The University of Jordan, Comp. Eng. Dept.
Networks laboratory: Experiment 6
EIGRP (IPv4 and IPv6) (Problem Sheet)

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Problem 1: Configuring EIGRP (IPv4) routing protocol

In this activity (i.e., Exp_6_Problem_1_EIGRP_IPv4.pka), you are requested to configure the EIGRP for IPv4 routing protocol with static and default routing for Internet access and ensure full connectivity between all devices in the network. Figure 1 shows the topology that you want to configure. The PCs, server, and routers' interfaces are configured for you. Accordingly, routers have information about the direct networks that they have on their own interfaces. Routers will not exchange this information between themselves. We need to implement the EIGRP routing protocol, which will insist they share this information.

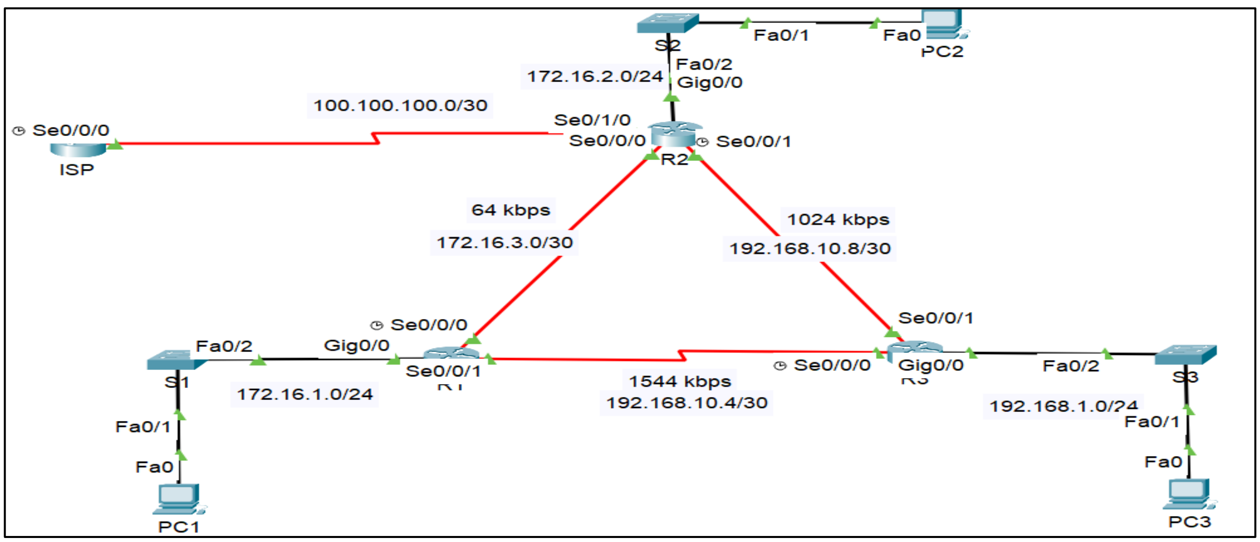

Figure 1. Network topology for problem 1.

Part 1: Configuring EIGRP for IPv4 on R1, R2, and R3 using the following instructions:

1. Verify IP addressing and interfaces. Use the `show ip interface brief` command to verify that the IP addressing is correct and that the interfaces are active.
2. Configure all routers with EIGRP routing except the ISP. In your configuration, make sure you do the following:
   - Enable the EIGRP routing process on each router using AS number 10.
   - Advertise directly connected networks with the correct wild mask.
   - Configure LAN interfaces to not advertise EIGRP updates as a passive interface on all routers.
   - Set a default route from R2 to the ISP using the outbound interface.
   - Redistribute the default route from R2.
3. Configure a summarized static route on the ISP using the directly connected option.

Part 2: Verify Configurations

1. **Verify full connectivity to all destinations.**

   - Every device should now be able to ping every other device inside the network. In addition, all devices should be able to ping the ISP and the Web Server.

2. **View the routing tables for Router 1, Router 2, and Router 3.**

   - Use the appropriate command to view the routing tables for Router 3. Notice that each router has a full listing of all the networks. You also see the default route listed. How the EIGRP does appears in the routing table? Write the code and the AD for EIGRP and for the default route listed in the routing table.

