Communication Networks 2

SS 2019

Assignment 3

Group 08

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1 Deliverables

1.1 Description of the solution

We used `nmap` to scan the network for hosts that would reply to pings. The other /16 IP addresses are ruled out by looking at the output of traceroute, i.e. which IPs act as routers and which act as hosts. We are operating on the Ethernet Layer in the local network, so packets are routed based on the MAC address (that is why the MAC Address doesn't change when a packet is routed to a different network).

If no hops occour between our host and a remote, we can make the assumption that they may be the same node (Listing 3). Only one hop and the same network therefore mean that this is the same node. To get an idea about the network layout, the `ping -R <IP>` command was used to record the routes to the IP adresses we found with `nmap` (Listing 4).

With these informations, the network diagram in Figure 1 can be established. The arrrows in the diagram represents, that we found at least one route in that direction.

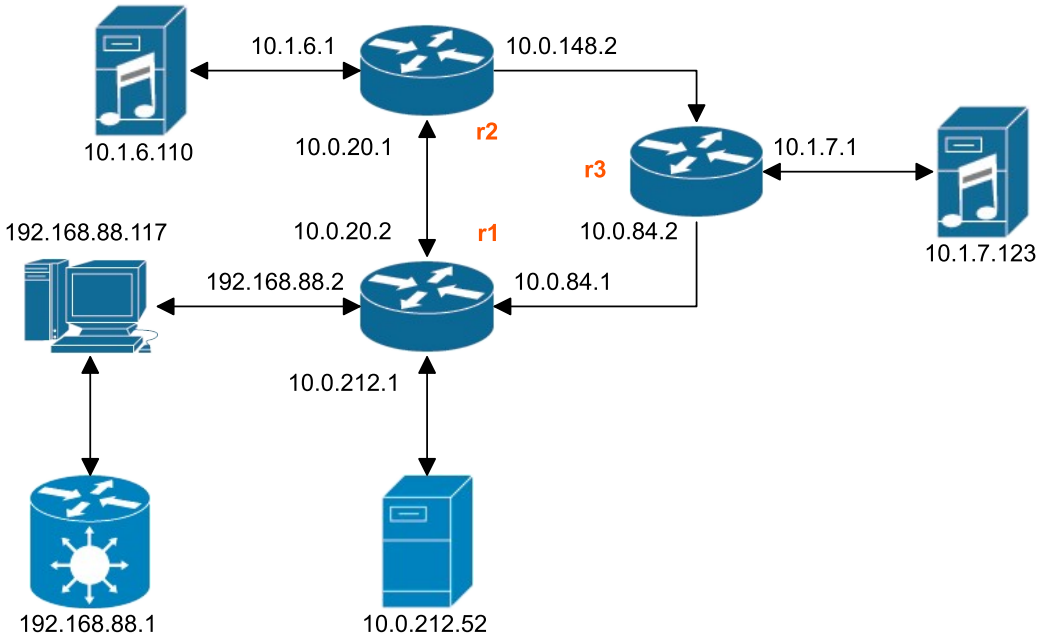

Figure 1: Diagram of the network and its different sub-networks

1.2 IP of the discovered host

The IP of the discovered host is `10.0.212.52`

1.3 Routing tables of the routers

The routing tables can be derived from the network diagram (Figure 1) and the discovered routes from and to our client (Listing 4) and is listed in Table 1. Since we have too less routing informations for `r2` and `r3`, we can not discover all routes.

Table 1: Routing table for our network

router	**destination**	**gateway**	**interface**	**hops**
r1	192.168.88.0/24	192.168.88.2	192.168.88.2	0
	10.0.20.0/24	10.0.20.2	10.0.20.2	0
	10.0.84.0/24	10.0.84.1	10.0.84.1	0
	10.0.212.0/24	10.0.212.1	10.0.212.1	0
	10.0.148.0/24	10.0.20.1	10.0.20.2	1
	10.1.6.0/24	10.0.20.1	10.0.20.2	1
	10.1.7.0/24	10.0.20.1	10.0.20.2	2
r2	10.0.6.0/24	10.1.6.1	10.1.6.1	0
	10.0.148.0/24	10.0.148.2	10.0.148.2	0
	10.0.20.0/24	10.0.20.1	10.0.20.1	0
	10.1.7.0/24	10.0.148.1	10.0.148.2	1
	10.0.212.0/24	10.0.20.2	10.0.20.1	1
	192.168.88.0/24	10.0.20.2	10.0.20.1	1
	10.0.84.0/24	*unknown*		
r3	10.1.7.0/24	10.1.7.1	10.1.7.1	0
	10.0.84.0/24	10.0.84.2	10.0.84.2	0
	10.0.148.0/24	10.0.148.1	10.0.148.1	0
	192.168.88.0/24	10.0.84.1	10.0.84.2	1
	10.0.212.0/24	10.0.84.1	10.0.84.2	1
	10.0.20.0/24	*unknown*		
	10.1.6.0/24	*unknown*		

