Practice 19-a

Preparing the Environment for Oracle 19c RAC

Practice Overview

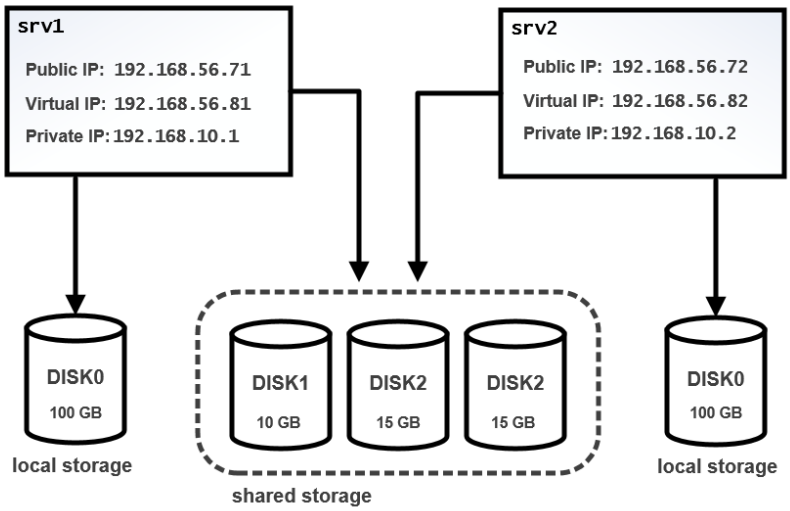
In this practice you will create two virtual appliances that will be used to create an Oracle 19c RAC database on Linux 7.

In high level, you will perform the following steps:

- Download Oracle Software installation files
- Install Oracle VirtualBox release 6.0.22 or later
- Create and configure an Oracle Linux 7.8 64-bit VirtualBox appliance (srv1)
- Build up and configure the second node (srv2) by cloning srv1
- Create and configure the shared disks

Practice Environment Architecture

The following diagram shows the architecture of the machines that you will create in this practice:



Practice Environment Preparation Procedure

A. Downloading Oracle Software Installation files

1. From Oracle site, download the following products:

- Oracle Database 19c (19.3) for Linux x86-64.
- Oracle Grid Infrastructure 19c (19.3) for Linux x86-64

  At the time of this writing, these products can be downloaded from the following link: https://www.oracle.com/database/technologies/oracle19c-linux-downloads.html

Note: do not download the rpm file. Download the zip files.

B. Installing the required software

2. Download and install the following software products in your hosting PC:

- Oracle VirtualBox version 6 for Windows (6.0.22 or later)

C. Creating and Configuring an Oracle Linux 7.8 64-bit VirtualBox Appliance

3. Create a Linux-based VirtualBox appliance with the specifications as shown in the table below. This is an Oracle VirtualBox appliance which has a fresh installation of Oracle Linux 7.8 installed on it.

- You can download a pre-built one from here. Make sure you download the file in the section titled as "**Oracle Linux 7.8 64-bit (Fresh Installation)**"

- Alternatively, you can create one from scratch. The procedure to create an VM machine with Linux 7.x is explained in many articles in the Internet. Just Google it!

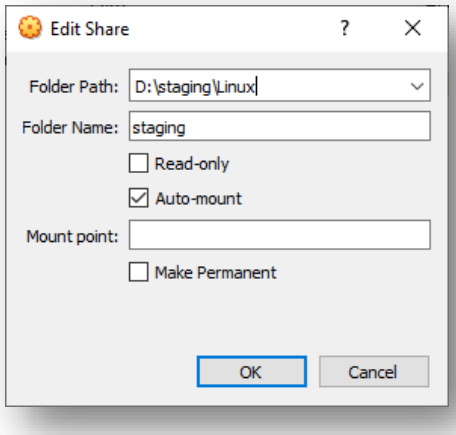
Item	Value
Hostname	srv1
Memory	**8 GB** **Note**: This is the minimum recommended value from Oracle
OS	Oracle Linux **7.8** 64-bit
Storage	100 GB (dynamic) **Note**: this is a local storage. You will create the shared storage later in the practice.

4. Make sure the virtual appliance is opened by Oracle VirtualBox Manager and is turned off.

5. Go to the appliance settings and change its name to `srv1` and enter a description about it in the description field.

6. Click on "**Shared Folders**" link in the right-hand pane. Add shared folder by pressing "**plus**" icon. Then select path to the location of the oracle software installation folder, and mark the checkbox "**Auto-mount**". You can change the "**Folder Name**", if you want to.

This folder will be used to easily exchange files between the hosting PC and Linux in the VM machine. In the rest of this tutorial document, this folder will be referred to as the **staging folder**.

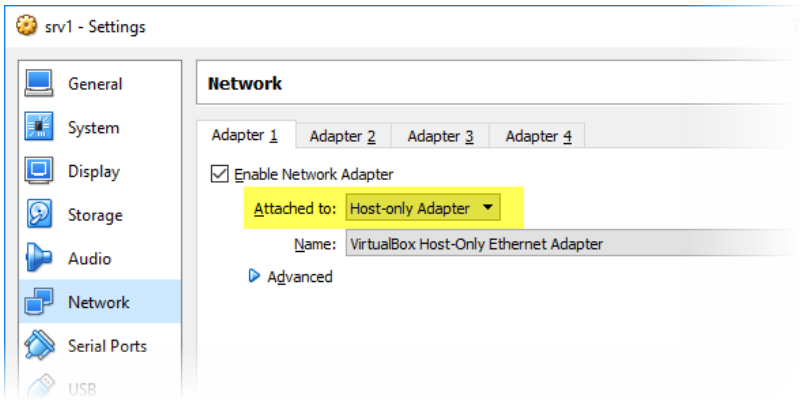


7. Add network adapters to `srv1` by performing the following steps:

- Eventually, you will have three network adapters created in `srv1`:
  - The first one will be used for public connection (Adapter type: Host-only)
  - The second one will be used for private connection (Adapter type: Internal Network)
  - Third one will be used for the Internet connection (Adapter type: Bridged Adapter)

