

Week 6 – Networking

Student number: 578438

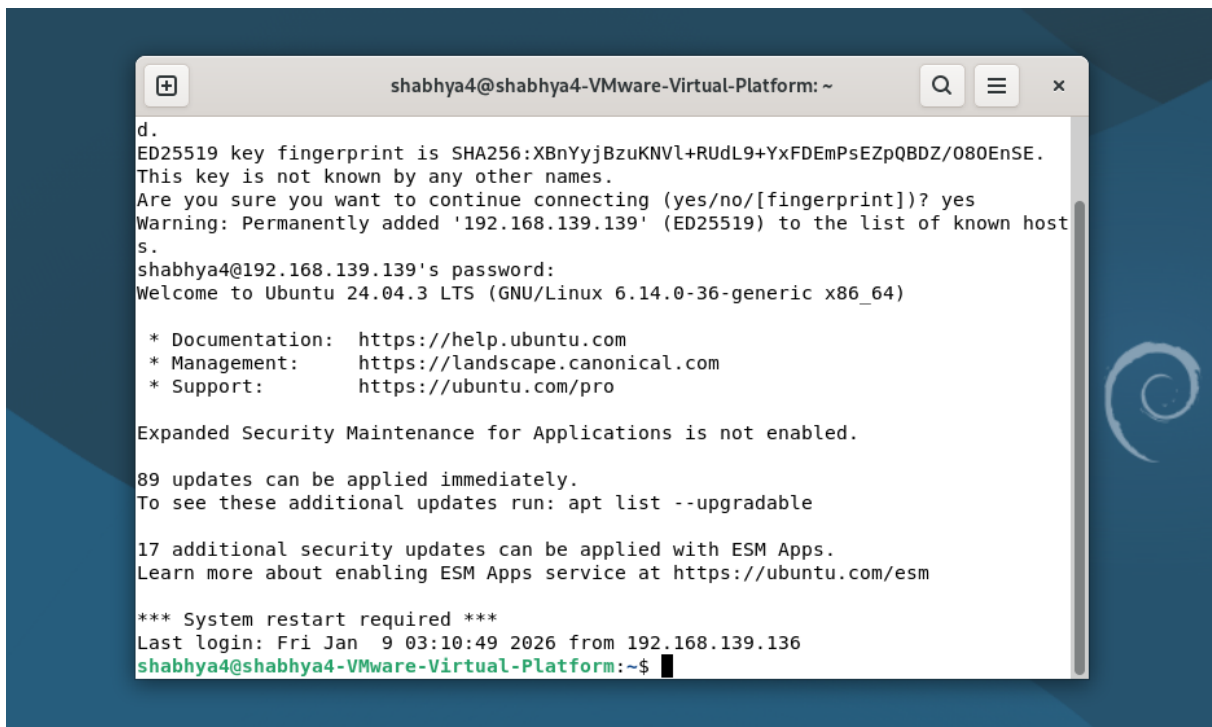
Assignment 6.1: Working from home

Screenshot installation openssh-server:

```
shabhya4@shabhya4-VMware-Virtual-Platform: ~
Created symlink /etc/systemd/system/ssh.service → /usr/lib/systemd/system/ssh.service.
Created symlink /etc/systemd/system/multi-user.target.wants/ssh.service → /usr/lib/systemd/system/ssh.service.
shabhya4@shabhya4-VMware-Virtual-Platform:~$ systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/usr/lib/systemd/system/ssh.service; enabled; preset: enabled)
   Active: active (running) since Fri 2026-01-09 02:58:48 CET; 12s ago
     TriggeredBy: ● ssh.socket
       Docs: man:sshd(8)
             man:sshd_config(5)
    Process: 4858 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCESS)
   Main PID: 4866 (sshd)
      Tasks: 1 (limit: 4542)
     Memory: 1.2M (peak: 1.5M)
        CPU: 27ms
    CGroup: /system.slice/ssh.service
            └─4866 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

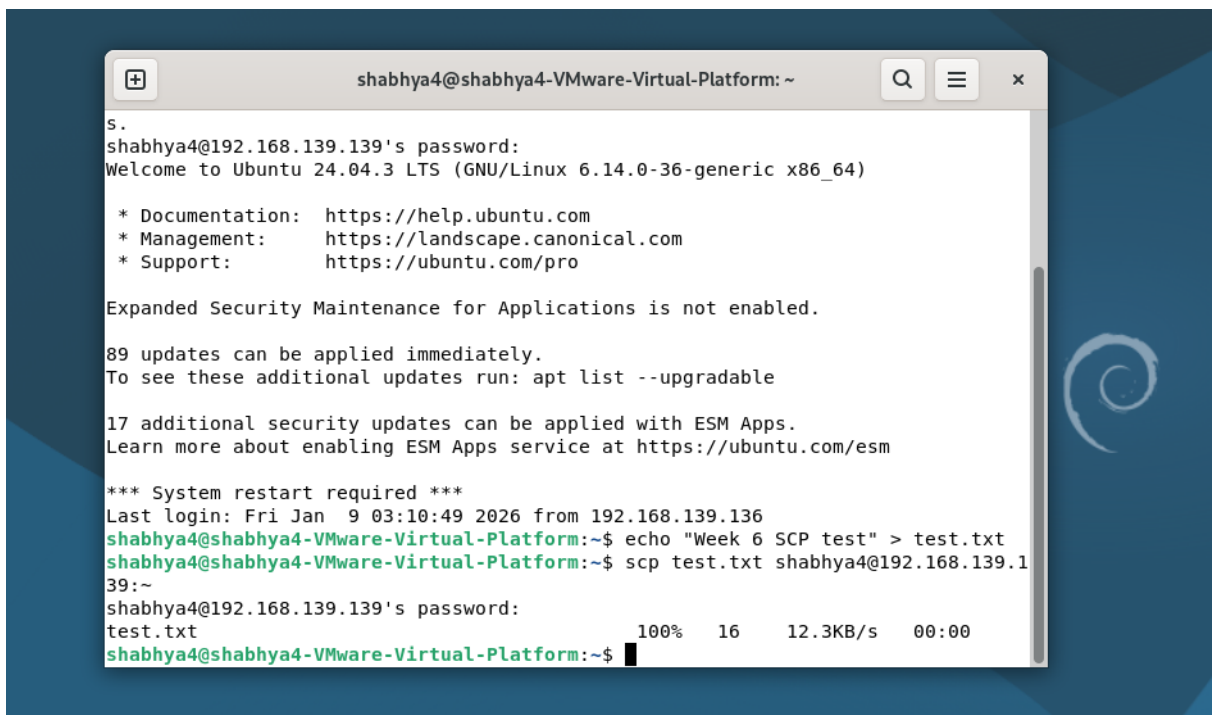
Jan 09 02:58:48 shabhya4-VMware-Virtual-Platform systemd[1]: Starting ssh.service:
Jan 09 02:58:48 shabhya4-VMware-Virtual-Platform sshd[4866]: Server listening on
Jan 09 02:58:48 shabhya4-VMware-Virtual-Platform sshd[4866]: Server listening on
Jan 09 02:58:48 shabhya4-VMware-Virtual-Platform systemd[1]: Started ssh.service:
lines 1-18/18 (END)...skipping...
```

