



UNIVERSITI TUN HUSSEIN ONN MALAYSIA
FACULTY OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY
(FSKTM)
SEMESTER I 2023/2024

OPERATING SYSTEM
BIC 20803
SECTION 04


GROUP ASSIGNMENT 1 (**GROUP 29**)

TITLE
NETWORK SETTING IN VIRTUAL MACHINE (VM)

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DATE SUBMISSION: 28th OCTOBER 2023

 UTHM Universiti Tun Hussein Onn Malaysia FACULTY OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY	Course Code	BIC20803	Item	ASSIGNMENT 1
	Course	OPERATING SYSTEM	Date Release	OCT 2023
Title	Network Setting in Virtual Machine (VM)			
Objectives	At the end of this task, student should be able to: i. Understand the configuration of virtual machine. ii. Apply the concept of operating system structures. iii. Demonstrate key skills for virtual machine services.			
Method	<ul style="list-style-type: none"> • VM installation and configuration • Observation • Books/Journals; Internet 			
Mode	□ Group (2 persons only)			
Submission	<ul style="list-style-type: none"> • Report Week 4 (29/10/2023 – 02/11/2023) • Author - Group Activities tab 			

TASK 1: Choose and install one of the following **hypervisors / virtual machine monitors (VMM)** in the host machine (Host OS)

- VMware Workstation Player /Oracle VirtualBox / Xvisor / Lguest or others



TASK 2: Install ONE virtual machine (Guest OS) in the installed hypervisor / virtual machine monitor (VMM)

- Using Linux Distro (e.g., CentOS, Ubuntu, Debian, Fedora)



TASK 3 (REPORT-WEEK 3):

Prepare a report containing the following information:

a. **CHAPTER 1: Network configuration**

- i. Explain **ALL** types of network connection in the VM.

There are five types of network connections that we can use for our Virtual Machine (VM) (Heddings, A., 2020). One of them is Network Address Translation (NAT). NAT enables the virtual machine to share the IP address of the host computer. This helps the virtual machine (VM) to connect to the internet by using the host's network connection. It frequently serves as VMs' default option.

Next, NAT Network. Every virtual machine in NAT Network mode has an internal router configuration unique to it. One virtual machine (VM) cannot access services on another VM with this configuration. Since everything is ultimately translated, each virtual machine (VM) might really have the same private IP address. While NAT Network operates on the same idea as NAT, it employs a single network for every virtual machine that is set on the same NAT Network. Similar to how a computer connected to one of your router's many Ethernet ports may talk with other devices on the network, this enables guest-to-guest communication via a virtual switch.

Other than that, Bridged mode is another network option in VMs. It does not isolate virtual machines like other modes do. When in bridged mode, virtual machines (VMs) use the host's network interface to connect directly with outside services. Because of this, even though virtual machines (VMs) are still linked to the same computer, they appear to your router as different IP addresses. With bridged mode, you have a great deal of freedom in hosting services on virtual machines (VMs) and accessing them locally on your network by using an address and port number. It's especially helpful if your server has several physical interfaces and Ethernet ports since it lets you operate virtual machines (VMs) on different networks depending on your actual wiring.

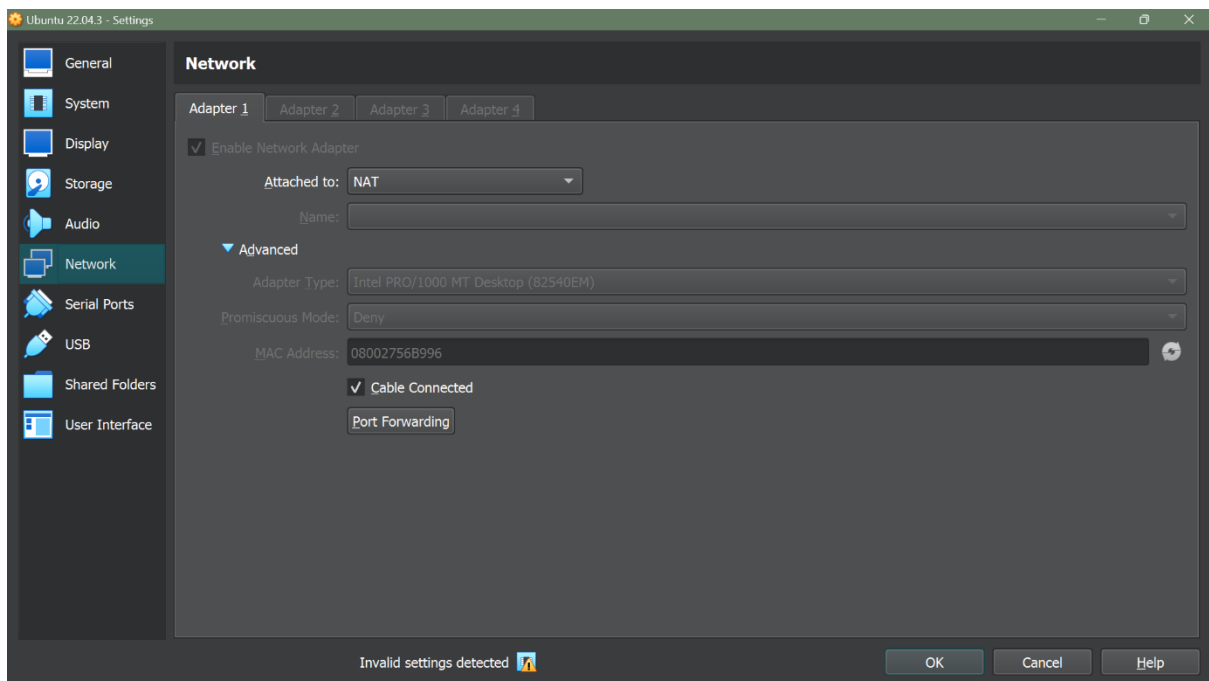
Apart from that, the fourth VM network option is Host-Only Adapter. Virtual machines are cut off from the internet in this mode, but they are still able to communicate with each other and with the host. Guests are usually assigned IP addresses by DHCP servers, which facilitates easy communication amongst guests. When considerable two-way communication between the host and guest is needed but the host does not have internet connection, the Host-Only mode is the best option. Bridged mode, which offers complete network access, may be used to accomplish both two-way communication and external access.

Last but not least, the Internal Network is a network option used to mimic real networks. It is by default closed off from the outside world, enabling communication amongst guests on the network but not with the host or the internet. This helps to simulate completely isolated networks, but it may also be set up to provide the private computers

access to the internet. Internal Network is a good option if you need the freedom to set up everything on your own or if you want to mimic or imitate a virtual network. Because it allows users to establish their network without requiring real gear, it's extremely helpful for training.

- ii. Which connection should you use to enable the Internet connection in the Guest OS? Provide screenshot of the connection setup.

