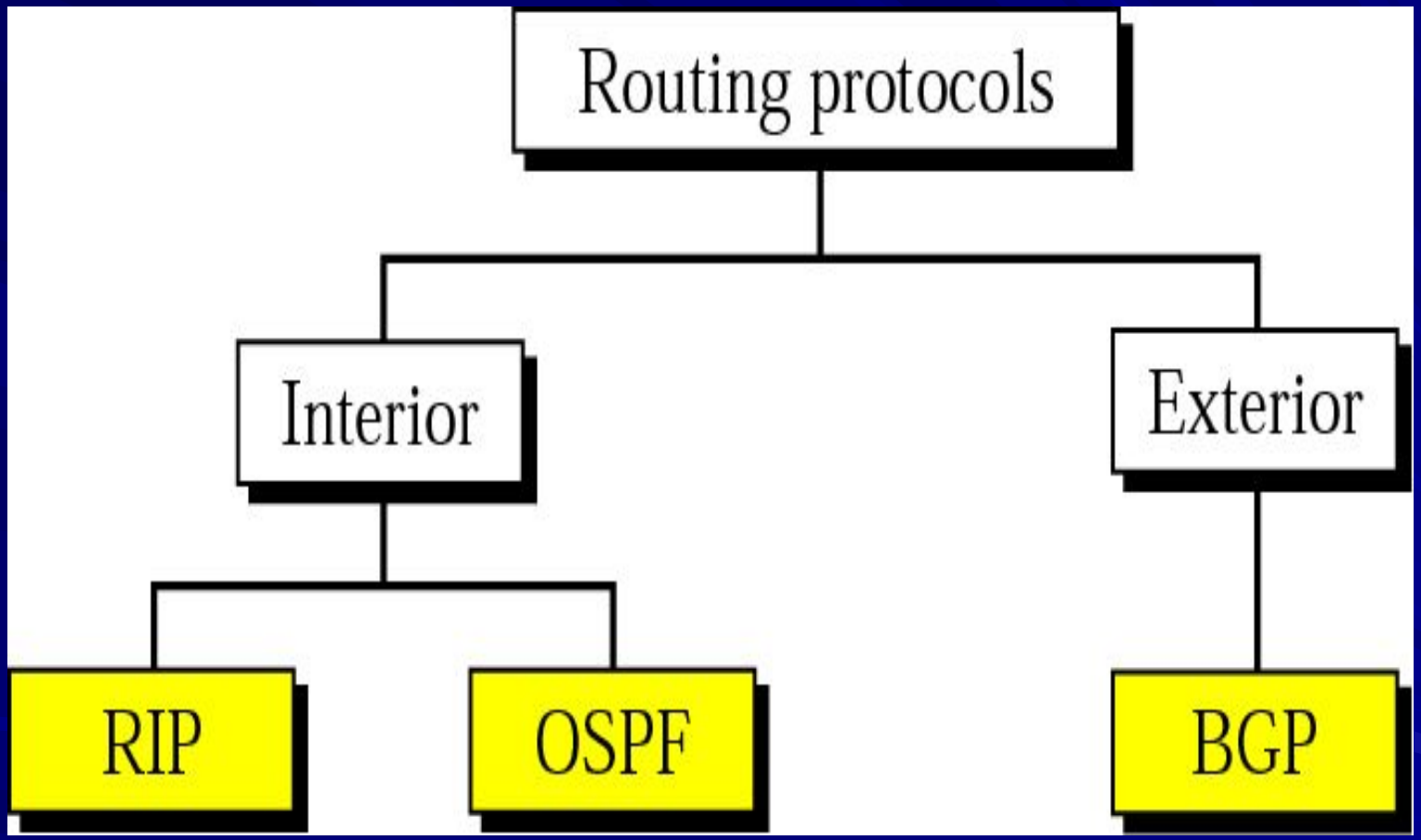
