Linnéuniversitetet
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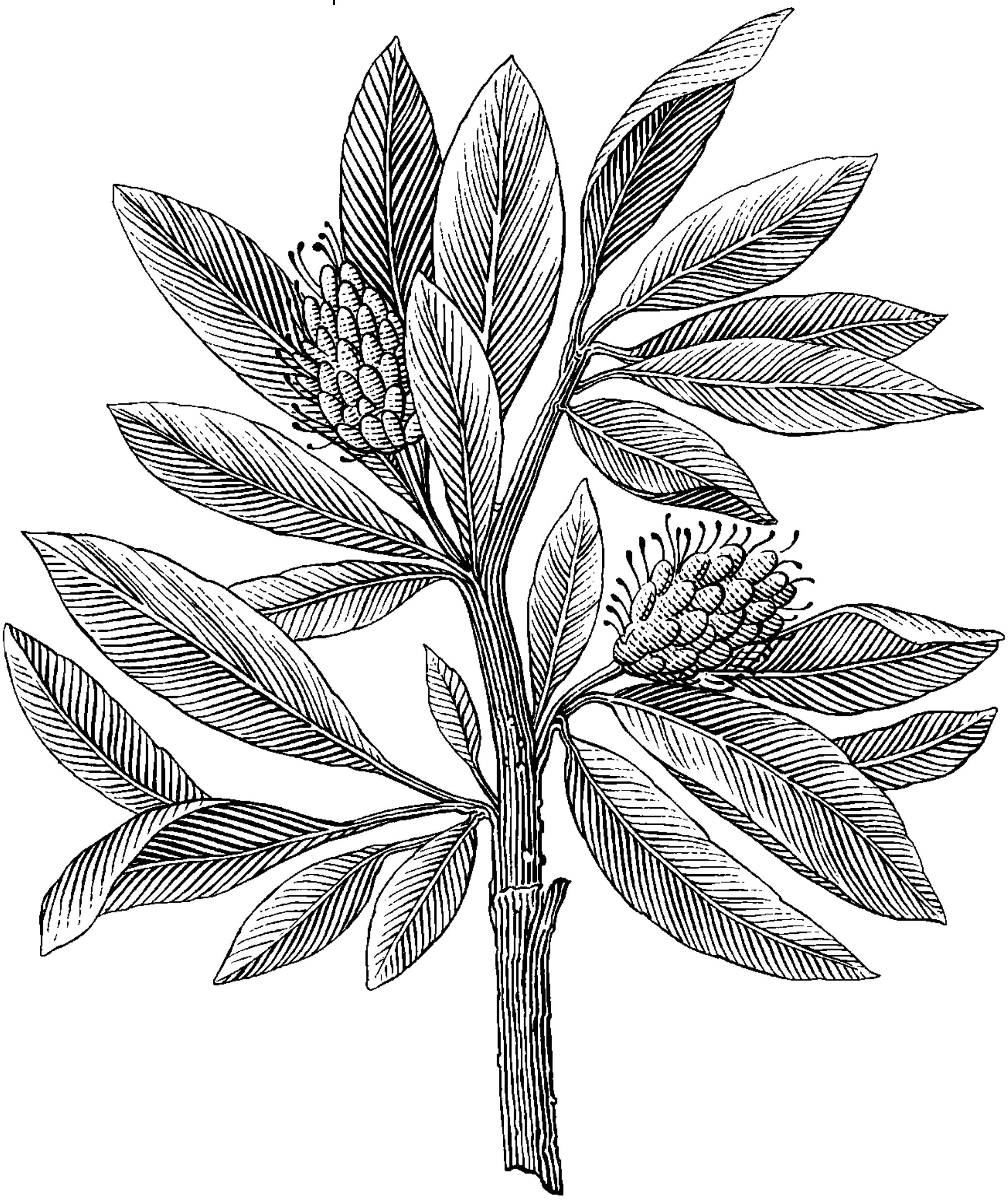
Report

