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Scenario: You, as a network admin, are going to set up your Ubuntu VM as a gateway to provide Internet access to another client Ubuntu VM. The client VM needs to be in the same internal network as the gateway (as shown in Figure 1). Once the connection is ready, you need to configure the firewall to secure the network properly. The following requirements need to be satisfied to receive full credits.

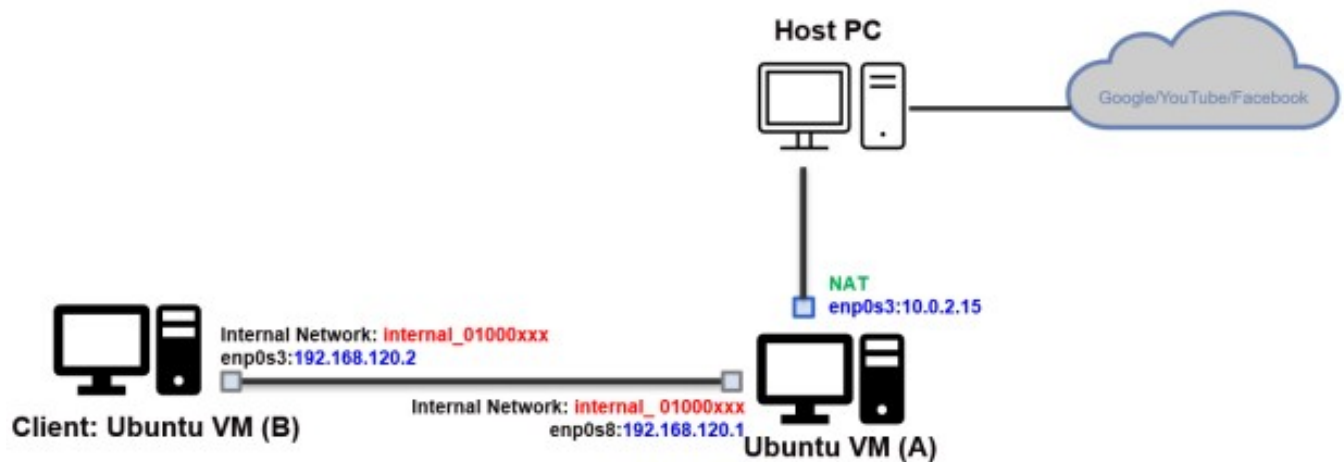


Figure 1 Desired Network Topology

Please note that you need to customize the value in the fields marked in RED above.