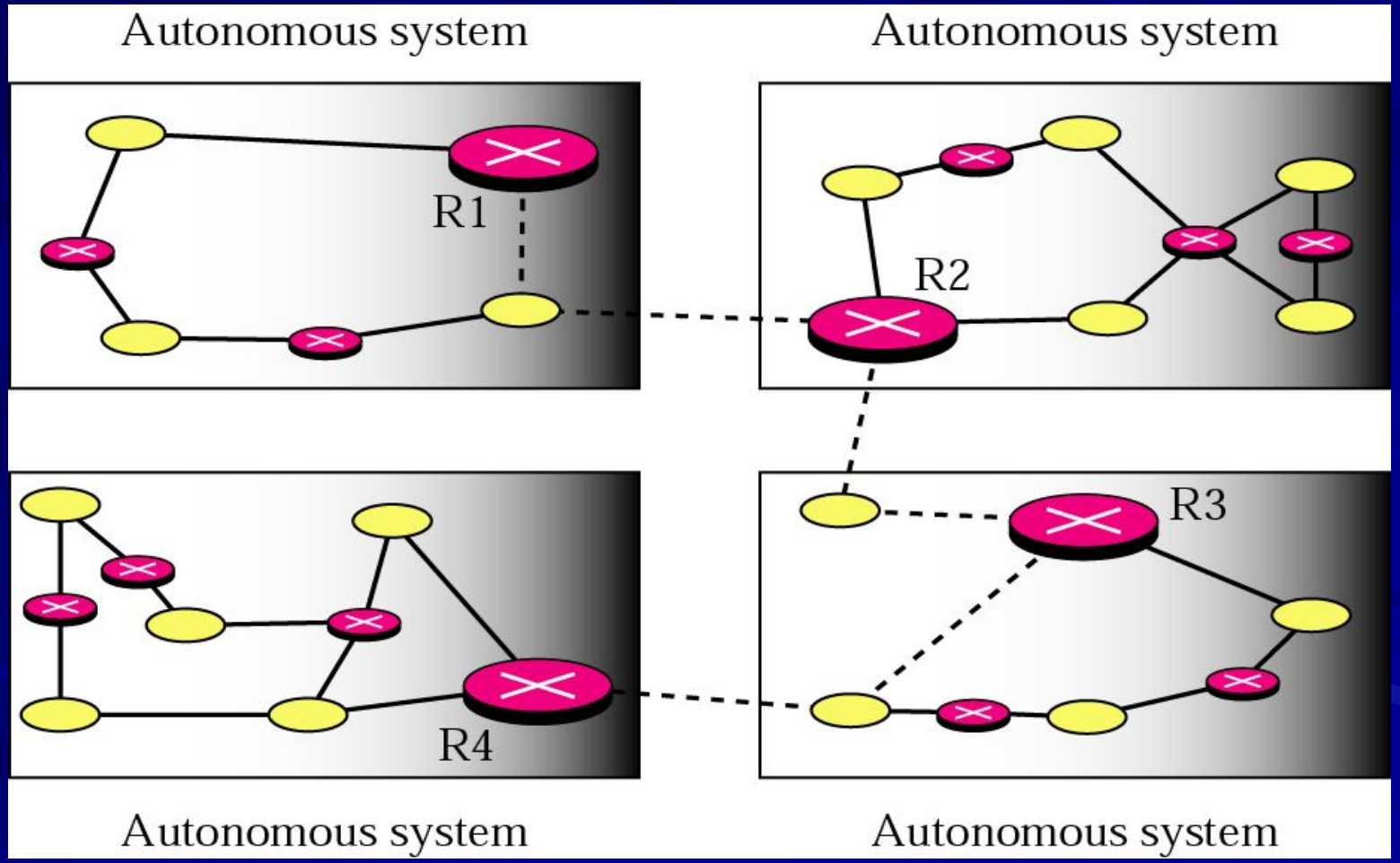
Routing
Part 2

