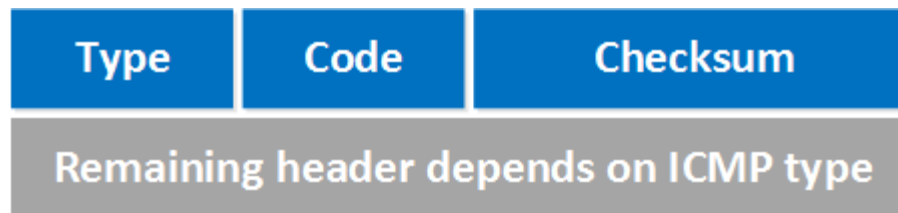


Network Layer

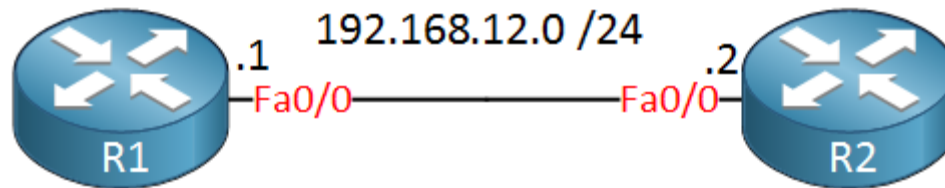
Presented by
Sumon Ahmed Sabir
F. M. Rashed Amin
Shaila Sharmin
M Abdullah Al Naser

Internet Control Message Protocol (ICMP)

- ICMP is a network layer protocol used for diagnostics and network management
- A good example is the “ping” utility
- “ping” uses an ICMP echo request and ICMP echo reply message
- When a certain host or port is unreachable, ICMP might send an error message to the source
- Another example of an application that uses ICMP is “traceroute”



Internet Control Message Protocol (ICMP)



```
R1#ping 192.168.12.2
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 192.168.12.2, timeout is 2 seconds:
```

```
!!!!
```

```
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/21/64 ms
```

Internet Control Message Protocol (ICMP)

```
Frame 5: 114 bytes on wire (912 bits), 114 bytes captured (912 bits) on interface 0
Ethernet II, Src: c2:01:1a:18:00:00 (c2:01:1a:18:00:00), Dst: c2:02:09:58:00:00 (c2:02:09:58:00:00)
Internet Protocol Version 4, Src: 192.168.12.1 (192.168.12.1), Dst: 192.168.12.2 (192.168.12.2)
Internet Control Message Protocol
  Type: 8 (Echo (ping) request)
  Code: 0
  Checksum: 0x6c78 [correct]
  Identifier (BE): 0 (0x0000)
  Identifier (LE): 0 (0x0000)
  Sequence number (BE): 1 (0x0001)
  Sequence number (LE): 256 (0x0100)
  [Response frame: 6]
Data (72 bytes)
  Data: 00000000000111d0abcdabcdabcdabcdabcdabcdabcd...
  [Length: 72]
```

```
Frame 6: 114 bytes on wire (912 bits), 114 bytes captured (912 bits) on interface 0
Ethernet II, Src: c2:02:09:58:00:00 (c2:02:09:58:00:00), Dst: c2:01:1a:18:00:00 (c2:01:1a:18:00:00)
Internet Protocol Version 4, Src: 192.168.12.2 (192.168.12.2), Dst: 192.168.12.1 (192.168.12.1)
Internet Control Message Protocol
  Type: 0 (Echo (ping) reply)
  Code: 0
  Checksum: 0x7478 [correct]
  Identifier (BE): 0 (0x0000)
  Identifier (LE): 0 (0x0000)
  Sequence number (BE): 1 (0x0001)
  Sequence number (LE): 256 (0x0100)
  [Request frame: 5]
  [Response time: 44,194 ms]
Data (72 bytes)
  Data: 00000000000111d0abcdabcdabcdabcdabcdabcdabcd...
  [Length: 72]
```

<https://www.iana.org/assignments/icmp-parameters/icmp-parameters.xhtml>

Internet Control Message Protocol (ICMP)

