Introduction to Dynamic Routing Protocol

Routing Protocols and Concepts – Chapter 3

Cisco | Networking Academy®
Mind Wide Open™

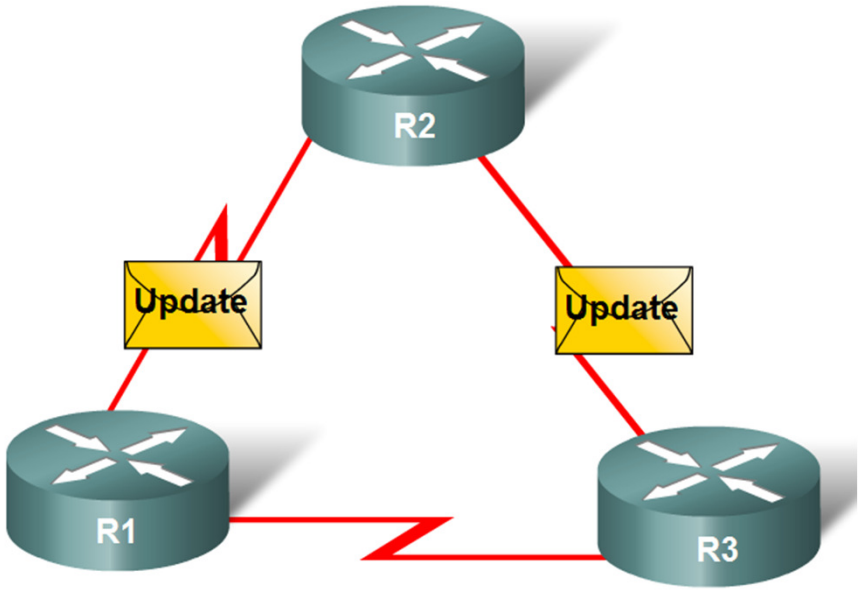
Objectives

- Describe the role of dynamic routing protocols and place these protocols in the context of modern network design.
- Identify several ways to classify routing protocols.
- Describe how metrics are used by routing protocols and identify the metric types used by dynamic routing protocols.
- Determine the administrative distance of a route and describe its importance in the routing process.
- Identify the different elements of the routing table.

Dynamic Routing Protocols

- Function(s) of Dynamic Routing Protocols:
  - -Dynamically share information between routers.
  - -Automatically update routing table when topology changes.
  - -Determine best path to a destination.

Routers Dynamically Pass Updates

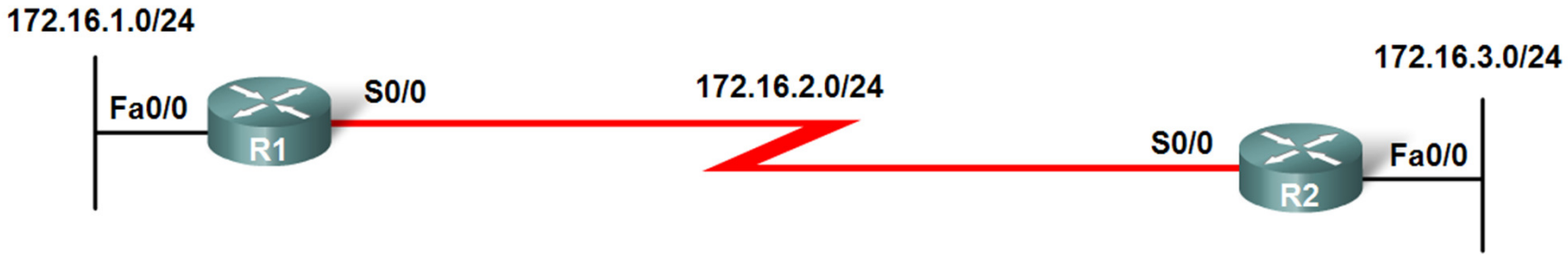


Dynamic Routing Protocols

- The **purpose of a dynamic routing protocol** is to:
  - -Discover remote networks
  - -Maintaining up-to-date routing information
  - -Choosing the best path to destination networks
  - -Ability to find a new best path if the current path is no longer available

Routing Protocol Operation

Routing protocols are used to exchange routing information between the routers.



Dynamic Routing Protocols

- **Components of a routing protocol**

Algorithm

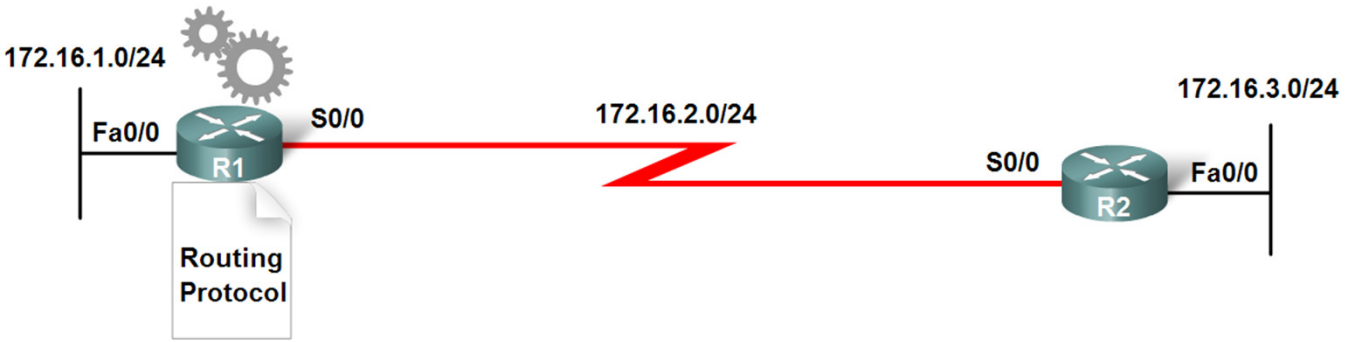
In the case of a routing protocol algorithms are used for facilitating routing information and best path determination

Routing protocol messages

These are messages for discovering neighbors and exchange of routing information

Routing Protocol Operation

Routing protocols are used to exchange routing information between the routers.