- **Dynamic Routing**
- Dynamic routing performs the same function as static routing except it is more robust. Static routing allows routing tables in specific routers to be set up in a static manner so network routes for packets are set. If a router on the route goes down the destination may become unreachable. Dynamic routing allows routing tables in routers to change as the possible routes change. There are several protocols used to support dynamic routing including RIP and OSPF.


Routing protocols
Interior
Exterior
RIP
OSPF
BGP


Autonomous system
Autonomous system
R1
R2
R3
R4
Autonomous system
Autonomous system

- RIP and OSPF can be used to update routing tables inside an autonomous system.
- BGP can be used to update routing tables for routers that join the autonomous systems together.
- In the previous diagram , Router R1, R2, R3 and R4 use an interior and an exterior routing protocol. The other router use only interior routing protocols.
- The solid lines show the communication between routers that use interior routing protocols.
- The dashed lines shows the communication between the routers that use a exterior routing protocols.

Distance Vector routing

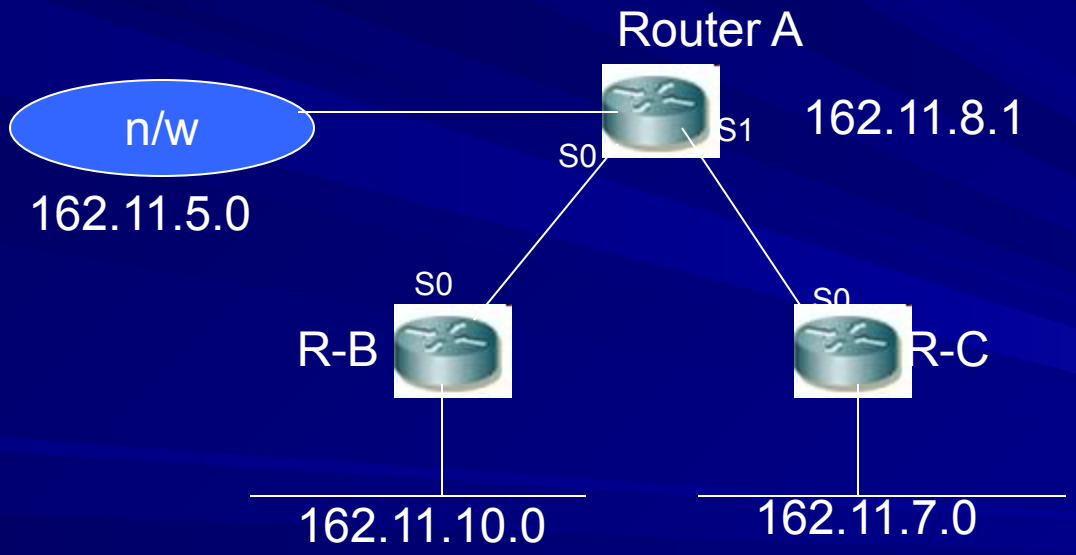
- In distance vector routing, each router periodically shares its knowledge about the entire internet with its neighbors.
- The 3 keys to understanding how this algorithm works are as follows….

1) Sharing knowledge about the entire autonomous system
2) Sharing only with neighbors – each router sends its knowledge only to neighbors. It sends whatever knowledge it has through its interfaces.
3) Sharing at regular intervals. Each router sends its knowledge to its neighbors at fixed intervals, for example – every 30 sec.

- Some time it is also called Bellman-Ford routing algorithm.
- The router is assume to know the “distance” to each of its neighbors. If the metric is hops, the distance is just 1 hop.

- Router used broadcast or multicast for routing updates.
- The metric defines how good the route is, i.e. lower metric routes are consider better routes.
- If router learn multiple route to the same subnet, it chose the best route based on the metric.

- Router send periodic update and expect to receive periodic updates from neighboring routers.



Updated table of Router C

Destination N/W	Outgoing Interface	Next Hop Router
162.11.5.0	S0	168.11.8.1
168.11.10.0	S0	168.11.8.1
162.11.7.0	E0	168.11.8.1