Assignment 4

1DV701



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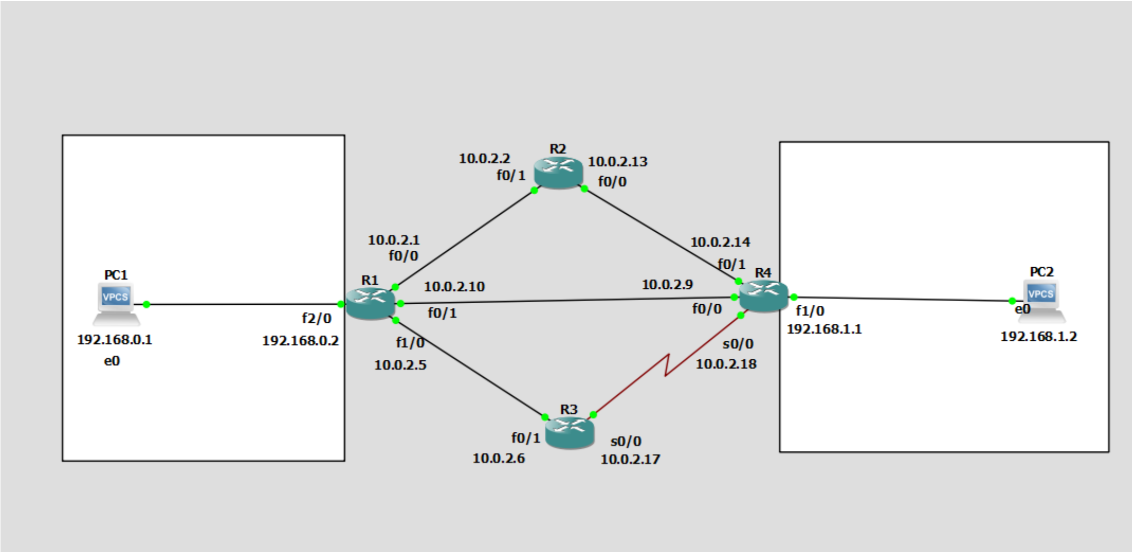
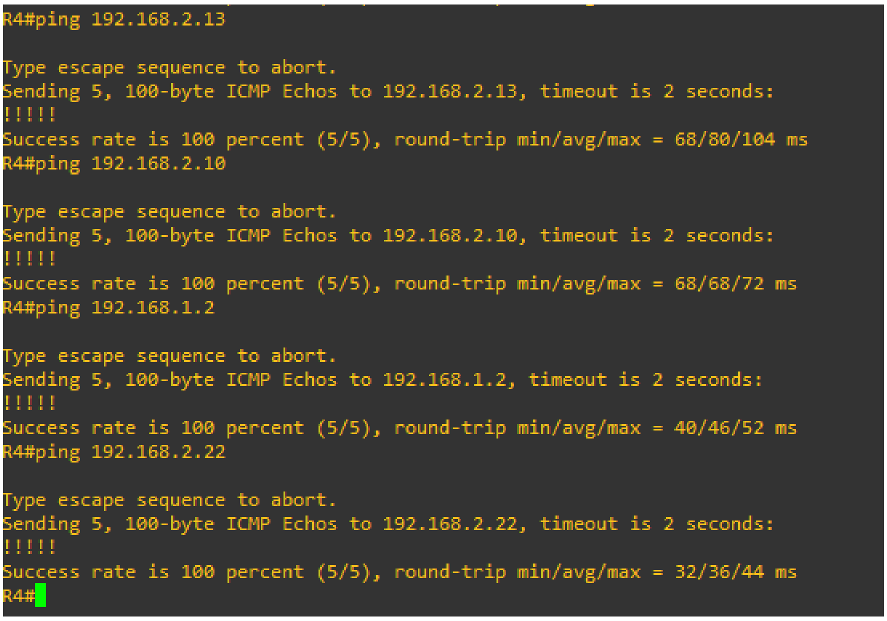
1 Problem 1

