# Oracle® Database Database Installation Guide



**19c for Linux** E96432-41 June 2025

ORACLE

Oracle Database Database Installation Guide, 19c for Linux

E96432-41

Copyright © 2015, 2025, Oracle and/or its affiliates.

Primary Authors: Prakash Jashnani, Subhash Chandra

Contributing Authors: Douglas Williams

Contributors: Ranjit Noronha, Jean-Francois Verrier, Richard Roddy, Rajesh Dasari, Smitha Viswanathan, Neha Avasthy, Sampath Ravindhran, Prasad Bagal, Subhranshu Banerjee, Gerald Venzl, Tammy Bednar, Avi Miller, Jean-Marc Thayer, Alok Sahu, Gavin Bowe, Gia-Khanh Nguyen, Darcy Christensen, Kiran Chamala, Jonathan Creighton, Benoit Dageville, Logeshwaran Rajan, Angad Gokakkar, Anu Natarajan, Girdhari Ghantiyala, Mani Mannampalli, Bernard Clouse, Chandrasekharan Iyer, Anil Nair, Sivaram Soma, Lisa Vaz, Vasu Venkatasubramanian, Sumanta Chatteriee, Margaret Susairaj, Malai Stalin, Markus Michalewicz, Subrahmanyam Kodavaluru, Sudip Datta, Madhu Hunasigi, Jim Erickson, Marcus Fallen, Joseph Francis, Allan Graves, Barbara Glover, Asad Hasan, Thirumaleshwara Hasandka, Putta Ramesh, Sergio Leunissen, Aneesh Khandelwal, Joel Kallman, Eugene Karichkin, Jai Krishnani, Prasad K Kulkarni, Ranjith Kundapur, Balaji Pagadala, Christopher Jones, Tak Wang, Bryn Llewellyn, Saar Maoz, Chao Liang, Gopal Mulagund, Pushkar Punit, Sivaselvam Narayanasamy, Ankur Kemkar, Sue Lee, Rich Long, Ricardo Alonso Gonzalez Acuna, Barb Lundhild, Sangeeth Jose, Rudregowda Mallegowda, Prasad Kuruvadi Nagaraj, Mughees Minhas, Krishna Mohan, Matthew McKerley, John McHugh, Gurudas Pai, Satish Panchumarthy , Rajesh Prasad, Rajendra Pingte, Ramesh Chakravarthula, Rajagopal Kunhappan, Srinivas Poovala, David Price, Hanlin Qian, Michael Coulter, Hema Ramamurthy, Sunil Ravindrachar, Mark Richwine, Dipak Saggi, Alan Tam, Ian Cookson, David Schreiner, Ara Shakian, Naveen Ramamurthy, Mohit Singhal, Dharma Sirnapalli, Akshay Shah, James Spiller, Roy Swonger, Binoy Sukumaran, Jagvir Yadav, Ravi Thammaiah, Shekhar Vaggu, Pablo Sainz Albanez, Hector Vieyra, Peter Wahl, John Haxby, Sergiusz Wolicki, Sivakumar Yarlagadda, Nagendra Kumar Ym

This software and related documentation are provided under a license agreement containing restrictions on use and disclosure and are protected by intellectual property laws. Except as expressly permitted in your license agreement or allowed by law, you may not use, copy, reproduce, translate, broadcast, modify, license, transmit, distribute, exhibit, perform, publish, or display any part, in any form, or by any means. Reverse engineering, disassembly, or decompilation of this software, unless required by law for interoperability, is prohibited.

The information contained herein is subject to change without notice and is not warranted to be error-free. If you find any errors, please report them to us in writing.

If this is software, software documentation, data (as defined in the Federal Acquisition Regulation), or related documentation that is delivered to the U.S. Government or anyone licensing it on behalf of the U.S. Government, then the following notice is applicable:

U.S. GOVERNMENT END USERS: Oracle programs (including any operating system, integrated software, any programs embedded, installed, or activated on delivered hardware, and modifications of such programs) and Oracle computer documentation or other Oracle data delivered to or accessed by U.S. Government end users are "commercial computer software," "commercial computer software documentation," or "limited rights data" pursuant to the applicable Federal Acquisition Regulation and agency-specific supplemental regulations. As such, the use, reproduction, duplication, release, display, disclosure, modification, preparation of derivative works, and/or adaptation of i) Oracle programs (including any operating system, integrated software, any programs embedded, installed, or activated on delivered hardware, and modifications of such programs), ii) Oracle computer documentation and/or iii) other Oracle data, is subject to the rights and limitations specified in the license contained in the applicable contract. The terms governing the U.S. Government's use of Oracle cloud services are defined by the applicable contract for such services. No other rights are granted to the U.S. Government.

This software or hardware is developed for general use in a variety of information management applications. It is not developed or intended for use in any inherently dangerous applications, including applications that may create a risk of personal injury. If you use this software or hardware in dangerous applications, then you shall be responsible to take all appropriate fail-safe, backup, redundancy, and other measures to ensure its safe use. Oracle Corporation and its affiliates disclaim any liability for any damages caused by use of this software or hardware in dangerous applications.

Oracle®, Java, MySQL, and NetSuite are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.

Intel and Intel Inside are trademarks or registered trademarks of Intel Corporation. All SPARC trademarks are used under license and are trademarks or registered trademarks of SPARC International, Inc. AMD, Epyc, and the AMD logo are trademarks or registered trademarks of Advanced Micro Devices. UNIX is a registered trademark of The Open Group.

This software or hardware and documentation may provide access to or information about content, products, and services from third parties. Oracle Corporation and its affiliates are not responsible for and expressly disclaim all warranties of any kind with respect to third-party content, products, and services unless otherwise set forth in an applicable agreement between you and Oracle. Oracle Corporation and its affiliates will not be responsible for any loss, costs, or damages incurred due to your access to or use of third-party content, products, or services, except as set forth in an applicable agreement between you and Oracle.

## Contents

#### Preface

Audience	xii
Documentation Accessibility	xii
Diversity and Inclusion	xii
Set Up Java Access Bridge to Implement Java Accessibility	xiii
Command Syntax	xiii
Conventions	xiv

#### Changes in this Release for Oracle Database

New Features	XV
Deprecated Features	xvi
Other Changes	xvii

#### 1 Oracle Database Installation Checklist

Server Hardware Checklist for Oracle Database Installation	1-1
Operating System Checklist for Oracle Database Installation on Linux	1-2
Server Configuration Checklist for Oracle Database Installation	1-3
Oracle User Environment Configuration Checklist for Oracle Database Installation	1-5
Storage Checklist for Oracle Database Installation	1-7
Installer Planning Checklist for Oracle Database	1-8
Deployment Checklist for Oracle Database	1-11

#### 2 Checking and Configuring the Server for Oracle Database

Logging In to a Remote System Using X Window System	2-1
Checking Server Hardware and Memory Configuration	2-2

#### 3 Automatically Configuring Oracle Linux with Oracle Database Preinstallation RPM

About the Oracle Database Preinstallation RPM	3-1
Overview of Oracle Linux Configuration with Oracle Database Preinstallation RPM	3-2



Installing the Oracle Database Preinstallation RPM Using ULN	3-3
Installing Oracle Database Preinstallation RPM During an Oracle Linux Installation	3-4
Installing Oracle Oracle Database Preinstallation RPM Using the Oracle Linux yum Server	3-5
Configure Additional Operating System Features	3-6

## 4 Configuring Operating Systems for Oracle Database on Linux

Guidelines for Linux Operating System Installation	4-2
Completing a Minimal or Default Linux Installation	4-2
About Oracle Linux with the Unbreakable Enterprise Kernel	4-3
About the Oracle Database Preinstallation RPM	4-4
Configuring HugePages on Linux	4-5
Restrictions for HugePages and Transparent HugePages Configurations	4-7
Reviewing Operating System and Software Upgrade Best Practices	4-8
General Upgrade Best Practices	4-8
New Server Operating System Upgrade Option	4-8
Oracle ASM Upgrade Notifications	4-9
Reviewing Operating System Security Common Practices	4-10
About Installation Fixup Scripts	4-10
About Operating System Requirements	4-11
Using Oracle RPM Checker on IBM: Linux on System z	4-11
Operating System Requirements for x86-64 Linux Platforms	4-12
General Guidelines for Operating System Packages	4-13
Supported Oracle Linux 9 Distributions for x86-64	4-14
Supported Oracle Linux 8 Distributions for x86-64	4-16
Supported Oracle Linux 7 Distributions for x86-64	4-18
Supported Red Hat Enterprise Linux 9 Distributions for x86-64	4-21
Supported Red Hat Enterprise Linux 8 Distributions for x86-64	4-23
Supported Red Hat Enterprise Linux 7 Distributions for x86-64	4-24
Supported SUSE Linux Enterprise Server 12 Distributions for x86-64	4-26
Supported SUSE Linux Enterprise Server 15 Distributions for x86-64	4-28
Installing Operating System Packages	4-30
Operating System Requirements for IBM: Linux on System z	4-30
Supported Red Hat Enterprise Linux 9 Distributions for IBM: Linux on System z	4-31
Supported Red Hat Enterprise Linux 8 Distributions for IBM: Linux on System z	4-32
Supported Red Hat Enterprise Linux 7 Distributions for IBM: Linux on System z	4-33
Supported SUSE Linux Enterprise Server 12 Distributions for IBM: Linux on System z	4-34
Supported SUSE Linux Enterprise Server 15 Distributions for IBM: Linux on System z	4-35
Operating System Requirements for Linux for Arm (aarch64)	4-38
Supported Oracle Linux 8 Distributions on Linux for Arm (aarch64)	4-38
Additional Drivers and Software Packages for Linux	4-40
Installing PAM for Login Authentication on Linux	4-40

Installing OCFS2	4-40
Installing Oracle Messaging Gateway	4-41
Installation Requirements for ODBC and LDAP	4-41
About ODBC Drivers and Oracle Database	4-42
Installing ODBC Drivers for Linux x86-64	4-42
About LDAP and Oracle Plug-ins	4-42
Installing the LDAP Package	4-42
Installation Requirements for Programming Environments for Linux	4-42
Installation Requirements for Programming Environments for Linux x86-64	4-43
Installation Requirements for Programming Environments for Linux for Arm (aarch64)	4-44
Installation Requirements for Programming Environments for IBM: Linux on System	
Z	4-44
Installation Requirements for Web Browsers	4-44
Checking Kernel and Package Requirements for Linux	4-45
Setting Clock Source for VMs on Linux x86-64	4-45
Installing the cvuqdisk RPM for Linux	4-46
Confirming Host Name Resolution	4-47
Setting and Disabling Transparent HugePages on UEK Kernels	4-47
Setting Transparent HugePages to madvise	4-47
Disabling Transparent HugePages	4-49
Using Automatic SSH Configuration During Installation	4-50
Verifying the Disk I/O Scheduler on Linux 8 and Later Systems	4-51
Verifying the Disk I/O Scheduler on Linux 7 Systems	4-52

#### Configuring Users, Groups and Environments for Oracle Grid Infrastructure and Oracle Database

Required Operating System Groups and Users	5-1
Determining If an Oracle Inventory and Oracle Inventory Group Exist	5-2
Creating the Oracle Inventory Group If an Oracle Inventory Does Not Exist	5-2
About Oracle Installation Owner Accounts	5-3
Identifying an Oracle Software Owner User Account	5-3
Oracle Installations with Standard and Job Role Separation Groups and Users	5-4
About Oracle Installations with Job Role Separation	5-5
Standard Oracle Database Groups for Database Administrators	5-5
Extended Oracle Database Groups for Job Role Separation	5-6
Creating an ASMSNMP User	5-7
Oracle Automatic Storage Management Groups for Job Role Separation	5-7
Creating Operating System Privileges Groups	5-8
Creating the OSDBA for ASM Group	5-8
Creating the OSOPER for ASM Group	5-9
Creating the OSDBA Group for Database Installations	5-9

#### ORACLE

5

Creating an OSOPER Group for Database Installations	5-9
Creating the OSBACKUPDBA Group for Database Installations	5-10
Creating the OSDGDBA Group for Database Installations	5-10
Creating the OSKMDBA Group for Database Installations	5-10
Creating the OSRACDBA Group for Database Installations	5-10
Creating Operating System Oracle Installation User Accounts	5-10
Creating an Oracle Software Owner User	5-11
Environment Requirements for Oracle Software Owners	5-11
Procedure for Configuring Oracle Software Owner Environments	5-12
Modifying Oracle Owner User Groups	5-15
Checking Resource Limits for Oracle Software Installation Users	5-15
Setting Remote Display and X11 Forwarding Configuration	5-17
Preventing Installation Errors Caused by Terminal Output Commands	5-18
Creating Oracle Database Vault User Accounts	5-18
Unsetting Oracle Installation Owner Environment Variables	5-19

## 6 Configuring Networks for Oracle Database

About Oracle Database Network Configuration Options	6-1
About Assigning Global Database Names During Installation	6-2
Network Configuration for Computers Completed After Installation	6-3
Network Configuration for Multihome Computers	6-3
Setting the ORACLE_HOSTNAME Environment Variable	6-4
Network Configuration for Computers with Multiple Aliases	6-4

#### 7 Supported Storage Options for Oracle Database and Oracle Grid Infrastructure

Supported Storage Options for Oracle Database	7-1
About Oracle Grid Infrastructure for a Standalone Server	7-2
About Upgrading Existing Oracle Automatic Storage Management Instances	7-3
About Managing Disk Groups for Older Database Versions	7-4
Oracle ACFS and Oracle ADVM	7-4
Oracle ACFS and Oracle ADVM Support on Linux x86–64	7-5
Restrictions and Guidelines for Oracle ACFS	7-6
File System Options for Oracle Database	7-7
Guidelines for Placing Oracle Database Files On a File System or Logical Volume	7-7
About NFS Storage for Data Files	7-8
About Direct NFS Client Mounts to NFS Storage Devices	7-8

## 8 Configuring File System Storage for Oracle Database

Deploying Oracle Direct NFS	8-1
Configuring NFS Buffer Size Parameters for Oracle Database	8-2
Checking TCP Network Protocol Buffer for Direct NFS Client	8-2
Creating an oranfstab File for Direct NFS Client	8-3
Enabling and Disabling Direct NFS Client Control of NFS	8-5
Enabling Hybrid Columnar Compression on Direct NFS Client	8-6
Deploying the Oracle Memory Speed File System	8-6
About Oracle Memory Speed	8-7
Requirements and Guidelines for Oracle Memory Speed	8-8
Setting-Up Hardware and Operating System Components for OMS	8-8
Verifying HugePages Availability	8-8
Configuring PMEM Devices	8-9
Setting-Up a DAX-Capable File System	8-12
Create an Uber File for Oracle Memory Speed	8-13
Setting-Up the Oracle Memory Speed File System	8-14
About the OMS Daemon	8-15
Creating and Mounting the Oracle Memory Speed File System	8-15
Deploying Oracle Database with Oracle Memory Speed	8-17
Enabling the OMS ODM Library	8-17
Turning-Off the OMS ODM Library	8-17
Verifying HugePages Behavior in XFS Files	8-18
omsfscmds Command Reference	8-19
Migrating Oracle Database to Oracle Memory Speed	8-20
Preparing for the OMS Migration	8-21
Adding Redo Log Files to OMS	8-21
Moving Data Files to OMS	8-23
Moving the Entire Database to OMS	8-24

#### 9 Configuring Storage for Oracle Grid Infrastructure for a Standalone Server

Configuring Storage for Oracle Automatic Storage Management	9-2
Identifying Storage Requirements for Oracle Automatic Storage Management	9-2
Oracle ASM Disk Space Requirements	9-5
ASM Disk Group Options for Installation	9-6
Using an Existing Oracle ASM Disk Group	9-6
Configuring Storage Device Path Persistence Using Oracle ASMLIB	9-7
About Oracle ASM with Oracle ASMLIB	9-8
Installing and Configuring Oracle ASMLIB Software	9-8
Configuring Disk Devices to Use Oracle ASMLIB	9-12

#### ORACLE

Administering Oracle ASMLIB and Disks	9-13
Deinstalling Oracle ASMLIB On Oracle Database	9-15
Migrating from Oracle ASM Filter Driver to Oracle ASMLib for Oracle Restart	9-16
Deconfiguring Oracle ASM Filter Driver	9-17
Creating DAS or SAN Disk Partitions for Oracle Automatic Storage Management	9-18
Creating Directories for Oracle Database Files	9-18
Creating Files on a NAS Device for Use with Oracle Automatic Storage Management	9-19

## 10 Installing and Configuring Oracle Grid Infrastructure for a Standalone Server

About Image-Based Oracle Grid Infrastructure Installation	10-2
Setup Wizard Installation Options for Creating Images	10-2
Installing Oracle Grid Infrastructure for a Standalone Server with a New Database Installation	10-3
Installing Oracle Grid Infrastructure for a Standalone Server for an Existing Database	10-5
Installing Oracle Grid Infrastructure for a Standalone Server Using a Software-Only Installation	10-6
About Oracle Grid Infrastructure Software-Only Installations	10-7
Installing Software Binaries for Oracle Grid Infrastructure for a Standalone Server	10-7
Configuring Software Binaries for Oracle Grid Infrastructure for a Standalone Server	10-8
Testing the Oracle Automatic Storage Management Installation	10-9
Relinking Oracle Restart and Oracle ASM Binaries	10-10
Configuring Oracle ASM Disk Groups Manually using Oracle ASMCA	10-11
Enabling Oracle ACFS on Oracle Restart Configurations	10-11
Applying Patches During an Oracle Grid Infrastructure Installation or Upgrade	10-12
Patching and Switching Oracle Grid Infrastructure Homes	10-12

#### 11 Installing Oracle Database

About Image-Based Oracle Database Installation	11-2
About Deploying Oracle Database Using Oracle Fleet Patching and Provisioning	11-2
Downloading Oracle Software	11-3
Downloading the Installation Archive Files from Oracle Website	11-3
Downloading the Software from Oracle Software Delivery Cloud Portal	11-4
About Character Set Selection During Installation	11-4
About Automatic Memory Management Installation Options	11-5
Running the Installer in a Different Language	11-6
Installing the Oracle Database Software	11-6
Setup Wizard Installation Options for Creating Images	11-7
Applying Patches During an Oracle Database Installation or Upgrade	11-7
Running Oracle Database Setup Wizard to Install Oracle Database	11-8
Installing Oracle Database Using RPM Packages	11-10

About RPM-Based Oracle Database Installation	11-10
Restrictions and Guidelines for RPM-Based Installations	11-10
RPM Packages Naming Convention	11-11
Running RPM Packages to Install Oracle Database	11-11
Installing Standard Edition High Availability	11-13
About Standard Edition High Availability	11-13
Requirements for Installing Standard Edition High Availability	11-14
Deploying Standard Edition High Availability	11-14
Installing Standard Edition High Availability Database Software on Local File System	11-15
Installing Standard Edition High Availability Database Software on Oracle ACFS	11-17

#### 12 Oracle Database Postinstallation Tasks

Required Postinstallation Tasks	12-1
Downloading Release Update Patches	12-2
Unlocking and Resetting Oracle Database User Passwords	12-2
Requirements for Database Passwords	12-3
Oracle Database System Privileges Accounts and Passwords	12-3
Guidelines for Changing System Privileges Account Passwords	12-6
Locking and Unlocking User Accounts	12-7
Using SQL*Plus to Unlock Accounts and Reset Passwords	12-7
Recommended Postinstallation Tasks	12-8
Creating a Backup of the root.sh Script	12-8
Setting Language and Locale Preferences for Client Connections	12-8
Recompile Invalid Objects in the Database	12-9
About Installing Oracle Autonomous Health Framework	12-11
About Changes in Default SGA Permissions for Oracle Database	12-11
Checking Installed Oracle Database Contents and Directory Location	12-12
Enabling and Disabling Oracle Database Options After Installation	12-12
Chopt Tool	12-13
Starting Oracle Enterprise Manager Database Express	12-14
Creating a Fast Recovery Area	12-14
About the Fast Recovery Area and the Fast Recovery Area Disk Group	12-14
Creating the Fast Recovery Area Disk Group	12-15
Cloning an Oracle Database Home	12-16

## 13 Removing Oracle Database Software

About Oracle Deinstallation Options	13-1
Oracle Deinstallation (Deinstall)	13-3
Deinstallation Examples for Oracle Database	13-5
Downgrading Oracle Restart	13-5

Removing an RPM-based Oracle Database Installation	13-7
Deinstalling Previous Release Grid Home	13-8

#### A Completing Preinstallation Tasks Manually

Configuring Kernel Parameters for Linux	A-1
Minimum Parameter Settings for Installation	A-1
Changing Kernel Parameter Values	A-3
Configuring Additional Kernel Settings for SUSE Linux	A-4
Setting UDP and TCP Kernel Parameters Manually	A-5
Configuring Default Thread Limits Value for SUSE Linux	A-6
Configuring Storage Device Path Persistence Manually	A-6
Configuring Device Persistence Manually for Oracle ASM	A-6

## B Response Files

How Response Files Work	B-1
Reasons for Using Silent Mode or Response File Mode	B-2
Using Response Files	B-2
Preparing Response Files	B-3
Editing a Response File Template	B-3
Recording Response Files	B-4
Running Oracle Universal Installer Using a Response File	B-5
Running Configuration Assistants Using Response Files	B-7
Running Net Configuration Assistant Using Response Files	B-7
Running Oracle DBCA Using Response Files	B-8
Postinstallation Configuration Using Response File Created During Installation	B-9
Using the Installation Response File for Postinstallation Configuration	B-9
Running Postinstallation Configuration Using Response File	B-11
Postinstallation Configuration Using the ConfigToolAllCommands Script	B-12
About the Postinstallation Configuration File	B-12
Creating a Password Response File	B-13
Running Postinstallation Configuration Using a Password Response File	B-14

#### C Optimal Flexible Architecture

About the Optimal Flexible Architecture Standard	C-1
About Multiple Oracle Homes Support	C-2
About the Oracle Inventory Directory and Installation	C-2
Oracle Base Directory Naming Convention	C-4
Oracle Home Directory Naming Convention	C-4

#### D Configuring Read-Only Oracle Homes

Evolution of Oracle Homes	D-1
About Read-Only Oracle Homes	D-2
About Oracle Base Homes	D-2
About Oracle Base Config	D-3
About orabasetab	D-3
Location of Networking Files in a Read-Only Oracle Home	D-4
Enabling a Read-Only Oracle Home	D-5
Copying demo Directories to Oracle Base Home	D-6
Determining if an Oracle Home is Read-Only	D-9
File Path and Directory Changes in Read-Only Oracle Homes	D-9

#### Oracle Memory Speed CLI Commands

mkfs and forcemkfs Command Reference	E-1
mount, unmount and Ismount Command Reference	E-2
df Command Reference	E-2
cp Command Reference	E-3
Is and IIs Command Reference	E-3
rm Command Reference	E-4
cd and pwd Command Reference	E-5
Isom and Isof Command Reference	E-5
Daemon Control Command Reference	E-6
Diagnostics and Tracing	E-7

#### Managing Oracle Database Port Numbers

About Managing Ports	F-1
Oracle Database Component Port Numbers and Protocols	F-1

#### Index

Ε

F



## Preface

This guide explains how to install and configure single-instance Oracle Database.

This guide also provides information about Optimal Flexible Architecture, cloning an Oracle home, and how to remove the database software.

- Audience This guide is intended for anyone responsible for installing Oracle Database 19c.
- Documentation Accessibility
- Diversity and Inclusion
- Set Up Java Access Bridge to Implement Java Accessibility Install Java Access Bridge so that assistive technologies on Microsoft Windows systems can use the Java Accessibility API.
- Command Syntax Refer to these command syntax conventions to understand command examples in this guide.
- Conventions

## Audience

This guide is intended for anyone responsible for installing Oracle Database 19c.