Dynamic Routing Protocols

- Advantages of **static routing**
  - -It can backup multiple interfaces/networks on a router
  - -Easy to configure
  - -No extra resources are needed
  - -More secure
- Disadvantages of **static routing**
  - -Network changes require manual reconfiguration
  - -Does not scale well in large topologies

Classifying Routing Protocols

- **Dynamic routing protocols** are grouped according to characteristics. Examples include:

  -RIP

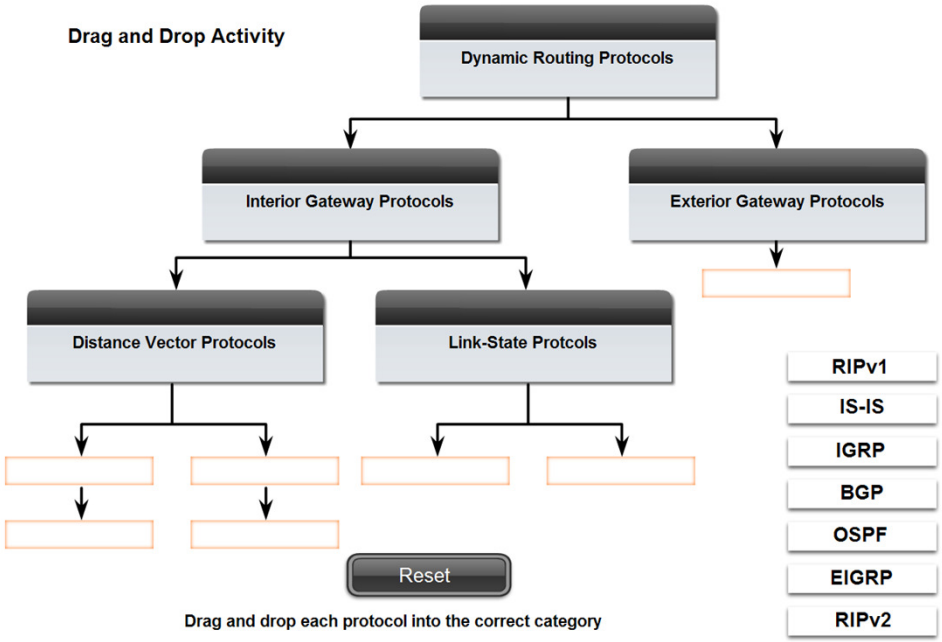
  -IGRP

  -EIGRP

  -OSPF

  -IS-IS

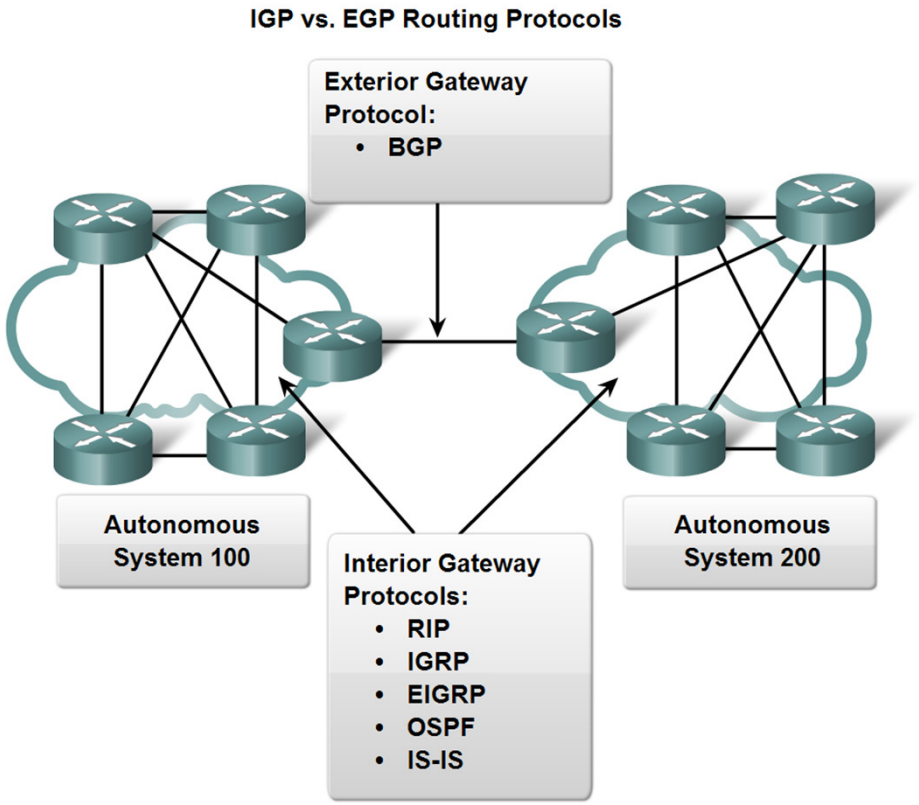
  -BGP



- **Autonomous System** is a group of routers under the control of a single authority.

