

# Communication Networks 2

SS 2021

## Assignment 3

### Group 06

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# 1 Task description

## 2 Procedure

### 2.1 Host discovery with nmap

There are different techniques to discover active hosts on a network. One of them is the use of nmap, which is a free and open source tool for network discovery and security auditing. To find the missing host in 10.0.0.0/16 the following command was used:

```
$ nmap --privileged -sn -n -T5 --min-parallelism 100 --min-hostgroup 100 10.0.0.0/16
```

To speed up the discovery process, which can take very long time in large networks, multiple options were added to the bare nmap command `$ nmap 10.0.0.0/16`. This reduced the waiting time to 23 minutes, which is still quite long.

Table 1 shows the result of this nmap host discovery search in 10.1.0.0/8 and 10.0.0.0/8.

No.	Network	IP address	latency
1	10.0.0.0/8	10.0.4.1	0.0075s
2	10.0.0.0/8	10.0.4.2	0.23s
3	10.0.0.0/8	10.0.120.1	0.20s
4	10.0.0.0/8	10.0.120.2	0.0085s
5	10.0.0.0/8	10.0.132.1	0.024s
6	10.0.0.0/8	10.0.132.68	0.18s
7	10.0.0.0/8	10.0.248.1	0.78s
8	10.0.0.0/8	10.0.248.2	0.16s
9	10.1.0.0/8	10.1.6.1	0.18s
10	10.1.0.0/8	10.1.6.110	0.18s
11	10.1.0.0/8	10.1.7.1	1.5s
12	10.1.0.0/8	10.1.7.123	0.78s

Table 1: Discovered IP addresses

Later research and additional information showed that the 6th found IP address 10.0.132.68 belongs to the missing host.

## 2.2 Ping measurements

To identify which IP address belongs to the landline and satellite host a simple ping command was sent out to the according DNS names. `landline.cn2lab.cn.tuwien.ac.at` was resolved to `10.1.6.110` and `satellite.cn2lab.cn.tuwien.ac.at` to `10.1.7.123`.

In order to obtain information about the network topology and the Round Trip Time (RTT) and loss rate of each host, the ping command was used as well. For each IP address from table 1 the following command was adapted and executed:

```
$ ping -c 50 -R 10.1.7.123 > 10_1_7_123.txt
```

This delivered 50 individual measurements of the RRT which were then saved to a text file and are discussed in section 3.

With the `-R` the record route option was activated. That means all internet modules that route this message add their IP address to the IP option field. This method is better than just using the command `tracert` because here the reverse path is recorded as well.

Some recorded routes show that the reverse path can be different from the forward path. This is for example the recorded route of the satellite host:

```
RR:  pc18.cn2lab.cn.tuwien.ac.at (192.168.88.118)
     10.0.120.2 (10.0.120.2)
     10.0.248.2 (10.0.248.2)
     10.1.7.1 (10.1.7.1)
     satellite.cn2lab.cn.tuwien.ac.at (10.1.7.123)
     satellite.cn2lab.cn.tuwien.ac.at (10.1.7.123)
     10.0.4.2 (10.0.4.2)
     border.cn2lab.cn.tuwien.ac.at (192.168.88.2)
     pc18.cn2lab.cn.tuwien.ac.at (192.168.88.118)
```

## 2.3 Network topology

Using the data of the `nmap` and ping commands, the network topology could be identified and a network diagram created which can be seen in figure 1. Table 2 shows the routing tables of the three routers. Some entries could not be identified by just using the ping command on the lab pc.

