

Template Week 6 – Networking

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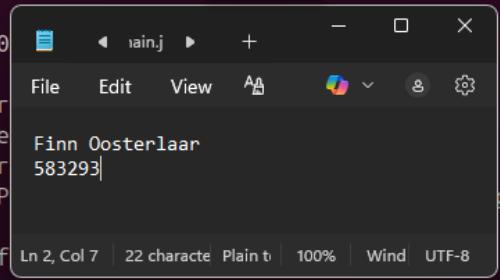
Assignment 6.1: Working from home

Screenshot installation openssh-server:

```
finn@finn-VMware-Virtual-Platform:~$ sudo apt install openssh-server -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
  liblvm19
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  ncurses-term openssh-client openssh-sftp-server ssh-import-id
Suggested packages:
  keychain libpam-ssh monkeysphere ssh-askpass molly-guard
The following NEW packages will be installed:
  ncurses-term openssh-server openssh-sftp-server
The following packages will be upgraded:
  openssh-client
1 upgraded, 4 newly installed, 0 to remove and 15
Need to get 1,738 kB of archives.
After this operation, 6,743 kB of additional disk space will be used.
Get:1 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-sftp-server amd64 1:9.6p1-3ubuntu13.14 [37.3 kB]
Get:2 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-server amd64 1:9.6p1-3ubuntu13.14 [906 kB]
Get:3 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-client amd64 1:9.6p1-3ubuntu13.14 [510 kB]
Get:4 http://nl.archive.ubuntu.com/ubuntu noble/main amd64 ncurses-term all 6.4+2024.0113-1ubuntu2 [275 kB]
Get:5 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 ssh-import-id all 5.11-0ubuntu2.24.04.1 [10.1 kB]
Fetched 1,738 kB in 0s (3,503 kB/s)
Preconfiguring packages ...
(Reading database ... 154692 files and directories currently installed.)
Preparing to unpack .../openssh-client_1%3a9.6p1-3ubuntu13.14_amd64.deb ...
Unpacking openssh-client (1:9.6p1-3ubuntu13.14) over (1:9.6p1-3ubuntu13.13) ...
Selecting previously unselected package openssh-sftp-server.
Preparing to unpack .../openssh-sftp-server_1%3a9.6p1-3ubuntu13.14_amd64.deb ...
Unpacking openssh-sftp-server (1:9.6p1-3ubuntu13.14) ...
Selecting previously unselected package openssh-server.
```

Screenshot successful SSH command execution:

```
finn@finn-VMware-Virtual-Platform:~$ sudo systemctl enable --now ssh
Synchronizing state of ssh.service with SysV service script with /usr/lib/systemd/sysv
stemd-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable ssh
Created symlink /etc/systemd/system/sshd.service → /usr/lib/systemd/system/ssh.servi
ce.
Created symlink /etc/systemd/system/multi-user.target.wants/ssh.service → /usr/lib/s
ystemd/system/ssh.service.
finn@finn-VMware-Virtual-Platform:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue st Add new tab 0WN group default ql
en 1000
    link/loopback 00:00:00:00:00:00 brd 00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft for
    inet6 ::1/128 scope host noprefixroute
        valid_lft forever preferred_lft for
2: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP>
    link/ether 00:0c:29:c4:5d:7a brd ff:ff
    altname enp2s1
    inet 192.168.139.132/24 brd 192.168.139.255 scope global dynamic noprefixroute e
ns33
        valid_lft 1712sec preferred_lft 1712sec
finn@finn-VMware-Virtual-Platform:~$
```



Put to this VM, click inside or press Ctrl+G.

The screenshot shows a terminal window with four tabs at the top: Home, Ubuntu 64-bit (ITF), Windows 11 x64, and Debian 12.x 64-bit (ITF). The active tab is 'Windows 11 x64'. The terminal output is as follows:

```
PS C:\Users\finn> ssh finn@192.168.139.132
The authenticity of host '192.168.139.132 (192.168.139.132)' can't be established.
ED25519 key fingerprint is SHA256:AYZejDQQc4m5LzBCIcG0m9pQ0melAdvxIPVaeNi5zUg.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.132' (ED25519) to the list of known hosts.
finn@192.168.139.132's password:
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-37-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

Expanded Security Maintenance for Applications is not enabled.

146 updates can be applied immediately.
11 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

17 additional security updates can be applied with ESM Apps.
Learn more about enabling ESM Apps service at https://ubuntu.com/esm

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

finn@finn-VMware-Virtual-Platform:~$
```

