing table with the following entries.

- (A) preferred input line , estimated time
- (B) preferred input line, estimated distance
- (C) preferred output line, estimated time
- (D) preferred output line, router

Link state packets are built in .....

- (A) short path first
- (B) distance vector routing
- (C) link state routing
- (D) hierarchical routing

In which routing method do all the routers have a common database?

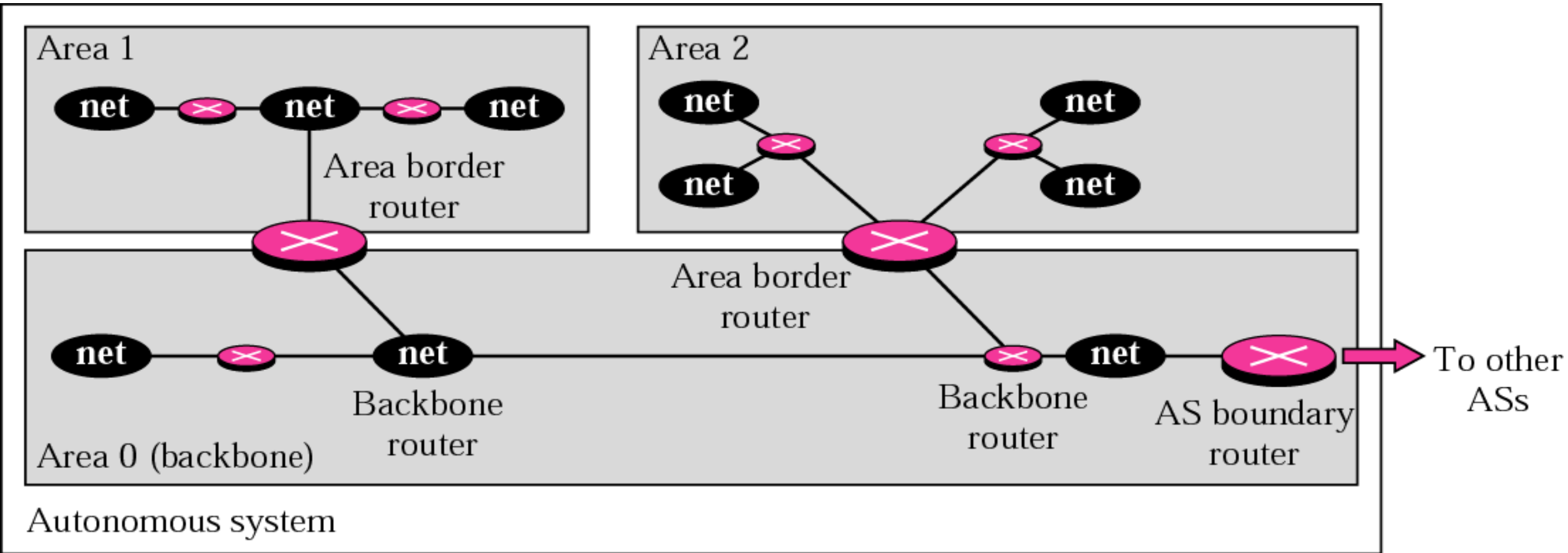
- (A) Distance Vector
- (B) Link Vector
- (C) Shortest path
- (D) Link State

# OSPF (Open Shortest Path First )

*The Open Shortest Path First (OSPF) protocol is an intradomain routing protocol based on link state routing.*

*Its domain is also an autonomous system.*

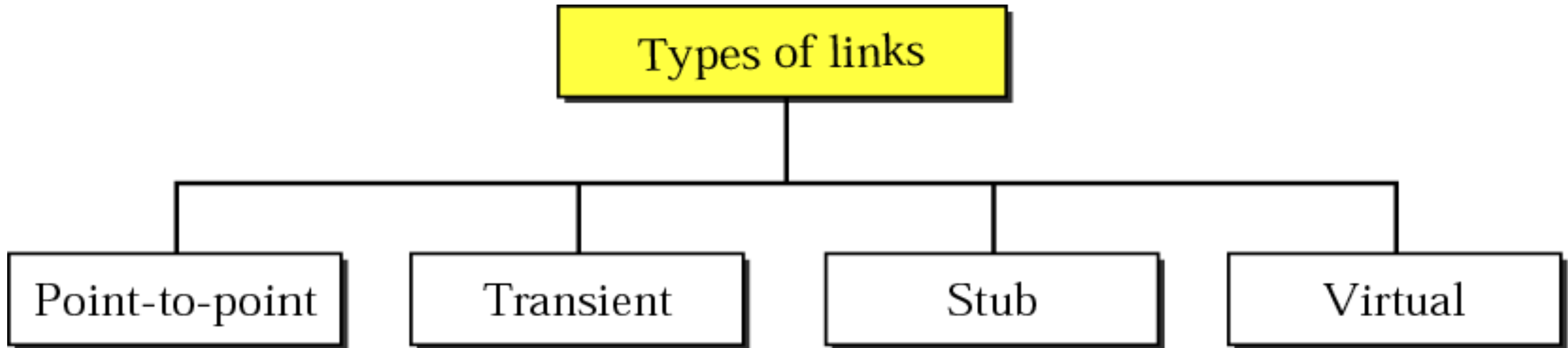
**Figure** *Areas in an autonomous system*



