Problem 1:

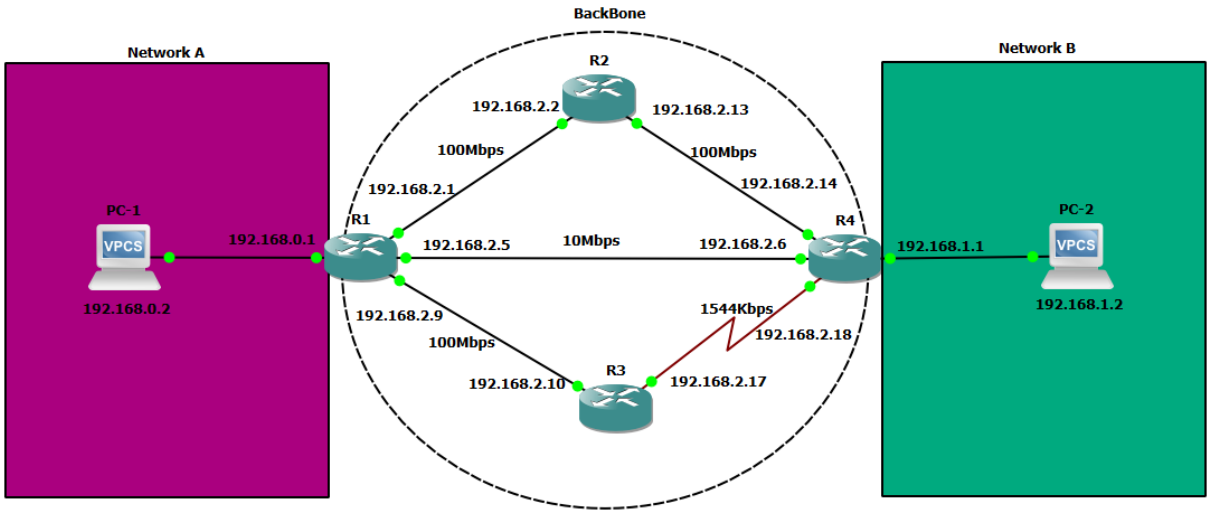

Figure 1 Screenshot of the GNS Model Topology

```
R1#
R1#
R1#ping 192.168.0.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/12/28 ms
R1#
```

Figure 2 ping from R1 to PC-1

```
R1#
R1#ping 192.168.2.6

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.6, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 24/28/32 ms
R1#
```

Figure 3 ping form R1 to R4

NM-1FE-TX and WIC-1T:

NM-1FE-TX	**WIC-1T**
NM-1FE-TX is a fast Ethernet network module that supports many features and standards for internetworking. It has a port "1- port" which is a fast Ethernet that has 10/10TX interface. Why: NM-1FE-TX can aid many features, but it does not have the ability to aid async.	WIC-1T is a "1- port" serial interface card which supply serial connections to legacy or remote serial network devices. Why: Provides an 8MB/ps max connection.

difference between a /24 and a /30 subnet:

/30 mask efficient and saves IP addresses (does not waste IP addresses more than needed), where /24 has many IP addresses that can be wasted

Problem 2:

ip route [ip] [mask] [router_interface] [metric]

[IP]: is the destination's network id.

[Mask]: is the mask of the destination's network id.

[Router_interface]: is the interface that will lead to the next hop for the destination.

[Metric]: is the priority assigned to each route in case of failure the router will choose the next metric number.

