Lab 03: Network

The exercises marked with * are obligatory to complete before the upcoming weeks lecture.

The purpose of this lab is to introduce tools that provide valuable information when working with networks. Additionally it enforces the students understanding of the layers in both the OSI and TCP/IP models.

Remember to write useful commands in your cheat sheets.

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Exercise 01*

In this exercise the student is going to use the Linux tools `ip` and `netstat`.

The tools are used to configure network interfaces, manipulating the routing table and showing network status.

`$ ip link` is used to show the devices interfaces.

`$ ip address` is used to show the ips that the devices interfaces hold.

`$ ip route` is used to show the networking routes of the device.

`$ netstat` is used to show current network connections.

Your tasks:

1. Examine the tools `ip link`, `ip address`, `ip route` and `netstat` and document their purposes and how they work.

The exercise will return the following message:

```
$ ip link
```

```
1: wlp0s20f3: <BROADCAST,MULTICAST,UP,LOWER_UP> state UP group default
    link/ether a3:12:03:ff:6c:c3 brd ff:ff:ff:ff:ff:ff
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> state UP group default
    link/ether ff:e0:4e:6a:ff:d5 brd ff:ff:ff:ff:ff:ff


$ ip address
1: wlp0s20f3: <BROADCAST,MULTICAST,UP,LOWER_UP> state UP group default
    link/ether a3:12:03:ff:6c:c3 brd ff:ff:ff:ff:ff:ff
    inet 10.94.100.100/24 brd 10.94.127.255 scope global wlp0s20f3
    inet6 fe80::7bed:a5b1:82d5:91ae/64 scope link noprefixroute
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP>  state UP group default
    link/ether ff:e0:4e:6a:ff:d5 brd ff:ff:ff:ff:ff:ff
    inet 192.168.10.11/24 scope global enx00e04e6a27d5
       valid_lft forever preferred_lft forever


$ ip route
default via 10.94.100.1 dev wlp0s20f3 proto dhcp metric 600
10.94.100.0/19 dev wlp0s20f3 kernel scope link src 10.94.100.100 metric 600
192.168.10.0/24 dev eth0 proto kernel scope link src 192.168.10.11

$ netstat
Active Internet connections (w/o servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0     64 192.168.10.11:ssh       192.168.10.10:56600     ESTABLISHED
```

Exercise 02*

In this exercise the group members are going to connect their computers either directly or through a switch. The students manually assign ip addresses and routes and try to visit a website hosted as a docker container on one of the machines.

Your tasks:

1. Connect your computer to a switch or directly to another computer.
2. Assign an ip address to your network interface.
3. Create a routing entry for routing communication to the new network.
4. Spin up the Docker compose from the previous exercise.
5. Let your group visit your website through your ip.

Exercise 03*

In this exercise the student is going to investigate the two network models (OSI and TCP/IP), explain how they work and what happens at each layer.

Your tasks:

1. Discuss the differences between the OSI model and the TCP/IP model
2. Which layers in the OSI model correspond to which layers in the TCP/IP model.
3. Take turns in explaining the different layers of the TCP/IP model to each other. What is the responsibility of the layer? What does it add/remove? How does addressing work on the layer? Do you know some details about how the layer is implemented?

Exercise 04*

In this exercise the student is going to explain how packages are sent over a network.

Your tasks:

1. Explain step by step how a package from *Computer A* with the ip 185.8.135.136 gets to *Computer B* with the ip 101.24.34.2.
2. Which layers (in the OSI model) does communication happen through?

Exercise 05

In this exercise the student is going to explain what Network Address Translation (NAT) is and how it works. You may have to research a little to answer the questions.

Your tasks:

1. Give an explanation to the following questions:
    a. What is NAT?
    b. Why is it useful?
    c. How does NAT work?

Exercise 06

In this exercise the student is going to describe what DHCP is and how it is useful.

Your tasks:

1. What is DHCP?
2. Where is it used?
3. What is it used for?

Exercise 07

In this exercise the student is going to explain the different zones found on a network.

Your tasks:

1. What are the different zones?
2. What is the internal zone?
3. What is the external zone?
4. What is the DMZ zone?