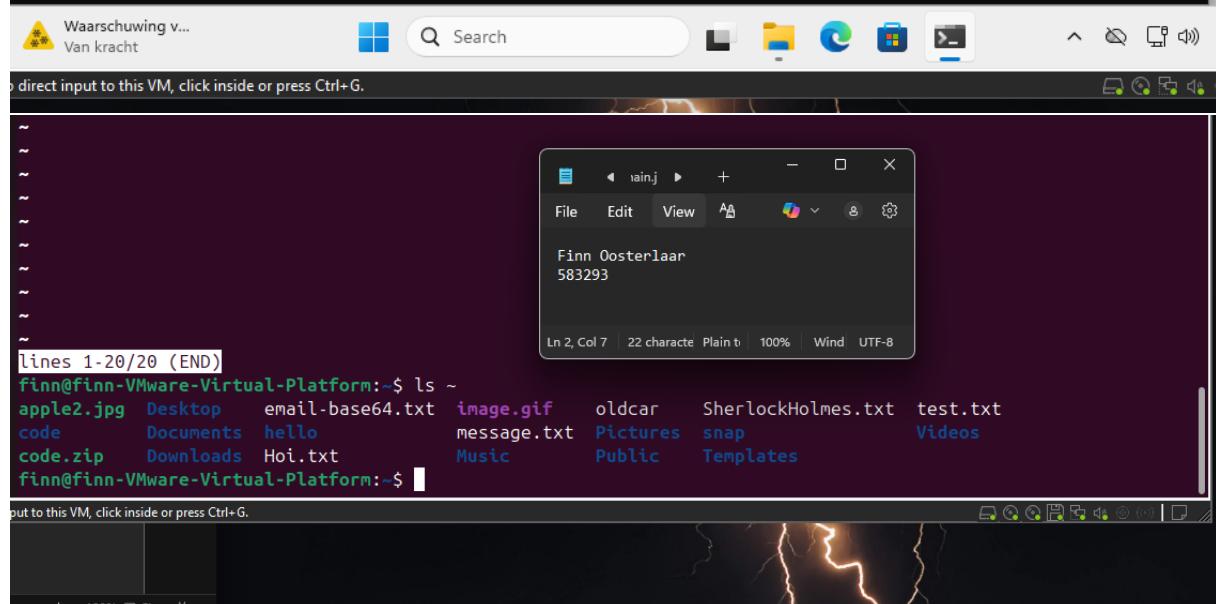
Screenshot successful execution SCP command:

```
PS C:\Users\finn> cd Documents
PS C:\Users\finn\Documents> dir

Directory: C:\Users\finn\Documents

Mode                LastWriteTime         Length Name
----                ——————          ——— —
-a---       1/7/2026   6:10 PM           3 Hoi.txt

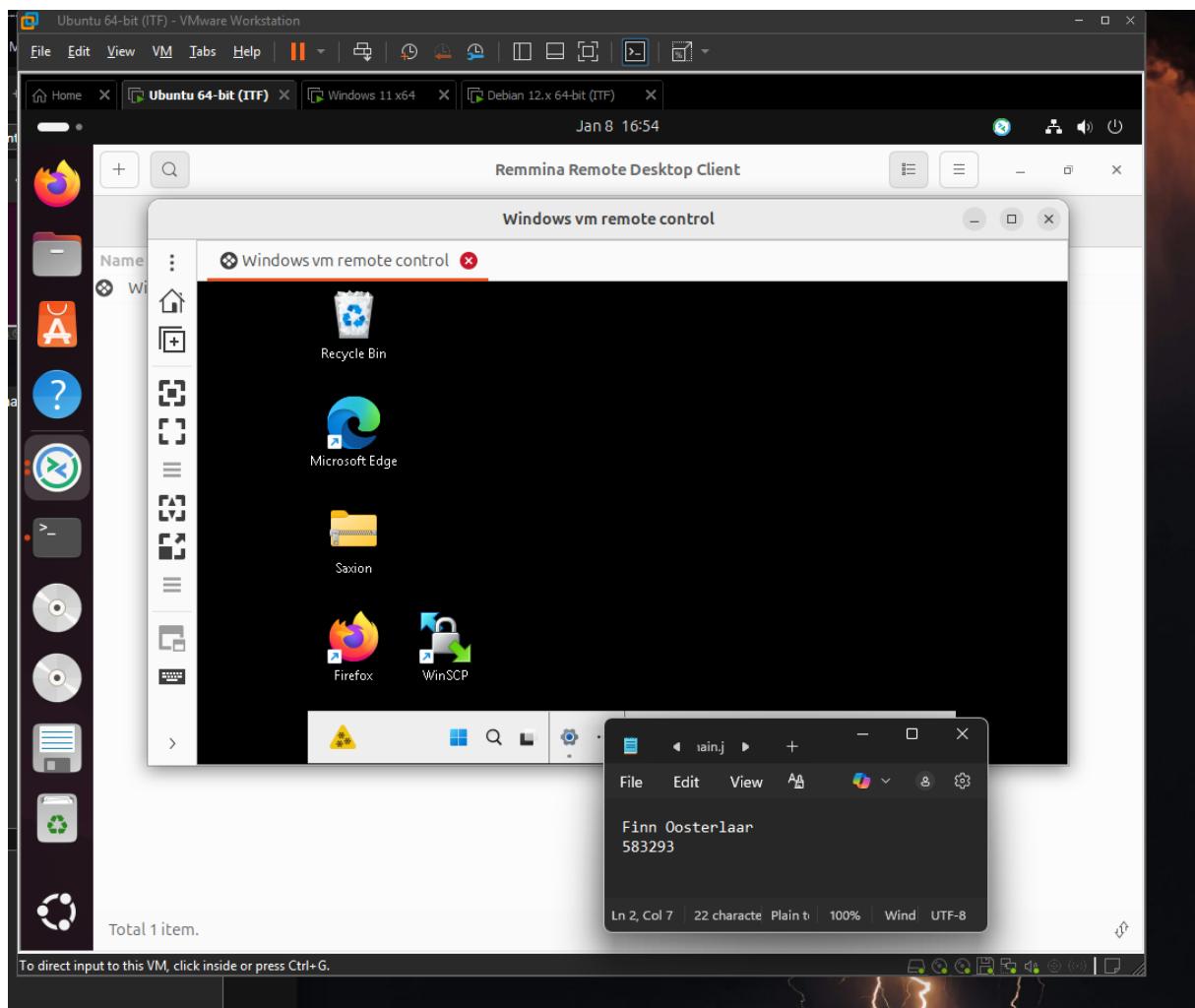
PS C:\Users\finn\Documents> scp Hoi.txt finn@192.168.139.132:/home/finn/
finn@192.168.139.132's password:
Hoi.txt                                         100%    3      1.5KB/s  00:00
PS C:\Users\finn\Documents>
```