Classifying Routing Protocols

- **Types of routing protocols**:
  - -**Interior Gateway Protocols** (IGP)
  - -**Exterior Gateway Protocols** (EGP)



Classifying Routing Protocols

- **Interior Gateway Routing Protocols (IGP)**

  -Used for routing inside an autonomous system & used to route within the individual networks themselves.

  -Examples: RIP, EIGRP, OSPF

- **Exterior Routing Protocols (EGP)**

  -Used for routing between autonomous systems

  -Example: BGPv4

Classifying Routing Protocols

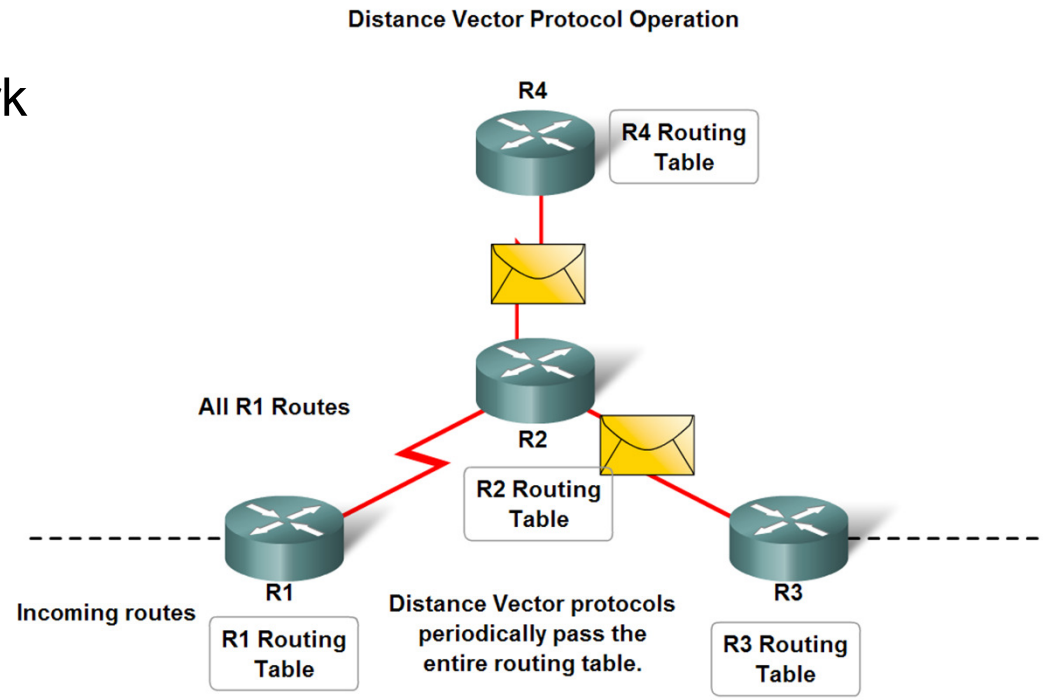
- IGP: **Comparison of Distance Vector & Link State** Routing Protocols

Distance vector

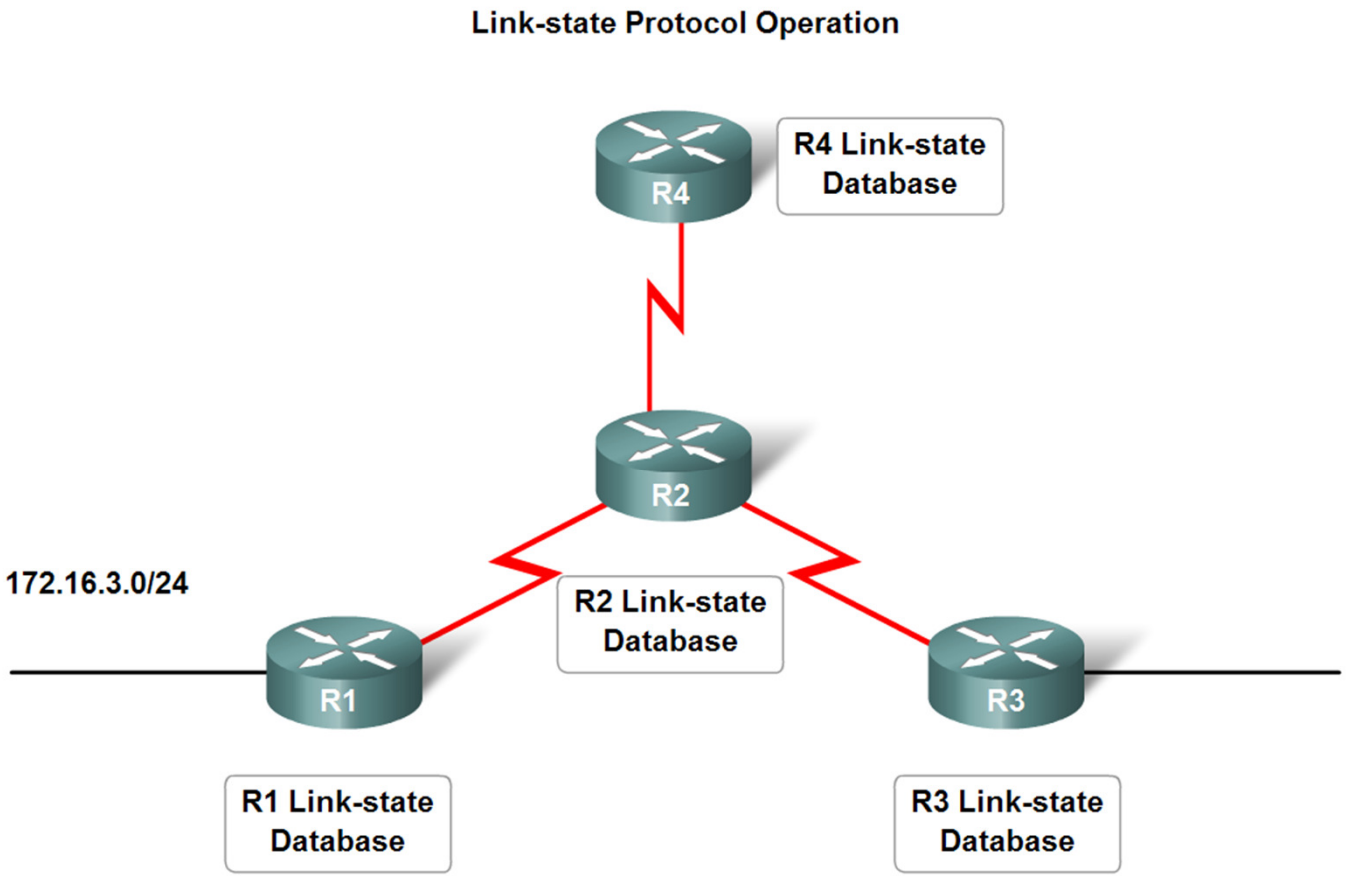
- routes are advertised as vectors of distance & direction.
- incomplete view of network topology.
- Generally, periodic updates.

