

Part 1. Network Layer Analysis

Part-1.1 ICMP Analysis

- 1) First response from the website can be seen on line 16. Therefore 15 hops is the max ttl.

```

1 smirfatihayyildiz@Emirs-MacBook-Pro - % traceroute ku.ac.ae
2 traceroute to ku.ac.ae (189.205.29.66), 64 hops max, 52 byte packets
3  1 mitrarat-home (192.168.1.1)  9.580 ms  1.949 ms  1.904 ms
4  2 10.0.0.238.152 (10.0.0.238.152)  6.616 ms  27.769 ms  29.283 ms
5  3 10.0.0.158 (10.0.0.158)  8.913 ms *
6  4 * * *
7  5 34-acibadem-xrs-t2-2---34-acibadem-sri2e-t3-8.statik.turktelekom.com.tr (81.212.216.12)  10.610 ms  4.584 ms  4.887 ms
8  6 * * *
9  7 388-buk-col-2---34-ebgp-acibadem-sri2e-k.statik.turktelekom.com.tr (212.156.139.68)  21.902 ms  15.758 ms  15.889 ms
10 8 83.217.231.61 (83.217.231.61)  44.892 ms
11 9 ae15.edge3.bucharest1.level3.net (212.162.26.177)  45.636 ms  45.715 ms
12 10 ae1.3186.edge5.amsterdam1.level3.net (4.69.162.194)  58.415 ms *
13 11 ae1.3186.edge5.amsterdam1.level3.net (4.69.162.82)  55.859 ms
14 12 emirates-1n.ear5.amsterdam1.level3.net (212.72.33.62)  52.859 ms
15 13 212.72.41.238 (212.72.41.238)  53.627 ms
16 14 ae-0.r21.vianet02.at.bb.gin.ntt.net (129.250.7.13)  50.288 ms
17 15 * * *
18 16 ae1.081.sngpsi07.sg.bb.gin.ntt.net (129.250.2.240)  1083.601 ms  926.361 ms  1013.873 ms
19 17 ae-0.emirates-dn.sngpsi07.sg.bb.gin.ntt.net (116.51.26.82)  192.191 ms * 191.814 ms
20 18 * * *
21 19 91.74.125.98 (91.74.125.98)  183.062 ms
22 20 189.205.28.4 (189.205.28.4)  167.722 ms * 173.280 ms
23 21 * * *
24 22 91.74.125.98 (91.74.125.98)  297.058 ms * 287.218 ms
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- 2) With command `tracert -q 2 www.ku.ac.ae`, we can indicate the number of packets used. Increasing probes increases reliability, however it increases the load on destination. We can see from the first picture that on line 19, there are 3 symbols, indicating the probs. Default probe is 3.

```

1 emirfatihyayildiz@Emirs-MacBook-Pro - % traceroute -q 1 www.ku.ac.ae
2 traceroute to www.gslb.ku.ac.ae (176.74.48.15), 64 hops max, 52 byte packets
3 1  mitraster.home (192.168.1.1)  3.658 ms
4 2  10.98.238.152 (10.98.238.152)  6.133 ms
5 3  10.0.0.158 (10.0.0.158)  6.565 ms
6 *
7 *
8 34-acibaden-xrs-t2-1---34-acibaden-sr12e-t3-8.statik.turktelekom.com.tr (81.212.216.50)  10.586 ms
9 *
10 *
11 301-fra-col-2---34-ebgp-acibaden-sr12e-k.statik.turktelekom.com.tr (212.156.181.238)  43.147 ms
12 gi-0-0-0.emix.net.ae (80.81.192.228)  37.272 ms
13 *
14 195.229.4.93 (195.229.4.93)  175.447 ms
15 94.56.249.71 (94.56.249.71)  159.891 ms
16 213.42.193.66 (213.42.193.66)  169.224 ms
17 213.42.193.66 (213.42.193.66)  488.469 ms
18 109.206.25.17 (109.206.25.17)  164.044 ms
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- 3) When a router receives packets but it doesn't pass to a specific router, the router discards the packets. This is called routing blackhole.