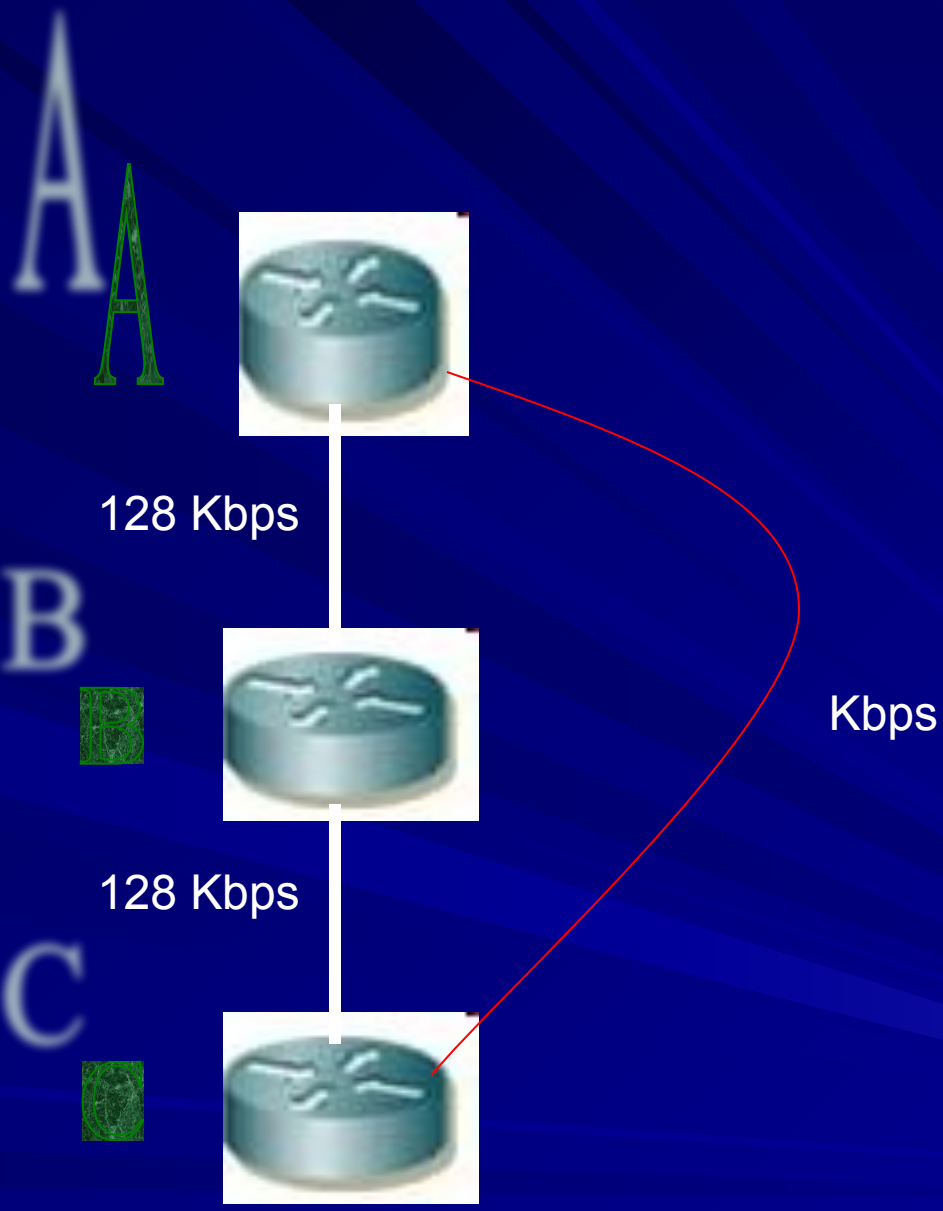
RIPv1 and RIPv2

- RIP is Routing Information Protocol, it is interior routing protocol used inside an autonomous system. The routing table is updated upon receipt of RIP response message.
- RIPv1 □1) Sends broadcast for routing table updates.

