# RIP

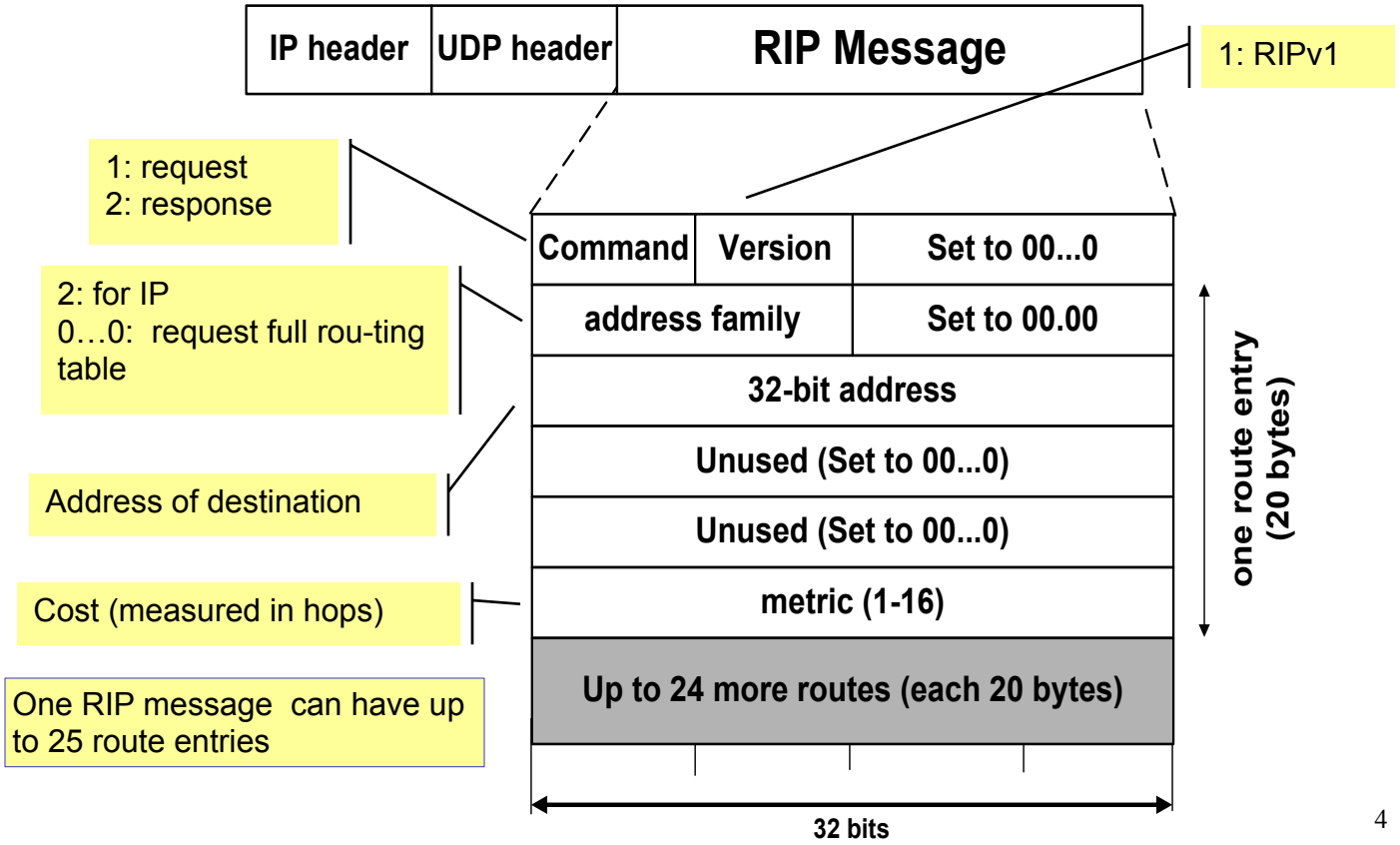
# RIP - Routing Information Protocol

- Um protocolo simples inter-domínio
- Implementação direta do Roteamento de Vetor de Distância
- Cada roteador anuncia seu vetor de distância a cada 30 segundos (ou sempre que sua tabela de roteamento mudar) para todos os seus vizinhos
- RIP sempre usa 1 como métrica de link
- A contagem máxima de saltos é 15, com "16" igual a "∞"
- Rotas são consideradas inativas (definidas para 16) após 3 minutos se não forem atualizadas

# RIP - História

- Final dos anos 1960: Protocolos de Vetor de Distância foram usados na ARPANET
- Meio dos anos 1970: O protocolo de roteamento XNS (Xerox Network System) é o precursor do RIP em IP (e o RIP do IPX da Novell e o protocolo de roteamento da Apple)
- 1982: Lançamento do routed para BSD Unix
- 1988: RIPv1 (RFC 1058) roteamento classful
- 1993: RIPv2 (RFC 1388) adiciona máscaras de sub-rede com cada entrada de rota; permite roteamento sem classes
- 1998: Versão atual do RIPv2 (RFC 2453)

