IPv6

Introduction:

You've no doubt heard the news stating that we will run out of IP addresses. The Number Resource Organization (NRO) reported that as of February 3, 2011, the free pool of IPv4 address space has been depleted.

IPv6 uses 128-bit addresses. That equates to $3.40292367 \times 10^{38}$ addresses. IPv6 addresses don't use decimals like IPv4. They are composed of groups of four-digit hexadecimal numbers separated by colons. Luckily, leading zeros can be eliminated within each set of colons. For example:

AA76:0000:0000:0000:0012:A322:FE33:2267

May be represented as:

AA76:0:0:0:12:A322:FE33:2267

Additionally,

Any consecutive number of zeros can be replaced by a double colon **once per address**. Thus:

AA76:0000:0000:0000:0012:A322:FE33:2267

May also be written as:

AA76::12:A322:FE33:2267

Address Types:

Unicast: Packets addressed to a unicast address are delivered to a single interface.

Global unicast addresses: These are like the public addresses in IPv4. Global addresses start at 2000::/3

Link-local addresses: These are like the private addresses in IPv4 in that they're not meant to be routed and they start with FE80::/10. Think of them as a handy tool that gives you the ability to throw a temporary LAN together

for meetings or to create a small LAN that's not going to be routed but still needs to share and access files and services locally.

Multicast: Again, same as in IPv4, packets addressed to a multicast address are delivered to all interfaces tuned into the multicast address.

Anycast: Like multicast addresses, an anycast address identifies multiple interfaces on multiple devices, but there's a big difference: The anycast packet is delivered to only one device—actually, to the closest one it finds defined in terms of routing distance.

You're probably wondering if there are any special, reserved addresses in IPv6 because you know they're there in IPv4. Well there are—plenty of them! Let's go over some of them now.

- 0:0:0:0:0:0:0:1 Equals ::1. The equivalent of 127.0.0.1 in IPv4.
- 0:0:0:0:0:0:192.168.100.1 This is how an IPv4 address would be written in a mixed IPv6/IPv4 network environment.
- 2000::/3 The global unicast address range.
- FE80::/10 The link-local unicast range.

Configuring Cisco Routers with IPv6:

To configure an IPv6 address on an interface. You use the interface configuration command

```
ipv6 address <ipv6prefix>/<prefix-length>
```

```
Router(config)#interface fastEthernet 0/0
```

```
Router(config-if)#ipv6 address 2001:11AA::1/64
```

IPv6 Routing Protocols:

In order to enable IPv6 routing on a router, you have to use the `ipv6 unicast-routing` global configuration command:

```
Router(config)#ipv6 unicast-routing
```

By default, IPv6 traffic forwarding is disabled, so using this command enables it.

All of the routing protocols have been upgraded for use in IPv6 networks.

Static routing

To configure a static route you can use the configuration command `ipv6 route <ipv6-prefix>/<prefix-length> <ipv6-next-hop-address>`

```
Router(config)#ipv6 route 2001:33AA::/64 2001:22AA::2
```

RIPng

To be honest, the primary features of RIPng are the same as they were with RIPv2. It is still a distance-vector protocol, has a max hop count of 15.

But of course there are differences in the new version or it wouldn't be a new version, would it? We know that routers keep the next-hop addresses of their neighbor routers for every destination network in their routing table. The difference is that with RIPng, the router keeps track of this next-hop address using the link-local address, not a global address.

Probably one of the biggest changes with RIPng is the fact that you configure or enable the advertisement of a network from interface configuration mode instead of with a network command in router configuration mode. So in RIPng's case, if you enable it directly on an interface without going into router configuration mode and starting a RIPng process, a new RIPng process will simply be started for you. It will look something like this:

```
Router(config)#interface fastEthernet 0/0

Router(config)#ipv6 rip 1 enable
```

That 1 you see in this command is a tag (that can also be named rather than numbered) that identifies the process of RIPng that's running, and as I said, this will start a process of RIPng so you don't have to go into router configuration mode.

PreLab

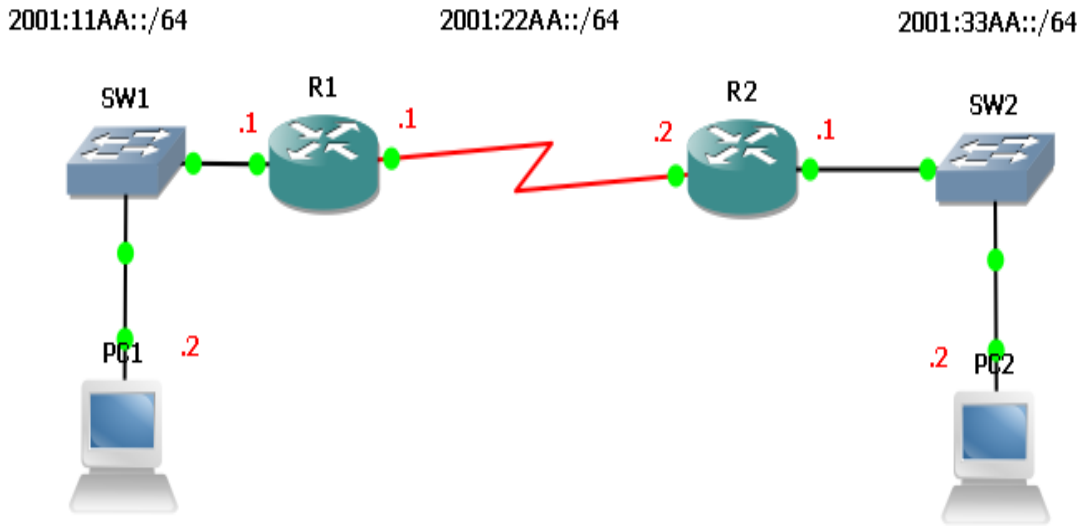
1. Which type of packets are addressed and delivered to only a single interface?
2. Which type of address is used just like a regular public routable address in IPv4?
3. IPv4 had a loopback address of 127.0.0.1. What is the IPv6 loopback address?
4. Write the following IPv6 addresses in shortened expressions:
   A) 2001:0DB8:3C4D:0012:0000:0000:1234:56AB
   B) FE80:0BA5:0000:0000:5210:0000:0000:02A1
   C) 2001:0000:0008:AA00:0000:22FF:FE00:002A

Equipment:

1. 2 Cisco Switches (i.e. 2950).
2. 2 Cisco Routers (i.e. 2811).
3. Network cables.