Figure 4 ping to pc-2 using the route R1-R2-R4

The reason to choose the path PC-1 - R1 – R2 – R3 – R4 – PC-2 is because it is the fasted route with 100Mbps connection.

```
84 bytes from 192.168.1.2 icmp_seq=27 ttl=62 time=62.485 ms
84 bytes from 192.168.1.2 icmp_seq=28 ttl=62 time=62.455 ms
84 bytes from 192.168.1.2 icmp_seq=29 ttl=62 time=62.455 ms
84 bytes from 192.168.1.2 icmp_seq=30 ttl=62 time=62.508 ms
84 bytes from 192.168.1.2 icmp_seq=31 ttl=62 time=62.485 ms
84 bytes from 192.168.1.2 icmp_seq=32 ttl=62 time=62.485 ms
84 bytes from 192.168.1.2 icmp_seq=33 ttl=62 time=63.606 ms
84 bytes from 192.168.1.2 icmp_seq=34 ttl=62 time=62.451 ms
84 bytes from 192.168.1.2 icmp_seq=35 ttl=62 time=62.486 ms
84 bytes from 192.168.1.2 icmp_seq=36 ttl=62 time=62.485 ms
84 bytes from 192.168.1.2 icmp_seq=37 ttl=62 time=62.518 ms
84 bytes from 192.168.1.2 icmp_seq=38 ttl=62 time=62.455 ms
84 bytes from 192.168.1.2 icmp_seq=39 ttl=62 time=62.484 ms
84 bytes from 192.168.1.2 icmp_seq=40 ttl=62 time=62.516 ms
84 bytes from 192.168.1.2 icmp_seq=41 ttl=62 time=62.520 ms
192.168.1.2 icmp_seq=42 timeout
192.168.1.2 icmp_seq=43 timeout
192.168.1.2 icmp_seq=44 timeout
84 bytes from 192.168.1.2 icmp_seq=45 ttl=61 time=75.971 ms
84 bytes from 192.168.1.2 icmp_seq=46 ttl=61 time=62.518 ms
84 bytes from 192.168.1.2 icmp_seq=47 ttl=61 time=63.453 ms
84 bytes from 192.168.1.2 icmp_seq=48 ttl=61 time=62.485 ms
84 bytes from 192.168.1.2 icmp_seq=49 ttl=61 time=62.484 ms
84 bytes from 192.168.1.2 icmp_seq=50 ttl=61 time=62.448 ms

PC-1>
```

Figure 5 ping to PC-2 after shutting both interfaces from R1 to R4 directly which lead to the new route from R1 - R3 - R4

After shutting down R1 – R2 – R4 interfaces and observed I routed R1 to R4 Directly and R1 – R3 – R4.

Shutting R1 – R4 interfaces lead to the new route R1 – R3 – R4.

I noticed 3 packets where lost when selecting a new route after shutting down the interface from R1(192.168.2.5) and R4(192.168.2.6).

VG task 1:

```
R4#show ip interface b
Interface                  IP-Address      OK? Method Status                Prot
ocol
FastEthernet0/0            192.168.2.14    YES NVRAM  up                    up

Serial0/0                  192.168.2.18    YES NVRAM  up                    up

FastEthernet0/1            192.168.2.6     YES NVRAM  up                    up

FastEthernet1/0            192.168.1.1     YES NVRAM  up                    up

FastEthernet2/0            unassigned      YES NVRAM  administratively down down

Loopback0                  192.168.5.2     YES manual up                    up

R4#
```

Figure 6 Loopback0 with the assigned IP address.

```
PC-1> ping 192.168.5.2
84 bytes from 192.168.5.2 icmp_seq=1 ttl=254 time=46.865 ms
84 bytes from 192.168.5.2 icmp_seq=2 ttl=254 time=46.866 ms
84 bytes from 192.168.5.2 icmp_seq=3 ttl=254 time=52.839 ms
84 bytes from 192.168.5.2 icmp_seq=4 ttl=254 time=46.856 ms
84 bytes from 192.168.5.2 icmp_seq=5 ttl=254 time=46.862 ms

PC-1>
```

Figure 7 ping to Loopback0 which in neighboring R4

Problem 3:

```
PC-1> trace 192.168.1.2
trace to 192.168.1.2, 8 hops max, press Ctrl+C to stop
 1   192.168.0.1   8.979 ms  8.932 ms  8.975 ms
 2   192.168.2.6   31.912 ms  31.915 ms  30.917 ms
 3     *  *  *
 4   *192.168.1.2   34.936 ms (ICMP type:3, code:3, Destination port unreachable
)

PC-1>
```