Link state

- complete view of network topology is created.
- updates are not periodic.



Classifying Routing Protocols



Link-state protocols pass updates when a link's state changes.

Classifying Routing Protocols

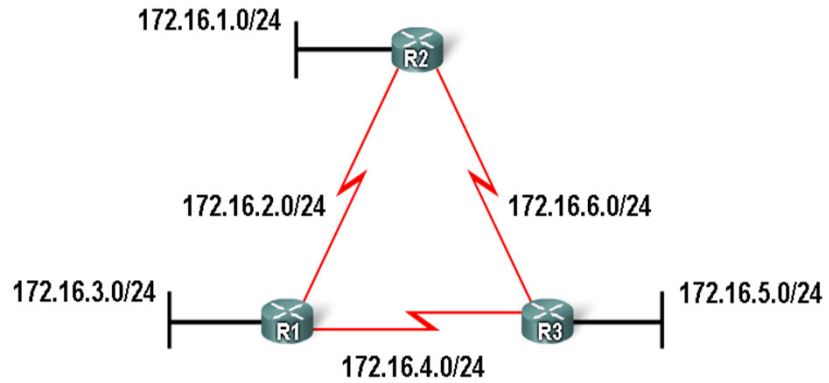
- **Classful routing protocols**

  Do NOT send subnet mask in routing updates

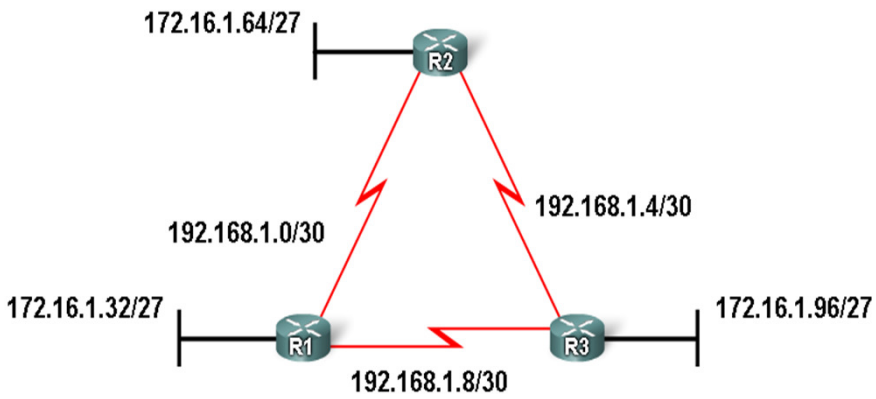
- **Classless routing protocols**

  Do send subnet mask in routing updates.

