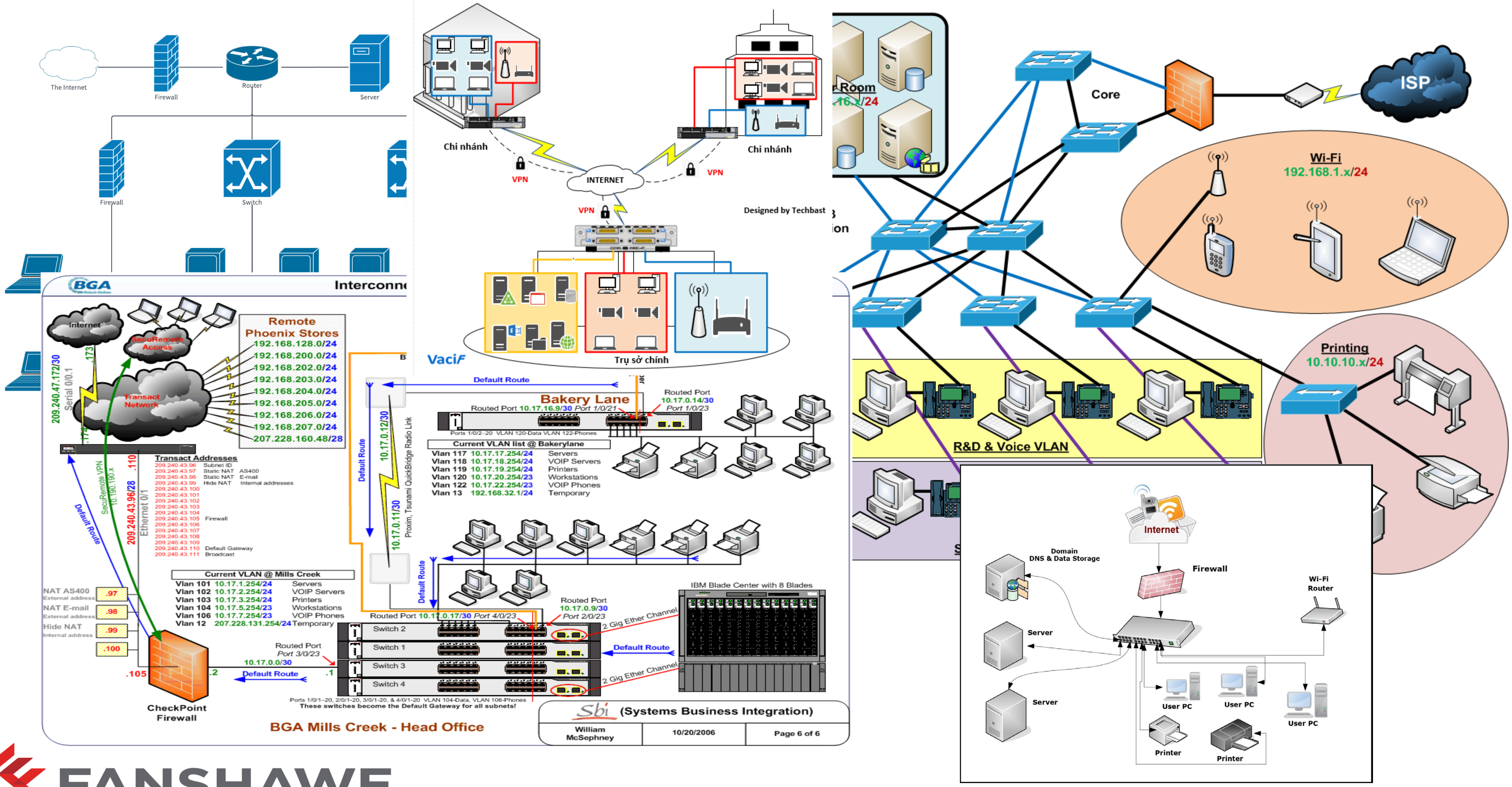
Dynamic Routing Protocols - RIP



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INFO-6047 Switching and Routing

ISM1 - Information Security Management (ISM1-ITY-20189) Detailed Weekly Content

Week	Date of Lecture or Tests, 7:00 – 9:00 PM EST	Lecture/Test	Reading	Lab Time INFO-6047-01 Wednesday 5:00 – 8:00 PM EST INFO-6047-02 Tuesday 5:00 – 8:00 PM EST	Grade
Week 01	Monday, January 02, 2023	College-Wide Orientation			
Week 02	Monday, January 09, 2023	Introduction	N/A	Lab 01 - Basics of PT	3.0%
Week 03	Monday, January 16, 2023	Basics of Routing	Chapter 01 & 02 *(Introduction to Networking, Network Media Copper)*	Lab 02 - Intro to Routing	3.0%
Week 04	Monday, January 23, 2023	Basics of Switching	Chapter 03 & 04 *(Network Media Fiber Network Media Wireless)*	Lab 03 - Intro to Switching	3.0%
Week 05	Monday, January 30, 2023	VLANs	Chapter 05 *(Data Encoding & Transmission)*	Lab 04 - VLANs	3.0%
Week 06	Monday, February 06, 2023	Routing	Chapter 06 *(Network OS & Communications)*	Lab 05 - Routing	3.0%
Week 07	Monday, February 13, 2023	Mid-Term Test		Mid-Term (Test 1)	32.0%
Study Break	Monday, February 20, 2023	Study Break - No Class This Week			
Week 08	Monday, February 27, 2023	Inter-VLAN Routing	Chapter 10 *(TCP/IP Fundamentals)*	Lab 06 - Inter VLAN Routing	3.0%
Week 09	Monday, March 06, 2023	Static Routing	Chapter 11 *(Subnetting)*	Lab 07 - Static & Default Routs	3.0%
Week 10	Monday, March 13, 2023	Dynamic Routing - RIP	Chapter 12 *(Additional Transmission Modalities)*	Lab 08 - RIP Protocol	3.0%
Week 11	Monday, March 20, 2023	Dynamic Routing - OSPF	Chapter 14 *(RA & LD Communications)*	Lab 09 - OSPF Protocol	3.0%
Week 12	Monday, March 27, 2023	Access Control Lists	Chapter 15 *(Network Security)*	Lab 10 - ACLs	3.0%
Week 13	Monday, April 03, 2023	DHCP	Chapter 16 *Maintaining the Network)*	Lab 11 - DHCP	3.0%
Week 14	Monday, April 10, 2023	NAT	Chapter 17 *(Troubleshooting Fundamentals of a Network)*	Lab 12 - NAT	3.0%
Week 15	Monday, April 17, 2023	Final Test		Final Test (Test 2)	32%

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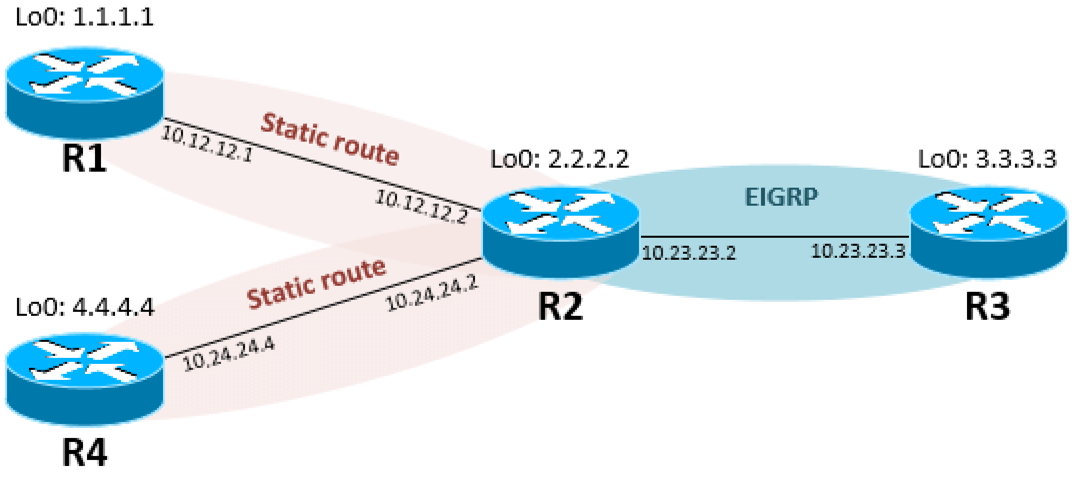
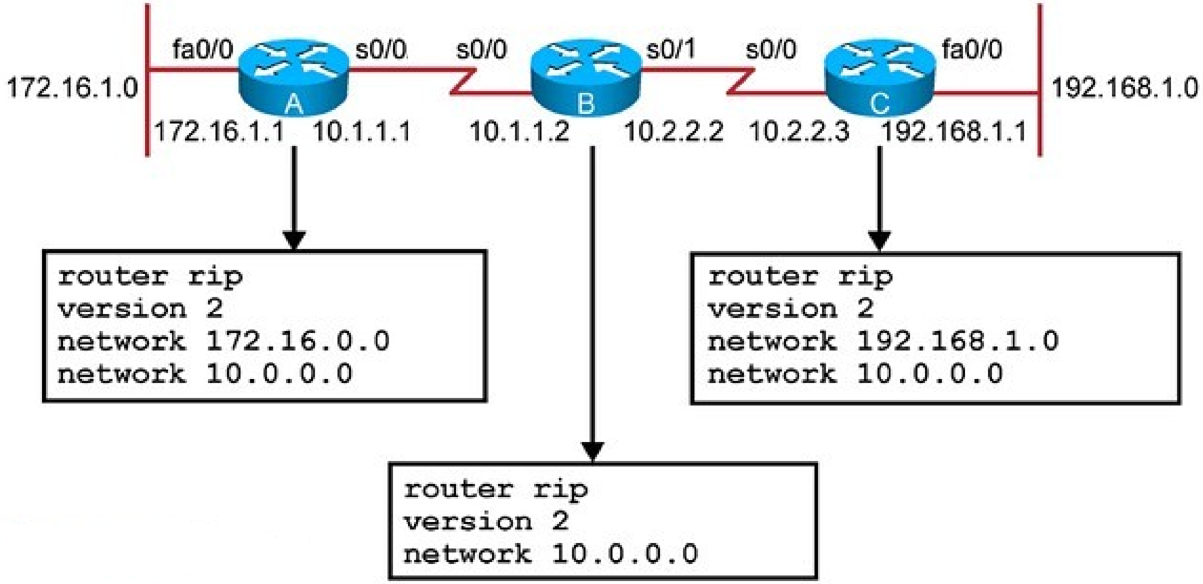
Review - Lecture 07 – Static Routing

- Static Routes
- Default Static Routes
- Floating Static Route
- IPv6
  - Link-Local
- Troubleshoot a Missing Route
- VLSM - CIDR
  - IP Addressing
  - Static Route Summarization
  - Route Summarization
  - Summarize IPv6 Addresses



Summary - Dynamic Routing - RIP

- Dynamic Routing Protocols
- Routing Protocol Operating Fundamentals
- Types of Routing Protocols
- Distance Vector Routing Protocol Operation
- RIP
- Configuring the RIP Protocol
- Configuring the RIPng Protocol
- Parts of an IPv4 Route Entry
- Parts of an IPv6 Route Entry
- Lab



Dynamic Routing Protocols

- Evolution of Dynamic Routing Protocols
  - Dynamic routing protocols used in networks since the late 1980s
  - Newer versions support the communication based on IPv6

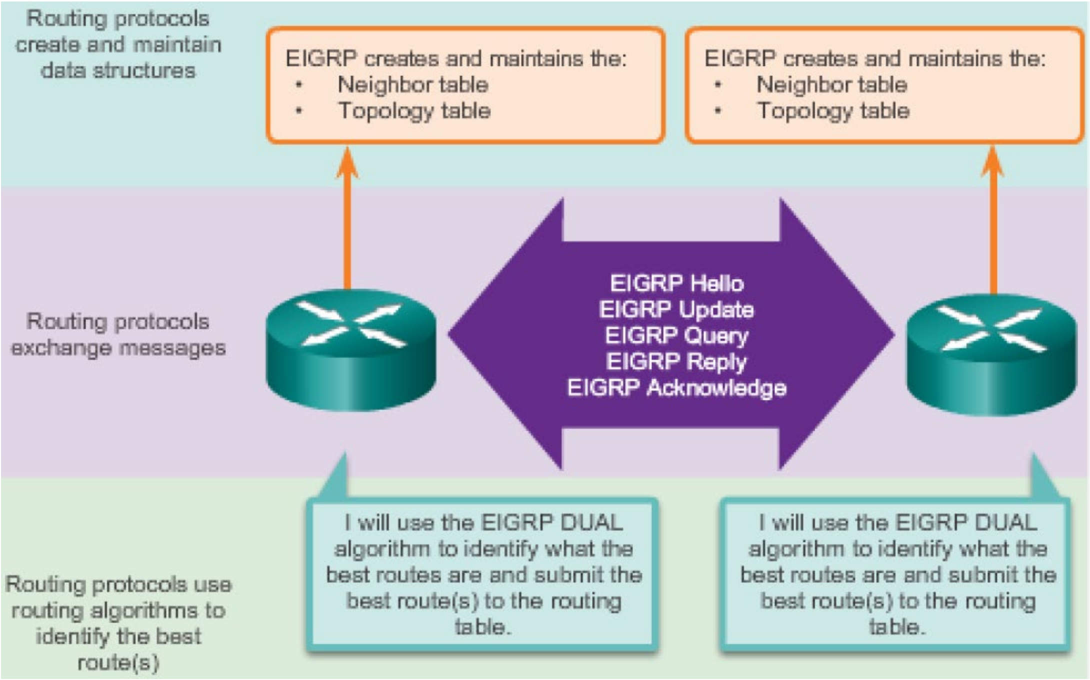
IP Version	Interior Gateway Protocols				Exterior Gateway Protocols
	Distance Vector		Link-State		Path Vector
IPv4	RIPv2	EIGRP	OSPFv2	IS-IS	BGP-4
IPv6	RIPng	EIGRP	OSPFv3	IS-IS	BGP-MP

- Routing Protocols are used to facilitate the exchange of routing information between routers.
- 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

Dynamic Routing Protocols (continued)

- Main components of dynamic routing protocols include:
  - **Data structures** - Routing protocols typically use tables or databases for its operations. This information is kept in RAM.
  - **Routing protocol messages** - Routing protocols use various types of messages to discover neighboring routers, exchange routing information, and other tasks to learn and maintain accurate information about the network.
  - **Algorithm** - Routing protocols use algorithms for facilitating routing information for best path determination.

