Data Communications and Networking
Lab 3 – Routing
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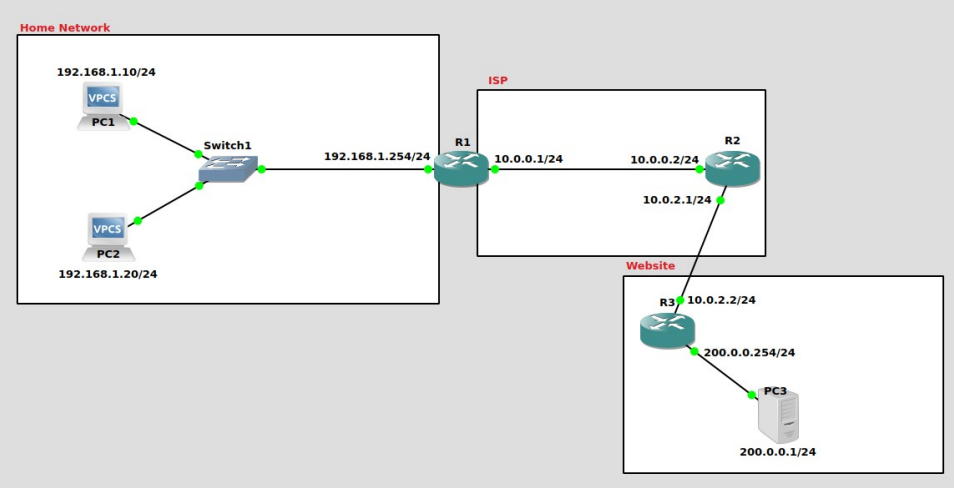
Part 1 (Topology):



Topology created as per instruction.

Host addresses assigned to VPC's and router interface ports as per instruction.

Part 2 (Static Routing):

```
R1#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 2 subnets
S       10.0.2.0 [1/0] via 10.0.0.2
C       10.0.0.0 is directly connected, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0
R1#
```

1st Gateway created on R1, accessing 10.0.2.0 from R2 fastEthernet interface 10.0.0.2

Q1: If you only configure R1 with the command (ip route 10.0.2.0 255.255.255.0 10.0.0.2), does a ping from PC1 to R2 work? Why?

A1: This **DOESN'T** ping as intended, because R2 doesn't have an established route to send a respond message back to PC1

```
PC1> ping 10.0.0.2

10.0.0.2 icmp_seq=1 timeout
10.0.0.2 icmp_seq=2 timeout
```

Resolution: By establishing a static route from R2 to the 192.168.1.0 network, a ping response can be sent once it is received from PC1

```
R2(config)#ip route 192.168.1.0 255.255.255.0 10.0.0.1
```

```
R2#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 2 subnets
C       10.0.2.0 is directly connected, FastEthernet0/1
C       10.0.0.0 is directly connected, FastEthernet0/0
S    192.168.1.0/24 [1/0] via 10.0.0.1
```

This provides a static route for R2 to respond to the ping from PC1

```
PC1> ping 10.0.0.2

84 bytes from 10.0.0.2 icmp_seq=1 ttl=254 time=19.653 ms
84 bytes from 10.0.0.2 icmp_seq=2 ttl=254 time=26.610 ms
84 bytes from 10.0.0.2 icmp_seq=3 ttl=254 time=17.594 ms
84 bytes from 10.0.0.2 icmp_seq=4 ttl=254 time=29.196 ms
84 bytes from 10.0.0.2 icmp_seq=5 ttl=254 time=16.778 ms
```

I now set up the static routes on each router

```
R1#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is 10.0.0.2 to network 0.0.0.0

     10.0.0.0/24 is subnetted, 2 subnets
S       10.0.2.0 [1/0] via 10.0.0.2
C       10.0.0.0 is directly connected, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 10.0.0.2
```

```
R2#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

S    200.0.0.0/24 [1/0] via 10.0.2.2
     10.0.0.0/24 is subnetted, 2 subnets
C       10.0.2.0 is directly connected, FastEthernet0/1
C       10.0.0.0 is directly connected, FastEthernet0/0
S    192.168.1.0/24 [1/0] via 10.0.0.1
```

```
R3#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is 10.0.2.0 to network 0.0.0.0

C    200.0.0.0/24 is directly connected, FastEthernet0/1
     10.0.0.0/24 is subnetted, 2 subnets
C       10.0.2.0 is directly connected, FastEthernet0/0
S       10.0.0.0 [1/0] via 10.0.2.1
S*   0.0.0.0/0 [1/0] via 10.0.2.0
```