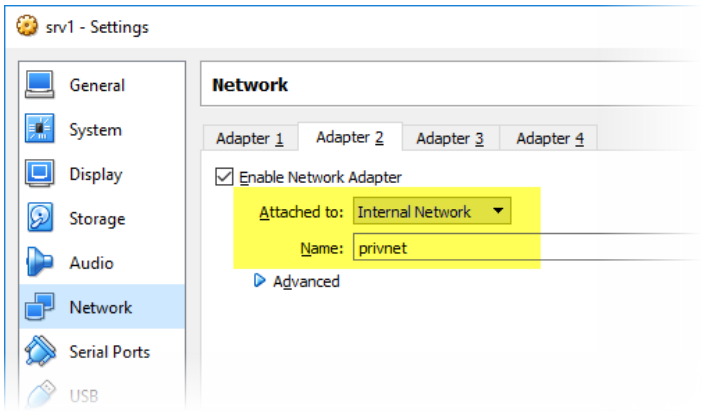
a. In Oracle VirtualBox, go to the network settings of your virtual appliance. Change the value of the "**Attached To**" field to "**Host-only Adapter**".

"Host-only" connection in VirtualBox allows connecting the VM machine to other VM machines as well as to the hosting PC. This adapter represents the public network.

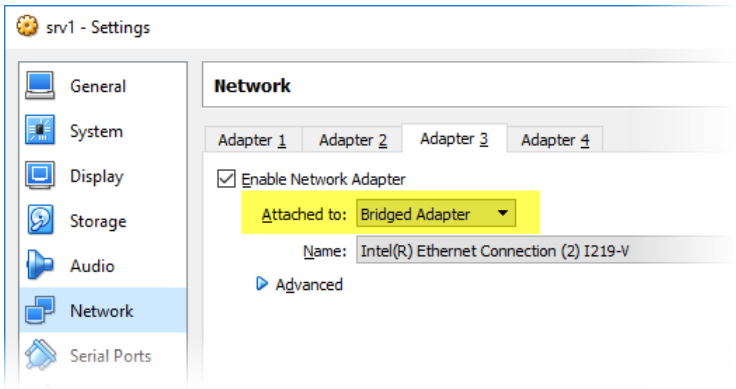


b. Click on the "**Adapter 2**" tab and enable it and set it attached to "**Internal Network**". Name this network "**privnet**".

In VirtualBox, the "Internal Network" configuration allows the VM machine to connect only to other VM machines. This adapter will be used for private connection in the RAC architecture.



c. Click on the "**Adapter 3**", enable it, and attach to "**Bridged Adapter**". This adapter will be used for connecting to the internet.



8. Start `srv1` and login to it as `root`

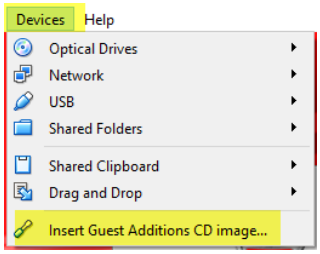
Note: If you are using the pre-built virtual machine from my web site, the readme file contains the root password. Readme file is available in my website download page.

9. If you are using a pre-built copy of the virtual machine (like the one available in my web site), make sure the Guest Additions version is upgraded to the version of the VirtualBox you are using.

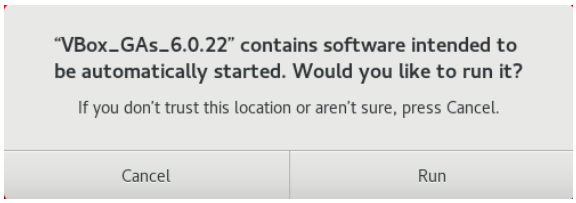
The pre-built virtual machine that is available in my site was created using version 6.0.22. If you are using a later version of Oracle VirtualBox, you should update its VirtualBox Guest Additions.

To Update the VirtualBox Guest Additions in the virtual machine, perform the following steps:

a. In the VirtualBox window, login as root and click on **Devices** menu | **Insert Guest Additions CD image**.



b. When the following window pops up, click on **Run** button



c. Wait for the installation to finish.

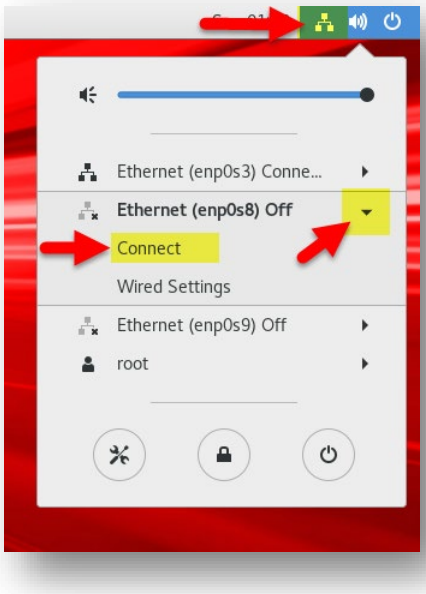
d. Reboot the machine and login to it as `root`.

e. Right click on the VirtualBox Additions CD icon and select **Eject** option.

10. If you have a firewall software installed into your hosting PC, configure it to allow the traffic to go to and come from Oracle VirtualBox appliance.

The NICs (network interface adapters) added to srv1 are not connected by default when you startup the system. In the following steps, you will connect the added NICs.

11. Click on the network icon in the upper right corner of the screen and connect the added two NICS (`enp0s8` and `enp0s9`).

