Dynamic Routing

CN5122 - Week 17
Data Communications and Networks

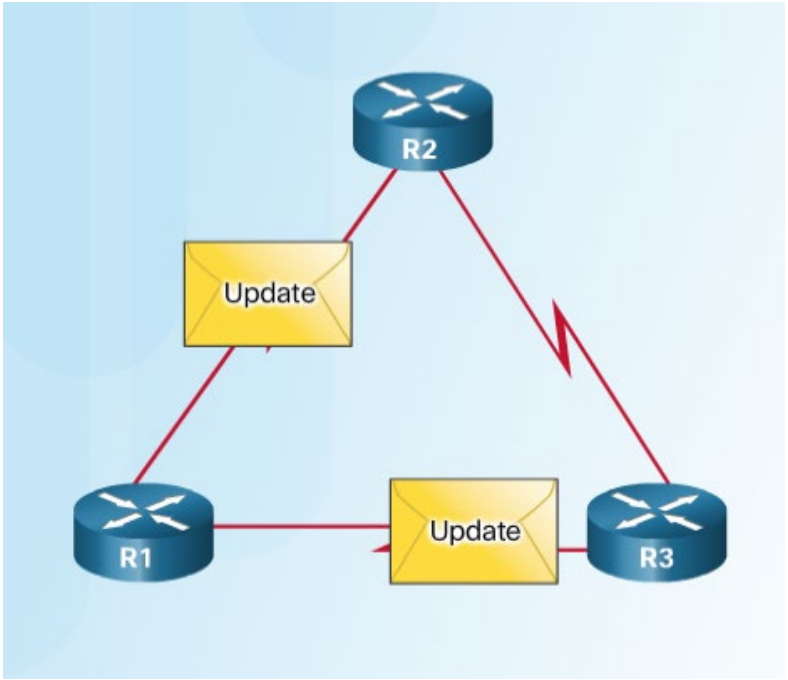
21st February 2020

Dynamic Routing Protocol Overview

	Interior Gateway Protocols				Exterior Gateway Protocols
	Distance Vector		Link-State		Path Vector
IPv4	RIPv2	EIGRP	OSPFv2	IS-IS	BGP-4
IPv6	RIPng	EIGRP for IPv6	OSPFv3	IS-IS for IPv6	BGP-MP

- RIP protocol was updated to RIPv2 to accommodate growth in the network environment
  - RIPv2 does not scale to current larger network implementations
- Routing Protocols developed to meet the need of larger networks include:
  - Open Shortest Path First (OSPF)
  - Intermediate System-to-Intermediate System (IS-IS).
  - Enhanced IGRP (EIGRP)
- Border Gateway Protocol (BGP) is used between Internet service providers (ISPs)

