

LABORATORY 9: IPv6

Objectives

By the end of the laboratory, students will be able to

- configure hosts with both IPv4 and IPv6 addresses.
- verify the implementation of dual-stack for co-existence of IPv4 and IPv6 in a network.

Introduction:

IPv4 addressing space has the limit of 4.3 billions IP addresses. To support the growing number of internet users and connected devices, IPv6 has been developed and implemented. However, the migration to IPv6 has to be implemented gradually, because many devices are still IPv4-only devices. The migration to IPv6 must support the existing IPv4-only devices, as well as the new IPv6-enabled devices. There are three categories of migration techniques for co-existence of IPv4 and IPv6, namely the “Dual-stack”, “Tunnelling” and “Translation”.

In this lab experiment, we will look at dual-stack implementation which is the easiest among the three techniques. A dual-stack system implements both the IPv4 and IPv6 protocol stacks. Routers supporting dual-stack will route both IPv4 and IPv6 packets; systems implementing dual-stack can send out and receive both IPv4 and IPv6 packets. To support dual-stack, the networking interface of the device is configured with both IPv4 and IPv6 addresses; subnet mask for IPv4 and prefix length for IPv6; default gateways and DNS server addresses. Basically there are two sets of IP configuration parameters. A device implementing dual-stack can communicate with IPv4-only, IPv6-only and dual-stack devices, hence offering the most flexible solution.

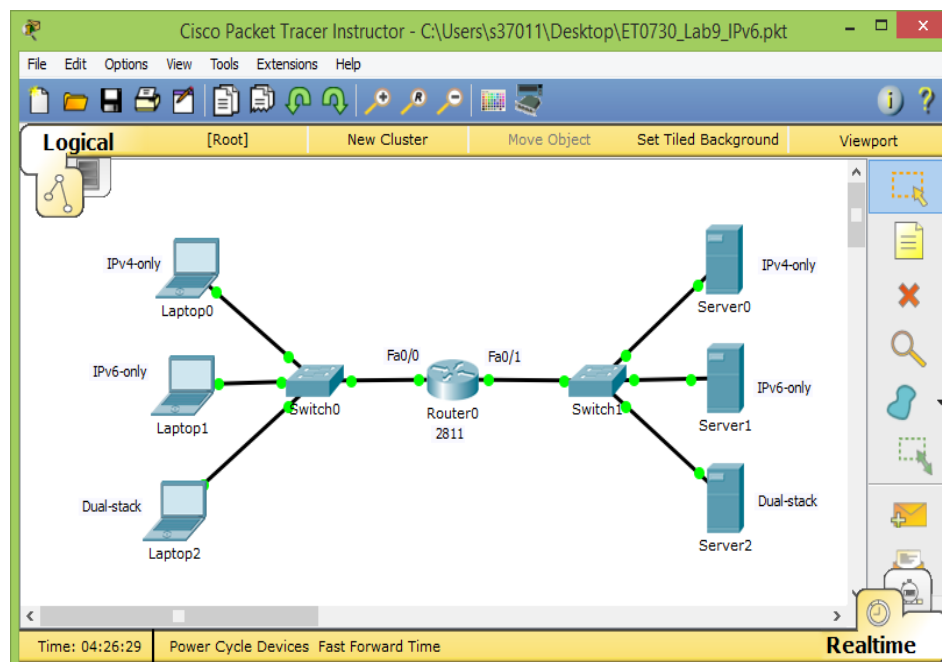
The GUI for routers in Cisco Packet Tracer does not support IPv6 parameters configuration. The configuration has to be done via **IOS command lines**. This can be done using the “CLI” (Command Line Interface) tab when you click on a router. The CLI provides a “terminal-like” interface that allows you to enter IOS commands to configure the router. Since “Cisco IOS commands” is out of syllabus of ET0730, you will be given a pre-configured router for this lab experiment. The router has been configured with two IPv6 addresses for each FastEthernet interface: Global Unicast IPv6 address and Link-local IPv6 address. The IOS command for enabling IPv6 routing is also included. You only need to configure the IPv4 address, subnet mask and default gateway.

Equipment:

Windows OS laptops with Cisco Packet Tracer installed.

Procedures:

1. **Construction and Configuration of a Computer Network for Testing Dual-stack implementation to support both IPv4 and IPv6.**
 - 1.1 Download the Packet Tracer file ET0730_Lab9_IPv6.pkt from ET0730's Black Board site. You can find the file under "Learning Resources → Lecture Notes & Lab-sheets → Chapter 9 - IPv6".
 - 1.2 Double-click the file to open it. You should find only a router, Router0. This is a pre-configured router with IPv6 addresses. Figure 9.1 shows the complete network. Insert the other devices and connect them as shown.

**Figure 9.1 - A network for testing dual-stack implementation.**

Device's interface		IP Address	Subnet Mask or prefix length	Default gateway
Laptop0's FastEthernet0	IPv4	10.10.10.2	255.255.255.0	10.10.10.1
	IPv6	N. A.	N. A.	N. A.
Laptop1's FastEthernet0	IPv4	N. A.	N. A.	N. A.
	IPv6	2001:CAFÉ:1:1::2	/64	FE80::1
Laptop2's FastEthernet0	IPv4	10.10.10.3	255.255.255.0	10.10.10.1
	IPv6	2001:CAFÉ:1:1::3	/64	FE80::1
Server0's FastEthernet0	IPv4	20.20.20.2	255.255.255.0	20.20.20.1
	IPv6	N. A.	N. A.	N. A.
Server1's FastEthernet0	IPv4	N. A.	N. A.	N. A.
	IPv6	2001:FACE:1:1::2	/64	FE80::1
Server2's FastEthernet0	IPv4	20.20.20.3	255.255.255.0	20.20.20.1
	IPv6	2001:FACE:1:1::3	/64	FE80::1

Table 9.1 – Network configuration parameters for Figure 9.2.

