

IT Technology

Assignment 16 - Linux routing table. Default gateway DGW or just Gateway GW.



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1 Introduction

In the next chapters it will be presented this week (39) assignment, documenting how to set the internet connection between two virtual machines one on Xubuntu and one on Raspberry Pi using the VNnet8. This assignment is using the VM Ware Workstation VMWW hardware and network virtualisation management tool.

2 Tasks

2.1.1 - Draw the network diagram and configure the PCs

2.1.2 - Verify the Linux routing table configuration.

2.1.3 - Change the DGW address on PC1 and PC2 to be different from the R1 IP address.

2.1.4 - Change i.e. correct the R1 IP address to the DGW address set on PC1 and PC2

2.1.5 - Delete the DGW on PC1 and PC2

2.1.6 - Reestablish manually the DGWs on PC1 and PC2

2.1.7 - Misconfigure the routing table on PC1

2.1.8 - Ping program outputs

3. Solution

2. Draw the network diagram and configure the PCs

- Draw the network design or network diagram.
- Configure the PCs network interfaces settings according to the network diagram.

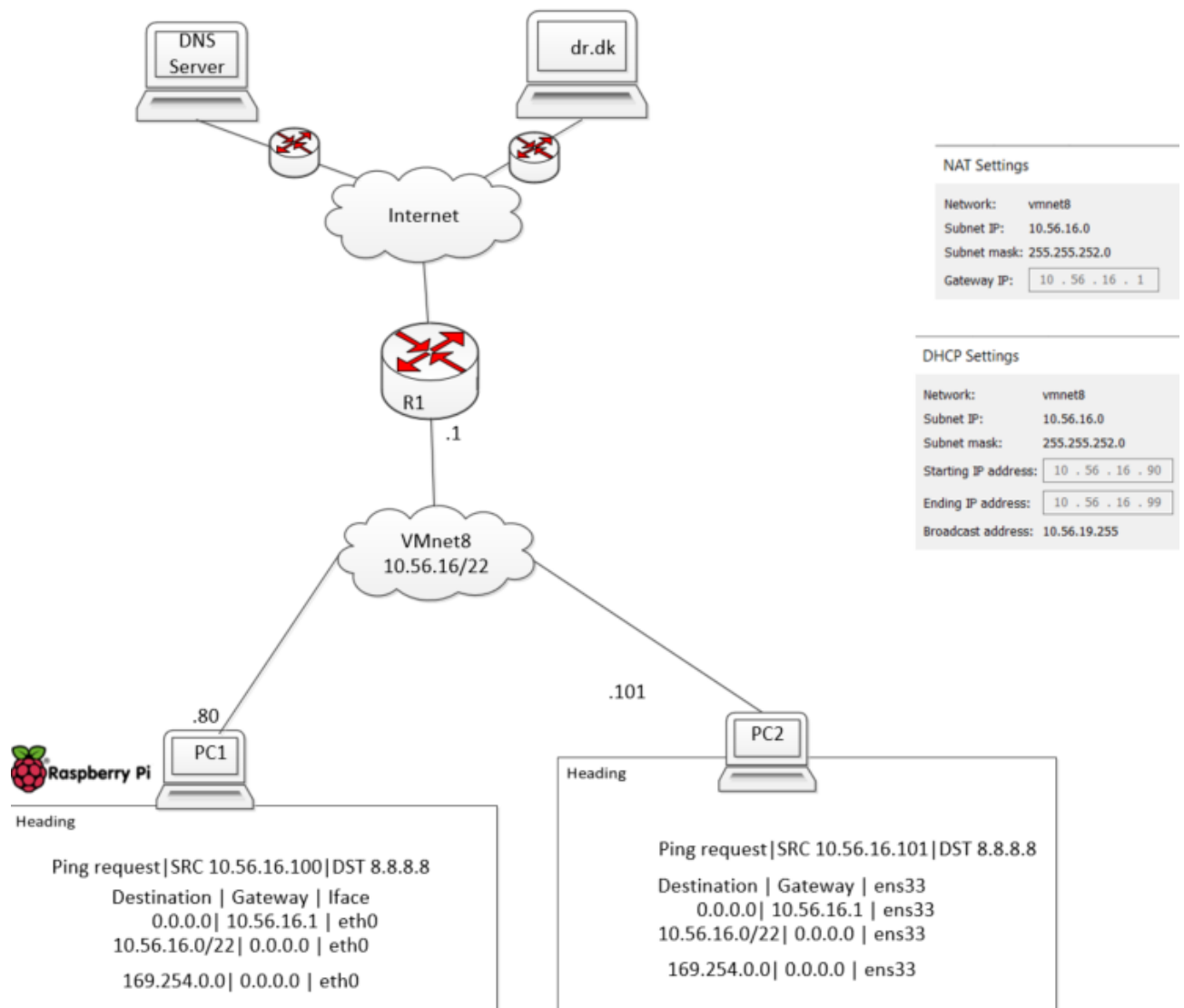
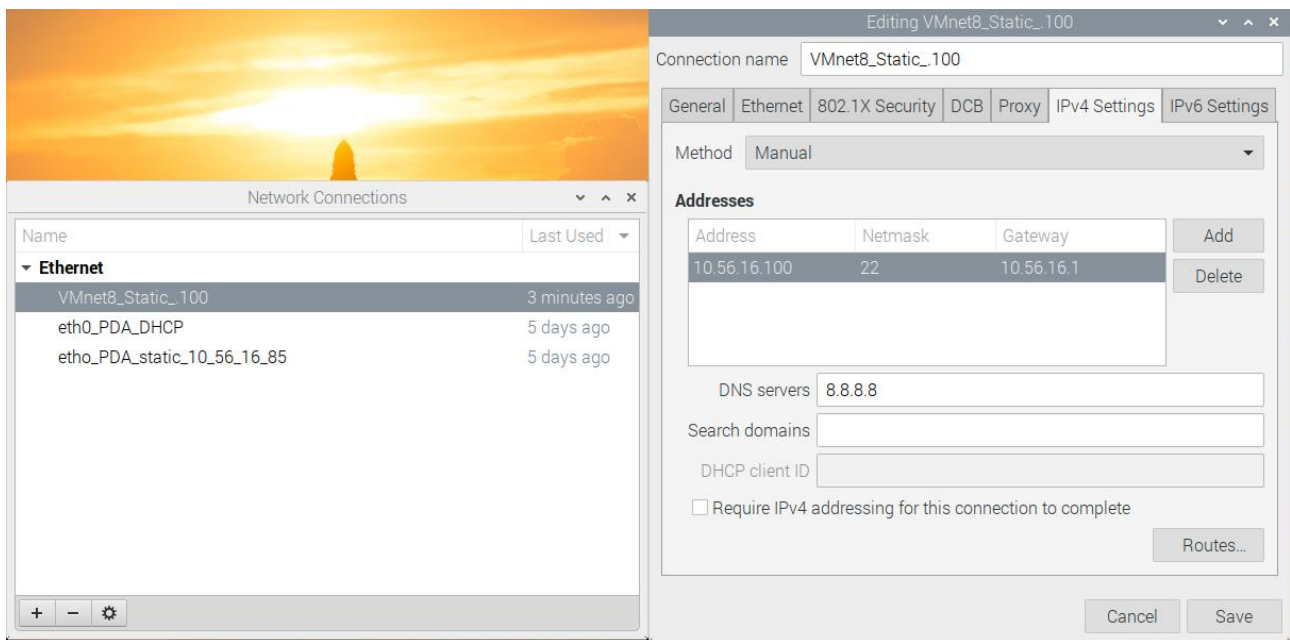
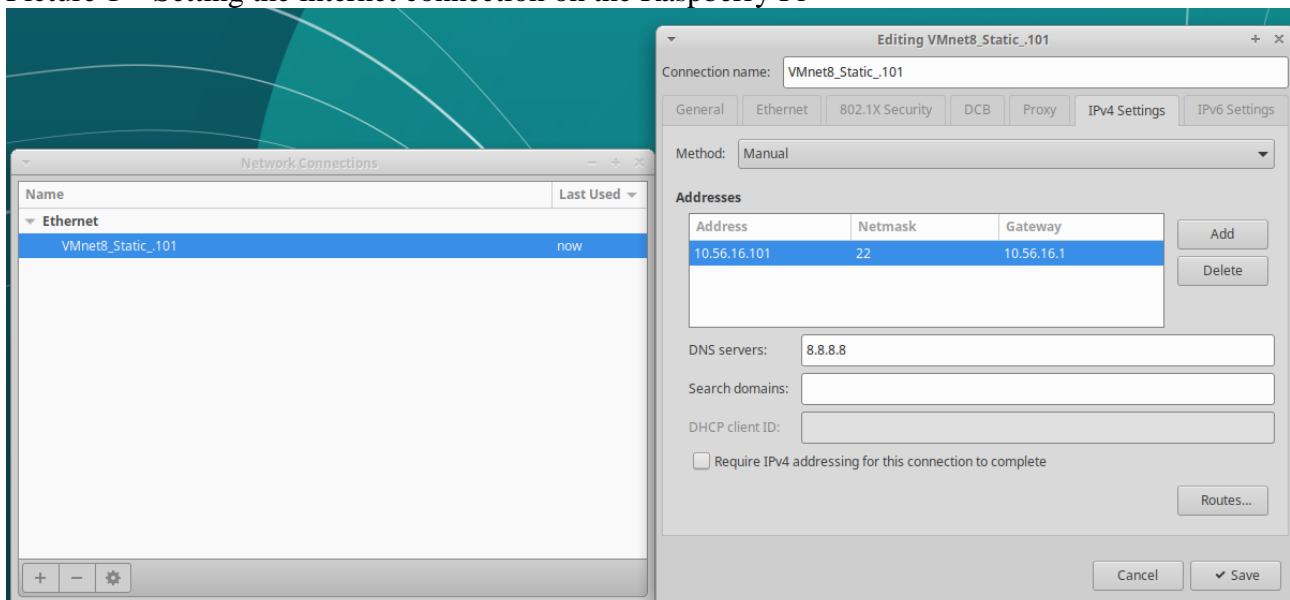


