



# RIPv2



## Routing Protocols and Concepts – Chapter 7

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# Objectives

- Encounter and describe the limitations of RIPv1's limitations.
- Apply the basic Routing Information Protocol Version 2 (RIPv2) configuration commands and evaluate RIPv2 classless routing updates.
- Analyze router output to see RIPv2 support for VLSM and CIDR
- Identify RIPv2 verification commands and common RIPv2 issues.
- Configure, verify, and troubleshoot RIPv2 in “hands-on” labs

# Introduction

- Chapter focus

- Difference between RIPv1 & RIPv2

- RIPv1

- A classful distance vector routing protocol
      - Does not support discontinuous subnets
      - Does not support VLSM
      - Does not send subnet mask in routing update
      - Routing updates are broadcast

- RIPv2

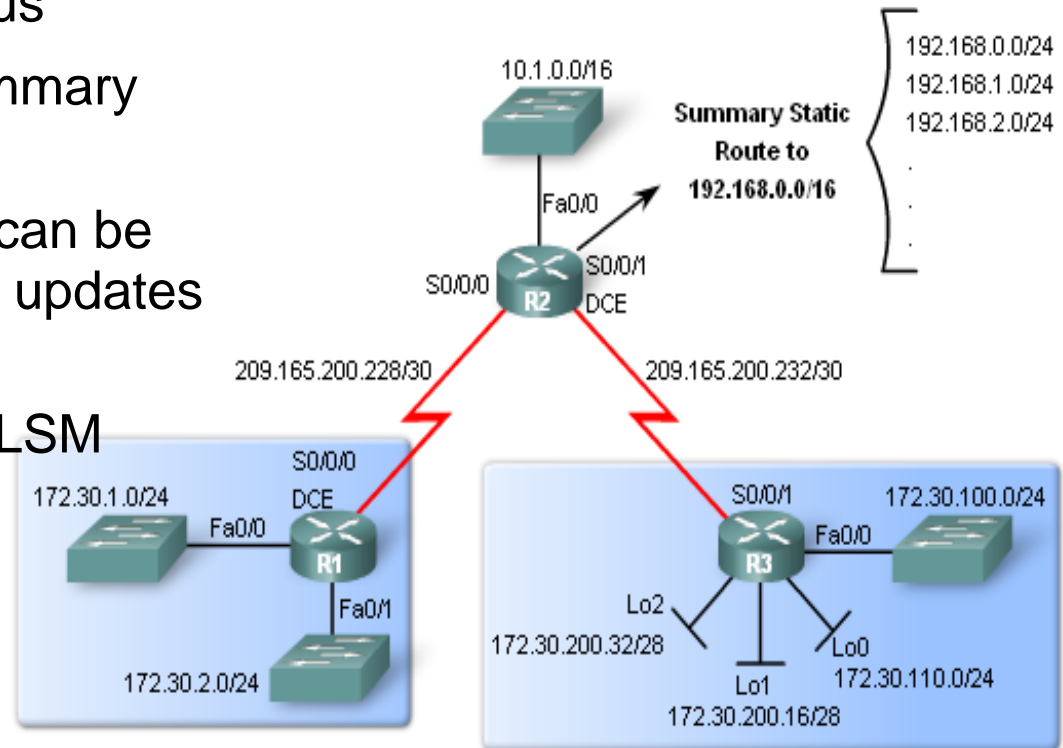
- A classless distance vector routing protocol that is an enhancement of RIPv1's features.
      - Next hop address is included in updates
      - Routing updates are multicast
      - The use of authentication is an option

# Introduction

- Similarities between RIPv1 & RIPv2
  - Use of timers to prevent routing loops
  - Use of split horizon or split horizon with poison reverse
  - Use of triggered updates
  - Maximum hop count of 15

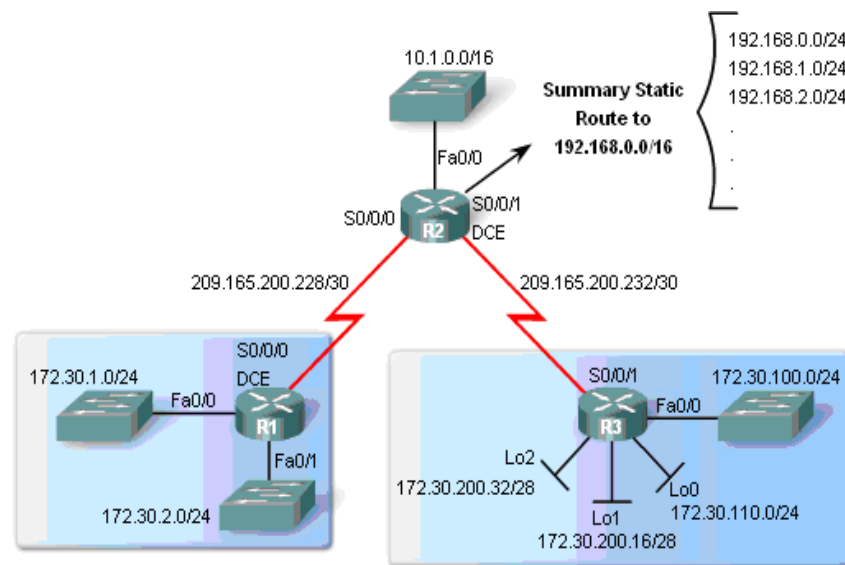
# RIPv1 Limitations

- Lab Topology
- Scenario:
  - 3 router set up
  - Topology is discontinuous
  - There exists a static summary route
  - Static route information can be injected into routing table updates using redistribution.
  - Routers 1 & 3 contain VLSM networks



