

## EXPERIMENT 3

Aim: Implementation of Host Based virtualization using KVM

- Test NAT to NAT
- Study of vmware KVM mode.

Theory:

Host Based virtualization

It includes all approaches that run desktops virtual directly on the server. With this, the entire computing power for providing the desktop environment and for operating applications is provided by the centralized server hardware. It requires additional software running on the host as a privileged task or process and clients must always be connected to the central server in order to access the virtual machine.

KVM

It is an open source virtualization technology built into linux. It lets you turn linux into a hypervisor that allows a host machine to run multiple, isolated virtual environments called vms

It is a relatively new and simple, yet powerful, virtualization engine which allows to implement

VMs as a regular Linux process, scheduled by the standard Linux scheduler, with dedicated virtual hardware like a network card, graphics adapter, CPU(s), memory and disks.

It makes use of virtual hardware to virtualize processor states and memory management is handled from within the level.

A Typical KVM installation consists of the following components:

- A device driver for managing the virtualization hardware
- A user-space component for emulating PC hardware
- The I/O model which is derived from QEMU's

Access and control to the VMs is provided to the user by a client device connected over a network. Multiple host-based virtual machines can run on a single server. The major drawback of host based virtualisation is that virtualization on each host must be manually configured and managed separately. The more administrative overhead this imposes.

VMware KVM mode

Use the `vmware-kvm.exe` command to run Workstation in KVM mode and to start and stop virtual machines.



You can include the command to start a virtual machine in a shortcut in the host operating systems startup group, so the virtual machine starts automatically when a user logs on to the host computer.

1. Open a command prompt
2. Change to the directory where workstation is installed.  
`cd <workstation installation directory>`
3. Run the command  
`vmware-kvm.exe [OPTIONS] virtual-machine-vmx-file.vmx`  
`virtual-machine-vmx-file.vmx` is a path to the .vmx file of the virtual machine
4. Enter KVM mode for more than one virtual machine to use the configured hot key to cycle between them.

### Conclusion:

We have successfully implemented Host Based virtualization using KVM.

- Tested NAT to NAT  
 and studied VMware KVM mode

## Installation

```
$ sudo apt-get install qemu-kvm libvirt-daemon-system libvirt-clients  
bridge-utils
```

After installation, add yourself to the libvirt or libvirtd group, whichever one you have, and then log out and log back in. This allows you to run commands without root privileges.

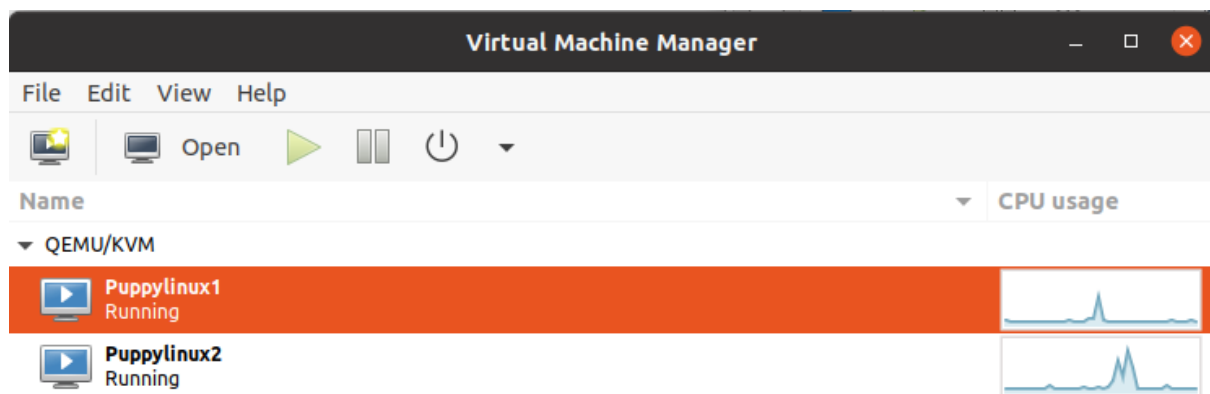
```
$ sudo adduser `id -un` libvirt  
Adding user '<username>' to group 'libvirt' ...  
$ sudo adduser `id -un` kvm  
Adding user '<username>' to group 'kvm' ...
```

You can test if your install has been successful with the following command:

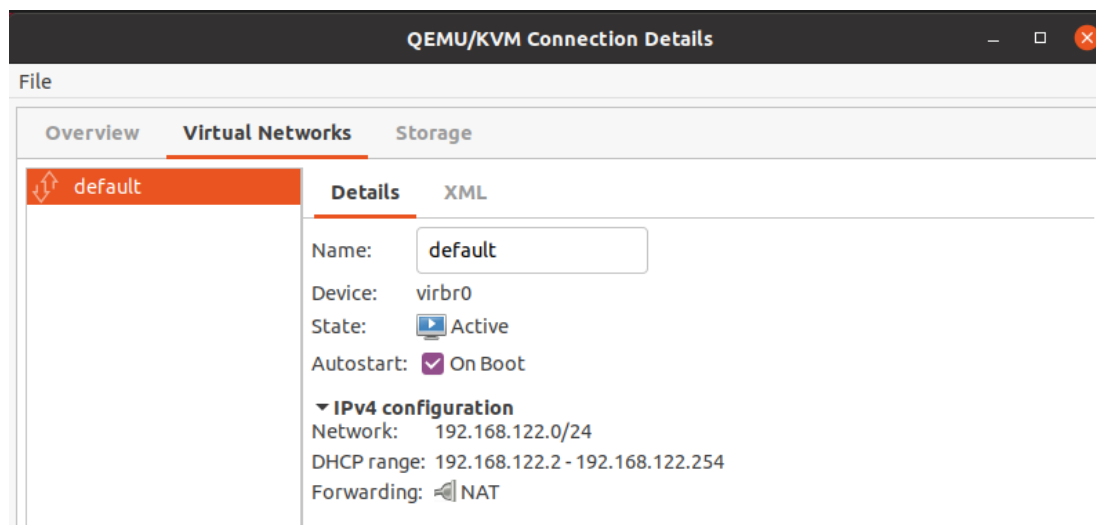
```
$ virsh list --all
```

```
$ virt-manager
```

Created 2 VMs



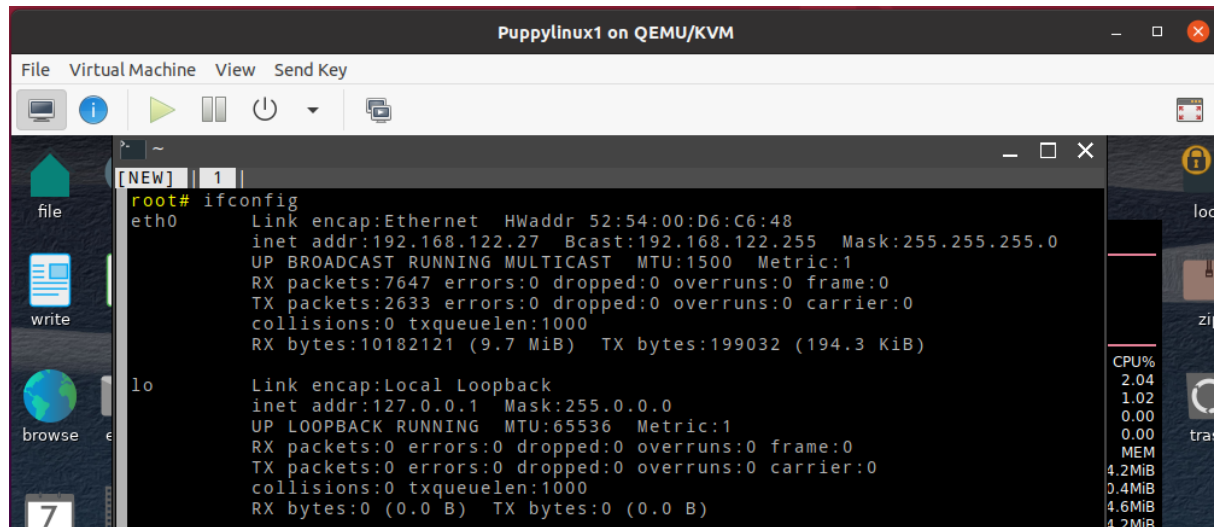
Network Details:



Host:

```
madmax@ubuntu: ~  
madmax@ubuntu:~$ ifconfig  
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet 192.168.1.3 netmask 255.255.255.0 broadcast 192.168.1.255  
    inet6 fe80::f3a4:65ef:f753:cd85 prefixlen 64 scopeid 0x20<link>  
    ether 00:0c:29:6d:6e:e4 txqueuelen 1000 (Ethernet)  
    RX packets 17703 bytes 22774945 (22.7 MB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 6200 bytes 467525 (467.5 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 300 bytes 25813 (25.8 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 300 bytes 25813 (25.8 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
virbr0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet 192.168.122.1 netmask 255.255.255.0 broadcast 192.168.122.255  
    ether 52:54:00:72:62:ff txqueuelen 1000 (Ethernet)  
    RX packets 5484 bytes 328959 (328.9 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 10505 bytes 22282168 (22.2 MB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
vnet0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 fe80::fc54:ff:fed6:c648 prefixlen 64 scopeid 0x20<link>  
    ether fe:54:00:d6:c6:48 txqueuelen 1000 (Ethernet)  
    RX packets 2637 bytes 199386 (199.3 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 8146 bytes 10211006 (10.2 MB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
vnet1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 fe80::fc54:ff:fec0:624d prefixlen 64 scopeid 0x20<link>  
    ether fe:54:00:c0:62:4d txqueuelen 1000 (Ethernet)  
    RX packets 2850 bytes 206529 (206.5 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 9290 bytes 12523842 (12.5 MB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

VM1:



The screenshot shows a terminal window titled "Puppylinux1 on QEMU/KVM". The terminal output for the command `ifconfig` is as follows:

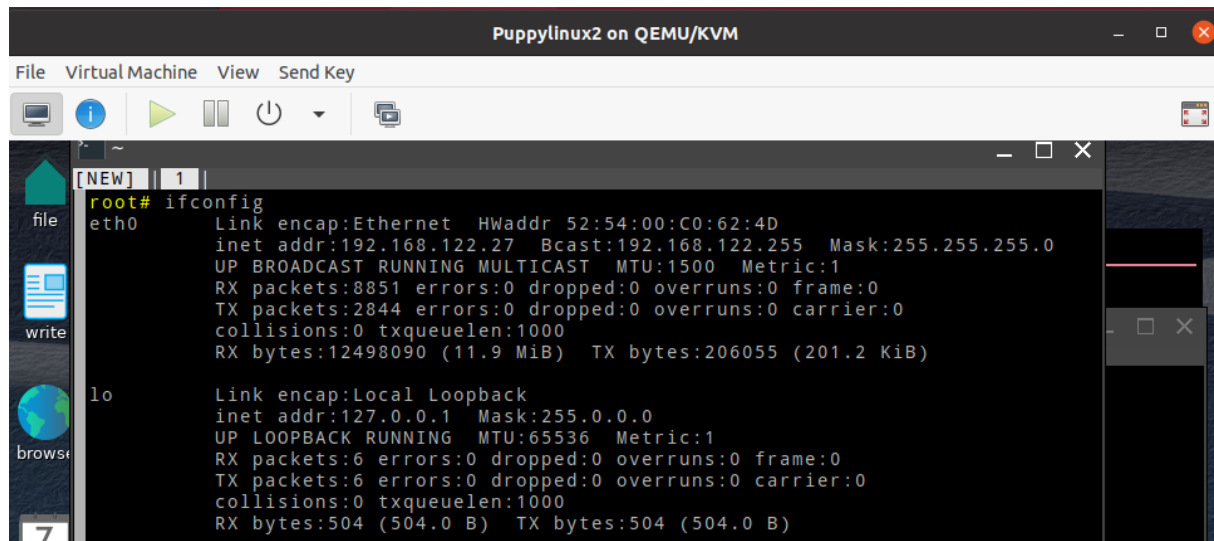
```
root# ifconfig
eth0      Link encap:Ethernet  HWaddr 52:54:00:D6:C6:48
          inet addr:192.168.122.27  Bcast:192.168.122.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:7647 errors:0 dropped:0 overruns:0 frame:0
          TX packets:2633 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:10182121 (9.7 MiB)  TX bytes:199032 (194.3 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)
```

On the right side of the terminal window, a system status panel displays the following metrics:

Metric	Value
CPU%	2.04
1.02	
0.00	
0.00	
MEM	
4.2MiB	
0.4MiB	
4.6MiB	
4.2MiB	

VM2:

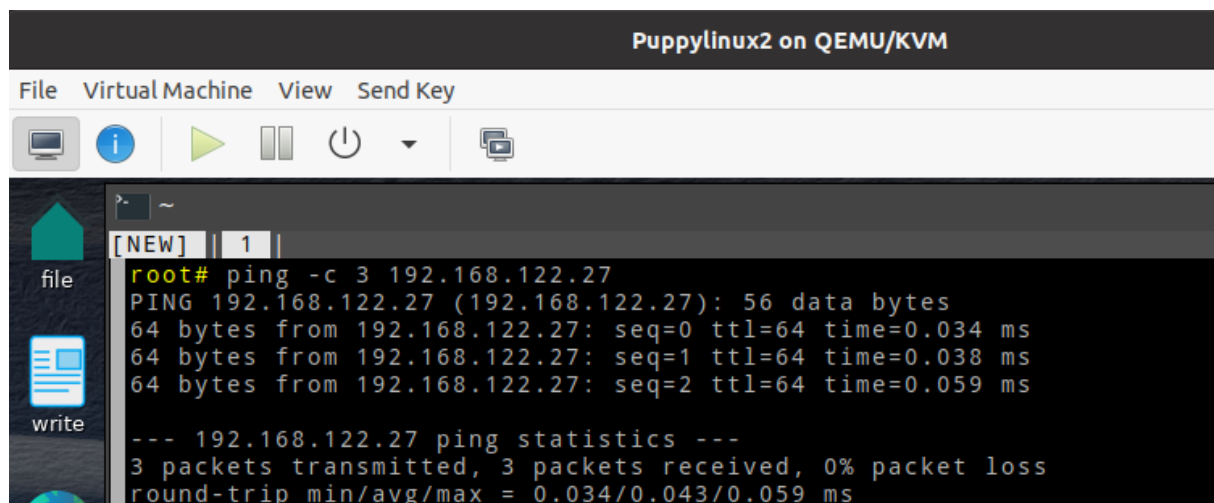


The screenshot shows a terminal window titled "Puppylinux2 on QEMU/KVM". The terminal output for the command `ifconfig` is as follows:

```
root# ifconfig
eth0      Link encap:Ethernet  HWaddr 52:54:00:C0:62:4D
          inet addr:192.168.122.27  Bcast:192.168.122.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:8851 errors:0 dropped:0 overruns:0 frame:0
          TX packets:2844 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:12498090 (11.9 MiB)  TX bytes:206055 (201.2 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:6 errors:0 dropped:0 overruns:0 frame:0
          TX packets:6 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:504 (504.0 B)  TX bytes:504 (504.0 B)
```

Guest to Guest:



The screenshot shows a terminal window titled "Puppylinux2 on QEMU/KVM". The terminal output for the command `ping -c 3 192.168.122.27` is as follows:

```
root# ping -c 3 192.168.122.27
PING 192.168.122.27 (192.168.122.27): 56 data bytes
64 bytes from 192.168.122.27: seq=0 ttl=64 time=0.034 ms
64 bytes from 192.168.122.27: seq=1 ttl=64 time=0.038 ms
64 bytes from 192.168.122.27: seq=2 ttl=64 time=0.059 ms

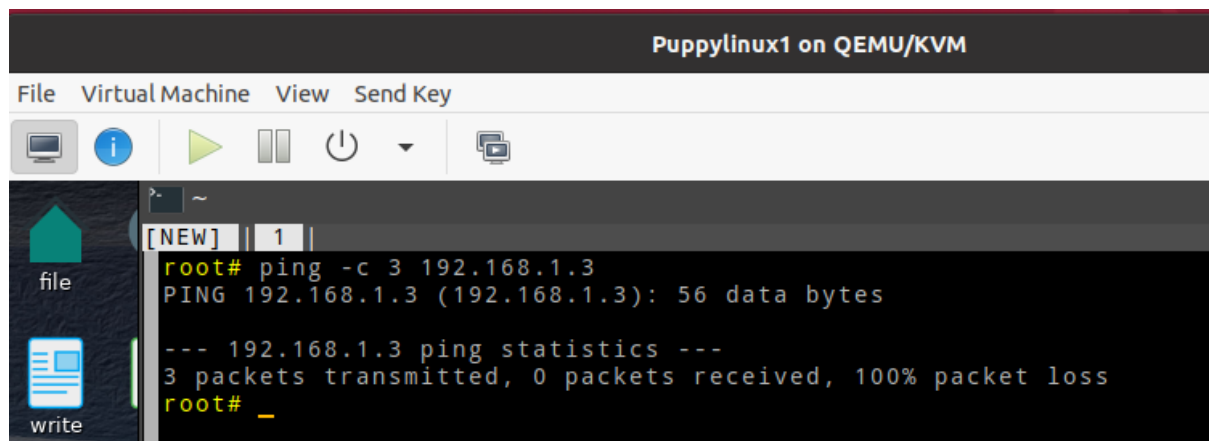
--- 192.168.122.27 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 0.034/0.043/0.059 ms
```

Host to Guest:

```
madmax@ubuntu:~$ ping -c 3 192.168.122.27
PING 192.168.122.27 (192.168.122.27) 56(84) bytes of data.
64 bytes from 192.168.122.27: icmp_seq=1 ttl=64 time=0.487 ms
64 bytes from 192.168.122.27: icmp_seq=2 ttl=64 time=0.736 ms
64 bytes from 192.168.122.27: icmp_seq=3 ttl=64 time=0.476 ms

--- 192.168.122.27 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2026ms
rtt min/avg/max/mdev = 0.476/0.566/0.736/0.120 ms
```

Guest to Host:





## EXP: 3

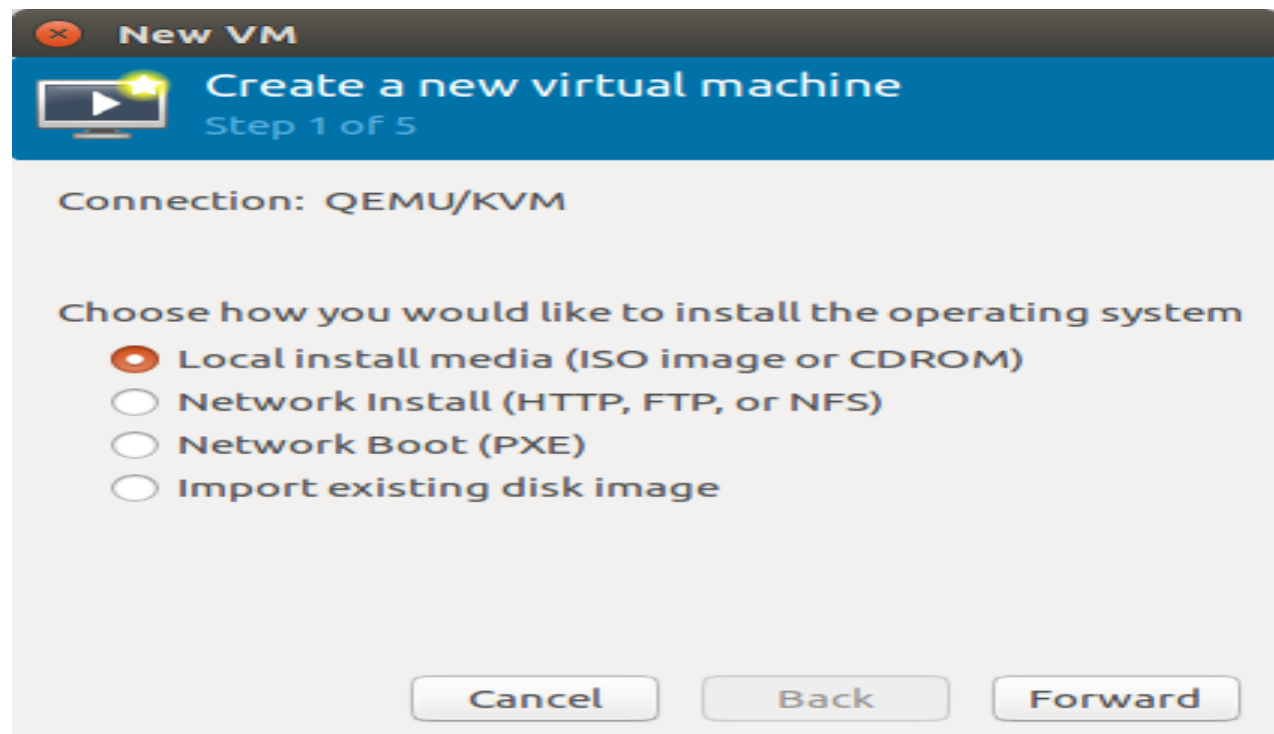
1. Check if virtualization is enabled by typing following command

