HOL 10471

How to Deploy Oracle Real Application Clusters (RAC) in Minutes Using Oracle VM Templates

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CONTENTS

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1 INTRODUCTION

1.1 LAB OBJECTIVE

This document details all actions that you will be running during Oracle OpenWorld session Hands On Lab HOL10471.

The objective of this lab is to demonstrate how OracleVM Templates provide an easy and fast way of deploying Oracle Applications. Those templates are designed to build test or production clusters of any number of nodes, while by default a 2-node cluster is created.

They include full support for Single Instance, Oracle Restart (Single Instance/HA) and Oracle RAC for both 11gR2 and 12c. The templates support Flex Cluster, Flex ASM as well as automation for Container/Pluggable databases in 12c.

During this session, you are going to deploy a 3-node Flex Cluster (2 Hub and 1 Leaf) with a dedicated network for ASM traffic.

STEPS TO PERFORM BEFORE CONTINUING READING :

TO SAVE TIME, THE FIRST THING TO DO IS TO START BOTH VirtualBox VMs (Oracle VM Manager and Oracle VM Server) :

- Select the VM called "**ovmm10471.oow.local**" and click on the icon ➡ to start it (Figure 1.1.1)

- Select the VM called "**ovs10471.oow.local**" and click on the icon ➡ to start it (Figure 1.1.1)
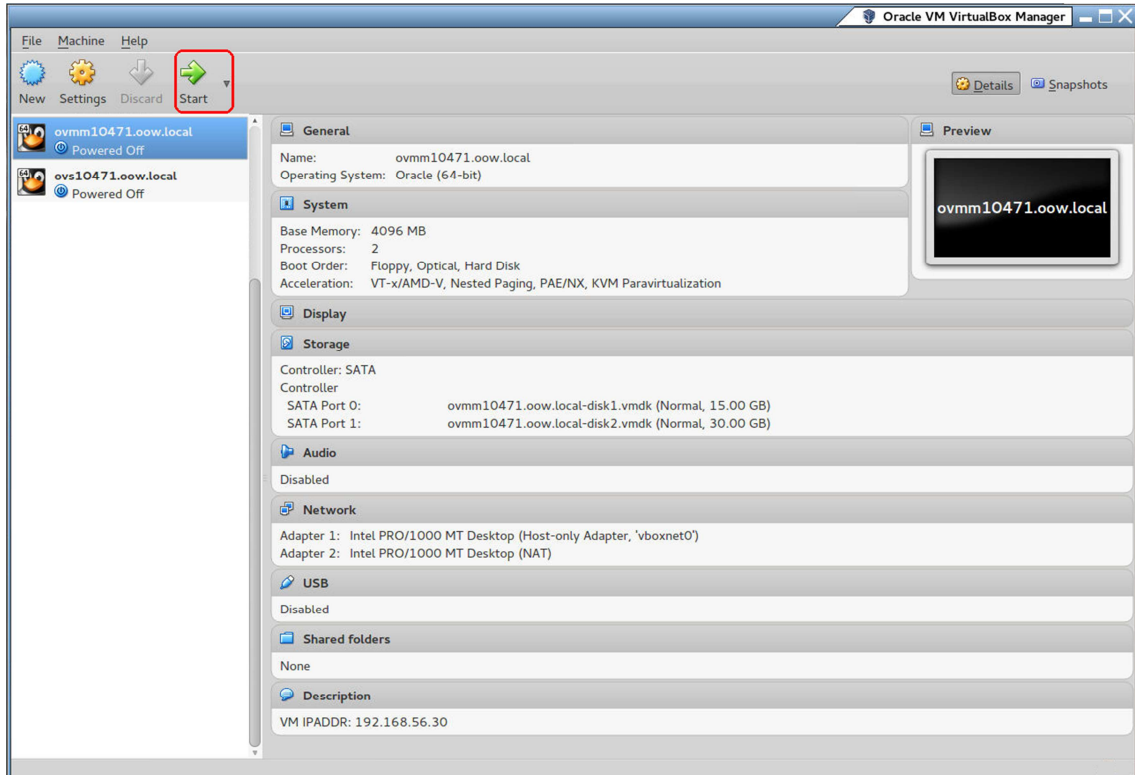
Figure 1.1.1

1.2 PREPARATION (HAS BEEN DONE BEFORE THE LAB)

To save time and fit in the one hour slot of Oracle OpenWorld labs, some actions were made before the actual lab.
Here is a quick list of actions which were already done :

- o Install Oracle Linux 6.7 (64 bits) on all the laptops.
- o Install Oracle VirtualBox 5.0.6 + Extension Pack on all the laptops.
- o Install an Oracle VM Manager 3.3.3 server in a VirtualBox virtual machine.
- o Install an Oracle VM Server 3.3.3 server in a VirtualBox virtual machine.

1.3 GLOBAL PICTURE

The following picture shows all the components of this HOL:
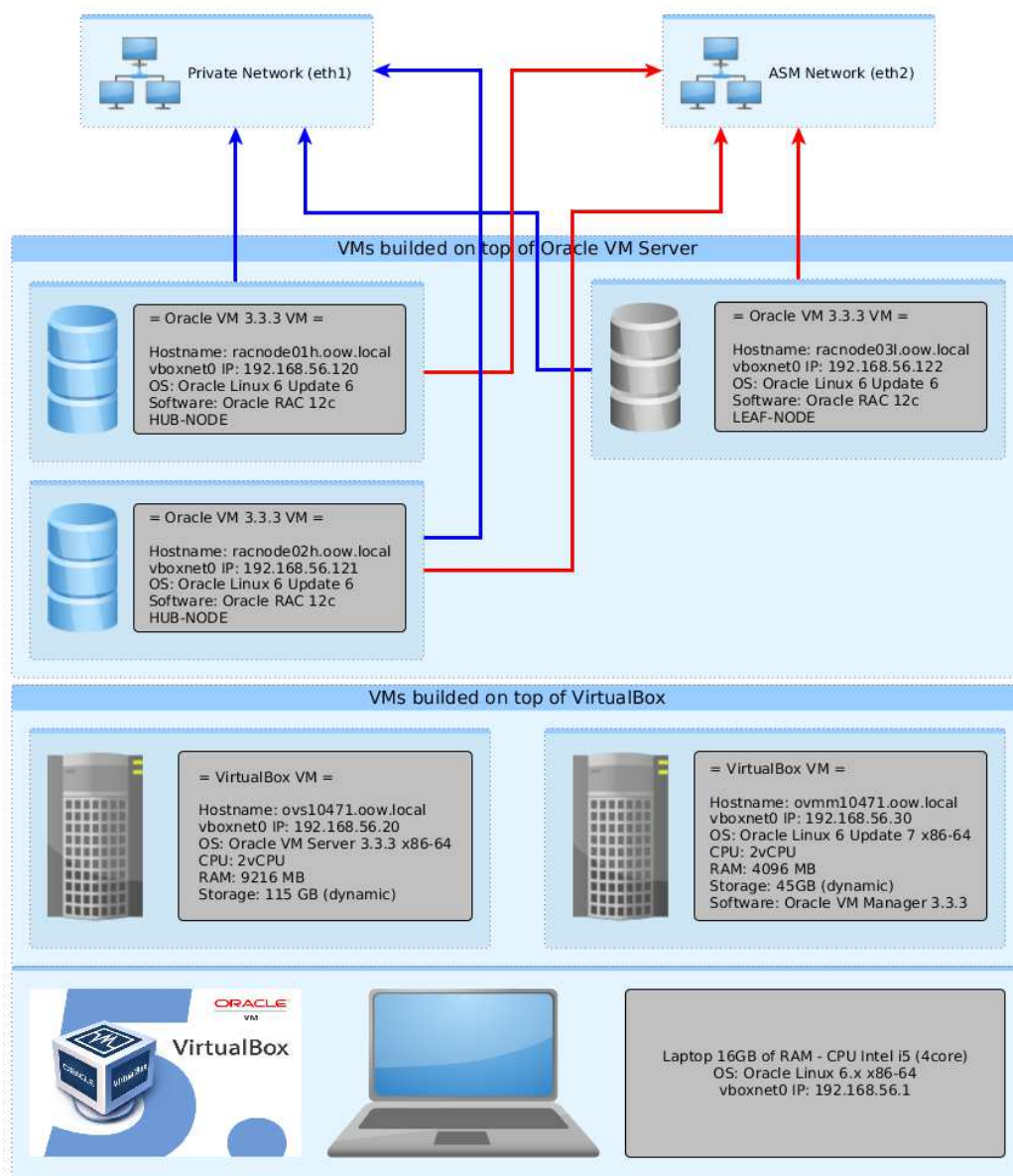
2 DETAILED INSTRUCTIONS

2.1 START BOTH SERVERS (VIRTUAL BOX VMS)

As previously explained, we will use Oracle VirtualBox to host the 2 servers (Oracle VM Server, Oracle VM Manager) on a single laptop.