1.1 Screenshot from GNC3



1.2 Pings



```
R4#ping 192.168.2.13

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.13, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 68/80/104 ms
R4#ping 192.168.2.10

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 68/68/72 ms
R4#ping 192.168.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/46/52 ms
R4#ping 192.168.2.22

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.22, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/36/44 ms
R4#
```

1.3 Explanation

NM-1FE-TX is 10/100 Mbps Fast Ethernet Network Module, 100 Base-TX, has a full or half-duplex [1]. Used to create an interface of an already existing ethernet connection to have tests made.

WIC-1T Supports a Max sync speed of 2 Mbps. Does not support hot swap [1]. Used to create an interface of an already existing wireless connection to have tests made.

1.4 Practical difference between a /24 and a /30 subnet?

Strictly the difference is that /30 only has 2 useable IP addresses
And they are strictly the only two needed compared to /24 that has 254 usable Ip addresses

The reason to have smaller available IP addresses is because of scalability.

2 Problem 2

2.1 Explain each of the parameters of the IP route command

IP route [ip] [mask] [router_interface] [metric]
IP: general IP ends in 0
mask: a mask that is linked to the IP
router_interface: the first line of contact with another interface, ie take it like in my example there are 3 points of contact for R1 10.0.2.2, 10.0.2.9, and 10.0.2.6, since its static then the only way the network will pick a path would be from an already determined router interface.
Metric, is a priority so if it can pick others over this path then it will as long as it’s a higher priority

2.2 Screenshots of route vpcs nodes PC-1 to PC2, traceroute included

I chose PC-1 -> R1 -> R2 -> R4 -> PC2 because the more megabytes the faster, and there are no things to consider such as length or maintenance

```
PC1> ping 192.168.1.2
84 bytes from 192.168.1.2 icmp_seq=1 ttl=61 time=92.038 ms
84 bytes from 192.168.1.2 icmp_seq=2 ttl=61 time=92.028 ms
84 bytes from 192.168.1.2 icmp_seq=3 ttl=61 time=92.992 ms
84 bytes from 192.168.1.2 icmp_seq=4 ttl=61 time=91.637 ms
84 bytes from 192.168.1.2 icmp_seq=5 ttl=61 time=90.939 ms

PC1> trace 192.168.1.2 -P 6
trace to 192.168.1.2, 8 hops max (TCP), press Ctrl+C to stop
 1   192.168.0.2   33.184 ms  14.564 ms  15.407 ms
 2   10.0.2.2   61.960 ms  46.241 ms  45.491 ms
 3   10.0.2.14   90.573 ms  77.022 ms  77.018 ms
 4   192.168.1.2   91.007 ms  92.654 ms  93.298 ms
```

2.3 Pings failing screenshot

PC1 - PuTTY

```
84 bytes from 192.168.1.2 icmp_seq=99 ttl=61 time=91.329 ms
84 bytes from 192.168.1.2 icmp_seq=100 ttl=61 time=91.851 ms
84 bytes from 192.168.1.2 icmp_seq=101 ttl=61 time=90.868 ms
84 bytes from 192.168.1.2 icmp_seq=102 ttl=61 time=91.165 ms
84 bytes from 192.168.1.2 icmp_seq=103 ttl=61 time=90.599 ms
84 bytes from 192.168.1.2 icmp_seq=104 ttl=61 time=91.119 ms
84 bytes from 192.168.1.2 icmp_seq=105 ttl=61 time=87.189 ms
84 bytes from 192.168.1.2 icmp_seq=106 ttl=61 time=76.873 ms
84 bytes from 192.168.1.2 icmp_seq=107 ttl=61 time=91.414 ms
84 bytes from 192.168.1.2 icmp_seq=108 ttl=61 time=91.052 ms
84 bytes from 192.168.1.2 icmp_seq=109 ttl=61 time=90.958 ms
84 bytes from 192.168.1.2 icmp_seq=110 ttl=61 time=90.831 ms
84 bytes from 192.168.1.2 icmp_seq=111 ttl=61 time=91.265 ms
84 bytes from 192.168.1.2 icmp_seq=112 ttl=61 time=91.418 ms
192.168.1.2 icmp_seq=113 timeout
192.168.1.2 icmp_seq=114 timeout
192.168.1.2 icmp_seq=115 timeout
192.168.1.2 icmp_seq=116 timeout
192.168.1.2 icmp_seq=117 timeout
192.168.1.2 icmp_seq=118 timeout
192.168.1.2 icmp_seq=119 timeout
192.168.1.2 icmp_seq=120 timeout

PC1>
```