Additional installation guides for Oracle Database, Oracle Real Application Clusters, Oracle Clusterware, Oracle Database Examples, and Oracle Enterprise Manager Cloud Control are available at the following URL:

http://docs.oracle.com

## **Documentation Accessibility**

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc.

#### Access to Oracle Support

Oracle customer access to and use of Oracle support services will be pursuant to the terms and conditions specified in their Oracle order for the applicable services.

## **Diversity and Inclusion**

Oracle is fully committed to diversity and inclusion. Oracle respects and values having a diverse workforce that increases thought leadership and innovation. As part of our initiative to build a more inclusive culture that positively impacts our employees, customers, and partners, we are working to remove insensitive terms from our products and documentation. We are also

mindful of the necessity to maintain compatibility with our customers' existing technologies and the need to ensure continuity of service as Oracle's offerings and industry standards evolve. Because of these technical constraints, our effort to remove insensitive terms is ongoing and will take time and external cooperation.

## Set Up Java Access Bridge to Implement Java Accessibility

Install Java Access Bridge so that assistive technologies on Microsoft Windows systems can use the Java Accessibility API.

Java Access Bridge is a technology that enables Java applications and applets that implement the Java Accessibility API to be visible to assistive technologies on Microsoft Windows systems.

Refer to Java Platform, Standard Edition Accessibility Guide for information about the minimum supported versions of assistive technologies required to use Java Access Bridge. Also refer to this guide to obtain installation and testing instructions, and instructions for how to use Java Access Bridge.

#### **Related Topics**

Java Platform, Standard Edition Java Accessibility Guide

## **Command Syntax**

Refer to these command syntax conventions to understand command examples in this guide.

Convention	Description
\$	Bourne or BASH shell prompt in a command example. Do not enter the prompt as part of the command.
00	C Shell prompt in a command example. Do not enter the prompt as part of the command.
#	Superuser (root) prompt in a command example. Do not enter the prompt as part of the command.
monospace	UNIX command syntax
backslash \	A backslash is the UNIX and Linux command continuation character. It is used in command examples that are too long to fit on a single line. Enter the command as displayed (with a backslash) or enter it on a single line without a backslash:
	dd if=/dev/rdsk/c0t1d0s6 of=/dev/rst0 bs=10b \ count=10000
braces { }	Braces indicate required items:
	.DEFINE {macrol}
brackets []	Brackets indicate optional items:
	cvtcrt termname [outfile]



Convention	Description
ellipses	Ellipses indicate an arbitrary number of similar items:
	CHKVAL fieldname value1 value2 valueN
italic	Italic type indicates a variable. Substitute a value for the variable:
	library_name
vertical line	A vertical line indicates a choice within braces or brackets:
	FILE filesize [K M]

## Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
monospace	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

## Changes in this Release for Oracle Database

Learn about the new features and changes in Oracle Database Installation Guide for Oracle Database 19c.

- New Features Review new features available with Oracle Database installation in Oracle Database 19c.
- Deprecated Features Review features that are deprecated starting with Oracle Database 19c.
- Other Changes
   Review other changes for Oracle Database 19c.

#### **Related Topics**

Oracle Database New Features Guide

## **New Features**

Review new features available with Oracle Database installation in Oracle Database 19c.

- Oracle Memory Speed Support for PMEM Devices
- Root Scripts Automation Support for Oracle Database Installation
- Simplified Image-Based Oracle Database Client Installation

#### Oracle Memory Speed Support for PMEM Devices

Oracle recommends that you use Oracle Database with the Oracle Memory Speed (OMS) file system to fully utilize the potential of persistent memory (PMEM) devices safely in data centers.

With PMEM as the backing device, OMS utilizes a memory-mapped file hosted on an XFSbased, DAX-enabled file system to perform I/O operations. You must export the PMEM device as a file using a DAX-enabled file system, such as XFS.

#### **Related Topics**

Deploying the Oracle Memory Speed File System
 Learn how to deploy the Oracle Memory Speed (OMS) file system on your persistent memory (PMEM) storage devices with a single-instance Oracle Database.

#### Root Scripts Automation Support for Oracle Database Installation

Starting with Oracle Database 19c, the database installer, or setup wizard, provides options to set up permissions to run the root configuration scripts automatically, as required, during a database installation. You continue to have the option to run the root configuration scripts manually.



Setting up permissions for root configuration scripts to run without user intervention can simplify database installation and help avoid inadvertent permission errors.

#### **Related Topics**

• Running Oracle Database Setup Wizard to Install Oracle Database Extract the database image files and use the runInstaller command to start the installation.

#### Simplified Image-Based Oracle Database Client Installation

Starting with Oracle Database 19c, the Oracle Database client software is available as an image file for download and installation. You must extract the image software into a directory where you want your Oracle home to be located, and then run the runInstaller script to start the Oracle Database client installation. Oracle Database client installation binaries continue to be available in the traditional format as non-image zip files.

As with Oracle Database and Oracle Grid Infrastructure image file installations, Oracle Database client image installations simplify Oracle Database client installations and ensure best practice deployments.

#### **Related Topics**

Installing Oracle Database Client Using Image File

## **Deprecated Features**

Review features that are deprecated starting with Oracle Database 19c.

The following feature is deprecated in this release, and may be desupported in another release. For more information about deprecated and desupported features, parameters and views, refer to *Oracle Database Upgrade Guide*.

Deprecation of clone.pl

The clone.pl script is deprecated in Oracle Database 19c. The functionality of performing a software-only installation, using the gold image, is available in the installer wizard. The clone.pl script can be removed in a future release. Instead of using the clone.pl script, Oracle recommends that you install the extracted gold image as a home, using the installer wizard.

Deprecation of the SERVICE\_NAMES parameter

The use of the SERVICE\_NAMES parameter is no longer actively supported. It must not be used for high availability (HA) deployments. It is not supported to use service names parameter for any HA operations. This restriction includes FAN, load balancing, FAILOVER\_TYPE, FAILOVER\_RESTORE, SESSION\_STATE\_CONSISTENCY, and any other uses.

Deprecation of Oracle ACFS on IBM AIX

The ACFS storage option on IBM AIX is deprecated in Oracle Database 19c. To align the support for the IBM AIX platform, Oracle Automatic Storage Management Cluster File System (ACFS) on IBM AIX (called Oracle Advanced Cluster File System starting with Oracle Database 21c) is deprecated in Oracle Database 19c. For data or files currently stored on an ACFS file system that cannot be stored in the Oracle database, the IBM General Parallel File System (GPFS) can be used.

#### **Related Topics**

Oracle Database Upgrade Guide



## **Other Changes**

Review other changes for Oracle Database 19c.

Rapid Home Provisioning Name Change

Starting with Oracle Database 19c and Oracle Grid Infrastructure 19c, Rapid Home Provisioning is renamed to Fleet Patching and Provisioning (FPP).

Operating System Package Names

To simplify the installation of operating system packages required for an Oracle Database and Oracle Grid Infrastructure installation on Linux, starting with 19c, only the operating system package names will be listed and not the exact package version. Install or update to the latest version of these packages from the minimum supported Linux distribution.Only packages that are officially released by Oracle or your operating system vendor are supported.



## 1 Oracle Database Installation Checklist

Use checklists to review system requirements, and to plan and carry out Oracle Database installation.

Oracle recommends that you use checklists as part of your installation planning process. Using checklists can help you to confirm that your server hardware and configuration meet minimum requirements for this release, and can help you to ensure you carry out a successful installation.

- Server Hardware Checklist for Oracle Database Installation Use this checklist to check hardware requirements for Oracle Database.
- Operating System Checklist for Oracle Database Installation on Linux Use this checklist to check minimum operating system requirements for Oracle Database.
- Server Configuration Checklist for Oracle Database Installation Use this checklist to check minimum server configuration requirements for Oracle Database installations.
- Oracle User Environment Configuration Checklist for Oracle Database Installation Use this checklist to plan operating system users, groups, and environments for Oracle Database management.
- Storage Checklist for Oracle Database Installation Use this checklist to review storage minimum requirements and assist with configuration planning.
- Installer Planning Checklist for Oracle Database
   Use this checklist to assist you to be prepared before starting Oracle Universal Installer.
- Deployment Checklist for Oracle Database
   Use this checklist to decide the deployment method for a single-instance Oracle Database.

## Server Hardware Checklist for Oracle Database Installation

Use this checklist to check hardware requirements for Oracle Database.

Table 1-1	Server Hardware Checklist for Oracle Database Installation
-----------	--

Check	Task
Runlevel	3 or 5
Server Display Cards	At least 1024 x 768 display resolution, which Oracle Universal Installer requires.
Minimum network connectivity	Server is connected to a network
Minimum RAM	<ul> <li>At least 1 GB RAM for Oracle Database installations. 2 GB RAM recommended.</li> <li>At least 8 GB RAM for Oracle Grid Infrastructure installations.</li> </ul>
Linux for Arm (aarch64) processor	Oracle Database 19c Linux for Arm (aarch64) requires a CPU capable of Neoverse N1. Oracle recommends using a server with an Ampere Altra or Ampere Altra Max CPU.



# Operating System Checklist for Oracle Database Installation on Linux

Use this checklist to check minimum operating system requirements for Oracle Database.

Table 1-2	Operating System General Checklist for Oracle Database on Linux
-----------	---

Item	Task
Operating system general requirements	OpenSSH installed manually, if you do not have it installed already as part of a default Linux installation.
	A Linux kernel in the list of supported kernels and releases listed in this guide.
Linux x86-64 operating	The following Linux x86-64 kernels are supported:
system requirements	<ul> <li>Oracle Linux 9 with the Unbreakable Enterprise Kernel 7: 5.15.0-1.43.4.2.el9uek.x86_64 or later Oracle Linux 9 with the Red Hat Compatible Kernel: 5.14.0-70.22.1.0.2.el9_0.x86_64 or later</li> <li>Oracle Linux 8.8 with the Unbreakable Enterprise Kernel 7: 5.15.0-202.135.2.el8uek.x86_64 or later Oracle Linux 8.1 with the Unbreakable Enterprise Kernel 6: 5.4.17-2011.0.7.el8uek.x86_64 or later Oracle Linux 8 with the Red Hat Compatible kernel: 4.18.0-80.el8.x86_64 or later</li> <li>Oracle Linux 7.4 with the Unbreakable Enterprise Kernel 4: 4.1.12-124.19.2.el7uek.x86_64 or later Oracle Linux 7.4 with the Unbreakable Enterprise Kernel 5: 4.14.35-1818.1.6.el7uek.x86_64 or later Oracle Linux 7.7 with the Unbreakable Enterprise Kernel 5: 4.14.35-1818.1.6.el7uek.x86_64 or later Oracle Linux 7.7 with the Unbreakable Enterprise Kernel 6: 5.4.17-2011.4.4.el7uek.x86_64 or later Oracle Linux 7.5 with the Red Hat Compatible Kernel: 3.10.0-862.11.6.el7.x86_64 or later</li> <li>Red Hat Enterprise Linux 9: 5.14.0-70.22.1.el9_0.x86_64 or later</li> <li>Red Hat Enterprise Linux 8: 4.18.0-80.el8.x86_64 or later</li> <li>Red Hat Enterprise Linux 7.5: 3.10.0-862.11.6.el7.x86_64 or later</li> <li>SUSE Linux Enterprise Server 15: 4.12.14-23-default or later</li> <li>SUSE Linux Enterprise Server 12 SP3: 4.4.162-94.72-default or later</li> <li>Review the system requirements section for a list of minimum package requirements.</li> </ul>
IBM: Linux on System z operating system requirements	<ul> <li>The following IBM: Linux on System z kernels are supported:</li> <li>Red Hat Enterprise Linux 9.2: 5.14.0-284.30.1.el9_2.s390x or later</li> <li>Red Hat Enterprise Linux 8.3: 4.18.0-240.el8.s390x or later</li> <li>Red Hat Enterprise Linux 7.4: 3.10.0-693.el7.s390x or later</li> <li>SUSE Linux Enterprise Server 15: 5.3.18-57-default s390x or later</li> <li>SUSE Linux Enterprise Server 12: 4.4.73-5-default s390x or later</li> <li>Review the system requirements section for a list of minimum package requirements.</li> </ul>

Item	Task
Linux for Arm (aarch64) operating	Starting with Oracle Database 19c Release 19.19, the Linux for Arm (aarch64) operating system is supported with the following minimum supported version:
system requirements	Oracle Linux 8.6 with Unbreakable Enterprise Kernel 7: 5.15.0-6.80.3.1.el8uek.aarch64 or later
	<b>Note:</b> Oracle recommends that you update Oracle Linux 8 to the latest available release level.
Oracle Database Preinstallation RPM for Oracle Linux	If you use Oracle Linux, then Oracle recommends that you run the Oracle Database Preinstallation RPM for your Linux release to configure your operating system for Oracle Database and Oracle Grid Infrastructure installations.
Oracle RPM Checker utility for IBM: Linux on System z	Oracle recommends that you use the Oracle RPM Checker utility to verify that you have the required Red Hat Enterprise Linux or SUSE packages installed on your IBM: Linux on System z operating system before you start the Oracle Database or Oracle Grid Infrastructure installation.
Disable Transparent HugePages	Oracle recommends that you disable Transparent HugePages and use standard HugePages for enhanced performance.

#### Table 1-2 (Cont.) Operating System General Checklist for Oracle Database on Linux

#### **Related Topics**

- Automatically Configuring Oracle Linux with Oracle Database Preinstallation RPM Use Oracle Database Preinstallation RPM to simplify operating system configuration in preparation for Oracle software installations.
- Operating System Requirements for x86-64 Linux Platforms The Linux distributions and packages listed in this section are supported for this release on x86-64.
- Setting Transparent HugePages to madvise

Transparent HugePages memory is enabled by default with Oracle Linux. However, for optimal performance, Oracle recommends that you set Transparent HugePages to madvise on all Oracle Database servers running UEK7 and later kernels before you start the installation.

## Server Configuration Checklist for Oracle Database Installation

Use this checklist to check minimum server configuration requirements for Oracle Database installations.

Check	Task
Disk space allocated to the /tmp directory	At least 1 GB of space in the $/ {\tt tmp}$ directory.
Swap space allocation relative to RAM (Oracle Database)	Between 1 GB and 2 GB: 1.5 times the size of the RAM Between 2 GB and 16 GB: Equal to the size of the RAM More than 16 GB: 16 GB <b>Note:</b> If you enable HugePages for your Linux servers, then you should deduct the memory allocated to HugePages from the available RAM before calculating swap space.

#### Table 1-3 Server Configuration Checklist for Oracle Database



Check	Task
Swap space allocation relative to RAM (Oracle Restart)	Between 8 GB and 16 GB: Equal to the size of the RAM More than 16 GB: 16 GB <b>Note:</b> If you enable HugePages for your Linux servers, then you should deduct the memory allocated to HugePages from the available RAM before calculating swap space.
Oracle Inventory (oralnventory) and OINSTALL Group Requirements	<ul> <li>For upgrades, the installer detects an existing oralnventory directory from the /etc/oraInst.loc file, and uses the existing oralnventory.</li> <li>For new installs, if you have not configured an oralnventory directory, then you can specify the oralnventory directory during the software installation and Oracle Universal Installer will set up the software directories for you. The Oracle inventory is one directory level up from the Oracle base for the Oracle software installation and designates the installation owner's primary group as the Oracle inventory group. Ensure that the oralnventory path that you specify is in compliance with the Oracle Optimal Flexible Architecture recommendations.</li> <li>The Oracle Inventory directory is the central inventory of Oracle Inventory group as their primary group are granted the OINSTALL privilege to write to the central inventory.</li> </ul>
	The OINSTALL group must be the primary group of all Oracle software installation owners on the server. It should be writable by any Oracle installation owner.
Groups and users	Oracle recommends that you create groups and user accounts required for your security plans before starting installation. Installation owners have resource limits settings and other requirements. Group and user names must use only ASCII characters.
Mount point paths for the software binaries	Oracle recommends that you create an Optimal Flexible Architecture configuration as described in the appendix "Optimal Flexible Architecture" in <i>Oracle Database Installation Guide</i> for your platform.
Ensure that the Oracle home (the Oracle home path you select for Oracle Database) uses only ASCII characters	The ASCII character restriction includes installation owner user names, which are used as a default for some home paths, as well as other directory names you may select for paths.
Unset Oracle software environment variables	If you have an existing Oracle software installation, and you are using the same user to install this installation, then unset the following environment variables: <code>\$ORACLE_HOME, \$ORA_NLS10</code> , and <code>\$TNS_ADMIN</code> .
	If you have set \$ORA_CRS_HOME as an environment variable, then unset it before starting an installation or upgrade. Do not use \$ORA_CRS_HOME as a user environment variable, except as directed by Oracle Support.
Set locale (if needed)	Specify the language and the territory, or locale, in which you want to use Oracle components. A locale is a linguistic and cultural environment in which a system or program is running. NLS (National Language Support) parameters determine the locale-specific behavior on both servers and clients. The locale setting of a component determines the language of the user interface of the component, and the globalization behavior, such as date and number formatting.

#### Table 1-3 (Cont.) Server Configuration Checklist for Oracle Database

Check	Task
Check Shared Memory File System Mount	By default, your operating system includes an entry in /etc/fstab to mount /dev/shm. However, if your Cluster Verification Utility (CVU) or installer checks fail, ensure that the /dev/shm mount area is of type tmpfs and is mounted with the following options:
	• rw and exec permissions set on it
	• Without noexec or nosuid set on it
	Note: These options may not be listed as they are usually set as the default permissions by your operating system.
Symlinks	Oracle home or Oracle base cannot be symlinks, nor can any of their parent directories, all the way to up to the root directory.

#### Table 1-3 (Cont.) Server Configuration Checklist for Oracle Database

#### **Related Topics**

- Checking and Configuring the Server for Oracle Database Verify that servers where you install Oracle Database meet the minimum requirements for installation.
- Configuring Users, Groups and Environments for Oracle Grid Infrastructure and Oracle Database
   Before installation, create operating system groups and users, and configure user environments.
- Oracle Database Globalization Support Guide

# Oracle User Environment Configuration Checklist for Oracle Database Installation

Use this checklist to plan operating system users, groups, and environments for Oracle Database management.

Check	Task
Review Oracle Inventory (oralnventory) and OINSTALL Group Requirements	The physical group you designate as the Oracle Inventory directory is the central inventory of Oracle software installed on your system. It should be the primary group for all Oracle software installation owners Users who have the Oracle Inventory group as their primary group are granted the OINSTALL privilege to read and write to the central inventory.
	<ul> <li>If you have an existing installation, then OUI detects the existing oralnventory directory from the/etc/oraInst.loc file, and uses this location.</li> </ul>
	<ul> <li>If you are installing Oracle software for the first time, then you can specify the Oracle inventory directory and the Oracle base directory during the Oracle software installation, and Oracle Universal Installer will set up the software directories for you. Ensure that the directory paths that you specify are in compliance with the Oracle Optimal Flexible Architecture recommendations.</li> <li>Ensure that the group designated as the OINSTALL group is available</li> </ul>
	as the primary group for all planned Oracle software installation owners.
Create operating system groups and users for standard or role-	The Preinstallation RPM automatically creates the oracle user and the oralnventory (oinstall) and OSDBA (dba) groups for you.
allocated system privileges	Create additional operating system groups and users depending on your security requirements as described in this installation guide.
	Set resource limits settings and other requirements for Oracle software installation owners.
	Group and user names must use only ASCII characters.
Unset Oracle Software Environment Variables	If you have had an existing installation on your system, and you are using the same user account for this installation, then unset the ORACLE_HOME, ORACLE_BASE, ORACLE_SID, TNS_ADMIN environment variables and any other environment variable set for the Oracle installation user that is connected with Oracle software homes.
Configure the Oracle Software Owner Environment	Configure the environment of the <code>oracle</code> or <code>grid</code> user by performing the following tasks:
	• Set the default file mode creation mask (umask) to 022 in the shel startup file.
	• Set the DISPLAY environment variable.

#### Table 1-4 User Environment Configuration for Oracle Database

#### **Related Topics**

• Optimal Flexible Architecture

Oracle Optimal Flexible Architecture (OFA) rules are a set of configuration guidelines created to ensure well-organized Oracle installations, which simplifies administration, support and maintenance.

#### **Related Topics**

Configuring Users, Groups and Environments for Oracle Grid Infrastructure and Oracle
 Database

Before installation, create operating system groups and users, and configure user environments.

## Storage Checklist for Oracle Database Installation

Use this checklist to review storage minimum requirements and assist with configuration planning.

Table 1-5	Storage	<b>Checklist for</b>	Oracle	Database
-----------	---------	----------------------	--------	----------

Check	Task
Minimum local disk storage space for Oracle software	For Linux x86-64 and Linux for Arm (aarch64): At least 6.5 GB for an Oracle Grid Infrastructure for a standalone server installation. At least 7.2 GB for Oracle Database Enterprise Edition. At least 7.2 GB for Oracle Database Standard Edition 2.
	For IBM: Linux on System z: At least 5.5 GB for an Oracle Grid Infrastructure for a standalone server installation. At least 5.9 GB for Oracle Database Enterprise Edition. At least 5.9 GB for Oracle Database Standard Edition 2.
	Note: Oracle recommends that you allocate approximately 100 GB to allow additional space for applying any future patches on top of the existing Oracle home. For specific patch-related disk space requirements, please refer to your patch documentation.
Select Database File Storage Option	<ul> <li>Ensure that you have one of the following storage options available:</li> <li>File system mounted on the server. Oracle recommends that the file system you select is separate from the file system used by the operating system or the Oracle software. Options include the following: <ul> <li>A file system on a logical volume manager (LVM) volume or a RAID device</li> <li>A network file system (NFS) mounted on a certified network-attached storage (NAS) device</li> </ul> </li> <li>Oracle Automatic Storage Management (Oracle ASM). <ul> <li>Oracle ASM is installed as part of an Oracle Grid Infrastructure installation. If you plan to use Oracle ASM for storage, then you should install Oracle</li> </ul> </li> </ul>
Determine your recovery plan	<ul> <li>Grid Infrastructure before you install and create the database.</li> <li>If you want to enable recovery during installation, then be prepared to select one of the following options:</li> <li>File system: Configure a fast recovery area on a file system during installation</li> <li>Oracle Automatic Storage Management: Configure a fast recovery area disk group using Oracle ASMCA.</li> <li>Review the storage configuration sections of this document for more information about configuring recovery.</li> </ul>

#### **Related Topics**

• Configuring File System Storage for Oracle Database Complete these procedures to use file system storage for Oracle Database.

## Installer Planning Checklist for Oracle Database

Use this checklist to assist you to be prepared before starting Oracle Universal Installer.

