1DV701 Assignment 4 Report

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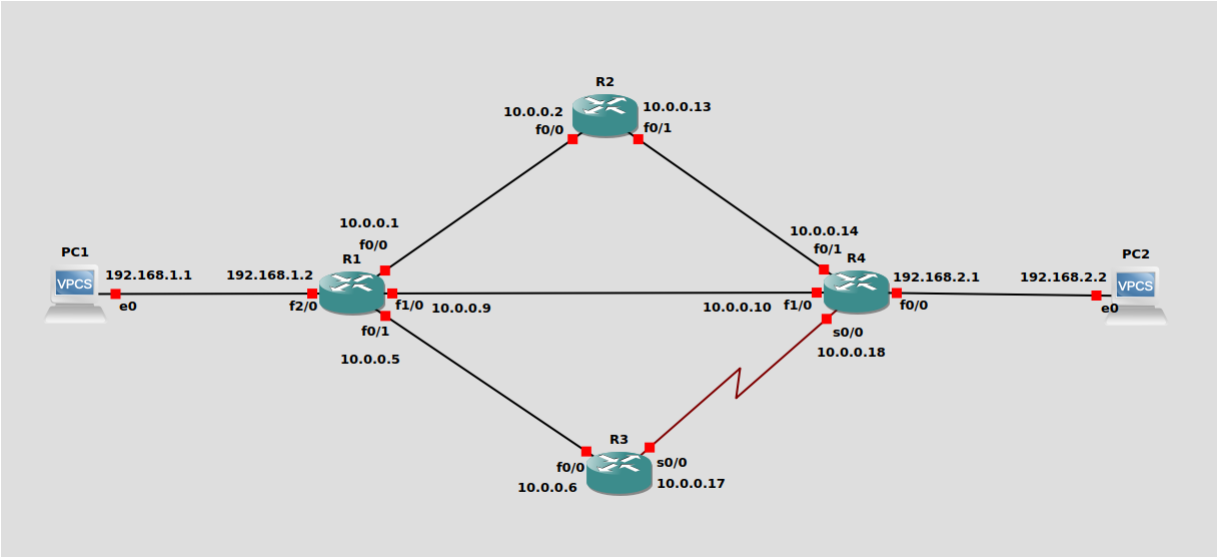
1 Problem 1

1.1 a)



1.2 b)

```
R1#ping 192.168.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/10/16 ms
R1#
```

Figure 1: R1 to PC-1

```
R1#ping 10.0.0.10

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/15/36 ms
```

Figure 2: R1 to R4

```
PC1> ping 192.168.2.2
*192.168.1.2 icmp_seq=1 ttl=255 time=9.133 ms (ICMP type:3, code:1, Destination
host unreachable)
*192.168.1.2 icmp_seq=2 ttl=255 time=4.167 ms (ICMP type:3, code:1, Destination
host unreachable)
*192.168.1.2 icmp_seq=3 ttl=255 time=6.526 ms (ICMP type:3, code:1, Destination
host unreachable)
*192.168.1.2 icmp_seq=4 ttl=255 time=9.814 ms (ICMP type:3, code:1, Destination
host unreachable)
*192.168.1.2 icmp_seq=5 ttl=255 time=7.342 ms (ICMP type:3, code:1, Destination
host unreachable)
^C
PC1>
```

Figure 3: PC-1 to PC-2 Failure

1.3 c)

- NM-1FE-TX - Cisco 1-Port Fast Ethernet Network Module, Ideal for a wide range of LAN applications, the Fast Ethernet network modules support many internetworking features and standards. The 1-port Fast Ethernet network module offers a single auto-sensing 10/100TX connection via an RJ-45 connector. This is used because there is no need for more ports.
- WIC-1T - The 1-port serial WAN interface card (WIC-1T) provides serial connections to remote sites or legacy serial network devices such as Synchronous Data Link Control (SDLC) concentrators, alarm systems, and packet over SONET (POS) devices. Again there is no need for more ports.

1.4 d)

The 30 sub net is the smallest sub net, it has 2 host addresses while the 24 sub net has 254 host addresses. A 30 sub net is more efficient because it is faster for our use-case since there is no need for more hosts in a private link.

2 Problem 2

2.1 a)

- ip - the network ips
- mask - the subnet for the ip
- router_interface - the next hop
- metric - the cost, for example, the metric can be valued in terms of link speed, hop count, or time delay.