2.4 Screenshot and explanation of packets lost before a new routing starts

```
84 bytes from 192.168.1.2 icmp_seq=65 ttl=61 time=60.704 ms
84 bytes from 192.168.1.2 icmp_seq=66 ttl=61 time=61.138 ms
84 bytes from 192.168.1.2 icmp_seq=67 ttl=61 time=60.330 ms
84 bytes from 192.168.1.2 icmp_seq=68 ttl=61 time=60.999 ms
84 bytes from 192.168.1.2 icmp_seq=69 ttl=61 time=60.704 ms
84 bytes from 192.168.1.2 icmp_seq=70 ttl=61 time=61.368 ms
84 bytes from 192.168.1.2 icmp_seq=71 ttl=61 time=60.821 ms
84 bytes from 192.168.1.2 icmp_seq=72 ttl=61 time=61.393 ms
84 bytes from 192.168.1.2 icmp_seq=73 ttl=61 time=61.147 ms
84 bytes from 192.168.1.2 icmp_seq=74 ttl=61 time=60.488 ms
84 bytes from 192.168.1.2 icmp_seq=75 ttl=61 time=60.592 ms
84 bytes from 192.168.1.2 icmp_seq=76 ttl=61 time=60.949 ms
84 bytes from 192.168.1.2 icmp_seq=77 ttl=61 time=60.450 ms
192.168.1.2 icmp_seq=78 timeout
84 bytes from 192.168.1.2 icmp_seq=79 ttl=61 time=77.097 ms
84 bytes from 192.168.1.2 icmp_seq=80 ttl=61 time=75.831 ms
84 bytes from 192.168.1.2 icmp_seq=81 ttl=61 time=75.580 ms
84 bytes from 192.168.1.2 icmp_seq=82 ttl=61 time=76.994 ms
84 bytes from 192.168.1.2 icmp_seq=83 ttl=61 time=75.585 ms
84 bytes from 192.168.1.2 icmp_seq=84 ttl=61 time=76.309 ms
84 bytes from 192.168.1.2 icmp_seq=85 ttl=61 time=75.045 ms
84 bytes from 192.168.1.2 icmp_seq=86 ttl=61 time=76.054 ms
84 bytes from 192.168.1.2 icmp_seq=87 ttl=61 time=75.616 ms
84 bytes from 192.168.1.2 icmp_seq=88 ttl=61 time=76.837 ms
84 bytes from 192.168.1.2 icmp_seq=89 ttl=61 time=76.078 ms
84 bytes from 192.168.1.2 icmp_seq=90 ttl=61 time=76.482 ms
84 bytes from 192.168.1.2 icmp_seq=91 ttl=61 time=76.992 ms
84 bytes from 192.168.1.2 icmp_seq=92 ttl=61 time=76.987 ms
84 bytes from 192.168.1.2 icmp_seq=93 ttl=61 time=75.243 ms
84 bytes from 192.168.1.2 icmp_seq=94 ttl=61 time=76.587 ms

PC1> trace 192.168.1.2 -P 6
trace to 192.168.1.2, 8 hops max (TCP), press Ctrl+C to stop
 1   192.168.0.2   15.230 ms  15.665 ms  15.070 ms
 2   10.0.2.9   61.223 ms  61.071 ms  60.837 ms
 3   192.168.1.2   75.647 ms  75.631 ms  76.544 ms
```

The screenshot shows one timeout and to describe the new path I would argue that it is because of the metrics, I wanted the program to follow a specific path, and since the lower metric value that is where the router will prioritize first.