Both VMs should have been started in 1.1, if not please start both VMs as described in Chapter 1.1

TO DO :
- Wait for both VMs to be ready
  - Wait for the Oracle Linux display screen on the VM HOL10471_ovm_mgr (Figure 2.1.2)
  - Wait for Oracle VM server display screen on the VM HOL10471_ovm_srv (Figure 2.1.2)
  - **Open a Terminal window and check you are able to ping both VMs :**
    ovmm10471.oow.local : 192.168.56.30
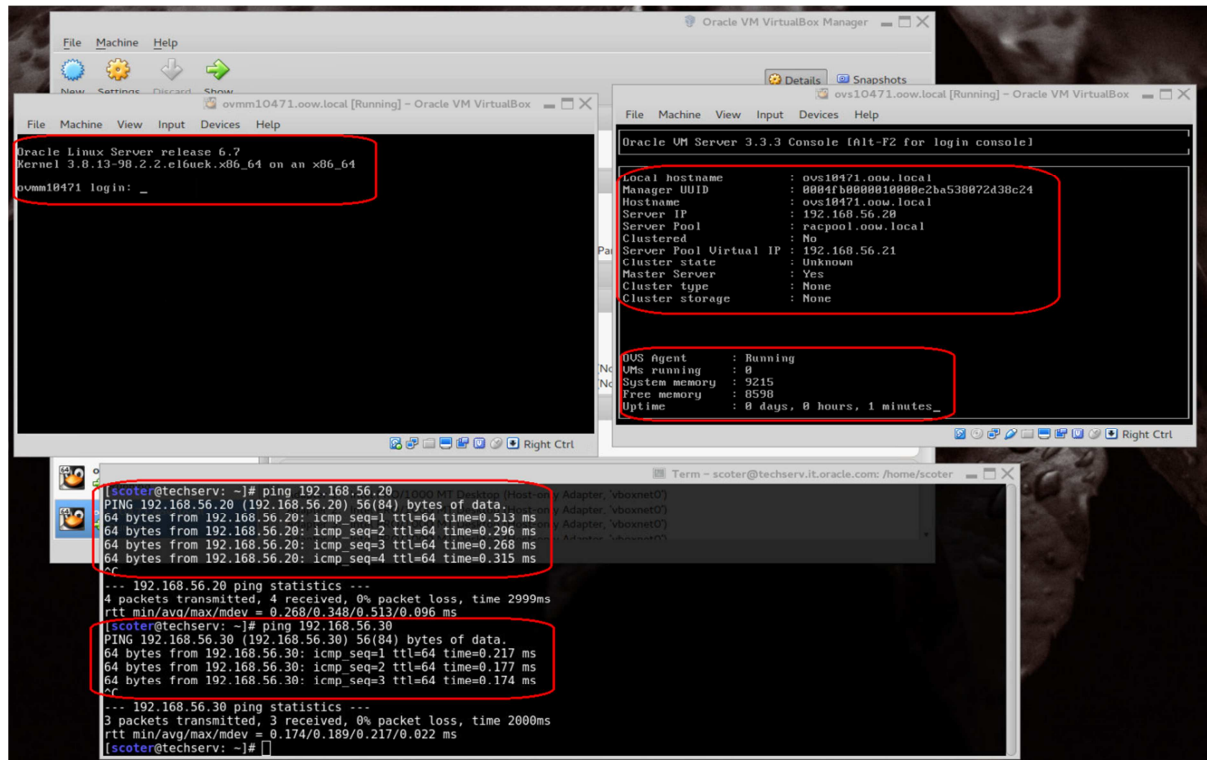   **ovs10471.oow.local : 192.168.56.20**

Figure 2.1.2

- Once both VMs are started and you have checked ping is OK you can :
  - Minimize the main VirtualBox program window
  - Minimize the Oracle VM Manager VirtualBox window
  - Minimize the Oracle VM Server window

All next steps will be done from your laptop native OS.

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2.2 CONNECT TO THE ORACLE VM MANAGER CONSOLE

TO DO :

- On your Linux physical desktop open a Firefox browser and connect to the **Oracle VM Manager** console using URL https://192.168.56.30:7002/ovm/console

-
  You should get the following login page :
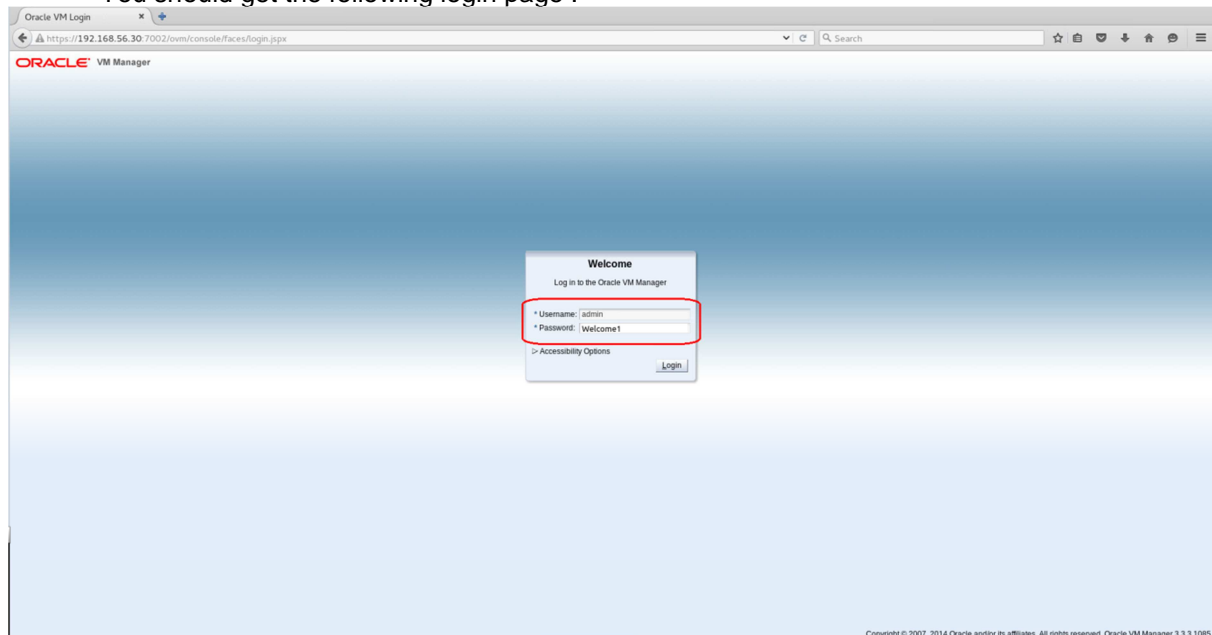
- Log in using the following credentials:
  - o   Login   : **admin**(Oracle VM Manager Administrator)
  - o   Password   : **Welcome1**

2.3 CREATE A STORAGE REPOSITORY

A storage repository is where Oracle VM resources may reside. Resources include virtual machines, templates for virtual machine creation, virtual machine assemblies, ISO files (DVD image files), shared virtual disks, and so on.
We will create a storage repository for Oracle VM by using a pre-existing disk. This disk already contains an existing repository with Oracle RAC template inside. Creating the repository is very simple but importing the Oracle RAC template would take too much time during this HOL session.

