Topology Summary:

PC1 telenet localhost:5004

     Ethernet0 -> FastEthernet0/0

R1 telenet localhost:5000

     FastEthernet0/0

     FastEthernet2/0

     FastEthernet2/1

R2 telenet localhost:5001

     FastEthernet0/0

     FastEthernet2/0
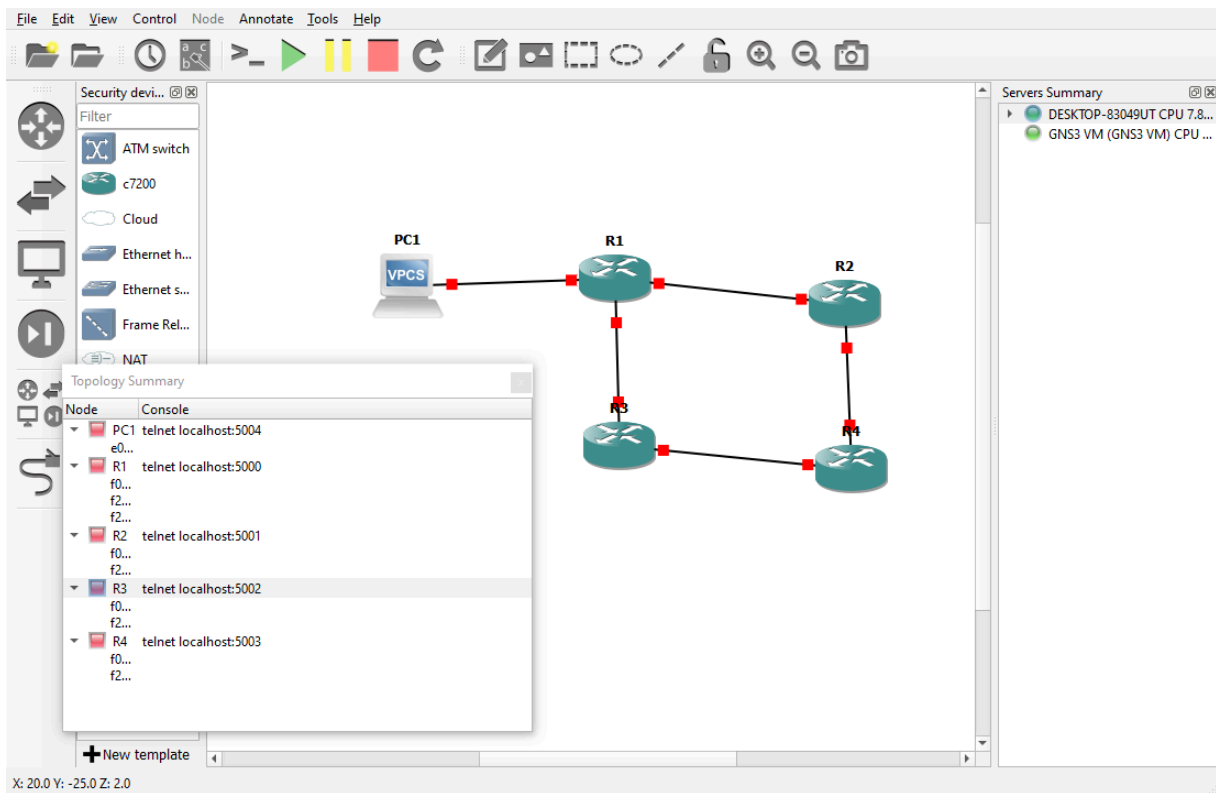
R3 telenet localhost:5002

     FastEthernet0/0

     FastEthernet2/0

R4 telenet localhost:5003

     FastEthernet0/0

     FastEthernet2/0

```
PC1> ip 192.168.1.2/24 192.168.1.1
Checking for duplicate address...
PC1 : 192.168.1.2 255.255.255.0 gateway 192.168.1.1

PC1> save
Saving startup configuration to startup.vpc
.  done

PC1>
```

