ORACLE

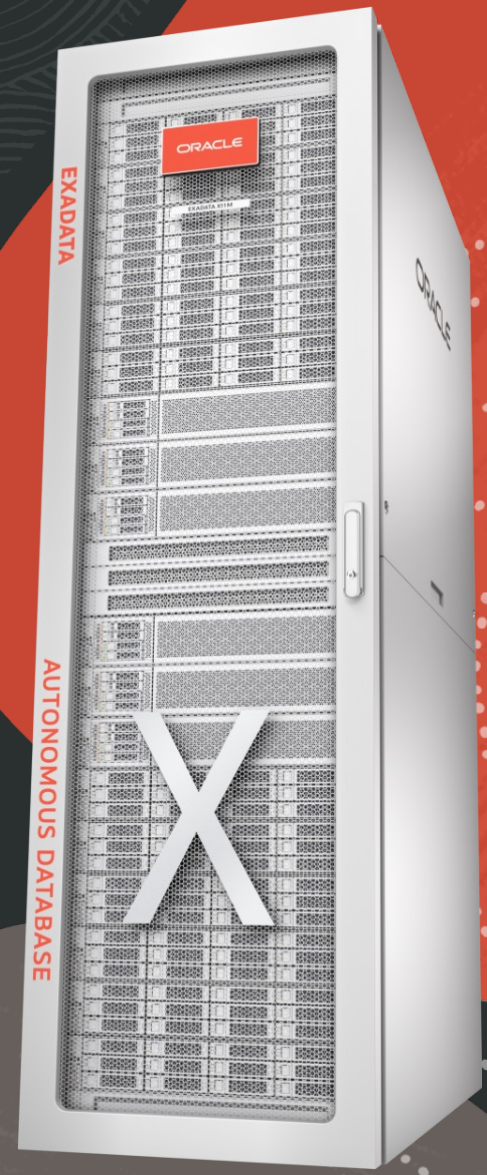
# KVM Virtualization Overview

## Best Practices for On-Premises RoCE-Based Exadata Systems

**Exadata System Software 26ai, release 26.2**

**Exadata Product Management**

November 2026



# Table of contents

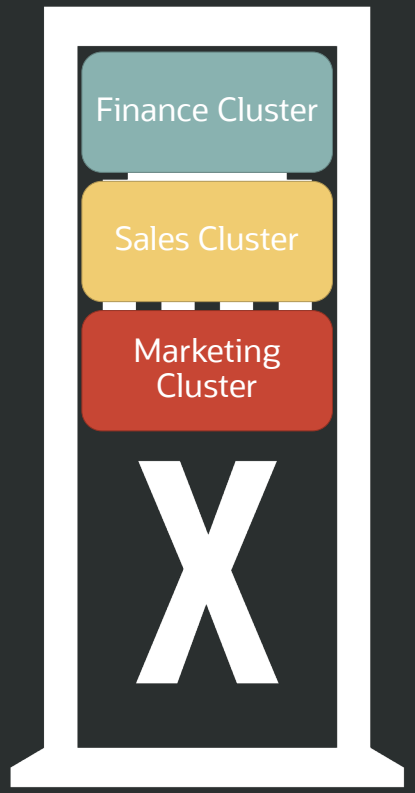

- Overview of virtualization on Exadata
- Exadata virtualization requirements
- Isolation considerations
- Virtualization sizing and prerequisites
- Deployment overview
- Administration and operational lifecycle
- Migration
- Backup/restore
- Upgrades and patching
- Monitoring and resource management



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# Exadata virtualization

## High-performance virtualized database platform using KVM




Kernel-based Virtual Machine (KVM) hypervisor

- Linux kernel-based type 1 hypervisor with improved performance
- Exadata RoCE based systems ***only*** (X11M, X10M, X9M-2, X8M-2)
  - Virtualization is not supported on 8-socket Exadata Database Servers (X8M-8, X9M-8)

VMs provide CPU, memory, OS, and system admin isolation for consolidated workloads

- Hosting, cloud, consolidation, test/dev, non-database or third-party applications

Exadata VMs deliver near **raw hardware performance**

- Database I/Os go directly to high-speed RDMA Network Fabric, bypassing hypervisor

Combined with Exadata network segmentation and I/O prioritization to achieve full isolation

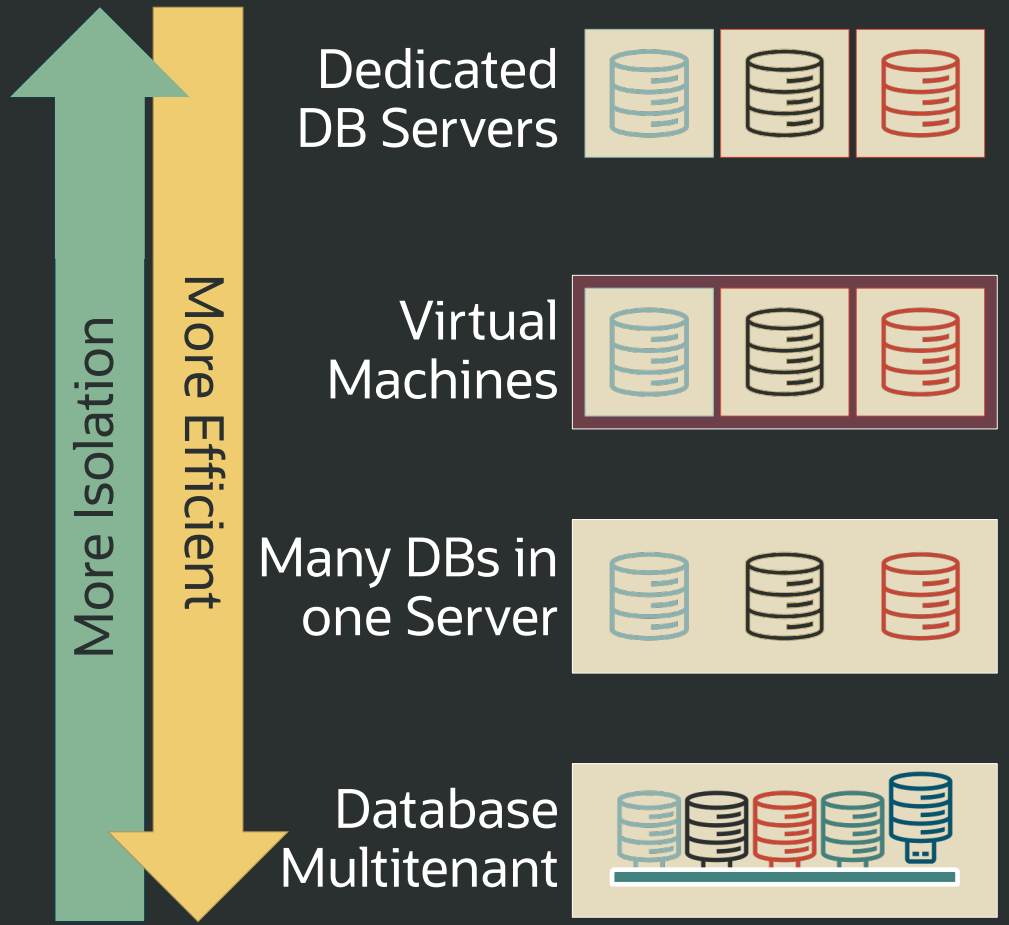
Trusted Partitions allow licensing by Virtual Machine

- See Oracle Exadata Database Machine Licensing Information User's Guide


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# Exadata consolidation options

## High-performance virtualized database platform using KVM




**Dedicated** Database Servers provide the **best isolation**

Virtualization has good isolation but requires more management overhead and resource usage

- 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

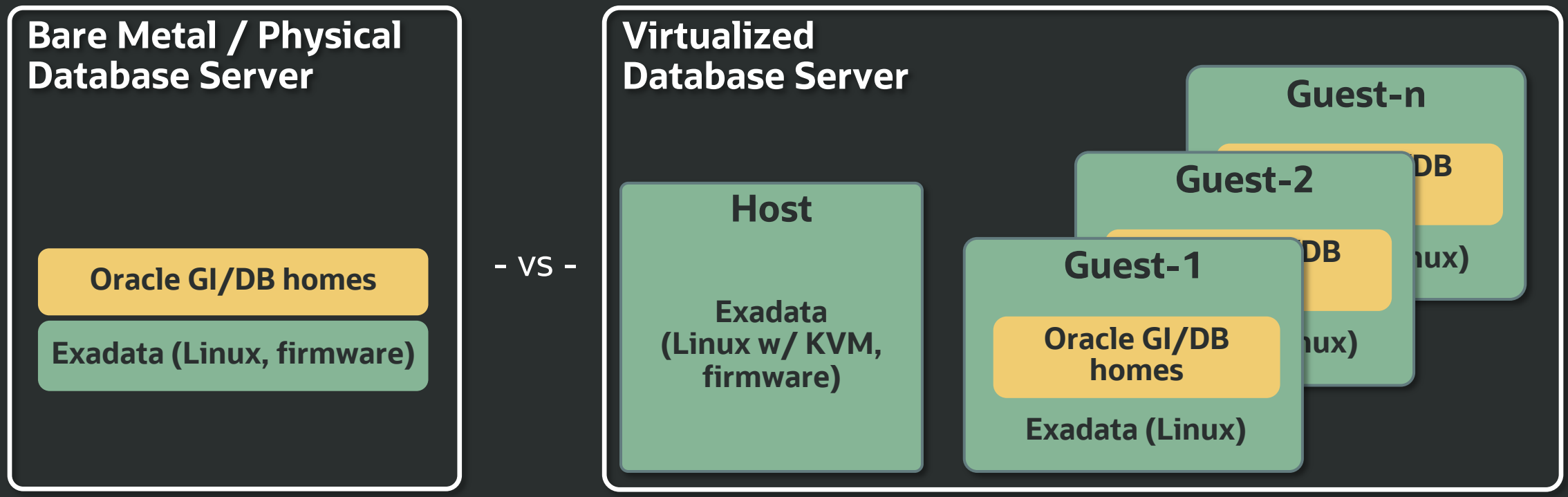
**Best strategy is to combine VMs with database native consolidation**

- Multiple trusted DBs or Pluggable DBs in a VM
- Few VMs per server to limit overhead of fragmenting CPUs/memory/software updates/patching etc.


