

Template Week 6 – Networking

Student number:

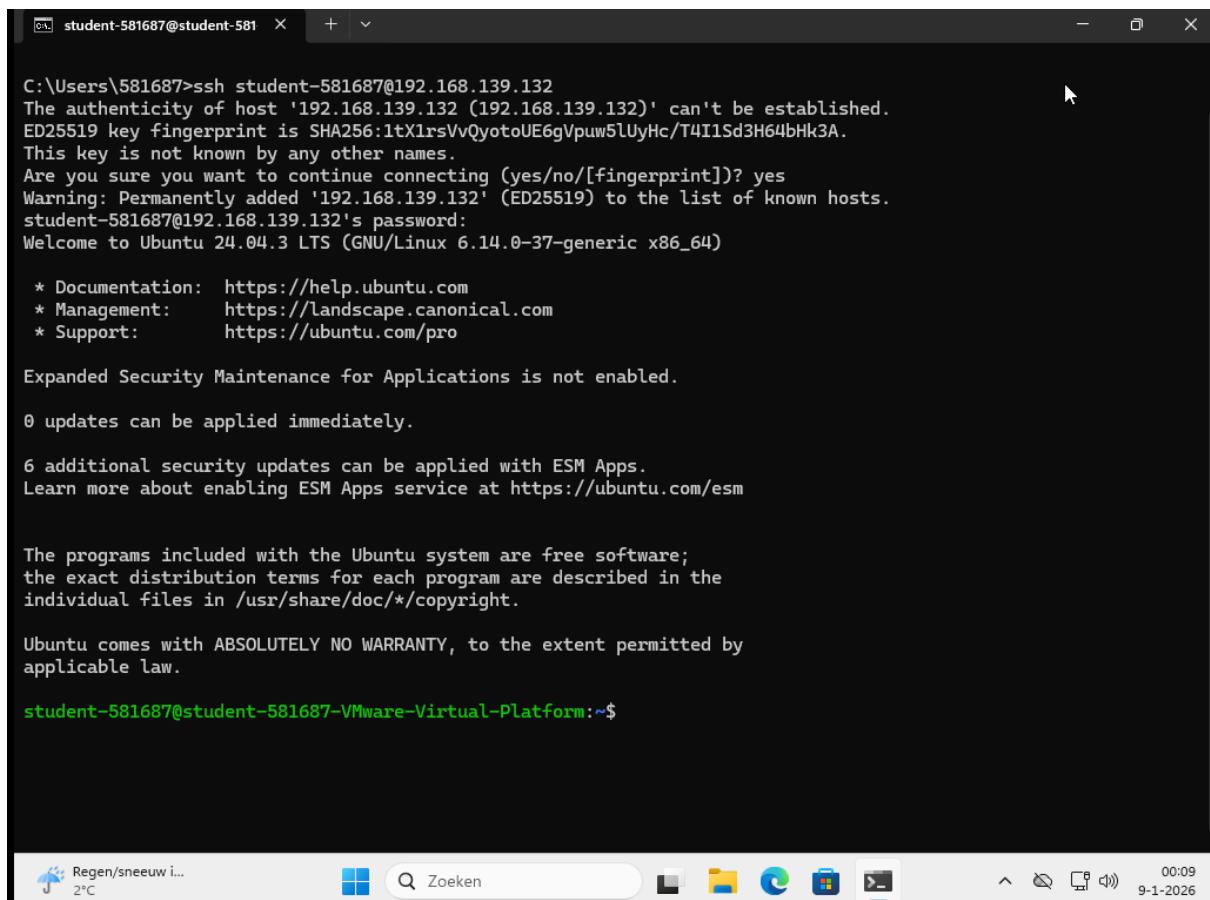
Assignment 6.1: Working from home

Screenshot installation openssh-server:

```
student-581687@student-581687-VMware-Virtual-Platform:~$ sudo apt install openssh-server
[sudo] password for student-581687:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
libl10n19
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
ncurses-term openssh-sftp-server ssh-import-id
Suggested packages:
molly-guard monkeysphere ssh-askpass
The following NEW packages will be installed:
ncurses-term openssh-server openssh-sftp-server ssh-import-id
0 upgraded, 4 newly installed, 0 to remove and 4 not upgraded.
Need to get 832 kB of archives.
After this operation, 6,743 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
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 [510 kB]
Get:3 http://nl.archive.ubuntu.com/ubuntu noble/main amd64 ncurses-term all 6.4+20240113-1ubuntu2 [275 kB]
Get:4 http://nl.archive.ubuntu.com/ubuntu noble-updates/main amd64 ssh-import-id all 5.11-0ubuntu2.24.04.1 [10.1 kB]
Fetched 832 kB in 1s (1,400 kB/s)
Preconfiguring packages ...
Selecting previously unselected package openssh-sftp-server.
(Reading database ... 156448 files and directories currently installed.)
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.
Preparing to unpack .../openssh-server_1%3a9.6p1-3ubuntu13.14_amd64.deb ...
Unpacking openssh-server (1:9.6p1-3ubuntu13.14) ...
Selecting previously unselected package ncurses-term.
Preparing to unpack .../ncurses-term_6.4+20240113-1ubuntu2_all.deb ...
Unpacking ncurses-term (6.4+20240113-1ubuntu2) ...
Selecting previously unselected package ssh-import-id.
Preparing to unpack .../ssh-import-id_5.11-0ubuntu2.24.04.1_all.deb ...
Unpacking ssh-import-id (5.11-0ubuntu2.24.04.1) ...
Setting up openssh-sftp-server (1:9.6p1-3ubuntu13.14) ...
