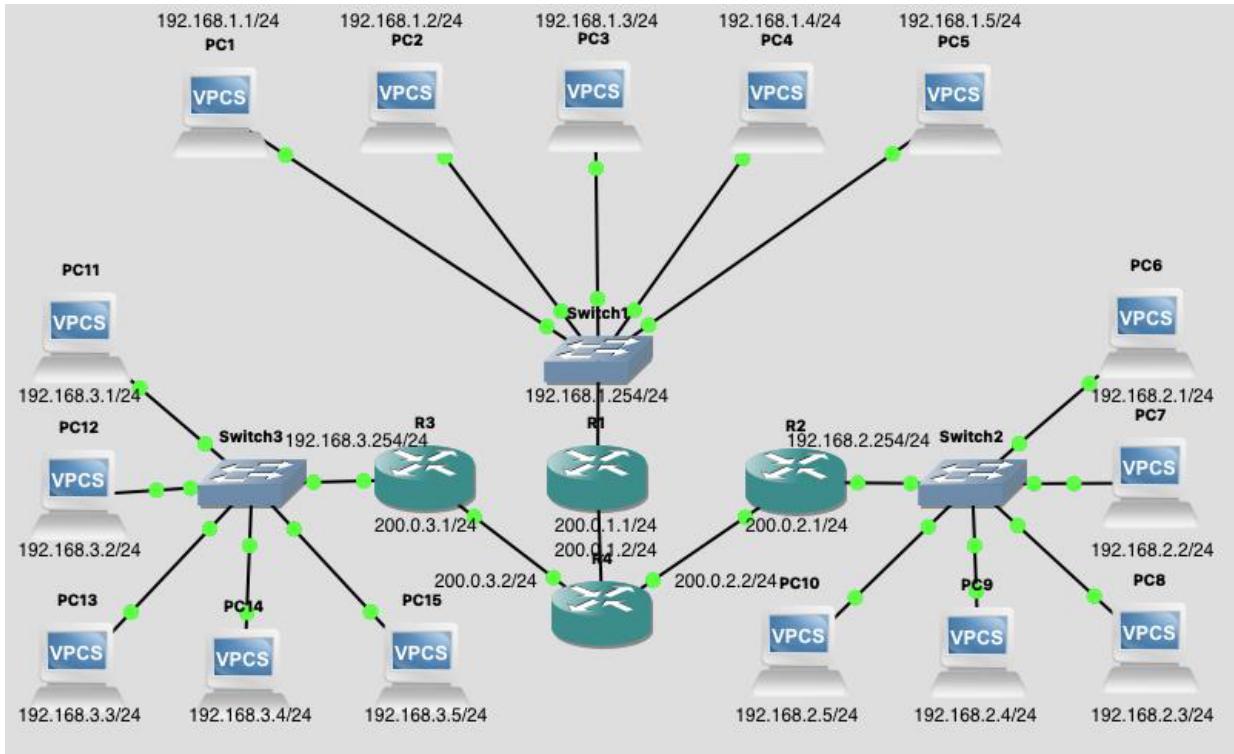


F29DC Lab 5

Topology A:



Topology A Routing Proof:

```

lucca - R1 - telnet localhost 5000 - 80x24
[R1]config-router#
[R1]#
*[#] 1 00:19:03.503: %SYS-5-CONFIG_I: Configured from console by console
[R1]write
Building configuration...
[OK]
[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

C  200.0.1.0/24 [120/1] via 200.0.3.2, 00:00:04, FastEthernet0/1
R  200.0.2.0/24 [120/1] via 200.0.3.2, 00:00:04, FastEthernet0/1
C  200.0.3.0/24 is directly connected, FastEthernet0/1
R  192.168.1.0/24 [120/2] via 200.0.3.2, 00:00:04, FastEthernet0/1
R  192.168.2.0/24 [120/2] via 200.0.3.2, 00:00:04, FastEthernet0/1
R  192.168.3.0/24 [120/2] via 200.0.3.2, 00:00:12, FastEthernet0/1
R1#]

lucca - R2 - telnet localhost 5001 - 80x24
[R2]config-router#
[R2]#
*[#] 1 00:18:58.175: %SYS-5-CONFIG_I: Configured from console by console
[R2]write
Building configuration...
[OK]
[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  200.0.1.0/24 [120/1] via 200.0.2.2, 00:00:13, FastEthernet0/1
R  200.0.2.0/24 is directly connected, FastEthernet0/1
R  200.0.3.0/24 [120/1] via 200.0.2.2, 00:00:13, FastEthernet0/1
R  192.168.1.0/24 [120/2] via 200.0.2.2, 00:00:14, FastEthernet0/1
C  192.168.2.0/24 is directly connected, FastEthernet0/0
R  192.168.3.0/24 [120/2] via 200.0.2.2, 00:00:14, FastEthernet0/1
R2#]

lucca - R3 - telnet localhost 5002 - 80x24
[R3]config-router#
[R3]#
*[#] 1 00:19:03.503: %SYS-5-CONFIG_I: Configured from console by console
[R3]write
Building configuration...
[OK]
[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

R  200.0.1.0/24 [120/1] via 200.0.3.2, 00:00:21, FastEthernet0/1
R  200.0.2.0/24 [120/1] via 200.0.3.2, 00:00:21, FastEthernet0/1
C  200.0.3.0/24 is directly connected, FastEthernet0/1
R  192.168.1.0/24 [120/2] via 200.0.3.2, 00:00:21, FastEthernet0/1
R  192.168.2.0/24 [120/2] via 200.0.3.2, 00:00:21, FastEthernet0/1
C  192.168.3.0/24 is directly connected, FastEthernet0/0
R3#]

lucca - R4 - telnet localhost 5003 - 80x24
[R4]config-router#
[R4]#
*[#] 1 00:18:58.175: %SYS-5-CONFIG_I: Configured from console by console
[R4]write
Building configuration...
[OK]
[R4]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  200.0.1.0/24 is directly connected, FastEthernet0/0
C  200.0.2.0/24 is directly connected, FastEthernet0/1
C  200.0.3.0/24 is directly connected, FastEthernet0/1
R  192.168.1.0/24 [120/1] via 200.0.1.1, 00:00:06, FastEthernet0/0
R  192.168.2.0/24 [120/1] via 200.0.2.1, 00:00:22, FastEthernet0/1
R  192.168.3.0/24 [120/1] via 200.0.3.1, 00:00:02, FastEthernet0/1
R4#]

```

Topology A Pings between PCs on Different Subnetworks:

Topology A ICMP PC1 to PC6 & PC11:

```
lucca — PC1 — telnet localhost 5011 — 80x24

84 bytes from 192.168.2.1 icmp_seq=1 ttl=61 time=43.779 ms
p184 bytes from 192.168.2.1 icmp_seq=2 ttl=61 time=46.986 ms
84 bytes from 192.168.2.1 icmp_seq=3 ttl=61 time=47.757 ms
84 bytes from 192.168.2.1 icmp_seq=4 ttl=61 time=43.520 ms
84 bytes from 192.168.2.1 icmp_seq=5 ttl=61 time=47.258 ms

[PC1] ping 192.168.2.1

84 bytes from 192.168.2.1 icmp_seq=1 ttl=61 time=40.351 ms
84 bytes from 192.168.2.1 icmp_seq=2 ttl=61 time=41.345 ms
84 bytes from 192.168.2.1 icmp_seq=3 ttl=61 time=46.972 ms
84 bytes from 192.168.2.1 icmp_seq=4 ttl=61 time=61.227 ms
84 bytes from 192.168.2.1 icmp_seq=5 ttl=61 time=42.252 ms

[PC1] ping 192.168.3.1

84 bytes from 192.168.3.1 icmp_seq=1 ttl=61 time=61.906 ms
84 bytes from 192.168.3.1 icmp_seq=2 ttl=61 time=39.974 ms
84 bytes from 192.168.3.1 icmp_seq=3 ttl=61 time=46.405 ms
84 bytes from 192.168.3.1 icmp_seq=4 ttl=61 time=40.560 ms
84 bytes from 192.168.3.1 icmp_seq=5 ttl=61 time=62.214 ms

[PC1]
```

Topology A UDP PC1 to PC6 & PC11:

```
lucca — PC1 — telnet localhost 5011 — 80x24

84 bytes from 192.168.3.1 icmp_seq=1 ttl=61 time=61.906 ms
84 bytes from 192.168.3.1 icmp_seq=2 ttl=61 time=39.974 ms
84 bytes from 192.168.3.1 icmp_seq=3 ttl=61 time=46.405 ms
84 bytes from 192.168.3.1 icmp_seq=4 ttl=61 time=40.560 ms
84 bytes from 192.168.3.1 icmp_seq=5 ttl=61 time=62.214 ms

[PC1] ping 192.168.2.1 -2

84 bytes from 192.168.2.1 udp_seq=1 ttl=61 time=48.258 ms
84 bytes from 192.168.2.1 udp_seq=2 ttl=61 time=49.372 ms
84 bytes from 192.168.2.1 udp_seq=3 ttl=61 time=42.019 ms
84 bytes from 192.168.2.1 udp_seq=4 ttl=61 time=51.652 ms
84 bytes from 192.168.2.1 udp_seq=5 ttl=61 time=45.814 ms

[PC1] ping 192.168.3.1 -2

84 bytes from 192.168.3.1 udp_seq=1 ttl=61 time=64.796 ms
84 bytes from 192.168.3.1 udp_seq=2 ttl=61 time=40.171 ms
84 bytes from 192.168.3.1 udp_seq=3 ttl=61 time=49.310 ms
84 bytes from 192.168.3.1 udp_seq=4 ttl=61 time=46.143 ms
84 bytes from 192.168.3.1 udp_seq=5 ttl=61 time=45.931 ms

[PC1]
```

Topology A TCP PC1 to PC6 & PC11:

```
lucca — PC1 — telnet localhost 5011 — 80x37

[PC1] ping 192.168.2.1 -3

Connect 7@192.168.2.1 seq=1 ttl=61 time=52.361 ms
SendData 7@192.168.2.1 seq=1 ttl=61 time=41.370 ms
Close 7@192.168.2.1 seq=1 ttl=61 time=56.144 ms
Connect 7@192.168.2.1 seq=2 ttl=61 time=49.205 ms
SendData 7@192.168.2.1 seq=2 ttl=61 time=56.127 ms
Close 7@192.168.2.1 seq=2 ttl=61 time=67.392 ms
Connect 7@192.168.2.1 seq=3 ttl=61 time=42.868 ms
SendData 7@192.168.2.1 seq=3 ttl=61 time=45.427 ms
Close 7@192.168.2.1 seq=3 ttl=61 time=68.617 ms
Connect 7@192.168.2.1 seq=4 ttl=61 time=57.047 ms
SendData 7@192.168.2.1 seq=4 ttl=61 time=49.988 ms
Close 7@192.168.2.1 seq=4 ttl=61 time=51.791 ms
Connect 7@192.168.2.1 seq=5 ttl=61 time=52.384 ms
SendData 7@192.168.2.1 seq=5 ttl=61 time=55.320 ms
Close 7@192.168.2.1 seq=5 ttl=61 time=74.038 ms

[PC1] ping 192.168.3.1 -3

Connect 7@192.168.3.1 seq=1 ttl=61 time=48.555 ms
SendData 7@192.168.3.1 seq=1 ttl=61 time=65.946 ms
Close 7@192.168.3.1 seq=1 ttl=61 time=56.186 ms
Connect 7@192.168.3.1 seq=2 ttl=61 time=49.239 ms
SendData 7@192.168.3.1 seq=2 ttl=61 time=42.383 ms
Close 7@192.168.3.1 seq=2 ttl=61 time=49.837 ms
Connect 7@192.168.3.1 seq=3 ttl=61 time=48.645 ms
SendData 7@192.168.3.1 seq=3 ttl=61 time=47.619 ms
Close 7@192.168.3.1 seq=3 ttl=61 time=69.873 ms
Connect 7@192.168.3.1 seq=4 ttl=61 time=62.823 ms
SendData 7@192.168.3.1 seq=4 ttl=61 time=43.251 ms
Close 7@192.168.3.1 seq=4 ttl=61 time=57.815 ms
Connect 7@192.168.3.1 seq=5 ttl=61 time=46.233 ms
SendData 7@192.168.3.1 seq=5 ttl=61 time=45.141 ms
Close 7@192.168.3.1 seq=5 ttl=61 time=65.957 ms

[PC1]
```

Topology A ICMP PC6 to PC1 & PC11:

```
lucca — PC6 — telnet localhost 5021 — 80x24

Connect 7@192.168.1.1 seq=4 ttl=61 time=41.505 ms
SendData 7@192.168.1.1 seq=4 ttl=61 time=46.081 ms
Close    7@192.168.1.1 seq=4 ttl=61 time=62.472 ms
Connect 7@192.168.1.1 seq=5 ttl=61 time=42.229 ms
SendData 7@192.168.1.1 seq=5 ttl=61 time=59.617 ms
Close    7@192.168.1.1 seq=5 ttl=61 time=59.961 ms

[PC6> ping 192.168.1.1

84 bytes from 192.168.1.1 icmp_seq=1 ttl=61 time=68.200 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=61 time=43.351 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=61 time=46.319 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=61 time=43.521 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=61 time=51.827 ms

[PC6> ping 192.168.3.1

84 bytes from 192.168.3.1 icmp_seq=1 ttl=61 time=70.131 ms
84 bytes from 192.168.3.1 icmp_seq=2 ttl=61 time=44.968 ms
84 bytes from 192.168.3.1 icmp_seq=3 ttl=61 time=55.655 ms
84 bytes from 192.168.3.1 icmp_seq=4 ttl=61 time=48.014 ms
84 bytes from 192.168.3.1 icmp_seq=5 ttl=61 time=48.951 ms

[PC6> ]
```