  2) supports only classful IP

- RIPv2 1) sends multicast for routing table updates

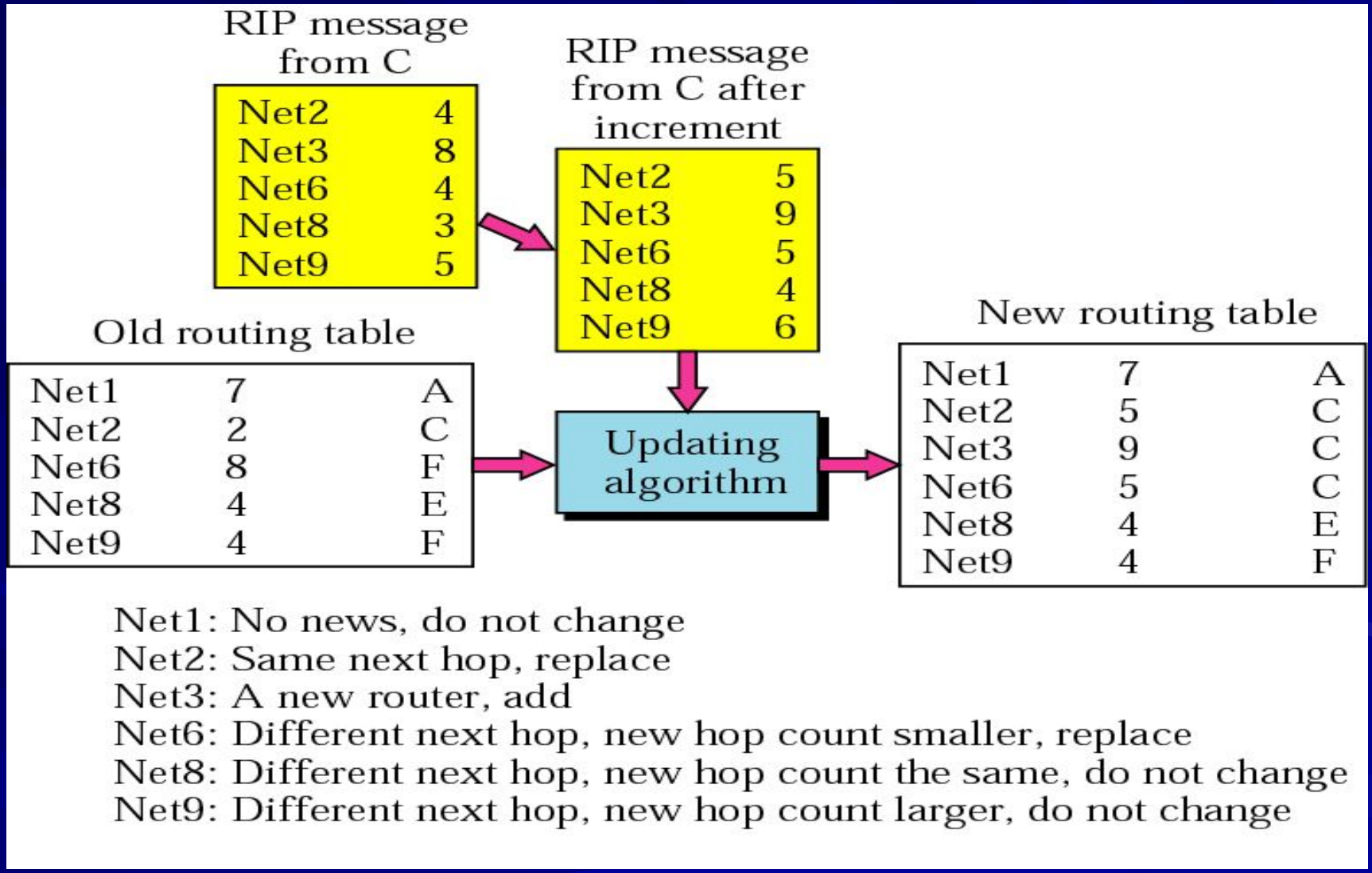
  2) supports classless IP
- It can go upto 15 hop max.
- A hop priority is maintained by RIP, In a n/w, packets chose the router where the less hop count is present.


A
A
128 Kbps
B
B
Kbps
128 Kbps
C
C

RIP Updating Algorithm

- The routing table is updated upon receipt of a RIP response message.

Example of updating a routing table



- In the previous example, a router receives a RIP message from router C. the message lists destination n/ws and their corresponding hop counts. The first step according to the updating algorithm is to increase the hop count by 1. next, this updated RIP packet and the old routing table with an up-to-date hop count for each destination.

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 the routing table)**
  - **1. Add the advertised information to the table.**
- **2. Else**
  - **1. If (next-hop field is the 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.

Link Sate Routing

- OSPF uses link state routing to update routing tables in an area.
- Link state routing is a process by which each router shares its knowledge about its neighborhood with every router in the area.
- The 3 keys to understanding how this method works

1) Sharing knowledge about the neighborhood.
2) Sharing with every other router.

sharing is done by flooding method. Its is a process whereby a router sends its information to all its neighbor (through all its output ports). Each neighbor sends the packet to all neighbors, and so on. Every router that receives the packet sends copies to each of its neighbors. Eventually, every router has received a copy of the same information.

