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Data Communications and Networking

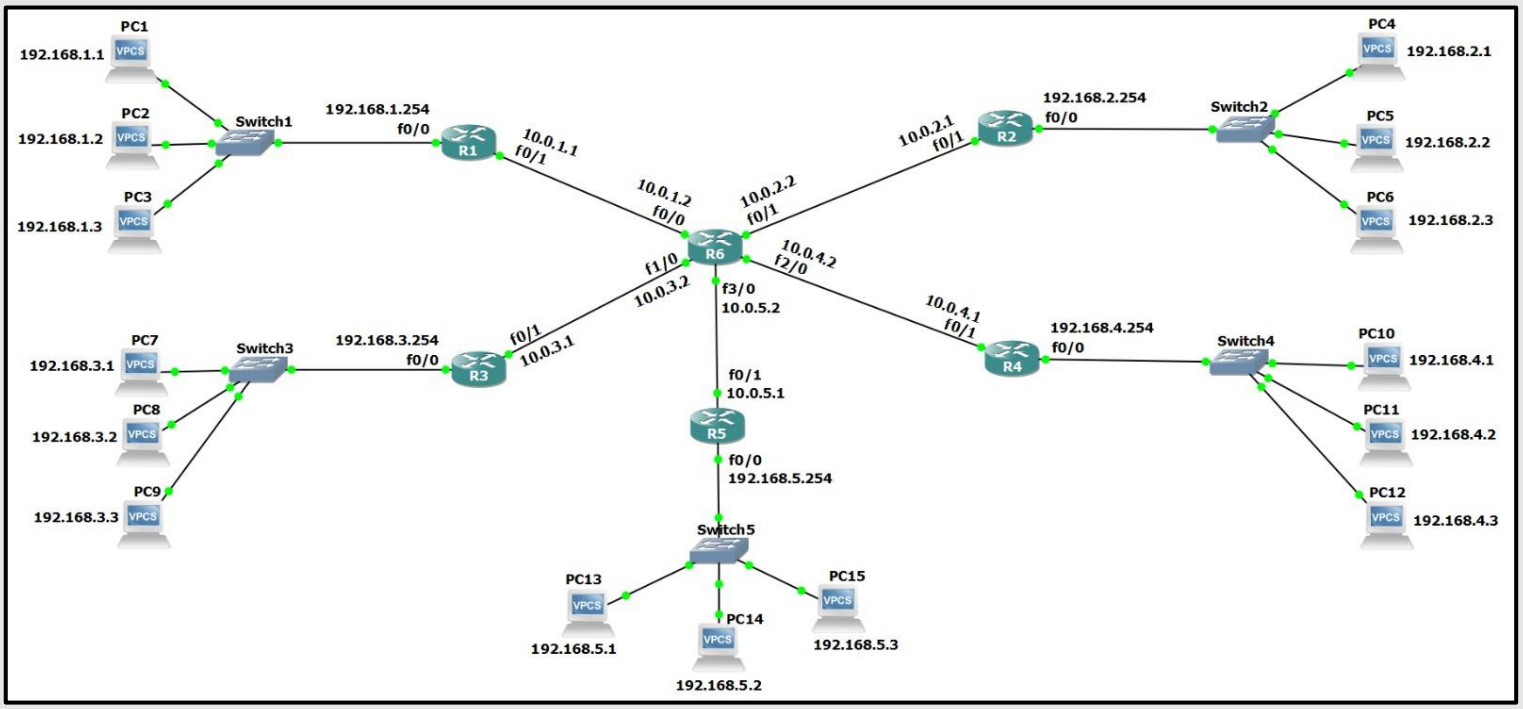
Lab - 5 (Network Topologies) Exercise

Requirement 1, where each topology has at least 15 end-users and at least 4 routers using RIP or static routing. As well as at least 5 subnets in each topology.

