

The University of Jordan, Comp. Eng. Dept.

Spring 2023: Networks lab: Experiment 4

Static Routing (Problem Sheet)

Problem 1: Configuring IPv4 static routing

In this activity, you will configure static and default routes for IPv4. A static route is a route that is entered manually by the network administrator to create a reliable and safe route. There are four different static routes that are used in this activity: a **recursive static route**, a **directly attached static route**, a **floating route**, and a **default route**. Figure 1 shows the topology that you want to configure.

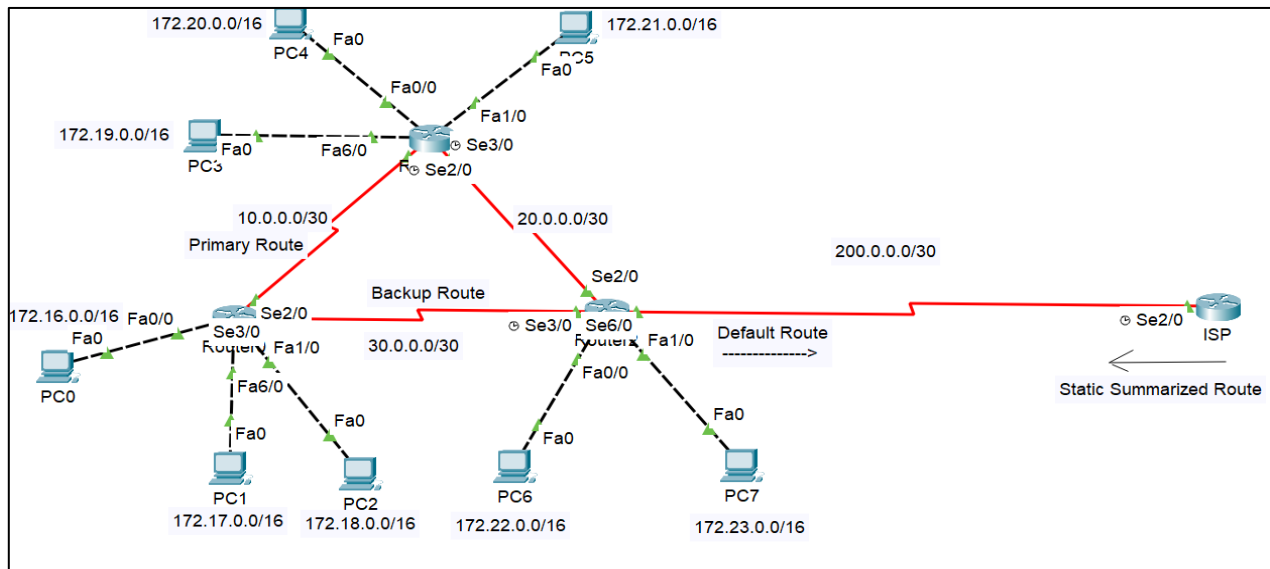


Figure 1. Network topology for problem 1.

In this activity (Exp_4_Problem_1_IPv4.pka), the routers' interfaces and PCs are configured for you with the addresses displayed in the addressing table (i.e., Table 1). You should use static routes to ensure full connectivity between all devices in the network.

Use the following instructions:

1. Configure the **directly attached static routes** (i.e., the exit interfaces) on Router 0 and Router 1.
2. Configure Router 2's static routes using **recursive static routes** (i.e., the next hop IP address).
3. **Configure static routes based on the next hop IP address on the ISP router.** Tip: There is a route that should be summarized, and the other remote networks should be configured as usual.
4. **Configure a default route** on the following routers considering the options mentioned:
 - Router 0 using the exit interface (i.e., serial 2/0),
 - Router 1 using the next hop IP address (i.e., 20.0.0.2),
 - Router 2 using 200.0.0.1 as the next hop IP address.
5. Verify static route configurations.
6. Verify the network connectivity by pinging all remote networks whereas every device should be able to ping every other device. If you couldn't, kindly review your static and default route configurations.
7. **Configure the network 30.0.0.0/30 as a remote network for Router 1 from serial 2/0 as a primary route and from serial 3/0 as a floating route with an administrative distance of 100.** Consider the case that

Router 1 is turned off for any reason. Accordingly, make proper configurations on Router 0 and Router 2 to reach all remote networks via the floating route with an administrative distance of 100. Tip: Use the exit interface (serial 3/0) for Router 0 and the next hop address (30.0.0.2) for Router 2. On the other hand, consider the following steps:

- ✓ Use this command to check your configuration of the primary and floating routes, namely, Router#show running-config.
- ✓ Verify the routing table after configuration using Router#sh ip route.
- ✓ Shut down the interfaces serial 2/0 and serial 3/0 of Router 1 and verify the routing table after doing the prior step. What do you observe?
- ✓ Re-enable the serial 2/0 and serial 3/0 interfaces and recheck the routing table. What do you observe?