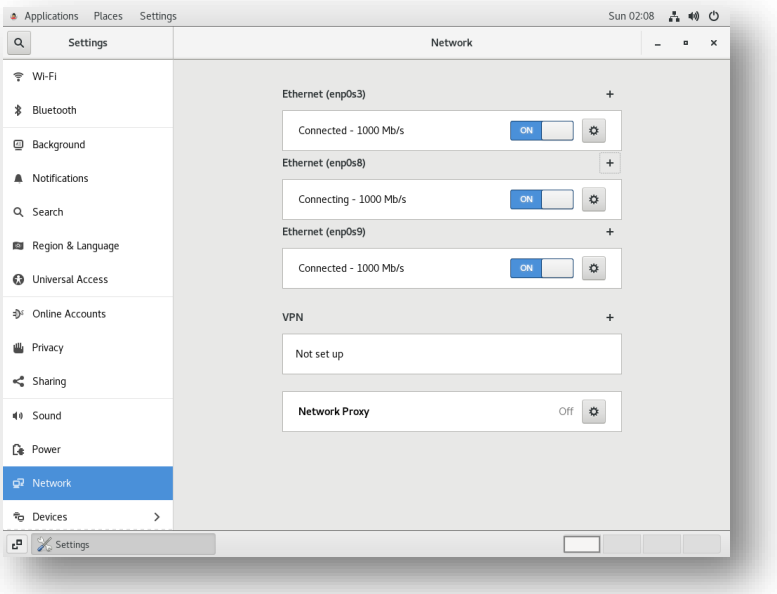


12. Perform the following steps to set the network adapter IP addresses:

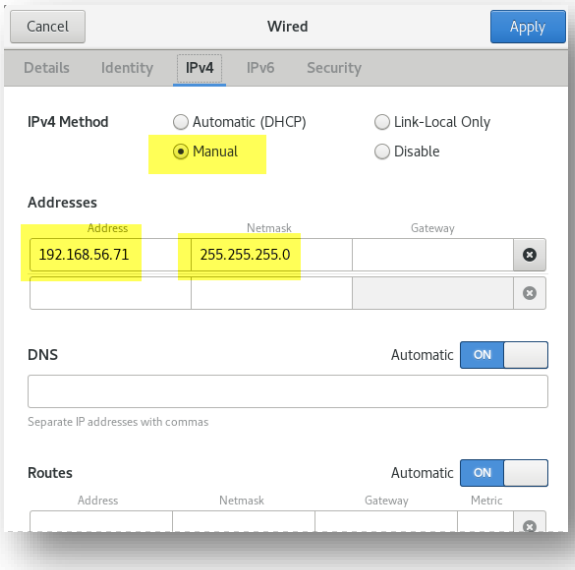
a. In the VirtualBox appliance window, open the Network Connections window

Applications | **System Tools** | **Settings** | **Network**

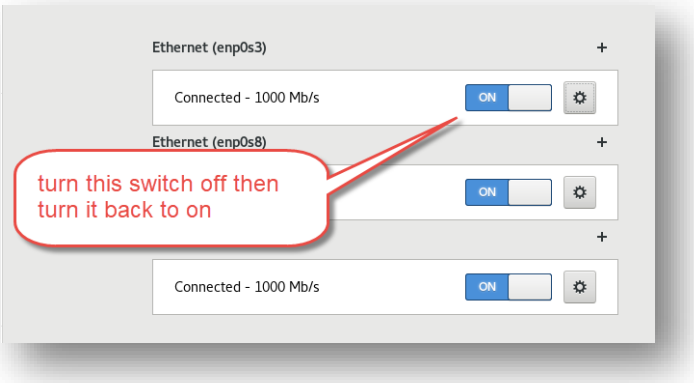
b. You should see the three adapters as shown in the following screenshot:



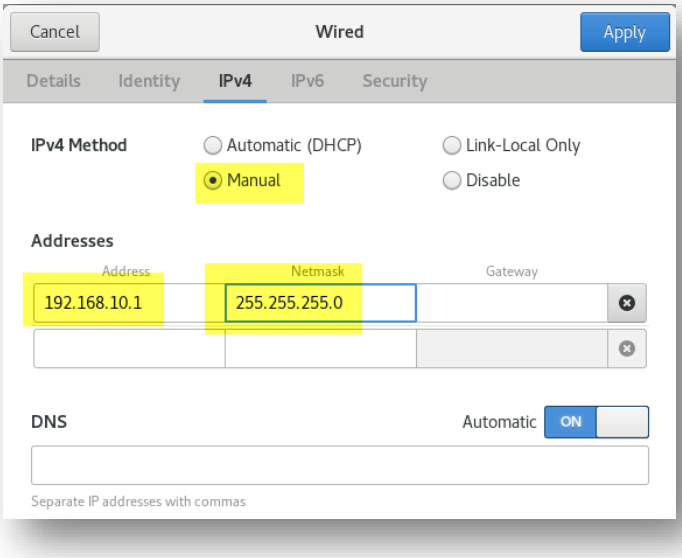
c. Click on the settings icon  of the **first** NIC (enp0s3). Click on **IPv4** tab and fill it in as follows, then click on **Apply** button:



d. To make the new IP address take effect, turn off the adapter then then turn it on again, as shown in the following screenshot:



e. Click on the settings icon  of the **second** NIC (enp0s8). Click on **IPv4** tab and fill it in as follows, then click on **Apply** button:



f. Turn off the second adapter then then turn it on again

g. Click on the settings icon  of the **third** NIC (enp0s9). Make sure the checkbox "**Connect automatically**" is marked. Click on **IPv4** tab make sure the **IPv4 Method** is set to **DHCP**.

h. Close the **Network** window.