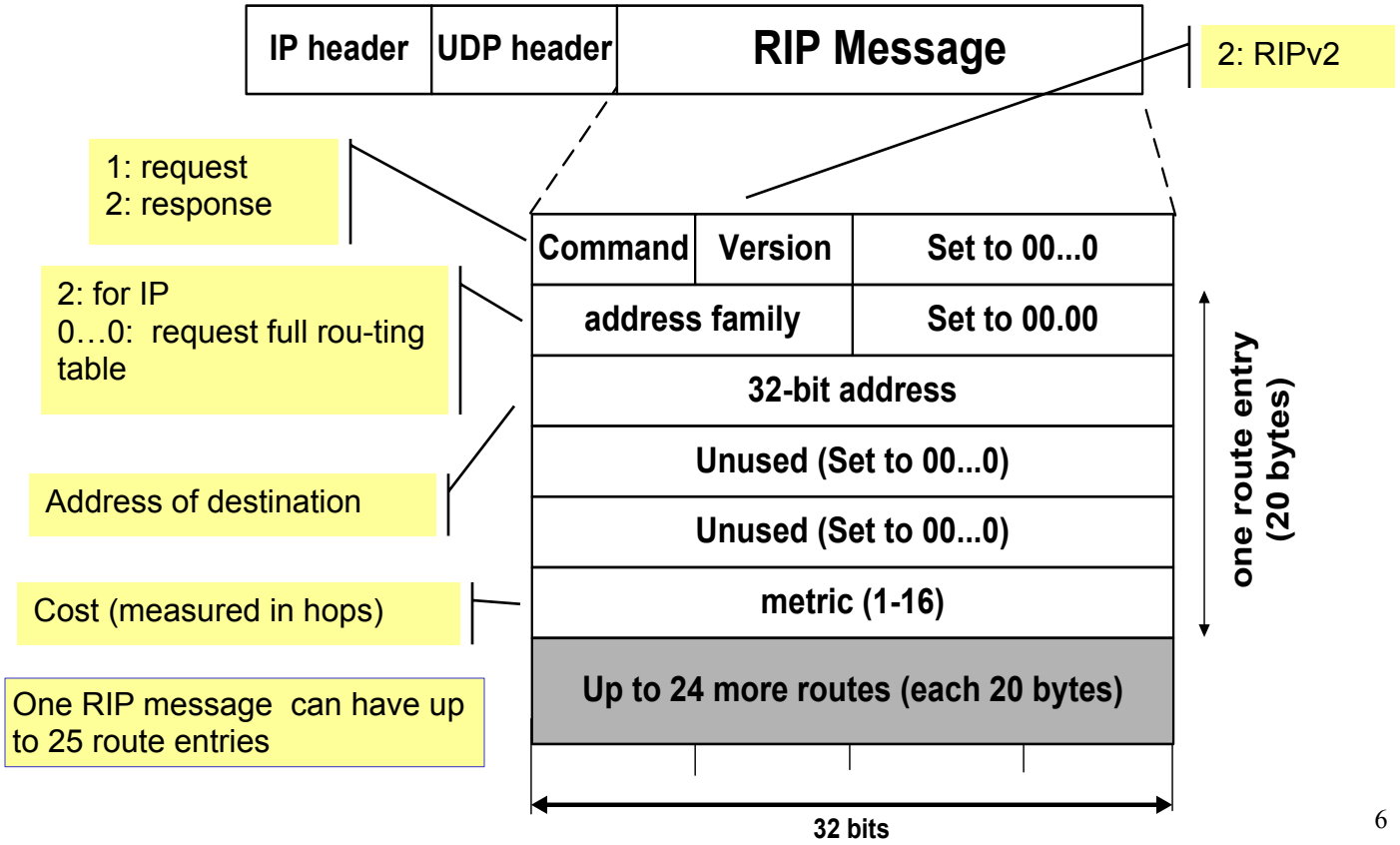
# RIPv1 Packet Format



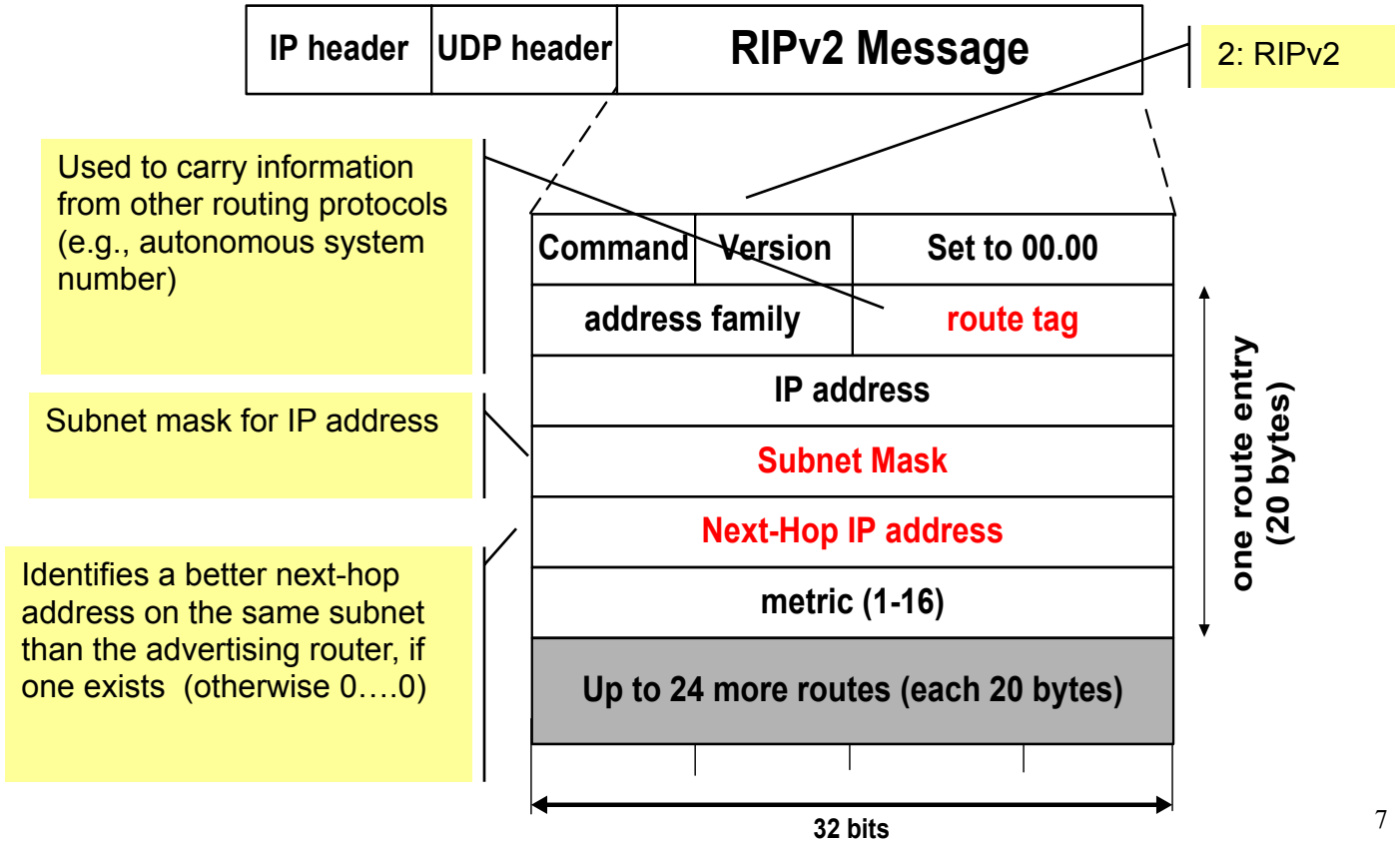
# RIPv2

- O RIPv2 é uma extensão do RIPv1:
  - Máscaras de sub-rede são incluídas nas informações de rota
  - Autenticação de mensagens de roteamento
  - Informações de rota apresentam o melhor endereço de próximo salto, se existir
  - Explora o multicasting IP
- Extensões do RIPv2 são incluídas em campos não utilizados das mensagens do RIPv1

# RIPv2 Packet Format



# RIPv2 Packet Format



# RIP Messages

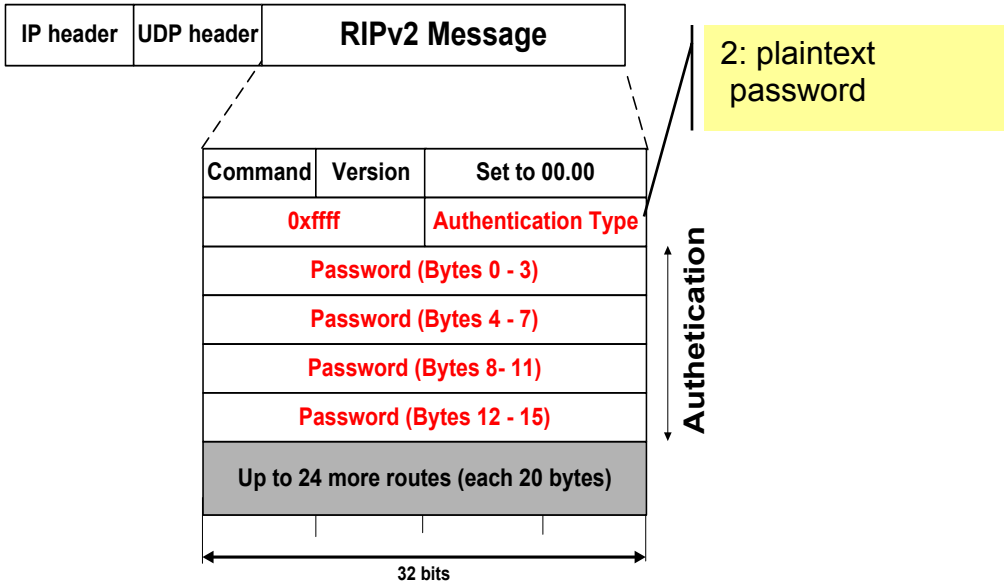
- Esta é a operação do RIP em routed. A porta dedicada para o RIP é a porta UDP 520.
- Dois tipos de mensagens:
  - Mensagens de solicitação
    - usadas para pedir aos nós vizinhos por uma atualização
  - Mensagens de resposta
    - contêm uma atualização

# Routing with RIP

- **Inicialização:** Enviar um pacote de solicitação (comando = 1, família de endereços = 0..0) em todas as interfaces:
  - RIPv1 usa broadcast, se possível,
  - RIPv2 usa o endereço multicast 224.0.0.9, se possível solicitando tabelas de roteamento dos roteadores vizinhos
- **Solicitação recebida**: Roteadores que recebem a solicitação acima enviam sua tabela de roteamento completa
- **Resposta recebida**: Atualizar a tabela de roteamento
- **Atualizações regulares de roteamento**: A cada 30 segundos, enviar toda ou parte das tabelas de roteamento para cada vizinho em uma mensagem de resposta
- **Atualizações Disparadas**: Sempre que a métrica para uma rota mudar, enviar a tabela de roteamento completa.