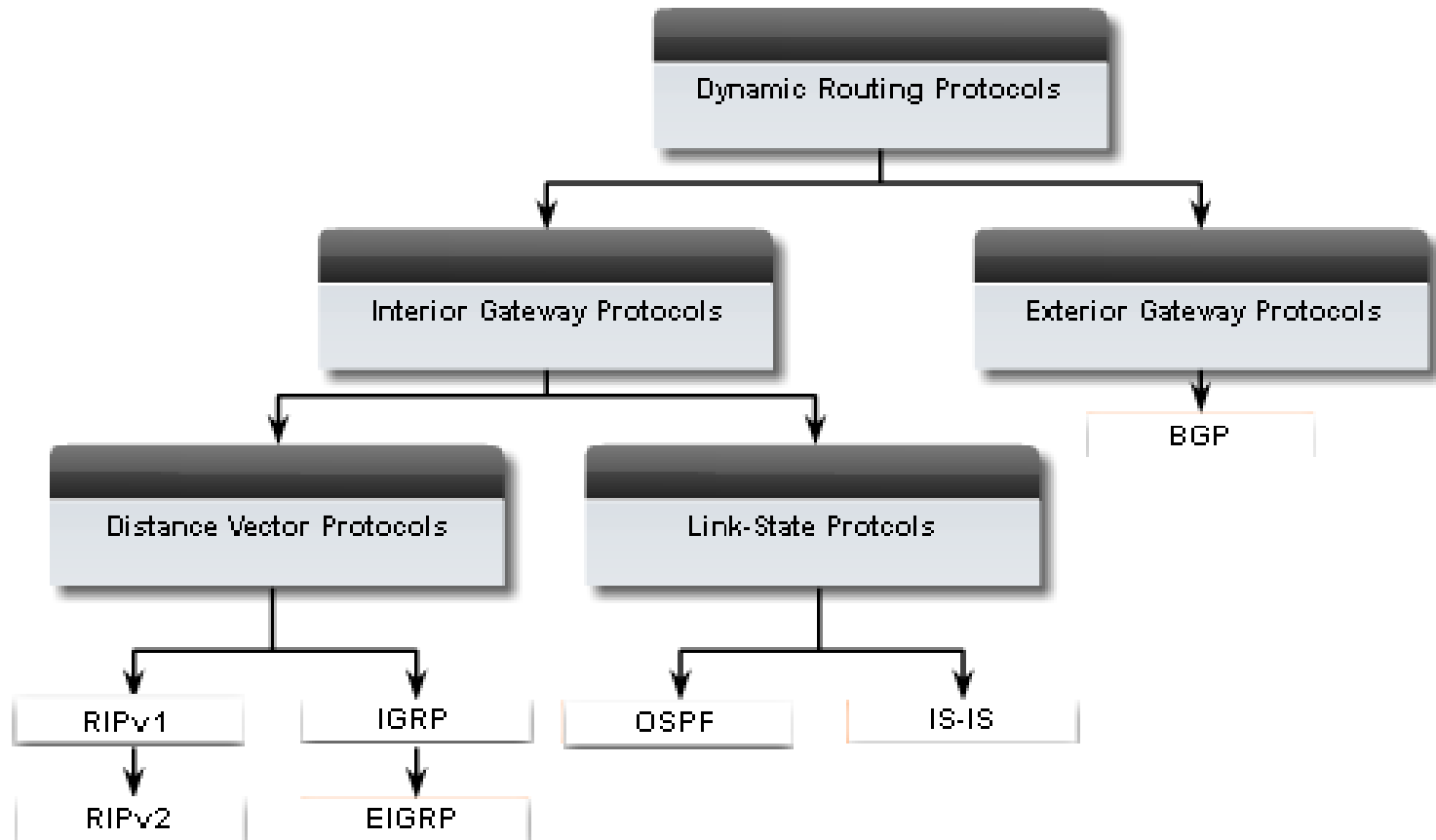
- Echo Request (Type 8 Code 0)
 - Echo Reply (Type 0 Code 0)
 - Destination Host Unreachable (Type 3 Code 1)
 - Destination Host Unreachable (Type 3 Code 13)
Request Timed Out (Admin Prohibited)
 - Destination Network Unreachable (Type 3 Code 0)
 - Time to Live exceeded in Transit (Type 11 Code 0)
- and so on !!