# RIPv1 Limitations

- Scenario Continued
- VLSM
  - Recall this is sub netting the subnet
- Private IP addresses are on LAN links
- Public IP addresses are used on WAN links
- Loopback interfaces
  - These are virtual interfaces that can be pinged and added to routing table



RFC 1918 Private Addresses

Class	Prefix/Mask	Address Range
A	10.0.0.0/8	10.0.0.0 to 10.255.255.255
B	172.16.0.0/12	172.16.0.0 to 172.31.255.255
C	192.168.0.0/16	192.168.0.0 to 192.168.255.255

Used for private IP addressing

Cisco Example IP Addresses

Prefix/Mask	Address Range
209.165.200.224/27	209.165.200.224 to 209.165.200.255
209.165.201.0/27	209.165.201.0 to 209.165.201.31
209.165.202.128/27	209.165.202.128 to 209.165.202.159

Used for public IP addressing when needed for example purposes.

# RIPv1 Limitations

- **Null Interfaces**

- This is a virtual interface that does not need to be created or configured
  - Traffic sent to a null interface is discarded
  - Null interfaces do not send or receive traffic

- **Static routes and null interfaces**

- null interfaces will serve as the exit interface for static route
  - Example of configuring a static supernet route with a null interface
  - R2(config)#ip route 192.168.0.0 255.255.0.0 Null0

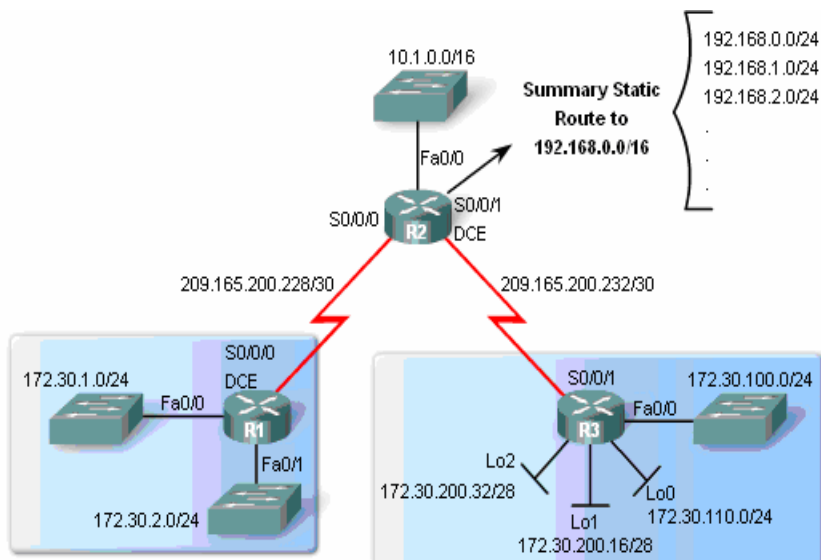
# RIPv1 Limitations

- **Route redistribution**

-Redistribution command is way to disseminate a static route from one router to another via a routing protocol

-Example

R2(config-router)#redistribute static



## Additional RIPv1 Configurations

```
R1(config)#router rip
R1(config-router)#network 172.30.0.0
R1(config-router)#network 209.165.200.0
```

```
R2(config)#ip route 192.168.0.0 255.255.0.0 null0
R2(config)#router rip
R2(config-router)#redistribute static
R2(config-router)#network 10.0.0.0
R2(config-router)#network 209.165.200.0
```

Static route configured and redistributed.

```
R3(config)#router rip
R3(config-router)#network 172.30.0.0
R3(config-router)#network 209.165.200.0
```