Answer:
D,90
D*EX,170

3. **View neighbors.**

   - On the Router2, use the `show ip eigrp neighbors` command to view the neighbor table and verify that EIGRP has established an adjacency with the R1 and R3 routers. You should be able to see the IP address of each adjacent router and the interface that R2 uses to reach that EIGRP neighbor. **Take screen shots of R2 neighbors table.**

Answer:

```
Router2#show ip eigrp neighbors
IP-EIGRP neighbors for process 10
H   Address         Interface      Hold Uptime    SRTT   RTO   Q    Seq
                                   (sec)          (ms)         Cnt  Num
0   192.168.10.10   Se0/0/1        11   00:21:22  40     1000  0    9
1   172.16.3.1      Se0/0/0        12   00:12:19  40     1000  0    14
```

4. **View routing protocol information.**

   - On the R1 router, use the `show ip protocols` command to view information about the routing protocol operation.
   - Answer the following questions?
     - ✓ What is the AS of EIGRP? EIGRP-IPv4 Protocol for AS(10)
     - ✓ What are the values of weight metrics used in EIGRP to calculate the metric?__Metric weight {K1=1, K2=0, K3=1, K4=0, K5=0}
     - ✓ What is the router ID? The Router-ID is: 172.16.1.1
     - ✓ What do you observe about the summarization? Disabled

5. **Use the `show ip protocols` command on R2 to verify the static route is being distributed.**

Answer: Redistributing: eigrp 10, static

6. **On R1, issue the `show ip route eigrp | include 0.0.0.0` command to view statements specific to the default route. How is the static default route represented in the output? What is the administrative distance (AD) for the propagated route? Write here the statement.**

Answer: **D*EX 0.0.0.0/0 [170/7289856] via 172.16.3.2, 01:16:46, Serial0/0/0**

Part 3: Configure EIGRP Metrics.

1. **View the EIGRP metric information.**

- Use the `show ip interface interface name` command to view the EIGRP metric information for the Serial0/0/0 interface on the R1 router. Notice the values that are shown for the bandwidth, delay, reliability, and load. `R1#show interface serial0/0/0`. What are the values of EIGRP metrics?

Answer: **MTU 1500 Bytes , BW 1544 Kbit, DLY 20000 usec,reliability 255/255, txload 1/255 rxload 1/255**

2. **Modify the bandwidth of the Serial interfaces.**

- For this lab, the link between R1 and R2 will be configured with a bandwidth of 64 kbps, and the link between R2 and R3 will be configured with a bandwidth of 1024 kbps. Use the bandwidth command to modify the bandwidth of the Serial interfaces of each router.

3. **Verify the bandwidth modifications.**

- Use the `show ip interface interface name` command to view the EIGRP metric information for the Serial0/0/0 interface on the R1, R2, and R3 routers. Notice the values that are shown for the bandwidth, delay, reliability, and load. `R1#show interface serial0/0/0`. What do you observe when it is compared to step 1?

Answer:
MTU 1500 Bytes , BW 64 Kbit, DLY 20000 usec, reliability 255/255, txload 1/255, rxload 1/255

Part 4: Examine Successors and Feasible Distances.

1. **Examine the successors and feasible distances in the routing table on R2.**

- Use the `show ip route` command on R2.
- Answer the following questions:
  - **What is the best path to PC1 (172.16.1.0/24)?**

Answer: **R2=>R3=>R1=>pc1**

  - **What is the IP address and exit name of the successor in this route?**

Answer: =via 192.168.10.10, 00:03:07, Serial0/0/1

  - **What is the feasible distance to the network that PC1 is on?**

Answer: 3526400

- A successor is a neighboring router that is currently being used for packet forwarding. A successor is the least-cost route to the destination network. The IP address of a successor is shown in a routing table entry right after the word "via".
- Feasible distance (FD) is the lowest calculated metric to reach that destination. FD is the metric listed in the routing table entry as the second number inside the brackets.
- A feasible successor is a neighbor who has a viable backup path to the same network as the successor. In order to be a feasible successor, R1 must satisfy the feasibility condition. The feasibility condition (FC) is met when a neighbor's reported distance (RD) to a network is less than the local router's feasible distance to the same destination network.

Part 5: Determine if R1 is a Feasible Successor for the Route from R2 to the 192.168.1.0 Network.