Subnet	VPCs	Gateway
Subnet 1	PC1, PC2 & PC3	192.168.1.254
Subnet 2	PC4, PC5 & PC6	192.168.2.254
Subnet 3	PC7, PC8 & PC9	192.168.3.254
Subnet 4	PC10, PC11 & PC12	192.168.4.254
Subnet 5	PC13, PC14 & PC15	192.168.5.254

- Table above applies for both Topology A and Topology B.

Topology A



RIP configurations

```
R1(config)#router rip
R1(config-router)#version 2
R1(config-router)#network 192.168.1.0
R1(config-router)#network 10.0.1.0
R1(config-router)#no auto-summary
R1(config-router)#^Z
R1#
*Mar  1 00:44:12.423: %SYS-5-CONFIG_I: Configured from console by console
R1#write
Building configuration...
[OK]
```

```
R2(config)#router rip
R2(config-router)#version 2
R2(config-router)#network 192.168.2.0
R2(config-router)#network 10.0.2.0
R2(config-router)#no auto-summary
R2(config-router)#^Z
R2#
*Mar  1 00:44:18.559: %SYS-5-CONFIG_I: Configured from console by console
R2#write
Building configuration...
[OK]
```

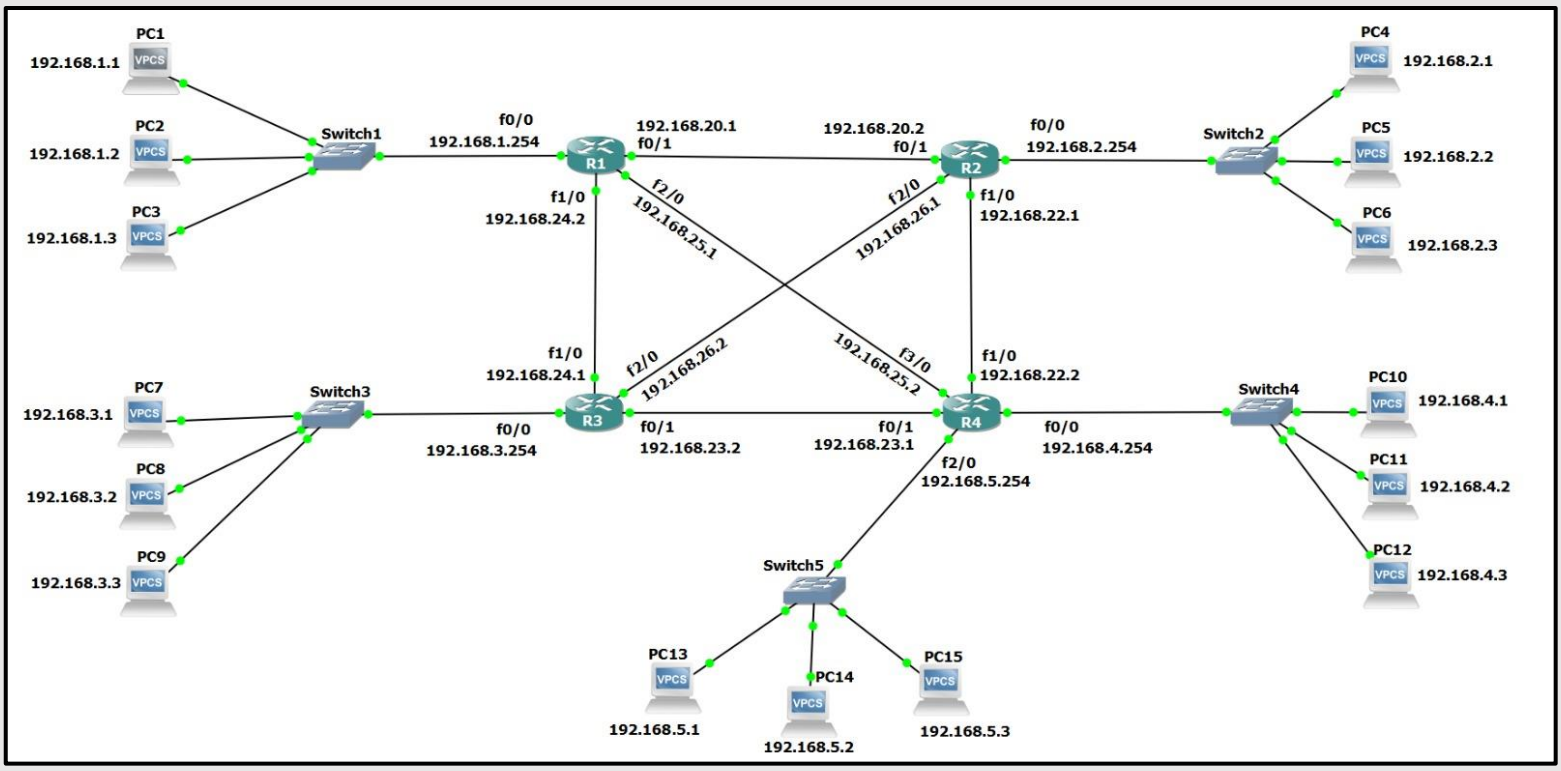
```
R3(config)#router rip
R3(config-router)#version 2
R3(config-router)#network 192.168.3.0
R3(config-router)#network 10.0.3.0
R3(config-router)#no auto-summary
R3(config-router)#^Z