13. Open a terminal window then modify the `hosts` file as follow:

In real life scenario, the SCAN addresses should not be defined in the `hosts` file. They should be defined on the DNS server to round-robin 3 addresses of the same subnet as the subnet of your public network. The same condition applies for the public IP address, hostname, and the VIP addresses. In this practice, the `hosts` file is used as a replacement to the DNS server.

```
vi /etc/hosts
```

```
127.0.0.1   localhost.localdomain localhost
# Public
192.168.56.71   srv1.localdomain        srv1
192.168.56.72   srv2.localdomain        srv2

# Private
192.168.10.1    srv1-priv.localdomain   srv1-priv
192.168.10.2    srv2-priv.localdomain   srv2-priv

# Virtual
192.168.56.81   srv1-vip.localdomain    srv1-vip
192.168.56.82   srv2-vip.localdomain    srv2-vip

# SCAN (in production this should be configured in DNS)
192.168.56.91   srv-scan.localdomain    srv-scan
192.168.56.92   srv-scan.localdomain    srv-scan
192.168.56.93   srv-scan.localdomain    srv-scan
```

14. Reboot the virtual machine.

15. Login to `srv1` as `root`, open a terminal window and, and to make sure that the VM machine is connected to the Internet by pinging google.com

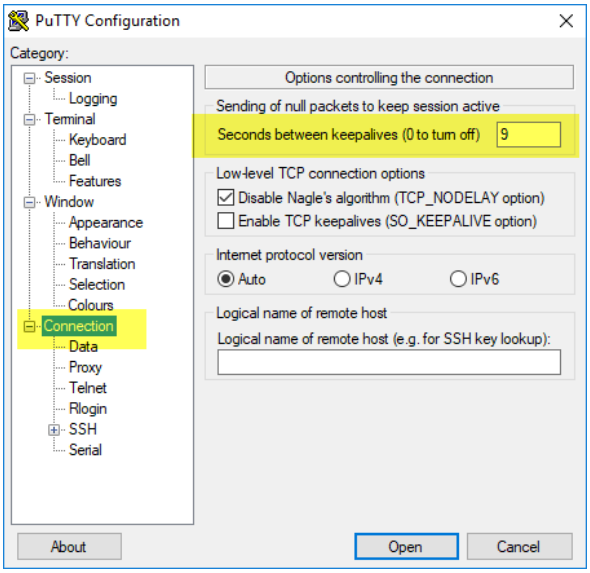
```
ping -c 3 google.com
```

16. In the hosting PC, open a command prompt window and ping the `srv1` public IP address.

Note: VIP and SCAN addresses are not pingable at this stage. They will be activated after installing Oracle Grid Infrastructure software.

```
ping 192.168.56.71
```

17. Configure `srv1` in PuTTY. I recommend setting the "keepalives" option to 9 seconds, as shown in the following screenshot:



18. Open a Putty session to `srv1` and login as `root` user.

19. In the following steps, you will create Oracle software owner users and groups.

a. Create the Oracle Grid Infrastructure home owner user (`grid`). Oracle database owner is already there (`oracle`).

```
groupadd asmadmin
groupadd asmdba
groupadd oinstall

useradd -u 54323 -g oinstall -G asmadmin,asmdba grid
```

b. Reset the `oracle` and `grid` user passwords. The practice documents assume that the passwords are set to "oracle".

```
passwd oracle
passwd grid
```

c. Add `oracle` user to the `asmdba` group

```
usermod -a -G asmdba oracle
usermod -g oinstall oracle
```

d. Add `oracle` and `grid` accounts to `vboxsf` group.

The `vboxsf` group was created by VirtualBox Guest Additions and it allows its members to access the shared folders in the hosting PC.

```
usermod -a -G vboxsf oracle
usermod -a -G vboxsf grid
```

20. Run the following command to install the libraries that are required for Oracle software installation.

Note: The command sets the kernel parameter variables as well.

```
yum install oracle-database-preinstall-19c
```

21. Run the following command to make the changes made on the kernel parameters take effect.

```
sysctl -p
```

22. Install and configure the ASM required packages by performing the following steps as `root`:

a. Install Oracle ASMLib packages

```
yum install oracleasm-support
yum install kmod-oracleasm
```

b. Configure and load the ASM kernel module (respond to the questions as highlighted in red)

```
oracleasm configure -i

Configuring the Oracle ASM library driver.
This will configure the on-boot properties of the Oracle ASM library
driver. The following questions will determine whether the driver is
loaded on boot and what permissions it will have. The current values
will be shown in brackets ('[]'). Hitting <ENTER> without typing an
answer will keep that current value. Ctrl-C will abort.
Default user to own the driver interface []: grid
Default group to own the driver interface []: oinstall
Start Oracle ASM library driver on boot (y/n) [n]: y
Scan for Oracle ASM disks on boot (y/n) [y]: y
Writing Oracle ASM library driver configuration: done
```

c. Load the `oracleasm` kernel module:

```
/usr/sbin/oracleasm init


Creating /dev/oracleasm mount point: /dev/oracleasm
Loading module "oracleasm": oracleasm
Configuring "oracleasm" to use device physical block size
Mounting ASMlib driver filesystem: /dev/oracleasm
```

23. Create the directory in which the Oracle software will be installed.

```
mkdir -p /u01/app/oracle/product
chown -R oracle:oinstall /u01
chmod -R 775 /u01

mkdir -p /u01/app/grid
mkdir -p /u01/app/19.0.0/grid
chown -R grid:oinstall /u01/app/grid
chown -R grid:oinstall /u01/app/19.0.0/grid
chmod -R 775 /u01
```