# RIPv1 Limitations

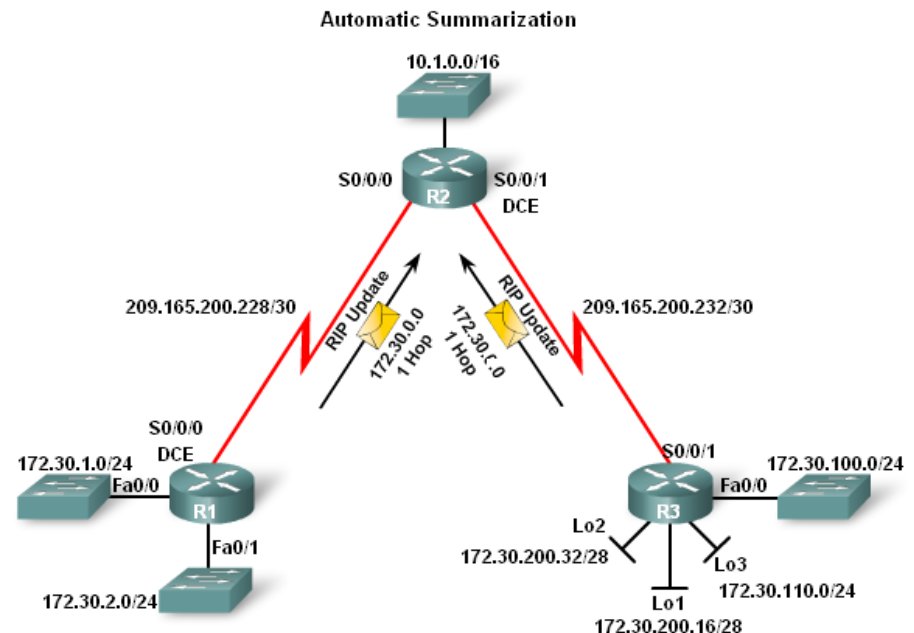
- Verifying and Testing Connectivity

Use the following commands:

- show ip interfaces brief
- ping
- traceroute

# RIPv1 Limitations

- **RIPv1** – a classful routing protocol
  - Subnet mask **are not sent** in updates
  - Summarizes networks at major network boundaries
  - if network is discontinuous and RIPv1 configured convergence will not be reached



# RIPv1 Limitations

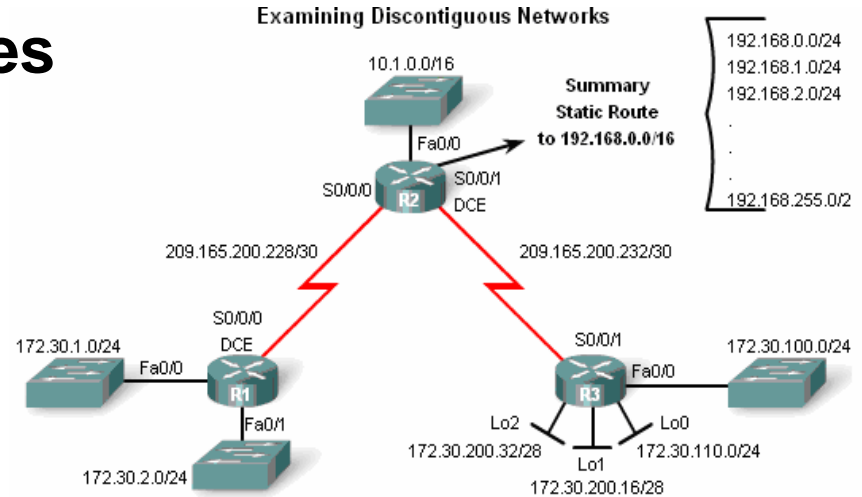
## Examining the routing tables

-To examine the contents of routing updates use the

*debug ip rip* command

-If RIPv1 is configured then

Subnet masks will not be included with the network address



```

R2#debug ip rip
RIP protocol debugging is on

RIP: received v1 update from 209.165.200.230 on Serial0/0/0
172.30.0.0 in 1 hops
RIP: received v1 update from 209.165.200.234 on Serial0/0/1
172.30.0.0 in 1 hops

R2#
RIP: sending v1 update to 255.255.255.255 via Serial0/0/0 (209.165.200.229)
RIP: build update entries
network 10.0.0.0 metric 1
subnet 209.165.200.232 metric 1
RIP: sending v1 update to 255.255.255.255 via Serial0/0/1 (209.165.200.233)
RIP: build update entries
network 10.0.0.0 metric 1
subnet 209.165.200.228 metric 1
    
```