I believe by using the NAT (Network Address Translation) connection will enable the internet access for the Guest OS in a VM (Virtual Machine). That was because this option allows the VM to share the host's network connection, enabling it to access the internet.

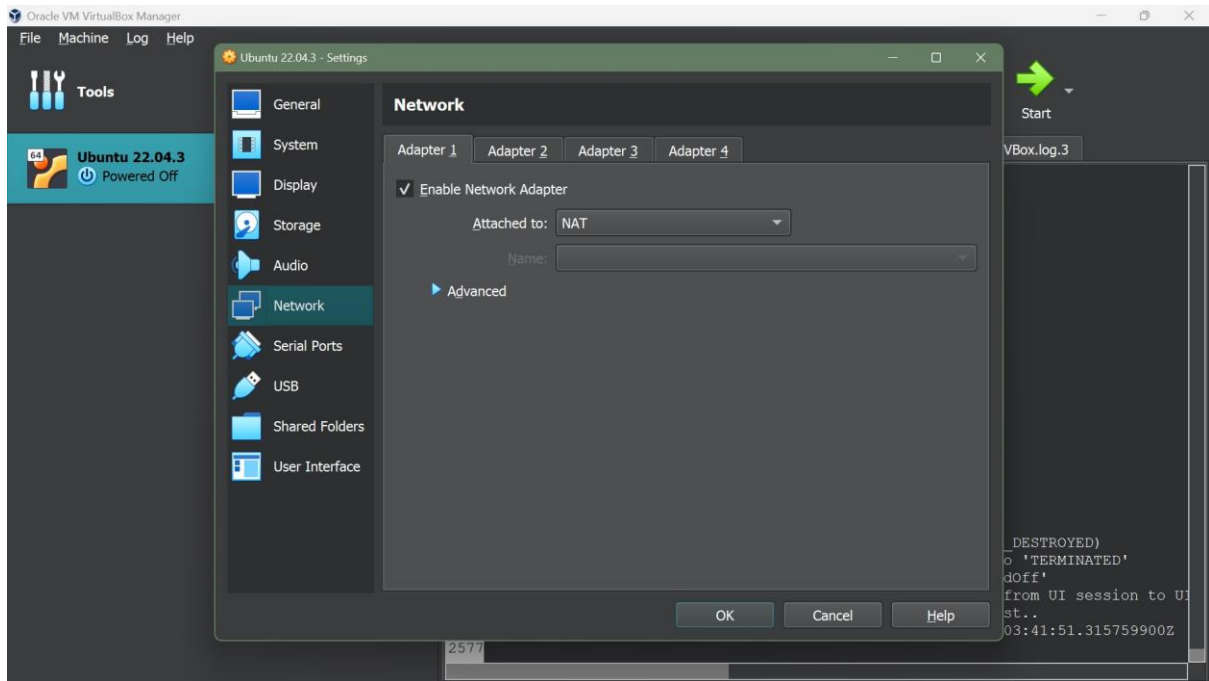


b. **CHAPTER 2: Experiment Observation & Explanation**

i. Setup network using the following experiment:

1. **Experiment 1: NAT**

a. Provide screenshot of the network setup (Network Setting for the specific experiment).



b. Execute experiment for each question in the following table and state the result.

c. Provide the result screenshot for each of the question in the table.

Network Setting: NAT	
Questions	Result (Yes/No)
A. Can VM ping to host?	Yes
B. Can host ping to VM?	No
C. Can VM access to external network? E.g., Browse the Internet or ping www.google.com	Yes
D. Can another computer on the same host network ping to VM?	Yes

EXPERIMENT RESULT

A)

The screenshot shows two windows. On the left is a Linux terminal window titled 'Terminal' with the prompt 'wana@wana-VirtualBox:~'. It displays the output of a 'ping 192.168.56.1' command, showing 38 successful pings with varying times. On the right is a Windows Command Prompt window titled 'Command Prompt' with the prompt 'C:\Users\user>'. It shows the output of 'ipconfig', displaying network configuration for Ethernet adapter Ethernet 2 and Wireless LAN adapter Local Area Connection* 3 and 4. The Ethernet adapter is connected, showing IPv4 address 192.168.56.1 and IPv6 address fe80::9199:4b30:ae71:ea8e%9. The wireless adapters are disconnected.

```
wana@wana-VirtualBox:~$ ping 192.168.56.1
PING 192.168.56.1 (192.168.56.1) 56(84) bytes of data:
64 bytes from 192.168.56.1: icmp_seq=1 ttl=127 time=35.6 ms
64 bytes from 192.168.56.1: icmp_seq=2 ttl=127 time=1.83 ms
64 bytes from 192.168.56.1: icmp_seq=3 ttl=127 time=1.42 ms
64 bytes from 192.168.56.1: icmp_seq=4 ttl=127 time=1.36 ms
64 bytes from 192.168.56.1: icmp_seq=5 ttl=127 time=4.60 ms
64 bytes from 192.168.56.1: icmp_seq=6 ttl=127 time=1.08 ms
64 bytes from 192.168.56.1: icmp_seq=7 ttl=127 time=1.10 ms
64 bytes from 192.168.56.1: icmp_seq=8 ttl=127 time=1.03 ms
64 bytes from 192.168.56.1: icmp_seq=9 ttl=127 time=2.71 ms
64 bytes from 192.168.56.1: icmp_seq=10 ttl=127 time=1.13 ms
64 bytes from 192.168.56.1: icmp_seq=11 ttl=127 time=2.08 ms
64 bytes from 192.168.56.1: icmp_seq=12 ttl=127 time=49.8 ms
64 bytes from 192.168.56.1: icmp_seq=13 ttl=127 time=2.10 ms
64 bytes from 192.168.56.1: icmp_seq=14 ttl=127 time=1.23 ms
64 bytes from 192.168.56.1: icmp_seq=15 ttl=127 time=1.38 ms
64 bytes from 192.168.56.1: icmp_seq=16 ttl=127 time=3.78 ms
64 bytes from 192.168.56.1: icmp_seq=17 ttl=127 time=5.12 ms
64 bytes from 192.168.56.1: icmp_seq=18 ttl=127 time=2.57 ms
64 bytes from 192.168.56.1: icmp_seq=19 ttl=127 time=1.32 ms
64 bytes from 192.168.56.1: icmp_seq=20 ttl=127 time=1.01 ms
64 bytes from 192.168.56.1: icmp_seq=21 ttl=127 time=1.21 ms
64 bytes from 192.168.56.1: icmp_seq=22 ttl=127 time=1.43 ms
64 bytes from 192.168.56.1: icmp_seq=23 ttl=127 time=1.35 ms
64 bytes from 192.168.56.1: icmp_seq=24 ttl=127 time=70.0 ms
64 bytes from 192.168.56.1: icmp_seq=25 ttl=127 time=450 ms
64 bytes from 192.168.56.1: icmp_seq=26 ttl=127 time=1.19 ms
64 bytes from 192.168.56.1: icmp_seq=27 ttl=127 time=1.89 ms
64 bytes from 192.168.56.1: icmp_seq=28 ttl=127 time=1.10 ms
64 bytes from 192.168.56.1: icmp_seq=29 ttl=127 time=2.33 ms
64 bytes from 192.168.56.1: icmp_seq=30 ttl=127 time=1.18 ms
64 bytes from 192.168.56.1: icmp_seq=31 ttl=127 time=2.34 ms
64 bytes from 192.168.56.1: icmp_seq=32 ttl=127 time=1.11 ms
64 bytes from 192.168.56.1: icmp_seq=33 ttl=127 time=1.16 ms
64 bytes from 192.168.56.1: icmp_seq=34 ttl=127 time=1.30 ms
64 bytes from 192.168.56.1: icmp_seq=35 ttl=127 time=2.99 ms
64 bytes from 192.168.56.1: icmp_seq=36 ttl=127 time=1.77 ms
64 bytes from 192.168.56.1: icmp_seq=37 ttl=127 time=6.67 ms
64 bytes from 192.168.56.1: icmp_seq=38 ttl=127 time=3.98 ms
```

```
C:\Users\user>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet 2:

    Connection-specific DNS Suffix  . : 
    Link-Local IPv6 Address...       : fe80::9199:4b30:ae71:ea8e%9
    IPv4 Address. . . . .             : 192.168.56.1
    Subnet Mask . . . . .             : 255.255.255.0
    Default Gateway . . . . .         : 

Wireless LAN adapter Local Area Connection* 3:

    Media State . . . . .             : Media disconnected
    Connection-specific DNS Suffix  . : 

Wireless LAN adapter Local Area Connection* 4:

    Media State . . . . .             : Media disconnected
    Connection-specific DNS Suffix  . : 

Ethernet adapter McAfee VPN:

    Media State . . . . .             : Media disconnected
    Connection-specific DNS Suffix  . : 

Wireless LAN adapter Wi-Fi:

    Connection-specific DNS Suffix  . : 
    IPv6 Address. . . . .             : 2001:d08:e1:983c:926d:75dd:8b6c:7aea
    Temporary IPv6 Address. . . . . : 2001:d08:e1:983c:d069:827e:7bd2:b579
    Link-Local IPv6 Address...       : fe80::14d2:2e59:e1b:2a9c%22
    IPv4 Address. . . . .             : 192.168.1.187
    Subnet Mask . . . . .             : 255.255.255.0
    Default Gateway . . . . .         : fe80::1%22
                                         192.168.1.254
```