Screenshot successful SSH command execution:



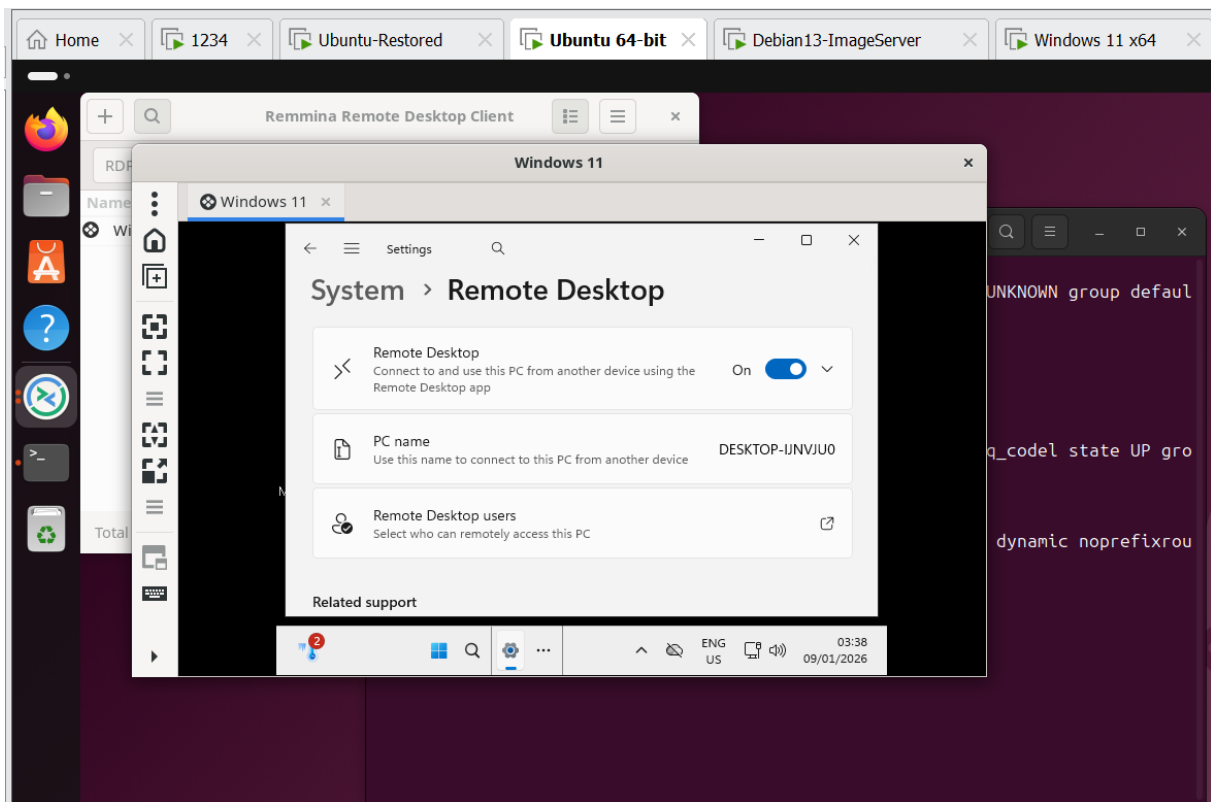
```
shabhya4@shabhya4-VMware-Virtual-Platform: ~  
d.  
ED25519 key fingerprint is SHA256:XBnYyjBzuKNVl+RUdL9+YxFDEmPsEZpQBDZ/080EnSE.  
This key is not known by any other names.  
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes  
Warning: Permanently added '192.168.139.139' (ED25519) to the list of known hosts.  
shabhya4@192.168.139.139's password:  
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-36-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.  
  
89 updates can be applied immediately.  
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  
  
*** System restart required ***  
Last login: Fri Jan  9 03:10:49 2026 from 192.168.139.136  
shabhya4@shabhya4-VMware-Virtual-Platform:~$
```