**R2 is not advertising 172.30.0.0 to R1 or R3.**

# RIPv1 Limitations

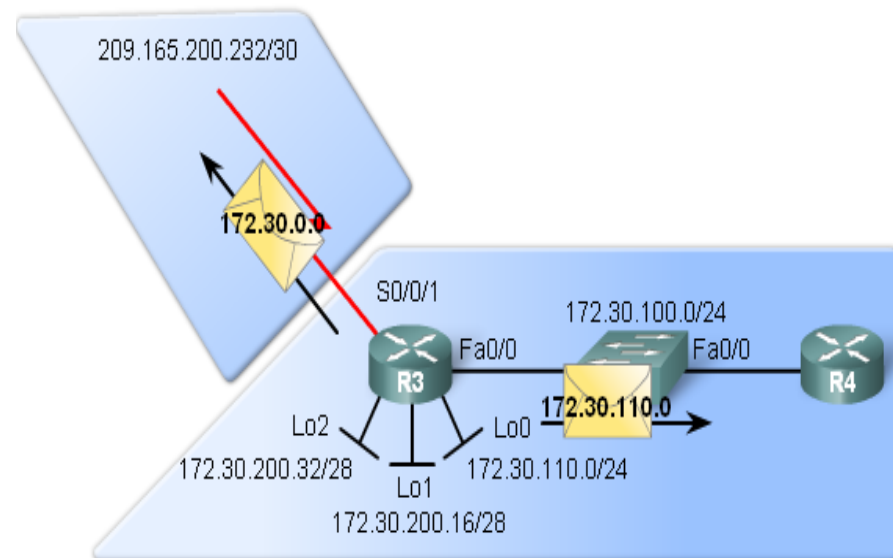
- RIPv1 does not support VLSM

Reason: RIPv1 does not send subnet mask in routing updates

- RIPv1 does summarize routes to the Classful boundary

Or uses the Subnet mask of the outgoing interface to determine which subnets to advertise

RIPv1 Updates Do Not Support VLSM



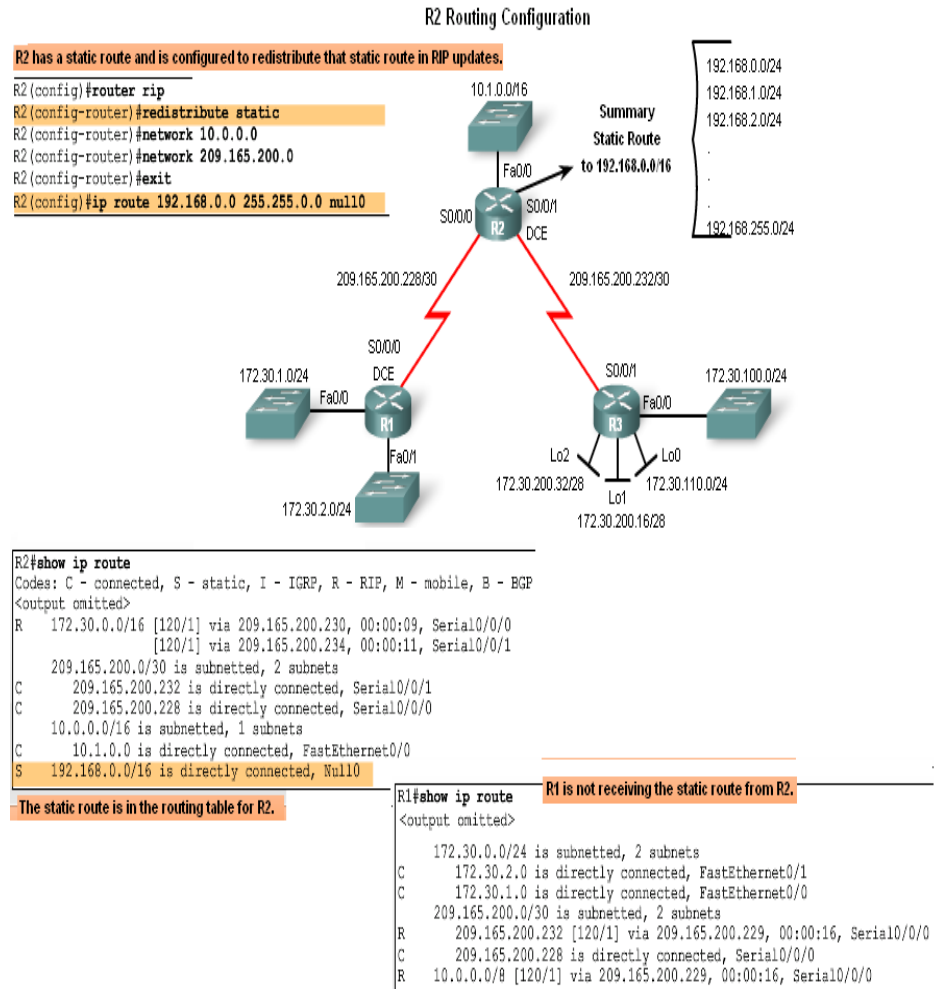
```
R3#debug ip rip
RIP protocol debugging is on
RIP: sending v1 update to 255.255.255.255 via FastEthernet0/0 (172.30.100.1)
RIP: build update entries
  network 10.0.0.0 metric 2
  subnet 172.30.110.0 metric 1
  network 209.165.200.0 metric 1
RIP: sending v1 update to 255.255.255.255 via Serial10/0/1 (209.165.200.234)
RIP: build update entries
  network 172.30.0.0 metric 1
```

Because 172.30.110.0 has the same subnet mask as the outgoing interface on 172.30.100.0, R3 includes 172.30.110.0 in updates to R4.