Classful vs. Classless Routing



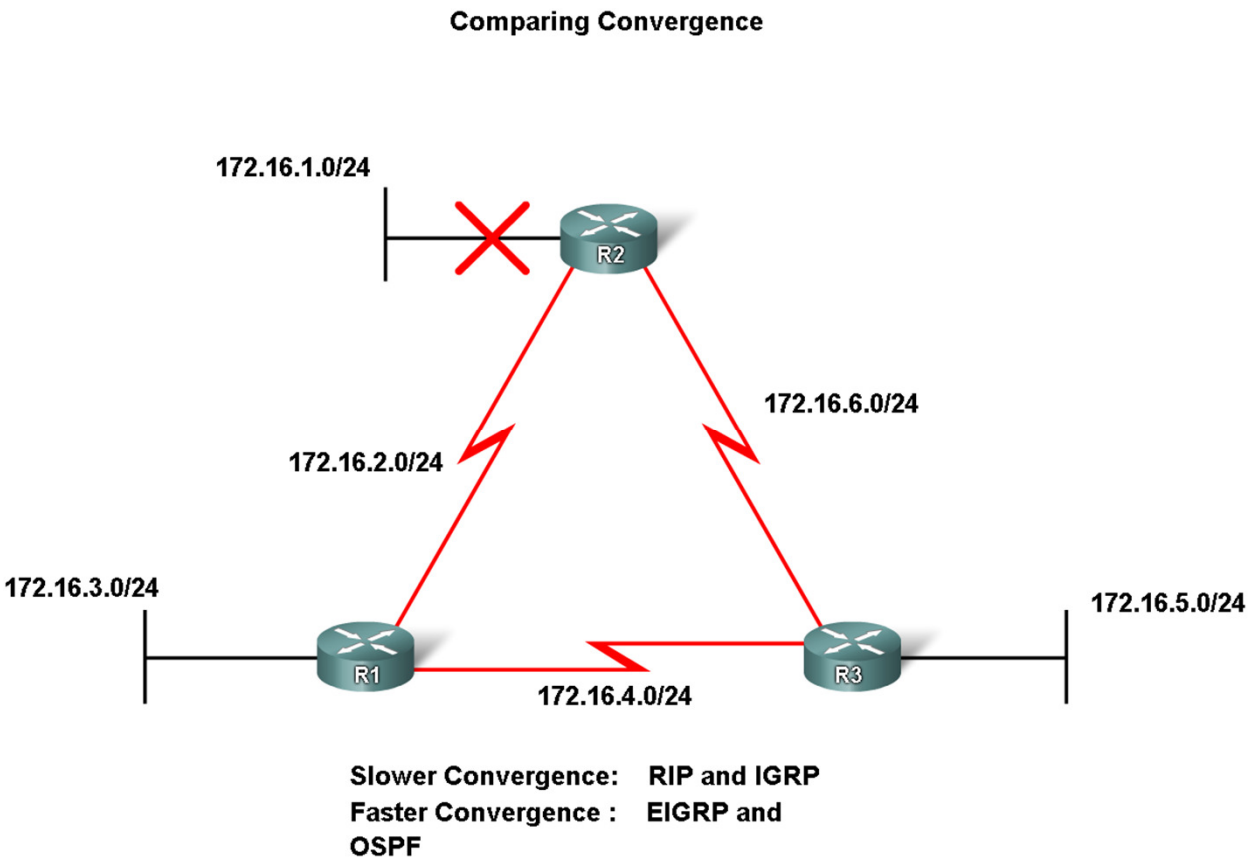
Classful: Subnet mask is the same throughout the topology



Classless: Subnet mask can vary in the topology

Classifying Routing Protocols

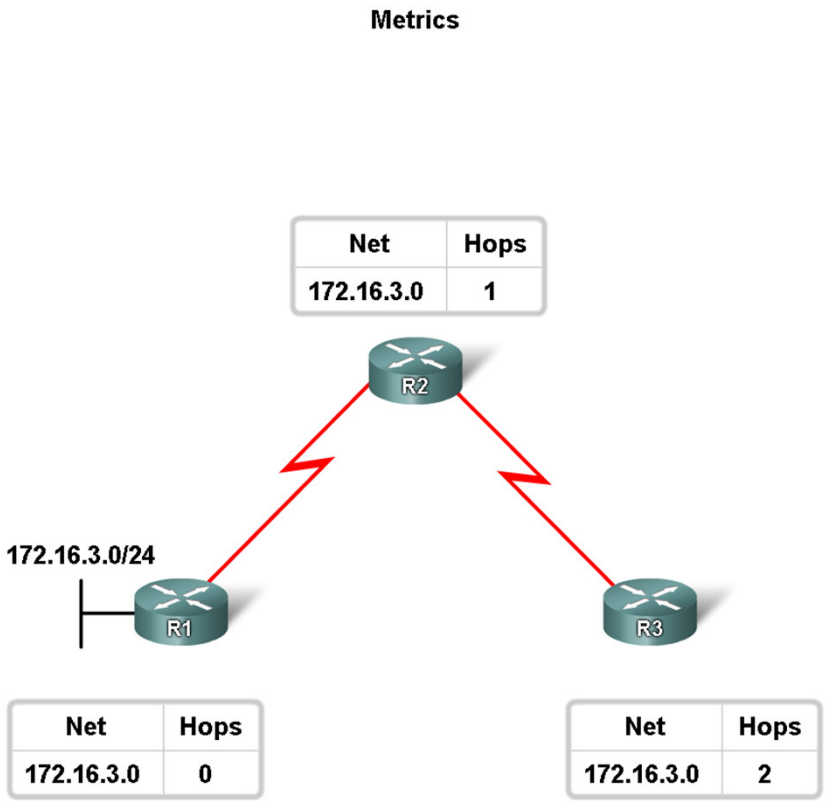
- **Convergence** is defined as when all routers' routing tables are at a state of consistency