De eerste screenshot laat zien dat ik op mijn windows vm het bestand Hoi.txt stuur naar de ubuntu vm via ssh.

De tweede screenshot laat het bestand Hoi.txt zien op de ubuntu vm.

Screenshot remmina:



Assignment 6.2: IP addresses websites

Relevant screenshots nslookup command:

To direct input to this VM, click inside or press Ctrl+G.

```
Ubuntu 64-bit (ITF) - VMware Workstation
File Edit View VM Tabs Help || Windows 11 x64 | Debian 12.x 64-bit (ITF)

Home X Ubuntu 64-bit (ITF) X Windows 11 x64 X Debian 12.x 64-bit (ITF)

fnn@finn-VMware-Virtual-Platform:~$ nslookup amazon.com
Server: 127.0.0.53
Address: 127.0.0.53#53

Non-authoritative answer:
Name: amazon.com
Address: 98.82.161.185
Name: amazon.com
Address: 98.87.176.74
Name: amazon.com
Address: 98.87.176.71

fnn@finn-VMware-Virtual-Platform:~$ nslookup google.com
Server: 127.0.0.53
Address: 127.0.0.53#53

Non-authoritative answer:
Name: google.com
Address: 142.258.179.174
Name: google.com
Address: 2a00:14:80e:803::200e

