

Aim: Implementation of Host-Based virtualization using VirtualBox / vmware workstation

Theory: In computing, virtualization refers to the act of creating a virtual (rather than actual) version of something, including virtual computer hardware platforms, operating systems, storage devices, and computer network resources.

why is virtualization useful?

The techniques and features that VirtualBox provides are useful for several scenarios.

- Running multiple operating systems simultaneously: VirtualBox allows you to run more than one operating system at a time. Since you can configure what kinds of "virtual" hardware should be presented to each such operating system, you can install an old OS such as DOS even if your real computer's hardware is no longer supported by that operating system.
- Easier software installations: Software vendors can use virtual machines to ship entire software configurations. For example, installing a complete mail server solution on a real machine can be a tedious task. With VirtualBox, such a complex setup can be packed into a virtual machine.

- **Testing and disaster recovery:** Once installed, a virtual machine and its virtual hard disks can be considered a "container" that can be arbitrarily frozen, woken up, copied, backed up, and transported between hosts. On top of that, with the use of another VirtualBox feature called "snapshots", one can save a particular state of a virtual machine and revert back to that state, if necessary. This way, one can freely experiment with a computing environment. If something goes wrong, one can easily switch back to a previous snapshot and avoid the need of frequent backups and restores.
- **Infrastructure consolidation:** virtualization can significantly reduce hardware and electricity costs. Most of the time, computers today only use a fraction of their potential power and run with low average system loads. A lot of hardware resources as well as electricity is thereby wasted. So, instead of running many such physical computers there are only partially used, one can pack many virtual machines onto a few powerful hosts and balance the loads between them.

Hypervisor: A hypervisor or virtual machine monitor (VMM) is a piece of computer software, firmware or hardware that contains and runs virtual machines. It allows multiple operating systems to share a single hardware host.

Each operating system appears to have the host processor, memory, and other resources all to itself. However, the hypervisor is actually controlling the host processor and resources, allocating what is needed at each operating system in turn and making sure that the guest operating systems (called virtual machines) cannot disrupt each other.

There are two types of hypervisors: Type 1 and Type 2

- Type 1 hypervisor (also called a bare metal hypervisor) is installed directly on physical host server hardware like an operating system. Type 1 hypervisor runs on dedicated hardware. They require a management console and are used in data centers. Examples include Oracle VM for SPARC, ESXi, Hyper-V and KVM.

App1	App2	...	App3	App4	...
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Operating System 1	Operating System 2
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Hypervisor	
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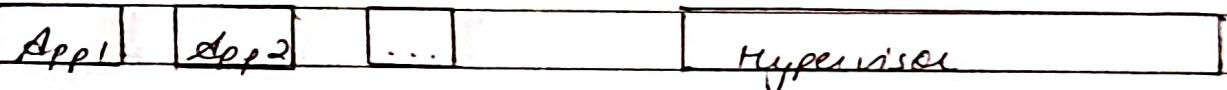
Hardware	
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Type 1 Hypervisor

Type 2 hypervisors support guest virtual machines by coordinating calls for CPU, memory, disk, network and other resources through the physical host's operating system. This makes it easy for an end user to run a virtual machine on a personal computing device. Examples include VMware Fusion, Oracle VirtualBox, Oracle VM for x86, Parallels and VMWare Workstation.



operating system & (guest)



### Type 2 Hypervisor

**Host operating system (Host OS):** This is the operating system of the physical computer on which VirtualBox was installed. There are various versions of VirtualBox for Windows, Mac OS X, Linux and Solaris hosts.

**Guest operating system (Guest OS):** This is the operating system that is running inside the virtual machine. Theoretically VirtualBox can run any operating system (DOS, Windows, openBSD, etc.)

## Networking modes

### 1) NAT (Network Address Translation)

- It is used to access an external network from the virtual machine
- The NAT device of vmware or virtual box passes the network data between virtual machine and external network.
- Accessing of internet is possible from the guest os
- NAT provides flexibility when connecting to the public internet

### 2) Bridged Adapter

- In bridged networking, a virtual machine is connected to a network using the network adapter on the host system.
- A host system has its own IP address and can communicate with other computer on the network, as if it is a physical computer on the network
- VMs connected to internal network can communicate with each other, but also they can communicate with host machine or any other host sending packets of to Guest os from host and vice versa can be possible

### 3) Internal network

- Virtual machines whose adapters are configured to work in the virtual box internal network mode are connected to as isolated virtual machines.

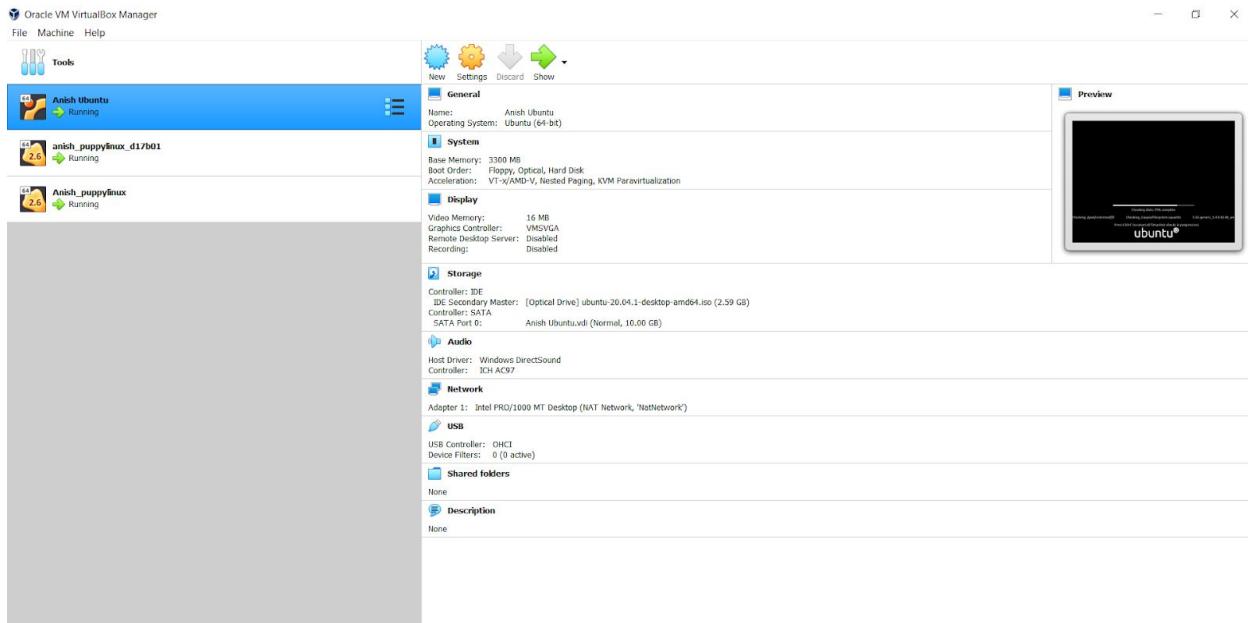
- VMs connected to this network can communicate with each other, but they cannot communicate with host machine or with other hosts in the physical network or in external network.
- VMs connected to internal network cannot be accessed from a host or any other device.
- Accessing of internet is not possible

#### 4) Host Only

- It creates a network that is totally contained within the host computer.
- This mode is used for communicating between a host and guest.
- A VM can communicate with other VMs connected to host-only network and with the host machine.