# RIP Security

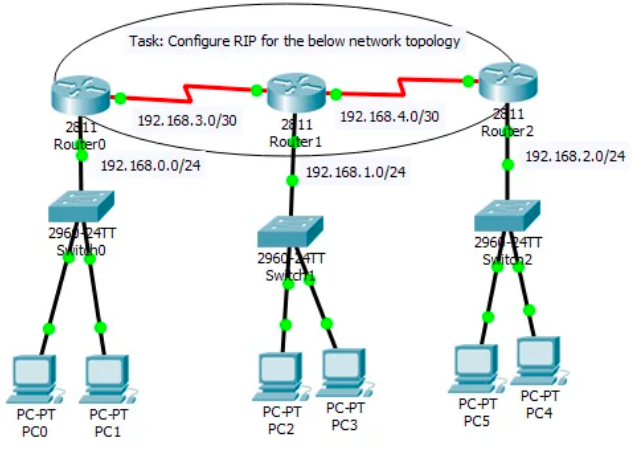
- Problema: Enviar atualizações de roteamento falsas para um roteador
- RIPv1: Sem proteção
- RIPv2: Esquema simples de autenticação



# RIP Problems

- O RIP demora muito para se estabilizar
  - Mesmo para uma rede pequena, leva vários minutos até que as tabelas de roteamento se estabilizem após uma mudança
- O RIP tem todos os problemas dos algoritmos de vetor de distância, por exemplo, contagem para o infinito
- O RIP usa o horizonte dividido para evitar a contagem para o infinito
- O caminho máximo no RIP é de 15 saltos

# Router RIP Configuration Mode




- Use the **router rip** command to enable RIP v1
- Use the **no router rip command** to disable RIP

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

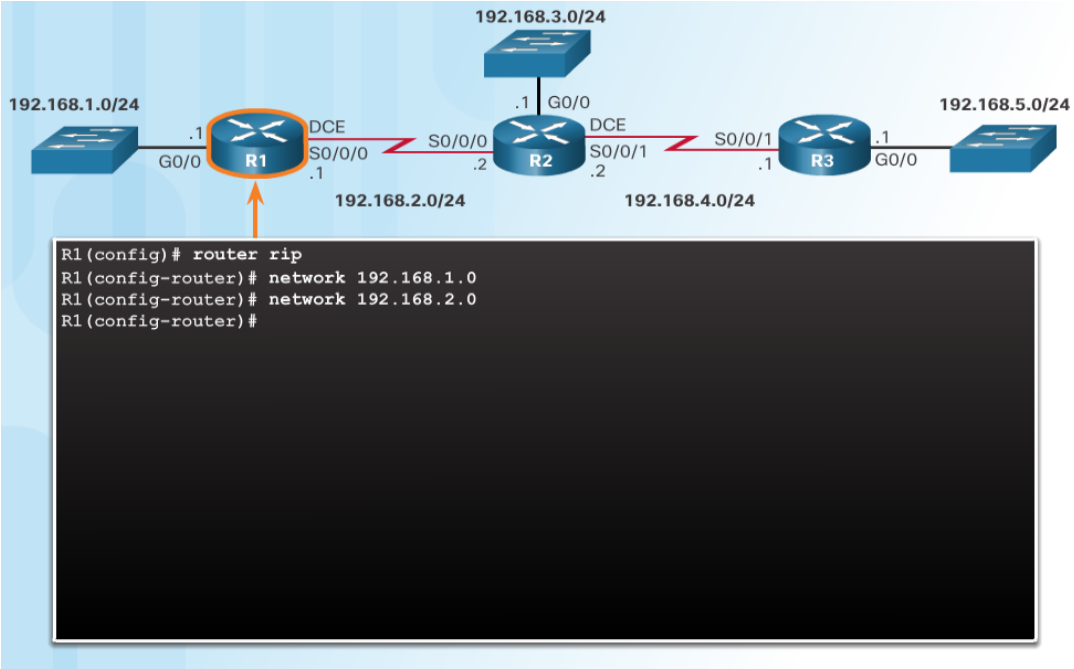
## RIP Configuration Options

```
R1(config-router)# ?

Router configuration commands:
  address-family           Enter Address Family command mode
  auto-summary             Enable automatic network number summarization
  default                  Set a command to its defaults
  default-information      Control distribution of default information
  default-metric           Set metric of redistributed routes
  distance                 Define an administrative distance
  distribute-list          Filter networks in routing updates
  exit                     Exit from routing protocol configuration mode
  flash-update-threshold   Specify flash update threshold insecond
  help                     Description of the interactive help system
  input-queue              Specify input queue depth
  maximum-paths            Forward packets over multiple paths
  neighbor                 Specify a neighbor router
  network                  Enable routing on an IP network
  no                       Negate a command or set its defaults
  offset-list              Add or subtract offset from RIP metrics
  output-delay             Interpacket delay for RIP updates
  passive-interface        Suppress routing updates on an interface
  redistribute             Redistribute information from another routing protocol
  timers                   Adjust routing timers
  traffic-share            How to compute traffic share over alternate paths
  validate-update-source   Perform sanity checks against source address of routing updates
  version                  Set routing protocol version

R1(config-router)#
```

# Advertise Networks




- The **network** *network-address* router configuration mode command:
  - Enables RIP on all interfaces that belong to a specific network
  - Advertises the network in RIP routing updates sent to other routers every 30 seconds.

**Note**: RIPv1 is a classful routing protocol for IPv4.

# Configuring the RIP Protocol
# Verify RIP Routing

```
R1# show ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "rip"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Sending updates every 30 seconds, next due in 16 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Redistributing: rip

  Default version control: send version 1, receive any version
    Interface              Send  Recv  Triggered RIP  Key-chain
    GigabitEthernet0/0     1     1 2
    Serial0/0/0            1     1 2

  Automatic network summarization is in effect
  Maximum path: 4
  Routing for Networks:
    192.168.1.0
    192.168.2.0

  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.2.2          120      00:00:15
  Distance: (default is 120)

R1#
```