B)

The screenshot shows two windows. On the left is a Linux terminal window titled 'Terminal' with the prompt 'wana@wana-VirtualBox:~'. It displays the output of 'ifconfig', showing network configuration for the 'enp0s3' and 'lo' interfaces. On the right is a Windows Command Prompt window titled 'Command Prompt' with the prompt 'C:\Users\user>'. It shows the output of 'ping 10.0.2.15', which fails with 100% loss.

```
wana@wana-VirtualBox:~$ 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::3076:1583:4119:e150 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:56:b9:96 txqueuelen 1000 (Ethernet)
    RX packets 2644 bytes 2738798 (2.7 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1007 bytes 166166 (166.1 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 335 bytes 37199 (37.1 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 335 bytes 37199 (37.1 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wana@wana-VirtualBox:~$
```

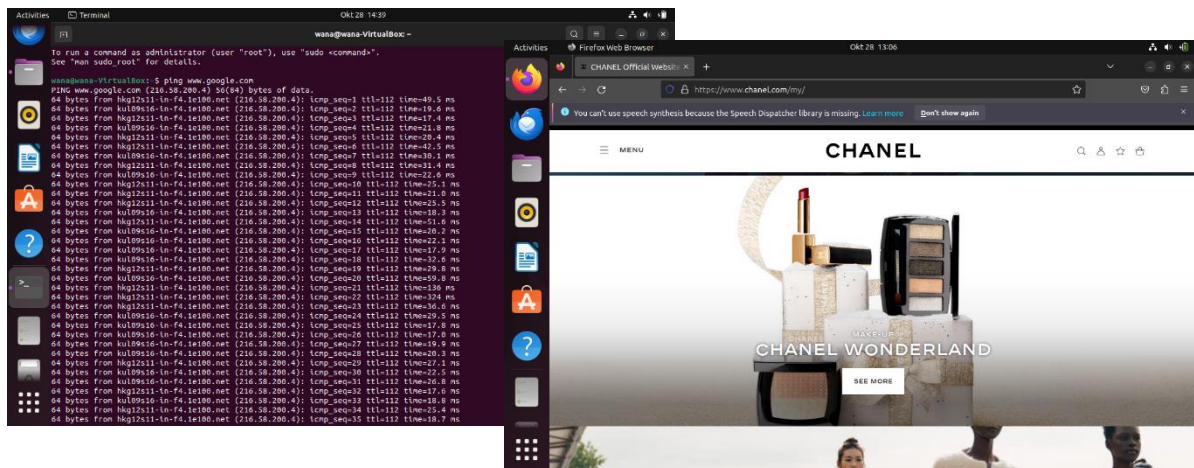
```
C:\Users\user>ping 10.0.2.15

Pinging 10.0.2.15 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

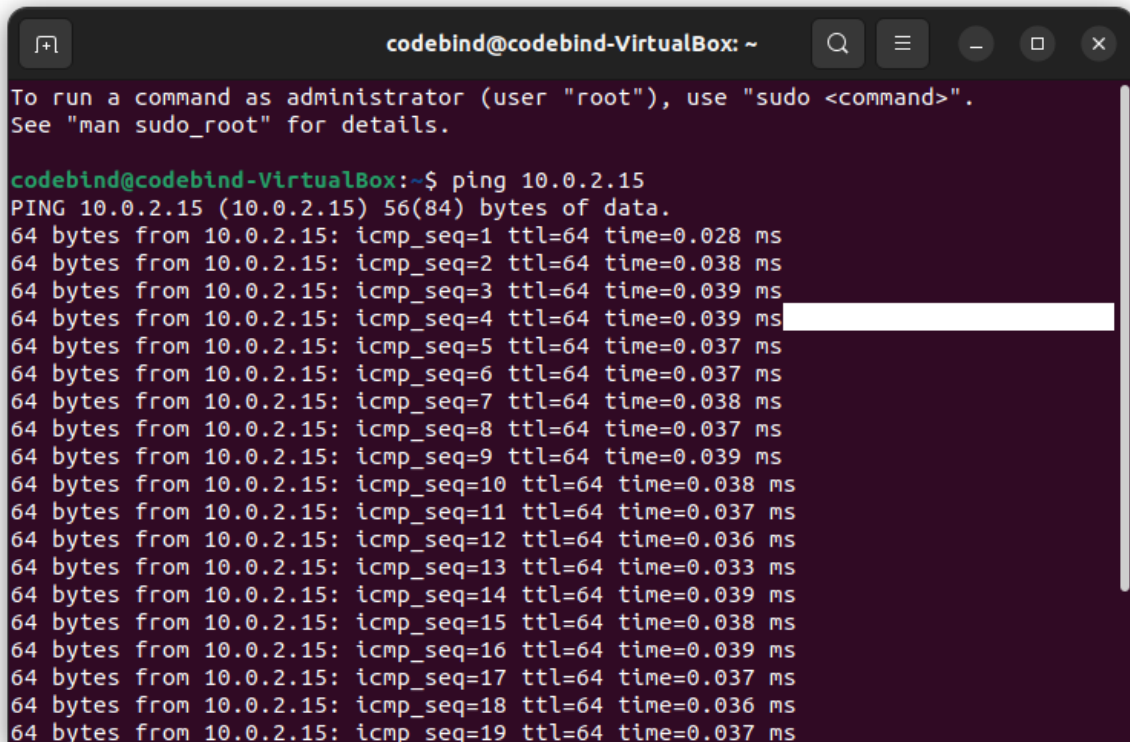
Ping statistics for 10.0.2.15:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\Users\user>
```