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# Software architecture comparison

Database server: bare metal / physical versus virtualized





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# Differences between physical and virtual deployments

| Topic | How Virtual differs from Physical |
|---|---|
| **Reduced licensing option** | Use Trusted Partitions to license database options within specific VM Clusters |
| **Cluster configuration** | System has one or more VM clusters, each with own Grid Infrastructure / Database software installations |
| **Network isolation** | Secure Fabric used to isolate cluster infrastructure network while sharing underlying Exadata storage |
| **Exadata storage configuration** | Separate grid disks / ASM disk groups or Exascale vaults for each cluster |
| **Database server disk configuration** | Default file system sizes are small<br>Grid Infrastructure and Database software homes attached as separate file systems |
| **Software updates** | Database servers require separate KVM host (eg. Linux, firmware) and KVM Guest (Linux) updates. |
| **EXAchk** | Run once for KVM host + storage servers + switches, run once for each VM Cluster |
| **Enterprise Manager** | Enterprise Manager + Oracle Virtual Infrastructure plug-in + Exadata plug-in |


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# Requirements for KVM virtualization

## Supported hardware, software, host and guest environments

### Hardware

- Exadata 2-socket systems with RDMA over Converged Ethernet (RoCE) networks
  - X11M, X10M, X9M-2, X8M-2

### Software

- Review MOS **KB153930** for recommended and minimum required versions
- KVM Host
  - Virtualization using Oracle Linux Kernel-based Virtual Machine (KVM)
  - KVM host and guests can run different Exadata System Software versions
- KVM Guests
  - Each guest runs Exadata System Software isolated from other guests
  - Each guest runs Grid Infrastructure and Database software isolated from other guests


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# Exadata virtualization interoperability and migration

Interoperability between KVM/RoCE and Xen/InfiniBand

- KVM supported only with RoCE interconnects
- Xen supported only with InfiniBand interconnects
  - X8 and earlier upgraded to or freshly deployed with latest Exadata software continue to be based on Xen
- Cannot inter-rack RoCE and InfiniBand
- Separate KVM/RoCE and Xen/InfiniBand systems can be used in same Data Guard / GoldenGate configuration
  - e.g., KVM-based system as primary, separate Xen-based system as standby

Migration from Xen to KVM

- Move database using Data Guard, GoldenGate, RMAN, ZDM


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# Exadata KVM isolation and security

Storage Isolation - Each VM RAC cluster has own Exadata grid disks and ASM Disk Groups

- Setting Up Oracle ASM-Scoped Security on Oracle Exadata Storage Servers
  - https://docs.oracle.com/en/engineered-systems/exadata-database-machine/dbmsq/exadata-security-practices.html

Network Isolation - 802.1Q VLAN Tagging for Client and Admin Ethernet Networks

- Configured w/ OEDA during deployment (requires pre-deployment switch config)
- https://docs.oracle.com/en/engineered-systems/exadata-database-machine/dbmmn/managing-oracle-vm-guests-kvm.html

RoCE Network Isolation - Secure RDMA Fabric Isolation with Oracle Linux KVM

- https://docs.oracle.com/en/engineered-systems/exadata-database-machine/dbmin/exadata-network-requirements.html

KVM Guest Secure Boot with UEFI (Exadata 24.1)

- https://docs.oracle.com/en/engineered-systems/exadata-database-machine/dbmsq/exadata-security-features.html

RESTful remote access for storage server administration through ExaCLI

- https://docs.oracle.com/en/engineered-systems/exadata-database-machine/dbmmn/exacli.html

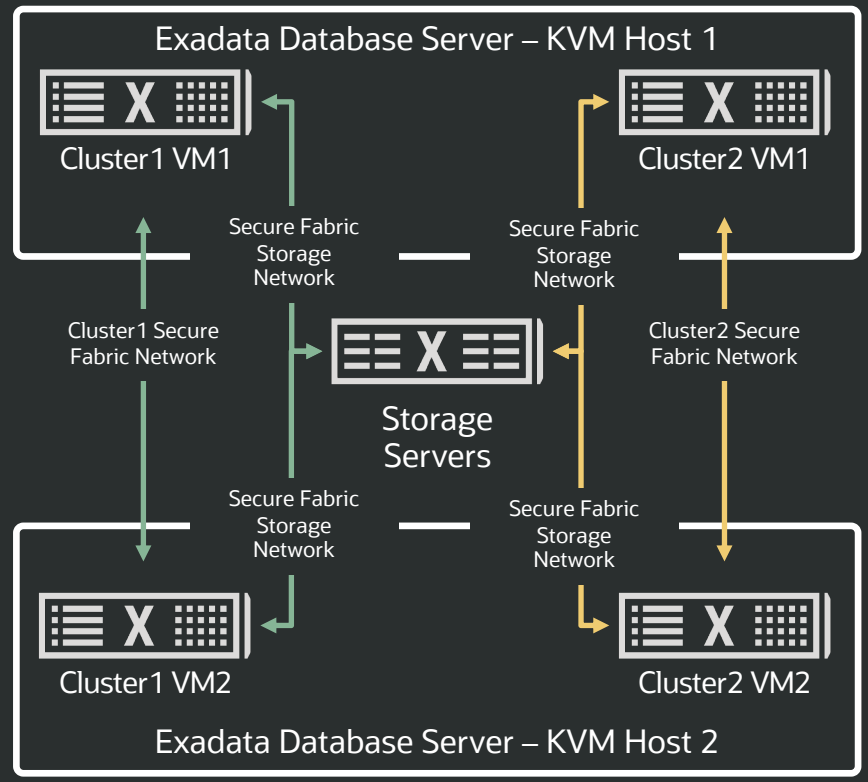

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# Secure RDMA Fabric Isolation for RoCE

**Exadata Secure Fabric** for RoCE systems implements network isolation for Virtual Machines while allowing access to common Exadata Storage Servers

- Each VM cluster is assigned a private network
- VM clusters cannot communicate with each other
- All VMs can communicate to the shared storage infrastructure
- Security cannot be bypassed
  - Enforcement done by the network card on every packet
  - Rules programmed by hypervisor automatically

Enabled by default in OEDA (Exadata 25.1) for new on-premises deployment





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# System sizing and VM resource allocation

## High-performance virtualized database platform using KVM

**Maximum of 50 KVM guests per database server (X11M, X10M with Exadata 24.1 and later)**

- X10M with Exadata 23.1, X9M, X8M – Maximum of 12 KVM guests per database server
- X11M-Z and Eighth Rack systems – Maximum of 4 KVM guests per database server

Consider KVM guest storage options

- Use KVM Host local disk storage
- Use Exascale volumes (independent of database storage or database version)
  - Enables VM Live Migration on X10M and newer platforms

Determine peak CPU, memory, disk space needed by each database

- Perform sizing evaluation prior to deployment, configure in OEDA accordingly
- Consider KVM host reserved memory and reserved CPU, KVM guest long-term local disk file system growth
  - Long lived KVM guests should budget for full space allocation
- Each VM cluster has its own grid disks and disk groups and/or Exascale vaults
  - Contact Oracle for sizing guidance


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# VM memory sizing

## Cannot over-provision physical memory

- Sum of all KVM guests + KVM host reserved memory <= installed physical memory

## KVM Host Reserved Memory

- KVM host reserves portion of installed memory
  - VM scheduling, networking, storage I/O, device management, monitoring, and host administration
- Not available to KVM guests, enforced by vm_maker


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# VM memory sizing

**KVM Guest memory sizing**

- Of total VM Memory Available
  - Allocate to single guest or divide among multiple guests

Minimum 16 GB memory for a guest

- To support OS, GI/ASM, starter DB, few connections

VM Memory size can not be changed online

- Guest restart required

| Memory Config | Supported Platforms | | | | Installed Memory (GB) | VM Memory (GB) |
|---|---|---|---|---|---|---|
| | X11M | X10M | X9M | X8M | | |
| 24 x 128 GB | ● | ● | | | 3072 | 2800 |
| 24 x 96 GB | ● | ● | | | 2304 | 2090 |
| 32 x 64 GB | | | ● | | 2048 | 1870 |
| 24 x 64 GB | ● | ● | ● | ● | 1536 | 1390 |
| 12 x 96 GB | ● | ● | | | 1152 | 1010 |
| 16 x 64 GB | | | ● | | 1024 | 920 |
| 12 x 64 GB | ● | ● | | ● | 768 | 660 |
| 16 x 32 GB | ● | ● | ● | | 512 | 440 |
| 12 x 32 GB | | ● | ● | ● | 384 | 328 |