3) Sharing when there is a change (***)

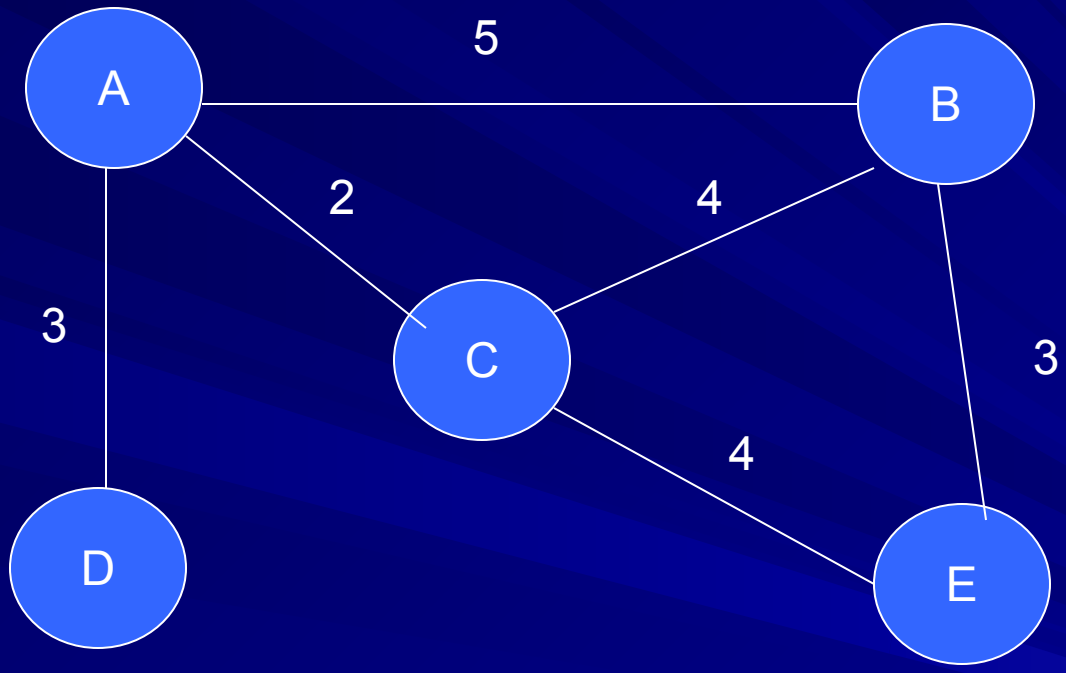
This rule contrasts with distance vector routing, where information is sent out at regular intervals regardless of change.

This characteristic result in lower internet traffic than that required by distance vector routing.

OSPF

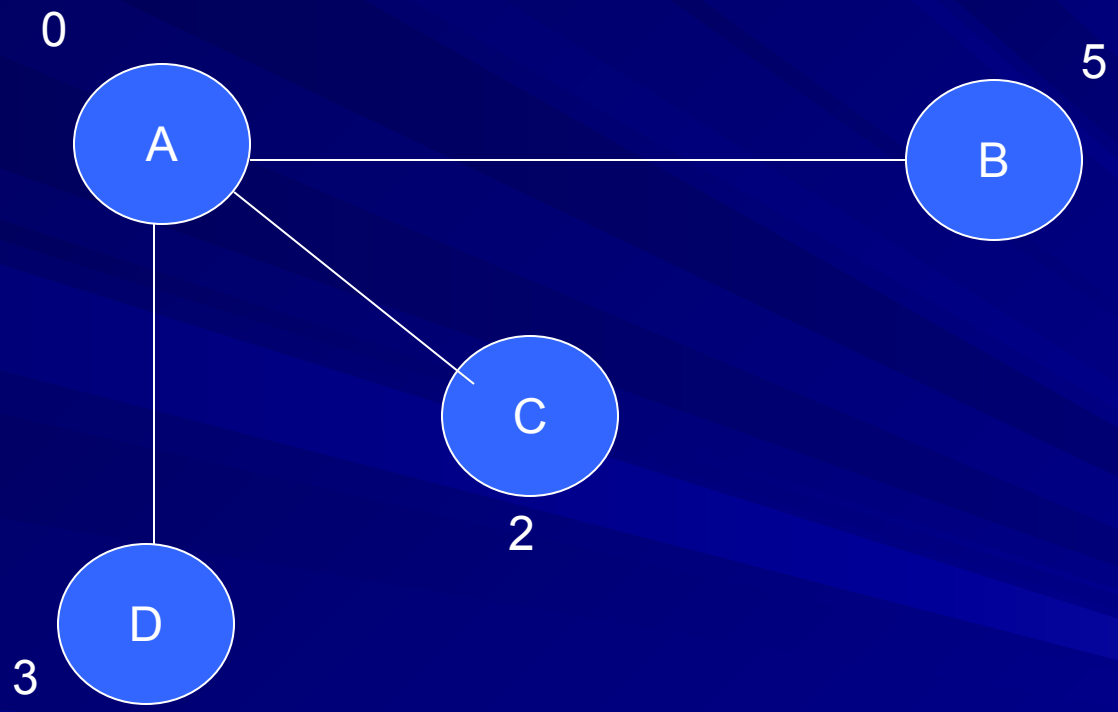
- OSPF is implemented by Dijkstra algorithm.
  - Start
  - Set root to local node and moved it to tentative list.
  - Tentative list is empty ? Stop
    - Y
    - N
  - Move one with the shortest path
  - Add each un-visited neighbor of last moved node to tentative list if not already there