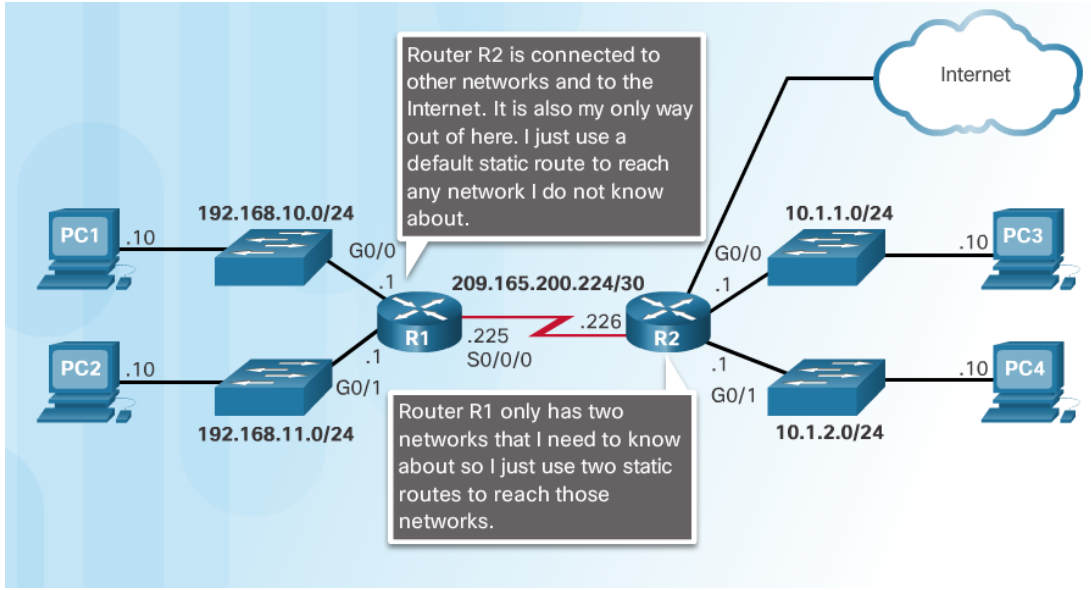
Dynamic Routing Protocol Components



- Purpose of dynamic routing protocols includes:
  - Discovery of 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
- The main components of dynamic routing protocols include:
  - Data structures - tables or databases kept in RAM.
  - Routing protocol messages - to discover neighboring routers, exchange routing information, and maintain accurate information about the network.
  - Algorithms – to facilitate learning routing information and for best path determination.

Static Routing Uses

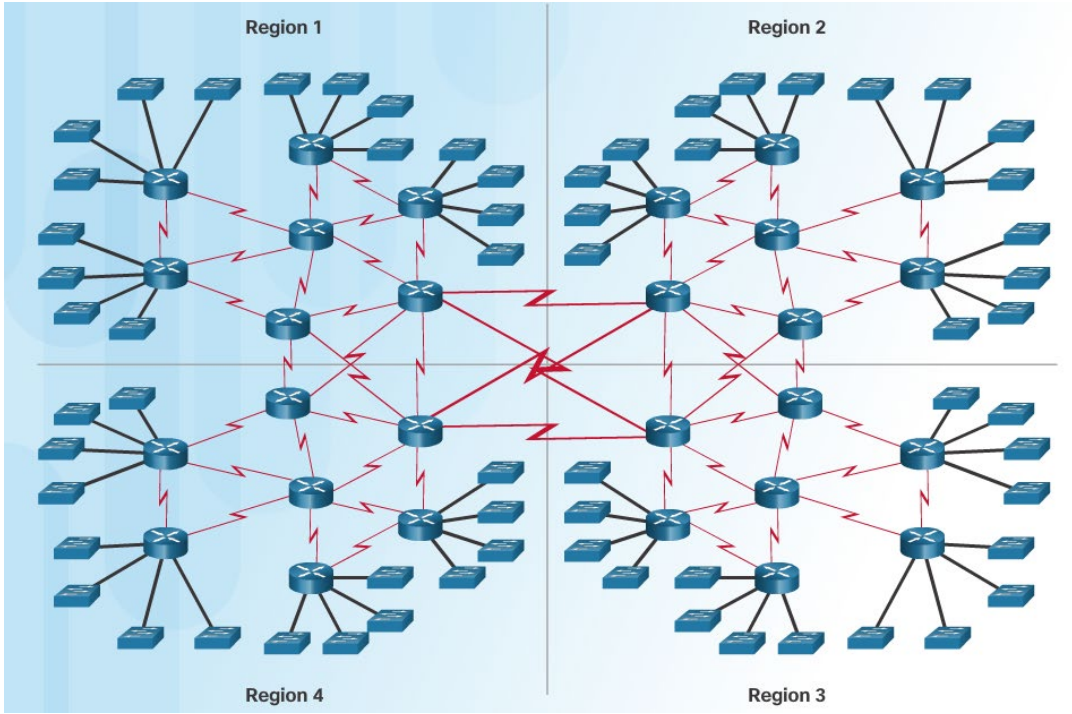
- Networks often use both static and dynamic routing.
- Static Routing is used as follows:
  - For easy routing table maintenance in small networks.
  - Routing to and from a stub network.
  - Accessing a single default route.



