

# Deploying Oracle Database 23ai: Real Application Cluster (RAC) on Compute Cloud@Customer and Private Cloud Appliance, and Standalone Deployment on Roving Edge

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Public

## Purpose statement

As the industry's only scale-everything, highly available database platform, Oracle Real Application Clusters (RAC) delivers unparalleled scalability and resilience for mission-critical workloads across diverse application domains, including OLTP, analytics, AI vector processing, SaaS, batch, graph, and IoT.

This solution paper outlines the architecture and deployment of Oracle Real Application Clusters (RAC) on Oracle Compute Cloud@Customer, Oracle Private Cloud Appliance X9 or X10 models, and Oracle Database 23ai Standalone on Roving Edge to enable customers to seamlessly scale complex enterprise applications, while maintaining continuous availability even through hardware failures and maintenance events.

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## Introduction

Oracle Database 23ai represents a significant advancement, offering native support for machine learning, AI-driven analytics, and autonomous data processing. Its powerful new features make it an ideal platform for modern AI workloads, delivering real-time insights, predictive capabilities, and intelligent automation across enterprise and edge environments.

As organizations modernize their mission-critical applications, the demand for greater data availability, workload scalability, and infrastructure flexibility continues to accelerate. Oracle Real Application Clusters (RAC), when deployed on Oracle Compute Cloud@Customer or Oracle Private Cloud Appliance models X9 or above, provides a robust foundation, delivering enterprise-grade high availability and seamless scalability across a wide range of workloads.

This solution paper outlines best practices and key recommendations for deploying Oracle Database 23ai Real Application Clusters on Oracle Compute Cloud@Customer and Oracle Private Cloud Appliance, models X9, X10 and above. It also covers the deployment of Oracle Database 23ai standalone releases on Oracle Roving Edge devices, enabling high-performance database capabilities at the edge cloud.

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## Architecture Overview

### Oracle Compute Cloud@Customer or Oracle Private Cloud Appliance

The solution architecture is designed to deliver a highly available, scalable, and resilient Oracle Database 23ai environment for mission-critical workloads on Oracle Compute Cloud@Customer and Oracle Private Cloud Appliance models X9, X10, and above. It features a three-node Oracle RAC deployment configured within a Virtual Cloud Network (VCN) that includes both public and private subnets. Each RAC node is equipped with dedicated VNICs for private communication and interconnect traffic, leveraging local block storage from Oracle Compute Cloud@Customer or Oracle Private Cloud Appliance to support ASM disk groups and database homes. SCAN VIPs and integrated DNS resolution are utilized to ensure optimal load balancing, high availability, and seamless failover across the cluster.

NOTE: Oracle Real Application Clusters (RAC) is only supported on Oracle Compute Cloud@Customer and Oracle Private Cloud Appliance models X9, X10 (or newer), running the 3.x software stack. Earlier models of Oracle Private Cloud Appliance running software stack 2.x are not supported for Oracle RAC deployments. Additionally, Roving Edge devices only supports Oracle Standalone deployment, not Oracle Real Application Clusters (RAC). For the list of supported Oracle Databases on Oracle Edge Cloud (Compute Cloud@Customer, Private Cloud Appliance, and Roving Edge) refer to the Release Schedule of Current Database Releases ([Doc ID 742060.1](#))

Key components of the architecture include:

- **Oracle Grid Infrastructure:** Oracle Grid Infrastructure is the integrated software suite that provides the essential cluster and storage management services required to run Oracle Real Application Clusters (RAC), Oracle ASM (Automatic Storage Management), and Oracle ASM Cluster File Systems (ACFS). It combines two key components: Oracle Clusterware, which manages server membership, failover, and critical cluster resources such as databases, listeners, and services; and Oracle ASM, which simplifies storage management by providing a high-performance, scalable storage platform for Oracle databases. Oracle Grid Infrastructure enables multiple servers to operate as a unified system, delivering high availability, scalability, and resiliency for mission-critical workloads. It is a mandatory installation for deploying Oracle RAC environments and is fundamental for managing clustered databases on Oracle Cloud and engineered systems.
- **Oracle Real Application Clusters (RAC)** is a cluster database solution built on a shared cache architecture, designed to overcome the limitations of traditional shared-nothing and shared-disk models. It delivers a highly scalable and highly available database platform, ideal for demanding business applications. Oracle RAC enables multiple servers to work together seamlessly, providing continuous service in the event of server failures and improving overall performance.
- **Oracle Linux 9.5 Instances:** Three virtual machine instances running Oracle Linux 9.5 release, which are members of the Oracle Real Application Cluster in the same private subnet within a Virtual Cloud Network (VCN)
- **Network Infrastructure:** A VCN with a private and public subnets, private and public IP addresses. Each RAC node has one VNIC in each subnet, plus a dedicated Virtual IP (VIP). Additional networking includes four VIPs for SCAN (Single Client Access Name) to support high availability and load balancing across the Oracle Real Appliance Cluster (RAC).
- **Oracle Database 23ai Release:** Listed below are the software releases utilized on this setup and qualified with Oracle Database 23ai on or Oracle Compute Cloud@Customer and Oracle Private Cloud Appliance, models X9, X10, and above
- **Oracle Private Cloud Appliance. Models X9, X10 or above and Oracle Compute Cloud@Customer:** Build number: 3.0.2-b1325160 or later. Please, refer to ([Doc ID 2906831.1](#)) for additional information

- Oracle Grid Infrastructure and Database:** Oracle Database 23ai Enterprise Edition Release 23.0.0.0.0 - for Oracle Cloud and Engineered Systems Version 23.8.0.25.04 or greater. Download the Oracle Database 23ai for engineering systems from Oracle Software Delivery Cloud. Example:

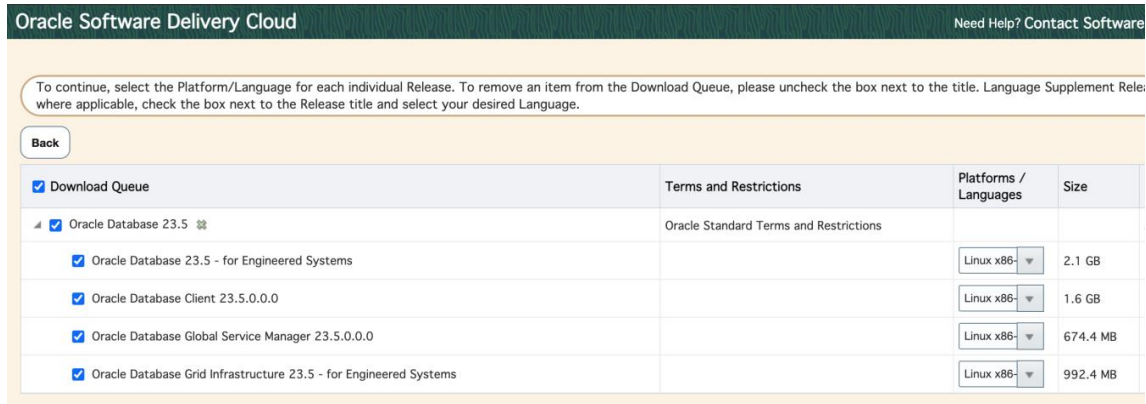


Figure 1. Oracle Software Delivery Cloud – Download of Oracle Database 23ai for Engineered Systems.

Listed below is the architecture overview of the Oracle Real Appliance Cluster (RAC) on Oracle Compute Cloud@Customer and Oracle Private Cloud Appliance, models: X9, X10 (or newer) running software stack 3.x.

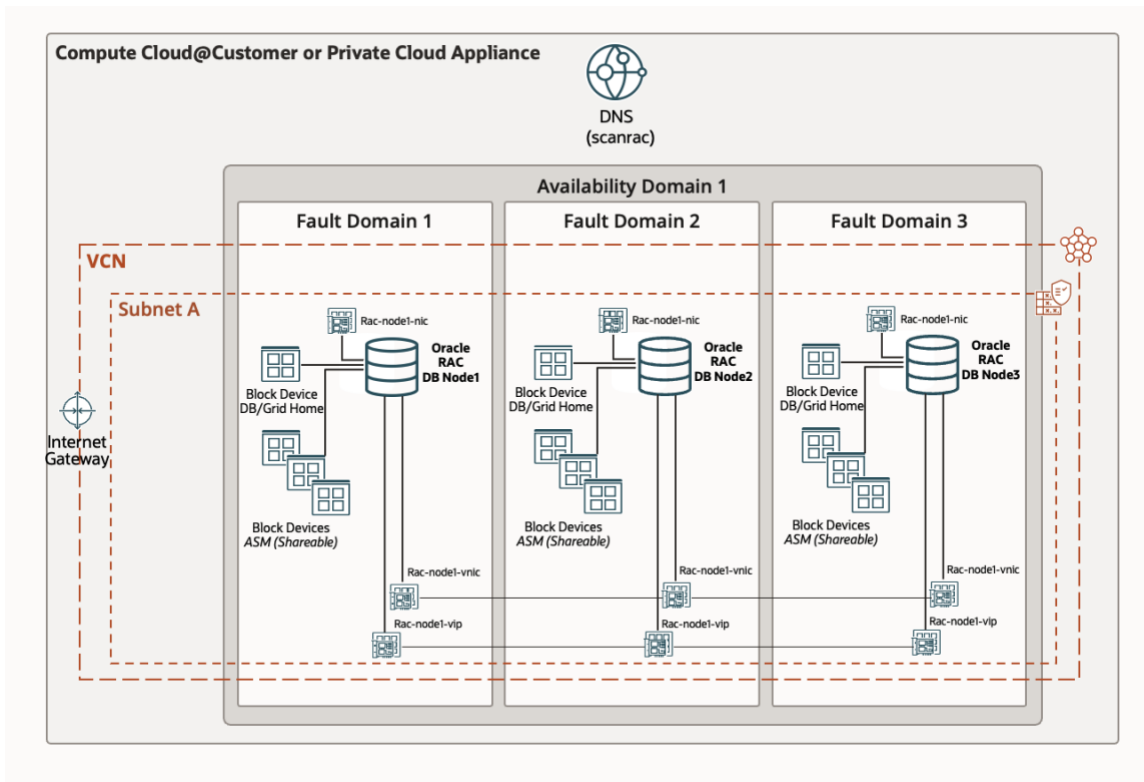


Figure 2. Architecture diagram of Oracle Real Appliance deployment on Oracle Private Cloud Appliance or Compute Cloud@Customer.

## Deployment of a 3-node Oracle RAC Database on Compute Cloud@Customer or Private Cloud Appliance

Listed below are the step-by-step to deploy a 3-node Oracle Real Appliance Cluster on Oracle Compute Cloud@Customer or Oracle Private Cloud Appliance, models: X9, X10 or above.

## Network Configuration

- On Oracle Compute Cloud@Customer or Oracle Private Cloud Appliance, all nodes of the Oracle RAC cluster must be connected to at least one public IP address or have access to the public/prod network/interface to allow user and application access to the database. In addition to the public network, a private interface is required for internal communication between cluster nodes and their respective database instances. Private interfaces are configured on the Compute Cloud@Customer or Private Cloud Appliances and attached to the Oracle Linux 9.5 instances which will be part of the Oracle Real Appliance Cluster (RAC). The private interface is utilized by Oracle Clusterware/Grid Infrastructure to build the interconnect. Also, each node needs a private interconnect interface. This interface is used specifically for communication between RAC instances to synchronize memory (SGA) blocks and coordinate database activity.
- Create a new VCN and define a valid CIDR range on Oracle Private Cloud Appliance or Oracle Compute Cloud@Customer. For this example, we are creating a new VCN named: racvcn.

**Create Virtual Cloud Network**

Name  
racvcn

Create in Compartment  
solutions

CIDR Block  
10.16.8.0/22

Use DNS hostnames in this VCN

Tagging >

Create Virtual Cloud Network Cancel

Figure 3 – VCN configuration for Oracle Real Appliance on Private Cloud Appliance or Compute Cloud@Customer.