- Example: -

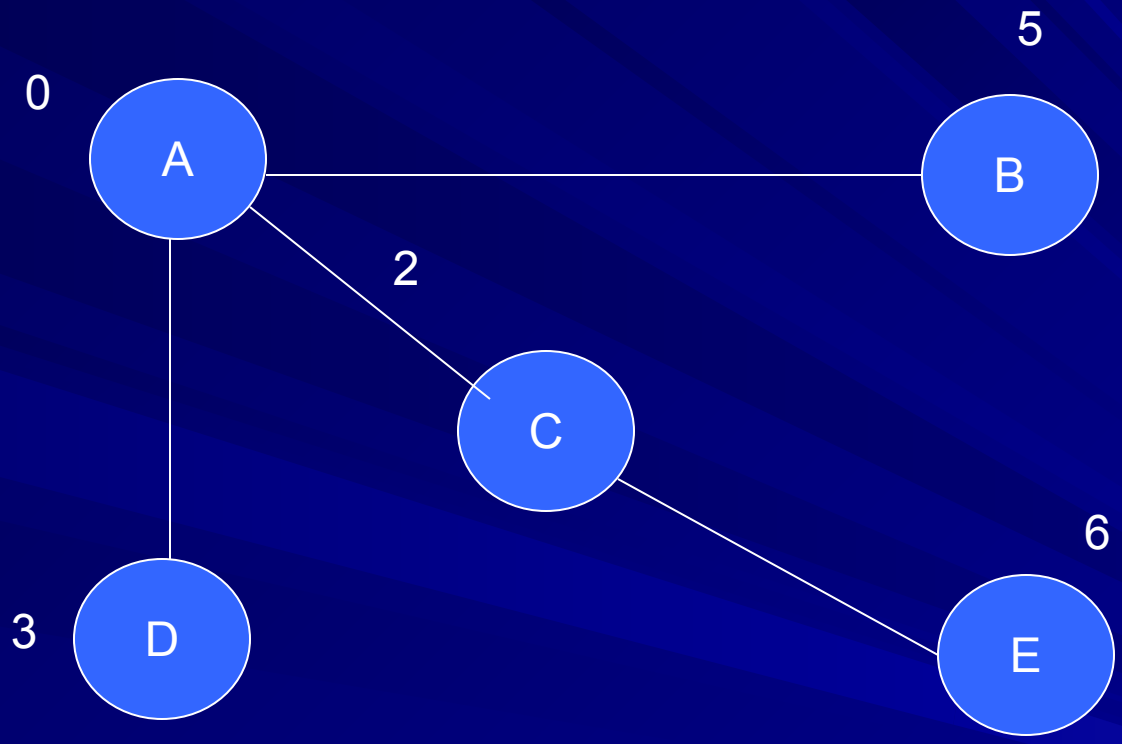


1) set root A and move A to tentative list.

2) Move A to permanent list and add B,C,D to tentative list



3) Move C to permanent and add E to tentative list



4) Move D to permanent list.
5) Move B to permanent list.
6) Move E to permanent list.