1.4 Measured network parameters

The `ping` and `mtrace` tools are used to obtain information on the network, especially for the Landline and Satellite hosts. With `mtrace`, routers on the way of a packet are

discovered by limiting the hop limit of the packet and listening for their expiration message. Figures 3, 2 and Table 2 show the generated results. We can observe a more severe packet loss on the routers that are between our host and our remote. As the packet loss is way lower for packets that shall reach the remote host, we assume that some kind of rate limiting process is taking place in the routers (i.e. router is dropping ICMP packets to save resources). We observe that Landline experiences no packet loss while Satellite losses 4.2% of its packets. This is the main reason for the degraded QoS that was experienced in Assignment 2.

Table 2: Results from mtrace

Destination	Packet Loss [%]	Avg [ms]	Best [ms]	Worst [ms]	Standard Deviation
Satellite	4.2	961.5	939.8	2694	58.9
Landline	0	159.1	151.6	167.1	3.2
10.0.20.1	27.7	159.3	151.7	166.6	3.2
10.0.84.2	6.1	961.7	940.6	2794	63.0

```
                                My traceroute  [v0.92]
pc12 (192.168.88.112)                                              2019-05-21T11:19:53+0200
Keys:  Help   Display mode   Restart statistics   Order of fields   quit
                                                        Packets               Pings
 Host                                                Loss%   Snt   Last   Avg  Best  Wrst StDev
 1. border.cn2lab.cn.tuwien.ac.at                     0.0%   711    3.1   3.0   2.8   3.5   0.2
 2. 10.0.20.1                                        27.7%   710  159.8 159.3 151.7 166.6   3.2
 3. landline.cn2lab.cn.tuwien.ac.at                   0.0%   710  160.1 159.1 151.6 167.1   3.2
```

Figure 2: mtrace to Satellite

```
                                My traceroute  [v0.92]
pc12 (192.168.88.112)                                              2019-05-21T11:20:35+0200
Keys:  Help   Display mode   Restart statistics   Order of fields   quit
                                                        Packets               Pings
 Host                                                Loss%   Snt   Last   Avg  Best  Wrst StDev
 1. border.cn2lab.cn.tuwien.ac.at                    77.9%   961    3.3   3.0   2.8   6.7   0.3
 2. 10.0.20.1                                        57.4%   961  163.9 159.6 151.9 317.2   8.4
 3. 10.0.84.2                                         6.1%   961  964.8 961.7 940.6 2794.  63.0
 4. satellite.cn2lab.cn.tuwien.ac.at                  4.2%   960  949.5 961.5 939.8 2694.  58.9
```

Figure 3: mtrace to Landline

1.5 Graphical representation of the measured data (e.g. Histogram, CDF, ...)

#TODO: Generate Matlab Graphs that were already used in Assignment 2? Problem: No Wireshark dumps for this task, only ping data. *Use active testing tools to probe*

```
--- 10.1.7.123 ping statistics ---
2023 packets transmitted, 1902 received, 5.98122% packet loss, time 1004ms
rtt min/avg/max/mdev = 939.878/959.329/982.266/11.445 ms, pipe 5
```

Listing 1: Landline Network Parameters

```
--- 10.1.6.110 ping statistics ---
2364 packets transmitted, 2363 received, 0.0423012% packet loss, time 1105ms
rtt min/avg/max/mdev = 151.477/159.317/166.917/3.244 ms
```

Listing 2: Landline Network Parameters

the network path between your client and the multimedia services and generate reliable statistics(for links and end-to-end connections) for the QoS-relevant parameters. Display these statistics graphically.