 Table 1-6
 Oracle Universal Installer Planning Checklist for Oracle Database Installation

Check	Task
Read the Release Notes	Review release notes for your platform, which are available for your release at the following URL:
	http://docs.oracle.com/en/database/database.html
Review Oracle Support Certification Matrix	New platforms and operating system software versions may be certified after this guide is published, review the certification matrix on the My Oracle Support website for the most up-to-date list of certified hardware platforms and operating system versions:
	https://support.oracle.com/
	You must register online before using My Oracle Support. After logging in, from the menu options, select the <b>Certifications</b> tab. On the Certifications page, use the <b>Certification Search</b> options to search by Product, Release, and Platform. You can also search using the <b>Certification Quick Link</b> options such as Product Delivery, and Lifetime Support.
Review the Licensing Information	You are permitted to use only those components in the Oracle Database media pack for which you have purchased licenses. For more information about licenses, refer to the following URL:
	Oracle Database Licensing Information
Run OUI with CVU and use fixup scripts	Oracle Universal Installer is fully integrated with Cluster Verification Utility (CVU), automating many CVU prerequisite checks. Oracle Universal Installer runs all prerequisite checks and creates fixup scripts when you run the installer. You can run OUI up to the Summary screen without starting the installation.
	You can also run CVU commands manually to check system readiness. For more information, see:
	Oracle Clusterware Administration and Deployment Guide

Check	Task
ORAchk for runtime and upgrade checks, or runtime health checks	Oracle recommends that you update to the latest version of Oracle ORAchk by installing the latest version of Autonomous Health Framework (AHF).
	The Oracle ORAchk utility provides system checks that can help to prevent issues before and after installation. These checks include kernel requirements, operating system resource allocations, and other system requirements.
	Use the Oracle ORAchk Upgrade Readiness Assessment to obtain an automated upgrade-specific system health check for upgrades to 19c. For example:
	Before you perform a fresh database installation:
	./orachk -profile preinstall
	• To upgrade your existing database to a higher version or release:
	./orachk -pregupgrade -targetversion 19.0.0.0.0
	The Oracle ORAchk Upgrade Readiness Assessment automates many of the manual pre- and post-upgrade checks described in Oracle upgrade documentation. Check My Oracle Support Note 2550798.1 for more information about Oracle ORAchk support.
	https://support.oracle.com/epmos/faces/DocContentDisplay? id=2550798.1&parent=DOCUMENTATION&sourceId=USERGUIDE
Verify if Oracle Grid Infrastructure is installed	If you want to use Oracle ASM or Oracle Restart, then install Oracle Grid Infrastructure for a standalone server before you install and create the database. Otherwise, to use Oracle ASM, you must complete an Oracle Grid Infrastructure installation, and then manually register the database with Oracle Restart.
	For Oracle Real Application Clusters (Oracle RAC) installations, ensure that you have installed and configured Oracle Grid Infrastructure for a cluster.
Check running Oracle processes, and shut down if necessary	<ul> <li>On a standalone database not using Oracle ASM: You do not need to shut down the database while you install Oracle Grid Infrastructure.</li> <li>On a standalone database using Oracle ASM: The Oracle ASM instances are restarted during installation.</li> </ul>
	<ul> <li>On an Oracle RAC Database node: This installation requires an upgrade of Oracle Clusterware, as Oracle Clusterware is required to run Oracle RAC. As part of the upgrade, you must shut down the database one node at a time as the rolling upgrade proceeds from node to node.</li> </ul>
Ensure cron jobs do not run during installation	If the installer is running when daily cron jobs start, then you may encounter unexplained installation problems if your cron job is performing cleanup, and temporary files are deleted before the installation is finished. Oracle recommends that you complete installation before daily cron jobs are run, or disable daily
	cron
	jobs that perform cleanup until after the installation is completed.

Table 1-6(Cont.) Oracle Universal Installer Planning Checklist for Oracle DatabaseInstallation

Check	Task
Obtain your My Oracle Support account information.	During installation, you may require a My Oracle Support user name and password to configure updates, download software updates, and other installation tasks. You can register for My Oracle Support at the following URL:
	https://support.oracle.com/
Decide Oracle Database management tool	By default, Oracle Database is managed by Oracle Enterprise Manager Database Express.
	If you have an existing Oracle Management Agent, and decide to use Oracle Enterprise Manager Cloud Control to centrally manage your database, then obtain the following information to enter during the database installation:
	<ul><li>OMS host</li><li>OMS port</li></ul>
	EM admin username
	EM admin password
	<ul> <li>Specify password of ASMSNMP user</li> </ul>
	For more information, see:
	Oracle Database 2 Day DBA
	Oracle Enterprise Manager Cloud Control Administrator's Guide
Review memory allocation and Automatic Memory Management feature	You can enable automatic memory management either during, or after Oracle Database installation. If you enable automatic memory managemen after installation, then you must shut down and restart the database.
	If the total physical memory of your database instance is greater than 4 GB then you cannot select the Oracle Automatic Memory Management option during database installation and creation. Instead, use automatic shared memory management. Automatic shared memory management automatically distributes the available memory among the various components as required, allowing the system to maximize the use of all available SGA memory.
	For more information, see:
	Oracle Database Administrator's Guide

## Table 1-6(Cont.) Oracle Universal Installer Planning Checklist for Oracle DatabaseInstallation

Check	Task
Determine superuser (root) privilege delegation option for installation	During a database or grid infrastructure installation, you are asked to run configuration scripts as the root user.
	You can either run these scripts manually as root when prompted, or you can provide configuration information and passwords using a root privilege delegation option.
	To run root scripts automatically, select Automatically run configuration scripts during installation.
	Use root user credentials
	Provide the superuser password for cluster member node servers.
	Use Sudo
	Sudo is a UNIX and Linux utility that allows members of the sudoers list privileges to run individual commands as root. Provide the username and password of an operating system user that is a member of sudoers, and is authorized to run Sudo on each cluster member node.
	To enable Sudo, have a system administrator with the appropriate privileges configure a user that is a member of the sudoers list, and provide the username and password when prompted during installation.
Oracle Database Client and Oracle Database interoperability	For information about interoperability between Oracle Database Client and Oracle Database releases, see My Oracle Support Note 207303.1: https://support.oracle.com/rs?type=doc&id=207303.1

## Table 1-6(Cont.) Oracle Universal Installer Planning Checklist for Oracle DatabaseInstallation

#### **Related Topics**

- Installing Oracle Database
   Oracle Database and Oracle Grid Infrastructure installation software is available as imagebased zip files and can be installed using several options.
- Installing and Configuring Oracle Grid Infrastructure for a Standalone Server Oracle Grid Infrastructure for a standalone server includes Oracle Restart and Oracle Automatic Storage Management.

## **Deployment Checklist for Oracle Database**

Use this checklist to decide the deployment method for a single-instance Oracle Database.

Item	Task
To deploy single- instance Oracle Database software	<ul> <li>Use one of the following deployment methods:</li> <li>Install Oracle Database software using Oracle Universal Installer (OUI).</li> <li>Provision Oracle Database software using Oracle Fleet Patching and Provisioning.</li> <li>Clone Oracle Database.</li> </ul>

#### Table 1-7 Deployment Checklist for Oracle Database (single-instance)



Item	Task
To deploy single- instance Oracle Database software and create databases	<ul> <li>Use one of the following deployment methods:</li> <li>Install Oracle Database software using Oracle Universal Installer (OUI).</li> <li>Provision Oracle Database software using Oracle Fleet Patching and Provisioning.</li> <li>Clone Oracle Database.</li> </ul>
To create single- instance Oracle Database in an already-installed Oracle home	<ul> <li>Use Oracle Database Configuration Assistant (Oracle DBCA).</li> <li>Use Oracle Fleet Patching and Provisioning</li> </ul>

#### Table 1-7 (Cont.) Deployment Checklist for Oracle Database (single-instance)

#### **Related Topics**

- Installing Oracle Database
   Oracle Database and Oracle Grid Infrastructure installation software is available as imagebased zip files and can be installed using several options.
- About Deploying Oracle Database Using Oracle Fleet Patching and Provisioning You can use Oracle Fleet Patching and Provisioning (Oracle FPP) to provision Oracle Database software.
- Oracle Database Administrator's Guide
- Oracle Fleet Patching and Provisioning Administrator's Guide



## Checking and Configuring the Server for Oracle Database

Verify that servers where you install Oracle Database meet the minimum requirements for installation.

This section provides minimum server requirements to complete installation of Oracle Database. It does not provide system resource guidelines, or other tuning guidelines for particular workloads.

- Logging In to a Remote System Using X Window System
  - Use this procedure to run Oracle Universal Installer (OUI) by logging on to a remote system where the runtime setting prohibits logging in directly to a graphical user interface (GUI).
- Checking Server Hardware and Memory Configuration Use this procedure to gather information about your server configuration.

## Logging In to a Remote System Using X Window System

Use this procedure to run Oracle Universal Installer (OUI) by logging on to a remote system where the runtime setting prohibits logging in directly to a graphical user interface (GUI).

OUI is a graphical user interface (GUI) application. On servers where the runtime settings prevent GUI applications from running, you can redirect the GUI display to a client system connecting to the server.



If you log in as another user (for example, oracle or grid), then repeat this procedure for that user as well.

- Start an X Window System session. If you are using an X Window System terminal emulator from a PC or similar system, then you may need to configure security settings to permit remote hosts to display X applications on your local system.
- Enter a command using the following syntax to enable remote hosts to display X
  applications on the local X server:

```
# xhost + RemoteHost
```

*RemoteHost* is the fully qualified remote host name. For example:

```
# xhost + somehost.example.com
somehost.example.com being added to the access control list
```



3. If you are not installing the software on the local system, then use the ssh command to connect to the system where you want to install the software:

# ssh -Y RemoteHost

*RemoteHost* is the fully qualified remote host name. The -Y flag ("yes") enables remote clients to have full access to the original server display. For example:

# ssh -Y somehost.example.com

4. If you are not logged in as the root user, and you are performing configuration steps that require root user privileges, then switch the user to root.

#### Note:

For more information about remote login using X Window System, refer to your X server documentation, or contact your X server vendor or system administrator. Depending on the X server software that you are using, you may have to complete the tasks in a different order.

## Checking Server Hardware and Memory Configuration

Use this procedure to gather information about your server configuration.

1. Use the following command to determine physical RAM size on the server:

```
# grep MemTotal /proc/meminfo
```

If the size of the physical RAM installed in the system is less than the required size, then you must install more memory before continuing.

- 2. Determine the size of the configured swap space:
  - # grep SwapTotal /proc/meminfo

If necessary, see your operating system documentation for information about how to configure additional swap space.

3. Determine the amount of space available in the /tmp directory:

# df -h /tmp

If the free space available in the  $/\,{\tt tmp}$  directory is less than what is required, then complete one of the following steps:

Delete unused files from the /tmp directory to meet the disk space requirement.

Note:

If you perform this step after installing Oracle software, then do not remove /tmp/.oracle or /var/tmp/.oracle directories or their files.

- When you set the Oracle user's environment, also set the TMP and TMPDIR environment variables to the directory you want to use instead of /tmp.
- 4. Determine the amount of free RAM and disk swap space on the system:

# free

5. Determine if the system architecture can run the software:

# uname -m

Verify that the processor architecture matches the Oracle software release to install. For example, you should see the following for a x86-64 bit system:

x86\_64

If you do not see the expected output, then you cannot install the software on this system.

6. Verify that shared memory (/dev/shm) is mounted properly with sufficient size:

df -h /dev/shm

The df-h command displays the filesystem on which /dev/shm is mounted, and also displays in GB the total size and free size of shared memory.

#### **Related Topics**

• Server Hardware Checklist for Oracle Database Installation Use this checklist to check hardware requirements for Oracle Database.



## 3

## Automatically Configuring Oracle Linux with Oracle Database Preinstallation RPM

Use Oracle Database Preinstallation RPM to simplify operating system configuration in preparation for Oracle software installations.

Oracle recommends that you install Oracle Linux and use Oracle Database Preinstallation RPM to configure your operating systems for Oracle Database and Oracle Grid Infrastructure installations.

- About the Oracle Database Preinstallation RPM If your Linux distribution is Oracle Linux, or Red Hat Enterprise Linux, and you are an Oracle Linux support customer, then you can complete most preinstallation configuration tasks by using the Oracle Database Preinstallation RPM for your release.
- Overview of Oracle Linux Configuration with Oracle Database Preinstallation RPM Use Oracle Database Preinstallation RPM to simplify operating system configuration, and to ensure that you have required kernel packages.
- Installing the Oracle Database Preinstallation RPM Using ULN Use this procedure to subscribe to Unbreakable Linux Network (ULN) Oracle Linux channels for your Oracle software.
- Installing Oracle Database Preinstallation RPM During an Oracle Linux Installation Use this procedure to install a new Oracle Linux installation and to perform system configuration with the Oracle Database Preinstallation RPM:
- Installing Oracle Oracle Database Preinstallation RPM Using the Oracle Linux yum Server Install Oracle Linux and configure your Oracle Linux installation for security errata or bug fix updates using the Oracle Linux yum server.
- Configure Additional Operating System Features Oracle recommends that you configure your operating system before starting installation with additional features, such as IPMI or additional programming environments.

## About the Oracle Database Preinstallation RPM

If your Linux distribution is Oracle Linux, or Red Hat Enterprise Linux, and you are an Oracle Linux support customer, then you can complete most preinstallation configuration tasks by using the Oracle Database Preinstallation RPM for your release.

Oracle Database Preinstallation RPMs are available from the Oracle Linux Network or available on the Oracle Linux DVDs. Using the Oracle Database Preinstallation RPM is not required, but Oracle recommends you use it to save time in setting up your cluster servers.

When installed, the Oracle Database Preinstallation RPM does the following:

- Automatically downloads and installs any additional RPM packages needed for installing Oracle Grid Infrastructure and Oracle Database, and resolves any dependencies
- Creates an oracle user, and creates the oralnventory (oinstall) and OSDBA (dba) groups for that user



- As needed, sets sysctl.conf settings, system startup parameters, and driver parameters to values based on recommendations from the Oracle Database Preinstallation RPM program
- Sets hard and soft resource limits
- Sets other recommended parameters, depending on your kernel version
- Sets numa=off in the kernel for Linux x86\_64 and Linux aarch64 machines.

Configure Oracle Database Preinstallation RPM only once on your operating system when you install Oracle Database or Oracle Grid Infrastructure for the first time on your system. For subsequent installations on the same system, do not install Oracle Database Preinstallation RPM again.

Do not install Oracle Database Preinstallation RPM on Oracle Engineered Systems, such as Oracle Exadata Database Machine. Oracle Engineered Systems include integrated system software that contain the required version of the operating system kernel and all software packages.

#### Note:

- The Oracle Database Preinstallation RPM designated for each Oracle Database release sets kernel parameters and resource limits only for the user account oracle. To use multiple software account owners, you must perform system configuration for other accounts manually.
- The Oracle Database Preinstallation RPM installs the X11 client libraries, but it does not install the X Window System server packages. To use graphical user interfaces such as OUI, configuration assistants, and Oracle Enterprise Manager, set the display to a system with X Window System server packages.

## Overview of Oracle Linux Configuration with Oracle Database Preinstallation RPM

Use Oracle Database Preinstallation RPM to simplify operating system configuration, and to ensure that you have required kernel packages.

Oracle recommends that you install Oracle Linux and use Oracle Database Preinstallation RPM to configure your operating systems for Oracle Database and Oracle Grid Infrastructure installations.

Configure Oracle Database Preinstallation RPM only once on your operating system when you install Oracle Database or Oracle Grid Infrastructure for the first time on your system. For subsequent installations on the same system, do not install Oracle Database Preinstallation RPM again.

Do not install Oracle Database Preinstallation RPM on Oracle Engineered Systems, such as Oracle Exadata Database Machine. Oracle Engineered Systems include integrated system software that contain the required version of the operating system kernel and all software packages.

The Oracle Database Preinstallation RPM for your Oracle Linux distributions and database release automatically installs any additional packages needed for installing Oracle Grid Infrastructure and Oracle Database, and configures your server operating system



automatically, including setting kernel parameters and other basic operating system requirements for installation. For more information about Oracle Linux and Oracle Database Preinstallation RPM, refer to:

https://docs.oracle.com/en/operating-systems/oracle-linux/

Configuring a server using Oracle Linux and the Oracle Database Preinstallation RPM consists of the following steps:

- 1. Install Oracle Linux.
- Register your Linux distribution with Oracle Unbreakable Linux Network (ULN) or download and configure the yum repository for your system using the Oracle Linux yum server for your Oracle Linux release.
- 3. Install the Oracle Database Preinstallation RPM with the RPM for your Oracle Grid Infrastructure and Oracle Database releases, and update your Linux release.
- 4. Create role-allocated groups and users with identical names and ID numbers.
- 5. Complete network interface configuration for each cluster node candidate.
- 6. Complete system configuration for shared storage access as required for each standard or core node cluster candidate.

After these steps are complete, you can proceed to install Oracle Grid Infrastructure and Oracle Database.

## Installing the Oracle Database Preinstallation RPM Using ULN

Use this procedure to subscribe to Unbreakable Linux Network (ULN) Oracle Linux channels for your Oracle software.

To obtain Unbreakable Linux Network (ULN) support, subscribe to Oracle Linux channels, and to add the Oracle Linux channel that distributes the Oracle Database Preinstallation RPM:

- 1. Download the Oracle Linux ISO from one of the following websites:
  - Oracle yum

https://yum.oracle.com/oracle-linux-isos.html

Oracle Software Delivery Cloud website:

https://edelivery.oracle.com/linux

#### Note:

Ensure that you use the latest available update release for Oracle Linux.

- 2. Register your server with Unbreakable Linux Network (ULN). By default, you are registered for the Oracle Linux Latest channel for your operating system and hardware.
  - Oracle Linux 7 https://docs.oracle.com/en/operating-systems/oracle-linux/uln-user/
  - Oracle Linux 8 and Oracle Linux 9 https://docs.oracle.com/en/operating-systems/oracle-linux/software-management/



3. Log in to Unbreakable Linux Network:

```
https://linux.oracle.com
```

- 4. Start a terminal session and enter the following command as root, depending on your platform. For example:
  - Oracle Linux 7

```
# yum install oracle-database-preinstall-19c
```

```
Note:
```

Use the -y option if you want yum to skip the package confirmation prompt.

Oracle Linux 8 and Oracle Linux 9

```
# dnf install oracle-database-preinstall-19c
```

You should see output indicating that you have subscribed to the Oracle Linux channel, and that packages are being installed.

The Oracle Database Preinstallation RPM automatically creates a standard (not roleallocated) Oracle installation owner and groups, and sets up other kernel configuration settings as required for Oracle installations.

5. Check the RPM log file to review the system configuration changes. For example:

/var/log/oracle-database-preinstall-19c/backup/timestamp/orakernel.log

6. Repeat steps 1 through 4 on all other servers in your cluster.

If you have a premier support subscription, you can enable Ksplice to provide zero downtime patching. Refer to the Ksplice User's Guide for installation instructions:

https://docs.oracle.com/en/operating-systems/oracle-linux/ksplice-user/

# Installing Oracle Database Preinstallation RPM During an Oracle Linux Installation

Use this procedure to install a new Oracle Linux installation and to perform system configuration with the Oracle Database Preinstallation RPM:

- 1. Obtain Oracle Linux by downloading disk images
  - Oracle yum

https://yum.oracle.com/oracle-linux-isos.html

Oracle Software Delivery Cloud website:

https://edelivery.oracle.com/linux



#### Note:

Ensure that you use the latest available update release for Oracle Linux.

- 2. Start the Oracle Linux installation and respond to installation screens with values appropriate for your environment.
- 3. Review the first software selection screen, which lists task-specific software options. At the bottom of the screen, there is an option to customize now or customize later. Select **Customize now**, and click **Next**.
- 4. On Oracle Linux, select **Servers** on the left of the screen and **System administration tools** on the right of the screen (options may vary between releases).

The Packages in System Tools window opens.

5. Select the Oracle Database Preinstallation RPM package box from the package list. For example, select a package similar to the following:

For Oracle Linux 7:

oracle-database-preinstall-19c-1.0-1.el7.x86\_64.rpm

For Oracle Linux 8:

oracle-database-preinstall-19c-1.0-1.el8.x86 64.rpm

(or)

oracle-database-preinstall-19c-1.0-1.el8.aarch64.rpm

For Oracle Linux 9:

oracle-database-preinstall-19c-1.0-1.el9.x86 64.rpm

If you do not have an Oracle Database Preinstallation RPM package option that is current for your Oracle Database release, because you are using an Oracle Linux installation that is previous to your Oracle Database and Oracle Grid Infrastructure release, then install the RPM for your release manually after completing the operating system installation.

- Close the optional package window and click Next.
- 7. Complete the other screens to finish the Oracle Linux installation.

Oracle Linux automatically creates a standard (not role-allocated) Oracle installation owner and groups, and sets up other kernel configuration settings as required for Oracle installations.

8. Repeat steps 2 through 6 on all other cluster member nodes.

# Installing Oracle Oracle Database Preinstallation RPM Using the Oracle Linux yum Server

Install Oracle Linux and configure your Oracle Linux installation for security errata or bug fix updates using the Oracle Linux yum server.



- 1. Refer to the official Oracle Linux documentation to install Oracle Linux:
  - Oracle Linux 7
     Oracle Linux 7 Installation Guide
     Oracle Linux 7: Managing Software
    - Oracle Linux 8 and Oracle Linux 9 Oracle Linux 8 Installation Guide

Oracle Linux 9 Installation Guide

Managing Software in Oracle Linux

- 2. After you have completed your Oracle Linux installation, run the command yum update as needed to obtain the most current security errata and bug fixes for your Oracle Linux installation.
- 3. Restart your system.
- 4. Start a terminal session and enter the following command as root:
  - Oracle Linux 7

```
# yum install oracle-database-preinstall-19c
```

Note:

Use the -y option if you want yum to skip the package confirmation prompt.

Oracle Linux 8 and Oracle Linux 9

```
# dnf install oracle-database-preinstall-19c
```

#### Note:

Use the -y option if you want yum to skip the package confirmation prompt.

You should see output indicating that you have subscribed to the Oracle Linux channel, and that packages are being installed.

The Oracle Database Preinstallation RPM automatically creates a standard (not roleallocated) Oracle installation owner and groups and sets up other kernel configuration settings as required for Oracle installations. If you plan to use job-role separation, then create the extended set of database users and groups depending on your requirements.

## **Configure Additional Operating System Features**

Oracle recommends that you configure your operating system before starting installation with additional features, such as IPMI or additional programming environments.

Review the preinstallation chapters to ensure that you have completed configuration as needed for the features you want.

# Configuring Operating Systems for Oracle Database on Linux

Complete operating system configuration requirements and checks for Linux operating systems before you start installation.

You must meet the minimum requirements such as the operating system distribution, packages, and other software requirements for this release before you start an Oracle Database or Oracle Grid Infrastructure installation.

- Guidelines for Linux Operating System Installation Operating system guidelines to be aware of before proceeding with an Oracle installation.
- Reviewing Operating System and Software Upgrade Best Practices These topics provide general planning guidelines and platform-specific information about upgrades and migration.
- Reviewing Operating System Security Common Practices Secure operating systems are an important basis for general system security.
- About Installation Fixup Scripts
   Oracle Universal Installer detects when the minimum requirements for an installation are
   not met, and creates shell scripts, called fixup scripts, to finish incomplete system
   configuration steps.
- About Operating System Requirements
   Depending on the products that you intend to install, verify that you have the required
   operating system kernel and packages installed.
- Using Oracle RPM Checker on IBM: Linux on System z

Use the Oracle RPM Checker utility to verify that you have the required Red Hat Enterprise Linux or SUSE packages installed on the operating system before you start the Oracle Database or Oracle Grid Infrastructure installation.

- Operating System Requirements for x86-64 Linux Platforms
   The Linux distributions and packages listed in this section are supported for this release on x86-64.
- Operating System Requirements for IBM: Linux on System z The Linux distributions and packages listed in this section are supported for this release on IBM: Linux on System z.
- Operating System Requirements for Linux for Arm (aarch64) The Linux distribution and packages listed in this section are supported for this release on Linux for Arm (aarch64).
- Additional Drivers and Software Packages for Linux Information about optional drivers and software packages.
- Checking Kernel and Package Requirements for Linux Verify your kernel and packages to see if they meet minimum requirements for installation.
- Setting Clock Source for VMs on Linux x86-64 Oracle recommends that you set the clock source to tsc for better performance in virtual environments (VM) on Linux x86-64.