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TO DO :

- In **servers and VMs Tab**, select **ovs10471.oow.local** and in **Perspective** choose Physicals disks (Figure 2.3.1)
- Select the 100 GB hard disk (SATA_VBOX_HARDDISK) (Figure 2.3.1)
- Click on 🔄 to refresh the Physical Disk (Figure 2.3.1) and click OK on the Confirmation windows
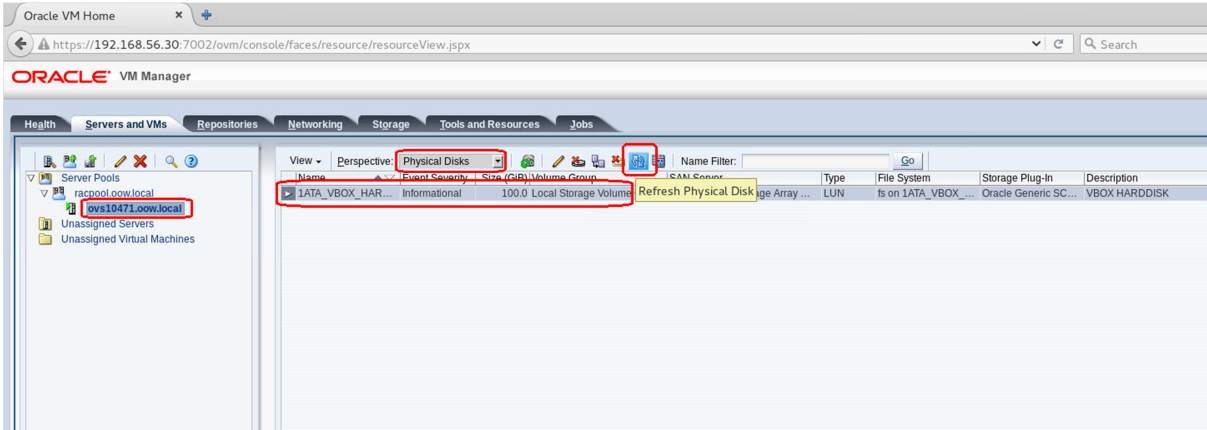
Figure 2.3.1

- In Repositories tab you will see the pre-existing repository named "repo01".
  For now, this repo is not already presented to any server
- Select the repository named "repo01" and click 🖉 to edit the Repository (Figure 2.3.2)
- In the Present Repository tab, add "racpool.oow.local(0/1)" to the Presents to Server Pool(s) list box (Figure 2.3.2)
- Click OK to complete
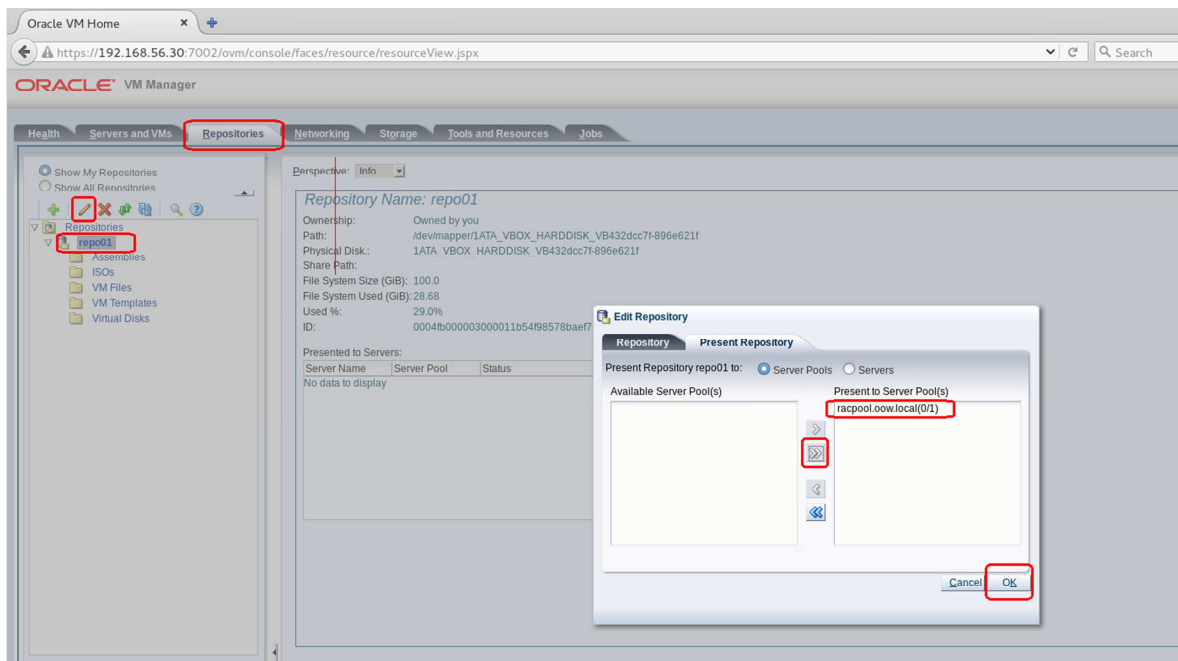
Figure 2.3.2

- The repository is now owned and presented to the Oracle VM Server "ovs10471.oow.local"
- You need to refresh the repository by clicking on 🔄 (Figure 2.3.3)

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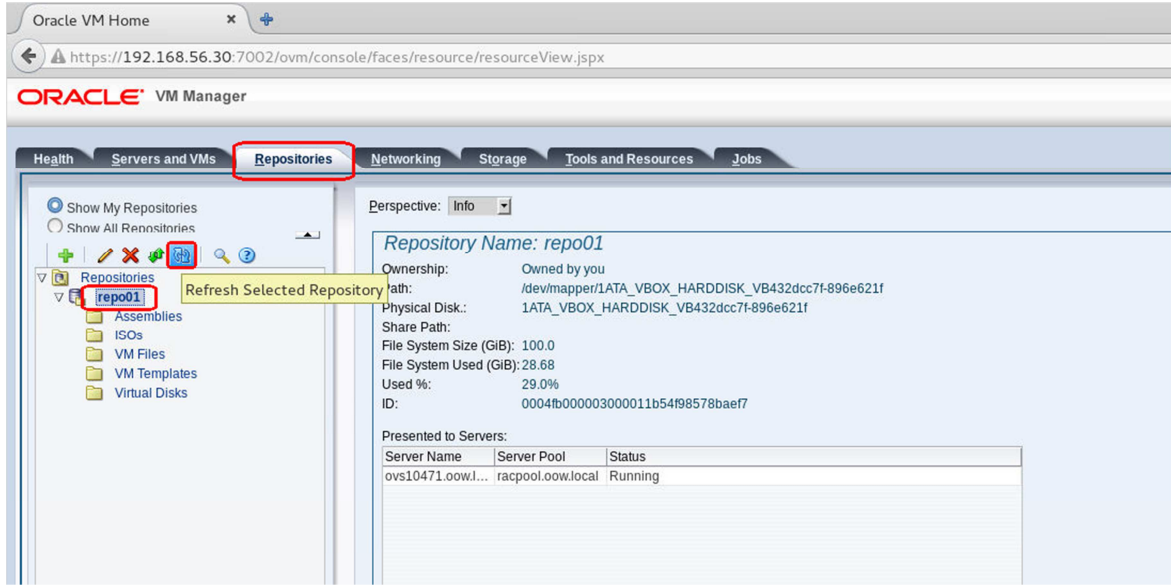
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Figure 2.3.3