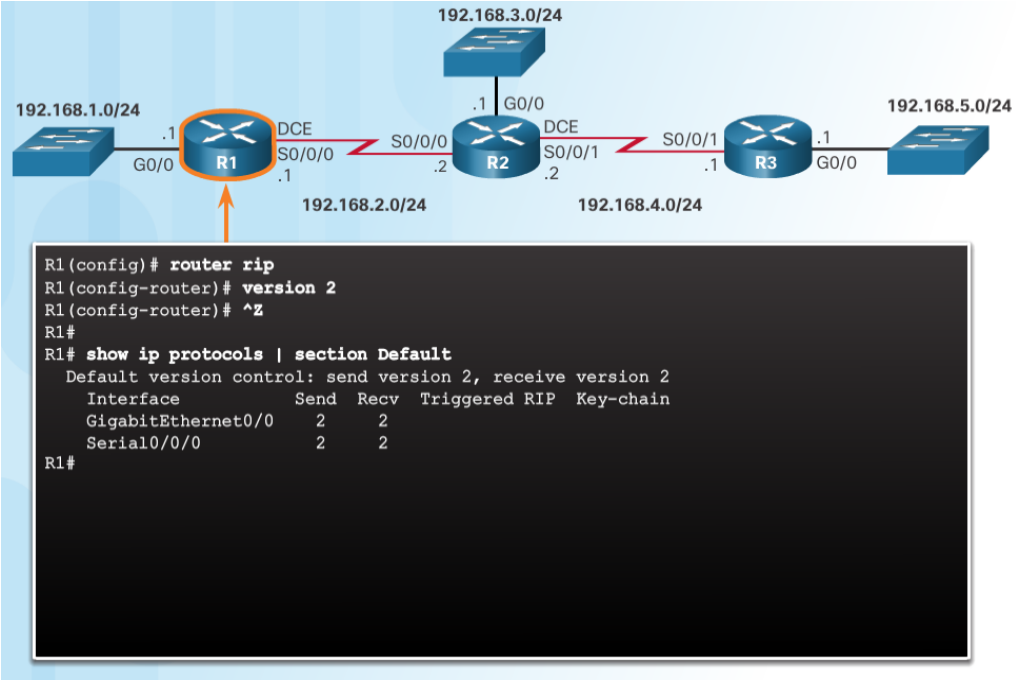
**show ip protocols –** displays IPv4 routing protocols configured on the router.

```
R1# show ip route | begin Gateway
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        192.168.2.0/24 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, 00:00:24,
Serial0/0/0
R     192.168.4.0/24 [120/1] via 192.168.2.2, 00:00:24,
Serial0/0/0
R     192.168.5.0/24 [120/2] via 192.168.2.2, 00:00:24,
Serial0/0/0
R1#
```

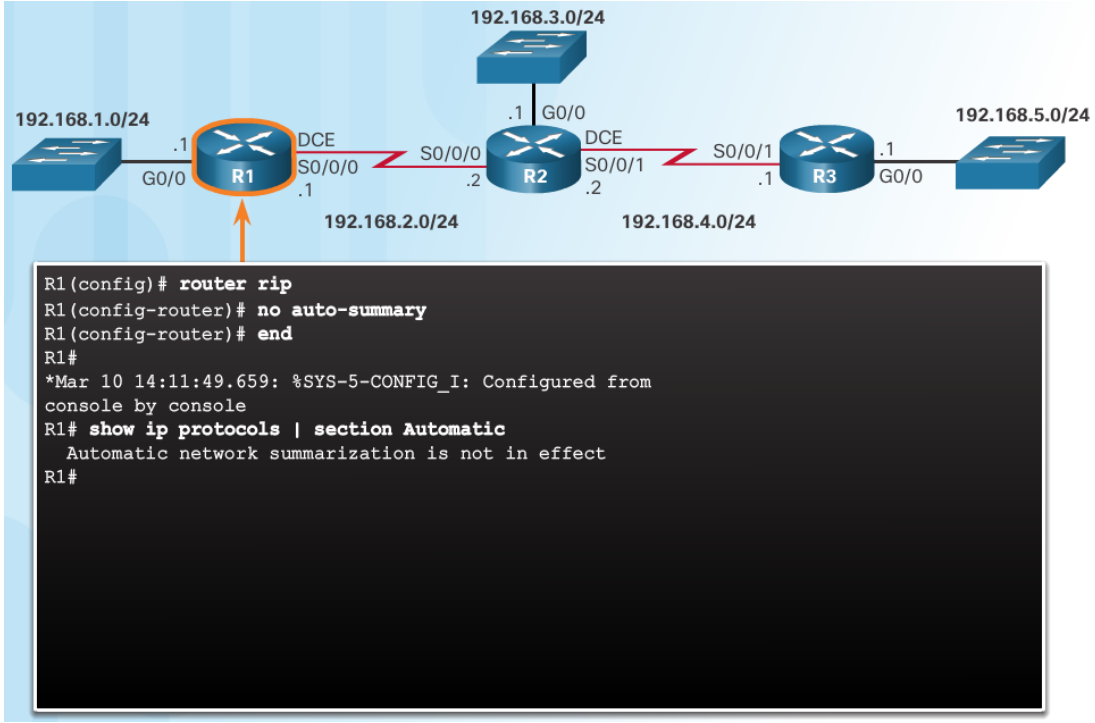
**show ip route –** displays RIP routes installed in the routing table.