```
#sudo grep -c "svm\|vmx" /proc/cpuinfo
```

2. #sudo apt-get install qemu-kvm libvirt-bin bridge-utils virt-manager

```
root@lab309b-OptiPlex-3020: /home/lab309b
root@lab309b-OptiPlex-3020:/home/lab309b# grep -c "svm\|vmx" /proc/cpuinfo
4
root@lab309b-OptiPlex-3020:/home/lab309b# apt-get install qemu-kvm libvirt-bin b
ridge-utils virt-manager
Reading package lists... Done
Building dependency tree
Reading state information... Done
virt-manager is already the newest version (1:1.3.2-3ubuntu1.16.04.4).
The following additional packages will be installed:
  augeas-lenses cgmanager cpu-checker ipxe-qemu libaugeas0 libfdt1 libnetcf1
  libSDL1.2debian msr-tools qemu-system-common qemu-system-x86 seabios
Suggested packages:
  augeas-doc augeas-tools samba vde2 sgabios ovmf
The following NEW packages will be installed:
  augeas-lenses bridge-utils cgmanager cpu-checker ipxe-qemu libaugeas0
  libfdt1 libnetcf1 libSDL1.2debian libvirt-bin msr-tools qemu-kvm
  qemu-system-common qemu-system-x86 seabios
0 upgraded, 15 newly installed, 0 to remove and 472 not upgraded.
Need to get 5,624 kB/8,077 kB of archives.
After this operation, 34.9 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://in.archive.ubuntu.com/ubuntu xenial-updates/main amd64 qemu-system-
common amd64 1:2.5+dfsg-5ubuntu10.16 [281 kB]
Get:2 http://in.archive.ubuntu.com/ubuntu xenial-updates/main amd64 augeas-lense
s all 1.4.0-0ubuntu1.1 [263 kB]
Get:3 http://in.archive.ubuntu.com/ubuntu xenial/main amd64 cgmanager amd64 0.39
-2ubuntu5 [76.4 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu xenial/main amd64 msr-tools amd64 1.3-
2 [10.6 kB]
```


3. Open "Virtual Machine Manager"





EXP: 3

New VM



Create a new virtual machine

Step 2 of 5

Locate your install media

☐ Use CDROM or DVD

No device present ▾

