BRYANTCCNA - SEC 11 : Distance Vector/RIPv2

SEC 11.1 Intro to distance Vector Protocols

RIPv2 is the last distance vector protocol standing. The original v1 protocol is rarely (if ever) used, and the original IGRP is no longer even available on Cisco routers, but EIGRP, the enhanced version is still around and important.

Problems with RIPv1/IGRP
- full routing update at fixed interval (RIPv2 also)
- didn't understand subnet masks
- didn't allow any form of packet authentication.

Routing Loops happen when packets get stuck in a logical loop and time out. The following routing protocols stop loops, but cause other things.

Split Horizon is simple. A route may not be advertised via the interface it was learned on.

Route Poisoning when routers agree on the current state of the network they have reached a state of convergence. A major reason DV is not used often is that DV protocols are very slow to converge, even in a lab environment.

SEC 11.2 Split Horizon and Poison Reverse

When a route becomes unavailable we want all routers to know about it and stop advertising. Without Route Poisoning, some routers would keep advertising routes that no longer exist.

Instead of not advertising the disconnected route, RIP advertises it with a distance of 16, which means it is unreachable. (ie with a poisoned metric)

Hop count neither version of RIP is very scientific, they only base metrics on # of hops.

Full Routing Updates, Every time, all the time: RIP sends full routing updates every 30 seconds by default. These unnecessary updates take up bandwidth and router system resources.

In contrast EIGRP sends a routing update only when a change occurs, and then only reports the changes, not the entire routing table.

Aside from all these disadvantages, RIPv2 was quite an improvement over V1:
- supports subnet masks, V1 does not
- multicasts to 224.0.0.9 rather than broadcasting to 255.255.255.255, like RIPv1
- V2 offers authentication, V1 does not
- V2 allows the network admin to configure route summarization manually.

SEC 11.3 RIP Lab begins

Same topology as last lab, no router setup.

```
R1(config)# router rip
R1(config-router)# network 172.12.123.0
```

For information about routing protocols:

```
R1# show ip protocols
```

To change RIP version send/recieve:

Per Interface
```
R1(config)# int s 1/0
R1(config-if)# ip rip send version 2
```
Global
```
R1(config)# router rip
R1(config-router)# version 2
```

SEC 11.4 RIP lab continues

Auto-summarization is on by default, but we really want to disable it for now. Will cover later.

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

Enable RIP on Spoke Routers:

```
R2(config)# router rip
R2(config-router)# version 2
                 # no auto-summary
                 # network 2.2.2.0
                 # network 172.12.123.0
```

and do the same for R3...
At this point everything seems to be routing.

In this lab, split horizon is disabled because of the serial protocol used. We will try disabling it:

```
R1(config)# int serial 1/0
R1(config-if)# ip split-horizon
```

Now, force a routing update by clearing routing tables on each router:

```
(config)# clear ip route *
```

This will break RIP because the hub (R1) has only one interface on the network. Split-horizon will not allow it to pass routing information between R2/R3 because it would have to go in/out a single interface.

SEC 11.6 The dangers of Auto summarization

RIP worked fine in the last Lab. In this lab we will replace the loopbacks with two subnets of 20.0.0.0/8 on R2 and two subnets of the same network on R3.

Subnets of the same major network number on different routers makes your network discontiguous. It's not a big problem though, and is quite common on modern networks, but RIP has some small problems with it.

Same topology with different loopback. Setup just the same way, but without disabling auto-summary. Let's check our routing table on R1:

```
R1# show ip route
...
     R 20.0.0.0/8 [120/1] via 10.1.2.3, ... g0/1
                  [120/1] via 10.1.1.2, ... g0/0
```

(different IPs in my local lab, but they're R2/R3)

We can see that RIP looks at all the loopbacks as simply members of 20.0.0.0/8 and summarizes their routes. It will then try to load balance between the two different routes...

Trying to ping a loopback on R2 from R1...

```
R1# ping 20.1.1.1
Sending 5, 100-byte ICMP Echos to 20.1.1.1, timeout is 2 sec
U!.!U
Success rate is 40 percent (2/5), round-trip min/avg/max ...
```

This is because of the autosummarization of subnets

SEC 11.7 The Cure for Autosummarization

Almost every production network running RIP will have auto-summarization disabled, whether they need to or not, because of the issues we just saw. So fixing it is more of an exam / job interview question.

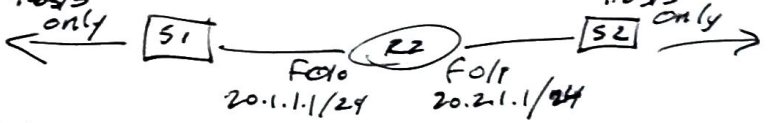
In this lab, auto-summary only needs to be disabled on R2/R3, because those are the routers actually performing the summarization. Disabling on R1 also is good practice, but does not effect the routing in this lab. So, do the following:

```
R2(config)# router rip
R2(config-router)# no auto
                  # 12
R2(config)# clear ip route *
```

Do this for R2/R3, and clear routing on R1.