Components of Routing Protocols

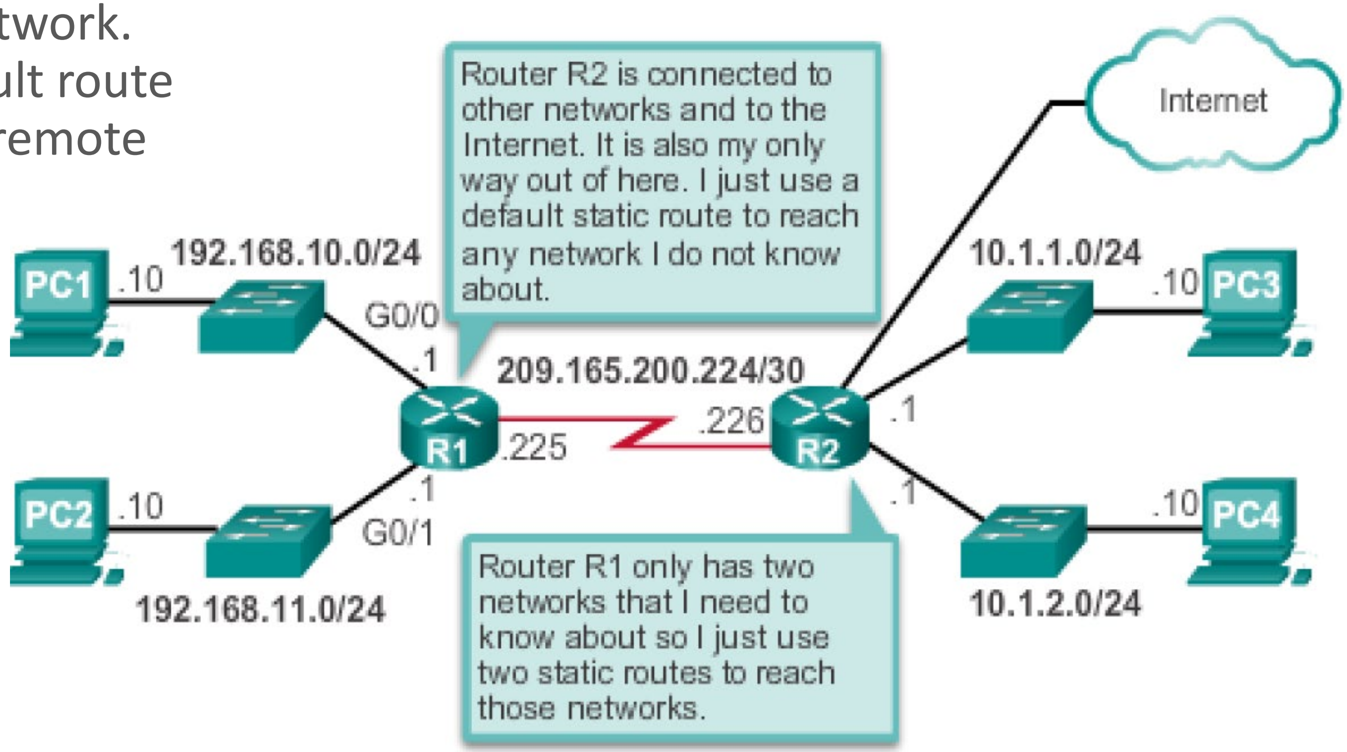


Dynamic Routing Protocols (continued)

- The Role of Dynamic Routing Protocols
  - Advantages of dynamic routing include:
    - Automatically share information about remote networks
    - Determine the best path to each network and add this information to their routing tables
    - Compared to static routing, dynamic routing protocols require less administrative overhead
    - Help the network administrator manage the time-consuming process of configuring and maintaining static routes
  - Disadvantages of dynamic routing include:
    - Part of a router's resources are dedicated for protocol operation, including CPU time and network link bandwidth
    - Times when static routing is more appropriate

Dynamic Routing Protocols (continued)

- Using Static Routing
  - Networks typically use a combination of both static and dynamic routing.
  - Static routing has several primary uses:
    - Providing ease of routing table maintenance in smaller networks that are not expected to grow significantly.
    - Routing to and from a stub network. A network with only one default route out and no knowledge of any remote networks.
    - Accessing a single default router. This is used to represent a path to any network that does not have a match in the routing table.



Dynamic Routing Protocols (continued)

- Static Routing vs Dynamic Routing Scorecard

Static Routing

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

Dynamic Routing

Advantages	Disadvantages
Suitable in all topologies where multiple routs 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 re-route traffic if possible	Route depends on the current topology
	Requires additional CPU, RAM, and link bandwidth

Routing Protocol Operating Fundamentals

- Dynamic Routing Protocol Operation
  - In general, the operations of a dynamic routing protocol can be described as follows:
    1. The router sends and receives routing messages on its interfaces.
    2. The router shares routing messages and routing information with other routers that are using the same routing protocol.
    3. Routers exchange routing information to learn about remote networks.
    4. When a router detects a topology change the routing protocol can advertise this change to other routers.

(The next 7 slides will take you through the steps above for the RIP protocol and 3 routers)

  - Network Discovery (starting at slide 2 of the next 7)
    - The routing table is built by the exchange of routing information
    - If a routing protocol is configured then routers will exchange routing information
    - Routing updates received from other routers
    - Router checks update for new information - new information is stored in routing table

Don’t confuse the above with the new protocol called “Network Discovery” in IPv6 (this has to do with the link-local part of IPv6)

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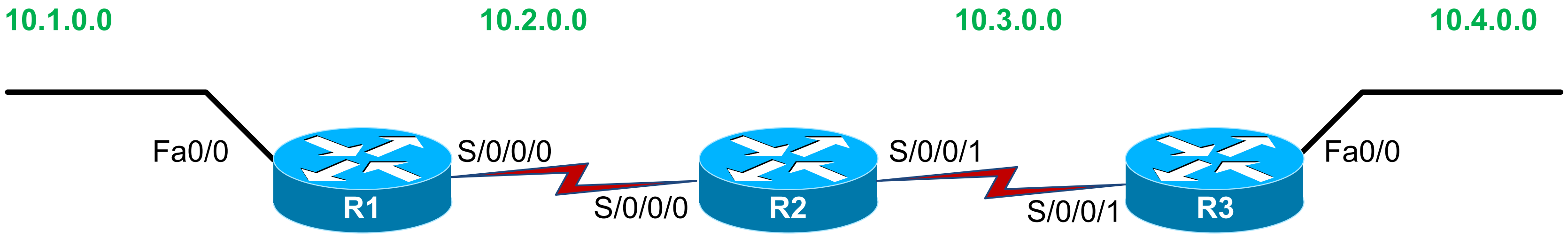
Routing Protocol Operating Fundamentals (continued)

- Cold Start



Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	s0/0/1	0

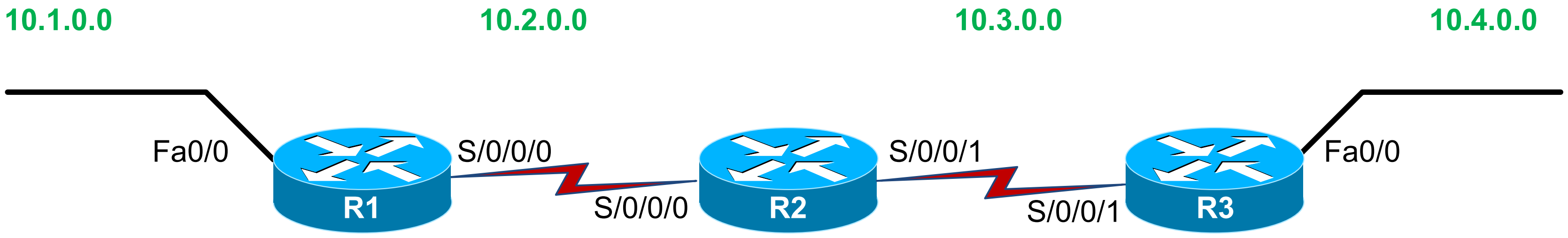
Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa0/0	0

Routers running RIPv2

- R1 adds the 10.1.0.0 network available through interface FastEthernet0/0 and 10.2.0.0 is available through interface Serial 0/0/0.
- R2 adds the 10.2.0.0 network available through interface Serial 0/0/0 and 10.3.0.0 is available through interface Serial 0/0/1.
- R3 adds the 10.3.0.0 network available through interface Serial 0/0/1 and 10.4.0.0 is available through interface FastEthernet0/0.

Routing Protocol Operating Fundamentals (continued)

- Network Discovery



Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	s0/0/1	0
10.1.0.0	S0/0/0	1

Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa0/0	0

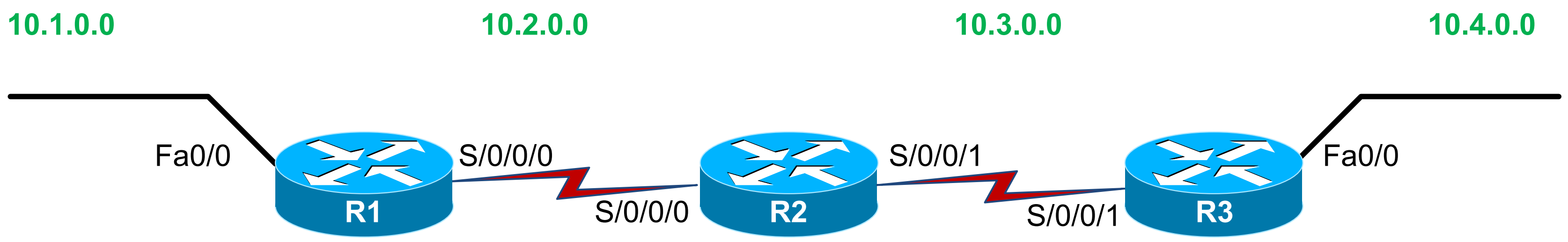
Routers running RIPv2

R1:

- Sends an update about network 10.1.0.0 out the Serial0/0/0 interface
- Sends an update about network 10.2.0.0 out the FastEthernet0/0 interface
- Receives update from R2 about network 10.3.0.0 with a metric of 1
- Stores network 10.3.0.0 in the routing table with a metric of 1

Routing Protocol Operating Fundamentals (continued)

- Network Discovery
  (Continued)



Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	s0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	1

Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa0/0	0
10.2.0.0	S0/0/1	1

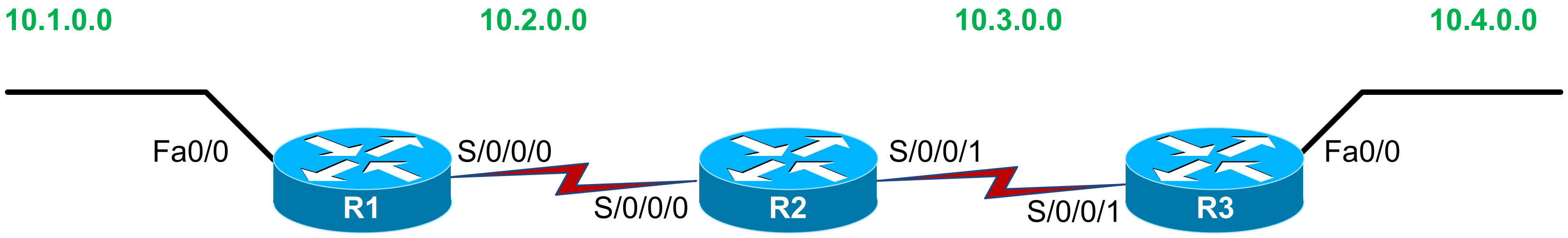
Routers running RIPv2

R2:

- Sends an update about network 10.3.0.0 out the Serial 0/0/0 interface
- Sends an update about network 10.2.0.0 out the Serial 0/0/1 interface
- Receives an update from R1 about network 10.1.0.0 with a metric of 1
- Stores network 10.1.0.0 in the routing table with a metric of 1
- Receives an update from R3 about network 10.4.0.0 with a metric of 1
- Stores network 10.4.0.0 in the routing table with a metric of 1

Routing Protocol Operating Fundamentals (continued)

- Network Discovery
  (Continued)



Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	s0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	1

Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa0/0	0
10.2.0.0	S0/0/1	1

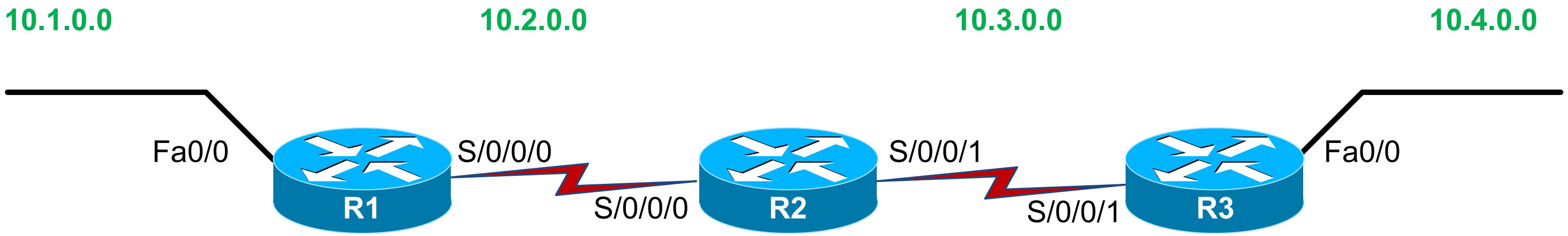
Routers running RIPv2

R3:

- Sends an update about network 10.4.0.0 out the Serial 0/0/1 interface
- Sends an update about network 10.3.0.0 out the FastEthernet0/0
- Receives an update from R2 about network 10.2.0.0 with a metric of 1
- Stores network 10.2.0.0 in the routing table with a metric of 1

Routing Protocol Operating Fundamentals (continued)

- Exchanging the Routing Information



Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1
10.4.0.0	S0/0/0	2

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	s0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	1

Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa0/0	0
10.2.0.0	S0/0/1	1

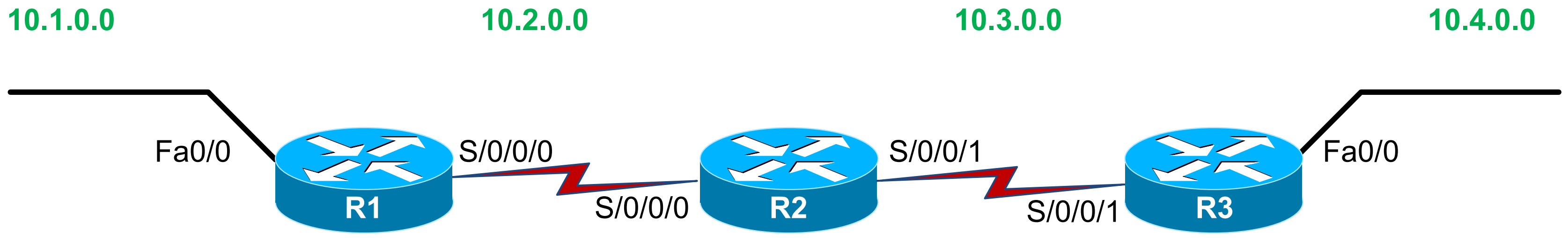
Routers running RIPv2

R1:

- Sends an update about network 10. 1. 0. 0 out the Serial 0/0/0 interface
- Sends an update about networks 10. 2. 0. 0 and 10. 3. 0. 0 out the FastEthernet0/0 interface
- Receives an update from R2 about network 10. 4. 0. 0 with a metric of 2
- Stores network 10. 4. 0. 0 in the routing table with a metric of 2
- Same update from R2 contains information about network 10. 3. 0. 0 with a metric of 1. There is no change; therefore, the routing information remains the same

Routing Protocol Operating Fundamentals (continued)

- Exchanging the Routing Information (continued)



Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1
10.4.0.0	S0/0/0	2

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	s0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	1

Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa0/0	0
10.2.0.0	S0/0/1	1
10.1.0.0	S0/0/1	2

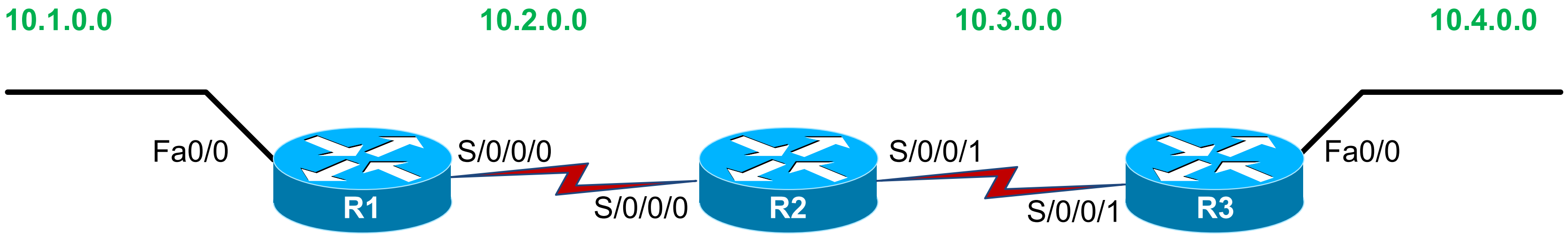
Routers running RIPv2

R2:

- Sends an update about networks 10. 3. 0. 0 and 10. 4. 0. 0 out of Serial 0/0/0 interface
- Sends an update about networks 10. 1. 0. 0 and 10. 2. 0. 0 out of Serial 0/0/1 interface
- Receives an update from R1 about network 10. 1. 0. 0. There is no change; therefore, the routing information remains the same.
- Receives an update from R3 about network 10. 4. 0. 0. There is no change; therefore, the routing information remains the same.

Routing Protocol Operating Fundamentals (continued)

- Exchanging the Routing Information (continued)



Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1
10.4.0.0	S0/0/0	2

Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	s0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	1

Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa0/0	0
10.2.0.0	S0/0/1	1
10.1.0.0	S0/0/1	2

Routers running RIPv2

R3:

- Sends an update about network 10. 4. 0. 0 out the Serial 0/0/1 interface
- Sends an update about networks 10. 2. 0. 0 and 10. 3. 0. 0 out the FastEthernet0/0 interface
- Receives an update from R2 about network 10. 1. 0. 0 with a metric of 2
- Stores network 10. 1. 0. 0 in the routing table with a metric of 2
- Same update from R2 contains information about network 10. 2. 0. 0 with a metric of 1. There is no change; therefore, the routing information remains the same.

Routing Protocol Operating Fundamentals (continued)

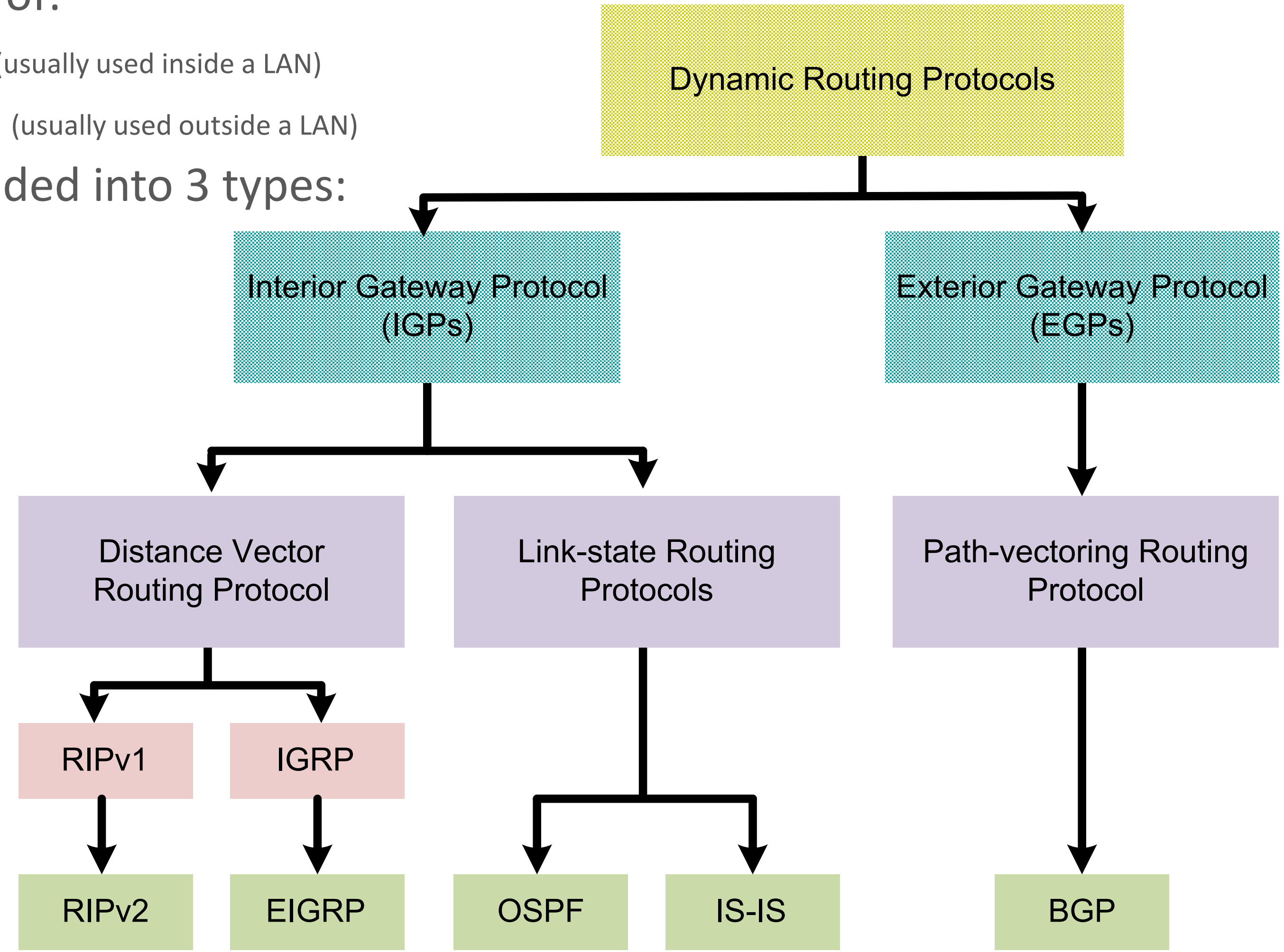
- Achieving Convergence
  - The network is converged when all routers have complete and accurate information about the entire network:
    - Convergence time is the time it takes routers to share information, calculate best paths, and update their routing tables.
    - A network is not completely operable until the network has converged.
    - Convergence properties include the speed of propagation of routing information and the calculation of optimal paths. The speed of propagation refers to the amount of time it takes for routers within the network to forward routing information.
    - Generally, older protocols, such as RIP, are slow to converge, whereas modern protocols, such as EIGRP and OSPF, converge more quickly.

NOTE!

This is not the same convergence we talked about in week 01 (Lecture-01-Introduction)slide 30ish “Converging of complex networks”

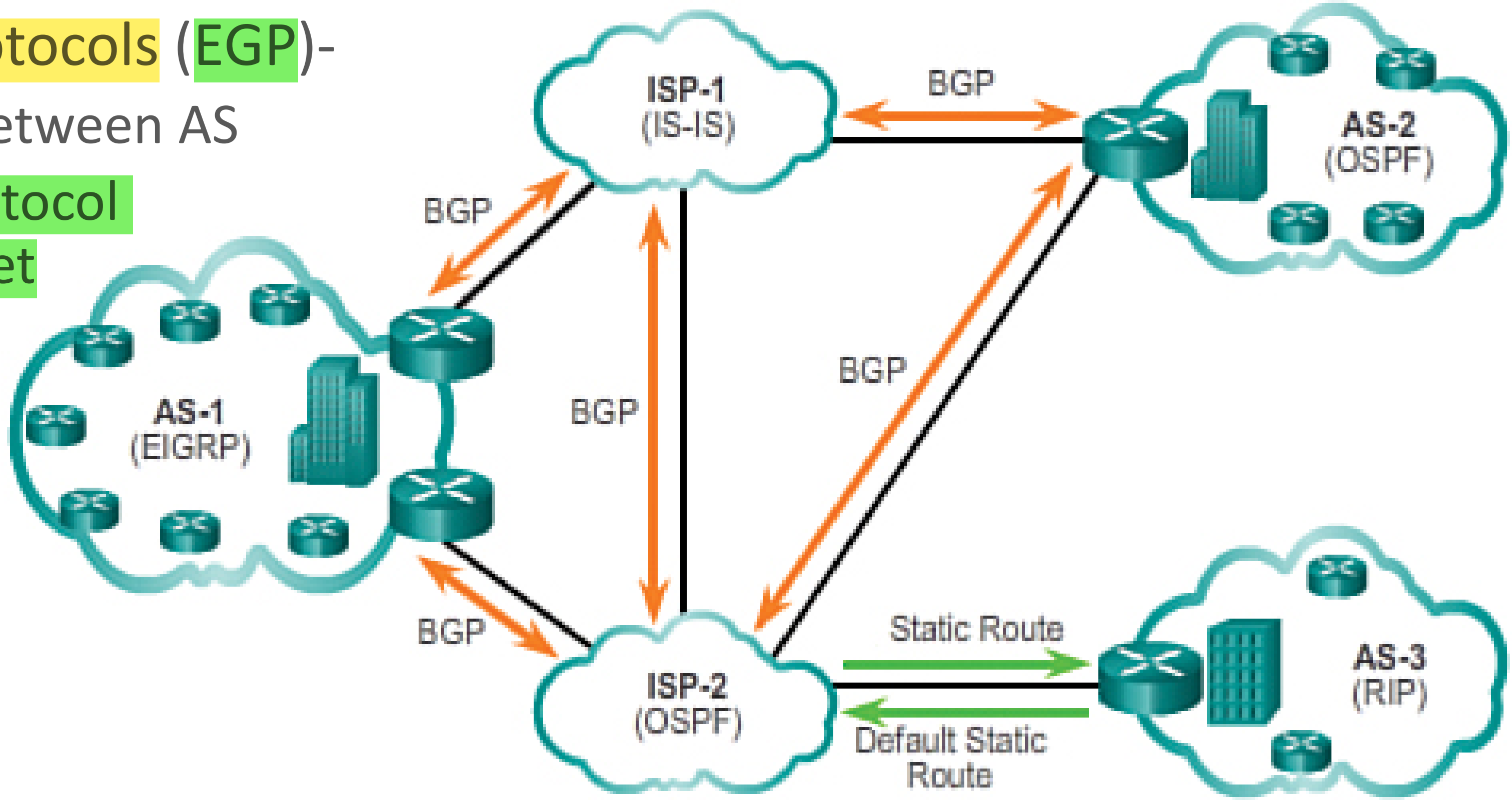
Types of Routing Protocols

- Classifying Routing Protocols
  - Dynamic routing protocols consist of:
    - Interior Gateway Protocols (IGP) (usually used inside a LAN)
    - Exterior Gateway Protocols (EGP) (usually used outside a LAN)
  - Dynamic routing protocols are divided into 3 types:
    - Distance Vectoring
    - Link-State
    - Path-Vectoring