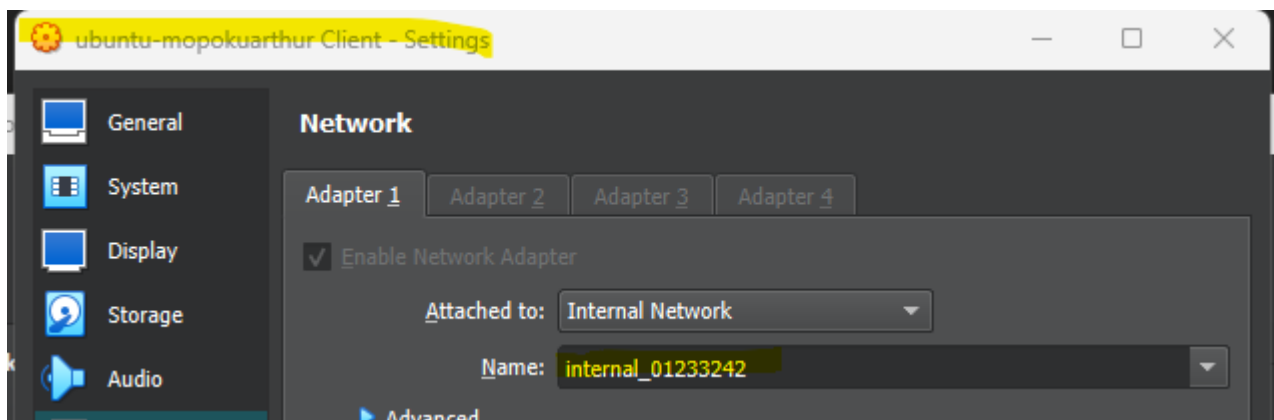
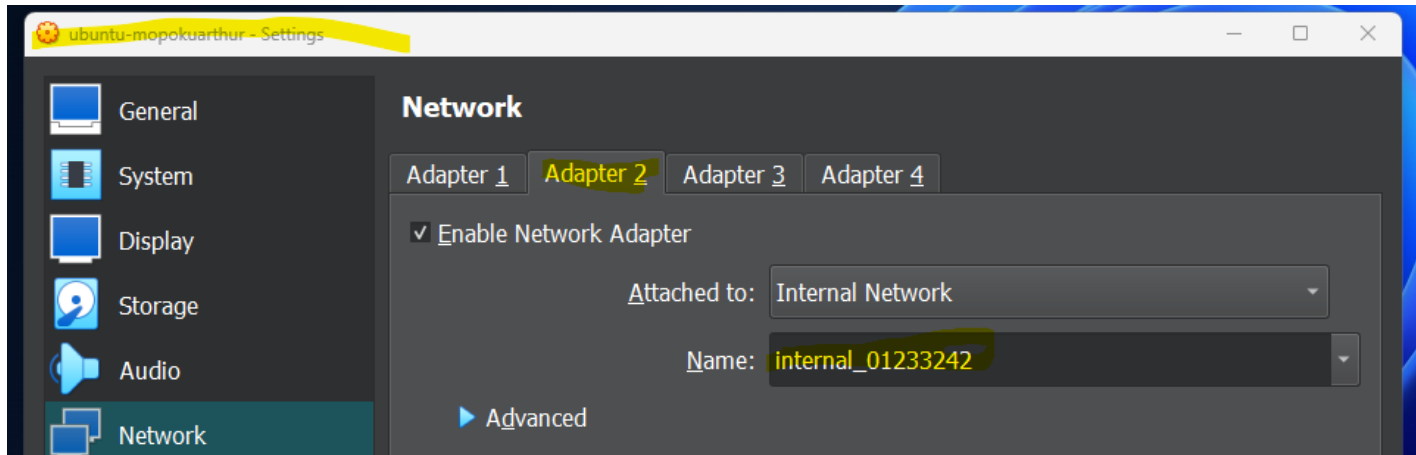
Please configure the network with the following requirement: (You need to clone the existing VM)

Task A –Network Configuration (60 points)

Please submit the screenshot for all the steps.

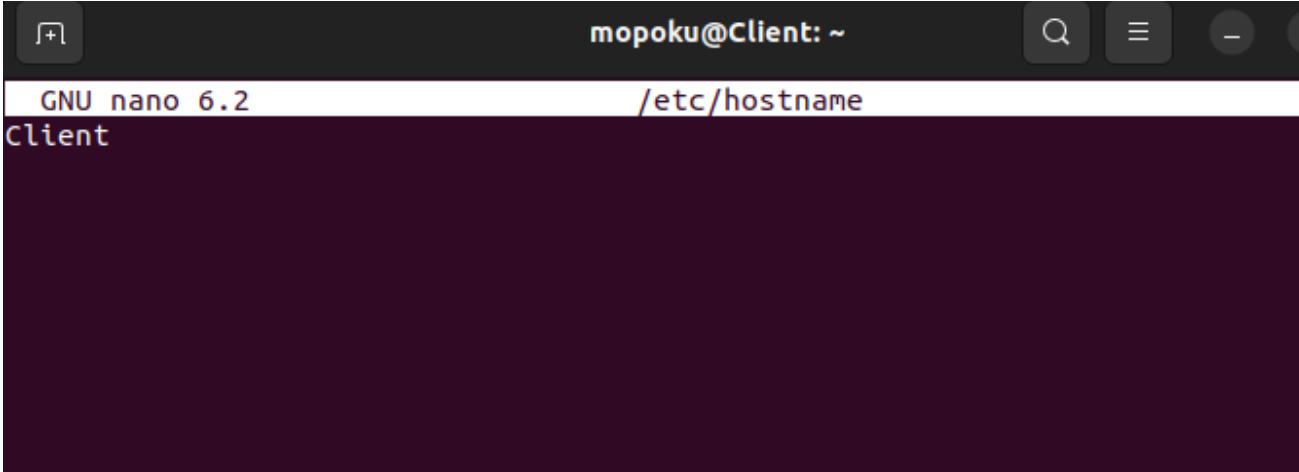
1. In the virtual box setting, connect two VMs in the same internal network, “internal_{UIN}”.