1. **Examine the routing table on R1 using the following** `show ip route` **command.**
2. **What is the reported distance to the 192.168.1.0 network?**

   Answer: 2172416
3. **Examine the routing table on R2.**
4. **What is the feasible distance to the 192.168.1.0 network?**

   Answer: 3014400
5. **Would R2 consider R1 to be a feasible successor to the 192.168.1.0 network? Discuss your answer?**

   Answer: Yes For Sure Because Rd<Fd

Part 6: Disable EIGRP Automatic Summarization.

1. **Disable automatic summarization on all three routers with the** `no auto-summary` **command.**
2. **Examine the routing table of the R3 router. What do you observe about 172.16.0.0 network? Explain your answer?**

   Answer: 172.16.0.0/16 is variably subnet
   3 subnets 2 masks
3. **Why is the R1 router (192.168.10.5) the only successor for the route to the 172.16.0.0/16 network?**

   Answer: Rd>Fd

Part 7: Configure Manual Summarization.

1. **Step 1: Add loopback addresses to R3 router.**

   - Add two loopback addresses, loopback1: 192.168.2.1/24 and loopback2:192.168.3.1/24, to the R3 router. These virtual interfaces will be used to represent networks to be manually summarized along with the 192.168.1.0/24 LAN.
   - Add the 192.168.2.0 and 192.168.3.0 networks to the EIGRP configuration on R3.
   - Verify new routes. View the routing table on the R1 router to verify that the new routes are being sent out in the EIGRP updates sent by R3. **Write down the roaring table entries about the 192.168.1.0 192.168.2.0 and 192.168.3.0 networks**

     Answer:

```
     172.16.0.0/16 is variably subnetted, 5 subnets, 3 masks
C       172.16.1.0/24 is directly connected, GigabitEthernet0/0
L       172.16.1.1/32 is directly connected, GigabitEthernet0/0
D       172.16.2.0/24 [90/3526400] via 192.168.10.6, 00:01:33, Serial0/0
C       172.16.3.0/30 is directly connected, Serial0/0/0
L       172.16.3.1/32 is directly connected, Serial0/0/0
D    192.168.0.0/22 [90/2172416] via 192.168.10.6, 00:01:33, Serial0/0/1
     192.168.10.0/24 is variably subnetted, 3 subnets, 2 masks
C       192.168.10.4/30 is directly connected, Serial0/0/1
L       192.168.10.5/32 is directly connected, Serial0/0/1
D       192.168.10.8/30 [90/3523840] via 192.168.10.6, 00:01:33, Serial0
D*EX 0.0.0.0/0 [170/8643840] via 192.168.10.6, 00:01:33, Serial0/0/1
```

- Apply manual summarization to outbound interfaces. The routes to the 192.168.1.0/24, 192.168.2.0/24, and 192.168.3.0/24 networks can be summarized in the single network 192.168.0.0/22. Use the `ip summary-address eigrp as-number networkaddress subnet-mask` command to configure manual summarization on each of the outbound interfaces connected to EIGRP neighbors.
- Verify the summary route. View the routing table on the R1 router to verify that the summary route is being sent out in the EIGRP updates sent by R3. **Take screen shot of R1' routing table.**

Answer:

```
     172.16.0.0/16 is variably subnetted, 5 subnets, 3 masks
C       172.16.1.0/24 is directly connected, GigabitEthernet0/0
L       172.16.1.1/32 is directly connected, GigabitEthernet0/0
D       172.16.2.0/24 [90/3526400] via 192.168.10.6, 00:01:33, Serial0/0/1
C       172.16.3.0/30 is directly connected, Serial0/0/0
L       172.16.3.1/32 is directly connected, Serial0/0/0
D    192.168.0.0/22 [90/2172416] via 192.168.10.6, 00:01:33, Serial0/0/1
     192.168.10.0/24 is variably subnetted, 3 subnets, 2 masks
C       192.168.10.4/30 is directly connected, Serial0/0/1
L       192.168.10.5/32 is directly connected, Serial0/0/1
D       192.168.10.8/30 [90/3523840] via 192.168.10.6, 00:01:33, Serial0/0/1
D*EX 0.0.0.0/0 [170/8643840] via 192.168.10.6, 00:01:33, Serial0/0/1
```

- What is the purposes of route summarization as you observed from the prior steps?

Answer: **For Reduce routing table**

Part 8: Examine the EIGRP Topology Table.

