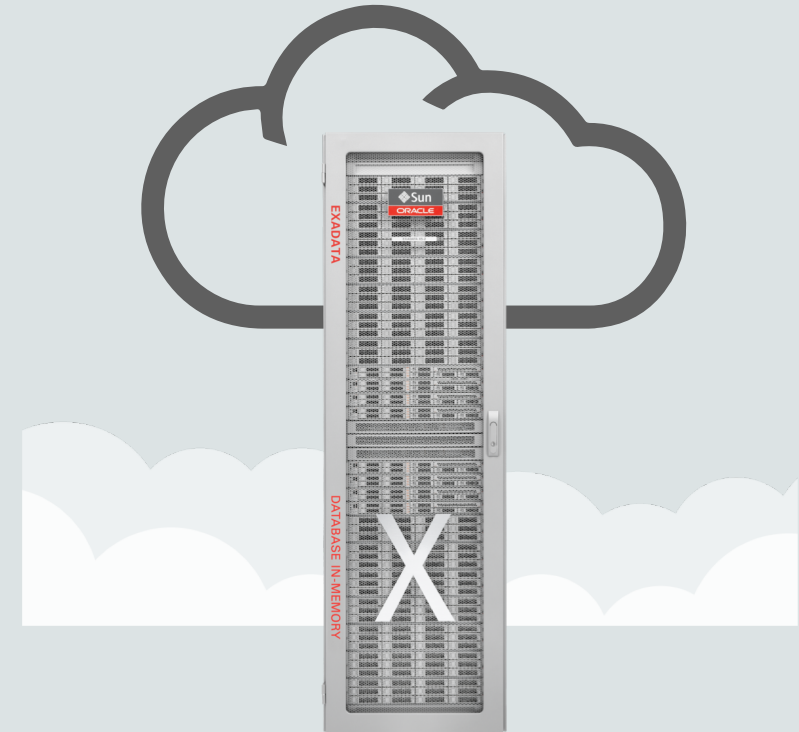# Oracle Exadata and OVM Best Practice Overview

Jul 2018 Update

Topics Covered

Use Cases

Exadata OVM Software Requirements

Exadata Isolation Considerations

Exadata OVM Sizing and Prerequisites

Exadata OVM Deployment Overview

Exadata OVM Administration and Operational Life Cycle

Migration, HA, Backup/Restore, Upgrading/Patching

Monitoring, Resource Management

Exadata Virtual Machines

High-Performance Virtualized Database Platform

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VM

No Additional Cost

X7-2, X6-2, X5-2, X4-2, X3-2, X2-2

DB 11.2 and higher

FINANCE

SALES

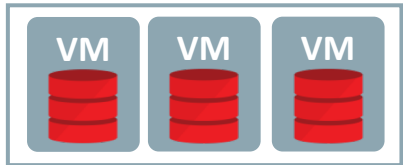DATABASE IN-MEMORY

X

SUPPLY CHAIN

- **VMs provide CPU, memory, OS, and sysadmin <u>isolation</u> for consolidated workloads**
  - Hosting, cloud, cross department consolidation, test/dev, non-database or third party applications
- **Exadata VMs deliver near raw hardware performance**
  - I/Os go directly to high-speed InfiniBand bypassing hypervisor
- **Combine with Exadata network and I/O prioritization to achieve unique full stack isolation**
- **Trusted Partitions allow licensing by virtual machine**

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Exadata Consolidation Options
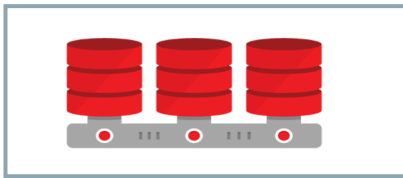
Dedicated
DB Servers

Virtual
Machines

Many DBs in
one Server

Database 12c
Multitenant

More Isolation

More Efficient

- **VMs have good Isolation but poor efficiency and high management**
  - VMs have separate OS, memory, CPUs, and patching
  - Isolation without need to trust DBA, System Admin

- **Database consolidation in a single OS is highly efficient but less isolated**
  - DB Resource manager isolation adds no overhead
  - Resources can be shared much more dynamically
  - But, must trust admins to configure systems correctly

- **Best strategy is to combine VMs with database native consolidation**
  - Multiple trusted DBs or Pluggable DBs in a VM
  - Few VMs per server to limit overhead of fragmenting CPUs/memory/patching etc.