Types of Routing Protocols (continued)

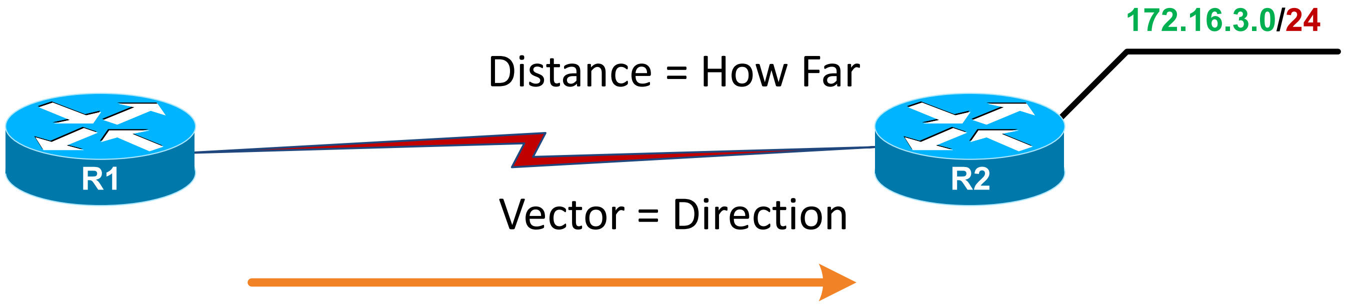
- IGP and EGP Routing Protocols
  - Interior Gateway Protocols (IGP)-
    - Used for routing within an AS
    - Include RIP, EIGRP, OSPF, and IS-IS
  - Exterior Gateway Protocols (EGP)-
    - Used for routing between AS
    - Official routing protocol used by the Internet



Types of Routing Protocols (continued)

- Distance Vector Routing Protocols
  - Distance vector IPv4 IGPs:
    - RIPv1-First generation legacy protocol
    - RIPv2-Simple distance vector routing protocol
    - IGRP-First generation Cisco proprietary protocol (obsolete)
    - EIGRP-Advanced version of distance vector routing

The Meaning of Distance Vector



For R1, 172.16.3.0/24 is one hop away (distance). It can be reached through R2 (vector).

Types of Routing Protocols (continued)

- **Distance vector routing protocols** - use routers as sign posts along the path to the final destination.

- **A link-state routing protocol** - is like having a complete map of the network topology. The sign posts along the way from source to destination are not necessary, because all link-state routers are using an identical map of the network. A link-state router uses the link-state information to create a topology map and to select the best path to all destination networks in the topology.

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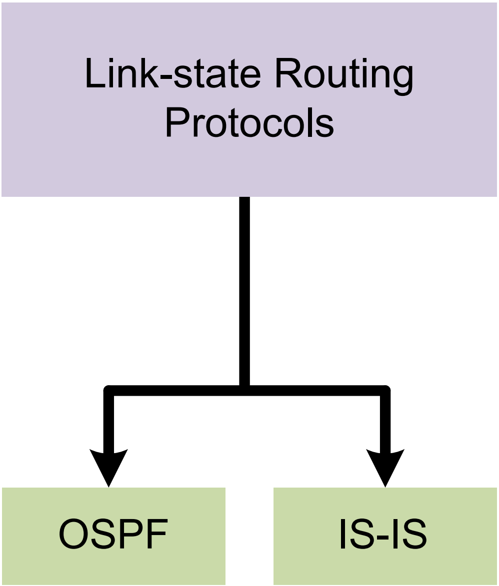
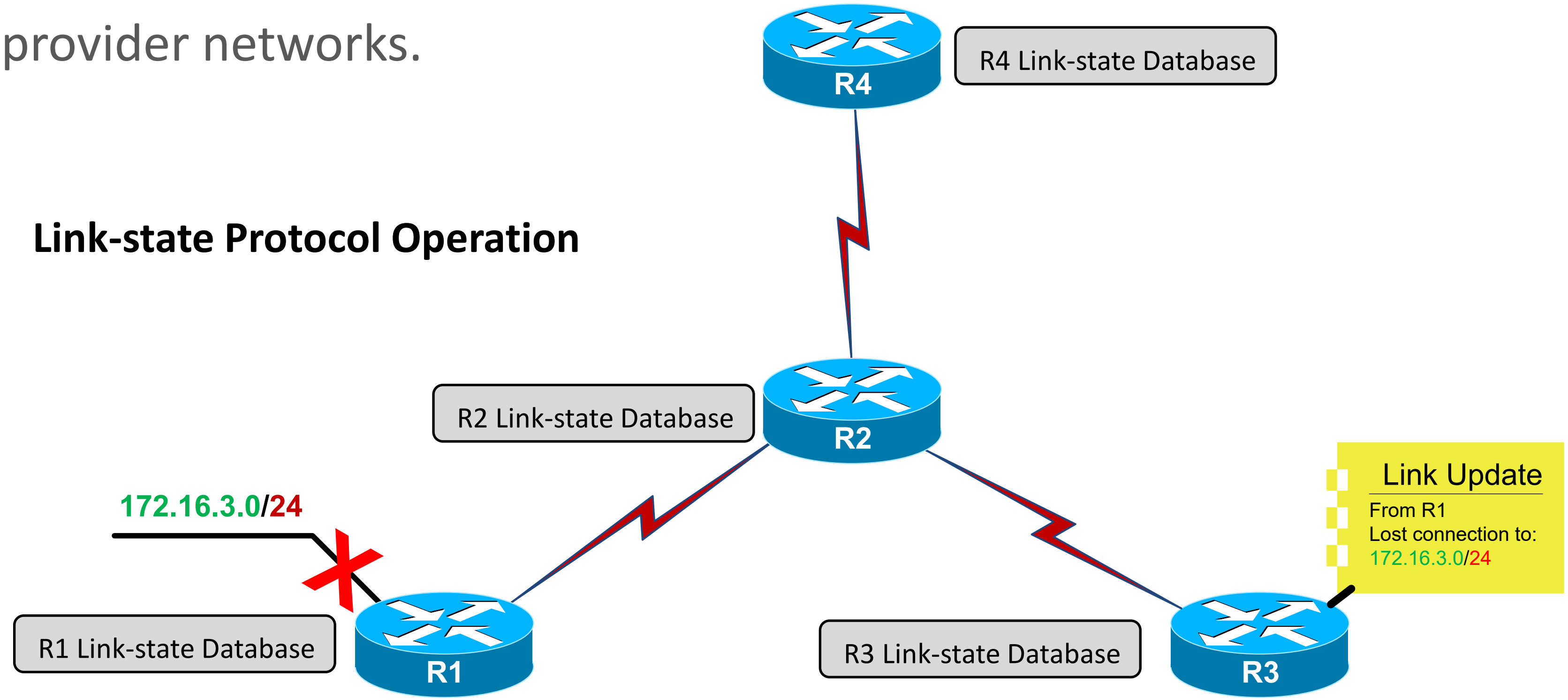
Types of Routing Protocols (continued)

- Link-State Routing Protocols
  - Link-state IPv4 IGPs:
    - OSPF -Popular standards based routing protocol
    - IS-IS -Popular in provider networks.





Link-state Protocol forwards updates when the state of a link changes

Types of Routing Protocols (continued)

- **Classful** Routing Protocols
  - Classful routing protocols do not send subnet mask information in their routing updates:
    - Only RIPv1 and IGRP are classful.
    - Created when network addresses were allocated based on classes (class A, B, or C).
    - Cannot provide **V**ariable **L**ength **S**ubnet **M**asks (**VLSM**s) and **C**lassless **I**nter**D**omain **R**outing (**CIDR**).
    - Create problems in discontinuous networks.

A = **0nnn nnnn** / **hhhh hhhh hhhh hhhh hhhh hhhh** = **16,777,216** hosts
0-127 / **X** . **X** . **X** = **127** networks

B = **10nn nnnn nnnn nnnn** / **hhhh hhhh hhhh hhhh** = **65,535** hosts
128-191 **(63)** . **X** / **X** . **X** = **16,128** networks

C = **110n nnnn nnnn nnnn nnnn nnnn** / **hhhh hhhh** = **256** hosts
192-223(31) . **X** . **X** **X** = **2,031,585** networks

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Types of Routing Protocols (continued)

- **Classless** Routing Protocols
  - Classless routing protocols include subnet mask information in the routing updates:
    - RIPv2, EIGRP, OSPF, and IS_IS
    - Support VLSM and CIDR
    - IPv6 routing protocols **(IPv6 can not be "class full"!)**
  - Today's networks are mostly no longer allocated based on class
    - Subnet mask cannot be determined by the value of the first octet (use prefix - /24)

Types of Routing Protocols (continued)

- Routing Protocol Characteristics

	Distance Vector				Link-state	
	RIPv1	RIPv2	IGRP	EIGRP	OSPF	IS-IS
Speed Convergence	Slow	Slow	Slow	Fast	Fast	Fast
Scalability - Size of network	Small	Small	Small	Large	Large	Large
Use of VLSM	No	Yes	No	Yes	Yes	Yes
Resource Usage	Low	Low	Low	Medium	High	High
Implementation & Maintenance	Simple	Simple	Simple	Complex	Complex	Complex

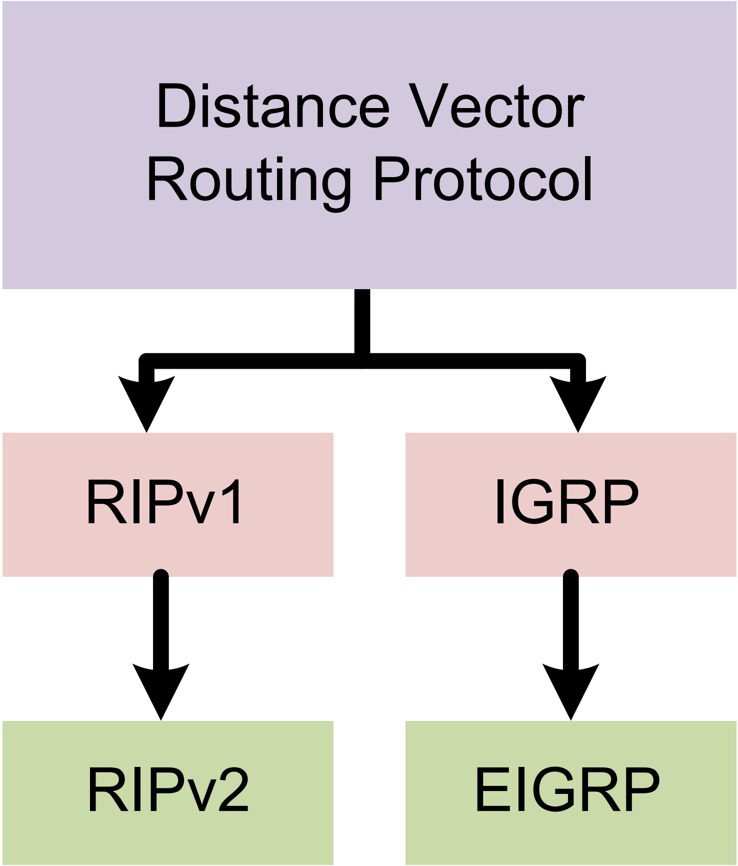
- Routing Protocol Metrics
  - A metric is a measurable value that is assigned by the routing protocol to different routes based on the usefulness of that route:
    - Used to determine the overall “cost” of a path from source to destination.
    - Routing protocols determine the best path based on the route with the lowest cost.

Types of Routing Protocols (continued)

- Routing Protocol Metrics (continued)
  - A metric is a measurable value that is assigned by the routing protocol to different routes based on the usefulness of that route:
    - Used to determine the overall “cost” of a path from source to destination.
    - Routing protocols determine the best path based on the route with the lowest cost.