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# VM CPU sizing

## CPU over-provisioning is allowed

- Up to 2x over-provisioning permitted with multiple VMs
  - Exceptions – No CPU over-provisioning on X10M and later systems:
    - with 512 GB memory
    - when Capacity-On-Demand is used
- Large increase in cores with X10M
  - CPU over-provisioning use cases decrease significantly compared to previous Exadata hardware
- Performance degradation may occur if all guests become fully active when over-provisioning

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

## KVM Host Reserved CPU

- Host is allocated 4 vCPUs (2 cores) – Not available to guests
  - X11M-Z and Eighth rack is allocated 2 vCPUs (1 core)

1 vCPU == 1 hyper-thread; 1 core == 2 hyper-threads == 2 vCPUs


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# VM CPU sizing

## Guest CPU sizing (X11M 2x96-core CPUs)

- Single guest vCPU
  - Minimum 4 vCPU
  - Maximum 380 vCPU
  - X11M-Z (1x32-core CPU)
    - Maximum 62 vCPU

- Sum of all guest's vCPUs
  - Max 380 vCPU if no over-provisioning
  - Max 760 vCPU if 2x over-provisioning[1,2]
  - X11M-Z (1x32-core CPU)
    - Max 62 vCPU if no over-provisioning
    - Max 124 vCPU if 2x over-provisioning[1]

| Hardware | Min vCPU per guest | Max vCPU per guest | Max over-provision vCPU all guests |
|---|---|---|---|
| **X11M, X10M** | 4 | 380 | 760[1,2] |
| **X11M-Z, X10M Eighth** | 4 | 62 | 124[1] |
| **X9M-2** | 4 | 124 | 248 |
| **X9M-2 Eighth** | 4 | 62 | 124 |
| **X8M-2** | 4 | 92 | 184 |
| **X8M-2 Eighth** | 4 | 46 | 92 |

1 – No CPU over-provisioning when Capacity-on-Demand is used
2 – No CPU over-provisioning on systems with 512GB memory

1 vCPU == 1 hyper-thread; 1 core == 2 hyper-threads == 2 vCPUs


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# VM storage considerations

## Database files and Grid Infrastructure shared files

- Default – store in Exadata storage managed by ASM
- Optional (Exadata 24.1) – store in Exadata storage managed by Exascale
  - Native Exascale support in Database 26ai
  - Database 19c may use Exascale Direct Volume (EDV) devices in VM guest as ASM grid disks in ASM disk groups

## VM Guest disk images

- Default – store in KVM host local disk, limited by local disk size (3.84TB)
- Optional (Exadata 24.1) – store in Exadata storage managed by Exascale (EDV devices in KVM host)

| Storage Type | Storage Options |
|---|---|
| **Database files (data, control, online/archived redo, etc.) Grid Infrastructure shared files (OCR, voting files)** | ASM (Automatic Storage Management) |
| | Exascale native (GI/DB 26ai only) |
| | Exascale EDV devices in VM guest + ASM (GI/DB 19c and 26ai) |
| **VM guest disk images** | KVM host local disk |
| | Exascale EDV devices in KVM host |


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# Storage for VM disk images – KVM host local disk

X11M, X10M database server – 2 x 3.84TB NVME drives configured RAID1

- Default local disk space available for VMs 1.46 TiB, online resizable to 3.4 TiB
- Option to add 2 x 3.84TB NVME drives RAID1, increase local disk space to 6.9 TiB

Default disk space used per KVM guest 228 GiB

- Extend after initial deployment by allocating new disk images in KVM host local disk
- Extend with shared storage (e.g., ACFS, DBFS, external NFS, OCI File Storage) for user files
  - Do not use shared storage for Oracle/Linux binaries/configuration/diagnostic files. Access/network issues may cause system crash or hang

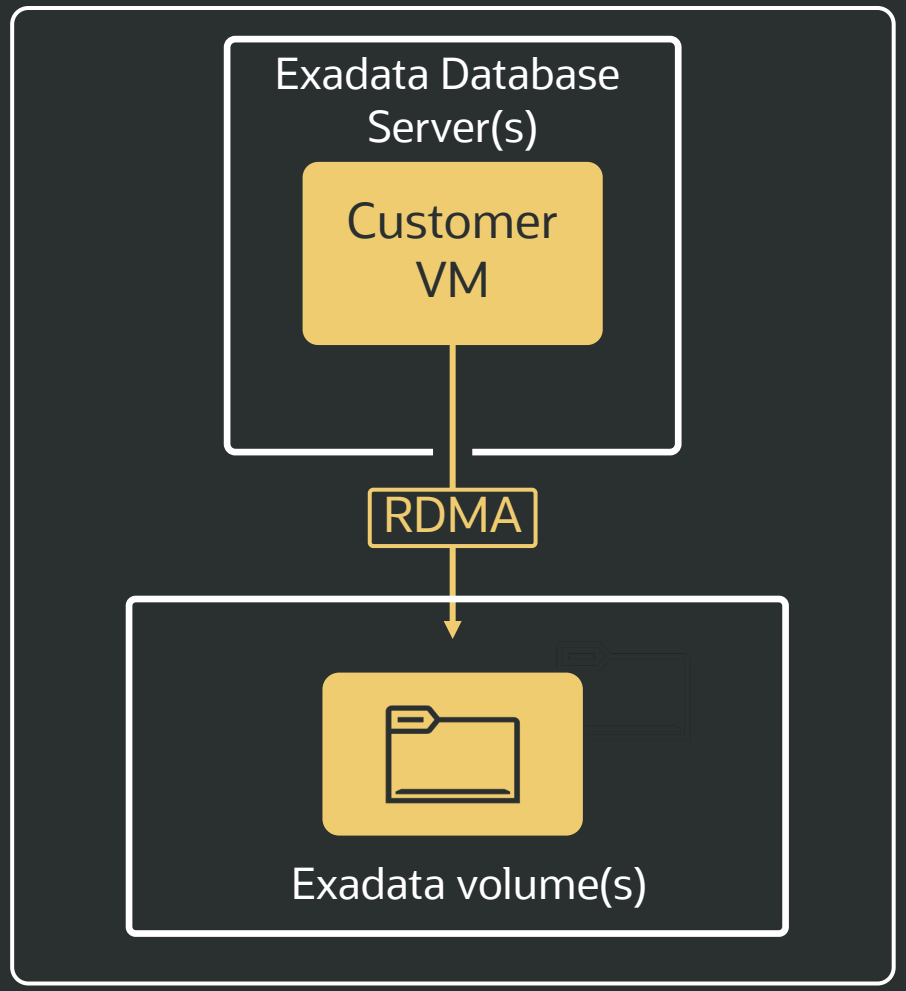
KVM guest local file system disk space over-provisioning **not recommended**, but possible

- Allocated space initially much lower than apparent space due to sparseness and shareable reflinks (with multiple VMs), but will grow over time (shared space diverges and becomes less sparse)
  - Long lived KVM guests should budget for full space allocation (assume no sparse/reflink benefit)
  - Over-provisioning may cause unpredictable out-of-space errors or prevent ability to restore disk image backup


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# Exascale volumes for VM filesystem storage

- Exadata Exascale provides shared storage for VM filesystems on X8M-2 and newer systems
- RDMA-enabled Exascale volumes improve VM I/O performance and VM density on X10M and newer systems
- Exascale volumes simplify VM mobility between KVM hosts for maintenance and resource management
- Deploy VMs with Exascale volumes through Oracle Exadata Deployment Assistant (OEDA)
- Reconfigure existing VMs to use Exascale volumes without redeploying the VM cluster





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# Customize database server filesystem layouts

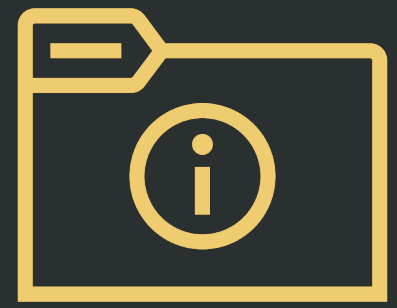
Meet site-specific application requirements with custom filesystem sizes and additional filesystems

Supported on Exadata KVM hosts and bare-metal database servers with Exadata System Software 26.1.0 or later and X8M-2 or newer hardware

Define mount points and sizes in `fslayout.json`. For example, customize `/var/log`, `/opt`, or `/EXAVMIMAGES`, or add a filesystem such as `/project/data`

Apply the layout during system imaging using PXE, NFS, or ISO or create a VM gold image for easy VM deployment

**Documentation: Customizing filesystem layout**




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# Create and reuse gold images with Exascale