- Create a public and private subnets in the new VCN created. In addition to defining subnets, it's essential to configure supporting network components such as Internet Gateways (IGW), security rules, DHCP options, and route tables to ensure proper connectivity and secure traffic flow based in your network infrastructure. The figures listed below show the configuration of public and private subnets to be utilized by the Oracle RAC nodes.

**Create Subnet**

Name  
public-sub

Create in Compartment  
solutions

CIDR Block  
10.16.9.0/26

Route Table  
Route Table solutions (change)  
Default Route Table for racvsn

Subnet Access  
 Private Subnet  
Prohibit public IP addresses for Instances in this Subnet  
 Public Subnet  
Allow public IP addresses for Instances in this Subnet

DNS Hostnames

Create Subnet Cancel

Figure 4 – Public subnet configuration for Oracle Real Appliance on Private Cloud Appliance or Compute Cloud@Customer.

**Create Subnet**

DNS Hostnames  
 Use DNS Hostnames in this Subnet  
Allows assignment of DNS hostname when launching an Instance  
 DNS Label  
public1

DHCP Options  
 DHCP Options solutions (change)  
DHCP Options

Security Lists

Tagging >

Create Subnet Cancel

Figure 5 – Public subnet DNS options configuration for Oracle Real Appliance on Private Cloud Appliance or Compute Cloud@Customer.



Figure 6 – Private subnet configuration for Oracle Real Appliance on Private Cloud Appliance or Compute Cloud@Customer.

Figure 7 – Private subnet DNS options configuration for Oracle Real Appliance on Private Cloud Appliance or Compute Cloud@Customer.

## Nodes Deployment

- On Oracle Private Cloud Appliance or Compute Cloud@Customer deploy three Oracle Linux instances using the latest Oracle Linux 9.5 platform image available (uln-pca-Oracle-Linux-9-2023.09.26\_0.oci image or greater, if available), each instance on different Fault Domain of the Oracle Private Cloud Appliance or Compute Cloud@Customer, Ex: (Node1 – Fault Domain1, Node2 – Fault Domain2, Node3 – Fault Domain3).
- Deploy the three Oracle Linux 9 instances within the designated Virtual Cloud Network (VCN) and public subnet configured on the network configuration session listed above.

<sup>9</sup> Deploying Oracle Database 23ai: Real Application Cluster (RAC) on Compute Cloud@Customer and Private Cloud Appliance, and Standalone Deployment on Roving Edge Public

- Choose the VM.PCAStandard1.x (on Private Cloud Appliance) or VM.PCAStandard.E5.Flex shape (on Compute Cloud@Customer), ensuring that each instance has at least 2 OCPUs and supports a minimum of two VNICs to meet RAC cluster requirements.

NOTE: Adjust the nodes OCPUs, memory and storage to best fit the demand of your production environment and workload.

Listed below is the configuration of all three Oracle Linux 9.5 instances for the Oracle RAC cluster:

Node Name	Public IP	Private IP	Shape	Fault Domain	Oracle Linux Image
db23ai-rac-node1	Instance public IP	10.16.9.2	VM.PCAStandard1.16 or VM.PCAStandard.E5.Flex	FAULT-DOMAIN-1	uln-pca-Oracle-Linux-9-2023.09.26_0.oci
db23ai-rac-node2	Instance public IP	10.16.9.3	VM.PCAStandard1.16 or VM.PCAStandard.E5.Flex	FAULT-DOMAIN-2	uln-pca-Oracle-Linux-9-2023.09.26_0.oci
db23ai-rac-node3	Instance public IP	10.16.9.4	VM.PCAStandard1.16 or VM.PCAStandard.E5.Flex	FAULT-DOMAIN-3	uln-pca-Oracle-Linux-9-2023.09.26_0.oci

Table 1 – Oracle Linux 9 instances configuration for Oracle Real Appliance Cluster on Private Cloud Appliance or Compute Cloud@Customer.

- For each compute instance in the Oracle RAC cluster, a primary VNIC is automatically created and attached to the same subnet within the VCN. This primary VNIC is assigned a hostname that corresponds to the intended cluster node name, example: db23ai-rac-node1, db23ai-rac-node2, and db23ai-rac-node3. For optimal networking performance, enable the **“Skip Source/Destination Check”** option on the primary (default) VNIC of each node of the Oracle RAC cluster. List below is the screenshot of the db23ai-rac-node1 with the **“Skip Source/Destination Check”** option enabled.

Figure 8 – Skip Source/Destination Check configuration for Oracle Real Appliance on Private Cloud Appliance or Compute Cloud@Customer.

- Enable virtual IP functionality required by Oracle RAC cluster, you must configure a secondary IP address on this VNIC and assign it a hostname in the format <cluster-node-name>-vip. For example: db23ai-rac-node1-vip, db23ai-rac-node2-vip, and db23ai-rac-node3-vip. The screenshot below shows the secondary IP address configuration of the db23ai-rac-node1-vip.

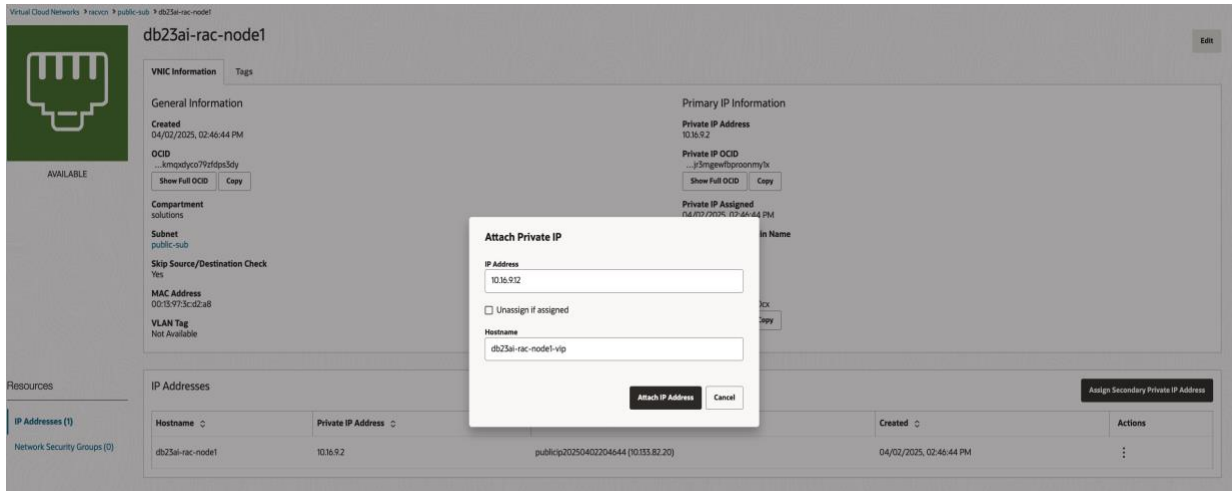


Figure 9 – Secondary IP address configuration on the Oracle Linux 9 instances on Private Cloud Appliance or Compute Cloud@Customer.

Listed below is the updated table with IP addressing information including the vip addressing required for the Oracle RAC utilized on this lab.

Node Name	Public IP	Private IP	Shape	Fault Domain	Oracle Linux Image
db23ai-rac-node1	Instance public IP	10.16.9.2	VM.PCAStandard1.16 or VM.PCAStandard.E5.Flex	FAULT-DOMAIN-1	uln-pca-Oracle-Linux-9-2023.09.26_0.oci
db23ai-rac-node1-vip		10.16.9.12			
db23ai-rac-node2	Instance public IP	10.16.9.3	VM.PCAStandard1.16 or VM.PCAStandard.E5.Flex	FAULT-DOMAIN-2	uln-pca-Oracle-Linux-9-2023.09.26_0.oci
db23ai-rac-node2-vip		10.16.9.13			
db23ai-rac-node3	Instance public IP	10.16.9.4	VM.PCAStandard1.16 or VM.PCAStandard.E5.Flex	FAULT-DOMAIN-3	uln-pca-Oracle-Linux-9-2023.09.26_0.oci
db23ai-rac-node3-vip		10.16.9.14			

Table 2 – Oracle Linux 9 instances vip configuration for Oracle Real Appliance on Private Cloud Appliance or Compute Cloud@Customer.

- For each Oracle Linux 9.5 node of the Oracle RAC cluster, create a secondary VNIC to serve as the private interconnect for Oracle RAC.
- Add the second VNIC in the private subnet of the same Virtual Cloud Network (VCN) on each node. You can either specify a private IP address manually or let the system assign one from the subnet's CIDR range.
- To enable the secondary VNIC inside of the Oracle Linux 9.5 nodes of the Oracle RAC, follow Oracle's documentation, which includes downloading and executing the `secondary_vnic_all_configure.sh` script or just editing the `/etc/sysconfig/network-scripts/ifcfg-*` configuration files.

Listed below are the configuration files and command line utilized to setup the secondary VNIC interface inside of the Oracle Linux 9.5 nodes of the Oracle RAC:

- Identify the secondary VNIC interface inside of the Oracle Linux 9.5 nodes of the Oracle RAC. On this example, the secondary VNIC is the ens5:

**nmcli connection show**

NAME	UUID	TYPE	DEVICE
Wired Connection ens5	b56e400f-3b23-4284-ae75-f060b7ad7be6	ethernet	ens3
lo	8126c120-a964-e959-ff98-ac4973344505	ethernet	ens5
System ens3	20ed2d5a-36b2-436b-b3e5-6d283ae30443	loopback	lo
	21d47e65-8523-1a06-af22-6f121086f085	ethernet	--

- Create a new configuration file for the ens5 VNIC and adjust to the IP address of your private subnet. Example:

```
/etc/sysconfig/network-scripts/ifcfg-ens5
DEVICE=ens5
NAME=ens5
TYPE=Ethernet
BOOTPROTO=none
ONBOOT=yes
IPADDR=10.16.10.2
PREFIX=26
NM_CONTROLLED=yes
```

- Restart the network service so the new network configuration can be enabled.

```
sudo nmcli connection reload
sudo nmcli connection down ens5
sudo nmcli connection up ens5
```

- Ensure all firewalls are disabled on each node to allow uninterrupted communication over the private interconnect network. Refer to the [Configuring the Instance OS for a Secondary VNIC](#)

Listed below is the example of the VNIC attachment on the node1 of the Oracle RAC cluster.

Figure 9 – Second VNIC attachment on Private Cloud Appliance or Compute Cloud@Customer.

Listed below is the updated table with IP addressing information including the node IP, the VIP address, and the secondary vNIC addressing required for the Oracle RAC.

Node Name	Public IP	Private IP	Shape	Fault Domain	Oracle Linux Image
<b>db23ai-rac-node1</b>		10.16.9.2			
<b>db23ai-rac-node1-vip</b>	Instance public IP	10.16.9.12	VM.PCAStandard1.16 or VM.PCAStandard.E5.Flex	FAULT-DOMAIN-1	uln-pca-Oracle-Linux-9-2023.09.26_0.oci
<b>db23ai-rac-node1-vnic</b>		10.16.10.2			
<b>db23ai-rac-node2</b>		10.16.9.3			
<b>db23ai-rac-node2-vip</b>	Instance public IP	10.16.9.13	VM.PCAStandard1.16 or VM.PCAStandard.E5.Flex	FAULT-DOMAIN-2	uln-pca-Oracle-Linux-9-2023.09.26_0.oci
<b>db23ai-rac-node2-vnic</b>		10.16.10.3			
<b>db23ai-rac-node3</b>		10.16.9.4			
<b>db23ai-rac-node3-vip</b>	Instance public IP	10.16.9.14	VM.PCAStandard1.16 or VM.PCAStandard.E5.Flex	FAULT-DOMAIN-3	uln-pca-Oracle-Linux-9-2023.09.26_0.oci
<b>db23ai-rac-node3-vnic</b>		10.16.10.4			

Table 3 – Oracle Linux 9 instances secondary vNICs configuration for Oracle Real Appliance on Private Cloud Appliance or Compute Cloud@Customer.