2.2 b)

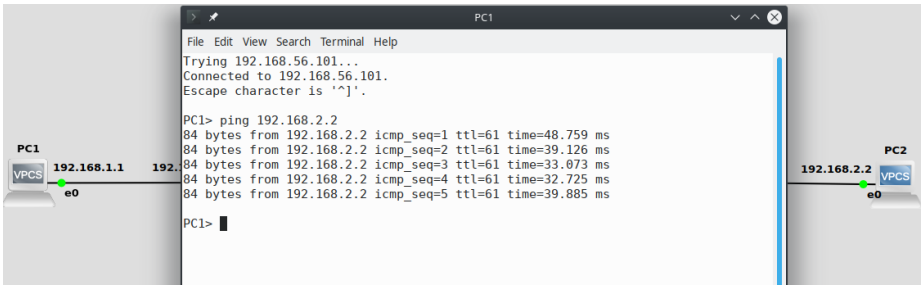


Figure 4: PC-1 to PC-2 Success

```
PC1> trace 192.168.2.2
trace to 192.168.2.2, 8 hops max, press Ctrl+C to stop
 1   192.168.1.2   6.973 ms  9.674 ms  9.361 ms
 2   10.0.0.2   18.452 ms  19.712 ms  19.412 ms
 3   10.0.0.14   38.873 ms  39.967 ms  29.310 ms
 4   *192.168.2.2   39.562 ms (ICMP type:3, code:3, Destination port unreachable
)
```

Figure 5: PC-1 to PC-2 Traceroute

I used this route because it has the biggest bandwidth. If I want to transfer a file I need bandwidth.

2.3 c)

```
PC1> ping 192.168.2.2 -t
84 bytes from 192.168.2.2 icmp_seq=1 ttl=61 time=52.751 ms
84 bytes from 192.168.2.2 icmp_seq=2 ttl=61 time=35.221 ms
84 bytes from 192.168.2.2 icmp_seq=3 ttl=61 time=49.314 ms
84 bytes from 192.168.2.2 icmp_seq=4 ttl=61 time=47.018 ms
84 bytes from 192.168.2.2 icmp_seq=5 ttl=61 time=38.028 ms
84 bytes from 192.168.2.2 icmp_seq=6 ttl=61 time=39.649 ms
84 bytes from 192.168.2.2 icmp_seq=7 ttl=61 time=48.194 ms
84 bytes from 192.168.2.2 icmp_seq=8 ttl=61 time=45.543 ms
84 bytes from 192.168.2.2 icmp_seq=9 ttl=61 time=50.190 ms
84 bytes from 192.168.2.2 icmp_seq=10 ttl=61 time=36.358 ms
84 bytes from 192.168.2.2 icmp_seq=11 ttl=61 time=52.891 ms
192.168.2.2 icmp_seq=12 timeout
*10.0.0.2 icmp_seq=13 ttl=254 time=338.223 ms (ICMP type:11, code:0, TTL expired
 in transit)
*10.0.0.2 icmp_seq=14 ttl=254 time=341.511 ms (ICMP type:11, code:0, TTL expired
 in transit)
*10.0.0.2 icmp_seq=15 ttl=254 time=330.889 ms (ICMP type:11, code:0, TTL expired
 in transit)
*10.0.0.2 icmp_seq=16 ttl=254 time=332.469 ms (ICMP type:11, code:0, TTL expired
 in transit)
*10.0.0.2 icmp_seq=17 ttl=254 time=350.414 ms (ICMP type:11, code:0, TTL expired
 in transit)
```

Figure 6: PC-1 to PC-2 Connection shut

2.4 d)

```
84 bytes from 192.168.2.2 icmp_seq=40 ttl=61 time=22.625 ms
84 bytes from 192.168.2.2 icmp_seq=41 ttl=61 time=28.907 ms
84 bytes from 192.168.2.2 icmp_seq=42 ttl=61 time=18.919 ms
84 bytes from 192.168.2.2 icmp_seq=43 ttl=61 time=23.112 ms
84 bytes from 192.168.2.2 icmp_seq=44 ttl=61 time=33.432 ms
84 bytes from 192.168.2.2 icmp_seq=45 ttl=61 time=28.263 ms
84 bytes from 192.168.2.2 icmp_seq=46 ttl=61 time=23.724 ms
84 bytes from 192.168.2.2 icmp_seq=47 ttl=61 time=27.671 ms
84 bytes from 192.168.2.2 icmp_seq=48 ttl=61 time=24.902 ms
84 bytes from 192.168.2.2 icmp_seq=49 ttl=61 time=29.494 ms
84 bytes from 192.168.2.2 icmp_seq=50 ttl=61 time=39.046 ms
84 bytes from 192.168.2.2 icmp_seq=51 ttl=61 time=21.943 ms
84 bytes from 192.168.2.2 icmp_seq=52 ttl=61 time=24.539 ms
192.168.2.2 icmp_seq=53 timeout
192.168.2.2 icmp_seq=54 timeout
84 bytes from 192.168.2.2 icmp_seq=55 ttl=61 time=42.116 ms
84 bytes from 192.168.2.2 icmp_seq=56 ttl=61 time=30.860 ms
84 bytes from 192.168.2.2 icmp_seq=57 ttl=61 time=26.395 ms
84 bytes from 192.168.2.2 icmp_seq=58 ttl=61 time=28.327 ms
84 bytes from 192.168.2.2 icmp_seq=59 ttl=61 time=34.095 ms
84 bytes from 192.168.2.2 icmp_seq=60 ttl=61 time=31.563 ms
84 bytes from 192.168.2.2 icmp_seq=61 ttl=61 time=33.144 ms
84 bytes from 192.168.2.2 icmp_seq=62 ttl=61 time=24.511 ms
```