1. **View the EIGRP topology table. Use the** `show ip eigrp topology` **command to view the EIGRP topology table on R2.**

```
Answer:
Router2>show ip eigrp topology
IP-EIGRP Topology Table for AS 10/ID(192.168.10.9)

Codes: P - Passive, A - Active, U - Update, Q - Query, R -
Reply,
       r - Reply status

P 0.0.0.0/0, 1 successors, FD is 6777856
         via Rstatic (6777856/0)
P 172.16.1.0/24, 1 successors, FD is 3526400
         via 192.168.10.10 (3526400/2172416), Serial0/0/1
         via 172.16.3.1 (40514560/5120), Serial0/0/0
P 172.16.2.0/24, 1 successors, FD is 5120
         via Connected, GigabitEthernet0/0
P 172.16.3.0/30, 1 successors, FD is 40512000
         via Connected, Serial0/0/0
P 192.168.0.0/22, 1 successors, FD is 3014400
         via 192.168.10.10 (3014400/5120), Serial0/0/1
         via 172.16.3.1 (41026560/2172416), Serial0/0/0
P 192.168.10.4/30, 1 successors, FD is 3523840
         via 192.168.10.10 (3523840/2169856), Serial0/0/1
         via 172.16.3.1 (41024000/2169856), Serial0/0/0
P 192.168.10.8/30, 1 successors, FD is 3011840
         via Connected, Serial0/0/1
Router2>
```

2. **View detailed EIGRP topology information on R2. Use the [network] parameter of the `show ip eigrp topology` command to view detailed EIGRP topology information for the 192.168.0.0 network.**

`show ip eigrp topology 192.168.0.0 255.255.252.0`

- Answer the following questions:
  - **How many successors are there for this network?** 1_______
  - **What is the feasible distance to this network?** 3014400________
  - **What is the IP address of the feasible successor?** 172.16.3.1__________
  - **What is the reported distance for 192.168.1.0 from the successor?** 5120_________
  - **What is the reported distance for 192.168.1.0 from the feasible successor?** 2172416_______
  - **Why R3 is considered a successor for R2?** FD IS THE SMALLEST_________________
  - **Why R1 is considered a feasible successor for R2?** RD>FD__________________

Table 1: Addressing table for IPv4 configuration for problem 1

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/0	172.16.1.1	255.255.255.0	--
	S0/0/0 (DCE)	172.16.3.1	255.255.255.252	--
	S0/0/1	192.168.10.5	255.255.255.252	--
R2	G0/0	172.16.2.1	255.255.255.0	--

	S0/0/0	172.16.3.2	255.255.255.252	--
	S0/0/1 (DCE)	192.168.10.9	255.255.255.252	--
	Serial0/1/0	100.100.100.2	255.255.255.252	--
R3	G0/0	192.168.1.1	255.255.255.0	--
	S0/0/0 (DCE)	192.168.10.6	255.255.255.252	--
	S0/0/1	192.168.10.10	255.255.255.252	--
	Loopback1	192.168.2.1	255.255.255.0	--
	Loopback2	192.168.3.1	255.255.255.0	--
ISP	Serial0/0/0	100.100.100.1	255.255.255.252	--
PC1	Fa0	172.16.1.100	255.255.255.0	172.16.1.1
PC2	Fa0	172.16.2.100	255.255.255.0	172.16.2.1
PC3	Fa0	192.168.1.100	255.255.255.0	192.168.1.1

Problem 2: Configuring EIGRP (IPv6) routing protocol

In this activity, you will configure an IPv6 network with the EIGRP routing protocol using the instructions and information given in Figure 2 and Table 2. In a few words, in this activity (Exp 6_Problem_2_EIGRP_IPv6.pka), you are requested to configure the EIGRP routing protocol with static and default routing for Internet access and ensure full connectivity between all devices in the network. Figure 2 shows the topology that you want to configure.

