ROUTING PROTOCOLS

Routing protocols server the following functions:
- Learn how to reach IP subnets from other routers
- Advertise known routes to other routers
- Choose the best route for each subnet to be placed in the local routing table
- Keep all of the above updated when the network topology changes, i.e. routes become (un)available.

IGP (Interior Gateway Protocol)—Routing protocols designed for use inside a single company or network.

EGP (Exterior Gateway Protocol)—designed for use *between* companies.

Hop Count—The metric used by RIP. The number of routers between our own router and a subnet (not counting ourselves).

Distance Vector (DV)—one category of routing protocols. Such routing protocols educate a router only as to the direction (next hop / exit interface) of a subnet and its cost metric (distance)

RIP

Update Messages—occur on a regular timer (30 seconds) and include all known routes. Multicast to 224.0.0.9 (RIPv2).

Split Horizon—Don't send updates concerning a route out that route's exit interface (you may be out of date and you'll just have a higher metric anyway). Common in DV protocols.

Route Poisoning—When a route fails, advertise it with an infinite metric (16 in RIP) to prevent routing loops. As a result, legitimate routes are limited to 15 hops in RIP.

RIPv2 (Routing Information Protocol version 2) Features—authentication, manual route summarization, and VLSM.

VLSM (Variable-Length Subnet Mask)—Routing updates include the mask. Therefore, more than one subnet size can be used in the same classful network.

RIPv2 Advantages Over RIPv1
- VLSM supported because v2 updates include the mask
- Supports manual route summarization
- Multicast updates (224.0.0.9) instead of broadcast (255.255.255.255)
- Authentication support

```
R1(config)# router rip
R1(config-router)# version 2
```
Send only version 2, process only version 2 packets received
```
R1(config-router)# network 10.0.0.0
```
The address should be classful, no matter what subnetting you've done (the IOS will even fix this for you). All interfaces with addresses within the classful address network will be included both in having advertising updates sent over them and in having their subnets included in the advertisements.
```
R1(config-router)# passive-interface gi0/0
```
Don't send RIP messages out that interface. This way, you can advertise a network without advertising TO that network. Good for access switches and ISP connections.
```
R1(config-router)# passive-interface default
R1(config-router)# no passive-interface gi0/1
```
The above two commands make all interfaces passive, except for Gi0/1.
```
R1(config-router)# maximum-paths 4
```
Limit equal-cost load balancing to only 4 of the routes having the best metric. Default is to place ALL exit interfaces that have the best metric in the routing table and let the router load-balance between them.

When load balancing is taking place, you can see it with "show ip route." One destination network will have two or more "via" lines.

```
R      192.168.6.0/24 [120/1] via 10.56.0.6, 00:00:16, GigabitEthernet0/0
                      [120/1] via 10.57.0.7, 00:00:23, GigabitEthernet0/1
```

AUTO-SUMMARY

Auto-Summarization—Before an advertisement is send over a link belonging to a different classful network, that advertisement is "rounded up" to include its entire classful network rather than just the portion it really represents. This is RIP's default behavior.

Discontiguous Subnets—Separating two subnets of the same classful network onto opposite sides of a link that uses a different classful network.
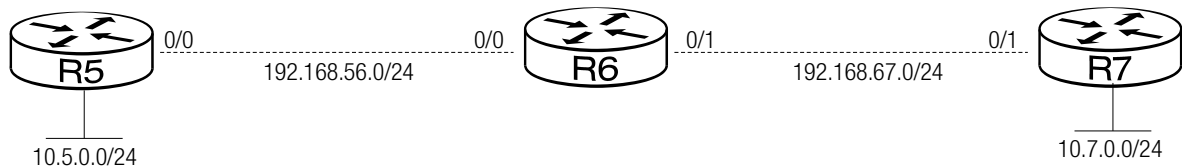
In the above drawing, when R5 and R7 send advertisements for their subnets of 10.0.0.0/8 to R6 across links in different classful networks (192.168.56.0 and 192.168.67.0, respectively), each advertisement is automatically summarized to *all* of 10.0.0.0/8. Since that gives R6 two RIP routes to 10.0.0.0/8 of equal cost (1 hop), R6 will put both routes in the routing table and IOS will automatically load-balance between them. Thus, when you ping 10.5.0.1 from R6, half the packets will go out exit interface 0/0 and half out 0/1, giving you a 50% packet loss.

```
R1(config-router)# no auto-summary
```
Cope with discontiguous subnets

```
R(config)# ip route 0.0.0.0 0.0.0.0 s0/0/0
```
Create the default route out s0/0/0 to the ISP
```
R(config)# router rip
R(config-router)# default-information originate
```
Tell RIP to share it.

TROUBLESHOOTING

Missing / Incorrect Network Commands—When that happens,

- That network won't be advertised
- Advertisements won't be sent out interfaces whose addresses are in that network because they're not in a network that is correctly configured to participate in RIP.

  show ip protocols
  > *Look at section "Routing for networks:"*
  >
  > *If you only have a partial output on an exam, you can derive it from two other sections:*
  > - *Per-interface send/receive RIP versions*
  > - *"Routing Information Sources" (bottom)—This could be important if you're on the other end looking back at a lack of updates.*

Passive Interfaces—If one router has a passive interface pointing at another RIP router, it'll still hear updates, without sending any out.

Auto-Summary—Look at the CIDR mask in "show ip route." If it's not auto-summarizing, you'll see

```
      10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
R        10.93.0.0/24 [120/1] via 10.58.0.8, 00:00:23, GigabitEthernet0/0
R        10.67.0.0/24 [120/1] via 10.56.0.6, 00:00:08, GigabitEthernet0/1
```

If it's being incorrectly (or correctly) auto-summarized, you'll just see the one-line route:

```
R        10.0.0.0/8 [120/1] via 10.56.0.6, 00:00:08, GigabitEthernet0/1
```

After that, start looking for other problems, like interfaces that are down, preventing updates in a very low-tech way.