Routing Protocols Metrics

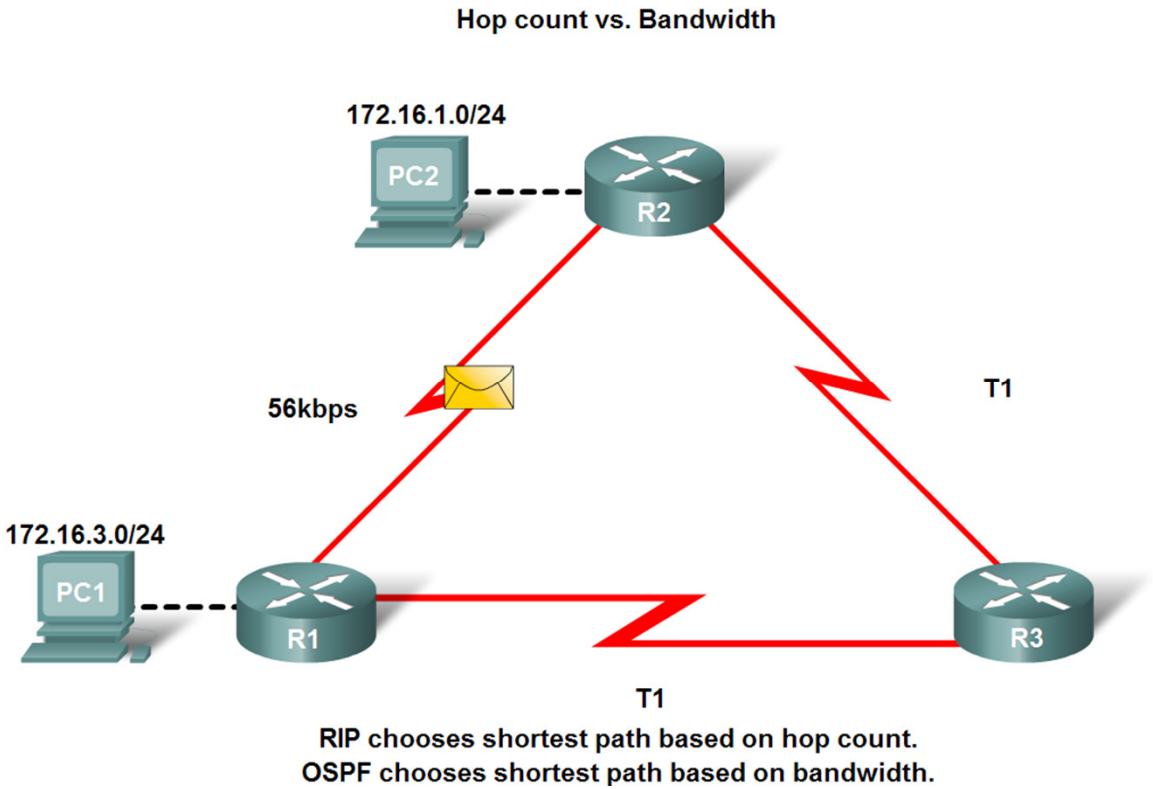
- **Metric**

  A value used by a routing protocol to determine which routes are better than others.



Routing Protocols Metrics

- **Metrics used in IP routing protocols**
  - -Bandwidth
  - -Cost
  - -Delay
  - -Hop count
  - -Load
  - -Reliability



Routing Protocols Metrics

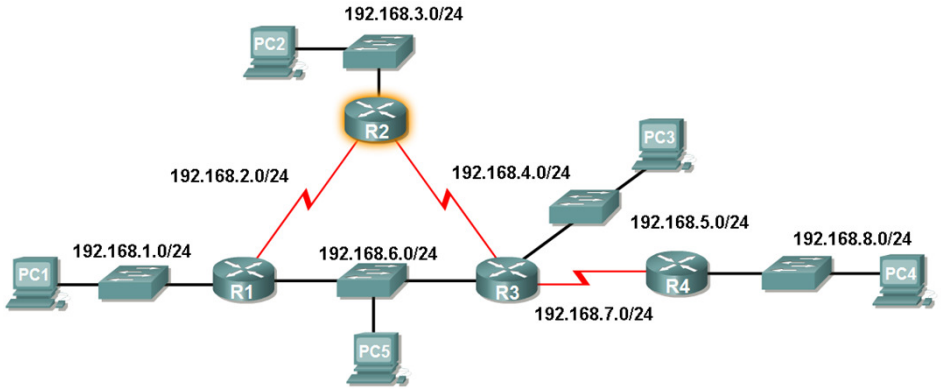
- The Metric Field in the Routing Table
- **Metric** used for each routing protocol

  -RIP - hop count

  -IGRP & EIGRP - Bandwidth (used by default), Delay (used by default), Load, Reliability

  -IS-IS & OSPF – Cost, Bandwidth (Cisco's implementation)

Metric in the Routing Table




```
R2#show ip route
<output omitted>

Gateway of last resort is not set

R    192.168.1.0/24 [120/1] via 192.168.2.1, 00:00:24, Serial0/0
C    192.168.2.0/24 is directly connected, Serial0/0
C    192.168.3.0/24 is directly connected, FastEthernet0/0
C    192.168.4.0/24 is directly connected, Serial0/1
R    192.168.5.0/24 [120/1] via 192.168.4.1, 00:00:26, Serial0/1
R    192.168.6.0/24 [120/1] via 192.168.2.1, 00:00:24, Serial0/0
                            [120/1] via 192.168.4.1, 00:00:26, Serial0/1
R    192.168.7.0/24 [120/1] via 192.168.4.1, 00:00:26, Serial0/1
R    192.168.8.0/24 [120/2] via 192.168.4.1, 00:00:26, Serial0/1
```