3 Problem 3

3.1 Use a traceroute command from PC-1 to PC-2 to see which routing path has been picked by RIPv2 as the most efficient.

Disclaimer, Maybe there was a better way of doing this but the default configuration didn't work at all for me, and had to manually change the network values inside the backbone, however, the results should not be that different from the expected results should be.

```
PC1> trace 192.168.1.2 -P 6
trace to 192.168.1.2, 8 hops max (TCP), press Ctrl+C to stop
 1   192.168.0.2   16.428 ms  15.617 ms  15.173 ms
 2   10.0.5.9   60.585 ms  61.142 ms  61.391 ms
 3   192.168.1.2   76.423 ms  76.031 ms  75.814 ms
```

It chose the shortest path but not the most bandwidth effective and it is because ripv2 has a maximum of 15 hops, so by design, it tries to choose the smaller amount of hops as possible, a hop means each action required to reach the desired network as illustrated in the screenshot.

3.2 Observe how many packets are lost before a new routing pass starts working and include a screenshot in your report. Use traceroute.

```
PC1> trace 192.168.1.2 -P 6
trace to 192.168.1.2, 8 hops max (TCP), press Ctrl+C to stop
 1   192.168.0.2   16.428 ms  15.617 ms  15.173 ms
 2   10.0.5.9   60.585 ms  61.142 ms  61.391 ms
 3   192.168.1.2   76.423 ms  76.031 ms  75.814 ms

PC1> ping 192.168.1.2 -t
84 bytes from 192.168.1.2 icmp_seq=1 ttl=62 time=61.287 ms
84 bytes from 192.168.1.2 icmp_seq=2 ttl=62 time=61.736 ms
192.168.1.2 icmp_seq=3 timeout
192.168.1.2 icmp_seq=4 timeout
84 bytes from 192.168.1.2 icmp_seq=5 ttl=62 time=60.698 ms
84 bytes from 192.168.1.2 icmp_seq=6 ttl=62 time=60.495 ms
84 bytes from 192.168.1.2 icmp_seq=7 ttl=62 time=62.339 ms
84 bytes from 192.168.1.2 icmp_seq=8 ttl=62 time=61.934 ms
84 bytes from 192.168.1.2 icmp_seq=9 ttl=62 time=60.362 ms
84 bytes from 192.168.1.2 icmp_seq=10 ttl=62 time=60.626 ms
84 bytes from 192.168.1.2 icmp_seq=11 ttl=62 time=61.102 ms
84 bytes from 192.168.1.2 icmp_seq=12 ttl=62 time=61.253 ms
84 bytes from 192.168.1.2 icmp_seq=13 ttl=62 time=60.748 ms
84 bytes from 192.168.1.2 icmp_seq=14 ttl=62 time=60.712 ms
84 bytes from 192.168.1.2 icmp_seq=15 ttl=62 time=61.228 ms
84 bytes from 192.168.1.2 icmp_seq=16 ttl=62 time=60.327 ms
84 bytes from 192.168.1.2 icmp_seq=17 ttl=62 time=61.372 ms
84 bytes from 192.168.1.2 icmp_seq=18 ttl=62 time=61.673 ms
84 bytes from 192.168.1.2 icmp_seq=19 ttl=62 time=61.384 ms
84 bytes from 192.168.1.2 icmp_seq=20 ttl=62 time=59.861 ms
84 bytes from 192.168.1.2 icmp_seq=21 ttl=62 time=61.632 ms
84 bytes from 192.168.1.2 icmp_seq=22 ttl=62 time=60.886 ms
84 bytes from 192.168.1.2 icmp_seq=23 ttl=62 time=61.249 ms
84 bytes from 192.168.1.2 icmp_seq=24 ttl=62 time=61.315 ms
*192.168.0.2 icmp_seq=25 ttl=255 time=15.287 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=26 ttl=255 time=15.218 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=27 ttl=255 time=15.613 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=28 ttl=255 time=15.342 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=29 ttl=255 time=15.949 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=30 ttl=255 time=15.011 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=31 ttl=255 time=15.685 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=32 ttl=255 time=15.675 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=33 ttl=255 time=15.932 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=34 ttl=255 time=15.551 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=35 ttl=255 time=15.702 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=36 ttl=255 time=15.906 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=37 ttl=255 time=15.722 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=38 ttl=255 time=15.243 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=39 ttl=255 time=15.326 ms (ICMP type:3, code:1, Destination host unreachable)
192.168.1.2 icmp_seq=40 timeout
84 bytes from 192.168.1.2 icmp_seq=41 ttl=61 time=91.361 ms
84 bytes from 192.168.1.2 icmp_seq=42 ttl=61 time=91.084 ms
84 bytes from 192.168.1.2 icmp_seq=43 ttl=61 time=92.739 ms
84 bytes from 192.168.1.2 icmp_seq=44 ttl=61 time=91.673 ms
84 bytes from 192.168.1.2 icmp_seq=45 ttl=61 time=92.137 ms
84 bytes from 192.168.1.2 icmp_seq=46 ttl=61 time=91.760 ms
84 bytes from 192.168.1.2 icmp_seq=47 ttl=61 time=90.341 ms
```

```
PC1> trace 192.168.1.2 -P 6
trace to 192.168.1.2, 8 hops max (TCP), press Ctrl+C to stop
 1   192.168.0.2   15.524 ms  16.068 ms  14.850 ms
 2   10.0.3.2   45.912 ms  45.461 ms  46.126 ms
 3   10.0.4.14   76.076 ms  76.353 ms  76.484 ms
 4   192.168.1.2   90.588 ms  91.775 ms  91.509 ms
```