Static Routing Advantages and Disadvantages

Advantages	Disadvantages
Easy to implement in a small network.	Suitable only for simple topologies or for special purposes such as a default static route.
Very secure. No advertisements are sent as compared to dynamic routing protocols.	Configuration complexity increases dramatically as network grows.
Route to destination is always the same.	Manual intervention required to re-route traffic.
No routing algorithm or update mechanism required; therefore, extra resources (CPU or RAM) are not required.	

Dynamic Routing Protocols Uses

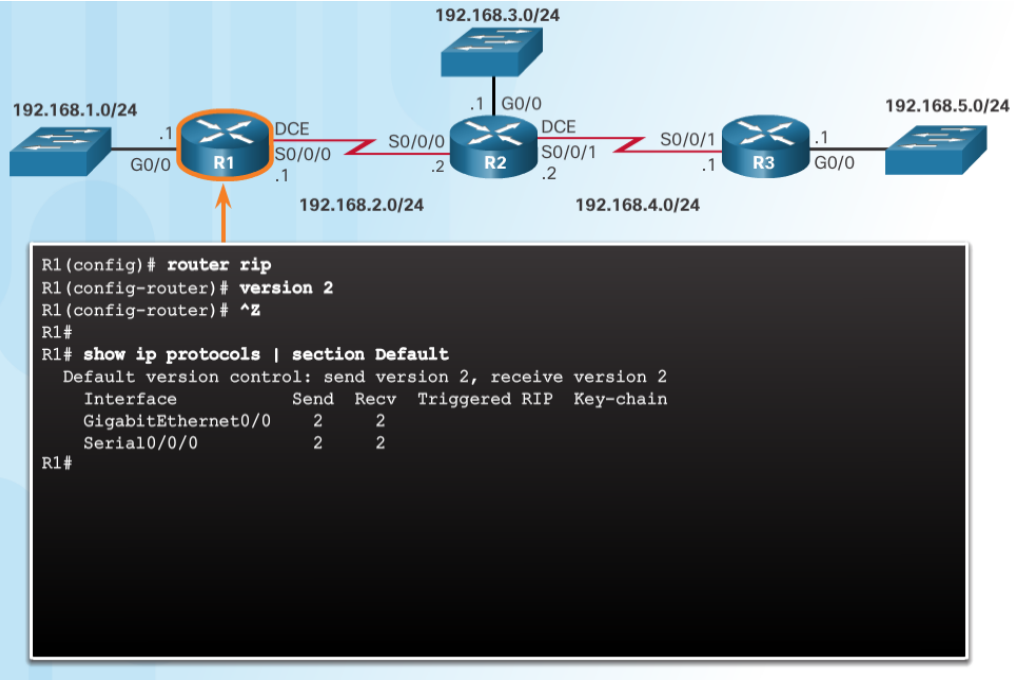


- Dynamic routing is the best choice for large networks
- Dynamic routing protocols help the network administrator manage the network:
  - Providing redundant paths
  - Automatically implementing the alternate path when a link goes down.