Screenshot successful execution SCP command:



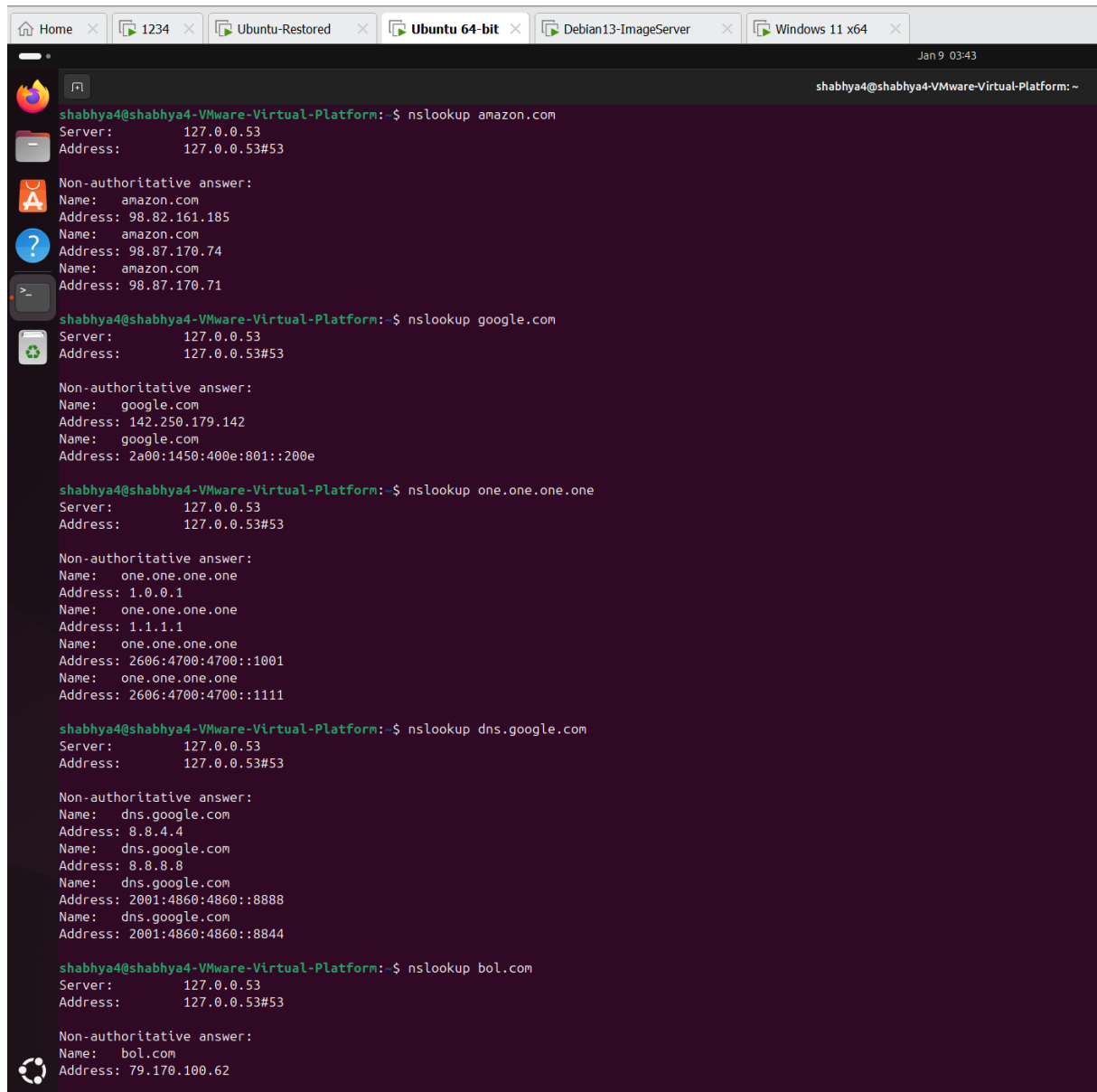
```
shabhya4@shabhya4-VMware-Virtual-Platform: ~  
S.  
shabhya4@192.168.139.139's password:  
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-36-generic x86_64)  
  
* Documentation:  https://help.ubuntu.com  
* Management:    https://landscape.canonical.com  
* Support:       https://ubuntu.com/pro  
  
Expanded Security Maintenance for Applications is not enabled.  
  
89 updates can be applied immediately.  
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  
  
*** System restart required ***  
Last login: Fri Jan  9 03:10:49 2026 from 192.168.139.136  
shabhya4@shabhya4-VMware-Virtual-Platform:~$ echo "Week 6 SCP test" > test.txt  
shabhya4@shabhya4-VMware-Virtual-Platform:~$ scp test.txt shabhya4@192.168.139.139:~  
shabhya4@192.168.139.139's password:  
test.txt                                100% 16    12.3KB/s   00:00  
shabhya4@shabhya4-VMware-Virtual-Platform:~$
```