C)

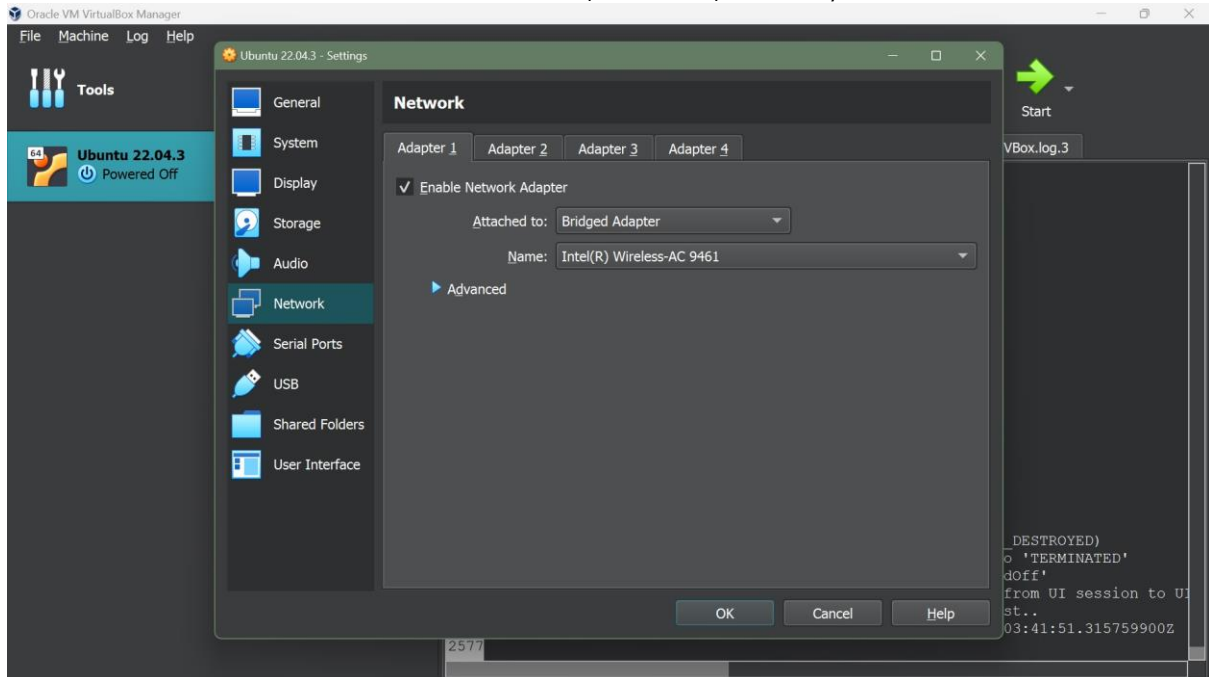


D)



2. Experiment 2: Bridge Adapter

- a. Provide screenshot of the network setup (Network Setting for the specific experiment).



- b. Execute experiment for each question in the following table and state the result.
- c. Provide the result screenshot for each of the question in the table.

Network Setting: Bridge Adapter	
Questions	Result (Yes/No)
A. Can VM ping to host?	No
B. Can host ping to VM?	No
C. Can VM access to external network? E.g., Browse the Internet or ping www.google.com	Yes
D. Can another computer on the same host network ping to VM?	No

EXPERIMENT RESULT

A)

```
wana@wana-VirtualBox:~$ sudo ping 192.168.56.1
PING 192.168.56.1 (192.168.56.1) 56(84) bytes of data.

From 203.78.193.237 icmp_seq=20 Destination Net Unreachable

From 203.78.193.237 icmp_seq=103 Destination Net Unreachable
From 203.78.193.237 icmp_seq=175 Destination Net Unreachable
From 203.78.193.237 icmp_seq=208 Destination Net Unreachable
From 203.78.193.237 icmp_seq=304 Destination Net Unreachable
From 203.78.193.237 icmp_seq=337 Destination Net Unreachable
From 203.78.193.237 icmp_seq=401 Destination Net Unreachable
From 203.78.193.237 icmp_seq=411 Destination Net Unreachable
From 203.78.193.237 icmp_seq=414 Destination Net Unreachable
```

```
Microsoft Windows [Version 10.0.22621.2428]
(c) Microsoft Corporation. All rights reserved.

C:\Users\user>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet 2:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::9199:4b30:ae71:ea8e%9
    IPv4 Address. . . . . : 192.168.56.1
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 

Wireless LAN adapter Local Area Connection* 3:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . : 

Wireless LAN adapter Local Area Connection* 4:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . : 

Ethernet adapter McAfee VPN:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . : 

Wireless LAN adapter Wi-Fi:

    Connection-specific DNS Suffix  . : 
    IPv6 Address. . . . . : 2001:d08:e1:983c:926d:75dd:8b6c:7aea
    Temporary IPv6 Address. . . . . : 2001:d08:e1:983c:d069:827e:7bd2:b579
    Link-local IPv6 Address . . . . . : fe80::14d2:2e59:e1b:2a9c%22
    IPv4 Address. . . . . : 192.168.1.187
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : fe80::1%22
                                192.168.1.254

C:\Users\user>
```

B)

```
wana@wana-VirtualBox:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.207 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 2001:d08:e1:983c:9e0b:87cf:575d:d3bd prefixlen 64 scopeid 0x0<global>
    inet6 fe80::3076:1583:4119:e150 prefixlen 64 scopeid 0x20<link>
    inet6 2001:d08:e1:983c:afed:92e4:92a6:5b28 prefixlen 64 scopeid 0x0<global>
    ether 08:00:27:56:b9:96 txqueuelen 1000 (Ethernet)
    RX packets 2803 bytes 2776622 (2.7 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1172 bytes 189424 (189.4 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 399 bytes 44245 (44.2 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 399 bytes 44245 (44.2 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wana@wana-VirtualBox:~$
```