- Installing the cvuqdisk RPM for Linux
   If you do not use an Oracle Database Preinstallation RPM, and you want to use the Cluster
   Verification Utility, then you must install the cvuqdisk RPM.
- Confirming Host Name Resolution Check to ensure that the host name for your server is resolvable.
- Setting and Disabling Transparent HugePages on UEK Kernels Learn when to set Transparent HugePages and when to disable Transparent HugePages depending on your UEK kernel version.
- Using Automatic SSH Configuration During Installation To install Oracle software, configure secure shell (SSH) connectivity between all cluster member nodes.
- Verifying the Disk I/O Scheduler on Linux 8 and Later Systems Disk I/O schedulers reorder, delay, or merge requests for disk I/O to achieve better throughput and lower latency.
- Verifying the Disk I/O Scheduler on Linux 7 Systems
   Disk I/O schedulers reorder, delay, or merge requests for disk I/O to achieve better throughput and lower latency.

## **Guidelines for Linux Operating System Installation**

Operating system guidelines to be aware of before proceeding with an Oracle installation.

This section provides information about installing a supported Linux distribution. Complete the minimum hardware configuration before you install the operating system.

- Completing a Minimal or Default Linux Installation You must perform either a minimal or default Linux installation.
- About Oracle Linux with the Unbreakable Enterprise Kernel The Unbreakable Enterprise Kernel for Oracle Linux provides the latest innovations from upstream development to customers who run Oracle Linux in the data center.
- About the Oracle Database Preinstallation RPM
- Configuring HugePages on Linux HugePages is a feature integrated into the Linux kernel. For Oracle Database, using HugePages reduces the operating system maintenance of page states and increases Translation Lookaside Buffer (TLB) hit ratio.
- Restrictions for HugePages and Transparent HugePages Configurations Review the HugePages and Transparent HugePages guidelines discussed in this section.

#### **Related Topics**

- Oracle Linux Operating System Documentation
- About the Oracle Database Preinstallation RPM

## Completing a Minimal or Default Linux Installation

You must perform either a minimal or default Linux installation.

To complete a minimal Linux installation, select one of the minimal installation options.

A minimal Linux installation option is either a custom installation where you select the **Minimal** option from Package Group Selection, or where you deselect all packages except for the Base pack. A minimal Linux installation lacks many RPMs required for database installation, so you



must use an RPM package for your Oracle Linux release to install the required packages. The package you use depends on your Linux release, and your support status with Unbreakable Linux Network (ULN).

If you do not install the Oracle Database Preinstallation RPM, then Oracle recommends that you install your Linux operating system with the default software packages (RPMs).

A default Linux installation includes most of the required packages and helps you limit manual verification of package dependencies. Oracle recommends that you do not customize the RPMs during installation.

Refer to the official Oracle Linux documentation for more information about installing Oracle Linux:

- Oracle Linux 7 Installation Guide
- Oracle Linux 7: Managing Software
- Oracle Linux 8 Installation Guide
- Oracle Linux 8: Managing Software

## About Oracle Linux with the Unbreakable Enterprise Kernel

The Unbreakable Enterprise Kernel for Oracle Linux provides the latest innovations from upstream development to customers who run Oracle Linux in the data center.

The Unbreakable Enterprise Kernel is included and enabled by default in Oracle Linux kernels. It is based on a recent stable mainline development Linux kernel, and also includes optimizations developed in collaboration with Oracle Database, Oracle middleware, and Oracle hardware engineering teams to ensure stability and optimal performance for the most demanding enterprise workloads.

Oracle highly recommends deploying the Unbreakable Enterprise Kernel in your Oracle Linux environment, especially if you run enterprise applications. However, using Unbreakable Enterprise Kernel is optional. If you require strict Red Hat Enterprise Linux (RHEL) kernel compatibility, then Oracle Linux also includes a kernel compatible with the RHEL Linux kernel, compiled directly from the RHEL source code.

You can obtain more information about the Unbreakable Enterprise Kernel for Oracle Linux at the following URL:

#### https://www.oracle.com/linux/

The Unbreakable Enterprise Kernel for Oracle Linux is the standard kernel used with Oracle products. The build and QA systems for Oracle Database and other Oracle products use the Unbreakable Enterprise Kernel for Oracle Linux exclusively. The Unbreakable Enterprise Kernel for Oracle Linux is also the kernel used in Oracle Exadata and Oracle Exalogic systems. Unbreakable Enterprise Kernel for Oracle Linux is used in all benchmark tests on Linux in which Oracle participates, as well as in the Oracle Database Preinstallation RPM program for x86-64.

Oracle Ksplice, which is part of Oracle Linux, updates the Linux operating system (OS) kernel, while it is running, without requiring restarts or any interruption. Ksplice is available only with Oracle Linux.



## About the Oracle Database Preinstallation RPM

If your Linux distribution is Oracle Linux, or Red Hat Enterprise Linux, and you are an Oracle Linux support customer, then you can complete most preinstallation configuration tasks by using the Oracle Database Preinstallation RPM for your release.

Oracle Database Preinstallation RPMs are available from the Oracle Linux Network or available on the Oracle Linux DVDs. Using the Oracle Database Preinstallation RPM is not required, but Oracle recommends you use it to save time in setting up your cluster servers.

When installed, the Oracle Database Preinstallation RPM does the following:

- Automatically downloads and installs any additional RPM packages needed for installing Oracle Grid Infrastructure and Oracle Database, and resolves any dependencies
- Creates an oracle user, and creates the oralnventory (oinstall) and OSDBA (dba) groups for that user
- As needed, sets sysctl.conf settings, system startup parameters, and driver parameters to values based on recommendations from the Oracle Database Preinstallation RPM program
- Sets hard and soft resource limits
- Sets other recommended parameters, depending on your kernel version
- Sets numa=off in the kernel for Linux x86\_64 and Linux aarch64 machines.

Configure Oracle Database Preinstallation RPM only once on your operating system when you install Oracle Database or Oracle Grid Infrastructure for the first time on your system. For subsequent installations on the same system, do not install Oracle Database Preinstallation RPM again.

Do not install Oracle Database Preinstallation RPM on Oracle Engineered Systems, such as Oracle Exadata Database Machine. Oracle Engineered Systems include integrated system software that contain the required version of the operating system kernel and all software packages.

#### Note:

- The Oracle Database Preinstallation RPM designated for each Oracle Database release sets kernel parameters and resource limits only for the user account oracle. To use multiple software account owners, you must perform system configuration for other accounts manually.
- The Oracle Database Preinstallation RPM installs the X11 client libraries, but it does not install the X Window System server packages. To use graphical user interfaces such as OUI, configuration assistants, and Oracle Enterprise Manager, set the display to a system with X Window System server packages.



## Configuring HugePages on Linux

HugePages is a feature integrated into the Linux kernel. For Oracle Database, using HugePages reduces the operating system maintenance of page states and increases Translation Lookaside Buffer (TLB) hit ratio.

## Note: HugePages support is available in kernels built with the CONFIG\_HUGETLBFS and CONFIG\_HUGETLB\_PAGE configuration options.

Oracle recommends that you reserve a minimum of 30 percent of the total memory for standard pages and not more than 70 percent of the total memory for HugePages.

Ensure that you have created the Oracle Database software owner (oracle) user accounts and all its groups. For more information see, Automatically Configuring Oracle Linux with Oracle Database Preinstallation RPM or Creating an Oracle Software Owner User.

#### **Enabling Using HugePages**

Perform these steps to enable HugePages on Linux:

- 1. Check if the kernel supports HugePages:
  - \$ grep Huge /proc/meminfo
- 2. Edit the memlock setting in the /etc/security/limits.conf file.

Specify the memlock setting in KB. Set the maximum locked memory limit to at least 90 percent of the current RAM when you enable HugePages memory and at least to 3145728 KB (3 GB) if you disable HugePages. For example, if you have 64 GB RAM, then add the following entries to increase the maximum locked-in-memory address space:

oracle soft memlock 60397977 oracle hard memlock 60397977

You can also set the memlock value higher than your SGA requirements.

## Note:

On Exadata systems, specify the memlock setting as unlimited.

3. Log in as the oracle user again and run the ulimit -1 command to verify the new memlock setting:

```
$ ulimit -1
60397977
```

4. Run the following command to display the value of the Hugepagesize variable:

```
$ grep Hugepagesize /proc/meminfo
```



5. Determine the gid or oracle user group ID value:

# id oracle

The output is similar to the following:

```
uid=54321(oracle) gid=54321(oinstall) groups=54321(oinstall),54322(dba),
54323(oper),54324(backupdba),54325(dgdba),54326(kmdba),54327(asmdba),54330(
racdba)
```

Note the value of gid.

6. Set the vm.hugetlb\_shm\_group kernel parameter value to the gid value:

```
# sysctl -w vm.hugetlb shm group=gid
```

where gid is the oracle user group ID. For example, value of gid=54321.

To ensure that this value is available even after the system restarts, add the following entry to the /etc/sysctl.d/99-hugetlb-shm-group.conf file that contains this setting.

vm.hugetlb\_shm\_group=gid

#### Configuring the Capacity for HugePages

To configure the required number of HugePages for your databases, perform this step after you complete the Oracle Database installation and create your databases.

- Complete the following procedure to create a script that computes recommended values for HugePages configuration for the current shared memory segments:
  - a. Create a text file hugepages settings.sh

See My Oracle Support note 401749.1 to create the hugepages\_settings.sh script.

b. Change the permission of the hugepages\_settings.sh file:

\$ chmod +x hugepages settings.sh

2. Run the hugepages\_settings.sh script to compute values for the HugePages configuration.

\$ ./hugepages\_settings.sh

#### Note:

Before you run this script, ensure that all the databases that use hugepages run.

3. Set the following kernel parameter, where value is the HugePages value that you determined in Step 2:

```
# sysctl -w vm.nr hugepages=value
```



4. To ensure that HugePages is allocated after the system restarts, add the following entry to the /etc/sysctl.d/99-nr\_hugepages.conf file, where value is the HugePages value that you determined in Step 2:

```
vm.nr hugepages=value
```

### Note:

If you cannot set your HugePages allocation using nr\_hugepages, then your available memory may be fragmented. Restart your server for the Hugepages allocation to take effect.

5. Run the following command to check the available HugePages:

\$ grep Huge /proc/meminfo

- 6. Restart the instances.
- 7. Run the following command to check the available HugePages (1 or 2 pages free):

```
$ grep Huge /proc/meminfo
```

## Restrictions for HugePages and Transparent HugePages Configurations

Review the HugePages and Transparent HugePages guidelines discussed in this section.

Oracle recommends that you disable Transparent HugePages, because they may cause delays in accessing memory that can result in node restarts in Oracle RAC environments, or performance issues or delays for Oracle Database single instances. Oracle continues to recommend using standard HugePages for Linux.

Transparent HugePages memory is enabled by default with Oracle Linux 6 and later, Red Hat Enterprise Linux 6 and later, SUSE 11 and later, kernels.

If you install Oracle Database Preinstallation RPM, then it disables Transparent HugePages.

Transparent Hugepages are similar to standard HugePages. However, while standard HugePages allocate memory at startup, Transparent Hugepages memory uses the khugepaged thread in the kernel to allocate memory dynamically during runtime, using swappable HugePages.

HugePages allocates non-swappable memory for large page tables using memory-mapped files. HugePages are not enabled by default. If you enable HugePages, then you should deduct the memory allocated to HugePages from the available RAM before calculating swap space. Refer to your distribution documentation and to Oracle Technology Network and My Oracle Support for more information.

During Oracle Grid Infrastructure installation, the Grid Infrastructure Management Repository (GIMR) is configured to use HugePages. Because the Grid Infrastructure Management Repository database starts before all other databases installed on the cluster, if the space allocated to HugePages is insufficient, then the System Global Area (SGA) of one or more databases may be mapped to regular pages, instead of Hugepages, which can adversely affect performance. Configure the HugePages memory allocation to a size large enough to accommodate the sum of the SGA sizes of all the databases you intend to install on the cluster, as well as the Grid Infrastructure Management Repository.



# Reviewing Operating System and Software Upgrade Best Practices

These topics provide general planning guidelines and platform-specific information about upgrades and migration.

- General Upgrade Best Practices Be aware of these guidelines as a best practice before you perform an upgrade.
- New Server Operating System Upgrade Option You can upgrade your operating system by installing a new operating system on a server, and then migrating your database either manually, or by using Export/Import method.
- Oracle ASM Upgrade Notifications Understand Oracle ASM upgrade options and restrictions.

## **General Upgrade Best Practices**

Be aware of these guidelines as a best practice before you perform an upgrade.

If you have an existing Oracle Database installation, then do the following:

- Record the version numbers, patches, and other configuration information
- Review upgrade procedures for your existing installation
- Review Oracle Database upgrade documentation before proceeding with installation, to decide how you want to proceed

#### Caution:

Always create a backup of existing databases before starting any configuration change.

Refer to *Oracle Database Upgrade Guide* for more information about required software updates, pre-upgrade tasks, post-upgrade tasks, compatibility, and interoperability between different releases.

#### **Related Topics**

Oracle Database Upgrade Guide

## New Server Operating System Upgrade Option

You can upgrade your operating system by installing a new operating system on a server, and then migrating your database either manually, or by using Export/Import method.



## Note:

Confirm that the server operating system is supported, and that kernel and package requirements for the operating system meet or exceed the minimum requirements for the Oracle Database release to which you want to migrate.

#### Manual, Command-Line Copy for Migrating Data and Upgrading Oracle Database

You can copy files to the new server and upgrade it manually. If you use this procedure, then you cannot use Oracle Database Upgrade Assistant. However, you can revert to your existing database if you encounter upgrade issues.

- 1. Copy the database files from the computer running the previous operating system to the one running the new operating system.
- 2. Re-create the control files on the computer running the new operating system.
- 3. Manually upgrade the database using command-line scripts and utilities.

#### See Also:

*Oracle Database Upgrade Guide* to review the procedure for upgrading the database manually, and to evaluate the risks and benefits of this option

#### Export/Import Method for Migrating Data and Upgrading Oracle Database

You can install the operating system on the new server, install the new Oracle Database release on the new server, and then use Oracle Data Pump Export and Import utilities to migrate a copy of data from your current database to a new database in the new release. Data Pump Export and Import are recommended for higher performance and to ensure support for new data types.

## See Also:

*Oracle Database Upgrade Guide* to review the Export/Import method for migrating data and upgrading Oracle Database

## Oracle ASM Upgrade Notifications

Understand Oracle ASM upgrade options and restrictions.

- You can upgrade Oracle Automatic Storage Management (Oracle ASM) 11g release 2 (11.2) and later without shutting down an Oracle RAC database by performing a rolling upgrade either of individual nodes, or of a set of nodes in the cluster. However, if you have a standalone database on a cluster that uses Oracle ASM, then you must shut down the standalone database before upgrading.
- The location of the Oracle ASM home changed in Oracle Grid Infrastructure 11g release 2 (11.2) so that Oracle ASM is installed with Oracle Clusterware in the Oracle Grid Infrastructure home (Grid home).

 Two nodes of different releases cannot run in the cluster. When upgrading from Oracle Grid Infrastructure 11g release 2 (11.2) or Oracle Grid Infrastructure 12c release 1 (12.1) to a later release, if there is an outage during the rolling upgrade, then when you restart the upgrade, ensure that you start the earlier release of Oracle Grid Infrastructure and bring the Oracle ASM cluster back in the rolling migration mode.

## **Reviewing Operating System Security Common Practices**

Secure operating systems are an important basis for general system security.

Ensure that your operating system deployment is in compliance with common security practices as described in your operating system vendor security guide.

## About Installation Fixup Scripts

Oracle Universal Installer detects when the minimum requirements for an installation are not met, and creates shell scripts, called fixup scripts, to finish incomplete system configuration steps.

If Oracle Universal Installer detects an incomplete task, then it generates fixup scripts (runfixup.sh). You can run the fixup script and click **Fix and Check Again**. The fixup script modifies both persistent parameter settings and parameters in memory, so you do not have to restart the system.

The Fixup script does the following tasks:

- Sets kernel parameters, if necessary, to values required for successful installation, including:
  - Shared memory parameters.
  - Open file descriptor and UDP send/receive parameters.
- Creates and sets permissions on the Oracle Inventory (central inventory) directory.
- Creates or reconfigures primary and secondary group memberships for the installation owner, if necessary, for the Oracle Inventory directory and the operating system privileges groups.
- Sets shell limits, if necessary, to required values.

#### Note:

Using fixup scripts does not ensure that all the prerequisites for installing Oracle Database are met. You must still verify that all the preinstallation requirements are met to ensure a successful installation.

Oracle Universal Installer is fully integrated with Cluster Verification Utility (CVU) automating many prerequisite checks for your Oracle Grid Infrastructure or Oracle Real Application Clusters (Oracle RAC) installation. You can also manually perform various CVU verifications by running the cluvfy command.

#### **Related Topics**

 Completing Preinstallation Tasks Manually You can complete the preinstallation configuration tasks manually.



- Minimum Parameter Settings for Installation Use this table to set parameters manually if you cannot use the fixup scripts.
- Oracle Clusterware Administration and Deployment Guide

## About Operating System Requirements

Depending on the products that you intend to install, verify that you have the required operating system kernel and packages installed.

Requirements listed in this document are current as of the date listed on the title page.

Oracle Universal Installer performs checks on your system to verify that it meets the listed operating system package requirements. To ensure that these checks complete successfully, verify the requirements before you start OUI.

### Note:

Oracle does not support running different operating system versions on cluster members, unless an operating system is being upgraded. You cannot run different operating system version binaries on members of the same cluster, even if each operating system is supported.

## Using Oracle RPM Checker on IBM: Linux on System z

Use the Oracle RPM Checker utility to verify that you have the required Red Hat Enterprise Linux or SUSE packages installed on the operating system before you start the Oracle Database or Oracle Grid Infrastructure installation.

- Download the Oracle RPM Checker utility for your IBM: Linux on System z distribution from the link in My Oracle Support Note 2553465.1.
- 2. Unzip the RPM, and install the RPM as root.
- 3. Run the utility as root to check your operating system packages. For example:

Download the Oracle RPM Checker utility for your IBM: Linux on System z distribution. Then,

On Red Hat Enterprise Linux 9:

# rpm -ivh ora-val-rpm-RH9-DB-19c-19.0.1-1.s390x.rpm

On Red Hat Enterprise Linux 8:

# rpm -ivh ora-val-rpm-RH8-DB-19c.s390x.rpm

On Red Hat Enterprise Linux 7:

```
# rpm -ivh ora-val-rpm-RH7-DB-19c.s390x.rpm
```

On SUSE Linux Enterprise Server 12:

# rpm -ivh ora-val-rpm-S12-DB-19c.s390x.rpm

On SUSE Linux Enterprise Server 15:

# rpm -ivh ora-val-rpm-S15-DB-19c.s390x.rpm

On Red Hat Enterprise Linux, the utility checks and also installs all required RPMs. For example:

On Red Hat Enterprise Linux 9:

# yum install ora-val-rpm-RH9-DB-19c-19.0.1-1.s390x.rpm

On Red Hat Enterprise Linux 8:

# yum install ora-val-rpm-RH8-DB-19c.s390x.rpm

On Red Hat Enterprise Linux 7:

# yum install ora-val-rpm-RH7-DB-19c.s390x.rpm

To remove the Oracle RPM Checker utility:

On Red Hat Enterprise Linux 9:

# rpm -e ora-val-rpm-RH9-DB-19c-19.0.1-1.s390x

On Red Hat Enterprise Linux 8:

```
# rpm -e ora-val-rpm-RH8-DB-19c.s390x
```

On Red Hat Enterprise Linux 7:

# rpm -e ora-val-rpm-RH7-DB-19c.s390x

On SUSE Linux Enterprise Server 12:

# rpm -e ora-val-rpm-S12-DB-19c.s390x

On SUSE Linux Enterprise Server 15:

# rpm -e ora-val-rpm-S15-DB-19c.s390x

## Operating System Requirements for x86-64 Linux Platforms

The Linux distributions and packages listed in this section are supported for this release on x86-64.



Identify the requirements for your Linux distribution, and ensure that you have a supported kernel and required packages installed before starting installation.

The platform-specific hardware and software requirements included in this guide were current when this guide was published. However, because new platforms and operating system software versions may be certified after this guide is published, review the certification matrix on the My Oracle Support website for the most up-to-date list of certified hardware platforms and operating system versions:

#### https://support.oracle.com/

- General Guidelines for Operating System Packages
   Review these guidelines before you proceed with installing operating system packages.
- Supported Oracle Linux 9 Distributions for x86-64 Use the following information to check supported Oracle Linux 9 distributions:
- Supported Oracle Linux 8 Distributions for x86-64
   Use the following information to check supported Oracle Linux 8 distributions:
- Supported Oracle Linux 7 Distributions for x86-64
   Use the following information to check supported Oracle Linux 7 distributions:
- Supported Red Hat Enterprise Linux 9 Distributions for x86-64
   Use the following information to check supported Red Hat Enterprise Linux 9 distributions:
- Supported Red Hat Enterprise Linux 8 Distributions for x86-64
   Use the following information to check supported Red Hat Enterprise Linux 8 distributions:
- Supported Red Hat Enterprise Linux 7 Distributions for x86-64
   Use the following information to check supported Red Hat Enterprise Linux 7 distributions:
- Supported SUSE Linux Enterprise Server 12 Distributions for x86-64 Use the following information to check supported SUSE Linux Enterprise Server 12 distributions:
- Supported SUSE Linux Enterprise Server 15 Distributions for x86-64
   Use the following information to check supported SUSE Linux Enterprise Server 15 distributions:
- Installing Operating System Packages
   Learn how to install the latest version of your Oracle Linux and SUSE Linux Enterprise
   Server operating system packages listed earlier.

## General Guidelines for Operating System Packages

Review these guidelines before you proceed with installing operating system packages.

- Oracle recommends that you install Oracle Linux and use Oracle Database Preinstallation RPM to configure your operating systems for Oracle Database and Oracle Grid Infrastructure installations.
- The Oracle Database installation requires an X Window System (for example, libX). The libX packages are not part of a default Linux installation. If you perform an installation on a system with a reduced set of packages, then you must ensure that libX or a similar X Window System package is installed.
- The Unbreakable Enterprise Kernel for Oracle Linux can be installed on x86-64 servers running either Oracle Linux or Red Hat Enterprise Linux. As of Oracle Linux 5 Update 6, the Unbreakable Enterprise Kernel is the default system kernel. An x86 (32-bit) release of Oracle Linux including the Unbreakable Enterprise Kernel is available with Oracle Linux 5 update 7 and later.



- 32-bit packages in these requirements lists are needed only if you intend to use 32-bit client applications to access 64-bit servers that have the same operating system.
- Oracle Database 12c Release 2 (12.2) and later does not require the compiler packages gcc and gcc-c++ on for Oracle Database or Oracle Grid Infrastructure installations.
- These operating system requirements do not apply to Oracle Engineered Systems, such as Oracle Exadata Database Machine. Oracle Engineered Systems include integrated system software that contain the required version of the operating system kernel and all software packages. Please verify that you have the minimum required Exadata image. Refer My Oracle Support note 888828.1 for more information.

#### **Related Topics**

My Oracle Support Note 888828.1

## Supported Oracle Linux 9 Distributions for x86-64

Use the following information to check supported Oracle Linux 9 distributions:

Item	Requirements
SSH Requirement	Ensure that OpenSSH is installed on your servers. OpenSSH is the required SSH software.
Oracle Linux 9	Starting with Oracle Database 19c Release 19.19, the following minimum versions are supported:
	<ul> <li>Oracle Linux 9 with the Unbreakable Enterprise Kernel 7: 5.15.0-1.43.4.2.el9uek.x86_64 or later</li> </ul>
	<ul> <li>Oracle Linux 9 with the Red Hat Compatible Kernel: 5.14.0-70.22.1.0.2.el9_0.x86_64 or later</li> </ul>
	<b>Note:</b> Oracle recommends that you update Oracle Linux to the latest available version and release level.

