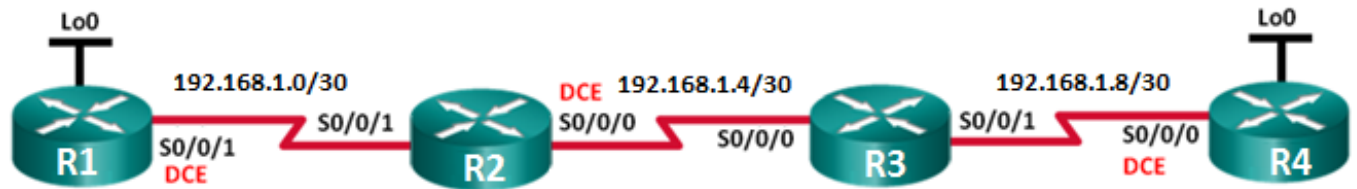# Anycast

Topology (lo0 on both routers should be replaced by PCs and run wireshark on both)

Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	S0/0/1	192.168.1.1	255.255.255.252	N/A
R2	S0/0/0 (DCE)	192.168.1.5	255.255.255.252	N/A
	S0/0/1	192.168.1.2	255.255.255.252	N/A
R3	S0/0/0	192.168.1.6	255.255.255.252	N/A
	S0/0/1	192.168.1.9	255.255.255.252	N/A
R4	S0/0/0 (DCE)	192.168.1.10	255.255.255.252	N/A

Introduction

Anycast is a network addressing and routing methodology in which a single destination address has multiple routing paths to two or more endpoint destinations. Routers will select the desired path on the basis of number of hops, distance, lowest cost, latency measurements or based on the least congested route. Anycast networks are widely used for content delivery network (CDN) products to bring their content closer to the end user.

In this lab, you will implement Anycast routing using RIP routing protocol. You will see how the routing protocol will select a different path to the Anycast server (simulated by loopback interfaces on R1 and R4) on each router according to the hop count metric. You will also introduce changes in the topology to force the routing protocol to adapt

Note: Make sure that the routers and switch have been erased and have no startup configurations.

Required Resources

- 4 Routers.
- 3 PCs.
- Console cables to configure the Cisco IOS devices via the console ports.
- Ethernet and serial cables as shown in the topology.

Part 1:   Build the Network and Verify Connectivity

In Part 1, you will set up the network topology and configure basic settings, such as the interface IP addresses, routing, device access, and passwords.

Step 1:   Cable the network as shown in the topology.

Step 2:   Configure basic settings for each router.

a.   Console into the router and enter global configuration mode.

b.   Do the following basic configuration on each router.

```
no ip domain-lookup
service password-encryption
enable secret pass
banner motd #
Unauthorized access is strictly prohibited. #
Line con 0
password pass
login
logging synchronous
line vty 0 4
password pass
login
end
```

c.   Configure the host name as shown in the topology.

d.   Configure and activate all interfaces on all routers.

Step 3:   Configure RIP routing.

a.   Configure RIP on all routers with the following commands:

```
Router(config)# router rip
Router(config-router)# version 2
Router(config-router)# network 192.168.1.0
Router(config-router)# no auto-summary
```

b.   Use the show ip route command on all routers to view the routing table.

```
R1#show ip route
  192.168.1.0/30 is subnetted, 3 subnets
C 192.168.1.0 is directly connected, Serial0/0/1
R 192.168.1.4 [120/1] via 192.168.1.2, 00:00:19, Serial0/0/1
R 192.168.1.8 [120/2] via 192.168.1.2, 00:00:19, Serial0/0/1
R1#
```

Step 4:   Verify network connectivity.

a.   Verify that you can ping across the serial links when you are finished. Use the following Tcl script to check full and partial connectivity.

```
R1# tclsh

foreach address {
192.168.1.2
192.168.1.5
192.168.1.6
192.168.1.9
192.168.1.10
} { ping $address }
```

b. Troubleshoot if the pings are unsuccessful.

Part 2:   Configure Anycast hosts

In Part 2, you will configure routers R1 and R4 to simulate an internet service that uses the Anycast IP address 10.10.10.10/32.

Step 1:   Enable route debugging

To view any changes to the routing table on R2 do the following:

```
R2# debug ip routing
```

Keep the console of R2 open at all times.

Step 2:   Create loopback 0 interface on R4

Create loopback 0 interface on R4:

```
R4(config)# interface lo0
R4(config-if)# ip address 10.10.10.10 255.255.255.255
```

Step 3:   Add lo0 to RIP.

```
R4(config)# router rip
R4(config-router)# network 10.0.0.0
```

Step 4:   View the debug output on R2.

Notice the messages on R2 console. What does it mean?

_____
_____
_____

Step 5:   Verify the new route was added to R2s' and R3s' routing table.

What is the next hop IP address for the Anycast network on R2 and R3?

