Kardan University
BCS
Network strategy

Outline

- What is routing?
- Static routing and Dynamic routing
- Default routing
- Routed and routing protocols
- Classification of routing protocols
- Distance Vector, Link-state & hybrid routing protocols
- Classful and classless routing protocols
- AD value and Metric

IP routing

- IP routing is the process of sending packets from a host on one network to another host on a different remote network through a router.
- Routers keep the information regarding the networks in a database called routing table.
- Routers examine the destination IP address of a packet , determine the next-hop address, and forward the packet.
- Routers use routing tables to determine a next hop address to which the packet should be forwarded.

Routing table info

- Each router maintains a routing table and stores it in RAM.
- A routing table is used by routers to determine the path to the destination network.

```
Router#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, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, FastEthernet0/1
C    192.168.0.0/24 is directly connected, FastEthernet0/0
Router#
```

IP Routing

- There are three types of routing
  - Static routing
  - Default routing
  - Dynamic routing

Static routing

- In static routing the Administrator must add the remote networks into the routing table of each router manually.
- If any changes occurs in the network (add or remove router) then the administrator must update all the changes in all the routers by hand.
- In large organization both static and dynamic routing is used

Advantages of static routing

- There is no overhead on the router CPU, which means you could possibly buy a cheaper router than you would use if you were using dynamic routing.
- It adds security because the administrator can choose to allow routing access to certain networks only.
- It does not use more bandwidth between Routers

Disadvantages of static routing

- The administrator must really understand the internetwork and how each router is connected in order to configure routes correctly.
- If a network is added to the internetwork, the administrator has to add a route to it on all routers—by hand.
- Its not suitable for large networks.

Static routing configuration

- ***Router(config)#ip route <destination-network> <subnet mask> <next-hop IP address>***
- ***Or***
- ***Router(config)#ip route <destination-network> <subnet-mask> <out going interface >***
- Ex:
- R1# ip route 192.168.10.0 255.255.255.0 192.168.20.1
- Or
- R1# ip route 192.168.10.0 255.255.255.0 serial 2/0