R3#
*Mar  1 00:44:08.899: %SYS-5-CONFIG_I: Configured from console by console
R3#write
Building configuration...
[OK]
```

```
R4(config)#router rip
R4(config-router)#version 2
R4(config-router)#network 192.168.4.0
R4(config-router)#network 10.0.4.0
R4(config-router)#no auto-summary
R4(config-router)#^Z
R4#
*Mar  1 00:44:10.679: %SYS-5-CONFIG_I: Configured from console by console
R4#write
Building configuration...
[OK]
```

```
R5(config)#router rip
R5(config-router)#version 2
R5(config-router)#network 192.168.5.0
R5(config-router)#network 10.0.5.0
R5(config-router)#no auto-summary
R5(config-router)#^Z
R5#
*Mar  1 00:44:09.523: %SYS-5-CONFIG_I: Configured from console by console
R5#write
Building configuration...
[OK]
```

```
R6(config)#router rip
R6(config-router)#version 2
R6(config-router)#network 10.0.1.0
R6(config-router)#network 10.0.2.0
R6(config-router)#network 10.0.3.0
R6(config-router)#network 10.0.4.0
R6(config-router)#network 10.0.5.0
R6(config-router)#no auto-summary
R6(config-router)#^Z
R6#
*Mar  1 00:03:32.995: %SYS-5-CONFIG_I: Configured from console by console
R6#write
Building configuration...
[OK]
```