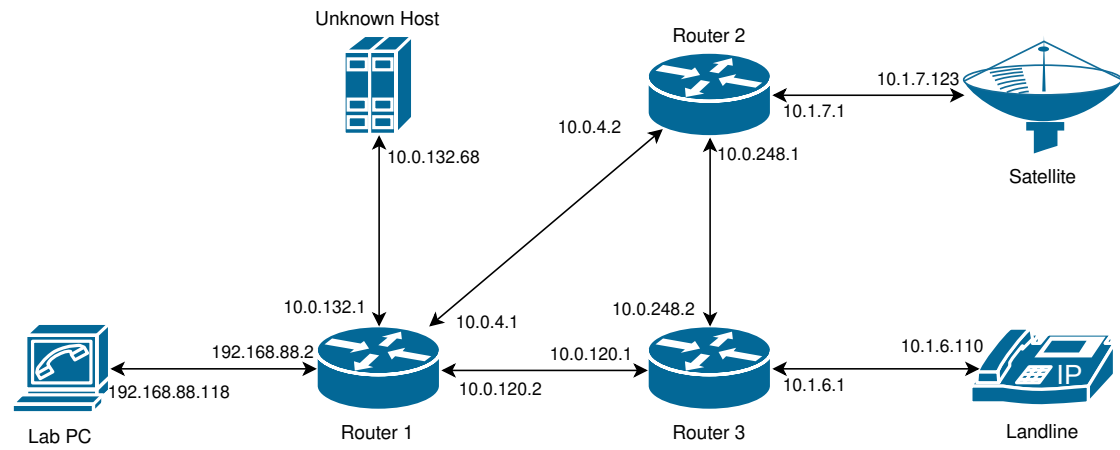


Figure 1: Network diagram

router	destination	via
r1	10.0.4.0/24	10.0.4.1
r1	10.0.120.0/24	10.0.120.2
r1	10.0.132.0/24	10.0.132.1
r1	10.0.248.0/24	10.0.120.2
r1	10.1.6.0/24	10.0.120.2
r1	10.1.7.0/24	10.0.120.2
r1	192.168.88.0/24	192.168.88.2
r2	10.0.4.0/24	-
r2	10.0.120.0/24	10.0.120.1
r2	10.0.132.0/24	-
r2	10.0.248.0/24	10.0.248.2
r2	10.1.6.0/24	10.1.6.1
r2	10.1.7.0/24	10.0.248.2
r2	192.168.88.0/24	10.0.120.1
r3	10.0.4.0/24	10.0.4.2
r3	10.0.120.0/24	-
r3	10.0.132.0/24	-
r3	10.0.248.0/24	10.0.248.1
r3	10.1.6.0/24	-
r3	10.1.7.0/24	10.0.7.1
r3	192.168.88.0/24	10.0.4.2

Table 2: Routing table

### 3 Data analysis and comparison

- Welche daten liefert ping
- Grafische Darstellung (besonders Vergleich von Landline und Satellite)
- Vergleich mit den gemessenen Daten von Task 2

One of the most important as metrics of a real-time communication like VoIP is the end-to-end ( $T_{EE}$ ) delay. In this context the ITU-T recommendation G.114 has classified the user acceptance for end-to-end delays in a VoIP call [**ITU-TRecommendationG.114**]:

End-to-End delay	User experience
$T_{EE} < 150$	acceptable for all users
$150 < T_{EE} < 300$	noticeable quality degradation, but still acceptable for most users
$T_{EE} \geq 300$	not acceptable

Table 3: Delay to user experience

To determine the one-way transmission time it is mandatory to divide the RRT value by two.

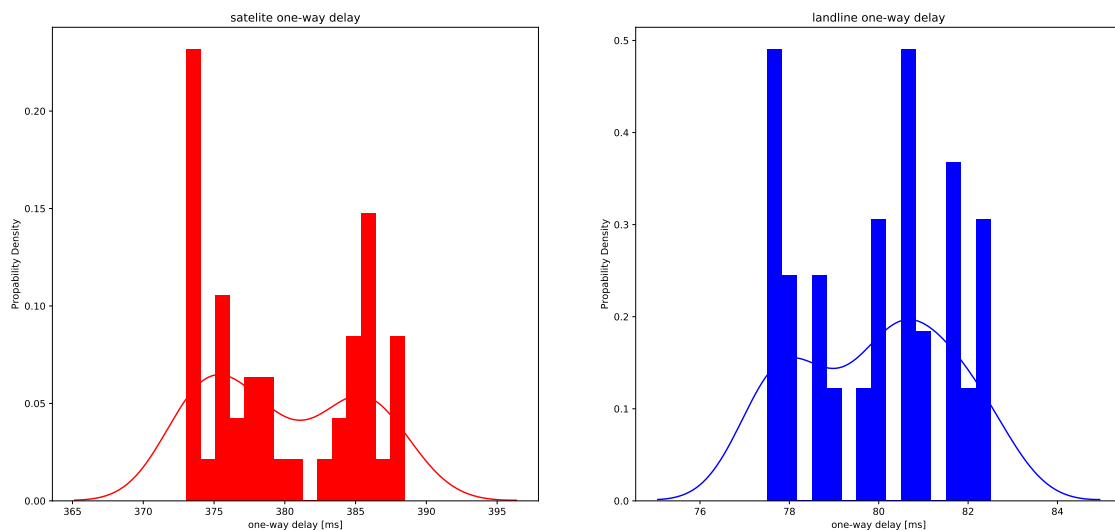


Figure 2: Propobility density of one way delay

## 4 Conclusion

Device	IP addresses	loss	avg. RTT
r1	10.0.120.2	0 %	8.116 ms
	10.0.4.1	0 %	8.117 ms
	10.0.132.1	0 %	8.164 ms
r2	10.0.120.1	0 %	163.019 ms
	10.0.248.2	0 %	160.040 ms
	10.1.6.1	0 %	160.757 ms
r3	10.0.4.2	0 %	163.382 ms
	10.0.248.1	6 %	759.654 ms
	10.1.7.1	8 %	759.357 ms
Satellite	10.1.7.123	6 %	759.713 ms
Landline	10.1.6.110	0 %	761.041 ms
Unknown host	10.0.132.68	0 %	8.189 ms

Table 4: Discovered IP addresses