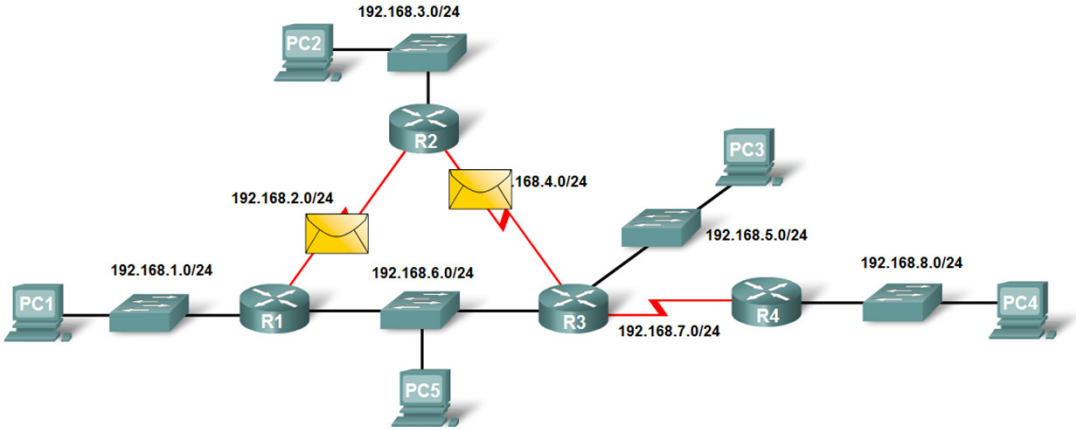
It is 2 hops from R2 to 192.168.8.0/24

Routing Protocols Metrics

- **Load balancing**

  This is the ability of a router to distribute packets among multiple same cost paths

Load Balancing Across Equal Cost Paths




```
R2#show ip route
<output omitted>

R    192.168.6.0/24 [120/1] via 192.168.2.1, 00:00:24, Serial0/0/0
                    [120/1] via 192.168.4.1, 00:00:26, Serial0/0/1
```

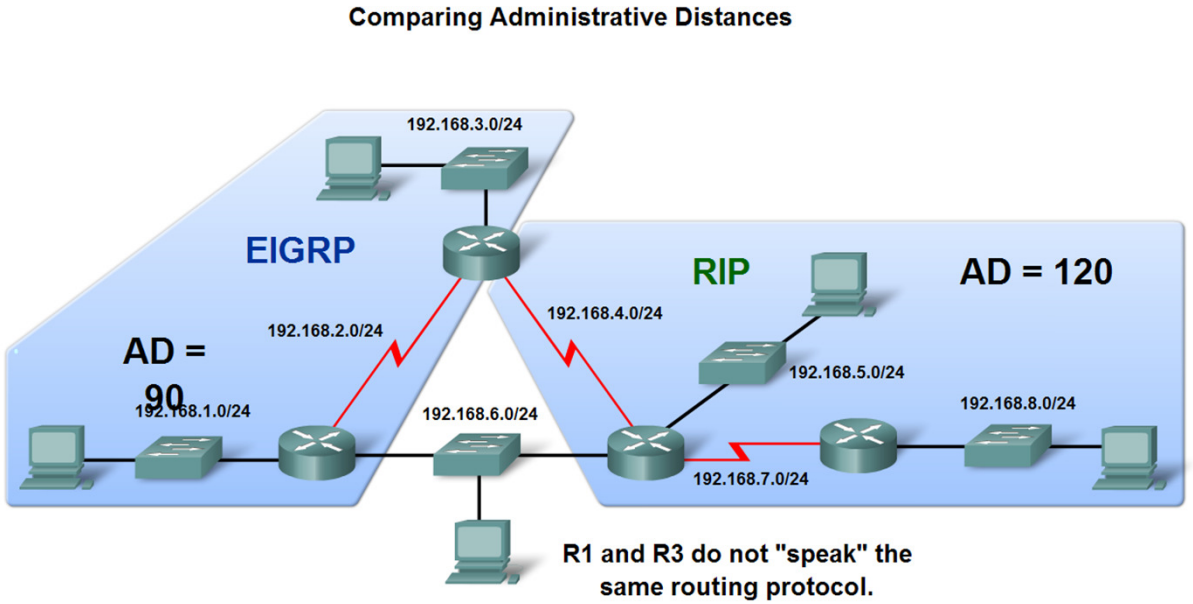
Administrative Distance of a Route

- **Purpose of a metric**

  It's a calculated value used to determine the best path to a destination

- **Purpose of Administrative Distance**

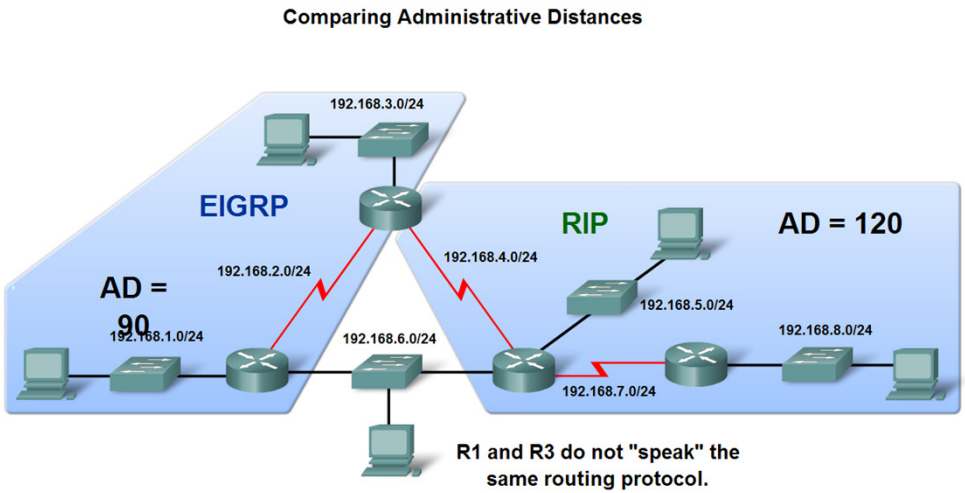
  It's a numeric value that specifies the preference of a particular route