Table 1: Addressing table for IPv4 configuration

Device	Interface	IPv4 Address	Subnet mask	Default Gateway	Connected with
Router 0	FastEthernet0/0	172.16.0.1	255.255.0.0	--	PC0
	FastEthernet1/0	172.18.0.1	255.255.0.0	--	PC2
	FastEthernet6/0	172.17.0.1	255.255.0.0	--	PC1
	Serial2/0	10.0.0.2	255.255.255.252	--	Router 1
	Serial3/0	30.0.0.2	255.255.255.252	--	Router 2
Router 1	FastEthernet0/0	172.20.0.1	255.255.0.0	--	PC4
	FastEthernet1/0	172.21.0.1	255.255.0.0	--	PC5
	FastEthernet6/0	172.19.0.1	255.255.0.0	--	PC3
	Serial2/0	10.0.0.1	255.255.255.252	--	Router 0
	Serial 3/0	20.0.0.1	255.255.255.252	--	Router 1
Router 2	FastEthernet0/0	172.22.0.1	255.255.0.0	--	PC6
	FastEthernet1/0	172.23.0.1	255.255.0.0	--	PC7
	Serial2/0	20.0.0.2	255.255.255.252	--	Router 1
	Serial3/0	30.0.0.1	255.255.255.252	--	Router 0
	Serial6/0	200.0.0.2	255.255.255.252	--	ISP
ISP	Serial2/0	200.0.0.1	255.255.255.252	--	Router 2
PC0	Fa0	172.16.0.2	255.255.0.0	172.16.0.1	Router 0
PC1	Fa0	172.17.0.2	255.255.0.0	172.17.0.1	Router 0
PC2	Fa0	172.18.0.2	255.255.0.0	172.18.0.1	Router 0
PC3	Fa0	172.19.0.2	255.255.0.0	172.19.0.1	Router 1
PC4	Fa0	172.20.0.2	255.255.0.0	172.20.0.1	Router 1
PC5	Fa0	172.21.0.2	255.255.0.0	172.21.0.1	Router 1
PC6	Fa0	172.22.0.2	255.255.0.0	172.22.0.1	Router 2
PC7	Fa0	172.23.0.2	255.255.0.0	172.23.0.1	Router 2

Problem 2: Configuring IPv6 static routing

In this activity, you will configure static and default routes for IPv6. Particularly, Figure 2 shows the topology that you want to configure. In few words, in this activity (Exp_4_Problem_2_IPv6.pka), you should use IPv6 static routes to ensure full connectivity between all devices in the network.

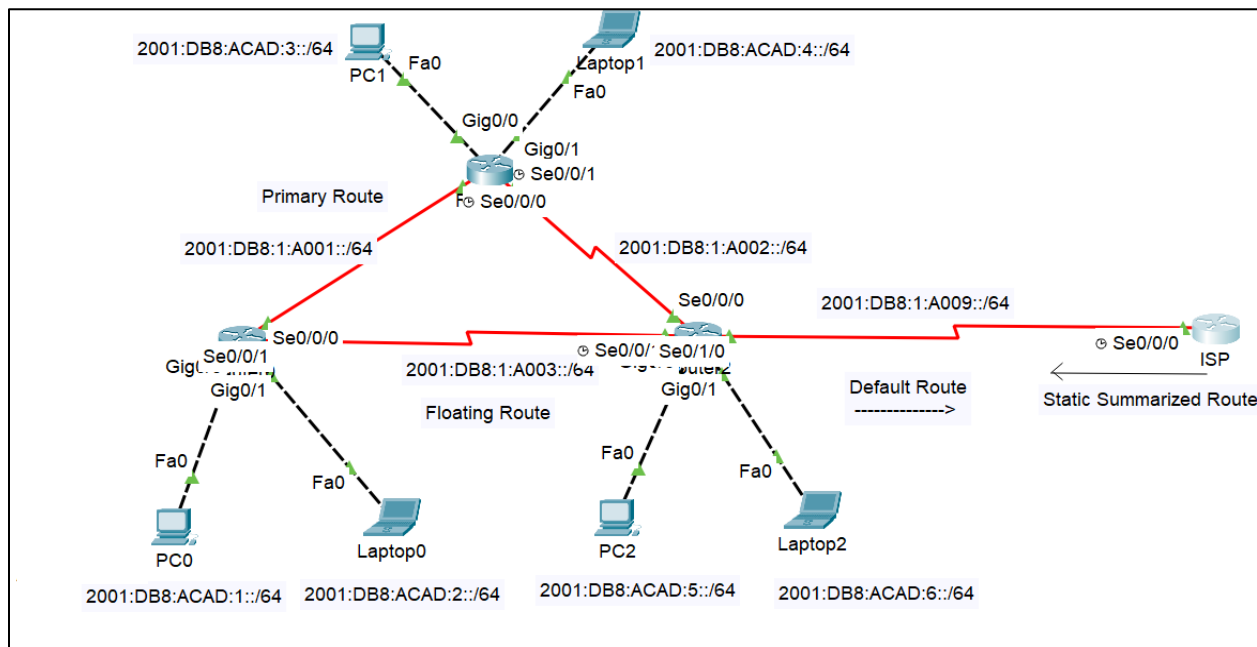


Figure 2. Network topology for problem 2.