# RIPv1 Limitations

- No CIDR Support
- In the diagram R2 will not include the static route in its update

Reason: Classful routing protocols **do not support CIDR** routes that are summarized with a smaller mask than the classful subnet mask

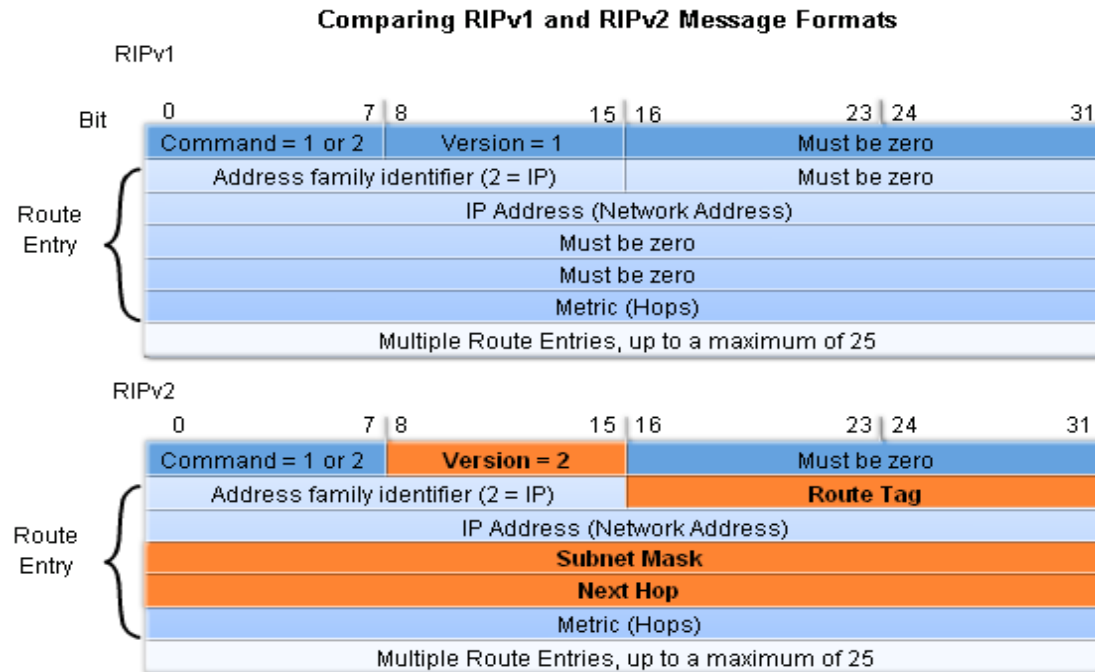


# Configuring RIPv2

## Comparing RIPv1 & RIPv2 Message Formats

-RIPv2 Message format is **similar** to RIPv1 **but** has 2 extensions

- 1st extension is the subnet mask field
- 2nd extension is the addition of next hop address



# Configuring RIPv2

- Enabling and Verifying RIPv2
  - Configuring RIP on a Cisco router
- By **default** it is running RIPv1

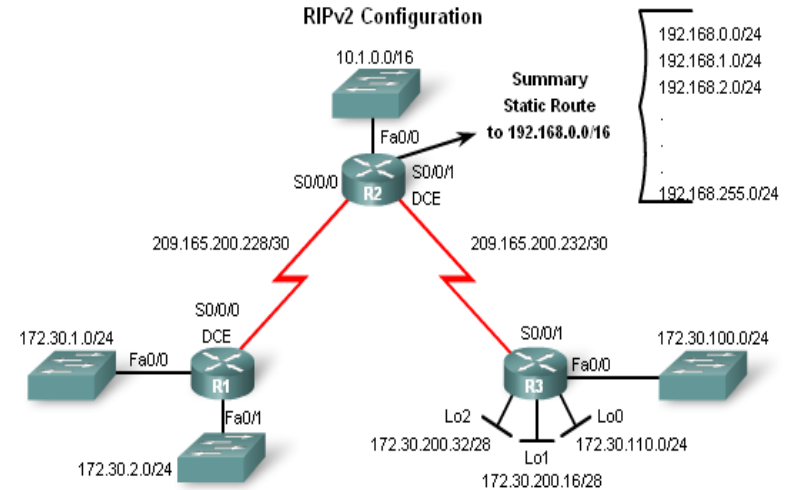
# Configuring RIPv2

- Configuring **RIPv2** on a Cisco router

-Requires using the **version 2** command

-RIPv2 ignores RIPv1 updates

- To verify RIPv2 is configured use the **show ip protocols** command



```
R1(config)#router rip
R1(config-router)#version 2

R2(config)#router rip
R2(config-router)#version 2

R3(config)#router rip
R3(config-router)#version 2
```

