

CO1507 Introduction to Networking

Lab 10 – IPv6 and Routing

Task 1 – Build your first IPv6 LAN

Construct the following LAN section.

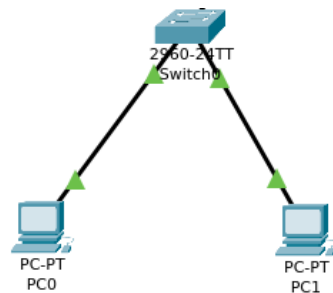


Figure 1 Small LAN

Click on one of the PCs and open the Desktop tab, look at the IPv6 Configuration and make a note of the Link Local address seen below.

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address: /

Link Local Address: FE80::204:9AFF:FEC9:C8E8

Default Gateway:

DNS Server:

802.1X

Figure 2 Link Local Address

A link local address begins with the prefix FE80 and the latter 64 bits includes the 48-bit MAC address as part of it's make up. Link-Local addresses are configured automatically and can be used to communicate locally.

Now on the OTHER PC attempt to ping the address you just noted. What happens? You should get a successful response.

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping FE80::204:9AFF:FEC9:C8E8

Pinging FE80::204:9AFF:FEC9:C8E8 with 32 bytes of data:

Reply from FE80::204:9AFF:FEC9:C8E8: bytes=32 time<1ms TTL=128
Reply from FE80::204:9AFF:FEC9:C8E8: bytes=32 time<1ms TTL=128
Reply from FE80::204:9AFF:FEC9:C8E8: bytes=32 time<1ms TTL=128
Reply from FE80::204:9AFF:FEC9:C8E8: bytes=32 time<1ms TTL=128

Ping statistics for FE80::204:9AFF:FEC9:C8E8:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

Figure 3 Successful Link Local Ping

Now repeat the process in reverse i.e. note down this PC's Link Local address then ping it from the other PC.

Task 2 – Configure Unique Local Addressing

We will now apply our own addressing schema using Unique Local Addresses. These are similar in concept to private IP address ranges in IPv4. In IPv6 Unique Local addresses always begin FC or FD.

Configure the PCs accordingly, note that you do not need to provide any IPv4 addressing information.

Under the Desktop tab go to IP address configuration.

Set IPv6 configuration on PC0 to:

IPv6 Address: **FD17:AC54:12EF:10::2 /64**

Link Local Address: Leave as is – do not edit.

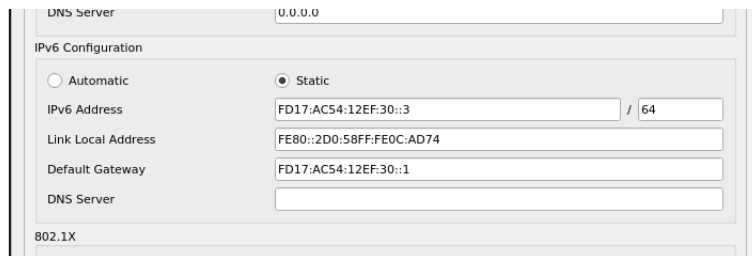


Figure 4 IPv6 Configuration

Then Set IPv6 configuration on PC1 to:

IPv6 Address: **FD17:AC54:12EF:10::3 /64**

Link Local Address: Leave as is – do not edit.

First Use the simple PDU tool (the envelope) to establish communication between the PCs, is it successful?

Then Goto Desktop, and Command Prompt on PC0 and type

```
ping FD17:AC54:12EF:10::3
```

It should be successful, you should have 4 replies, do you see the expected output?

