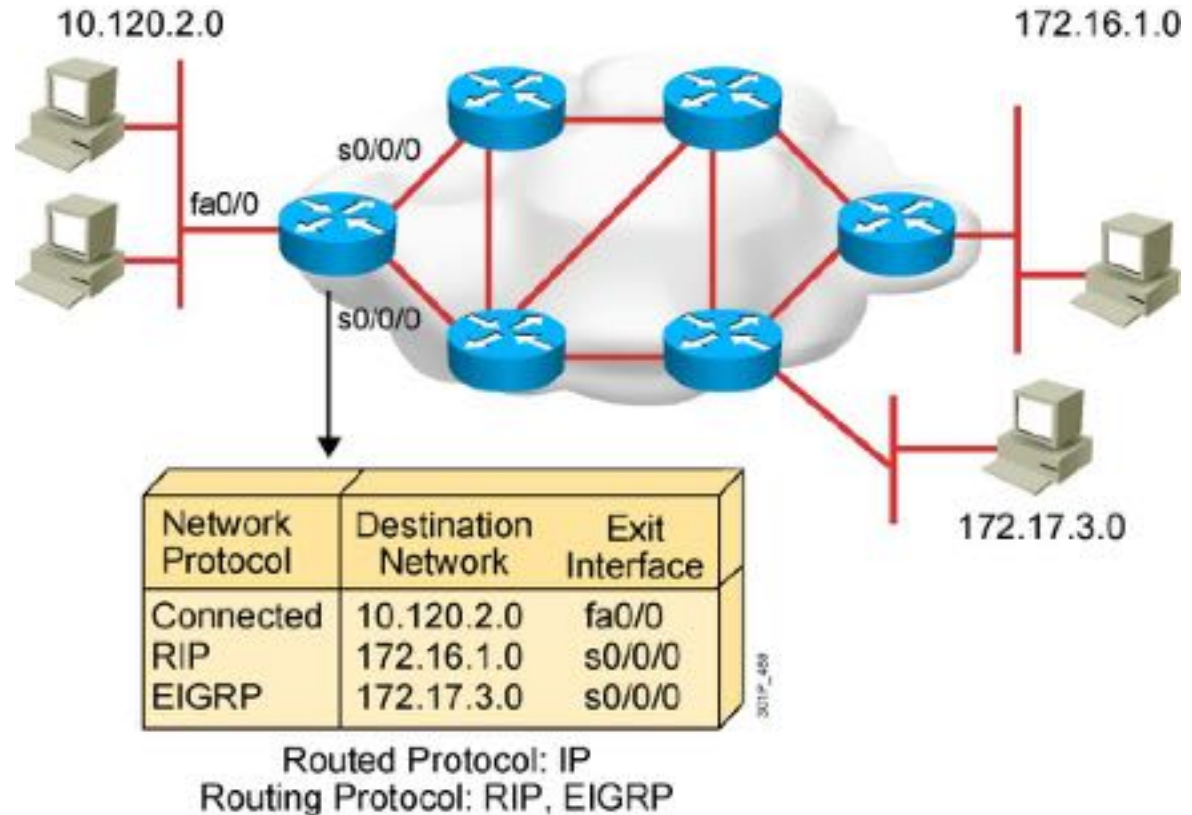


Distance Vector Routing Protocol

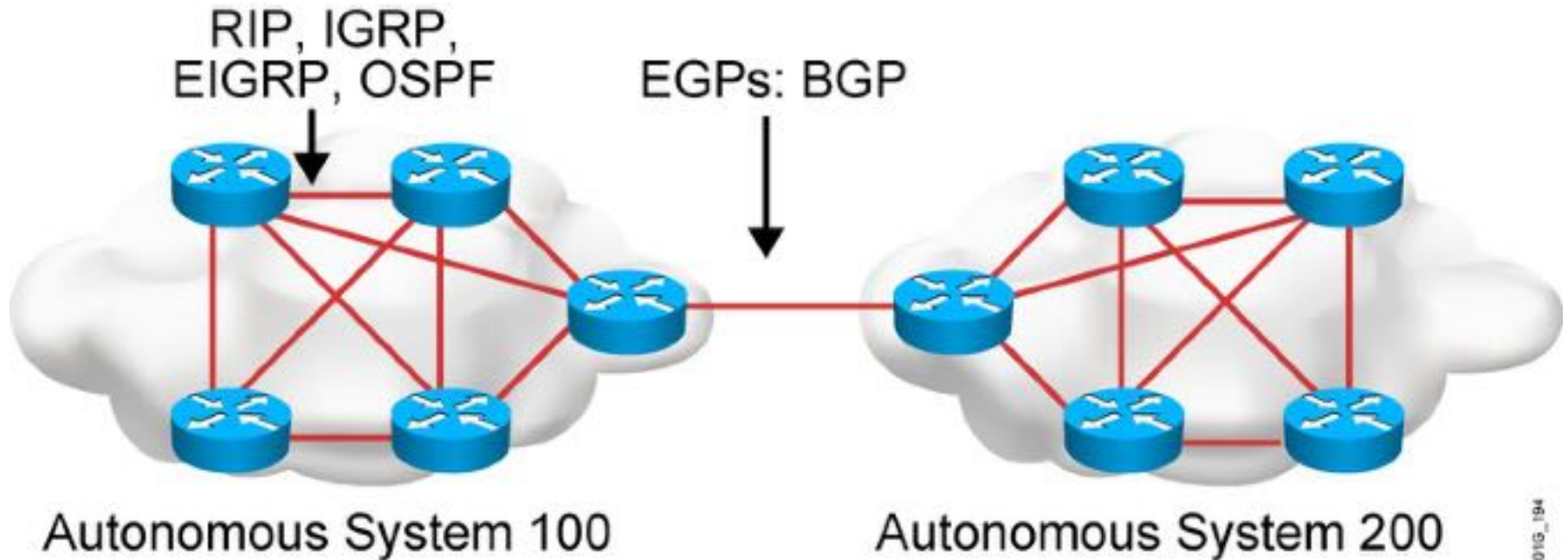


What Is a Routing Protocol?

- **Routing** protocols are used between routers to determine paths and maintain routing tables.
- After the path is determined, a router can route a **routed** protocol.



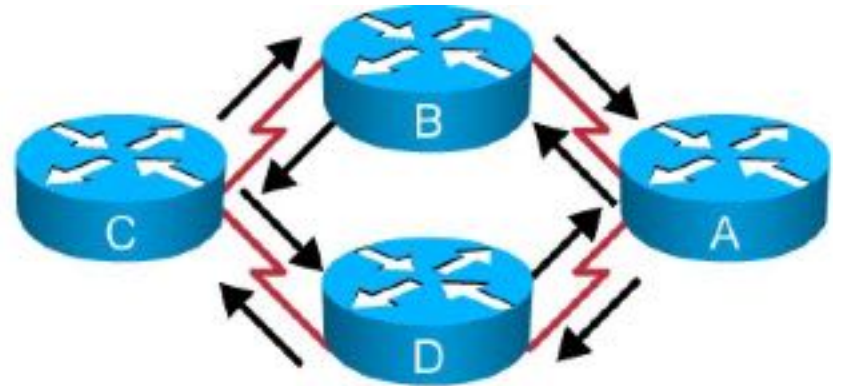
Autonomous Systems: Interior or Exterior Routing Protocols



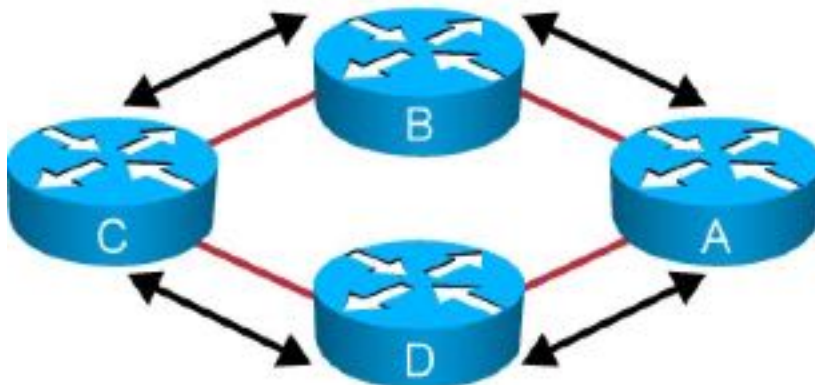
- An autonomous system is a collection of networks under a common administrative domain.
- IGPs operate within an autonomous system.
- EGPs connect different autonomous systems.