Topology A UDP PC6 to PC1 & PC11:

```
lucca — PC6 — telnet localhost 5021 — 80x24

84 bytes from 192.168.3.1 icmp_seq=1 ttl=61 time=70.131 ms
84 bytes from 192.168.3.1 icmp_seq=2 ttl=61 time=44.968 ms
84 bytes from 192.168.3.1 icmp_seq=3 ttl=61 time=55.655 ms
84 bytes from 192.168.3.1 icmp_seq=4 ttl=61 time=48.014 ms
84 bytes from 192.168.3.1 icmp_seq=5 ttl=61 time=48.951 ms

[PC6> ping 192.168.1.1 -2

84 bytes from 192.168.1.1 udp_seq=1 ttl=61 time=51.418 ms
84 bytes from 192.168.1.1 udp_seq=2 ttl=61 time=46.063 ms
84 bytes from 192.168.1.1 udp_seq=3 ttl=61 time=36.846 ms
84 bytes from 192.168.1.1 udp_seq=4 ttl=61 time=38.961 ms
84 bytes from 192.168.1.1 udp_seq=5 ttl=61 time=54.932 ms

[PC6> ping 192.168.3.1 -2

84 bytes from 192.168.3.1 udp_seq=1 ttl=61 time=49.000 ms
84 bytes from 192.168.3.1 udp_seq=2 ttl=61 time=51.174 ms
84 bytes from 192.168.3.1 udp_seq=3 ttl=61 time=50.236 ms
84 bytes from 192.168.3.1 udp_seq=4 ttl=61 time=50.766 ms
84 bytes from 192.168.3.1 udp_seq=5 ttl=61 time=46.966 ms

[PC6> ]
```

Topology A TCP PC6 to PC1 & PC11:

```
lucca — PC6 — telnet localhost 5021 — 80x37

[PC6> ping 192.168.1.1 -3

Connect 7@192.168.1.1 seq=1 ttl=61 time=40.081 ms
SendData 7@192.168.1.1 seq=1 ttl=61 time=60.736 ms
Close    7@192.168.1.1 seq=1 ttl=61 time=62.187 ms
Connect 7@192.168.1.1 seq=2 ttl=61 time=49.788 ms
SendData 7@192.168.1.1 seq=2 ttl=61 time=40.086 ms
Close    7@192.168.1.1 seq=2 ttl=61 time=57.197 ms
Connect 7@192.168.1.1 seq=3 ttl=61 time=40.105 ms
SendData 7@192.168.1.1 seq=3 ttl=61 time=57.920 ms
Close    7@192.168.1.1 seq=3 ttl=61 time=82.150 ms
Connect 7@192.168.1.1 seq=4 ttl=61 time=62.064 ms
SendData 7@192.168.1.1 seq=4 ttl=61 time=45.901 ms
Close    7@192.168.1.1 seq=4 ttl=61 time=70.784 ms
Connect 7@192.168.1.1 seq=5 ttl=61 time=43.610 ms
SendData 7@192.168.1.1 seq=5 ttl=61 time=43.835 ms
Close    7@192.168.1.1 seq=5 ttl=61 time=57.933 ms

[PC6> ping 192.168.3.1 -3

Connect 7@192.168.3.1 seq=1 ttl=61 time=47.851 ms
SendData 7@192.168.3.1 seq=1 ttl=61 time=44.906 ms
Close    7@192.168.3.1 seq=1 ttl=61 time=55.581 ms
Connect 7@192.168.3.1 seq=2 ttl=61 time=51.299 ms
SendData 7@192.168.3.1 seq=2 ttl=61 time=54.404 ms
Close    7@192.168.3.1 seq=2 ttl=61 time=65.498 ms
Connect 7@192.168.3.1 seq=3 ttl=61 time=62.460 ms
SendData 7@192.168.3.1 seq=3 ttl=61 time=44.677 ms
Close    7@192.168.3.1 seq=3 ttl=61 time=71.373 ms
Connect 7@192.168.3.1 seq=4 ttl=61 time=39.433 ms
SendData 7@192.168.3.1 seq=4 ttl=61 time=47.108 ms
Close    7@192.168.3.1 seq=4 ttl=61 time=60.256 ms
Connect 7@192.168.3.1 seq=5 ttl=61 time=38.571 ms
SendData 7@192.168.3.1 seq=5 ttl=61 time=60.696 ms
Close    7@192.168.3.1 seq=5 ttl=61 time=62.257 ms

[PC6> ]
```

Topology A ICMP PC11 to PC1 & PC6:

```
lucca — PC11 — telnet localhost 5031 — 80x24

Connect 7@192.168.1.1 seq=4 ttl=61 time=44.362 ms
SendData 7@192.168.1.1 seq=4 ttl=61 time=49.287 ms
Close 7@192.168.1.1 seq=4 ttl=61 time=58.642 ms
Connect 7@192.168.1.1 seq=5 ttl=61 time=40.840 ms
SendData 7@192.168.1.1 seq=5 ttl=61 time=57.319 ms
Close 7@192.168.1.1 seq=5 ttl=61 time=58.390 ms

|PC11> ping 192.168.1.1

84 bytes from 192.168.1.1 icmp_seq=1 ttl=61 time=43.088 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=61 time=46.658 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=61 time=42.490 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=61 time=63.329 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=61 time=41.351 ms

|PC11> ping 192.168.2.1

84 bytes from 192.168.2.1 icmp_seq=1 ttl=61 time=50.102 ms
84 bytes from 192.168.2.1 icmp_seq=2 ttl=61 time=45.920 ms
84 bytes from 192.168.2.1 icmp_seq=3 ttl=61 time=42.302 ms
84 bytes from 192.168.2.1 icmp_seq=4 ttl=61 time=38.076 ms
84 bytes from 192.168.2.1 icmp_seq=5 ttl=61 time=59.428 ms

PC11>
```

Topology A UDP PC11 to PC1 & PC6:

```
lucca — PC11 — telnet localhost 5031 — 80x24

84 bytes from 192.168.2.1 icmp_seq=1 ttl=61 time=50.102 ms
84 bytes from 192.168.2.1 icmp_seq=2 ttl=61 time=45.920 ms
84 bytes from 192.168.2.1 icmp_seq=3 ttl=61 time=42.302 ms
84 bytes from 192.168.2.1 icmp_seq=4 ttl=61 time=38.076 ms
84 bytes from 192.168.2.1 icmp_seq=5 ttl=61 time=59.428 ms

|PC11> ping 192.168.1.1 -2

84 bytes from 192.168.1.1 udp_seq=1 ttl=61 time=58.720 ms
84 bytes from 192.168.1.1 udp_seq=2 ttl=61 time=40.798 ms
84 bytes from 192.168.1.1 udp_seq=3 ttl=61 time=47.259 ms
84 bytes from 192.168.1.1 udp_seq=4 ttl=61 time=59.373 ms
84 bytes from 192.168.1.1 udp_seq=5 ttl=61 time=43.241 ms

|PC11> ping 192.168.2.1 -2

84 bytes from 192.168.2.1 udp_seq=1 ttl=61 time=47.012 ms
84 bytes from 192.168.2.1 udp_seq=2 ttl=61 time=51.681 ms
84 bytes from 192.168.2.1 udp_seq=3 ttl=61 time=44.393 ms
84 bytes from 192.168.2.1 udp_seq=4 ttl=61 time=41.818 ms
84 bytes from 192.168.2.1 udp_seq=5 ttl=61 time=44.151 ms

PC11>
```