Replace {UIN} with your real UIN.



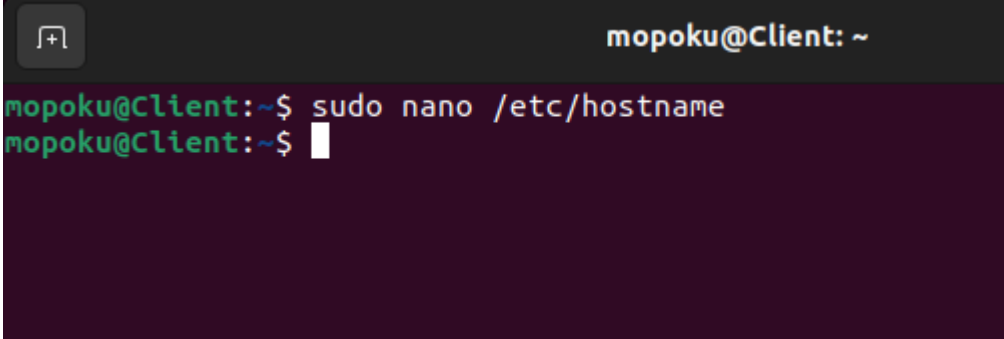
2. Change the hostname of the Client VM to "{MIDASname}-Client." **Replace {MIDAS name} with your real MIDAS name. Don't forget to reboot your client VM to reflect the change in hostname.**

a



```
mopoku@Client: ~  
GNU nano 6.2 /etc/hostname  
Client
```

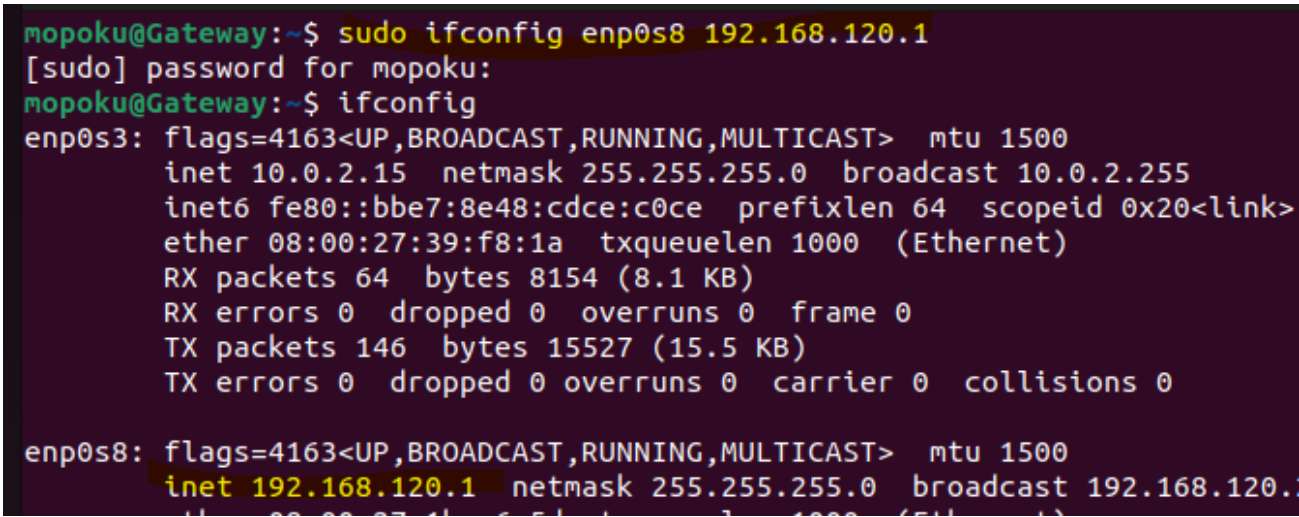
b



```
mopoku@Client:~$ sudo nano /etc/hostname  
mopoku@Client:~$
```