Conclusion: Hence we have successfully implemented host based virtualization using VirtualBox and tried out various network adapters like NAT, Bridged Adapter, Host Only adapter.

## Creating virtual machines on Oracle VM VirtualBox



## Trying out NAT

### Host OS

```
C:\ Command Prompt
Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . . .

Ethernet adapter VirtualBox Host-Only Network:

Connection-specific DNS Suffix . . .
Link-local IPv6 Address . . . . : fe80::8140:c4b2:d586:b65a%4
Autoconfiguration IPv4 Address. . . : 169.254.182.90
Subnet Mask . . . . . . . . . : 255.255.0.0
Default Gateway . . . . . . . . . :

Wireless LAN adapter Local Area Connection* 1:

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

Wireless LAN adapter Local Area Connection* 2:

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

Wireless LAN adapter Wi-Fi:

Connection-specific DNS Suffix . . .
Link-local IPv6 Address . . . . : fe80::b8a6:563:cf9b:3f3b%7
IPv4 Address. . . . . . . . . : 192.168.0.109
Subnet Mask . . . . . . . . . : 255.255.255.0
Default Gateway . . . . . . . . . : 192.168.0.1

C:\Users\User>
```

### Guest OS 1

anish\_puppylinux\_d17b01\_nat [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

```
root# ipconfig
bash: ipconfig: command not found
root# ifconfig
eth0      Link encap:Ethernet HWaddr 08:00:27:7C:06:DD
          inet addr:10.0.2.15 Bcast:10.0.2.255 Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:10 errors:0 dropped:0 overruns:0 frame:0
          TX packets:16 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1897 (1.8 KiB) TX bytes:1799 (1.7 KiB)

lo       Link encap:Local Loopback
          inet addr:127.0.0.1 Mask:255.0.0.0
          UP LOOPBACK RUNNING MTU:65536 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)
```

## Guest OS 2

Anish\_puppylinux\_nat [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

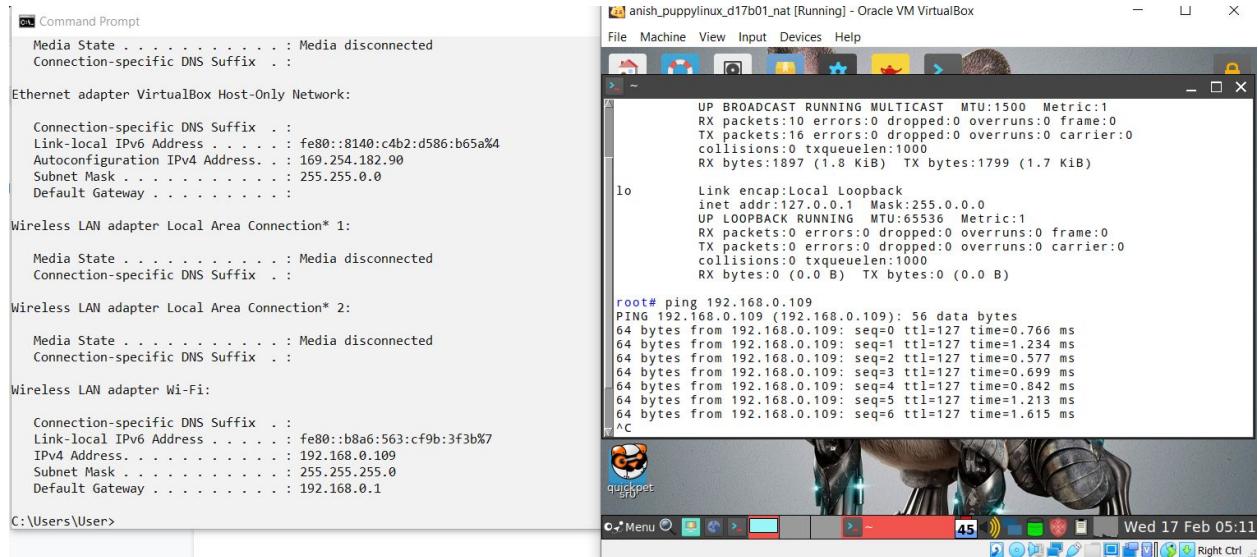
```
root# ifconfig
eth0      Link encap:Ethernet HWaddr 08:00:27:07:36:42
          inet addr:10.0.2.15 Bcast:10.0.2.255 Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:10 errors:0 dropped:0 overruns:0 frame:0
          TX packets:16 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1897 (1.8 KiB) TX bytes:1799 (1.7 KiB)

lo       Link encap:Local Loopback
          inet addr:127.0.0.1 Mask:255.0.0.0
          UP LOOPBACK RUNNING MTU:65536 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root#
```

Checking connection

## Guest OS to Host OS (Success)



anish\_puppylinux\_d17b01\_nat [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Ethernet adapter VirtualBox Host-Only Network:

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

Wireless LAN adapter Local Area Connection\* 1:

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

Wireless LAN adapter Local Area Connection\* 2:

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

Wireless LAN adapter Wi-Fi:

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

Wireless LAN adapter Local Area Connection\* 2:

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

C:\Users\User>

anish\_puppylinux\_d17b01\_nat [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Ethernet adapter VirtualBox Host-Only Network:

```
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:10 errors:0 dropped:0 overruns:0 frame:0
TX packets:16 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:1897 (1.8 Kib) TX bytes:1799 (1.7 Kib)
```