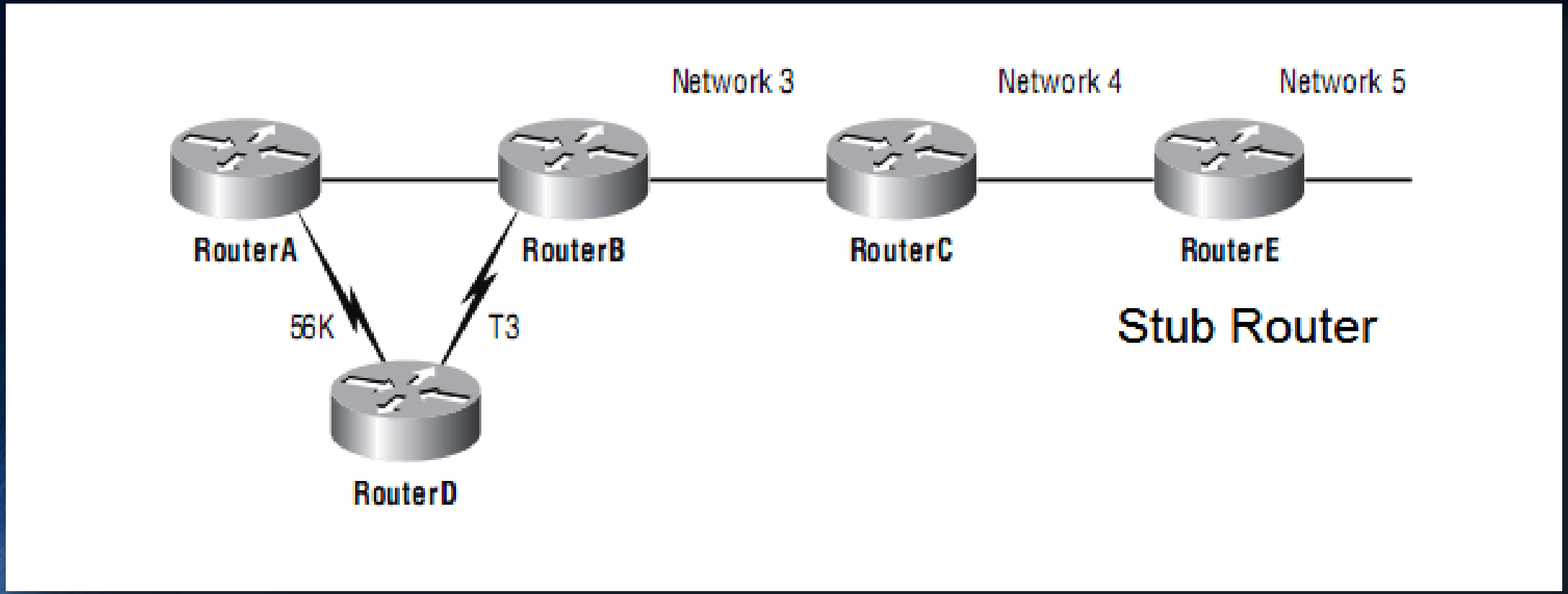
Static routing verification

- *R1#show ip interface brief*
- *R1# show ip route*
- *R1# show ip route static*
- *R1# show run | include ip route*
- *R1# show ip protocol*
- *R1#show ip route <Prefix> <Mask>*
- *In networking, sometimes the NID is called a prefix*

Default routing

- The default routing is used only on stub routers.
- Stub routers are those with only one exit path out of the network.
- *R0(config)#ip route 0.0.0.0 0.0.0.0 {next-hop ip address or Exit interface}*
- *Verification:*
  - *R1#debug ip packets*
  - *R1#debug ip routing*

Default routing



Dynamic routing

- Dynamic routing is when protocols are used to find networks and update routing tables on routers. True, this is easier than using static or default routing, but it’ll cost you in terms of router CPU processes and bandwidth on the network links.
- Functions of routing protocols:
  - Dynamically share information between routers.
  - Automatically update routing table when topology changes.
  - Determine best path to a destination