Figure 1 - Network diagram

In the figure 1 is presented the network diagram between two virtual machines Raspberry Pi and Xubuntu OS. For configuring according to the diagram, we enter settings, preferences and advanced network configuration. We need to follow picture 1 and add the configuration from the diagram. For Xubuntu OS we need to follow the same instruction just from picture 2, and don't forget the internet settings can be found in the upper toolbar, the two arrows in opposition, and select Edit connection.

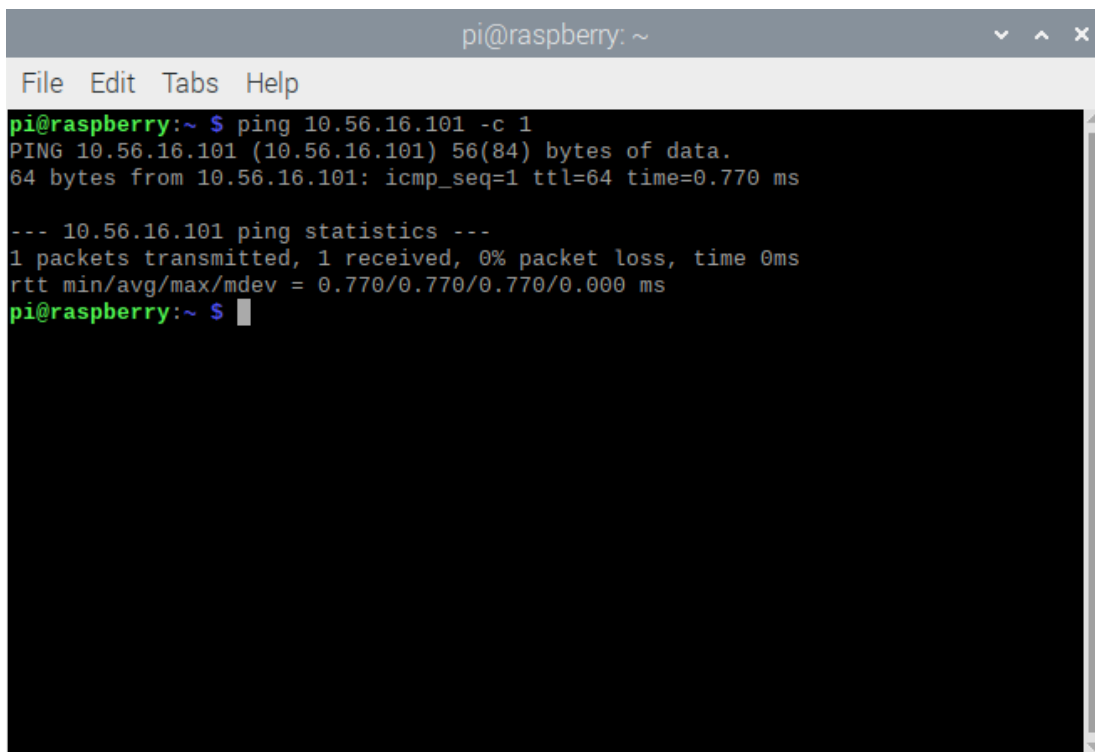


Picture 1 – Setting the internet connection on the Raspberry Pi



Picture 2 – Setting the internet connection on the Xubuntu

As we can see in Picture 3 we were able to ping the PC2 from PC1 (Raspberry). Seeing the receiver IP address (.101).