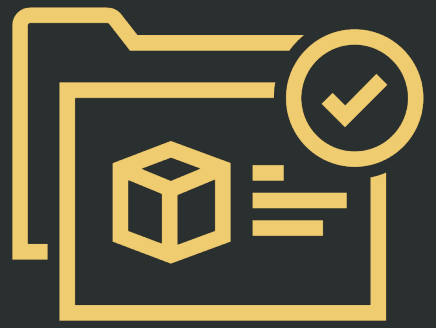
Provision VMs consistently without repeating image customization for each deployment

Create a gold image with libguestfs tools. Include Database and Grid Infrastructure software, patches, and custom file systems

Store the gold image on Exascale volumes, then clone it to VM hosts

Use OEDA or OEDACLI for repeatable guest provisioning

**Documentation: Customizing the guest image**




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# Storage for Database and Grid Infrastructure – ASM

Storage on cells may be shared between ASM and Exascale

Spread ASM disk groups for each VM cluster across all disks on all cells

- Every VM cluster has its own grid disks
- Disk group size for initial VM clusters should consider future VM additions
  - Using all space initially will require shrinking the existing disk group before adding a new disk group

- Option to enable ASM-Scoped Security so each VM cluster can access only its assigned grid disks

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


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# Deployment specifications and limits

| Category | | X8M-2 | X9M-2 | X10M | X11M |
|---|---|---|---|---|---|
| VMs | Max guests per database server | 12 | 12 | 50 (12[1]) | 50 |
| | Max guests per Eighth Rack and X11M-Z database servers | 4 | 4 | 4 | 4 |
| Memory | Min GB per guest | 16 | 16 | 16 | 16 |
| | Max GB per guest / all guests | 1390[2] | 1870[2] | 2800[2] | 2800[2] |
| CPU/vCPU | Min vCPU per guest | 4 | 4 | 4 | 4 |
| | Max vCPU per guest | 92 | 124 | 380 | 380 |
| | Max over-provisioned vCPU all guests | 184 | 248 | 760[3,4] | 760[3,4] |
| Disk space | Usable TiB per DB server for all guests | 3.15 | 3.40 / 6.97[5] | 3.40 / 6.97[5] | 3.40 / 6.97[5] |
| | Used GiB per guest at deployment | 141 | 228 | 228 | 228 |

1 – X11M supports 50 guests w/ Exadata 24.1 and later, Exadata 23.1 and earlier supports 12
2 – Using maximum memory configuration
3 – No CPU over-provisioning when Capacity-on-Demand is used
4 – No CPU over-provisioning on systems with 512GB memory
5 – When local disk expanded to 4 drives


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# Oracle Exadata Deployment Assistant overview

The Oracle Exadata Deployment Assistant, also known as OEDA, is the only tool to create VMs on Exadata

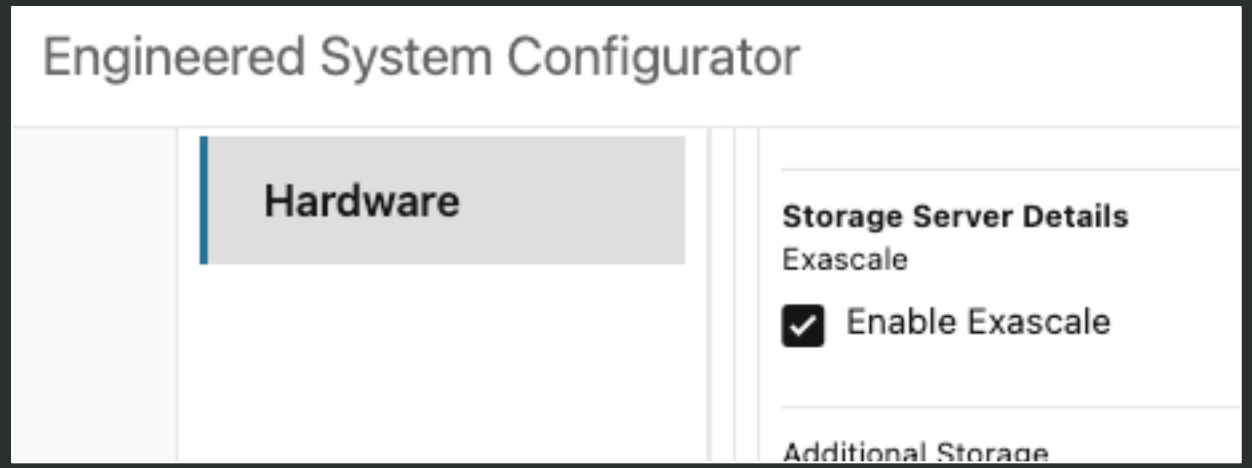
1. Create configuration with OEDA Web User Interface
2. Prepare customer environment for OEDA deployment
   - Configure DNS, switches for VLANs, and Secure Fabric
3. Prepare Exadata system for OEDA deployment
   - # switch_to_ovm.sh, applyElasticConfig.sh
4. Deploy system with OEDA Deployment Tool
   - # install.sh


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# Choose to deploy Exascale

- Initial configuration choice can be to enable Exascale
  - Exascale can also be deployed into existing environments

- Storage pool size and VM use of Exascale in later OEDA screens



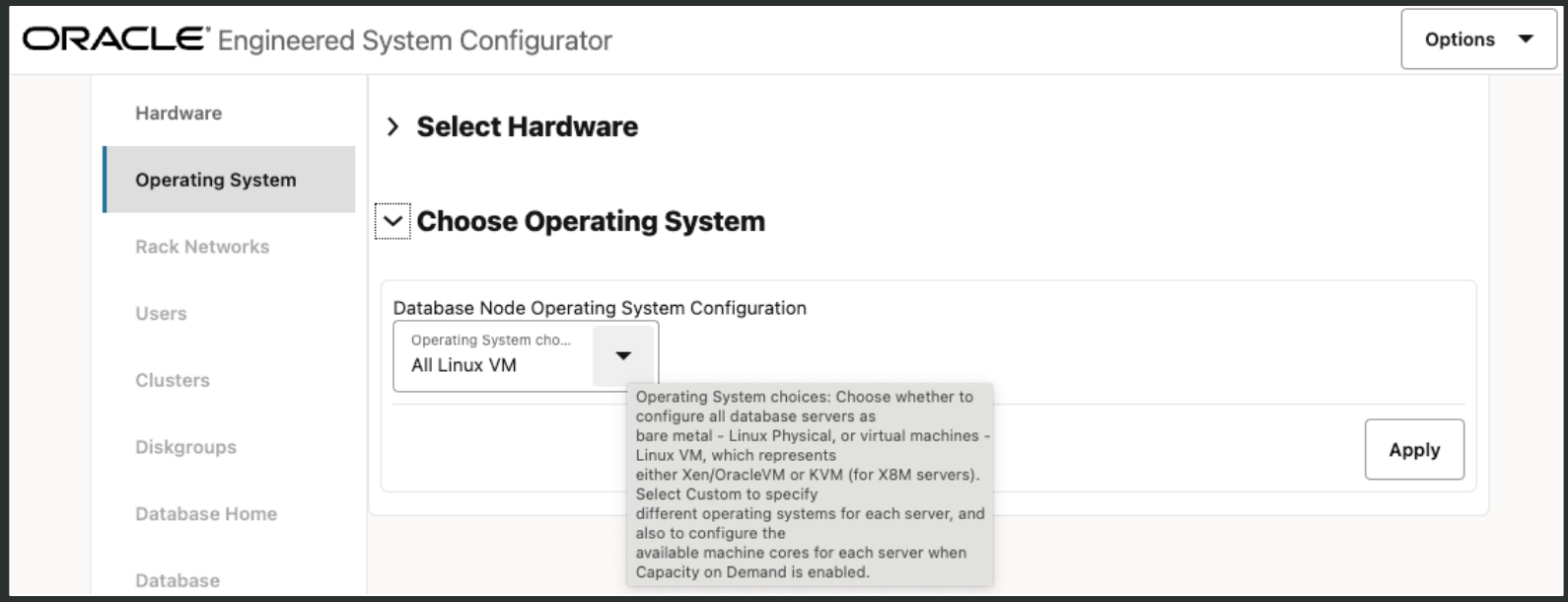


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# Choose virtual or physical database server configuration

- Virtual or physical configuration
  - All Linux VM
  - All Linux Physical
  - Custom (some servers VM, some servers physical)