## DNS Configuration

Proper DNS configuration is essential for a successful Oracle RAC deployment. All hostnames, virtual IPs, and SCAN addresses must resolve correctly via DNS. On Oracle Compute Cloud@Customer or Oracle Private Cloud Appliance, you can use either the platform’s built-in DNS service or an external DNS server within your network.

For this lab, we’ve defined the rac.lab.zone DNS zone. This file defines name resolution for all critical components in a three-node Oracle RAC cluster. It includes forward DNS entries for each cluster node (db23ai-rac-node1, node2, and node3), their associated virtual IPs (VIPs), and private interconnect addresses used for cluster heartbeat communication.

It also defines a multi-entry SCAN (Single Client Access Name) record (scanrac) with four IP addresses for high availability and load-balanced client connections. The zone file specifies a local name server (ns1.rac.lab.) and includes standard SOA (Start of Authority) directives to support reliable DNS operations within the rac.lab domain.

In an Oracle RAC (Real Application Clusters) environment, the SCAN (Single Client Access Name) provides a consistent and simplified client connection mechanism to the clustered database. The SCAN hostname is registered in the DNS to resolve to four distinct IP addresses, corresponding to the three-node RAC cluster and a floating IP.

These IP addresses are associated with SCAN listeners that run on the cluster nodes and are dynamically managed by Oracle Grid Infrastructure. When a client attempts to connect to the RAC database, it queries the SCAN name, and one of the three IPs is returned via DNS in a round-robin fashion. The SCAN listener then redirects the connection to the appropriate local listener on the node currently servicing the requested database service.

This design decouples the client configuration from specific node addresses, enabling seamless scalability, load balancing, and high availability within the RAC cluster.

The sample listed below is from a DNS server. Ensure that you have a similar DNS configuration.

```

rac.lab.zone
$TTL 86400
@ IN SOA rac.lab. root.rac.lab. (
    2025042502 ; Serial
    3600       ; Refresh
    1800      ; Retry
    604800    ; Expire
    86400 )    ; Minimum TTL

@ IN NS ns1.rac.lab.

ns1 IN A 10.16.9.5

# DB hostnames
db23ai-rac-node1 IN A 10.16.9.2
db23ai-rac-node2 IN A 10.16.9.3
db23ai-rac-node3 IN A 10.16.9.4

# DB Nodes Virtual IPs
db23ai-rac-node1-vip IN A 10.16.9.12
db23ai-rac-node2-vip IN A 10.16.9.13
db23ai-rac-node3-vip IN A 10.16.9.14

# DB Nodes Private IPs
db23ai-rac-node1-priv IN A 10.16.10.2
db23ai-rac-node2-priv IN A 10.16.10.3
db23ai-rac-node3-priv IN A 10.16.10.4

scannac IN A 10.16.9.20
        IN A 10.16.9.21
        IN A 10.16.9.22
        IN A 10.16.9.23

```

NOTE: This configuration can also be set on the Oracle Compute Cloud@Customer or Oracle Private Cloud Appliance using the platform’s built-in DNS service. Refer to the [Name Resolution](#) section of the Oracle Compute Cloud@Customer official documentation for additional information.

- Ensure that all nodes of the Oracle RAC Cluster (nodes 1, 2, and 3) have the /etc/hosts properly configured. For example:

# Oracle RAC Nodes information

```
# Public hostnames
10.16.9.2    db23ai-rac-node1    db23ai-rac-node1.rac.lab
10.16.9.3    db23ai-rac-node2    db23ai-rac-node2.rac.lab
10.16.9.4    db23ai-rac-node3    db23ai-rac-node3.rac.lab

# Virtual IPs
10.16.9.12   db23ai-rac-node1-vip db23ai-rac-node1-vip.rac.lab
10.16.9.13   db23ai-rac-node2-vip db23ai-rac-node2-vip.rac.lab
10.16.9.14   db23ai-rac-node3-vip db23ai-rac-node3-vip.rac.lab

# Private Interconnect
10.16.10.2   db23ai-rac-node1-priv    db23ai-rac-node1-priv.rac.lab
10.16.10.3   db23ai-rac-node2-priv    db23ai-rac-node2-priv.rac.lab
10.16.10.4   db23ai-rac-node3-priv    db23ai-rac-node3-priv.rac.lab
```

- Ensure the nodes1, 2, and 3 of the Oracle RAC cluster can resolve the IP addresses all VIP interfaces. For example, utilized nslookup command on each node to check is the IP addresses of the VIP interfaces are resolving correctly. The nslookup for the scanrac entry needs to the return four different IP addresses:

```
[root@db23ai-rac-node1 ~]# nslookup db23ai-rac-node1
Server:          10.16.9.5
Address:         10.16.9.5#53
```

```
Name: db23ai-rac-node1.rac.lab
Address: 10.16.9.2
```

```
[root@db23ai-rac-node1 ~]# nslookup db23ai-rac-node2
Server:          10.16.9.5
Address:         10.16.9.5#53
```

```
Name: db23ai-rac-node2.rac.lab
Address: 10.16.9.3
```

```
[root@db23ai-rac-node1 ~]# nslookup db23ai-rac-node3
Server:          10.16.9.5
Address:         10.16.9.5#53
```

```
Name: db23ai-rac-node3.rac.lab
Address: 10.16.9.4
```

```
[root@db23ai-rac-node1 ~]# nslookup db23ai-rac-node1-vip
Server:          10.16.9.5
Address:         10.16.9.5#53
```

```
Name: db23ai-rac-node1-vip.rac.lab
Address: 10.16.9.12
```

```
[root@db23ai-rac-node1 ~]# nslookup db23ai-rac-node2-vip
Server:          10.16.9.5
Address:         10.16.9.5#53
```

```
Name: db23ai-rac-node2-vip.rac.lab
Address: 10.16.9.13
```

```
[root@db23ai-rac-node1 ~]# nslookup db23ai-rac-node3-vip
Server:          10.16.9.5
Address:         10.16.9.5#53
```

```
Name: db23ai-rac-node3-vip.rac.lab
Address: 10.16.9.14
```

```
[root@db23ai-rac-node1 ~]# nslookup db23ai-rac-node1-priv
Server:          10.16.9.5
Address:         10.16.9.5#53
Name: db23ai-rac-node1-priv.rac.lab
Address: 10.16.10.2
```

```
[root@db23ai-rac-node1 ~]# nslookup db23ai-rac-node2-priv
Server:          10.16.9.5
Address:         10.16.9.5#53
```

```
Name: db23ai-rac-node2-priv.rac.lab
Address: 10.16.10.3
```

```
[root@db23ai-rac-node1 ~]# nslookup db23ai-rac-node3-priv
Server:          10.16.9.5
Address:         10.16.9.5#53
```



```
Name: db23ai-rac-node3-priv.rac.lab
Address: 10.16.10.4
```

```
[root@db23ai-rac-node1 ~]# nslookup scanrac
Server:          10.16.9.5
Address:        10.16.9.5#53
```

```
Name: scanrac.rac.lab
Address: 10.16.9.20
Name: scanrac.rac.lab
Address: 10.16.9.22
Name: scanrac.rac.lab
Address: 10.16.9.21
Name: scanrac.rac.lab
Address: 10.16.9.23
```

## Storage Configuration

Oracle Real Application Clusters (RAC) leverages Oracle Automatic Storage Management (ASM) to efficiently manage shared storage. ASM serves as a cluster-aware volume manager and file system, specifically optimized for Oracle Database files. It provides the high performance of raw I/O while offering the simplicity and manageability of a traditional file system. ASM ensures consistent storage management across diverse server and storage platforms.

Listed below is the recommended storage configuration for the Oracle RAC on Oracle Compute Cloud@Customer or Oracle Private Cloud Appliance:

- **Oracle Grid and Database Home:** On each node of the Oracle RAC Cluster, create a dedicated Block Volume (one per cluster node) and attach it as Read/Write mode. This volume will host both the Oracle Grid Infrastructure Home and the Oracle Database Home. The /u01 folder.
- Choose a block volume size appropriate for your environment and workload. In this example, a 250GB block volume was used per node.
- If available, select the High-Performance volume type (20 VPU/GB), which is recommended for I/O-intensive workloads such as large databases, where maximum performance is critical.
- Set the backup policy to "Gold" to ensure a high level of data protection and retention.
- Attach each block volume to its respective node with read/write permissions.
- Format the block volumes, then create the /u01 directory on each node.
- Mount the file system to /u01 on each node.
- Update /etc/fstab on each node to ensure the mount point remains persistent after reboots.

Below is an example of the block volume configuration for Node 1. Apply the same configuration to each of the remaining nodes in the Oracle RAC cluster, then attach the block volumes as read and write to the nodes.

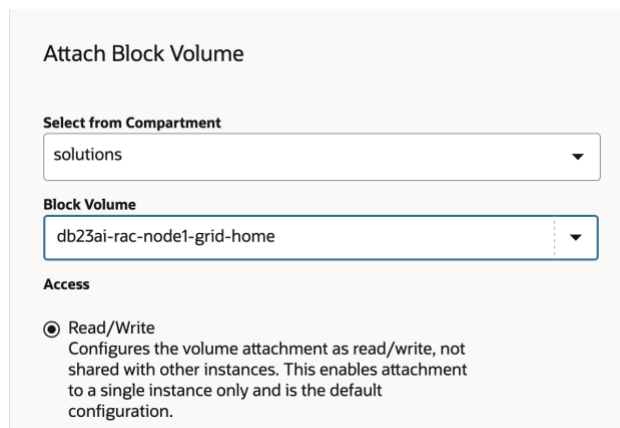
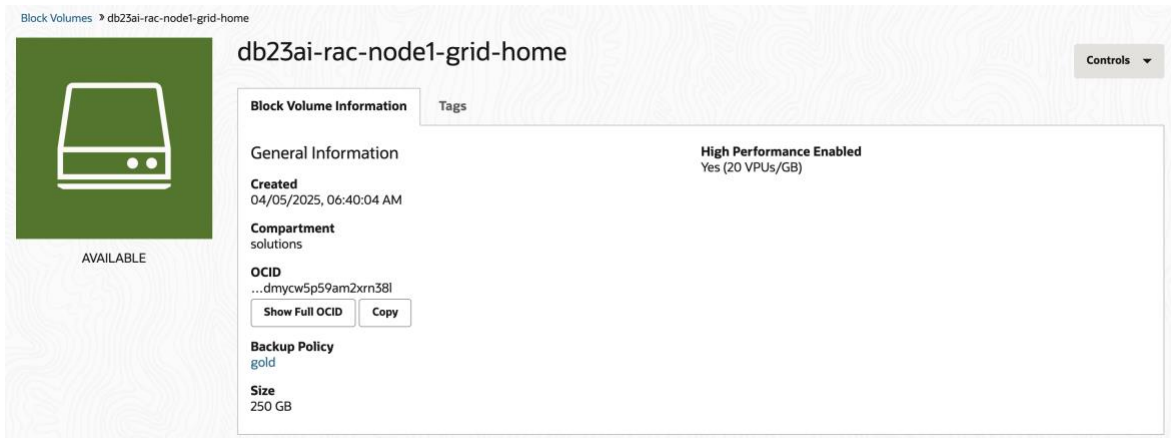


Figure 10 – Grid and Databases home configuration for Oracle Real Appliance on Private Cloud Appliance or Compute Cloud@Customer.

- **ASM Disk Groups:** Create additional block volumes to be used as ASM disk groups. In this example, we are provisioning three block volumes, each with a capacity of 100GB. **NOTE:** Choose the block volume size appropriate for your environment and workload.
- If available, select the High-Performance volume type, (20 VPU's/GB), which is recommended for I/O-intensive workloads such as large databases, where maximum performance is critical.
- Set the backup policy to "Gold" to ensure a high level of data protection and retention.

Name	State	Size	Backup Policy	Created	Actions
rac-asm-01	Available	100 GB	gold	04/05/2025, 06:56:35 AM	⋮
rac-asm-02	Available	100 GB	gold	04/05/2025, 06:57:17 AM	⋮
rac-asm-03	Available	100 GB	gold	04/05/2025, 06:57:40 AM	⋮

Figure 11 – ASM block volumes configuration for Oracle Real Appliance on Private Cloud Appliance or Compute Cloud@Customer.