fnn@finn-VMware-Virtual-Platform:~$ nslookup one.one.one.one
Server: 127.0.0.53
Address: 127.0.0.53#53

Non-authoritative answer:
Name: one.one.one.one
Address: 1.0.0.1
Name: one.one.one.one
Address: 1.1.1.1
Name: one.one.one.one
Address: 2606:4700:4700::1001
Name: one.one.one.one
Address: 2606:4700:4700::1111

fnn@finn-VMware-Virtual-Platform:~$ nslookup dns.google.com
Server: 127.0.0.53
Address: 127.0.0.53#53

Non-authoritative answer:
Name: dns.google.com
Address: 8.8.8.8
Name: dns.google.com
Address: 8.8.4.4
Name: dns.google.com
Address: 2001:4860:4860::8888
Name: dns.google.com
Address: 2001:4860:4860::8844

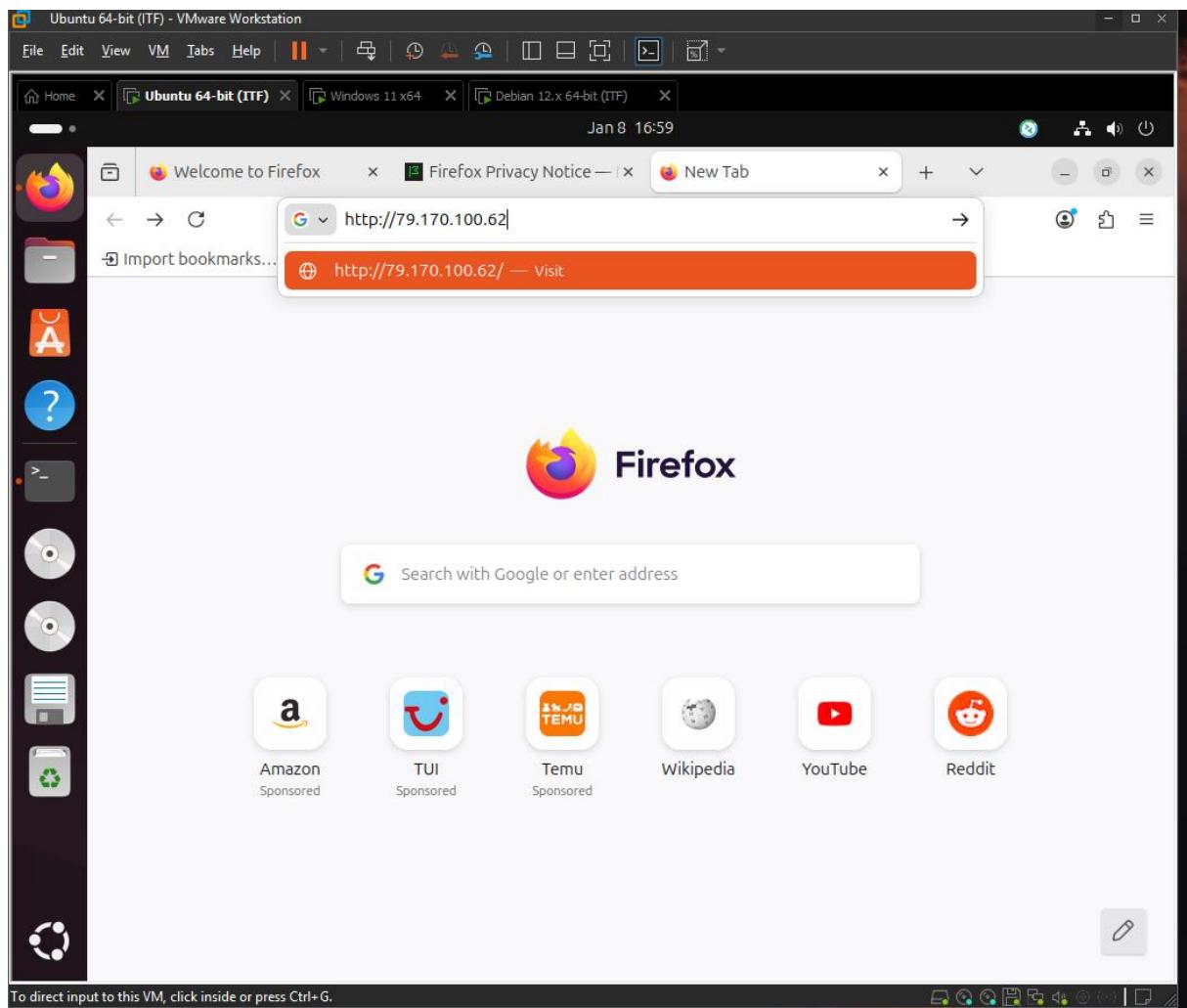
fnn@finn-VMware-Virtual-Platform:~$ nslookup bol.com
Server: 127.0.0.53
Address: 127.0.0.53#53

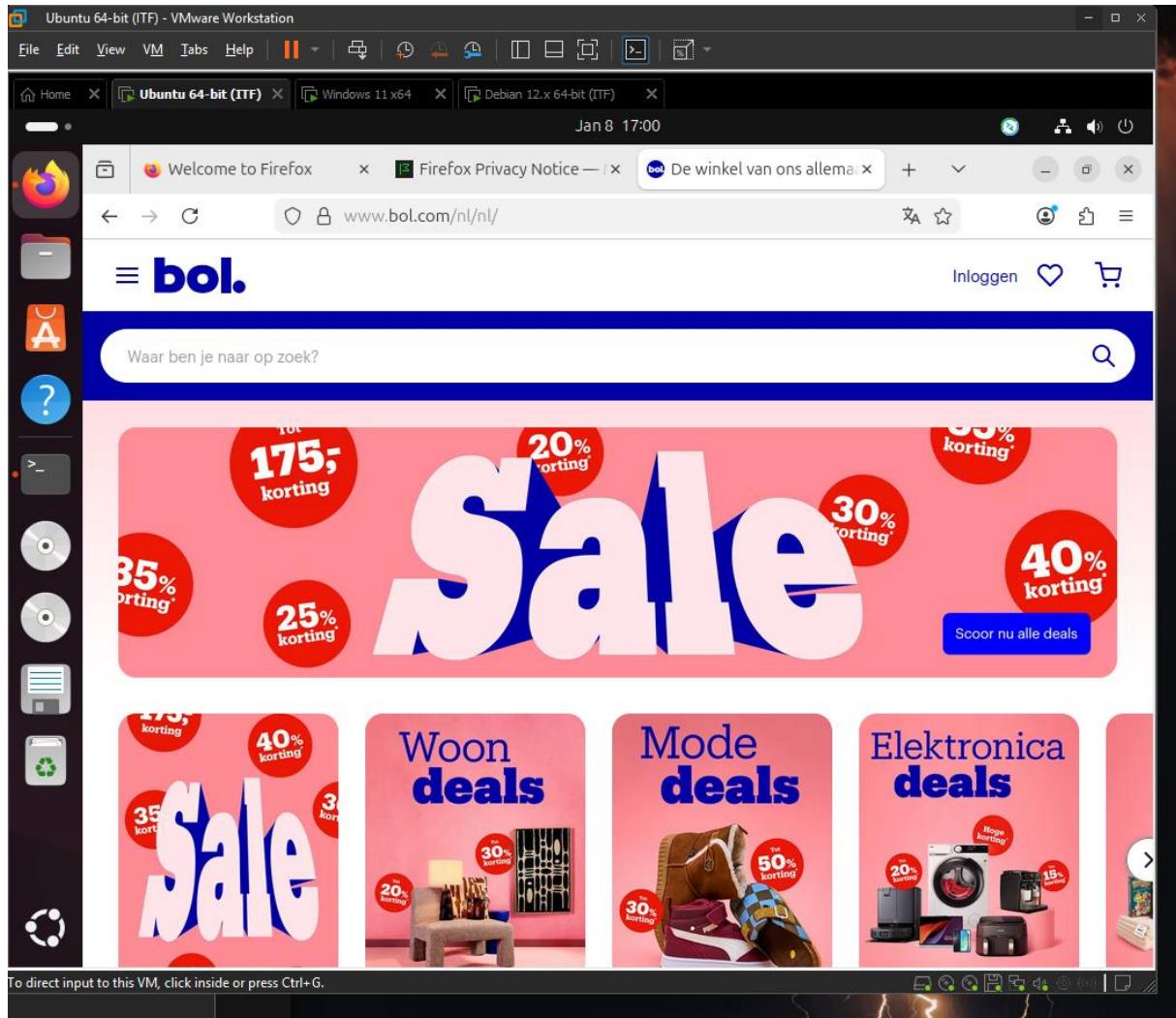
Non-authoritative answer:
Name: bol.com
Address: 79.170.100.62

fnn@finn-VMware-Virtual-Platform:~$ nslookup w3schools.com
Server: 127.0.0.53
Address: 127.0.0.53#53

Non-authoritative answer:
Name: w3schools.com
```