- An individual database server is configured either VM or Physical

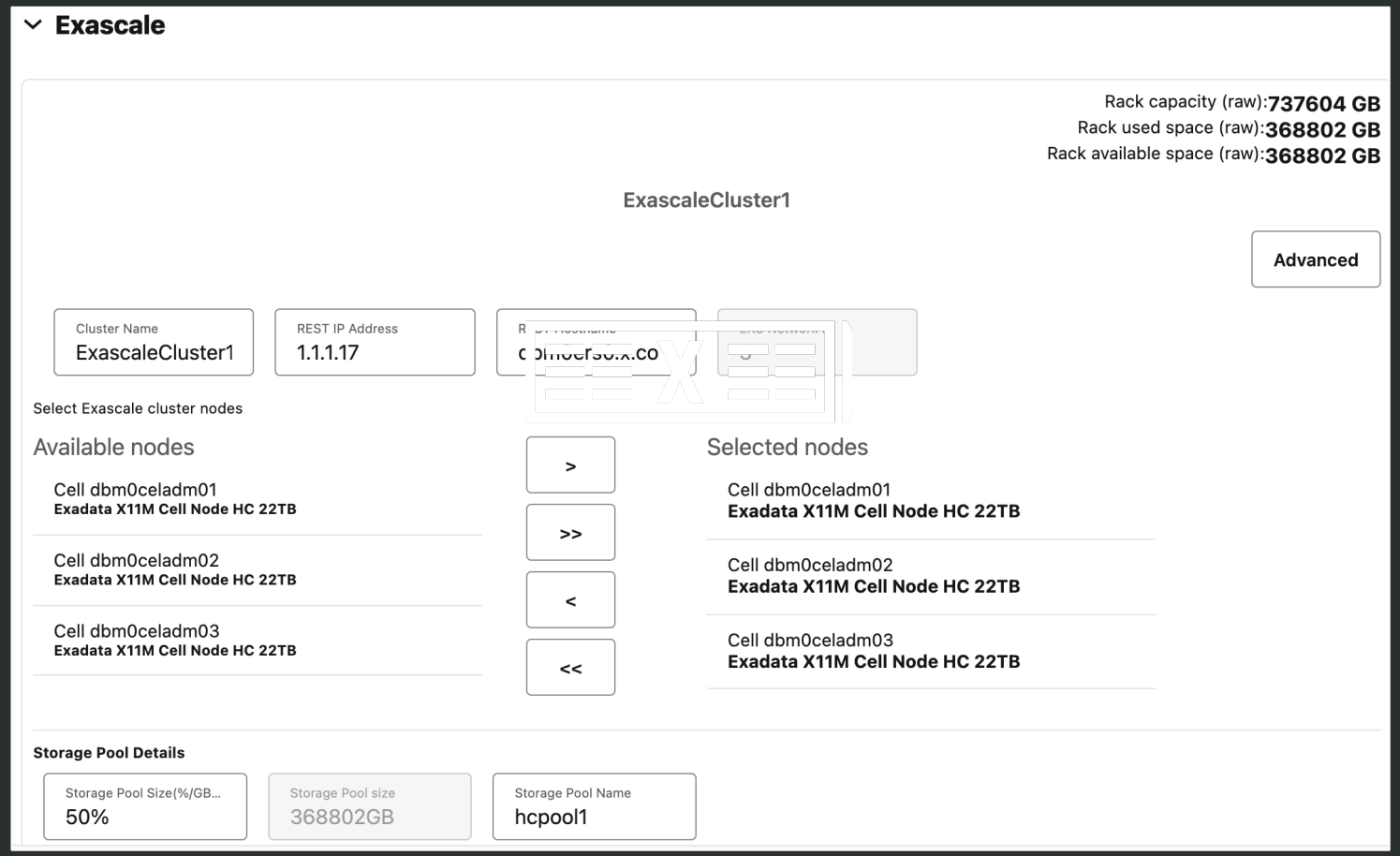




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# Configure Exascale storage pool

- Select cells for Exascale storage pool
  - Recommend selecting all available cells
- Configure storage pool size
  - Space allocated to storage pool used for Exascale
  - Unallocated space used for future Exascale expansion or ASM storage



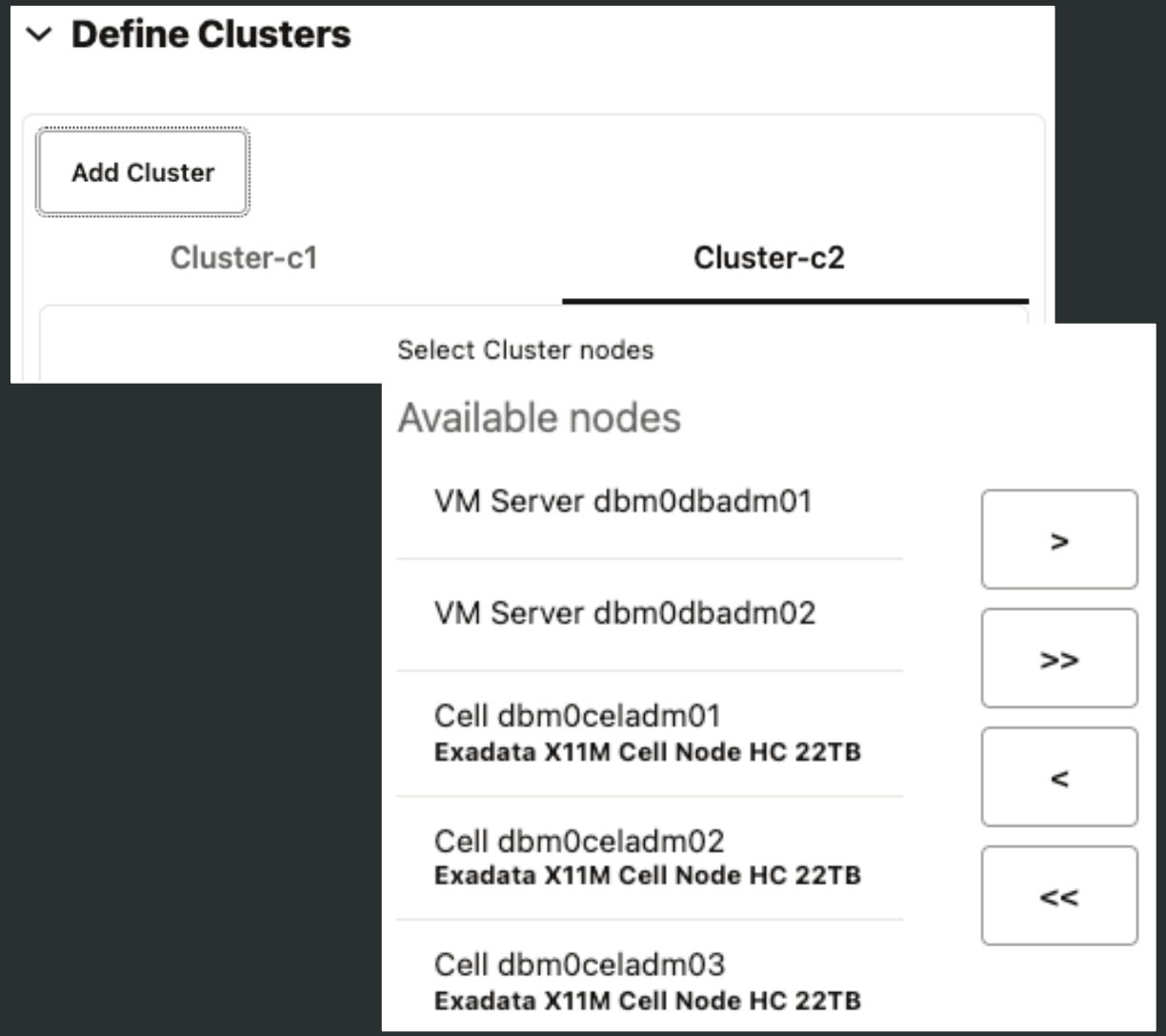


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# Define clusters

- Decide
  - Number of VM clusters to create
  - Database servers and Storage servers that will make up those VM clusters

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





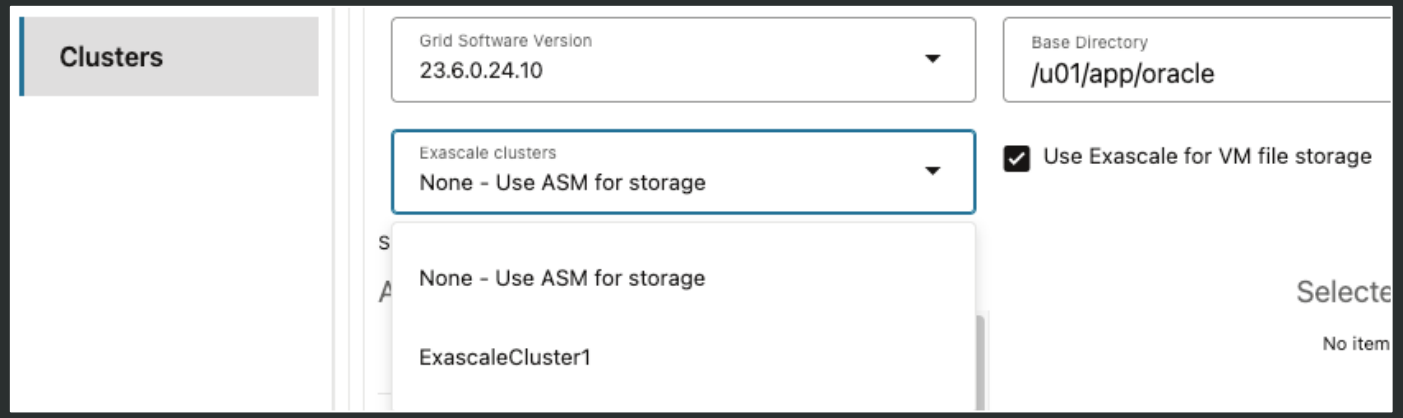
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# Configure VM use of Exascale

- Decide
  - Vault size
  - Store VM guest disk images in Exascale vault(s) or local disks
  - Store GI/DB files in Exascale vault(s) (26ai only) or ASM disk groups