3. Configure the temporary IP address on the Gateway Ubuntu, as shown in Figure 1.

a



```
mopoku@Gateway:~$ sudo ifconfig enp0s8 192.168.120.1  
[sudo] password for mopoku:  
mopoku@Gateway:~$ ifconfig  
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255  
    inet6 fe80::bbe7:8e48:cdce:c0ce prefixlen 64 scopeid 0x20<link>  
    ether 08:00:27:39:f8:1a txqueuelen 1000 (Ethernet)  
    RX packets 64 bytes 8154 (8.1 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 146 bytes 15527 (15.5 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet 192.168.120.1 netmask 255.255.255.0 broadcast 192.168.120.255  
    ether 08:00:27:39:f8:1a txqueuelen 1000 (Ethernet)
```

4. Configure the temporary IP address, routing table, and DNS server on Client VM as shown in Figure 1.

a

```
mopoku@Client:~$ sudo ifconfig enp0s3 192.168.120.2
[sudo] password for mopoku:
mopoku@Client:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.120.2 netmask 255.255.255.0 broadcast 192.168.120.255
    ether 08:00:27:93:e4:57 txqueuelen 1000 (Ethernet)
    RX packets 51 bytes 10346 (10.3 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 113 bytes 18077 (18.0 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

b

```
mopoku@Client:~$ sudo ip route add default via 192.168.120.1
mopoku@Client:~$ sudo ip route add 192.168.120.0/24 dev enp0s3
RTNETLINK answers: File exists
mopoku@Client:~$ route -n
Kernel IP routing table
Destination        Gateway            Genmask           Flags Metric Ref    Use Iface
0.0.0.0            192.168.120.1    0.0.0.0           UG      0      0        0 enp0s3
169.254.0.0        0.0.0.0          255.255.0.0       U        1000    0        0 enp0s3
192.168.120.0      0.0.0.0          255.255.255.0     U        0      0        0 enp0s3
mopoku@Client:~$
```

c

```
GNU nano 6.2 /etc/resolv.conf *
#
# This file might be symlinked as /etc/resolv.conf. If you're
# here, you should move the original file to here first, and
# then make a symlink from /etc/resolv.conf to here.
#
# This is a dynamic resolv.conf file for connecting local client
# DNS requests to the internal DNS stub resolver of systemd-resolved. This file lists
# the configured search domains.
#
# Run "resolvectl status" to see details about the uplink DNS
# currently in use.
#
# Third party programs should typically not access this file directly,
# but rather use the symlink at /etc/resolv.conf. To manage man:resolved.conf(8)
# in a different way, replace this symlink by a static file or a
# directory, and restart systemd-resolved and rename this file to
# something like /etc/resolv.conf.d/01.conf.
# See man:systemd-resolved.service(8) for details about the
# operation for /etc/resolv.conf.
nameserver 8.8.8.8
```

```
mopoku@Client:~$ sudo nano /etc/resolv.conf  
mopoku@Client:~$
```

d

5. Configure gateway Ubuntu to enable IP forwarding (to forward the traffic) (also NAT configuration)

```
mopoku@Gateway:~$ sudo iptables -A FORWARD -i enp0s3 -o enp0s8 -m state --state RELATED,ESTABLISHED -j ACCEPT
iptables v1.8.7 (nf_tables): unknown option "--stateRELATED,ESTABLISHED"
Try `iptables -h' or 'iptables --help' for more information.
mopoku@Gateway:~$ sudo iptables -A FORWARD -i enp0s3 -o enp0s8 -m state --state RELATED,ESTABLISHED -j ACCEPT
mopoku@Gateway:~$ sudo iptables -A FORWARD -i enp0s8 -o enp0s3 -j ACCEPT
mopoku@Gateway:~$ iptables -L
iptables v1.8.7 (nf_tables): Could not fetch rule set generation id: Permission denied (you must be root)

mopoku@Gateway:~$ sudo iptables -L
Chain INPUT (policy ACCEPT)
target     prot opt source                destination