Software Architecture Comparison

Database Server: Bare Metal / Physical versus OVM

Bare Metal / Physical Database Server

Oracle GI/DB homes

Exadata (Linux, fw)

OVM Database Server

dom0

Exadata (Linux, Xen, fw)

domU-1

Oracle GI/DB homes

Exadata (Linux)

domU-2

domU-3

No change to **Storage Grid**, **Networking,** or **Other**

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Major Differences Between Physical and OVM

- Details expanded throughout remaining slides

Topic	How OVM differs from Physical
Hardware support	2-socket only
Cluster config	System has one or more VM clusters, each with own GI/RAC/DB install
Exadata storage config	Separate griddisks/DATA/RECO for each VM cluster; By default no DBFS disk group
Dbnode disk config	VM filesystem sizes are small; GI/DB separate filesystems
Software updates	Dbnodes require separate dom0 (Linux+fw) and domU (Linux) patchmgr updates
Exachk	Run once for dom0/cells/ibswitches, run once for each VM cluster
Enterprise Manager	EM + Exadata plugin + Virtualization Infrastructure plugin

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Exadata VM Usage

- Primary focused on consolidation and isolation
- Can only run certified Oracle Linux versions
  - Windows, RedHat, and other guest operating systems are not supported
- Can virtualize other lightweight products
  - E.g. Lightweight apps, management tools, ETL tools, security tools, etc.
- Not recommended for heavyweight applications
  - E.g. E-business Suite or SAP application tier
  - Instead use Exalogic, Supercluster, or Private Cloud Appliance

Exadata OVM Requirements

- Hardware
  - 2-socket database servers supported (X2-2 and later)

- Software
  - Recommend latest Exadata 18.1 software
    - Supplied software (update with patchmgr - see MOS 888828.1)
      - domU and dom0 run same UEK kernel as physical (e.g. 4.1.12-94.8.4.el6uek (ueknano) for 18.1.7.0.0)
      - domU runs same Oracle Linux (OL) as physical (e.g. OL 6.9 for 18.1.7.0.0)
      - dom0 runs Oracle VM Server (OVS) 3.x (e.g. OVS 3.4.4 for 18.1.7.0.0)
  - Grid Infrastructure / Database
    - Recommend 18, 12.2.0.1, or 12.1.0.2 with latest quarterly update
    - Supported 18, 12.2.0.1, 12.1.0.2, or 11.2.0.4

Exadata Security Isolation Recommendations

- Each VM RAC cluster has its own Exadata grid disks and ASM Disk Groups
  - [Setting Up Oracle ASM-Scoped Security on Oracle Exadata Storage Servers](#)

- 802.1Q VLAN Tagging for Client and Management Ethernet Networks
  - Dbnodes configured w/ OEDA during deployment (requires pre-deployment switch config)
  - Or configure manually post-deployment
    - Client network - MOS 2018550.1   Management network - MOS 2090345.1

- InfiniBand Partitioning with PKEYs for Exadata Private Network
  - OS and InfiniBand switches configured w/ OEDA during deployment

- Storage Server administration isolation through ExaCLI

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Exadata OVM Sizing Recommendations

- Use Reference Architecture Sizing Tool to determine CPUs, memory, disk space needed by each database

  - Sizing evaluation should be done prior to deployment since OEDA will deploy your desired VM configuration in an automated and simple manner.

  - Changes can be made post deployment, but requires many more steps

  - Sizing approach does not really change except for accommodating DOM0, and additional system resources per VM

  - Sizing tool currently does not size virtual systems

  - Consider dom0 memory and CPU usage in sizing

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Memory Sizing Recommendations

- Can not over-provision physical memory

  - Sum of all VM + dom0 memory used cannot exceed physical memory

- dom0 memory sizing

  - Change dom0 memory size **<u>only</u>** for database servers with memory expansion. See MOS xxxxxxx.1.

- VM memory sizing

  - Minimum 16 GB per VM to support starter database, plus OS, Java, GI/ASM, etc.

    - Increase VM memory for larger database or additional databases (DB processes, PGA, SGA)

  - Maximum 720 GB for single VM (X6-2/X7-2 with memory expansion)

  - VM memory can **not** be changed online (no ballooning), memory resize requires reboot

  - OEDA VM template defaults (Adjustable at config time)

    - Small – 16 GB; Medium – 32 GB; Large – 64 GB

CPU Sizing Recommendations

- CPU over-provisioning is possible
  - But workload performance conflicts can arise if all VMs become fully active
  - Dom0 allocated 2 cores (4 vCPUs)

- Minimum per VM is 1 core (2 vCPUs)
  - 1 vCPU == 1 hyper-thread; 1 core == 2 hyper-threads == 2 vCPUs

- Maximum per VM is number of cores minus 2 for dom0
  - Example X7-2 maximum is 46 cores per VM (48 total minus 2 for dom0)

- Number of vCPUs assigned to a VM can be changed online

- OEDA VM template defaults (Adjustable at config time)
  - Small – 2 cores (4 vCPUs); Medium – 4 cores (8 vCPUs); Large – 8 cores (16 vCPUs)

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Local Disk Sizing Recommendations

- Total local disk space for VMs is 1.6TB (X4 and later), 3.7TB with disk expansion kit