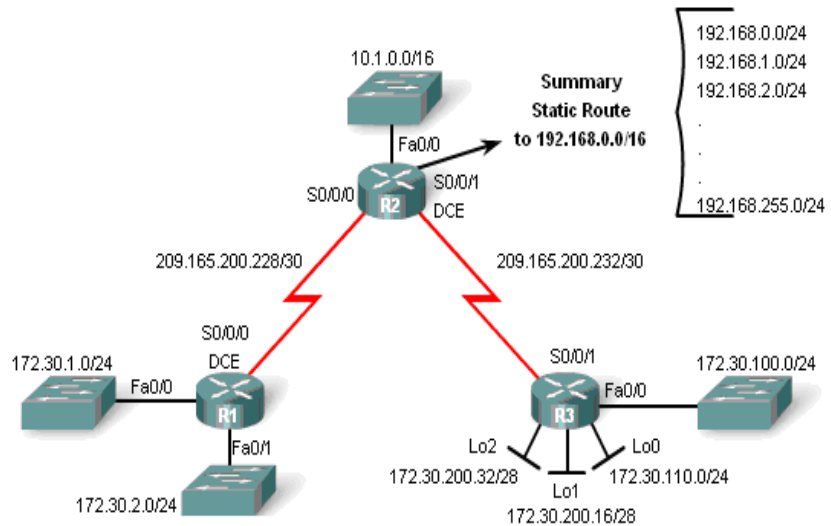
```
R2#show ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 1 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is
  Incoming update filter list for all interfaces is
  Redistributing: static, rip
  Default version control: send version 2, receive version 2
  Interface          Send Recv  Triggered RIP  Key-chain
  Serial0/0/0         2      2
  Serial0/0/1         2      2
  Automatic network summarization is in effect
  Routing for Networks:
    10.0.0.0
    209.165.200.0
  Passive Interface(s):
    FastEthernet0/0
  Routing Information Sources:
    Gateway         Distance    Last Update
    209.165.200.234  120        00:00:03
    209.165.200.230  120        00:00:17
  Distance: (default is 120)
```

**R2 After RIPv2 Configuration: RIPv2 ignores RIPv1 updates**



# Configuring RIPv2

- Auto-Summary & RIPv2
- RIPv2 will automatically summarize routes at major network boundaries **and** can also summarize routes with a subnet mask that is smaller than the classful subnet mask



```

R1#show ip route
R1 now has supernet.
Gateway of last resort is not set
 172.30.0.0/24 is subnetted, 2 subnets
 C    172.30.2.0 is directly connected, Loopback0
 C    172.30.1.0 is directly connected, FastEthernet0/0
 209.165.200.0/30 is subnetted, 2 subnets
 R    209.165.200.232 [120/1] via 209.165.200.229, 00:00:04, Serial10/0/0
 C    209.165.200.228 is directly connected, Serial10/0/0
 C    10.0.0.0/8 [120/1] via 209.165.200.229, 00:00:04, Serial10/0/0
 R    192.168.0.0/16 [120/1] via 209.165.200.229, 00:00:04, Serial10/0/0
    
```

```

R1#debug ip rip
R1 still sending summary route but now with subnet mask /16.
RIP protocol debugging is on
R1#
RIP: sending v2 update to 224.0.0.9 via Serial10/0/0 (209.165.200.230)
RIP: build update entries
      172.30.0.0/16 via 0.0.0.0, metric 1, tag 0
R1#
<output omitted for brevity>
RIP: received v2 update from 209.165.200.229 on Serial10/0/0
 10.0.0.0/8 via 0.0.0.0 in 1 hops
 192.168.0.0/16 via 0.0.0.0 in 1 hops
 209.165.200.232/30 via 0.0.0.0 in 1 hops
<output omitted for brevity>
    
```

```

R1#show ip protocols
show ip protocols command verifies auto summarization.
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 version 2
    Interface        Send Recv  Triggered RIP  Key-chain
  FastEthernet0/0    2        2
  FastEthernet0/1    2        2
  Serial10/1/0       2        2
  Automatic network summarization is in effect.
  Maximum path: 4
    
```

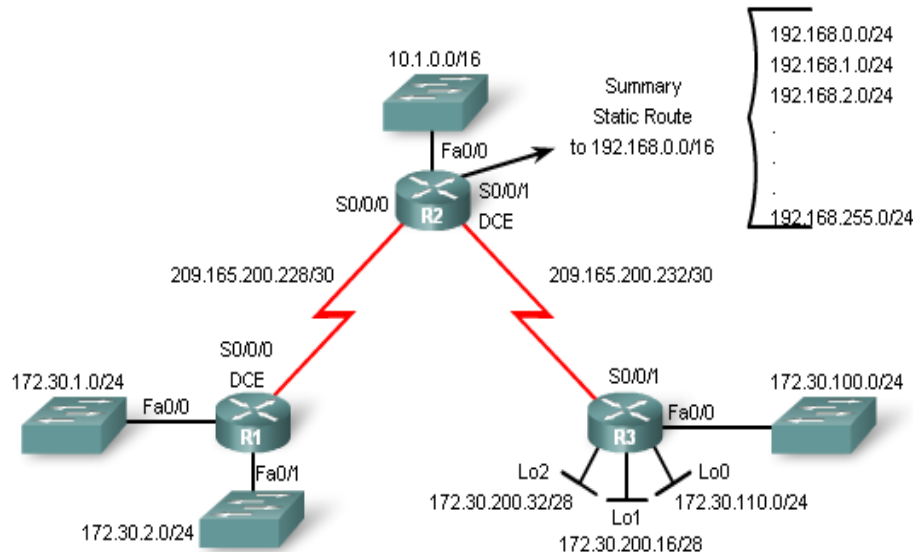
```

R1#debug ip rip
Supernets are now included in RIPv2 updates.
RIP protocol debugging is on
R1#
RIP: sending v2 update to 224.0.0.9 via Serial10/1/0 (209.165.200.230)
RIP: build update entries
      172.30.0.0/16 via 0.0.0.0, metric 1, tag 0
R1#
<output omitted for brevity>
RIP: received v2 update from 209.165.200.229 on Serial10/1/0
 10.0.0.0/8 via 0.0.0.0 in 1 hops
 192.168.0.0/16 via 0.0.0.0 in 1 hops
 209.165.200.232/30 via 0.0.0.0 in 1 hops
<output omitted for brevity>
    
```