Link between PC1 and PC2 established

```
PC1> ping 192.168.1.20

84 bytes from 192.168.1.20 icmp_seq=1 ttl=64 time=0.797 ms
84 bytes from 192.168.1.20 icmp_seq=2 ttl=64 time=0.925 ms
84 bytes from 192.168.1.20 icmp_seq=3 ttl=64 time=1.293 ms
84 bytes from 192.168.1.20 icmp_seq=4 ttl=64 time=1.192 ms
84 bytes from 192.168.1.20 icmp_seq=5 ttl=64 time=0.987 ms
```

Ping between PC1-PC2

Link between PC1 and PC3 established

```
PC1> ping 200.0.0.1

84 bytes from 200.0.0.1 icmp_seq=1 ttl=61 time=57.513 ms
84 bytes from 200.0.0.1 icmp_seq=2 ttl=61 time=50.966 ms
84 bytes from 200.0.0.1 icmp_seq=3 ttl=61 time=38.402 ms
84 bytes from 200.0.0.1 icmp_seq=4 ttl=61 time=48.382 ms
84 bytes from 200.0.0.1 icmp_seq=5 ttl=61 time=37.512 ms
```

Ping between PC1-PC3

Link between PC2 and PC3 established

```
PC2> ping 200.0.0.1

84 bytes from 200.0.0.1 icmp_seq=1 ttl=61 time=50.925 ms
84 bytes from 200.0.0.1 icmp_seq=2 ttl=61 time=39.764 ms
84 bytes from 200.0.0.1 icmp_seq=3 ttl=61 time=38.913 ms
84 bytes from 200.0.0.1 icmp_seq=4 ttl=61 time=31.579 ms
84 bytes from 200.0.0.1 icmp_seq=5 ttl=61 time=39.873 ms
```

Ping between PC2-PC3

Part 3: RIP

Q2: What do you notice about the RIP packets?

```
▸ Frame 10: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface -, id 0
▸ Ethernet II, Src: c0:02:3c:60:00:00 (c0:02:3c:60:00:00), Dst: IPv4mcast_09 (01:00:5e:00:00:09)
▸ Internet Protocol Version 4, Src: 10.0.0.2, Dst: 224.0.0.9
▸ User Datagram Protocol, Src Port: 520, Dst Port: 520
▾ Routing Information Protocol
    Command: Response (2)
    Version: RIPv2 (2)
  ▾ IP Address: 10.0.2.0, Metric: 1
      Address Family: IP (2)
      Route Tag: 0
      IP Address: 10.0.2.0
      Netmask: 255.255.255.0
      Next Hop: 0.0.0.0
      Metric: 1
  ▾ IP Address: 200.0.0.0, Metric: 2
      Address Family: IP (2)
      Route Tag: 0
      IP Address: 200.0.0.0
      Netmask: 255.255.255.0
      Next Hop: 0.0.0.0
      Metric: 2
```

A2: Sends a packet that outlines what networks the source has access to and the hop count(Metric: x) needed to access it from the souce.

```
R1#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
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       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    200.0.0.0/24 [120/2] via 10.0.0.2, 00:00:17, FastEthernet0/1
     10.0.0.0/24 is subnetted, 2 subnets
R       10.0.2.0 [120/1] via 10.0.0.2, 00:00:17, FastEthernet0/1
C       10.0.0.0 is directly connected, FastEthernet0/1
C    192.168.1.0/24 is directly connected, FastEthernet0/0
```

R1 routing table

```
R2#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

R    200.0.0.0/24 [120/1] via 10.0.2.2, 00:00:25, FastEthernet0/1
     10.0.0.0/24 is subnetted, 2 subnets
C       10.0.2.0 is directly connected, FastEthernet0/1
C       10.0.0.0 is directly connected, FastEthernet0/0
R    192.168.1.0/24 [120/1] via 10.0.0.1, 00:00:15, FastEthernet0/0
```

R2 routing table

```
R3#show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

C    200.0.0.0/24 is directly connected, FastEthernet0/1
     10.0.0.0/24 is subnetted, 2 subnets
C       10.0.2.0 is directly connected, FastEthernet0/0
R       10.0.0.0 [120/1] via 10.0.2.1, 00:00:21, FastEthernet0/0
R    192.168.1.0/24 [120/2] via 10.0.2.1, 00:00:21, FastEthernet0/0
```

R3 routing table