

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 occur between our host and a remote, we can make the assumption that they may be the same node. 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 addresses we found with `nmap`.

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

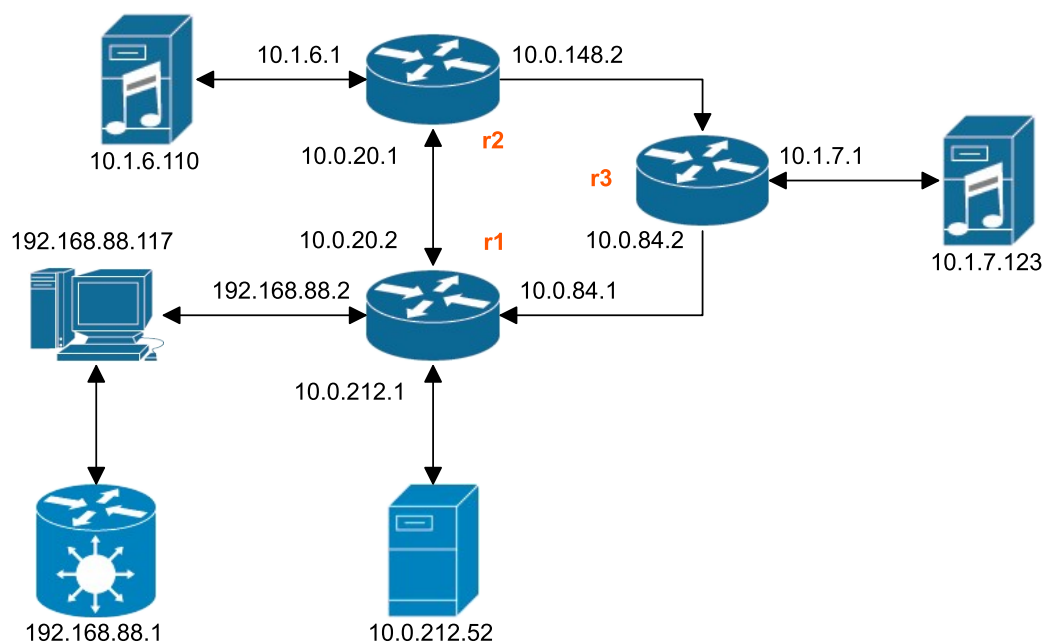


Figure 1: Diagram of the network and its different sub-networks

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 are listed in Table 1. Since we don't have enough routing information 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.x | 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 | <i>unknown</i> | | |
| 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.x | 10.0.148.x | 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 | <i>unknown</i> | | |
| | 10.1.6.0/24 | <i>unknown</i> | | |

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 loses 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

Host
1. border.cn2lab.cn.tuwien.ac.at
2. 10.0.20.1
3. landline.cn2lab.cn.tuwien.ac.at

Packets
Loss% Snt Last Avg Best Wrst StDev
0.0% 711 3.1 3.0 2.8 3.5 0.2
27.7% 710 159.8 159.3 151.7 166.6 3.2
0.0% 710 160.1 159.1 151.6 167.1 3.2
Pings

```

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

Host
1. border.cn2lab.cn.tuwien.ac.at
2. 10.0.20.1
3. 10.0.84.2
4. satellite.cn2lab.cn.tuwien.ac.at

Packets
Loss% Snt Last Avg Best Wrst StDev
77.9% 961 3.3 3.0 2.8 6.7 0.3
57.4% 961 163.9 159.6 151.9 317.2 8.4
6.1% 961 964.8 961.7 940.6 2794. 63.0
4.2% 960 949.5 961.5 939.8 2694. 58.9
Pings

```

Figure 3: mtrace to Landline

1.5 Graphical representation of the measured data

Figure 4 depicts the histograms of the ping times to all hosts in the network. It underlines the measured network parameters from Table 2.

```

--- 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

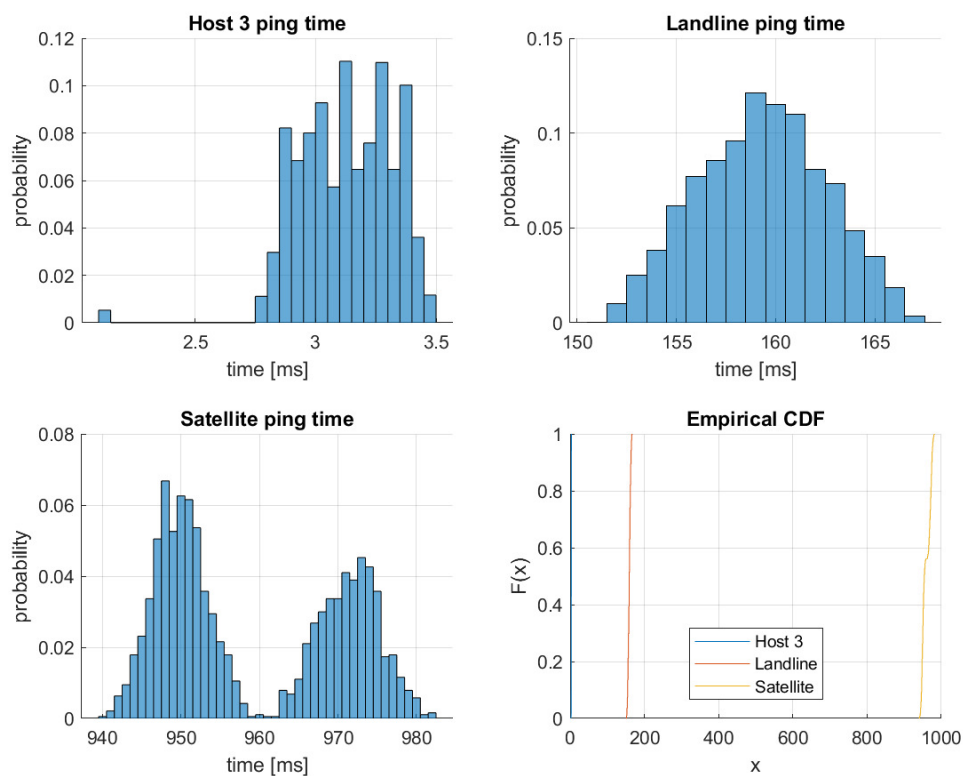


Figure 4: Ping times [ms] to the different hosts.

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

The measurements of this assignment back up the observations of assignment 2. Network performance of the subnets show that the landline sub-network is better (lower packet loss, lower latency) than the satellite sub-network.