Try the opposite on PC1

```
ping FD17:AC54:12EF:10::2
```

Is it successful? See expected output below:

```
C:\>ping FD17:AC54:12EF:10::2

Pinging FD17:AC54:12EF:10::2 with 32 bytes of data:

Reply from FD17:AC54:12EF:10::2: bytes=32 time<1ms TTL=128
Reply from FD17:AC54:12EF:10::2: bytes=32 time=30ms TTL=128
Reply from FD17:AC54:12EF:10::2: bytes=32 time<1ms TTL=128
Reply from FD17:AC54:12EF:10::2: bytes=32 time=30ms TTL=128

Ping statistics for FD17:AC54:12EF:10::2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 30ms, Average = 15ms

C:\>|
```

Figure 5 IPv6 Successful Ping

If all is well come onto task 2, otherwise troubleshoot before consulting your tutor for assistance.

Task 3 – Add a Router

Add a router to your network; **IMPORTANT** for the purposes of today use router **1941** only!

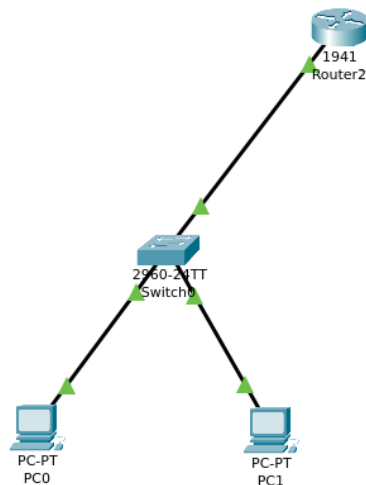


Figure 6 Addition of 1941 router

On the router go to the CLI tab and type the following commands:

```
enable
config terminal
int g0/0
ipv6 enable
ipv6 address FD17:AC54:12EF:0010::1/64
no shutdown
```

Next try to ping the router from PC0 and PC1, it should be successful. If not troubleshoot.

Next, we are going to configure the routers second ethernet interface as next we will be connecting a second network.

In the routers CLI type:

```
int g0/1
ipv6 enable
ipv6 address FD17:AC54:12EF:0020::1/64
no shutdown
```

Task 4 – Complete the Wide Area Network

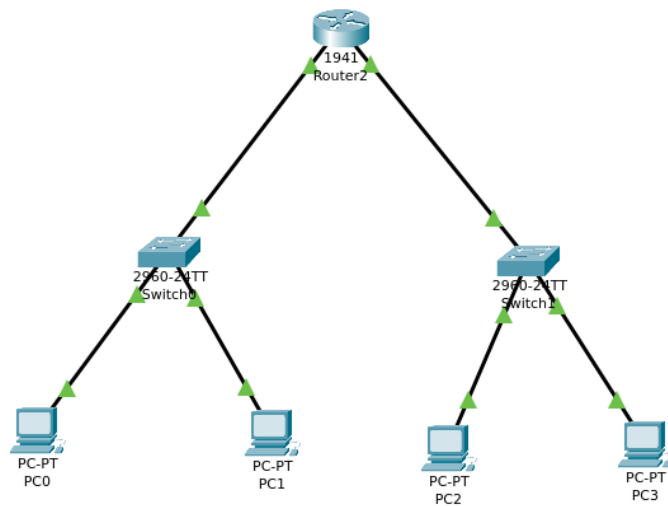


Figure 7 IPv6 enabled wide area network.

Set the PCs in the new network segment with the IPv6 addresses:

PC2:

IPv6 Address: **FD17:AC54:12EF:20::2 /64**

Link Local Address: Leave as is – do not edit.

Default Gateway: **FD17:AC54:12EF:20::1**

PC3:

IPv6 Address: **FD17:AC54:12EF:20::3 /64**

Link Local Address: Leave as is – do not edit.

Default Gateway: **FD17:AC54:12EF:20::1**

Go back to the first network segment we created in task 1 and add the missing default gateways as when we setup addressing requirements originally there was no router.

The address of that router interface should be **FD17:AC54:12EF:10::1** as so this should be the default gateway.

Go back to the Routers CLI and type the following command

```
ipv6 unicast-routing
```

Now finally attempt to ping from PCs in one LAN to PCs in the other and vice-versa.

Task 5 – Questions

Answer these questions in your notes, you will find the answers in the lecture as well as researching on the web.