- Disk space used per VM at deployment depends on VM size selected in OEDA
  - Small 190 GB; Medium 210 GB; Large 230 GB (selectable but <u>not</u> adjustable in OEDA)
    - 70 GB system (root sys1/sys2, swap)
    - 100 GB software homes (50 GB GIhome, 50 GB DBhome)
    - User /u01 – Small template 20 GB; Medium template 40 GB; Large template 60 GB
  - Actual allocated space for domU disk images <u>initially</u> much lower due to sparseness and shareable reflinks, but will grow with domU use as shared space diverges and becomes less sparse
    - Over-provisioning disk may cause unpredictable out-of-space errors inside VMs if dom0 space is exhausted
    - Restoring VM backup will reduce (may eliminate) space savings (i.e. relying on over-provisioning may prevent full VM restore)
    - Long lived / prod VMs should budget for full space allocation (assume no benefit from sparseness and shareable reflinks)
    - Short lived test/dev VMs can assume 100 GB allocation

- DomU local space can be extended after initial deployment by adding local disk images
  - Additionally, domU space can be extended with shared storage (e.g. ACFS, DBFS, external NFS) for user / app files
  - Avoid shared storage for Oracle/Linux binaries/config files. Access/network issues may cause system crash or hang.

Database Server Disk Expansion

- 2 socket database servers have 8 disk bays, only 4 are populated out of the factory

- Virtual Machines need more storage on the database servers

- X7-2, X6-2, and X5-2 database servers now support 8 x 600 GB HDDs
  - Only two supported configurations 4 drives or 8 drives
  - Servers will ship with only 4 drives out of the factory, customers can add 4 more hard drives in the field

- Minimum software version – Exadata Storage Software 12.1.2.3.0

Exadata Storage Recommendation

- DATA/RECO size for initial VM clusters should consider future VM additions
  - Using all space initially will require shrinking existing DATA/RECO before adding new
- Spread DATA/RECO for each VM cluster across all disks on all cells
  - By default no DBFS disk group
- Enable ASM-Scoped Security to limit grid disk access

VM Cluster	Cluster nodes	Grid disks (DATA/RECO for all clusters on all disks in all cells)
clu1	db01vm01 db02vm01	DATAC1_CD_{00..11}_cel01 RECOC1_CD_{00..11}_cel01 DATAC1_CD_{00..11}_cel02 RECOC1_CD_{00..11}_cel02 DATAC1_CD_{00..11}_cel03 RECOC1_CD_{00..11}_cel03
clu2	db01vm02 db02vm02	DATAC2_CD_{00..11}_cel01 RECOC2_CD_{00..11}_cel01 DATAC2_CD_{00..11}_cel02 RECOC2_CD_{00..11}_cel02 DATAC2_CD_{00..11}_cel03 RECOC2_CD_{00..11}_cel03

Deployment Specifications and Limits

	Hardware	X2-2	X3-2	X4-2	X5-2	X6-2	X7-2
VMs	Max VMs per database server	8					
Memory	Physical per node (default/max)	72 GB 144 GB	256 GB 512 GB	256 GB 512 GB	256 GB 768 GB	256 GB 1.5 TB	384 GB 1.5 TB
	Min per domU	16 GB min + additional DBs or app memory					
	Max per domU	96 GB	464 GB			720 GB	
	OEDA template defaults	Small – 16 GB; Medium – 32 GB; Large – 64 GB (adjustable at config time)					
CPU*	Cores* per node	12	16	24	36	44	48
	Min per VM	1 core (2 vCPUs)					
	Max per VM	Cores minus 2 (dom0 assigned 2 cores/4vCPUs)					
	OEDA template defaults	Small – 2 cores; Medium – 4 cores; Large – 8 cores (adjustable at config time)					
Disk	Total usable disk per node for all domUs	700 GB		1.6 TB	1.6 TB (3.7 TB w/ DB Storage Expansion Kit)		
	Used disk per domU at deployment (based on OEDA templates)	Small 190 GB; Medium 210 GB; Large 230 GB (not adjustable at config time) Actual allocated space for domU disk images initially much lower due to sparseness and shareable reflinks, but will grow with domU use as shared space diverges and becomes less sparse, hence budget for these values when sizing.					

*1 core = 1 OCPU = 2 hyper-threads = 2 vCPUs

Deployment Overview

- **OEDA is the only tool that should be used to create VMs on Exadata**

1. Create configuration with OEDA Configuration Tool

2. Prepare customer environment for OEDA deployment
   - Configure DNS, configure switches for VLANs (if necessary)

3. Prepare Exadata system for OEDA deployment
   - switch_to_ovm.sh; reclaimdisks.sh; applyElasticConfig.sh

4. Deploy system with OEDA Deployment Tool

Note: OS VLAN config can be done by OEDA or post deployment (MOS 2018550.1)

OEDA Configuration Tool

Advanced Network Configuration

- Ethernet Network 802.1Q VLAN Tagging

  – For OVM define VM-specific VLAN IDs in Cluster configuration pages later on

  – Ethernet switches (customer and Cisco) must have VLAN tag configuration done before OEDA deployment

- InfiniBand Network Partitioning with PKEYS

Advanced Setting

☑ Enable Infiniband Security
☑ Enable Network VLAN
☐ Enable Sparse DiskGroup
  (Requires GI Version >= 12.1.0.2 DBBP5)
☐ Remove PDU Nodes

OK

Define Customer Networks

Exadata requires a minimum of 2 separate customer subn... which is the Private infinband network. Some customers ... 'backup', 'replication', 'dr' or for an 'independent client' net... mandatory for deployment
Click Advanced button to enable infiniBand security and V...

