

# Template Week 6 – Networking

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## Assignment 6.1: Working from home

Screenshot installation openssh-server:

```
charbel@helpdesk:~$ sudo apt update
[sudo] password for charbel:
charbel@helpdesk:~$ sudo apt install openssh-server -y
charbel@helpdesk:~$ sudo systemctl enable --now ssh
Synchronizing state of ssh.service with SysV service script with /usr/lib/systemd/systemd-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable ssh
Created symlink /etc/systemd/system/sshd.service → /usr/lib/systemd/system/ssh.service.
Created symlink /etc/systemd/system/multi-user.target.wants/ssh.service → /usr/lib/systemd/system/ssh.service.
charbel@helpdesk:~$ systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
    Loaded: loaded (/usr/lib/systemd/system/ssh.service; enabled; preset: enabled)
      Active: active (running) since Tue 2026-01-06 22:39:54 CET; 14s ago
     TriggeredBy: ● ssh.socket
       Docs: man:sshd(8)
              man:sshd_config(5)
    Process: 4803 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCESS)
   Main PID: 4805 (sshd)
      Tasks: 1 (limit: 4545)
     Memory: 1.2M (peak: 1.6M)
        CPU: 39ms
       CGroup: /system.slice/ssh.service
               └─4805 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Jan 06 22:39:54 helpdesk systemd[1]: Starting ssh.service - OpenBSD Secure Shell server...
Jan 06 22:39:54 helpdesk sshd[4805]: Server listening on 0.0.0.0 port 22.
Jan 06 22:39:54 helpdesk sshd[4805]: Server listening on :: port 22.
Jan 06 22:39:54 helpdesk systemd[1]: Started ssh.service - OpenBSD Secure Shell server.
charbel@helpdesk:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default 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 group default qlen 1000
    link/ether 00:0c:29:7f:b8:8a brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.139.135/24 brd 192.168.139.255 scope global dynamic noprefixroute ens33
        valid_lft 1612sec preferred_lft 1612sec
    inet6 fe80::20c:29ff:fe7f:b88a/64 scope link
        valid_lft forever preferred_lft forever
charbel@helpdesk:~$
```

Screenshot successful SSH command execution:

```
C:\Users\charbel>ssh charbel@192.168.139.135
charbel@192.168.139.135'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

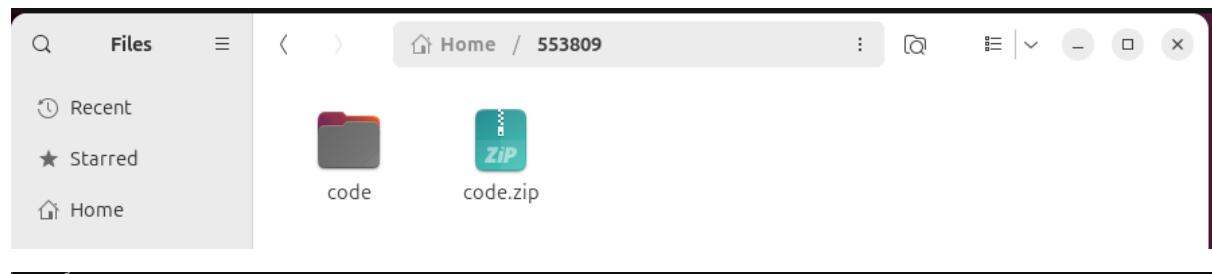
Expanded Security Maintenance for Applications is not enabled.

144 updates can be applied immediately.
4 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

Last login: Tue Jan  6 22:45:08 2026 from 192.168.139.132
charbel@helpdesk:~$
```