Classes of Routing Protocols

Distance Vector

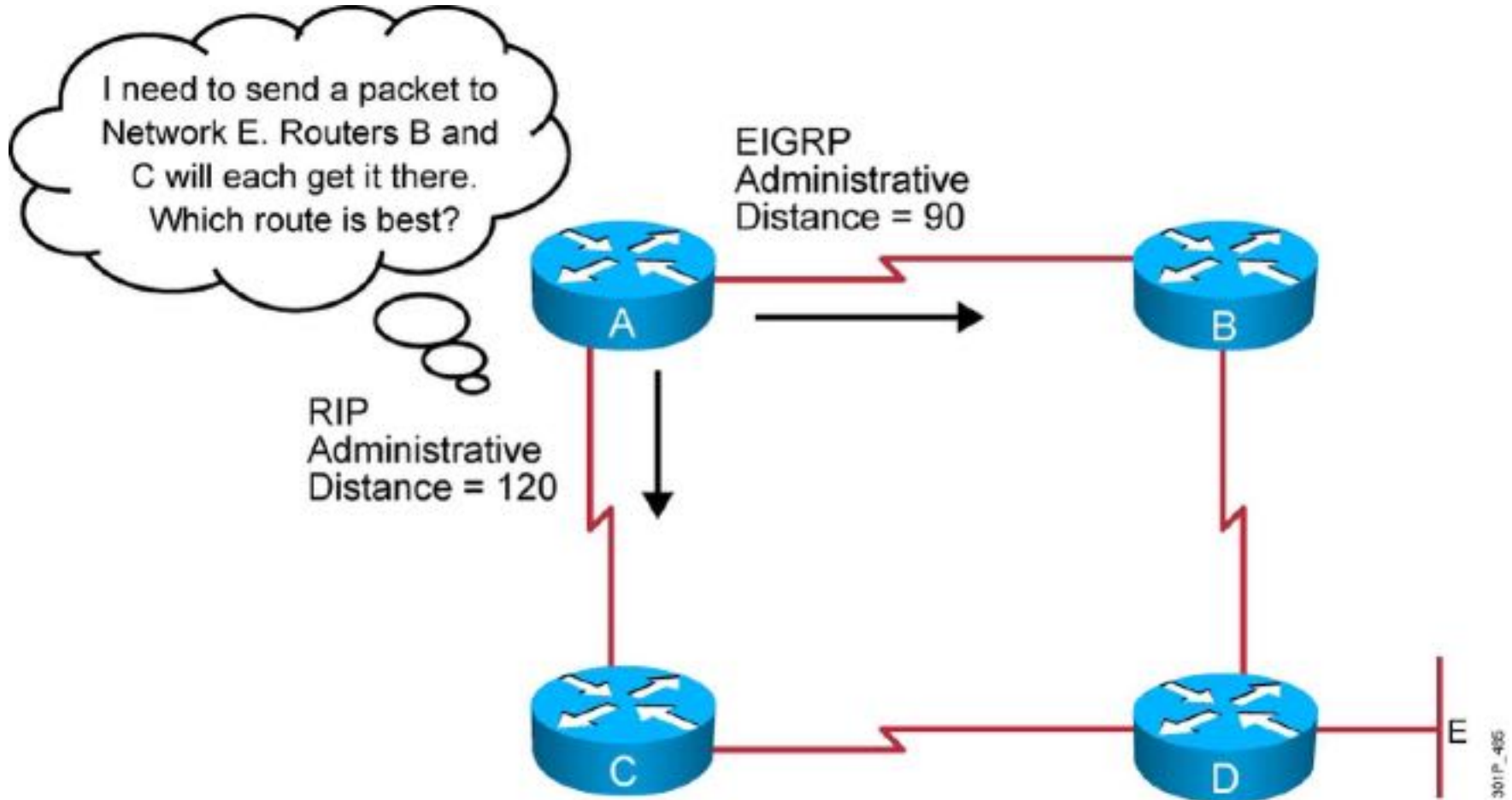


Hybrid Routing



Link-State

Administrative Distance: Ranking Routes



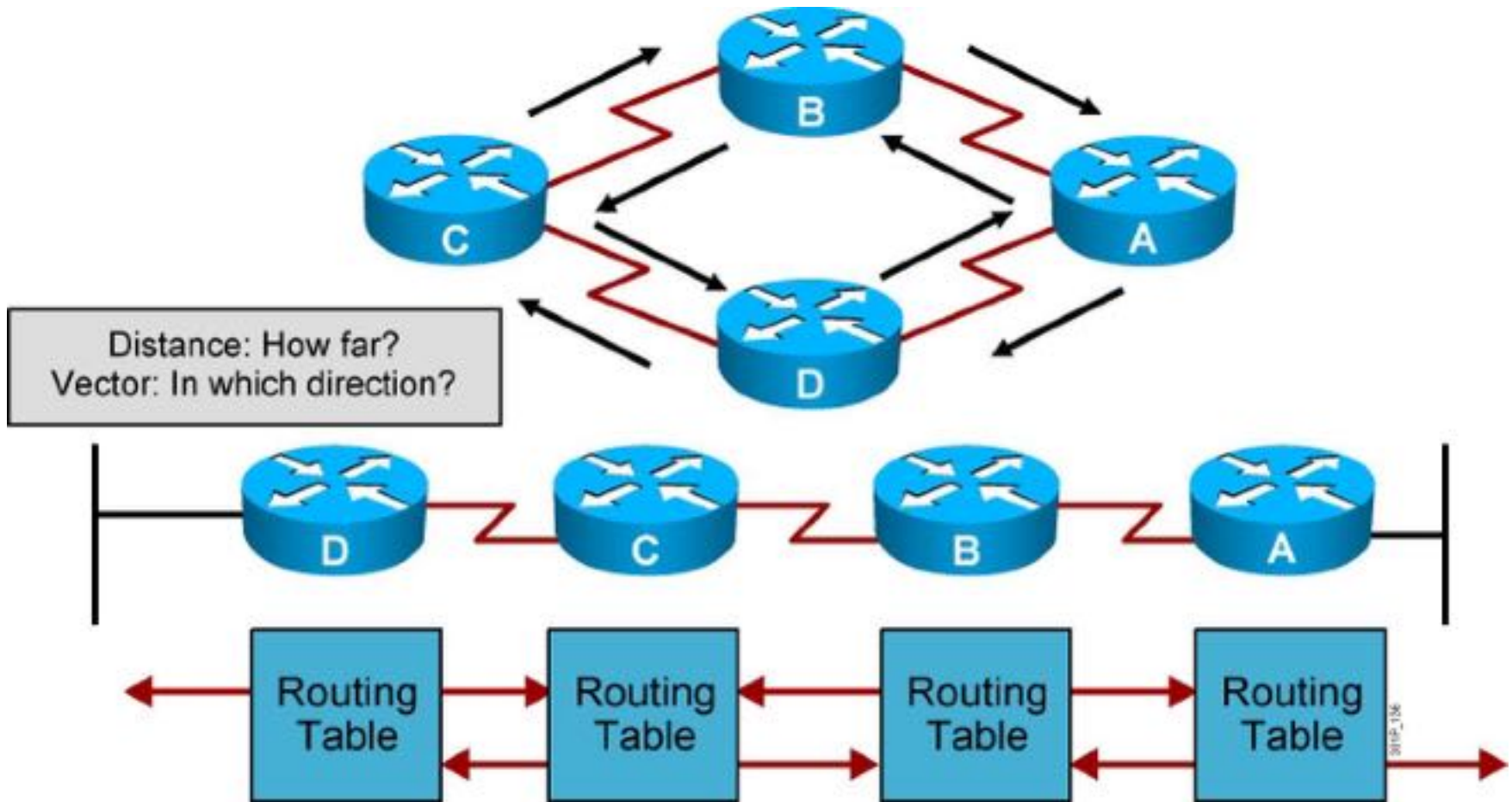
Classful Routing Protocol

- Classful routing protocols do not include the subnet mask with the route advertisement.
- Within the same network, consistency of the subnet masks is assumed.
- Summary routes are exchanged between foreign networks.
- These are examples of classful routing protocols:
 - RIPv1
 - IGRP

Classless Routing Protocol

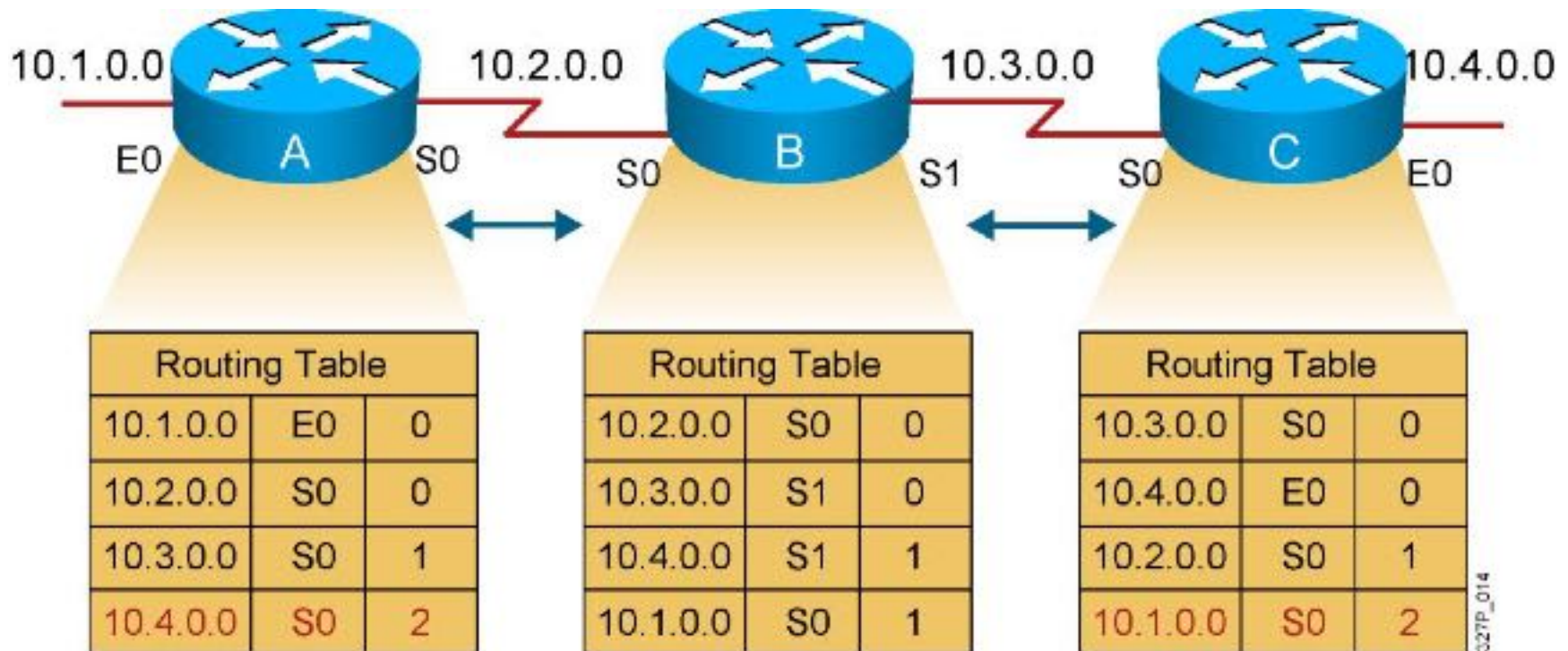
- Classless routing protocols include the subnet mask with the route advertisement.
- Classless routing protocols support a variable-length subnet mask (VLSM).
- Summary routes can be manually controlled within the network.
- These are examples of classless routing protocols:
 - RIPv2
 - EIGRP
 - OSPF
 - IS-IS