Subnet 1

Name : **Admin**   ○ Bonded
Subnet Mask : 255.255.255.0   ⊙ Non Bonded
Gateway : 1.1.1.1   VLAN ID : 1000
Admin Network Format : ⊙ 1/10 Gbit Copper Base-T ○ 10 Gbit Optical

Subnet 2

Name : **Client**   ⊙ Bonded
Subnet Mask : 255.255.255.0   ○ Non Bonded
Gateway : 2.2.2.1   VLAN ID : 2000
Client Network Format : ⊙ 1/10 Gbit Copper Base-T ○ 10 Gbit Optical

Subnet 3

Name : **Private**   ⊙ Bonded
Subnet Mask : 255.255.252.0   ○ Non Bonded
Private Network Format : ⊙ InfiniBand
  ☑ Implement InfiniBand Network Security

Subnet 4

☐ Available Network : Backup   ○ Bonded ☐ Share Client Network ports
  ...net Mask : 255.255.255.0   ⊙ Non Bonded

Advanced...   Import...   Oracle VM Defaults...   Save

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OEDA Configuration Tool

Identify Nodes

- Screen to decide OVM or Physical
  - All OVM
  - All Physical
  - Some OVM, some physical

OEDA Configuration Tool

Define Clusters

- Decide
  - Number of VM clusters to create
  - Dbnodes and Cells that will make up those VM clusters
    - Recommend using all cells

- What is a "VM cluster?"
  - 1 or more user domains on different database servers running Oracle GI/RAC, each accessing the same shared Exadata storage managed by ASM.

Define Clusters

Number of Clusters to create : 2

Cluster 1 | Cluster 2

Cluster Name : cluster-clu1

OVS dm01dbadm01.domain.com
OVS dm01dbadm02.domain.com
CELL dm01celadm01.domain.com
CELL dm01celadm02.domain.com
CELL dm01celadm03.domain.com

Add >
All >>
Remove <
Clear <<

dm01dbadm01.domain.com - Guest
dm01dbadm02.domain.com - Guest
dm01celadm01.domain.com
dm01celadm02.domain.com
dm01celadm03.domain.com

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OEDA Configuration Tool

Cluster Configuration

- Each VM cluster has its own configuration page
  - VM size (memory, CPU)
  - Exadata software version
  - Networking config
  - OS users and groups
  - GI/DB version and location
  - Starter database config
  - ASM disk group config

OEDA Configuration Tool

Cluster Configuration

- Virtual Guest size
  - Define CPU and Memory configured during deployment
  - Adjust by changing defaults
  - 1 vCPU == 1 hyper-thread
  - 1 core == 2 hyper-threads == 2 vCPUs
  - /u01 "local disk" size is fixed
    - Small 20GB; Medium 40GB; Large 60GB
    - GI/DB homes are separate fs (not /u01)