A terminal window titled 'pi@raspberrypi: ~' with a menu bar (File, Edit, Tabs, Help). The terminal shows a successful ping command: 'ping 10.56.16.101 -c 1'. The output indicates that 56(84) bytes of data were sent, and 64 bytes were received from 10.56.16.101 with an icmp_seq=1, ttl=64, and time=0.770 ms. Ping statistics show 1 packet transmitted, 1 received, 0% packet loss, and an rtt of 0.770/0.770/0.770/0.000 ms. The prompt 'pi@raspberrypi:~ \$' is visible at the bottom.

```
pi@raspberrypi:~ $ ping 10.56.16.101 -c 1
PING 10.56.16.101 (10.56.16.101) 56(84) bytes of data.
64 bytes from 10.56.16.101: icmp_seq=1 ttl=64 time=0.770 ms

--- 10.56.16.101 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.770/0.770/0.770/0.000 ms
pi@raspberrypi:~ $
```

Picture 3 – Ping from Raspberry vm(pc1) to Xubuntu vm(pc2)

Verify the Linux routing table configuration.

- List the routing table on PC1 and PC2 and compare to the design.
Explain: What is the Default Gateway DGW in the table?

The default configure address is 10.56.16.1 address on router .1, from picture 1/ diagram.

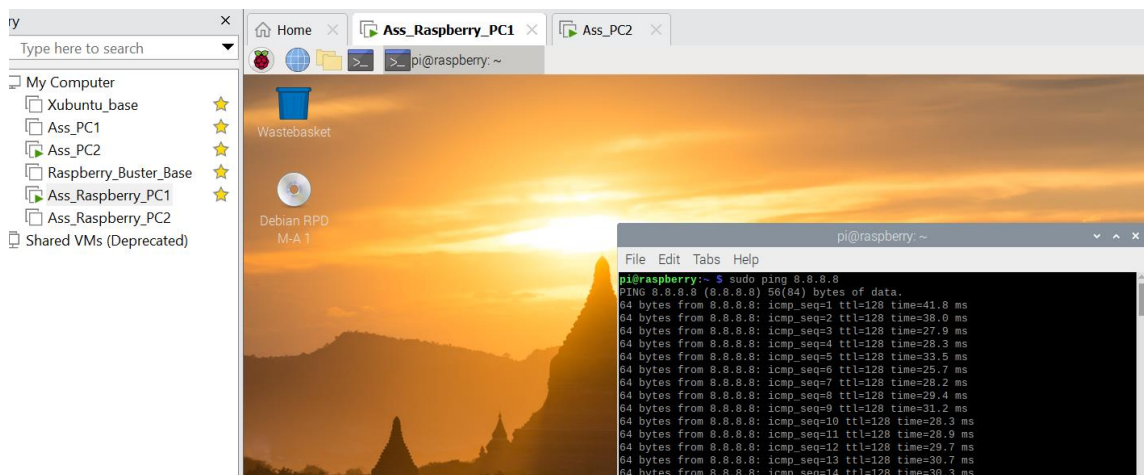
- What is the route to the directly connected network?

The route to the directly connected internet is R1 (router) and then the internet.

- Any other route listed in the table.

Yes, the 169.254.0.0

- Verify that the routing table works:
 - Ping e.g, 8.8.8.8. Explain if it works.



Picture 4 – Pinning 8.8.8.8

When we settled the ethernet setting for VNnet8 on the Raspberry PC1 we chose the DNS servers **8.8.8.8** (like in picture 4). It means that it works and direct match between the destination **0.0.0.0** as no other direct match in the destination column in the Picture 1.

3. Change the DGW address on PC1 and PC2 to be different from the R1 IP address.

- On both PCs configure the DGWs to a new IP address that is not 10.56.16.1. It has to be the same address i.e. DGW on both PCs. The address has to be between 2 and 254 and should not be between 90 and 99.
- Draw a new network diagram to match this error prone network.

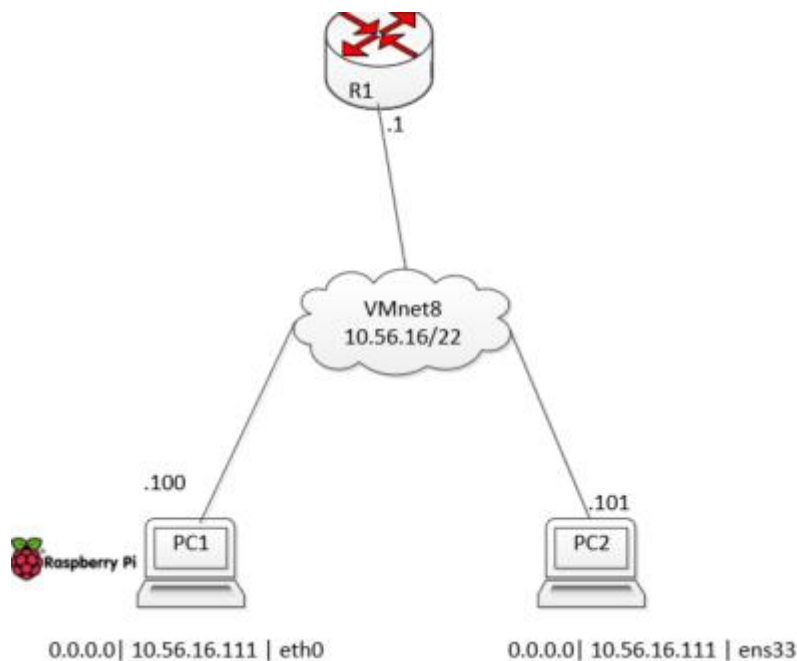


Figure 2 – The error diagram with the wrong DGW

The new default gateway (DGW) is **10.56.16.111** as we can see in figure 2 and picture 5.

- List the routing tables and compare to the design.

Explain:

- What is the R1 address, in the network diagram?

The default gateway is on router one. That now is not matching with the new gateway we selected (.111), like in picture 4. We can look now how the routing table looks like in Picture 5(pc1) and 6(pc2). By inserting the commands:

ip route

route

route -n

(in this order).

```

pi@raspberrypi:~$ ip route
default via 10.56.16.111 dev eth0 proto static metric 100
10.56.16.0/22 dev eth0 proto kernel scope link src 10.56.16.100 metric 100
169.254.0.0/16 dev eth0 scope link metric 1000
pi@raspberrypi:~$ route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
default 0.0.0.0 0.0.0.0 UG 100 0 0 eth0
10.56.16.0 0.0.0.0 255.255.252.0 U 100 0 0 eth0
link-local 0.0.0.0 255.255.0.0 U 1000 0 0 eth0
pi@raspberrypi:~$ route -n
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
0.0.0.0 10.56.16.111 0.0.0.0 UG 100 0 0 eth0
10.56.16.0 0.0.0.0 255.255.252.0 U 100 0 0 eth0
169.254.0.0 0.0.0.0 255.255.0.0 U 1000 0 0 eth0
pi@raspberrypi:~$

```

Picture 5 - new default gateway route on pc1

```

romulus@ubuntu:~$ ip route
default via 10.56.16.111 dev ens33 proto static metric 100
10.56.16.0/22 dev ens33 proto kernel scope link src 10.56.16.101 metric 100
169.254.0.0/16 dev ens33 scope link metric 1000
romulus@ubuntu:~$ route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
default 10.56.16.111 0.0.0.0 UG 100 0 0 ens33
10.56.16.0 0.0.0.0 255.255.252.0 U 100 0 0 ens33
link-local 0.0.0.0 255.255.0.0 U 1000 0 0 ens33
romulus@ubuntu:~$ route -n
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
0.0.0.0 10.56.16.111 0.0.0.0 UG 100 0 0 ens33
10.56.16.0 0.0.0.0 255.255.252.0 U 100 0 0 ens33
169.254.0.0 0.0.0.0 255.255.0.0 U 1000 0 0 ens33
romulus@ubuntu:~$

```

Picture 6 – new default gateway route on pc2

- What is the Default Gateway in the table on PC1 and PC2?