Dynamic Routing Advantages and Disadvantages

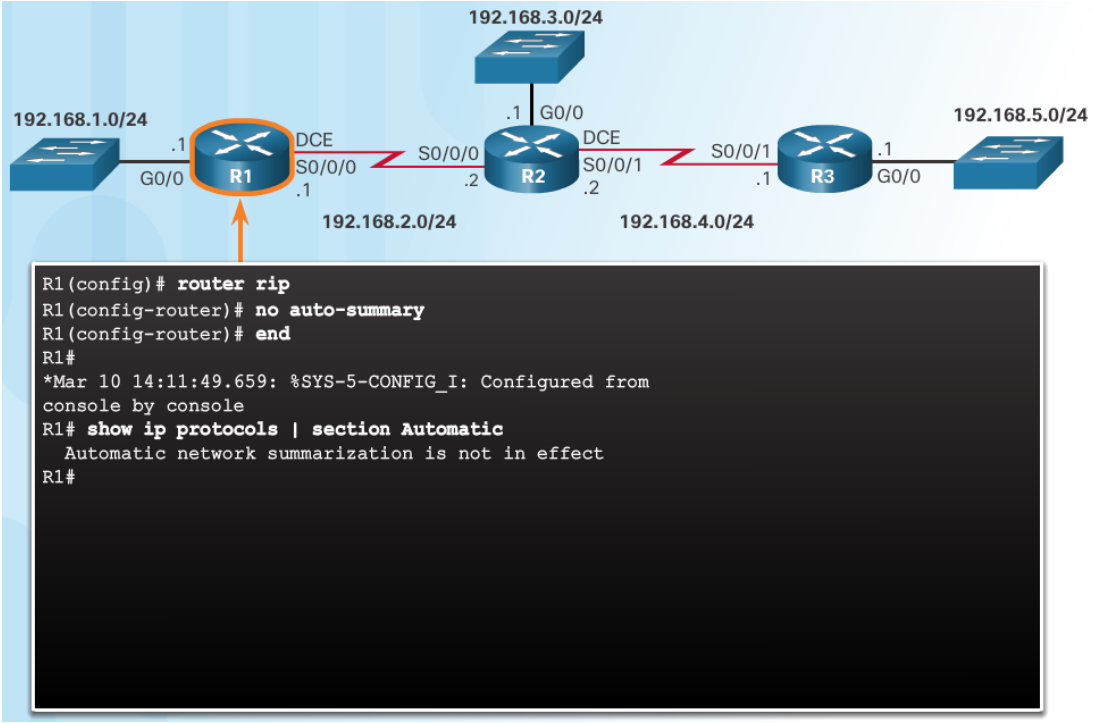
Advantages	Disadvantages
Suitable in all topologies where multiple routers are required.	Can be more complex to implement.
Generally independent of the network size.	Less secure. Additional configuration settings are required to secure.
Automatically adapts topology to reroute traffic if possible.	Route depends on the current topology.
	Requires additional CPU, RAM, and link bandwidth.

Enable and Verify RIPv2



- Use the **version 2** router configuration mode command to enable RIPv2
- Use the **show ip protocols** command to verify that RIPv2 is configured.
- Use the **show ip route** command to verify the RIPv2 routes in the routing table.

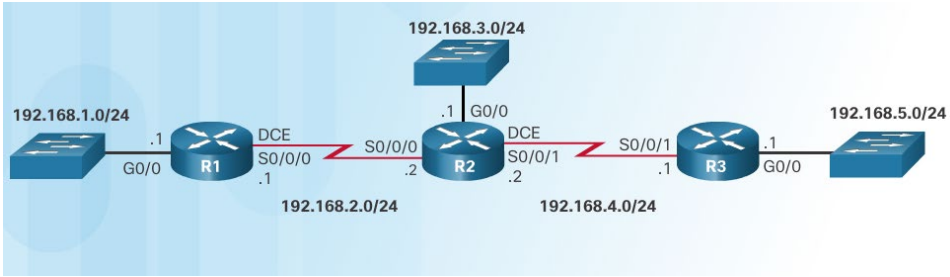
Disable Auto Summarization



- RIPv2 automatically summarizes networks at major network boundaries.
- Use the **no auto-summary** router configuration mode command to disable auto summarization.
- Use the **show ip protocols** command to verify that auto summarization is off.

Configure Passive Interfaces

- RIP updates:
  - Are forwarded out all RIP-enabled interfaces by default.
  - Only need to be sent out interfaces that are connected to other RIP-enabled routers.
- Sending RIP updates to LANs wastes bandwidth, wastes resources, and is a security risk.
- Use the **passive-interface** router configuration command to stop routing updates out the interface. Still allows that network to be advertised to other routers.