Routing in Internet

RIP, OSPF, BGP

Classification of Dynamic Protocols



Routing Information Protocol (RIP)

Routing Information Protocol (RIP) was originally specified in **RFC 1058**. It has the following key characteristics:

- RIP is a **distance vector** routing protocol
- **Hop count** is used as the metric for path selection.
- If the hop count for a network is greater than **15**, RIP cannot supply a route to that network.
- Routing updates are broadcast or multicast every **30 seconds**, by default
- RIP has two versions: **1** and **2**

Routing Information Protocol (RIP)

Distance Vector

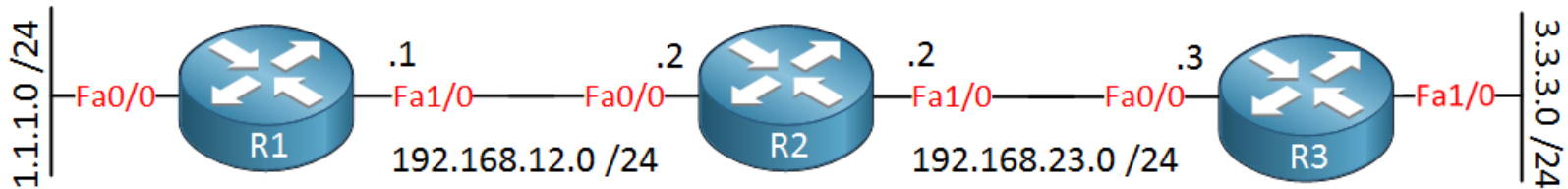


Distance: How far away?

Vector: Which direction?

Routing Information Protocol (RIP)

RIP Exchange



Routing Table	
1.1.1.0 /24	Fa0/0 0
192.168.12.0 /24	Fa1/0 0

Routing Table	
192.168.12.0 /24	Fa0/0 0
192.168.23.0 /24	Fa1/0 0

Routing Table	
192.168.23.0 /24	Fa0/0 0
3.3.3.0 /24	Fa1/0 0

Routing Information Protocol (RIP)

RIP Exchange



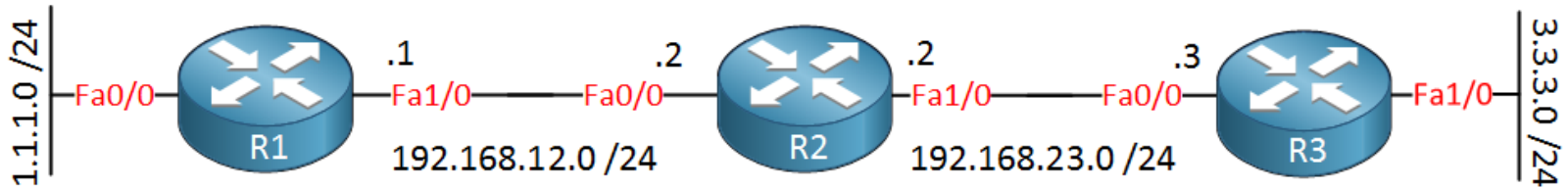
Routing Table		
1.1.1.0 /24	Fa0/0	0
192.168.12.0 /24	Fa1/0	0
192.168.23.0 /24	Fa1/0	1

Routing Table		
192.168.12.0 /24	Fa0/0	0
192.168.23.0 /24	Fa1/0	0
1.1.1.0 /24	Fa0/0	1
3.3.3.0 /24	Fa1/0	1

Routing Table		
192.168.23.0 /24	Fa0/0	0
3.3.3.0 /24	Fa1/0	0
192.168.12.0 /24	Fa0/0	1

Routing Information Protocol (RIP)