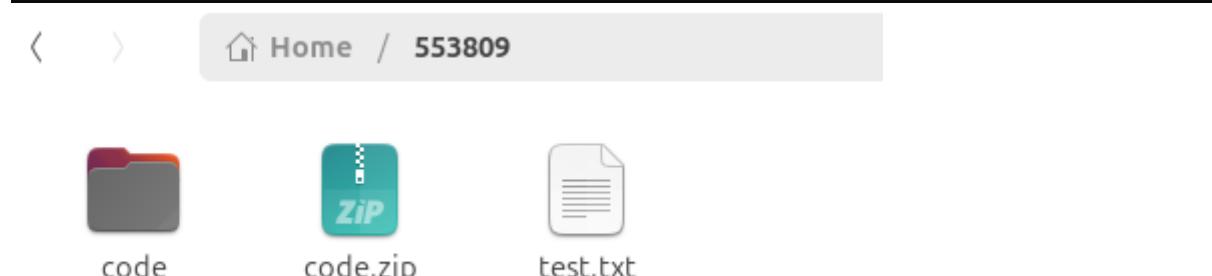
Screenshot successful execution SCP command:



The screenshot shows a file manager interface with a sidebar on the left containing 'Recent' and 'Starred' sections, and a 'Home' button. In the main area, there are two files: 'code' (represented by a folder icon) and 'code.zip' (represented by a ZIP archive icon).

```
charbel@helpdesk:~$ scp test.txt charbel@192.168.139.135:/home/charbel/
The authenticity of host '192.168.139.135 (192.168.139.135)' can't be established.
ED25519 key fingerprint is SHA256:J6Qx3H8fm/9+KaIeyXLbeaGURSK0W1M53DxDj6WfQ.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.139.135' (ED25519) to the list of known hosts.
charbel@192.168.139.135's password.
test.txt
100%    5      4.9KB/s   00:00
charbel@helpdesk:~$ |
```

```
charbel@helpdesk:~$ scp test.txt charbel@192.168.139.135:/home/charbel/553809/
charbel@192.168.139.135's password:
test.txt
100%    5      6.2KB/s   00:00
```



The screenshot shows a file manager interface with a sidebar on the left containing 'Recent' and 'Starred' sections, and a 'Home' button. In the main area, there are three files: 'code' (represented by a folder icon), 'code.zip' (represented by a ZIP archive icon), and 'test.txt' (represented by a document icon).

Screenshot remmina:

```
charbel@helpdesk:~$ sudo apt install remmina remmina-plugin-rdp
[...]
```