Setting up openssh-server (1:9.6p1-3ubuntu13.14) ...
Creating config file /etc/ssh/sshd_config with new version
```

```
Created symlink /etc/systemd/system/sockets.target.wants/ssh.socket → /usr/lib/s
ystemd/system/ssh.socket.
Created symlink /etc/systemd/system/ssh.service.requires/ssh.socket → /usr/lib/s
ystemd/system/ssh.socket.
Setting up ssh-import-id (5.11-0ubuntu2.24.04.1) ...
Setting up ncurses-term (6.4+20240113-1ubuntu2) ...
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for ufw (0.36.2-6) ...
student-581687@student-581687-VMware-Virtual-Platform:~$ sudo systemctl enable 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.
student-581687@student-581687-VMware-Virtual-Platform:~$ sudo systemctl start ssh
```

Screenshot successful SSH command execution:



A screenshot of a terminal window titled "student-581687@student-581". The window displays the output of an SSH command to connect to an Ubuntu 24.04.3 LTS host. The session starts with a warning about host key fingerprint authentication, followed by a password prompt. Once connected, the terminal shows standard Ubuntu system information, including software updates and ESM Apps details. The session ends with a prompt for further commands.

```
C:\Users\581687>ssh student-581687@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:itXlrsVvQyotoUE6gVpuw5lUyHc/T4I1Sd3H64bHk3A.
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.
student-581687@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.

0 updates can be applied immediately.

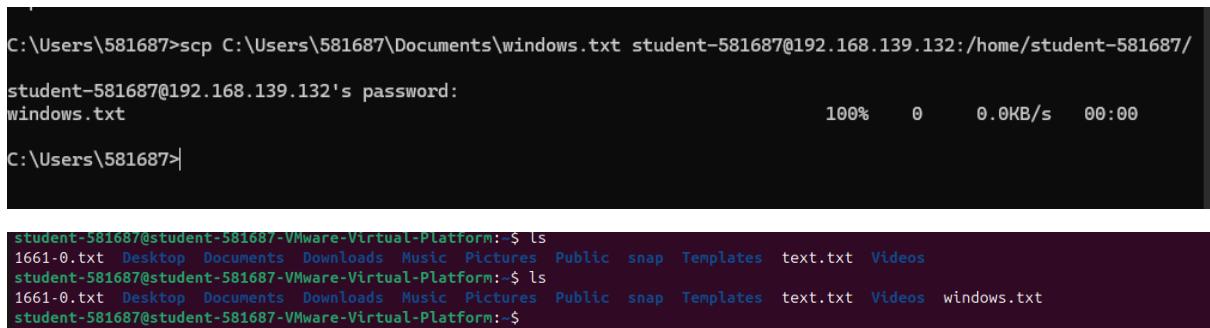
6 additional security updates can be applied with ESM Apps.
Learn more about enabling ESM Apps service at https://ubuntu.com/esm

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.

student-581687@student-581687-VMware-Virtual-Platform:~$
```

Screenshot successful execution SCP command:



A screenshot of a terminal window titled "student-581687@student-581687-VMware-Virtual-Platform". The user runs an SCP command to copy a file from their local Windows directory to a remote Ubuntu host. The command prompts for the password of the remote user. After entering the password, the file is transferred successfully, indicated by the 100% completion message. The session then ends with a prompt for further commands.

```
C:\Users\581687>scp C:\Users\581687\Documents\windows.txt student-581687@192.168.139.132:/home/student-581687/
student-581687@192.168.139.132's password: windows.txt          100%   0     0.0KB/s   00:00
C:\Users\581687>
```



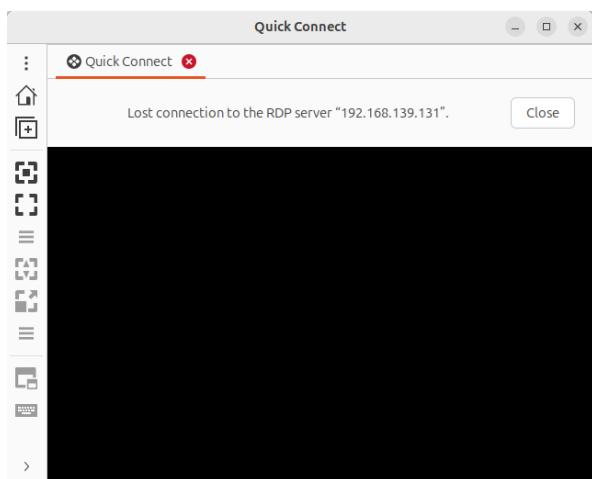
```
student-581687@student-581687-VMware-Virtual-Platform:~$ ls
1661-0.txt Desktop Documents Downloads Music Pictures Public snap Templates text.txt Videos
student-581687@student-581687-VMware-Virtual-Platform:~$ ls
1661-0.txt Desktop Documents Downloads Music Pictures Public snap Templates text.txt Videos windows.txt
student-581687@student-581687-VMware-Virtual-Platform:~$
```

Screenshot remmina:

```
student-581687@student-581687-VMware-Virtual-Platform:~$ sudo apt install remmina remmina-plugin-rdp
[sudo] password for student-581687:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
  libl10n10

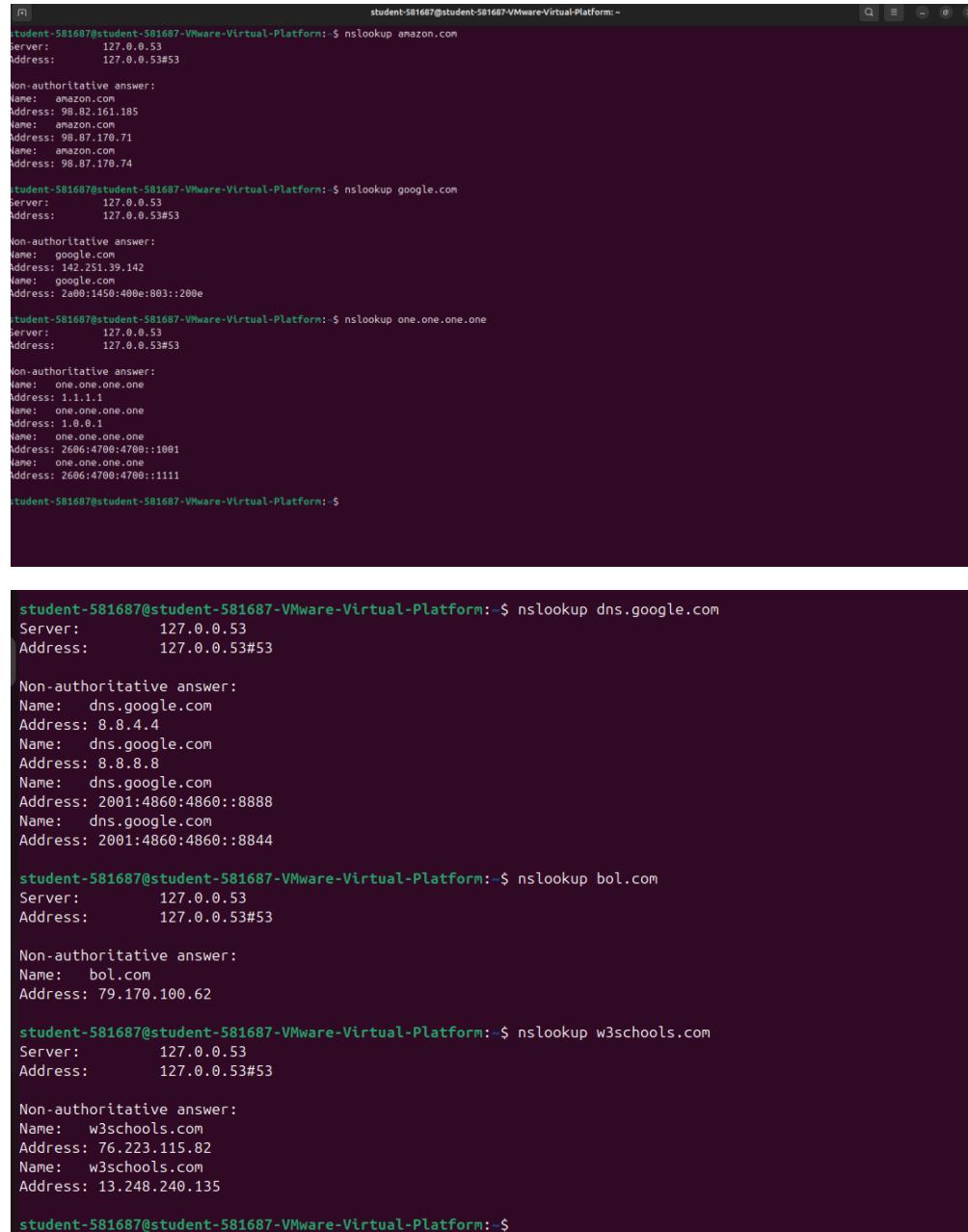
Processing triggers for shared-mime-info (2.4-4) ...
Processing triggers for desktop-file-utils (0.27-2build1) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for gnome-menus (3.36.0-1.lubuntu3) ...
Processing triggers for libc-bin (2.39-0ubuntu8.6) ...
student-581687@student-581687-VMware-Virtual-Platform:~$
```