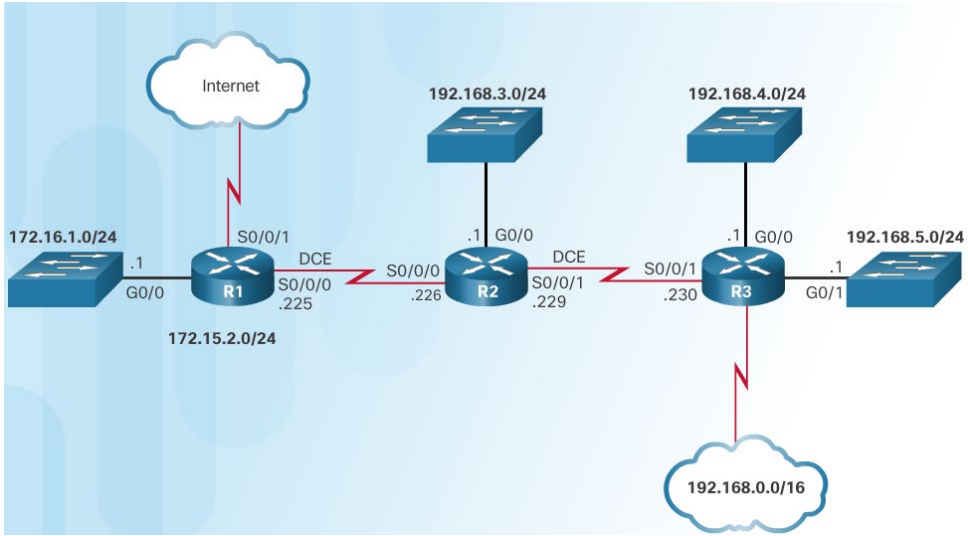



```
R1(config)# router rip
R1(config-router)# passive-interface g0/0
R1(config-router)# end
R1#
R1# show ip protocols | begin Default
  Default version control: send version 2, receive version 2
    Interface              Send  Recv  Triggered RIP  Key-
chain
    Serial0/0/0            2     2
  Automatic network summarization is not in effect
  Maximum path: 4
  Routing for Networks:
    192.168.1.0
    192.168.2.0
  Passive Interface(s):
    GigabitEthernet0/0
  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.2.2          120      00:00:06
  Distance: (default is 120)

R1#
```

Parts of an IPv4 Route Entry

Routing Table Entries



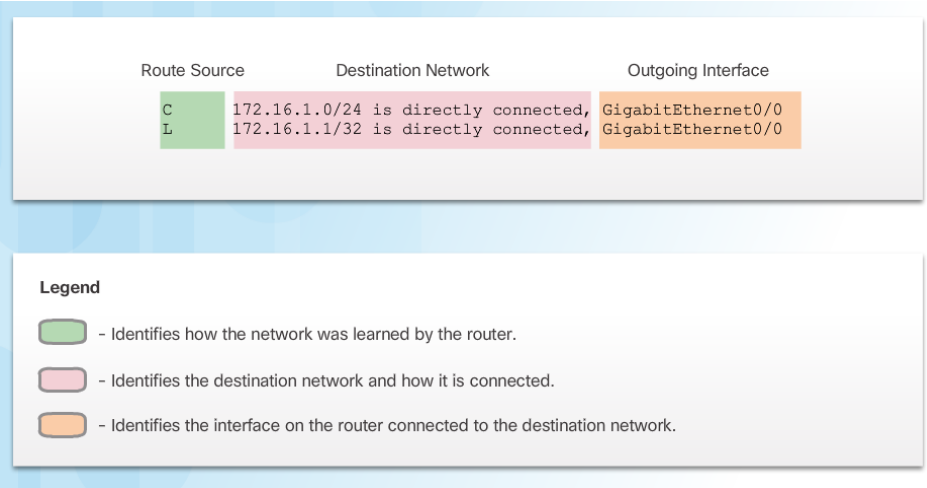

```
R1# show ip route | begin Gateway
Gateway of last resort is 209.165.200.234 to network 0.0.0.0

S* 0.0.0.0/0 [1/0] via 209.165.200.234, Serial0/0/1
                   is directly connected, Serial0/0/1
     172.16.0.0/16 is variably subnetted, 5 subnets, 3 masks
C    172.16.1.0/24 is directly connected, GigabitEthernet0/0
L    172.16.1.1/32 is directly connected, GigabitEthernet0/0
R    172.16.2.0/24 [120/1] via 209.165.200.226, 00:00:12, Serial0/0/0
R    172.16.3.0/24 [120/2] via 209.165.200.226, 00:00:12, Serial0/0/0
R    172.16.4.0/28 [120/2] via 209.165.200.226, 00:00:12, Serial0/0/0
R    192.168.0.0/16 [120/2] via 209.165.200.226, 00:00:03, Serial0/0/0
     209.165.200.0/24 is variably subnetted, 5 subnets, 2 masks
C    209.165.200.224/30 is directly connected, Serial0/0/0
L    209.165.200.225/32 is directly connected, Serial0/0/0
R    209.165.200.228/30 [120/1] via 209.165.200.226, 00:00:12, Serial0/0/0
C    209.165.200.232/30 is directly connected, Serial0/0/1
L    209.165.200.233/30 is directly connected, Serial0/0/1
R1#
```