Screenshot remmina:



Assignment 6.2: IP addresses websites

Relevant screenshots nslookup command:



```
shabhya4@shabhya4-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: 98.87.170.74
Name:   amazon.com
Address: 98.87.170.71

shabhya4@shabhya4-VMware-Virtual-Platform:~$ nslookup google.com
Server:      127.0.0.53
Address:     127.0.0.53#53

Non-authoritative answer:
Name:   google.com
Address: 142.250.179.142
Name:   google.com
Address: 2a00:1450:400e:801::200e

shabhya4@shabhya4-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

shabhya4@shabhya4-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

shabhya4@shabhya4-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
```

```
shabhya4@shabhya4-VMware-Virtual-Platform:~$ nslookup bol.com
Server:      127.0.0.53
Address:     127.0.0.53#53

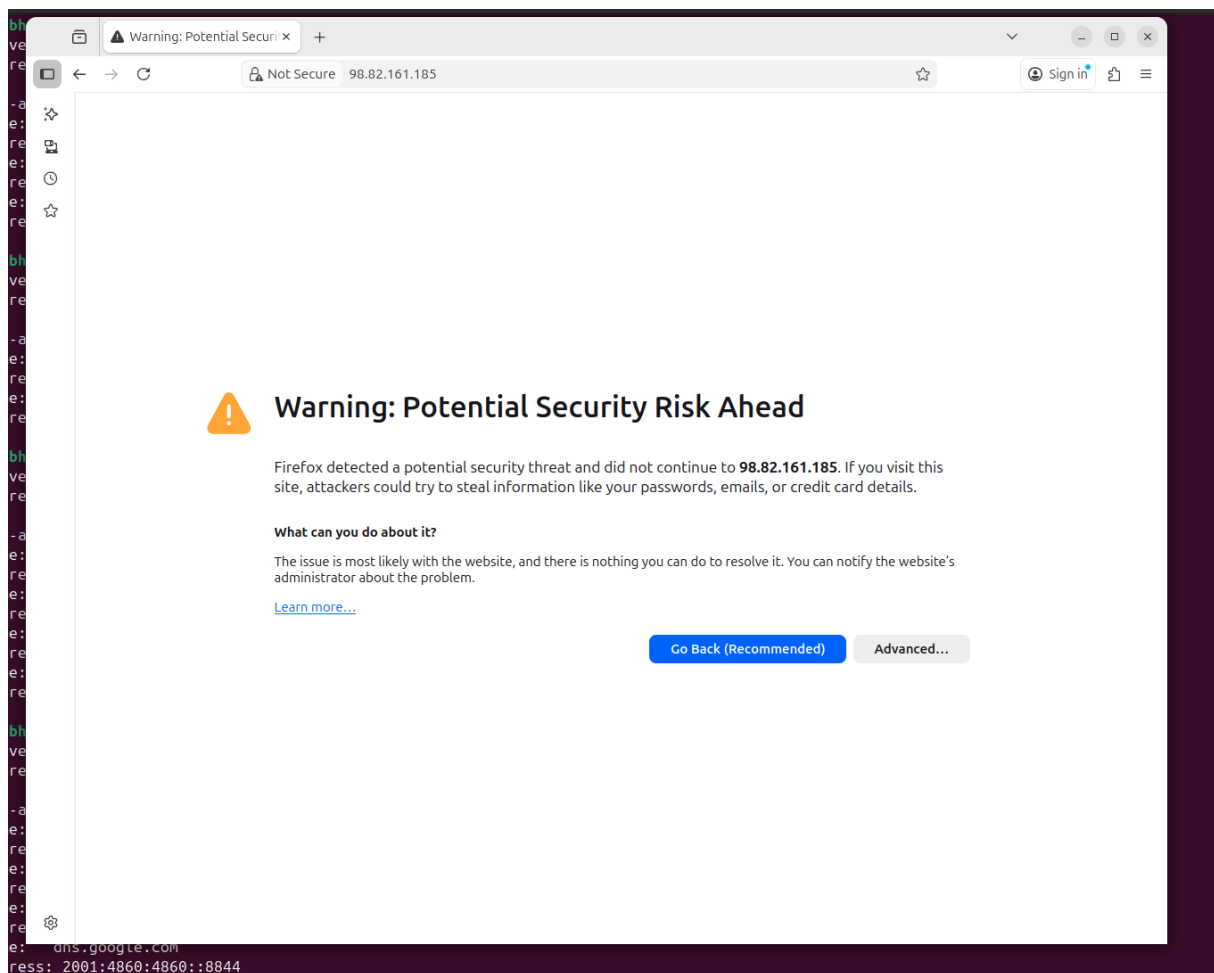
Non-authoritative answer:
Name:   bol.com
Address: 79.170.100.62

shabhya4@shabhya4-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

shabhya4@shabhya4-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?

→ There are 128 IP addresses in the network 192.168.110.128/25.

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

→ The usable host range is 192.168.110.129 up to 192.168.110.254, which gives 126 usable IP addresses.

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