Distance Vector Routing Protocols



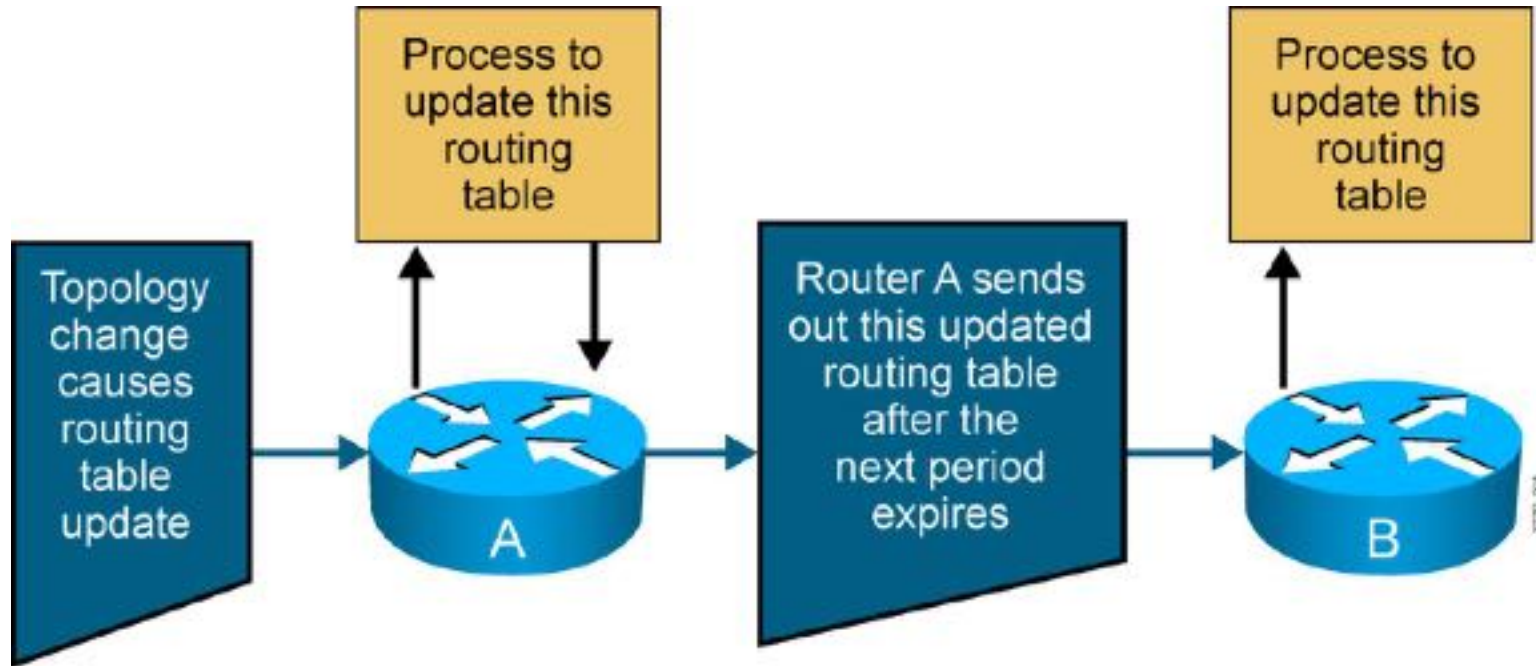
- Routers pass periodic copies of their routing table to neighboring routers and accumulate distance vectors

Sources of Information and Discovering Routes



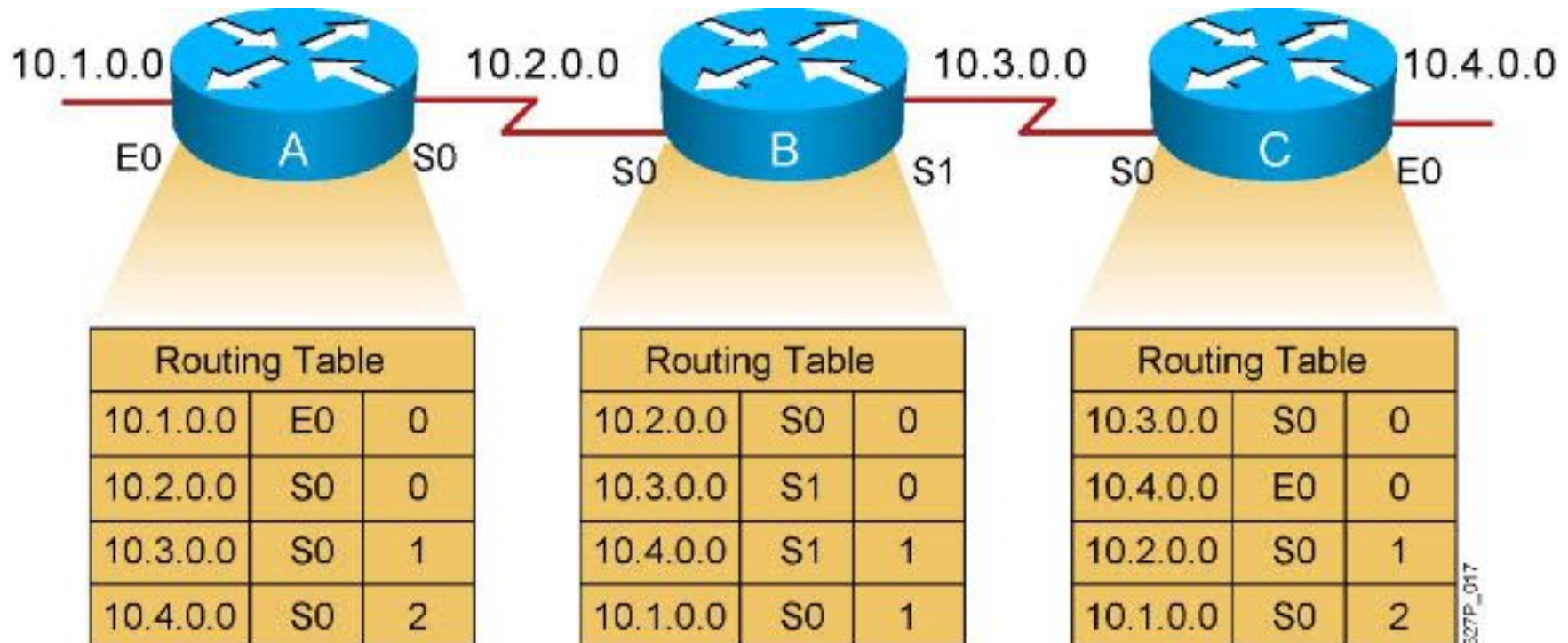
- Routers discover the best path to destinations from each neighbor.

Maintaining Routing Information



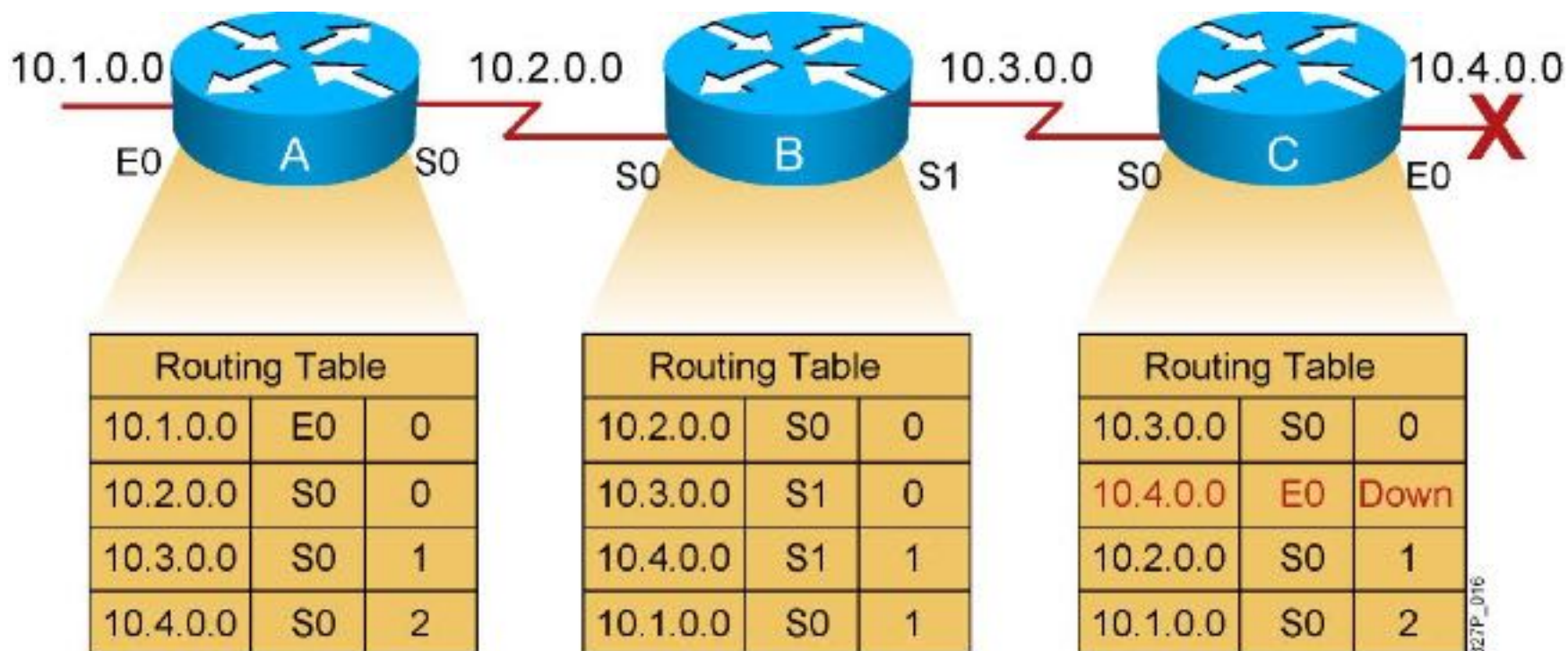
- Updates proceed step by step from router to router.