1.6 Discussion of the results, comparing with the results from assignment 2

```
traceroute 192.168.88.2
 1 border.cn2lab.cn.tuwien.ac.at (192.168.88.2)

traceroute 10.0.20.2
 1 10.0.20.2 (10.0.20.2)

traceroute 10.0.20.1
 1 border.cn2lab.cn.tuwien.ac.at (192.168.88.2)
 2 10.0.20.1 (10.0.20.1)

traceroute 10.0.212.1
 1 10.0.212.1 (10.0.212.1)

traceroute 10.0.212.52
 1 border.cn2lab.cn.tuwien.ac.at (192.168.88.2)
 2 10.0.212.52 (10.0.212.52)

traceroute 10.1.6.1
 1 border.cn2lab.cn.tuwien.ac.at (192.168.88.2)
 2 10.1.6.1 (10.1.6.1)

traceroute 10.1.6.110
 1 border.cn2lab.cn.tuwien.ac.at (192.168.88.2)
 2 10.0.20.1 (10.0.20.1)
```

```
 3 landline.cn2lab.cn.tuwien.ac.at (10.1.6.110)

traceroute 10.0.84.1
 1 10.0.84.1 (10.0.84.1)

traceroute 10.0.84.2
 1 border.cn2lab.cn.tuwien.ac.at (192.168.88.2)
 2 10.0.20.1 (10.0.20.1)
 3 10.0.84.2 (10.0.84.2)

traceroute 10.1.7.1
 1 border.cn2lab.cn.tuwien.ac.at (192.168.88.2)
 2 10.0.20.1 (10.0.20.1)
 3 10.1.7.1 (10.1.7.1)

traceroute 10.1.7.123
 1 border.cn2lab.cn.tuwien.ac.at (192.168.88.2)
 2 10.0.20.1 (10.0.20.1)
 3 10.0.84.2 (10.0.84.2)
 4 satellite.cn2lab.cn.tuwien.ac.at (10.1.7.123)

traceroute 192.168.88.1
 1 cn2lab.cn.tuwien.ac.at (192.168.88.1)
```

Listing 3: Routes discovered by `traceroute <IP>`

```
ping -R 192.168.88.2:
    -> 192.168.88.112
    -> 192.168.88.2
    <- 192.168.88.2
    <- 192.168.88.112

ping -R 10.0.212.1:
    -> 192.168.88.112
    -> 10.0.212.1
    <- 10.0.212.1
    <- 192.168.88.112

ping -R 10.0.212.52:
    -> 192.168.88.112
    -> 10.0.212.1
    -> 10.0.212.52
    <- 10.0.212.52
    <- 192.168.88.2
    <- 192.168.88.112

ping -R 10.0.20.2:
    -> 192.168.88.112
    -> 10.0.20.2
    <- 10.0.20.2
```

```
    <- 192.168.88.112

ping -R 10.0.20.1:
    -> 192.168.88.112
    -> 10.0.20.2
    -> 10.0.20.1
    <- 10.0.20.1
    <- 192.168.88.2
    <- 192.168.88.112

ping -R 10.1.6.1:
    -> 192.168.88.112
    -> 10.0.20.2
    -> 10.1.6.1
    <- 10.1.6.1
    <- 192.168.88.2
    <- 192.168.88.112

ping -R 10.0.84.2:
    -> 192.168.88.112
    -> 10.0.20.2
    -> 10.0.148.2
    -> 10.0.84.2
    <- 10.0.84.2
    <- 192.168.88.2
    <- 192.168.88.112

ping -R 10.0.84.1:
    -> 192.168.88.112
    -> 10.0.84.1
    <- 10.0.84.1
    <- 192.168.88.112

ping -R 10.1.7.1:
    -> 192.168.88.112
    -> 10.0.20.2
    -> 10.0.148.2
    -> 10.1.7.1
    <- 10.1.7.1
    <- 192.168.88.2
    <- 192.168.88.112

ping -R 10.1.7.123:
    -> 192.168.88.112
    -> 10.0.20.2
    -> 10.0.148.2
    -> 10.1.7.1
    -> 10.1.7.123
    <- 10.1.7.123
    <- 10.0.84.2
    <- 192.168.88.2
    <- 192.168.88.112

ping -R 192.168.88.1:
```

```
    -> 192.168.88.112
    -> 192.168.88.1
    <- 192.168.88.1
    <- 192.168.88.112
```

Listing 4: Routes discovered by `ping -R <IP>`