```
shabhya4@shabhya4-VMware-Virtual-Platform:~$ ipcalc 192.168.110.128/25
Address: 192.168.110.128      11000000.10101000.01101110.1 0000000
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 0000000
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

shabhya4@shabhya4-VMware-Virtual-Platform:~$
```

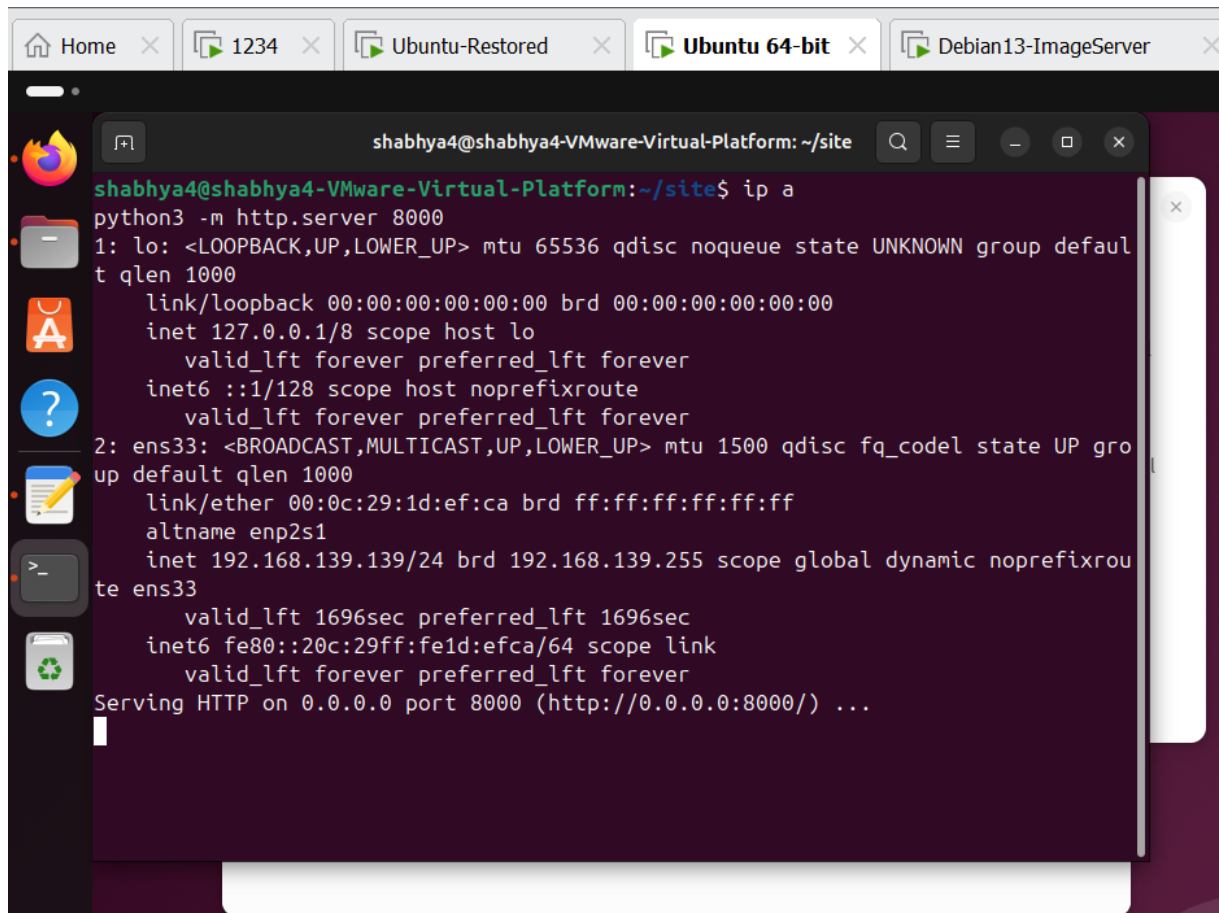
Running `ipcalc 192.168.110.128/25` confirms my answers: it shows Network 192.168.110.128, HostMin 192.168.110.129, HostMax 192.168.110.254 and Hosts/Net 126

Explain the above calculation in your own words.

→ The “/25” means 25 bits are used for the network part and the remaining 7 bits are for hosts. With 7 host bits there are $2^7 = 128$ total addresses in this subnet. The subnet range is from 192.168.110.128 to 192.168.110.255. The first address (192.168.110.128) is the network address, and the last address (192.168.110.255) is the broadcast address, so they cannot be assigned to devices. All addresses in between (192.168.110.129–192.168.110.254) are usable for hosts, which gives $128 - 2 = 126$ usable host addresses

Assignment 6.4: HTML

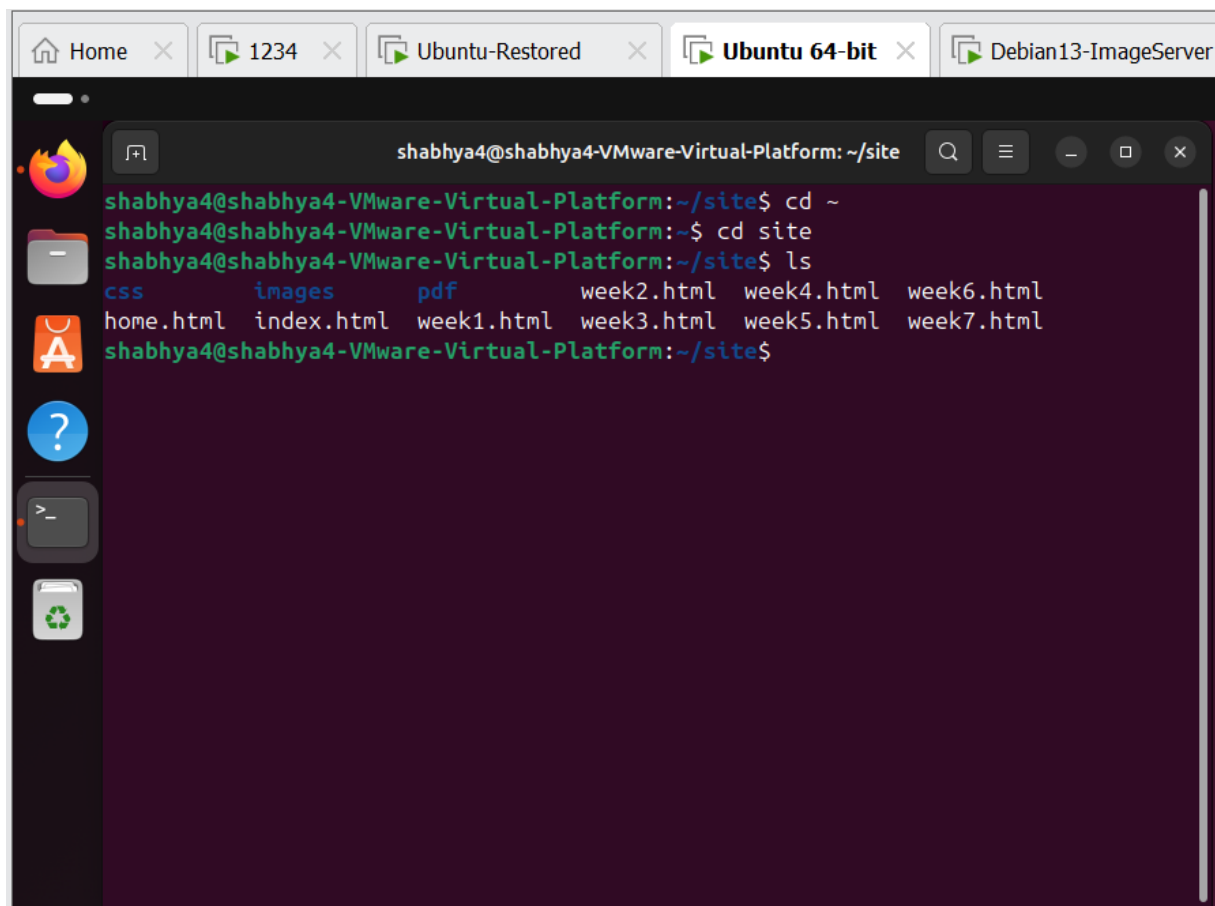
Screenshot IP address Ubuntu VM:



The screenshot shows a terminal window within a virtual machine environment. The terminal title bar indicates the user is 'shabhya4' at 'shabhya4-VMware-Virtual-Platform' in the directory '~/site'. The terminal output shows the command 'ip a' being executed, displaying details for the loopback interface 'lo' (127.0.0.1) and the ethernet interface 'ens33' (192.168.139.139). Additionally, it shows the command 'python3 -m http.server 8000' being executed, resulting in the message 'Serving HTTP on 0.0.0.0 port 8000 (http://0.0.0.0:8000/) ...'. The terminal window is overlaid on a desktop environment with a sidebar containing icons for applications like Firefox, Files, and the Dash icon.