Screenshot website visit via IP address:





Assignment 6.3: subnetting

How many IP addresses are in this network configuration 192.168.110.128/25?

De /25 betekent dat er 7 bits over zijn voor hosts. Dus er zijn $2^{7} = 128$ ip adressen.

What is the usable IP range to hand out to the connected computers?

192.168.110.128 en 192.168.110.225 zijn niet te gebruiken voor aangesloten computers aangezien die door het netwerk zelf gebruikt worden. Dat betekent dat de ip adressen van 192.168.110.129 tot en met 192.168.110.254 bruikbaar zijn. Dus 126 bruikbare ip adressen.

Check your two previous answers with this Linux command: `ipcalc 192.168.110.128/25`

```

finn@finn-VMware-Virtual-Platform:~$ ipcalc 192.168.110.128/25
Address: 192.168.110.128      11000000.10101000.01101110.1 00000000
Netmask: 255.255.255.128 = 25 11111111.11111111.11111111.1 00000000
Wildcard: 0.0.0.127          00000000.00000000.00000000.0 11111111
=>
Network: 192.168.110.128/25  11000000.10101000.01101110.1 00000000
HostMin: 192.168.110.129    11000000.10101000.01101110.1 00000001
HostMax: 192.168.110.254    11000000.10101000.01101110.1 11111110
Broadcast: 192.168.110.255  11000000.10101000.01101110.1 11111111
Hosts/Net: 126              Class C, Private Internet

```

```

Finn Oosterlaar
583293

```

Explain the above calculation in your own words.

Bij een /25 netwerk wordt het normale /24 netwerk in twee gelijke delen gesplitst. Daardoor blijven er dus 7 bits over voor de hostadressen. Daarom heb je dus 128 IP adressen waarvan er twee gereserveerd zijn, een voor het netwerk en een voor het broadcasten van het netwerk. De rest kun je dus andere apparaten aan koppelen binnen je netwerk.