- Under "repo01", VM Templates check that Oracle RAC 12c template is present (Figure 2.3.4)
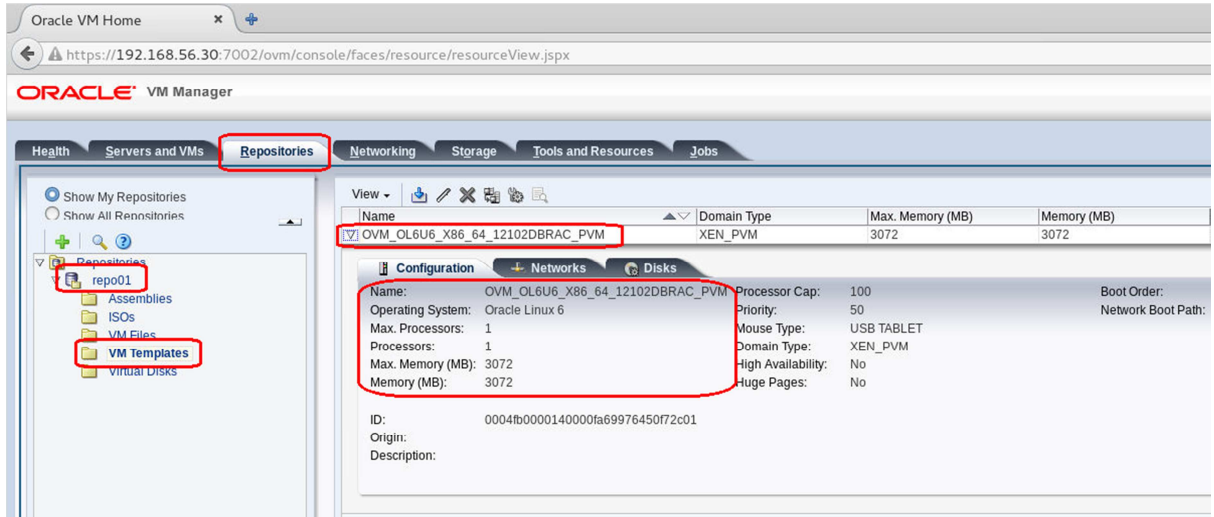
Figure 2.3.4

Now that you have a repository and an Oracle RAC 12c template inside, you are going to create 3 virtual machines from this template.

2.4 CLONE 3 VMS FROM DB/RAC ORACLE VM TEMPLATE

The goal of this HOL LAB is to configure a 3 nodes RAC cluster, you will need to create 3 virtual machines:

- Click the **Servers and VMs** tab (Figure 2.4.1)
- Click **Create Virtual Machine** in the toolbar (Figure 2.4.1)
- From Create Virtual Machine wizard (Figure 2.4.1)
    - Select **Clone from an existing VM Template**
    - **Clone Count = 3**
    - **Name Index = 1**
    - **VM Name = racnode0**
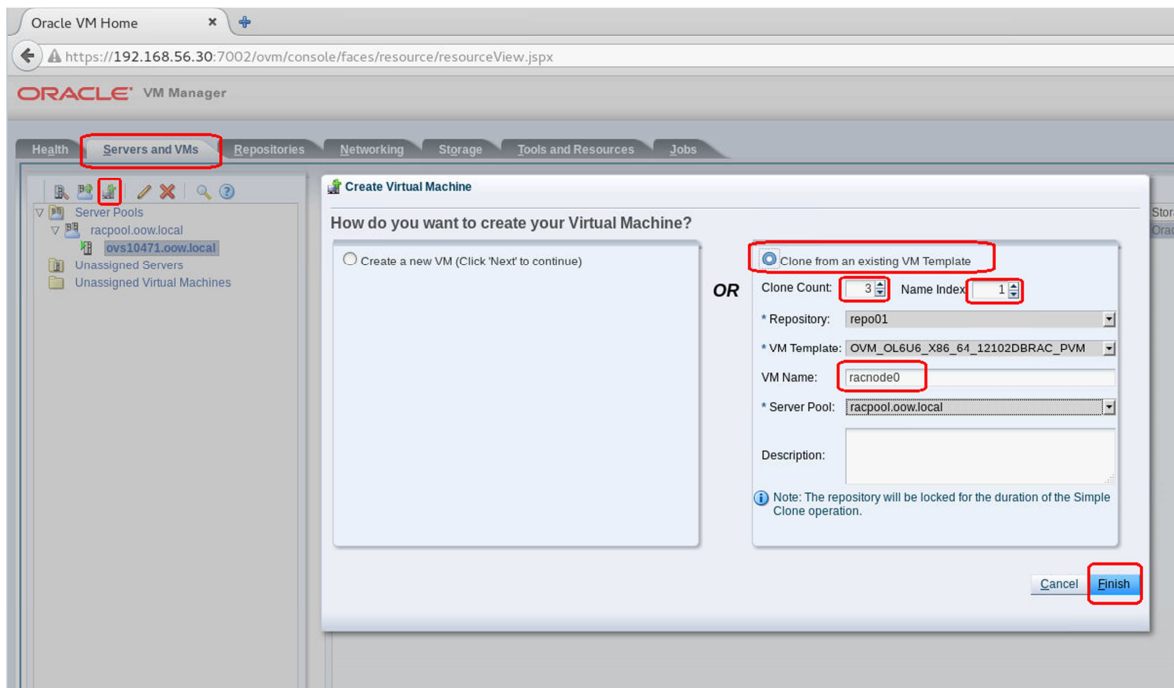
Figure 2.4.1

- Click Finish
- In **Servers and VMs** Tab, In **Perspective** select **Virtual Machines**, you should have 3 VMs : racnode0.1, racnode0.2 and racnode0.3 (Figure 2.4.2)

Figure 2.4.2

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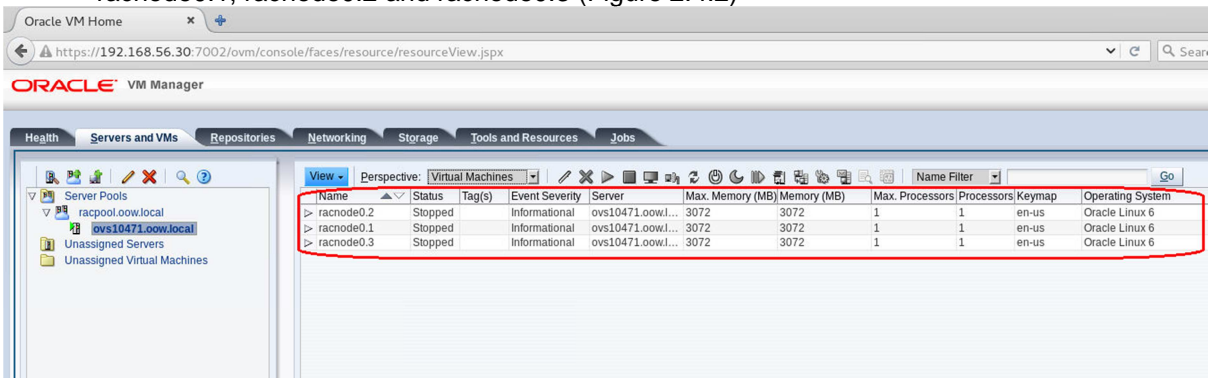
- Edit vm named "**racnode0.3**" to reduce the size of the RAM available (LEAF node):