It chose the top path, the one with the highest bandwidth, the off-time was due to the protocol searching after another available path and it is going through different paths and trying to pick the lowest amount of hops path, and why did it pick the top path? Well, if I were to guess, it’s because I put the top path first in the settings, or it picked it randomly.

4 Problem 4

4.1 Describe how OSPF uses metrics to select the best path and what metric different links in your network have.

In OSPF while setting up areas the program finds all the costs measured in a route to the nearby routers, and the cost is measured from a ratio of 100mbs to the bandwidth of a network
Possible costs we can find are: 100000/100000 = 1, 100000/10000 = 10, 100000/1544 = 64

The cost is used for finding the metrics the algorithm will use to route to the other routers

The areas are manually assigned and they follow a rule
0 – backbone
1 – standard
2- stub
3 – totally stub
4- not so stub

All networks should be connected to where the backbone is located.

Backbone is where most of the routing processing of metrics and hops is located
Standard is where in short words is where the endings of a metric are found.

2, 3, 4 are related to stub and it’s a scenario where a backbone contains routers that follow a different routing protocol. The values mostly describe scale in order to use them or skip them if necessary.

4.2 Repeat all testing scenarios from Problem 3 and include explanations/screenshots in your report

```
PC1> trace 192.168.1.2 -P 6
trace to 192.168.1.2, 8 hops max (TCP), press Ctrl+C to stop
 1   192.168.0.2   15.331 ms  15.022 ms  15.355 ms
 2   10.0.2.2   44.518 ms  45.453 ms  46.617 ms
 3   10.0.2.14   75.239 ms  75.124 ms  75.824 ms
 4   192.168.1.2   90.345 ms  90.620 ms  91.139 ms

PC1> ping 192.168.1.2 -t
84 bytes from 192.168.1.2 icmp_seq=1 ttl=61 time=91.556 ms
84 bytes from 192.168.1.2 icmp_seq=2 ttl=61 time=90.531 ms
84 bytes from 192.168.1.2 icmp_seq=3 ttl=61 time=91.712 ms
84 bytes from 192.168.1.2 icmp_seq=4 ttl=61 time=91.556 ms
84 bytes from 192.168.1.2 icmp_seq=5 ttl=61 time=90.768 ms
84 bytes from 192.168.1.2 icmp_seq=6 ttl=61 time=91.654 ms
84 bytes from 192.168.1.2 icmp_seq=7 ttl=61 time=91.920 ms
84 bytes from 192.168.1.2 icmp_seq=8 ttl=61 time=90.789 ms
*192.168.0.2 icmp_seq=9 ttl=255 time=15.116 ms (ICMP type:3, code:1, Destination host unreachable)
*192.168.0.2 icmp_seq=10 ttl=255 time=14.724 ms (ICMP type:3, code:1, Destination host unreachable
)
*192.168.0.2 icmp_seq=11 ttl=255 time=15.495 ms (ICMP type:3, code:1, Destination host unreachable
)
*192.168.0.2 icmp_seq=12 ttl=255 time=15.299 ms (ICMP type:3, code:1, Destination host unreachable
)