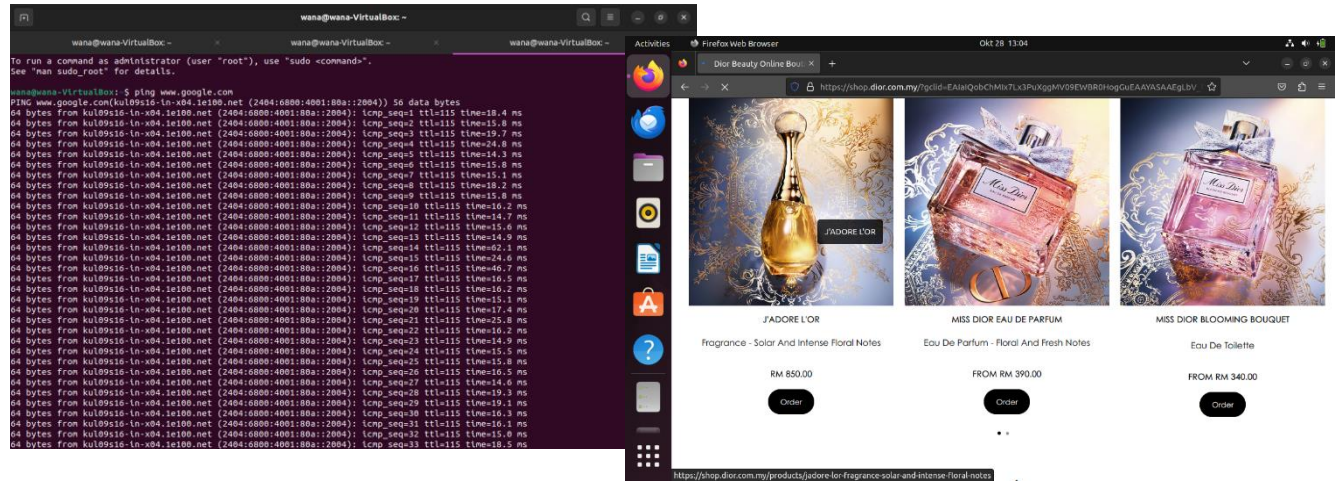
```
C:\Users\user>ping 10.0.2.15

Pinging 10.0.2.15 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

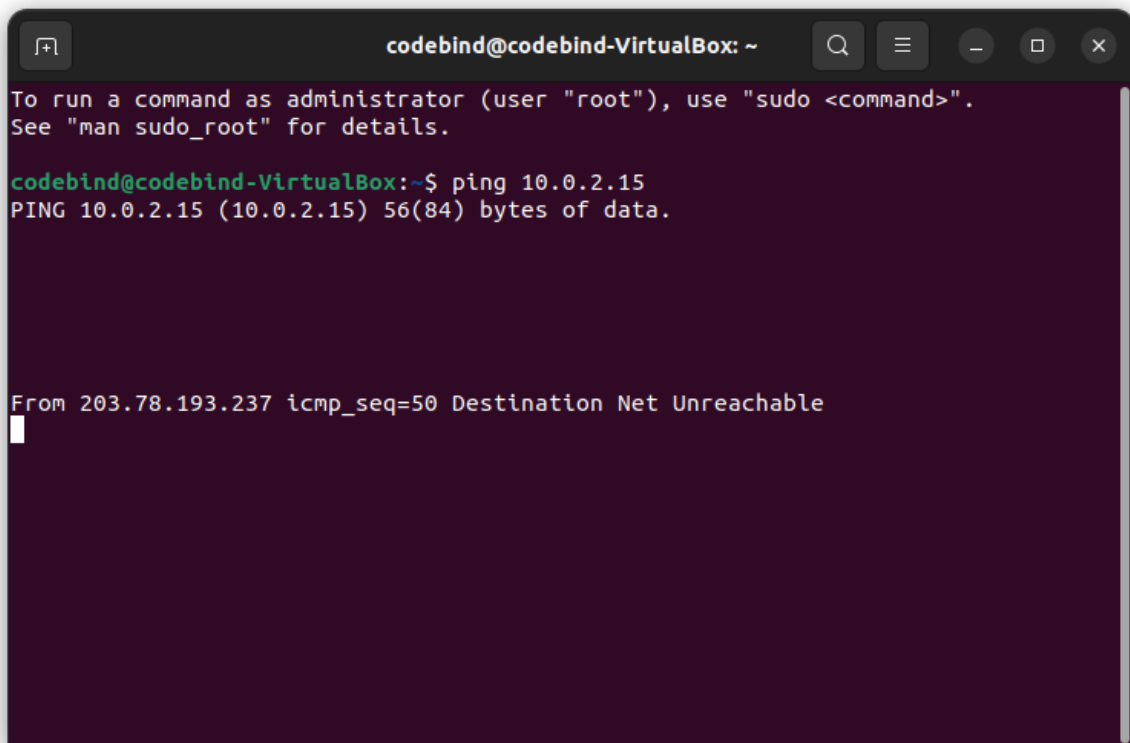
Ping statistics for 10.0.2.15:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\Users\user>
```

C)