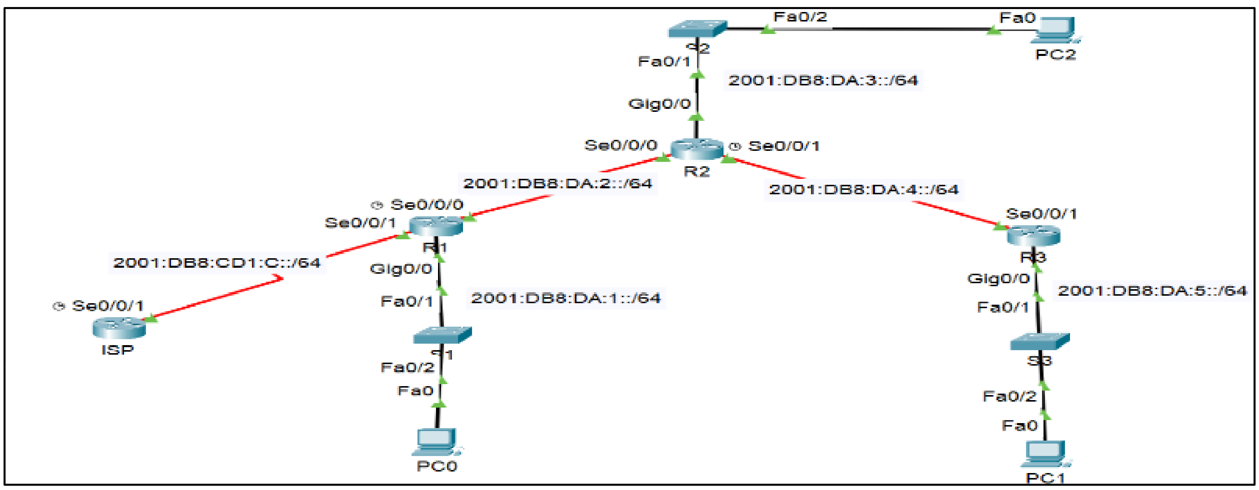

Figure 2. Network topology for problem 2.

Table 2: Addressing table for IPv6 configuration for problem 2

Device	Interface	IPv6 Address	Link-local	Default Gateway	Connected with
R1	S0/0/0(DCE)	2001:DB8:DA:2::1/64	FE80::1	--	R2
	S0/0/1	2001:DB8:CD1:C::2/64	FE80::1	--	ISP
	G0/0	2001:DB8:DA:1::1/64	FE80::1	--	PC0
R2	S0/0/0	2001:DB8:DA:2::2/64	FE80::2	--	R1
	S0/0/1(DCE)	2001:DB8:DA:4::1/64	FE80::2	--	R3
	G0/0	2001:DB8:DA:3::1/64	FE80::2	--	PC2
R3	S0/0/1	2001:DB8:DA:4::2/64	FE80::3	--	R2
	G0/0	2001:DB8:DA:5::1/64	FE80::3	--	PC1
ISP	S0/0/1(DCE)	2001:DB8:CD1:C::1/64	FE80::C	--	R1
PC0	Fa0	2001:DB8:DA:1::A/64	--	FE80::1	R1
PC1	Fa0	2001:DB8:DA:5::A/64	--	FE80::3	R3

PC2	Fa0	2001:DB8:DA:3::A/64	--	FE80::2	R2

Part1: Configuring the PCs and routers' interfaces

- Configure the PCs, server, and routers' interfaces with the IP addresses provided to you in Table 2. Accordingly, routers will have information about the direct networks that they have on their own interfaces.
- Set the clock rate to 128000.

Part2: Configuring a network with EIGRP (IPv6):

Routers will not exchange this information between themselves. We need to implement the EIGRP routing protocol, which will insist they share this information.

1. **On all routers, configure the following:**
   - Enable IPv6 routing.
2. **On all routers except the ISP:**
   - Enable EIGRP with AS equal to 7 on each router.
   - Configure LAN interfaces to not advertise EIGRP updates as a passive interface on all routers.
   - Configure EIGRP for IPv6 on each interface
   - Set the router ID as follows:
     - ✓ R1: 1.1.1.1
     - ✓ R2: 2.2.2.2
     - ✓ R3: 3.3.3.3
3. **On Router 1:**
   - Configure an IPv6 default route out of the s0/0/01 interface and propagate that route to the rest of the network using EIGRP.
4. **On the ISP router:**
   - Configure an Ipv6 summary route, out of the s0/0/1 interface, to reach all Router 0, Router 1, and Router 2 subnets.

Part 3: Verify Configurations

1. **View routing tables of Router 1, Router 2, and Router 3.**
   - Use the appropriate command to show the routing table of Router 1. EIGRP (D) now appears with connected (C) and local (L) routes in the routing table. All networks have an entry. You also see a default route listed.
   - View the routing tables for Router 2 and Router 3. Notice that each router has a full listing of all the networks. You also see a default route listed, as EX.
2. **Verify full connectivity to all destinations.**
   - Every device should now be able to ping every other device inside the network. In addition, all devices should be able to ping the ISP.