D. Building up and Configuring srv2 by Cloning srv1

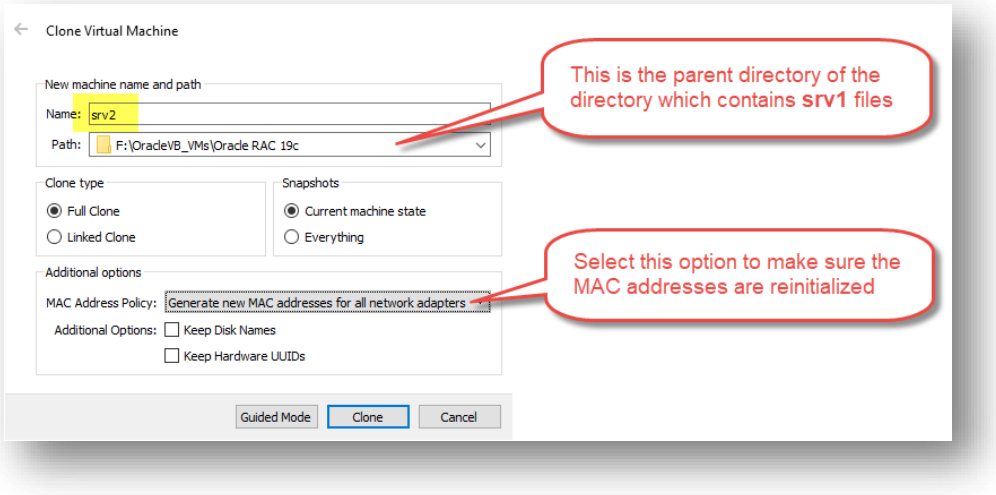
In the following steps, you will clone `srv1` and make changes on the cloned machine to convert it to `srv2`.

24. Shutdown `srv1`

25. Make a clone of the virtual appliance `srv1`. Give the new machine the name `srv2`. When you clone the machine, make sure to **initialize the network cards.**

a. In Oracle VirtualBox Manager, **Right-click** on the srv1, select **Clone** command.

b. Fill-in the displayed window as follows.



c. Click on **Clone** button.

The directories that contain `srv1` and `srv2` both of them should be under the provided parent directory.

26. Activate the network cards.

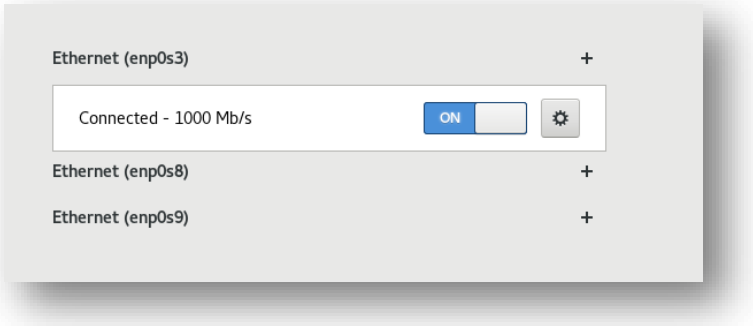
While cloning srv2, the MAC address of its network cards got re-initialized. As a result, they got de-activated. To re-activate the cards, perform the following:

a. Login to `srv2` as `root`

b. In the VirtualBox appliance window, open the Network Connections window

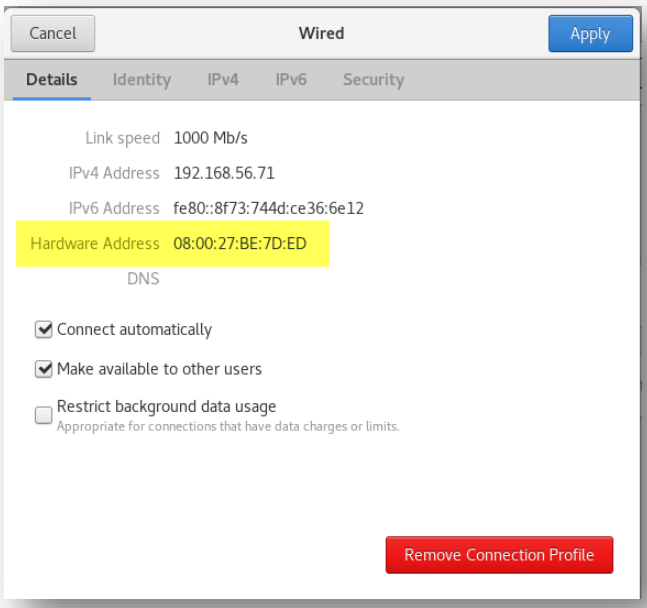
Applications | **System Tools** | **Settings** | **Network**

c. The network adapters should look like the following. Only one adapter is enabled and the other two are offline.

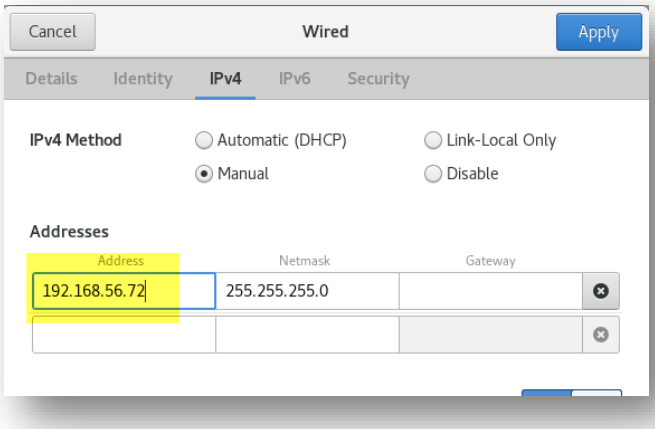


d. Open the settings of the **first** adapter. Check its MAC address. Make sure it is the same as the MAC address that you took note of.

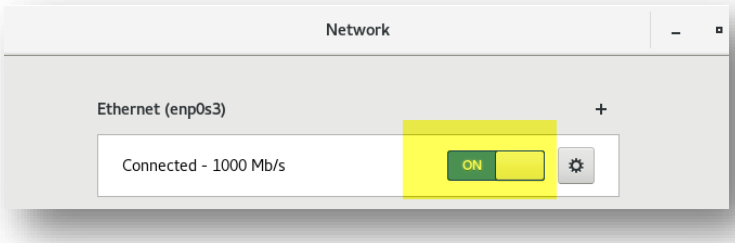
If it is not the same as the new MAC address, click on **Identify** tab and select the correct MAC address from the dropdown list.



