

Tutorial:**Installing and Creating an Oracle Database 19c on Linux 7 with ASM****By Ahmed Baraka****Tutorial Overview**

In this tutorial, we will demonstrated the procedure to create an Oracle database 19c on Linux 7 with ASM.

In high level, you will perform the following:

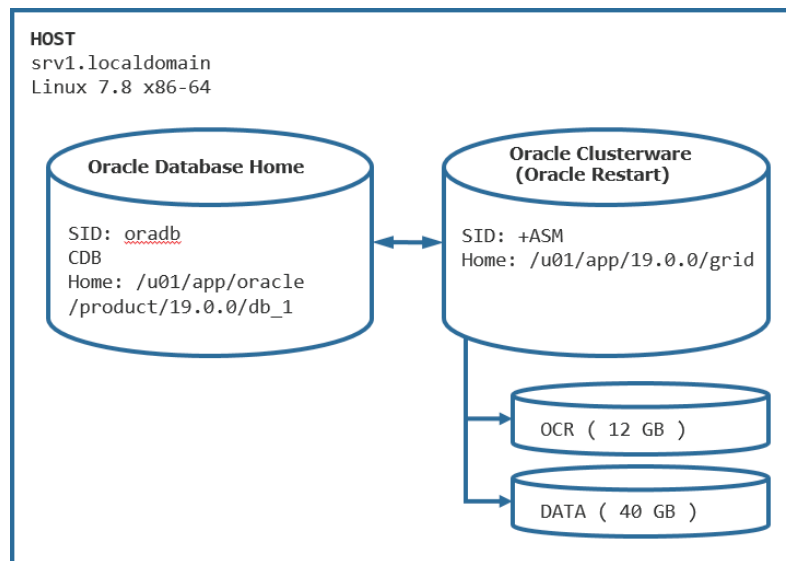
- Change the Settings of the Appliance srv1
- Create Virtual Hardisks (to be used by ASM)
- Make the machine IP address static
- Configure Putty to connect to srv1
- Set up the environment variables for the OS Accounts: grid and oracle
- Install ASM Packages and Create ASM disk volumes
- Change the kernel parameter values to the recommended values
- Install more packages
- Install Oracle Grid Infrastructure Software (Oracle Restart)
- Create ASM Disk Groups
- Install Oracle database software and create the sample database

Required Resources

- A PC with a **free 8GB** in its memory. This means the RAM memory in your PC should be **at least 12GB**.
- At least 50GB free disk space.
- The PC is connected to the Internet

Installation Architecture

The tutorial builds a system the same as the following architecture diagram:



Required Software and Packages

To implement this tutorial, you must have the following:

- **Oracle VirtualBox**, version 6. This tutorial was implemented on VirtualBox 6.0.22 for Windows. It can be obtained from the following [link](#).
- **Oracle Virtualbox appliance** with a fresh installation of Oracle Linux 7.x. You can download a pre-built one with Oracle Linux 7.8 from [here](#). 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!
- **Oracle Grid Infrastructure 19c** installation files for Linux x86-64. This can be downloaded from Oracle site. Search the Internet for "oracle grid infrastructure 19c download". At the time of this writing, its link is [here](#). This tutorial was implemented using Oracle Grid Infrastructure 19c (version 19.3).
Note: download the zip file, not the rpm file.
- **Oracle Database 19c** installation files for Linux x86-64. This can be downloaded from Oracle site. Search the Internet for "Oracle Database 19c installation files for Linux x86-64". At the time of this writing, its link is [here](#). This tutorial was implemented using Oracle Database 19c (version 19.3) for Linux x86-64.
Note: download the zip file, not the rpm file.
- **Putty**: which is a utility that provides a command line prompt to connect to a Linux server from Windows.