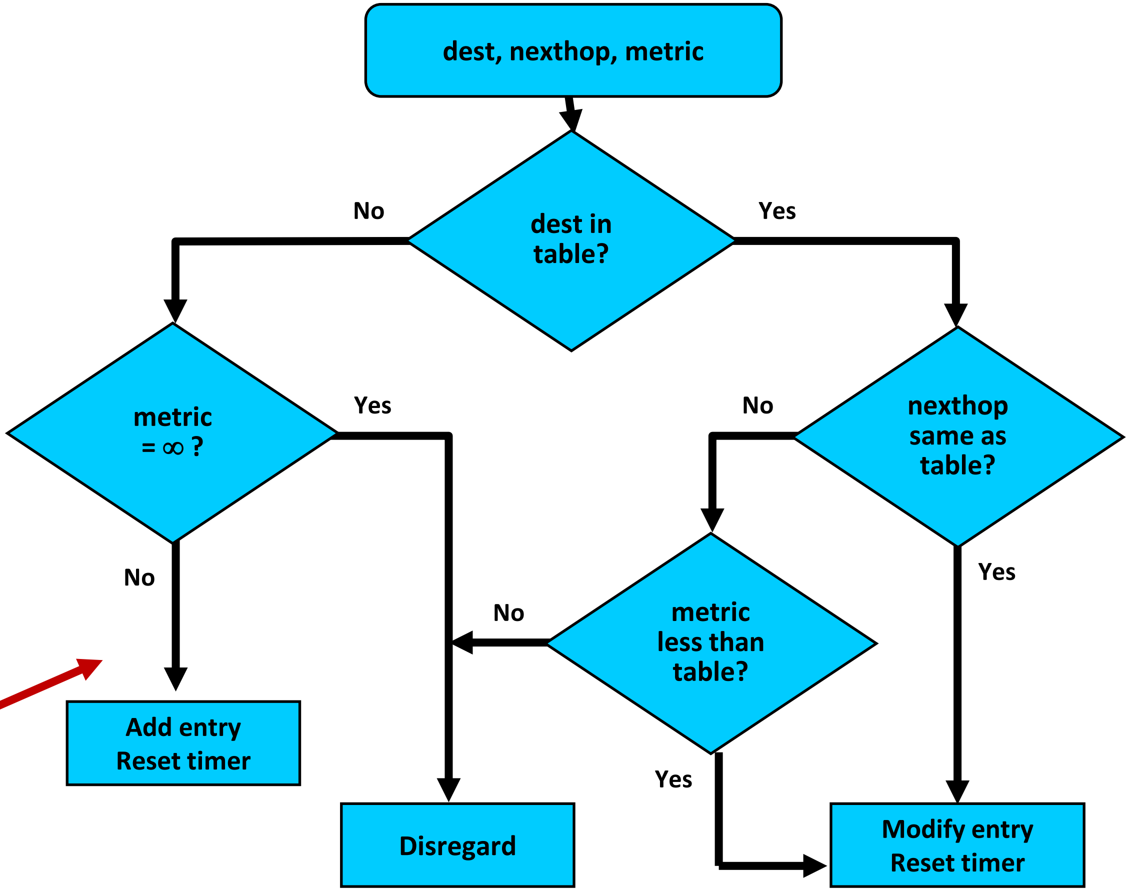
Distance Vector Routing Protocol Operation

- Distance Vector Technologies
  - Distance vector routing protocols:
    - Share updates between neighbors
    - Not aware of the network topology
    - Some send periodic updates to broadcast IP 255.255.255.255 even if topology has not changed
    - Updates consume bandwidth and network device CPU resources
    - RIPv2 and EIGRP use multicast addresses
    - EIGRP will only send an update when topology has changed



Distance Vector Routing Protocol Operation (continued)

- Distance Vector Algorithm
  - Purpose of routing Algorithms
    - Send and receive updates
    - Calculate best path and install route
    - Detect and react to topology changes



- RIP uses the **Bellman-Ford** algorithm as its routing algorithm.
- IGRP and EIGRP use the **D**iffusing **U**pdate **Al**gorithm (**DUAL**) routing algorithm developed by Cisco.

Distance Vector Routing Protocol Operation (continued)

- **R**outing **I**nformation **P**rotocol (**RIP**):
  - Routing updates broadcasted every 30 seconds
  - Updates use UDP port 520
  - RIPng is based on RIPv2 with a 15 hop limitation and the administrative distance of 120

Characteristics and Features	RIPv1	RIPv2
Metric	Both use hop count as a simple metric. The maximum number of hops is 15.	
Updates Forwarded to Address	255.255.255.255	224.0.0.9
Supports VLSM	✗	✓
Supports CIDR	✗	✓
Supports Summarization	✗	✓
Supports Authentication	✗	✓

Distance Vector Routing Protocol Operation (continued)

- **E**nhanced **I**nterior-**G**ateway **R**outing **P**rotocol (**EIGRP**)
  - Is bounded triggered updates
  - Uses a Hello keepalives mechanism
  - Maintains a topology table
  - Supports rapid convergence
  - Is a multiple network layer protocol support

Characteristics and Features	IGRP	EIGRP
Metric	Both use a composite metric consisting of bandwidth and delay. Reliability and load can also be included in the metric calculation.	
Updates Forwarded to Address	255.255.255.255	224.0.0.10
Supports VLSM	✗	✓
Supports CIDR	✗	✓
Supports Summarization	✗	✓
Supports Authentication	✗	✓

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RIP

- Generally
  - Metric based on hop count
  - Routing updates sent every 30 seconds by default
  - Maximum hops is 15 by default - limited to networks whose longest path (the network's diameter) is 15 hops -16 hops means unreachable
  - Uses UDP as transport layer protocol, port 520
- Differences RIPv1 & RIPv2
  - RIPv1
    - A classful distance vector routing protocol
    - Does not send subnet mask in routing update
    - Does not support VLSM & CIDR – does not support discontinuous subnet
    - Routing updates are broadcast
  - RIPv2
    - A classless distance vector routing protocol that is an enhancement of RIPv1’s features.
    - Subnet mask is included in updates (supports VLSM & CIDR)
    - Routing updates are multicast (224.0.0.9)
    - The use of authentication is an option

RIP (continued)

- RIP Operation
  - RIP Operation
    - 2 message types:
      - Request message - sent out on startup by each RIP enabled interface -requests all RIP enabled neighbors to send routing table
      - Response message - message sent to requesting router containing routing table
- RIP Timers
  - Periodic updates: RIPv1 & RIPv2
    - the time intervals in which a router sends out its entire routing table – **every 30 seconds**
  - RIP uses **4 timers**
    - update timer – 30 sec
    - invalid timer – 180 sec - If an update has not been received in 180 seconds (the default), the route is marked as invalid by setting the metric to 16 (16 means unreachable)
    - hold-down timer – 180 sec
    - flush timer – 240 sec - when the flush timer expires, the route is removed from the routing table

RIP (continued)

- Routing Loops
  - A condition in which a packet is continuously transmitted within a series of routers without ever reaching its destination
  - May be caused by:
    - slow convergence
    - incorrectly configured static routes
    - incorrectly configured route redistribution
  - Can create the following issues:
    - excess use of bandwidth
    - CPU resources may be strained
    - network convergence is degraded
    - routing updates may be lost or not processed in a timely manner

RIP (continued)

- Prevent Routing Loops
  - Defining a maximum metric - count to infinity
  - Triggered updates
  - Hold-down timers - allow a router to not accept any changes to a route for a specified period of time
  - Split horizon
  - Poison Reverse is also used to prevent routing loops
    - instead of not advertising routes to the source, routes are advertised back to the source with a metric of 16

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RIP (continued)

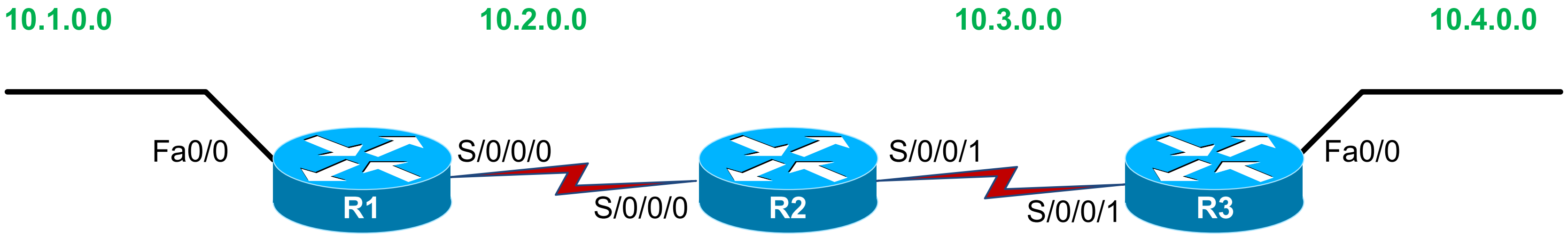
- Prevent Routing Loops (continued)
  - **Split Horizon** - a router should not advertise a network out through the interface from which the update was received

Split Horizon Rule for 10.4.0.0

R2 only advertises 10.3.0.0 and 10.4.0.0 to R1
R2 only advertises 10.2.0.0 and 10.1.0.0 to R3

R1 only advertises 10.1.0.0 to R2

R3 only advertises 10.4.0.0 to R2



Network	Interface	Hop
10.1.0.0	Fa0/0	0
10.2.0.0	S0/0/0	0
10.3.0.0	S0/0/0	1
10.4.0.0	S0/0/0	2

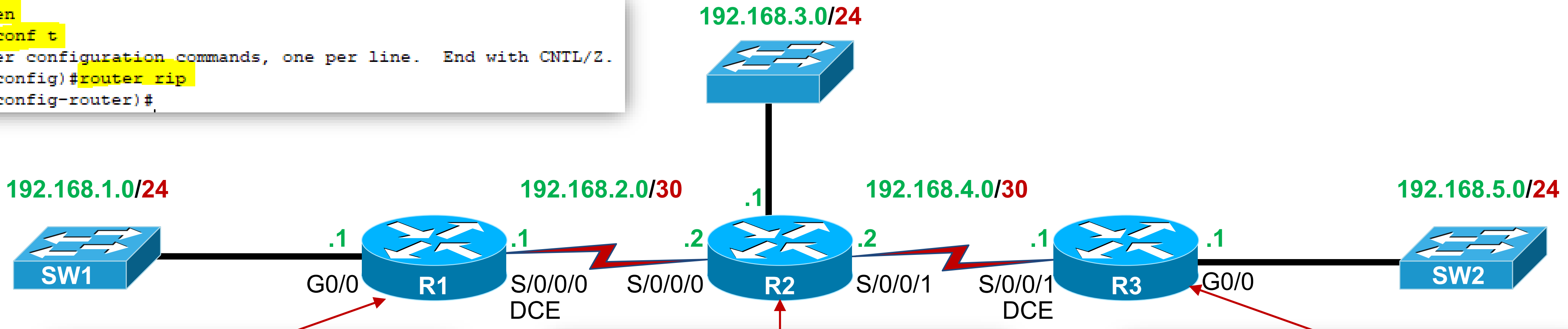
Network	Interface	Hop
10.2.0.0	S0/0/0	0
10.3.0.0	s0/0/1	0
10.1.0.0	S0/0/0	1
10.4.0.0	S0/0/1	1

Network	Interface	Hop
10.3.0.0	S0/0/1	0
10.4.0.0	Fa0/0	0
10.2.0.0	S0/0/1	1
10.1.0.0	S0/0/1	2

Configuring the RIP Protocol

- Router RIP Configuration Mode - Advertising Networks

```
R1>en
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router rip
R1(config-router)#
```




```
R1(config)#router rip
R1(config-router)#network 192.168.1.0
R1(config-router)#network 192.168.2.0
R1(config-router)#ver 2
```

```
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#network 192.168.2.0
Router(config-router)#network 192.168.3.0
Router(config-router)#network 192.168.4.0
```

```
Router(config)#router rip
Router(config-router)#ver 2
Router(config-router)#network 192.168.4.0
Router(config-router)#network 192.168.5.0
```

```
Gateway of last resort is not set

     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0
L       192.168.1.1/32 is directly connected, GigabitEthernet0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/30 is directly connected, Serial0/0/0
L       192.168.2.1/32 is directly connected, Serial0/0/0
R    192.168.3.0/24 [120/1] via 192.168.2.2, 00:00:14, Serial0/0/0
R    192.168.4.0/24 [120/1] via 192.168.2.2, 00:00:14, Serial0/0/0
R    192.168.5.0/24 [120/2] via 192.168.2.2, 00:00:14, Serial0/0/0
```

```
Gateway of last resort is not set

R    192.168.1.0/24 [120/1] via 192.168.2.1, 00:00:07, Serial0/0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/30 is directly connected, Serial0/0/0
L       192.168.2.2/32 is directly connected, Serial0/0/0
     192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, GigabitEthernet0/0
L       192.168.3.1/32 is directly connected, GigabitEthernet0/0
     192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.4.0/30 is directly connected, Serial0/0/1
L       192.168.4.2/32 is directly connected, Serial0/0/1
R    192.168.5.0/24 [120/1] via 192.168.4.1, 00:00:14, Serial0/0/1
```

```
Gateway of last resort is not set

R    192.168.1.0/24 [120/2] via 192.168.4.2, 00:00:06, Serial0/0/1
R    192.168.2.0/24 [120/1] via 192.168.4.2, 00:00:06, Serial0/0/1
R    192.168.3.0/24 [120/1] via 192.168.4.2, 00:00:06, Serial0/0/1
     192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.4.0/30 is directly connected, Serial0/0/1
L       192.168.4.1/32 is directly connected, Serial0/0/1
     192.168.5.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.5.0/24 is directly connected, GigabitEthernet0/0
L       192.168.5.1/32 is directly connected, GigabitEthernet0/0
```

Configuring the RIP Protocol (continued)

- Enabling RIPv2
  - Verifying RIP settings on R1
    - (**do**) **show ip protocols**

```
R1(config-router)#do show IP pro
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 8 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 1, receive 1
  Interface             Send  Recv  Triggered RIP  Key-chain
  GigabitEthernet0/0    1     1
  Serial0/0/0           1     1
Automatic network summarization is in effect
Maximum path: 4
Routing for Networks:
          192.168.1.0
          192.168.2.0
Passive Interface(s):
Routing Information Sources:
          Gateway         Distance      Last Update
          192.168.2.2          120      00:00:46
Distance: (default is 120)
```

```
R1(config-router)#ver 2
R1(config-router)#do show IP pro
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 21 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 2
  Interface             Send  Recv  Triggered RIP  Key-chain
  GigabitEthernet0/0    2     2
  Serial0/0/0           2     2
Automatic network summarization is in effect
Maximum path: 4
Routing for Networks:
          192.168.1.0
          192.168.2.0
Passive Interface(s):
Routing Information Sources:
          Gateway         Distance      Last Update
          192.168.2.2          120      00:01:01
Distance: (default is 120)
```

Configuring the RIP Protocol (continued)

- Disabling Auto Summarization
  - Similarly to RIPv1, RIPv2 automatically summarizes networks at **major network boundaries** by default.
  - To modify the default RIPv2behavior of automatic summarization, use the **no auto-summary** router configuration mode command.
  - This command has no effect when using RIPv1.
  - When automatic summarization has been disabled, RIPv2 no longer summarizes networks to their classful address at boundary routers. **RIPv2** now includes all subnets and their appropriate masks in its routing updates.
  - The **show ip protocols** now states that automatic network summarization is not in effect.

