HY435 - Lab 3

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1. Standard Connectivity

We used the below commands to set up the addresses on the routing tables.

sudo ip address add <address> dev eth0

sudo route del default

sudo route add default via <address>

1.1. PC Routing Tables:

PCs:

PC1:

Address	Gateway	Interface
0.0.0.0/0	147.52.20.149	eth0
192.168.4.0	0.0.0.0	vlan1000

PC2:

Address	Gateway	Interface
0.0.0.0.0/0	192.168.8.1	eth0
192.168.8.0/24	0.0.0.0	eth0
192.168.4.0	0.0.0.0	vlan1000

PC3:

Address	Gateway	Interface
0.0.0.0.0/0	192.168.9.1	eth0
192.168.9.0/24	0.0.0.0	eth0
192.168.4.0/24	0.0.0.0	vlan1000

Routers:

R1:

Destination	Next Hop	Interface	Route Type	Description
0.0.0.0/0	147.52.17.1	eth4	static	Default gw
147.52.20.144/28	192.168.21.5	eth1	static	Route to subnet 5
192.168.0.0/16	192.168.21.5	eth1	static	Route to local subnet

R2:

Destination	Next Hop	Interface	Route Type	Description
0.0.0.0/0	192.168.21.4	eth2	static	Default gw
192.168.0.0/16	192.168.22.2	eth1	static	Backup route
192.168.0.0/16		eth3	static	Route to local subnet
192.168.21.0/24	192.168.21.4		static	Route to subnet 1
147.52.20.144/28	147.52.20.150		static	Route to subnet 5

R3:

Destination	Next Hop	Interface	Route Type	Description
0.0.0.0/0	192.168.21.2	eth2	static	Default gw
192.168.20.0/30	192.168.20.2	eth3	static	Route to subnet 3
192.168.0.0/22	192.168.20.2	eth3	static	Route to subnet 4
147.52.20.144/28	192.168.21.2	eth2	static	Route to subnet 5
192.168.8.0/24	192.168.20.2	eth3	static	Route to subnet 6
192.168.9.0/24	192.168.20.2	eth3	static	Route to subnet 7

R4:

Destination	Next Hop	Interface	Route Type	Description
0.0.0.0/0	192.168.0.3	eth3	static	Default gw
192.168.0.0/22	192.168.0.3		static	Route to subnet 4
192.168.8.0/24		eth4	static	Route to subnet 6

R5:

Destination	Next Hop	Interface	Route Type	Description
0.0.0.0/0	192.168.20.1	eth2	static	Default gw
0.0.0.0/0	192.168.22.1	eth1	static	Backup default gw
192.168.0.0/22		switch0	static	Route to subnet 4
192.168.8.0/24	192.168.0.1	switch0	static	Route to subnet 6
192.168.9.0/24	192.168.0.2	switch0	static	Route to subnet 7

R6:

Destination	Next Hop	Interface	Route Type	Description
0.0.0.0/0	192.168.0.3	eth3	static	Default gw
192.168.9.0/24	192.168.9.2		static	Route to subnet 7

1.2 Traceroutes:

PC2 -> PC3:

traceroute to 192.168.9.2 (192.168.9.2), 30 hops max, 60 byte packets
1 192.168.8.1 0.276ms 0.263ms 0.244ms
2 192.168.0.3 0.403ms 0.391ms 0.373ms
3 192.168.0.2 0.599ms 0.579ms 0.566ms
4 192.168.9.2 0.760ms 0.627ms 0.513ms

PC3 -> PC2:

traceroute to 192.168.8.2 (192.168.8.2), 30 hops max, 60 byte packets
1 192.168.9.1 (192.168.9.1) 0.300 ms 0.207 ms 0.270 ms
2 192.168.0.3 (192.168.0.3) 0.509 ms 0.490 ms 0.622 ms
3 192.168.0.1 (192.168.0.1) 0.831 ms 0.812 ms 0.804 ms
4 192.168.8.2 (192.168.8.2) 0.990 ms 0.974 ms *

PC2 -> PC1:

traceroute to 147.52.20.150 (147.52.20.150), 30 hops max, 60 byte packets
1 192.168.8.1 (192.168.8.1) 0.303ms 0.285ms 0.274ms
2 192.168.0.3 (192.168.0.3) 0.585ms 0.698ms 0.558ms
3 192.168.20.1 (192.168.20.1) 0.894ms 0.884ms 0.982ms
4 192.168.21.2 (192.168.21.2) 0.967ms 0.844ms 0.946ms
5 147.52.20.150 (147.52.20.150) 1.174ms 1.166ms 1.151ms