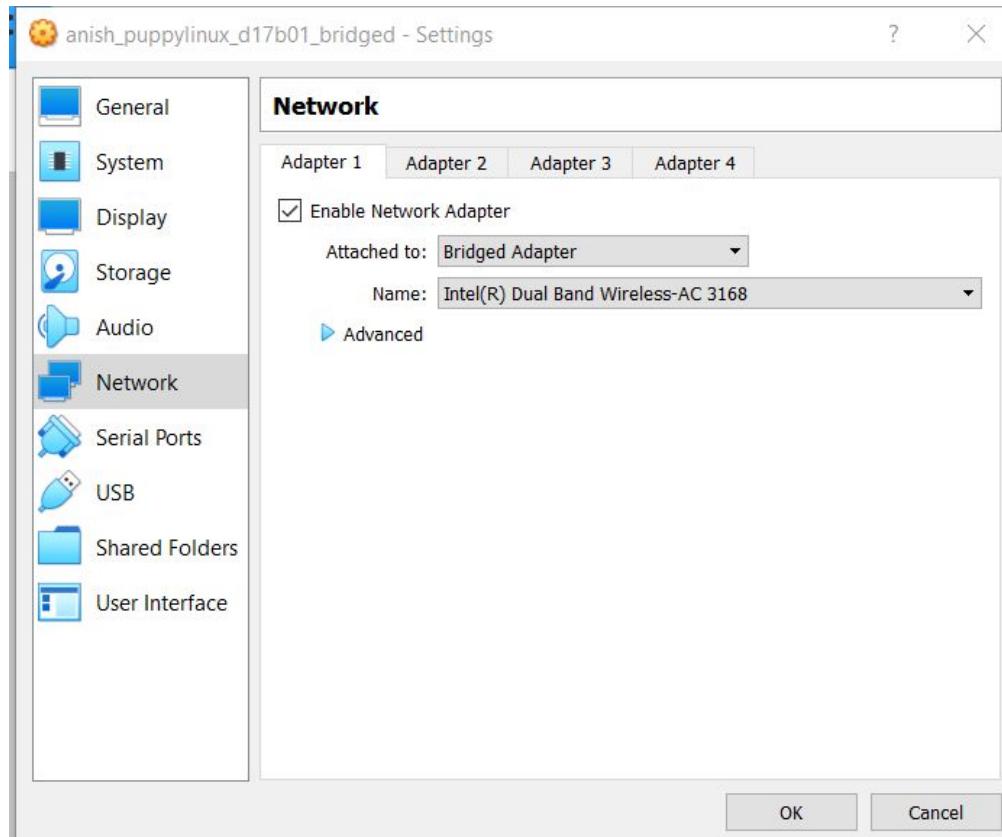
lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
UP LOOPBACK RUNNING MTU:65536 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root# ping 192.168.0.109
PING 192.168.0.109 (192.168.0.109): 56 data bytes
64 bytes from 192.168.0.109: seq=0 ttl=127 time=0.766 ms
64 bytes from 192.168.0.109: seq=1 ttl=127 time=1.234 ms
64 bytes from 192.168.0.109: seq=2 ttl=127 time=0.577 ms
64 bytes from 192.168.0.109: seq=3 ttl=127 time=0.699 ms
64 bytes from 192.168.0.109: seq=4 ttl=127 time=0.842 ms
64 bytes from 192.168.0.109: seq=5 ttl=127 time=1.213 ms
64 bytes from 192.168.0.109: seq=6 ttl=127 time=1.615 ms

Wed 17 Feb 05:11

## Trying out Bridged Adapter

Attach the network adapters of virtual machines to Bridged Adapter



## Guest OS1

```
root# ifconfig
eth0      Link encap:Ethernet HWaddr 08:00:27:7C:06:DD
          inet addr:192.168.0.105 Bcast:192.168.0.255 Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:73 errors:0 dropped:0 overruns:0 frame:0
          TX packets:17 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:7520 (7.3 KiB) TX bytes:1895 (1.8 KiB)

lo       Link encap:Local Loopback
          inet addr:127.0.0.1 Mask:255.0.0.0
          UP LOOPBACK RUNNING MTU:65536 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root#
```

## Guest OS2

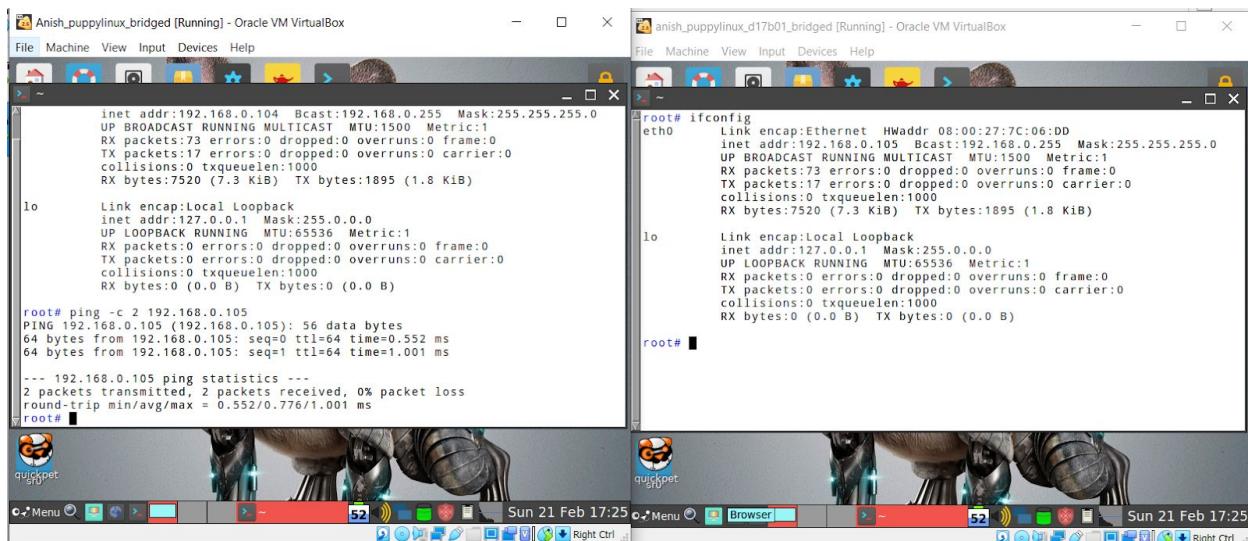
```
root# ifconfig
eth0      Link encap:Ethernet HWaddr 08:00:27:07:36:42
          inet addr:192.168.0.104 Bcast:192.168.0.255 Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:73 errors:0 dropped:0 overruns:0 frame:0
          TX packets:17 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:7520 (7.3 KiB) TX bytes:1895 (1.8 KiB)

lo       Link encap:Local Loopback
          inet addr:127.0.0.1 Mask:255.0.0.0
          UP LOOPBACK RUNNING MTU:65536 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

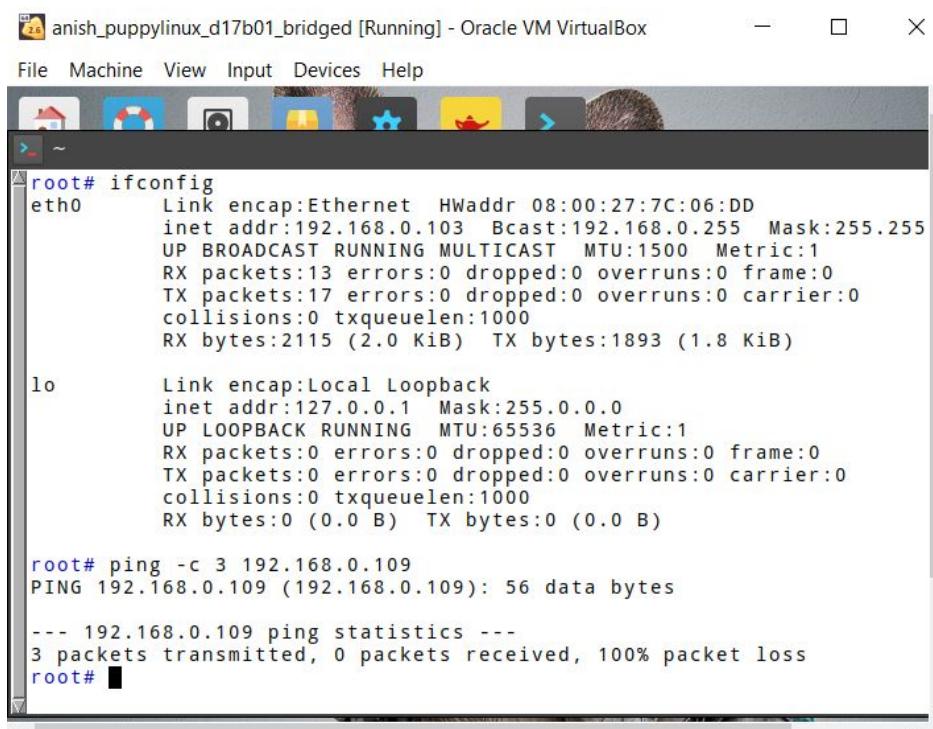
root#
```