Use the following instructions:

1. Enable IPv6 routing on all routers (**Router(config)#ipv6 unicast-routing**).
2. Configure the routers' interfaces with the IPv6 addresses you specified in the Addressing Table (i.e., Table 2). Tip: Use **eui-64 format global unicast address**. Follow these steps to do that:
 - ✓ You should enable IPv6 under the interfaces using "**ipv6 enable**" command.
 - ✓ To configure an interface with EUI-64 format, firstly we will go under the interface, then we will use "**ipv6 address {ipv6-address/prefix-length} eui-64**" command.
 - ✓ For example, suppose that the IPv6 prefix and prefix-length are **2001:AAAA:BBBB:CCCC::/64**. The real eui-64 Global Unicast Address will be created with this address and MAC address right after IPv6 configuration as follows:
 - Activate the interfaces.


```
Router(config)# interface GigabitEthernet0/0/0
Router(config-if)# ipv6 enable
Router(config-if)# ipv6 address 2001:AAAA:BBBB:CCCC::/64 eui-64
Router(config-if)# no shutdown
```
 - To check the IPv6 address that is created with EUI-64 format with "**show ipv6 interface brief**" command.


```
R1# show ipv6 interface brief
GigabitEthernet0/0/0 [up/up]
FE80::2E0:B0FF:FE0E:7701
→ 2001:AAAA:BBBB:CCCC:2E0:B0FF:FE0E:7701
```
3. Configure the PCs considering autoconfiguration option where each one should then automatically receive full IPv6 addresses from the routers. To check the ipv6 of PCs, double click on the PC, go to the desktop tab, and enter the command prompt. Thereafter, print **ipv6config** to see the IPv6 address provided to be used for pinging purposes.

Table 2: Addressing table for IPv6 configuration

Device	Interface	IPv6 prefix and the prefix length	Connected with
Router 0	GigabitEthernet0/0	2001:DB8:ACAD:1::/64	PC0
	GigabitEthernet0/1	2001:DB8:ACAD:2::/64	Laptop0
	Serial0/0/0	2001:DB8:1:A001::/64	Router 1
	Serial0/0/1	2001:DB8:1:A003::/64	Router 2
Router 1	GigabitEthernet0/0	2001:DB8:ACAD:3::/64	PC1
	GigabitEthernet0/1	2001:DB8:ACAD:4::/64	Laptop1
	Serial0/0/0	2001:DB8:1:A001::/64	Router 0
	Serial0/0/1	2001:DB8:1:A002::/64	Router 2
Router 2	GigabitEthernet0/0	2001:DB8:ACAD:5::/64	PC2
	GigabitEthernet0/1	2001:DB8:ACAD:6::/64	Laptop2
	Serial0/0/0	2001:DB8:1:A002::/64	Router 1
	Serial0/0/1	2001:DB8:1:A003::/64	Router 0
	Serial0/1/0	2001:DB8:1:A009::/64	ISP
ISP	Serial0/0/0	2001:DB8:1:A009::/64	Router 2
PC0	Fa0	Auto Config	Router 0
Laptop0	Fa0	Auto Config	Router 0
PC1	Fa0	Auto Config	Router 1
Laptop1	Fa0	Auto Config	Router 1
PC2	Fa0	Auto Config	Router 2
Laptop2	Fa0	Auto Config	Router 2

4. Configure the directly attached static routes (i.e., the exit interfaces) on Router 0, Router 1, and Router 2.
5. Configure static routes based on the next hop IP address on the ISP router. Tip: There is a route that should be summarized and the other remote networks should be configured as usual.
6. Configure a default route on the following routers considering the options mentioned:
 - Router 0 using the exit interface (serial 0/0/0),
 - Router 1 using the exit interface (serial 0/0/1),
 - Router 2 using the exit interface (serial 0/1/0).
7. Verify the static route configurations.
8. Verify the network connectivity by pinging all remote networks whereas every device should be able to ping every other device. If you couldn't, kindly review your static and default route configurations.
9. Configure the network 2001:DB8:1:A003::/64 as a remote network for Router 1 from serial 0/0/0 as a primary route and from serial 0/0/1 as a floating route with an administrative distance of 100. Consider the case that Router 1 is turned off for any reason. Consequently, make proper configurations on Router 0 and Router 2 to reach all remote networks via the floating route with an administrative distance of 100. Tip: use the exit interface (Serial0/0/1) for Router 0 and Router 2. On the other hand, consider the following steps:
 - ✓ Use this command to check your configuration of the primary and floating routes, namely, Router#show running-config.
 - ✓ Verify the routing table after configuration using Router#sh ipv6 route.
 - ✓ Shut down the interfaces serial 0/0/0 and serial 0/0/1 of Router 1 and verify the routing table after doing the previous step. What do you observe?
 - ✓ Re-enable the serial 0/0/0 and serial 0/0/1 interfaces and recheck the routing table. What do you observe?