Routing Table for R1

Parts of an IPv4 Route Entry

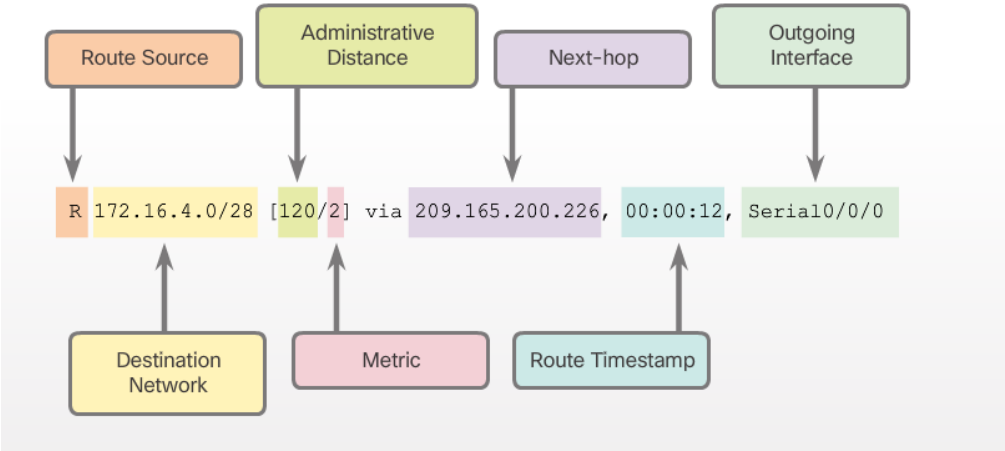
Directly Connected Entries



- Directly Connected Networks (C) are automatically added to the routing table when the interface is configured and activated.
- Entries contain the following information:
  - Route source - how the route was learned.
  - Destination network – remote network.
  - Outgoing Interface – exit interface used to forward packets to destination.
- Other route source entries include:
  - S –Static Route
  - D – EIGRP routing protocol
  - O – OSPF routing protocol
  - R - RIP routing protocol

Parts of an IPv4 Route Entry

Remote Network Entries



- Routes to remote networks contain the following information:
  - Route source – how route was learned
  - Destination network
  - Administrative distance (AD) - trustworthiness of the route.
  - Metric – value assigned to reach the remote network. Lower is better.
  - Next hop – IPv4 address of the next router that the packet should be forwarded to.
  - Route timestamp – time since the route was updated.
  - Outgoing interface - the exit interface to use to forward the packet