Checking of both Guest OS are able to communicate with over bridged adapter

## Guest OS to Guest OS (Success)



## Guest OS to Host OS(Unsuccessful)



## Host OS to Guest OS (Success)

Administrator: Command Prompt

```
C:\Windows\system32>ping 192.168.0.105

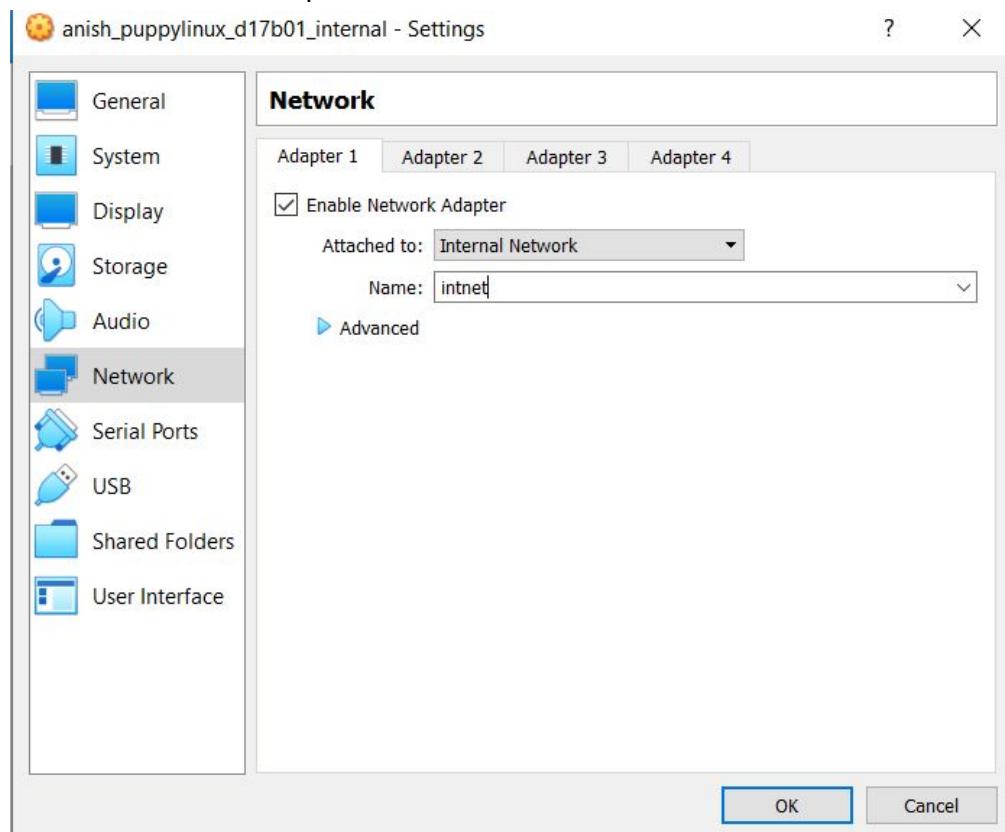
Pinging 192.168.0.105 with 32 bytes of data:
Reply from 192.168.0.105: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.0.105:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Windows\system32>
```

## Trying out Internal Network

Attach the network adapters of virtual machines to Internal Network



## Guest OS1

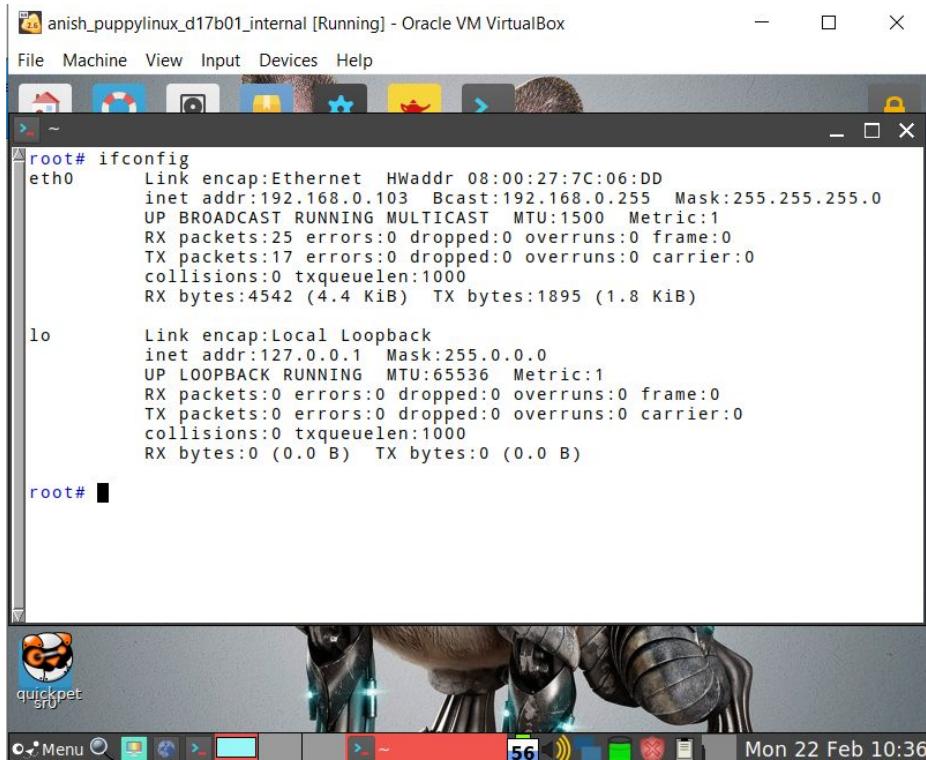
Anish\_puppylinux\_d17b01\_internal [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

```
root# ifconfig
eth0      Link encap:Ethernet HWaddr 08:00:27:7C:06:DD
          inet addr:192.168.0.103 Bcast:192.168.0.255 Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:25 errors:0 dropped:0 overruns:0 frame:0
          TX packets:17 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:4542 (4.4 KiB) TX bytes:1895 (1.8 KiB)

lo       Link encap:Local Loopback
          inet addr:127.0.0.1 Mask:255.0.0.0
          UP LOOPBACK RUNNING MTU:65536 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root#
```