Table 4-1 x86-64 Oracle Linux 9 Minimum Operating System Requirements

Item	Requirements
Packages for Oracle Linux 9	Subscribe to the Oracle Linux 9 channel on the Unbreakable Linux Network, or configure a yum repository from the Oracle Linux yum server website, and then install the Oracle Database Preinstallation RPM, oracle- database-preinstall-19c. The Oracle Database Preinstallation RPM, oracle-database-preinstall-19c, automatically installs all required packages listed in the table below, their dependencies for Oracle Grid Infrastructure and Oracle Database installations, and also performs othe system configuration. If you install the Oracle Database Preinstallation RPM, oracle-database-preinstall-19c, then you do not have to install these packages, as the Oracle Database Preinstallation RPM automatically installs them. Install the latest released versions of the following packages:
	bc
	binutils
	compat-openssl11
	elfutils-libelf
	fontconfig
	glibc
	glibc-devel
	ksh libeia
	libacon
	libasan liblsan
	libX11
	libXau
	libXi
	libXrender
	libXtst
	libxcrypt-compat
	libgcc
	libibverbs
	librdmaam
	librdmacm libstdc++
	libxcb
	libvirt-libs
	make
	policycoreutils
	policycoreutils-python-utils
	smartmontools
	sysstat
	<b>Note:</b> If you intend to use 32-bit client applications to access 64-bit servers, then you must also install (where available) the latest 32-bit versions of the packages listed in this table.

## Table 4-1 (Cont.) x86-64 Oracle Linux 9 Minimum Operating System Requirements

Item	Requirements
Optional Packages for Oracle Linux 9	Based on your requirement, install the latest released versions of the following packages:
	glibc-headers (for application development only) ipmiutil (for Intelligent Platform Management Interface) libnsl2 (for Oracle Database Client only) libnsl2-devel (for Oracle Database Client only) net-tools (for Oracle RAC and Oracle Clusterware) nfs-utils (for Oracle ACFS)

#### Table 4-1 (Cont.) x86-64 Oracle Linux 9 Minimum Operating System Requirements

#### **Related Topics**

- Installing Oracle Database 19c (19.19) on Oracle Linux 9
- Installing Oracle Database 19c (19.20) on Oracle Linux 9
- Known Issues and Bugs

## Supported Oracle Linux 8 Distributions for x86-64

Use the following information to check supported Oracle Linux 8 distributions:

#### Table 4-2 x86-64 Oracle Linux 8 Minimum Operating System Requirements

Item	Requirements
SSH Requirement	Ensure that OpenSSH is installed on your servers. OpenSSH is the required SSH software.
Oracle Linux 8	<ul> <li>Minimum supported versions:</li> <li>Oracle Linux 8.1 with the Unbreakable Enterprise Kernel 6: 5.4.17-2011.0.7.el8uek.x86_64 or later</li> <li>Oracle Linux 8 with the Red Hat Compatible Kernel: 4.18.0-80.el8.x86_64 or later</li> <li>Starting with Oracle Database 19c Release 19.21, the following minimum version is supported: Oracle Linux 8.8 with the Unbreakable Enterprise Kernel 7: 5.15.0-202.135.2.el8uek.x86_64 or later</li> <li>Starting with Oracle Grid Infrastructure 19c Release 19.23, the following minimum version is supported: Oracle Linux 8.8 with the Unbreakable Enterprise Kernel 7: 5.15.0-202.135.2.el8uek.x86_64 or later</li> </ul>
	Note: Oracle recommends that you update Oracle Linux to the latest available version and release level.

ltem	Requirements
Packages for Oracle Linux 8	Subscribe to the Oracle Linux 8 channel on the Unbreakable Linux Network, or configure a yum repository from the Oracle Linux yum server website, and then install the Oracle Database Preinstallation RPM, oracle- database-preinstall-19c. The Oracle Database Preinstallation RPM, oracle-database-preinstall-19c, automatically installs all required packages listed in the table below, their dependencies for Oracle Grid Infrastructure and Oracle Database installations, and also performs othe system configuration. If you install the Oracle Database Preinstall-19c, then you do not have to install these packages, as the Oracle Database Preinstallation RPM automatically installs them.
	bc binutils compat-openssI10 elfutils-libelf elfutils-libelf-devel fontconfig glibc glibc-devel ksh libaio libaio-devel libXrender libX11 libXxu libX11 libXau libXi libXtst libgcc libnsl librdmacm libstdc++ libstdc++-devel libxcb libiverbs libasan liblaan make policycoreutils policycoreutils policycoreutils policycoreutils policycoreutils policycoreutils policycoreutils policycoreutils policycoreutils policycoreutils policycoreutils policycoreutils policycoreutils policycoreutils policycoreutils

## Table 4-2 (Cont.) x86-64 Oracle Linux 8 Minimum Operating System Requirements

## Note:

If you intend to use 32-bit client applications to access 64-bit servers, then you must also install

Item	Requirements
	(where available) the latest 32-bit versions of the packages listed in this table.
Optional Packages for Oracle Linux 8	Based on your requirement, install the latest released versions of the following packages:
	ipmiutil (for Intelligent Platform Management Interface) libnsl2 (for Oracle Database Client only) libnsl2-devel (for Oracle Database Client only) libvirt-libs (for KVM) net-tools (for Oracle RAC and Oracle Clusterware) nfs-utils (for Oracle ACFS)
Patches and Known Issues	<ul> <li>For a list of latest Oracle Database Release Updates (RU) and Release Update Revisions (RUR) patches for Oracle Linux Enterprise Linux 8 and Red Hat Enterprise Linux 8, visit My Oracle Support</li> <li>For a list of known issues and open bugs for Oracle Linux 8 and Red Hat Enterprise Linux 8, read the Oracle Database Release Notes</li> </ul>
KVM virtualization	Kernel-based virtual machine (KVM), also known as KVM virtualization, is certified on Oracle Database 19c for all supported Oracle Linux 8 distributions. For more information on supported virtualization technologies for Oracle Database, refer to the virtualization matrix: https://www.oracle.com/database/technologies/virtualization-matrix.html

## Table 4-2 (Cont.) x86-64 Oracle Linux 8 Minimum Operating System Requirements

## Supported Oracle Linux 7 Distributions for x86-64

Use the following information to check supported Oracle Linux 7 distributions:

Table 4-3	x86-64 Oracle Linux 7 Minimur	n Operating System Requirements
-----------	-------------------------------	---------------------------------

Item	Requirements
SSH Requirement	Ensure that OpenSSH is installed on your servers. OpenSSH is the required SSH software.

Item	Requirements
Oracle Linux 7	Minimum supported versions:
	<ul> <li>Oracle Linux 7.4 with the Unbreakable Enterprise Kernel 4: 4.1.12-124.19.2.el7uek.x86_64 or later</li> <li>Oracle Linux 7.4 with the Unbreakable Enterprise Kernel 5:</li> </ul>
	4.14.35-1818.1.6.el7uek.x86_64 or later
	<ul> <li>Oracle Linux 7.7 with the Unbreakable Enterprise Kernel 6: 5.4.17-2011.4.4.el7uek.x86_64 or later</li> </ul>
	<ul> <li>Oracle Linux 7.5 with the Red Hat Compatible Kernel: 3.10.0-862.11.6.el7.x86_64 or later</li> </ul>
	Note:
	Oracle recommends that you update Oracle Linux to the latest available version and release level.

Table 4-3 (Cont.) x86-64 Oracle Linux 7 Minimum Operating System Requirements



Item	Requirements
Packages for Oracle Linux 7	Subscribe to the Oracle Linux 7 channel on the Unbreakable Linux Network, or configure a yum repository from the Oracle Linux yum server website, and then install the Oracle Database Preinstallation RPM, oracle- database-preinstall-19c. The Oracle Database Preinstallation RPM, oracle-database-preinstall-19c, automatically installs al required packages listed in the table below, their dependencies for Oracle Grid Infrastructure and Oracle Database installations, and also performs oth system configuration. If you install the Oracle Database Preinstallation RPM oracle-database-preinstall-19c, then you do not have to install these packages, as the Oracle Database Preinstallation RPM automatically installs them.
	bc binutils compat-libcap1 compat-libstdc++-33 elfutils-libelf elfutils-libelf-devel fontconfig-devel glibc glibc-devel ksh libaio libaio-devel libXrender libXrender-devel libX11
	libXau libXi libXtst libgcc libstdc++ libstdc++-devel libxcb make policycoreutils policycoreutils-python smartmontools sysstat
	Note:

## Table 4-3 (Cont.) x86-64 Oracle Linux 7 Minimum Operating System Requirements

If you intend to use 32-bit client applications to access 64-bit servers, then you must also install (where available) the latest 32-bit versions of the packages listed in this table.

Item	Requirements
Optional Packages for Oracle Linux 7	Based on your requirement, install the latest released versions of the following packages:
	ipmiutil (for Intelligent Platform Management Interface) net-tools (for Oracle RAC and Oracle Clusterware) libvirt-libs (for KVM) nfs-utils (for Oracle ACFS) python (for Oracle ACFS Remote) python-configshell (for Oracle ACFS Remote) python-rtslib (for Oracle ACFS Remote) python-six (for Oracle ACFS Remote) targetcli (for Oracle ACFS Remote)
KVM virtualization	Kernel-based virtual machine (KVM), also known as KVM virtualization, is certified on Oracle Database 19c for all supported Oracle Linux 7 distributions. For more information on supported virtualization technologies for Oracle Database, refer to the virtualization matrix:
	https://www.oracle.com/database/technologies/virtualization-matrix.html

#### Table 4-3 (Cont.) x86-64 Oracle Linux 7 Minimum Operating System Requirements

#### **Related Topics**

Installing Operating System Packages
 Learn how to install the latest version of your Oracle Linux and SUSE Linux Enterprise
 Server operating system packages listed earlier.

#### **Related Topics**

Installing Operating System Packages
 Learn how to install the latest version of your Oracle Linux and SUSE Linux Enterprise
 Server operating system packages listed earlier.

## Supported Red Hat Enterprise Linux 9 Distributions for x86-64

Use the following information to check supported Red Hat Enterprise Linux 9 distributions:

Item	Requirements
SSH Requirement	Ensure that OpenSSH is installed on your servers. OpenSSH is the required SSH software.
Red Hat Enterprise Linux 9	Starting with Oracle Database 19c Release 19.19, the following minimum versions are supported:
	Red Hat Enterprise Linux 9: 5.14.0-70.22.1.el9_0.x86_64 or later

Table 4-4 x86-64 Red Hat Enterprise Linux 9 Minimum Operating System Requirements



Item	Requirements
Packages for Red Hat Enterprise Linux 9	Install the latest released versions of the following packages:
	bc
	binutils
	compat-openssl11
	elfutils-libelf
	fontconfig
	glibc
	glibc-devel
	ksh
	libaio
	libasan
	liblsan
	libX11
	libXau
	libXi
	libXrender
	libXtst
	libxcrypt-compat
	libgcc
	libibverbs
	libnsl
	librdmacm
	libstdc++
	libxcb
	libvirt-libs
	make
	policycoreutils
	policycoreutils-python-utils
	smartmontools
	sysstat
	<b>Note:</b> If you intend to use 32-bit client applications to access 64-bit servers, then you must also install (where available) the latest 32-bit versions of the packages listed in this table.
Optional Packages for Red Hat Enterprise	Based on your requirement, install the latest released versions of the followin packages:
Linux 9	chkconfig (for Oracle Database and Oracle RAC only)
	glibc-headers (for application development only)
	ipmiutil (for Intelligent Platform Management Interface)
	libnsl2 (for Oracle Database Client only)
	libnsl2-devel (for Oracle Database Client only)
	net-tools (for Oracle RAC and Oracle Clusterware)
	nfs-utils (for Oracle ACFS)

# Table 4-4 (Cont.) x86-64 Red Hat Enterprise Linux 9 Minimum Operating SystemRequirements

#### **Related Topics**

- Installing Oracle Database 19c (19.19) on Red Hat Enterprise Linux 9
- Installing Oracle Database 19c (19.20) on Red Hat Enterprise Linux 9

Known Issues and Bugs

## Supported Red Hat Enterprise Linux 8 Distributions for x86-64

Use the following information to check supported Red Hat Enterprise Linux 8 distributions:

Table 4-5 x86-64 Red Hat Enterprise Linux 8 Minimum Operating System Requirements

Item	Requirements
SSH Requirement	Ensure that OpenSSH is installed on your servers. OpenSSH is the required SSH software.
Red Hat Enterprise Linux 8	Minimum supported versions:
	• Red Hat Enterprise Linux 8: 4.18.0-80.el8.x86_64 or later
Packages for Red Hat Enterprise Linux 8	Install the latest released versions of the following packages:
	bc binutils elfutils-libelf elfutils-libelf-devel glibc glibc-devel ksh libaio libaio-devel libXrender libX11 libXau libXi libXst libXst libgcc libnsl librdmacm libstdc++ libstdc++-devel libstdc++-devel libxcb libibverbs make policycoreutils policycoreutils-python-utils smartmontools sysstat
	Note: If you intend to use 32-bit client applications to access 64-bit servers, then you must also install (where available) the latest 32-bit versions of the packages listed in this table.

Item	Requirements
Optional Packages for Red Hat Enterprise Linux 8	Based on your requirement, install the latest released versions of the following packages:
	ipmiutil (for Intelligent Platform Management Interface) libnsl2 (for Oracle Database Client only) libnsl2-devel (for Oracle Database Client only) net-tools (for Oracle RAC and Oracle Clusterware) nfs-utils (for Oracle ACFS)
Patches and Known Issues	<ul> <li>For a list of latest Oracle Database Release Updates (RU) and Release Update Revisions (RUR) patches for Oracle Linux Enterprise Linux 8 and Red Hat Enterprise Linux 8, visit My Oracle Support</li> <li>For a list of known issues and open bugs for Oracle Linux 8 and Red Hat Enterprise Linux 8, read the Oracle Database Release Notes</li> </ul>

# Table 4-5 (Cont.) x86-64 Red Hat Enterprise Linux 8 Minimum Operating SystemRequirements

## Supported Red Hat Enterprise Linux 7 Distributions for x86-64

Use the following information to check supported Red Hat Enterprise Linux 7 distributions:

Item	Requirements
SSH Requirement	Ensure that OpenSSH is installed on your servers. OpenSSH is the required SSH software.
Red Hat Enterprise Linux 7	Minimum supported versions:
	<ul> <li>Red Hat Enterprise Linux 7.5: 3.10.0-862.11.6.el7.x86_64 or later</li> </ul>

Item	Requirements
Packages for Red Hat Enterprise Linux 7	Install the latest released versions of the following packages:
	bc binutils compat-libcap1 compat-libstdc++-33 elfutils-libelf elfutils-libelf-devel fontconfig-devel glibc glibc-devel ksh libaio libaio-devel libX11 libXau libXi libXtst libXtst libXrender libXrender libgcc libstdc++ libstdc++-devel libccb make smartmontools sysstat
	Note: If you intend to use 32-bit client applications to access 64-bit servers, then you must also install (where available) the latest 32-bit versions of the packages listed in this table.
Optional Packages for Red Hat Enterprise Linux 7	Based on your requirement, install the latest released versions of the followin packages:
	ipmiutil (for Intelligent Platform Management Interface) net-tools (for Oracle RAC and Oracle Clusterware) nfs-utils (for Oracle ACFS) python (for Oracle ACFS Remote) python-configshell (for Oracle ACFS Remote) python-rtslib (for Oracle ACFS Remote) python-six (for Oracle ACFS Remote) targetcli (for Oracle ACFS Remote)

# Table 4-6 (Cont.) x86-64 Red Hat Enterprise Linux 7 Minimum Operating SystemRequirements

## Supported SUSE Linux Enterprise Server 12 Distributions for x86-64

Use the following information to check supported SUSE Linux Enterprise Server 12 distributions:

# Table 4-7x86-64 SUSE Linux Enterprise Server 12 Minimum Operating SystemRequirements

ltem	Requirements
SSH Requirement	Ensure that OpenSSH is installed on your servers. OpenSSH is the required SSH software.
SUSE Linux Enterprise Server	Minimum supported version: SUSE Linux Enterprise Server 12 SP3: 4.4.162-94.72-default or later or later



Item	Requirements
Packages for SUSE Linux Enterprise Server 12	Install the latest released versions of the following packages:
	bc
	binutils
	glibc
	glibc-devel
	libX11
	libXau6
	libXtst6
	libcap-ng-utils
	libcap-ng0
	libcap-progs
	libcap1
	libcap2
	libelf-devel
	libgcc_s1
	libjpeg-turbo
	libjpeg62
	libjpeg62-turbo
	libpcap1
	libpcre1
	libpcre16-0
	libpng16-16
	libstdc++6
	libtiff5
	libaio-devel
	libaio1
	libXrender1
	make
	mksh
	pixz
	rdma-core
	rdma-core-devel
	smartmontools
	sysstat
	xorg-x11-libs
	XZ
	Note:

Table 4-7	(Cont.) x86-64 SUSE Linux Enterprise Server 12 Minimum Operating System
Requirem	ents

If you intend to use 32-bit client applications to access 64-bit servers, then you must also install (where available) the latest 32-bit versions of the packages listed in this table.

I on your requirement, install the latest released versions of the following ges:
ools (for Oracle RAC and Oracle Clusterware) ernel-server ( for Oracle ACFS)

# Table 4-7 (Cont.) x86-64 SUSE Linux Enterprise Server 12 Minimum Operating SystemRequirements

Installing Operating System Packages
 Learn how to install the latest version of your Oracle Linux and SUSE Linux Enterprise
 Server operating system packages listed earlier.

## Supported SUSE Linux Enterprise Server 15 Distributions for x86-64

Use the following information to check supported SUSE Linux Enterprise Server 15 distributions:

## Table 4-8x86-64 SUSE Linux Enterprise Server 15 Minimum Operating SystemRequirements

Item	Requirements
SSH Requirement	Ensure that OpenSSH is installed on your servers. OpenSSH is the required SSH software.
SUSE Linux Enterprise Server	Minimum supported version: SUSE Linux Enterprise Server 15: 4.12.14-23-default or later

Item	Requirements
Packages for SUSE Linux Enterprise Server 15	Install the latest released versions of the following packages:
	bc
	binutils
	glibc
	glibc-devel
	insserv-compat
	libaio-devel
	libaio1
	libX11-6
	libXau6
	libXext-devel
	libXext6
	libXi-devel
	libXi6
	libXrender-devel
	libXrender1
	libXtst6
	libcap-ng-utils
	libcap-ng0
	libcap-progs
	libcap1
	libcap2
	libelf1
	libgcc_s1
	libjpeg8
	libpcap1
	libpcre1
	libpcre16-0
	libpng16-16
	libstdc++6
	libtiff5
	libgfortran4
	mksh
	make
	pixz
	rdma-core
	rdma-core-devel
	smartmontools
	sysstat
	xorg-x11-libs
	XZ

# Table 4-8(Cont.) x86-64 SUSE Linux Enterprise Server 15 Minimum Operating SystemRequirements

Note:

If you intend to use 32-bit client applications to access 64-bit servers, then you must also install

Item	Requirements
	(where available) the latest 32-bit versions of the packages listed in this table.
Optional Packages for SUSE Linux Enterprise Server 15	Based on your requirement, install the latest released versions of the following packages:
	net-tools (for Oracle RAC and Oracle Clusterware) nfs-kernel-server (for Oracle ACFS)
Patches and Known Issues	<ul> <li>For a list of latest Release Updates (RU) and Release Update Revisions (RUR) patches for SUSE Linux Enterprise Server 15, visit My Oracle Support</li> </ul>
	<ul> <li>For a list of known issues and open bugs for SUSE Linux Enterprise Server 15, read the Oracle Database Release Notes</li> </ul>

Table 4-8(Cont.) x86-64 SUSE Linux Enterprise Server 15 Minimum Operating SystemRequirements

## Installing Operating System Packages

Learn how to install the latest version of your Oracle Linux and SUSE Linux Enterprise Server operating system packages listed earlier.

You must install the latest version of your operating system packages from the respective operating system vendor repository by using a package manager like YUM or YaST depending on your operating system.

Ensure that the appropriate channel or repository is enabled to include these packages.

For example:

On Oracle Linux or Red Hat Enterprise Linux, to install the latest bc package using YUM, run the following command:

\$ yum install bc

On SUSE Linux Enterprise Server, to install the latest bc package using YaST, run the following command:

```
$ yast --install bc
```

## Operating System Requirements for IBM: Linux on System z

The Linux distributions and packages listed in this section are supported for this release on IBM: Linux on System z.

Identify the requirements for your IBM: Linux on System z distribution, and ensure that you have a supported kernel and required packages installed before starting installation.



### Note:

32-bit packages in these requirements lists are needed only if you intend to use 32bit client applications to access 64-bit servers.

The platform-specific hardware and software requirements included in this guide were current when this guide was published. However, because new platforms and operating system software versions may be certified after this guide is published, review the certification matrix on the My Oracle Support website for the most up-to-date list of certified hardware platforms and operating system versions:

https://support.oracle.com/

- Supported Red Hat Enterprise Linux 9 Distributions for IBM: Linux on System z Use the following information to check supported Red Hat Enterprise Linux 9 distributions:
- Supported Red Hat Enterprise Linux 8 Distributions for IBM: Linux on System z Use the following information to check supported Red Hat Enterprise Linux 8 distributions:
- Supported Red Hat Enterprise Linux 7 Distributions for IBM: Linux on System z Use the following information to check supported Red Hat Enterprise Linux 7 distributions:
- Supported SUSE Linux Enterprise Server 12 Distributions for IBM: Linux on System z Use the following information to check supported SUSE Linux Enterprise Server 12 distributions:
- Supported SUSE Linux Enterprise Server 15 Distributions for IBM: Linux on System z Use the following information to check supported SUSE Linux Enterprise Server 15 distributions:

# Supported Red Hat Enterprise Linux 9 Distributions for IBM: Linux on System z

Use the following information to check supported Red Hat Enterprise Linux 9 distributions:

Table 4-9	Red Hat Enterprise Linux 9 Minimum Operating System Requirements
-----------	--

Item	Requirements
SSH Requirement	Ensure that OpenSSH is installed on your servers. OpenSSH is the required SSH software.
Red Hat Enterprise Linux 9	Starting with Oracle Database 19c Release 19.23, the following minimum version is supported: Red Hat Enterprise Linux 9.2: 5.14.0-284.30.1.el9_2.s390x or later



Item	Requirements
Packages for Red Hat Enterprise Linux 9	Install the latest released versions of the following packages:
	glibc-devel
	ksh
	libaio
	libasan
	liblsan
	libX11
	libXau
	libXi
	libXrender
	libXtst
	libxcrypt-compat
	libgcc
	libibverbs
	libnsl
	librdmacm
	libstdc++
	libxcb
	libvirt-libs
	make
	policycoreutils
	policycoreutils-python-utils
	smartmontools
	sysstat
Optional Packages for Red Hat Enterprise Linux 9	Based on your requirement, install the latest released versions of the following packages:
	chkconfig (for Oracle RAC and Oracle Clusterware only)
	glibc-headers (for application development only)
	ipmiutil (for Intelligent Platform Management Interface)
	libnsl2 (for Oracle Database Client only)
	libnsl2-devel (for Oracle Database Client only)
	net-tools (for Oracle RAC and Oracle Clusterware only)

Table 4-9 (Cont.) Red Hat Enterprise Linux 9 Minimum Operating SystemRequirements

Supported Red Hat Enterprise Linux 8 Distributions for IBM: Linux on System z

Use the following information to check supported Red Hat Enterprise Linux 8 distributions:

Table 4-10 Red Hat Enterprise Linux 8 Minimum Operating System Requirements

ltem	Requirements
SSH Requirement	Ensure that OpenSSH is installed on your servers. OpenSSH is the required SSH software.