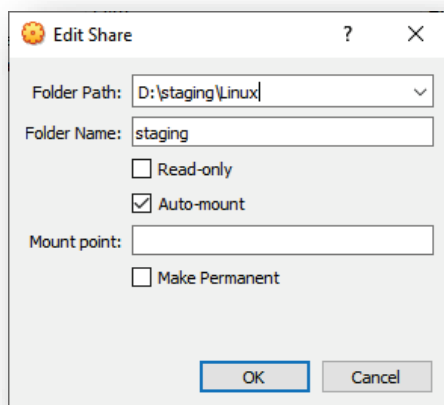
Tutorial Steps

A. Changing the Settings of the Appliance `srv1`

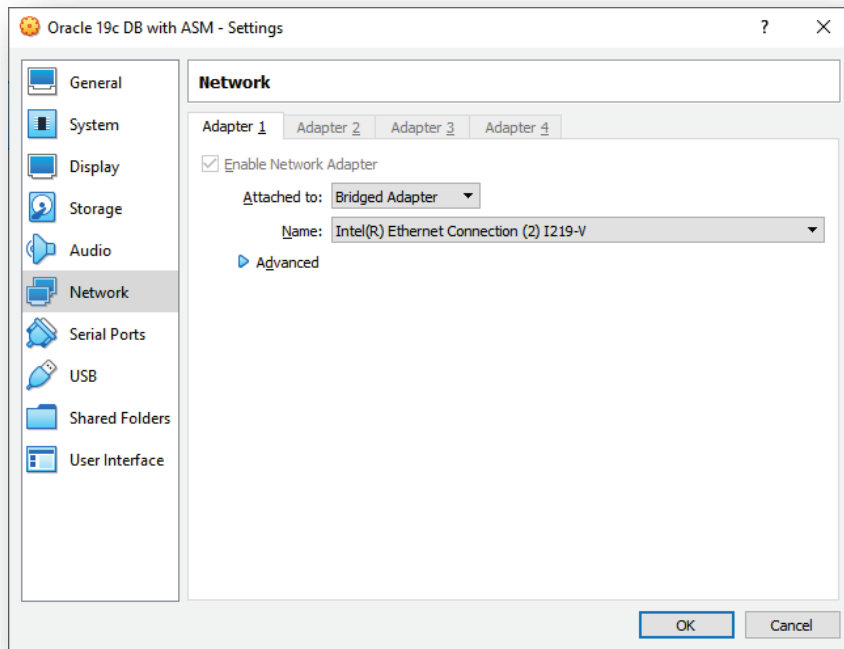
In the following steps, you will prepare the appliance `srv1` for the tutorial. The tutorial steps assume that you have the appliance opened in the VirtualBox window.

1. In VirtualBox Manager, open the "**Settings**" of `srv1`, 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**.



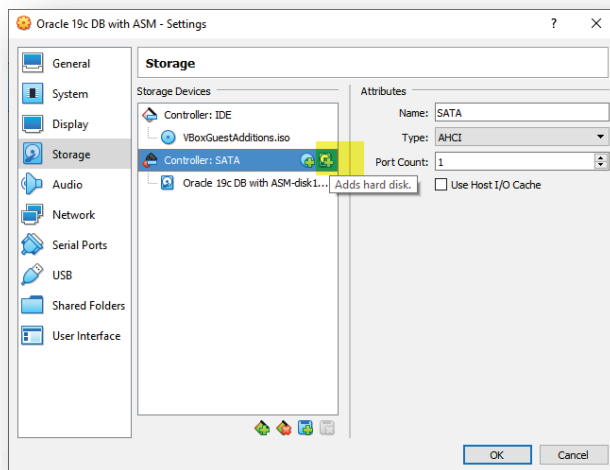
2. Make sure the Network adapter type **Bridged Adapter** and its name is the same as the network card of your PC. This makes your VM appliance appears in your network as a separate host and will be assigned an IP address based on your network configuration.



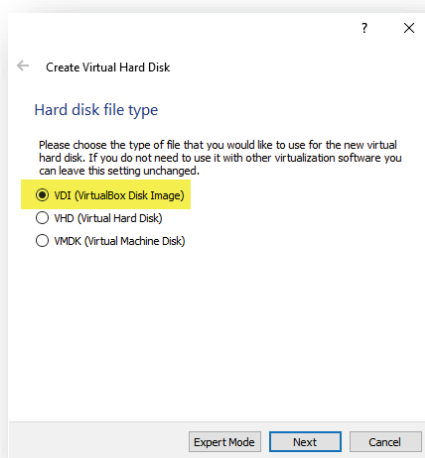
B. Creating Virtual Harddisks for ASM

In OracleVirtualBox manager window, perform the following steps on `srv1` to create two ASM disks: OCRDISK1 (12 GB) and DATADISK1 (40GB)

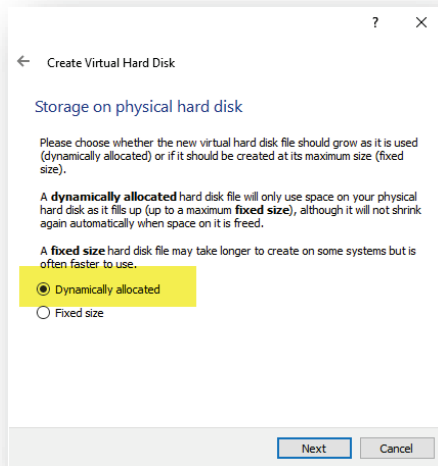
3. In the Oracle VirtualBox manager window, perform the following steps:
 - a. Open the **settings** of `srv1`
 - b. Click on **Storage** then Ad "**hard disk**" button