Administrative Distance of a Route

- **Identifying the Administrative Distance** (AD) in a routing table

  It is the first number in the brackets in the routing table




```
R2#show ip route
<output omitted>

Gateway of last resort is not set

D    192.168.1.0/24 [90/2172416] via 192.168.2.1, 00:00:24, Serial0/0/0
C    192.168.2.0/24 is directly connected, Serial0/0/0
C    192.168.3.0/24 is directly connected, FastEthernet0/0
C    192.168.4.0/24 is directly connected, Serial0/0/1
R    192.168.5.0/24 [120/1] via 192.168.4.1, 00:00:08, Serial0/0/1
D    192.168.6.0/24 [90/2172416] via 192.168.2.1, 00:00:24, Serial0/0/0
R    192.168.7.0/24 [120/1] via 192.168.4.1, 00:00:08, Serial0/0/1
R    192.168.8.0/24 [120/2] via 192.168.4.1, 00:00:08, Serial0/0/1
```

```
R2#show ip rip database
192.168.3.0/24    directly connected, FastEthernet0/0
192.168.4.0/24    directly connected, Serial0/0/1
192.168.5.0/24
    [1] via 192.168.4.1, Serial0/0/1
192.168.6.0/24
    [1] via 192.168.4.1, Serial0/0/1
192.168.7.0/24
    [1] via 192.168.4.1, Serial0/0/1
192.168.8.0/24
    [2] via 192.168.4.1, Serial0/0/1
```

Administrative Distance of a Route

- **Dynamic Routing Protocols**

Default Administrative Distances

Route source	Default AD
Connected interface	0
Static	1
EIGRP summary route	5
eBGP	20
EIGRP (Internal)	90
IGRP	100
OSPF	110
IS - IS	115
RIP	120
EIGRP (External)	170
iBGP	200
Unknown	255

Administrative Distance of a Route

- **Directly connected routes**

  Have a default **AD of 0**

- **Static Routes**

  Administrative distance of a static route has a **default value of 1**

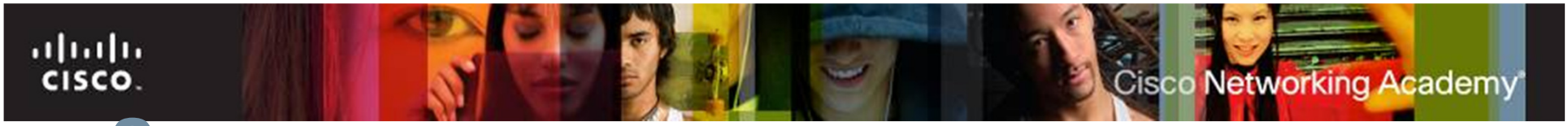
```
R2#show ip route 172.16.3.0
Routing entry for 172.16.3.0/24
Known via "static", distance 1, metric 0 (connected)
  Routing Descriptor Blocks:
  * directly connected, via Serial0/0/0
      Route metric is 0, traffic share count is 1
```

Administrative Distance of a Route

- **Directly connected routes**

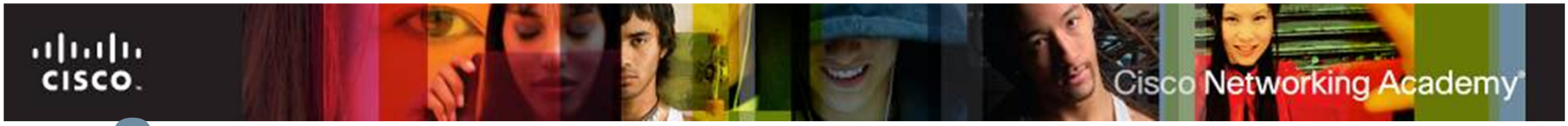
  -Immediately appear in the routing table as soon as the interface is configured

```
R2#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

     172.16.0.0/24 is subnetted, 3 subnets
C       172.16.1.0 is directly connected, FastEthernet0/0
C       172.16.2.0 is directly connected, Serial0/0/0
S       172.16.3.0 is directly connected, Serial0/0/0
C    192.168.1.0/24 is directly connected, Serial0/0/1
S    192.168.2.0/24 [1/0] via 192.168.1.1
```



Summary

- **Dynamic routing protocols** fulfill the following functions
  - -Dynamically share information between routers
  - -Automatically update routing table when topology changes
  - -Determine best path to a destination
- **Routing protocols are grouped as either**
  - -Interior gateway protocols (IGP)**Or**
  - -Exterior gateway protocols(EGP)
- **Types of IGPs include**
  - -Classless routing protocols - these protocols include subnet mask in routing updates
  - -Classful routing protocols - these protocols do not include subnet mask in routing update



Summary

- **Metrics** are used by dynamic routing protocols to calculate the best path to a destination.
- **Administrative distance** is an integer value that is used to indicate a router's "trustworthiness"
- **Components of a routing table** include:
  - -Route source
  - -Administrative distance
  - -Metric