Topology B



RIP configurations

```
R1#show conf | section rip
router rip
 version 2
 network 192.168.1.0
 network 192.168.20.0
 network 192.168.24.0
 network 192.168.25.0
R1#
```

```
R2#show conf | section rip
router rip
 version 2
 network 192.168.2.0
 network 192.168.20.0
 network 192.168.22.0
 network 192.168.26.0
R2#
```

```
R3#show conf | section rip
router rip
 version 2
 network 192.168.3.0
 network 192.168.23.0
 network 192.168.24.0
 network 192.168.26.0
R3#
```

```
R4#show conf | section rip
router rip
 version 2
 network 192.168.4.0
 network 192.168.5.0
 network 192.168.22.0
 network 192.168.23.0
 network 192.168.25.0
R4#
```

Requirement 2, where any two hosts are able to communicate using at least two different protocols.

For topology A;

[Test 1]

We trace ping and trace PC8's IP (subnet 3) from PC4 (subnet 2)

```
PC4> ping 192.168.3.2
192.168.3.2 icmp_seq=1 timeout
84 bytes from 192.168.3.2 icmp_seq=2 ttl=61 time=91.334 ms
84 bytes from 192.168.3.2 icmp_seq=3 ttl=61 time=93.138 ms
84 bytes from 192.168.3.2 icmp_seq=4 ttl=61 time=77.922 ms
84 bytes from 192.168.3.2 icmp_seq=5 ttl=61 time=97.152 ms

PC4> trace 192.168.3.2
trace to 192.168.3.2, 8 hops max, press Ctrl+C to stop
 1   192.168.2.254   17.130 ms  16.410 ms  17.449 ms
 2   10.0.2.2   45.552 ms  46.727 ms  48.182 ms
 3   10.0.3.1   76.932 ms  77.340 ms  77.200 ms
 4   *192.168.3.2   92.484 ms (ICMP type:3, code:3, Destination port unreachable)
```

- PC4 pings to PC8 using protocols UDP and TCP

```
PC4> ping 192.168.3.2 -2
84 bytes from 192.168.3.2 udp_seq=1 ttl=61 time=94.141 ms
84 bytes from 192.168.3.2 udp_seq=2 ttl=61 time=91.994 ms
84 bytes from 192.168.3.2 udp_seq=3 ttl=61 time=92.196 ms
84 bytes from 192.168.3.2 udp_seq=4 ttl=61 time=91.782 ms
84 bytes from 192.168.3.2 udp_seq=5 ttl=61 time=93.000 ms

PC4> ping 192.168.3.2 -3
Connect   7@192.168.3.2 timeout
Connect   7@192.168.3.2 seq=2 ttl=61 time=106.100 ms
SendData  7@192.168.3.2 seq=2 ttl=61 time=106.357 ms
Close     7@192.168.3.2 seq=2 ttl=61 time=137.176 ms
Connect   7@192.168.3.2 seq=3 ttl=61 time=107.250 ms
SendData  7@192.168.3.2 seq=3 ttl=61 time=107.836 ms
Close     7@192.168.3.2 seq=3 ttl=61 time=123.309 ms
Connect   7@192.168.3.2 seq=4 ttl=61 time=107.576 ms
SendData  7@192.168.3.2 seq=4 ttl=61 time=106.908 ms
Close     7@192.168.3.2 seq=4 ttl=61 time=124.201 ms
Connect   7@192.168.3.2 seq=5 ttl=61 time=106.562 ms
SendData  7@192.168.3.2 seq=5 ttl=61 time=106.733 ms
Close     7@192.168.3.2 seq=5 ttl=61 time=122.608 ms

PC4>
```

[Test 2]

We trace ping and trace PC15's IP (subnet 5) from PC9 (subnet 3)

```
PC9> ping 192.168.5.3
192.168.5.3 icmp_seq=1 timeout
84 bytes from 192.168.5.3 icmp_seq=2 ttl=61 time=92.611 ms
84 bytes from 192.168.5.3 icmp_seq=3 ttl=61 time=91.768 ms
84 bytes from 192.168.5.3 icmp_seq=4 ttl=61 time=92.657 ms
84 bytes from 192.168.5.3 icmp_seq=5 ttl=61 time=92.247 ms

PC9> trace 192.168.5.3
trace to 192.168.5.3, 8 hops max, press Ctrl+C to stop
 1   192.168.3.254   15.856 ms  16.401 ms  16.152 ms
 2   10.0.3.2   47.305 ms  47.632 ms  46.403 ms
 3   10.0.5.1   77.748 ms  77.926 ms  77.017 ms
 4   *192.168.5.3   91.616 ms (ICMP type:3, code:3, Destination port unreachable)
```