_____
_____

Step 6:   Create lo0 on R1

Create loopback 0 interface on R1:

```
R1(config)# interface lo0
```

```
R1(config-if)# ip address 10.10.10.10 255.255.255.255
```

Step 7:   Add lo0 to RIP.

Add the Anycast network to the RIP routing process on R1.

Step 8:   View the debug output on R2.

Notice the messages on R2 console. What does it mean?

_____
_____
_____

Step 9:   Verify the Anycast route on R2.

a.   What is the next hop IP address for the Anycast network on R2 and R3?

_____
_____

b.   Use the traceroute command to list the path of traffic to the Anycast IP from R2 and R3:
R2 path: _____

_____

R3 path:_____

_____

c.   Shut down loopback 0 on R1.

d.   Notice the messages on R2 console. What does it mean?

_____
_____

e.   Enable loopback 0 on R1.

Part 3: IPv6 Anycast

An anycast address is an address that is assigned to a set of interfaces that typically belong to different nodes. A packet sent to an anycast address is delivered to the closest interface (as defined by the routing protocols in use) identified by the anycast address. Anycast addresses are syntactically indistinguishable from unicast addresses, because anycast addresses are allocated from the unicast address space. Assigning a unicast address to more than one interface makes a unicast address an anycast address. Nodes to which the anycast address is assigned must be explicitly configured to recognize that the address is an anycast address.

In Part 3, you will configure IPv6 anycast using the same topology. The addressing table is listed here:

Device	Interface	IPv6 Address
R1	S0/0/1	2001:db8:acad:1::1/64 FE80::1 link-local
R2	S0/0/0 (DCE)	2001:db8:acad:2::1/64 FE80::2 link-local
	S0/0/1	2001:db8:acad:1::2/64 FE80::2 link-local
R3	S0/0/0	2001:db8:acad:2::2/64 FE80::3 link-local
	S0/0/1	2001:db8:acad:3::1/64 FE80::3 link-local
R4	S0/0/0 (DCE)	2001:db8:acad:3::2/64 FE80::4 link-local

Step 1: Configure IPv6 on all routers.

Configure all routers as follows:

    a. Enable IPv6 unicast routing.

    b. Configure all interfaces with their IPv6 global and link local addresses.

    c. Enable RIPng for all interfaces.

Following is the configuration for R1 as an example:

```
R1(config)# ipv6 unicast-routing
R1(config)# ipv6 router rip RIP1
R1(config)# interface s0/0/1
R1(config-if)# ipv6 address 2001:db8:acad:1::1/64
R1(config-if)# ipv6 address FE80::1 link-local
R1(config-if)# ipv6 rip RIP1 enable
```

Step 2:   Verify routing for IPv6

a. Use the **show ipv6 route** command on all routers to view the routing table.
All destinations should be present on all routers.

b. Use the **show ipv6 protocols** to verify RIPng routing protocol.

Step 3:   Verify network connectivity.

Verify that you can ping across the serial links when you are finished.
From router R1 ping all global unicast addresses of other routers:

2001:db8:acad:2::1 successful?_____

2001:db8:acad:1::2 successful?_____

2001:db8:acad:2::2 successful?_____

2001:db8:acad:3::1 successful?_____

2001:db8:acad:3::2 successful?_____

a. Troubleshoot if the pings are unsuccessful.

Part 4:   Configure Anycast hosts

In Part 4, you will configure routers R1 and R4 to simulate an internet service that uses the Anycast IPv6
address 100::1/128.

Step 1:   Configure loopback 0 interface on R4

Configure loopback 0 interface on R4 with IPv6 anycast address 100::1/128:

```
R4(config)# interface lo0
R4(config-if)# ipv6 address 100::1/128 anycast
R4(config-if)# ipv6 rip RIP1 enable
```

Step 2:   Verify the new route was added to R2s' and R3s' IPv6 routing table.

What is the next hop IPv6 address for the Anycast network on R2 and R3?
_____
_____

Step 3:   Configure lo0 on R1

Configure loopback 0 interface on R1:

```
R1(config)# interface lo0
R1(config-if)# ipv6 address 100::1/128 anycast
R1(config-if)# ipv6 rip RIP1 enable
```

Step 4:   Verify the Anycast route on R2.

a. What is the next hop IPv6 address for the Anycast network on R2 and R3?
_____
_____

b.   Use the **traceroute** command to list the path of traffic to the Anycast IPv6 address from R2 and R3:
R2 path: _____

_____

R3 path:_____

_____

c.   Shut down loopback 0 on R1.

d.   What effect does that have on the network?

_____
_____

e.   **Traceroute 100::1** on R2 what is the path taken?

_____
_____
_____

f.   Use the following command on R4:
R4#**ping 2001:db8:acad:1::2 source lo0**

g.   What was the result? Explain.

_____
_____
_____