Procedure:

Scenario: Build and configure the following topology based on the following requirements.



Requirements:

To help guide this initial configuration, you've assembled a list of requirements.

- Configure the necessary IPv6 addresses on R1 and R2 as follows:

Interface	R1	R2
FastEthernet	2001:11AA::1/64	2001:33AA::1/64
Serial	2001:22AA::1/64	2001:22AA::2/64

- Configure PC1 and PC2 with the following configuration:

	PC1	PC2
Interface:	NIC	NIC
IPv6Address:	2001:11AA::2/64	2001:33AA::2/64
Gateway:	2001:11AA::1	2001:33AA::1

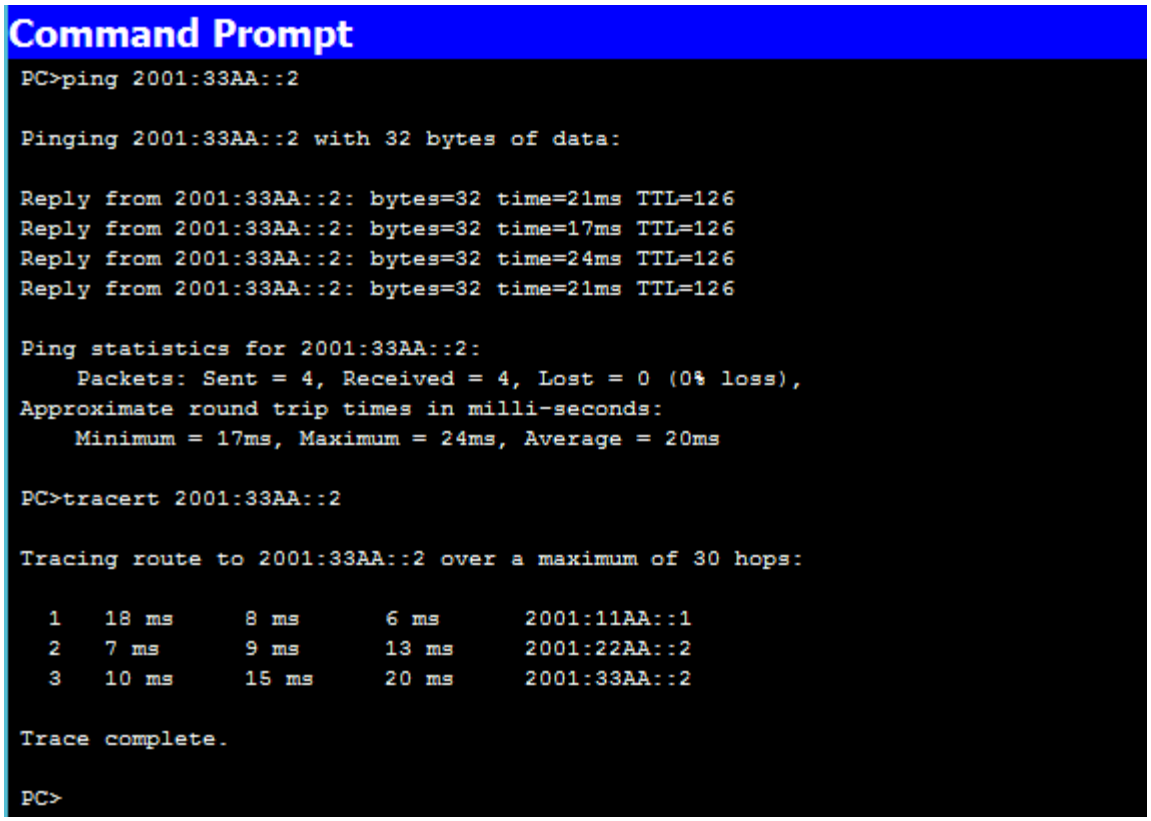
Task 1

- Implement IPv6 static routing.

Task 2

- Implement RIPng.

- Testing
  1. PC1 should be able to perform a ping and traceroute to PC2.


Command Prompt
PC>ping 2001:33AA::2
Pinging 2001:33AA::2 with 32 bytes of data:
Reply from 2001:33AA::2: bytes=32 time=21ms TTL=126
Reply from 2001:33AA::2: bytes=32 time=17ms TTL=126
Reply from 2001:33AA::2: bytes=32 time=24ms TTL=126
Reply from 2001:33AA::2: bytes=32 time=21ms TTL=126
Ping statistics for 2001:33AA::2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 17ms, Maximum = 24ms, Average = 20ms
PC>tracert 2001:33AA::2
Tracing route to 2001:33AA::2 over a maximum of 30 hops:
1 18 ms 8 ms 6 ms 2001:11AA::1
2 7 ms 9 ms 13 ms 2001:22AA::2
3 10 ms 15 ms 20 ms 2001:33AA::2
Trace complete.
PC>