# Configuring RIPv2

- Disabling Auto-Summary in RIPv2
- To disable automatic summarization issue the *no auto-summary* command

No Automatic Summarization



```
R1(config)#router rip
R1(config-router)#no auto-summary
R1(config-router)#end
R1#show ip protocols
Routing Protocol is "rip"
<output omitted for brevity>
  Default version control: send version 2, receive version 2
  Interface          Send  Recv  Triggered RIP  Key-chain
  FastEthernet0/0    2     2
  FastEthernet0/1    2     2
  Serial0/1/0        2     2
  Automatic network summarization is not in effect
  <output omitted for brevity>
```

```
R2(config)#router rip
R2(config-router)# no auto-summary
```

```
R3(config)#router rip
R3(config-router)#no auto-summary
```

# Configuring RIPv2

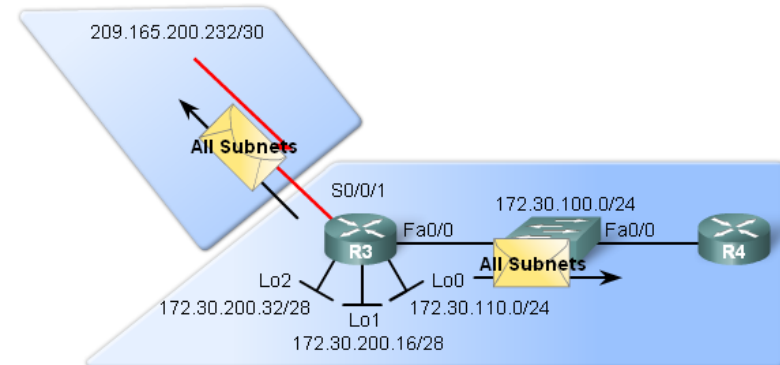
- Verifying RIPv2 Updates
- When using RIPv2 with automatic summarization turned off
  - Each subnet and mask has its own specific entry, along with the exit interface and next-hop address to reach that subnet.
- To verify information being sent by RIPv2 use the *debug ip rip* command

# VLSM & CIDR

- IPv2 and VLSM
- Networks using a VLSM IP addressing scheme

Use **classless routing protocols** (i.e. IPv2) to disseminate network addresses and their subnet masks

R3 Debug Output



R3 Debug Output

```

R3#debug ip rip
RIP protocol debugging is on
R3#
RIP: received v2 update from 209.165.200.233 on Serial0/0/1
  10.1.0.0/16 via 0.0.0.0 in 1 hops
  172.30.1.0/24 via 0.0.0.0 in 2 hops
  172.30.2.0/24 via 0.0.0.0 in 2 hops
  192.168.0.0/16 via 0.0.0.0 in 1 hops
  209.165.200.228/30 via 0.0.0.0 in 1 hops
R3#
RIP: sending v2 update to 224.0.0.9 via FastEthernet0/0 (172.30.100.1)
RIP: build update entries
  10.1.0.0/16 via 0.0.0.0, metric 2, tag 0
  172.30.1.0/24 via 0.0.0.0, metric 3, tag 0
  172.30.2.0/24 via 0.0.0.0, metric 3, tag 0
  172.30.110.0/24 via 0.0.0.0, metric 1, tag 0
  172.30.200.16/28 via 0.0.0.0, metric 1, tag 0
  172.30.200.32/28 via 0.0.0.0, metric 1, tag 0
  192.168.0.0/16 via 0.0.0.0, metric 2, tag 0
  209.165.200.228/30 via 0.0.0.0, metric 2, tag 0
  209.165.200.232/30 via 0.0.0.0, metric 1, tag 0
- RIP: sending v2 update to 224.0.0.9 via Serial0/0/1 (209.165.200.234)
RIP: build update entries
  172.30.100.0/24 via 0.0.0.0, metric 1, tag 0
  172.30.110.0/24 via 0.0.0.0, metric 1, tag 0
  172.30.200.16/28 via 0.0.0.0, metric 1, tag 0
  172.30.200.32/28 via 0.0.0.0, metric 1, tag 0
    
```