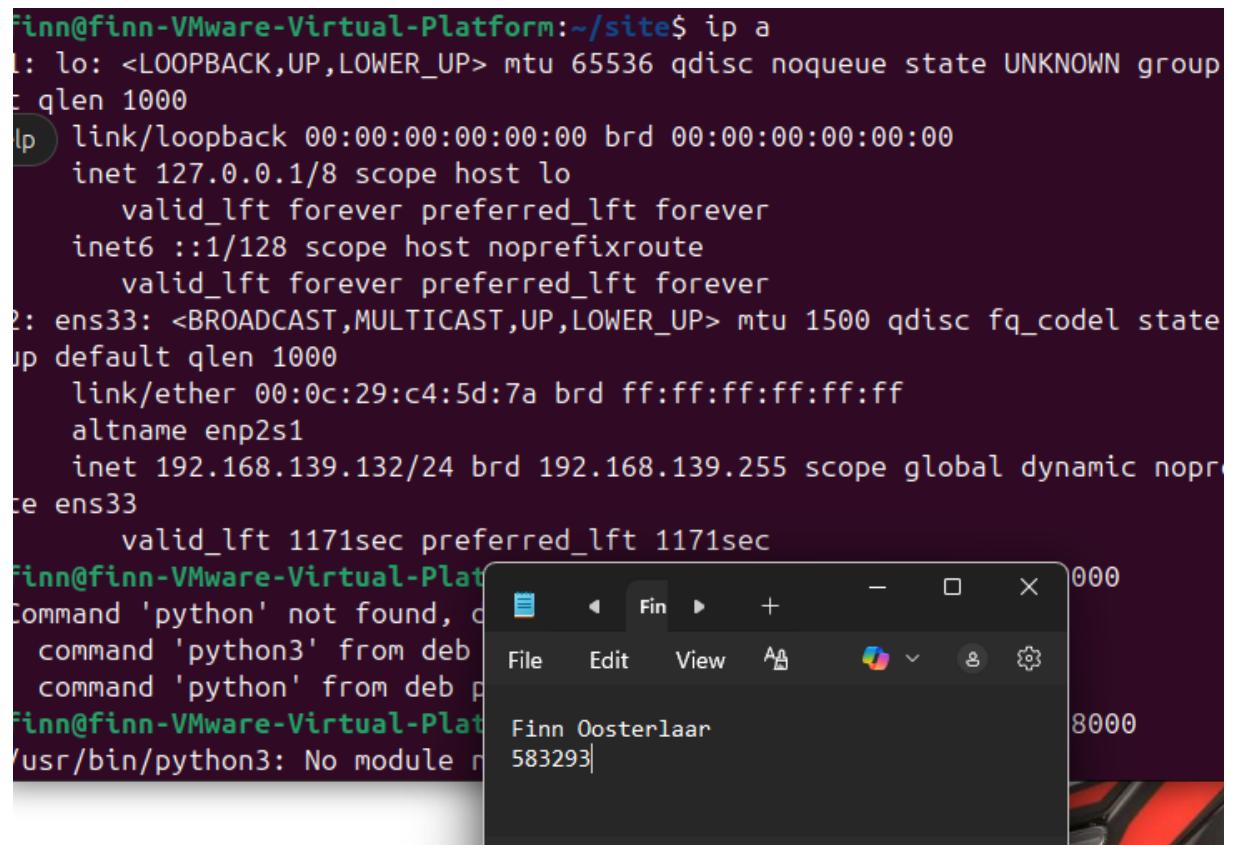
Assignment 6.4: HTML

Screenshot IP address Ubuntu VM:

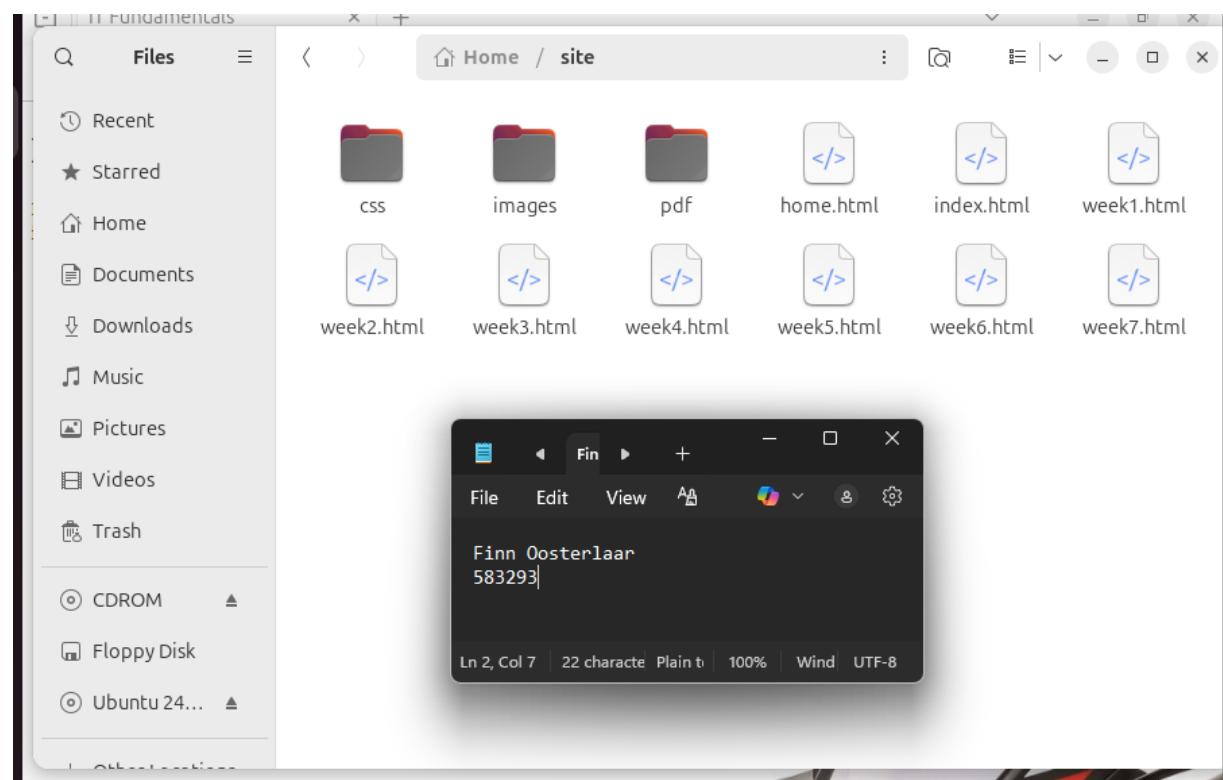
```

Finn@finn-Virtual-Platform:~/site$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group
  qlen 1000
  link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
      valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host noprefixroute
      valid_lft forever preferred_lft forever
2: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state
  up default qlen 1000
  link/ether 00:0c:29:c4:5d:7a brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.139.132/24 brd 192.168.139.255 scope global dynamic nopro
  te ens33
      valid_lft 1171sec preferred_lft 1171sec
Finn@finn-Virtual-Platform:~/site$ command 'python' not found, o
  command 'python3' from deb
  command 'python' from deb p
Finn@finn-Virtual-Platform:~/site$ /usr/bin/python3: No module n