Inconsistent Routing Entries: Counting to Infinity and Routing Loops



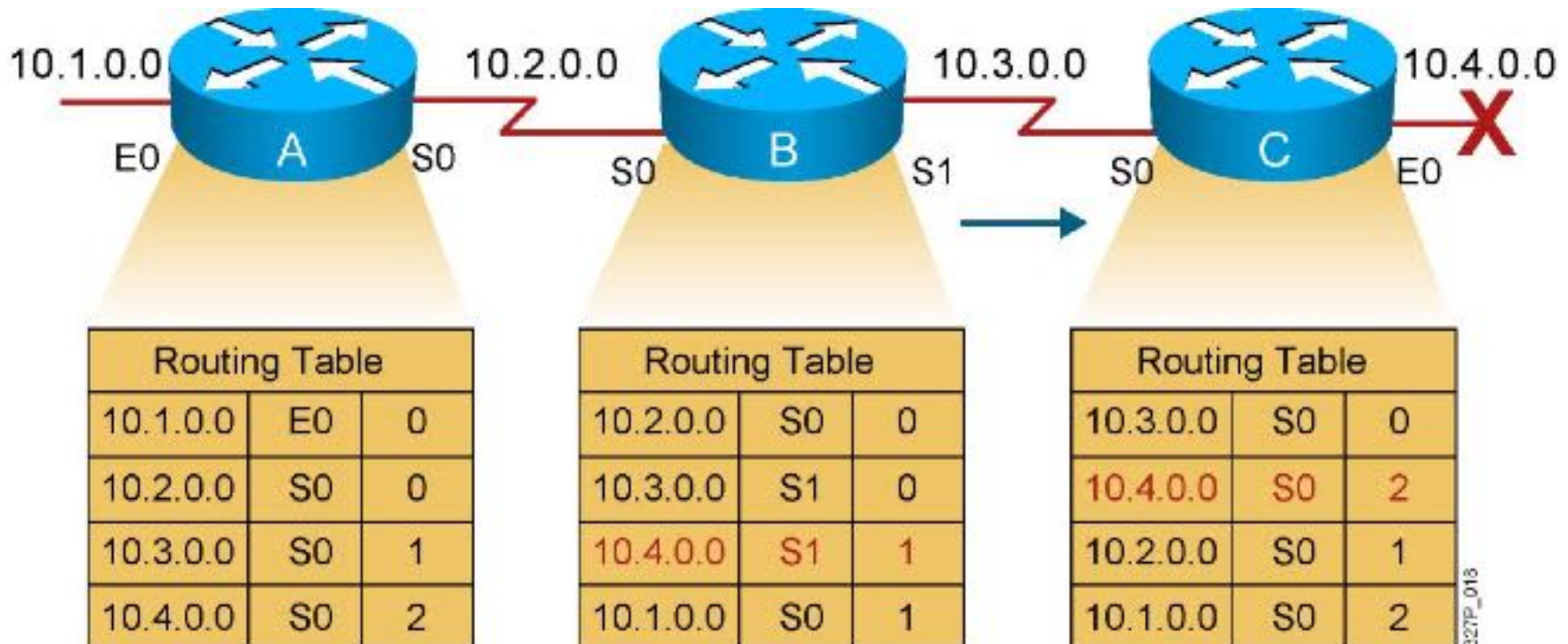
- Each node maintains the distance from itself to each possible destination network.

Counting to Infinity



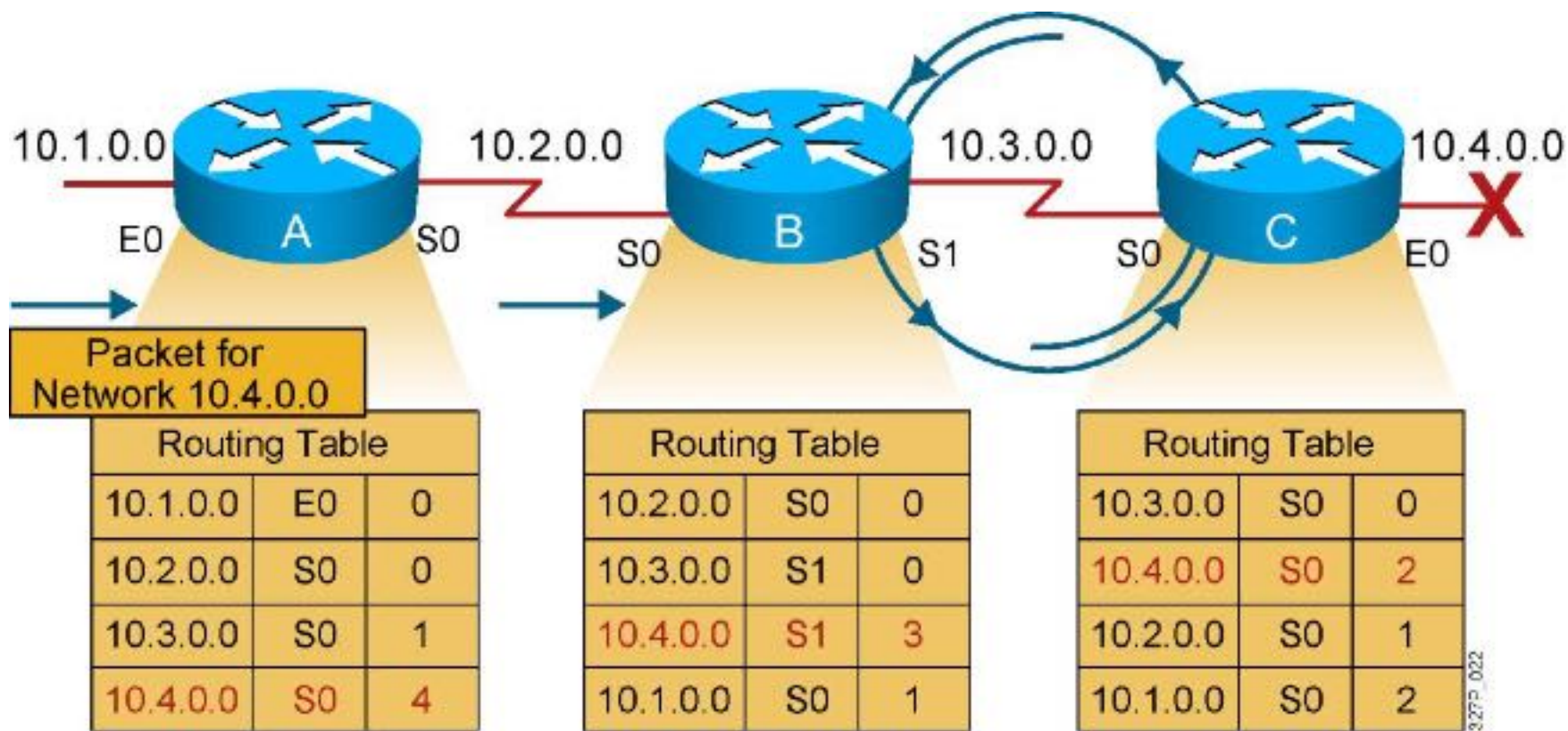
- Slow convergence produces inconsistent routing.

Counting to Infinity (Cont.)