## Guest OS2

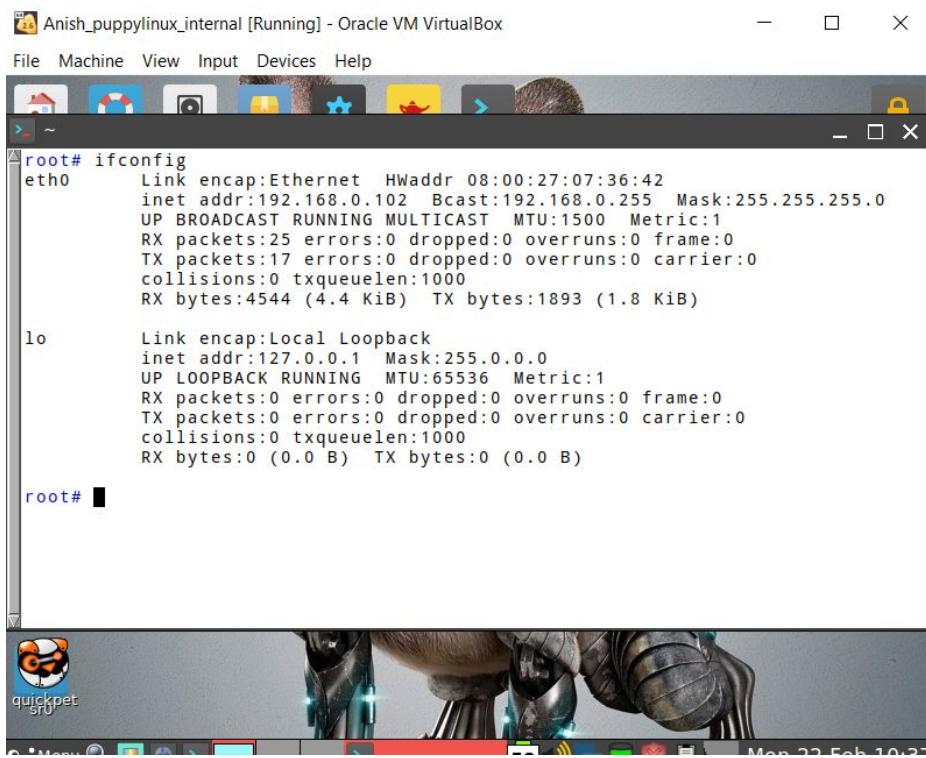
Anish\_puppylinux\_internal [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

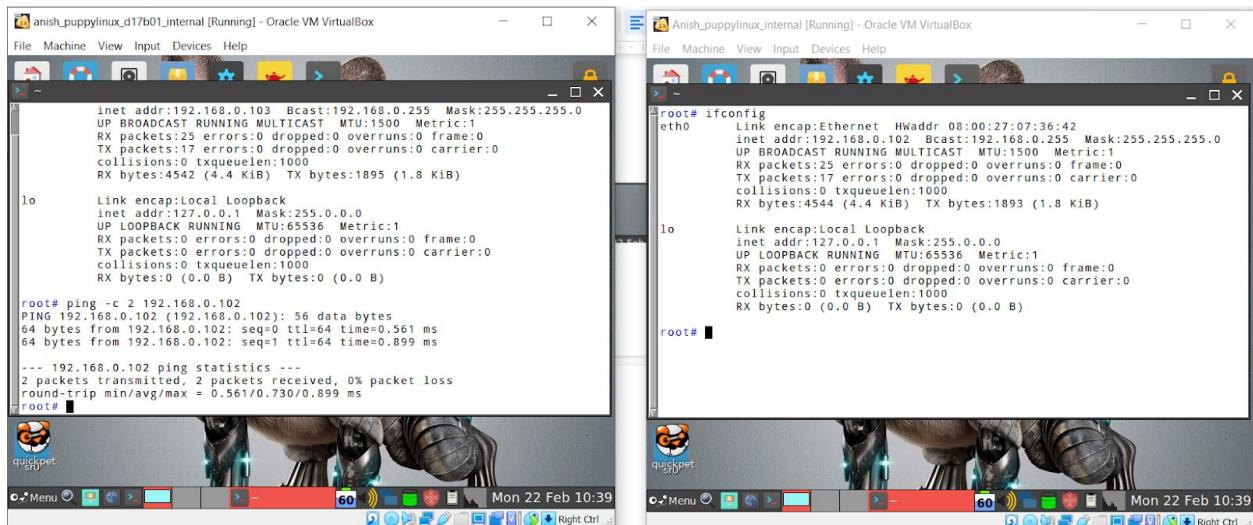
```
root# ifconfig
eth0      Link encap:Ethernet HWaddr 08:00:27:07:36:42
          inet addr:192.168.0.102 Bcast:192.168.0.255 Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:25 errors:0 dropped:0 overruns:0 frame:0
          TX packets:17 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:4544 (4.4 KiB) TX bytes:1893 (1.8 KiB)

lo       Link encap:Local Loopback
          inet addr:127.0.0.1 Mask:255.0.0.0
          UP LOOPBACK RUNNING MTU:65536 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root#
```



## Guest OS to Guest OS(Success)



## Host OS to Guest OS(Success)

```
C:\ Command Prompt
Link-local IPv6 Address . . . . . : fe80::58cf:ff4d:3a51:8df%7
IPv4 Address. . . . . : 192.168.0.109
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.0.1

Wireless LAN adapter Local Area Connection* 2:

Connection-specific DNS Suffix . :
Link-local IPv6 Address . . . . . : fe80::f8bb:2705:3806:1fb6%2
IPv4 Address. . . . . : 192.168.137.1
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . :

C:\Users\User>ping -c 3 192.168.0.103
Access denied. Option -c requires administrative privileges.

C:\Users\User>ping 192.168.0.103

Pinging 192.168.0.103 with 32 bytes of data:
Reply from 192.168.0.103: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.0.103:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

## Guest OS to Host OS(Unsuccessful)

Anish\_puppylinux\_internal [Running] - Oracle VM VirtualBox

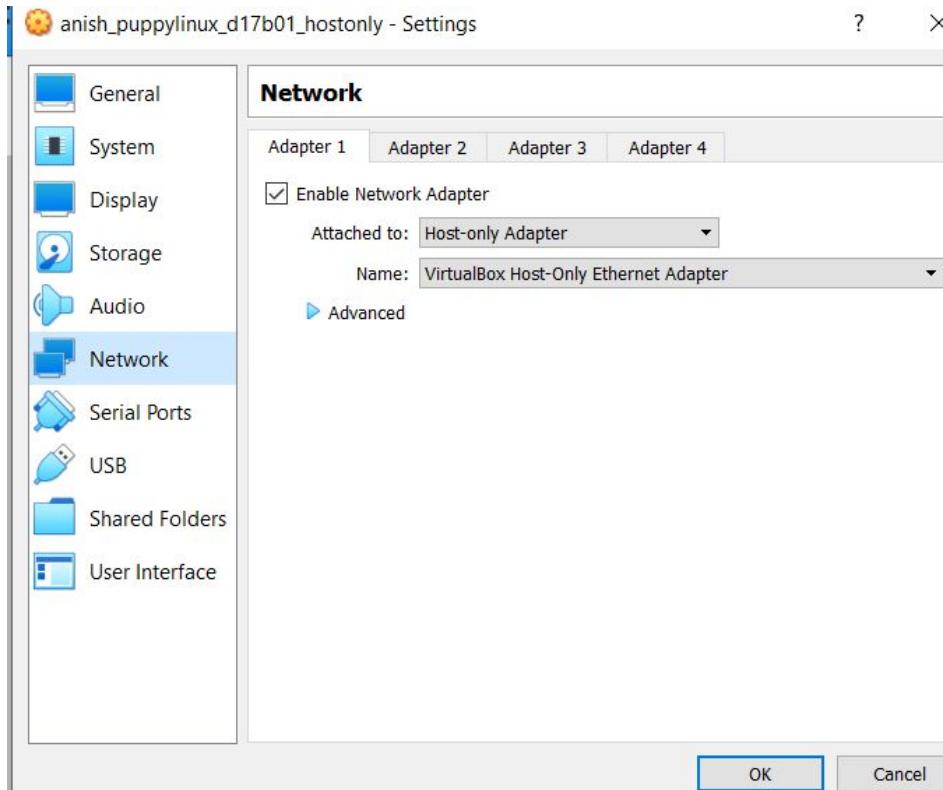
File Machine View Input Devices Help