Topology A TCP PC11 to PC1 & PC6:

```
lucca — PC11 — telnet localhost 5031 — 80x37

|PC11> ping 192.168.1.1 -3

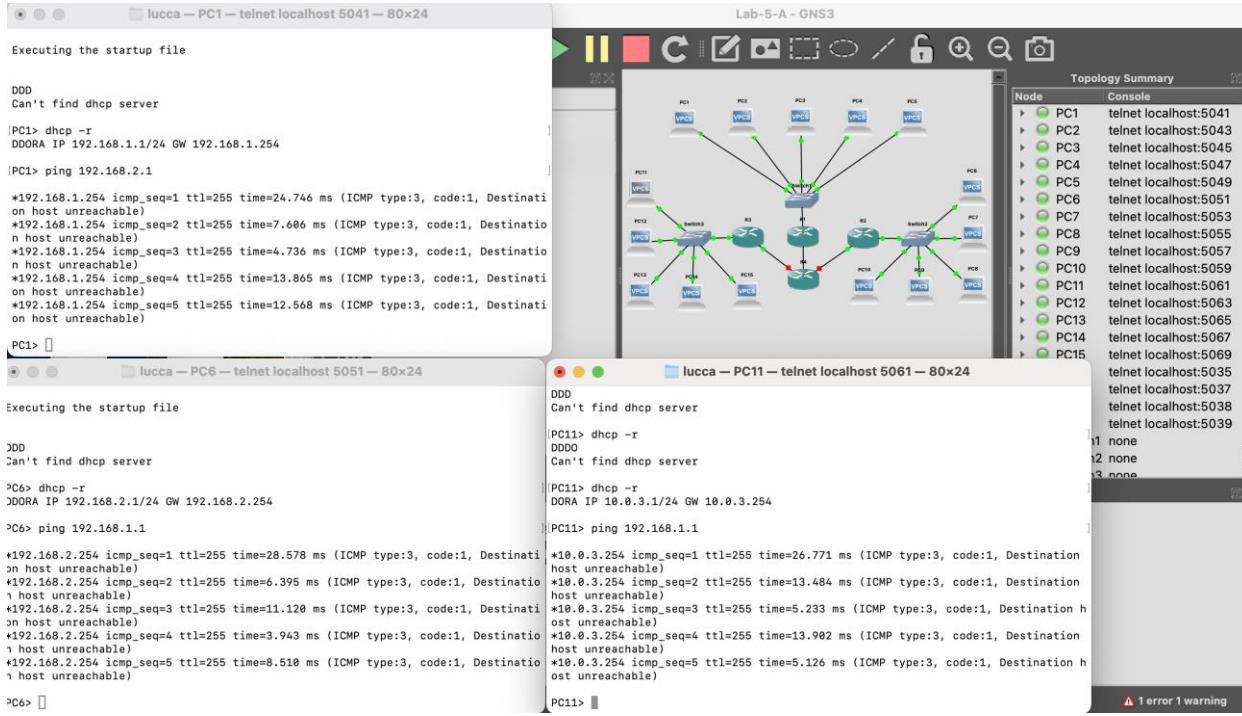
Connect 7@192.168.1.1 seq=1 ttl=61 time=43.947 ms
SendData 7@192.168.1.1 seq=1 ttl=61 time=67.650 ms
Close 7@192.168.1.1 seq=1 ttl=61 time=71.868 ms
Connect 7@192.168.1.1 seq=2 ttl=61 time=51.815 ms
SendData 7@192.168.1.1 seq=2 ttl=61 time=39.234 ms
Close 7@192.168.1.1 seq=2 ttl=61 time=53.159 ms
Connect 7@192.168.1.1 seq=3 ttl=61 time=57.986 ms
SendData 7@192.168.1.1 seq=3 ttl=61 time=37.996 ms
Close 7@192.168.1.1 seq=3 ttl=61 time=59.980 ms
Connect 7@192.168.1.1 seq=4 ttl=61 time=45.768 ms
SendData 7@192.168.1.1 seq=4 ttl=61 time=56.557 ms
Close 7@192.168.1.1 seq=4 ttl=61 time=57.194 ms
Connect 7@192.168.1.1 seq=5 ttl=61 time=57.885 ms
SendData 7@192.168.1.1 seq=5 ttl=61 time=37.837 ms
Close 7@192.168.1.1 seq=5 ttl=61 time=61.274 ms

|PC11> ping 192.168.2.1 -3

Connect 7@192.168.2.1 seq=1 ttl=61 time=64.554 ms
SendData 7@192.168.2.1 seq=1 ttl=61 time=57.525 ms
Close 7@192.168.2.1 seq=1 ttl=61 time=56.949 ms
Connect 7@192.168.2.1 seq=2 ttl=61 time=40.036 ms
SendData 7@192.168.2.1 seq=2 ttl=61 time=48.723 ms
Close 7@192.168.2.1 seq=2 ttl=61 time=61.087 ms
Connect 7@192.168.2.1 seq=3 ttl=61 time=50.447 ms
SendData 7@192.168.2.1 seq=3 ttl=61 time=44.027 ms
Close 7@192.168.2.1 seq=3 ttl=61 time=54.893 ms
Connect 7@192.168.2.1 seq=4 ttl=61 time=58.042 ms
SendData 7@192.168.2.1 seq=4 ttl=61 time=51.833 ms
Close 7@192.168.2.1 seq=4 ttl=61 time=59.841 ms
Connect 7@192.168.2.1 seq=5 ttl=61 time=57.200 ms
SendData 7@192.168.2.1 seq=5 ttl=61 time=51.072 ms
Close 7@192.168.2.1 seq=5 ttl=61 time=73.447 ms

PC11>
```