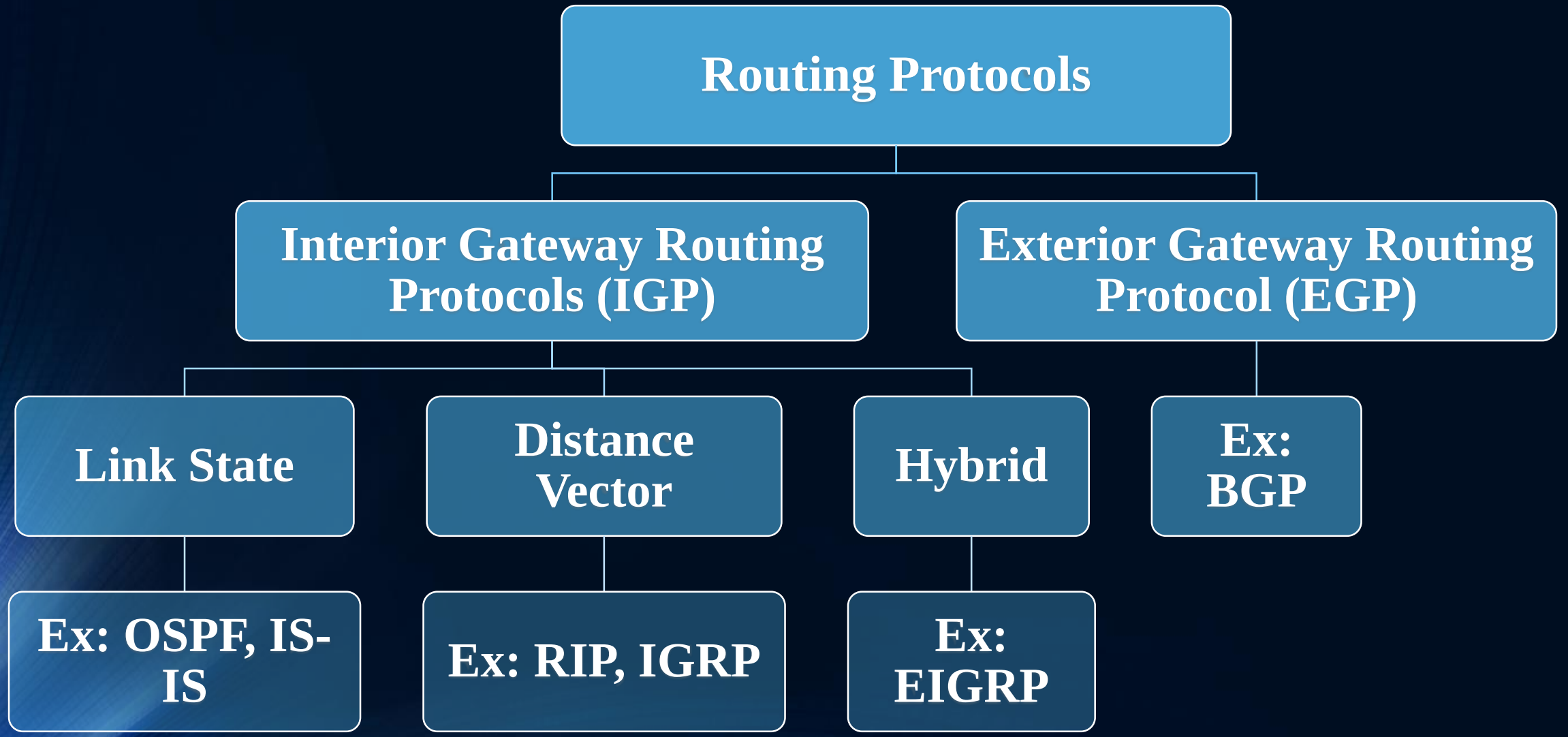
Routed vs routing protocol

- Routed protocols are the ones which are used for data transfer.
- Routed protocols are used by the Routers, Hosts, Servers & APs
- Examples: IPv4, IPv6, IPX, AppleTalk
- Routing protocols, on the other hand, are used by routers to propagate the routing information to other routers.
- Examples: RIP, EIGRP, OSPF

Components of routing protocols

- Algorithm
  - In the case of a routing protocol, algorithms are used for facilitating routing information and best path determination
- Routing protocol messages
  - These are messages for discovering neighbors and exchange of routing information

Classification of routing protocols



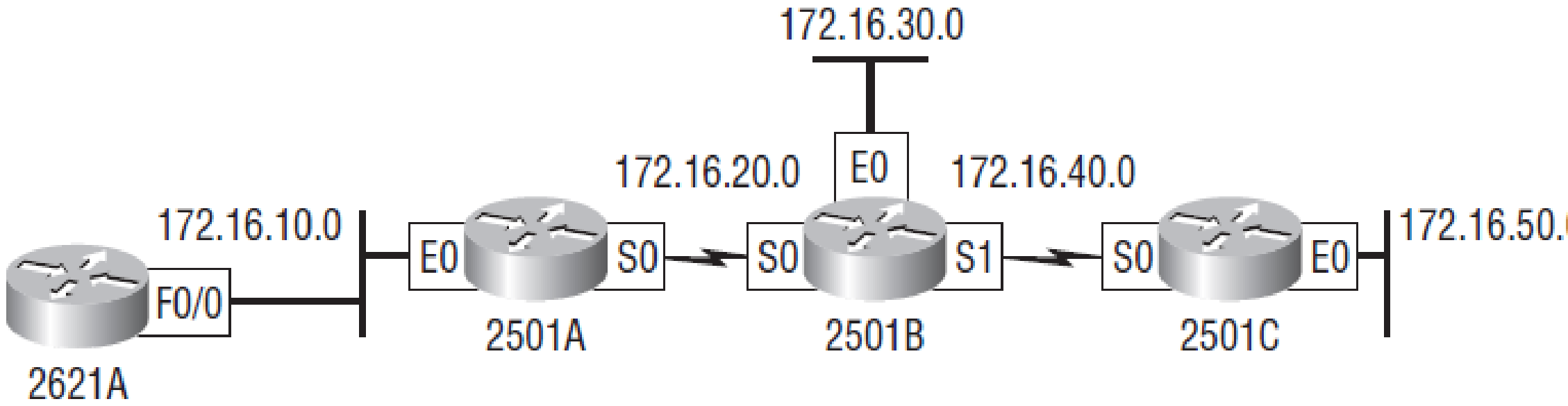
IGP & EGP

- The IGP Protocols are used in the private or internal internetworks of an organization.
- But the EGP protocols are used on the external WAN (or ISP) internetworks.

Distance vector Protocols

- They find the best path to remote network by judging distance
- Each time a packet goes through Router, its called a *HOP*
- The route with the less number of *HOP* is called to be the best path.
- They send the entire routing table to the directly connected neighbors (called routing by Rumor).
- Both RIP and IGRP are distance vector protocols