RIP Convergence



Routing Table		
1.1.1.0 /24	Fa0/0	0
192.168.12.0 /24	Fa1/0	0
192.168.23.0 /24	Fa1/0	1
3.3.3.0 /24	Fa1/0	2

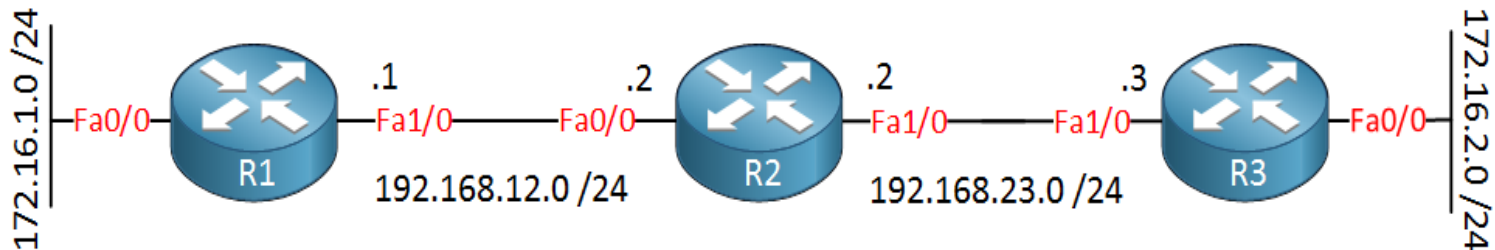
Routing Table		
192.168.12.0 /24	Fa0/0	0
192.168.23.0 /24	Fa1/0	0
1.1.1.0 /24	Fa0/0	1
3.3.3.0 /24	Fa1/0	1

Routing Table		
192.168.23.0 /24	Fa0/0	0
3.3.3.0 /24	Fa1/0	0
192.168.12.0 /24	Fa0/0	1
1.1.1.0 /24	Fa0/0	2

Converged!!

Routing Information Protocol (RIP)

Configuring RIPv1



```
R1(config)#router rip
```

```
R1(config-router)#network 172.16.1.0
```

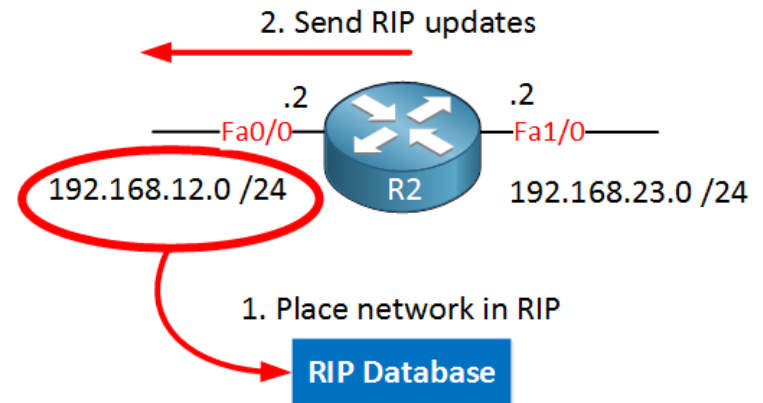
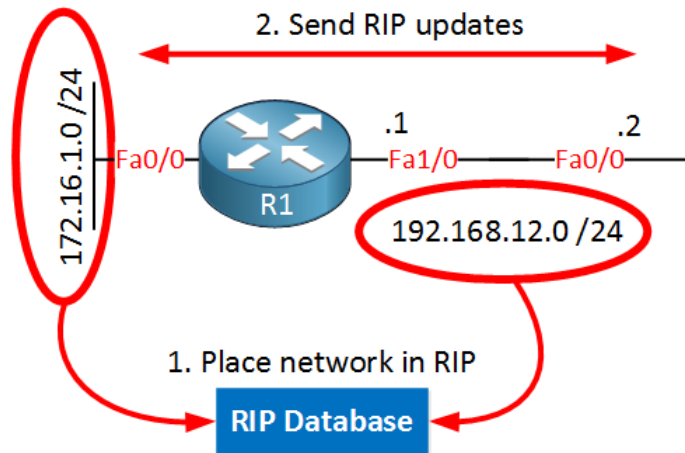
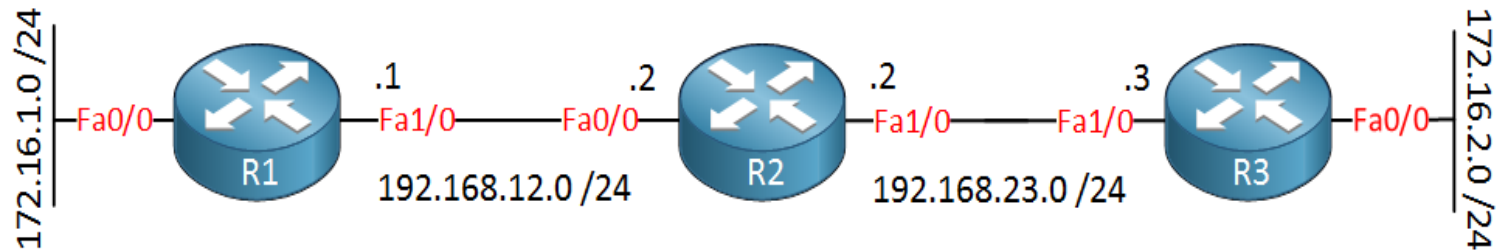
```
R1(config-router)#network 192.168.12.0
```

```
R2(config)#router rip
```

```
R2(config-router)#network 192.168.12.0
```