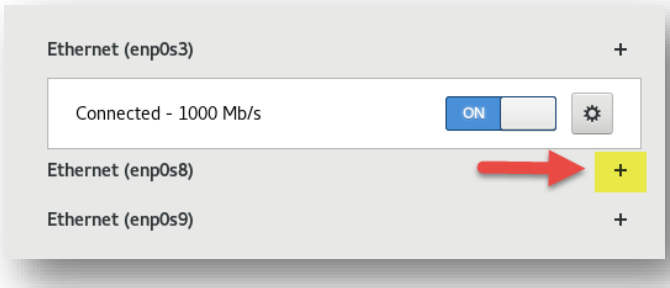
e. Click on IPv4 tab and change the IP address as follows, then click on **Apply** button:



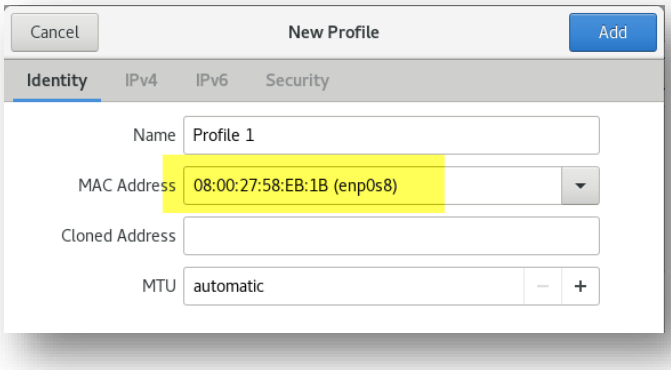
f. Turn the adapter off then turn it on again so that the changes take effect.



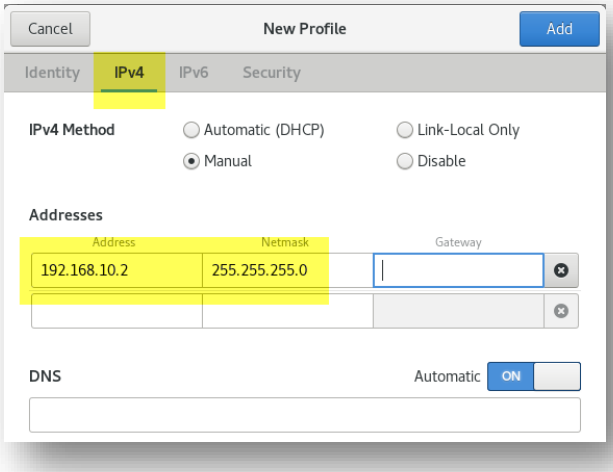
g. Click on the plus symbol beside the **second** adapter



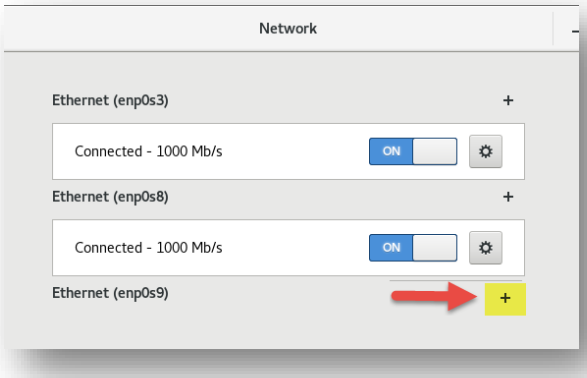
h. You should see a window like the following. Select the correct MAC address from the drop list for this adapter.



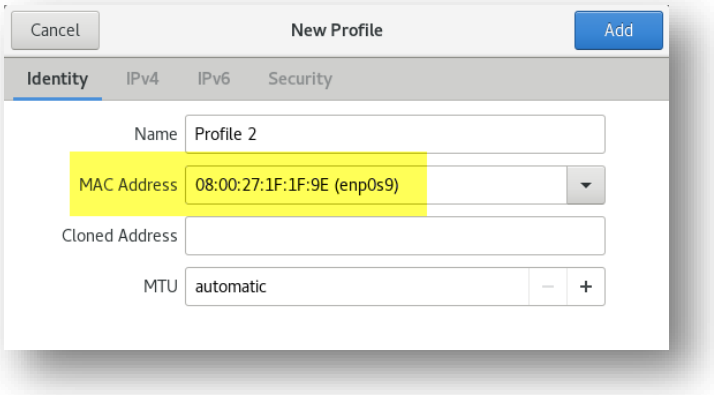
i. Click on IPv4 tab then fill in the IP address as follows, then click on **Add** button:



j. Click on the plus symbol beside the **third** adapter:



k. Select the correct MAC address from the drop list for this adapter, then click on **Add** button:



27. To list the network adapters installed in the system and their status, run the following command:

Note: virbr0 is a virtual network card used by xen virtualization. You can just ignore it.

```
nmcli device status
```

28. Run the following command to change the hostname of the appliance to `srv2`

```
hostnamectl set-hostname srv2.localdomain

# to verify:
hostnamectl status
```

29. Start `srv1`

30. Login to every machine as `root` and make sure that they can ping each other.

The ping command in Linux by default keeps displaying its reply output. To stop it, you can press the [Ctl]+[c] key combination. If you are using the command in a terminal window in a VirtualBox window, the right [Ctl]+[c] shortcut will be recognized by Oracle VirtualBox as a shortcut to switch the Scale mode. If you want to stop the output of the ping command, use the **Left [Ctl]+[c]** shortcut instead.