Select vm and click on ✎ button and modify following parameters (Figure 2.4.3):
  - **Max.Memory (MB): 2048** (was 3072)
  - **Memory (MB): 2048** (was 3072)
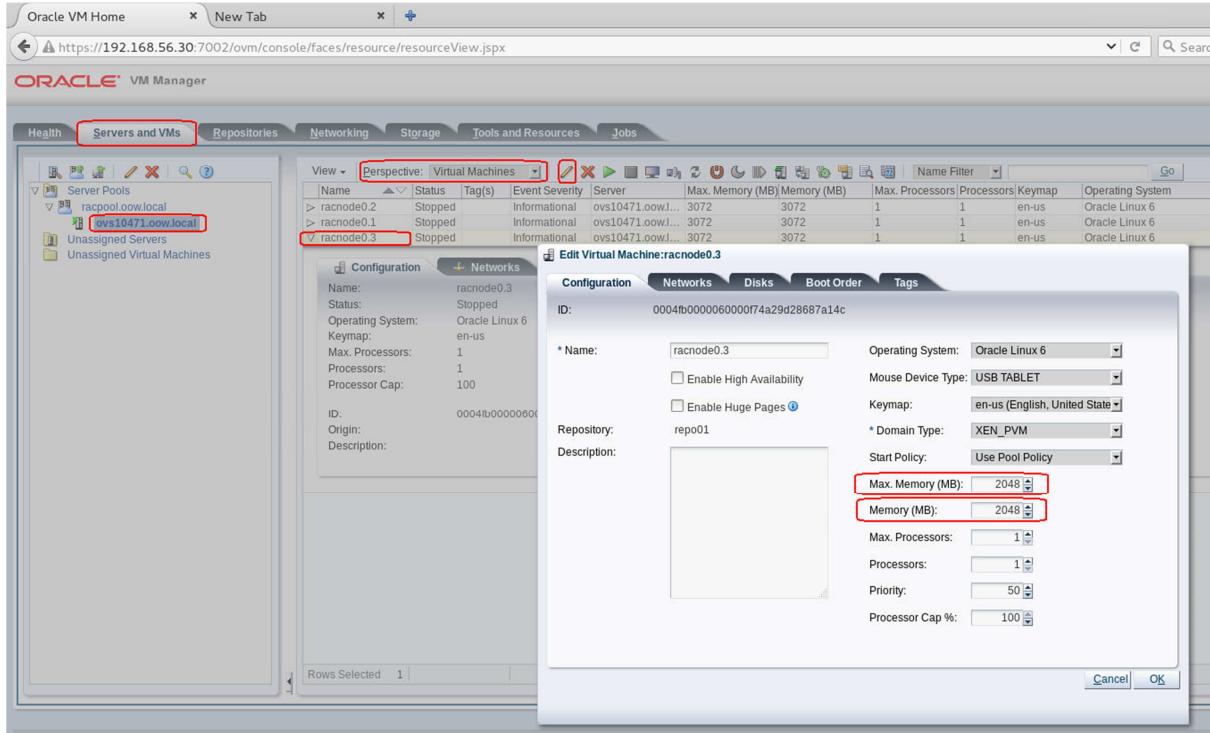
Figure 2.4.3

2.5 CREATING SHARED DISK FOR ASM CONFIGURATION

ASM is a volume manager and a file system for Oracle database files that supports single-instance Oracle Database and Oracle Real Application Clusters (Oracle RAC) configurations. ASM is Oracle's recommended storage management solution that provides an alternative to conventional volume managers, file systems, and raw devices.

ASM uses disk groups to store datafiles; an ASM disk group is a collection of disks that ASM manages as a unit. Within a disk group, ASM exposes a file system interface for Oracle database files. The content of files that are stored in a disk group are evenly distributed, or striped, to eliminate hot spots and to provide uniform performance across the disks. The performance is comparable to the performance of raw devices.

In this session we will create only one ASM disk. In a real world scenario we would have more than one ASM disk. Although those disks could be created using Oracle VM Manager GUI, the process would be very repetitive. Instead you are going to use CLI commands to create and map our ASM disk to VM racnode0.1, racnode0.2 and racnode0.3. Because VM racnode0.3 will be the LEAF node, we don't give it access to the shared disk.
Oracle VM CLI commands can be scripted which is more user friendly for automatic and repetitive command. The CLI is included in the Oracle VM Manager installation.

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TO DO :

- According your os open a terminal windows or a putty and connect on ovmm10471.oow.local with ssh (**192.168.56.30**) with credential **admin/Welcome1** on port **10000** (Figure 2.5.1) :
  Linux command : **ssh admin@192.168.56.30 -p 10000**
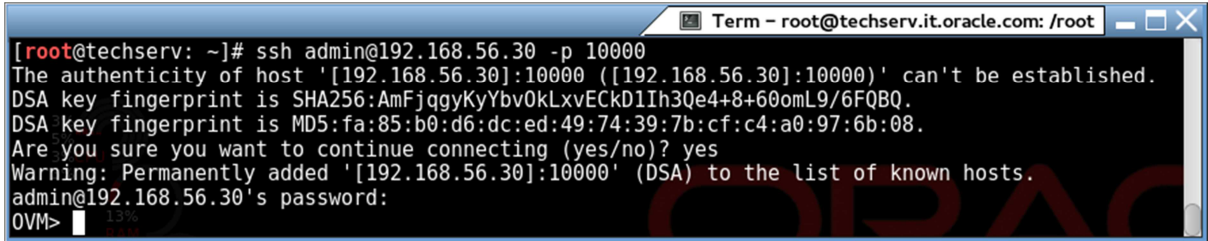
Figure 2.5.1

- Creation of the shared disk using create VirtualDisk command (Figure 2.5.2) :
  create VirtualDisk name=racasm1 size=5 sparse=no shareable=yes on Repository name=repo01

- Mapping shared disk to each VM (Figure 2.5.2) :
  create vmDiskMapping name=racasm1 slot=2 virtualDisk=racasm1 on vm name=racnode0.1
  create vmDiskMapping name=racasm1 slot=2 virtualDisk=racasm1 on vm name=racnode0.2
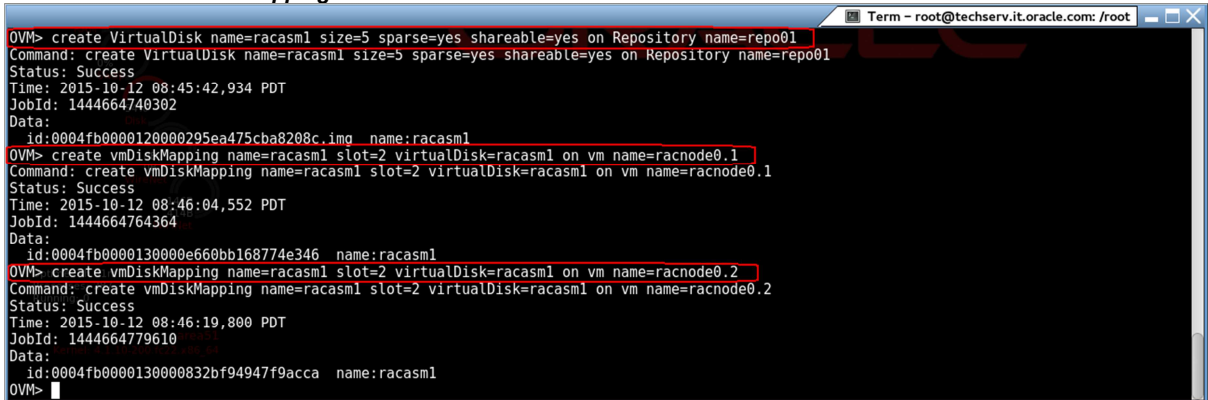
Figure 2.5.2