- 1.3 Configure the laptops and servers with parameters as shown in Table 9.1 below. To configure the IPv4 and IPv6 parameters, click the device and select the “Desktop” tab, then click “IP Configuration”. Figure 9.2 shows the “IP Configuration” window for Laptop2, for which you have to enter both the IPv4 and IPv6 parameters. For Laptop0 and Laptop1, the approach is the same, except that the unused IPv4 or IPv6 parameters are simply left blank.

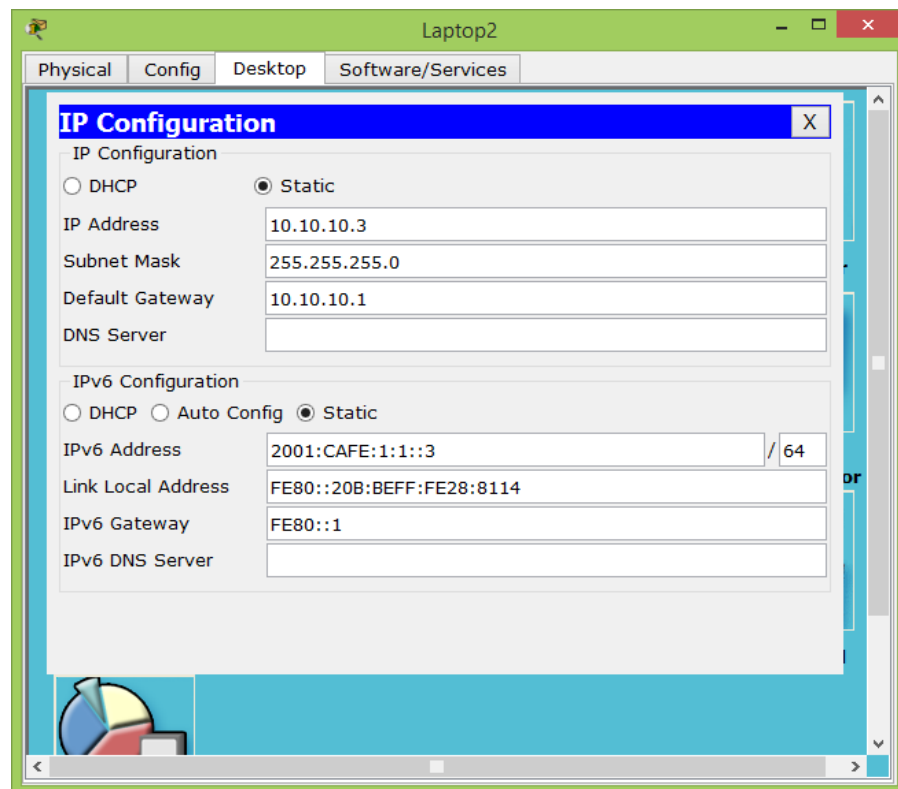


Figure 9.2 – IPv4 and IPv6 parameters can be configured using the “IP Configuration” function under the “Desktop” tab of a device.

- 1.4 Configure Router0 with parameters shown in Table 9.2. The IPv6 parameters have been pre-configured. You just need to configure the IPv4 parameters using the “Config” tab.

Device's interface		IP Address	Subnet Mask or prefix length	Default gateway
Router0's Fa0/0	IPv4	10.10.10.1	255.255.255.0	N. A.
	IPv6	2001:CAFE:1:1::1	/64	N. A.
		FE80::1	/64	N. A.
Router0's Fa0/1	IPv4	20.20.20.1	255.255.255.0	N. A.
	IPv6	2001:FACE:1:1::1	/64	N. A.
		FE80::1	/64	N. A.

Table 9.2 – Network configuration parameters for Router0.

- 1.5 After configuring Router0 with IPv4 parameters, verify the connectivity between Laptop0 and its default gateway, 10.10.10.1.
- 1.6 Verify the connectivity between Laptop1 and its default gateway, FE80::1.
- 1.7 Verify the connectivity between Laptop2 and its default gateways, 10.10.10.1 and FE80::1.
- 1.8 Verify the connectivity between Server0 and its default gateway, 20.20.20.1.
- 1.9 Verify the connectivity between Server1 and its default gateway, FE80::1.
- 1.10 Verify the connectivity between Server2 and its default gateways, 20.20.20.1 and FE80::1.
- 1.11 You will now investigate the connectivity between IPv4 and IPv6 devices. Table 9.3 shows a matrix of connectivity tests you will carry out. For each pair of laptop-server, test the connectivity and record your result (either “Passed” or “Failed”) using Table 9.3.

	Server0 (IPv4-only)	Server1 (IPv6-only)	Server2 (Dual-stack)
Laptop0 (IPv4-only)			
Laptop1 (IPv6-only)			
Laptop2 (Dual-stack)			

Table 9.3 – Matrix of connectivity tests. Based on your finding, record either “Passed” or “Failed” in each box. You may check the ET0730 lecture notes for the answer.

- 1.12 Router0 has been configured to implement dual-stack to route both IPv4 and IPv6 packets. If it has not implemented dual-stack, only IPv4 traffic will be routed. Prove this by inserting a new router and then configure it with IPv4 parameters only as shown in Table 9.2 (excluding IPv6 parameters).
- 1.13 Disconnect Switch0 and Switch1 from Router0, and connect them to the new router.
- 1.14 Power off and then power on the laptops and servers to clear the ARP cache. Carry the connectivity tests in Table 9.3 and observe the outcomes.