```
shabhya4@shabhya4-VMware-Virtual-Platform: ~/site$ ip a
python3 -m http.server 8000
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:29:1d:ef:ca brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.139.139/24 brd 192.168.139.255 scope global dynamic noprefixroute ens33
        valid_lft 1696sec preferred_lft 1696sec
    inet6 fe80::20c:29ff:fe1d:efca/64 scope link
        valid_lft forever preferred_lft forever
Serving HTTP on 0.0.0.0 port 8000 (http://0.0.0.0:8000/) ...
```

Screenshot of Site directory contents:

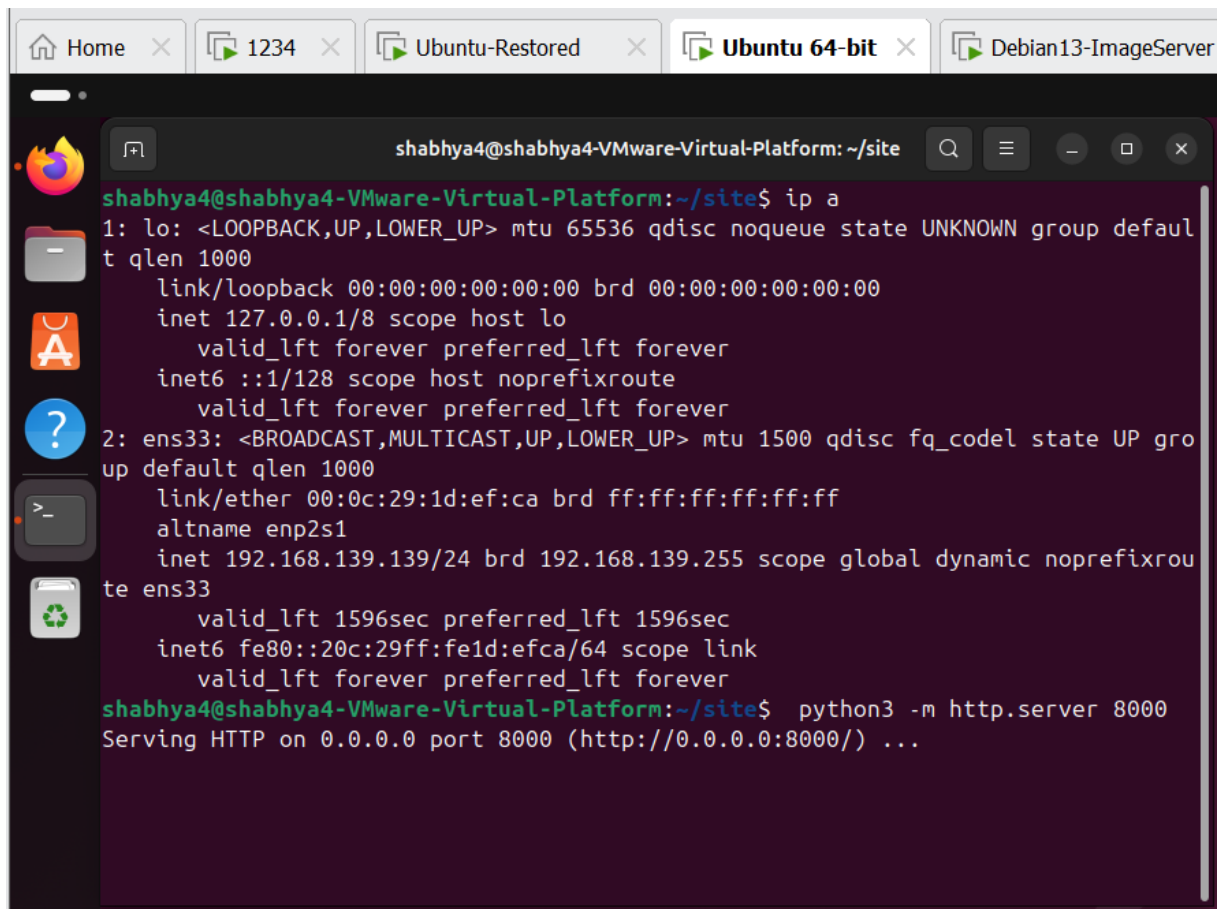


The screenshot shows a terminal window titled "shabhya4@shabhya4-VMware-Virtual-Platform: ~/site". The terminal output shows the following commands and results:

```
shabhya4@shabhya4-VMware-Virtual-Platform:~/site$ cd ~
shabhya4@shabhya4-VMware-Virtual-Platform:~$ cd site
shabhya4@shabhya4-VMware-Virtual-Platform:~/site$ ls
css          images      pdf         week2.html  week4.html  week6.html
home.html   index.html  week1.html  week3.html  week5.html  week7.html
shabhya4@shabhya4-VMware-Virtual-Platform:~/site$
```

The terminal window has a dark purple background. The left sidebar contains icons for Firefox, a file manager, an application store, a help icon, a terminal icon, and a trash icon. The top of the window shows a browser-like tab bar with tabs for "Home", "1234", "Ubuntu-Restored", "Ubuntu 64-bit", and "Debian13-ImageServer".

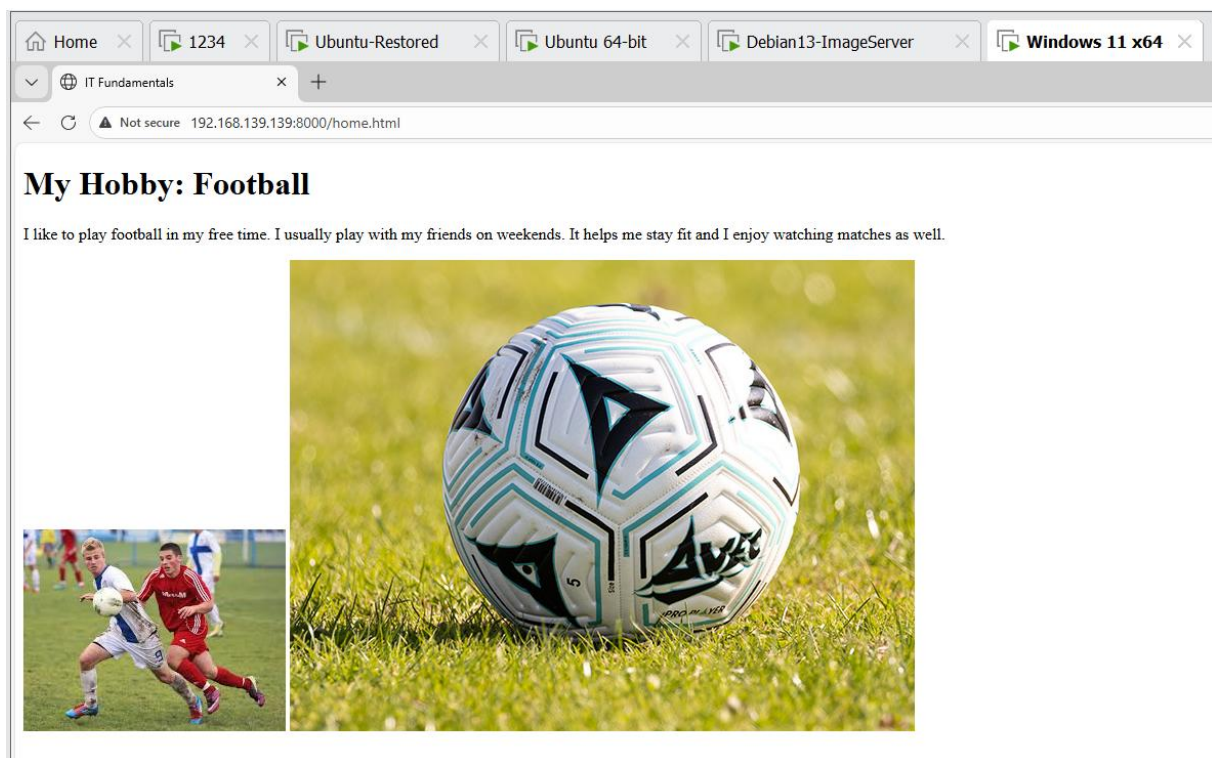
Screenshot python3 webserver command:



The screenshot shows a terminal window titled "shabhya4@shabhya4-VMware-Virtual-Platform: ~/site". The terminal output shows the command `ip a` being executed, displaying network interface details for `lo` and `ens33`. The `lo` interface is a loopback address `127.0.0.1`. The `ens33` interface is an Ethernet address `192.168.139.139`. The terminal also shows the command `python3 -m http.server 8000` being executed, which starts a web server on port 8000.