Note:
- A VM may use Exascale for VM image files and ASM for database file storage
- A 26ai database may use only Exascale or ASM for file storage





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# Cluster configuration

Each VM cluster has its own configuration

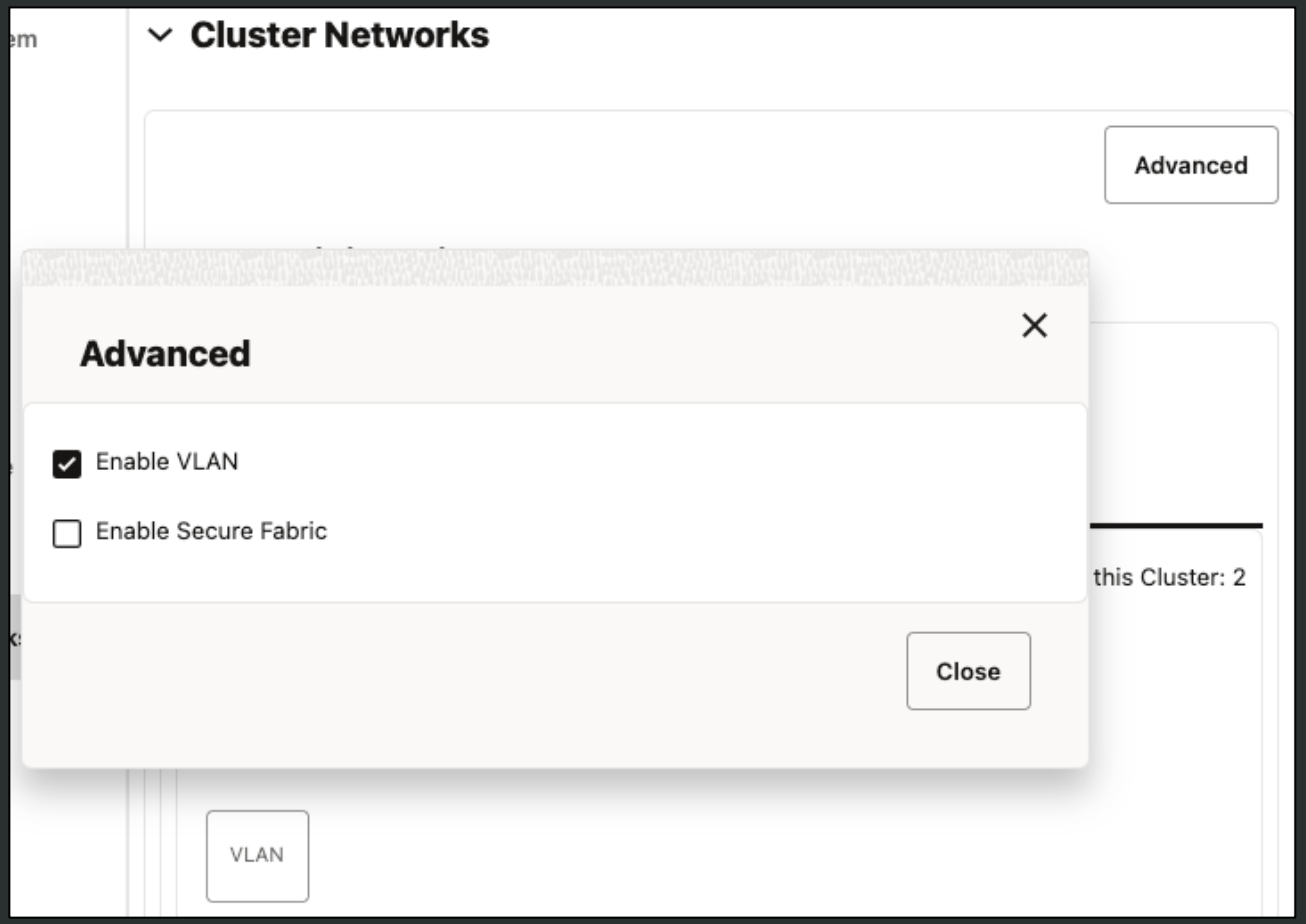
- OS users and groups
- VM size (memory, CPU)
- Grid infrastructure version and software location
- KVM guests can use different Exadata System Software and Oracle Linux versions
  - Keeping versions aligned is recommended
- Database version(s) and software location(s)
- Starter database configuration
- Client, Backup, and Admin networking configuration


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# Advanced network configuration - VLANs

Admin and Client Networks 802.1Q VLAN Tagging

- To separate Admin and Client Networks traffic across VMs, use distinct VLAN ID and IP info for each cluster
- Admin and Client Network switches must have VLAN tag configuration done before OEDA deployment



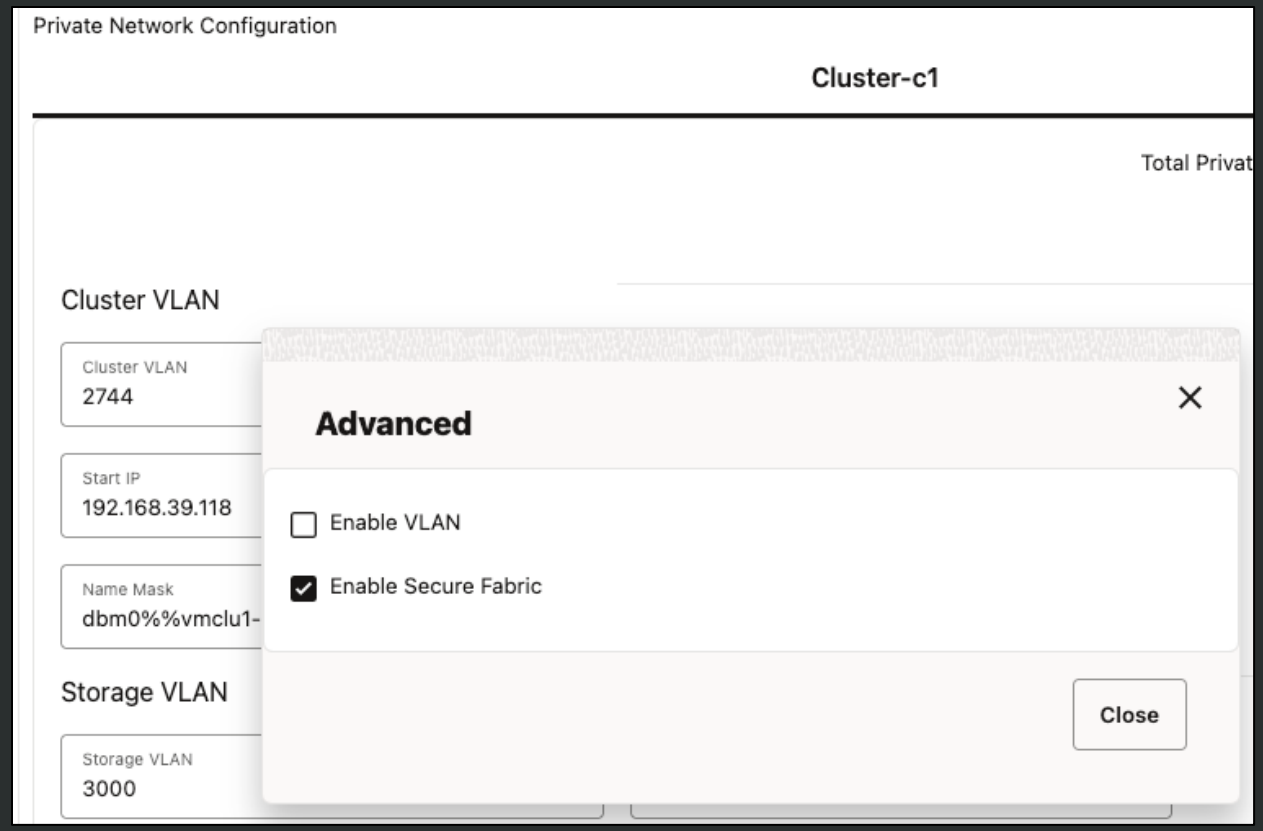


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# Advanced network configuration – Secure Fabric

Private Network Secure Fabric

- Secure RDMA Fabric Isolation uses RoCE VLANs to enable strict network isolation for Oracle RAC clusters
- Multiple VM clusters share storage server resources but cannot communicate with each other
- Secure Fabric is chosen by default for new on-premises deployments starting with the Oct 2024 OEDA release
  - Secure Fabric is required for Exascale





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# OEDA installation template

Verify proper settings for all VM clusters in the Installation Template so that the environment is validated before deployment (DNS, switches, VLANs, etc.)