- Check racasm1 disk is present and assigned to VMs racnode0.1 and racnode0.2:
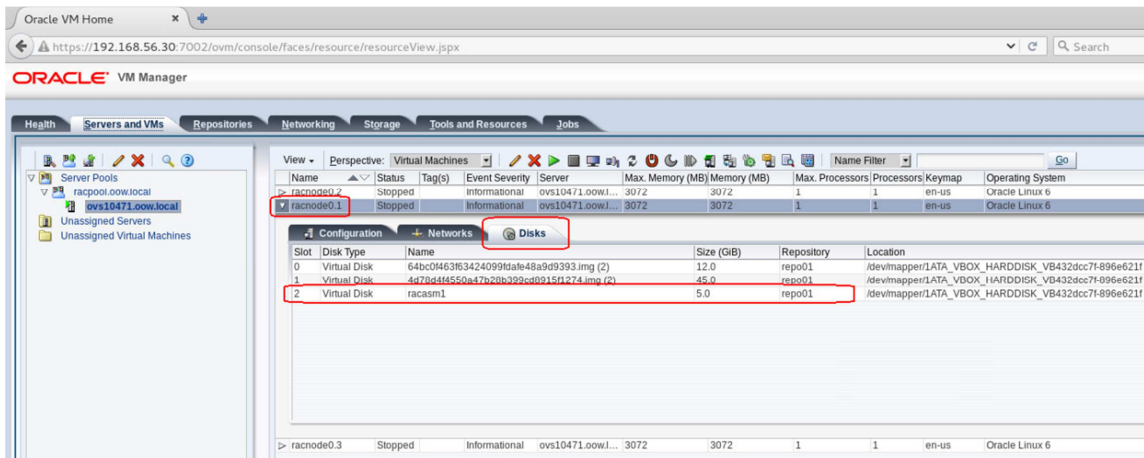
You will now be able to start/configure all VMs using the deploycluster tool.

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3 START INSTALLATION USING DEPLOYCLUSTER

Oracle VM 3 users can benefit from the **DeployCluster tool** which now fully supports **Single Instance**, **Oracle Restart** (SIHA) or **RAC** deployments. The tool leverages the Oracle VM 3 API so that given a set of VMs it quickly boots them up sends the needed configuration details, and an automated Single Instance or cluster build is initiated, without requiring the user to login to Dom0, any of the involved VMs or Oracle VM Manager.

In Oracle RAC deployments there are two ways to deploy the templates (hence two separate documents):

- Production – Supported: where the shared disk is configured as physical devices passed through to the guest Oracle VMs. For more details on running Oracle RAC in Oracle VM environment, see: http://www.oracle.com/technetwork/database/clustering/oracle-rac-in-oracle-vm-environment-131948.pdf
- Test – Unsupported: where the shared disk is configured as virtual devices – in this configuration both guests can also run on one Oracle VM server.

Production environments may not:
a) Run more than one VM belonging to same Cluster on the same Oracle VM Server (DOM-0)
b) Use files in DOM-0 to emulate shared disks for the Oracle RAC Nodes/VMs.

In this HOL LAB, you are going to deploy the template in Test mode.

3.1 CREATE A NETCONFIG.INI FILE FOR DEPLOYMENT

To save time, the deploycluster tool was already downloaded on the Oracle VM Manager.
The file is DBRACOVM-Deploycluster-tool.zip and was already unzipped.
Because of limited resources we have on the laptop, a 3 nodes RAC (Flex Cluster, Flex ASM) will take ~ 1hour to deploy so you will should not see the end of the deployment. By comparison, a similar deployment on bare metal/OVM environment could take around 20-30 minutes.

TO DO :
- ssh on ovmm10471.oow.local (credential root/ovsroot)
  ssh root@192.168.56.30
- Copy the "DeployCluster" tool from your laptop to the Oracle VM Manager machine (from an other ssh session execute):
  cd <directory_contains_deployclustertool>
  scp deploycluster_internal_hol10471.tar.gz root@192.168.56.30:/root/
- Extract content of the file copied above:
  tar xvfz deploycluster_internal_hol10471.tar.gz
- You should find following directory :
  o deploycluster directory

- change directory to /root/deploycluster/utils and check netconfig12cRAC3node.ini :

```
# Node specific information
NODE1=racnode01h                                        # Node 1 name
NODE1IP=192.168.56.120                                  # Node 1 IP adress
NODE1PRIV=racnode01h-priv                               # Private IP name for RAC
NODE1PRIVIP=10.10.10.230                                # Private IP for RAC
NODE1VIP=racnode01h-vip                                 # Virtual IP name for RAC
NODE1VIPIP=192.168.56.230                               # Virtual IP for RAC
NODE1ROLE=HUB                                           # ROLE NODE (HUB or LEAF)

NODE2=racnode02h
NODE2IP=192.168.56.121
NODE2PRIV=racnode02h-priv
NODE2PRIVIP=10.10.10.231
NODE2VIP=racnode02h-vip
NODE2VIPIP=192.168.56.231
NODE2ROLE=HUB

NODE3=racnode03h
NODE3IP=192.168.56.122
NODE3PRIV=racnode03h-priv
NODE3PRIVIP=10.10.10.232
NODE3VIP=racnode03h-vip
NODE3VIPIP=192.168.56.232
NODE3ROLE=LEAF

# Common data
PUBADAP=eth0                                            # Public interface is eth0
PUBMASK=255.255.255.0
PUBGW=192.168.56.1
PRIVADAP=eth1                                           # Private interface is eth1
PRIVMASK=255.255.255.0
RACCLUSTERNAME=oow12c                                   # Cluster name
DOMAINNAME=oow.local  # May be blank
DNSIP=  # Starting from 2013 Templates allows multi value
# Device used to transfer network information to second node
# in interview mode
NETCONFIG_DEV=/dev/xvdc
# 11gR2 specific data
SCANNAME=oow12c-scan                                    # SCAN name
SCANIP=192.168.56.235                                   # SCAN IP address
GNS_ADDRESS=192.168.56.236                              # Grid Naming Service IP address

# 12c Flex parameters (uncomment to take effect)
FLEX_CLUSTER=yes  # If 'yes' implies Flex ASM as well   # Building a FLEX Cluster
FLEX_ASM=yes
ASMADAP=eth2  # Must be different than private/public   # FLEX ASM require dedicated net
ASMMASK=255.255.255.0
NODE1ASMIP=10.11.0.230
NODE2ASMIP=10.11.0.231
NODE3ASMIP=10.11.0.232

# Single Instance (description in params.ini)
# CLONE_SINGLEINSTANCE=yes  # Setup Single Instance
#CLONE_SINGLEINSTANCE_HA=yes # Setup Single
Instance/HA (Oracnodele Restart)
```

3.2 RUNNING DEPLOYCLUSTER.PY

Deploycluster tool can be run with several parameters, here we will use :
- -u : Oracle VM Manager user
- -M : list of VMs
- -N : netconfig file to be used during deployment
- -P : parameter for the building cluster
- -D : Dryrun mode to see a simulation of the operation that will be performed

TO DO :