☒ Use ISO image:

/home/lab309b/Desktop/ubuntu-14.04.2- ▾

Browse...

☒ Automatically detect operating system based on install media

OS type: Linux


Version: Ubuntu 14.04 LTS

Cancel

Back

Forward

New VM



Create a new virtual machine

Step 4 of 5

☒ Enable storage for this virtual machine

☒ Create a disk image for the virtual machine

8.0

—

+

GiB

148.2 GiB available in the default location

☐ Select or create custom storage

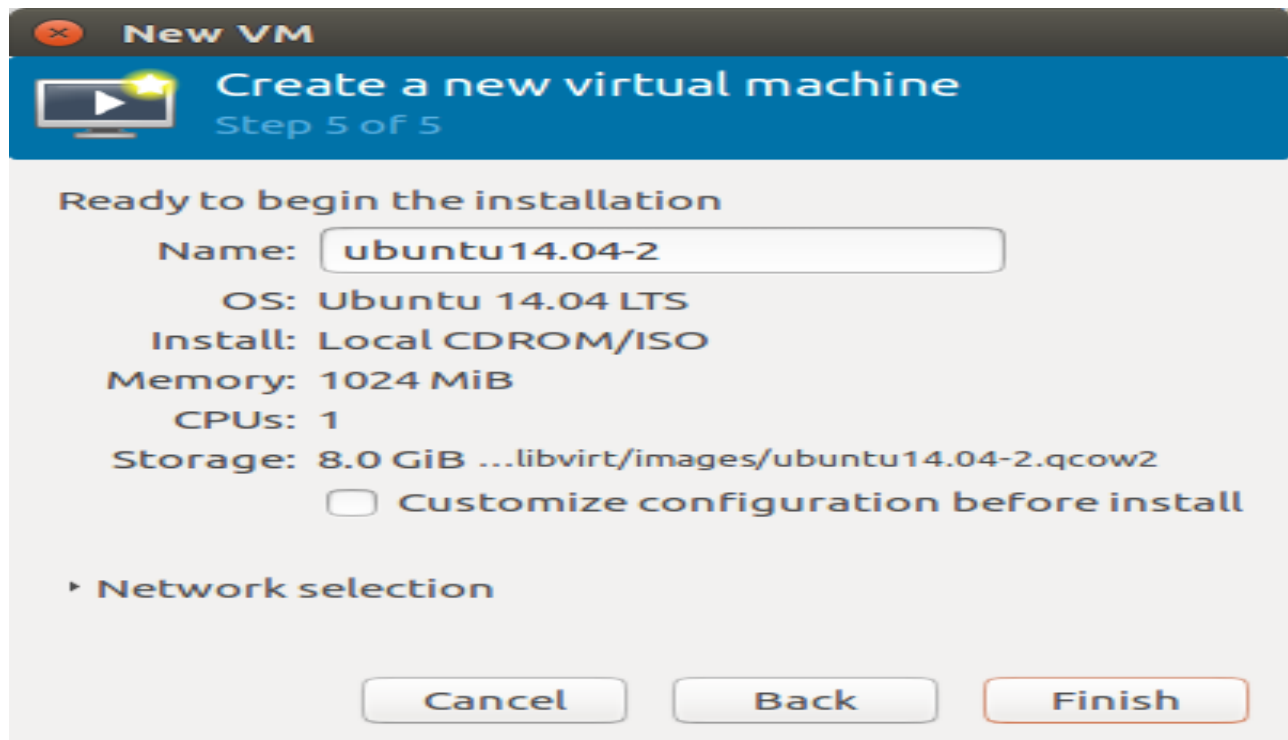
Manage...

Cancel

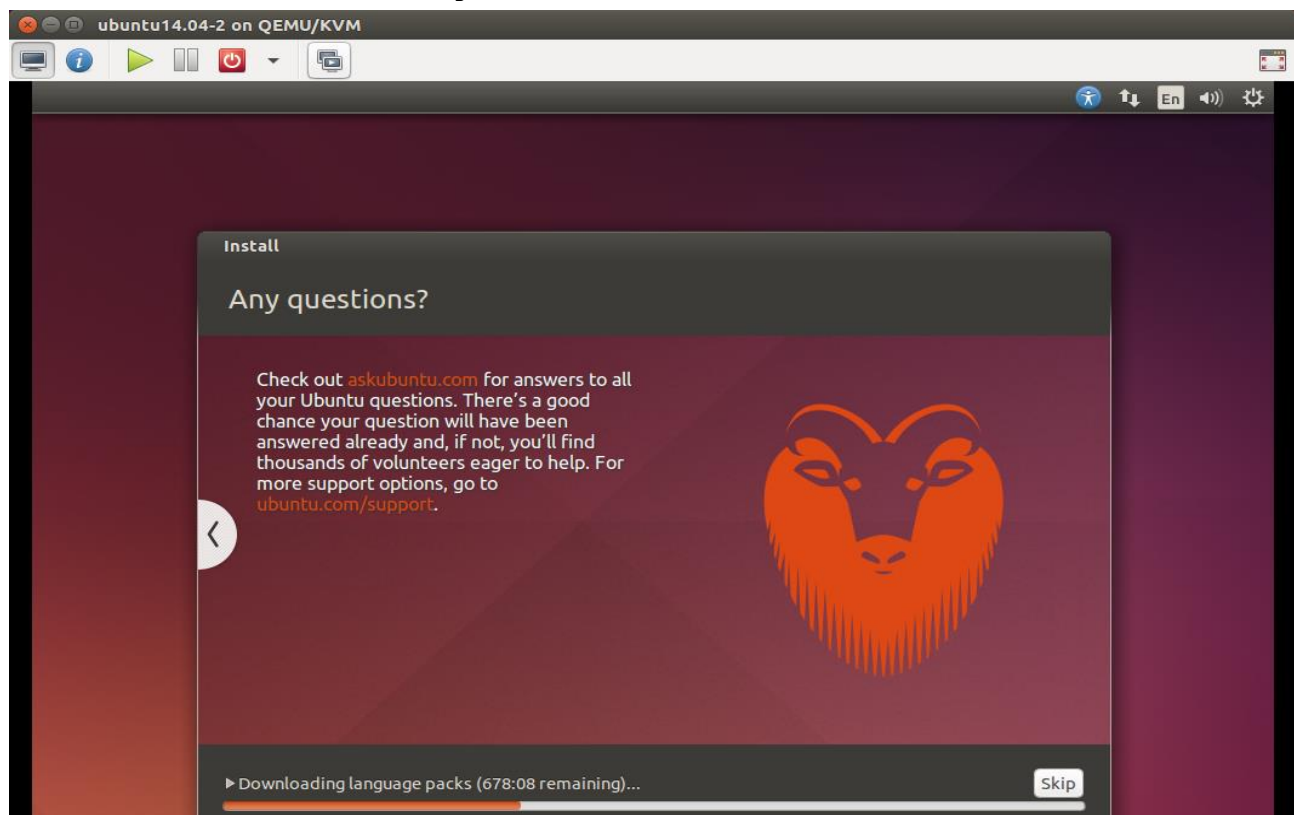
Back

Forward

EXP: 3

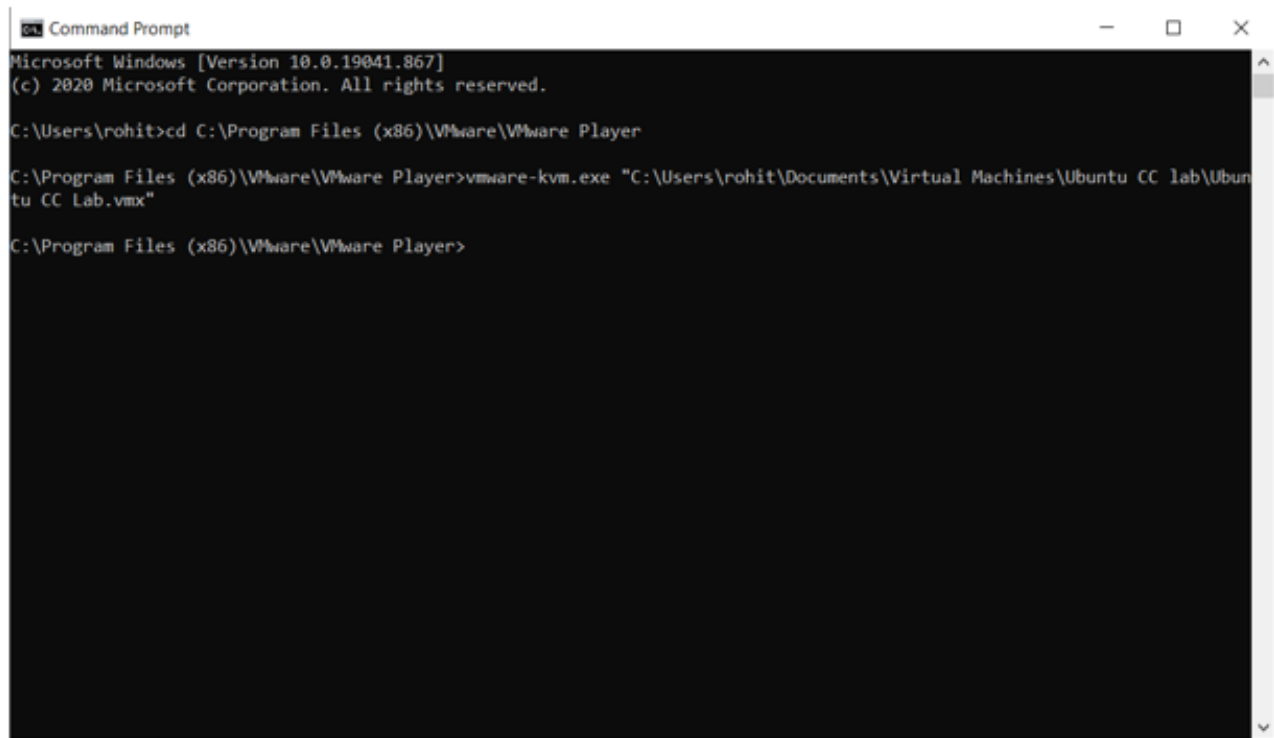


4. Ubuntu Machine will get installed.



## EXP: 3

5. Navigate to VMware workstation directory and type to following command



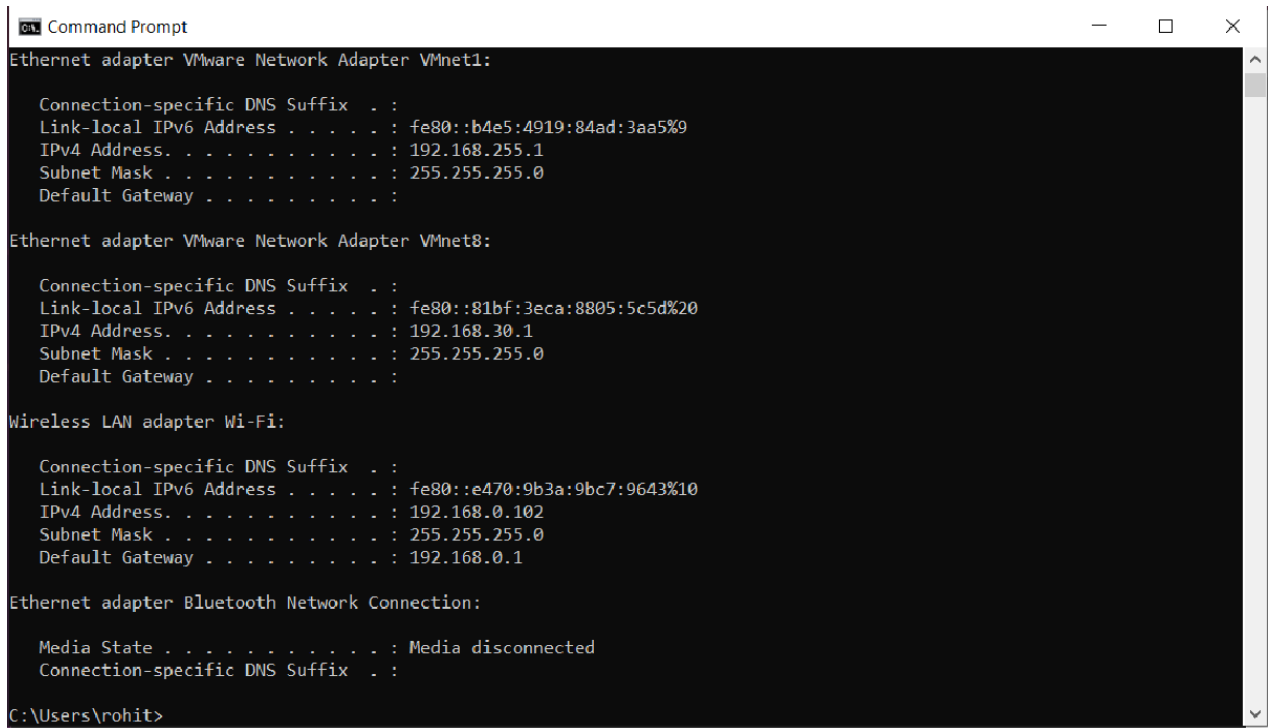
```
Command Prompt
Microsoft Windows [Version 10.0.19041.867]
(c) 2020 Microsoft Corporation. All rights reserved.