Figure 7: PC-1 to PC-2 Reroute

```
PC1> trace 192.168.2.2
trace to 192.168.2.2, 8 hops max, press Ctrl+C to stop
 1   192.168.1.2   8.800 ms  9.007 ms  9.089 ms
 2   10.0.0.6   18.978 ms  19.409 ms  19.335 ms
 3   10.0.0.18   18.820 ms  19.619 ms  19.671 ms
 4   *192.168.2.2   21.869 ms (ICMP type:3, code:3, Destination port unreachable
)
```

Figure 8: PC-1 to PC-2 New trace

In this case the path that was chosen here was because both of the other two paths were closed and this one was the only one remaining.

3 Problem 3

3.1 a)

```
PC1> trace 192.168.2.2
trace to 192.168.2.2, 8 hops max, press Ctrl+C to stop
 1   192.168.1.2   6.365 ms  10.039 ms  9.020 ms
 2   10.0.0.10   29.097 ms  30.213 ms  30.229 ms
 3   *192.168.2.2   40.219 ms (ICMP type:3, code:3, Destination port unreachable
)
```

Figure 9: PC-1 to PC-2 Traceroute

RIP counts the shortest path to the desired network, this has 2 hops the alternatives are both 3 hops away.

3.2 b)

```
PC1
File  Edit  View  Search  Terminal  Help
84 bytes from 192.168.2.2 icmp_seq=133 ttl=62 time=28.952 ms
84 bytes from 192.168.2.2 icmp_seq=134 ttl=62 time=36.801 ms
*192.168.1.2 icmp_seq=135 ttl=255 time=10.001 ms (ICMP type:3, code:1, Destinat
ion host unreachable)
*192.168.1.2 icmp_seq=136 ttl=255 time=9.254 ms (ICMP type:3, code:1, Destinati
on host unreachable)
*192.168.1.2 icmp_seq=137 ttl=255 time=2.072 ms (ICMP type:3, code:1, Destinati
on host unreachable)
*192.168.1.2 icmp_seq=138 ttl=255 time=4.141 ms (ICMP type:3, code:1, Destinati
on host unreachable)
*192.168.1.2 icmp_seq=139 ttl=255 time=1.719 ms (ICMP type:3, code:1, Destinati
on host unreachable)
*192.168.1.2 icmp_seq=140 ttl=255 time=2.839 ms (ICMP type:3, code:1, Destinati
on host unreachable)
*192.168.1.2 icmp_seq=141 ttl=255 time=1.847 ms (ICMP type:3, code:1, Destinati
on host unreachable)
*192.168.1.2 icmp_seq=142 ttl=255 time=9.979 ms (ICMP type:3, code:1, Destinati
on host unreachable)
*192.168.1.2 icmp_seq=143 ttl=255 time=4.761 ms (ICMP type:3, code:1, Destinati
on host unreachable)
*192.168.1.2 icmp_seq=144 ttl=255 time=9.357 ms (ICMP type:3, code:1, Destinati
on host unreachable)
*192.168.1.2 icmp_seq=145 ttl=255 time=5.339 ms (ICMP type:3, code:1, Destinati
on host unreachable)
*192.168.1.2 icmp_seq=146 ttl=255 time=4.598 ms (ICMP type:3, code:1, Destinati
on host unreachable)
*192.168.1.2 icmp_seq=147 ttl=255 time=7.090 ms (ICMP type:3, code:1, Destinati
on host unreachable)
84 bytes from 192.168.2.2 icmp_seq=148 ttl=61 time=33.089 ms
84 bytes from 192.168.2.2 icmp_seq=149 ttl=61 time=32.580 ms
84 bytes from 192.168.2.2 icmp_seq=150 ttl=61 time=35.686 ms
```

Figure 10: PC-1 to PC-2 Reroute

Rerouting here takes longer than for static routing.

```
PC1> trace 192.168.2.2
trace to 192.168.2.2, 8 hops max, press Ctrl+C to stop
 1   192.168.1.2   5.283 ms  10.182 ms  8.795 ms
 2   10.0.0.6   18.980 ms  19.280 ms  18.975 ms
 3   10.0.0.18   29.771 ms  29.176 ms  29.560 ms
 4   *192.168.2.2   18.684 ms (ICMP type:3, code:3, Destination port unreachabl
e)
```

Figure 11: PC-1 to PC-2 New trace

This path is chosen randomly since both the alternatives are 3 hops away.

