SOMNOG 6
Somali Network Operators Group
WORKSHOPS AND CONFERENCE
21 - 26 October 2023

Introduction to Routing Protocols

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Basic Routing

- Routing is the process of determining where to send data packets that are destined for addresses outside the local network.

- Routers gather and maintain routing information to enable the transmission and receipt of these data packets.

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Types of Routes

- There are three ways to control routing decisions on your router:
- Static routes
- Default routes
- Dynamic routes

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Static Routes

- Use a static route when you want to manually define the path that the packet will take through your network. Static routes are useful in small networks with rarely changing routes, when you have little bandwidth and do not want the overhead of a dynamic routing protocol, or when you want to manually define all of your routes for security reasons. Static routes are created in global configuration mode. The syntax for the static route is as follows:

- **ip route destination network address [subnet mask] {next-hop-address | interface] [distance]**

Default routes

- This is the special type of static route, commonly called the gateway of last resort.
- If the specified destination is not listed in the routing table, the default route can be used to route the packet. A default route has an IP address of 0.0.0.0 and a subnet mask of 0.0.0.0, often represented as 0.0.0.0/0.
- Default routes are commonly used in small networks on a perimeter router pointing to the directly connected ISP router.

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Dynamic Routes

- A router learns dynamic routes by running a routing protocol. Routing protocols will learn about routes from other neighboring routers running the same routing protocol. Through this sharing process, a router will eventually learn about all of the reachable network and subnet numbers in the network.

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Routed vs Routing Protocols

- **Routed protocol:**
- Any network protocol that provides enough information in its network layer address to enable a packet to be forwarded from one host to another host based on the addressing scheme, without knowing the entire path from source to destination. Packets generally are conveyed from end system to end system. IP is an example of a routed protocol.
- **Routing protocol:**
- Facilitates the exchange of routing information between networks, enabling routers to build routing tables dynamically. Traditional IP routing stays simple because it uses next-hop (next-router) routing, in which the router needs to consider only where it7sends the packet and does not need to consider the subsequent path of the packet on the remaining hops (routers). Routing Information Protocol (RIP) is an example of a routing protocol.

Dynamic Routing Protocols

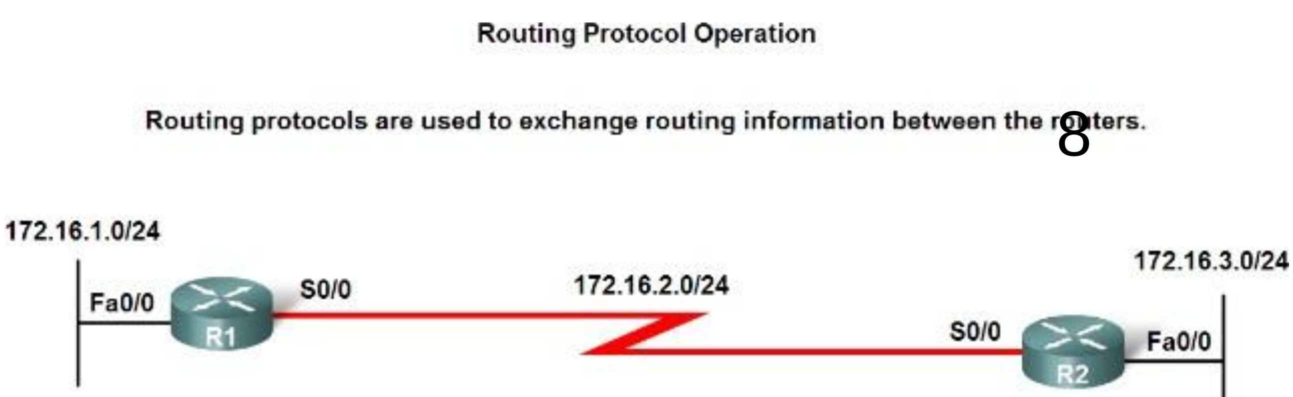
- The **purpose of a dynamic routing protocol** is to:

  -Discover remote networks

  -Maintaining up-to-date routing information

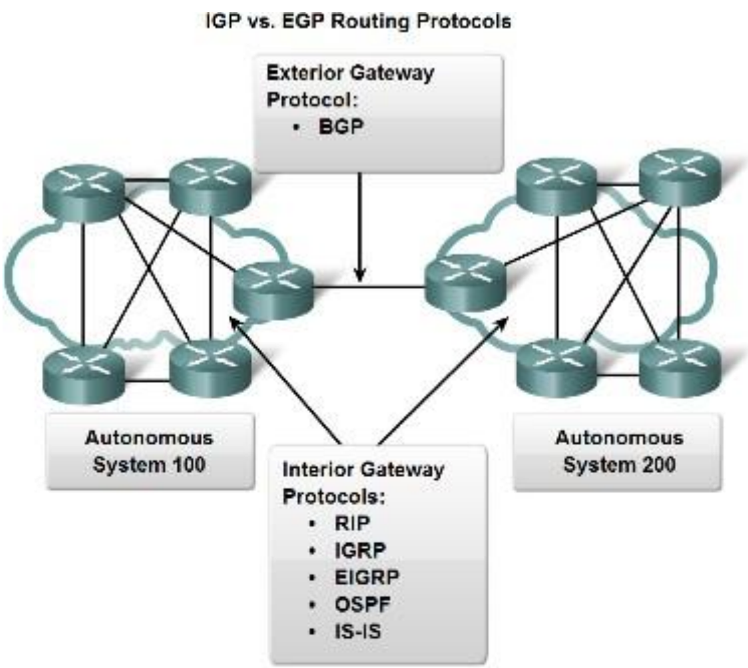
  -Choosing the best path to destination networks

  -Ability to find a new best path if the current path is no longer available



There are two types of routing protocols:

- **Interior Gateway Protocols (IGP):** These routing protocols exchange routing information within an autonomous system. Routing Information Protocol version 2 (RIPv2), Enhanced Interior Gateway Routing (EIGRP), and Open Shortest Path First (OSPF) are examples of IGPs.
- **Exterior Gateway Protocols (EGP):** These routing protocols are used to route between autonomous systems. Border Gateway Protocol (BGP) is the EGP of choice in networks today.


IGP vs. EGP Routing Protocols
Exterior Gateway Protocol:
• BGP
Autonomous System 100
Autonomous System 200
Interior Gateway Protocols:
• RIP
• IGRP
• EIGRP
• OSPF
• IS-IS

Routing protocols can be further classified into three categories:

- Distance vector routing protocols
- Link state routing protocols
- Path vector routing protocols

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

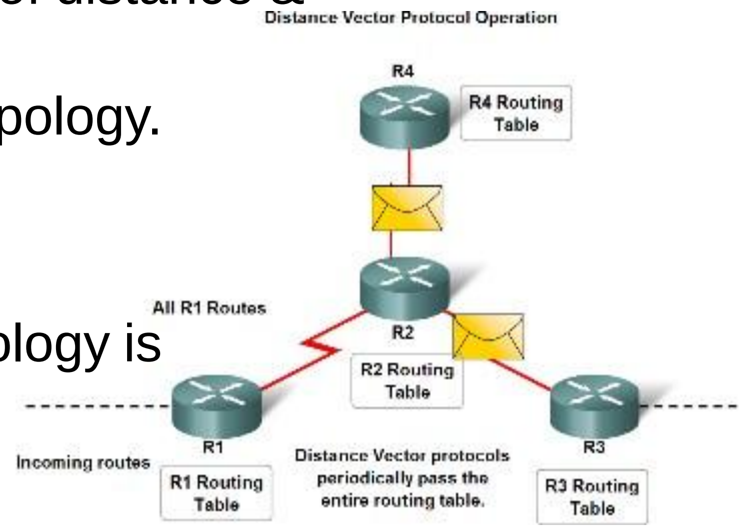
– complete view of network topology is created.

updates are not periodic.