```
shabhya4@shabhya4-VMware-Virtual-Platform: ~/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 UP group default qlen 1000
    link/ether 00:0c:29:1d:ef:ca brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.139.139/24 brd 192.168.139.255 scope global dynamic noprefixroute ens33
        valid_lft 1596sec preferred_lft 1596sec
    inet6 fe80::20c:29ff:fe1d:efca/64 scope link
        valid_lft forever preferred_lft forever
shabhya4@shabhya4-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



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 NetworkSegment {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);

        System.out.print("Enter IP address (e.g. 192.168.1.100): ");
        String ipStr = sc.nextLine().trim();

        System.out.print("Enter subnet mask (e.g. 255.255.255.224): ");
        String maskStr = sc.nextLine().trim();

        int[] ip = parseIp(ipStr);
        int[] mask = parseIp(maskStr);
        int[] net = new int[4];

        // bitwise AND each octet
        for (int i = 0; i < 4; i++) {
            net[i] = ip[i] & mask[i];
        }

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

    // Convert "192.168.1.100" to {192, 168, 1, 100}
    private static int[] parseIp(String s) {
        String[] parts = s.split("\\.");
        if (parts.length != 4) {
```

```

        throw new IllegalArgumentException("Invalid IP format: " + s);
    }

    int[] result = new int[4];
    for (int i = 0; i < 4; i++) {
        result[i] = Integer.parseInt(parts[i]);
    }
    return result;
}
}

```

The screenshot shows a terminal window titled "shabhya4@shabhya4-VMware-Virtual-Platform: ~/week6java". The terminal output shows the installation of Java packages: default-jdk-headless, default-jdk, default-jre-headless, and default-jre. After installation, the user runs "java -version", which shows "openjdk version "21.0.9" 2025-10-21". The user then runs "mkdir -p ~/week6java" and "cd ~/week6java". The user creates a file "NetworkSegment.java" using "nano" and runs "javac NetworkSegment.java". Finally, the user runs "java NetworkSegment", which prompts for an IP address (192.168.1.100), a subnet mask (255.255.255.224), and a network address (192.168.1.96).

```

shabhya4@shabhya4-VMware-Virtual-Platform: ~/week6java
Selecting previously unselected package default-jdk-headless.
Preparing to unpack .../default-jdk-headless_2%3a1.21-75+exp1_amd64.deb ...
Unpacking default-jdk-headless (2:1.21-75+exp1) ...
Selecting previously unselected package default-jdk.
Preparing to unpack .../default-jdk_2%3a1.21-75+exp1_amd64.deb ...
Unpacking default-jdk (2:1.21-75+exp1) ...
Setting up default-jre-headless (2:1.21-75+exp1) ...
Setting up default-jre (2:1.21-75+exp1) ...
Setting up default-jdk-headless (2:1.21-75+exp1) ...
Setting up default-jdk (2:1.21-75+exp1) ...
shabhya4@shabhya4-VMware-Virtual-Platform:~$ java -version
openjdk version "21.0.9" 2025-10-21
OpenJDK Runtime Environment (build 21.0.9+10-Ubuntu-124.04)
OpenJDK 64-Bit Server VM (build 21.0.9+10-Ubuntu-124.04, mixed mode, sharing)
shabhya4@shabhya4-VMware-Virtual-Platform:~$ mkdir -p ~/week6java
cd ~/week6java
nano NetworkSegment.java
shabhya4@shabhya4-VMware-Virtual-Platform:~/week6java$ javac NetworkSegment.java

java NetworkSegment
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
shabhya4@shabhya4-VMware-Virtual-Platform:~/week6java$

```

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