Tentative list is Empty

Routing Table for node A

Node	Cost
A	0
B	5
C	2
D	3
E	6

Figure Initial routing tables in a small autonomous system

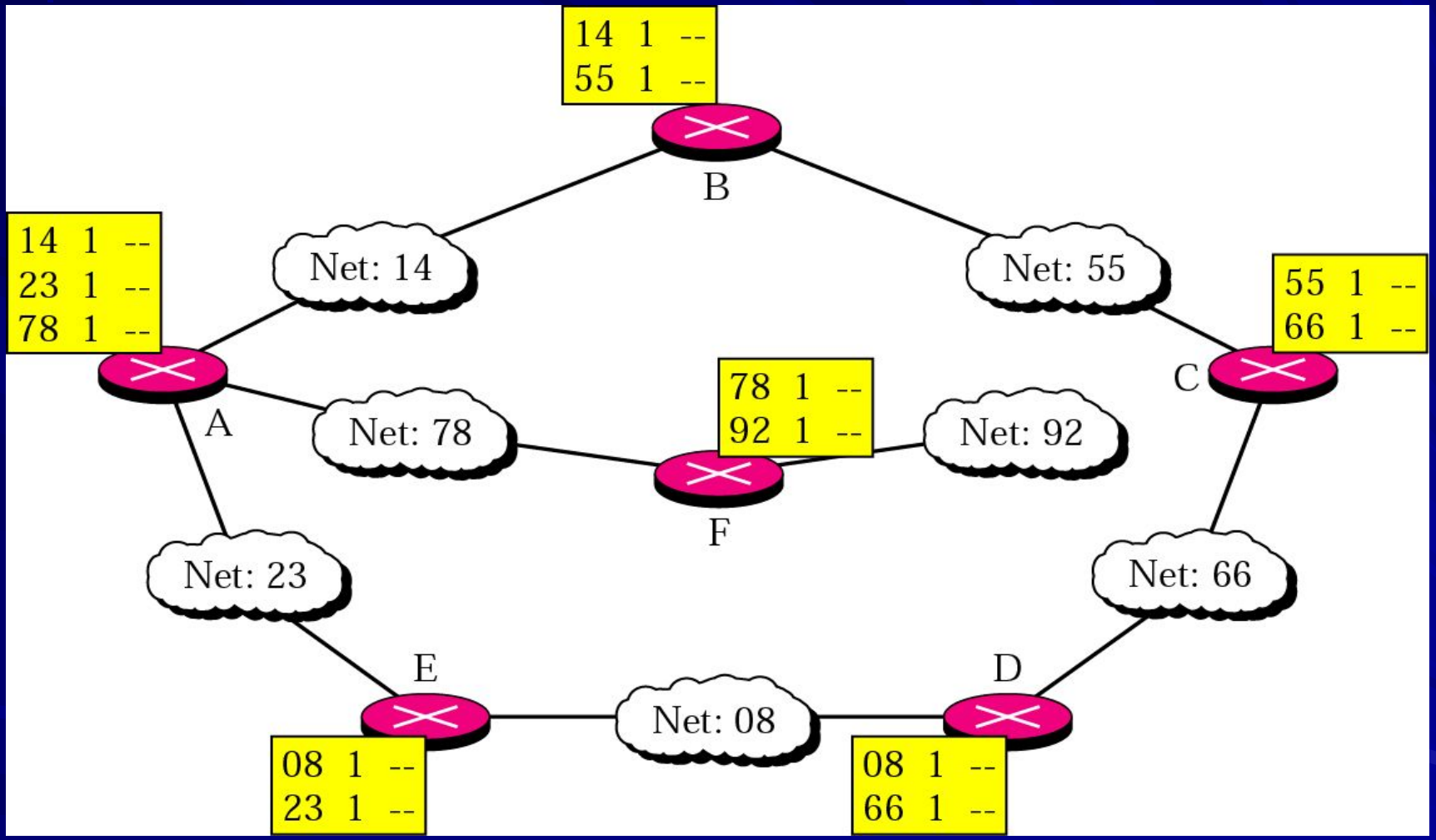


Figure Final routing tables for Figure 21.5