1. What is the main difference between IPv4 and IPv6?
2. How does IPv6 address notation differ from IPv4?
3. What is the theoretical maximum number of IPv6 addresses?
4. List four types of IPv6 address
5. What are the two ways we can shorten an IPv6 address?
6. Shorten the following IPv6 addresses as much as is possible:
 - a. 2C41:0000:040F:0000:0000:0000:C05B:001B
 - b. 2001:0DB8:0001:0000:0000:0AB9:C0A8:0102
 - c. FE80:0000:0000:0046:DEBF:0000:8215:8AB6
7. Reconstruct the following IPv6 addresses to be written in full:
 - a. 2001:DB8::123:123:123:123
 - b. ::1234:5678:91:123:4:56
 - c. 2001:DB8::1234:5678:7:8
8. Besides there being many more IPv6 addresses than IPv4 what are some of the other benefits of IPv6?
9. What are some of the reasons for the slow uptake of IPv6?

Task 6 – Extension Configuring IPv4 Static Routes

Back in the world of IPv4 lets expand on what we did with routing last week. Last week we used RIP which is a dynamic routing protocol. This week we will configure static routes. Both will be explained in greater detail in next week's lecture.

Start by constructing the following topology in Packet tracer using the addressing requirements in the table below.

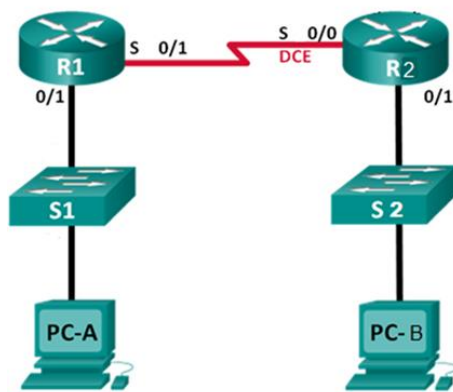


Figure 8 Wide Area Network with 2 routers

Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	f0/1	192.168.10.1	255.255.255.0	N/A
	s0/1	192.168.100.1	255.255.255.0	N/A
R2	f0/1	192.168.20.1	255.255.255.0	N/A
	s0/0	192.168.100.2	255.255.255.0	N/A
PC-A	NIC	192.168.10.10	255.255.255.0	192.168.10.1
PC-B	NIC	192.168.20.10	255.255.255.0	192.168.20.1

Objectives:

- Set Up the Topology and Initialize Devices
- Configure Basic Device Settings and Verify Connectivity
- Configure Static Routes
- Configure a recursive static route
- Configure a directly connected static route
- Configure and remove static routes

You already know how to configure PCs as end devices in packet tracer, as well as how to configure a CISCO routers Fast-Ethernet/Gigabit-Ethernet interfaces.

However, there is also a serial connection present here between the two routers.

Use the following cisco IOS commands to configure.

```
Router>enable  
Router#config t
```

Router R1:

```
Router(config)# interface s0/0  
Router(config-if)# ip address 192.168.100.1 255.255.255.0  
Router(config-if)# no shutdown
```

Router R2:

```
Router(config)# interface s0/0  
Router(config-if)# ip address 19.168.100.2 255.255.255.0  
Router(config-if)# clock rate 128000  
Router(config-if)# no shutdown
```

Static routing

```
Router(config)#ip route [network-address] [subnet-mask] [ip-address]
```

Router R1:

```
Router(config)#ip route 192.168.20.0 255.255.255.0 192.168.100.2
```

Explanation: To access network 192.168.2.0/24 you need to go to the next hop at interface 192.168.100.2 (on R2)

Router R2:

```
Router(config)#ip route 192.168.10.0 255.255.255.0 192.168.100.1
```

Explanation: To access network 192.168.10.0/24 you need to go to the next hop at interface 192.168.100.1 (on R1)

Test the network for full connectivity.

Extension-extension activity...

If you still are not done with this lab, think about how the above network could more efficiently allocate IP addresses by using custom subnets.