- PC9 pings to PC15 using protocols UDP and TCP

```
PC9> ping 192.168.5.3 -2
84 bytes from 192.168.5.3 udp_seq=1 ttl=61 time=92.328 ms
84 bytes from 192.168.5.3 udp_seq=2 ttl=61 time=92.539 ms
84 bytes from 192.168.5.3 udp_seq=3 ttl=61 time=92.344 ms
84 bytes from 192.168.5.3 udp_seq=4 ttl=61 time=92.315 ms
84 bytes from 192.168.5.3 udp_seq=5 ttl=61 time=92.818 ms

PC9> ping 192.168.5.3 -3
Connect   7@192.168.5.3 seq=1 ttl=61 time=107.947 ms
SendData  7@192.168.5.3 seq=1 ttl=61 time=106.884 ms
Close     7@192.168.5.3 seq=1 ttl=61 time=123.343 ms
Connect   7@192.168.5.3 seq=2 ttl=61 time=107.476 ms
SendData  7@192.168.5.3 seq=2 ttl=61 time=106.602 ms
Close     7@192.168.5.3 seq=2 ttl=61 time=123.336 ms
Connect   7@192.168.5.3 seq=3 ttl=61 time=106.460 ms
SendData  7@192.168.5.3 seq=3 ttl=61 time=92.815 ms
Close     7@192.168.5.3 seq=3 ttl=61 time=122.096 ms
Connect   7@192.168.5.3 seq=4 ttl=61 time=107.537 ms
SendData  7@192.168.5.3 seq=4 ttl=61 time=105.543 ms
Close     7@192.168.5.3 seq=4 ttl=61 time=122.935 ms
Connect   7@192.168.5.3 seq=5 ttl=61 time=107.337 ms
SendData  7@192.168.5.3 seq=5 ttl=61 time=107.860 ms
Close     7@192.168.5.3 seq=5 ttl=61 time=120.898 ms

PC9>
```

For topology B;

[Test 1]

We trace ping & trace PC1's IP (subnet 1) from PC12 (subnet 4)

```
PC12> ping 192.168.1.1
192.168.1.1 icmp_seq=1 timeout
192.168.1.1 icmp_seq=2 timeout
84 bytes from 192.168.1.1 icmp_seq=3 ttl=62 time=62.137 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=62 time=62.543 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=62 time=61.752 ms

PC12> trace 192.168.1.1
trace to 192.168.1.1, 8 hops max, press Ctrl+C to stop
 1   192.168.4.254   16.570 ms  16.861 ms  16.671 ms
 2   192.168.25.1    45.474 ms  46.704 ms  47.898 ms
 3   *192.168.1.1    61.462 ms (ICMP type:3, code:3, Destination port unreachable)
```

- PC12 pings to PC1 using protocols UDP and TCP

```
PC12> ping 192.168.1.1 -2
84 bytes from 192.168.1.1 udp_seq=1 ttl=62 time=62.060 ms
84 bytes from 192.168.1.1 udp_seq=2 ttl=62 time=62.714 ms
84 bytes from 192.168.1.1 udp_seq=3 ttl=62 time=62.533 ms
84 bytes from 192.168.1.1 udp_seq=4 ttl=62 time=60.858 ms
84 bytes from 192.168.1.1 udp_seq=5 ttl=62 time=61.625 ms

PC12> ping 192.168.1.1 -3
Connect   7@192.168.1.1 seq=1 ttl=62 time=75.422 ms
SendData  7@192.168.1.1 seq=1 ttl=62 time=76.831 ms
Close     7@192.168.1.1 seq=1 ttl=62 time=91.762 ms
Connect   7@192.168.1.1 seq=2 ttl=62 time=75.861 ms
SendData  7@192.168.1.1 seq=2 ttl=62 time=77.380 ms
Close     7@192.168.1.1 seq=2 ttl=62 time=90.813 ms
Connect   7@192.168.1.1 seq=3 ttl=62 time=77.301 ms
SendData  7@192.168.1.1 seq=3 ttl=62 time=77.918 ms
Close     7@192.168.1.1 seq=3 ttl=62 time=92.421 ms
Connect   7@192.168.1.1 seq=4 ttl=62 time=75.562 ms
SendData  7@192.168.1.1 seq=4 ttl=62 time=75.970 ms
Close     7@192.168.1.1 seq=4 ttl=62 time=91.934 ms
Connect   7@192.168.1.1 seq=5 ttl=62 time=77.502 ms
SendData  7@192.168.1.1 seq=5 ttl=62 time=75.952 ms
Close     7@192.168.1.1 seq=5 ttl=62 time=93.421 ms

PC12>
```

[Test 2]