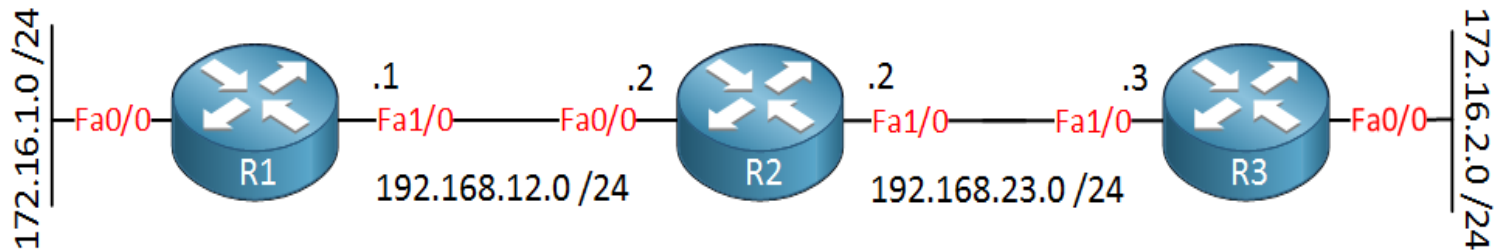
Routing Information Protocol (RIP)

RIP Database and Update



Routing Information Protocol (RIP)

RIP Database and Update



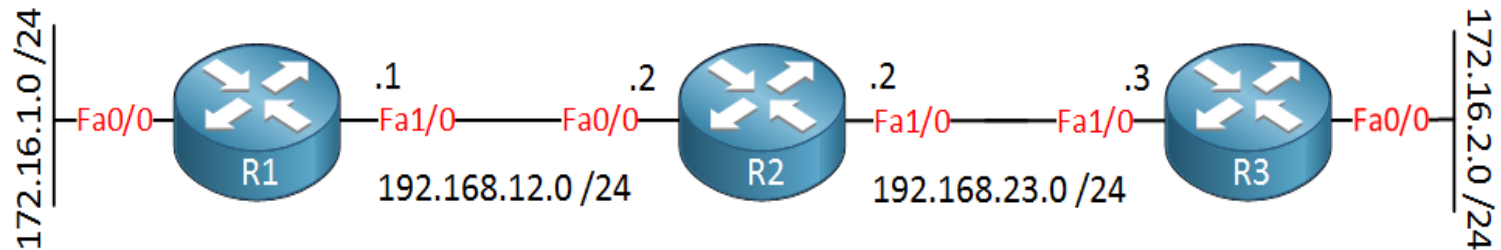
```
R2#show ip route rip
```

```
R 172.16.0.0/16 [120/1] via 192.168.12.1, 00:00:21, FastEthernet0/0
```

- The “R” means that this entry was learned through RIP
- “[120/1]” The first number (120) is the administrative distance. The second number (1) is the metric
- “via 192.168.12.1” this is the next hop IP address
- “00:00:21” This is the time since the last update for this entry
- “FastEthernet0/0” This is the outgoing interface

Routing Information Protocol (RIP)

Configuring RIPv1 (Cont.)

