CS 553
CLOUD COMPUTING

HOMEWORK-1

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01/20/2024

1. Question 1

a. Read & Download Oracle VirtualBox White Paper

b. Download VirtualBox 7.0

c. Install VirtualBox 7.0 using UTM

d. Download Ubuntu 22.04 Linux ISO image

e. Create Virtual Machine (VM), to support Linux, Ubuntu, 64-bit, 4GB RAM, Virtual Disk 25GB, VDI image, dynamically allocated, 2-core, and a network interface with a Bridged Adapter in the machine

UTM
Hardware
Memory
4096
MB
CPU
CPU Cores
2
Cancel
Go Back
Continue

UTM
Storage
Size
Specify the size of the drive where data will be stored into.
25
GB
Cancel
Go Back
Continue

f. Install Linux from the ISO image

g. Create a user id and password

h. Turn on Firewall and block all ports

```
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo ufw status
[sudo] password for vijayp:
Status: inactive
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo ufw enable
Firewall is active and enabled on system startup
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo ufw status
Status: active
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo ufw disable
Firewall stopped and disabled on system startup
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo ufw status
Status: inactive
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo ufw default deny incoming
Default incoming policy changed to 'deny'
(be sure to update your rules accordingly)
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo ufw default deny outgoing
Default outgoing policy changed to 'deny'
(be sure to update your rules accordingly)
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo ufw status verbose
Status: inactive
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo ufw enable
Firewall is active and enabled on system startup
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo ufw status verbose
Status: active
Logging: on (low)
Default: deny (incoming), deny (outgoing), disabled (routed)
New profiles: skip
```

i. Enable SSH access to your new Linux installation; open SSH port in firewall

```
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo service ssh start
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo ufw allow 22/tcp
Skipping adding existing rule
Skipping adding existing rule (v6)
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo ufw status verbose
Status: active
Logging: on (low)
Default: deny (incoming), deny (outgoing), disabled (routed)
New profiles: skip

To                         Action      From
--                         ------      ----
22/tcp                     ALLOW IN    Anywhere
22/tcp (v6)                ALLOW IN    Anywhere (v6)
```

```
vijayp@vijayp-QEMU-Virtual-Machine:~$ ssh localhost
The authenticity of host 'localhost (127.0.0.1)' can't be established.
ED25519 key fingerprint is SHA256:M7DrI8bVdmPnhctWphCA8iTUmgcsXr4k0UeiYixqF0U.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'localhost' (ED25519) to the list of known hosts.
vijayp@localhost's password:
Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 6.5.0-14-generic aarch64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro
```

```
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo apt update
Hit:1 http://us.ports.ubuntu.com/ubuntu-ports jammy InRelease
Hit:2 http://us.ports.ubuntu.com/ubuntu-ports jammy-backports InRelease
Get:3 http://us.ports.ubuntu.com/ubuntu-ports jammy-updates InRelease [119 kB]
Get:4 http://ports.ubuntu.com/ubuntu-ports jammy-security InRelease [110 kB]
Get:5 http://ports.ubuntu.com/ubuntu-ports jammy-proposed InRelease [270 kB]
Fetched 499 kB in 2s (223 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
All packages are up to date.
vijayp@vijayp-QEMU-Virtual-Machine:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  ncurses-term openssh-sftp-server ssh-import-id
```

j. Repeat steps 5 through 9, and create another VM with the same specifications as the first one

```
vijayp22@vijayp22-QEMU-Virtual-Machine:~$ sudo service ssh start
vijayp22@vijayp22-QEMU-Virtual-Machine:~$ sudo ufw allow 22/tcp
Skipping adding existing rule
Skipping adding existing rule (v6)
vijayp22@vijayp22-QEMU-Virtual-Machine:~$ sudo ufw status verbose
Status: active
Logging: on (low)
Default: deny (incoming), deny (outgoing), disabled (routed)
New profiles: skip

To                         Action      From
--                         ------      ----
22/tcp                     ALLOW IN    Anywhere
22/tcp (v6)                ALLOW IN    Anywhere (v6)
```

```
vijayp22@vijayp22-QEMU-Virtual-Machine:~$ ssh localhost
The authenticity of host 'localhost (127.0.0.1)' can't be established.
ED25519 key fingerprint is SHA256:SanR09gWW3lt5V3/W4v97V3OaSY60OY2NJ0PHy6cynI.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'localhost' (ED25519) to the list of known hosts.
vijayp22@localhost's password:
Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 6.5.0-14-generic aarch64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status


The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.
```

k. Create private/public keys and install them properly in both of your new VMs

VM-1:

```
vijayp@vijayp-QEMU-Virtual-Machine: ~
vijayp@vijayp-QEMU-Virtual-Machine:~$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/vijayp/.ssh/id_rsa):
/home/vijayp/.ssh/id_rsa already exists.
Overwrite (y/n)? y
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/vijayp/.ssh/id_rsa
Your public key has been saved in /home/vijayp/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:Y2tLwk92t2Qwtz1Mxp6PRpfc+/lYBn3q7MENp0oL/Q4 vijayp@vijayp-QEMU-Virtual-Machine
The key's randomart image is:
+---[RSA 3072]----+
|                 |
|                 |
|                 |
|             . . |
|        S o . B *|
|     . . o = O.@+|
|      o * o E.@.=|
|       B o * O.X.|
|        o   ++O.*|
+----[SHA256]-----+
vijayp@vijayp-QEMU-Virtual-Machine:~$
```

VM-2:

```
vijayp22@vijayp22-QEMU-Virtual-Machine: ~
vijayp22@vijayp22-QEMU-Virtual-Machine:~$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/vijayp22/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/vijayp22/.ssh/id_rsa
Your public key has been saved in /home/vijayp22/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:hb8sRDw96GZLDj8zXZ/+rysJoYzFRsAmWijLhsdV0xE vijayp22@vijayp22-QEMU-Virtua
l-Machine
The key's randomart image is:
+---[RSA 3072]----+
|   . o+oEo       |
|. . + ooo+       |
|o+ + o o* +      |
|oo+    o++..     |
|..    .=S....    |
|      .Oo+.o . . |
|        O +. .o  |
|          =  o.  |
|             .+++|
+----[SHA256]-----+
```

l. Test that you can connect remotely to your VMs with your keys, from one VM to the other VM

VM-1:

```
vijayp@vijayp-QEMU-Virtual-Machine: ~
vijayp22@vijayp22-QEMU-Virtual-Machine:~$ ssh vijayp@192.168.64.3
vijayp@192.168.64.3's password:
Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 6.5.0-14-generic aarch64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

Last login: Tue Jan 16 22:02:50 2024 from 127.0.0.1
vijayp@vijayp-QEMU-Virtual-Machine:~$
```

VM-2:

```
vijayp22@vijayp22-QEMU-Virtual-Machine: ~
vijayp@vijayp-QEMU-Virtual-Machine:~$ ssh vijayp22@192.168.64.4
vijayp22@192.168.64.4's password:
Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 6.5.0-14-generic aarch64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

Failed to connect to https://changelogs.ubuntu.com/meta-release-lts. Check your
Internet connection or proxy settings

Last login: Thu Jan 18 19:22:47 2024 from 192.168.64.3
vijayp22@vijayp22-QEMU-Virtual-Machine:~$
```