We trace ping & trace PC7's IP (subnet 3) from PC4 (subnet 2)

```
PC4> ping 192.168.3.1
192.168.3.1 icmp_seq=1 timeout
84 bytes from 192.168.3.1 icmp_seq=2 ttl=62 time=62.176 ms
84 bytes from 192.168.3.1 icmp_seq=3 ttl=62 time=60.562 ms
84 bytes from 192.168.3.1 icmp_seq=4 ttl=62 time=62.467 ms
84 bytes from 192.168.3.1 icmp_seq=5 ttl=62 time=63.167 ms

PC4> trace 192.168.3.1
trace to 192.168.3.1, 8 hops max, press Ctrl+C to stop
 1   192.168.2.254   16.533 ms  16.313 ms  15.250 ms
 2   192.168.26.2   46.325 ms  46.599 ms  46.306 ms
 3   *192.168.3.1   63.468 ms (ICMP type:3, code:3, Destination port unreachable)
```

- PC4 pings to PC7 using protocols UDP and TCP

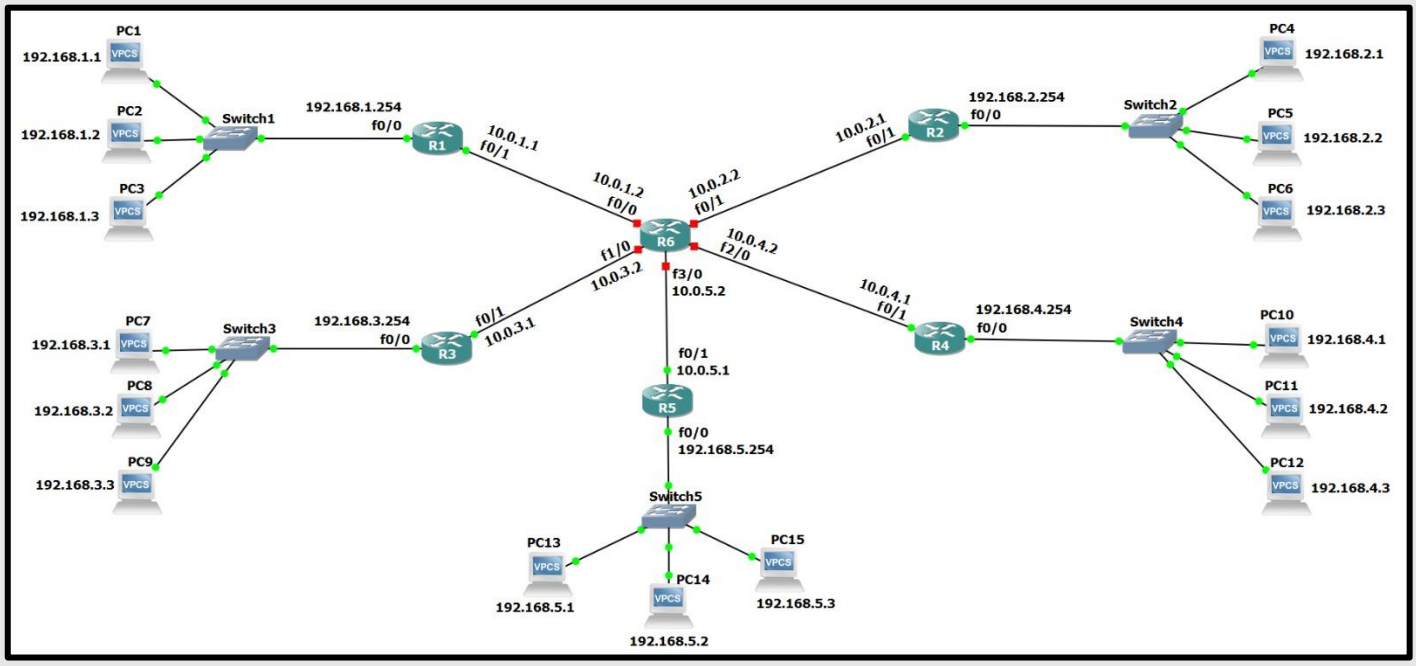
```
PC4> ping 192.168.3.1 -2
84 bytes from 192.168.3.1 udp_seq=1 ttl=62 time=60.374 ms
84 bytes from 192.168.3.1 udp_seq=2 ttl=62 time=61.247 ms
84 bytes from 192.168.3.1 udp_seq=3 ttl=62 time=61.334 ms
84 bytes from 192.168.3.1 udp_seq=4 ttl=62 time=63.084 ms
84 bytes from 192.168.3.1 udp_seq=5 ttl=62 time=47.309 ms

PC4> ping 192.168.3.1 -3
Connect   7@192.168.3.1 seq=1 ttl=62 time=75.321 ms
SendData  7@192.168.3.1 seq=1 ttl=62 time=75.968 ms
Close     7@192.168.3.1 seq=1 ttl=62 time=92.055 ms
Connect   7@192.168.3.1 seq=2 ttl=62 time=77.372 ms
SendData  7@192.168.3.1 seq=2 ttl=62 time=76.892 ms
Close     7@192.168.3.1 seq=2 ttl=62 time=90.871 ms
Connect   7@192.168.3.1 seq=3 ttl=62 time=75.358 ms
SendData  7@192.168.3.1 seq=3 ttl=62 time=74.881 ms
Close     7@192.168.3.1 seq=3 ttl=62 time=92.406 ms
Connect   7@192.168.3.1 seq=4 ttl=62 time=76.079 ms
SendData  7@192.168.3.1 seq=4 ttl=62 time=75.789 ms
Close     7@192.168.3.1 seq=4 ttl=62 time=92.152 ms
Connect   7@192.168.3.1 seq=5 ttl=62 time=75.811 ms
SendData  7@192.168.3.1 seq=5 ttl=62 time=76.134 ms
Close     7@192.168.3.1 seq=5 ttl=62 time=92.417 ms

PC4>
```