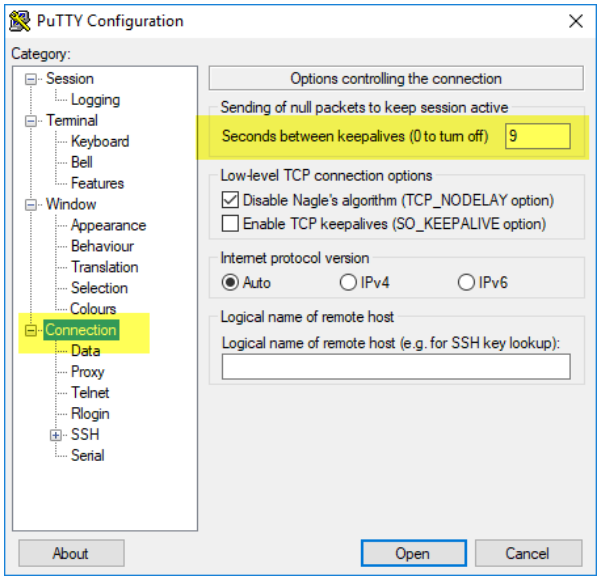
```
ping -c 3 srv1
ping -c 3 srv1.localdomain
ping -c 3 srv1-priv
ping -c 3 srv1-priv.localdomain

ping -c 3 srv2
ping -c 3 srv2.localdomain
ping -c 3 srv2-priv
ping -c 3 srv2-priv.localdomain
```

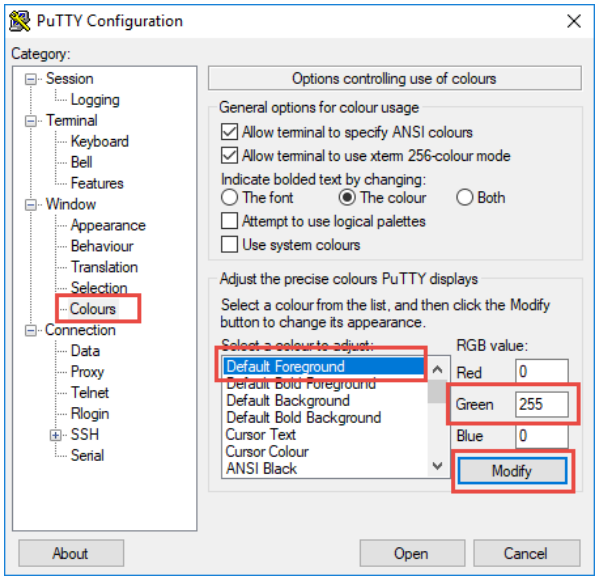
31. Open Putty and save a connection configuration of `srv2` in it as follows:

a. Save the configuration of `srv2` in Putty. You can use the `srv2` public IP address to save its connection configuration in Putty.

b. Set the "**Keepalives**" value to 9 seconds.



c. Change the font text color of `srv2` connection to the light green. This is to make it easy for you to distinguish between windows connected to `srv1` and `srv2`.



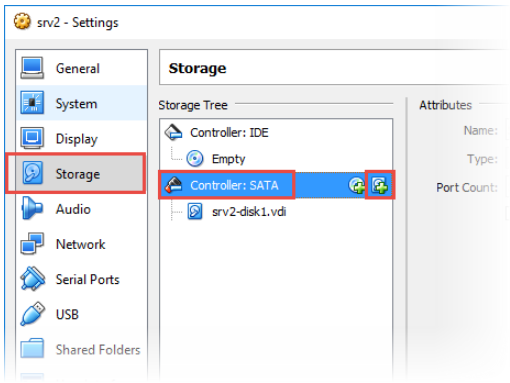
d. Save the configuration.

E. Create and configure the Shared Disks

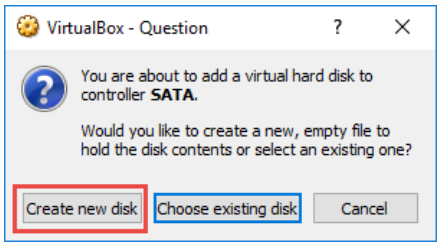
In this section of the practice, you will create three disks which will be shared by `srv1` and `srv2`. Those disks will later be configured to be used by the ASM.

32. Shut down both virtual machines `srv1` and `srv2`.

33. In Oracle VirtualBox, select `srv1` VM, then click on "**Settings**" | "**Storage**" link | "**SATA Controller**" icon | "**Add Hard Disk**" button.

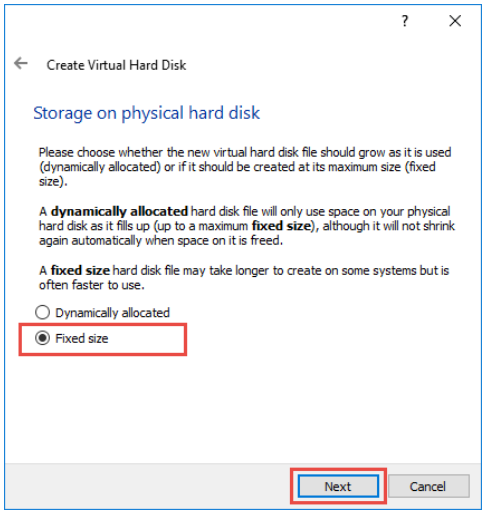


34. In the pop-up window, click on "**Create new disk**" button:



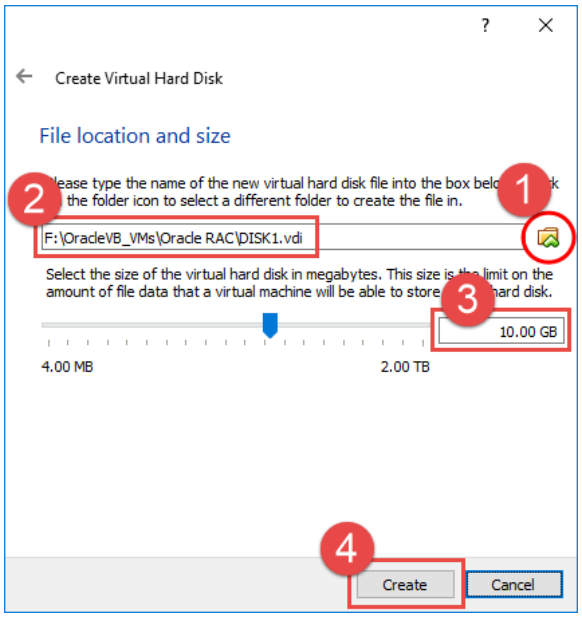
35. In the "Hard disk file type" window, select "**VDI (VirtualBox Disk Image)**" then click on **Next**:

36. In the "**Storage on physical hard disk**" window, select "**Fixed size**" then click on **Next**:



37. In the "**File location and size**" window, click on the "**select folder**" icon (marked with step number 1 on the screenshot below), select the **parent folder** of the current virtual machine. Change the **disk name** to **DISK1.vdi**, set its size to **10 GB**, then click on "**Create**" button.