Chain FORWARD (policy ACCEPT)
target     prot opt source                destination
ACCEPT     all  --  anywhere              anywhere            state RELATED,ESTABLISHED
ACCEPT     all  --  anywhere              anywhere

Chain OUTPUT (policy ACCEPT)
target     prot opt source                destination

a mopoku@Gateway:~$ 
mopoku@Gateway:~$ su root
Password:
root@Gateway:/home/mopoku# echo > 1 /proc/sys/net/ipv4/ip_forward
root@Gateway:/home/mopoku# cat /proc/sys/net/ipv4/ip_forward
0
root@Gateway:/home/mopoku# cat /proc/sys/net/ipv4/ip_forward
0
root@Gateway:/home/mopoku# echo 1 > /proc/sys/net/ipv4/ip_forward
bash: /proc/sys/net/ipv4/ip_forward: No such file or directory
root@Gateway:/home/mopoku# echo 1 > /proc/sys/net/ipv4/ip_forward
bash: /proc/sys/net/ipv4/ip_forward: No such file or directory
root@Gateway:/home/mopoku# cat /proc/sys/net/ipv4/ip_forward
0
root@Gateway:/home/mopoku# echo 1 > /proc/sys/net/ipv4/ip_forward
root@Gateway:/home/mopoku# cat /proc/sys/net/ipv4/ip_forward
1
b
```

6. Test your ping connection to 8.8.8.8 and www.google.com in the client VM, respectively.

```
^Cmopoku@Client:~$ ping 8.8.8.8 -c 3
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=111 time=13.0 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=111 time=11.8 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=111 time=12.0 ms

--- 8.8.8.8 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2007ms
rtt min/avg/max/mdev = 11.815/12.278/13.007/0.521 ms
mopoku@Client:~$ ping www.google.com -c 3
PING www.google.com (142.251.16.99) 56(84) bytes of data.
64 bytes from bl-in-f99.1e100.net (142.251.16.99): icmp_seq=1 ttl=52 time=18.317 ms
64 bytes from bl-in-f99.1e100.net (142.251.16.99): icmp_seq=2 ttl=52 time=22.662 ms
64 bytes from bl-in-f99.1e100.net (142.251.16.99): icmp_seq=3 ttl=52 time=31.214 ms

--- www.google.com ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2078ms
rtt min/avg/max/mdev = 18.317/22.662/31.214/6.047 ms
```

a

Task B –Firewall Configuration (40 points)

1. Configure the iptables on the gateway Ubuntu to block all the inbound ICMP packets from the Client VM.

```
mopoku@Gateway:~$ sudo iptables -A INPUT -s 192.168.120.2 -p icmp -j DROP
[sudo] password for mopoku:
Sorry, try again.
[sudo] password for mopoku:
```

a

2. Configure the iptables on the gateway Ubuntu to block all the outbound ICMP packets that originated from the gateway Ubuntu itself.

a

```
mopoku@Gateway:~$ sudo iptables -A OUTPUT -s 192.168.120.1 -p icmp -j DROP
mopoku@Gateway:~$ sudo iptables -L
Chain INPUT (policy ACCEPT)
target     prot opt source                destination
DROP       icmp -- 192.168.120.2         anywhere

Chain FORWARD (policy ACCEPT)
target     prot opt source                destination      state
ACCEPT     all  --  anywhere             anywhere        RELATED
BLISHED
ACCEPT     all  --  anywhere             anywhere

Chain OUTPUT (policy ACCEPT)
target     prot opt source                destination
DROP       icmp -- Gateway             anywhere

b
mopoku@Gateway:~$ ping 192.168.120.2
mopoku@Gateway:~$ ping 192.168.120.2
PING 192.168.120.2 (192.168.120.2) 56(84) bytes of data.
^C
--- 192.168.120.2 ping statistics ---
10 packets transmitted, 0 received, 100% packet loss, time 9257ms

c
mopoku@Client:~$ ping 192.168.120.1
PING 192.168.120.1 (192.168.120.1) 56(84) bytes of data.
^C
--- 192.168.120.1 ping statistics ---
5 packets transmitted, 0 received, 100% packet loss, time 4251ms

d
```