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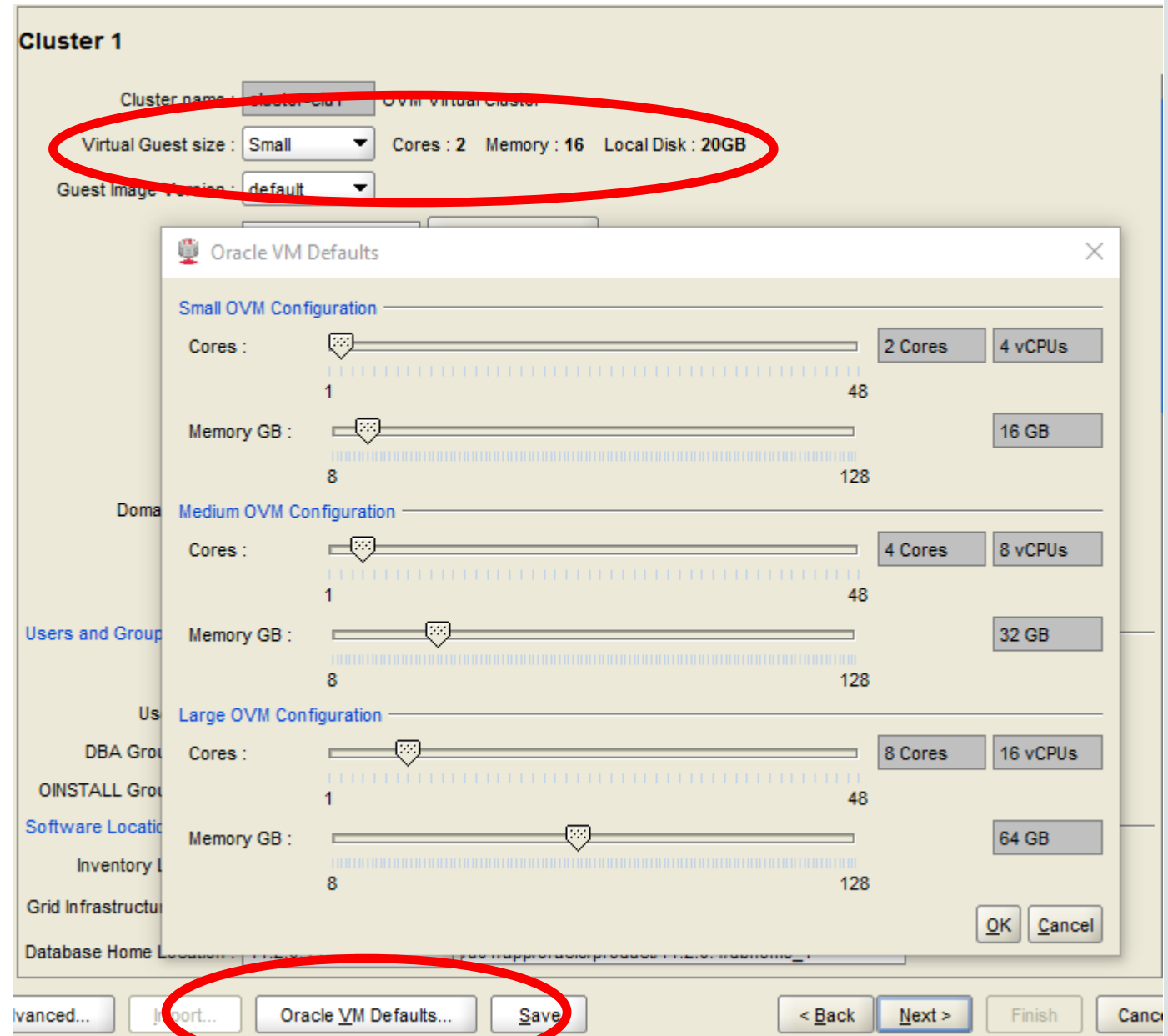
OEDA Configuration Tool

Cluster Configuration

- Grid infrastructure installed in each VM (grid disks "owned" by a VM cluster)
  - Cluster 1 - DATAC1 / RECOC1 across all cells
  - Cluster 2 - DATAC2 / RECOC2 across all cells
  - Consider future clusters when sizing
  - DBFS not configured
  - **ASM-Scoped Security** permits a cluster to access only its own grid disks. Available with Advanced button.

Cluster 1

Disk Group Details

Diskgroup Layout : ○ Legacy 80%:20%   ○ Legacy 40%:60%   ◉ Custom

DBFS DiskGroup : [   ] [UNUSED ▼] Size : [   ]

DATA DiskGroup : [DATAC1] [HIGH ▼] Size : [3TB]

RECO DiskGroup : [RECOC1] [NORMAL ▼] Size : [2TB]

☑ Configure ASM-Scoped Security Model

Cluster 2

Disk Group Details

Diskgroup Layout : ○ Legacy 80%:20%   ○ Legacy 40%:60%   ◉ Custom

DBFS DiskGroup : [   ] [UNUSED ▼] Size : [   ]

DATA DiskGroup : [DATAC2] [HIGH ▼] Size : [3TB]

RECO DiskGroup : [RECOC2] [NORMAL ▼] Size : [2TB]

☐ Configure ASM-Scoped Security Model

If this is a **critical production database**, Oracle recommends configuring the **DATA** diskgroup with **HIGH** redundancy

Initial Database

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OEDA Configuration Tool

Cluster Advanced Network Configuration

- Ethernet VLAN ID and IP details
  - To separate Ethernet traffic across VMs, use distinct VLAN ID and IP info for each cluster

- InfiniBand PKEY and IP details
  - Typically just use OEDA defaults
  - **Compute Cluster network** for dbnode-to-dbnode RAC traffic. Separates IB traffic by using distinct Cluster PKEY and IP subnet for each cluster.
  - **Storage network** for dbnode-to-cell or cell-to-cell traffic - same PKEY/subnet for all clusters

Cluster 1

Client Network
- Base Adapter : Client   Domain : x.com
- Start IP : 2.2.2.2
- Subnet Mask : 255.255.255.0   Pool size : 19
- Gateway IP : 2.2.2.1   VLAN ID : 1002
- Name mask : dm01%%vm01   Start Id : 1
- VIP Name mask : dm01%%vm01-vip   Start Id : 1
- SCAN Name : dm01-scan   SCAN Port : 1521
- ☐ Define Domu client hostname for database servers