*192.168.0.2 icmp_seq=13 ttl=255 time=15.422 ms (ICMP type:3, code:1, Destination host unreachable
)
*192.168.0.2 icmp_seq=14 ttl=255 time=16.113 ms (ICMP type:3, code:1, Destination host unreachable
)
*192.168.0.2 icmp_seq=15 ttl=255 time=15.141 ms (ICMP type:3, code:1, Destination host unreachable
)
*192.168.0.2 icmp_seq=16 ttl=255 time=15.186 ms (ICMP type:3, code:1, Destination host unreachable
)
*192.168.0.2 icmp_seq=17 ttl=255 time=14.896 ms (ICMP type:3, code:1, Destination host unreachable
)
*192.168.0.2 icmp_seq=18 ttl=255 time=15.263 ms (ICMP type:3, code:1, Destination host unreachable
)
*192.168.0.2 icmp_seq=19 ttl=255 time=16.014 ms (ICMP type:3, code:1, Destination host unreachable
)
*192.168.0.2 icmp_seq=20 ttl=255 time=15.640 ms (ICMP type:3, code:1, Destination host unreachable
)
```

```
*192.168.0.2 icmp_seq=20 ttl=255 time=15.640 ms (ICMP type:3, code:1, Destination host unreachable
)
*192.168.0.2 icmp_seq=21 ttl=255 time=15.657 ms (ICMP type:3, code:1, Destination host unreachable
)
*192.168.0.2 icmp_seq=22 ttl=255 time=15.296 ms (ICMP type:3, code:1, Destination host unreachable
)
*192.168.0.2 icmp_seq=23 ttl=255 time=14.933 ms (ICMP type:3, code:1, Destination host unreachable
)
84 bytes from 192.168.1.2 icmp_seq=24 ttl=61 time=60.943 ms
84 bytes from 192.168.1.2 icmp_seq=25 ttl=61 time=61.371 ms
84 bytes from 192.168.1.2 icmp_seq=26 ttl=62 time=60.333 ms
84 bytes from 192.168.1.2 icmp_seq=27 ttl=62 time=61.641 ms
84 bytes from 192.168.1.2 icmp_seq=28 ttl=62 time=60.155 ms
84 bytes from 192.168.1.2 icmp_seq=29 ttl=62 time=59.957 ms
192.168.1.2 icmp_seq=30 timeout
192.168.1.2 icmp_seq=31 timeout
84 bytes from 192.168.1.2 icmp_seq=32 ttl=62 time=61.469 ms
84 bytes from 192.168.1.2 icmp_seq=33 ttl=62 time=61.615 ms
84 bytes from 192.168.1.2 icmp_seq=34 ttl=62 time=75.776 ms
84 bytes from 192.168.1.2 icmp_seq=35 ttl=62 time=61.053 ms
84 bytes from 192.168.1.2 icmp_seq=36 ttl=62 time=60.628 ms
84 bytes from 192.168.1.2 icmp_seq=37 ttl=62 time=61.373 ms
84 bytes from 192.168.1.2 icmp_seq=38 ttl=62 time=61.367 ms
84 bytes from 192.168.1.2 icmp_seq=39 ttl=62 time=61.077 ms
84 bytes from 192.168.1.2 icmp_seq=40 ttl=62 time=61.084 ms
84 bytes from 192.168.1.2 icmp_seq=41 ttl=62 time=60.759 ms
84 bytes from 192.168.1.2 icmp_seq=42 ttl=62 time=62.209 ms
84 bytes from 192.168.1.2 icmp_seq=43 ttl=62 time=60.242 ms
84 bytes from 192.168.1.2 icmp_seq=44 ttl=62 time=61.292 ms
84 bytes from 192.168.1.2 icmp_seq=45 ttl=62 time=61.276 ms
84 bytes from 192.168.1.2 icmp_seq=46 ttl=62 time=60.662 ms

PC1> trace 192.168.1.2 -P 6
trace to 192.168.1.2, 8 hops max (TCP), press Ctrl+C to stop
 1   192.168.0.2   15.784 ms  15.717 ms  15.381 ms
 2   10.0.2.9   45.706 ms  44.474 ms  45.769 ms
 3   192.168.1.2   61.181 ms  60.556 ms  61.583 ms
```