```
root# ifconfig
eth0      Link encap:Ethernet HWaddr 08:00:27:07:36:42
          inet addr:192.168.0.102 Bcast:192.168.0.255 Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:25 errors:0 dropped:0 overruns:0 frame:0
          TX packets:17 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:4544 (4.4 KiB) TX bytes:1893 (1.8 KiB)

lo       Link encap:Local Loopback
          inet addr:127.0.0.1 Mask:255.0.0.0
          UP LOOPBACK RUNNING MTU:65536 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root# ping -c 2 192.168.0.109
PING 192.168.0.109 (192.168.0.109): 56 data bytes
--- 192.168.0.109 ping statistics ---
2 packets transmitted, 0 packets received, 100% packet loss
root# ping -c 2 192.168.0.109
```

## Trying out Host Only Adapter



## Guest OS1

Anish\_puppylinux\_d17b01\_hostonly [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

```
root# ifconfig
eth0      Link encap:Ethernet HWaddr 08:00:27:7C:06:DD
          inet addr:192.168.0.103 Bcast:192.168.0.255 Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:25 errors:0 dropped:0 overruns:0 frame:0
          TX packets:17 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:4542 (4.4 KiB) TX bytes:1895 (1.8 KiB)

lo       Link encap:Local Loopback
          inet addr:127.0.0.1 Mask:255.0.0.0
          UP LOOPBACK RUNNING MTU:65536 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root#
```



## Guest OS2

Anish\_puppylinux\_hostonly [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

```
root# ifconfig
eth0      Link encap:Ethernet HWaddr 08:00:27:07:36:42
          inet addr:192.168.0.102 Bcast:192.168.0.255 Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:25 errors:0 dropped:0 overruns:0 frame:0
          TX packets:17 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:4544 (4.4 KiB) TX bytes:1893 (1.8 KiB)

lo       Link encap:Local Loopback
          inet addr:127.0.0.1 Mask:255.0.0.0
          UP LOOPBACK RUNNING MTU:65536 Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root#
```



## 'Guest OS to Guest OS(Success)

The screenshot shows two windows of the Oracle VM VirtualBox interface. Both windows display terminal sessions on a Puppy Linux guest OS. The left window shows a standard user session with the command prompt 'root#'. The right window shows a root session with the command prompt 'root#'. Both sessions run the 'ifconfig' command to show network interface statistics and the 'ping' command to test connectivity between the two virtual machines.

```
inet addr:192.168.0.103 Bcast:192.168.0.255 Mask:255.255.255.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:25 errors:0 dropped:0 overruns:0 frame:0
TX packets:17 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:4542 (4.4 KiB) TX bytes:1895 (1.8 KiB)

1o Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
UP LOOPBACK RUNNING MTU:65536 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root# ping -c 2 192.168.0.102
PING 192.168.0.102 (192.168.0.102): 56 data bytes
64 bytes from 192.168.0.102: seq=0 ttl=64 time=0.731 ms
64 bytes from 192.168.0.102: seq=1 ttl=64 time=1.037 ms
--- 192.168.0.102 ping statistics ---
2 packets transmitted, 2 packets received, 0% packet loss
round-trip min/avg/max = 0.731/0.884/1.037 ms
root#
```

```
Link encap:Ethernet HWaddr 08:00:27:07:36:42
inet addr:192.168.0.102 Bcast:192.168.0.255 Mask:255.255.255.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:25 errors:0 dropped:0 overruns:0 frame:0
TX packets:17 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:4544 (4.4 KiB) TX bytes:1893 (1.8 KiB)

1o Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
UP LOOPBACK RUNNING MTU:65536 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root#
```

## Host Os to Guest OS(Success)

The screenshot shows a terminal window on a host operating system (Windows 7). The user runs the 'ping' command with the '-c 2' option to the IP address '192.168.0.102'. The output shows that the connection is denied because the user does not have administrative privileges.

```
Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\User>ping -c 2 192.168.0.102
Access denied. Option -c requires administrative privileges.

C:\Users\User>ping 192.168.0.102

Pinging 192.168.0.102 with 32 bytes of data:
Reply from 192.168.0.102: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.0.102:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\User>
```

Below the terminal window, there is another window titled 'Anish\_puppylinux\_hostonly [Running] - Oracle VM VirtualBox' which appears to be a terminal session on the guest OS, showing the output of the 'ifconfig' and 'ping' commands described above.

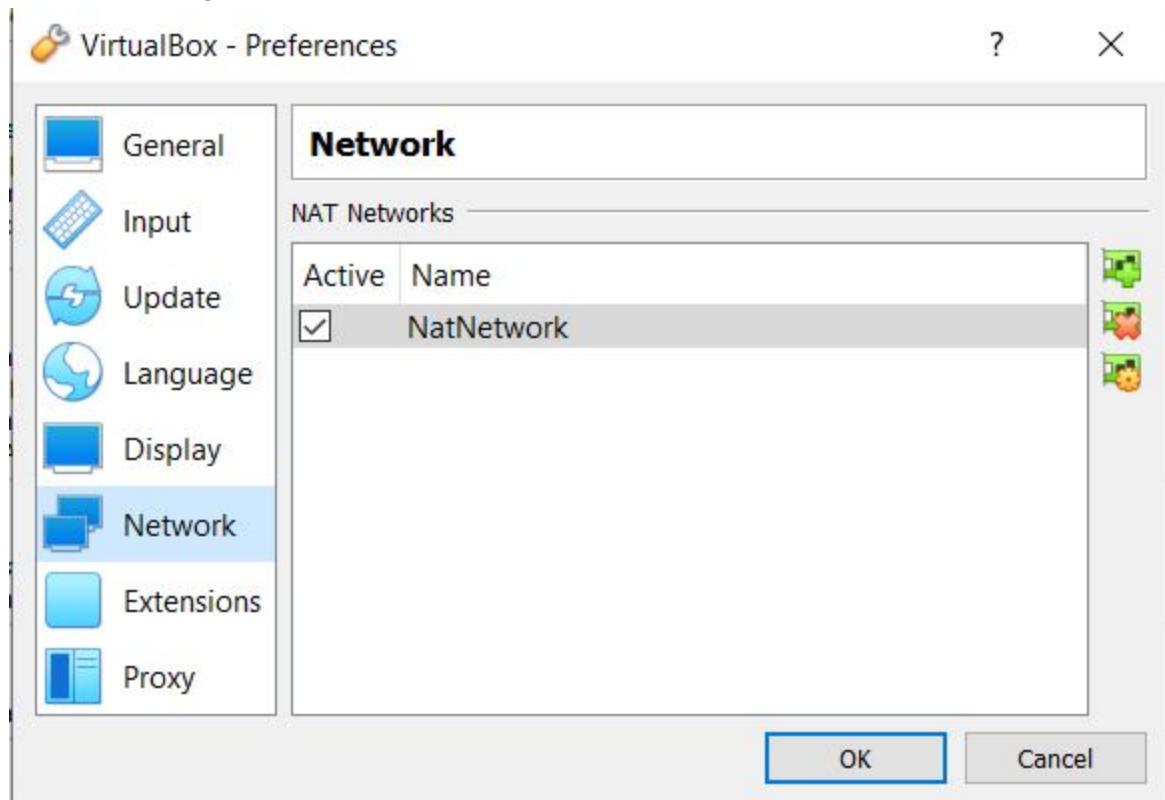
```
Link encap:Ethernet HWaddr 08:00:27:07:36:42
inet addr:192.168.0.102 Bcast:192.168.0.255 Mask:255.255.255.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:25 errors:0 dropped:0 overruns:0 frame:0
TX packets:17 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:4544 (4.4 KiB) TX bytes:1893 (1.8 KiB)