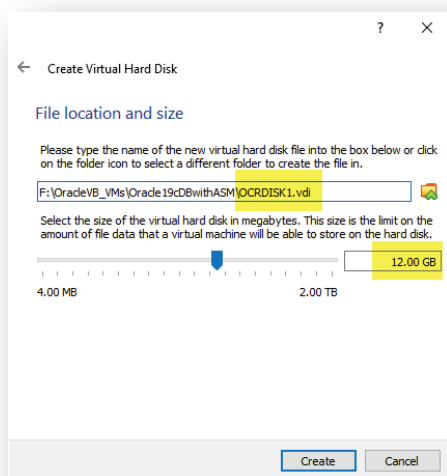
- c. Select VDI option



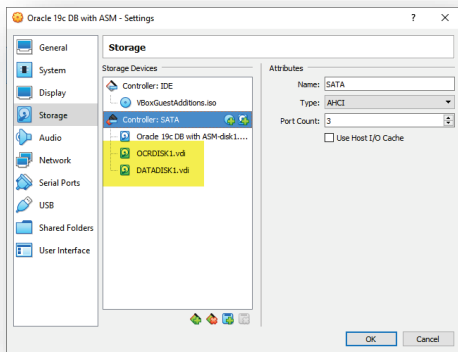
d. Select Dynamically allocated



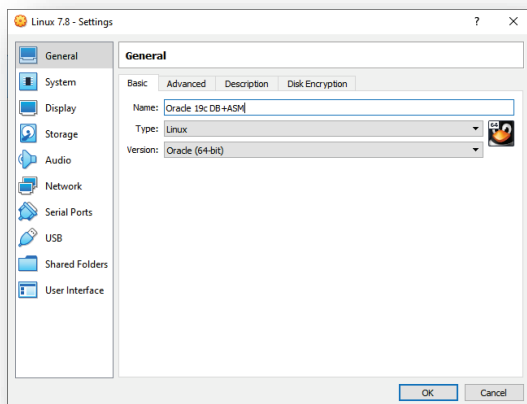
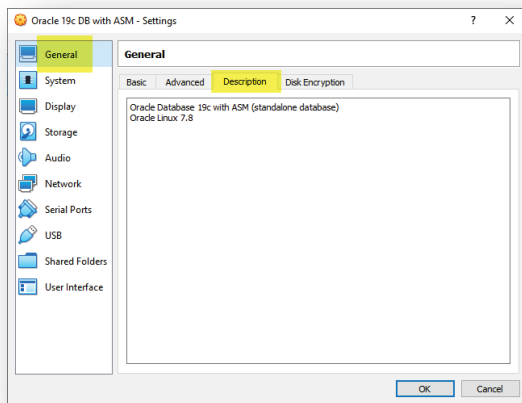
e. Set the OCR disk file name and its size.



- f. Perform the same steps again to create the DATA disk, of size 40 GB. You should end up with having two disks as follows:



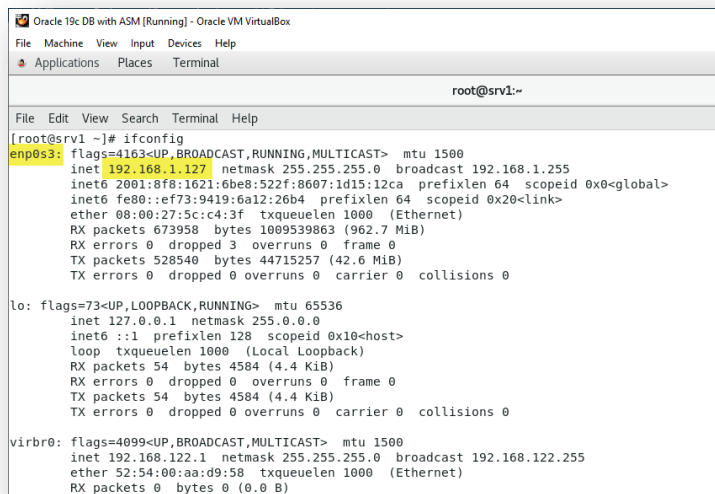
- g. Optionally, set a description for the appliance and change its name to "Oracle 19c DB+ASM"



C. Making the IP Address Static

In the following steps, you will make the IP address assigned to `srv1` static. We need to make this step because we want to make sure that the machine will always have the same IP address when it is rebooted.

4. Start `srv1`
5. Login to the VirtualBox window of `srv1` as `root`
6. Open a terminal window, issue `ifconfig` command, and obtain the current IP address assigned to the machine. It is the IP address assigned to the NIC `enp0s3`