InfiniBand Partitioning - Compute Cluster Network
- Cluster PKEY : 0xa000
- Subnet Mask : 255.255.254.0
- Start IP : 192.168.112.1
- Name Mask : dm01db%%vmclu01-priv   Start ID : 1

InfiniBand Partitioning - Storage Network
- Storage PKEY : 0xaa00
- Subnet Mask : 255.255.254.0
- Start IP : 192.168.12.1
- Compute Name Mask : dm01db%%vm01str-priv   Start ID : 1
- Cell Name Mask : dm01cell%%vmclu01-priv   Start ID : 1

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OEDA Configuration Tool

Review and Edit

- This page lists all network details for each VM guest in all VM clusters

Review and Edit SCAN, Client, VIP and optional Backup Networks

[Re-Generate] [Lookup IP]

Cluster cluster-clu1

SCAN Name : dm01-scan

SCAN IP : 1.1.2.6 | 1.1.2.7 | 1.1.2.8

Compute Node 1

Admin Name : dm01adm01vm01   IP : 1.1.1.17
Client Name : dm0101vm01   IP : 1.1.2.2
VIP Name : dm0101vm01-vip   IP : 1.1.2.3
Private Name : dm01db01vm01-priv1   IP : 192.168.10.11

Compute Node 2

Admin Name : dm01adm02vm01   IP : 1.1.1.18
Client Name : dm0102vm01   IP : 1.1.2.4
VIP Name : dm0102vm01-vip   IP : 1.1.2.5
Private Name : dm01db02vm01-priv1   IP : 192.168.10.13

Cluster cluster-clu2

SCAN Name : dm01-scan2

OEDA Configuration Tool

Installation Template

- Verify proper settings for all VM clusters in Installation Template so the environment can properly configured before deployment (DNS, switches, VLANs, etc.).

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Installation Template

Clusters Information

Cluster:c0_clusterHome

Cluster Information:

Version	12.1.0.2.160419
Name	cluster-clu1
Home	/u01/app/12.1.0.2/grid
Inventory Location	/u01/app/oraInventory
Base Dir	/u01/app/oracle
Client Domain	x.com

Database:

Version	12.1.0.2.160419
Name	dbm01
Database Home	/u01/app/oracle/product/12.1.0
Inventory Location	/u01/app/oraInventory
Block Size	8192
Database Template	OLTP

Client Access Network

Starting IP Address :	2.2.2.2
Subnet Mask :	255.255.255.0
Gateway :	2.2.2.1
Total IP Addresses :	19
Ending IP Addresses :	2.2.2.20
Client Network Type :	1/10Gbit Copper Bonded
LACP :	Disabled

BONDING_OPTS="mode=active-backup miimon=100 downdelay=5000 updelay=5000 num_grat_arp=100"

Rack U Location	Component	Client Name	Client IP Address	VIP Name	VIP IP Address	VLAN ID
X6-2 Full Rack HC 8TB						
26	Database Server			N/A	N/A	
	VM	dm0108vm01	2.2.2.16	dm0108vm01-vip	2.2.2.17	1002
	VM	dm0108vm02	2.2.2.35	dm0108vm02-vip	2.2.2.36	1003
25	Database Server			N/A	N/A	
	VM	dm0107vm01	2.2.2.14	dm0107vm01-vip	2.2.2.15	1002
	VM	dm0107vm02	2.2.2.33	dm0107vm02-vip	2.2.2.34	1003
24	Database Server			N/A	N/A	

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OEDA Configuration Tool

Network Requirements

Component	Domain	Network	Example hostname
Database servers	dom0 (one per database server)	Mgmt eth0	dm01dbadm01
		Mgmt ILOM	dm01dbadm01-ilom
	domU (one or more per database server)	Mgmt eth0	dm01dbadm01**vm01**
		Client bondeth0	dm01client01**vm01**
		Client VIP	dm01client01**vm01**-vip
		Client SCAN	dm01**vm01**-scan
		Private ib	dm01dbadm01**vm01**-priv1
Storage servers (same as physical)		Mgmt eth0	dm01celadm01
		Mgmt ILOM	dm01celadm01-ilom
		Private ib	dm01celadm01-priv1
Switches (same as physical)		Mgmt eth0	dm01sw-*

Exadata OVM Basic Maintenance

- Refer to Exadata Database Maintenance Guide: Managing Oracle VM Domains on Oracle Exadata Database Machine
  - Show Running Domains, Monitoring, Startup, Shutdown
  - Disabling User Domain Automatic Start
  - Modify Memory, CPU, local disk space in a user domain
  - Remove/Create RAC VM Cluster
  - Expand Oracle RAC VM cluster
  - Create User Domain without Grid Infrastructure (e.g. App VM)
  - Moving a User Domain to a Different Database Server
  - Deleting a User Domain from an Oracle RAC VM Cluster
  - Running exachk