Configuring R1 FastEthernet0/0, FastEthernet2/0, and FastEthernet2/1

```
R1#configure
Configuring from terminal, memory, or network [terminal]? terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#interface f0/0
R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#
*Sep 28 16:06:12.959: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
R1(config)#
*Sep 28 16:06:13.959: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
R1(config)#interface f1/0
                       ^
% Invalid input detected at '^' marker.

R1(config)#interface f0/1
                          ^
% Invalid input detected at '^' marker.

R1(config)#interface f2/0
R1(config-if)#ip address 192.168.12.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#
*Sep 28 16:07:02.443: %LINK-3-UPDOWN: Interface FastEthernet2/0, changed state to up
*Sep 28 16:07:03.443: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet2/0, changed state to up
R1(config)#interface f2/1
R1(config-if)#ip address 192.168.13.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#
*Sep 28 16:07:38.771: %LINK-3-UPDOWN: Interface FastEthernet2/1, changed state to up
*Sep 28 16:07:39.771: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet2/1, changed state to up
R1(config)#
```

Configuring R2 FastEthernet2/0 and FastEthernet0/0

```
R2#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#interface f2/0
R2(config-if)#ip address 192.168.12.2 255.255.255.0
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#
*Sep 28 16:09:21.647: %LINK-3-UPDOWN: Interface FastEthernet2/0, changed state to up
*Sep 28 16:09:22.647: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet2/0, changed state to up
R2(config)#interface f2/0
R2(config-if)#ip address 192.168.24.1 255.255.255.0
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#interface f2/0
R2(config-if)#ip address 192.168.12.2 255.255.255.0
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#interface f0/0
R2(config-if)#ip address 192.168.24.1 255.255.255.0
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#
*Sep 28 16:21:43.147: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Sep 28 16:21:44.147: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
R2(config)#
```

Configure R4 FastEthernet0/0 and FastEthernet2/0

```
R4#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R4(config)#interface f0/0
R4(config-if)#ip address 192.168.24.2 255.255.255.0
R4(config-if)#no shutdown
R4(config-if)#exit
R4(config)#
*Sep 28 16:13:44.855: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
R4(config)#
*Sep 28 16:13:45.855: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
R4(config)#interface f1/0
                    ^
% Invalid input detected at '^' marker.

R4(config)#interface f2/0
R4(config-if)#ip address 192.168.34.1 255.255.255.0
R4(config-if)#no shutdown
R4(config-if)#exit
R4(config)#
*Sep 28 16:14:14.171: %LINK-3-UPDOWN: Interface FastEthernet2/0, changed state to up
*Sep 28 16:14:15.171: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet2/0, changed state to up
R4(config)#
```

Configure R3 FastEthernet0/0 and FastEthernet2/0

```
R3#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#interface f0/0
R3(config-if)#ip address 192.168.34.2
% Incomplete command.

R3(config-if)#ip address 192.168.34.2 255.255.255.0
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#
*Sep 28 16:15:47.103: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Sep 28 16:15:48.103: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
R3(config)#interface f2/0
R3(config-if)#ip address 192.168.13.2 255.255.255.0
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#
*Sep 28 16:16:09.487: %LINK-3-UPDOWN: Interface FastEthernet2/0, changed state to up
*Sep 28 16:16:10.487: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet2/0, changed state to up
R3(config)#
```

Configure Loopback0 on R4

```
R4#config
Configuring from terminal, memory, or network [terminal]? terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R4(config)#interface Loopback0
R4(config-if)#
*Sep 28 16:17:30.483: %LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up
R4(config-if)#ip address 4.4.4.4 255.255.255.255
R4(config-if)#
```