Ik krijg continu een rdp error vanuit ubuntu met remmina. Alles is up to date en vanuit windows staan alle instellingen in orde. Rdp stond uit en geblokkeerd vanuit de firewall en ik heb dit omgedraaid. Het lukt alsnog niet om een connectie te krijgen.



Assignment 6.2: IP addresses websites

Relevant screenshots nslookup command:



```
student-581687@student-581687-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: 98.87.170.71
Name:  amazon.com
Address: 98.87.170.74

student-581687@student-581687-VMware-Virtual-Platform:~$ nslookup google.com
Server:      127.0.0.53
Address:    127.0.0.53#53

Non-authoritative answer:
Name:  google.com
Address: 142.251.39.142
Name:  google.com
Address: 2a00:1450:400e:803::200e

student-581687@student-581687-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: 1.1.1.1
Name:  one.one.one.one
Address: 1.0.0.1
Name:  one.one.one.one
Address: 2606:4700:4700::1001
Name:  one.one.one.one
Address: 2606:4700:4700::1111

student-581687@student-581687-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: 8.8.4.4
Name:  dns.google.com
Address: 8.8.8.8
Name:  dns.google.com
Address: 2001:4860:4860::8888
Name:  dns.google.com
Address: 2001:4860:4860::8844

student-581687@student-581687-VMware-Virtual-Platform:~$ nslookup bol.com
Server:      127.0.0.53
Address:    127.0.0.53#53

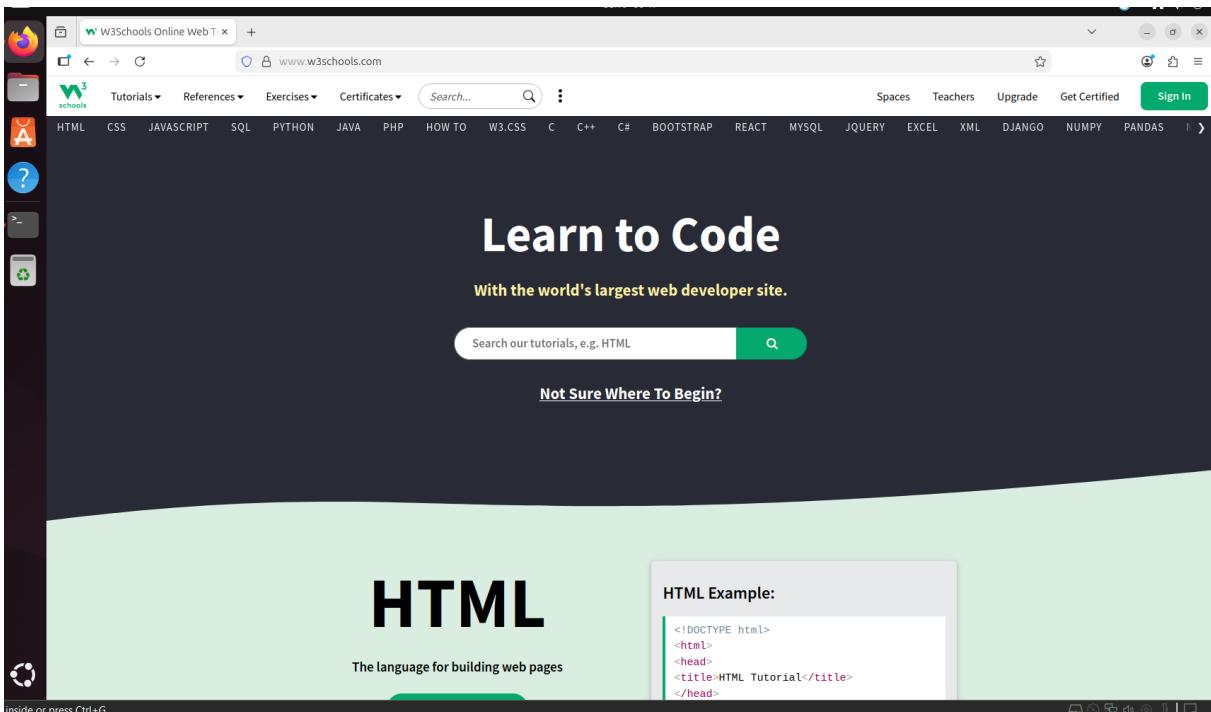
Non-authoritative answer:
Name:  bol.com
Address: 79.170.100.62

student-581687@student-581687-VMware-Virtual-Platform:~$ nslookup 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

student-581687@student-581687-VMware-Virtual-Platform:~$
```