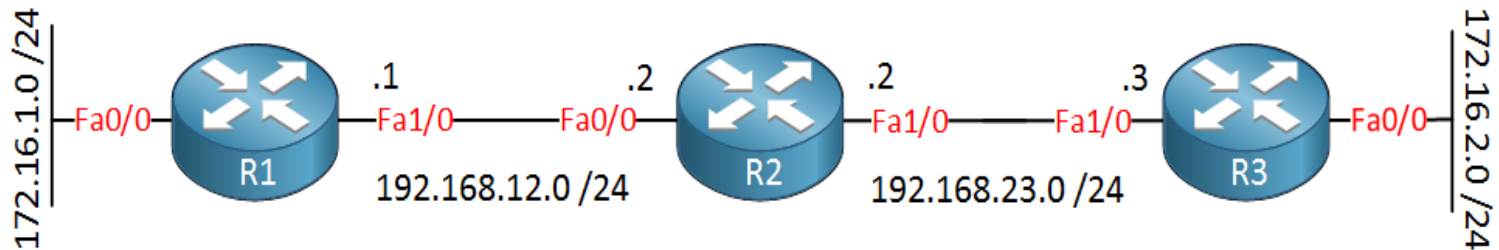


```
R2(config)#router rip  
R2(config-router)#network 192.168.23.0
```

```
R3(config)#router rip  
R3(config-router)#network 192.168.23.0  
R3(config-router)#network 172.16.2.0
```


Routing Information Protocol (RIP)

Configuring RIPv1 (Cont.)



```
R1#show ip route rip
```

```
R 192.168.23.0/24 [120/1] via 192.168.12.2, 00:00:21, FastEthernet1/0
```

```
R2#show ip route rip
```

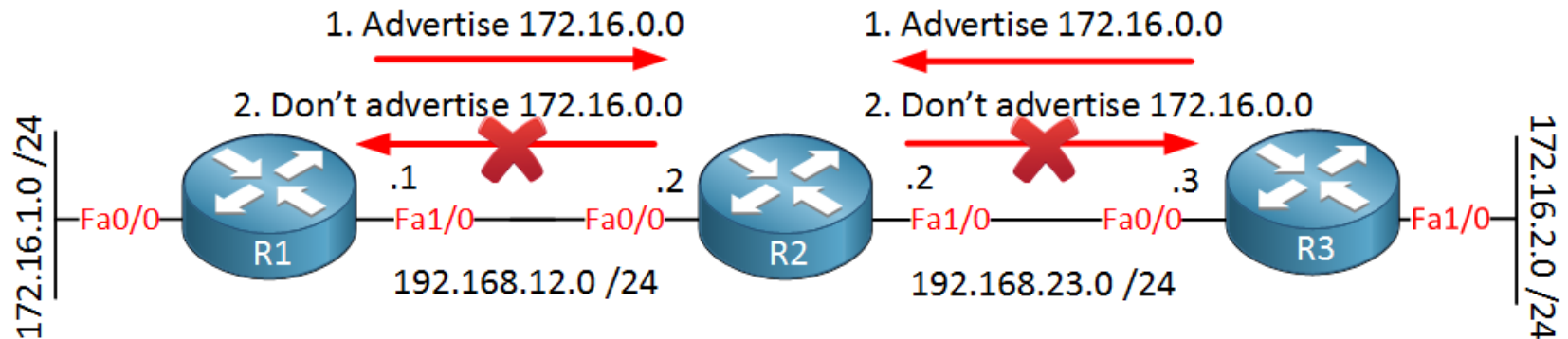
```
R 172.16.0.0/16 [120/1] via 192.168.23.3, 00:00:15, FastEthernet1/0  
[120/1] via 192.168.12.1, 00:00:11, FastEthernet0/0
```

```
R3#show ip route rip
```

```
R 192.168.12.0/24 [120/1] via 192.168.23.2, 00:00:26, FastEthernet1/0
```