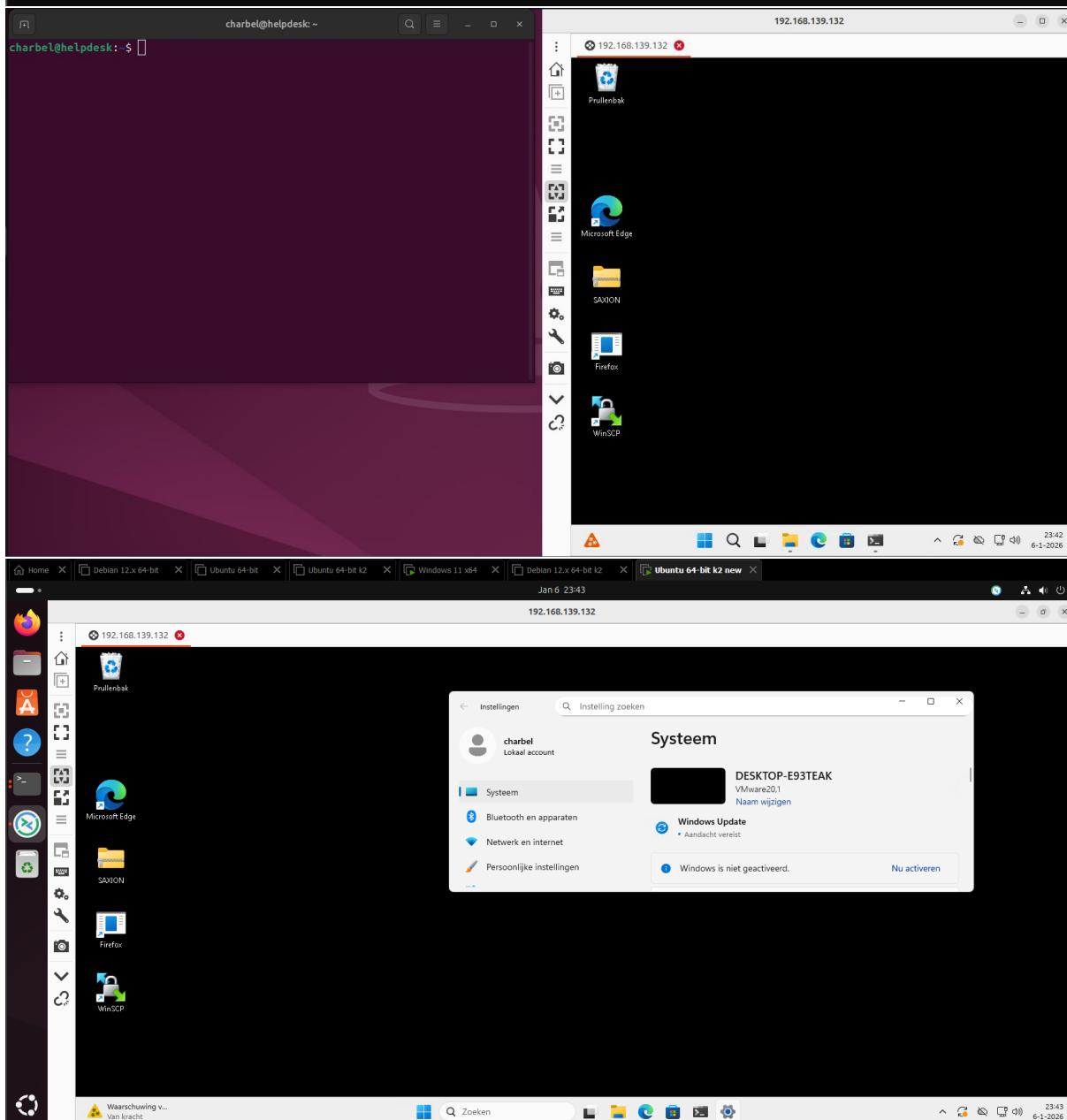
```
C:\Users\charbel>ipconfig
```

### Windows IP Configuration

#### Ethernet adapter Ethernet0:

```
Connection-specific DNS Suffix . : localdomain
Link-local IPv6 Address . . . . . : fe80::d734:cc82:5934:283b%3
IPv4 Address . . . . . : 192.168.139.132
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.139.2
```

```
C:\Users\charbel>
```