Item	Requirements
Red Hat Enterprise Linux 8	Red Hat Enterprise Linux 8.3: 4.18.0-240.el8.s390x or later
Packages for Red Hat Enterprise Linux 8	The following packages (or later versions) must be installed:
	bc-1.07.1-5.el8 (s390x)
	binutils-2.30-79.el8 (s390x)
	elfutils-libelf-0.180-1.el8 (s390x)
	elfutils-libelf-devel-0.180-1.el8 (s390x)
	fontconfig-2.13.1-3.el8 (s390x)
	gcc-8.3.1-5.1.el8 (s390x)
	gcc-c++-8.3.1-5.1.el8 (s390x)
	glibc-2.28-127.el8_3.2 (s390x)
	glibc-devel-2.28-127.el8_3.2 (s390x)
	ksh-20120801-254.el8 (s390x)
	libnsl2-1.2.0-2.20180605git4a062cf.el8 (s390x)
	libX11-1.6.8-3.el8 (s390x)
	libXau-1.0.9-3.el8 (s390x)
	libXaw-1.0.13-10.el8 (s390x)
	libXi-1.7.10-1.el8 (s390x)
	libXrender-0.9.10-7.el8 (s390x)
	libXtst-1.2.3-7.el8 (s390x)
	libaio-0.3.112-1.el8 (s390x)
	libaio-devel-0.3.112-1.el8 (s390x)
	libattr-devel-2.4.48-3.el8 (s390x)
	libgcc-8.3.1-5.1.el8 (s390x)
	libgfortran-8.3.1-5.1.el8 (s390x)
	libibverbs-29.0-3.el8 (s390x)
	libnsl-2.28-127.el8_3.2 (s390x)
	librdmacm-29.0-3.el8 (s390x)
	libstdc++-8.3.1-5.1.el8 (s390x)
	libstdc++-devel-8.3.1-5.1.el8 (s390x)
	libxcb-1.13.1-1.el8 (s390x)
	make-4.2.1-10.el8 (s390x)
	net-tools-2.0-0.52.20160912git.el8 (s390x)
	pam-1.3.1-11.el8 (s390x)
	pam-devel-1.3.1-11.el8 (s390x)
	policycoreutils-2.9-9.el8 (s390x)
	policycoreutils-python-utils-2.9-9.el8.noarch
	smartmontools-7.1-1.el8 (s390x)
	sysstat-11.7.3-5.el8 (s390x)

Table 4-10 (Cont.) Red Hat Enterprise Linux 8 Minimum Operating SystemRequirements

Supported Red Hat Enterprise Linux 7 Distributions for IBM: Linux on System z

Use the following information to check supported Red Hat Enterprise Linux 7 distributions:

Item	Requirements
SSH Requirement	Ensure that OpenSSH is installed on your servers. OpenSSH is the required SSH software.
Red Hat Enterprise Linux 7	Red Hat Enterprise Linux 7.4: 3.10.0-693.el7.s390x or later
Packages for Red Hat Enterprise Linux 7	The following packages (or later versions) must be installed:
	binutils-2.25.1-31.base.el7 (s390x)
	compat-libcap1-1.10-7.el7 (s390x)
	gcc-4.8.5-16.el7 (s390x)
	gcc-c++-4.8.5-16.el7 (s390x)
	glibc-2.17-196.el7 (s390)
	glibc-2.17-196.el7 (s390x)
	glibc-devel-2.17-196.el7 (s390)
	glibc-devel-2.17-196.el7 (s390x)
	ksh-20120801-34.el7 (s390x)
	libX11-1.6.5-1.el7 (s390)
	libX11-1.6.5-1.el7 (s390x)
	libXaw-1.0.13-4.el7 (s390x)
	libXft-2.3.2-2.el7 (s390)
	libXi-1.7.9-1.el7 (s390)
	libXi-1.7.9-1.el7 (s390x)
	libXmu-1.1.2-2.el7 (s390)
	libXp-1.0.2-2.1.el7 (s390)
	libXtst-1.2.3-1.el7 (s390)
	libXtst-1.2.3-1.el7 (s390x)
	libaio-0.3.109-13.el7 (s390)
	libaio-0.3.109-13.el7 (s390x)
	libaio-devel-0.3.109-13.el7 (s390x)
	libattr-devel-2.4.46-12.el7 (s390)
	libattr-devel-2.4.46-12.el7 (s390x)
	libgcc-4.8.5-16.el7 (s390)
	libgcc-4.8.5-16.el7 (s390x)
	libgfortran-4.8.5-16.el7 (s390x)
	libstdc++-4.8.5-16.el7 (s390x)
	libstdc++-devel-4.8.5-16.el7 (s390x)
	make-3.82-23.el7 (s390x)
	pam-1.1.8-18.el7 (s390x)
	pam-devel-1.1.8-18.el7 (s390x)
	sysstat-10.1.5-12.el7 (s390x)

### Table 4-11 Red Hat Enterprise Linux 7 Minimum Operating System Requirements

Supported SUSE Linux Enterprise Server 12 Distributions for IBM: Linux on System z

Use the following information to check supported SUSE Linux Enterprise Server 12 distributions:

Item	Requirements			
SSH Requirement	Ensure that OpenSSH is installed on your servers. OpenSSH is the require SSH software.			
SUSE Linux Enterprise Server 12	SUSE Linux Enterprise Server 12: 4.4.73-5-default s390x or later			
Packages for SUSE Linux Enterprise Server	The following packages (or later versions) must be installed:			
12	binutils-2.26.1-9.12.1 (s390x)			
	gcc-4.8-6.189 (s390x)			
	gcc-c++-4.8-6.189 (s390x)			
	glibc-2.22-61.3 (s390x)			
	glibc-2.22-61.3 (s390)			
	glibc-devel-2.22-61.3 (s390x)			
	glibc-devel-2.22-61.3 (s390)			
	libaio-devel-0.3.109-17.15 (s390x)			
	libaio1-0.3.109-17.15 (s390x)			
	libaio1-0.3.109-17.15 (s390)			
	libX11-6-1.6.2-11.1 (s390x)			
	libXau6-1.0.8-4.58 (s390x)			
	libXau6-1.0.8-4.58 (s390x)			
	libXaw7-1.0.12-4.1 (s390x)			
	libXext6-1.3.2-3.61 (s390x)			
	libXext6-1.3.2-3.61 (s390)			
	libXft2-2.3.1-9.32 (s390x)			
	libXft2-2.3.1-9.32 (s390)			
	libXi6-1.7.4-17.1 (s390x)			
	libXi6-1.7.4-17.1 (s390)			
	libXmu6-1.1.2-3.60 (s390x)			
	libXp6-1.0.2-3.58 (s390x)			
	libXp6-1.0.2-3.58 (s390)			
	libXtst6-1.2.2-7.1 (s390x)			
	libXtst6-1.2.2-7.1 (s390)			
	libcap2-2.22-13.1 (s390x)			
	libstdc++48-devel-4.8.5-30.1 (s390)			
	libstdc++48-devel-4.8.5-30.1 (s390x)			
	libstdc++6-6.2.1+r239768-2.4 (s390)			
	libstdc++6-6.2.1+r239768-2.4 (s390x)			
	libxcb1-1.10-3.1 (s390x)			
	libxcb1-1.10-3.1 (s390)			
	libXmu6-1.1.2-3.60 (s390x)			
	mksh-50-2.13 (s390x)			
	make-4.0-4.1 (s390x)			

#### Table 4-12 SUSE Linux Enterprise Server 12 Minimum Operating System Requirements

Supported SUSE Linux Enterprise Server 15 Distributions for IBM: Linux on System z

Use the following information to check supported SUSE Linux Enterprise Server 15 distributions:

ltem	Requirements
SSH Requirement	Ensure that OpenSSH is installed on your servers. OpenSSH is the required SSH software.
SUSE Linux Enterprise Server 15	SUSE Linux Enterprise Server 15: 5.3.18-57-default s390x or later

#### Table 4-13 SUSE Linux Enterprise Server 15 Minimum Operating System Requirements

Item	Requirements
Packages for SUSE	The following packages (or later versions) must be installed:
Linux Enterprise Server	bc-1.07.1-11.37.s390x.rpm
15	binutils-2.35.1-7.18.1.s390x
	gcc-7-3.3.22.s390x
	gcc-c++-7-3.3.22.s390x
	glibc-2.31-7.30.s390x
	glibc-devel-2.31-7.30.s390x
	libaio-devel-0.3.109-1.25.s390x
	libaio1-0.3.109-1.25.s390x
	libX11-6-1.6.5-3.15.1.s390x
	libXau6-1.0.8-1.26.s390x
	libXaw7-1.0.13-3.3.8.s390x
	libXext6-1.3.3-1.30.s390x
	libXft2-2.3.2-1.33.s390x
	libXi-devel-1.7.9-3.2.1.s390x
	libXi6-1.7.9-3.2.1.s390x
	libXmu6-1.1.2-1.30.s390x
	libXp6-1.0.3-1.24.s390x
	libXrender-devel-0.9.10-1.30.s390x
	libXrender1-0.9.10-1.30.s390x
	libXtst6-1.2.3-1.24.s390x
	libcap-ng-utils-0.7.9-4.37.s390x
	libcap-ng0-0.7.9-4.37.s390x
	libcap-progs-2.26-4.6.1.s390x
	libcap1-1.97-1.15.s390x
	libcap2-2.26-4.6.1.s390x
	libelf1-0.168-4.5.3.s390x
	libgcc_s1-10.2.1+git583-1.3.4.s390x
	libjpeg8-8.1.2-5.15.7.s390x
	libpcap1-1.9.1-1.33.s390x
	libpcre1-8.41-4.20.s390x
	libstdc++6-10.2.1+git583-1.3.4.s390x
	libtiff5-4.0.9-5.30.28.s390x
	libgfortran4-7.5.0+r278197-4.25.1.s390x
	libxcb1-1.13-3.5.1.s390x
	libXmu6-1.1.2-1.30.s390x
	mksh-56c-1.10.s390x
	make-4.2.1-7.3.2.s390x
	net-tools-2.0+git20170221.479bb4a-3.11.s390x
	net-tools-deprecated-2.0+git20170221.479bb4a-3.11.s390x.rpm
	pixz-1.0.6-1.13.s390x
	rdma-core-31.0-2.14.s390x
	rdma-core-devel-31.0-2.14.s390x
	smartmontools-7.0-6.1.s390x
	sysstat-12.0.2-3.27.1.s390x
	xorg-x11-libs-7.6.1-1.16.noarch
	xz-5.2.3-4.3.1.s390x

Table 4-13 (Cont.) SUSE Linux Enterprise Server 15 Minimum Operating SystemRequirements

Table 4-13 (Cont.) SUSE Linux Enterprise Server 15 Minimum Operating SystemRequirements

Item	Requirements
	<b>Note:</b> If you intend to use 32-bit client applications to access 64-bit servers, then you must also install (where available) the latest 32-bit versions of the packages listed in this table.

# Operating System Requirements for Linux for Arm (aarch64)

The Linux distribution and packages listed in this section are supported for this release on Linux for Arm (aarch64).

Identify the requirements for your Linux distribution, and ensure that you have a supported kernel and required packages installed before starting installation.

The platform-specific hardware and software requirements included in this guide were current when this guide was published. However, because new platforms and operating system software versions may be certified after this guide is published, review the certification matrix on the My Oracle Support website for the most up-to-date list of certified hardware platforms and operating system versions:

https://support.oracle.com/

• Supported Oracle Linux 8 Distributions on Linux for Arm (aarch64) Use the following information to check supported Oracle Linux 8 distributions:

### Supported Oracle Linux 8 Distributions on Linux for Arm (aarch64)

Use the following information to check supported Oracle Linux 8 distributions:

Item	Requirements
Oracle Linux 8	Starting with Oracle Database 19c Release 19.19, the Linux for Arm (aarch64) operating system is supported with the following minimum supported version:
	Oracle Linux 8.6 with Unbreakable Enterprise Kernel 7: 5.15.0-6.80.3.1.el8uek.aarch64 or later
	Note:
	<ul> <li>Oracle recommends that you update Oracle Linux 8 to the latest available release level.</li> </ul>
	<ul> <li>The Oracle Database 19c Release 19.19 Linux for Arm (aarch64) includes all the content from the Oracle Database 19c RU (19.19).</li> </ul>

Table 4-14	Linux Arm (aarch64) Oracle Linux 8 Minimum Operating System
Requiremer	nts



Packages for Oracle Linux 8	Install the latest released versions of the following packages:
Linux 8	metan the latest released versione of the fenering packages.
	Subscribe to the Oracle Linux 8 channel on the Unbreakable Linux Network, or configure a yum repository from the Oracle Linux yum server website, and then install the Oracle Database Preinstallation RPM, oracle- database-preinstall-19c. The Oracle Database Preinstallation RPM, oracle-database-preinstall-19c, automatically installs all required packages listed in the table below, their dependencies for Oracle Grid Infrastructure and Oracle Database installations, and also performs othe system configuration. If you install the Oracle Database Preinstallation RPM, oracle-database-preinstall-19c, then you do not have to install these packages, as the Oracle Database Preinstallation RPM automatically installs them.
	bc binutils elfutils-libelf fontconfig-devel fontconfig-devel gcc gcc-c++ glibc glibc-devel ksh libaio libaio-devel libgcc libgfortran libiverbs libnsl libnsl libnsl2 librdmacm libstdc+++ libstdc+++devel libxcb libxt1 libxau libXi lib

Table 4-14 (Cont.) Linux Arm (aarch64) Oracle Linux 8 Minimum Operating SystemRequirements

#### **Related Topics**

• Installation Requirements for Programming Environments for Linux for Arm (aarch64) Ensure that your system meets the requirements for the programming environment you want to configure:



Issues Affecting Linux for Arm (aarch64) for Oracle Database 19c

# Additional Drivers and Software Packages for Linux

Information about optional drivers and software packages.

You are not required to install additional drivers and packages, but you may choose to install or configure these drivers and packages.

- Installing PAM for Login Authentication on Linux Pluggable Authentication Modules (PAM) is a system of libraries that handle user authentication tasks for applications.
- Installing OCFS2 You can use Oracle Cluster File System 2 (OCFS2) with Oracle Grid Infrastructure. However, you are not required to use OCFS2.
- Installing Oracle Messaging Gateway
   Oracle Messaging Gateway is installed with Enterprise Edition of Oracle Database.

   However, you may require a CSD or Fix Packs.
- Installation Requirements for ODBC and LDAP Review these topics to install Open Database Connectivity (ODBC) and Lightweight Directory Access Protocol (LDAP).
- Installation Requirements for Programming Environments for Linux Review the following section to install programming environments:
- Installation Requirements for Web Browsers
   Web browsers are required only if you intend to use Oracle Enterprise Manager Database
   Express and Oracle Enterprise Manager Cloud Control. Web browsers must support
   JavaScript, and the HTML 4.0 and CSS 1.0 standards.

### Installing PAM for Login Authentication on Linux

Pluggable Authentication Modules (PAM) is a system of libraries that handle user authentication tasks for applications.

On Linux, external scheduler jobs require PAM. Oracle strongly recommends that you install the latest Linux-PAM library for your Linux distribution.

Use a package management system (yum, up2date, YaST) for your distribution to install the latest pam (Pluggable Authentication Modules for Linux) library.

### Installing OCFS2

You can use Oracle Cluster File System 2 (OCFS2) with Oracle Grid Infrastructure. However, you are not required to use OCFS2.

OCFS2 is a POSIX-compliant general purpose shared disk cluster file system for Linux. OCFS2 is supported for this release only with Oracle Linux.

An OCFS2 installation consists of two parts, the kernel module and the tools module.

The supported version of the OCFS2 kernel module depends on the version of Unbreakable Enterprise Kernel available with Oracle Linux. Run the following command to install the latest version of the OCFS2 kernel module:

# yum install kernel-uek ocfs2



OCFS2 Release 1.8.6–9 is the supported version of OCFS2 tools module for this release. After you install the OCFS2 kernel module, run the following command, to install the OCFS2 tools module:

# yum install ocfs2-tools-1.8.6-9



https://oss.oracle.com/projects/ocfs2/

# Installing Oracle Messaging Gateway

Oracle Messaging Gateway is installed with Enterprise Edition of Oracle Database. However, you may require a CSD or Fix Packs.

If you require a CSD or Fix Packs for IBM WebSphere MQ, then see the following website for more information:

https://www.ibm.com/support/

#### Note:

- Oracle Messaging Gateway does not support the integration of Advanced Queuing with TIBCO Rendezvous on IBM: Linux on System z.
- Oracle Messaging Gateway is not supported on Linux for Arm (aarch64).

#### **Related Topics**

Oracle Database Advanced Queuing User's Guide

### Installation Requirements for ODBC and LDAP

Review these topics to install Open Database Connectivity (ODBC) and Lightweight Directory Access Protocol (LDAP).

- About ODBC Drivers and Oracle Database
   Open Database Connectivity (ODBC) is a set of database access APIs that connect to the database, prepare, and then run SQL statements on the database.
- Installing ODBC Drivers for Linux x86-64
   If you intend to install Oracle's ODBC driver, then you must also install the most recent
   ODBC Driver Manager for Linux.
- About LDAP and Oracle Plug-ins
   Lightweight Directory Access Protocol (LDAP) is an application protocol for accessing and
   maintaining distributed directory information services over IP networks.



#### Installing the LDAP Package

LDAP is included in a default Linux operating system installation.

### About ODBC Drivers and Oracle Database

Open Database Connectivity (ODBC) is a set of database access APIs that connect to the database, prepare, and then run SQL statements on the database.

An application that uses an ODBC driver can access non-uniform data sources, such as spreadsheets and comma-delimited files.

#### Installing ODBC Drivers for Linux x86-64

If you intend to install Oracle's ODBC driver, then you must also install the most recent ODBC Driver Manager for Linux.

Download and install the ODBC Driver Manager and Linux RPMs from the following website:

#### http://www.unixodbc.org

Review the minimum supported ODBC driver releases, and install ODBC drivers of the following or later releases for all Linux distributions:

unixODBC-2.3.4 or later

### About LDAP and Oracle Plug-ins

Lightweight Directory Access Protocol (LDAP) is an application protocol for accessing and maintaining distributed directory information services over IP networks.

You require the LDAP package if you want to use features requiring LDAP, including the Oracle Database scripts odisrvreg and oidca for Oracle Internet Directory, or schemasync for third-party LDAP directories.

### Installing the LDAP Package

LDAP is included in a default Linux operating system installation.

If you did not perform a default Linux installation, and you intend to use Oracle scripts requiring LDAP, then use a package management system (up2date, YaST) for your distribution to install a supported LDAP package for your distribution, and install any other required packages for that LDAP package.

### Installation Requirements for Programming Environments for Linux

Review the following section to install programming environments:

- Installation Requirements for Programming Environments for Linux x86-64 Ensure that your system meets the requirements for the programming environment you want to configure:
- Installation Requirements for Programming Environments for Linux for Arm (aarch64) Ensure that your system meets the requirements for the programming environment you want to configure:



• Installation Requirements for Programming Environments for IBM: Linux on System z Ensure that your system meets the requirements for the programming environment you want to configure:

### Installation Requirements for Programming Environments for Linux x86-64

Ensure that your system meets the requirements for the programming environment you want to configure:

Programming Environments	Support Requirements		
Java Database Connectivity (JDBC) / JDBC Oracle Call Interface (JDBC OCI)	JDK 8 (Java SE Development Kit) with the JNDI extension with Oracle Java Database Connectivity.		
Oracle Call Interface (OCI) Oracle C++ Call Interface Pro*C/C++	Latest released version of the Intel C/C++ Compiler or the GNU C and C++ compilers. Oracle C++ Call Interface (OCCI) applications can be built with the latest released version of the g++ or Intel C++ Compiler used with the standard template libraries of the gcc compilers listed in this table.		
gcc compiler packages	Install the latest released versions of the gcc packages listed here.		
	gcc gcc-c++ gcc-info gcc-locale gcc48 gcc48-info gcc48-locale gcc48-c++		
	Note: If you intend to use 32-bit client applications to access 64-bit servers, then you must also install the latest 32-bit versions of the packages listed in this table.		
Oracle XML Developer's Kit (XDK)	Oracle XML Developer's Kit is supported with the same compilers as OCCI.		
Pro*COBOL	<ul> <li>Micro Focus Visual COBOL for Eclipse 2.3 - Update 2</li> <li>Micro Focus Visual COBOL v6.0</li> </ul>		
Python	cx_oracle users should install Python 3.9 or later. Python 3.9 is the minimum supported version on Oracle Linux 9. For installing Python on Oracle Linux 9, see Installing Python.		

#### Table 4-15 Requirements for Programming Environments for Linux X86–64



### Installation Requirements for Programming Environments for Linux for Arm (aarch64)

Ensure that your system meets the requirements for the programming environment you want to configure:

Programming Environments	Support Requirements
Java Database Connectivity (JDBC) / JDBC Oracle Call Interface (JDBC OCI)	JDK 8 (Java SE Development Kit) with the JNDI extension with Oracle Java Database Connectivity.
Oracle Call Interface (OCI)	The GNU C and C++ compilers listed in this table.
Oracle C++ Call Interface	Oracle C++ Call Interface (OCCI) applications can be built with
Pro*C/C++	g++ used with the standard template libraries of the gcc compilers listed in this table.
gcc compiler packages	Install the latest released versions of the gcc packages listed here.
	gcc
	gcc-c++
Oracle XML Developer's Kit (XDK)	Oracle XML Developer's Kit is supported with the same compilers as OCCI.

Table 4-16 Requirements for Programming Environments for Linux for Arm (aarch64)

### Installation Requirements for Programming Environments for IBM: Linux on System z

Ensure that your system meets the requirements for the programming environment you want to configure:

Programming Environments	Support Requirements
Java Database Connectivity (JDBC) / Oracle Call Interface (OCI)	JDK 8 (Java SE Development Kit) with the JNDI extension with Oracle Java Database Connectivity.
Pro*COBOL	Micro Focus Visual COBOL v6.0
	Micro Focus Server Express 5.1
	Micro Focus Visual COBOL Development Hub 2.3 - Update 2

Table 4-17 Requirements for Programming Environments for IBM: Linux on System z

### Installation Requirements for Web Browsers

Web browsers are required only if you intend to use Oracle Enterprise Manager Database Express and Oracle Enterprise Manager Cloud Control. Web browsers must support JavaScript, and the HTML 4.0 and CSS 1.0 standards.

https://support.oracle.com

#### **Related Topics**

Oracle Enterprise Manager Cloud Control Basic Installation Guide



# **Checking Kernel and Package Requirements for Linux**

Verify your kernel and packages to see if they meet minimum requirements for installation.

**1.** To determine the distribution and version of Linux installed, enter one of the following commands:

```
# cat /etc/oracle-release
# cat /etc/redhat-release
# cat /etc/os-release
# lsb release -id
```

2. To determine if the required kernel errata is installed, enter the following command:

# uname -r

The following is an example of the output this command displays on an Oracle Linux 7 system:

4.14.35-1902.0.18.el7uek.x86 6

Review the required errata level for your distribution. If the errata level is previous to the required minimum errata update, then obtain and install the latest kernel update from your Linux distributor.

**3.** To determine whether the required packages are installed, enter commands similar to the following:

# rpm -q package name

Alternatively, if you require specific system architecture information, then enter the following command:

```
\# rpm -qa --queryformat "%{NAME}-%{VERSION}-%{RELEASE} (%{ARCH}) n" | grep package name
```

You can also combine a query for multiple packages, and review the output for the correct versions. For example:

```
# rpm -q binutils compat-libstdc++ gcc glibc libaio libgcc libstdc++ \
make sysstat unixodbc
```

If a package is not installed, then install it from your Linux distribution media or download the required package version from your Linux distributor's website.

# Setting Clock Source for VMs on Linux x86-64

Oracle recommends that you set the clock source to tsc for better performance in virtual environments (VM) on Linux x86-64.