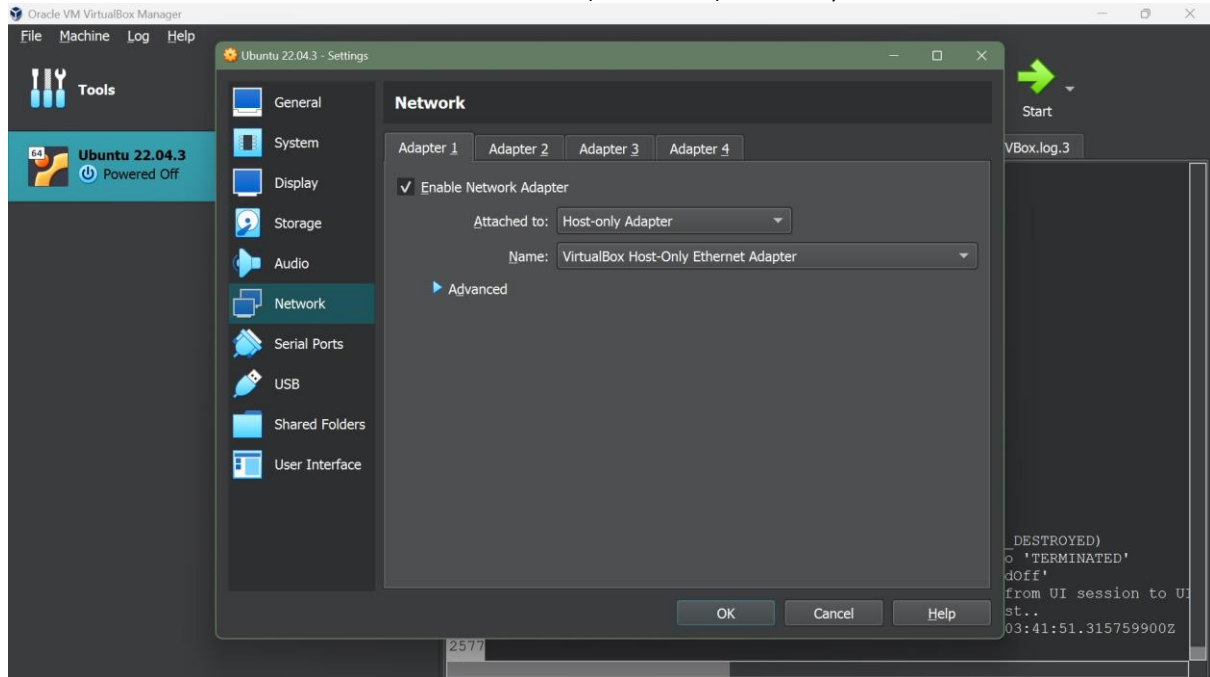


D)



3. Experiment 3: Host-only Adapter

- a. Provide screenshot of the network setup (Network Setting for the specific experiment).



- b. Execute experiment for each question in the following table and state the result.
- c. Provide the result screenshot for each of the question in the table.

Network Setting: Host-only Adapter	
Questions	Result (Yes/No)
A. Can VM ping to host?	Yes
B. Can host ping to VM?	No
C. Can VM access to external network? E.g., Browse the Internet or ping www.google.com	No
D. Can another computer on the same host network ping to VM?	No

EXPERIMENT RESULT

A)

```
wana@wana-VirtualBox: ~  
To run a command as administrator (user "root"), use "sudo <command>"  
See "man sudo_root" for details.  
  
wana@wana-VirtualBox:~$ ping 192.168.56.1  
PING 192.168.56.1 (192.168.56.1) 56(84) bytes of data.  
64 bytes from 192.168.56.1: icmp_seq=1 ttl=128 time=0.912 ms  
64 bytes from 192.168.56.1: icmp_seq=2 ttl=128 time=0.989 ms  
64 bytes from 192.168.56.1: icmp_seq=3 ttl=128 time=0.555 ms  
64 bytes from 192.168.56.1: icmp_seq=4 ttl=128 time=0.538 ms  
64 bytes from 192.168.56.1: icmp_seq=5 ttl=128 time=0.481 ms  
64 bytes from 192.168.56.1: icmp_seq=6 ttl=128 time=0.584 ms  
64 bytes from 192.168.56.1: icmp_seq=7 ttl=128 time=0.523 ms  
64 bytes from 192.168.56.1: icmp_seq=8 ttl=128 time=0.573 ms  
64 bytes from 192.168.56.1: icmp_seq=9 ttl=128 time=1.01 ms  
64 bytes from 192.168.56.1: icmp_seq=10 ttl=128 time=1.37 ms  
64 bytes from 192.168.56.1: icmp_seq=11 ttl=128 time=0.652 ms  
64 bytes from 192.168.56.1: icmp_seq=12 ttl=128 time=1.55 ms  
64 bytes from 192.168.56.1: icmp_seq=13 ttl=128 time=1.78 ms  
64 bytes from 192.168.56.1: icmp_seq=14 ttl=128 time=0.667 ms  
64 bytes from 192.168.56.1: icmp_seq=15 ttl=128 time=1.06 ms  
64 bytes from 192.168.56.1: icmp_seq=16 ttl=128 time=0.618 ms  
64 bytes from 192.168.56.1: icmp_seq=17 ttl=128 time=1.16 ms  
64 bytes from 192.168.56.1: icmp_seq=18 ttl=128 time=1.11 ms  
64 bytes from 192.168.56.1: icmp_seq=19 ttl=128 time=1.02 ms  
64 bytes from 192.168.56.1: icmp_seq=20 ttl=128 time=1.11 ms  
64 bytes from 192.168.56.1: icmp_seq=21 ttl=128 time=1.71 ms  
64 bytes from 192.168.56.1: icmp_seq=22 ttl=128 time=1.41 ms  
64 bytes from 192.168.56.1: icmp_seq=23 ttl=128 time=0.629 ms  
64 bytes from 192.168.56.1: icmp_seq=24 ttl=128 time=0.854 ms  
64 bytes from 192.168.56.1: icmp_seq=25 ttl=128 time=0.726 ms  
64 bytes from 192.168.56.1: icmp_seq=26 ttl=128 time=1.96 ms  
64 bytes from 192.168.56.1: icmp_seq=27 ttl=128 time=1.25 ms  
64 bytes from 192.168.56.1: icmp_seq=28 ttl=128 time=1.25 ms  
64 bytes from 192.168.56.1: icmp_seq=29 ttl=128 time=0.844 ms  
64 bytes from 192.168.56.1: icmp_seq=30 ttl=128 time=3.28 ms  
64 bytes from 192.168.56.1: icmp_seq=31 ttl=128 time=0.771 ms  
64 bytes from 192.168.56.1: icmp_seq=32 ttl=128 time=0.637 ms  
64 bytes from 192.168.56.1: icmp_seq=33 ttl=128 time=15.3 ms
```