- change to directory /root/deploycluster
- run the following deploy command in Dryrun mode :
  ./deploycluster.py -u admin -p Welcome1 -H localhost --vms racnode0.? -N utils/netconfig12cRAC3node.ini -P utils/params12c.ini -D


```
                                                                    Term – root@ovmm1
Oracle VM Manager Core WS-API Shell 3.3.3.1085 (20150712_1085)

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Connecting to https://localhost:7002/...
Successfully connected to Oracle VM Manager Core API endpoint...

INFO: Oracle VM Client CONNECTED to Oracle VM Manager (3.3.3.1085) UUID (0004fb0000010000e2ba538072d38c24)

INFO: Inspecting utils/netconfig12cRAC3node.ini for number of nodes defined....
INFO: Detected 3 nodes in: utils/netconfig12cRAC3node.ini

INFO: Located a total of (3) VMs;
      3 VMs with a simple name of: ['racnode0.1', 'racnode0.2', 'racnode0.3']

INFO: Detected (2) Hub nodes and (1) Leaf node in the Flex Cluster

INFO: Detected a RAC deployment...

INFO: Starting all (3) VMs -- "dryrun" mode

INFO: VM with a simple name of "racnode0.1" (Hub node) is in a Stopped state, however, not starting it due to "dryrun" option passed on command line.

INFO: VM with a simple name of "racnode0.2" (Hub node) is in a Stopped state, however, not starting it due to "dryrun" option passed on command line.

INFO: VM with a simple name of "racnode0.3" (Leaf node) is in a Stopped state, however, not starting it due to "dryrun" option passed on command line.

INFO: Verifying that all (3) VMs are in Running state and pass prerequisite checks -- "dryrun" mode...

INFO: Detected Flex ASM enabled with a dedicated network adapter (eth2), all VMs will require a minimum of (3) Vnics...
...

INFO: Detected that all (2) Hub node VMs specified on command line have (1) common shared disk between them (ASM_MIN_DISKS=1)

INFO: The (3) VMs passed basic sanity checks (dry-run mode), not sending cluster details as follows:
      netconfig.ini (Network setup): utils/netconfig12cRAC3node.ini
      params.ini (Overall build options): utils/params12c.ini
      buildcluster: yes

INFO: Exiting without sending above parameters due to "dryrun" option passed on command line.

INFO: deploycluster.py completed successfully at 10:26:50 in 12.1 seconds (0h:00m:12s)
Logfile at: /root/deploycluster/deploycluster1.log
[root@ovmm10471 deploycluster]#
```

Figure 3.2.1

- Check for any error, all steps should be green, if not, correct any issue
- When OK, run the same command than before without the -D :
  ./deploycluster.py -u admin -p Welcome1 -H localhost --vms racnode0.? -N utils/netconfig12cRAC3node.ini -P utils/params12c.ini

Here an output example:

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```
Connecting to https://localhost:7002/...
Successfully connected to Oracle VM Manager Core API endpoint...

INFO: Oracle VM Client CONNECTED to Oracle VM Manager (3.3.3.1085) UUID (0004fb0000010000e2ba538072d38c24)

INFO: Inspecting utils/netconfig12cRAC3node.ini for number of nodes defined....
INFO: Detected 3 nodes in: utils/netconfig12cRAC3node.ini

INFO: Located a total of (3) VMs;
      3 VMs with a simple name of: ['racnode0.1', 'racnode0.2', 'racnode0.3']

INFO: Detected (2) Hub nodes and (1) Leaf node in the Flex Cluster

INFO: Detected a RAC deployment...

INFO: Starting all (3) VMs...

INFO: VM with a simple name of "racnode0.1" (Hub node) is in a Stopped state, attempting to start it........OK.

INFO: VM with a simple name of "racnode0.2" (Hub node) is in a Stopped state, attempting to start it........OK.

INFO: VM with a simple name of "racnode0.3" (Leaf node) is in a Stopped state, attempting to start it........OK.

INFO: Verifying that all (3) VMs are in Running state and pass prerequisite checks...

INFO: Detected Flex ASM enabled with a dedicated network adapter (eth2), all VMs will require a minimum of (3) Vnics...
...

INFO: Detected that all (2) Hub node VMs specified on command line have (1) common shared disk between them (ASM_MIN_DISKS=1)

INFO: The (3) VMs passed basic sanity checks and in Running state, sending cluster details as follows:
      netconfig.ini (Network setup): utils/netconfig12cRAC3node.ini
      params.ini (Overall build options): utils/params12c.ini
      buildcluster: yes

INFO: Starting to send configuration details to all (3) VM(s).........
INFO: Sending to VM with a simple name of "racnode0.1" (Hub node).............
INFO: Sending to VM with a simple name of "racnode0.2" (Hub node).......
INFO: Sending to VM with a simple name of "racnode0.3" (Leaf node)........

INFO: Configuration details sent to (3) VMs...
      Check log (default location /u01/racovm/buildcluster.log) on build VM (racnode0.1)...

INFO: deploycluster.py completed successfully at 10:43:25 in 61.1 seconds (0h:01m:01s)
Logfile at: /root/deploycluster/deploycluster3.log
[root@ovmm10471 deploycluster]#
```

- In Oracle VM Manager GUI, check that all VMs are starting/running and open a console on VM racnode0.1 by selecting the VM and clicking on 🖥 (Figure 3.2.2)
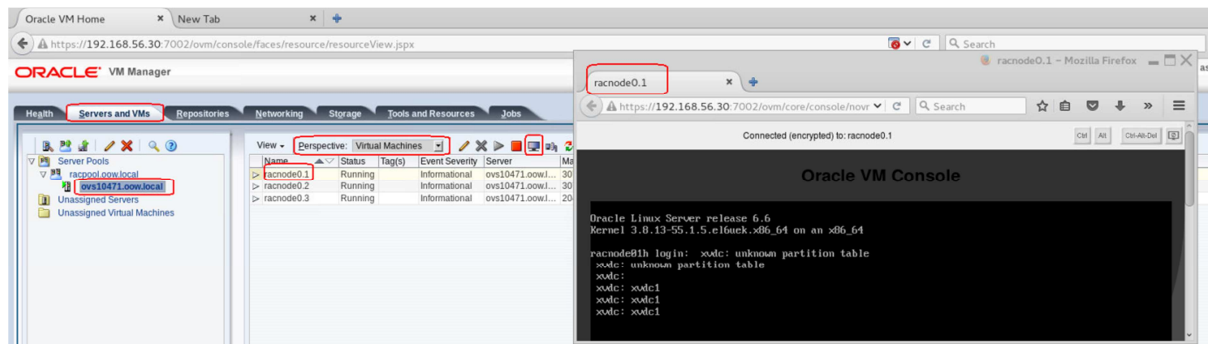
(Figure 3.2.2)

It is possible to monitor the buildcluster progress, by ssh to the first VM (rac.0) and looking at /u01/racovm/buildcluster.log. This logfile will have all commands executed in verbose mode, so you can see as the various tools, like clone.pl, netca, emca are executed along with their output.

TO DO :
- Wait for prompt login on VM racnode0.1

- Connect on VM racnode0.1 using ssh (as defined in netconfig file IP of the VM is 192.168.56.120)
  ssh root@192.168.56.120 (password is ovsroot)
- Check progress in the log file of the buildcluster operation : /u01/racovm/buildcluster.log
  tail -f /u01/racovm/buildcluster.log
- On the VMs you can also find a wrapped script (/usr/local/bin/crsstat) able to show cluster resources and their status by executing (Figure 3.2.3):
  crsstat -t