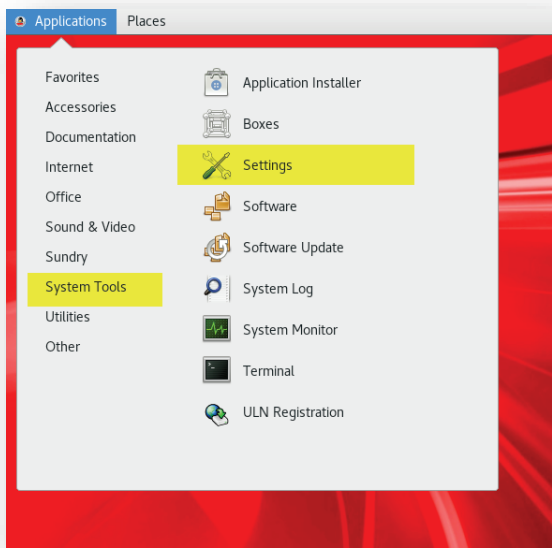


```
Oracle 19c DB with ASM [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Applications Places Terminal
root@srv1:~
File Edit View Search Terminal Help
[root@srv1 ~]# ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.127 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 2001:8f8:1621:6be8:522f:8607:1d15:12ca prefixlen 64 scopeid 0x0<global>
    inet6 fe80::ef73:9419:6a12:26b4 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:5c:c4:3f txqueuelen 1000 (Ethernet)
    RX packets 673958 bytes 1009539863 (962.7 MiB)
    RX errors 0 dropped 3 overruns 0 frame 0
    TX packets 528540 bytes 44715257 (42.6 MiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

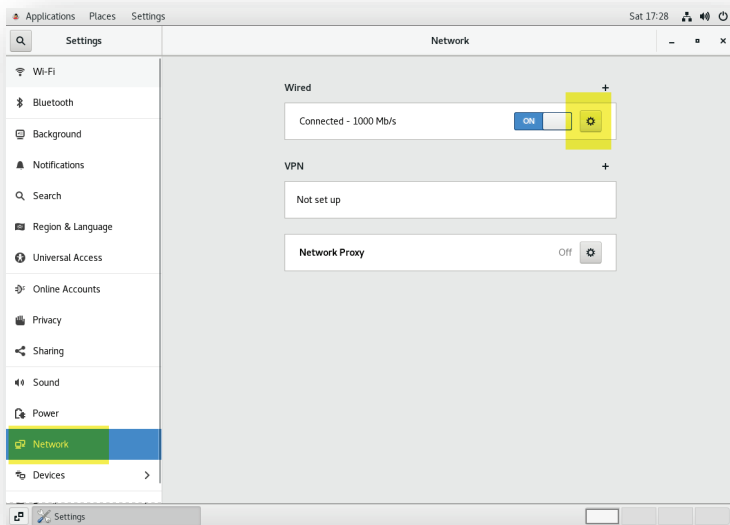
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 54 bytes 4584 (4.4 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 54 bytes 4584 (4.4 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

virbr0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    inet 192.168.122.1 netmask 255.255.255.0 broadcast 192.168.122.255
    ether 52:54:00:aa:d9:58 txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
```

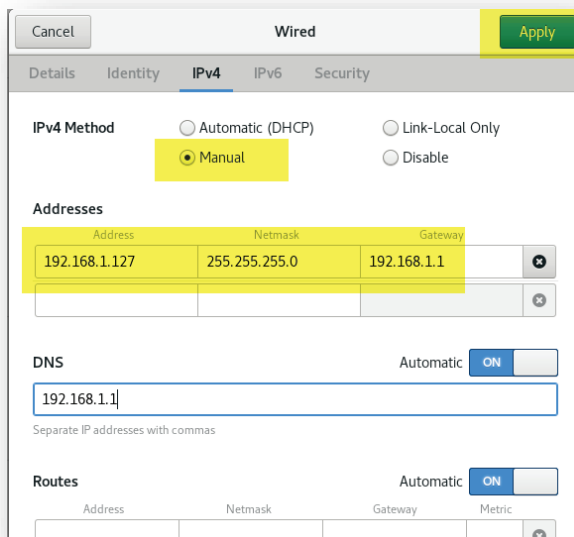
7. Open Settings window: **Applications -> System Tools -> Settings**



8. Open Network settings



- Click on **IPv4** tab, select the **Manual** option, then enter the IP address and DNS information. Then click on **Apply** button.



- In the Terminal window, ping the IP address to make sure that the changes are successful.
- Edit the `/etc/hosts` file and add the hostname and the IP address to it.

```
vi /etc/hosts
```

```
192.168.1.127 srv1.localdomain srv1
```

- Verify that the changes are registered in the NIC configuration file.

```
cat /etc/sysconfig/network-scripts/ifcfg-enp0s3
```

- Ping `srv1` to make sure the changes were successful.

```
ping srv1
```

- In the hosting PC, open a command line window and make sure you can ping the IP address of `srv1`.

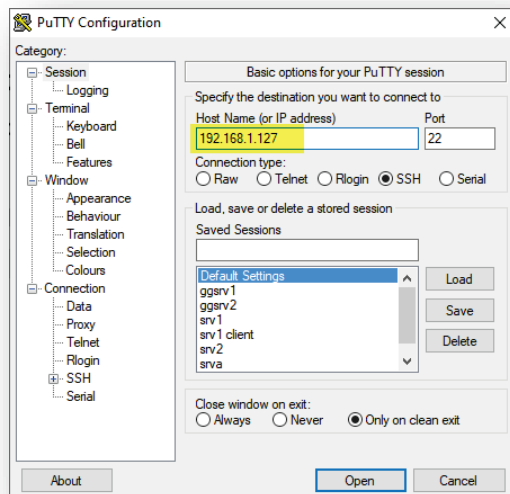
Note: Make sure the firewall in your PC allows communication with Oracle VirtualBox.

```
C:\> ping 192.168.1.127
```