In PC1 we have **10.56.16.111** and for PC2 we have **10.56.16.111** as we can see in picture 5 and 6. Although, it needs to be the same with the router.

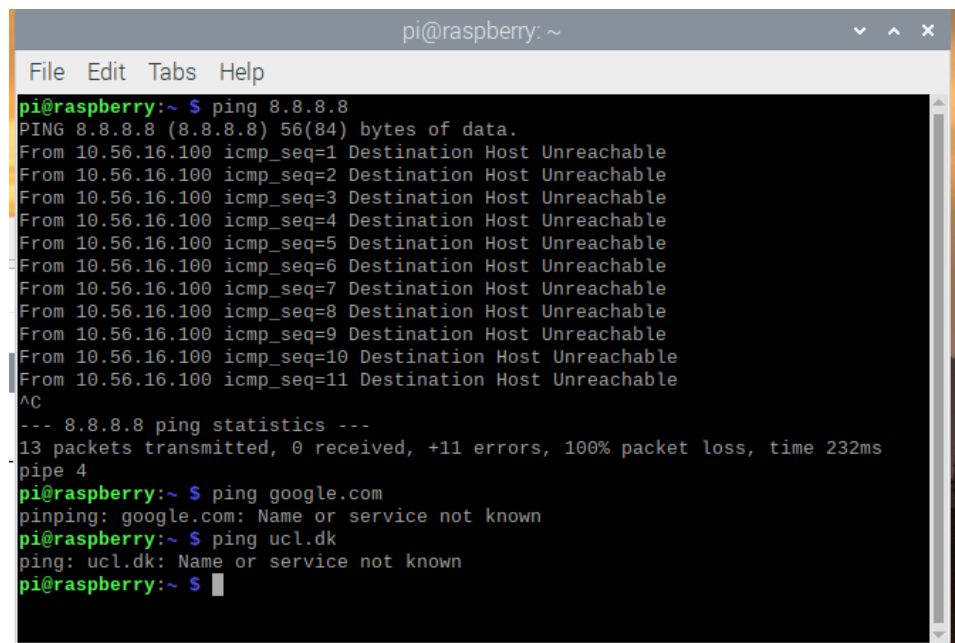
- Is this a problem?

We will not be able to sync with the router which has .1 if our default gateway ends with .100

- Does a wrong gateway prevent PC1 and PC2 from pinging each other?
 - Why/Why not?

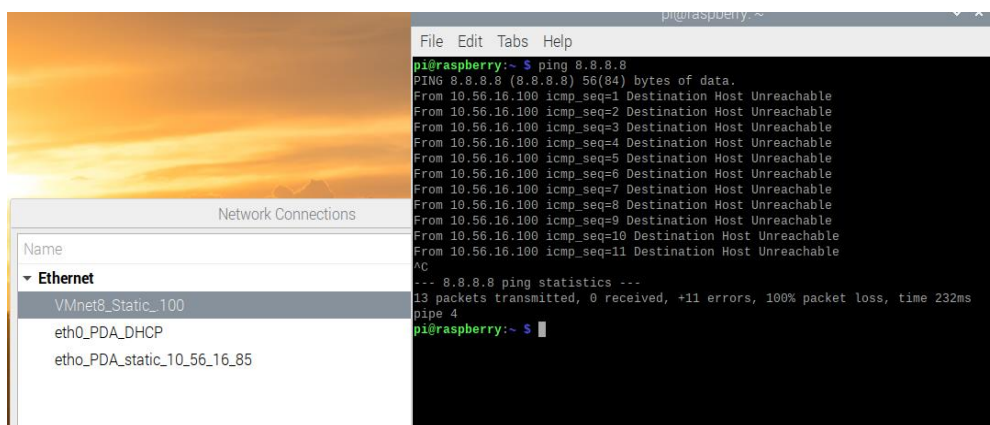
The R1 is the one establishing a connection between the two PC's, without it they can't pin, communicate with each other.

As we can see in picture 7 and 8 we can't ping from both PC1 and PC2 to send a pin request to 8.8.8.8 a routing process will take place, the IP package will not be able to get to the default gateway as the router R1 (.1) has a different address.



```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi:~$ ping 8.8.8.8  
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.  
From 10.56.16.100 icmp_seq=1 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=2 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=3 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=4 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=5 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=6 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=7 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=8 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=9 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=10 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=11 Destination Host Unreachable  
^C  
--- 8.8.8.8 ping statistics ---  
13 packets transmitted, 0 received, +11 errors, 100% packet loss, time 232ms  
pipe 4  
pi@raspberrypi:~$ ping google.com  
ping: google.com: Name or service not known  
pi@raspberrypi:~$ ping ucl.dk  
ping: ucl.dk: Name or service not known  
pi@raspberrypi:~$
```