C:\Users\rohit>cd C:\Program Files (x86)\VMware\VMware Player

C:\Program Files (x86)\VMware\VMware Player>vmware-kvm.exe "C:\Users\rohit\Documents\Virtual Machines\Ubuntu CC lab\Ubuntu CC Lab.vmx"

C:\Program Files (x86)\VMware\VMware Player>
```

## 6. NAT Network Host OS



```
Command Prompt

Ethernet adapter VMware Network Adapter VMnet1:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::b4e5:4919:84ad:3aa5%9
    IPv4 Address. . . . . : 192.168.255.1
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 

Ethernet adapter VMware Network Adapter VMnet8:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::81bf:3eca:8805:5c5d%20
    IPv4 Address. . . . . : 192.168.30.1
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 

Wireless LAN adapter Wi-Fi:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::e470:9b3a:9bc7:9643%10
    IPv4 Address. . . . . : 192.168.0.102
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.0.1

Ethernet adapter Bluetooth Network Connection:

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

C:\Users\rohit>
```

## EXP: 3

```
Command Prompt
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . :

Wireless LAN adapter Wi-Fi:

Connection-specific DNS Suffix . :
Link-local IPv6 Address . . . . . : fe80::e470:9b3a:9bc7:9643%10
IPv4 Address. . . . . : 192.168.0.102
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.0.1

Ethernet adapter Bluetooth Network Connection:

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

C:\Users\rohit>ping 192.168.30.133

Pinging 192.168.30.133 with 32 bytes of data:
Reply from 192.168.30.133: bytes=32 time<1ms TTL=64
Reply from 192.168.30.133: bytes=32 time<1ms TTL=64
Reply from 192.168.30.133: bytes=32 time<1ms TTL=64
Reply from 192.168.30.133: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.30.133:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\rohit>
```

## 7. Guest OS

```
cloudcomputing@cloudcomputing: ~
cloudcomputing@cloudcomputing:~$ ifconfig
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.30.133 netmask 255.255.255.0 broadcast 192.168.30.255
    inet6 fe80::d5f8:e599:17c2:b768 prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:9d:63:07 txqueuelen 1000 (Ethernet)
    RX packets 19750 bytes 29496266 (29.4 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 2820 bytes 199568 (199.5 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 180 bytes 15403 (15.4 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 180 bytes 15403 (15.4 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

cloudcomputing@cloudcomputing:~$
```



### EXP: 3

```
cloudcomputing@cloudcomputing: ~  
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 196  bytes 16693 (16.6 KB)  
    RX errors 0  dropped 0  overruns 0  frame 0  
    TX packets 196  bytes 16693 (16.6 KB)  
    TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0  
  
cloudcomputing@cloudcomputing:~$ ping 192.168.0.102  
PING 192.168.0.102 (192.168.0.102) 56(84) bytes of data.  
64 bytes from 192.168.0.102: icmp_seq=1 ttl=128 time=0.592 ms  
64 bytes from 192.168.0.102: icmp_seq=2 ttl=128 time=0.956 ms  
64 bytes from 192.168.0.102: icmp_seq=3 ttl=128 time=1.01 ms  
64 bytes from 192.168.0.102: icmp_seq=4 ttl=128 time=1.07 ms  
64 bytes from 192.168.0.102: icmp_seq=5 ttl=128 time=1.06 ms  
64 bytes from 192.168.0.102: icmp_seq=6 ttl=128 time=0.921 ms  
^C  
--- 192.168.0.102 ping statistics ---  
6 packets transmitted, 6 received, 0% packet loss, time 5021ms  
rtt min/avg/max/mdev = 0.592/0.933/1.065/0.161 ms  
cloudcomputing@cloudcomputing:~$
```