Figure 8 trace to PC-2 showing the best and fastest route

The RIPv2 uses the hop count and choose the route from PC-1 – R1 – R4 – PC-2.

```
84 bytes from 192.168.1.2 icmp_seq=134 ttl=62 time=39.923 ms
84 bytes from 192.168.1.2 icmp_seq=135 ttl=62 time=33.941 ms
84 bytes from 192.168.1.2 icmp_seq=136 ttl=62 time=35.905 ms
84 bytes from 192.168.1.2 icmp_seq=137 ttl=62 time=23.936 ms
84 bytes from 192.168.1.2 icmp_seq=138 ttl=62 time=35.917 ms
84 bytes from 192.168.1.2 icmp_seq=139 ttl=62 time=41.889 ms
192.168.1.2 icmp_seq=140 timeout
*192.168.0.1 icmp_seq=141 ttl=255 time=39.893 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.1 icmp_seq=142 ttl=255 time=10.970 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.1 icmp_seq=143 ttl=255 time=2.984 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.1 icmp_seq=144 ttl=255 time=6.982 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.1 icmp_seq=145 ttl=255 time=3.991 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.1 icmp_seq=146 ttl=255 time=1.002 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.1 icmp_seq=147 ttl=255 time=2.994 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.1 icmp_seq=148 ttl=255 time=4.989 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.1 icmp_seq=149 ttl=255 time=0.997 ms (ICMP type:3, code:1, Destination host unreachable)
192.168.1.2 icmp_seq=150 timeout
192.168.1.2 icmp_seq=151 timeout
84 bytes from 192.168.1.2 icmp_seq=152 ttl=61 time=61.865 ms
84 bytes from 192.168.1.2 icmp_seq=153 ttl=61 time=54.853 ms
84 bytes from 192.168.1.2 icmp_seq=154 ttl=61 time=56.815 ms
84 bytes from 192.168.1.2 icmp_seq=155 ttl=61 time=53.856 ms
84 bytes from 192.168.1.2 icmp_seq=156 ttl=61 time=44.884 ms
84 bytes from 192.168.1.2 icmp_seq=157 ttl=61 time=43.917 ms
84 bytes from 192.168.1.2 icmp_seq=158 ttl=61 time=49.900 ms
84 bytes from 192.168.1.2 icmp_seq=159 ttl=61 time=46.496 ms
```

Figure 9 Ping to PC-2 after shutting down best Route which is R1 directly to R4.

I noticed 12 packets where lost when selecting a new route after shutting down the best route which is the interface from R1(192.168.2.5) and R4(192.168.2.6).

```
PC-1> trace 192.168.1.2
trace to 192.168.1.2, 8 hops max, press Ctrl+C to stop
 1   192.168.0.1   9.973 ms  9.974 ms  8.975 ms
 2   192.168.2.2   31.917 ms  30.919 ms  31.164 ms
 3   192.168.2.14   51.892 ms  52.827 ms  53.845 ms
 4     *  *  *
 5   *192.168.1.2   51.888 ms (ICMP type:3, code:3, Destination port unreachable)

PC-1>
```

Figure 10 Best new route after shutting down the best route.

Since both PC-1 – R1 – R2 – R4 – PC-2 and PC-1 – R1 – R3 – R4 – PC-2 has the same amounts of hops the RIPv2 chooses between the two routes at random without regarding to connection speed.

VG-task1 problem 3:

```
R4#show ip interface b
Interface                  IP-Address      OK? Method Status                Prot
ocol
FastEthernet0/0            192.168.2.14    YES NVRAM  up                    up

Serial0/0                  192.168.2.18    YES NVRAM  up                    up

FastEthernet0/1            192.168.2.6     YES NVRAM  up                    up

FastEthernet1/0            192.168.1.1     YES NVRAM  up                    up

FastEthernet2/0            unassigned      YES NVRAM  administratively down down

Loopback0                  192.168.5.2     YES manual up                    up

R4#
```

Figure 11 Loopback0 with the assigned IP address

```
Gateway of last resort is not set

R    192.168.5.0/24 [120/1] via 192.168.2.6, 00:00:13, FastEthernet1/0
C    192.168.0.0/24 is directly connected, FastEthernet0/0
R    192.168.1.0/24 [120/1] via 192.168.2.6, 00:00:13, FastEthernet1/0
     192.168.2.0/30 is subnetted, 5 subnets
C       192.168.2.8 is directly connected, FastEthernet2/0
R       192.168.2.12 [120/1] via 192.168.2.6, 00:00:13, FastEthernet1/0
                     [120/1] via 192.168.2.2, 00:00:21, FastEthernet0/1
C       192.168.2.0 is directly connected, FastEthernet0/1
C       192.168.2.4 is directly connected, FastEthernet1/0
R       192.168.2.16 [120/1] via 192.168.2.10, 00:00:02, FastEthernet2/0
                     [120/1] via 192.168.2.6, 00:00:14, FastEthernet1/0
R1#
```

Figure 12 Routing Table

```
PC-1> ping 192.168.5.2
84 bytes from 192.168.5.2 icmp_seq=1 ttl=254 time=27.893 ms
84 bytes from 192.168.5.2 icmp_seq=2 ttl=254 time=22.938 ms
84 bytes from 192.168.5.2 icmp_seq=3 ttl=254 time=31.880 ms
84 bytes from 192.168.5.2 icmp_seq=4 ttl=254 time=24.934 ms
84 bytes from 192.168.5.2 icmp_seq=5 ttl=254 time=26.928 ms

PC-1>
```