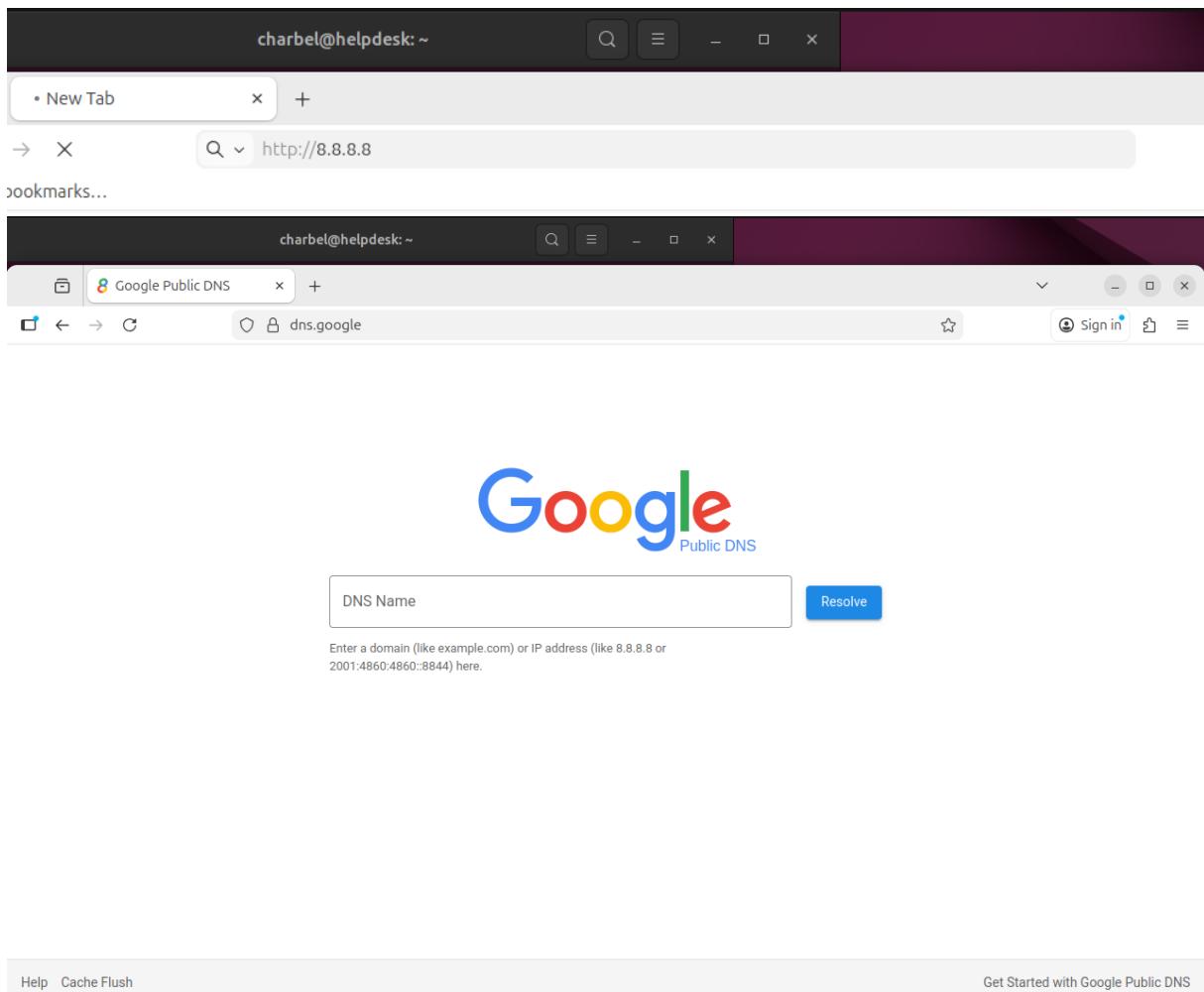


### Assignment 6.2: IP addresses websites

Relevant screenshots nslookup command:

<pre>charbel@helpdesk:~\$ nslookup &gt; amazon.com Server:          127.0.0.53 Address:         127.0.0.53#53  Non-authoritative answer: Name:   amazon.com Address: 98.87.170.74 Name:   amazon.com Address: 98.82.161.185 Name:   amazon.com Address: 98.87.170.71 &gt; google.com Server:          127.0.0.53 Address:         127.0.0.53#53  Non-authoritative answer: Name:   google.com Address: 142.250.179.174 Name:   google.com Address: 2a00:1450:400e:802::200e &gt; one.one.one.one Server:          127.0.0.53 Address:         127.0.0.53#53  Non-authoritative answer: Name:   one.one.one.one Address: 1.1.1.1 Name:   one.one.one.one Address: 1.0.0.1 Name:   one.one.one.one Address: 2606:4700:4700::1111 Name:   one.one.one.one Address: 2606:4700:4700::1001</pre>	<pre>Name:   dns.google.com Address: 8.8.4.4 Name:   dns.google.com Address: 8.8.8.8 Name:   dns.google.com Address: 2001:4860:4860::8844 Name:   dns.google.com Address: 2001:4860:4860::8888 &gt; bol.com Server:          127.0.0.53 Address:         127.0.0.53#53  Non-authoritative answer: Name:   bol.com Address: 79.170.100.62 &gt; w3schools.com Server:          127.0.0.53 Address:         127.0.0.53#53  Non-authoritative answer: Name:   w3schools.com Address: 76.223.115.82 Name:   w3schools.com Address: 13.248.240.135 &gt; [REDACTED]</pre>
--	--

Screenshot website visit via IP address:



### Assignment 6.3: subnetting

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

128 -1 voor ip van modem en nog eens -1 voor de laatste die voor iedereen op de netwerk melding te geven