Routing Information Protocol (RIP)

RIP Classful Issue / Split Horizon



RIP Split Horizon Rule:

R2 doesn't advertise to neighbors what it learned from them...

Note: default RIP is running version 1 which is classful.

It **does NOT** send a subnet mask along with the routing updates.

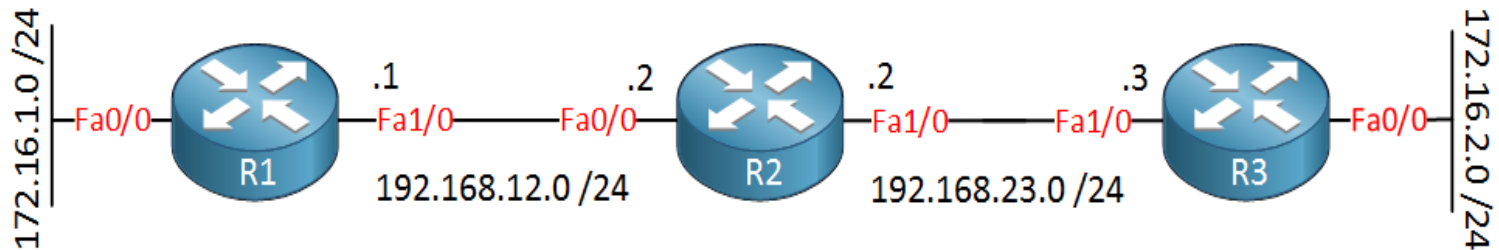
Routing Information Protocol (RIP)

RIP Version

RIP	Version 1	Version 2
Class	Classful	Classless
Addressing Type	Broadcast	Multicast
Support manual summaries	No	Yes
Authentication support	No	Yes

Routing Information Protocol (RIP)

Configuring RIPv2



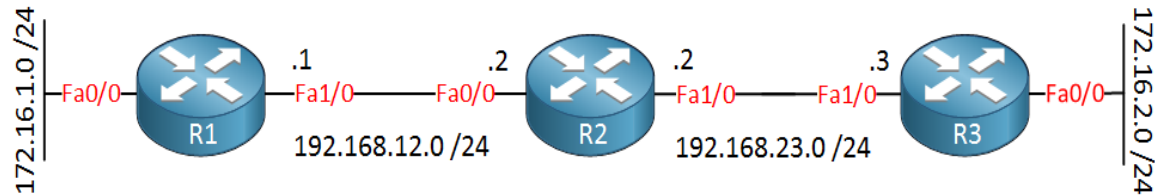
```
R1(config)#router rip  
R1(config-router)#version 2  
R1(config-router)#no auto-summary
```

```
R2(config)#router rip  
R2(config-router)#version 2  
R2(config-router)#no auto-summary
```

```
R3(config)#router rip  
R3(config-router)#version 2  
R3(config-router)#no auto-summary
```

Routing Information Protocol (RIP)

Configuring RIPv2



```
R1#show ip route rip
```

```
172.16.0.0/24 is subnetted, 2 subnets
```

```
R 172.16.2.0 [120/2] via 192.168.12.2, 00:00:24, FastEthernet1/0
```

```
R 192.168.23.0/24 [120/1] via 192.168.12.2, 00:00:24, FastEthernet1/0
```

```
R2#show ip route rip
```

```
172.16.0.0/24 is subnetted, 2 subnets
```

```
R 172.16.1.0 [120/1] via 192.168.12.1, 00:00:08, FastEthernet0/0
```

```
R 172.16.2.0 [120/1] via 192.168.23.3, 00:00:26, FastEthernet1/0
```

```
R3#show ip route rip
```

```
R 192.168.12.0/24 [120/1] via 192.168.23.2, 00:00:16, FastEthernet1/0
```

```
172.16.0.0/24 is subnetted, 2 subnets
```

```
R 172.16.1.0 [120/2] via 192.168.23.2, 00:00:16, FastEthernet1/0
```