- Attach the ASM Block Volumes in Shared mode to all nodes in the Oracle RAC cluster. These shared volumes will be used as the clustered ASM disks across the RAC cluster.

### Attach Block Volume

---

**Access**

Read/Write  
Configures the volume attachment as read/write, not shared with other instances. This enables attachment to a single instance only and is the default configuration.

Read/Write - Shareable  
Configures the volume attachment as read/write, shareable with other instances. This enables read/write attachment to multiple instances.

Read Only - Shareable  
Configures the volume attachment as read-only, enabling attachment to multiple instances.

Attach to Instance
Cancel

Figure 12 – ASM block read/write – shareable mode configuration for Oracle Real Appliance on Private Cloud Appliance or Compute Cloud@Customer.

### Attached Block Volumes Attach Block Volume

Name	State	Type	Read Only?	Shareable?	Created	Actions
db23ai-rac-node1-grid-home	Attached	paravirtualized	No	No	04/05/2025, 06:46:27 AM	⋮
rac-asm-01	Attached	paravirtualized	No	Yes	04/05/2025, 07:06:25 AM	⋮
rac-asm-02	Attached	paravirtualized	No	Yes	04/05/2025, 07:06:40 AM	⋮
rac-asm-03	Attached	paravirtualized	No	Yes	04/05/2025, 07:06:55 AM	⋮

Figure 13 – ASM block volumes attachment configuration for Oracle Real Appliance on Private Cloud Appliance or Compute Cloud@Customer.

## Oracle RAC Environment Preparation

The `setup_oracle_env.sh` script listed below automates the preparation of an Oracle RAC system for Grid Infrastructure and Oracle Database 23ai installation on Oracle Linux on Compute Cloud@Customer or Private Cloud Appliance. It ensures consistency, reduces manual effort, and eliminates configuration errors across nodes in the cluster.

Listed below are the key functions performed by the script and how to execute it in your environment.

### 1. GRUB Clocksource Configuration: Updates all kernels with the recommended tsc clocksource:

```
grubby --update-kernel=ALL --args="tsc=reliable clocksource=tsc"
```

- Ensures deterministic and consistent timing in virtualized and bare-metal environments.
- Requires a reboot for the change to take effect.
- Post-reboot verification: To ensure the tsc clocksource has been setup correctly, manually run the following command on each node after reboot:

```
cat /sys/devices/system/clocksource/clocksource0/current_clocksource
```

### 2. Swap Space Creation

- Creates a secure 16GB swap file using fallocate command line.
- Applies proper permissions (chmod 600), formats with mkswap, activates with swapon.
- Persists the swap configuration in /etc/fstab.

### 3. Oracle User and Group Provisioning

- Creates required Oracle groups with standard GIDs: asmadmin (54331), asmdba (54332), asmoper (54333)
- Creates the grid user (UID 54330) with the correct group memberships for ASM and RAC operations.

### 4. Directory Structure Setup

- Creates all required base directories for Oracle Grid Infrastructure and RDBMS:
- /u01/app/23ai/grid
- /u01/app/grid
- /u01/app/oracle
- Applies correct ownership and permissions (grid:oinstall and oracle:oinstall, chmod 775).
- Creates and secures the Oracle Inventory directory at /etc/oraInventory.

### 5. Logical Volume Management for /u01

- Scans for unpartitioned block devices of size 250GB. NOTE: Adjust the size of the block device to best fit your environment. On this deployment, we are working with a 250GB block device size for the /u01 mount point.
- Creates a volume group (voldb) and logical volume (lvoldb) using 100% of the free space.
- Formats the logical volume with XFS filesystem.
- Mounts the volume at /u01.
- Persists the mount configuration in /etc/fstab using UUID= syntax.

**Copy the script content below and save it as:** /usr/local/bin/setup\_u01\_filesystem.

**Make it executable:** chmod 755 /usr/local/bin/setup\_u01\_filesystem. Run the script as root or with sudo privileges on each node of the Oracle RAC cluster.

```

#!/bin/bash
# setup_oracle_env.sh
# Automates the configuration of Oracle RAC filesystem, users, clocksource, and swap space.

set -e

# === GRUB clocksource tuning ===
echo "Adjusting GRUB clocksource..."
grubby --update-kernel=ALL --args="tsc=reliable clocksource=tsc"
echo "GRUB updated. A reboot is required for changes to take effect."

# === Create 16GB swap file ===
echo "Creating 16GB swap file..."
fallocate -l 16G /swapfile
chmod 600 /swapfile
mkswap /swapfile
swapon /swapfile
echo '/swapfile swap swap defaults 0 0' >> /etc/fstab
echo "Swap file created and enabled."

# === Create Oracle groups ===
echo "Creating Oracle groups..."
groupadd -g 54331 asmadmin || echo "Group asmadmin created"
groupadd -g 54332 asmdba || echo "Group asmdba created"
groupadd -g 54333 asmoper || echo "Group asmoper created"

# === Create grid user ===
echo "Creating grid user..."
useradd -u 54330 -g oinstall -G asmadmin,asmdba,asmoper,dba grid -d /home/grid -m -s /bin/bash
|| echo "User grid already exists"

# === Configure /u01 Logical Volume ===
TARGET_SIZE="250G"
VG_NAME="voldb"
LV_NAME="lvoldb"
MOUNT_POINT="/u01"

echo "Identifying available $TARGET_SIZE block devices..."
NEW_DEVICES=$(lsblk -o NAME,SIZE -dn | awk -v size="$TARGET_SIZE" '$2 == size {print "/dev/"$1}')

if [ -z "$NEW_DEVICES" ]; then
    echo "No new block devices with size $TARGET_SIZE found. Exiting..."
    exit 1
fi

echo "Creating volume group $VG_NAME with $NEW_DEVICES..."
vgcreate $VG_NAME $NEW_DEVICES

echo "Creating logical volume $LV_NAME..."
lvcreate -l 100%FREE -n $LV_NAME $VG_NAME

LV_PATH="/dev/$VG_NAME/$LV_NAME"
echo "Formatting $LV_PATH with XFS..."
mkfs.xfs $LV_PATH

echo "Mounting $LV_PATH at $MOUNT_POINT..."
mkdir -p $MOUNT_POINT

```

```

mount $LV_PATH $MOUNT_POINT

UUID=$(blkid -s UUID -o value $LV_PATH)
echo "Updating /etc/fstab..."
echo "UUID=$UUID $MOUNT_POINT xfs defaults 0 0" >> /etc/fstab

echo "Environment setup complete. Please reboot the system to apply GRUB clocksource changes."

# === Create Oracle base directories ===
echo "Creating Oracle base directories..."
mkdir -p /u01/app/23ai/grid
mkdir -p /u01/app/grid
mkdir -p /u01/app/oracle
chown -R grid:oinstall /u01
chown oracle:oinstall /u01/app/oracle
chmod -R 775 /u01/

# === Create Oracle Inventory directory ===
echo "Creating Oracle Inventory directory..."
mkdir -p /etc/oraInventory
chown grid:oinstall /etc/oraInventory
chmod 770 /etc/oraInventory

```

## Oracle Database 23ai Software Installation

- **Firewall Configuration:** Make sure all firewalls are disabled to allow private interconnect traffic to go through without issues.
- **Install the Oracle Database 23ai preinstall package:** The Oracle Database 23ai preinstall package (oracle-database-preinstall-23ai) is a convenience RPM package provided by Oracle to help automate and streamline the setup of an Oracle Database 23ai environment on Oracle Linux.

```
sudo dnf install -y oracle-database-preinstall-23ai
```

When installed, it performs the following:

**Installs Required OS Packages.** It installs all necessary dependencies such as:

- binutils
- glibc
- libaio
- ksh
- gcc, make
- compat-libcap1
- smartmontools
- sysstat
- And many more based on Oracle's requirements for the 23ai release

**Creates Oracle User and Groups.** It automatically:

- Creates the oracle user (if it doesn't exist)
- Creates groups like:
- oinstall
- dba
- asmadmin, asmdba, asmoper (for Grid Infrastructure)

- Sets default passwords and home directories

**Sets Kernel Parameters:** It configures `/etc/sysctl.conf` with optimized values for Oracle DB, such as:

```
fs.file-max = 6815744
kernel.sem = 250 32000 100 128
kernel.shmmax = [half of RAM]
net.ipv4.ip_local_port_range = 9000 65500
Then applies the changes via sysctl -p.
```

**Sets User Resource Limits:** It updates `/etc/security/limits.d/oracle-database-preinstall-23ai.conf` with:

```
oracle soft nofile 1024
oracle hard nofile 65536
oracle soft nproc 16384
oracle hard nproc 16384
oracle soft stack 10240
oracle hard stack 32768
```

**Configures PAM and Shell Profiles:** It adds Oracle environment settings to:

```
/etc/pam.d/login
/etc/profile.d/oracle.sh (for setting ORACLE_HOME, PATH, etc.)
```

**Ensures Consistency Across Nodes:** On RAC systems, this package helps ensure all nodes have identical OS-level configuration, simplifying installation of Oracle Grid Infrastructure and RAC databases.

## SSH Configuration

Ensure that all nodes of the cluster can access each other without password, using passwordless SSH configuration. Follow the steps listed below to properly setup passwordless SSH on all nodes of the Oracle RAC Cluster.

- With root user, setup passwords for both users, grid and oracle:

```
passwd grid
passwd oracle
```

Repeat these steps **for each user** (root, grid, oracle) and ensure you do them **on all three nodes**.

- `sudo vi /etc/ssh/sshd_config`. Find (or add) this line: **PasswordAuthentication yes**

```
sudo systemctl restart sshd
```

**NOTE:** This allows you to log in using passwords temporarily to set up key-based auth.

- Generate SSH Keys (on each node, for each user). For each user (root, grid, oracle), on each node run:

```
ssh-keygen -t rsa
cat ~/.ssh/id_rsa.pub >> ~/.ssh/authorized_keys
chmod 700 ~/.ssh
chmod 600 ~/.ssh/authorized_keys
```

- Copy Public Keys Between Nodes (for oracle and grid users)

- For oracle user:

On db23ai-rac-node1

```
scp ~/.ssh/id_rsa.pub oracle@db23ai-rac-node2:/tmp/node1-oracle.pub
scp ~/.ssh/id_rsa.pub oracle@db23ai-rac-node3:/tmp/node1-oracle.pub
```

On db23ai-rac-node2

```
scp ~/.ssh/id_rsa.pub oracle@db23ai-rac-node1:/tmp/node2-oracle.pub
scp ~/.ssh/id_rsa.pub oracle@db23ai-rac-node3:/tmp/node2-oracle.pub
```

On db23ai-rac-node3

```
scp ~/.ssh/id_rsa.pub oracle@db23ai-rac-node1:/tmp/node3-oracle.pub
scp ~/.ssh/id_rsa.pub oracle@db23ai-rac-node2:/tmp/node3-oracle.pub
```

- For grid user:

On db23ai-rac-node1

```
scp ~/.ssh/id_rsa.pub grid@db23ai-rac-node2:/tmp/node1-grid.pub
scp ~/.ssh/id_rsa.pub grid@db23ai-rac-node3:/tmp/node1-grid.pub
```

On db23ai-rac-node2

```
scp ~/.ssh/id_rsa.pub grid@db23ai-rac-node1:/tmp/node2-grid.pub
scp ~/.ssh/id_rsa.pub grid@db23ai-rac-node3:/tmp/node2-grid.pub
```

On db23ai-rac-node3

```
scp ~/.ssh/id_rsa.pub grid@db23ai-rac-node1:/tmp/node3-grid.pub
scp ~/.ssh/id_rsa.pub grid@db23ai-rac-node2:/tmp/node3-grid.pub
```

- Combine Public Keys into authorized\_keys (for ALL USERS)

For oracle user:

On each node (db23ai-rac-node1, node2, node3):

```
cat /tmp/node1-oracle.pub >> ~/.ssh/authorized_keys
cat /tmp/node2-oracle.pub >> ~/.ssh/authorized_keys
cat /tmp/node3-oracle.pub >> ~/.ssh/authorized_keys
chmod 600 ~/.ssh/authorized_keys
```

For grid user:

On each node (db23ai-rac-node1, node2, node3):



```
cat /tmp/node1-grid.pub >> ~/.ssh/authorized_keys
cat /tmp/node2-grid.pub >> ~/.ssh/authorized_keys
cat /tmp/node3-grid.pub >> ~/.ssh/authorized_keys
chmod 600 ~/.ssh/authorized_keys
```

- Test Passwordless SSH. From node1 for each user. No password should be prompted. Example:

```
ssh db23ai-rac-node1
ssh db23ai-rac-node2
ssh db23ai-rac-node3
```

## Oracle RAC Installation

- Setup the correct permissions for the block volumes which will be utilized by the ASM. On this example, we are using three 100GB block volumes: /dev/sdc, /dev/sdd, and /dev/sdf which will be configured for use with Oracle RAC ASM. Ensure that the correct ownership and permissions are set for the grid user and asmdba group by executing the following commands:

```
chown grid:asmdba /dev/sdc /dev/sdd /dev/sdf
chmod 660 /dev/sdc /dev/sdd /dev/sdf
```

**IMPORTANT:** No ASM disk labeling or disk group configuration manual is needed. The ASM disks and ASM Disk Group will be labeled and configured with the gridSetup script, explained in the Grid Infrastructure installation section of this solution paper.