Picture 7 – Ping 8.8.8.8 from pc1



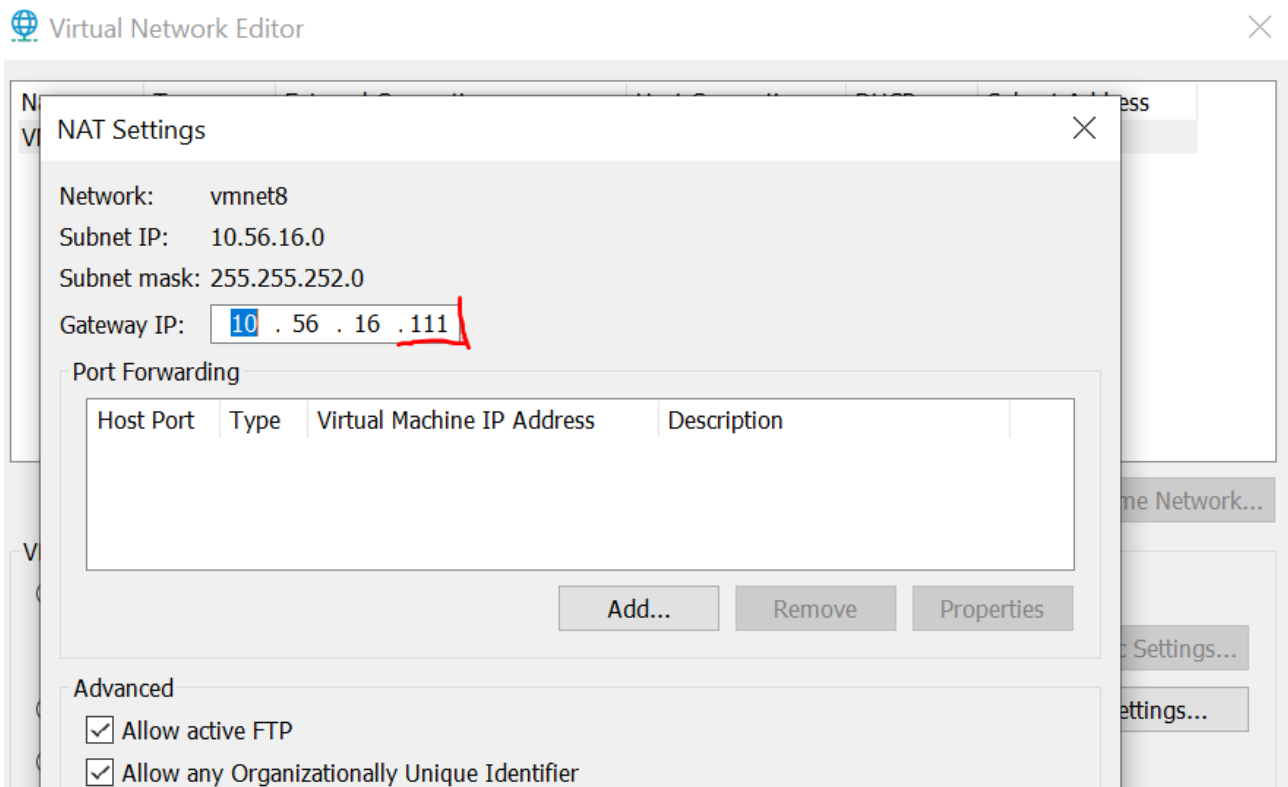
```
Network Connections  
Name  
▼ Ethernet  
VMnet8_Static_100  
eth0_PDA_DHCP  
eth0_PDA_static_10.56.16.85  
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi:~$ ping 8.8.8.8  
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.  
From 10.56.16.100 icmp_seq=1 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=2 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=3 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=4 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=5 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=6 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=7 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=8 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=9 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=10 Destination Host Unreachable  
From 10.56.16.100 icmp_seq=11 Destination Host Unreachable  
^C  
--- 8.8.8.8 ping statistics ---  
13 packets transmitted, 0 received, +11 errors, 100% packet loss, time 232ms  
pipe 4  
pi@raspberrypi:~$
```

Picture 8 – Ping 8.8.8.8 form pc2

- Show what the output from the ping program says and explain what it means.
 - Output example for PC1:
From 10.56.16.100 icmp_seq=1 Destination Host Unreachable
- Run Wireshark with Display Filter `icmp`
 - Why does Wireshark not show any ping/icmp ip packets when pinging to the internet , e.g. ping 8.8.8.8?
 - List the PC1s ARP or MAC table. `$ ip neigh`
 - Why is the Gateway entry ... dev eth0 INCOMPLETE?

Change i.e. correct the R1 IP address to the DGW address set on PC1 dn PC2

- Change the router R1 IP address in VMWW Virtual Network Editor NAT settings for VMNet8 to the address set as the DGW the PC1 dn PC2 above. In Virtual Network Editor the R1 address is called: Gateway IP:



Picture 9 – Changing the NAT setting with the PC1 and PC2 default gateway.

- Draw or correct the network design or diagram accordingly by correcting the R1 IP address.
- Explain/show:

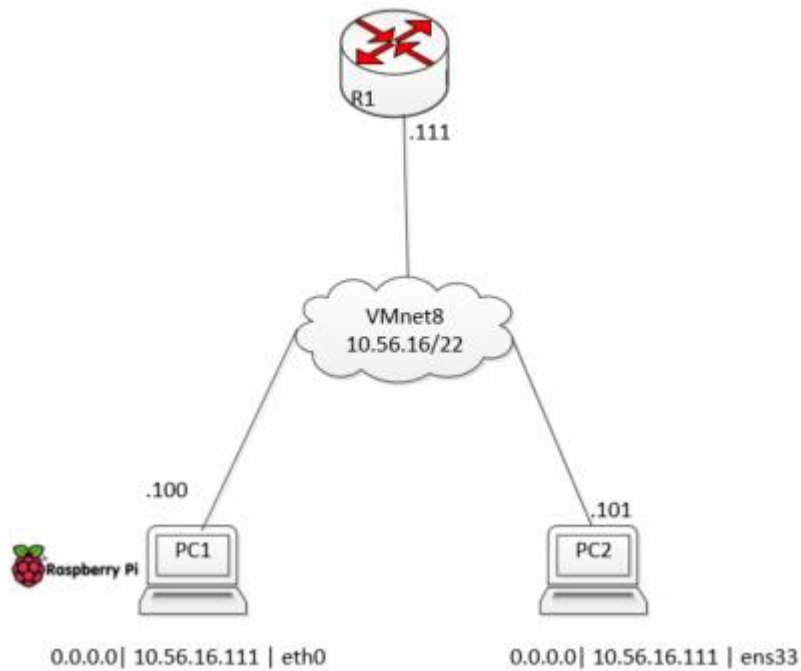


Figure 3 – The new network diagram with the R1(router) with the same address as the PC1 AND PC2 default gateway.

- What is the R1 address, in the network diagram?