## Cluster:exadpm01010202

### Cluster Information:

| | |
|---|---|
| *Version* | **23.26.2.0.0** |
| *Name* | **exadpm01010202** |
| *Customer Name* | **exadpm01adm0106celadm0103** |
| *Application* | **ExadataPM-261-12VMs** |
| *Home* | **/u01/app/23.26.2.0/grid** |
| *Inventory Location* | **/u01/app/oraInventory** |
| *Base Dir* | **/u01/app/oracle** |
| *Client Domain* | **us.oracle.com** |
| *ASM-Scoped Security* | **true** |
| *Compute Secure Fabric Vlan* | **2749** |
| *Storage Secure Fabric Vlan* | **3617** |

### Database:

| | |
|---|---|
| *Version* | **23.26.2.0.0** |
| *CDB Name* | **c2db1** |
| *Unique Name* | **c2db1_exadpm01ers05** |
| *PDB Name* | **c2db1pdb1**<br>**c2db1pdb2** |
| *Database Home* | **/u01/app/oracle/product/23.26.2.0/dbhome_1** |
| *Inventory Location* | **/u01/app/oraInventory** |
| *Block Size* | **8192** |
| *Database Template* | **OLTP** |
| *Character Sets* | **AL32UTF8** |
| *Base Dir* | **/u01/app/oracle** |


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# Network requirements for VM deployment

| Component | Domain | Network | Example hostname |
|---|---|---|---|
| Database servers | KVM host (one per database server) | Mgmt eth0 | dm01dbadm01 |
| | | Mgmt ILOM | dm01dbadm01-ilom |
| | KVM guest (one or more per database server) | Mgmt eth0 | dm01dbadm01vm01 |
| | | Client bondeth0 | dm01client01vm01 |
| | | Client VIP | dm01client01vm01-vip |
| | | Client SCAN | dm01vm01-scan |
| | | Private RoCE | dm01dbadm01vm01-priv |
| Storage servers (same as physical) | | Mgmt eth0 | dm01celadm01 |
| | | Mgmt ILOM | dm01celadm01-ilom |
| | | Private RoCE | dm01celadm01-priv |
| Switches (same as physical) | | Mgmt and Private | dm01sw-adm, dm01sw-roce |


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# Guest disk layout

| File system | Size | Use |
|---|---|---|
| **/ (root)** | 15G | Root file system |
| **/u01** | 20G | Oracle BASE |
| **/u01/app/<ver>/grid** | 50G | Grid infrastructure software home |
| **/u01/app/oracle/product/<ver>/dbhome_1** | 50G | Database software home |
| **/tmp** | 3G | /tmp |
| **/home** | 4G | User home directories |
| **/var** | 2G | /var |
| **/var/log** | 18G | System logs |
| **/var/log/audit** | 1G | System audit logs |
| **/crashfiles** | 20G | System kdump kernel crash vmcore |
| **/boot** | 512M | System boot |
| **Other LVM space** | 44G | LVDbSwap1, LVDbSys2, LVDbVar2, LVDoNotRemoveOrUse |
| **TOTAL** | **228G** | |


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# Exadata KVM basic maintenance

Primary maintenance tools

- **OEDACLI** – OEDA Command Line Interface
- **vm_maker**

Refer to Exadata Database Machine Maintenance Guide

- **Managing Oracle Linux KVM Guests**


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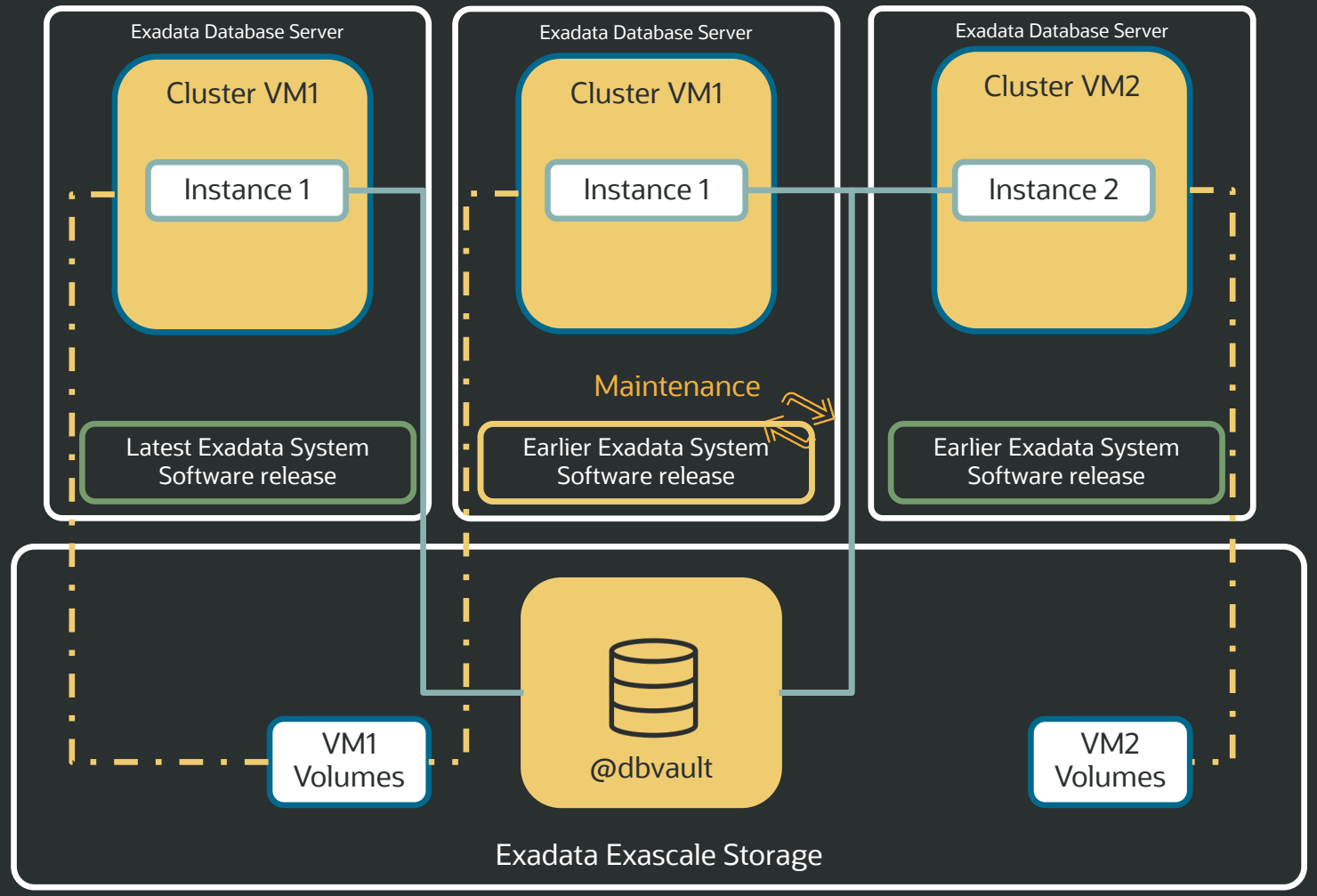
# Virtual Machine offline mobility during host maintenance

Use offline migration when:

- Live Migration requirements are not met, VMs use Exascale volumes
- Migration targeted VM has high memory-write activity

Use OEDA to do an offline migration to an already updated KVM host

Ensure the use Transparent Application Continuity best practices





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# Exadata VM Live Migration

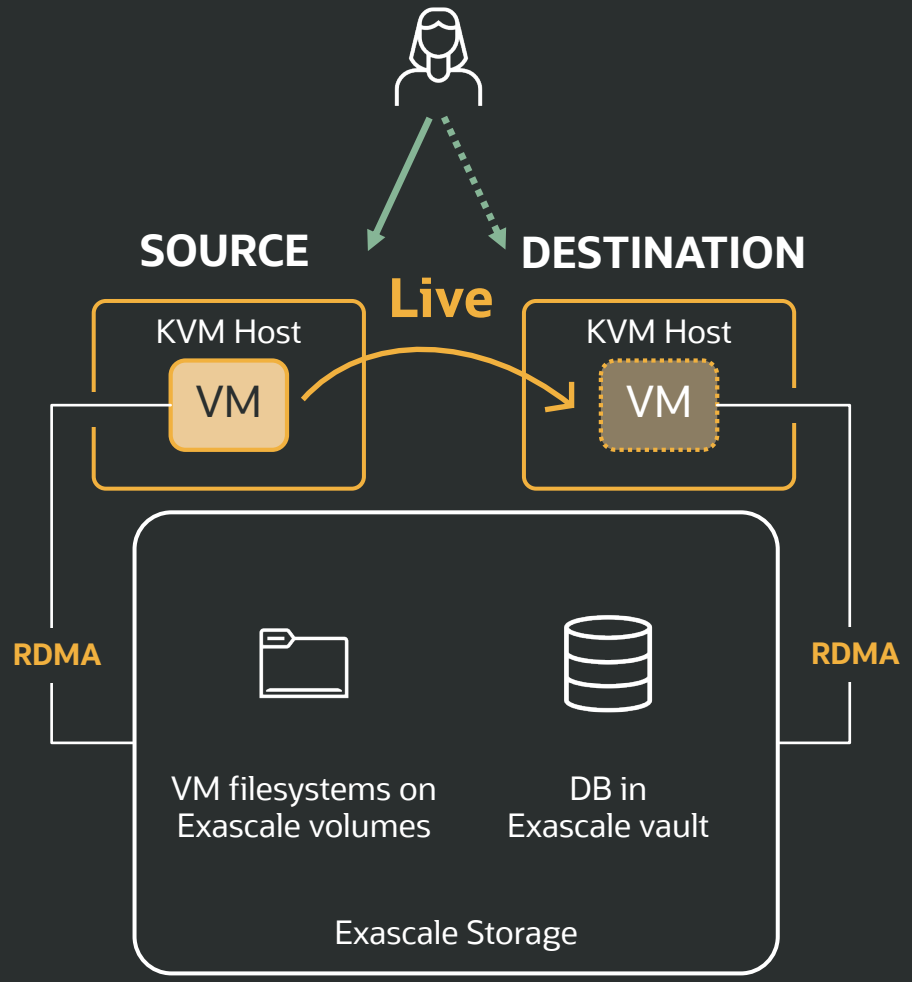
Exadata VMs run RDMA-enabled Oracle Database