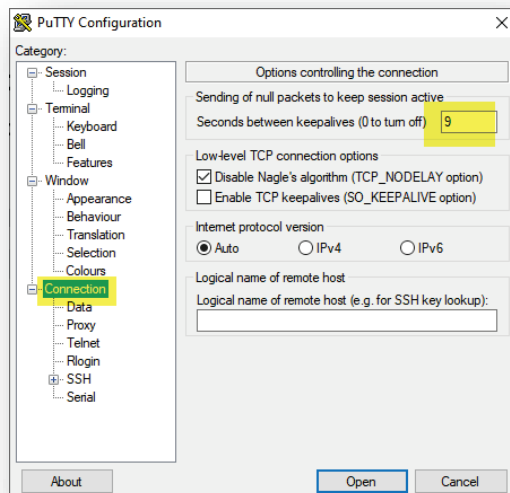
D. Configuring Putty

In the following steps, you will configure Putty to connect to `srv1`

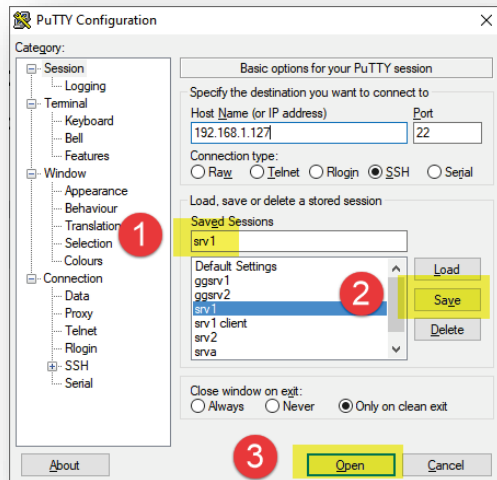
15. Open Putty then enter the IP address of `srv1` in the **Host Name** field.



16. Click on Connection then set the "Seconds between keepalives" to 9.



17. Save the configuration as `srv1` then open the session.



18. Login as `root` in the Putty session.

E. Setting up Environment Variables for OS Accounts: `grid` and `oracle`

In the following steps, you will configure the OS variables for the software owner accounts. `oracle` is the software owner of the database software and `grid` is the software owner of the Grid Clusterware software.

19. In the Putty session, switch current user to `oracle` and make a backup copy of the current bash profile file:

```
su - oracle
mv ~/.bash_profile ~/.bash_profile_bkp
```

20. Open the `.bash_profile` file with the vi editor

```
vi ~/.bash_profile
```

21. Add the following to it.

```
# .bash_profile

# OS User: oracle
# Application: Oracle Database Software Owner
# Version: Oracle 19c
# -----
# Get the aliases and functions
if [ -f ~/.bashrc ]; then
. ~/.bashrc
fi

ORACLE_BASE=/u01/app/oracle; export ORACLE_BASE
ORACLE_SID=oradb; export ORACLE_SID
ORACLE_HOME=$ORACLE_BASE/product/19.0.0/db_1; export ORACLE_HOME

NLS_DATE_FORMAT="DD-MON-YYYY HH24:MI:SS"; export NLS_DATE_FORMAT
TNS_ADMIN=$ORACLE_HOME/network/admin; export TNS_ADMIN

PATH=$PATH:$HOME/.local/bin:$HOME/bin
PATH=${PATH}:/usr/bin:/bin:/usr/local/bin
PATH=.:${PATH}:/usr/local/bin
export PATH

LD_LIBRARY_PATH=$ORACLE_HOME/lib
LD_LIBRARY_PATH=${LD_LIBRARY_PATH}:/usr/lib:/usr/local/lib
LD_LIBRARY_PATH=${LD_LIBRARY_PATH}:/lib:/usr/lib:/usr/local/lib
export LD_LIBRARY_PATH

CLASSPATH=$ORACLE_HOME/JRE
CLASSPATH=${CLASSPATH}:/usr/lib:/usr/local/lib
CLASSPATH=${CLASSPATH}:/usr/local/lib
CLASSPATH=${CLASSPATH}:/usr/local/lib
export CLASSPATH
export TEMP=/tmp
export TMPDIR=/tmp
umask 022
```

22. Switch current user back to `root` then run the following code to create required groups, `grid` user and modify the accounts.

```
su -
groupadd asmadmin
groupadd oinstall
groupadd asmdba
usermod -g oinstall oracle
usermod -a -G asmdba oracle
useradd -u 54323 -g oinstall -G asmadmin,asmdba grid

passwd grid
```

23. 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 folder (staging folder) in the hosting machine.

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

24. Create Oracle Clusterware home directories:

```
mkdir -p /u01/app/oracle/product/19.0.0/db_1
mkdir -p /u01/app/grid
mkdir -p /u01/app/19.0.0/grid
chown -R grid:oinstall /u01
chown -R oracle:oinstall /u01/app/oracle
chmod -R 775 /u01
```

25. Switch to `grid` user and modify its bash profile as follows:

```
su - grid
mv ~/.bash_profile ~/.bash_profile_bkp

vi ~/.bash_profile

# .bash_profile
# Get the aliases and functions
if [ -f ~/.bashrc ]; then
. ~/.bashrc
fi
ORACLE_SID=+ASM; export ORACLE_SID
ORACLE_BASE=/u01/app/grid; export ORACLE_BASE
ORACLE_HOME=/u01/app/19.0.0/grid; export ORACLE_HOME

ORACLE_TERM=xterm; export ORACLE_TERM
TNS_ADMIN=$ORACLE_HOME/network/admin; export TNS_ADMIN
PATH=.:${JAVA_HOME}/bin:${PATH}:$HOME/bin:$ORACLE_HOME/bin
PATH=${PATH}:/usr/bin:/bin:/usr/local/bin
export PATH
export TEMP=/tmp
export TMPDIR=/tmp
umask 022
```

F. Installing ASM Packages and Creating ASM Disk Volumes

In the following steps, you will install ASM packages then create ASM disk volumes.