FIGURE 6.13 The internetwork with distance-vector routing

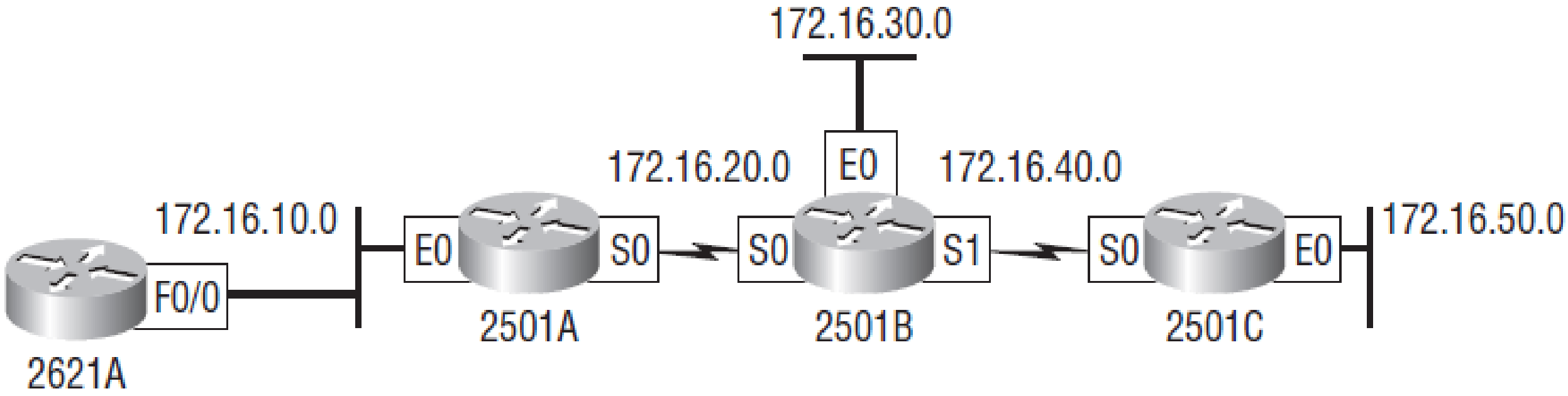


Routing Table		
172.16.10.0	F0/0	0

Routing Table		
172.16.10.0	E0	0
172.16.20.0	S0	0

Routing Table		
172.16.20.0	S0	0
172.16.30.0	E0	0
172.16.40.0	S1	0

Routing Table		
172.16.40.0	S0	0
172.16.50.0	E0	0



Routing Table		
172.16.10.0	F0/0	0
172.16.20.0	F0/0	1
172.16.30.0	F0/0	2
172.16.40.0	F0/0	2
172.16.50.0	F0/0	3

Routing Table		
172.16.10.0	E0	0
172.16.20.0	S0	0
172.16.30.0	S0	1
172.16.40.0	S0	1
172.16.50.0	S0	2

Routing Table		
172.16.20.0	S0	0
172.16.30.0	E0	0
172.16.40.0	S1	0
172.16.10.0	S0	1
172.16.50.0	S1	1

Routing Table		
172.16.40.0	S0	0
172.16.50.0	E0	0
172.16.10.0	S0	2
172.16.20.0	S0	1
172.16.30.0	S0	1

Link-state routing protocols

- Also called *Shortest-Path-First (SPF)*, in which the Router create three separate tables :
  - One keeps track of directly connected neighbors
  - One determines the topology of the entire internetwork
  - One is used as the Routing table
- Link State sends updates containing the state of their own link to all the routers in the internetwork.
- and its make decision based on cost
- OSPF is pure link state protocol

Hybrid routing protocols

- Hybrid uses the aspects of both link state and distance vector
- EIGRP is an example for hybrid protocol

Comparison of DV and LS

- Distance vector
  - Incomplete view of network topology.
  - Generally, periodic updates.
  - Ex: IGRP, RIPv1 and RIPv2
- Link state
  - Complete view of network topology is created.
  - Updates are not periodic.
  - Ex: OSPF & IS-SI

Classful & Classless routing protocols

- **The IGP can also be classified into two categories as follows:**
- **Classful routing protocols**
  - All networks have the same subnet mask,
  - Does not send Subnet mask with routing protocol updates
  - Ex: RIPv1 and IGRP
- **Classless routing protocols**
  - All networks can have different subnet masks
  - Send Subnet mask with routing protocol updates
  - Ex: RIPv2, EIGRP, OSPF, IS-IS

Metric

- A value used by a routing protocol to determine which routes are better than others.
- It’s a calculated value used to determine the best path to a destination
- Metric used for each routing protocol
  - RIP - hop count
  - IGRP & EIGRP - Bandwidth (used by default), Delay (used by default), Load, Reliability
  - OSPF – Cost, Bandwidth (Cisco’s implementation)

Administrative Distance (AD) value

- AD shows the trustworthiness of the routing information.
- AD is an 8-btis value between 0 and 255, the lower the value the trustworthy the routing information

Route Source	Default AD
Connected interface	**0**
Static route	**1**
EIGRP, External EIGRP	**90, 170**
IGRP	**100**
OSPF	**110**
RIP	**120**
Unknown 255 (this route will never be used)	

NOTE

- Gateway of Last Resort
  - A Gateway of Last Resort or Default gateway is a route used by the router when no other known route exists to transmit the IP packet. Known routes are present in the routing table. Hence, any route not known by the routing table is forwarded to the default route.
  - Each router which receives this packet will treat the packet the same way, if the route is known, packet will be forwarded to the known route

REFERENCES

- https://study-ccna.com/administrative-distance-metric/

THANK YOU