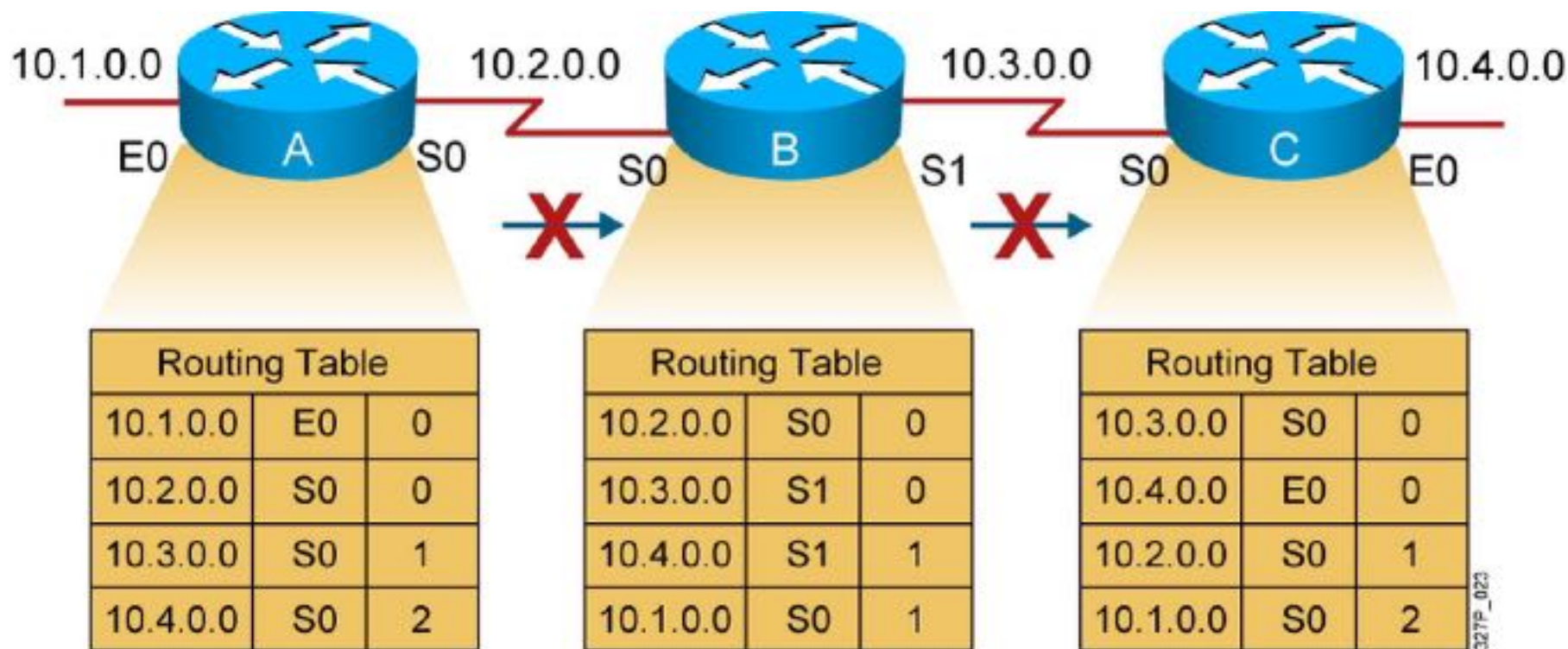
Router C concludes that the best path to network 10.4.0.0 is through router B.

Routing Loops



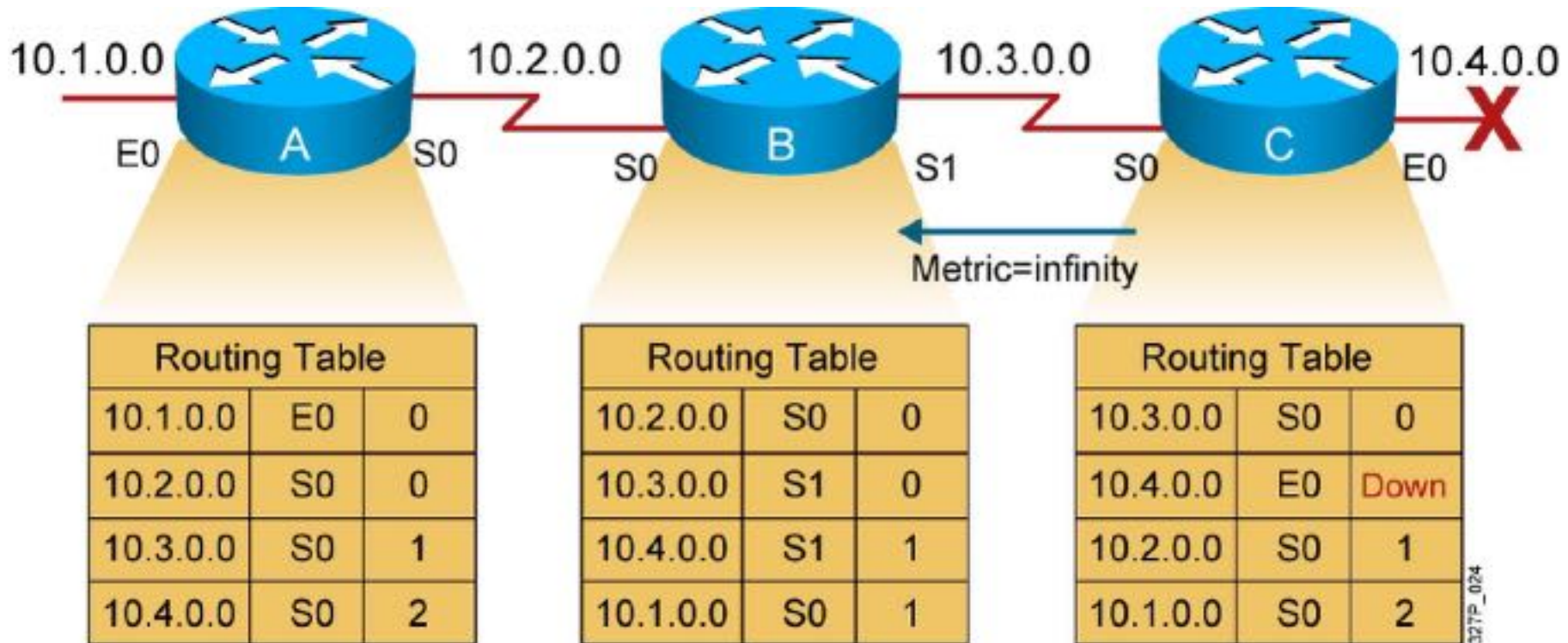
Packets for network 10.4.0.0 bounce (loop) between routers B and C.

Solution to Routing Loops: Split Horizon



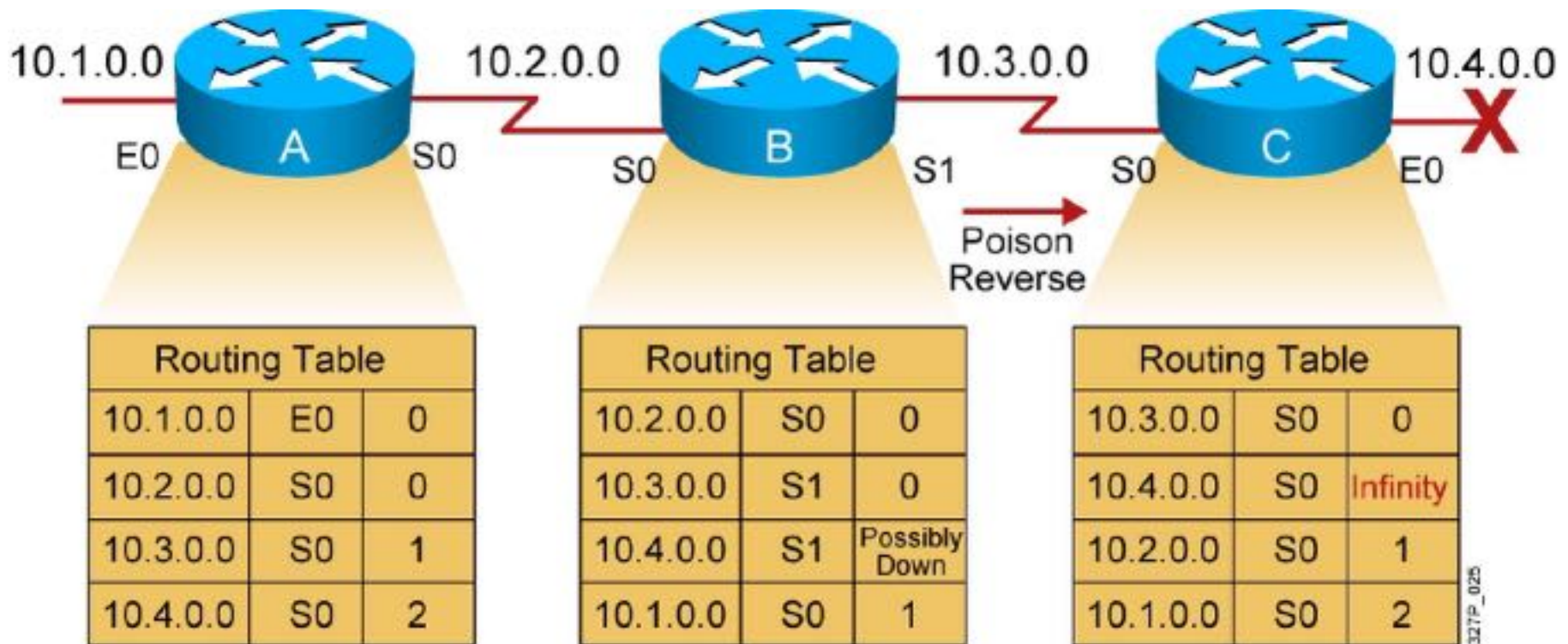
- It is never useful to send information about a route back in the direction from which the original information came.