Requirement 3

1) For Topology A, switching off R6 and testing.



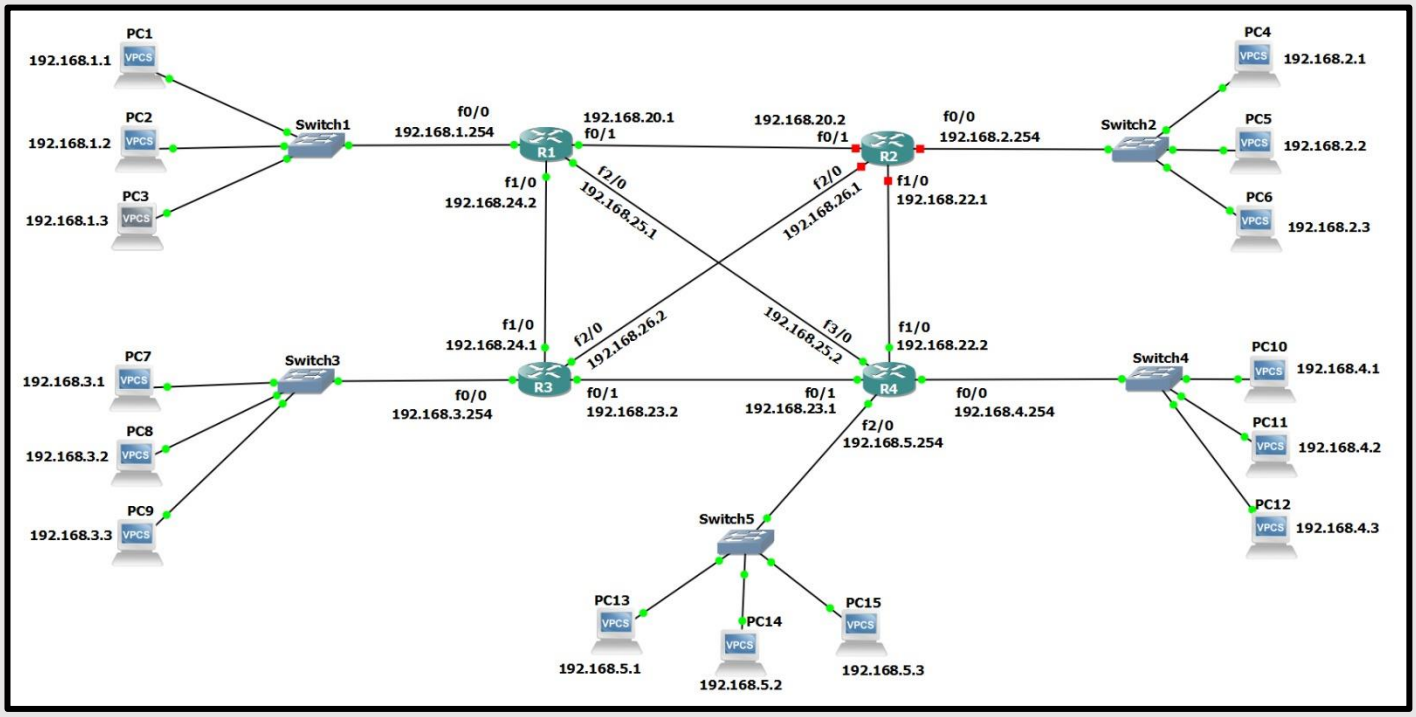
2) Pinging PC11 from PC3 which are on different subnets, won't ping.

```
PC3> ping 192.168.4.2
192.168.4.2 icmp_seq=1 timeout
192.168.4.2 icmp_seq=2 timeout
192.168.4.2 icmp_seq=3 timeout
192.168.4.2 icmp_seq=4 timeout
192.168.4.2 icmp_seq=5 timeout

PC3> trace 192.168.4.2
trace to 192.168.4.2, 8 hops max, press Ctrl+C to stop
 1   192.168.1.254   15.895 ms  16.802 ms  17.171 ms
 2     *   *   *
 3     *   *   *
 4     *   *   *
 5     *   *   *
 6     *   *   *
 7     *   *   *
 8     *   *   *

PC3>
```