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Configuring the RIP Protocol (continued)

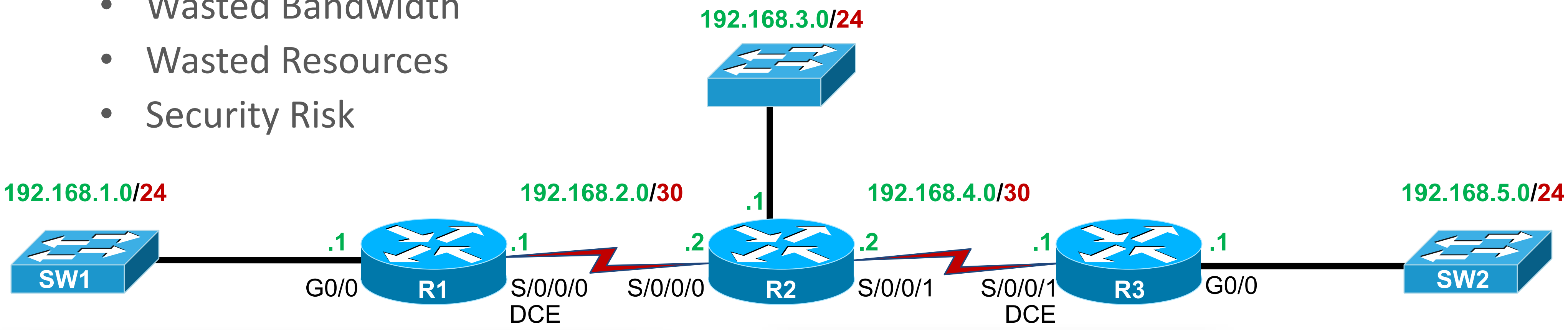
- Disabling Auto Summarization (continued)
  - By issuing the command **no auto-summery**

```
R1(config-router)#do show ip protocols
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 27 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 2
  Interface             Send  Recv  Triggered RIP  Key-chain
  GigabitEthernet0/0    2     2
  Serial0/0/0           2     2
Automatic network summarization is in effect
Maximum path: 4
Routing for Networks:
           192.168.1.0
           192.168.2.0
Passive Interface(s):
Routing Information Sources:
           Gateway         Distance      Last Update
           192.168.2.2          120      00:00:12
Distance: (default is 120)
```

```
R1(config-router)#no auto-summary
R1(config-router)#
R1(config-router)#do show ip protocols
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 20 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 2
  Interface             Send  Recv  Triggered RIP  Key-chain
  GigabitEthernet0/0    2     2
  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):
Routing Information Sources:
           Gateway         Distance      Last Update
           192.168.2.2          120      00:00:22
Distance: (default is 120)
```

Configuring the RIP Protocol (continued)

- Configuring Passive Interfaces
  - Sending out unneeded updates on a LAN impacts the network in three ways:
    - Wasted Bandwidth
    - Wasted Resources
    - Security Risk



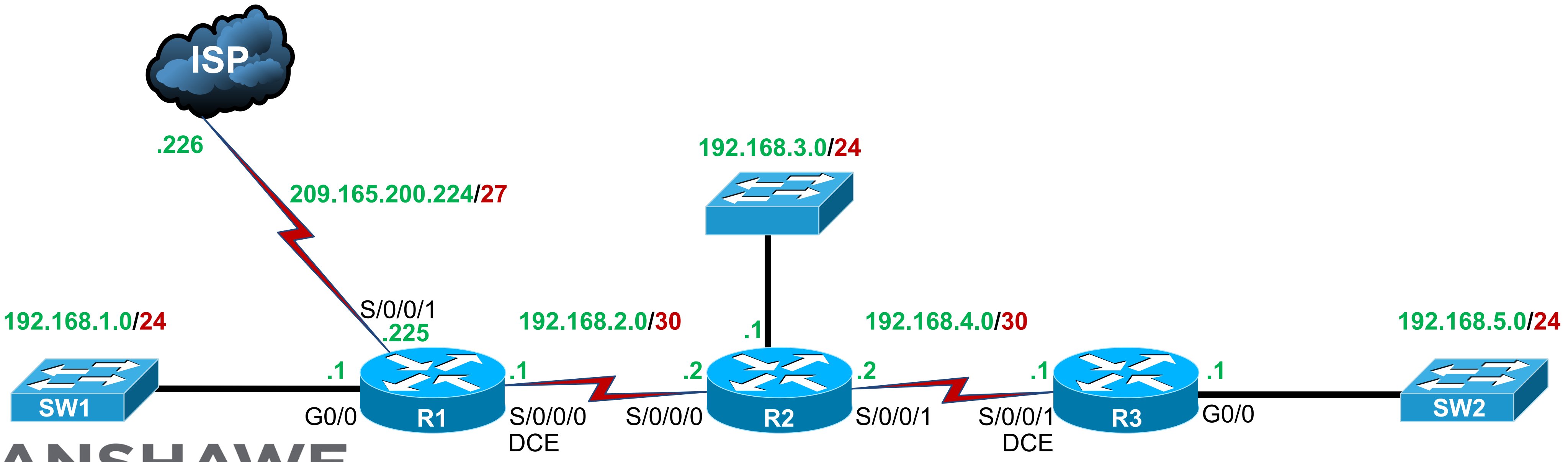

```
Default version control: send version 2, receive 2
  Interface             Send  Recv  Triggered RIP  Key-chain
  GigabitEthernet0/0    2     2
  Serial0/0/0           2     2
Automatic network summarization is not in effect
Maximum path: 4
Routing for Networks:
          192.168.1.0
          192.168.2.0
Passive Interface(s):
Routing Information Sources:
          Gateway         Distance      Last Update
          192.168.2.2          120      00:00:12
Distance: (default is 120)
```

```
R1(config)#router rip
R1(config-router)#passive-interface g0/0
```

```
Default version control: send version 2, receive 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      00:00:27
Distance: (default is 120)
```

Configuring the RIP Protocol (continued)

- Propagating a Default Static Route
  - In some sicarios there will be a need for a static default route to be in the network such as below for access to the internet
  - This is all and good for router 1, BUT how does this information (the static route) get to routers 2 and 3… that only have dynamic routing running on them?
    - We need to create the static route on Router 1 **ip route 0.0.0.0 0.0.0.0 209.165.200.226**
      any network / any mask / next hop
    - Then propagate the route in the dynamic routing table (in this case RIP)
    - Getting back into the router configuration and using the command **default-information originate**



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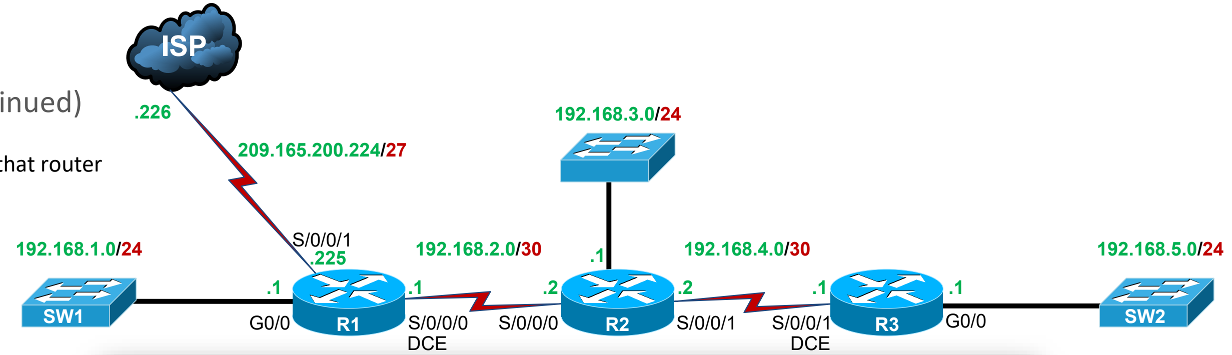
Configuring the RIP Protocol (continued)

- ## Propagating a Default Static Route (continued)

The 4 windows that start "Gateway of last resort" are snippets from the **show ip route** command on that router



R1

```
Gateway of last resort is not set

     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0
L       192.168.1.1/32 is directly connected, GigabitEthernet0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/30 is directly connected, Serial0/0/0
L       192.168.2.1/32 is directly connected, Serial0/0/0
R    192.168.3.0/24 [120/1] via 192.168.2.2, 00:00:22, Serial0/0/0
R    192.168.4.0/24 [120/1] via 192.168.2.2, 00:00:22, Serial0/0/0
R    192.168.5.0/24 [120/2] via 192.168.2.2, 00:00:22, Serial0/0/0
     209.165.200.0/24 is variably subnetted, 2 subnets, 2 masks
C       209.165.200.224/27 is directly connected, Serial0/0/1
L       209.165.200.225/32 is directly connected, Serial0/0/1
```

```
R1(config)#
R1(config)#ip route 0.0.0.0 0.0.0.0 209.165.200.226
R1(config)#
```

```
Gateway of last resort is 209.165.200.226 to network 0.0.0.0

     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0
L       192.168.1.1/32 is directly connected, GigabitEthernet0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/30 is directly connected, Serial0/0/0
L       192.168.2.1/32 is directly connected, Serial0/0/0
R    192.168.3.0/24 [120/1] via 192.168.2.2, 00:00:18, Serial0/0/0
R    192.168.4.0/24 [120/1] via 192.168.2.2, 00:00:18, Serial0/0/0
R    192.168.5.0/24 [120/2] via 192.168.2.2, 00:00:18, Serial0/0/0
     209.165.200.0/24 is variably subnetted, 2 subnets, 2 masks
C       209.165.200.224/27 is directly connected, Serial0/0/1
L       209.165.200.225/32 is directly connected, Serial0/0/1
S*   0.0.0.0/0 [1/0] via 209.165.200.226
```

R3

```
Gateway of last resort is not set

R    192.168.1.0/24 [120/2] via 192.168.4.2, 00:00:09, Serial0/0/1
R    192.168.2.0/24 [120/1] via 192.168.4.2, 00:00:09, Serial0/0/1
R    192.168.3.0/24 [120/1] via 192.168.4.2, 00:00:09, Serial0/0/1
     192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.4.0/30 is directly connected, Serial0/0/1
L       192.168.4.1/32 is directly connected, Serial0/0/1
     192.168.5.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.5.0/24 is directly connected, GigabitEthernet0/0
L       192.168.5.1/32 is directly connected, GigabitEthernet0/0
```

R1

```
R1(config)#router rip
R1(config-router)#default-information originate
```

```
Gateway of last resort is 192.168.4.2 to network 0.0.0.0

R    192.168.1.0/24 [120/2] via 192.168.4.2, 00:00:14, Serial0/0/1
R    192.168.2.0/24 [120/1] via 192.168.4.2, 00:00:14, Serial0/0/1
R    192.168.3.0/24 [120/1] via 192.168.4.2, 00:00:14, Serial0/0/1
     192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.4.0/30 is directly connected, Serial0/0/1
L       192.168.4.1/32 is directly connected, Serial0/0/1
     192.168.5.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.5.0/24 is directly connected, GigabitEthernet0/0
L       192.168.5.1/32 is directly connected, GigabitEthernet0/0
R*   0.0.0.0/0 [120/2] via 192.168.4.2, 00:00:14, Serial0/0/1
```

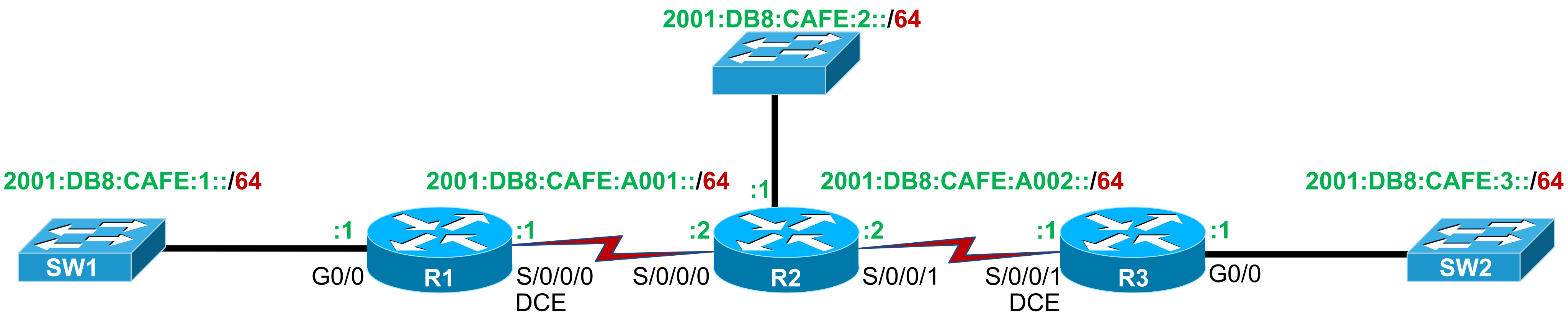
Configuring the RIPng Protocol

- Advertising IPv6 Networks
  - IPv4 RIP all configuration is done in the “router rip” section of the configuration as shown here in a section of the **sh running** command
  - The change in IPv6 is the advertising of the network in IPv4 it is done with the “network” command