1o Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
UP LOOPBACK RUNNING MTU:65536 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

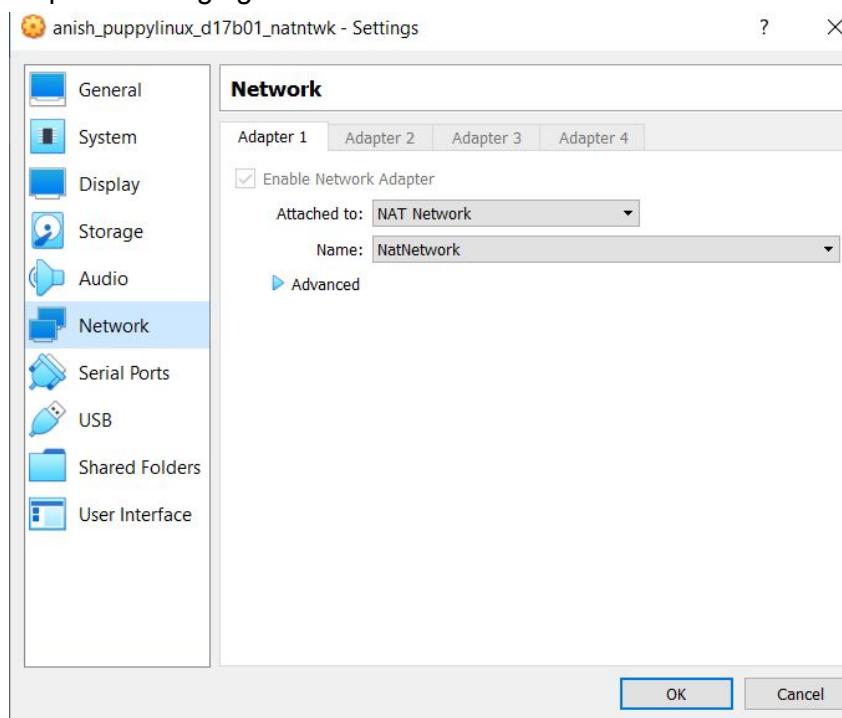
root#
```

## Trying out NAT Network

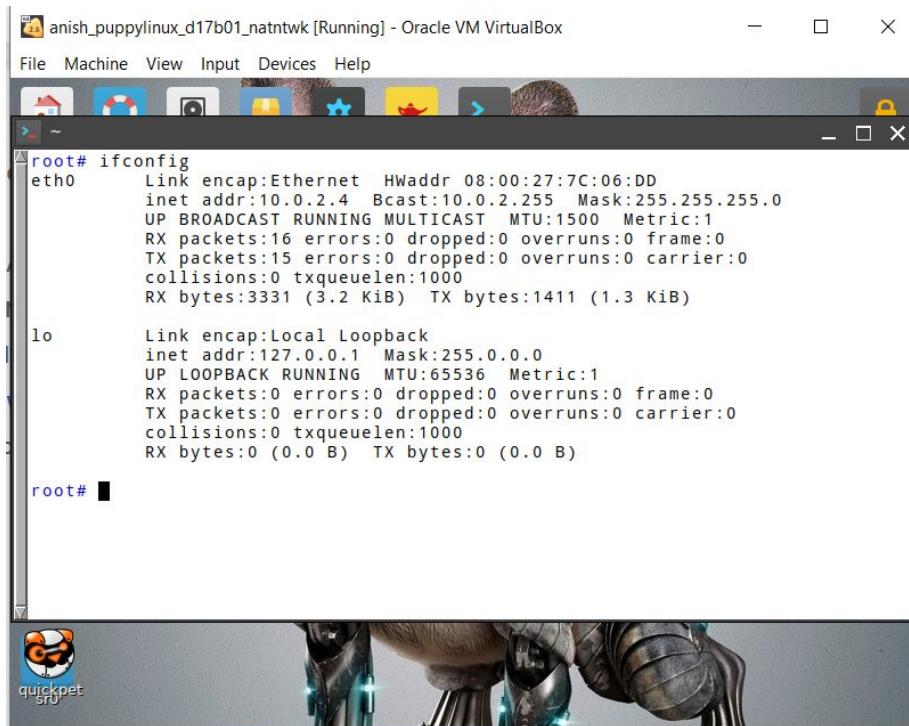
Step 1: Creating a new Nat Network named “NatNetwork”



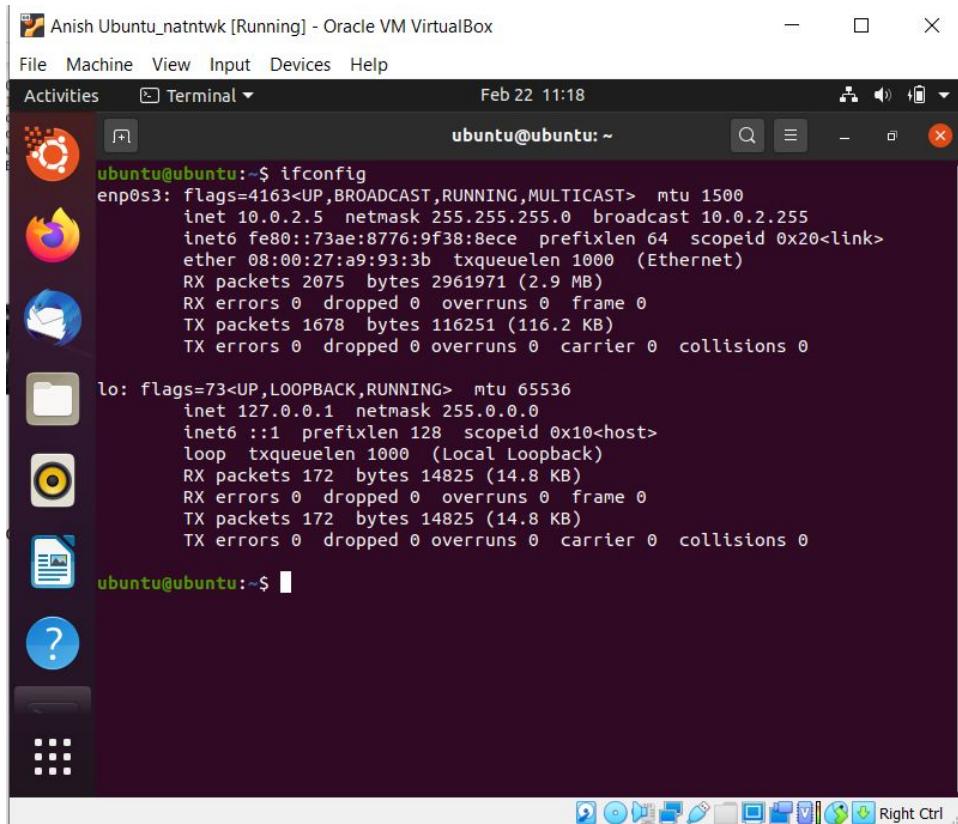
Step 2: A changing network of all the virtual machines created to the “NatNetwork” created



## Guest OS1



## Guest OS2



## Guest OS to Guest OS(Success)

The screenshot shows two windows from Oracle VM VirtualBox. The left window is titled "anish\_puppylinux\_d17b01\_natntwk [Running] - Oracle VM VirtualBox" and the right window is titled "ubuntu\_natntwk [Running] - Oracle VM VirtualBox". Both windows have a terminal tab open.

The terminal in the left window (puppylinux) shows the output of the `ifconfig` command:

```
inet addr:10.0.2.4 Bcast:10.0.2.255 Mask:255.255.255.0
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:16 errors:0 dropped:0 overruns:0 frame:0
TX packets:15 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:3331 (3.2 Kib) TX bytes:1411 (1.3 Kib)

lo Link encap:Local Loopback
inet addr:127.0.0.1 Mask:255.0.0.0
UP LOOPBACK RUNNING MTU:65536 Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root# ping -c 2 10.0.2.5
PING 10.0.2.5 (10.0.2.5): 56 data bytes
64 bytes from 10.0.2.5: seq=0 ttl=64 time=0.615 ms
64 bytes from 10.0.2.5: seq=1 ttl=64 time=0.731 ms

--- 10.0.2.5 ping statistics ---
2 packets transmitted, 2 packets received, 0% packet loss
round-trip min/avg/max = 0.615/0.673/0.731 ms
root#
```

The terminal in the right window (ubuntu) shows the output of the `ifconfig` command:

```
p0s3: flags=4163 mtu 1500
inet 10.0.2.5 netmask 255.255.255.0 broadcast 10.0.2.255
inet6 fe80::73ae:8776:9f38:bece prefixlen 64 scopedid 0x20<link>
ether 08:00:27:a9:93:3b txqueuelen 1000 (Ethernet)
RX packets 2075 bytes 2961971 (2.9 MB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 1678 bytes 116251 (116.2 KB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

: flags=73 mtu 65536
inet 127.0.0.1 netmask 255.0.0.0
inet6 ::1 prefixlen 128 scopedid 0x10<host>
loop txqueuelen 1000 (Local Loopback)
RX packets 172 bytes 14825 (14.8 KB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 172 bytes 14825 (14.8 KB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

ubuntu@ubuntu:~$
```

## Guest OS to Host OS(Success)

The screenshot shows two windows from Oracle VM VirtualBox. The left window is titled "anish\_puppylinux\_d17b01\_natntwk [Running] - Oracle VM VirtualBox" and the right window is titled "Command Prompt".

The terminal in the left window (puppylinux) shows the output of the `ping` command:

```
root# ping -c 3 192.168.0.109
PING 192.168.0.109 (192.168.0.109): 56 data bytes
64 bytes from 192.168.0.109: seq=0 ttl=127 time=0.777 ms
64 bytes from 192.168.0.109: seq=1 ttl=127 time=0.970 ms
64 bytes from 192.168.0.109: seq=2 ttl=127 time=1.896 ms

--- 192.168.0.109 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 0.777/1.214/1.896 ms
root#
```

The terminal in the right window (Command Prompt) shows the output of the `ipconfig` command:

```
Ethernet adapter VMware Network Adapter VMnet8:
Connection-specific DNS Suffix . :
Link-local IPv6 Address . . . . . : fe80::4529:c13b:8762:d0%1
IPv4 Address . . . . . : 192.168.13.1
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . :

Wireless LAN adapter Wi-Fi:
Connection-specific DNS Suffix . :
Link-local IPv6 Address . . . . . : fe80::58cf:ff4d:3a51:8df%7
IPv4 Address . . . . . : 192.168.0.109
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.0.1

Wireless LAN adapter Local Area Connection* 2:
Connection-specific DNS Suffix . :
Link-local IPv6 Address . . . . . : fe80::f8bb:2705:3806:1fb6%
IPv4 Address . . . . . : 192.168.137.1
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . :

C:\Users\User>ping -c 3 192.168.0.103
Access denied. Option -c requires administrative privileges.

C:\Users\User>ping 192.168.0.103
```

## Host OS to Guest OS(Unsuccessful)

The screenshot shows two windows from Oracle VM VirtualBox. The left window is titled "anish\_puppylinux\_d17b01\_natntwk [Running] - Oracle VM VirtualBox" and the right window is titled "Command Prompt".

The terminal in the left window (puppylinux) shows the output of the `ping` command:

```
64 bytes from 192.168.0.109: seq=1 ttl=127 time=0.970 ms
64 bytes from 192.168.0.109: seq=2 ttl=127 time=1.896 ms

--- 192.168.0.109 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 0.777/1.214/1.896 ms
root# ifconfig
eth0 Link encap:Ethernet HWaddr 08:00:27:7C:06:DD
      inet addr:10.0.2.4 Bcast:10.0.2.255 Mask:255.255.255.0
      UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
      RX packets:10981 errors:0 dropped:0 overruns:0 frame:0
      TX packets:5692 errors:0 dropped:0 overruns:0 carrier:0
      collisions:0 txqueuelen:1000
      RX bytes:16170239 (15.4 MB) TX bytes:352959 (344.6 Kib)

lo Link encap:Local Loopback
      inet addr:127.0.0.1 Mask:255.0.0.0
      UP LOOPBACK RUNNING MTU:65536 Metric:1
      RX packets:0 errors:0 dropped:0 overruns:0 frame:0
      TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
      collisions:0 txqueuelen:1000
      RX bytes:0 (0.0 B) TX bytes:0 (0.0 B)

root#
```

The terminal in the right window (Command Prompt) shows the output of the `ping` command:

```
C:\Users\User>ping 10.0.2.4
Pinging 10.0.2.4 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 10.0.2.4:
  Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\Users\User>
```

## Adapter not connected