4 Problem 4

4.1 a)

Open Shortest Path First (OSPF) is a routing protocol for Internet Protocol (IP) networks. It uses a link state routing (LSR) algorithm. OSPF is a widely used in large enterprise networks. It is the newest algorithm out of all 3 ways of routing. It supports areas, I have 3 areas: area 1 for PC1, area 0 for the backbone, and area 2 for PC2. It detects intra-area nodes. It selecs the fastest link. It uses hello messages to talk to neighboring nodes.

4.2 b)

```
PC1> trace 192.168.2.2
trace to 192.168.2.2, 8 hops max, press Ctrl+C to stop
 1   192.168.1.2   6.901 ms  10.011 ms  9.157 ms
 2   10.0.0.2   21.635 ms  19.727 ms  17.797 ms
 3   10.0.0.14   40.500 ms  30.918 ms  29.366 ms
 4   *192.168.2.2   39.717 ms (ICMP type:3, code:3, Destination port unreachable
)
```

Figure 12: PC-1 to PC-2 Traceroute

This is chosen because OSPF chooses the fastest link available.

```
84 bytes from 192.168.2.2 icmp_seq=53 ttl=61 time=49.948 ms
84 bytes from 192.168.2.2 icmp_seq=54 ttl=61 time=51.657 ms
*192.168.1.2 icmp_seq=55 ttl=255 time=9.293 ms (ICMP type:3, code:1, Destination
 host unreachable)
*192.168.1.2 icmp_seq=56 ttl=255 time=9.450 ms (ICMP type:3, code:1, Destination
 host unreachable)
*192.168.1.2 icmp_seq=57 ttl=255 time=9.140 ms (ICMP type:3, code:1, Destination
 host unreachable)
*192.168.1.2 icmp_seq=58 ttl=255 time=22.503 ms (ICMP type:3, code:1, Destinatio
n host unreachable)
*192.168.1.2 icmp_seq=59 ttl=255 time=9.080 ms (ICMP type:3, code:1, Destination
 host unreachable)
84 bytes from 192.168.2.2 icmp_seq=60 ttl=62 time=32.606 ms
84 bytes from 192.168.2.2 icmp_seq=61 ttl=62 time=34.132 ms
84 bytes from 192.168.2.2 icmp_seq=62 ttl=62 time=27.073 ms
84 bytes from 192.168.2.2 icmp_seq=63 ttl=62 time=27.279 ms
84 bytes from 192.168.2.2 icmp_seq=64 ttl=62 time=35.414 ms
84 bytes from 192.168.2.2 icmp_seq=65 ttl=62 time=25.002 ms
84 bytes from 192.168.2.2 icmp_seq=66 ttl=62 time=29.713 ms
84 bytes from 192.168.2.2 icmp_seq=67 ttl=62 time=24.262 ms
84 bytes from 192.168.2.2 icmp_seq=68 ttl=62 time=36.726 ms
84 bytes from 192.168.2.2 icmp_seq=69 ttl=62 time=34.748 ms
```

Figure 13: PC-1 to PC-2 Reroute

The waiting time is 5 packets but on other runs I have seen waiting times of 2-3 packets.

```
PC1> trace 192.168.2.2
trace to 192.168.2.2, 8 hops max, press Ctrl+C to stop
 1   192.168.1.2   9.428 ms  9.027 ms  9.943 ms
 2   10.0.0.10   19.989 ms  19.947 ms  19.140 ms
 3   *192.168.2.2   29.530 ms (ICMP type:3, code:3, Destination port unreachable
)
```

Figure 14: PC-1 to PC-2 New trace

This choice is done because it is the faster link between the 2 available left routes.

5 Problem 5

- static - The oldest way. It is easy to configure but it can be used only in small networks since it is done manually.
- RIPv2 - The newer option. It works well for medium sized networks with a limit of 15 hops, as easy to configure as static routing. This does not take into account bandwidth, it just picks the shortest path.
- OSPF - The newest algorithm. It can be used everywhere since it has the most features and is as easy to configure as the other 2 older options.