Solution to Routing Loops: Route Poisoning and Poison Reverse



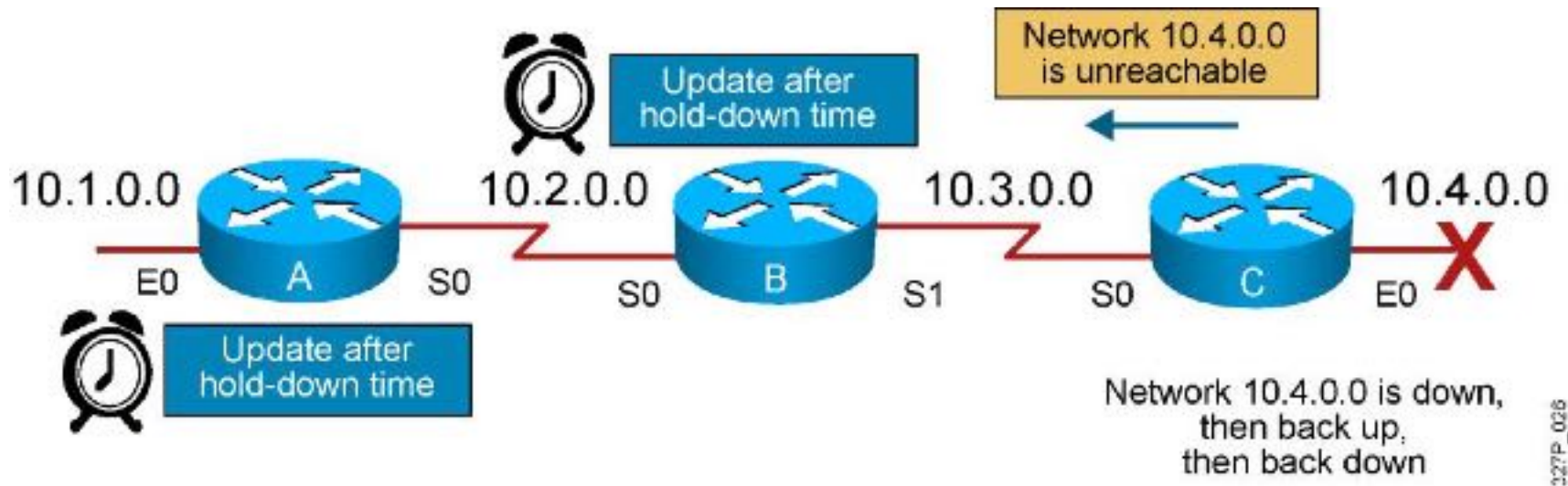
- Routers advertise the distance of routes that have gone down to infinity.

Solution to Routing Loops: Route Poisoning and Poison Reverse (Cont.)



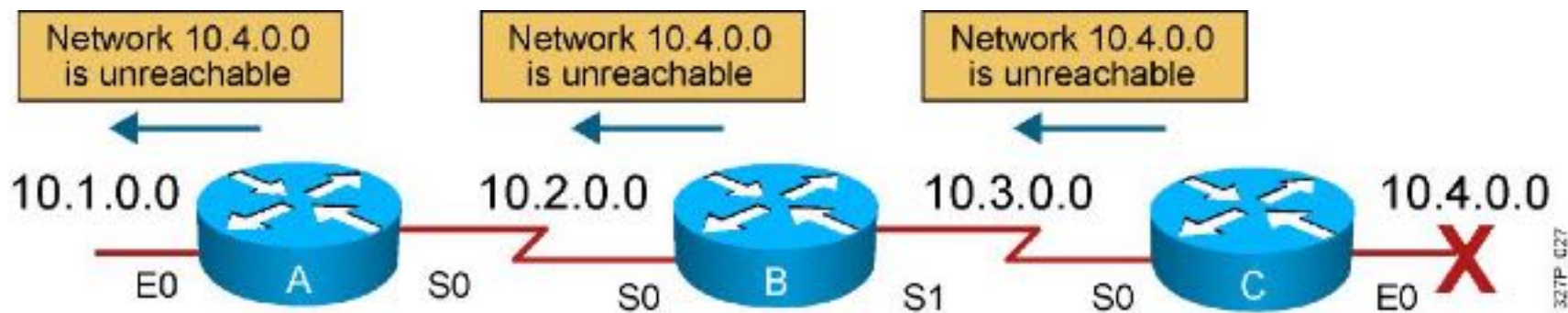
- Poison reverse overrides split horizon.

Solution to Routing Loops: Hold-Down Timers



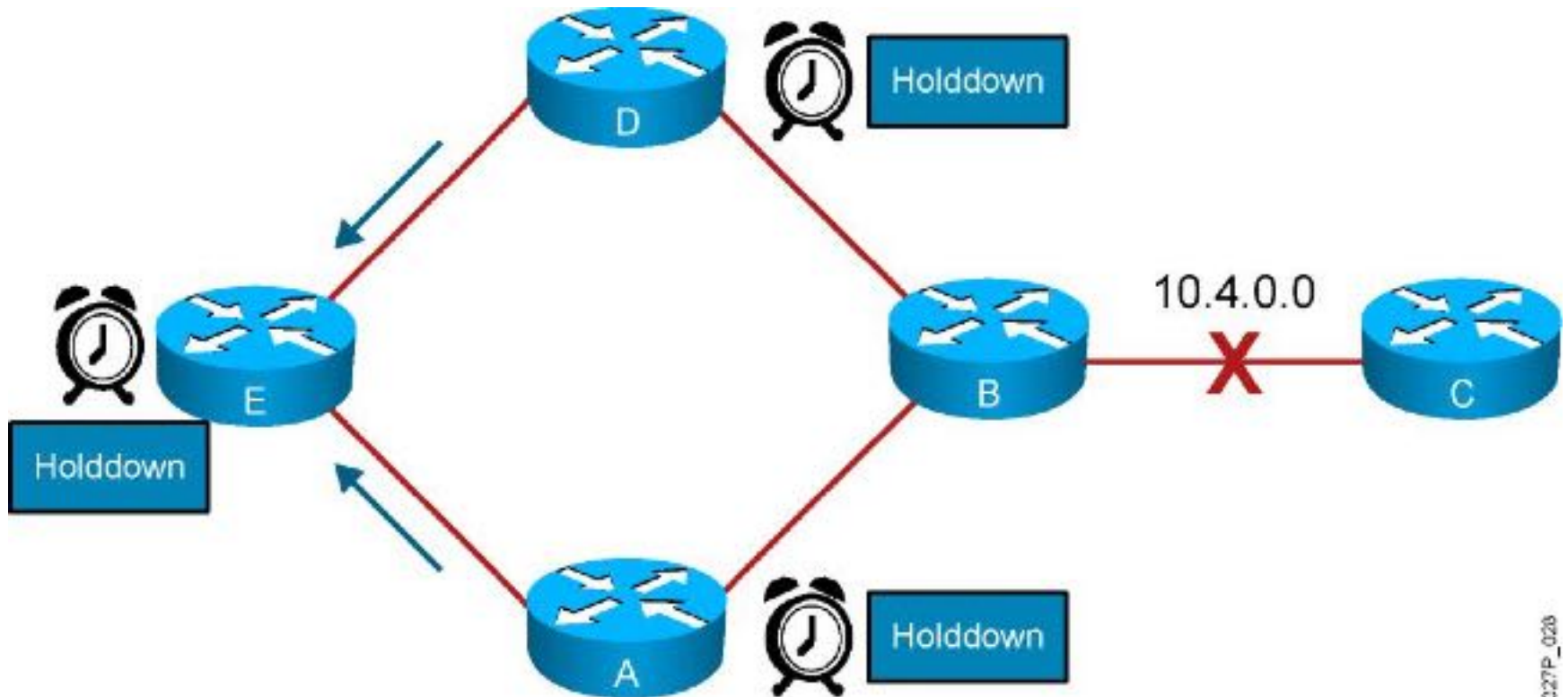
- The router keeps an entry for the “possibly down” state in the network, allowing time for other routers to recompute for this topology change.

Triggered Updates

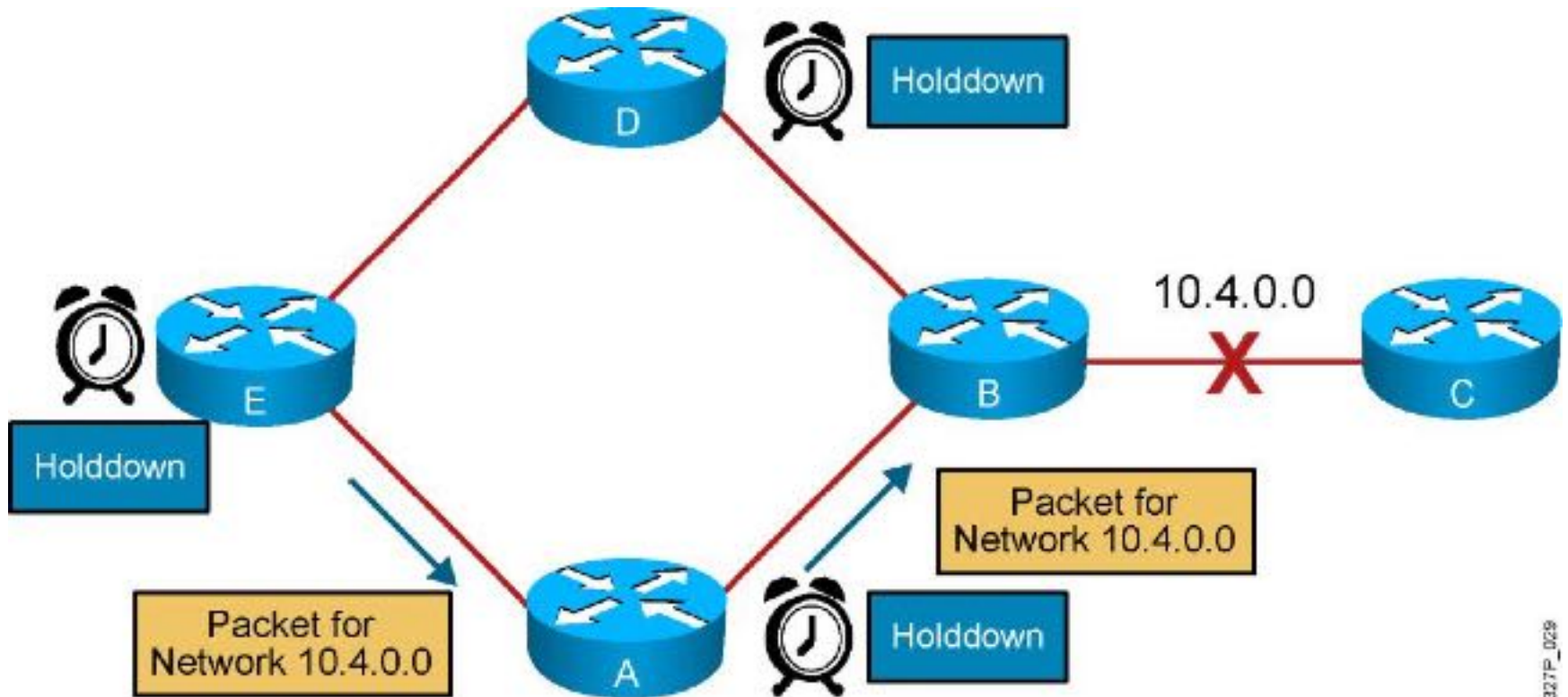


- The router sends updates when a change in its routing table occurs.