The new R1 address is **.111**

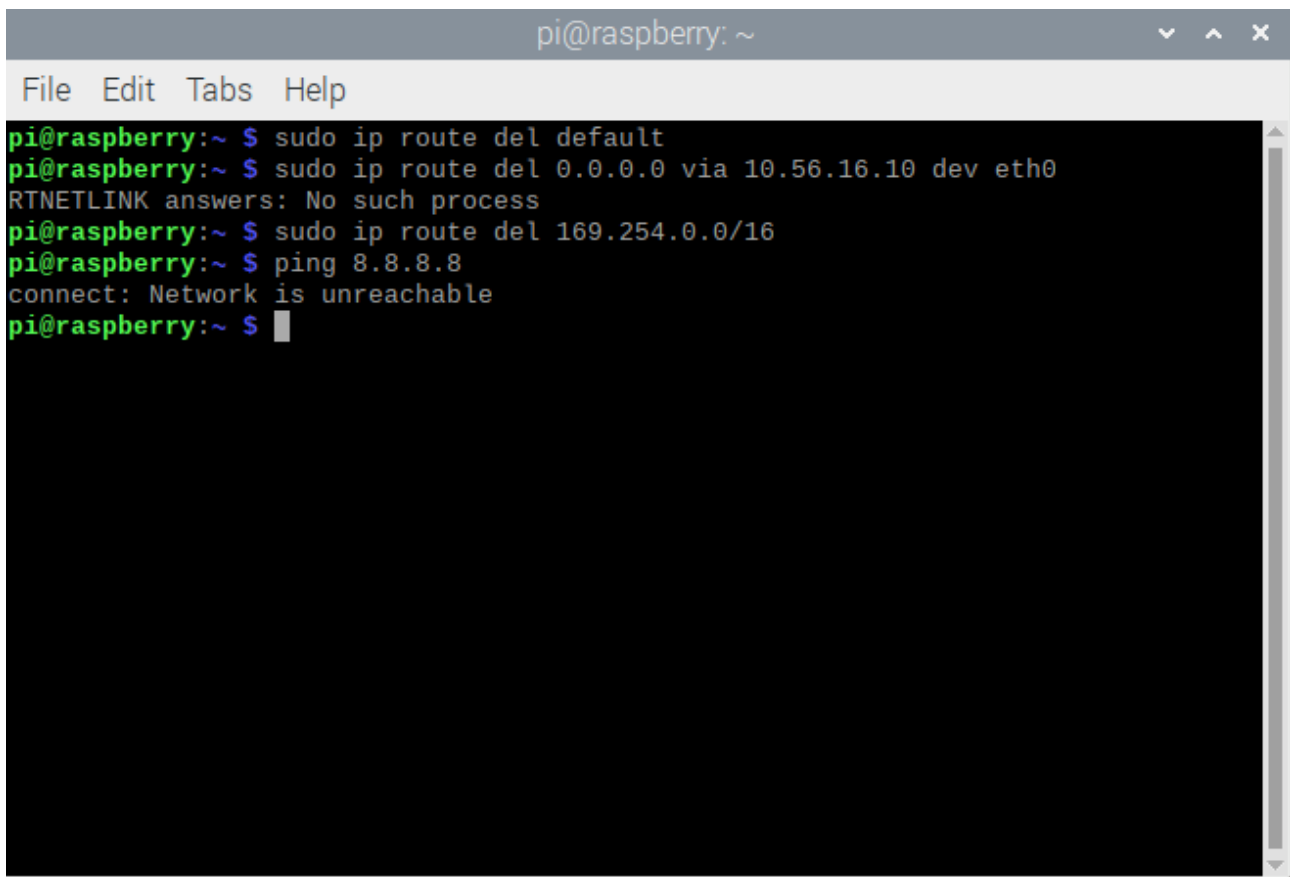
```

pi@raspberrypi:~$ ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
From 10.56.16.100 icmp_seq=1 Destination Host Unreachable
From 10.56.16.100 icmp_seq=2 Destination Host Unreachable
From 10.56.16.100 icmp_seq=3 Destination Host Unreachable
From 10.56.16.100 icmp_seq=4 Destination Host Unreachable
From 10.56.16.100 icmp_seq=5 Destination Host Unreachable
From 10.56.16.100 icmp_seq=6 Destination Host Unreachable
From 10.56.16.100 icmp_seq=7 Destination Host Unreachable
From 10.56.16.100 icmp_seq=8 Destination Host Unreachable
From 10.56.16.100 icmp_seq=9 Destination Host Unreachable
From 10.56.16.100 icmp_seq=10 Destination Host Unreachable

```

Picture 10 – R1 and DGA changes

As we can see in the picture 10, we can't ping 8.8.8.8 even though now we have the same R1 (router address) with the default gateway on PC1 and PC2.



```
pi@raspberrypi:~ $ sudo ip route del default
pi@raspberrypi:~ $ sudo ip route del 0.0.0.0 via 10.56.16.10 dev eth0
RTNETLINK answers: No such process
pi@raspberrypi:~ $ sudo ip route del 169.254.0.0/16
pi@raspberrypi:~ $ ping 8.8.8.8
connect: Network is unreachable
pi@raspberrypi:~ $
```

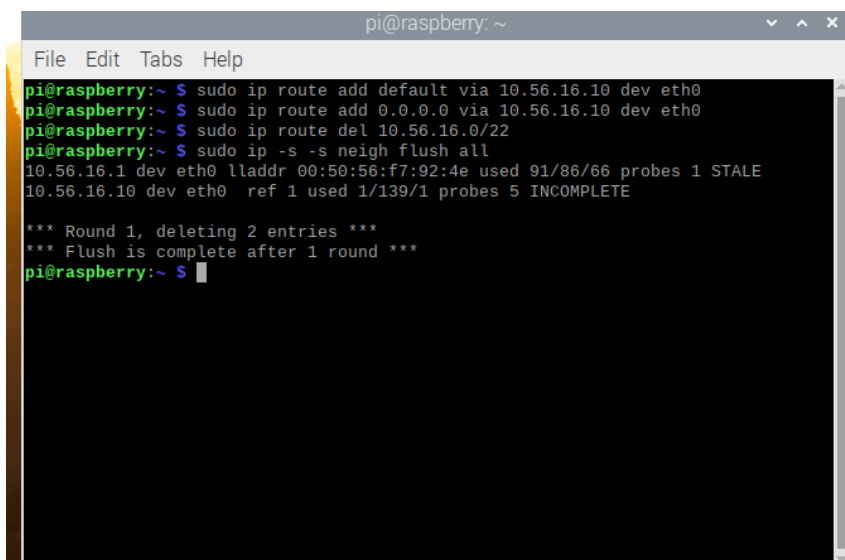
Picture 11 – more changes

As we can see we can't ping 8.8.8.8 as the virtual network editor is not working, since we changed to the default gateway address on pc1 and 2pi

Misconfigure the routing table on PC1

Misconfigure the routing table on PC1 by deleting the route to the 10.56.16.0/22 network and flushing the ARP table:

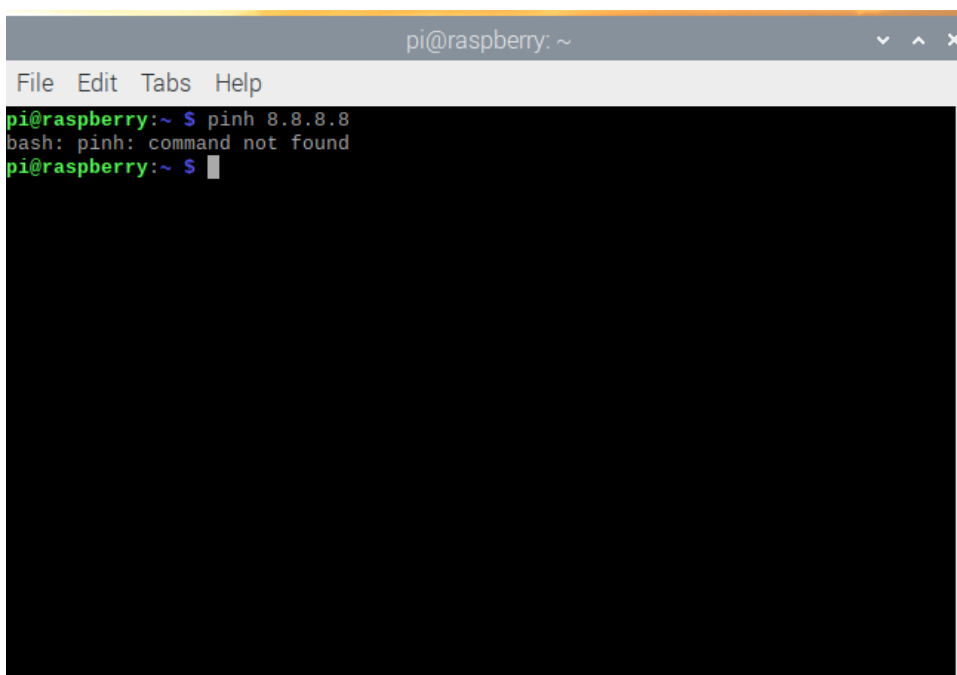
- `$ sudo ip route del 10.56.16.0/22`
- `$ sudo ip -s -s neigh flush all`



```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi:~$ sudo ip route add default via 10.56.16.10 dev eth0  
pi@raspberrypi:~$ sudo ip route add 0.0.0.0 via 10.56.16.10 dev eth0  
pi@raspberrypi:~$ sudo ip route del 10.56.16.0/22  
pi@raspberrypi:~$ sudo ip -s -s neigh flush all  
10.56.16.1 dev eth0 lladdr 00:50:56:f7:92:4e used 91/86/66 probes 1 STALE  
10.56.16.10 dev eth0 ref 1 used 1/139/1 probes 5 INCOMPLETE  
  
*** Round 1, deleting 2 entries ***  
*** Flush is complete after 1 round ***  
pi@raspberrypi:~$
```