Since as explained before the router uses the costs system to determine where to go next after the destination host was unreachable, it kept going but right after it went through a timeout and an educated guess would be that it took R1 - > R3 path first since the cost was 1 there, it realized that it has cost 64 and quickly shifted to R1 -> R4 instead

If that happened under 2 sequences then the program shows to be rather effective at routing to the most effective network as quickly as possible

5 Problem 5

5.1 Explain the key differences between the three routing methods (static/RIPv2/OSPF) and give a few scenarios where each of these methods would be the most efficient to use.

Static: rudimental but allows manual metric direction so routers know what path to send information to, this however is rather ineffective the larger the scale of the networks is, because manually creating redirections because it becomes a large scale to consider and time spent. Scenario: usage in a network that uses wired connections and wireless as well, so in those cases, the admin would require making most connections as effective as possible and allows consideration of the bandwidth as well.

Ripv2 Uses vector algorithms and tries to always pick the shortest hop count, which may not pick the most bandwidth effective path but rather the shortest path instead. LANs are usually best equipped to use RIPv2 since most bandwidth in a small area will not differ drastically so in that case it will mostly provide the shortest path
Scenario: most LAN networks, since wireless paths will probably be the farthest apart from hosts to other hosts and the shortest path would be the effective means of saving resources that would not be spent instead.

OSPF Uses a combination of areas and costs to define the metrics, areas is a collection of networks and the backbone area is where the routing information for all areas is located,

Cost is a ratio of 100mbps to the network bandwidth and is used to obtain the network bandwidth information and use it as a factor when trying to create a metric

Scenario: OSPF works well in many scenarios from LAN to WAN since every network is connected through a backbone it allows the most efficient paths to be calculated and taken, if they are connected to routers that use a different means of routing ie RIPv2 then those routers would use special area denominations so they would be treated differently, I suppose that if you have hardware issues then you would have issues trying to set up another path and it might go through a roundabout way probably as well.

Resources

[1] https://www.cisco.com/web/ANZ/cpp/refguide/hview/router/3700.html#nm-1fe-tx

OSPF https://www.ibm.com/docs/en/i/7.3?topic=concepts-ospf-routing-domain-areas