In the screenshot example below, instead of saving the disk in "F:\OracleVB_VMs\Oracle RAC\srv1", it is saved in the folder "F:\OracleVB_VMs\Oracle RAC".



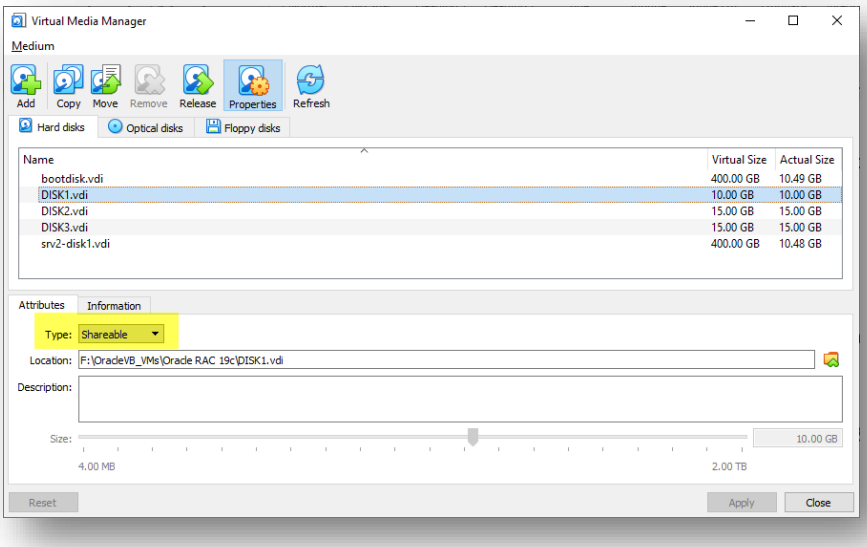
38. Repeat the steps above to create an additional two disks named "**DISK2**" and "**DISK3**", set the size of each to **15 GB**, and save them in the same parent folder where you created DISK1.

39. Click on **OK** button and close the storage settings.

40. You should end up with three shared disks, as follows:

Disk	Size	Used for which ASM Disk Group?
DISK1	10 GB	OCR
DISK2	15 GB	DATA
DISK3	15 GB	FRA

41. Change the type of the shared disks to "Shareable". Click on **File** menu | **Virtual Media Manager** (Ctrl+D) | select **DISK1** | change its type to **Shareable** option | click on **Apply** button



Note: You **must** click on **Apply** button after changing the type of **each** disk. Otherwise, the change will not take effect.

42. Change the type of the other two disks (**DISK2** and **DISK3**) to "Shareable".

43. Close the Virtual Media Manager window.

44. Attach the shared disks to the other VM using (`srv2`). In Oracle VirtualBox, select `srv2` machine, click on "**Storage**" page | click on the **SATA controller** | click on "**Add hardisk**" icon | click on "**Choose existing disk**" button | select the shared disk file

45. Start `srv1`

46. In a Putty command prompt, login as `root` to `srv1`

47. List the disks as seen by `srv1`. You should see the shareable disks that have been added to the machine (sdb, sdc, and sdd).

```
ls /dev/sd*
```

48. Use the `fdisk` utility to create partitions in the new disks `/dev/sdb` , `/dev/sdc` and `/dev/sdd`

The sequence of your answers should be "**n**", "**p**", "**1**", "**Return**", "**Return**" and "**w**".

Following is an example:

```
[root@srv1 ~]# fdisk /dev/sdb
Device contains neither a valid DOS partition table, nor Sun, SGI or OSF
disklabel
Building a new DOS disklabel with disk identifier 0xe3033fca.
Changes will remain in memory only, until you decide to write them.
After that, of course, the previous content won't be recoverable.

Warning: invalid flag 0x0000 of partition table 4 will be corrected by w(rite)

WARNING: DOS-compatible mode is deprecated. It's strongly recommended to
         switch off the mode (command 'c') and change display units to
         sectors (command 'u').

Command (m for help): n
Command action
   e   extended
   p   primary partition (1-4)
p
Partition number (1-4): 1
First cylinder (1-1305, default 1): [ENTER] pressed
Using default value 1
Last cylinder, +cylinders or +size{K,M,G} (1-1305, default 1305): [ENTER]
pressed
Using default value 1305

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.
```

49. List the partitions that have been created.

```
ls /dev/sd*
```

50. Create the ASM disks

```
oracleasm createdisk DISK1 /dev/sdb1
oracleasm createdisk DISK2 /dev/sdc1
oracleasm createdisk DISK3 /dev/sdd1
```

51. Run the oracleasm command `scandisks` to refresh the ASMLib disk configuration.

```
oracleasm scandisks
```

52. Verify that the disks are visible to ASM

```
oracleasm listdisks
```

53. Start `srv2` and verify that the same disks are visible to ASM.

```
oracleasm listdisks
```

Summary

In this practice you have created two virtual machines and configured three shared storage disks connected to each machine.

You now have an environment ready to install Oracle Grid Infrastructure 19c software, Oracle Database 19c software, and create an Oracle RAC database.