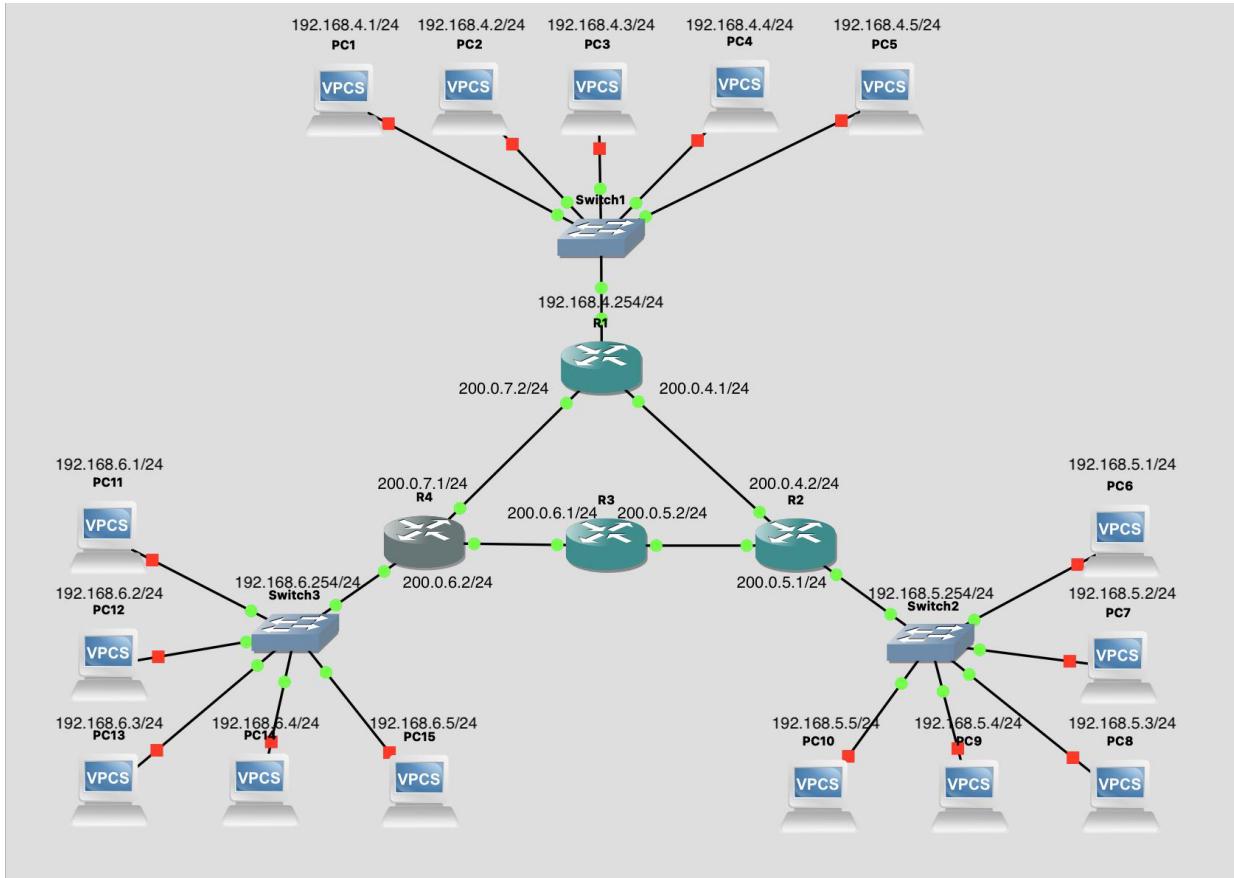
Removing a Router in Topology A:



Topology A Traceroute Proof:

```
[PC1> trace 192.168.2.1
trace to 192.168.2.1, 8 hops max, press Ctrl+C to stop
 1  192.168.1.254  56.442 ms  11.136 ms  12.321 ms
 2  200.0.1.2    36.234 ms  22.749 ms  22.529 ms
 3  200.0.2.1    58.686 ms  35.071 ms  35.056 ms
 4  *192.168.2.1   58.246 ms (ICMP type:3, code:3, Destination port unreachable
)
```

Topology B:



Topology B Routing Proof:

```

lucca -- R1 -- telnet localhost 5029 -- 80x24
R 200.0.5.0/24 [120/1] via 200.0.4.2, 00:00:26, FastEthernet0/1
R 200.0.6.0/24 [120/2] via 200.0.4.2, 00:00:24, FastEthernet0/1
C 200.0.7.0/24 is directly connected, FastEthernet1/0
C 192.168.4.0/24 is directly connected, FastEthernet0/0
R 192.168.5.0/24 [120/1] via 200.0.4.2, 00:00:26, FastEthernet0/1
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

C 200.0.4.0/24 is directly connected, FastEthernet0/1
R 200.0.5.0/24 [120/1] via 200.0.4.2, 00:00:86, FastEthernet0/1
R 200.0.6.0/24 [120/2] via 200.0.4.2, 00:00:86, FastEthernet0/1
C 200.0.7.0/24 is directly connected, FastEthernet1/0
C 192.168.4.0/24 is directly connected, FastEthernet0/0
R 192.168.5.0/24 [120/1] via 200.0.4.2, 00:00:86, FastEthernet0/1
R 192.168.6.0/24 [120/3] via 200.0.4.2, 00:00:86, FastEthernet0/1
R1# 

lucca -- R2 -- telnet localhost 5033 -- 80x24
R2(config-router)#network 200.0.6.0
R2(config-router)#
R2#
*Mar 1 00:41:49.263: %SYS-5-CONFIG_I: Configured from console by console
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

C 200.0.4.0/24 [120/1] via 200.0.5.1, 00:00:01, FastEthernet0/1
C 200.0.5.0/24 is directly connected, FastEthernet0/1
C 200.0.6.0/24 is directly connected, FastEthernet0/0
R 200.0.7.0/24 [120/1] via 200.0.6.2, 00:00:17, FastEthernet0/0
R 192.168.4.0/24 [120/2] via 200.0.6.2, 00:00:17, FastEthernet0/0
R 192.168.5.0/24 [120/1] via 200.0.5.1, 00:00:01, FastEthernet0/1
R 192.168.5.0/24 [120/1] via 200.0.5.1, 00:00:01, FastEthernet0/1
R 192.168.6.0/24 [120/1] via 200.0.6.2, 00:00:19, FastEthernet0/0
R2# 

lucca -- R3 -- telnet localhost 5035 -- 80x24
R3(config-router)#network 200.0.6.0
R3(config-router)#
R3#
*Mar 1 00:41:58.203: %SYS-5-CONFIG_I: Configured from console by console
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

R 200.0.4.0/24 [120/1] via 200.0.5.1, 00:00:01, FastEthernet0/1
C 200.0.5.0/24 is directly connected, FastEthernet0/1
C 200.0.6.0/24 is directly connected, FastEthernet0/0
R 200.0.7.0/24 [120/1] via 200.0.6.2, 00:00:17, FastEthernet0/0
R 192.168.4.0/24 [120/2] via 200.0.6.2, 00:00:17, FastEthernet0/0
R 192.168.5.0/24 [120/1] via 200.0.5.1, 00:00:01, FastEthernet0/1
R 192.168.5.0/24 [120/1] via 200.0.5.1, 00:00:01, FastEthernet0/1
R 192.168.6.0/24 [120/1] via 200.0.6.2, 00:00:19, FastEthernet0/0
R3# 

lucca -- R4 -- telnet localhost 5036 -- 80x24
R4(config-router)#network 200.0.7.0
R4(config-router)#
R4#
*Mar 1 00:42:03.227: %SYS-5-CONFIG_I: Configured from console by console
R4#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 200.0.4.0/24 [120/1] via 200.0.7.2, 00:00:04, FastEthernet0/1
R 200.0.5.0/24 [120/1] via 200.0.6.1, 00:00:00, FastEthernet1/0
C 200.0.6.0/24 is directly connected, FastEthernet1/0
C 200.0.7.0/24 is directly connected, FastEthernet0/1
R 192.168.4.0/24 [120/1] via 200.0.7.2, 00:00:04, FastEthernet0/1
R 192.168.5.0/24 [120/2] via 200.0.6.1, 00:00:00, FastEthernet1/0
C 192.168.6.0/24 is directly connected, FastEthernet0/0
R 192.168.6.0/24 [120/2] via 200.0.5.2, 00:00:04, FastEthernet0/1
R4# 

```

Topology B Pings between PCs on Different Subnetworks:

Topology B ICMP PC1 to PC6 & PC11:

```
lucca — PC1 — telnet localhost 5034 — 80x24

Executing the startup file

[PC1]> dhcp -r
DDORA IP 192.168.4.1/24 GW 192.168.4.254

[PC1]> ping 192.168.5.1

84 bytes from 192.168.5.1 icmp_seq=1 ttl=62 time=60.116 ms
84 bytes from 192.168.5.1 icmp_seq=2 ttl=62 time=42.042 ms
84 bytes from 192.168.5.1 icmp_seq=3 ttl=62 time=32.996 ms
84 bytes from 192.168.5.1 icmp_seq=4 ttl=62 time=36.227 ms
84 bytes from 192.168.5.1 icmp_seq=5 ttl=62 time=33.603 ms

[PC1]> ping 192.168.6.1

84 bytes from 192.168.6.1 icmp_seq=1 ttl=62 time=33.280 ms
84 bytes from 192.168.6.1 icmp_seq=2 ttl=62 time=32.920 ms
84 bytes from 192.168.6.1 icmp_seq=3 ttl=62 time=25.294 ms
84 bytes from 192.168.6.1 icmp_seq=4 ttl=62 time=35.880 ms
84 bytes from 192.168.6.1 icmp_seq=5 ttl=62 time=27.059 ms

PC1> 
```

Topology B UDP PC1 to PC6 & PC11:

```
lucca — PC1 — telnet localhost 5034 — 80x24

84 bytes from 192.168.6.1 icmp_seq=1 ttl=62 time=33.280 ms
84 bytes from 192.168.6.1 icmp_seq=2 ttl=62 time=32.920 ms
84 bytes from 192.168.6.1 icmp_seq=3 ttl=62 time=25.294 ms
84 bytes from 192.168.6.1 icmp_seq=4 ttl=62 time=35.880 ms
84 bytes from 192.168.6.1 icmp_seq=5 ttl=62 time=27.059 ms

[PC1]> ping 192.168.5.1 -2

84 bytes from 192.168.5.1 udp_seq=1 ttl=62 time=47.414 ms
84 bytes from 192.168.5.1 udp_seq=2 ttl=62 time=33.258 ms
84 bytes from 192.168.5.1 udp_seq=3 ttl=62 time=42.763 ms
84 bytes from 192.168.5.1 udp_seq=4 ttl=62 time=26.939 ms
84 bytes from 192.168.5.1 udp_seq=5 ttl=62 time=41.075 ms

[PC1]> ping 192.168.6.1 -2

84 bytes from 192.168.6.1 udp_seq=1 ttl=62 time=27.502 ms
84 bytes from 192.168.6.1 udp_seq=2 ttl=62 time=27.861 ms
84 bytes from 192.168.6.1 udp_seq=3 ttl=62 time=15.213 ms
84 bytes from 192.168.6.1 udp_seq=4 ttl=62 time=35.457 ms
84 bytes from 192.168.6.1 udp_seq=5 ttl=62 time=46.806 ms

PC1> 
```

Topology B TCP PC1 to PC6 & PC11:

```
lucca — PC1 — telnet localhost 5034 — 80x37

[PC1]> ping 192.168.5.1 -3

Connect 70192.168.5.1 seq=1 ttl=62 time=46.677 ms
SendData 70192.168.5.1 seq=1 ttl=62 time=31.249 ms
Close 70192.168.5.1 seq=1 ttl=62 time=40.889 ms
Connect 70192.168.5.1 seq=2 ttl=62 time=26.622 ms
SendData 70192.168.5.1 seq=2 ttl=62 time=30.799 ms
Close 70192.168.5.1 seq=2 ttl=62 time=45.234 ms
Connect 70192.168.5.1 seq=3 ttl=62 time=38.726 ms
SendData 70192.168.5.1 seq=3 ttl=62 time=25.127 ms
Close 70192.168.5.1 seq=3 ttl=62 time=39.824 ms
Connect 70192.168.5.1 seq=4 ttl=62 time=36.350 ms
SendData 70192.168.5.1 seq=4 ttl=62 time=26.353 ms
Close 70192.168.5.1 seq=4 ttl=62 time=39.849 ms
Connect 70192.168.5.1 seq=5 ttl=62 time=27.310 ms
SendData 70192.168.5.1 seq=5 ttl=62 time=29.454 ms
Close 70192.168.5.1 seq=5 ttl=62 time=45.531 ms

[PC1]> ping 192.168.6.1 -3

Connect 70192.168.6.1 seq=1 ttl=62 time=42.152 ms
SendData 70192.168.6.1 seq=1 ttl=62 time=35.556 ms
Close 70192.168.6.1 seq=1 ttl=62 time=41.935 ms
Connect 70192.168.6.1 seq=2 ttl=62 time=37.550 ms
SendData 70192.168.6.1 seq=2 ttl=62 time=36.186 ms
Close 70192.168.6.1 seq=2 ttl=62 time=37.552 ms
Connect 70192.168.6.1 seq=3 ttl=62 time=39.734 ms
SendData 70192.168.6.1 seq=3 ttl=62 time=33.065 ms
Close 70192.168.6.1 seq=3 ttl=62 time=45.884 ms
Connect 70192.168.6.1 seq=4 ttl=62 time=27.280 ms
SendData 70192.168.6.1 seq=4 ttl=62 time=28.300 ms
Close 70192.168.6.1 seq=4 ttl=62 time=44.593 ms
Connect 70192.168.6.1 seq=5 ttl=62 time=45.899 ms
SendData 70192.168.6.1 seq=5 ttl=62 time=36.221 ms
Close 70192.168.6.1 seq=5 ttl=62 time=52.679 ms

PC1> 
```

Topology B ICMP PC6 to PC1 & PC11:

```
lucca — PC6 — telnet localhost 5009 — 80x24

Executing the startup file

[PC6> dhcp -r
DDORA IP 192.168.5.1/24 GW 192.168.5.254

[PC6> ping 192.168.4.1

84 bytes from 192.168.4.1 icmp_seq=1 ttl=62 time=26.177 ms
84 bytes from 192.168.4.1 icmp_seq=2 ttl=62 time=35.274 ms
84 bytes from 192.168.4.1 icmp_seq=3 ttl=62 time=30.001 ms
84 bytes from 192.168.4.1 icmp_seq=4 ttl=62 time=34.005 ms
84 bytes from 192.168.4.1 icmp_seq=5 ttl=62 time=28.805 ms

[PC6> ping 192.168.6.1

84 bytes from 192.168.6.1 icmp_seq=1 ttl=61 time=55.952 ms
84 bytes from 192.168.6.1 icmp_seq=2 ttl=61 time=43.025 ms
84 bytes from 192.168.6.1 icmp_seq=3 ttl=61 time=49.100 ms
84 bytes from 192.168.6.1 icmp_seq=4 ttl=61 time=50.904 ms
84 bytes from 192.168.6.1 icmp_seq=5 ttl=61 time=55.489 ms

PC6> ]
```