Routing Information Protocol (RIP)

RIP Timer

Update

This is how often RIP sends routing updates, the default is **30 seconds**

Invalid

The number of seconds since RIP received the last valid update, once this timer expires the route goes into holddown, the default is **180 seconds**

Holddown

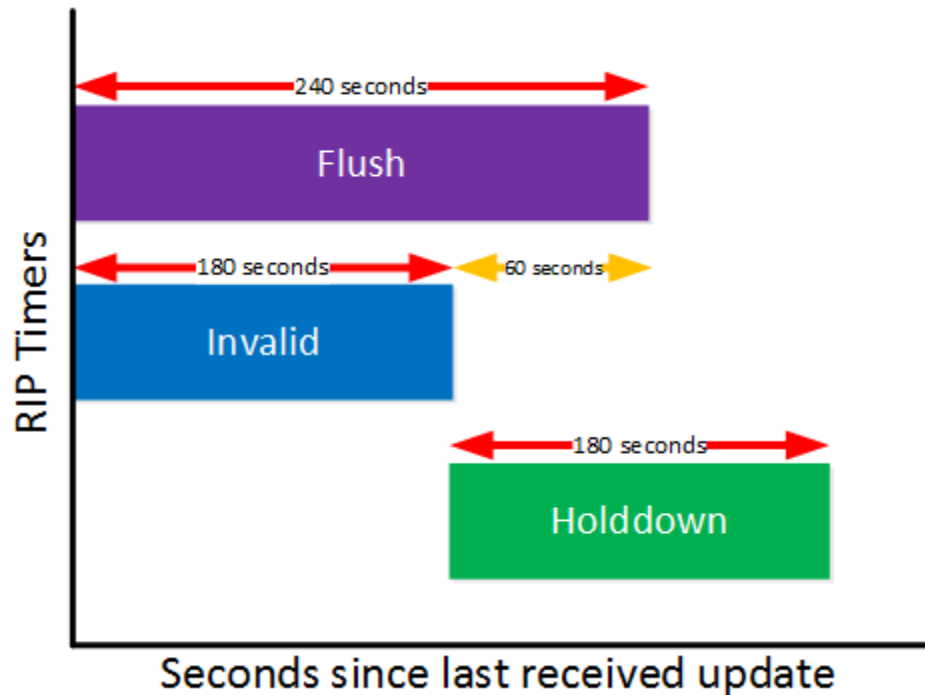
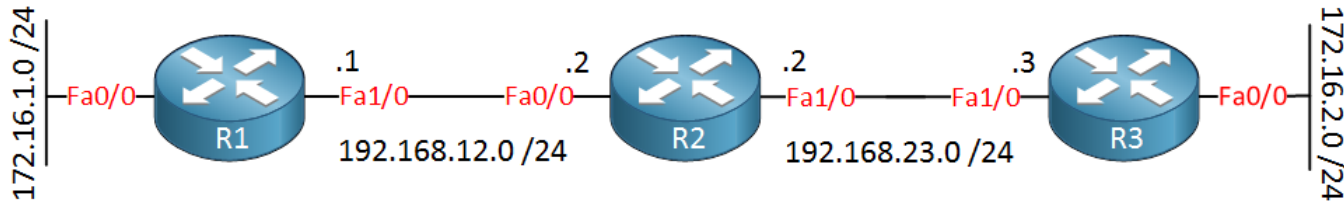
The number of seconds that RIP wait before it accept any new updates for the route that is in holddown, the default is **180 seconds**

Flush

How many seconds since RIP received the last valid update until it throw the route away, the default is **240 seconds**

Routing Information Protocol (RIP)

RIP Timer



Thank You