# 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.

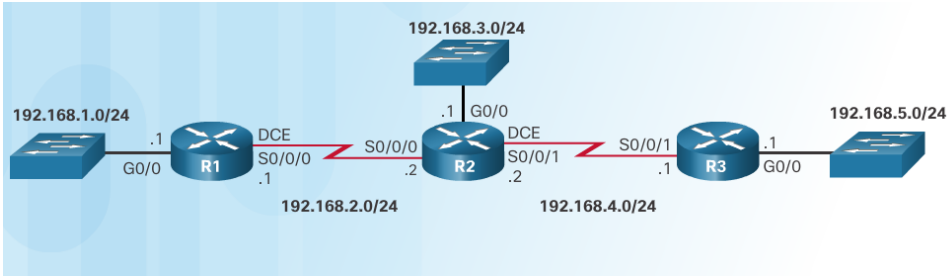
# Disable Auto Summarization




- 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

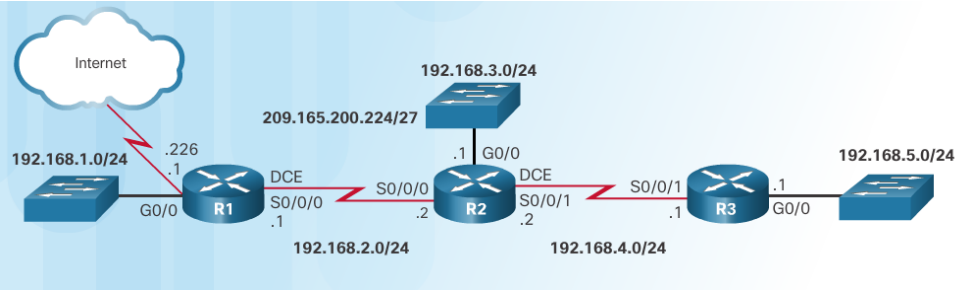
- RIP updates:
  - Are forwarded out all RIP-enabled interfaces by default.
  - Only need to be sent out interfaces that are connected to other RIP-enabled routers.
- Sending RIP updates to LANs wastes bandwidth, wastes resources, and is a security risk.
- Use the **passive-interface** router configuration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

# Propagate a Default Route



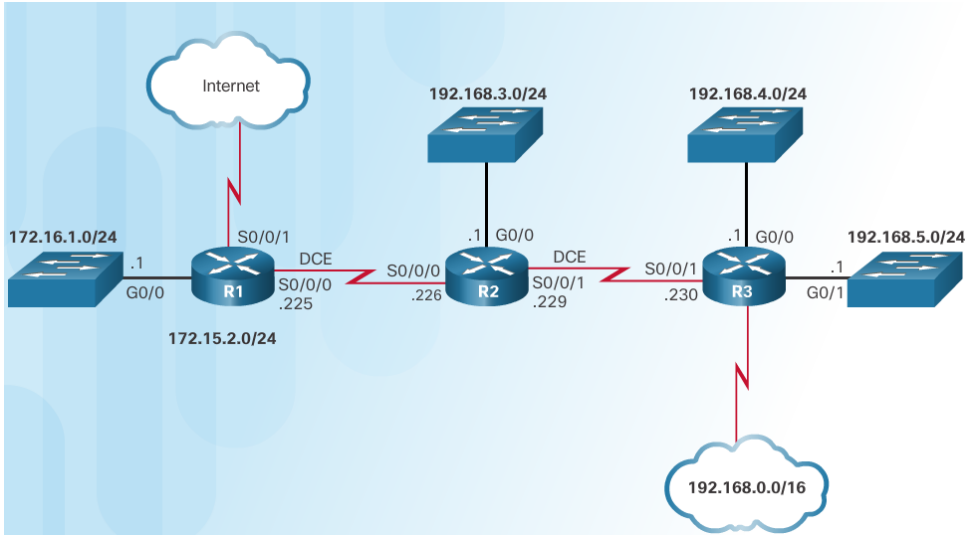

```
R1(config)# ip route 0.0.0.0 0.0.0.0 S0/0/1 209.165.200.226
R1(config)# router rip
R1(config-router)# default-information originate
R1(config-router)# ^Z
R1#
*Mar 10 23:33:51.801: %SYS-5-CONFIG_I: Configured from console by console
R1# show ip route | begin Gateway
Gateway of last resort is 209.165.200.226 to network 0.0.0.0

S*    0.0.0.0/0 [1/0] via 209.165.200.226, Serial0/0/1
      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        192.168.2.0/24 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, 00:00:08, Serial0/0/0
R     192.168.4.0/24 [120/1] via 192.168.2.2, 00:00:08, Serial0/0/0
R     192.168.5.0/24 [120/2] via 192.168.2.2, 00:00:08, Serial0/0/0
      209.165.200.0/24 is variably subnetted, 2 subnets, 2 masks
C        209.165.200.0/24 is directly connected, Serial0/0/1
L        209.165.200.225/27 is directly connected, Serial0/0/1
R1#
```

- In the diagram a default static route to the Internet is configured on R1.
- The **default-information originate** router configuration command instructs R1 to send the default static route information in the RIP updates.