# Metric in OSPF

- OSPF allows administrator to assign a cost called metric.
- The metric can be based on type of service- minimum delay, maximum throughput and so on.
- Therefore, a router can have multiple routing tables based on different type of service.

**Figure** *Types of links*





**Figure** *Point-to-point link*

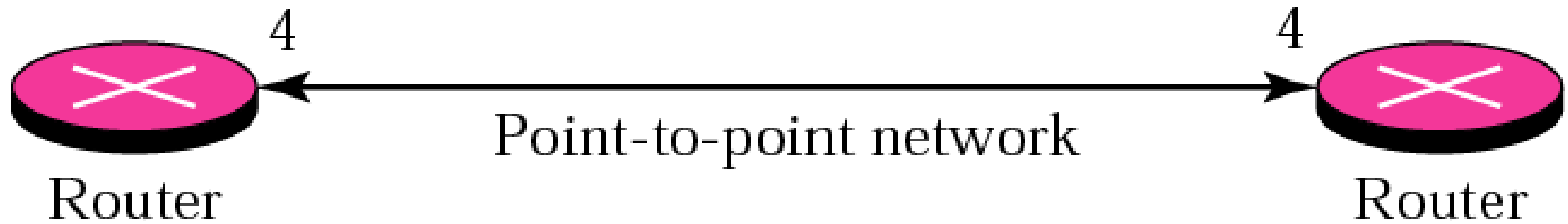
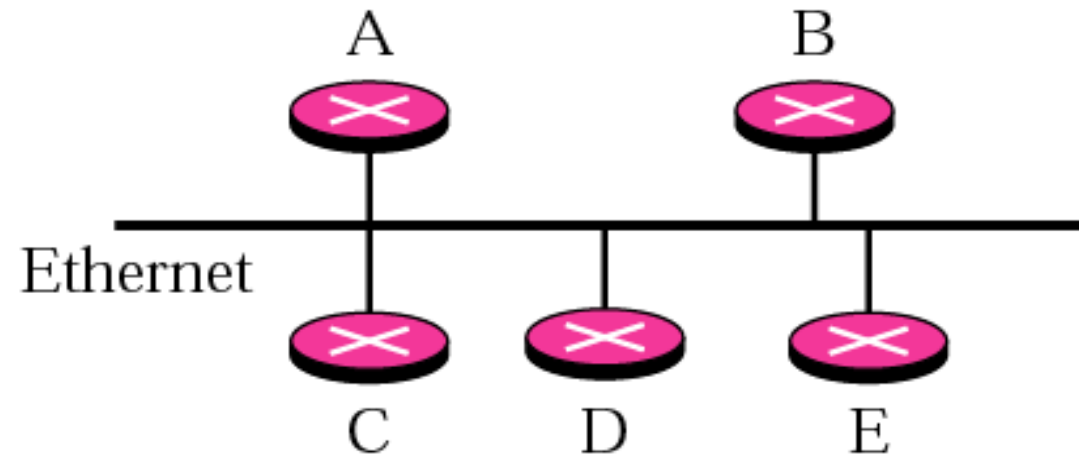
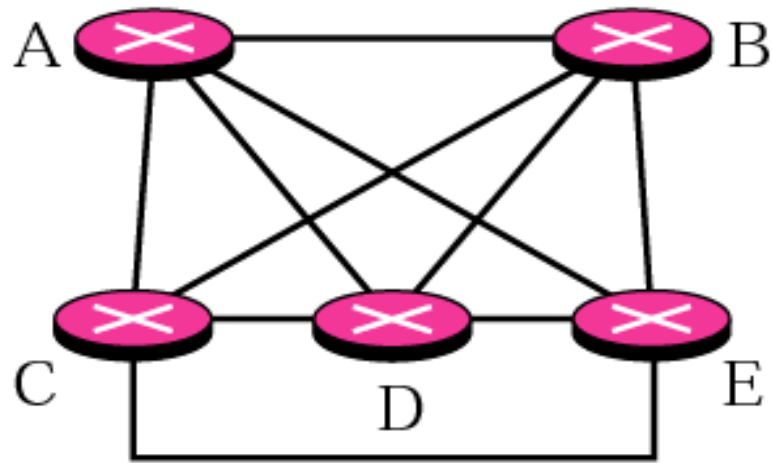