**IMPORTANT:** At this stage, it is highly recommended to create a backup image of the three Oracle Linux 9.5 instances that will be part of the Oracle RAC Cluster. These images serve as a recovery point in case of issues during the installation of Oracle Grid Infrastructure or Oracle RAC Database 23ai. They can also be reused later to simplify the expansion of the cluster—for example, when adding nodes 4, 5, or more.

- Download the latest Oracle DB23ai for Engineering Systems and the Oracle Database Grid Infrastructure packages from Oracle Software Delivery Cloud.

The screenshot shows the Oracle Software Delivery Cloud interface. At the top, there is a header with "Oracle Software Delivery Cloud" on the left and "Need Help? Contact Software" on the right. Below the header, a message states: "To continue, select the Platform/Language for each individual Release. To remove an item from the Download Queue, please uncheck the box next to the title. Language Supplement Release where applicable, check the box next to the Release title and select your desired Language." Below this message is a "Back" button and a table with the following columns: "Download Queue", "Terms and Restrictions", "Platforms / Languages", and "Size".

<input checked="" type="checkbox"/> Download Queue	Terms and Restrictions	Platforms / Languages	Size
<input checked="" type="checkbox"/> Oracle Database 23.5	Oracle Standard Terms and Restrictions		
<input checked="" type="checkbox"/> Oracle Database 23.5 - for Engineered Systems		Linux x86	2.1 GB
<input checked="" type="checkbox"/> Oracle Database Client 23.5.0.0.0		Linux x86	1.6 GB
<input checked="" type="checkbox"/> Oracle Database Global Service Manager 23.5.0.0.0		Linux x86	674.4 MB
<input checked="" type="checkbox"/> Oracle Database Grid Infrastructure 23.5 - for Engineered Systems		Linux x86	992.4 MB

Figure 14 – Oracle Software Delivery Cloud – Download of Oracle Database and Grid Infrastructure 23ai.

- With oracle user, (sudo su – oracle) unzip the Oracle Database 23.5 – For Engineered Systems package into the following directory listed below:

```
mkdir -p /u01/app/oracle/product/23ai/dbhome_1
chown oracle:oinstall /u01/app/oracle/product/23ai/dbhome_1
cd /u01/app/oracle/product/23ai/dbhome_1/
unzip /u01/db37703495_250319041827.zip
```

- With grid user, (sudo su – grid) unzip the Oracle Database Grid Infrastructure package into the following directory listed below:

```
cd /u01/app/23ai/grid
unzip grid37689703_250412211854.zip
```

- With grid user, run the cluster verification utility with the following command line:

```
/u01/app/23ai/grid/runcluvfy.sh stage -pre crsinst -n db23ai-rac-node1,db23ai-rac-node2,db23ai-rac-node3 -fixup -verbose
```

Below is the final part/summary of the cluvfy command line. cluvfy output shows that the Oracle Grid Infrastructure pre-installation check (stage -pre crsinst) for the 3-node Oracle RAC setup has completed successfully. All mandatory checks passed with no fixable issues found.

```
CVU operation performed:      stage -pre crsinst
Date:                        Apr 22, 2025, 7:45:53 PM
CVU version:                  23.8.0.25.4 (040125x8664)
CVU home:                     /u01/app/23ai/grid
User:                         oracle
Operating system:            Linux5.15.0-307.178.5.el9uek.x86_64
```

No fixable verification failures to fix

**IMPORTANT:** Before proceeding with the installation, run the Cluster Verification Utility (CLUVFY) to confirm that all nodes meet the required pre-installation prerequisites. If any errors are reported in the verification output, resolve them before continuing. CLUVFY will automatically generate fixup scripts and place them under the /tmp directory on each node. These scripts can be executed to address most of the issues identified during the verification process. Refer to the [Oracle Database 23ai official documentation](#) for additional recommendations and tunable options for production environments.

## Grid Infrastructure installation

The command listed below will install Oracle Grid Infrastructure 23ai in silent mode in all 3-nodes of the Oracle RAC cluster. It runs without prompting for any GUI interaction and all required input is provided through parameters and a response file. It will set up ASM using /dev/sd\* devices with AFD enabled and disables optional GIMR and IPMI services. The full list of parameters with explanation of each one is listed on the table below.

To install Oracle Grid Infrastructure on the three nodes of the Oracle RAC cluster, please run the command line listed below on the node1 (db23ai-rac-node1) with Oracle user.

NOTE: Adjust the options highlighted in red below to best fit your production environment, such as:

- Scan name
- Cluster name
- Nodes names
- Network interfaces
- SYSASMP and Monitor passwords
- Block volumes and ASM disk group names

```
/u01/app/23ai/grid/gridSetup.sh -silent \
-responseFile /u01/app/23ai/grid/install/response/gridsetup.rsp \
ORACLE_BASE=/u01/app/oracle \
ORACLE_HOME=/u01/app/23ai/grid \
oracle.install.option=CRS_CONFIG \
oracle.install.crs.config.gnp.scanName=scanrac.rac.lab \
oracle.install.crs.config.gnp.scanPort=1521 \
oracle.install.crs.config.ClusterConfiguration=CLUSTER_NEW \
oracle.install.crs.config.clusterName=db23ai-cluster \
oracle.install.crs.config.clusterNodes=db23ai-rac-node1:db23ai-rac-node1-vip,db23ai-rac-
node2:db23ai-rac-node2-vip,db23ai-rac-node3:db23ai-rac-node3-vip \
oracle.install.crs.config.networkInterfaceList=ens3:10.16.9.0:1,ens5:10.16.10.0:5 \
oracle.install.crs.configureGIMR=false \
oracle.install.crs.config.useIPMI=false \
oracle.install.asm.OSDBA=asmdba \
oracle.install.asm.OSOPER=asmoper \
oracle.install.asm.OSASM=asmadmin \
oracle.install.crs.rootconfig.executeRootScript=false \
oracle.install.asm.SYSASMPassword=Your password \
oracle.install.asm.diskGroup.name=DATA \
oracle.install.asm.diskGroup.redundancy=EXTERNAL \
oracle.install.asm.diskGroup.AUSize=4 \
oracle.install.asm.diskGroup.disks=/dev/sdb,/dev/sdc,/dev/sdd \
oracle.install.asm.diskGroup.disksWithFailureGroupNames=/dev/sdb,,/dev/sdc,,/dev/sdd, \
oracle.install.asm.diskGroup.diskDiscoveryString=/dev/sd* \
oracle.install.asm.monitorPassword=Your Password \
oracle.install.asm.configureGIMRDataDG=false \
oracle.install.asm.configureAFD=true
```

Listed below is the explanation of each parameter passed to the gridSetup.sh script:

Script option	Description
/u01/app/23ai/grid/gridSetup.sh -silent	Launch the Grid Infrastructure installer silently (no GUI).
-responseFile /u01/app/23ai/grid/install/response/gridsetup.rsp	Use the specified response file for default parameters.
ORACLE_BASE=/u01/app/oracle	Set Oracle Base directory where administrative files will be stored.
ORACLE_HOME=/u01/app/23ai/grid	Set Oracle Home directory for Grid Infrastructure binaries.
oracle.install.option=CRS_CONFIG	Install and configure Oracle Clusterware (RAC cluster infrastructure).

Script option	Description
oracle.install.crs.config.gnp.scanName=scanrac.rac.lab	Set the SCAN (Single Client Access Name) for the cluster.
oracle.install.crs.config.gnp.scanPort=1521	Set the SCAN port (default for Oracle is 1521).
oracle.install.crs.config.ClusterConfiguration=CLUSTER_NEW	Create a new cluster (not adding to an existing one).
oracle.install.crs.config.clusterName=db23ai-cluster	Name the new cluster.
oracle.install.crs.config.clusterNodes	List the cluster nodes and their corresponding VIPs (Virtual IPs).
oracle.install.crs.config.networkInterfaceList	Define private (interconnect) and public network interfaces by their IP subnets and roles.
oracle.install.crs.configureGIMR=false	Do not configure the Oracle Grid Infrastructure Management Repository (GIMR).
oracle.install.crs.config.useIPMI=false	Do not configure IPMI (hardware-based cluster fencing).
oracle.install.asm.OSDBA=asmdba	Set OSDBA group for ASM.
oracle.install.asm.OSOPER=asmoper	Set OSOPER group for ASM.
oracle.install.asm.OSASM=asmadmin	Set OSASM group for ASM.
oracle.install.crs.rootconfig.executeRootScript=false	automatically run root scripts (you will run them manually later).
oracle.install.asm.SYSASMPassword=Your password	Set the SYSASM password for ASM administration.
oracle.install.asm.diskGroup.name=DATA	Create a disk group named DATA for ASM.
oracle.install.asm.diskGroup.redundancy=EXTERNAL	Disk group has no mirroring (External redundancy; storage is assumed to protect itself).
oracle.install.asm.diskGroup.AUSize=4	Set ASM Allocation Unit (AU) size to 4MB.
oracle.install.asm.diskGroup.disks=/dev/sdb,/dev/sdc,/dev/sdd	Use these block devices to create the DATA disk group.
oracle.install.asm.diskGroup.disksWithFailureGroupNames=/dev/sdb,/,dev/sdc,/,dev/sdd,	Assign disks (no custom failure groups).
oracle.install.asm.diskGroup.diskDiscoveryString=/dev/sd*	Set disk discovery path for ASM.
oracle.install.asm.monitorPassword=Welcome1	Password for monitoring ASM.
oracle.install.asm.configureGIMRDataDG=false	Do not configure GIMR storage in ASM.
oracle.install.asm.configureAFD=true	Configure ASM Filter Driver (AFD) for enhanced disk access security and performance.

Listed below is output of the successful installation of the Oracle Grid Infrastructure on the three nodes of the Oracle RAC Cluster:

The response file for this session can be found at:  
/u01/app/23ai/grid/install/response/grid\_2025-04-25\_05-43-37PM.rsp

You can find the log of this install session at: /tmp/GridSetupActions2025-04-25\_05-43-37PM/gridSetupActions2025-04-25\_05-43-37PM.log

Successfully Setup Software.

**Note:** Please refer to the below MOS note before proceeding with running Root.sh on all three nodes of the Oracle RAC Cluster: Steps to configure Grid Infrastructure in a PCA X9-2 RACK (Doc ID 2901750.1). Once the configuration listed on this MOS note has been successfully applied, proceed to the next step.