Topology B UDP PC6 to PC1 & PC11:

```
lucca — PC6 — telnet localhost 5009 — 80x24

84 bytes from 192.168.6.1 icmp_seq=1 ttl=61 time=55.952 ms
84 bytes from 192.168.6.1 icmp_seq=2 ttl=61 time=43.025 ms
84 bytes from 192.168.6.1 icmp_seq=3 ttl=61 time=49.100 ms
84 bytes from 192.168.6.1 icmp_seq=4 ttl=61 time=50.904 ms
84 bytes from 192.168.6.1 icmp_seq=5 ttl=61 time=55.489 ms

[PC6> ping 192.168.4.1 -2

84 bytes from 192.168.4.1 udp_seq=1 ttl=62 time=34.517 ms
84 bytes from 192.168.4.1 udp_seq=2 ttl=62 time=25.568 ms
84 bytes from 192.168.4.1 udp_seq=3 ttl=62 time=40.154 ms
84 bytes from 192.168.4.1 udp_seq=4 ttl=62 time=33.934 ms
84 bytes from 192.168.4.1 udp_seq=5 ttl=62 time=29.896 ms

[PC6> ping 192.168.6.1 -2

84 bytes from 192.168.6.1 udp_seq=1 ttl=61 time=56.524 ms
84 bytes from 192.168.6.1 udp_seq=2 ttl=61 time=64.490 ms
84 bytes from 192.168.6.1 udp_seq=3 ttl=61 time=38.081 ms
84 bytes from 192.168.6.1 udp_seq=4 ttl=61 time=37.620 ms
84 bytes from 192.168.6.1 udp_seq=5 ttl=61 time=63.955 ms

PC6> ]
```

Topology B TCP PC6 to PC1 & PC11:

```
lucca — PC6 — telnet localhost 5009 — 80x37

[PC6> ping 192.168.4.1 -3

Connect 7@192.168.4.1 seq=1 ttl=62 time=35.292 ms
SendData 7@192.168.4.1 seq=1 ttl=62 time=39.158 ms
Close 7@192.168.4.1 seq=1 ttl=62 time=46.784 ms
Connect 7@192.168.4.1 seq=2 ttl=62 time=35.656 ms
SendData 7@192.168.4.1 seq=2 ttl=62 time=23.877 ms
Close 7@192.168.4.1 seq=2 ttl=62 time=49.345 ms
Connect 7@192.168.4.1 seq=3 ttl=62 time=43.036 ms
SendData 7@192.168.4.1 seq=3 ttl=62 time=32.883 ms
Close 7@192.168.4.1 seq=3 ttl=62 time=43.230 ms
Connect 7@192.168.4.1 seq=4 ttl=62 time=28.501 ms
SendData 7@192.168.4.1 seq=4 ttl=62 time=31.443 ms
Close 7@192.168.4.1 seq=4 ttl=62 time=39.908 ms
Connect 7@192.168.4.1 seq=5 ttl=62 time=31.986 ms
SendData 7@192.168.4.1 seq=5 ttl=62 time=27.910 ms
Close 7@192.168.4.1 seq=5 ttl=62 time=37.555 ms

[PC6> ping 192.168.6.1 -3

Connect 7@192.168.6.1 seq=1 ttl=61 time=46.544 ms
SendData 7@192.168.6.1 seq=1 ttl=61 time=43.448 ms
Close 7@192.168.6.1 seq=1 ttl=61 time=54.749 ms
Connect 7@192.168.6.1 seq=2 ttl=61 time=62.182 ms
SendData 7@192.168.6.1 seq=2 ttl=61 time=45.010 ms
Close 7@192.168.6.1 seq=2 ttl=61 time=56.976 ms
Connect 7@192.168.6.1 seq=3 ttl=61 time=31.998 ms
SendData 7@192.168.6.1 seq=3 ttl=61 time=37.610 ms
Close 7@192.168.6.1 seq=3 ttl=61 time=56.234 ms
Connect 7@192.168.6.1 seq=4 ttl=61 time=46.839 ms
SendData 7@192.168.6.1 seq=4 ttl=61 time=42.232 ms
Close 7@192.168.6.1 seq=4 ttl=61 time=52.358 ms
Connect 7@192.168.6.1 seq=5 ttl=61 time=50.938 ms
SendData 7@192.168.6.1 seq=5 ttl=61 time=29.246 ms
Close 7@192.168.6.1 seq=5 ttl=61 time=53.356 ms

PC6> ]
```

Topology B ICMP PC11 to PC1 & PC6:

```
lucca -- PC11 -- telnet localhost 5019 -- 80x24

Executing the startup file

[PC11] dhcp -r
DDORA IP 192.168.6.1/24 GW 192.168.6.254

[PC11] ping 192.168.4.1

84 bytes from 192.168.4.1 icmp_seq=1 ttl=62 time=33.430 ms
84 bytes from 192.168.4.1 icmp_seq=2 ttl=62 time=33.188 ms
84 bytes from 192.168.4.1 icmp_seq=3 ttl=62 time=31.267 ms
84 bytes from 192.168.4.1 icmp_seq=4 ttl=62 time=33.334 ms
84 bytes from 192.168.4.1 icmp_seq=5 ttl=62 time=28.159 ms

[PC11] ping 192.168.5.1

84 bytes from 192.168.5.1 icmp_seq=1 ttl=61 time=50.336 ms
84 bytes from 192.168.5.1 icmp_seq=2 ttl=61 time=41.517 ms
84 bytes from 192.168.5.1 icmp_seq=3 ttl=61 time=46.343 ms
84 bytes from 192.168.5.1 icmp_seq=4 ttl=61 time=46.459 ms
84 bytes from 192.168.5.1 icmp_seq=5 ttl=61 time=51.268 ms

PC11> 
```

Topology B UDP PC11 to PC1 & PC6:

```
lucca -- PC11 -- telnet localhost 5019 -- 80x24

84 bytes from 192.168.5.1 icmp_seq=1 ttl=61 time=50.336 ms
84 bytes from 192.168.5.1 icmp_seq=2 ttl=61 time=41.517 ms
84 bytes from 192.168.5.1 icmp_seq=3 ttl=61 time=46.343 ms
84 bytes from 192.168.5.1 icmp_seq=4 ttl=61 time=46.459 ms
84 bytes from 192.168.5.1 icmp_seq=5 ttl=61 time=51.268 ms

[PC11] ping 192.168.4.1 -2

84 bytes from 192.168.4.1 udp_seq=1 ttl=62 time=36.051 ms
84 bytes from 192.168.4.1 udp_seq=2 ttl=62 time=32.093 ms
84 bytes from 192.168.4.1 udp_seq=3 ttl=62 time=26.076 ms
84 bytes from 192.168.4.1 udp_seq=4 ttl=62 time=26.347 ms
84 bytes from 192.168.4.1 udp_seq=5 ttl=62 time=36.582 ms

[PC11] ping 192.168.5.1 -2

84 bytes from 192.168.5.1 udp_seq=1 ttl=61 time=45.614 ms
84 bytes from 192.168.5.1 udp_seq=2 ttl=61 time=46.024 ms
84 bytes from 192.168.5.1 udp_seq=3 ttl=61 time=41.469 ms
84 bytes from 192.168.5.1 udp_seq=4 ttl=61 time=37.680 ms
84 bytes from 192.168.5.1 udp_seq=5 ttl=61 time=50.283 ms

PC11> 
```