I attempted to set up the OSPF connections but it didn't work. I have a few ideas as to what the issue could be but I didn't have time to resolve the issue. Here's the attempt to set the OSPF up on R1, R2, R3, and R4. I assume this is a problem with the FastEthernet connections in the topology.

```
R1(config)#router ospf 1
R1(config-router)#network 192.168.1.0 0.0.0.255 area 0
R1(config-router)#network 192.168.12.0 0.0.0.255 area 0
R1(config-router)#network 192.168.13.0 0.0.0.255 area 0
R1(config-router)#exit
R1(config)#exit
R1#show ip ro
*Sep 28 16:19:59.583: %SYS-5-CONFIG_I: Configured from console by console
R1#show ip route
Codes: L - local, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.1.0/24 is directly connected, FastEthernet0/0
L        192.168.1.1/32 is directly connected, FastEthernet0/0
      192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.12.0/24 is directly connected, FastEthernet2/0
L        192.168.12.1/32 is directly connected, FastEthernet2/0
      192.168.13.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.13.0/24 is directly connected, FastEthernet2/1
L        192.168.13.1/32 is directly connected, FastEthernet2/1
R1#show ip route
Codes: L - local, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override
```

```
R2(config)#router ospf 1
R2(config-router)#network 192.168.12.0 0.0.0.255 area 0
R2(config-router)#network 192.168.24.0 0.0.0.255 area 0
R2(config-router)#exit
R2(config)#exit
R2#
*Sep 28 16:27:48.675: %SYS-5-CONFIG_I: Configured from console by console
R2#show ip route
Codes: L - local, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      192.168.12.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.12.0/24 is directly connected, FastEthernet2/0
L        192.168.12.2/32 is directly connected, FastEthernet2/0
      192.168.24.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.24.0/24 is directly connected, FastEthernet0/0
L        192.168.24.1/32 is directly connected, FastEthernet0/0
```

```
R3(config)#router ospf 1
R3(config-router)#network 192.168.34.0 0.0.0.255 area 0
R3(config-router)#network 192.168.13.0 0.0.0.255 area 0
R3(config-router)#exit
R3(config)#exit
R3#show ip
*Sep 28 16:34:39.599: %SYS-5-CONFIG_I: Configured from console by console
R3#show ip route
Codes: L - local, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      192.168.13.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.13.0/24 is directly connected, FastEthernet2/0
L        192.168.13.2/32 is directly connected, FastEthernet2/0
      192.168.34.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.34.0/24 is directly connected, FastEthernet0/0
L        192.168.34.2/32 is directly connected, FastEthernet0/0
```

```
R4(config)#router ospf 1
R4(config-router)#network 192.168.24.0 0.0.0.255 area 0
R4(config-router)#network 192.168.34.0 0.0.0.255 area 0
R4(config-router)#exit
R4(config)#exit
R4#
*Sep 28 16:31:19.635: %SYS-5-CONFIG_I: Configured from console by console
R4#show ip route
Codes: L - local, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      4.0.0.0/32 is subnetted, 1 subnets
C        4.4.4.4 is directly connected, Loopback0
      192.168.24.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.24.0/24 is directly connected, FastEthernet0/0
L        192.168.24.2/32 is directly connected, FastEthernet0/0
      192.168.34.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.34.0/24 is directly connected, FastEthernet2/0
L        192.168.34.1/32 is directly connected, FastEthernet2/0
```

Because the OSPF couldn't be set up correctly, I could not ping 4.4.4.4 on PC1.

```
PC1> ping 4.4.4.4
*192.168.1.1 icmp_seq=1 ttl=255 time=74.554 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.1.1 icmp_seq=2 ttl=255 time=6.096 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.1.1 icmp_seq=3 ttl=255 time=7.152 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.1.1 icmp_seq=4 ttl=255 time=7.056 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.1.1 icmp_seq=5 ttl=255 time=8.093 ms (ICMP type:3, code:1, Destination host unreachable)
```

Here's setting up ICMP traffic from PC1 for 4.4.4.4 crossing the link between R1/R3.

```
R1#config
Configuring from terminal, memory, or network [terminal]? terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ip access-list extended ICMP_H1
R1(config-ext-nacl)#permit icmp host 192.168.1.100 host 4.4.4.4
R1(config-ext-nacl)#exit
R1(config)#route-map PBR_H1 permit 10
R1(config-route-map)#match ip address ICMP_H1
R1(config-route-map)#set ip next-hop 192.168.13.2
R1(config-route-map)#exit
R1(config)#ip local policy route-map PBR_R1
R1(config)#exit
R1#show route-
*Sep 28 16:42:06.055: %SYS-5-CONFIG_I: Configured from console by console
R1#show route-map
route-map PBR_H1, permit, sequence 10
  Match clauses:
    ip address (access-lists): ICMP_H1
  Set clauses:
    ip next-hop 192.168.13.2
  Policy routing matches: 0 packets, 0 bytes
```

Assuming OSPF was working in this instance you could imagine that traffic from 4.4.4.4 from the Loopback to PC1 would all go straight to R3 so other Routers would not receive the same traffic. In this instance, the route map shows that the set clauses next-hop is 192.168.13.2 which is the route to R3. If you changed the set ip next-hop -t to a different IP that same traffic would route to the new router.

I learned how to configure a Loopback to test a network's receiving and transmission functions and connections.