Picture 12 - Misconfigure the routing table on PC1

- Does ping to an address on a network on the internet work?
 - * Why/Why not? Ping e.g. 8.8.8.8.
 - * Show what the output from the ping program says and explain what it means.

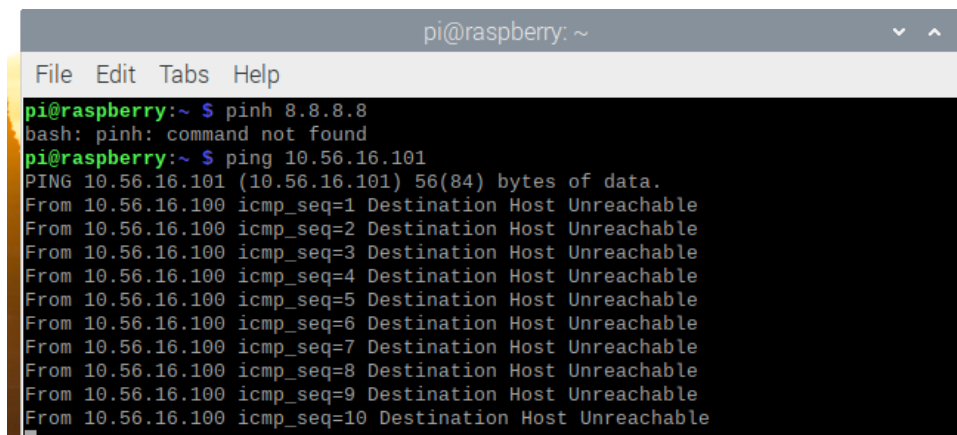


```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi:~$ pingh 8.8.8.8  
bash: pingh: command not found  
pi@raspberrypi:~$
```

Picture 13 – Ping 8.8.8.8 after we deleted the ARP

Without the ARP table and the route destination Xubuntu can't find the command as the network table is empty.

- Does ping to PC2 work?

A screenshot of a terminal window titled 'pi@raspberrypi: ~'. The window has a menu bar with 'File', 'Edit', 'Tabs', and 'Help'. The terminal shows the following commands and output:

```
pi@raspberrypi:~ $ ping 8.8.8.8
bash: ping: command not found
pi@raspberrypi:~ $ ping 10.56.16.101
PING 10.56.16.101 (10.56.16.101) 56(84) bytes of data.
From 10.56.16.100 icmp_seq=1 Destination Host Unreachable
From 10.56.16.100 icmp_seq=2 Destination Host Unreachable
From 10.56.16.100 icmp_seq=3 Destination Host Unreachable
From 10.56.16.100 icmp_seq=4 Destination Host Unreachable
From 10.56.16.100 icmp_seq=5 Destination Host Unreachable
From 10.56.16.100 icmp_seq=6 Destination Host Unreachable
From 10.56.16.100 icmp_seq=7 Destination Host Unreachable
From 10.56.16.100 icmp_seq=8 Destination Host Unreachable
From 10.56.16.100 icmp_seq=9 Destination Host Unreachable
From 10.56.16.100 icmp_seq=10 Destination Host Unreachable
```

Picture 13 – ping PC2

By ping 10.56.16.101 which is pc2, without the address pc1 can't connect, like in picture 13.

8. Ping program outputs

- From the above "experiments", compile a debugging list that in oneliners explains what misconfiguration(s) will generate the following icmp or ping messages:
 - Destination Host Unreachable (Misconfigure the routing table, different address between default gateway and R1 (router))
 - connect: Network is unreachable (When the computer can't ping an address, either because of our network connection, network setting, default gateway)
- Go online and investigate how these outputs from the ping program occur:
 - No route to host {Will be a reply from a router firewall.}

Check that the server that you're trying to connect to is even online. We may be trying to connect on the incorrect port. Iptables Is Blocking the Connection. The DNS is not configured properly

Check that the server that you're trying to connect to is even online.

- Request Timed Out

problem is with your ssh configuration

3 Audience

The main audience for this report is people without advanced knowledge about installing VM (virtual machines) and another OS (operating system) such as Ubuntu inside the VM. The wide audience can be formed of students, employees or people that have to install another OS on their computer.

4 Inventory

In order to proceed to the next step, which is downloading, and installing the VM (virtual machine) the next components and software are required:

Vmware workstation

A laptop

Internet connection

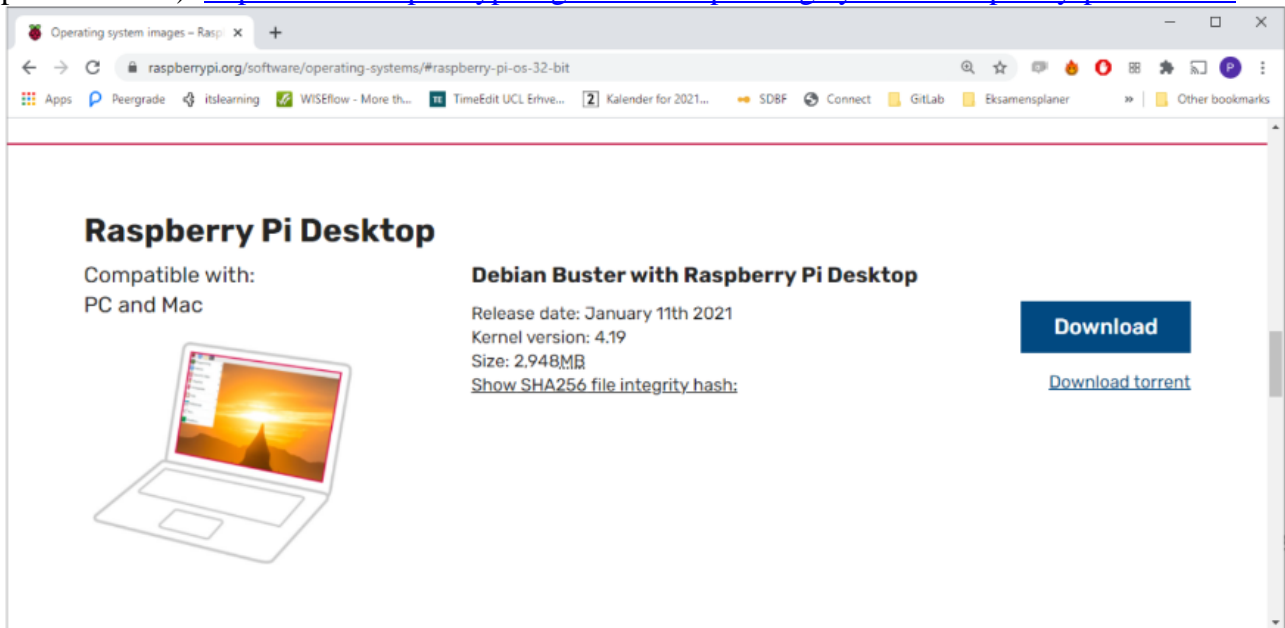
An xubuntu-20.04.3-desktop-amd64.iso

Raspberry Pi Buster Operating system

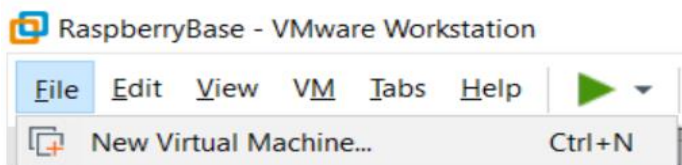
Visio (Microsoft)

5 Installing a Raspberry Pi Buster Operating system on a Virtual Machine VM in VMWW and connecting it to the internet VMnet8.

First we need to download the Raspberry Pi Linux Debian OS from their website (just like in the picture below): <https://www.raspberrypi.org/software/operating-systems/#raspberry-pi-os-32-bit>

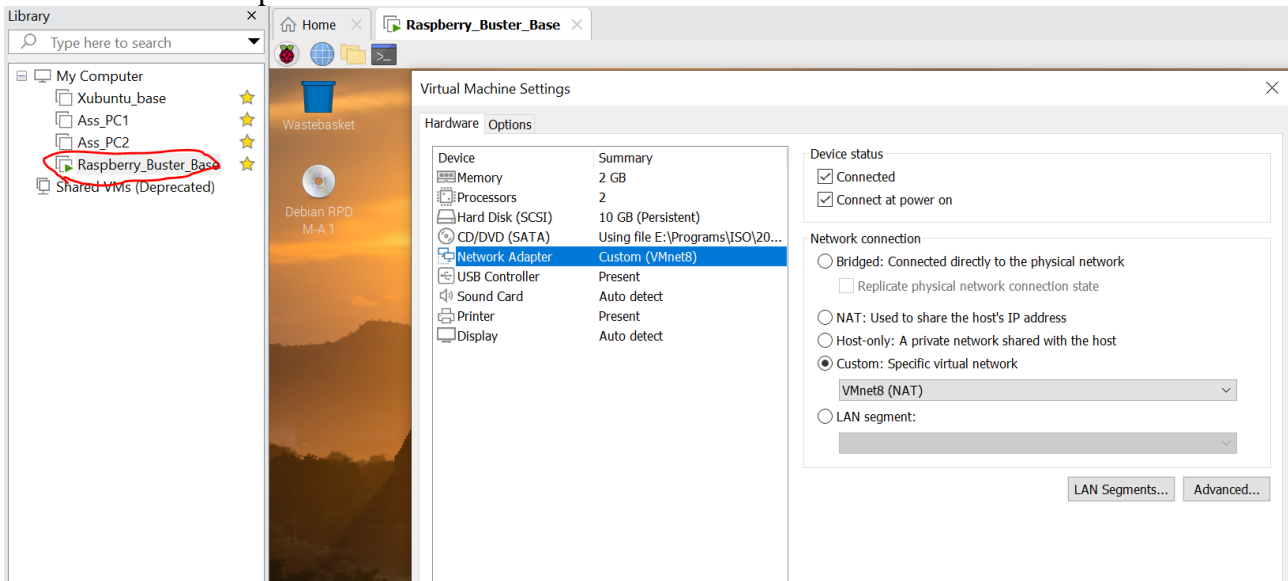


After we have downloaded and saved on our computer the iso image of the Raspberry Pi OS we open the VMware we select it and run it.

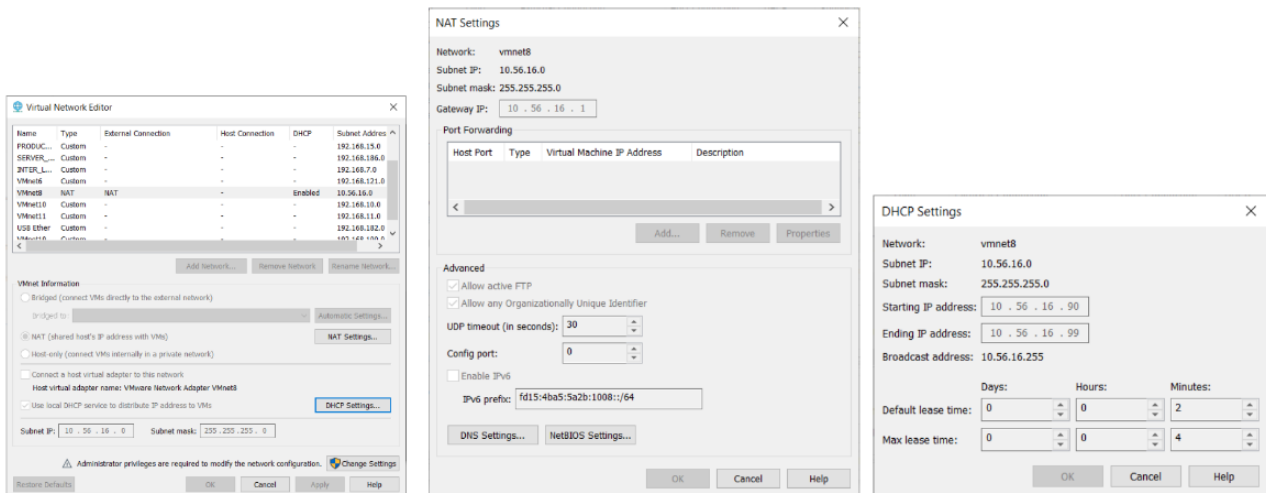


The rest of the instructions are usual, with the file directory, , maximum disk size it is advised for 10 GB.

For setting up the internet we right click on Raspberry_Buster_Base and click on Settings and we select Netowrk Adapter.



And we make sure we have the VMnet8 settings just like in the picture below.



6 Sources

The sources are from the software and webpages we used to install the VM and the new OS:

[vmware.com/products/workstation-pro](https://www.vmware.com/products/workstation-pro)
<https://xubuntu.org/download>
VM workstation software

7 Conclusion