```
[root@racnode01h ~]# crsstat -t
HA Resource                      Type                       Target           State
---------------------------      ---------------------      ---------------  -------------------------
ora.ASMNET1LSNR_ASM.lsnr         ora.asm_listener.type      ONLINE, ONLINE   ONLINE on racnode01h, ONLINE on racnode02h
ora.DATA.dg                      ora.diskgroup.type         ONLINE, OFFLINE  ONLINE on racnode01h, OFFLINE
ora.LISTENER.lsnr                ora.listener.type          ONLINE, OFFLINE  ONLINE on racnode01h, OFFLINE
ora.LISTENER_LEAF.lsnr           ora.leaf_listener.type     OFFLINE,         OFFLINE,
ora.LISTENER_SCAN1.lsnr          ora.scan_listener.type     ONLINE,          ONLINE on racnode01h,
ora.asm                          ora.asm.type               ONLINE, ONLINE   ONLINE on racnode01h, OFFLINE
ora.cvu                          ora.cvu.type               OFFLINE,         OFFLINE,
ora.gns                          ora.gns.type               ONLINE,          ONLINE on racnode01h,
ora.gns.vip                      ora.gns_vip.type           ONLINE,          ONLINE on racnode01h,
ora.net1.network                 ora.network.type           ONLINE, ONLINE   ONLINE on racnode01h, ONLINE on racnode02h
ora.oc4j                         ora.oc4j.type              OFFLINE,         OFFLINE,
ora.ons                          ora.ons.type               ONLINE, ONLINE   ONLINE on racnode01h, ONLINE on racnode02h
ora.racnode01h.vip               ora.cluster_vip_net1.type  ONLINE,          ONLINE on racnode01h,
ora.scan1.vip                    ora.scan_vip.type          ONLINE,          ONLINE on racnode01h,
[root@racnode01h ~]#
```

Figure 3.2.3

Congratulations,
You are now at the end of this HOL session.
As you can see you are pretty much at the limit of what we can achieve with a "small" laptop..
Because of several laptop resources limitation (CPU, disk access and network bandwidth) the RAC deployment should take more than 50 minutes and you should not be able to see the end of the deployment during this session.

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4 REFERENCES:

4.1 ORACLE VM 3.3 DOCUMENTATION

http://docs.oracle.com/cd/E50245_01/

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Oracle VM Web Services API Developer's Guide for Release 3.3	ePub	HTML	PDF
Oracle VM Security Guide for Release 3.3	ePub	HTML	PDF
Oracle VM Paravirtual Drivers Installation Guide for Microsoft Windows for Release 3.2.3	ePub	HTML	PDF
Oracle VM Third-Party Licensing Information for Release 3.3	ePub	HTML	PDF

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4.2 DB/RAC ORACLE VM TEMPLATE DOCUMENTATION

http://www.oracle.com/technetwork/server-storage/vm/database-templates-12c-11gr2-1972804.html

Oracle VM Templates for Oracle Database - Availability

Number	Name	Version	Release Date	Usage Notes	Download From
11.	**Single Instance** & Oracle Real Application Clusters (RAC) 12c Release 1 (64-bit) on Oracle Linux **6.4** (w/OVMAPI Support)	12.1.0.1.0	AUG2013	For Test / For Production	Images hosted on the Software Delivery Cloud **Media Pack:** B74026-01 "Oracle VM Templates for Oracle Database Media Pack for x86 (64 bit)" **Files:** V38984-01, V38985-01
10.	**Single Instance** & Oracle Real Application Clusters (RAC) 11g Release 2 (x86 32-bit and 64-bit) on Oracle Linux **5.9** (w/OVMAPI Support)	11.2.0.3.7	AUG2013	For Test For Production	My Oracle Support Patch# 14000092 32Bit & 64Bit Linux
9.	Oracle Real Application Clusters (RAC) 11g Release 2 (x86 32-bit and 64-bit) on Oracle Linux **6.2** (w/OVMAPI Support)	11.2.0.3.2	JUN2012, AUG2012 (update)	For Test For Production	My Oracle Support Patch# 13818831 32Bit & 64Bit Linux
8.	Oracle Real Application Clusters (RAC) 11g Release 2 (x86 32-bit and 64-bit) on Oracle Linux **5.8** (w/OVMAPI Support)	11.2.0.2.6	MAY2012	For Test For Production	My Oracle Support Patch# 14000016 32Bit & 64Bit Linux
7.	Oracle Real Application Clusters (RAC) 11g Release 2 (x86 32-bit and 64-bit) on Oracle Linux **5.7**	11.2.0.3.0	SEP2011	For Test For Production	My Oracle Support Patch# 12694014 32Bit & 64Bit Linux
6.	Oracle Real Application Clusters (RAC) 11g Release 2 (x86 32-bit and 64-bit) on Oracle Linux **5.6**	11.2.0.2.2	JUL2011	For Test For Production	My Oracle Support Patch# 11836831 32Bit & 64Bit Linux
5.	Oracle Real Application Clusters (RAC) 11g Release 2 (x86 32-bit and 64-bit) on Oracle Linux **5.5**	11.2.0.1.4	APR2011	For Test / For Production	Images hosted on the Software Delivery Cloud **Media Pack:** B60419-02 "Oracle VM Templates for Oracle RAC 11gR2 Media Pack for x86_64 (64 bit)" or B60417-02 "Oracle VM Templates for Oracle RAC 11gR2 Media Pack for x86 (32 bit)"

More versions available, see My Oracle Support Note ID 1185244.1

4.3 ORACLE FLEX ASM

In a typical Grid Infrastructure installation, each node will have its own ASM instance running and act as the storage container for the databases running on the node. There is a single point-of-failure threat with this setup. For example, if the ASM instance on the node suffers or fails, all the databases and instances running on the node will be impacted. To avoid ASM instance single-point-failure, Oracle 12c provides a Flex ASM feature. The Flex ASM is a different concept and architecture all

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together. Only a fewer number of ASM Instances need to run on a group of servers in the cluster. When an ASM instance fails on a node, Oracle Clusterware automatically starts reviving (replacement) the ASM instance on a different node to maintain availability. In addition, this setup also provides ASM instance load balancing capabilities for the instances running on the node. Another advantage of Flex ASM is that it can be configured on a separate node.
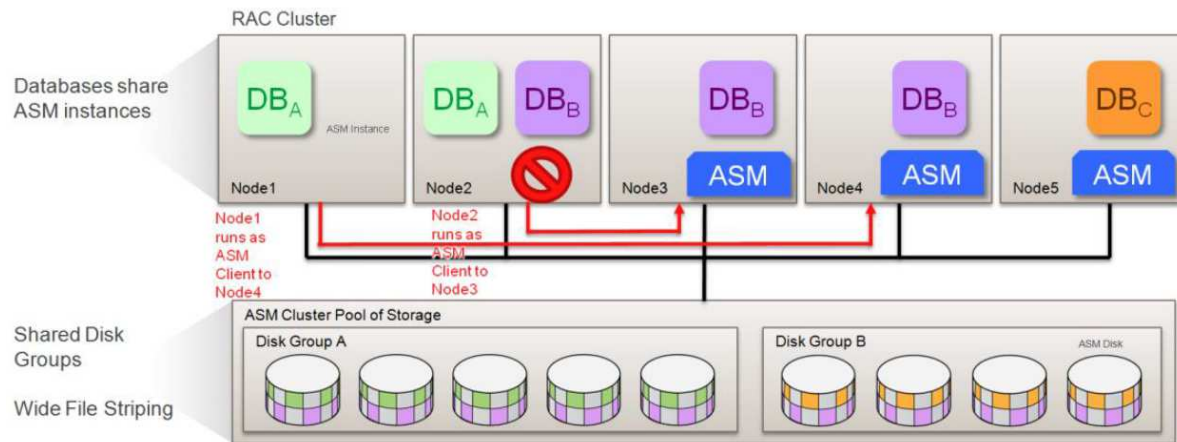
4.4 ORACLE FLEX CLUSTER

Oracle 12c support two types of cluster configuration at the time of Clusterware installation: Traditional Standard Cluster and Flex cluster. In a traditional standard cluster, all nodes in a cluster are tightly integrated to each other and interact through a private network and can access the storage directly. On the other hand, the Flex Cluster introduces two types of nodes arranged in Hub and Leaf nodes architecture. The nodes arranged in Hub nodes category are similar to the traditional standard cluster, i.e. they are interconnected to each other through a private network and have the directly storage read/write access. The Leaf nodes are different from the Hub nodes. They don't need to have direct access to the underlying storage; rather they access the storage/data through Hub nodes.

You can configure Hub nodes up to 64, and Leaf nodes can be many. In an Oracle Flex Cluster, you can have Hub nodes without having Leaf nodes configured, but no Leaf nodes exist without Hub nodes. You can configure multiple Leaf nodes to a single Hub node. In Oracle Flex Cluster, only Hub nodes will have direct access to the OCR/Voting disks. When you plan large scale Cluster environments, this would be a great feature to use. This sort of setup greatly reduces interconnect traffic, provides room to scale up the cluster to the traditional standard cluster.

4.5 THIS DOCUMENT

This document can be found on https://blogs.oracle.com/scoter