- As a root user, run the following scripts on all three nodes of the Oracle RAC Cluster. Successfully Setup Software:

```
/u01/app/23ai/grid/root.sh
/u01/app/oraInventory/orainstRoot.sh
```

- As grid user, run the gridSetup.sh script with the response file listed above to complete the configuration of the Oracle Grid Infrastructure

```
/u01/app/23ai/grid/gridSetup.sh -silent -executeConfigTools -responseFile /u01/app/23ai/grid/install/response/grid_2025-04-25_05-43-37PM.rsp
```

- After successful installation of the Oracle Grid Infrastructure, check the post installation with the following command line:

```
/u01/app/23ai/grid/bin/cluvfy stage -post crsinst -n db23ai-rac-node1,db23ai-rac-node2,db23ai-rac-node3
```

Listed below is the output of the successful post installation verification of the Grid Infrastructure:

Performing following verification checks ...

Node Connectivity ...

Hosts File ...PASSED

Check that maximum (MTU) size packet goes through subnet ...PASSED

subnet mask consistency for subnet "10.16.10.0" ...PASSED

subnet mask consistency for subnet "10.16.9.0" ...PASSED

Node Connectivity ...PASSED

Vendor cluster check ...PASSED

Path existence, ownership, permissions and attributes ...

Path "/var" ...PASSED

Path "/var/lib/oracle" ...PASSED

Path "/u01/app/oraInventory/ContentsXML/inventory.xml" ...PASSED

Path "/dev/asm" ...PASSED

Path "/dev/shm" ...PASSED

Path "/etc/oracleafd.conf" ...PASSED

Path "/etc/init.d/ohasd" ...PASSED

Path "/etc/init.d/init.ohasd" ...PASSED

Path "/etc/init.d/init.tfa" ...PASSED

Path "/etc/oracle/maps" ...PASSED

Path "/etc/oraInst.loc" ...PASSED

Path "/etc/tmpfiles.d/oracleGI.conf" ...PASSED

Path "/u01/app/oracle/diag/crs/db23ai-rac-node1/crs/incpkg" ...PASSED

Path "/u01/app/oracle/diag/crs/db23ai-rac-node1/crs/sweep" ...PASSED

Path "/u01/app/oracle/diag/crs/db23ai-rac-node1/crs/metadata\_dgif" ...PASSED

Path "/u01/app/oracle/diag/crs/db23ai-rac-node1/crs/alert" ...PASSED

Path "/u01/app/oracle/diag/crs/db23ai-rac-node1/crs/incident" ...PASSED

Path "/u01/app/oracle/diag/crs/db23ai-rac-node1/crs/cdump" ...PASSED

Path "/u01/app/oracle/diag/crs/db23ai-rac-node1/crs/stage" ...PASSED

Path "/u01/app/oracle/diag/crs/db23ai-rac-node1/crs/trace" ...PASSED

Path "/u01/app/oracle/diag/crs/db23ai-rac-node1/crs/metadata" ...PASSED

Path "/u01/app/oracle/diag/crs/db23ai-rac-node1/crs/lck" ...PASSED

Path "/u01/app/oracle/diag/crs/db23ai-rac-node1/crs/log" ...PASSED

Path "/u01/app/oracle/diag/crs/db23ai-rac-node1/crs/metadata\_pv" ...PASSED

Path "/u01/app/23ai/grid/gnp/wallets/peer/cwallet.sso" ...PASSED

Path "/u01/app/23ai/grid/gnp/wallets/root/ewallet.p12" ...PASSED

Path "/u01/app/23ai/grid/gnp/profiles/peer/profile.xml" ...PASSED

Path existence, ownership, permissions and attributes ...PASSED

Cluster Integrity ...PASSED

CRS Integrity ...

Clusterware Version Consistency ...PASSED

CRS Integrity ...PASSED

User Not In Group "root": grid ...PASSED

Oracle Net Services configuration ...PASSED

Package: psmisc-22.6-19 ...PASSED

File system mount options for path GI\_HOME ...PASSED

File system mount option hidepid for proc filesystem ...PASSED

Cleanup of communication socket files ...PASSED

Domain Sockets ...PASSED

ORAchk health score ...

CSS reboot time ...PASSED

Verify clusterware internal patch metadata matches grid home OPatch inventory ...PASSED

GI/CRS - Private interconnect interface name check ...PASSED

TFA Collector status ...PASSED

VIP NIC bonding config. ...PASSED

Verify Cluster health Monitor(CHM) configuration ...PASSED

Clusterware version comparison ...PASSED

Clusterware software version comparison ...PASSED

```

Verify / at the end of ORACLE_HOME ...PASSED
HAIP and Bonded interface ...PASSED
RAC interconnect network card speed ...PASSED
Operating System Version comparison ...PASSED
Root time zone ...PASSED
Verify Cluster health analyzer (CHA) configuration ...PASSED
Public interface existence ...PASSED
Verify private and public network subnet configuration in Oracle Clusterware registry
...PASSED
Check the integrity of key GI startup files ...PASSED
CSS log file size ...PASSED
CSS disktimeout ...PASSED
Old log files in client directory in crs_home ...PASSED
3rd Party Clusterware Node Numbering ...PASSED
Non-routable network for interconnect ...PASSED
Jumbo frames configuration for interconnect ...PASSED
Verify Cluster Synchronization Services (CSS) misscount value ...PASSED
Verify CRS Attribute RESOURCE_USE_ENABLED ...PASSED
Hang and Deadlock material ...PASSED
GI/CRS software owner across cluster ...PASSED
Verify online (hot) patches are not applied on CRS_HOME ...PASSED
ORACHK health score 91% ...PASSED

```

Post-check for cluster services setup was successful.

```

CVU operation performed:    stage -post crsinst
Date:                      Apr 25, 2025, 7:34:59 PM
CVU version:                23.8.0.25.4 (040125x8664)
Clusterware version:       23.0.0.0.0
CVU home:                   /u01/app/23ai/grid
Grid home:                  /u01/app/23ai/grid
User:                       grid
Operating system:          Linux5.15.0-307.178.5.el9uek.x86_64

```

At this stage, the Grid Infrastructure is ready for the Oracle RAC Database installation.

## Oracle RAC Database Software Installation

Follow the steps listed below to install Oracle RAC Database 23ai:

- With oracle user, (sudo su – oracle) unzip the golden image into the following directory listed below:

```

cd /u01/app/oracle/product/23ai/dbhome_1/
unzip /u01/db37703495_250319041827.zip

```

- Ensure the variables environment is correctly set for the Oracle user:

```

vi /home/oracle/.bash_profile:

```

```

export ORACLE_HOME=/u01/app/oracle/product/23ai/dbhome_1
export ORACLE_BASE=/u01/app/oracle
export ORACLE_SID=orcl
export PATH=$ORACLE_HOME/bin:$PATH

```

- Run the Oracle Database 23ai Installer in silent mode:

```
cd /u01/app/oracle/product/23ai/dbhome_1/

./runInstaller -silent \
-responseFile /u01/app/oracle/product/23ai/dbhome_1/install/response/db_install.rsp \
oracle.install.option=INSTALL_DB_SWONLY \
ORACLE_BASE=/u01/app/oracle \
ORACLE_HOME=/u01/app/oracle/product/23ai/dbhome_1 \
oracle.install.db.InstallEdition=EE \
oracle.install.db.OSDBA_GROUP=dba \
oracle.install.db.OSOPER_GROUP=oper \
oracle.install.db.OSBACKUPDBA_GROUP=backupdba \
oracle.install.db.OSDGDBA_GROUP=dgdba \
oracle.install.db.OSKMDBA_GROUP=kmdba \
oracle.install.db.OSRACDBA_GROUP=racdba \
DECLINE_SECURITY_UPDATES=true
```

- After successfully installing the Oracle Database 23ai, as a root user, run the following script(s):

```
/u01/app/oraInventory/orainstRoot.sh
/u01/app/oracle/product/23ai/dbhome_1/root.sh
```

- At this stage, Oracle Database 23ai will be installed and ready for database creation steps.

## Oracle RAC Database 23ai Creation

Listed below are the steps to create a new database on top of Oracle RAC 23ai:

- With oracle user (sudo su – oracle) Create a new database with the following command line. NOTE: Adjust the database name and the parameters highlighted in red below to best fit your production environment.

**NOTE:** The command line below will ask for the PDBADMIN user password previously configured.

```
/u01/app/oracle/product/23ai/dbhome_1/bin/dbca -silent -createDatabase \
-templateName General_Purpose.dbc \
-gdbName orcl \
-sid orcl \
-createAsContainerDatabase true \
-numberOfPDBs 1 \
-pdbName pdb1 \
-createListener default \
-responseFile NO_VALUE \
-characterSet AL32UTF8 \
-memoryPercentage 30 \
-emConfiguration NONE \
-dbsnmpPassword Your password \
-sysPassword Your password \
-systemPassword Your password
```

Expected output:



Enter PDBADMIN User Password:

```
Prepare for db operation
8% complete
Copying database files
31% complete
Creating and starting Oracle instance
32% complete
36% complete
39% complete
42% complete
46% complete
Completing Database Creation
51% complete
53% complete
54% complete
Creating Pluggable Databases
58% complete
77% complete
Executing Post Configuration Actions
100% complete
Database creation complete. For details check the logfiles at:
/u01/app/oracle/cfgtoollogs/dbca/orcl.
Database Information:
Global Database Name:orcl
System Identifier(SID):orcl
Look at the log file "/u01/app/oracle/cfgtoollogs/dbca/orcl/orcl.log" for further details.
```

- Verify the Installation

```
ps -ef | grep pmon
```

```
oracle 4049789      1  0 20:33 ?          00:00:00 ora_pmon_orcl
grid   4083992 4082554  0 21:04 pts/0      00:00:00 grep --color=auto pmon
```

- Start and check the listener status

```
lsnrctl start
lsnrctl status
```

LSNRCTL for Linux: Version 23.0.0.0.0 - for Oracle Cloud and Engineered Systems on 29-APR-2025 21:01:31

Copyright (c) 1991, 2025, Oracle. All rights reserved.

```
Connecting to (DESCRIPTION=(ADDRESS=(PROTOCOL=IPC)(KEY=LISTENER)))
STATUS of the LISTENER
```

```
-----
Alias                LISTENER
Version              TNSLSNR for Linux: Version 23.0.0.0.0 - for Oracle Cloud and
Engineered Systems
Start Date           29-APR-2025 21:01:18
Uptime               0 days 0 hr. 0 min. 13 sec
Trace Level          off
Security             ON: Local OS Authentication
SNMP                 OFF
Listener Parameter File /u01/app/23ai/grid/network/admin/listener.ora
Listener Log File    /u01/app/oracle/diag/tnslsnr/db23ai-rac-node1/listener/alert/log.xml
Listening Endpoints Summary...
  (DESCRIPTION=(ADDRESS=(PROTOCOL=ipc)(KEY=LISTENER)))
  (DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=10.16.9.2)(PORT=1521)))
  (DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=10.16.9.12)(PORT=1521)))
Services Summary...
Service "329b06e95d2c1287e063a9865e6483fa" has 1 instance(s).
  Instance "orcl", status READY, has 1 handler(s) for this service...
Service "33a0e38e73c76eefe0630209100a0041" has 1 instance(s).
  Instance "orcl", status READY, has 1 handler(s) for this service...
Service "orcl" has 1 instance(s).
  Instance "orcl", status READY, has 1 handler(s) for this service...
Service "orclXDB" has 1 instance(s).
  Instance "orcl", status READY, has 1 handler(s) for this service...
Service "pdb1" has 1 instance(s).
  Instance "orcl", status READY, has 1 handler(s) for this service...
The command completed successfully
```

- Adjust the tsnames.ora file to best fit your environment.