Part-1.2 Network Interface Analysis

- 1) Ip link: it is used to display interface links of interfaces

```
emirfatihayyildiz — -zsh — 80x24
emirfatihayyildiz@Emirs-MacBook-Pro ~ % ip link show dev utun0
utun0: flags=8051<UP,POINTOPOINT,RUNNING,MULTICAST> mtu 1500
        nd6 options=201<PERFORMNUD,DAD>
```

- 2) Ip addr: it is used to display all ip information of interfaces

```
emirfatihayyildiz — -zsh — 80x24
emirfatihayyildiz@Emirs-MacBook-Pro ~ % ip addr show dev utun0
utun0: flags=8051<UP,POINTOPOINT,RUNNING,MULTICAST> mtu 1500
        inet6 fe80::bff8:4140:c410:cd2a/64 scopeid 0xe
```

- 3) Ip route: it is used to display the routing table

```
emirfatihayyildiz@Emirs-MacBook-Pro ~ % ip route add 192.168.1.2/26 via 192.168.1.1
Executing: /usr/bin/sudo /sbin/route add 192.168.1.2/26 192.168.1.1
add net 192.168.1.2: gateway 192.168.1.1
emirfatihayyildiz@Emirs-MacBook-Pro ~ %
```

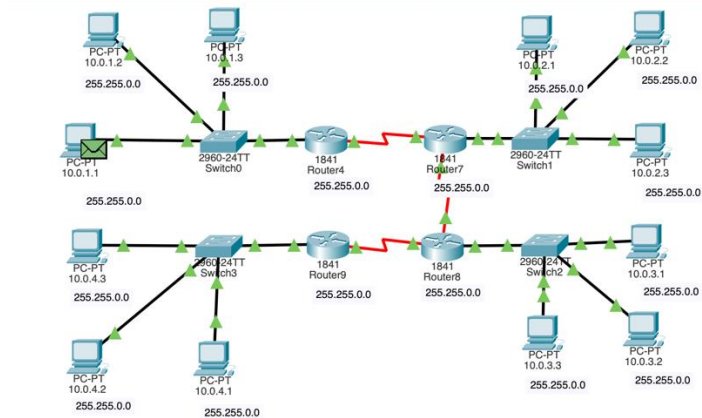
Part 2. Understanding IP and Subnetting:

```
emirfatihayildiz@Emirs-MacBook-Pro ~ % ip addr show
lo0: flags=8049<UP,LOOPBACK,RUNNING,MULTICAST> mtu 16384
    inet 127.0.0.1/8 lo0
    inet6 ::1/128
    inet6 fe80::1/64 scopeid 0x1
en5: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    ether ac:de:48:00:11:22
    inet6 fe80::aede:48ff:fe00:1122/64 scopeid 0x4
en0: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    ether f8:ff:c2:46:d9:33
    inet6 fe80::1827:562c:8e41:aab6/64 secured scopeid 0x6
    inet 192.168.1.44/24 brd 192.168.1.255 en0
awdl0: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    ether f6:85:4b:cc:5a:ed
    inet6 fe80::f485:4bff:fecc:5aed/64 scopeid 0x7
llw0: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    ether f6:85:4b:cc:5a:ed
    inet6 fe80::f485:4bff:fecc:5aed/64 scopeid 0x8
utun0: flags=8051<UP,POINTOPOINT,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::fb4a:b95c:c3a1:b039/64 scopeid 0xe
utun1: flags=8051<UP,POINTOPOINT,RUNNING,MULTICAST> mtu 1380
    inet6 fe80::1bbe:8014:f09a:a8c4/64 scopeid 0xf
utun2: flags=8051<UP,POINTOPOINT,RUNNING,MULTICAST> mtu 2000
    inet6 fe80::c49c:e6df:a0d7:c024/64 scopeid 0x10
utun3: flags=8051<UP,POINTOPOINT,RUNNING,MULTICAST> mtu 1000
    inet6 fe80::ce81:b1c:bd2c:69e/64 scopeid 0x11
```

- 1) the IP address of the network I am currently connected to is 192.168.1.44, from en0.
- 2) Subnet of en0 is /24, which is 255.255.255.0
- 3) The network address I am connected to is 192.168.1.0. I used bitmask my ip address and subnet.
- 4) Broadcast Address is 192.168.1.255
- 5) There are 256 addresses in total, 2 of these are reserved for network and broadcast addresses. So, there are room for 254 devices.

Part 3. Simulations with Cisco Packet Tracer

1)



2)

Devices:

- Headquarters: 30 devices
- Branch A: 20 devices
- Branch B: 15 devices
- Branch C: 25 devices

Options for ip addresses:

- Option I: 192.168.1.0/24
- **Option II: 10.0.0.0/16**
- Option III: 172.16.0.0/20

For now, any option is enough to contain 90 devices. Subnet of option 2 has 16 bites and 16 bites for host part. When we are adding branches, bits from 16 to 24 are occupied and when we are adding hosts, last 8 bits are occupied. By using option 2, we can add many branches and many host devices for future use. Option 1 doesn't allow for new branches and option 3 has allowance for less branches than option 2.

3) there can be 256 branches from 2^8 and each branch has 256 connections from 2^8 . 2 of them are reserved so there can be $256 - 2 = 254$ devices connected to each branch