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

126

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

```
charbel@helpdesk:~$ 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
```

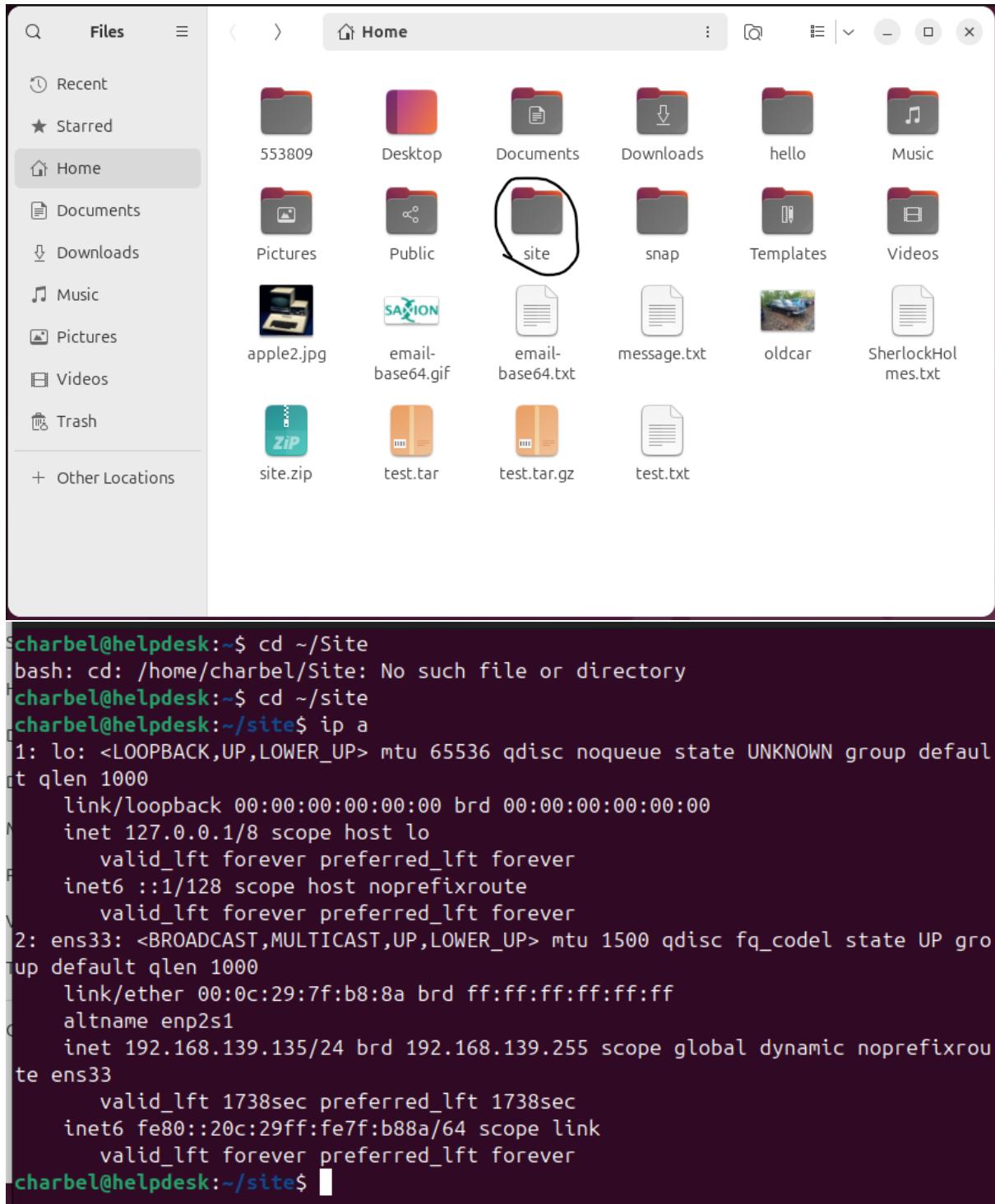
```
charbel@helpdesk:~$
```

Explain the above calculation in your own words.