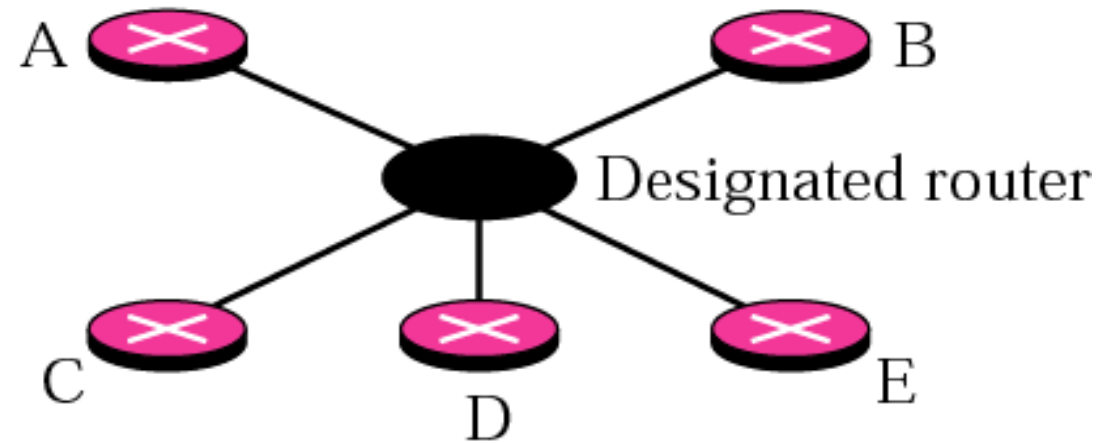
Figure *Transient link*



a. Transient network

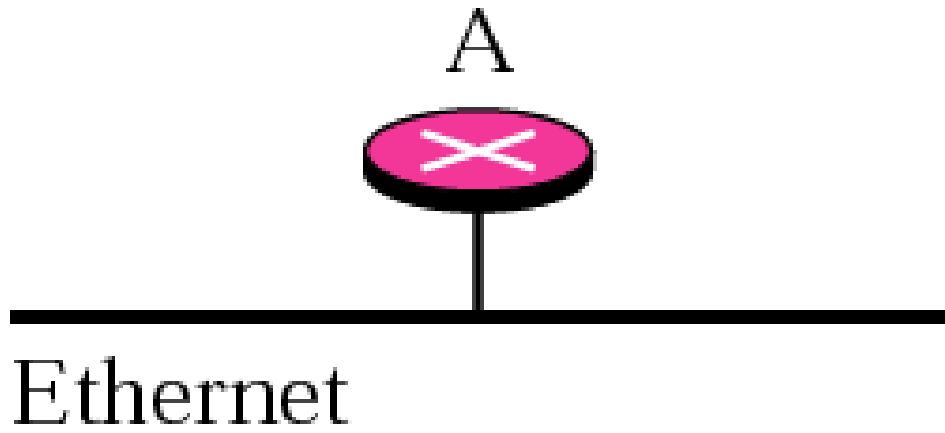


b. Unrealistic representation



c. Realistic representation

**Figure** *Stub link*



a. Stub network



b. Representation

# PATH VECTOR ROUTING

*Path vector routing is similar to distance vector routing. There is at least one node, called the speaker node, in each AS that creates a routing table and advertises it to speaker nodes in the neighboring ASs..*