Exadata OVM Basic Maintenance

- Backing Up and Restoring Oracle Databases on Oracle VM User Domains
- Creating Oracle VM Oracle RAC Clusters
- Creating Oracle VM without GI and Database for Apps
- Add or Drop Oracle RAC nodes in Oracle VM
- Expanding /EXAVMIMAGES on User Domains after Database Server Disk Expansion
- Implementing Tagged VLAN Interfaces
- Implementing InfiniBand Partitioning across OVM RAC Clusters on Oracle Exadata
- Backing up the Management Domain (dom0) and User Domains (domU) in an Oracle Virtual Server Deployment
- Migrating a Bare Metal Oracle RAC Cluster to an OVM RAC Cluster

OEDACLI to Perform Maintenance Operations

- OEDA command line oedacli (Doc ID 2293678.1)
  - First released with OEDA August 2017 – always use most recent to get latest/greatest
  - Relies on original OEDA configuration/XML file used for deployment

- Supported post-deployment operations with VMs (as of September 2017)
  - Add/Remove node
  - Add/Remove database
  - Add/Remove database home
  - Add/Remove storage cell
  - Resize ASM disk group
  - Upgrade Oracle Clusterware 12.1.0.2 to 12.2.0.1

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Exadata OVM Migration

- Dynamic or online method to change physical to virtual
  - Data Guard or backups can be used to move databases – minimum downtime
  - Convert one node or subset of nodes to virtual at a time
- Migrating an existing physical Exadata rack to use virtual requires
  - Backing up existing databases, redeploying existing HW with OEDA and then Restoring Databases
  - Duplicating the databases to existing Exadata OVM configuration
  - If moving from source to a new target, standard Exadata migration practices still apply. Refer to Best Practices for Migrating to Exadata Database Machine

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Exadata OVM Migration

- Dynamic or online method to change physical to virtual using any of the procedures below
  - Migrate to OVM RAC cluster using the existing bare metal Oracle RAC cluster with zero downtime
  - Migrate to OVM RAC cluster by creating a new OVM RAC cluster with minimal downtime
  - Migrate to OVM RAC cluster using Oracle Data Guard with minimal downtime
  - Migrate to OVM RAC cluster using RMAN backup and restore with complete downtime

- For requirements and detailed steps, refer to My Oracle Support note 2099488.1.

Backup/Restore of Virtualized Environment

- Dom0 – Standard backup/restore practices to external

- DomU – Two Methods
  - Backup from Dom0: Snapshot the VM image and backup snapshot externally
  - Backup from DomU: Standard OS backup/restore practices apply
  - If over-provisioning local disk space - Restoring VM backup will reduce (may eliminate) space savings (i.e. relying on over-provisioning may prevent full VM restore)

- Database backups/restore: Standard Exadata MAA backup/restore practices still apply with Exadata or with ZFS Storage

- Refer to Exadata Maintenance Guide:
  - Backing up the Management Domain (dom0) and User Domains (domU) in an Oracle Virtual Server Deployment
  - Recovering in an Oracle Virtual Server Deployment

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Updating Software

Component to update	Method
Storage servers	Same as physical - run patchmgr from any server with ssh access to all cells, or use Storage Server Cloud Scale Software Update feature (starting in 18.1).
InfiniBand switches	Same as physical - run patchmgr from dom0 with ssh access to all switches.
Database server – dom0	Run patchmgr from any server with ssh access to all dom0s. Dom0 update upgrades database server firmware. Dom0 reboot requires restart of all local domUs. DomU software not updated during dom0 update. Dom0/domU do not have to run same version, although specific update ordering may be required (see 888828.1).
Database server – domU	Run patchmgr from any server with ssh access to all domUs. Typically done on a per-VM cluster basis (e.g. vm01 on all nodes, then vm02, etc.), or update all VMs on a server before moving to next.
Grid Infrastructure / Database	Standard upgrade and patching methods apply, maintained on a per-VM cluster scope. GI/DB homes should be mounted disk images, like initial deployment. 12.2 upgrade MOS 2111010.1.