#### Final Verification

- Use sqlplus to connect to the database and confirm connectivity is working correctly. Example:

```
sqlplus / as sysdba
```

```
SQL*Plus: Release 23.0.0.0.0 - for Oracle Cloud and Engineered Systems on Tue Apr 29 21:06:20  
2025  
Version 23.8.0.25.04
```

```
Copyright (c) 1982, 2025, Oracle. All rights reserved.
```

```
Connected to:  
Oracle Database 23ai Enterprise Edition Release 23.0.0.0.0 - for Oracle Cloud and Engineered  
Systems  
Version 23.8.0.25.04
```

```
SQL> SELECT name, open_mode, database_role FROM v$database;
```

NAME	OPEN_MODE	DATABASE_ROLE
ORCL	READ WRITE	PRIMARY

```
SQL> SELECT instance_name, status FROM v$instance;
```

INSTANCE_NAME	STATUS
orcl	OPEN

```
SQL> SELECT * FROM v$version;
```

```
BANNER  
-----  
BANNER_FULL  
-----  
BANNER_LEGACY  
-----  
CON_ID  
-----  
Oracle Database 23ai Enterprise Edition Release 23.0.0.0.0 - for Oracle Cloud an  
d Engineered Systems  
Oracle Database 23ai Enterprise Edition Release 23.0.0.0.0 - for Oracle Cloud an  
d Engineered Systems  
Version 23.8.0.25.04
```

- Ensure the SCAN and VIP names are online.
- Run `crsctl stat res -t` to verify that all cluster resources are up and running.

```
sudo /u01/app/23ai/grid/bin/crsctl stat res -t
```

Name	Target	State	Server	State details
-----				
Local Resources				
-----				
ora.LISTENER.lsnr				
	ONLINE	ONLINE	db23ai-rac-node1	STABLE
	ONLINE	ONLINE	db23ai-rac-node2	STABLE
	ONLINE	ONLINE	db23ai-rac-node3	STABLE
ora.chad				
	ONLINE	ONLINE	db23ai-rac-node1	STABLE
	ONLINE	ONLINE	db23ai-rac-node2	STABLE
	ONLINE	ONLINE	db23ai-rac-node3	STABLE
ora.helper				
	OFFLINE	OFFLINE	db23ai-rac-node1	IDLE,STABLE
	OFFLINE	OFFLINE	db23ai-rac-node2	IDLE,STABLE
	OFFLINE	OFFLINE	db23ai-rac-node3	IDLE,STABLE
ora.net1.network				
	ONLINE	ONLINE	db23ai-rac-node1	STABLE
	ONLINE	ONLINE	db23ai-rac-node2	STABLE
	ONLINE	ONLINE	db23ai-rac-node3	STABLE
ora.ons				
	ONLINE	OFFLINE	db23ai-rac-node1	STABLE
	ONLINE	ONLINE	db23ai-rac-node2	STABLE
	ONLINE	ONLINE	db23ai-rac-node3	STABLE
-----				
Cluster Resources				
-----				
ora.ASMNET1LSNR_ASM.lsnr(ora.asmgrou)				
1	ONLINE	ONLINE	db23ai-rac-node1	STABLE
2	ONLINE	ONLINE	db23ai-rac-node3	STABLE
3	ONLINE	ONLINE	db23ai-rac-node2	STABLE
ora.DATA.dg(ora.asmgrou)				
1	OFFLINE	OFFLINE		STABLE
2	ONLINE	ONLINE	db23ai-rac-node3	STABLE
3	ONLINE	ONLINE	db23ai-rac-node2	STABLE
ora.LISTENER_SCAN1.lsnr				
1	ONLINE	ONLINE	db23ai-rac-node2	STABLE
ora.LISTENER_SCAN2.lsnr				
1	ONLINE	ONLINE	db23ai-rac-node2	STABLE
ora.LISTENER_SCAN3.lsnr				
1	ONLINE	ONLINE	db23ai-rac-node2	STABLE
ora.LISTENER_SCAN4.lsnr				
1	ONLINE	ONLINE	db23ai-rac-node3	STABLE
ora.asm(ora.asmgrou)				
1	ONLINE	OFFLINE		STABLE
2	ONLINE	ONLINE	db23ai-rac-node3	Started,STABLE
3	ONLINE	ONLINE	db23ai-rac-node2	Started,STABLE
ora.asmnet1.asmnetwork(ora.asmgrou)				
1	ONLINE	ONLINE	db23ai-rac-node1	STABLE
2	ONLINE	ONLINE	db23ai-rac-node3	STABLE
3	ONLINE	ONLINE	db23ai-rac-node2	STABLE
ora.cdp1.cdp				
1	ONLINE	ONLINE	db23ai-rac-node2	STABLE
ora.cdp2.cdp				
1	ONLINE	ONLINE	db23ai-rac-node2	STABLE
ora.cdp3.cdp				

ora.cdp4.cdp	1	ONLINE	ONLINE	db23ai-rac-node2	STABLE
ora.cvu	1	ONLINE	ONLINE	db23ai-rac-node3	STABLE
ora.db23ai-rac-node1.vip	1	ONLINE	ONLINE	db23ai-rac-node2	STABLE
ora.db23ai-rac-node2.vip	1	ONLINE	ONLINE	db23ai-rac-node1	STABLE
ora.db23ai-rac-node3.vip	1	ONLINE	ONLINE	db23ai-rac-node2	STABLE
ora.orcl.db	1	ONLINE	ONLINE	db23ai-rac-node3	STABLE
ora.orcl.pdb1.pdb	1	ONLINE	ONLINE	db23ai-rac-node1	Open,HOME=/u01/app/oracle/product/23ai/dbhome_1,STABLE
ora.rhpserver	1	OFFLINE	OFFLINE		STABLE
ora.scan1.vip	1	OFFLINE	OFFLINE		STABLE
ora.scan2.vip	1	ONLINE	ONLINE	db23ai-rac-node2	STABLE
ora.scan3.vip	1	ONLINE	ONLINE	db23ai-rac-node2	STABLE
ora.scan4.vip	1	ONLINE	ONLINE	db23ai-rac-node2	STABLE
	1	ONLINE	ONLINE	db23ai-rac-node3	STABLE

- Check the status of all nodes of the Oracle RAC Cluster:

```
[grid@db23ai-rac-node1 ~]$ olsnodes -n -s -t
db23ai-rac-node1    1    Active Unpinned
db23ai-rac-node2    2    Active Unpinned
db23ai-rac-node3    3    Active Unpinned
[grid@db23ai-rac-node1 ~]$ crsctl check cluster -all
*****
db23ai-rac-node1:
CRS-4537: Cluster Ready Services is online
CRS-4529: Cluster Synchronization Services is online
CRS-4533: Event Manager is online
*****
db23ai-rac-node2:
CRS-4537: Cluster Ready Services is online
CRS-4529: Cluster Synchronization Services is online
CRS-4533: Event Manager is online
*****
db23ai-rac-node3:
CRS-4537: Cluster Ready Services is online
CRS-4529: Cluster Synchronization Services is online
CRS-4533: Event Manager is online
*****
[grid@db23ai-rac-node1 ~]$
```

- To support connections from applications or non-SYS users, verify and update the tnsnames.ora file located under \$ORACLE\_HOME/network/admin.

- Run orachk to assess the system configuration and review the health score.
- If connecting from a server on a different subnet, ensure the tnsnames.ora entry is also copied to the client server.

## Deploying Standalone Oracle Database 23ai on Roving Edge

### Prerequisites

- One VCN, one private subnet, and one public IP for the Oracle Database 23ai standalone.
  - NOTE: Roving Edge support only one VCN per tenancy.

For the list of supported Oracle Databases on Oracle Edge Cloud (Compute Cloud@Customer, Private Cloud Appliance, and Roving Edge) refer to the Release Schedule of Current Database Releases ([Doc ID 742060.1](#))

**Software Releases:** Listed below are the software releases utilized on this setup and qualified with Oracle Database 23ai on Oracle Private Cloud Appliance or Oracle Compute Cloud@Customer.

- **Roving Edge:** Build number: 3.0.2-b1325160 or later. Please, refer to ([Doc ID 2906831.1](#)) for additional information
- **Oracle Database:** Oracle Database 23ai Enterprise Edition Release 23.0.0.0.0 - for Oracle Cloud and Engineered Systems Version 23.8.0.25.04 or greater
- **Operating System:** Oracle Linux 8.8 or greater
- **Boot Volume:** 100GB
- **Instance Shape:** VM.Standard.EDGE.16 (16 OCPUs and 128GB of memory)
- **Boot volume for the Oracle DB23ai instance:** At least 250GB.
- **Block volume for the Oracle DB23ai instance:** For this example, we are using 1TB block volume from the Roving Edge device. Adjust the size of the block volume to best fit your data sizing and workload.

Listed below is the subnet created for the Oracle DB 23ai Standalone deployment, and the instance configuration details on the Roving Edge device.

The screenshot shows the 'Create Subnet' configuration interface. The fields are as follows:

- Name:** oracledb
- CIDR Block:** 192.168.2.0/24 (Specified IP addresses: 192.168.2.0-192.168.2.255 (256 IP addresses))
- DNS Resolution:**  Use DNS hostnames in this SUBNET (Allows assignment of DNS hostname when launching an Instance)
- DNS Label:** oracledb (Only letters and numbers, starting with a letter. 15 characters max.)
- DNS Domain Name (Read-only):** oracledb.platformvcn.oraclevcn.com
- DHCP Options:** Default DHCP Options for platformvcn

Figure 15 – Subnet configuration on Roving Edge.

Block Volume configuration for the Oracle DB23ai:

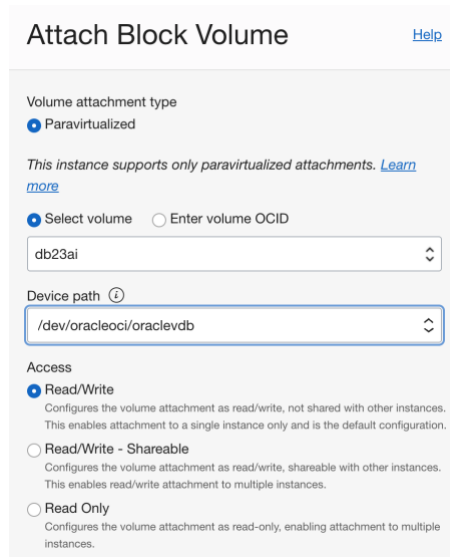


Figure 16 – Block volume configuration for Oracle Database 23ai on Roving Edge.

Oracle Linux 8 instance configuration for the Oracle DB23ai:

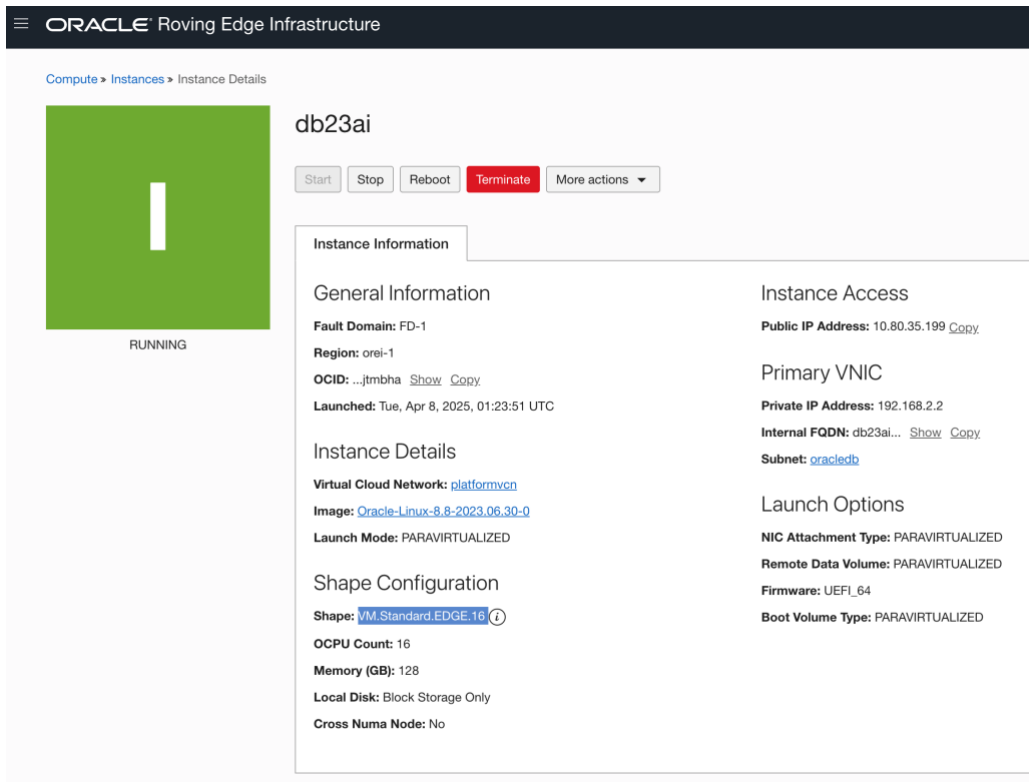


Figure 17 – Oracle Linux 8 instance for Oracle Database 23ai on Roving Edge.