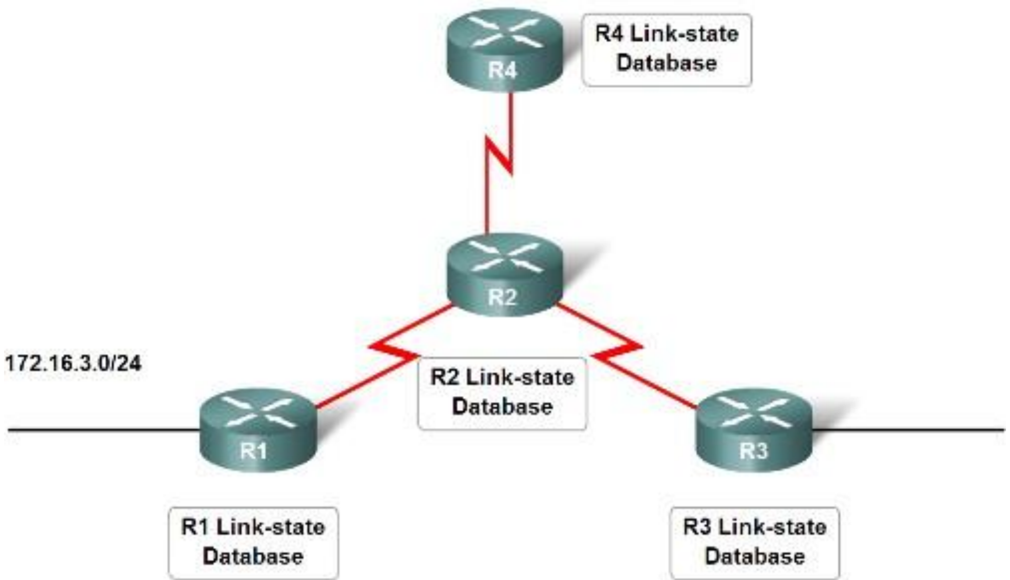
– **path vector** protocols rely on analysis of the path to