RIPv2 supports VLSM

# VLSM & CIDR

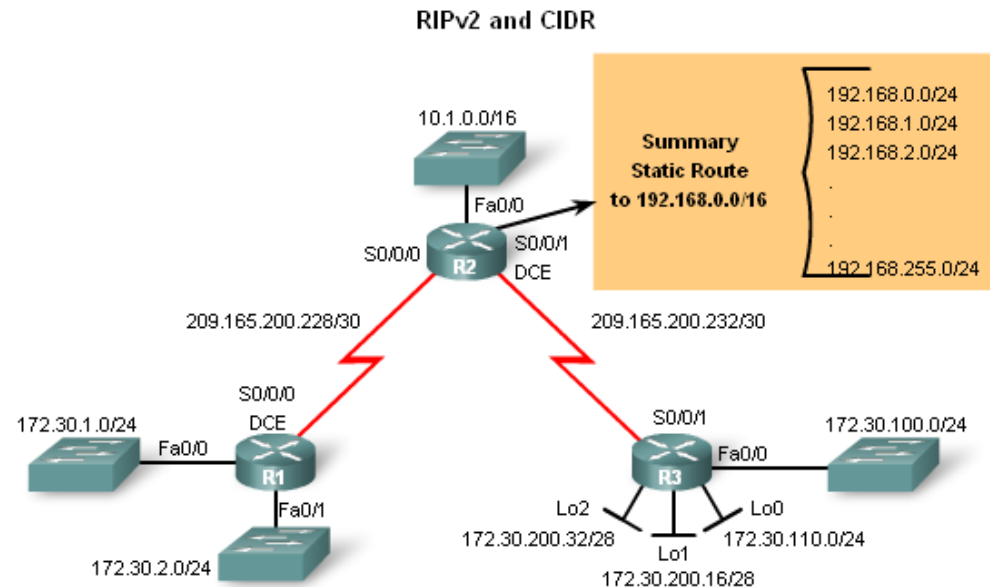
- CIDR uses Supernetting

Supernetting is a bunch of contiguous classful networks that is addressed as a single network.

# VLSM & CIDR

- To **verify** that **supernets** are being sent and received use the following commands

- Show ip route
- Debug ip rip



**RIPv2 and CIDR**

```

R2(config)#router rip
R2(config-router)#redistribute static
R2(config-router)#network 10.0.0.0
R2(config-router)#network 209.165.200.0
R2(config-router)#exit
R2(config)#ip route 192.168.0.0 255.255.0.0 null0
    
```

**192.168.0.0/16 is a Supernet.**

```

R2#debug ip rip
RIP protocol debugging is on
R2#
RIP: sending v2 update to 224.0.0.9 via Serial10/0/0 (209.165.200.229)
RIP: build update entries
  10.1.0.0/16 via 0.0.0.0, metric 1, tag 0
  172.30.100.0/24 via 0.0.0.0, metric 2, tag 0
  172.30.110.0/24 via 0.0.0.0, metric 2, tag 0
  172.30.200.16/28 via 0.0.0.0, metric 2, tag 0
  172.30.200.32/28 via 0.0.0.0, metric 2, tag 0
  192.168.0.0/16 via 0.0.0.0, metric 1, tag 0
  209.165.200.232/30 via 0.0.0.0, metric 1, tag 0
    
```

**Supernet is sent by R2.**

# Verifying & Troubleshooting RIPv2

- **Basic Troubleshooting** steps
  - Check the status of all links
  - Check cabling
  - Check IP address & subnet mask configuration
  - Remove any unneeded configuration commands
- **Commands used to verify proper operation of RIPv2**
  - Show ip interfaces brief
  - Show ip protocols
  - Debug ip rip
  - Show ip route

# Verifying & Troubleshooting RIPv2

- Common RIPv2 Issues
- When trouble shooting RIPv2 examine the following issues:
  - Version
    - Check to make sure you are using version 2
  - Network statements
    - Network statements may be incorrectly typed or missing
  - Automatic summarization
    - If summarized routes are not needed then disable automatic summarization



# Verifying & Troubleshooting RIPv2

- Reasons why it's good to authenticate routing information
  - Prevent the possibility of accepting invalid routing updates
  - Contents of routing updates are encrypted
- Types of routing protocols that can use authentication
  - RIPv2
  - EIGRP
  - OSPF
  - IS-IS
  - BGP

# Summary

Routing Protocol	Distance Vector	Classless Routing Protocol	Uses Hold-Down Timers	Use of Split Horizon or Split Horizon w/ Poison Reverse	Max Hop count = 15	Auto Summary	Support CIDR	Supports VLSM	Uses Authentication
<b>RIPv1</b>	Yes	No	Yes	Yes	Yes	Yes	No	No	No
<b>RIPv2</b>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