Health Checks and Monitoring

- Exachk runs in Dom0 and DomU (cells and IB switches checks run with Dom0)
  - Run in one dom0 for all dom0s, cells, switches
  - Run in one domU of <u>each</u> VM cluster for all domUs, GI/DB of that cluster
- EM Monitoring support (MOS 1967701.1)
  - Requires EM Framework 12.1.0.4 (recommend 12.1.0.5), Exadata Plugin 12.1.0.6, VI Plugin 12.1.0.1.
- Exawatcher runs in Dom0 and DomU
- Database/GI monitoring practices still apply
- Considerations
  - Dom0-specific utilities (xmtop)
  - Dom0 is not sized to accommodate EM or custom agents
  - Oracle VM Manager **not** supported on Exadata

EM Support for Exadata Virtualization Provisioning

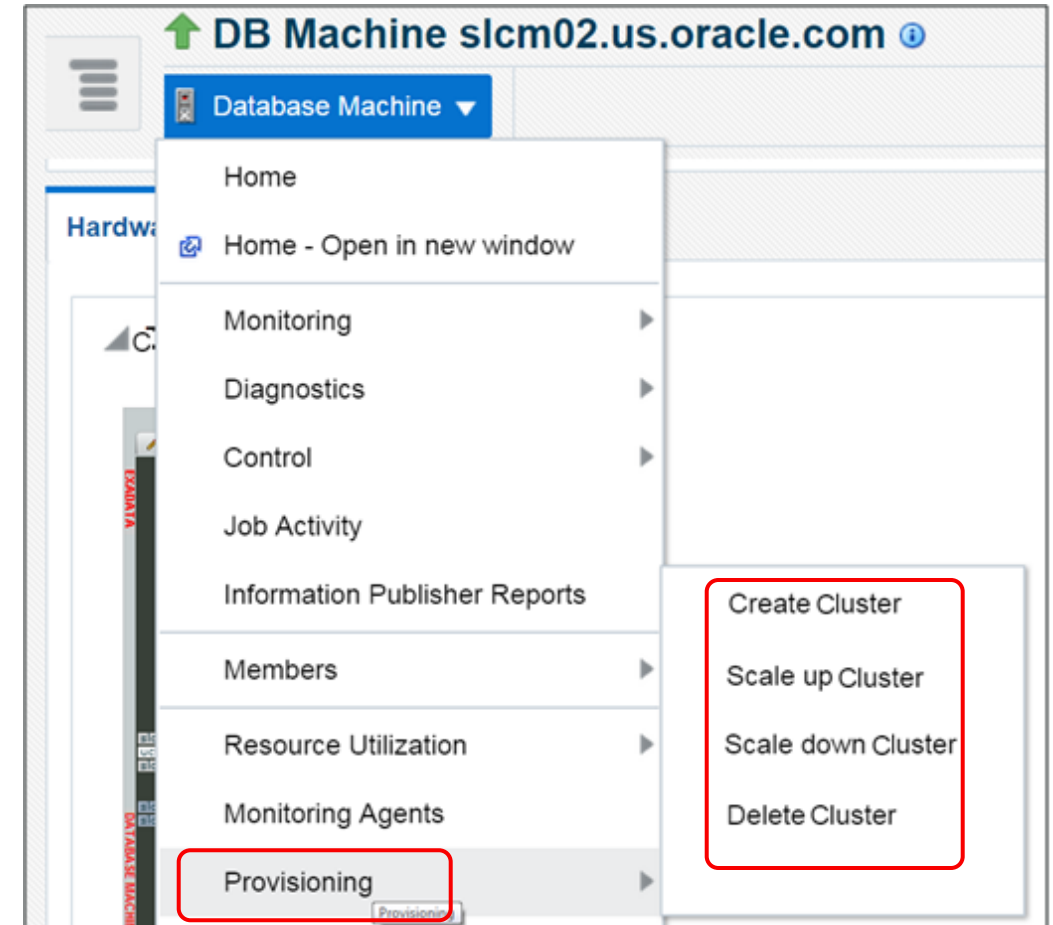**VM provisioning on Virtualized Exadata involves reliable, automated, & scheduled mass deployment of RAC Cluster**

- Includes VMs/DB/GI/ASM

Create / delete RAC Cluster

- Including DB/GI/ASM

Scale up / down RAC Cluster by adding or removing VMs

- Includes DB/GI/ASM

⬆ **DB Machine slcm02.us.oracle.com** ⓘ

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Provisioning

Create Cluster

Scale up Cluster

Scale down Cluster

Delete Cluster

Increase Operational Efficiency by Deploying RAC Cluster Faster on Virtualized Exadata

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Exadata MAA/HA

- Exadata MAA failure/repair practices still applicable. Refer to [MAA Best Practices for Oracle Exadata Database Machine](#)

- OVM Live Migration is not supported – use RAC to move workloads between nodes

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Resource Management

- Exadata Resource Management practices still apply

  – Exadata IO and flash resource management are all applicable and useful

- Within VMs and within a cluster, database resource management practices still apply

  – CPU count still needs to be set at the database instance level for multiple databases in a VM. Recommended min = 2

- No local disk resource management and prioritization

  – IO intensive workloads should not use local disks

  – For higher IO performance and bandwidth, use ACFS or DBFS on Exadata or NFS.

- All databases that share Exadata cells require unique DB_UNIQUE_NAME, even across different clusters. Cloned test databases require new name.

Integrated Cloud

Applications & Platform Services

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