***The topics discussed in this section include:***

*Initialization*

*Sharing*

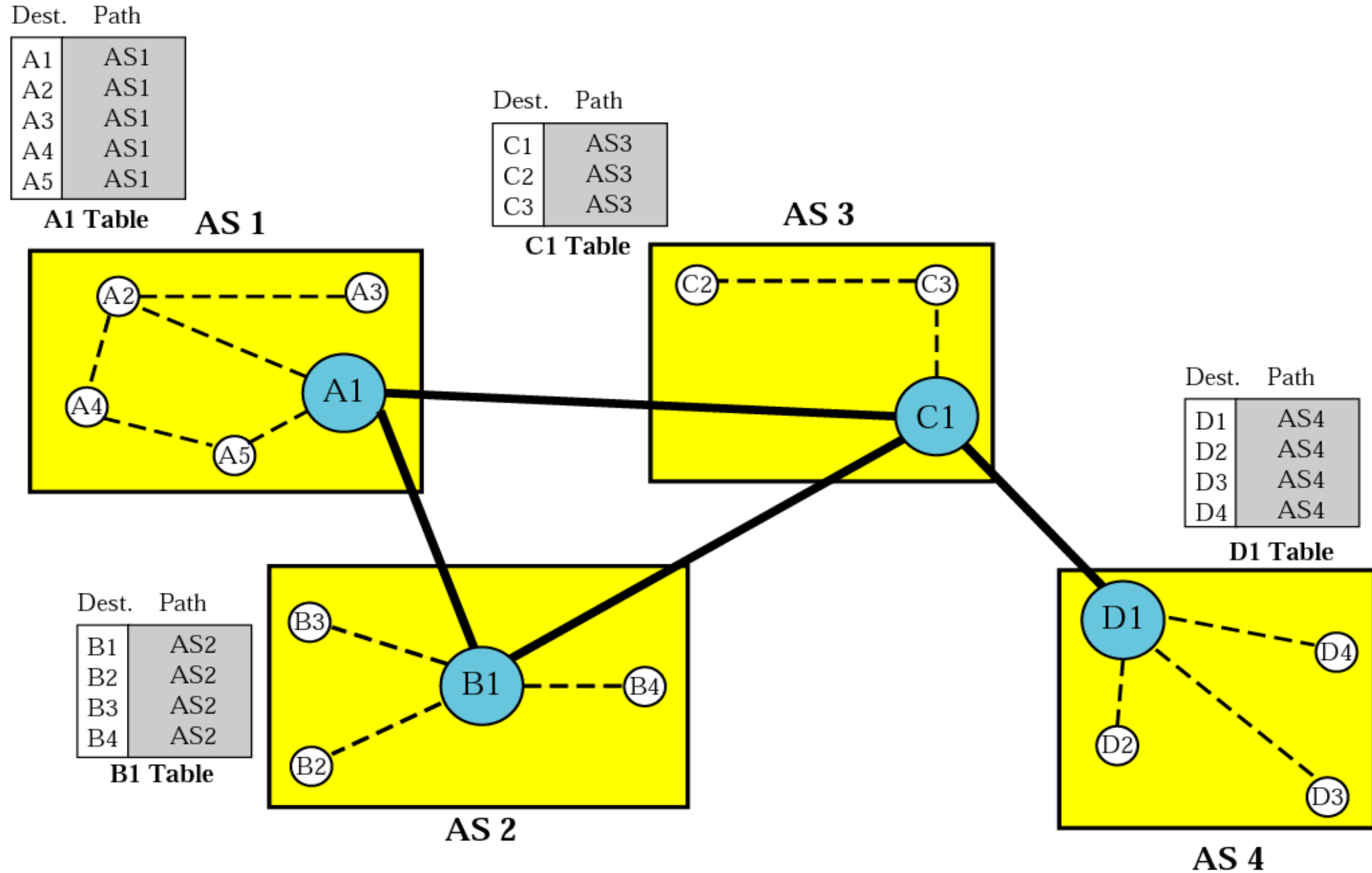
*Updating*

- Problem in distance vector is node instability.
- Problem in link state routing is heavy traffic due to flooding and extra resources required for generating routing tables.

# Steps in path vector Routing

- Initialization
- Sharing
- Updating– Loop prevention, policy routing, optimum path.