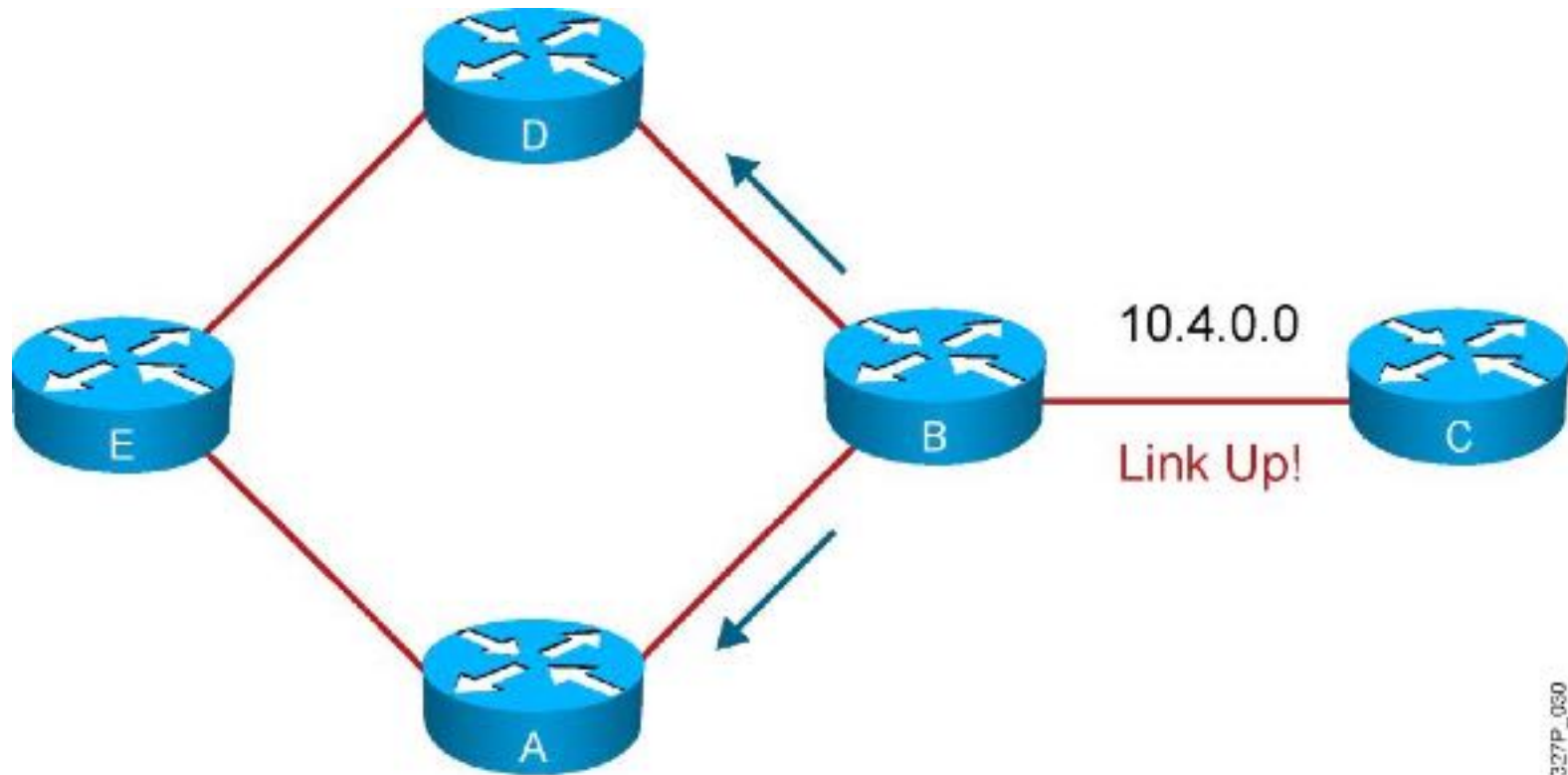
Eliminating Routing Loops



Eliminating Routing Loops (Cont.)

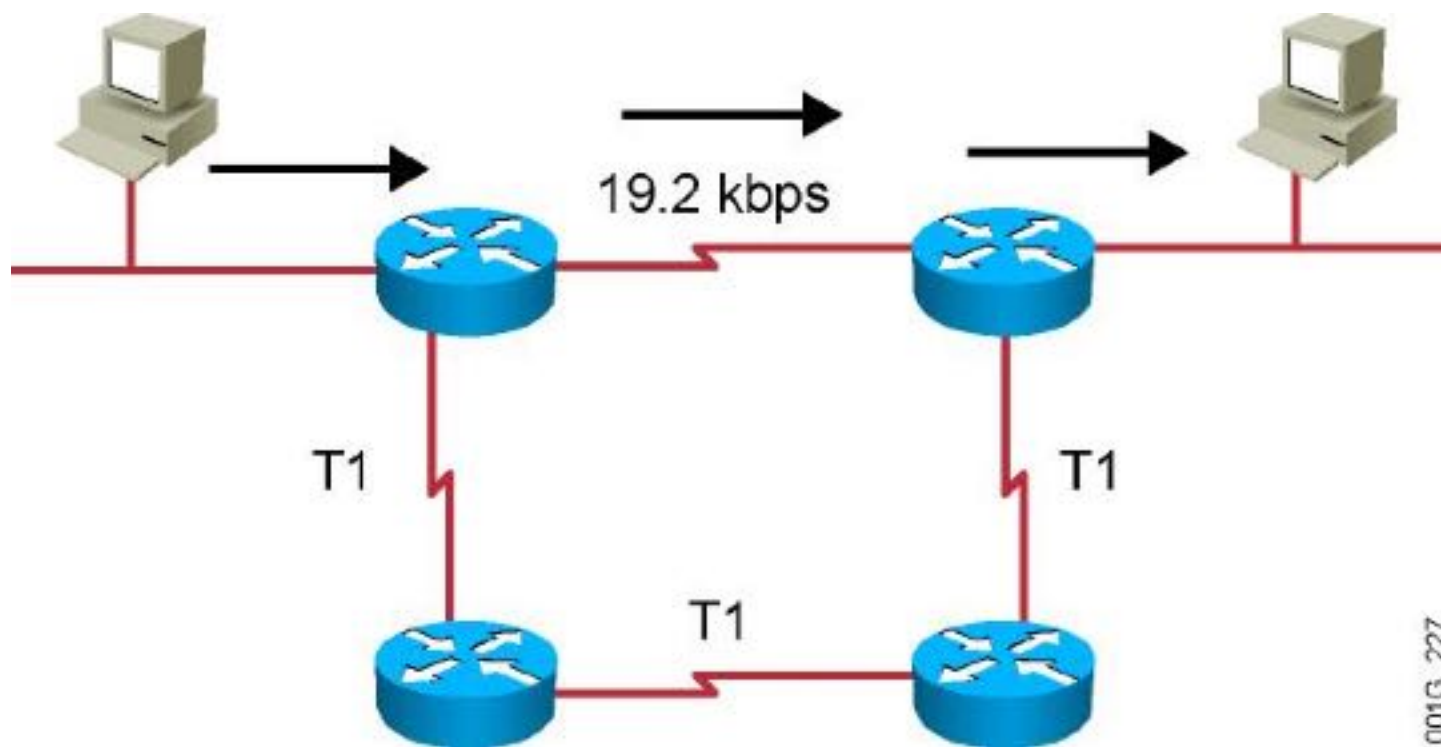


Eliminating Routing Loops (Cont.)



327P_050

RIP Overview



- Maximum is 16 equal-cost paths (default = 4)
- Hop-count metric selects the path
- Routes update every 30 seconds

RIPv1 and RIPv2 Comparison

	RIPv1	RIPv2
Routing protocol	Classful	Classless
Supports variable-length subnet mask?	No	Yes
Sends the subnet mask along with the routing update?	No	Yes
Addressing type	Broadcast	Multicast
Defined in ...	RFC 1058	RFCs 1721, 1722, and 2453
Supports manual route summarization?	No	Yes
Authentication support?	No	Yes