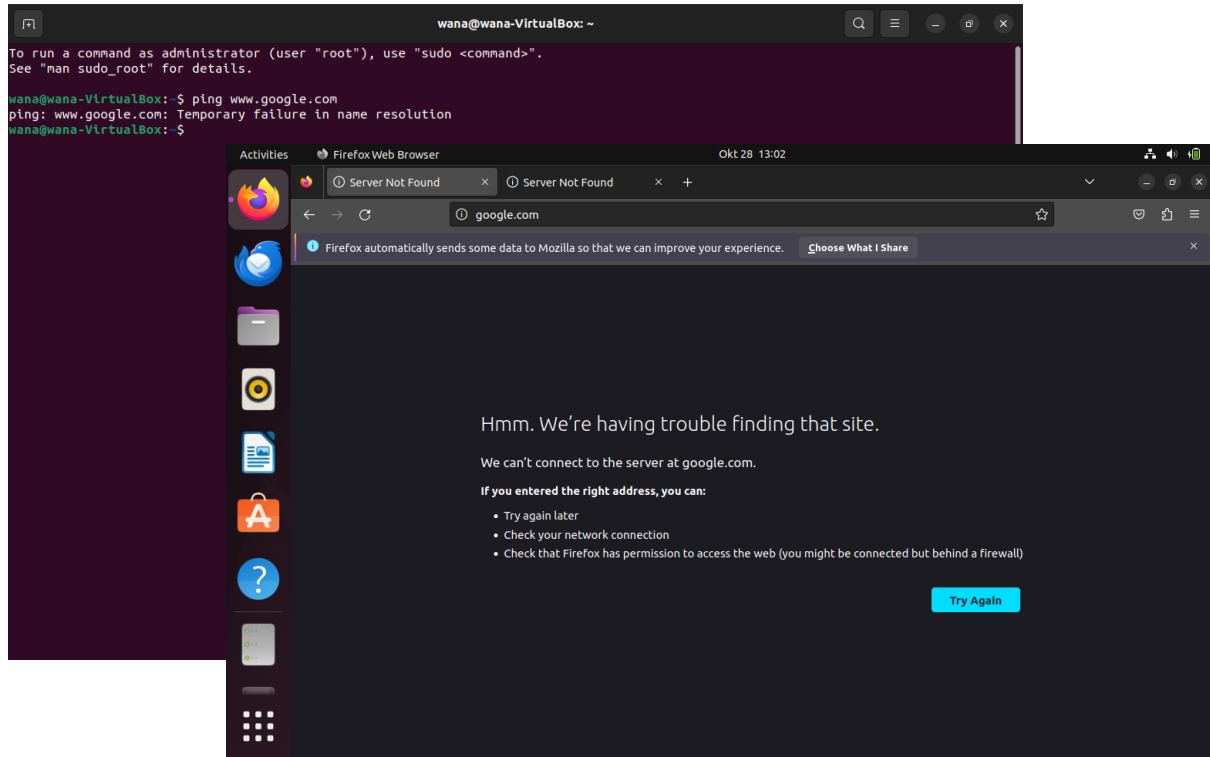
```
Microsoft Windows [Version 10.0.22621.2428]  
(c) Microsoft Corporation. All rights reserved.  
  
C:\Users\user>ipconfig  
  
Windows IP Configuration  
  
Ethernet adapter Ethernet 2:  
  
    Connection-specific DNS Suffix  . :  
    Link-local IPv6 Address . . . . . : fe80::9199:4b30:ae71:ea8e%9  
    IPv4 Address. . . . . : 192.168.56.1  
    Subnet Mask . . . . . : 255.255.255.0  
    Default Gateway . . . . . :  
  
Wireless LAN adapter Local Area Connection* 3:  
  
    Media State . . . . . : Media disconnected  
    Connection-specific DNS Suffix  . :  
  
Wireless LAN adapter Local Area Connection* 4:  
  
    Media State . . . . . : Media disconnected  
    Connection-specific DNS Suffix  . :  
  
Ethernet adapter McAfee VPN:  
  
    Media State . . . . . : Media disconnected  
    Connection-specific DNS Suffix  . :  
  
Wireless LAN adapter Wi-Fi:  
  
    Connection-specific DNS Suffix  . :  
    IPv6 Address. . . . . : 2001:d08:e1:983c:926d:75dd:8b6c:7aea  
    Temporary IPv6 Address. . . . . : 2001:d08:e1:983c:d069:827e:7bd2:b579  
    Link-local IPv6 Address . . . . . : fe80::14d2:2e59:e1b:2a9c%22  
    IPv4 Address. . . . . : 192.168.1.187  
    Subnet Mask . . . . . : 255.255.255.0  
    Default Gateway . . . . . : fe80::1%22  
                                192.168.1.254  
  
C:\Users\user>
```

B)

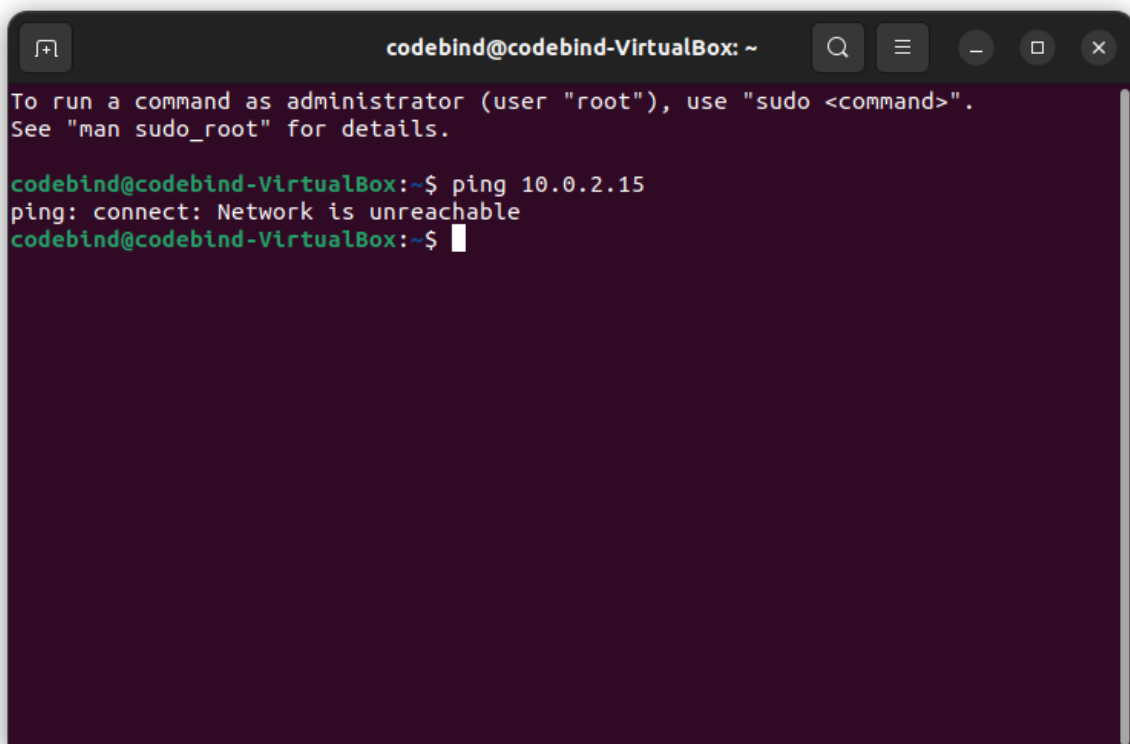
```
wana@wana-VirtualBox: ~  
wana@wana-VirtualBox:~$ ifconfig  
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet 192.168.56.101 netmask 255.255.255.0 broadcast 192.168.56.255  
    inet6 fe80::3076:1583:4119:e150 prefixlen 64 scopeid 0x20<link>  
    ether 08:00:27:56:b9:96 txqueuelen 1000 (Ethernet)  
    RX packets 3036 bytes 2805055 (2.8 MB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 1227 bytes 196380 (196.3 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536  
    inet 127.0.0.1 netmask 255.0.0.0  
    inet6 ::1 prefixlen 128 scopeid 0x10<host>  
    loop txqueuelen 1000 (Local Loopback)  
    RX packets 471 bytes 50093 (50.0 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 471 bytes 50093 (50.0 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
wana@wana-VirtualBox:~$
```

```
C:\Users\user>ping 10.0.2.15  
  
Pinging 10.0.2.15 with 32 bytes of data:  
Request timed out.  
Request timed out.  
Request timed out.  
Request timed out.  
  
Ping statistics for 10.0.2.15:  
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
  
C:\Users\user>
```

C)



D)



- ii. Observe the differences of the above three settings (Experiment 1, 2 & 3). Elaborate your observation and make a short conclusion.