1. As the root user, check if the tsc clock source is available on your system.

```
# cat /sys/devices/system/clocksource/clocksource0/available_clocksource
kvm-clock tsc acpi pm
```



2. If the tsc clock source is available, then set tsc as the current clock source.

```
# echo "tsc">/sys/devices/system/clocksource/clocksource0/
current clocksource
```

3. Verify that the current clock source is set to tsc.

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

4. Using any text editor, append the clocksource directive to the GRUB\_CMDLINE\_LINUX line in the /etc/default/grub file to retain this clock source setting even after a reboot.

```
GRUB_CMDLINE_LINUX="rd.lvm.lv=ol/root rd.lvm.lv=ol/swap rhgb quiet
numa=off transparent hugepage=never clocksource=tsc"
```

5. Run the following command to update GRUB and ensure that these settings are retained even after a reboot:

```
# grub2-mkconfig -o /boot/grub2/grub.cfg
```

# Installing the cvuqdisk RPM for Linux

If you do not use an Oracle Database Preinstallation RPM, and you want to use the Cluster Verification Utility, then you must install the cvuqdisk RPM.

Without cvuqdisk, Cluster Verification Utility cannot discover shared disks, and you receive the error message "Package cvuqdisk not installed" when you run Cluster Verification Utility. Use the cvuqdisk RPM for your hardware (for example, x86 64).

- 1. Locate the cvuqdisk RPM package, which is located in the directory *Grid\_home*/cv/rpm. Where *Grid\_home* is the Oracle Grid Infrastructure home directory.
- 2. Copy the cvuqdisk package to each node on the cluster. You should ensure that each node is running the same version of Linux.
- 3. Log in as root.
- Use the following command to find if you have an existing version of the cvuqdisk package:

```
# rpm -qi cvuqdisk
```

If you have an existing version of cvuqdisk, then enter the following command to deinstall the existing version:

```
# rpm -e cvuqdisk
```

- 5. Set the environment variable CVUQDISK\_GRP to point to the group that owns cvuqdisk, typically oinstall. For example:
  - # CVUQDISK GRP=oinstall; export CVUQDISK GRP

6. In the directory where you have saved the cvuqdisk RPM, use the command rpm -iv package to install the cvuqdisk package. For example:

```
# rpm -iv cvuqdisk-1.0.10-1.rpm
```

# **Confirming Host Name Resolution**

Check to ensure that the host name for your server is resolvable.

Typically, the computer on which you want to install Oracle Database is connected to a network. Ensure that the computer host name is resolvable, either through a Domain Name System (DNS), a network information service (NIS), or a centrally-maintained TCP/IP host file, such as /etc/hosts. Use the ping command to ensure that your computer host name is resolvable. For example:

```
ping myhostname
pinging myhostname.example.com [192.0.2.2] with 32 bytes of data:
Reply from 192.0.2.2: bytes=32 time=138ms TTL=56
```

#### **Related Topics**

Configuring Networks for Oracle Database

If you install Oracle Databases on servers with multiple Oracle homes, multiple aliases, or without a static IP address, then review these network configuration topics.

# Setting and Disabling Transparent HugePages on UEK Kernels

Learn when to set Transparent HugePages and when to disable Transparent HugePages depending on your UEK kernel version.

Setting Transparent HugePages to madvise

Transparent HugePages memory is enabled by default with Oracle Linux. However, for optimal performance, Oracle recommends that you set Transparent HugePages to madvise on all Oracle Database servers running UEK7 and later kernels before you start the installation.

Disabling Transparent HugePages
 On Oracle Database servers running UEK release earlier than UEK7, Oracle recommends that you disable Transparent HugePages before you start installation.

### Setting Transparent HugePages to madvise

Transparent HugePages memory is enabled by default with Oracle Linux. However, for optimal performance, Oracle recommends that you set Transparent HugePages to madvise on all Oracle Database servers running UEK7 and later kernels before you start the installation.

On Oracle Database servers running UEK release earlier than UEK7, Oracle recommends that you disable Transparent HugePages before you start the installation. See Disabling Transparent HugePages. Later on, if the UEK version is upgraded to UEK7 or later, apply the steps in this topic.

If you install Oracle Database Preinstallation RPM, then it sets Transparent HugePages to madvise on all Oracle Database servers running UEK7 and later kernels.

To set madvise on Transparent HugePages:



 For Oracle Linux and Red Hat Enterprise Linux, add or modify the transparent\_hugepage=madvise parameter in the /etc/default/grub file. For example:

```
GRUB_TIMEOUT=5
GRUB_DISTRIBUTOR="$(sed 's, release .*$,,g' /etc/system-release)"
GRUB_DEFAULT=saved
GRUB_DISABLE_SUBMENU=true
GRUB_TERMINAL_OUTPUT="console"
GRUB_CMDLINE_LINUX="crashkernel=auto rhgb quiet
transparent_hugepage=madvise"
GRUB_DISABLE_RECOVERY="true"
```

### Note:

The file name may vary depending on your operating system and hardware. For example, on Oracle Cloud Infrastructure (OCI) the <code>grub.cfg</code> file is located at / <code>boot/efi/EFI/redhat/</code>. Check your operating system documentation for the exact file name.

2. Run the grub2-mkconfig command to regenerate the grub.cfg file.

On Oracle Linux 8

# grub2-mkconfig -o /boot/grub2/grub.cfg

On Oracle Linux 9

grub2-mkconfig -o /boot/grub2/grub.cfg --update-bls-cmdline

Restart the system to make the changes permanent. If you do not want to restart your system, then enter the following command:

4. To check if Transparent HugePages is enabled and configured with madvise, run one of the following commands as the root user:

Oracle Linux kernels:

# cat /sys/kernel/mm/transparent hugepage/enabled

Red Hat Enterprise Linux kernels:

# cat /sys/kernel/mm/redhat transparent hugepage/enabled

The following is a sample output that shows Transparent HugePages is being used and set to madvise.

```
always [madvise] never
```



### **Disabling Transparent HugePages**

On Oracle Database servers running UEK release earlier than UEK7, Oracle recommends that you disable Transparent HugePages before you start installation.

Transparent HugePages memory differs from standard HugePages memory because the kernel khugepaged thread allocates memory dynamically during runtime. Standard HugePages memory is pre-allocated at startup, and does not change during runtime.

### Note:

Although Transparent HugePages is disabled on UEK2 and later UEK kernels, Transparent HugePages may be enabled by default on your Linux system.

Transparent HugePages memory is enabled by default with Oracle Linux 6 and later, Red Hat Enterprise Linux 6 and later, SUSE 11 and later, kernels.

Transparent HugePages can cause memory allocation delays during runtime. To avoid performance issues, Oracle recommends that you disable Transparent HugePages on all Oracle Database servers. Oracle recommends that you instead use standard HugePages for enhanced performance.

To check if Transparent HugePages is enabled, run one of the following commands as the root user:

Red Hat Enterprise Linux kernels:

# cat /sys/kernel/mm/redhat transparent hugepage/enabled

Other kernels:

# cat /sys/kernel/mm/transparent\_hugepage/enabled

The following is a sample output that shows Transparent HugePages are being used as the [always] flag is enabled.

[always] never

#### Note:

If Transparent HugePages is removed from the kernel, then neither /sys/ kernel/mm/transparent\_hugepage nor /sys/kernel/mm/ redhat transparent hugepage files exist.

To disable Transparent HugePages:



 For Oracle Linux 7, Oracle Linux 8, Red Hat Enterprise Linux 7, and Red Hat Enterprise Linux 8, add or modify the transparent\_hugepage=never parameter in the /etc/ default/grub file:

transparent hugepage=never

#### For example:

```
GRUB_TIMEOUT=5
GRUB_DISTRIBUTOR="$(sed 's, release .*$,,g' /etc/system-release)"
GRUB_DEFAULT=saved
GRUB_DISABLE_SUBMENU=true
GRUB_TERMINAL_OUTPUT="console"
GRUB_CMDLINE_LINUX="crashkernel=auto rhgb quiet transparent_hugepage=never"
GRUB_DISABLE_RECOVERY="true"
```

#### Note:

The file name may vary for your operating systems. Check your operating system documentation for the exact file name and the steps to disable Transparent HugePages.

2. Run the grub2-mkconfig command to regenerate the grub.cfg file.

```
# grub2-mkconfig -o /boot/grub2/grub.cfg
```

3. Restart the system to make the changes permanent.

# Using Automatic SSH Configuration During Installation

To install Oracle software, configure secure shell (SSH) connectivity between all cluster member nodes.

Oracle Universal Installer (OUI) uses the ssh and sftp commands during installation to run remote commands on and copy files to the other cluster nodes. You must configure SSH so that these commands do not prompt for a password.

#### Note:

Oracle configuration assistants use SSH for configuration operations from local to remote nodes. Oracle Enterprise Manager also uses SSH. RSH is no longer supported.

You can configure SSH from the OUI interface during installation for the user account running the installation. The automatic configuration creates passwordless SSH connectivity between all cluster member nodes. Oracle recommends that you use the automatic procedure if possible.

To enable the script to run, you must remove stty commands from the profiles of any existing Oracle software installation owners you want to use, and remove other security measures that



are triggered during a login, and that generate messages to the terminal. These messages, mail checks, and other displays prevent Oracle software installation owners from using the SSH configuration script that is built into OUI. If they are not disabled, then SSH must be configured manually before an installation can be run.

In rare cases, Oracle Clusterware installation can fail during the "AttachHome" operation when the remote node closes the SSH connection. To avoid this problem, set the timeout wait to unlimited by setting the following parameter in the SSH daemon configuration file /etc/ssh/sshd config on all cluster nodes:

LoginGraceTime 0

#### **Related Topics**

• Preventing Installation Errors Caused by Terminal Output Commands During an Oracle Grid Infrastructure installation, OUI uses SSH to run commands and copy files to the other nodes. During the installation, hidden files on the system (for example, .bashrc or .cshrc) can cause makefile and other installation errors if they contain terminal output commands.

# Verifying the Disk I/O Scheduler on Linux 8 and Later Systems

Disk I/O schedulers reorder, delay, or merge requests for disk I/O to achieve better throughput and lower latency.

Linux has multiple disk I/O schedulers available, including mq-deadline, none, kyber, and bfq on Oracle Linux 8 and later, RHEL 8 and later, and SUSE Linux Enterprise Server 15 and later systems. You should consult with your storage vendor for the appropriate I/O scheduler configuration to achieve best performance on Oracle Automatic Storage Management (Oracle ASM).

In general, Oracle recommends that you set the I/O Scheduler to mq-deadline for rotating storage devices (HDDs) and to none for non-rotating storage devices such as SSDs and NVMe on Oracle Linux 8 and later, RHEL 8 and later, and SUSE Linux Enterprise Server 15 and later systems.

On all cluster nodes, enter the following command as root to verify the configured disk I/O scheduler value.

```
cat /sys/block/${ASM_DISK}/queue/scheduler
none [mq-deadline] kyber bfq
```

In this example, the default disk I/O scheduler is mq-deadline and ASM\_DISK is a rotational Oracle ASM disk device.

#### Note:

Contact your storage vendor for more information about how to configure I/O scheduler on Linux for your storage devices.



# Verifying the Disk I/O Scheduler on Linux 7 Systems

Disk I/O schedulers reorder, delay, or merge requests for disk I/O to achieve better throughput and lower latency.

Linux has multiple disk I/O schedulers available, including deadline, noop, anticipatory, and Completely Fair Queuing (cfq) on Oracle Linux 7, Red Hat Enterprise Linux 7, and SUSE Linux Enterprise Server 12 systems. You should consult with your storage vendor for the appropriate I/O scheduler configuration to achieve best performance on Oracle Automatic Storage Management (Oracle ASM).

In general, Oracle recommends that you set the I/O Scheduler to deadline for rotating storage devices (HDDs) and to none for non-rotating storage devices such as SSDs and NVMe on Oracle Linux 7, Red Hat Enterprise Linux 7, and SUSE Linux Enterprise Server 12 systems.

On each cluster node, enter the following command as root to verify the configured disk I/O scheduler value.

```
cat /sys/block/${ASM_DISK}/queue/scheduler
noop [deadline] cfq
```

In this example, the default disk I/O scheduler is deadline and ASM\_DISK is a rotational Oracle ASM disk device.

#### Note:

Contact your storage vendor for more information about how to configure I/O scheduler on Linux for your storage devices.



# 5

# Configuring Users, Groups and Environments for Oracle Grid Infrastructure and Oracle Database

Before installation, create operating system groups and users, and configure user environments.

- Required Operating System Groups and Users Oracle software installations require an installation owner, an Oracle Inventory group, which is the primary group of all Oracle installation owners, and at least one group designated as a system privileges group.
- Oracle Installations with Standard and Job Role Separation Groups and Users A job role separation configuration of Oracle Database and Oracle ASM is a configuration with groups and users to provide separate groups for operating system authentication.
- Creating Operating System Privileges Groups The following sections describe how to create operating system groups for Oracle Grid Infrastructure and Oracle Database:
- Creating Operating System Oracle Installation User Accounts Before starting installation, create Oracle software owner user accounts, and configure their environments.
- Creating Oracle Database Vault User Accounts
   If you intend to use Oracle Database Vault by default, then you must create an Oracle
   Database Vault user account, and configure that user.
- Unsetting Oracle Installation Owner Environment Variables
   Unset Oracle installation owner environment variables before you start the installation.

# **Required Operating System Groups and Users**

Oracle software installations require an installation owner, an Oracle Inventory group, which is the primary group of all Oracle installation owners, and at least one group designated as a system privileges group.

Review group and user options with your system administrator. If you have system administration privileges, then review the topics in this section and configure operating system groups and users as needed.

• Determining If an Oracle Inventory and Oracle Inventory Group Exist

Determine if you have an existing Oracle central inventory, and ensure that you use the same Oracle Inventory for all Oracle software installations. Also, ensure that all Oracle software users you intend to use for installation have permissions to write to this directory.

• Creating the Oracle Inventory Group If an Oracle Inventory Does Not Exist Create an Oracle Inventory group manually as part of a planned installation, particularly where more than one Oracle software product is installed on servers.



#### About Oracle Installation Owner Accounts

Select or create an Oracle installation owner for your installation, depending on the group and user management plan you want to use for your installations.

Identifying an Oracle Software Owner User Account
 You must create at least one software owner user account the first time you install Oracle software on the system. Either use an existing Oracle software user account, or create an Oracle software owner user account for your installation.

### Determining If an Oracle Inventory and Oracle Inventory Group Exist

Determine if you have an existing Oracle central inventory, and ensure that you use the same Oracle Inventory for all Oracle software installations. Also, ensure that all Oracle software users you intend to use for installation have permissions to write to this directory.

When you install Oracle software on the system for the first time, OUI creates the oraInst.loc file. This file identifies the name of the Oracle Inventory group (by default, oinstall), and the path of the Oracle central inventory directory. If you have an existing Oracle central inventory, then ensure that you use the same Oracle Inventory for all Oracle software installations, and ensure that all Oracle software users you intend to use for installation have permissions to write to this directory.

```
oraInst.loccentral_inventory_locationgroup
```

```
inventory_loc=central_inventory_location
inst_group=group
```

Use the more command to determine if you have an Oracle central inventory on your system. For example:

```
# more /etc/oraInst.loc
inventory_loc=/u01/app/oraInventory
inst_group=oinstall
```

Use the command grep groupname /etc/group to confirm that the group specified as the Oracle Inventory group still exists on the system. For example:

```
$ grep oinstall /etc/group
oinstall:x:54321:grid,oracle
```

#### Note:

Do not put the oraInventory directory under the Oracle base directory for a new installation, because that can result in user permission errors for other installations.

### Creating the Oracle Inventory Group If an Oracle Inventory Does Not Exist

Create an Oracle Inventory group manually as part of a planned installation, particularly where more than one Oracle software product is installed on servers.

By default, if an oral ventory group does not exist, then the installer uses the primary group of the installation owner for the Oracle software being installed as the oral ventory group. Ensure



that this group is available as a primary group for all planned Oracle software installation owners.

```
oraInst.loc
# /usr/sbin/groupadd -g 54321 oinstall
```

### About Oracle Installation Owner Accounts

Select or create an Oracle installation owner for your installation, depending on the group and user management plan you want to use for your installations.

You must create a software owner for your installation in the following circumstances:

- If an Oracle software owner user does not exist; for example, if this is the first installation of Oracle software on the system.
- If an Oracle software owner user exists, but you want to use a different operating system user, with different group membership, to separate Oracle Grid Infrastructure administrative privileges from Oracle Database administrative privileges.

In Oracle documentation, a user created to own only Oracle Grid Infrastructure software installations is called the Grid user (grid). This user owns both the Oracle Clusterware and Oracle Automatic Storage Management binaries. A user created to own either all Oracle installations, or one or more Oracle database installations, is called the Oracle user (oracle). You can have only one Oracle Grid Infrastructure installation owner, but you can have different Oracle users to own different installations.

Oracle software owners must have the Oracle Inventory group as their primary group, so that each Oracle software installation owner can write to the central inventory (oralnventory), and so that OCR and Oracle Clusterware resource permissions are set correctly. The database software owner must also have the OSDBA group and (if you create them) the OSOPER, OSBACKUPDBA, OSDGDBA, OSRACDBA, and OSKMDBA groups as secondary groups.

### Identifying an Oracle Software Owner User Account

You must create at least one software owner user account the first time you install Oracle software on the system. Either use an existing Oracle software user account, or create an Oracle software owner user account for your installation.

To use an existing user account, obtain the name of an existing Oracle installation owner from your system administrator. Confirm that the existing owner is a member of the Oracle Inventory group.

For example, if you know that the name of the Oracle Inventory group is <code>oinstall</code>, then an Oracle software owner should be listed as a member of <code>oinstall</code>:

```
$ grep "oinstall" /etc/group
oinstall:x:54321:grid,oracle
```

You can then use the ID command to verify that the Oracle installation owners you intend to use have the Oracle Inventory group as their primary group. For example:

```
$ id oracle
uid=54321(oracle) gid=54321(oinstall) groups=54321(oinstall),54322(dba),
```



```
54323(oper), 54324(backupdba), 54325(dgdba), 54326(kmdba), 54327(asmdba), 54330(rac dba)
```

```
$ id grid
uid=54331(grid) gid=54321(oinstall) groups=54321(oinstall),
54327(asmdba),54328(asmoper),54329(asmadmin),54330(racdba)
```

#### Note:

For Oracle Restart installations, to successfully install Oracle Database, ensure that the grid user is a member of the racdba group.

After you create operating system groups, create or modify Oracle user accounts in accordance with your operating system authentication planning.

#### **Related Topics**

- Creating an Oracle Software Owner User
   If the Oracle software owner user (oracle or grid) does not exist, or if you require a new
   Oracle software owner user, then create it as described in this section.
- Modifying Oracle Owner User Groups
   If you have created an Oracle software installation owner account, but it is not a member of
   the groups you want to designate as the OSDBA, OSOPER, OSDBA for ASM,
   ASMADMIN, or other system privileges group, then modify the group settings for that user
   before installation.

# Oracle Installations with Standard and Job Role Separation Groups and Users

A job role separation configuration of Oracle Database and Oracle ASM is a configuration with groups and users to provide separate groups for operating system authentication.

Review the following sections to understand more about a Job Role Separation deployment:

- About Oracle Installations with Job Role Separation
   Job role separation requires that you create different operating system groups for each set
   of system privileges that you grant through operating system authorization.
- Standard Oracle Database Groups for Database Administrators
   Oracle Database has two standard administration groups: OSDBA, which is required, and OSOPER, which is optional.
- Extended Oracle Database Groups for Job Role Separation
   Oracle Database provides an extended set of database groups to grant task-specific system privileges for database administration.
- Creating an ASMSNMP User The ASMSNMP user is an Oracle ASM user with privileges to monitor Oracle ASM instances. You are prompted to provide a password for this user during installation.
- Oracle Automatic Storage Management Groups for Job Role Separation
   Oracle Grid Infrastructure operating system groups provide their members task-specific
   system privileges to access and to administer Oracle Automatic Storage Management.



### About Oracle Installations with Job Role Separation

Job role separation requires that you create different operating system groups for each set of system privileges that you grant through operating system authorization.

With Oracle Grid Infrastructure job role separation, Oracle ASM has separate operating system groups that provide operating system authorization for Oracle ASM system privileges for storage tier administration. This operating system authorization is separated from Oracle Database operating system authorization. In addition, the Oracle Grid Infrastructure installation owner provides operating system user authorization for modifications to Oracle Grid Infrastructure binaries.

With Oracle Database job role separation, each Oracle Database installation has separate operating system groups to provide authorization for system privileges on that Oracle Database. Multiple databases can, therefore, be installed on the cluster without sharing operating system authorization for system privileges. In addition, each Oracle software installation is owned by a separate installation owner, to provide operating system user authorization for modifications to Oracle Database binaries. Note that any Oracle software owner can start and stop all databases and shared Oracle Grid Infrastructure resources such as Oracle ASM or Virtual IP (VIP). Job role separation configuration enables database security, and does not restrict user roles in starting and stopping various Oracle Clusterware resources.

You can choose to create one administrative user and one group for operating system authentication for all system privileges on the storage and database tiers. For example, you can designate the oracle user to be the installation owner for all Oracle software, and designate oinstall to be the group whose members are granted all system privileges for Oracle Clusterware; all system privileges for Oracle ASM; all system privileges for all Oracle Databases on the servers; and all OINSTALL system privileges for installation owners. This group must also be the Oracle Inventory group.

If you do not want to use role allocation groups, then Oracle strongly recommends that you use at least two groups:

- A system privileges group whose members are granted administrative system privileges, including OSDBA, OSASM, and other system privileges groups.
- An installation owner group (the oraInventory group) whose members are granted Oracle installation owner system privileges (the OINSTALL system privilege).

#### Note:

To configure users for installation that are on a network directory service such as Network Information Services (NIS), refer to your directory service documentation.

#### **Related Topics**

- Oracle Database Administrator's Guide
- Oracle Automatic Storage Management Administrator's Guide

### Standard Oracle Database Groups for Database Administrators

Oracle Database has two standard administration groups: OSDBA, which is required, and OSOPER, which is optional.

• The OSDBA group (typically, dba)

You must create this group the first time you install Oracle Database software on the system. This group identifies operating system user accounts that have database administrative privileges (the SYSDBA privilege).

If you do not create separate OSDBA, OSOPER, and OSASM groups for the Oracle ASM instance, then operating system user accounts that have the SYSOPER and SYSASM privileges must be members of this group. The name used for this group in Oracle code examples is dba. If you do not designate a separate group as the OSASM group, then the OSDBA group you define is also by default the OSASM group.

The OSOPER group for Oracle Database (typically, oper)

OSOPER grants the OPERATOR privilege to start up and shut down the database (the SYSOPER privilege). By default, members of the OSDBA group have all privileges granted by the SYSOPER privilege.

### Extended Oracle Database Groups for Job Role Separation

Oracle Database provides an extended set of database groups to grant task-specific system privileges for database administration.

The extended set of Oracle Database system privileges groups are task-specific and less privileged than the OSDBA/SYSDBA system privileges. They are designed to provide privileges to carry out everyday database operations. Users granted these system privileges are also authorized through operating system group membership.

You do not have to create these specific group names, but during interactive and silent installation, you must assign operating system groups whose members are granted access to these system privileges. You can assign the same group to provide authorization for these privileges, but Oracle recommends that you provide a unique group to designate each privilege.

The subset of OSDBA job role separation privileges and groups consist of the following:

OSBACKUPDBA group for Oracle Database (typically, backupdba)

Create this group if you want a separate group of operating system users to have a limited set of database backup and recovery related administrative privileges (the SYSBACKUP privilege).

• OSDGDBA group for Oracle Data Guard (typically, dgdba)

Create this group if you want a separate group of operating system users to have a limited set of privileges to administer and monitor Oracle Data Guard (the SYSDG privilege). To use this privilege, add the Oracle Database installation owners as members of this group.