  - With IPv6 the advertising command is done on the interface

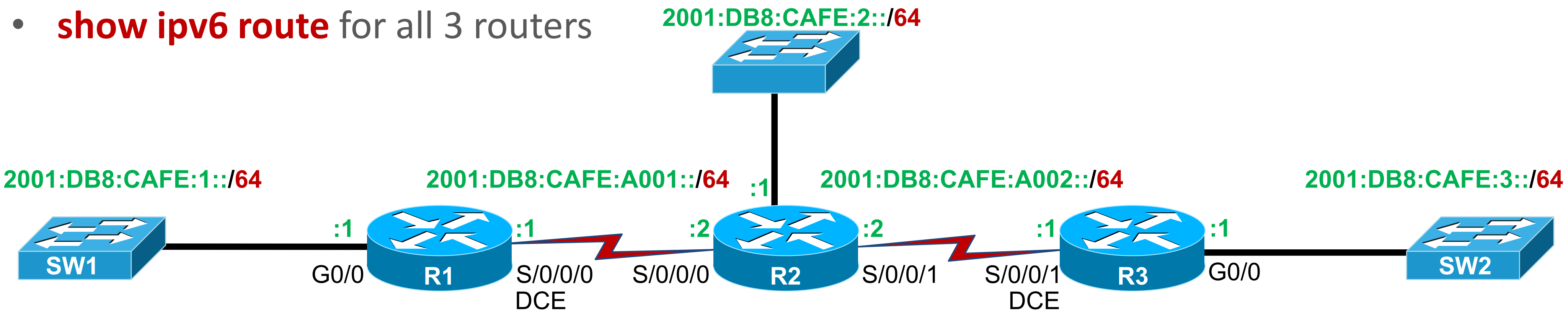
R1: IPv4 RIP configuration

```
router rip
 version 2
 passive-interface GigabitEthernet0/0
 network 192.168.1.0
 network 192.168.2.0
 default-information originate
 no auto-summary
!
ip classless
ip route 0.0.0.0 0.0.0.0 209.165.200.226
```



Configuring the RIPng Protocol (continued)

- Advertising IPv6 Networks (continued)
  - **show ipv6 route** for all 3 routers



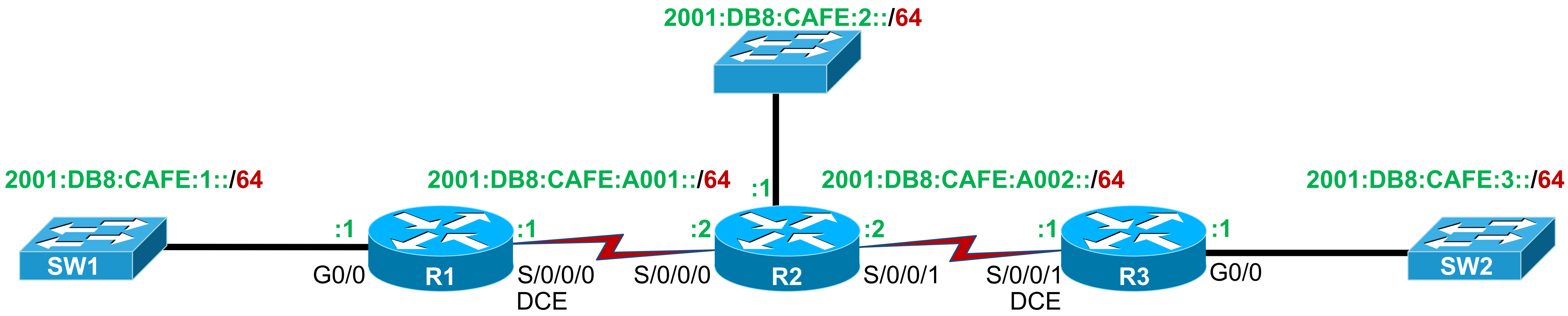

```
C    2001:DB8:CAFE:1::/64 [0/0]
      via GigabitEthernet0/0, directly connected
L    2001:DB8:CAFE:1::1/128 [0/0]
      via GigabitEthernet0/0, receive
C    2001:DB8:CAFE:A001::/64 [0/0]
      via Serial0/0/0, directly connected
L    2001:DB8:CAFE:A001::2/128 [0/0]
      via Serial0/0/0, receive
L    FF00::/8 [0/0]
      via Null0, receive
```

```
C    2001:DB8:CAFE:2::/64 [0/0]
      via GigabitEthernet0/0, directly connected
L    2001:DB8:CAFE:2::1/128 [0/0]
      via GigabitEthernet0/0, receive
C    2001:DB8:CAFE:A001::/64 [0/0]
      via Serial0/0/0, directly connected
L    2001:DB8:CAFE:A001::2/128 [0/0]
      via Serial0/0/0, receive
C    2001:DB8:CAFE:A002::/64 [0/0]
      via Serial0/0/1, directly connected
L    2001:DB8:CAFE:A002::2/128 [0/0]
      via Serial0/0/1, receive
L    FF00::/8 [0/0]
      via Null0, receive
```

```
C    2001:DB8:CAFE:3::/64 [0/0]
      via GigabitEthernet0/0, directly connected
L    2001:DB8:CAFE:3::1/128 [0/0]
      via GigabitEthernet0/0, receive
C    2001:DB8:CAFE:A002::/64 [0/0]
      via Serial0/0/1, directly connected
L    2001:DB8:CAFE:A002::1/128 [0/0]
      via Serial0/0/1, receive
L    FF00::/8 [0/0]
      via Null0, receive
```

Configuring the RIPng Protocol (continued)

- Advertising IPv6 Networks (continued)
  - Commands to advertise the networks for all 3 routers



Enable IPv6 Routing
On the interface
Enable RIP routing
Router group name (RIP-AS)

```
R1(config)#ipv6 unicast-routing
R1(config)#
R1(config)#inter g0/0
R1(config-if)#ipv6 rip RIP-AS enable
R1(config-if)#exit
R1(config)#inter serial 0/0/0
R1(config-if)#ipv6 rip RIP-AS enable
R1(config-if)#exit
```

```
R2(config)#ipv6 unicast-routing
R2(config)#
R2(config)#inter g0/0
R2(config-if)#ipv6 rip RIP-AS enable
R2(config-if)#inter s0/0/0
R2(config-if)#ipv6 rip RIP-AS enable
R2(config-if)#inter s0/0/1
R2(config-if)#ipv6 rip RIP-AS enable
R2(config-if)#exit
```

```
R3(config)#ipv6 unicast-routing
R3(config)#
R3(config)#inter g0/0
R3(config-if)#ipv6 rip RIP-AS enable
R3(config-if)#inter s0/0/1
R3(config-if)#ipv6 rip RIP-AS enable
R3(config-if)#exit
```

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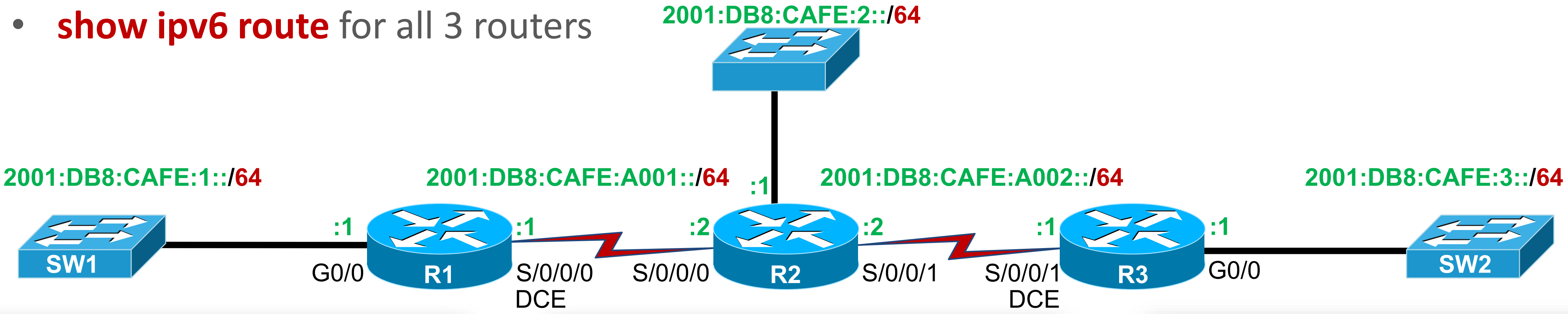
Configuring the RIPng Protocol (continued)

- Advertising IPv6 Networks (continued)
  - **show ipv6 route** for all 3 routers




```
C   2001:DB8:CAFE:1::/64 [0/0]
     via GigabitEthernet0/0, directly connected
L   2001:DB8:CAFE:1::1/128 [0/0]
     via GigabitEthernet0/0, receive
R   2001:DB8:CAFE:2::/64 [120/2]
     via FE80::201:C9FF:FE58:E401, Serial0/0/0
R   2001:DB8:CAFE:3::/64 [120/3]
     via FE80::201:C9FF:FE58:E401, Serial0/0/0
C   2001:DB8:CAFE:A001::/64 [0/0]
     via Serial0/0/0, directly connected
L   2001:DB8:CAFE:A001::2/128 [0/0]
     via Serial0/0/0, receive
R   2001:DB8:CAFE:A002::/64 [120/2]
     via FE80::201:C9FF:FE58:E401, Serial0/0/0
L   FF00::/8 [0/0]
     via Null0, receive
```

```
R   2001:DB8:CAFE:1::/64 [120/2]
     via FE80::201:C9FF:FE8D:AA01, Serial0/0/0
C   2001:DB8:CAFE:2::/64 [0/0]
     via GigabitEthernet0/0, directly connected
L   2001:DB8:CAFE:2::1/128 [0/0]
     via GigabitEthernet0/0, receive
R   2001:DB8:CAFE:3::/64 [120/2]
     via FE80::201:43FF:FE9A:CB01, Serial0/0/1
C   2001:DB8:CAFE:A001::/64 [0/0]
     via Serial0/0/0, directly connected
L   2001:DB8:CAFE:A001::2/128 [0/0]
     via Serial0/0/0, receive
C   2001:DB8:CAFE:A002::/64 [0/0]
     via Serial0/0/1, directly connected
L   2001:DB8:CAFE:A002::2/128 [0/0]
     via Serial0/0/1, receive
L   FF00::/8 [0/0]
     via Null0, receive
```

```
R   2001:DB8:CAFE:1::/64 [120/3]
     via FE80::201:C9FF:FE58:E401, Serial0/0/1
R   2001:DB8:CAFE:2::/64 [120/2]
     via FE80::201:C9FF:FE58:E401, Serial0/0/1
C   2001:DB8:CAFE:3::/64 [0/0]
     via GigabitEthernet0/0, directly connected
L   2001:DB8:CAFE:3::1/128 [0/0]
     via GigabitEthernet0/0, receive
R   2001:DB8:CAFE:A001::/64 [120/2]
     via FE80::201:C9FF:FE58:E401, Serial0/0/1
C   2001:DB8:CAFE:A002::/64 [0/0]
     via Serial0/0/1, directly connected
L   2001:DB8:CAFE:A002::1/128 [0/0]
     via Serial0/0/1, receive
L   FF00::/8 [0/0]
     via Null0, receive
```

Configuring the RIPng Protocol (continued)

- Examining the RIPng Configuration

Verify RIPng Settings

```
R1#sh ipv6 protocols
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "rip RIP-AS"
  Interfaces:
    GigabitEthernet0/0
    Serial0/0/0
  Redistribution:
    None
```

Verifying Routes

```
R1#sh ipv6 route
IPv6 Routing Table - 8 entries
     Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
     U - Per-user Static route, M - MIPv6
     I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
     ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect
     O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
     ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
     D - EIGRP, EX - EIGRP external
C 2001:DB8:CAFE:1::/64 [0/0]
     via GigabitEthernet0/0, directly connected
L 2001:DB8:CAFE:1::1/128 [0/0]
     via GigabitEthernet0/0, receive
R 2001:DB8:CAFE:2::/64 [120/2]
     via FE80::201:C9FF:FE58:E401, Serial0/0/0
R 2001:DB8:CAFE:3::/64 [120/3]
     via FE80::201:C9FF:FE58:E401, Serial0/0/0
C 2001:DB8:CAFE:A001::/64 [0/0]
     via Serial0/0/0, directly connected
L 2001:DB8:CAFE:A001::2/128 [0/0]
     via Serial0/0/0, receive
R 2001:DB8:CAFE:A002::/64 [120/2]
     via FE80::201:C9FF:FE58:E401, Serial0/0/0
L FF00::/8 [0/0]
     via Null0, receive
```

- Another command you can try in the classroom is
  show ipv6 route rip
  this should only show RIP entries in the routing table…
  (**this does not work in Packet Tracer**)

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Parts of an IPv4 Route Entry

- Routing Table Entries
  - In a routing table
    - The first number in the brackets is the **administrative distance**
    - The second number in the brackets is the **metric** (hop count)

```
R2# show ip route

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
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
R    192.168.7.0/24 [120/1] via 192.168.4.1, Serial0/0/1
R    192.168.8.0/24 [120/2] via 192.168.4.1, Serial0/0/1
```

Parts of an IPv4 Route Entry (continued)

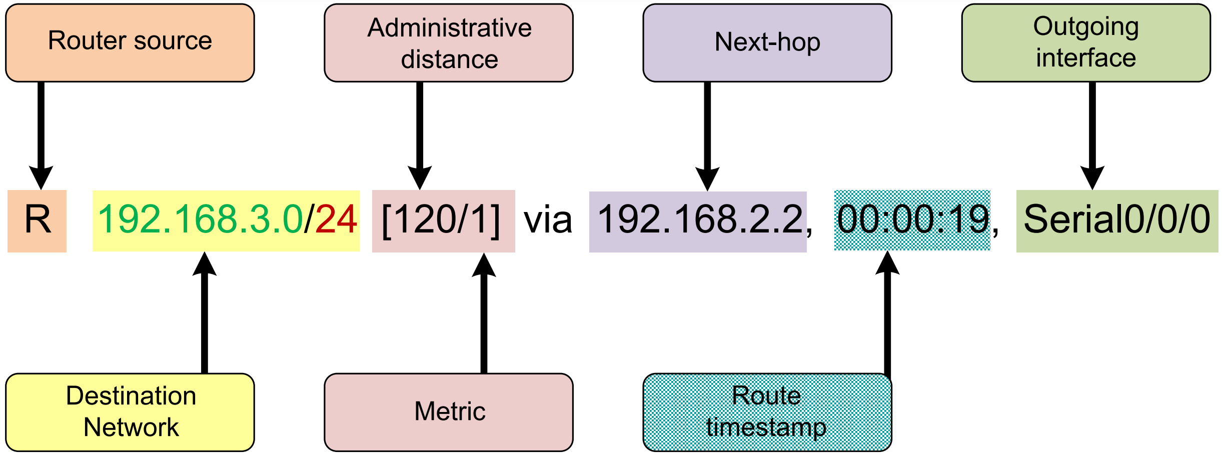
- Routing Table Entries
  - C - Connected (the network)
  - L - Local (the local interface address)
  - R - RIP (the type of routing being used)
  - S - Static (static routs added to the router)
  - * - candidate default
    (for "Gateway of last resort")

```
R1#sh ip rout
Codes: L - local, C - connected, S - static, 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 209.165.200.226 to network 0.0.0.0

     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0
L       192.168.1.1/32 is directly connected, GigabitEthernet0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/30 is directly connected, Serial0/0/0
L       192.168.2.1/32 is directly connected, Serial0/0/0
R    192.168.3.0/24 [120/1] via 192.168.2.2, 00:00:19, Serial0/0/0
R    192.168.4.0/24 [120/1] via 192.168.2.2, 00:00:19, Serial0/0/0
R    192.168.5.0/24 [120/2] via 192.168.2.2, 00:00:19, Serial0/0/0
     209.165.200.0/24 is variably subnetted, 2 subnets, 2 masks
C       209.165.200.224/27 is directly connected, Serial0/0/1
L       209.165.200.225/32 is directly connected, Serial0/0/1
S*   0.0.0.0/0 [1/0] via 209.165.200.226
```