In Experiment 1, the VM may reach the external network via the host, but it may not be immediately available from other machines on the same network unless port forwarding is used. While by using Bridged in Experiment 2, the VM acts as an independent machine on the same network as the host, making it immediately reachable by other machines on the same network. Last but not least, in Experiment 3, the VM can connect with the host and other VMs on the same host-only network but cannot likely access the external network directly.

To conclude, the network configuration, such as NAT, Bridged, or Host-only, is specified by the demands of the computer. NAT is appropriate for the majority of internet-connected contexts, Bridged allows VMs to function as independent machines on the network, and Host-only excludes VMs from the external network while providing connectivity between them and the host.

**** Note:** You may need to execute command '*ipconfig*' in command prompt (if using Windows) and '*ifconfig*' in terminal (if using Linux) to get the IP information for executing the above-mentioned experiments.

REFERENCES

1. Heddings, A. (2020, July 23). Which Type of Networking Should You Use for Your Virtual Machine? How-to Geek.
<https://www.howtogeek.com/devops/which-type-of-networking-should-you-use-for-your-virtual-machine/>

** Sample of experiment results:

```
hazalila@hazalila-VirtualBoxUbuntu: ~  
TX packets 2199 bytes 152519 (152.5 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536  
inet 127.0.0.1 netmask 255.0.0.0  
inet6 ::1 prefixlen 128 scopeid 0x10<host>  
loop txqueuelen 1000 (Local Loopback)  
RX packets 163 bytes 14108 (14.1 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 163 bytes 14108 (14.1 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
hazalila@hazalila-VirtualBoxUbuntu:~$ ping 10.65.60.93  
PING 10.65.60.93 (10.65.60.93) 56(84) bytes of data:  
64 bytes from 10.65.60.93: icmp_seq=1 ttl=127 time=0.831 ms  
64 bytes from 10.65.60.93: icmp_seq=2 ttl=127 time=1.59 ms  
64 bytes from 10.65.60.93: icmp_seq=3 ttl=127 time=1.07 ms  
64 bytes from 10.65.60.93: icmp_seq=4 ttl=127 time=1.65 ms  
64 bytes from 10.65.60.93: icmp_seq=5 ttl=127 time=1.68 ms  
^C  
--- 10.65.60.93 ping statistics ---  
5 packets transmitted, 5 received, 0% packet loss, time 401 ms  
rtt min/avg/max/mdev = 0.831/1.363/1.682/0.348 ms  
hazalila@hazalila-VirtualBoxUbuntu:~$
```

```
Command Prompt  
Wireless LAN adapter Wi-Fi:  
Media State . . . . . : Media disconnected  
Connection-specific DNS Suffix . :  
Wireless LAN adapter Local Area Connection* 3:  
Media State . . . . . : Media disconnected  
Connection-specific DNS Suffix . :  
Wireless LAN adapter Local Area Connection* 12:  
Media State . . . . . : Media disconnected  
Connection-specific DNS Suffix . :  
Ethernet adapter Ethernet:  
Connection-specific DNS Suffix . : lan  
Link-local IPv6 Address . . . . . : fe80::c824:11b2:2920:d18a%2  
IPv4 Address. . . . . : 10.65.60.93  
Subnet Mask . . . . . : 255.255.252.0  
Default Gateway . . . . . : 10.65.63.254  
Ethernet adapter Bluetooth Network Connection:  
Media State . . . . . : Media disconnected  
Connection-specific DNS Suffix . :  
C:\Users\User>
```

```
hazalila@hazalila-VirtualBoxUbuntu: ~  
hazalila@hazalila-VirtualBoxUbuntu:~$ 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::e63f:5b:5a41:6a7f prefixlen 64 scopeid 0x20<eth>  
ether 08:00:27:5a:86:31 txqueuelen 1000 (Ethernet)  
RX packets 5233 bytes 4804180 (4.8 MB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 2199 bytes 152519 (152.5 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536  
inet 127.0.0.1 netmask 255.0.0.0  
inet6 ::1 prefixlen 128 scopeid 0x10<host>  
loop txqueuelen 1000 (Local Loopback)  
RX packets 163 bytes 14108 (14.1 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 163 bytes 14108 (14.1 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
hazalila@hazalila-VirtualBoxUbuntu:~$
```

```
Command Prompt  
Ping statistics for 10.65.63.254:  
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 1ms, Maximum = 2ms, Average = 1ms  
C:\Users\User>ping 10.65.61.232  
Pinging 10.65.61.232 with 32 bytes of data:  
Reply from 10.65.61.232: bytes=32 time=2ms TTL=128  
Reply from 10.65.61.232: bytes=32 time<1ms TTL=128  
Reply from 10.65.61.232: bytes=32 time=1ms TTL=128  
Reply from 10.65.61.232: bytes=32 time=1ms TTL=128  
Ping statistics for 10.65.61.232:  
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 0ms, Maximum = 2ms, Average = 1ms  
C:\Users\User>ping 10.0.2.15  
Pinging 10.0.2.15 with 32 bytes of data:  
Request timed out.  
Request timed out.  
Request timed out.  
Request timed out.  
Ping statistics for 10.0.2.15:  
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
C:\Users\User>
```

```
hazalila@hazalila-VirtualBoxUbuntu: ~  
hazalila@hazalila-VirtualBoxUbuntu:~$  
hazalila@hazalila-VirtualBoxUbuntu:~$ ping www.google.com  
PING www.google.com (216.58.196.36) 56(84) bytes of data:  
64 bytes from kul09s12-in-f4.1e100.net (216.58.196.36): icmp_seq=1 ttl=116 time=13.6 ms  
64 bytes from kul09s12-in-f4.1e100.net (216.58.196.36): icmp_seq=2 ttl=116 time=13.5 ms  
64 bytes from kul09s12-in-f4.1e100.net (216.58.196.36): icmp_seq=3 ttl=116 time=13.3 ms  
64 bytes from kul09s12-in-f4.1e100.net (216.58.196.36): icmp_seq=4 ttl=116 time=13.6 ms  
64 bytes from kul09s12-in-f4.1e100.net (216.58.196.36): icmp_seq=5 ttl=116 time=13.2 ms  
^C  
--- www.google.com ping statistics ---  
5 packets transmitted, 5 received, 0% packet loss, time 4008ms  
rtt min/avg/max/mdev = 13.155/13.418/13.583/0.158 ms  
hazalila@hazalila-VirtualBoxUbuntu:~$
```