SEC 11.8 Passive Interfaces

Using passive interfaces, we can advertise the networks associated with interfaces, but not send out RIP routing information over those interfaces.




```
R2(config)# router-rip
R2(config-router)# passive-int fast 0/1
                  # passive-int fast 0/0
```

Now, RIP will still be fully functional, but not sending packets containing routing information over the interfaces that are only host-facing.

SEC 11.9 Administrative Distances

Sometimes a router will hear about a given route from multiple sources and must decide which route to place in its IP routing table.

First, the router looks at the subnet mask length. So, if it recieved 172.12.123.0/25 over EIGRP, and 172.12.123.0 over RIP, it would always choose the former, because its netmask is longer. The other route would only be put into the table if the first route was lost.

Then, if the subnet masks are the same, Administrative distance comes into play. (as a tie breaker)

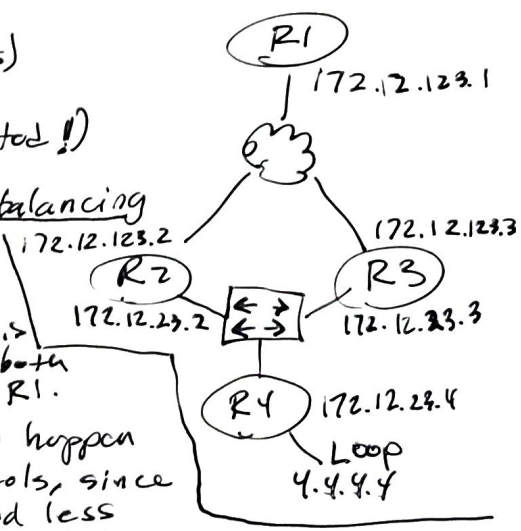
Administrative Distance can be found inside the brakets in the IP routing table. The first number is the AD, while the second number is that route's metric. In this lab the RIP routes all have the AD 120, which is the default of RIP.

Default Administrative Distances

0	connected
1	static
5	EIGRP Summary
90	EIGRP Internal
110	OSPF
115	IS-IS
120	RIP (both versions)
170	EIGRP External
200	BGP Internal
255	Unknown (untrusted!)

SEC 11.10 Fun with RIP load balancing

The topology to the right has two valid routes from R1 to R4. By simply setting up this topology and enabling RIP, both routes will be available to R1.



This is much more likely to happen with RIP than other protocols, since they are more complex and less likely to have the same metrics.

maximum-paths controls the number used in load balancing. To disable equal cost load sharing, set maximum to one.

SEC 11.11 More RIP load balancing, Traceroute intro

traceroute is another tool helpful for troubleshooting. While ping only tells if two hosts are connected, traceroute provides more information about the path between them, and info even if they can't connect.

Running traceroute without a destination argument will enter the advanced mode and prompt for many more options.

SEC 11.12 version mismatches and debugging tips

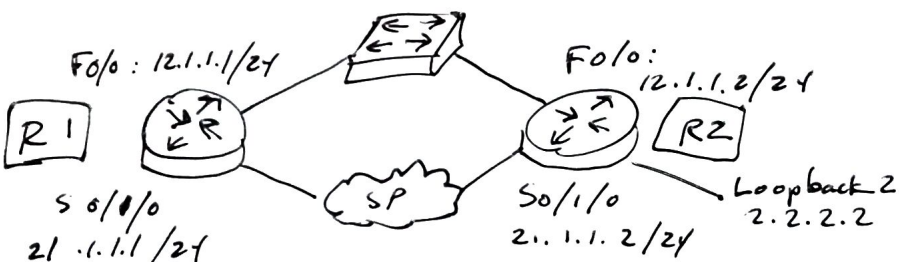
RIPv1 and RIPv2 will not communicate with eachother. v1 will ignore v2 multicast packets if v1 is set explicity.

check with protocol debug messages:

R1# debug ip rip

SEC 11.13 Floating static Route lab begins

Sometimes there are situations you will not want the overhead of a dynamic routing protocol. (unstable client/connection.) This lab covers that situation.



The client does not want Dynamic Routing Traffic over the serial link, but they do want the backup link. So -

- no dynamic routing protocol over serial link
- use RIP over 12.0.0.0 segment
- 21.0.0.0 segment should only be used to reach 2.2.2.0 if the RIP route for that network leaves the table.

To start, we configure RIPv2 on each router as usual with the 12.0.a0 network segment on both, and the 2.0.0.0 loopback added on R2. At this point, all traffic is going over the FastEthernet link, as well as routing traffic, but the serial link is not configured as a failsafe.

If we add a static route now, it will work via the serial link, but the static route replaces the RIP route.

SEC 11.14 Floating Static Route Lab Continues.

The static route and the RIP route both have the same mask length, so the Administrative Distance is used as a tie breaker, so all traffic to 2.2.2.0 is going to go over the unstable serial link.

So, we need to create a static route with a higher administrative distance:

```
R1(config)#ip route 2.2.2.0 255.255.255.0 21.1.1.2 121
```

By removing 2.0.0.0 from RIP on R2, we can see that our static route becomes active, replacing the network in RIP causes the route to return.

SEC 11.15 Originating a default route with RIP

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

This causes (or allows) R1 to distribute a default route, even though none is set on R1 itself.

Also note that any more specific routes will not be automatically filtered out. This is beyond the scope of CCNA and requires ACLs, so we will come back after learning ACLs.