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 addressen

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

x.x.x.128-x.x.x.254

dus 126 addressen in totaal. Het eerste en laatste zijn gereserveerd.

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

```
student-581687@student-581687-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

student-581687@student-581687-Virtual-Platform:~$
```

Explain the above calculation in your own words.

/25 betekent dat er in totaal 7 bits beschikbaar zijn van de 32 bits voor de hosts wat op 128 adressen uitkomt

.128 is het netwerkadres en 255 wordt gebruikt voor het broadcast adres. Dus er zijn 2 adressen gereserveerd wat op 126 adressen uitkomt voor de hosts.

Assignment 6.4: HTML

Screenshot IP address Ubuntu VM:

```
student-581687@student-581687-VMware-Virtual-Platform:~/Documents/site$ 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 UNKNOWN group default qlen 1000
    link/ether 00:0c:29:47:27:bd brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.139.132/24 brd 192.168.139.255 scope global dynamic noprefixroute ens33
        valid_lft 1756sec preferred_lft 1756sec
    inet6 fe80::20c:29ff:fe47:27bd/64 scope link
        valid_lft forever preferred_lft forever
```

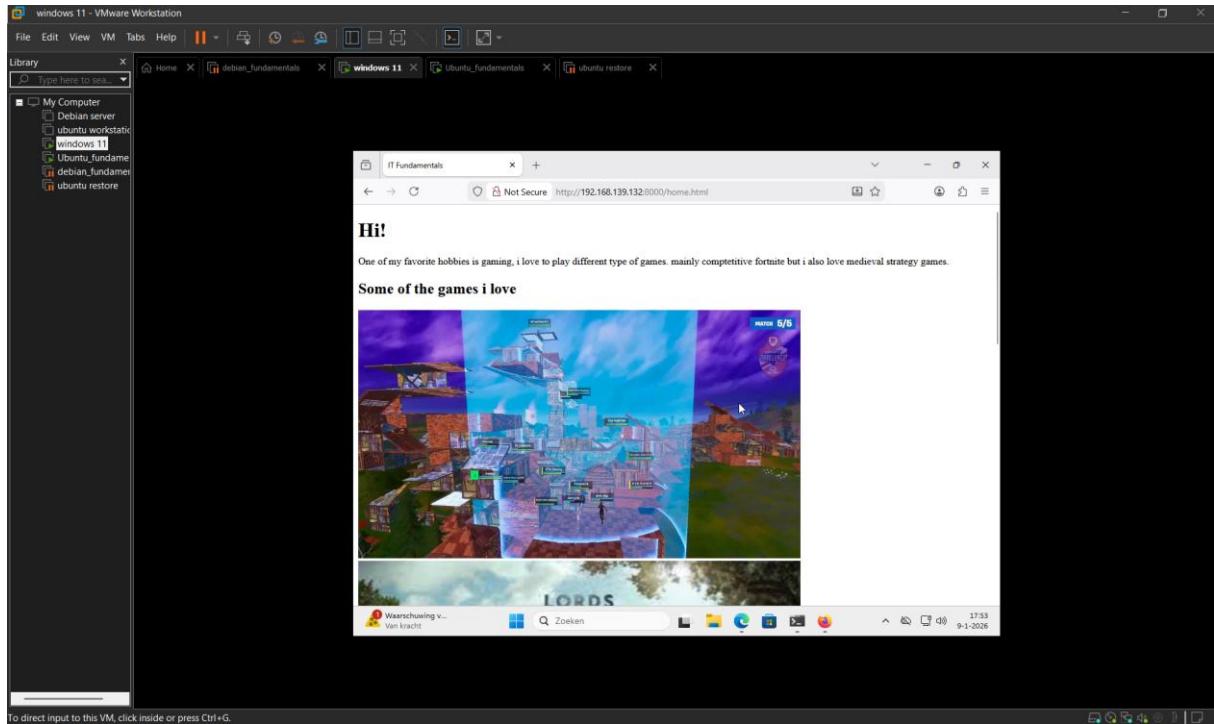
Screenshot of Site directory contents:

```
student-581687@student-581687-VMware-Virtual-Platform:~/Documents/site$ ls
css  home.html  images  index.html  pdf  week1.html  week2.html  week3.html  week4.html  week5.html  week6.html  week7.html
student-581687@student-581687-VMware-Virtual-Platform:~/Documents/site$ cd images
student-581687@student-581687-VMware-Virtual-Platform:~/Documents/site/images$ ls
bannerlord2.jpeg  fortnite.jpeg  manor_lords.jpeg  warband.jpeg
student-581687@student-581687-VMware-Virtual-Platform:~/Documents/site/images$
```

Screenshot python3 webserver command:

```
student-581687@student-581687-VMware-Virtual-Platform:~/Documents/site/images$ cd ..
student-581687@student-581687-VMware-Virtual-Platform:~/Documents/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.

```
import java.util.Scanner;

public class Main {

    public static void main(String[] args) {

        Scanner input = new Scanner(System.in);

        System.out.print("enter a number: ");
        int number = input.nextInt();