```



Screenshot of Site directory contents:

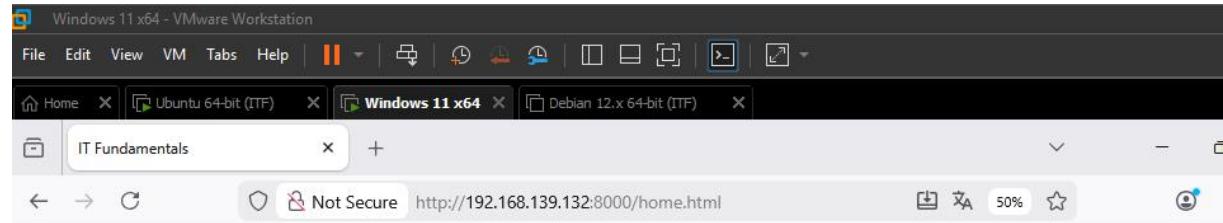


Screenshot python3 webserver command:

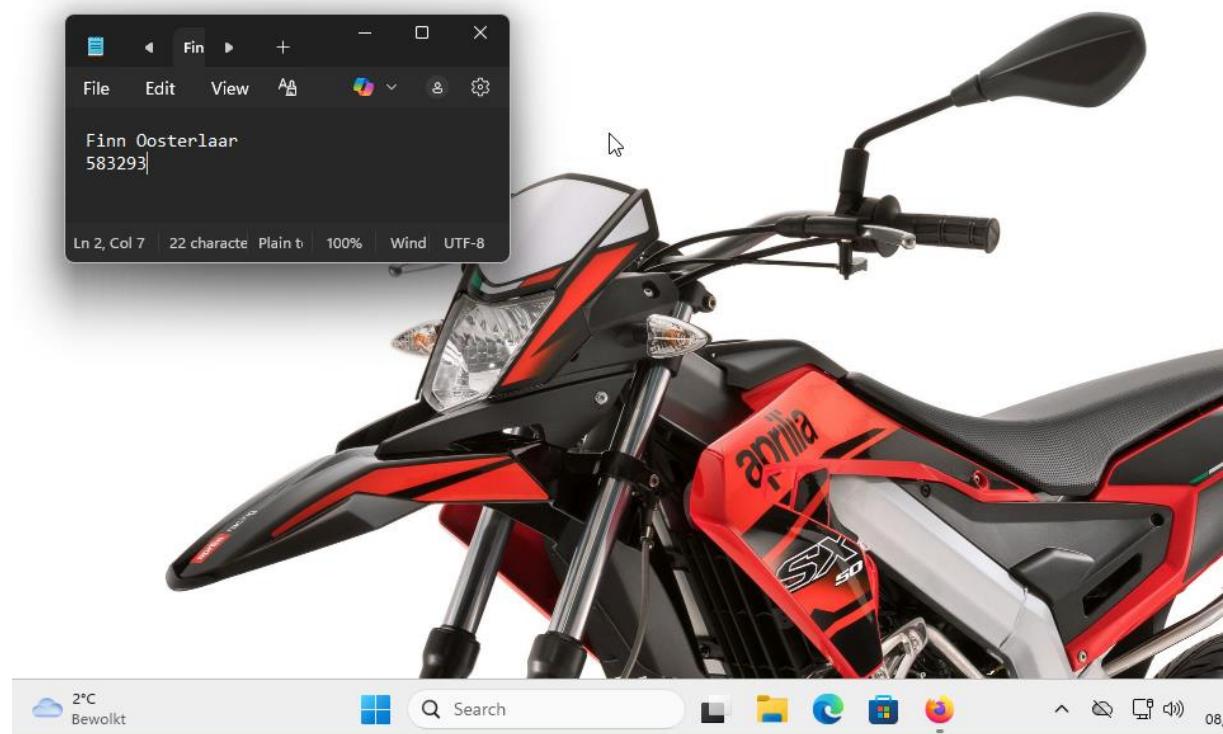
```
finn@finn-VMware-Virtual-Platform:~/site$ python3 -m http.server 8000
Serving HTTP on 0.0.0.0 port 8000 (http://0.0.0.0:8000/) ...
```