26. Change the current user to `root` user

```
su -
```

27. Install Oracle ASMLib package

```
yum install oracleasm-support
```

```
# the following command will take a few minutes to finish:
```

```
yum install kmod-oracleasm
```

28. Configure and load the ASM kernel module. Respond to the command as illustrated by the code in red color.

```
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
```

29. Load the `oracleasm` kernel module:

```
/usr/sbin/oracleasm init
```

30. List the disks as seen by the OS. You should see the disks created in the VirtualBox and attached to the appliance.

```
fdisk -l | grep "Disk /dev/sd"
```

31. Use `fdisk` to create partitions in the disk.

Do the following for the disks `sdb` and `sdc`

```
fdisk <device file>
```

```
then press: n, p, 1, ENTER, ENTER, w - to apply changes
```

Following is the output done on `sdb`:

```
[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 0xd2973f79.
```

```
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 (1-261, default 1):
Using default value 1
Last cylinder, +cylinders or +size{K,M,G} (1-261, default 261):
Using default value 261

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

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

32. Verify that the partitions are created.

```
fdisk -l | grep "/dev/s"
```

33. Create the ASM disks

```
oracleasm createdisk OCRDISK1 /dev/sdb1
oracleasm createdisk DATADISK1 /dev/sdc1
oracleasm listdisks
```

G. Changing Kernel Parameter Values

In the following step, you will change the kernel parameter values to the values recommended by Oracle.

- 34.** Create the following file then add the code that follows to it.

```
vi /etc/sysctl.d/97-oracle-database-sysctl.conf
```

```
fs.aio-max-nr = 1048576
fs.file-max = 6815744
kernel.shmall = 2097152
kernel.shmmax = 4294967295
kernel.shmmni = 4096
kernel.sem = 250 32000 100 128
net.ipv4.ip_local_port_range = 9000 65500
net.core.rmem_default = 262144
net.core.rmem_max = 4194304
net.core.wmem_default = 262144
net.core.wmem_max = 1048576
```

- 35.** Change the current values of the kernel parameters:

```
/sbin/sysctl --system
```

- 36.** Reboot `srv1`

H. Install More Packages

In the following step, you will install further packages in `srv1` that are required by Oracle Grid Infrastructure and database software.

37. Open Putty and login to `srv1` as `root`

38. Run the following code to install further packages required by Oracle software.

```
yum install ksh  
yum install libaio-devel.x86_64
```

I. Installing Oracle Grid Infrastructure Software (Oracle Restart)

In the following steps, you will install Oracle Grid Infrastructure software in `srv1`. The installation procedure automatically creates and start the Clusterware services.

- 39.** Copy the Oracle Grid Infrastructure software installation file to the staging folder.

At the time of this writing, the installation file name downloaded from Oracle site is `LINUX.X64_193000_grid_home.zip`

- 40.** Extract the installation file into the Oracle Grid Infrastructure software home directory

```
su - grid
unzip /media/sf_staging/LINUX.X64_193000_grid_home.zip -d $ORACLE_HOME
```

- 41.** Install the `cvuqdisk` in `srv1` as `root`

The package `cvuqdisk` must be installed before installing the Clusterware software

```
# exit to return back to the root shell:
exit

cd /u01/app/19.0.0/grid/cv/rpm/
CVUQDISK_GRP=oinstall; export CVUQDISK_GRP
rpm -iv cvuqdisk-1.0.10-1.rpm
```

- 42.** Login to the VirtualBox window of `srv1` as `grid`.

- 43.** Open a terminal window, change the current directory to the Grid Infrastructure software home directory and run the `gridSetup.sh` script.

```
cd $ORACLE_HOME
./gridSetup.sh
```

- 44.** Respond to the Installer windows as follows:

Window	Action
Configuration Option	Select the following option: "Configure Oracle Grid Infrastructure for a Standalone Server (Oracle Restart)"
Create ASM Disk Group	<ol style="list-style-type: none"> 1. Click on Change Discovery Path button 2. Enter the Discovery Path as follows: <code>/dev/oracleasm/disks/*</code> 3. Fill in the fields as follows: Disk Group Name: <code>OCRDISK</code>

	Redundancy: External Select Disks: OCRDISK1
ASM Password	Enter the password
Management Option	Make sure the Checkbox is unselected
Operating System Groups	Make sure the following are the selected values: OSASM: asmadmin OSDBA: asmdba
Installation Location	Oracle Base and Oracle Grid Home should automatically point to the values of their corresponding variables. Note: Observe the grid home is not under the Oracle grid base home.
Create Inventory	It should automatically point to /u01/app/oraInventory
Root Script Execution	Mark the checkbox "Automatically run configuration scripts" and enter the root password
Prerequisite Checks	All the Prerequisite Checks should pass except the memory. It complains the available memory is 7.5. We can ignore this warning. Select Ignore All checkbox then click on Next button. Click Yes on the confirmation dialog box. Note: If you see other warnings, you have to resolve them before you proceed.
Install Product	When the installation reaches to nearly 11%, it will display a confirmation message. Click on Yes button.

45. Check CRS services status:

```
su - grid
crsctl status resource -t
```

J. Creating ASM Disk Groups

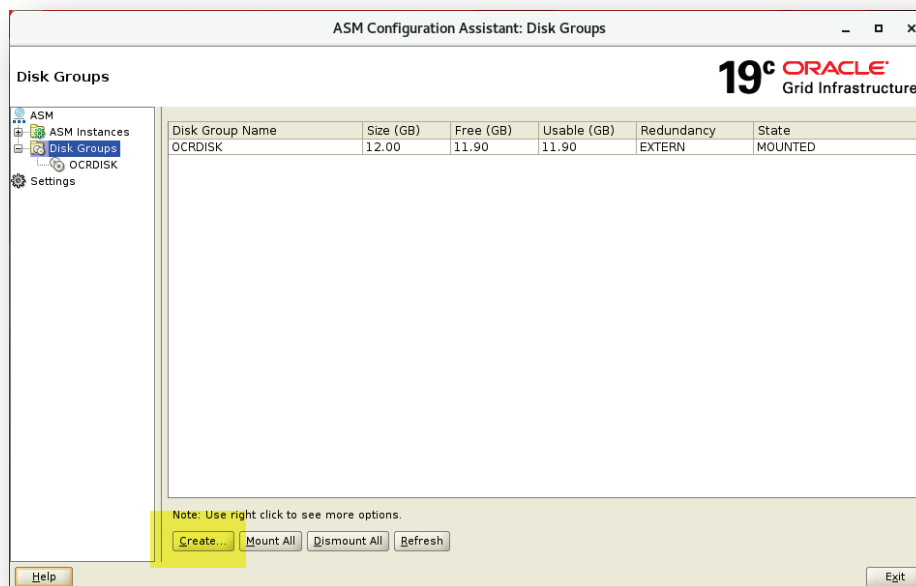
In the following steps, you will create the Diskgroup that will be used by Oracle database to store its datafiles.

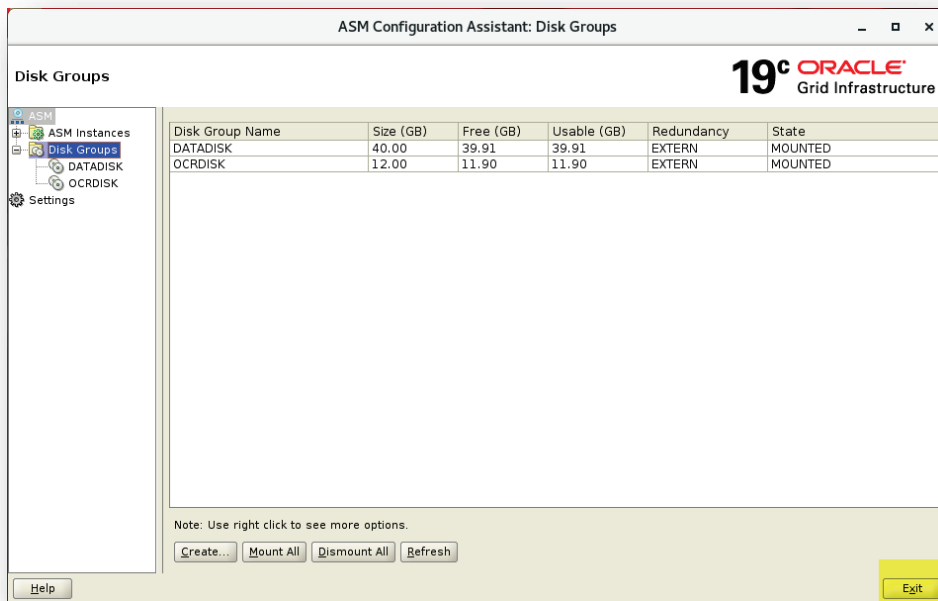
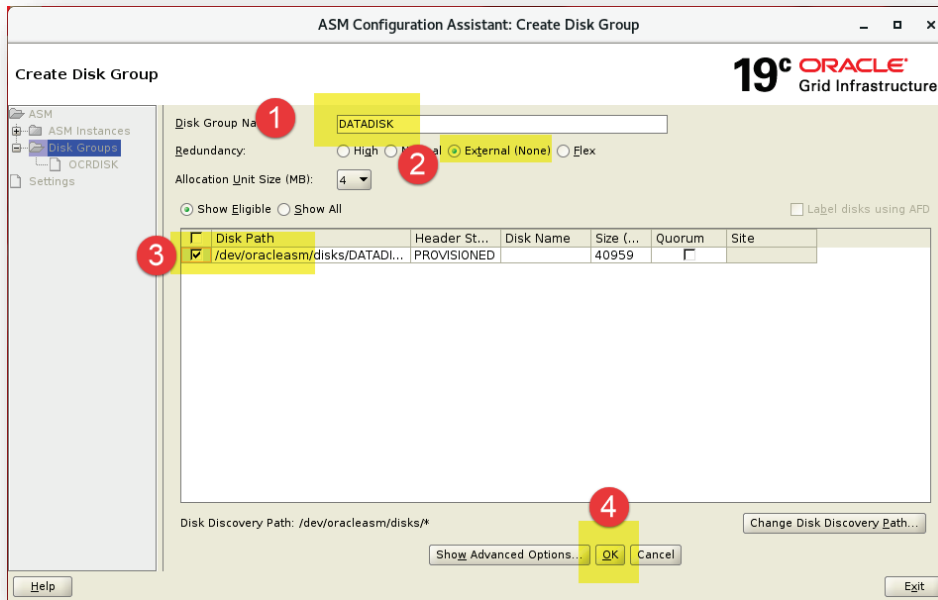
Note: In real life scenario, we might create more than one disk group. For example, one for the data files and one for the FRA.

46. In the VirtualBox window, initiate ASM Configuration Assistant