- Remote Network Entries

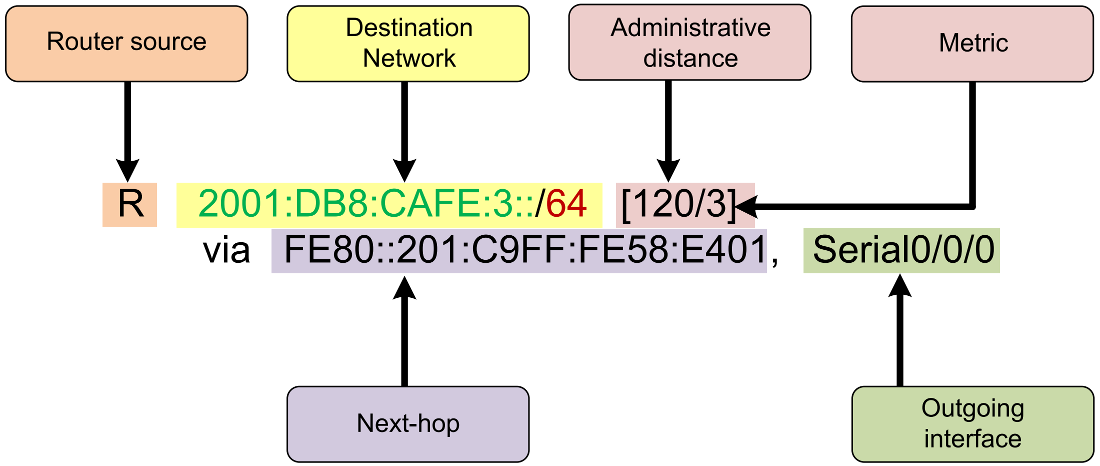


Parts of an IPv6 Route Entry

- Routing Table Entries
  - Components of the IPv6 routing table are very similar to the IPv4 routing table (directly connected interfaces, static routes, and dynamically learned routes)
  - IPv6 is classless by design
    - C - Connected (the network)
    - L - Local (the local interface address)
    - R - RIP (the type of routing being used)
    - S - Static (static routs added to the router)

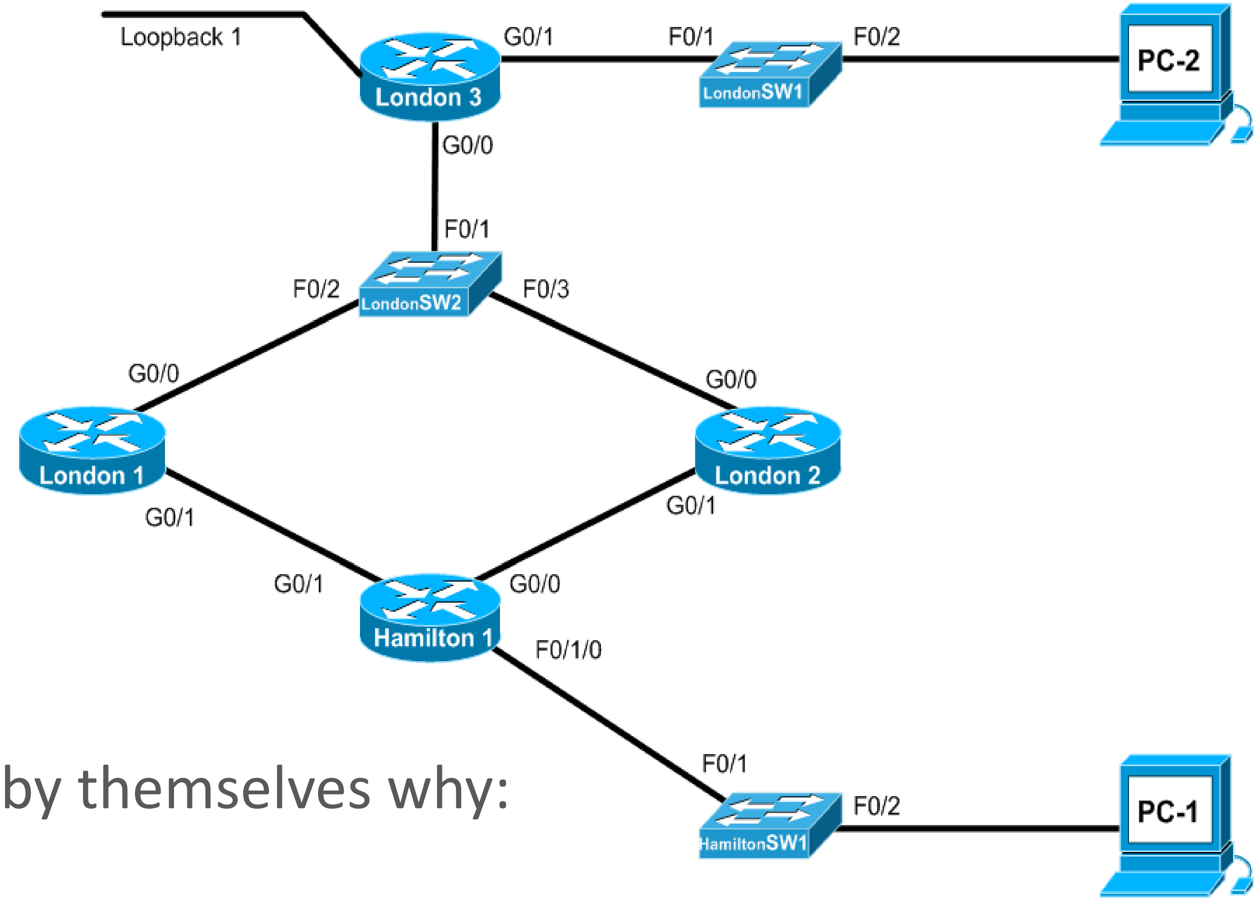
```
R1#sh ipv6 rout
IPv6 Routing Table - 8 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route, M - MIPv6
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       ND - ND Default, NDp - ND Prefix, DCE - Destination, NDr - Redirect
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
       D - EIGRP, EX - EIGRP external
C   2001:DB8:CAFE:1::/64 [0/0]
     via GigabitEthernet0/0, directly connected
L   2001:DB8:CAFE:1::1/128 [0/0]
     via GigabitEthernet0/0, receive
R   2001:DB8:CAFE:2::/64 [120/2]
     via FE80::201:C9FF:FE58:E401, Serial0/0/0
R   2001:DB8:CAFE:3::/64 [120/3]
     via FE80::201:C9FF:FE58:E401, Serial0/0/0
C   2001:DB8:CAFE:A001::/64 [0/0]
     via Serial0/0/0, directly connected
L   2001:DB8:CAFE:A001::2/128 [0/0]
     via Serial0/0/0, receive
R   2001:DB8:CAFE:A002::/64 [120/2]
     via FE80::201:C9FF:FE58:E401, Serial0/0/0
L   FF00::/8 [0/0]
     via Null0, receive
```

- Remote Network Entries



Lab

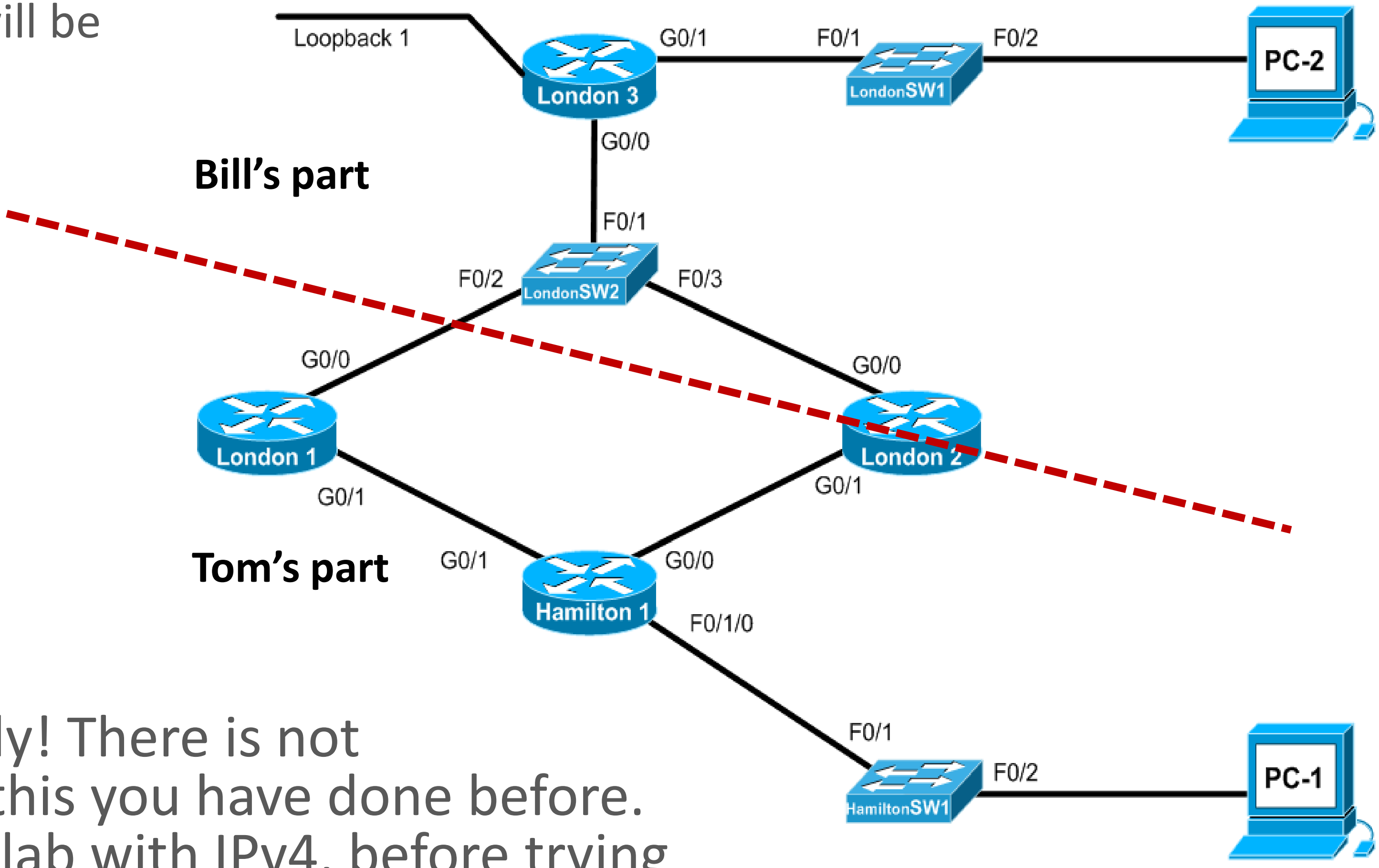
- Two labs this week
  - Lab 8- Dynamic Routing IPv4
  - Lab 8- Dynamic Routing IPv6



- Wow! Too big for one person to do by themselves why:
  - You will not have enough cables
  - You will find, not enough equipment in the pods.

Lab (continued)

- Multiple people working on something together….
  - Draw out what each of you will be doing !



- Read the instruction carefully! There is not much help because a lot of this you have done before. You must complete the first lab with IPv4, before trying the second with IPv6 on the same hardware (do not remove any of the IPv4 configuration).

Lab (continued)

Device Name	interface	IPV4 Address / mask	Default Gateway	Ports	Vlan
PC-1		172.20.50.2/28	172.20.50.1		
PC-2		172.16.10.2/28	172.16.10.1		
LondonSW1		172.16.10.3/28	172.16.10.1		1
LondonSW2		192.168.2.3/24	192.168.2.4		1
London1	G0/0	192.168.2.5/24			
	G0/1	172.20.30.14/30			
London2	G0/0	192.168.2.6/24			
	G0/1	172.20.40.5/30			
London3	G0/0	192.168.2.4/24			
	G0/1	172.16.10.1/28			
	Lo1	172.16.11.1/24			
Hamilton1	G0/0	172.20.40.6/30			
	G0/1	172.20.30.13/30			
	G0/0/0				10
	Vlan10	172.20.50.1/28			
HamiltonSW1		172.20.50.3/28	172.20.50.1	1-12	10

There is a lot of information here this week…. Make a drawing with the information on it and decide who will do what parts of the config!

This will cause errors and may cause your network not to work. Be careful with the Vlans!

Read the Lab and the PowerPoint documents carefully, or you will have problems!

QUESTIONS

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