RIP Configuration

```
RouterX(config)# router rip
```

- Starts the RIP routing process

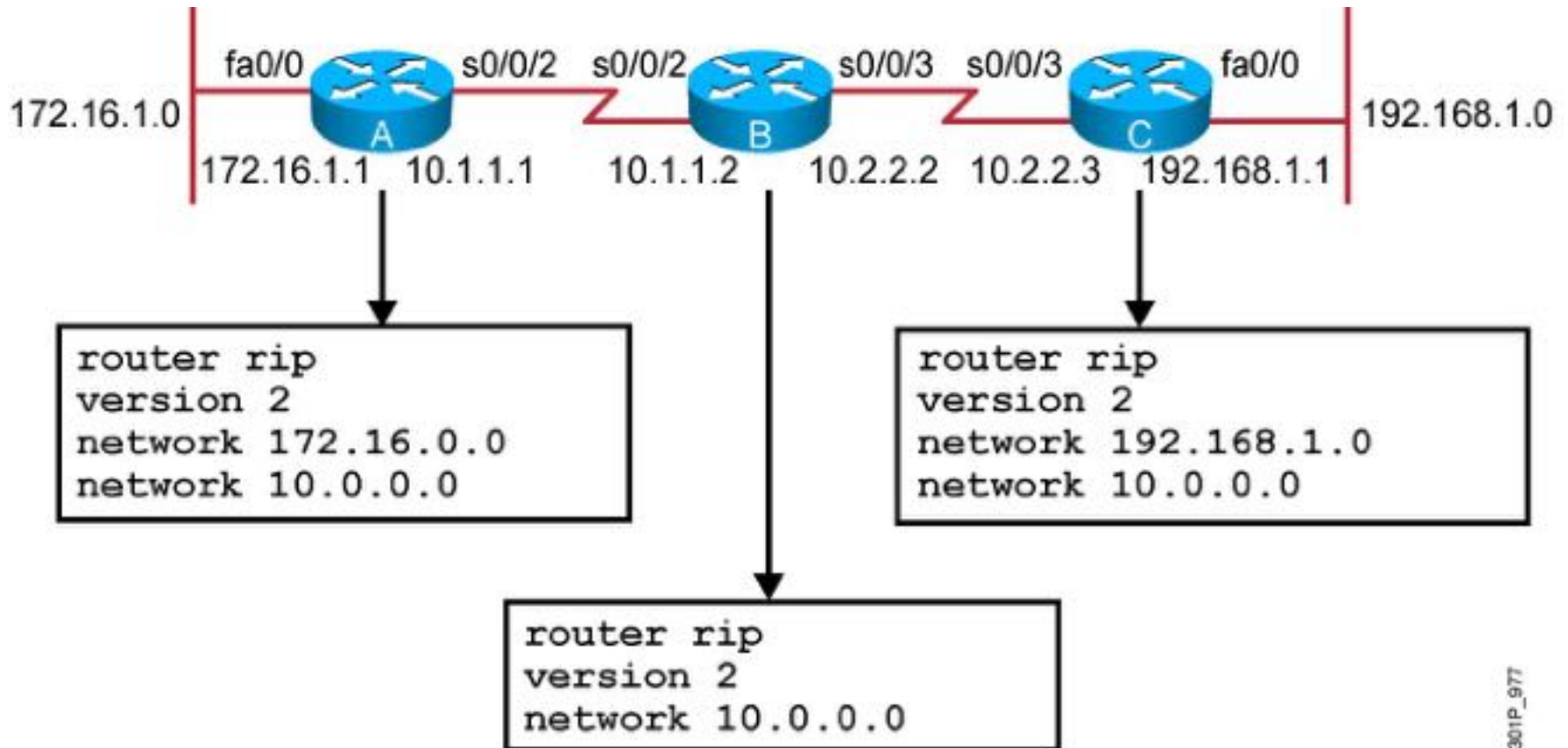
```
RouterX(config-router)# version 2
```

- Enables RIP version 2

```
RouterX(config-router)# network network-number
```

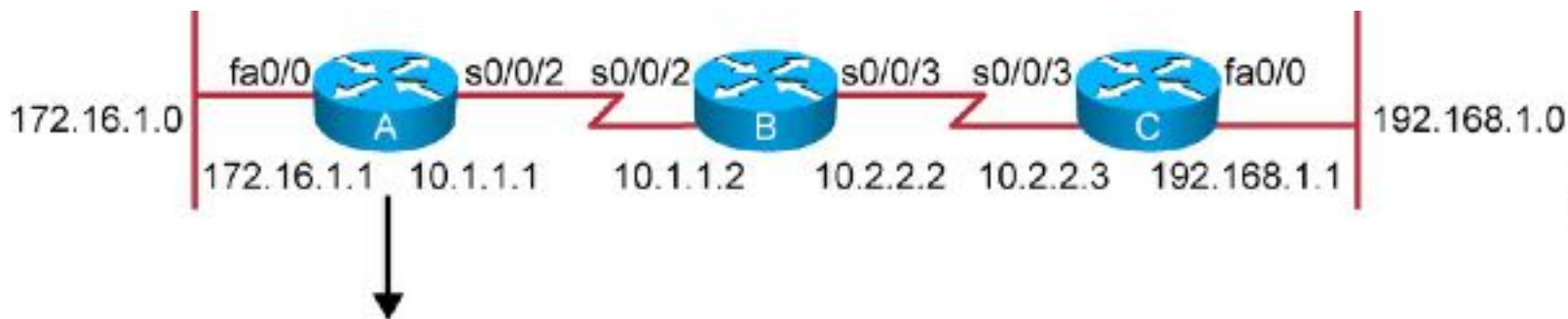
- Selects participating attached networks
- Requires a major classful network number

RIP Configuration Example



301P_977

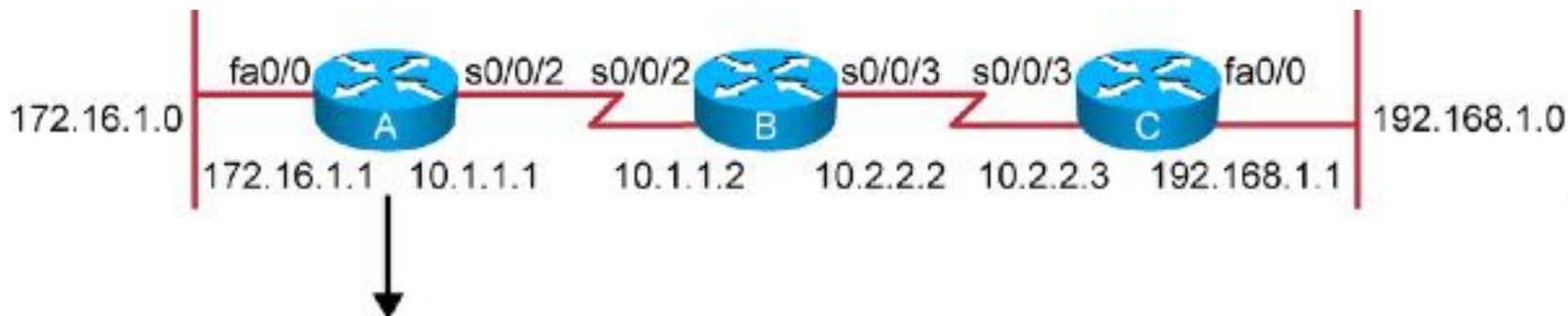
Verifying the RIP Configuration



```
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 6 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 2, receive version 2
    Interface          Send  Recv  Triggered RIP  Key-chain
    FastEthernet0/0    2     2
    Serial10/0/2       2     2
  Automatic network summarization is in effect
  Maximum path: 4
  Routing for Networks:
    10.0.0.0
    172.16.0.0
  Routing Information Sources:
    Gateway          Distance    Last Update
    10.1.1.2         120        00:00:25
  Distance: (default is 120)
```

RouterA#

Displaying the IP Routing Table



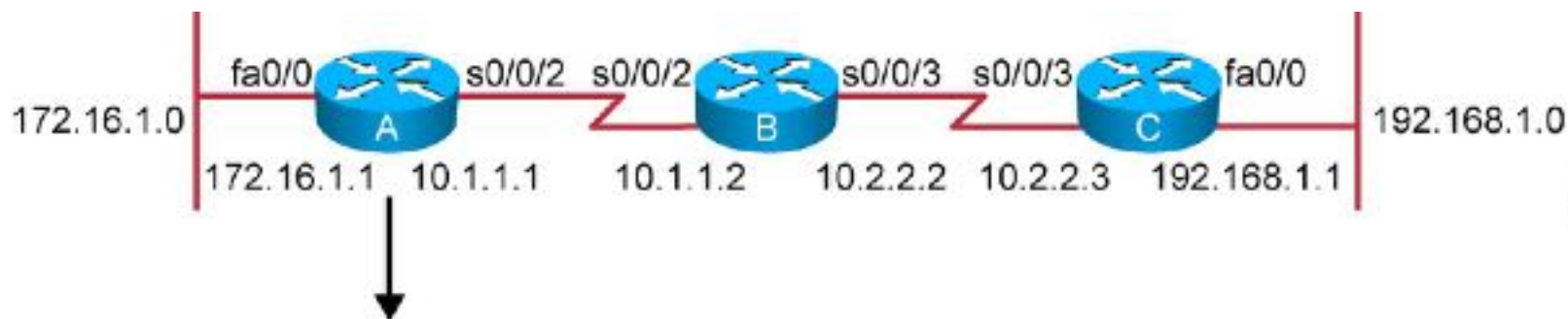
```
RouterA# show ip route
```

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP  
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area  
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2  
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP  
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default  
U - per-user static route, o - ODR  
T - traffic engineered route
```

```
Gateway of last resort is not set
```

```
172.16.0.0/24 is subnetted, 1 subnets  
C 172.16.1.0 is directly connected, fastethernet0/0  
10.0.0.0/24 is subnetted, 2 subnets  
R 10.2.2.0 [120/1] via 10.1.1.2, 00:00:07, Serial0/0/2  
C 10.1.1.0 is directly connected, Serial0/0/2  
R 192.168.1.0/24 [120/2] via 10.1.1.2, 00:00:07, Serial0/0/2
```

debug ip rip Command



```
RouterA# debug ip rip
RIP protocol debugging is on
RouterA#
00:06:24: RIP: received v1 update from 10.1.1.2 on Serial0/0/2
00:06:24:      10.2.2.0 in 1 hops
00:06:24:      192.168.1.0 in 2 hops
00:06:33: RIP: sending v1 update to 255.255.255.255 via FastEthernet0/0 (172.16.1.1)
00:06:34:      network 10.0.0.0, metric 1
00:06:34:      network 192.168.1.0, metric 3
00:06:34: RIP: sending v1 update to 255.255.255.255 via Serial0/0/2 (10.1.1.1)
00:06:34:      network 172.16.0.0, metric 1
```