– reach the destination to

– learn if it is loop free or not



Link-state Protocol Operation



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

Classifying Routing Protocols

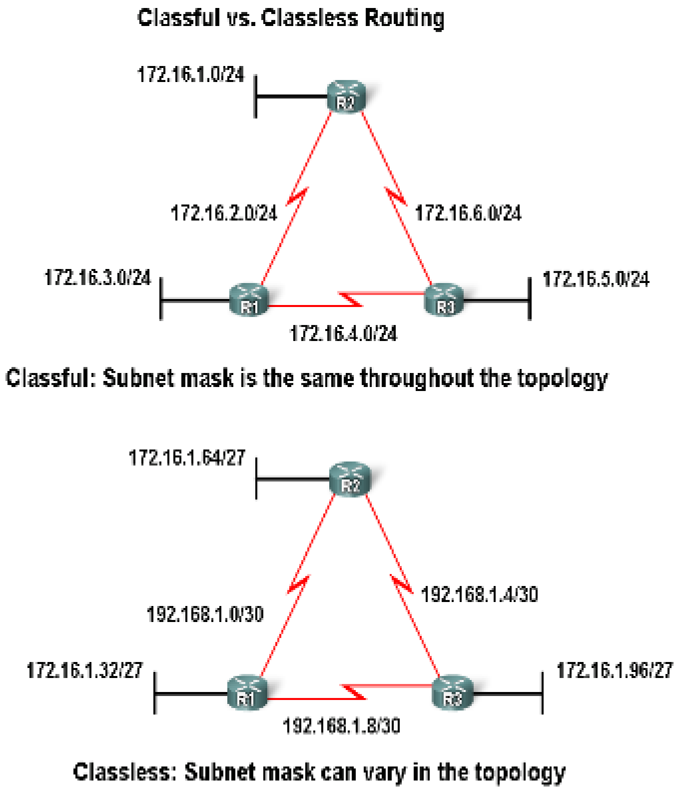
- **Classful routing protocols**

  Do NOT send subnet mask in routing updates

- **Classless routing protocols**

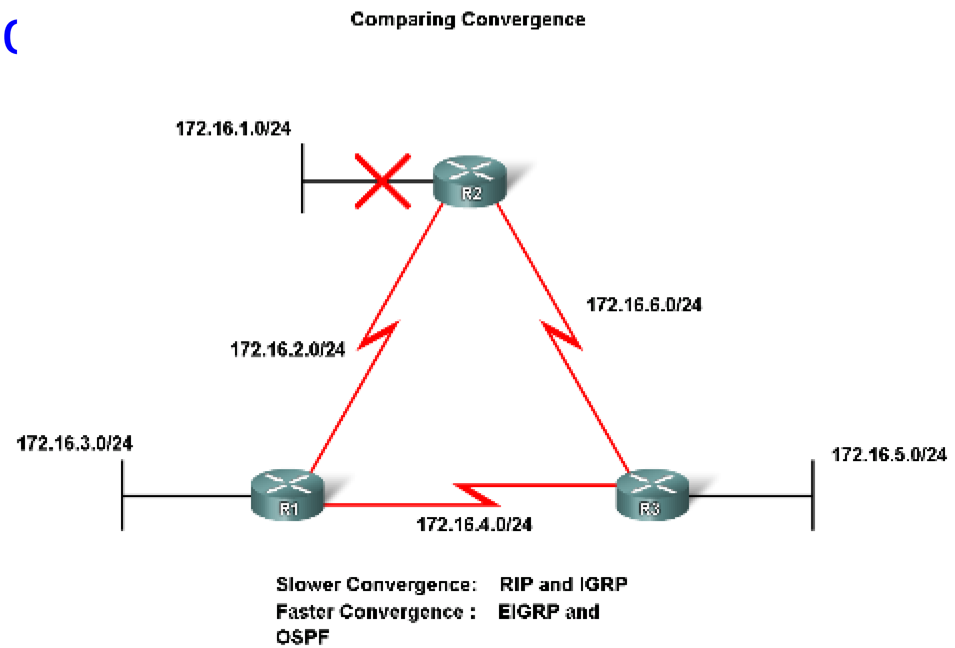
  Do send subnet mask in

  routing updates.



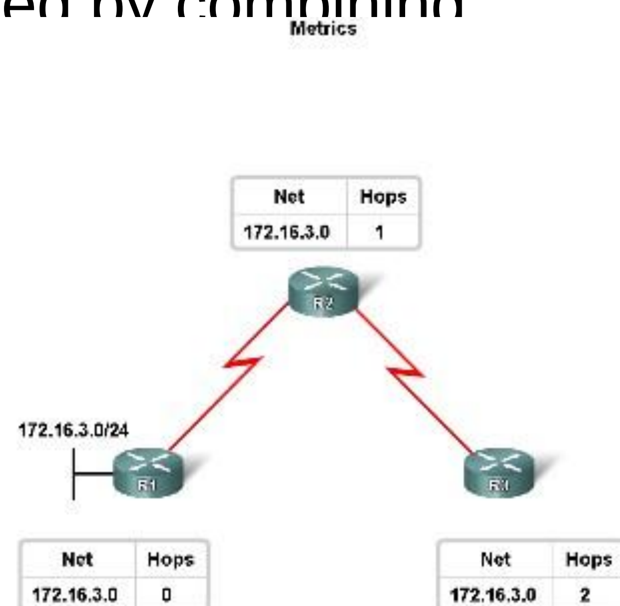
Classifying Routing Protocols

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



Metrics

- A value used by a routing protocol to determine which routes are better than others.
- Metrics can be calculated based on a single characteristic of a path. More complex metrics can be calculated by combining several path characte



The metrics that routing protocols most commonly use are as follows:

- **Hop count:**
  The number of times that a packet passes through the output port of one router
- **Bandwidth:**
  The data capacity of a link; for instance, normally, a 10-Mbps Ethernet link is preferable to a 64-kbps leased line
- **Delay:**
  The length of time that is required to move a packet from source to destination
- **Load:**
  The amount of activity on a network resource, such as a router or link
- **Reliability:**
  Usually refers to the bit error rate of each network link
- **Cost:**
  A configurable value that on Cisco routers is based by default on the bandwidth of the Interface

Autonomous system

An **autonomous system (AS)** is a group of networks under a single administrative control, which could be your company, a division within your company, or a group of companies.

Not every routing protocol understands the concept of an AS.

Routing protocols that understand the concept of an AS are EIGRP, OSPF, IS-IS, and BGP. RIP doesn't understand autonomous systems, while OSPF does; but OSPF doesn't require you to configure the AS number, whereas other protocols, such as EIGRP, do.

Administrative Distance

- **Administrative distance** is the measure of trustworthiness that a router assigns to how a route to a network was learned.
- An administrative distance is an integer from 0 to 255. A routing protocol with a lower administrative distance is more trustworthy than one with a higher administrative distance.

Administrative Distance	Route Type
0	Connected interface route
1	Static route
90	Internal EIGRP route (within the same AS)
110	OSPF route
120	RIPv1 and v2 route
170	External EIGRP (from another AS)
255	Unknown route (is considered an invalid route and will not be used)

LAB Session

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