```
asmca
```

47. Create the disk group `DATADISK` by responding to the Assistant as follows:





K. Installing Oracle Database Software and Creating the Database

In the following steps, you will install Oracle database software in `srv1` and create the database.

- 48.** Copy the Oracle database software installation file to the staging folder.

At the time of this writing, the installation file name downloaded from Oracle site is `LINUX.X64_193000_db_home.zip`

- 49.** In the Putty session, change the current user to `oracle` then extract the installation file into the Oracle database software home directory

```
su - oracle
unzip /media/sf_staging/LINUX.X64_193000_db_home.zip -d $ORACLE_HOME
```

- 50.** Logout from the VirtualBox window and login to it again as `oracle`

- 51.** Open a terminal window, change the current directory to the Oracle database home directory and run the `runInstaller` script.

```
cd $ORACLE_HOME
./runInstaller
```

- 52.** Respond to the Installer windows as follows:

Window	Action
Configuration Option	Select the following option: "Create and Configure a single instance database."
System Class	Select the following option: "Server Class"
Database Edition	Select the following option: "Enterprise Edition"
Installation Location	Keep the default value
Configuration Type	Select the following option: General Purpose
Database Identifiers	Global Database Name: oradb.localdomain Oracle SID: oradb Pluggable Database Name: pdb1

Configuration Options	Do not mark the AMM checkbox Memory: 5120 MB Character set: Use Unicode (AL32UTF8) Sample Schemas: (optional) Mark the checkbox "Install sample schema in the database"
Database Storage	Make sure ASM is selected
Management Options	Make sure the checkbox is not marked.
Recovery Option	Mark the checkbox Enable Recovery Make sure ASM is selected
ASM Diskgroup	Select DATADISK
Schema Password	Set passwords for the accounts
Operating System Groups	Select the " oinstall " group for all the options, except the OSOPER keep it blank.
Root Script Execution	Mark the checkbox "Automatically run configuration scripts" and enter the root password
Prerequisite Checks	All the Prerequisite Checks should pass.
Summary	Click on Install button
Install Product	When the installation reaches to nearly 12%, it will display a confirmation message. Click on Yes button.
Finish	click on Close button

- 53.** After the installation and database creation are finished, verify the database is up and running by logging to it as sysdba

```
sqlplus / as sysdba
```

- 54.** Check the status of the database (can be run as `oracle` or as `grid`)

```
srvctl status database -d oradb
```

- 55.** Check if a connection entry to `oradb` is added to the `tnsnames.ora` file

The `tnsnames.ora` file was not even created.

```
ls $TNS_ADMIN/tnsnames.ora
```

- 56.** In the VirtualBox window of `srv1`, start the Firefox browser and open the EM Express using the following URL

The browser returns the error "Secure Connection Failed". This error is generated because the listener runs as `grid` user and this user does not have write access to XDB wallet. You will fix this issue in the next tutorial section.

`https://srv1:5500/em`

Note: Following is a reference for EM Express known issues and how to resolve them:

Doc ID 1604062.1 : Troubleshooting Why EM Express is not Working

- 57.** In the Putty session, run the following command to grant permission on the XDB wallet to the `grid` user:

XDB wallet folder can be obtained from the output of the `lsnrctl status`

```
setfacl -R -m u:grid:rwX /u01/app/oracle/product/19.0.0/db_1/admin/oradb/xdb_wallet
```

- 58.** Try opening the EM Express on the browser. Accept the warning displayed by the browser. Enter the `sys` username, its password, leave the container name blank then click on Login button.
- 59.** Explore the EM Express. When you are done, close the browser.
- 60.** Restart the machine. Then make sure the database is automatically started up after the VM is rebooted.

Summary

- We can build up an Oracle database 19c with ASM on a VirtualBox machine.
- In high level, the procedure goes through the following stages:
 - Decide about the storage size and architecture
 - Prepare the machines and the operating system
 - Install Oracle Grid Infrastructure (Oracle Restart)
 - Install Oracle database software and create Oracle database

Note: The appliance created by me in this tutorial can be downloaded from the following link:
<http://www.ahmedbaraka.com/public/download/>