        input.nextLine();

        while (true) {

            System.out.println("\nmenu");
            System.out.println("1. odd or even");
            System.out.println("2. power of two");
            System.out.println("3. twos complement");
            System.out.println("4. network segment");
            System.out.println("5. exit");
            System.out.print("choose: ");

            int choice = input.nextInt();
            input.nextLine();

            if (choice == 1) {
                odd(number);
            } else if (choice == 2) {
                power2(number);
            } else if (choice == 3) {
                twos(number);
            } else if (choice == 4) {
                network(input);
            } else if (choice == 5) {
                break;
            } else {
                System.out.println("wrong choice");
            }
        }

        input.close();
    }
}
```

```

public static void odd(int n) {
    if ((n & 1) == 1)
        System.out.println("number is odd");
    else
        System.out.println("number is even");
}

public static void power2(int n) {
    if (n > 0 && (n & (n - 1)) == 0)
        System.out.println("number is power of two");
    else
        System.out.println("number is not power of two");
}

public static void twos(int n) {
    System.out.println("twos complement: " + (~n + 1));
}

public static void network(Scanner input) {

    System.out.print("enter ip: ");
    String ip = input.nextLine();

    System.out.print("enter subnet: ");
    String subnet = input.nextLine();

    String[] ipPart = ip.split("\\.");
    String[] subPart = subnet.split("\\.");

    int[] net = new int[4];

    for (int i = 0; i < 4; i++) {
        net[i] =
            Integer.parseInt(ipPart[i]) &
            Integer.parseInt(subPart[i]);
    }

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

    int size = 256 - Integer.parseInt(subPart[3]);

    System.out.println("range: "
        + net[0] + "." + net[1] + "." + net[2] + "." + net[3]
        + " - "
        + net[0] + "." + net[1] + "." + net[2] + "." + (net[3] + size - 1));
}
}

```

```
choose: 4
enter ip: 192.168.1.100
enter subnet: 255.255.255.224
network address: 192.168.1.96
range: 192.168.1.96 - 192.168.1.127
```

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