# 3.3 The Routing Table

# Parts of an IPv4 Route Entry
# Routing Table Entries

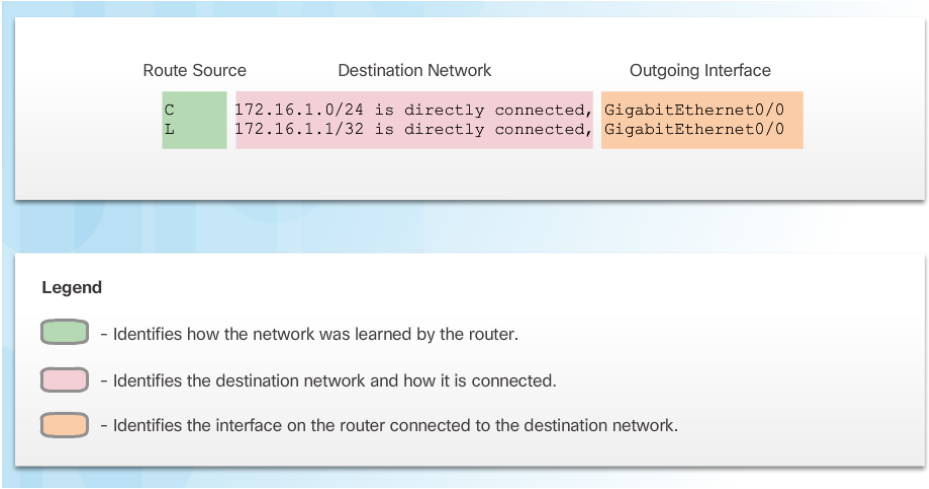



```
R1# show ip route | begin Gateway
Gateway of last resort is 209.165.200.234 to network 0.0.0.0

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

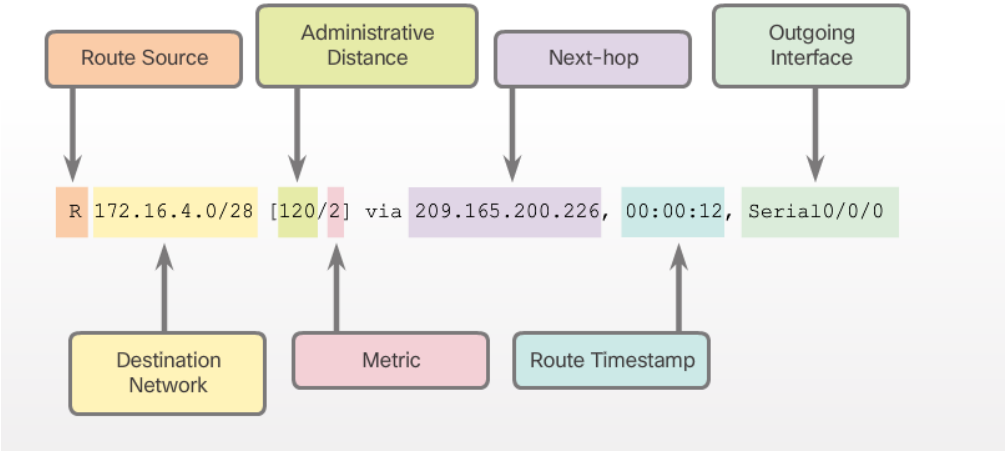
# Directly Connected Entries




- 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

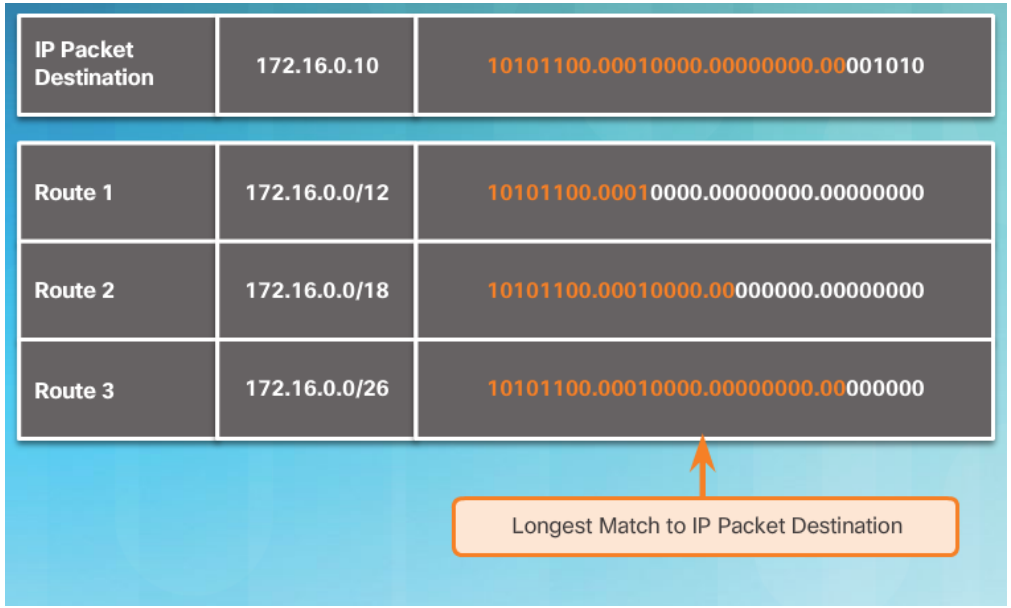
# Remote Network Entries




- 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

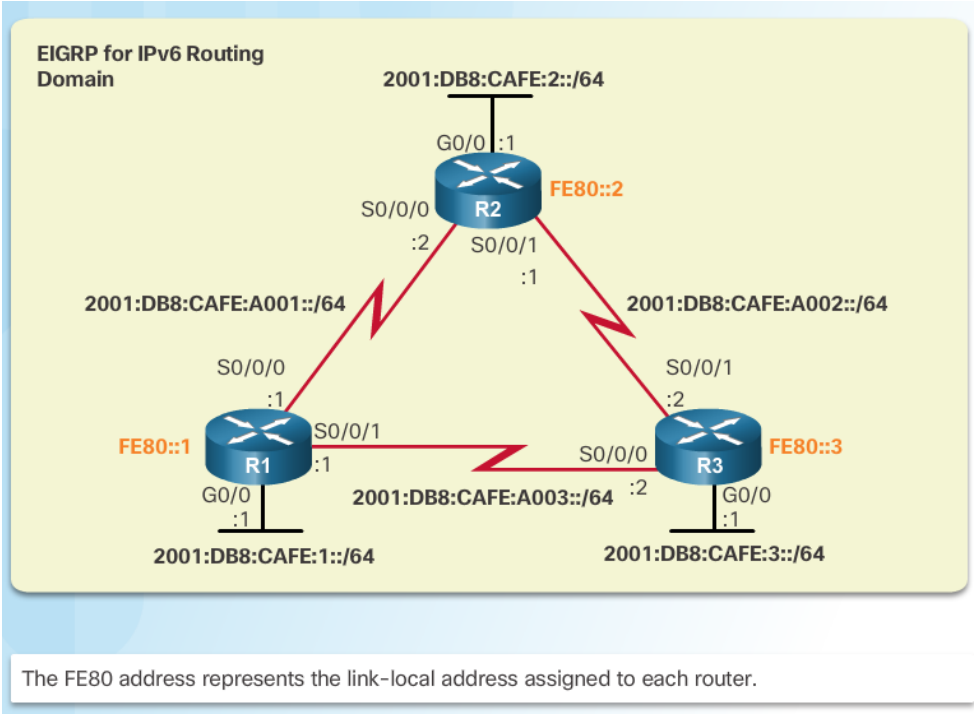
# Best Route = Longest Match

- The best match is the route in the routing table that has the most number of far left matching bits with the destination IPv4 address of the packet.
- The route with the greatest number of equivalent far left bits, or the longest match, is always the preferred route.

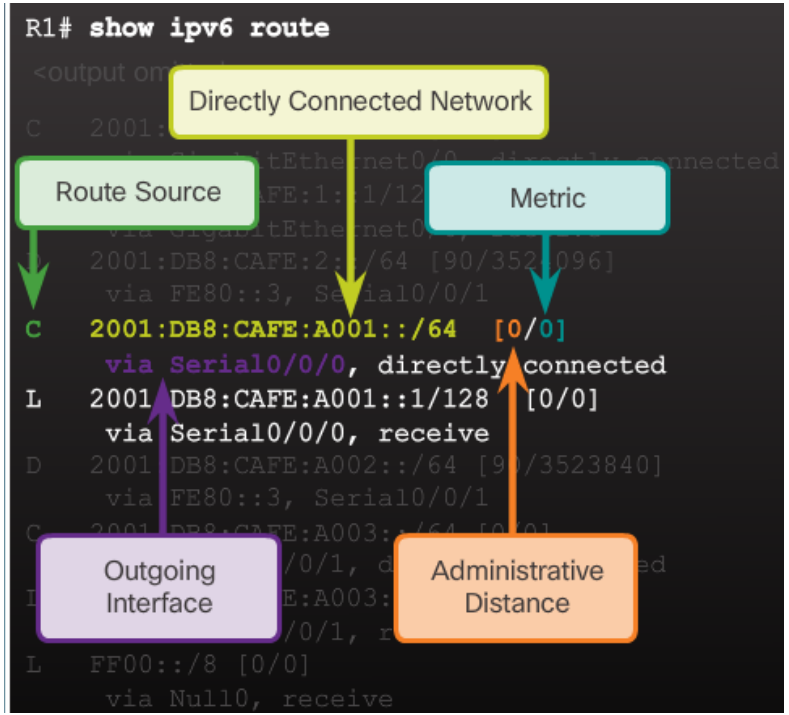


# IPv6 Routing Table Entries

- An IPv6 routing table includes directly connected, static and dynamically learned routes.