Screenshot web browser visits your site



Brommers kiekn is mijn hobby
Hoi hoi, mijn hobby is aan brommers sleutelen en er op rijden. Hieronder kan je dezelfde brommer zien die ik ook heb. Hoewel die van mij wel iets gemodificeerd is natuurlijk.



Assignment 6.5: Network segment

Remember that bitwise java application you've made in week 2? Expand that application so that you can also calculate a network segment as explained in the PowerPoint slides of week 6. Use the bitwise & AND operator. You need to be able to input two Strings. An IP address and a subnet.

IP: 192.168.1.100 and subnet: 255.255.255.224 for /27

Example: 192.168.1.100/27
Calculate the network segment
IP Address: 11000000.10101000.00000001.01100100
Subnet Mask: 11111111.11111111.11111111.11100000

Network Addr: 11000000.10101000.00000001.01100000

This gives 192.168.1.96 in decimal as the network address.
For a /27 subnet, each segment (or subnet) has 32 IP addresses (2^5).
The range of this network segment is from 192.168.1.96 to 192.168.1.127.

Paste source code here, with a screenshot of a working application.

```
import java.util.Scanner;
```

```
public class Main {
```

```
    public static void main(String[] args) {
```

```
        Scanner scanner = new Scanner(System.in);
```

```
        int choice;
```

```
        System.out.println("==> Bit Calculations Program ==<");
```

```
        do {
```

```
            System.out.println("\nMenu:");
```

```
            System.out.println("1. Is number odd?");
```

```
            System.out.println("2. Is number a power of 2?");
```

```
            System.out.println("3. Two's complement");
```

```
            System.out.println("5. Calculate network segment");
```

```
            System.out.println("4. Exit");
```

```
            System.out.print("Choose option: ");
```

```
            choice = scanner.nextInt();
```

```

switch (choice) {

    case 1:
        System.out.print("Enter number: ");
        System.out.println("Odd? " + isOdd(scanner.nextInt()));
        break;

    case 2:
        System.out.print("Enter number: ");
        System.out.println("Power of 2? " + isPowerOfTwo(scanner.nextInt()));
        break;

    case 3:
        System.out.print("Enter number: ");
        System.out.println("Two's complement: " +
                           twoComplement(scanner.nextInt()));
        break;

    case 5:
        int[] ip = new int[4];
        int[] subnet = new int[4];

        System.out.println("Enter IP address (4 numbers):");
        for (int i = 0; i < 4; i++) {
            ip[i] = scanner.nextInt();
        }

        System.out.println("Enter subnet mask (4 numbers):");
        for (int i = 0; i < 4; i++) {
            subnet[i] = scanner.nextInt();
        }
}

```

```

        int[] network = calculateNetwork(ip, subnet);

        System.out.println("Network address: "
            + network[0] + "." + network[1] + "."
            + network[2] + "." + network[3]);

        break;

    case 4:
        System.out.println("Exiting...");
        break;

    default:
        System.out.println("Invalid option!");

    }

} while (choice != 4);

scanner.close();

}

//week 2 methoden

public static boolean isOdd(int number) {
    return (number & 1) == 1;
}

public static boolean isPowerOfTwo(int number) {
    return number > 0 && (number & (number - 1)) == 0;
}

```

```

public static int twosComplement(int number) {
    return (~number) + 1;
}

// week 6 uitbreiding

public static int[] calculateNetwork(int[] ip, int[] subnet) {
    int[] network = new int[4];
    for (int i = 0; i < 4; i++) {
        network[i] = ip[i] & subnet[i];
    }
    return network;
}

```

```

finn@finn-VMware-Virtual-Platform:~/java$ javac Main.java
finn@finn-VMware-Virtual-Platform:~/java$ java Main
==> Bit Calculations Program ==

Menu:
1. Is number odd?
2. Is number a power of 2?
3. Two's complement
4. Calculate network segment
5. Exit
Choose option: 5
Enter IP address (4 numbers):
192 168 1 100
Enter subnet mask (4 numbers):
255 255 255 224
Network address: 192.168.1.96

```

Ready? Save this file and export it as a pdf file with the name: [week6.pdf](#)