PC3 -> PC1:

traceroute to 147.52.20.150 (147.52.20.150), 30 hops max, 60 byte packets
1 192.168.9.1 (192.168.9.1) 0.320ms 0.303ms 0.287ms
2 192.168.0.3 (192.168.0.3) 0.486ms 0.474ms 0.458ms
3 192.168.20.1 (192.168.20.1) 0.653ms 0.639ms 0.816ms
4 192.168.21.2 (192.168.21.2) 0.762ms 0.731ms 0.816ms
5 147.52.20.150 (147.52.20.150) 0.807ms 0.794ms 0.775ms

PC1 -> 8.8.8.8:

traceroute to 8.8.8.8 (8.8.8.8), 30 hops max, 60 byte packets
 1 147.52.20.149 (147.52.20.149) 0.318 ms 0.307 ms 0.291 ms
 2 192.168.21.4 (192.168.21.4) 0.901 ms 1.342 ms 0.506 ms
 3 evros-gw.ucnet.uoc.gr (147.52.17.1) 6.348 ms 6.342 ms 6.296 ms
 4 147.52.2.209 (147.52.2.209) 3.265 ms 3.246 ms 3.335 ms
 5 10.78.140.1 (10.78.140.1) 3.081 ms 2.606 ms 3.049 ms
 6 uoc-voutes-1-gw.eier.access-link.grnet.gr (62.217.96.232) 7.946 ms 7.576 ms 7.558 ms
 7 grnet-ias-geant-gw.mx2.ath.gr.geant.net (83.97.88.69) 9.031 ms 7.809 ms 7.791 ms
 8 ae2.mx1.mil2.it.geant.net (62.40.98.150) 33.379 ms 33.322 ms 32.768 ms
 9 72.14.203.32 (72.14.203.32) 32.231 ms 31.514 ms 33.261 ms
10 108.170.245.81 (108.170.245.81) 34.296 ms 108.170.245.65 (108.170.245.65) 32.105 ms 74.125.245.241 (74.125.245.241) 32.425 ms
11 142.251.50.141 (142.251.50.141) 33.135 ms 142.250.211.23 (142.250.211.23) 33.023 ms 142.251.235.179 (142.251.235.179) 31.185 ms
12 dns.google (8.8.8.8) 32.330 ms 30.943 ms 31.304 ms

PC2 -> R1:eth4:

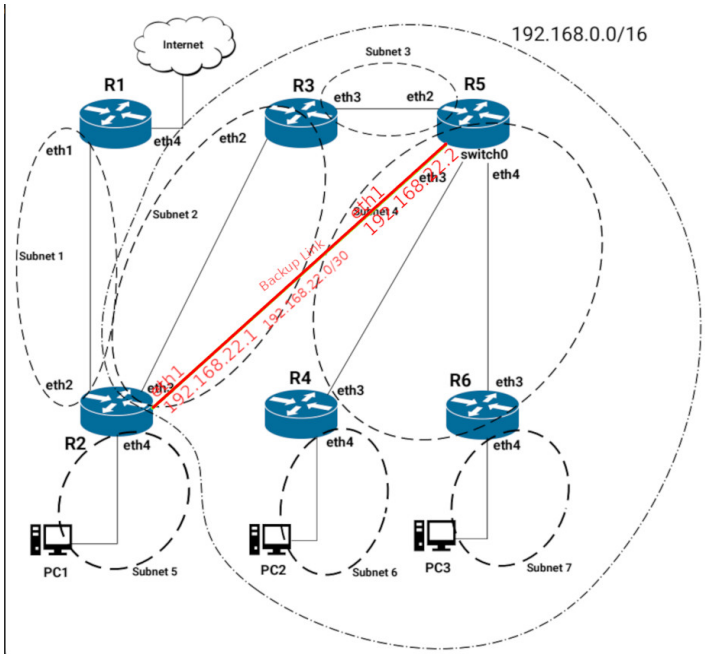
traceroute to 147.52.17.85 (147.52.17.85), 30 hops max, 60 byte packets
 1 192.168.8.1 (192.168.8.1) 0.285 ms 0.366 ms 0.240 ms
 2 192.168.0.3 (192.168.0.3) 0.545 ms 0.519 ms 0.513 ms
 3 192.168.20.1 (192.168.20.1) 0.739 ms 0.727 ms 0.713 ms
 4 192.168.21.2 (192.168.21.2) 0.700 ms 0.906 ms 0.895 ms
 5 147.52.17.85 (147.52.17.85) 1.311 ms 1.416 ms 0.955 ms