## Oracle Database 23ai deployment

- With root user, update the Oracle Linux instance, reboot the Oracle Linux instance, then install the required packages:

```
sudo dnf update -y
sudo dnf install -y oracle-database-preinstall-23ai zip unzip libaio glibc libnsl
smartmontools ksh compat-openssl11
```

NOTE: Ensure that all required Oracle Linux repositories for the packages listed above are enabled.

- Create a new volume/logical groups and filesystem for the Oracle /u01 filesystem on top of the 1TB block block volume previously configured. Listed below is a script that can be utilized to perform this task. NOTE: Adjust the script to the correct name of your block device. On the example below, we are using the /dev/sdb.

The script below will perform the following tasks:

- Use a dedicated 1TB disk (/dev/sdb)
- Create a new LVM volume group (vg\_u01)
- Create a logical volume (lv\_u01) using all space
- Format it as xfs
- Mount it to /u01
- Update /etc/fstab for persistence
- Create Oracle base directory structure and set permissions

Add the code below to a new file **setup\_sdb\_u01\_lvm.sh**, adjust the permission and execute the script:

```
chmod +x setup_sdb_u01_lvm.sh
sudo ./setup_sdb_u01_lvm.sh
```



```
#!/bin/bash

set -e

DEVICE="/dev/sdb"
VG_NAME="vg_u01"
LV_NAME="lv_u01"
MOUNT_POINT="/u01"

# Check if the device exists
if [ ! -b "$DEVICE" ]; then
    echo "Error: Block device $DEVICE not found."
    exit 1
fi

echo "Preparing LVM setup on $DEVICE..."

# Create physical volume
sudo pvcreate $DEVICE

# Create volume group
sudo vgcreate $VG_NAME $DEVICE

# Create logical volume using 100% of the VG
sudo lvcreate -l 100%FREE -n $LV_NAME $VG_NAME

# Format the LV with XFS
sudo mkfs.xfs /dev/$VG_NAME/$LV_NAME

# Create the mount point
sudo mkdir -p $MOUNT_POINT

# Mount the LV
sudo mount /dev/$VG_NAME/$LV_NAME $MOUNT_POINT

# Get UUID and update fstab
UUID=$(blkid -s UUID -o value /dev/$VG_NAME/$LV_NAME)
FSTYPE=$(blkid -s TYPE -o value /dev/$VG_NAME/$LV_NAME)
echo "UUID=$UUID    $MOUNT_POINT    $FSTYPE    defaults    0 0" | sudo tee -a /etc/fstab

# Create Oracle base directory structure and set permissions
echo "Creating /u01/app/oracle and setting ownership..."
sudo mkdir -p /u01/app/oracle
sudo mkdir -p /u01/app/oracle/product/23ai/dbhome_1
sudo chown -R oracle:oinstall /u01
sudo chmod -R 775 /u01

echo "/u01 is now ready for Oracle software (VG: $VG_NAME, LV: $LV_NAME, Owner:
oracle:oinstall)"
```

Listed below is the expected output of the script execution. The /u01 will be mounted and available for the Oracle database 23ai standalone installation.

```
./setup_sdb_u01_lvm.sh
Preparing LVM setup on /dev/sdb...
Physical volume "/dev/sdb" successfully created.
Volume group "vg_u01" successfully created
Logical volume "lv_u01" created.
meta-data=/dev/vg_u01/lv_u01      isize=512    agcount=4, agsize=65535744 blks
      =                               sectsz=512   attr=2, projid32bit=1
      =                               crc=1       finobt=1, sparse=1, rmapbt=0
      =                               reflink=1    bigtime=0 inobtcount=0
data      =                               bsize=4096  blocks=262142976, imaxpct=25
      =                               sunit=0     swidth=0 blks
naming    =version 2                   bsize=4096  ascii-ci=0, ftype=1
log       =internal log                bsize=4096  blocks=127999, version=2
      =                               sectsz=512   sunit=0 blks, lazy-count=1
realtime  =none                       extsz=4096  blocks=0, rtextents=0
Discarding blocks...Done.
UUID=4c115a85-81e1-4690-a4ae-20097f2d993d /u01 xfs defaults 0 0
Creating /u01/app/oracle and setting ownership...
/u01 is now ready for Oracle software (VG: vg_u01, LV: lv_u01, Owner: oracle:oinstall)
```

NOTE: Refer to the [Oracle Database 23ai official documentation](#) for additional recommendations and tunable options for production environments.

- Download the latest Oracle DB23ai for Engineering Systems from Oracle Software Delivery Cloud, then unzip the Gold Image in the Oracle directory, example:

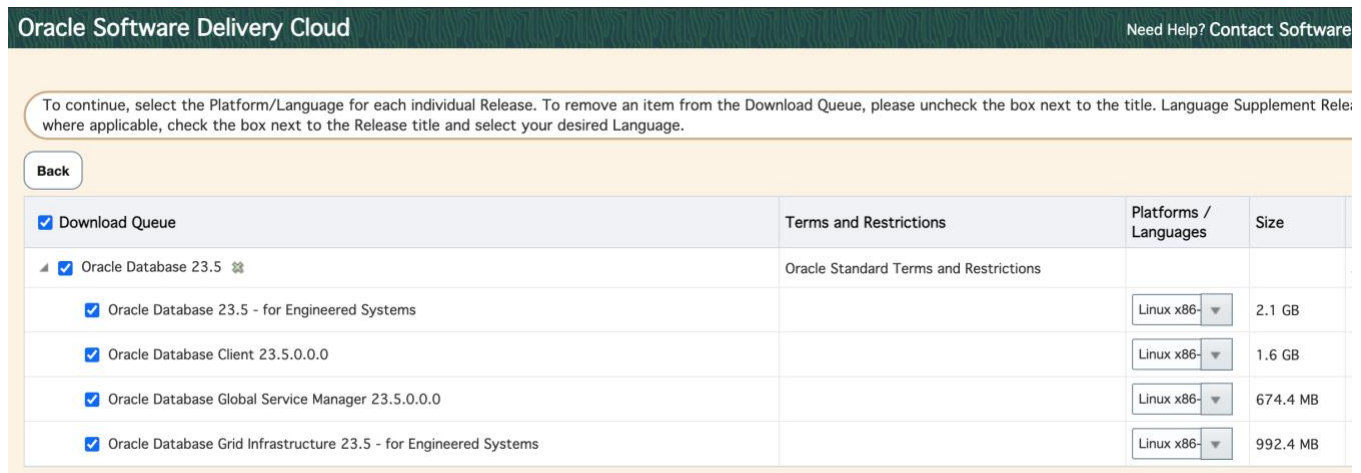


Figure 18 – Oracle Software Delivery Cloud – Download of Oracle Database and Grid Infrastructure 23ai.

- With oracle user, (sudo su – oracle) unzip the golden image into the following directory listed below:

```
cd /u01/app/oracle/product/23ai/dbhome_1/
unzip /u01/db37703495_250319041827.zip
```

- Run the Oracle Database 23ai Installer in silent mode:

```
cd /u01/app/oracle/database
```

```
./runInstaller -silent \  
-responseFile /u01/app/oracle/product/23ai/dbhome_1/install/response/db_install.rsp \  
oracle.install.option=INSTALL_DB_SWONLY \  
ORACLE_BASE=/u01/app/oracle \  
ORACLE_HOME=/u01/app/oracle/product/23ai/dbhome_1 \  
oracle.install.db.InstallEdition=EE \  
oracle.install.db.OSDBA_GROUP=dba \  
oracle.install.db.OSOPER_GROUP=oper \  
oracle.install.db.OSBACKUPDBA_GROUP=backupdba \  
oracle.install.db.OSDGDBA_GROUP=dgdba \  
oracle.install.db.OSKMDBA_GROUP=kmdba \  
oracle.install.db.OSRACDBA_GROUP=racdba \  
DECLINE_SECURITY_UPDATES=true
```

- As a root user, run the following script(s):

```
/u01/app/oraInventory/orainstRoot.sh  
/u01/app/oracle/product/23ai/dbhome_1/root.sh
```

- (Optional) With oracle user (sudo su – oracle) Create a new database. For example:

```
/u01/app/oracle/product/23ai/dbhome_1/bin/dbca -silent -createDatabase \  
-templateName General_Purpose.dbc \  
-gdbName orcl \  
-sid orcl \  
-createAsContainerDatabase true \  
-numberOfPDBs 1 \  
-pdbName pdb1 \  
-createListener default \  
-responseFile NO_VALUE \  
-characterSet AL32UTF8 \  
-memoryPercentage 30 \  
-emConfiguration NONE \  
-dbSNMPPassword Welcome1 \  
-sysPassword Welcome1 \  
-systemPassword Welcome1
```

Expected output:

```

Enter PDBADMIN User Password:
Prepare for db operation
8% complete
Copying database files
31% complete
Creating and starting Oracle instance
32% complete
36% complete
39% complete
42% complete
46% complete
Completing Database Creation
51% complete
53% complete
54% complete
Creating Pluggable Databases
58% complete
77% complete
Executing Post Configuration Actions
100% complete
Database creation complete. For details check the logfiles at:
 /u01/app/oracle/cfgtoollogs/dbca/orcl.
Database Information:
Global Database Name:orcl
System Identifier(SID):orcl
Look at the log file "/u01/app/oracle/cfgtoollogs/dbca/orcl/orcl.log" for further details.

```

- Verify the Installation

```

ps -ef | grep pmon
lsnrctl status

```

- Set Environment Variables

```

vi /home/oracle/.bash_profile:

export ORACLE_HOME=/u01/app/oracle/product/23ai/dbhome_1
export ORACLE_BASE=/u01/app/oracle
export ORACLE_SID=orcl
export PATH=$ORACLE_HOME/bin:$PATH

```

- Start and check the listener status

NOTE: Adjust the tsnames.ora file to best fit your environment.

```
lsnrctl start  
lsnrctl status
```

```
LSNRCTL for Linux: Version 23.0.0.0.0 - for Oracle Cloud and Engineered Systems on 08-APR-2025  
15:50:17
```

```
Copyright (c) 1991, 2025, Oracle. All rights reserved.
```

```
Connecting to (ADDRESS=(PROTOCOL=tcp)(HOST=)(PORT=1521))  
STATUS of the LISTENER
```

```
-----  
Alias                LISTENER  
Version              TNSLSNR for Linux: Version 23.0.0.0.0 - for Oracle Cloud and  
Engineered Systems  
Start Date           08-APR-2025 15:49:00  
Uptime               0 days 0 hr. 1 min. 17 sec  
Trace Level          off  
Security             ON: Local OS Authentication  
SNMP                 OFF  
Listener Log File    /u01/app/oracle/diag/tnslsnr/db23ai/listener/alert/log.xml  
Listening Endpoints Summary...
```

```
(DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=db23ai.oracledb.platformvcn.oraclevcn.com)(PORT=1521))  
)
```

```
Services Summary...
```

```
Service "308cd001106939bbe063f5dc5e64528d" has 1 instance(s).  
  Instance "orcl", status READY, has 1 handler(s) for this service...  
Service "32473db796f7d08be0630202a8c0134c" has 1 instance(s).  
  Instance "orcl", status READY, has 1 handler(s) for this service...  
Service "orcl" has 1 instance(s).  
  Instance "orcl", status READY, has 1 handler(s) for this service...  
Service "orclXDB" has 1 instance(s).  
  Instance "orcl", status READY, has 1 handler(s) for this service...  
Service "pdb1" has 1 instance(s).  
  Instance "orcl", status READY, has 1 handler(s) for this service...  
The command completed successfully
```

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