Figure 13 ping the Loopback0

Problem 4:

```
PC-1> ping 192.168.1.2
192.168.1.2 icmp_seq=1 timeout
84 bytes from 192.168.1.2 icmp_seq=2 ttl=61 time=34.907 ms
84 bytes from 192.168.1.2 icmp_seq=3 ttl=61 time=40.891 ms
84 bytes from 192.168.1.2 icmp_seq=4 ttl=61 time=39.893 ms
84 bytes from 192.168.1.2 icmp_seq=5 ttl=61 time=39.894 ms

PC-1>
```

Figure 14 ping to PC-2 using the OSPF

```
PC-1> trace 192.168.1.2
trace to 192.168.1.2, 8 hops max, press Ctrl+C to stop
 1   192.168.0.1   9.974 ms  8.976 ms  9.972 ms
 2   192.168.2.2   20.944 ms  20.945 ms  19.945 ms
 3   192.168.2.14   31.918 ms  30.917 ms  30.918 ms
 4     *  *  *
 5   *192.168.1.2   37.904 ms (ICMP type:3, code:3, Destination port unreachable
)

PC-1>
```

Figure 15 the route chosen by OSPF to trace PC-2

Both screenshots show how OSPF chooses the best and most efficient route to PC-2.

The reason to choose the Route PC-1 – R1 – R2 – R4 – PC-2 is that the OSPF is a link-state, which shows for example how R4 knows that R1 is neighboring PC-1

```
84 bytes from 192.168.1.2 icmp_seq=95 ttl=61 time=39.894 ms
84 bytes from 192.168.1.2 icmp_seq=96 ttl=61 time=45.877 ms
84 bytes from 192.168.1.2 icmp_seq=97 ttl=61 time=39.894 ms
84 bytes from 192.168.1.2 icmp_seq=98 ttl=61 time=39.414 ms
84 bytes from 192.168.1.2 icmp_seq=99 ttl=61 time=40.890 ms
84 bytes from 192.168.1.2 icmp_seq=100 ttl=61 time=40.891 ms
84 bytes from 192.168.1.2 icmp_seq=101 ttl=61 time=39.894 ms
*192.168.0.1 icmp_seq=102 ttl=255 time=17.952 ms (ICMP type:3, code:1, Destinati
on host unreachable)
*192.168.0.1 icmp_seq=103 ttl=255 time=4.987 ms (ICMP type:3, code:1, Destinatio
n host unreachable)
*192.168.0.1 icmp_seq=104 ttl=255 time=6.981 ms (ICMP type:3, code:1, Destinatio
n host unreachable)
*192.168.0.1 icmp_seq=105 ttl=255 time=6.981 ms (ICMP type:3, code:1, Destinatio
n host unreachable)
*192.168.0.1 icmp_seq=106 ttl=255 time=6.982 ms (ICMP type:3, code:1, Destinatio
n host unreachable)
84 bytes from 192.168.1.2 icmp_seq=107 ttl=62 time=40.890 ms
84 bytes from 192.168.1.2 icmp_seq=108 ttl=62 time=21.156 ms
84 bytes from 192.168.1.2 icmp_seq=109 ttl=62 time=26.928 ms
84 bytes from 192.168.1.2 icmp_seq=110 ttl=62 time=29.921 ms
84 bytes from 192.168.1.2 icmp_seq=111 ttl=62 time=28.924 ms
84 bytes from 192.168.1.2 icmp_seq=112 ttl=62 time=29.921 ms
84 bytes from 192.168.1.2 icmp_seq=113 ttl=62 time=27.927 ms

PC-1>
```

Figure 16 Ping to PC-2 after shutting down R1 to R2 interface and R4 to R2 interface

I noticed 5 packets where lost when selecting a new route after shutting down the best route which is the interface from R1(192.168.2.1) to R2(192.168.2.2) to R4(192.168.2.14).

OSPF selects the second-best route which is Route PC-1 – R1– R4 – PC-2. R1(192.168.2.5) and R4(192.168.2.6) which has the speed 10Mb/ps instead of the Route PC-1 – R1– R3 – R4 – PC-2 which has a slower connection of 1544Kb/ps.

Differences between the three routing methods (static/RIPv2/OSPF):

Static: is manually configured it is on layer 2 it can be used in small networks.

RIPv2: build on Distance Vector it is on layer 3 it can be used in small networks with small hop counts.

OSPF: build on link state it is on layer 3 it can be used in small and large networks.