Eigenlijk 128 maar 126 die gebruikt kunnen worden, want de eerste wordt gebruikt voor ip adres van de netwerk en de laatste voor een algemene melding naar iedereen die de netwerk gebruikt.

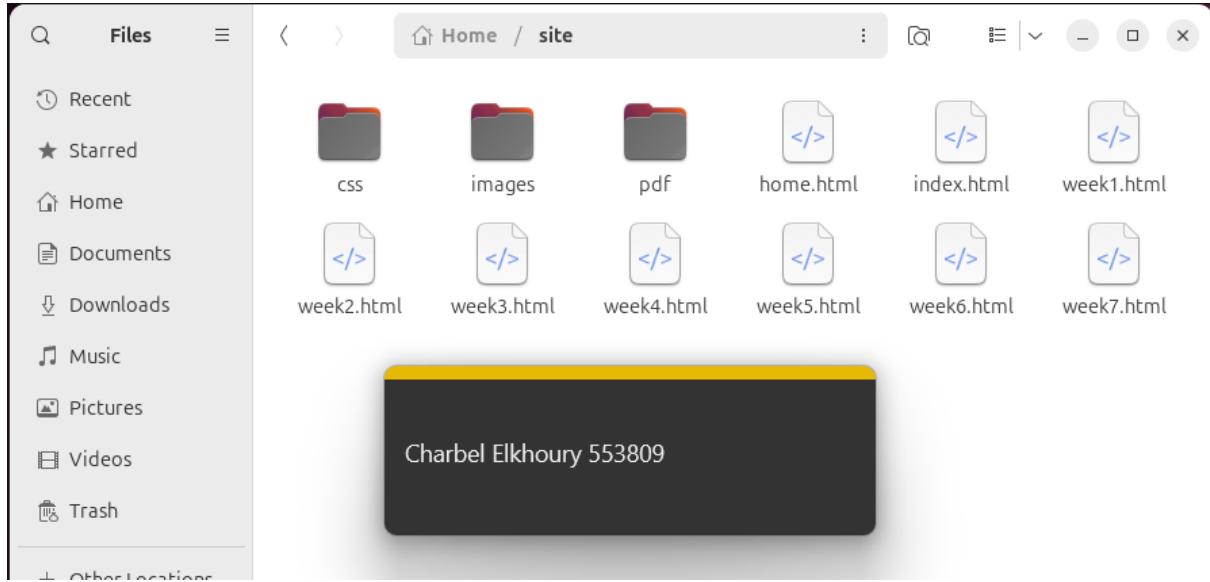
#### Assignment 6.4: HTML

Screenshot IP address Ubuntu VM:



192.168.139.135

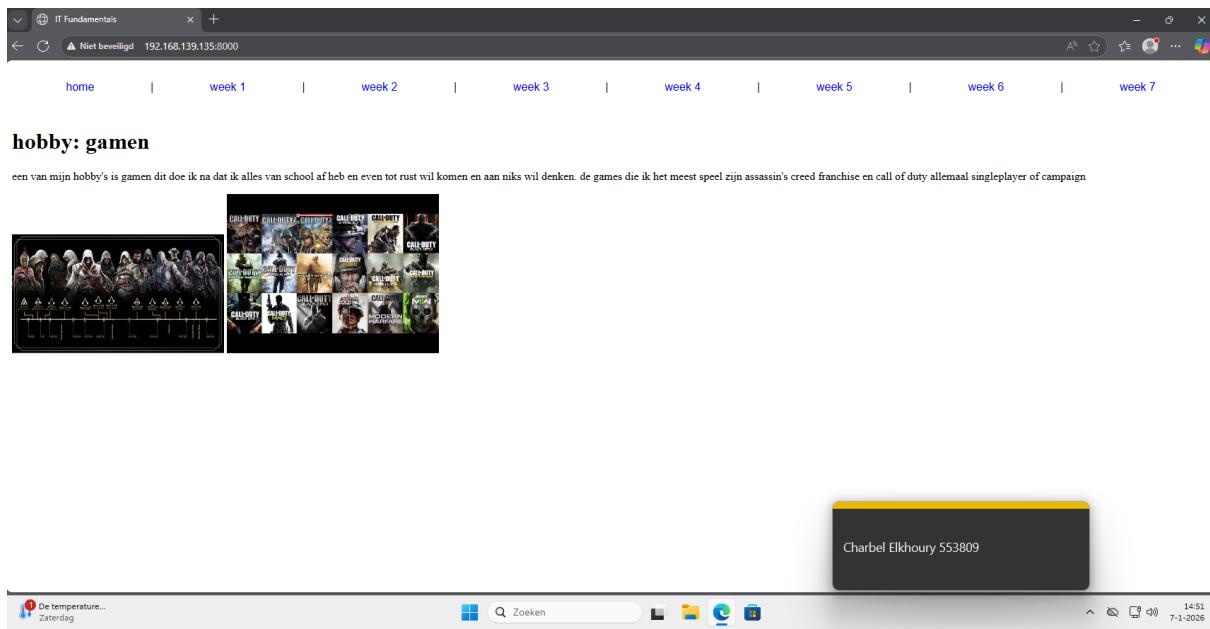
Screenshot of Site directory contents:



Screenshot python3 webserver command:

```
charbel@helpdesk:~/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



### 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.

```
1. Is number odd?  
2. Is number a power of 2?  
3. Two's complement of number?  
4. Calculate network segment  
Choose between 1, 2, 3 or 4: 4  
Enter IP address (e.g. 192.168.1.100): 192.168.1.100  
Enter subnet mask (e.g. 255.255.255.224): 255.255.255.224  
Network address: 192.168.1.96  
  
Charbel Elkhoury 553809
```

```
import nl.saxion.app.SaxionApp;  
  
public class Application implements Runnable {  
  
    public static void main(String[] args) {  
        SaxionApp.start(new Application(), 800, 800);  
    }  
}
```

```

}

public void run() {
    // Your code goes here!

    SaxionApp.print("1. Is number odd?\n" +
        "2. Is number a power of 2?\n" +
        "3. Two's complement of number?\n" +
        "4. Calculate network segment\n");
    SaxionApp.print("Choose between 1, 2, 3 or 4: ");
    int userInput = SaxionApp.readInt();

    switch (userInput){
        case 1:
            SaxionApp.print("Give number: ");
            int oddNumber = SaxionApp.readInt();
            SaxionApp.printLine("is " + oddNumber + " odd?");
            SaxionApp.printLine(isOdd(oddNumber));
            break;
        case 2:
            SaxionApp.print("Give number: ");
            int powerNumber = SaxionApp.readInt();
            SaxionApp.printLine("is " + powerNumber + " a power of 2?");
            SaxionApp.printLine(isPowerOfTwo(powerNumber));
            break;
        case 3:
            SaxionApp.print("Give number: ");
            int twoNumber = SaxionApp.readInt();
            SaxionApp.print("Two's complement of " + twoNumber + " is ");
            SaxionApp.printLine(twosComplement(twoNumber));
            break;
        case 4:
            SaxionApp.print("Enter IP address (e.g. 192.168.1.100): ");
            String ipAddress = SaxionApp.readString();

            SaxionApp.print("Enter subnet mask (e.g. 255.255.255.224): ");
            String subnetAddress = SaxionApp.readString();

            SaxionApp.printLine("Network address: " + calculateNetwork(ipAddress, subnetAddress));
            break;
        default:
            SaxionApp.printLine("Invalid option.");
    }
}

public boolean isOdd(int number) {

```

```

        return (number & 1) == 1;
    }

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

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

public String calculateNetwork(String ip, String subnet) {
    String[] ipPart = ip.split("\\.");
    String[] subnetPart = subnet.split("\\.");

    int[] network = new int[4];

    for (int i = 0; i < 4; i++) {
        int ipByte = Integer.parseInt(ipPart[i]);
        int subnetByte = Integer.parseInt(subnetPart[i]);

        network[i] = ipByte & subnetByte;
    }

    return network[0] + "." + network[1] + "." + network[2] + "." + network[3];
}
}

```

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