Topology B TCP PC11 to PC1 & PC6:

```
lucca -- PC11 -- telnet localhost 5019 -- 80x37

[PC11] ping 192.168.4.1 -3

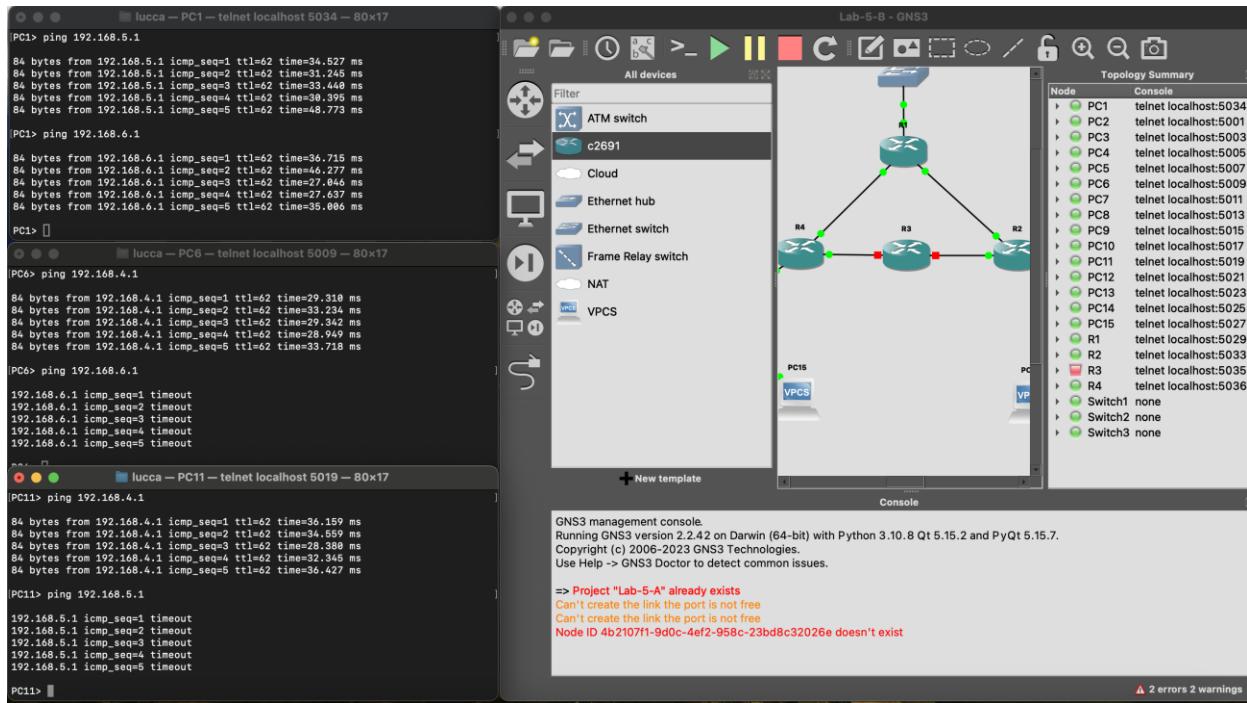
Connect 7@192.168.4.1 seq=1 ttl=62 time=37.437 ms
SendData 7@192.168.4.1 seq=1 ttl=62 time=36.301 ms
Close 7@192.168.4.1 seq=1 ttl=62 time=48.282 ms
Connect 7@192.168.4.1 seq=2 ttl=62 time=26.098 ms
SendData 7@192.168.4.1 seq=2 ttl=62 time=31.585 ms
Close 7@192.168.4.1 seq=2 ttl=62 time=44.027 ms
Connect 7@192.168.4.1 seq=3 ttl=62 time=35.607 ms
SendData 7@192.168.4.1 seq=3 ttl=62 time=25.764 ms
Close 7@192.168.4.1 seq=3 ttl=62 time=49.941 ms
Connect 7@192.168.4.1 seq=4 ttl=62 time=28.968 ms
SendData 7@192.168.4.1 seq=4 ttl=62 time=29.657 ms
Close 7@192.168.4.1 seq=4 ttl=62 time=38.596 ms
Connect 7@192.168.4.1 seq=5 ttl=62 time=34.168 ms
SendData 7@192.168.4.1 seq=5 ttl=62 time=48.893 ms
Close 7@192.168.4.1 seq=5 ttl=62 time=37.318 ms

[PC11] ping 192.168.5.1 -3

Connect 7@192.168.5.1 seq=1 ttl=61 time=46.560 ms
SendData 7@192.168.5.1 seq=1 ttl=61 time=41.920 ms
Close 7@192.168.5.1 seq=1 ttl=61 time=65.065 ms
Connect 7@192.168.5.1 seq=2 ttl=61 time=58.171 ms
SendData 7@192.168.5.1 seq=2 ttl=61 time=48.363 ms
Close 7@192.168.5.1 seq=2 ttl=61 time=61.570 ms
Connect 7@192.168.5.1 seq=3 ttl=61 time=50.153 ms
SendData 7@192.168.5.1 seq=3 ttl=61 time=39.951 ms
Close 7@192.168.5.1 seq=3 ttl=61 time=62.932 ms
Connect 7@192.168.5.1 seq=4 ttl=61 time=39.885 ms
SendData 7@192.168.5.1 seq=4 ttl=61 time=43.616 ms
Close 7@192.168.5.1 seq=4 ttl=61 time=64.974 ms
Connect 7@192.168.5.1 seq=5 ttl=61 time=49.940 ms
SendData 7@192.168.5.1 seq=5 ttl=61 time=39.684 ms
Close 7@192.168.5.1 seq=5 ttl=61 time=54.986 ms

PC11> 
```

Removing a Router in Topology B:



Topology B Traceroute Proof:

```
[PC1]> trace 192.168.5.1
trace to 192.168.5.1, 8 hops max, press Ctrl+C to stop
 1  192.168.4.254  14.183 ms  11.211 ms  12.295 ms
 2  200.0.4.2  37.321 ms  24.468 ms  24.306 ms
 3  *192.168.5.1  37.013 ms (ICMP type:3, code:3, Destination port unreachable
)
```

Explanation of Requirement 2:

Requirement 2, that any two hosts are able to communicate with at least 2 different protocols, was met through my screenshots above. These demonstrate that in both Topology A and B, three PCs from three different subnets were able to communicate with each other using ICMP, TCP and UDP protocols without fail, provided all routers were online and properly configured using RIPv2. All of the PCs were dynamically assigned IP addresses through DHCP; those DHCP addresses were generated by routers acting as DHCP servers that the PCs were connected to.

Explanation of Requirement 3:

Requirement 3, that topology A has a router acting as a single point-of-failure and topology B should be able to survive the loss of any one router, was met through my screenshots above demonstrating what happens if you remove a router from each topology. In topology A, if R4 is taken offline, no two PCs from different subnetworks are able to communicate with each other. This means that R4 acts as a single point of failure. In topology B, if any router is taken offline, only the PCs directly connected to it are not able to communicate with PCs outside of their subnetwork. There is an interesting edge case though, which I captured in my screenshot above - which takes place if R3 is taken offline. Basically, R4 and R2 are configured to go through R3 in order to communicate with each other automatically, as specified by RIP, but since neither of them have the interface in which they usually communicate with each other taken offline in any way, they still try to communicate through R3, even though it has no way of receiving and forwarding the packets they send to it.