1) For Topology B, switching off R2 and testing.



2) As you can see below, despite R2 remains switched-off PC3 is still able to ping PC11 and PC7.

```
PC3> ping 192.168.4.2
192.168.4.2 icmp_seq=1 timeout
192.168.4.2 icmp_seq=2 timeout
84 bytes from 192.168.4.2 icmp_seq=3 ttl=62 time=61.723 ms
84 bytes from 192.168.4.2 icmp_seq=4 ttl=62 time=63.928 ms
84 bytes from 192.168.4.2 icmp_seq=5 ttl=62 time=63.265 ms

PC3> trace 192.168.4.2
trace to 192.168.4.2, 8 hops max, press Ctrl+C to stop
 1   192.168.1.254   16.841 ms  16.042 ms  15.962 ms
 2   192.168.25.2   48.184 ms  45.621 ms  45.746 ms
 3   *192.168.4.2   62.699 ms (ICMP type:3, code:3, Destination port unreachable)

PC3>
```

```
PC3> trace 192.168.3.1
trace to 192.168.3.1, 8 hops max, press Ctrl+C to stop
 1   192.168.1.254   16.292 ms  17.474 ms  16.865 ms
 2   192.168.24.1   47.362 ms  47.214 ms  46.422 ms
 3     **192.168.3.1   61.834 ms (ICMP type:3, code:3, Destination port unreachable)

PC3> ping 192.168.3.1
84 bytes from 192.168.3.1 icmp_seq=1 ttl=62 time=61.299 ms
84 bytes from 192.168.3.1 icmp_seq=2 ttl=62 time=63.398 ms
84 bytes from 192.168.3.1 icmp_seq=3 ttl=62 time=62.370 ms
84 bytes from 192.168.3.1 icmp_seq=4 ttl=62 time=61.163 ms
84 bytes from 192.168.3.1 icmp_seq=5 ttl=62 time=62.919 ms

PC3>
```

(Basically we can ping all the PCs except the ones that belong to subnet 2 since R2 is switched off)