- All IPv6 routes are level 1 ultimate routes.

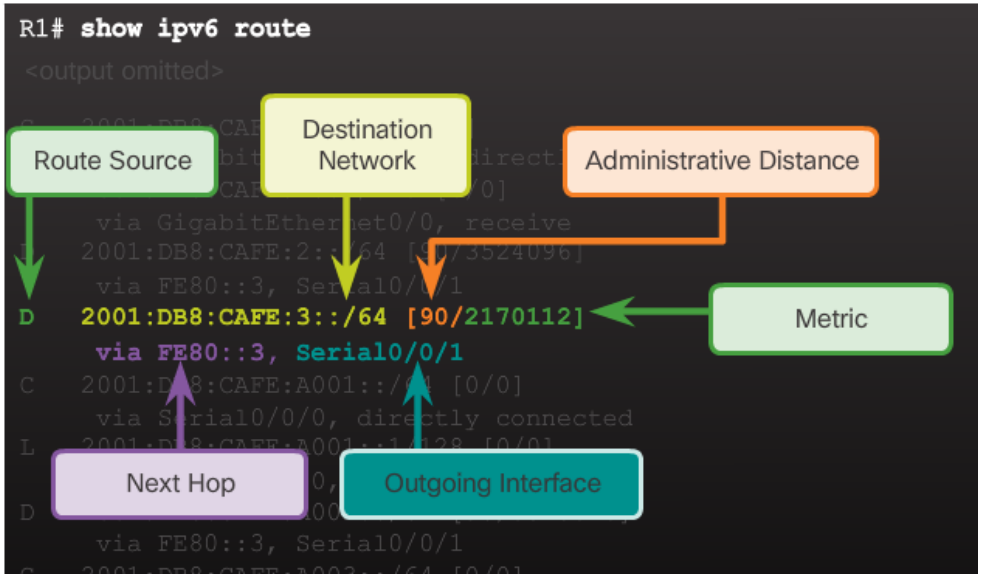


# Directly Connected Entries




- Use the **show ipv6 route** command to display the IPv6 routing table.
- The directly connected route entries include the following:
  - Route source – How the route was learned. Directly connected indicated with a C and L for local route.
  - Directly connected network address.
  - Administrative distance – Trustworthiness of the route (lower more trustworthy).
  - Metric – Value assigned to reach the network (lower is preferred route).
  - Outgoing interface – Exit interface used to forward packet.

# Remote IPv6 Network Entries




- The remote IPv6 route entries also include the following:
  - Route source – How the route was learned. Common codes include O (OSPF), D (EIGRP), R (RIP), and S (Static route).
  - Next hop - Identifies the IPv6 address of the next router to forward the packet to.
- The IPv6 router lookup process:
  - Examines level 1 network routes for the best match.
  - Longest match is the best match.

# Proximo desafio…