**Figure** *Initial routing tables in path vector routing*



**Figure** *Stabilized tables for four autonomous systems*

Dest.	Path
A1	AS1
...	
A5	AS1
B1	AS1-AS2
...	...
B4	AS1-AS2
C1	AS1-AS3
...	...
C3	AS1-AS3
D1	AS1-AS2-AS4
...	...
D4	AS1-AS2-AS4

**A1 Table**

Dest.	Path
A1	AS2-AS1
...	
A5	AS2-AS1
B1	AS2
...	...
B4	AS2
C1	AS2-AS3
...	...
C3	AS2-AS3
D1	AS2-AS3-AS4
...	...
D4	AS2-AS3-AS4

**B1 Table**

Dest.	Path
A1	AS3-AS1
...	
A5	AS3-AS1
B1	AS3-AS2
...	...
B4	AS3-AS2
C1	AS3
...	...
C3	AS3
D1	AS3-AS4
...	...
D4	AS3-AS4

**C1 Table**

Dest.	Path
A1	AS4-AS3-AS1
...	
A5	AS4-AS3-AS1
B1	AS4-AS3-AS2
...	...
B4	AS4-AS3-AS2
C1	AS4-AS3
...	...
C3	AS4-AS3
D1	AS4
...	...
D4	AS4

**D1 Table**



# BGP

*Border Gateway Protocol (BGP) is an interdomain routing protocol using path vector routing. It first appeared in 1989 and has gone through four versions.*

***The topics discussed in this section include:***

*Types of Autonomous Systems*

*Path Attributes*

*BGP Sessions*

*External and Internal BGP*

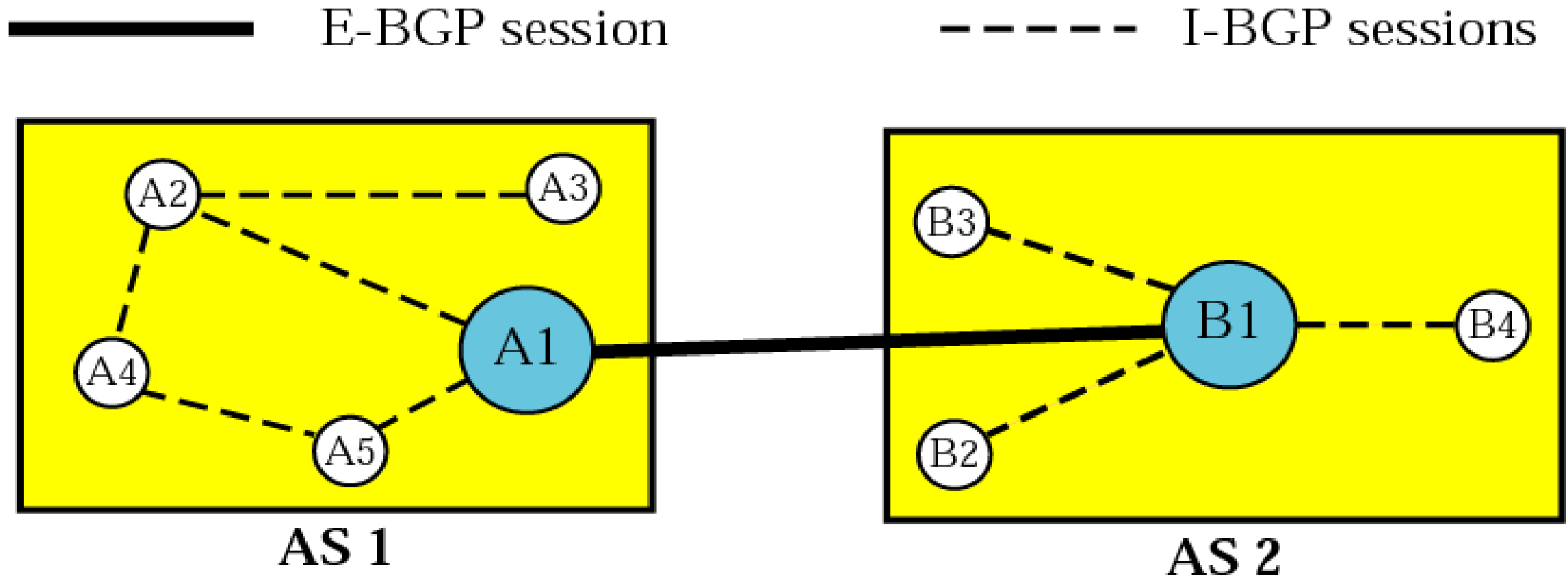
## *Path Attributes*

- Well Known attribute
  - Mandatory
  - Discretionary
- Optional attribute
  - Transitive
  - Non-transitive

# BGP Sessions

- Using TCP connections—reliable
- Last for long time so it is called as semi permanent connections.

**Figure** *Internal and external BGP sessions*



Thank you class!!!

“Keep Practicing”  
MCQ Questions