Live Migration of running VMs between compatible KVM hosts is supported, fully online

- Applies to X10M and newer platforms only
- Within the same platform generation only (i.e. X10M->X10M, X11M->X11M)
- VMs must be configured to use Exascale volumes but can use ASM or Exascale and any supported DB/GI version
- The general requirements that apply to Exadata VM Live Migration are defined in the docs

Migration maintains active RDMA connections

Exascale shared storage accessed from the source host is accessible from the destination host after migration





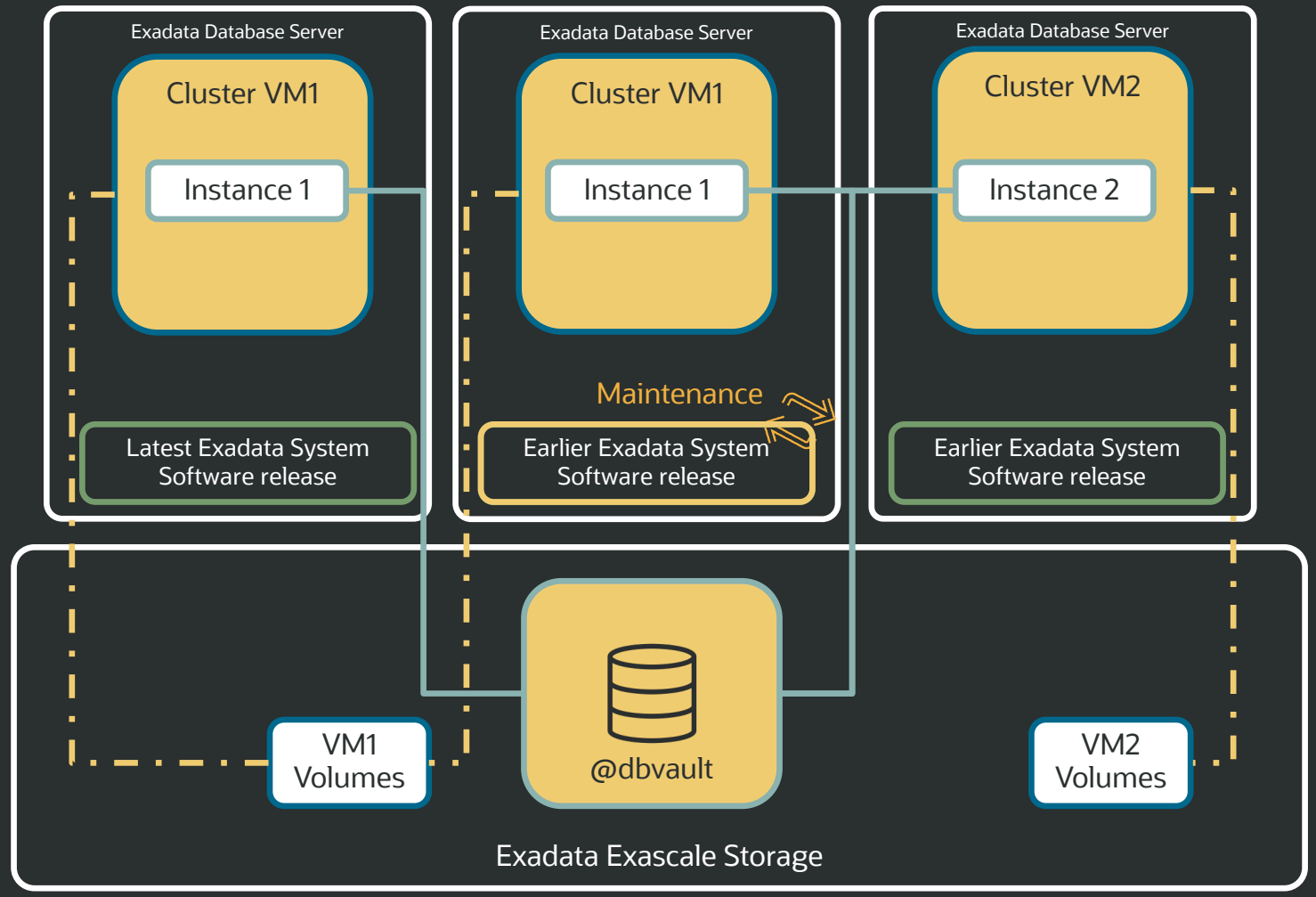
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# Virtual Machine online mobility during host maintenance

When VMs use Exascale volumes, use OEDA perform an **online VM live migration** to an already updated KVM host

Databases remain available with RAC

Use Transparent Application Continuity best practices





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# Exadata VM Live Migration using OEDACLI

Discover the environment and generate an up-to-date OEDA XML in a specified LOCATION

- The discovered XML will be named Discovered-<rack-prefix>.xml (e.g., Discovered-dm01.xml)

```
[user@dm01db01 ~]# ./oedacli
oedacli> discover es hostnames='dm01db01,dm01db02,dm01cel01,dm01cel02,dm01cel03' LOCATION=/output_dir
Discovering nodes [dm01db01,dm01db02,dm01cel01,dm01cel02,dm01cel03]…
...
```

Create a file containing a scripted series of commands that are to be run for VM migration

```
[user@dm01db01 ~]# cat migrate_db01vm01_db01_db02.cli
MIGRATE GUEST HOSTNAME=dm01db01vm01 MODE=LIVE SRCHOST=dm01db01 TGTHOST=dm01db02
save action
merge actions
deploy actions
```

Perform live migration using the discovered OEDA XML and the scripted migration command file

```
[user@dm01db01 ~] ./oedacli -c /output_dir/discovered_09252025_1/Discovered-dm01.xml -f migrate_db01vm01_db01_db02.cli
SUCCESS - file loaded OK
…
Migrate Guest Starting Guest Migration: dm01db01vm01
```


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# Backup/restore of virtualized environment

KVM host

Standard backup/restore practices to external location

KVM guest

- Install or back up VM images to Exascale volumes
  - Keep VM images and backups off local DB server storage
  - Enables independent recovery of guest VMs
- Backup within KVM host: Snapshot the VM disk images and back up snapshot externally
- Backup within KVM guest: Standard OS backup/restore practices apply
- If over-provisioning local disk space – Restoring VM backup will reduce or eliminate space savings (i.e., relying on over-provisioning may prevent full VM restore)

Database backup/restore

Use standard Exadata MAA practices with RMAN, ZDLRA, and Cloud Storage

Refer to Exadata Database Machine Maintenance Guide


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# Updating Exadata software

| Component to update | Method |
|---|---|
| **Storage servers** | Same as physical – run patchmgr from any server with ssh access to all storage servers or use Storage Server Cloud Scale Software Update feature. |
| **RDMA Network Fabric switches** | Same as physical – run patchmgr from any server with ssh access to all switches. |
| **Database server – KVM host** | Run patchmgr from any server with ssh access to all KVM hosts.<br>KVM host update upgrades database server firmware.<br>KVM host reboot requires restart of all local VMs.<br>KVM guest software not updated during KVM host update.<br>KVM host/guest do not have to run same version, although specific update ordering may be required (see MOS KB153930). |
| **Database server – KVM guest** | Run patchmgr from any server with ssh access to all KVM guests. Typically done on a per-VM cluster basis (e.g., vm01 on all nodes, then vm02, etc.), or update all VMs on a KVM host before moving to next. |
| **Grid Infrastructure / Database** | Use Fleet Patching and Provisioning (FPP), OEDACLI, or standard upgrade and patching methods, maintained on a per-VM cluster scope. GI/DB homes should be mounted disk images, like initial deployment. |


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# Health checks and monitoring

Exachk (AHF) runs in KVM host and KVM guest

- Run in one KVM host – evaluates all KVM hosts, cells, switches
- Run in one KVM guest of each VM cluster – evaluates all KVM guests, GI/DB of that cluster

Exadata Storage Software Versions Supported by the Oracle Enterprise Manager Exadata Plug-in (KB492866)

Exawatcher runs in KVM host and KVM guest

Database and Grid Infrastructure monitoring practices still apply

Considerations

- KVM host is not sized to accommodate Enterprise Manager or custom agents


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# Database and IO resource management

Manage Exadata resources using Exadata I/O Resource Management (IORM)

Manage resources within VMs and within a cluster using Database Resource Management (DBRM)

- cpu_count set at the database instance level for multiple databases in a VM
- Recommended minimum cpu_count=2

No local disk resource management and prioritization

- I/O intensive workloads should not use local disks
- For higher I/O performance and bandwidth, use ACFS or NFS


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