PC3 -> R1:eth4:

traceroute to 147.52.17.85 (147.52.17.85), 30 hops max, 60 byte packets
 1 192.168.9.1 (192.168.9.1) 0.256 ms 0.226 ms 0.218 ms
 2 192.168.0.3 (192.168.0.3) 0.551 ms 0.542 ms 0.526 ms
 3 192.168.20.1 (192.168.20.1) 0.618 ms 0.599 ms 0.572 ms
 4 192.168.21.2 (192.168.21.2) 0.771 ms 0.762 ms 0.746 ms
 5 147.52.17.85 (147.52.17.85) 0.936 ms 0.919 ms 0.906 ms

2. Backup Connectivity

In the image next we added a backup link, using an ethernet cable from R2:eth1 to R5:eth1. That way if R3 goes offline we can still have connectivity between all our hosts and the internet. The backup link is in the subnet 192.168.22.0/30 and the interface ips are:
R2:eth1 : 192.168.22.1,
R5:eth1 : 192.168.22.2.



The traceroutes affected when router R3 goes offline can be seen below (when R3 goes offline)

PC2->PC1:

traceroute to 147.52.20.150 (147.52.20.150), 30 hops max, 60 byte packets
1 192.168.8.1 (192.168.8.1) 0.301 ms 0.270 ms 0.267 ms
2 192.168.0.3 (192.168.0.3) 0.517 ms 0.495 ms 0.491 ms
3 192.168.22.1 (192.168.22.1) 0.623 ms 0.605 ms 0.449 ms
4 147.52.20.150 (147.52.20.150) 0.712 ms 0.700 ms 0.688 ms

PC3->PC1:

traceroute to 147.52.20.150 (147.52.20.150), 30 hops max, 60 byte packets
1 192.168.8.1 (192.168.8.1) 0.251 ms 0.345 ms 0.207 ms
2 192.168.0.3 (192.168.0.3) 0.452 ms 0.442 ms 0.426 ms
3 192.168.22.1 (192.168.22.1) 0.630 ms 0.612 ms 0.584 ms
4 147.52.20.150 (147.52.20.150) 0.736 ms 0.735 ms 0.715 ms

PC2->R1:eth4:

traceroute to 147.52.17.85 (147.52.17.85), 30 hops max, 60 byte packets
1 192.168.8.1 (192.168.8.1) 0.249 ms 0.336 ms 0.207 ms
2 192.168.0.3 (192.168.0.3) 0.634 ms 0.463 ms 0.445 ms
3 192.168.22.1 (192.168.22.1) 0.585 ms 0.760 ms 0.544 ms
4 147.52.17.85 (147.52.17.85) 0.720 ms 1.089 ms 0.819 ms

PC3->R1:eth4:

traceroute to 147.52.17.85 (147.52.17.85), 30 hops max, 60 byte packets
 1 192.168.9.1 (192.168.9.1) 0.292 ms 0.261 ms 0.258 ms
 2 192.168.0.3 (192.168.0.3) 0.468 ms 0.444 ms 0.434 ms
 3 192.168.22.1 (192.168.22.1) 0.744 ms 0.726 ms 0.689 ms
 4 147.52.17.85 (147.52.17.85) 0.831 ms 0.816 ms 0.806 ms

3. Backup Link Problems

As you can see on our routing tables, on the R2 router the route to the main subnet is set up as a gateway. That is because we couldn't get it to work as an Interface (that would have solved the problem described next). When router R3 goes offline, router R2 will still think the address 192.168.21.1 is reachable because it is included in the Subnet 1. As a workaround to this problem, we changed Subnet 1 to 192.168.23.0/24 (R2:eth2 : 192.168.23.5, R1:eth1 : 192.168.23.4). With this change R2 will no longer think 192.168.21.1 is reachable when its interface eth3 goes down. In the turned in configurations, there is a folder called “Subnet1 workaround” that includes the configuration file for R2, and screenshots showing the configuration on the R1 router.

4.Pinging 8.8.8.8 from PC2 and PC3

We can’t ping 8.8.8.8 from PC2 and PC3 because without using NAT the receiver of traceroute probes cannot reply to 192.168.0.0/16. PC1 works becauses it uses an IP address which is contained in the subnet defined by R1:eth4 thus is visible to the outside internet world.