The OSKMDBA group for encryption key management (typically, kmdba)

Create this group if you want a separate group of operating system users to have a limited set of privileges for encryption key management such as Oracle Wallet Manager management (the SYSKM privilege). To use this privilege, add the Oracle Database installation owners as members of this group.

The OSRACDBA group for Oracle Real Application Clusters Administration (typically, racdba)

Create this group if you want a separate group of operating system users to have a limited set of Oracle Real Application Clusters (RAC) administrative privileges (the SYSRAC privilege). To use this privilege:



- Add the Oracle Database installation owners as members of this group.
- For Oracle Restart configurations, if you have a separate Oracle Grid Infrastructure installation owner user (grid), then you must also add the grid user as a member of the OSRACDBA group of the database to enable Oracle Grid Infrastructure components to connect to the database.

#### **Related Topics**

- Oracle Database Administrator's Guide
- Oracle Database Security Guide

### Creating an ASMSNMP User

The ASMSNMP user is an Oracle ASM user with privileges to monitor Oracle ASM instances. You are prompted to provide a password for this user during installation.

In addition to the OSASM group, whose members are granted the SYSASM system privilege to administer Oracle ASM, Oracle recommends that you create a less privileged user, ASMSNMP, and grant that user SYSDBA privileges to monitor the Oracle ASM instance. Oracle Enterprise Manager uses the ASMSNMP user to monitor Oracle ASM status.

During installation, you are prompted to provide a password for the ASMSNMP user. You can create an operating system authenticated user, or you can create an Oracle Database user called asmsnmp. In either case, grant the user SYSDBA privileges.

### Oracle Automatic Storage Management Groups for Job Role Separation

Oracle Grid Infrastructure operating system groups provide their members task-specific system privileges to access and to administer Oracle Automatic Storage Management.

The OSASM group for Oracle ASM Administration (typically, asmadmin)

Create this group as a separate group to separate administration privileges groups for Oracle ASM and Oracle Database administrators. Members of this group are granted the SYSASM system privileges to administer Oracle ASM. In Oracle documentation, the operating system group whose members are granted privileges is called the OSASM group, and in code examples, where there is a group specifically created to grant this privilege, it is referred to as asmadmin.

Oracle ASM can support multiple databases. If you have multiple databases on your system, and use multiple OSDBA groups so that you can provide separate SYSDBA privileges for each database, then you should create a group whose members are granted the OSASM/SYSASM administrative privileges, and create a grid infrastructure user (grid) that does not own a database installation, so that you separate Oracle Grid Infrastructure SYSASM administrative privileges from a database administrative privileges group.

Members of the OSASM group can use SQL to connect to an Oracle ASM instance as SYSASM using operating system authentication. The SYSASM privileges permit mounting and dismounting disk groups, and other storage administration tasks. SYSASM privileges provide no access privileges on an RDBMS instance.

If you do not designate a separate group as the OSASM group, but you do define an OSDBA group for database administration, then by default the OSDBA group you define is also defined as the OSASM group.

The OSOPER group for Oracle ASM (typically, asmoper)



This is an optional group. Create this group if you want a separate group of operating system users to have a limited set of Oracle instance administrative privileges (the SYSOPER for ASM privilege), including starting up and stopping the Oracle ASM instance. By default, members of the OSASM group also have all privileges granted by the SYSOPER for ASM privilege.

# **Creating Operating System Privileges Groups**

The following sections describe how to create operating system groups for Oracle Grid Infrastructure and Oracle Database:

Creating the OSDBA for ASM Group

•

You must designate a group as the OSDBA for ASM (asmdba) group during installation. Members of this group are also allowed to access the Oracle Automatic Storage Management (Oracle ASM) disk devices.

- Creating the OSOPER for ASM Group You can choose to designate a group as the OSOPER for ASM group (asmoper) during installation. Members of this group are granted startup and shutdown privileges to Oracle Automatic Storage Management.
- Creating the OSDBA Group for Database Installations
   Each Oracle Database requires an operating system group to be designated as the OSDBA group. Members of this group are granted the SYSDBA system privileges to administer the database.
- Creating an OSOPER Group for Database Installations
   Create an OSOPER group only if you want to identify a group of operating system users with a limited set of database administrative privileges (SYSOPER operator privileges).
- Creating the OSBACKUPDBA Group for Database Installations
   You must designate a group as the OSBACKUPDBA group during installation. Members of
   this group are granted the SYSBACKUP privileges to perform backup and recovery
   operations using RMAN or SQL\*Plus.
- Creating the OSDGDBA Group for Database Installations You must designate a group as the OSDGDBA group during installation. Members of this group are granted the SYSDG privileges to perform Data Guard operations.
- Creating the OSKMDBA Group for Database Installations
   You must designate a group as the OSKMDBA group during installation. Members of this
   group are granted the SYSKM privileges to perform Transparent Data Encryption keystore
   operations.
- Creating the OSRACDBA Group for Database Installations
   You must designate a group as the OSRACDBA group during database installation.

   Members of this group are granted the SYSRAC privileges to perform day–to–day
   administration of Oracle databases on an Oracle RAC cluster.

# Creating the OSDBA for ASM Group

You must designate a group as the OSDBA for ASM (asmdba) group during installation. Members of this group are also allowed to access the Oracle Automatic Storage Management (Oracle ASM) disk devices.

The Oracle ASM disk devices should be owned by this group.



Create an OSDBA for ASM group using the group name asmdba unless a group with that name already exists:

# /usr/sbin/groupadd -g 54327 asmdba

### Creating the OSOPER for ASM Group

You can choose to designate a group as the OSOPER for ASM group (asmoper) during installation. Members of this group are granted startup and shutdown privileges to Oracle Automatic Storage Management.

If you want to create an OSOPER for ASM group, use the group name asmoper unless a group with that name already exists:

# /usr/sbin/groupadd -g 54328 asmoper

### Creating the OSDBA Group for Database Installations

Each Oracle Database requires an operating system group to be designated as the OSDBA group. Members of this group are granted the SYSDBA system privileges to administer the database.

You must create an OSDBA group in the following circumstances:

- An OSDBA group does not exist, for example, if this is the first installation of Oracle Database software on the system
- An OSDBA group exists, but you want to give a different group of operating system users database administrative privileges for a new Oracle Database installation

Create the OSDBA group using the group name dba, unless a group with that name already exists:

# /usr/sbin/groupadd -g 54322 dba

# Creating an OSOPER Group for Database Installations

Create an OSOPER group only if you want to identify a group of operating system users with a limited set of database administrative privileges (SYSOPER operator privileges).

For most installations, it is sufficient to create only the OSDBA group. However, to use an OSOPER group, create it in the following circumstances:

- If an OSOPER group does not exist; for example, if this is the first installation of Oracle Database software on the system
- If an OSOPER group exists, but you want to give a different group of operating system users database operator privileges in a new Oracle installation

If the OSOPER group does not exist, or if you require a new OSOPER group, then create it. Use the group name oper unless a group with that name already exists. For example:

# groupadd -g 54323 oper



### Creating the OSBACKUPDBA Group for Database Installations

You must designate a group as the OSBACKUPDBA group during installation. Members of this group are granted the SYSBACKUP privileges to perform backup and recovery operations using RMAN or SQL\*Plus.

Create the OSBACKUPDBA group using the group name backupdba, unless a group with that name already exists:

# /usr/sbin/groupadd -g 54324 backupdba

### Creating the OSDGDBA Group for Database Installations

You must designate a group as the OSDGDBA group during installation. Members of this group are granted the SYSDG privileges to perform Data Guard operations.

Create the OSDGDBA group using the group name dgdba, unless a group with that name already exists:

# /usr/sbin/groupadd -g 54325 dgdba

### Creating the OSKMDBA Group for Database Installations

You must designate a group as the OSKMDBA group during installation. Members of this group are granted the SYSKM privileges to perform Transparent Data Encryption keystore operations.

If you want a separate group for Transparent Data Encryption, then create the OSKMDBA group using the group name kmdba unless a group with that name already exists:

# /usr/sbin/groupadd -g 54326 kmdba

### Creating the OSRACDBA Group for Database Installations

You must designate a group as the OSRACDBA group during database installation. Members of this group are granted the SYSRAC privileges to perform day–to–day administration of Oracle databases on an Oracle RAC cluster.

Create the OSRACDBA group using the groups name racdba unless a group with that name already exists:

# /usr/sbin/groupadd -g 54330 racdba

# Creating Operating System Oracle Installation User Accounts

Before starting installation, create Oracle software owner user accounts, and configure their environments.

Oracle software owner user accounts require resource settings and other environment configuration. To protect against accidents, Oracle recommends that you create one software installation owner account for each Oracle software program you install.



- Creating an Oracle Software Owner User If the Oracle software owner user (oracle or grid) does not exist, or if you require a new Oracle software owner user, then create it as described in this section.
- Environment Requirements for Oracle Software Owners
   You must make the following changes to configure Oracle software owner environments:
- Procedure for Configuring Oracle Software Owner Environments Configure each Oracle installation owner user account environment:
- Modifying Oracle Owner User Groups

If you have created an Oracle software installation owner account, but it is not a member of the groups you want to designate as the OSDBA, OSOPER, OSDBA for ASM, ASMADMIN, or other system privileges group, then modify the group settings for that user before installation.

- Checking Resource Limits for Oracle Software Installation Users For each installation software owner user account, check the resource limits for installation.
- Setting Remote Display and X11 Forwarding Configuration If you are on a remote terminal, and the local system has only one visual (which is typical), then use the following syntax to set your user account DISPLAY environment variable:
- Preventing Installation Errors Caused by Terminal Output Commands During an Oracle Grid Infrastructure installation, OUI uses SSH to run commands and copy files to the other nodes. During the installation, hidden files on the system (for example, .bashrc or .cshrc) can cause makefile and other installation errors if they contain terminal output commands.

### Creating an Oracle Software Owner User

If the Oracle software owner user (oracle or grid) does not exist, or if you require a new Oracle software owner user, then create it as described in this section.

The following example shows how to create the user oracle with the user ID 54321; with the primary group oinstall; and with secondary groups dba, asmdba, backupdba, dgdba, kmdba, and racdba:

```
# /usr/sbin/useradd -u 54321 -g oinstall -G
dba,asmdba,backupdba,dgdba,kmdba,racdba oracle
```

The following example shows how to create the user grid with the user ID 54331; with the primary group oinstall; and with secondary groups asmadmin, asmdba, backupdba, dgdba, kmdba, and racdba:

```
# /usr/sbin/useradd -u 54331 -g oinstall -G
asmadmin,asmdba,backupdba,dgdba,kmdba,racdba grid
```

You must note the user ID number for installation users, because you need it during preinstallation.

### Environment Requirements for Oracle Software Owners

You must make the following changes to configure Oracle software owner environments:

- Set the installation software owner user (grid, oracle) default file mode creation mask (umask) to 022 in the shell startup file. Setting the mask to 022 ensures that the user performing the software installation creates files with 644 permissions.
- Set ulimit settings for file descriptors and processes for the installation software owner (grid, oracle).
- Set the DISPLAY environment variable in preparation for running an Oracle Universal Installer (OUI) installation.

#### Caution:

If you have existing Oracle installations that you installed with the user ID that is your Oracle Grid Infrastructure software owner, then unset all Oracle environment variable settings for that user.

### Procedure for Configuring Oracle Software Owner Environments

Configure each Oracle installation owner user account environment:

- 1. Start an X terminal session (xterm) on the server where you are running the installation.
- Enter the following command to ensure that X Window applications can display on this system, where hostname is the fully qualified name of the local host from which you are accessing the server:

```
$ xhost + hostname
```

3. If you are not logged in as the software owner user, then switch to the software owner user you are configuring. For example, with the user grid:

```
$ su - grid
```

On systems where you cannot run su commands, use sudo instead:

```
$ sudo -u grid -s
```

4. To determine the default shell for the user, enter the following command:

\$ echo \$SHELL

- 5. Open the user's shell startup file in any text editor:
  - Bash shell (bash):

\$ vi .bash profile

• Bourne shell (sh) or Korn shell (ksh):

\$ vi .profile



C shell (csh or tcsh):

```
% vi .login
```

6. Enter or edit the following line, specifying a value of 022 for the default file mode creation mask:

umask 022

- 7. If the ORACLE\_SID, ORACLE\_HOME, or ORACLE\_BASE environment variables are set in the file, then remove these lines from the file.
- 8. Save the file, and exit from the text editor.
- 9. To run the shell startup script, enter one of the following commands:
  - Bash shell:

\$ . ./.bash profile

Bourne, Bash, or Korn shell:

```
$ . ./.profile
```

C shell:

% source ./.login

10. Use the following command to check the PATH environment variable:

\$ echo \$PATH

Remove any Oracle environment variables.

**11.** Unset any Oracle environment variables.

If you have an existing Oracle software installation, and you are using the same user to install this installation, then unset the \$ORACLE\_HOME, \$ORA\_NLS10, and \$TNS ADMIN environment variables.

If you have set \$ORA\_CRS\_HOME as an environment variable, then unset it before starting an installation or upgrade. Do not use \$ORA\_CRS\_HOME as a user environment variable, except as directed by Oracle Support.

- **12.** If you are not installing the software on the local system, then enter a command similar to the following to direct X applications to display on the local system:
  - Bourne, Bash, or Korn shell:

\$ export DISPLAY=local host:0.0

- C shell:
  - % setenv DISPLAY local host:0.0

In this example, <code>local\_host</code> is the host name or IP address of the system (your workstation, or another client) on which you want to display the installer.



**13.** If the /tmp directory has less than 1 GB of free space, then identify a file system with at least 1 GB of free space and set the TMP and TMPDIR environment variables to specify a temporary directory on this file system:

#### Note:

You cannot use a shared file system as the location of the temporary file directory (typically /tmp) for Oracle RAC installations. If you place /tmp on a shared file system, then the installation fails.

- a. Use the df -h command to identify a suitable file system with sufficient free space.
- b. If necessary, enter commands similar to the following to create a temporary directory on the file system that you identified, and set the appropriate permissions on the directory:

```
$ sudo -s
# mkdir /mount_point/tmp
# chmod 775 /mount_point/tmp
# exit
```

c. Enter commands similar to the following to set the TMP and TMPDIR environment variables:

Bourne, Bash, or Korn shell:

```
$ TMP=/mount_point/tmp
$ TMPDIR=/mount_point/tmp
$ export TMP TMPDIR
```

C shell:

```
% setenv TMP /mount_point/tmp
```

- % setenv TMPDIR /mount\_point/tmp
- **14.** To verify that the environment has been set correctly, enter the following commands:

```
$ umask
$ env | more
```

Verify that the umask command displays a value of 22, 022, or 0022 and that the environment variables you set in this section have the correct values.



### Modifying Oracle Owner User Groups

If you have created an Oracle software installation owner account, but it is not a member of the groups you want to designate as the OSDBA, OSOPER, OSDBA for ASM, ASMADMIN, or other system privileges group, then modify the group settings for that user before installation.

#### 🖍 Warning:

Each Oracle software owner must be a member of the same central inventory group. Do not modify the primary group of an existing Oracle software owner account, or designate different groups as the OINSTALL group. If Oracle software owner accounts have different groups as their primary group, then you can corrupt the central inventory.

During installation, the user who is installing the software should have the OINSTALL group as its primary group, and it must be a member of the operating system groups appropriate for your installation. For example:

# /usr/sbin/usermod -g oinstall -G
dba,asmdba,backupdba,dgdba,kmdba,racdba[,oper] oracle

### Checking Resource Limits for Oracle Software Installation Users

For each installation software owner user account, check the resource limits for installation.

On Oracle Linux systems, Oracle recommends that you install Oracle Database Preinstallation RPMs to meet preinstallation requirements like configuring your operating system to set the resource limits in the limits.conf file.

Use the following ranges as guidelines for resource allocation to Oracle software installation owners for standard installations and to Oracle Grid Infrastructure software installation owners for job role separation:

Table 5-1Oracle Software Installation Owner and Oracle Grid Infrastructure SoftwareInstallation Owner Resource Limit Recommended Ranges

Resource Shell Limit	Resource	Soft Limit	Hard Limit
Open file descriptors	nofile	at least 1024	at least 65536
Number of processes available to a single user	nproc	at least 2047	at least 16384
Size of the stack segment of the process	stack	at least 10240 KB	at least 10240 KB, and at most 32768 KB



Resource Shell Limit	Resource	Soft Limit	Hard Limit
Maximum locked memory limit	memlock	at least 90 percent of the current RAM when HugePages memory is enabled and at least 3145728 KB (3 GB) when HugePages memory is disabled.	at least 90 percent of the current RAM when HugePages memory is enabled and at least 3145728 KB (3 GB) when HugePages memory is disabled
		<b>Note:</b> unlimited on Exadata systems.	Note: unlimited on Exadata systems.

Table 5-1 (Cont.) Oracle Software Installation Owner and Oracle Grid InfrastructureSoftware Installation Owner Resource Limit Recommended Ranges

To check resource limits:

- 1. Log in as an installation owner.
- 2. Check the soft and hard limits for the file descriptor setting. Ensure that the result is in the recommended range. For example:

```
$ ulimit -Sn
1024
$ ulimit -Hn
65536
```

3. Check the soft and hard limits for the number of processes available to a user. Ensure that the result is in the recommended range. For example:

```
$ ulimit -Su
2047
$ ulimit -Hu
16384
```

**4.** Check the soft limit for the stack setting. Ensure that the result is in the recommended range. For example:

```
$ ulimit -Ss
10240
$ ulimit -Hs
32768
```

5. Repeat this procedure for each Oracle software installation owner.

If necessary, update the resource limits in the /etc/security/limits.conf configuration file for the installation owner. However, the configuration file may be distribution specific. Contact your system administrator for distribution specific configuration file information.



#### Note:

If you make changes to an Oracle installation user account and that user account is logged in, then changes to the <code>limits.conf</code> file do not take effect until you log these users out and log them back in. You must do this before you use these accounts for installation.

### Setting Remote Display and X11 Forwarding Configuration

If you are on a remote terminal, and the local system has only one visual (which is typical), then use the following syntax to set your user account DISPLAY environment variable:

#### **Remote Display**

```
Bourne, Korn, and Bash shells

$ export DISPLAY=hostname:0

C shell

% setenv DISPLAY hostname:0
```

For example, if you are using the Bash shell and if your host name is <code>local\_host</code>, then enter the following command:

```
$ export DISPLAY=node1:0
```

#### X11 Forwarding

To ensure that X11 forwarding does not cause the installation to fail, use the following procedure to create a user-level SSH client configuration file for Oracle installation owner user accounts:

- 1. Using any text editor, edit or create the software installation owner's ~/.ssh/config file.
- 2. Ensure that the ForwardX11 attribute in the ~/.ssh/config file is set to no. For example:

```
Host *
ForwardX11 no
```

3. Ensure that the permissions on ~/.ssh are secured to the Oracle installation owner user account. For example:

```
$ 1s -al .ssh
total 28
drwx----- 2 grid oinstall 4096 Jun 21 2020
drwx----- 19 grid oinstall 4096 Jun 21 2020
-rw-r--r-- 1 grid oinstall 1202 Jun 21 2020 authorized_keys
-rwx----- 1 grid oinstall 668 Jun 21 2020 id_dsa
-rwx----- 1 grid oinstall 601 Jun 21 2020 id_dsa.pub
-rwx----- 1 grid oinstall 1610 Jun 21 2020 known hosts
```



### Preventing Installation Errors Caused by Terminal Output Commands

During an Oracle Grid Infrastructure installation, OUI uses SSH to run commands and copy files to the other nodes. During the installation, hidden files on the system (for example, .bashrc or .cshrc) can cause makefile and other installation errors if they contain terminal output commands.

To avoid this problem, you must modify hidden files in each Oracle installation owner user home directory to suppress all output on STDOUT or STDERR (for example, stty, xtitle, and other such commands) as in the following examples:

Bourne, Bash, or Korn shell:

```
if [ -t 0 ]; then
   stty intr ^C
fi
```

C shell:

```
test -t 0
if ($status == 0) then
   stty intr ^C
endif
```

#### Note:

If the remote shell can load hidden files that contain stty commands, then OUI indicates an error and stops the installation.

# **Creating Oracle Database Vault User Accounts**

If you intend to use Oracle Database Vault by default, then you must create an Oracle Database Vault user account, and configure that user.

You must create the Database Vault Owner account before you can use Oracle Database Vault. You can also create a Database Vault Account Manager administrative account.

Oracle Database Vault installs a baseline database auditing policy. This policy covers the access control configuration information stored in Oracle Database Vault database tables, information stored in Oracle Catalog (rollback segments, tablespaces, and so on), the use of system privileges, and Oracle Label Security configuration. When you install Oracle Database Vault, the security specific database initialization parameters are initialized with default values.

#### **Related Topics**

Oracle Database Vault Administrator's Guide

# **Unsetting Oracle Installation Owner Environment Variables**

Unset Oracle installation owner environment variables before you start the installation.

The environment variables you have set for the Oracle installation owner account you use to run the installation can cause issues if they are set to values that conflict with the values needed for installation.

If you have set ORA\_CRS\_HOME as an environment variable, following instructions from Oracle Support, then unset it before starting an installation or upgrade. You should never use ORA\_CRS\_HOME as an environment variable except under explicit direction from Oracle Support.

If you have had an existing installation on your system, and you are using the same user account to install this installation, then unset the following environment variables: ORA\_CRS\_HOME, ORACLE\_HOME, ORA\_NLS10, TNS\_ADMIN, and any other environment variable set for the Oracle installation user that is connected with Oracle software homes.

Also, ensure that the <code>\$ORACLE\_HOME/bin</code> path is removed from your PATH environment variable.



# 6 Configuring Networks for Oracle Database

If you install Oracle Databases on servers with multiple Oracle homes, multiple aliases, or without a static IP address, then review these network configuration topics.

If you are installing Oracle Database on a server with a static host name and IP address and at least one network interface, then no special network configuration is required.

#### Note:

If you have a firewall running, ensure that all the required ports are open. See, Oracle Database Component Port Numbers and Protocols for a list of port numbers and protocols configured for Oracle Database components.

- About Oracle Database Network Configuration Options You can enable database clients to connect to servers associated with multiple IP addresses, and you can install Oracle Database on servers with no network connections, and set up database services after installation.
- About Assigning Global Database Names During Installation The database name input field is used to set the DB\_NAME, DB\_UNIQUE\_NAME, and DB\_DOMAIN Oracle initialization parameter values.
- Network Configuration for Computers Completed After Installation You must confirm that a non-networked computer can connect to itself to ensure that you can configure client network resolution after installation. A non-networked computer is a computer that does not have a fixed network address, such as a computer using DHCP.
- Network Configuration for Multihome Computers
   You must set the ORACLE\_HOSTNAME environment variable to install Oracle Database on a
   multihomed computer. A multihomed computer is associated with multiple IP addresses.
- Setting the ORACLE\_HOSTNAME Environment Variable Run the commands shown in this example as the Oracle user account to set the ORACLE HOSTNAME environment variable.
- Network Configuration for Computers with Multiple Aliases You must set the ORACLE\_HOSTNAME environment variable to install Oracle Database on a multialias computer. A multialias computer is one to which multiple aliases resolve.

# About Oracle Database Network Configuration Options

You can enable database clients to connect to servers associated with multiple IP addresses, and you can install Oracle Database on servers with no network connections, and set up database services after installation.

Typically, the computer on which you want to install Oracle Database is a server running a single database instance, with a single host name that is resolvable on a network. Oracle Universal Installer uses the host name and Oracle Database instance information to set up



network services automatically. The database provides database services to clients using a connect descriptor that resolves to the host name where the database instance is running.

However, you can configure Oracle Database on servers with the following nonstandard configurations:

- Multihomed Computers: Servers with multiple Oracle Database installations
- Multiple Alias Computers: Servers with multiple aliases, so that more than one host name resolves to the computer
- Non-Networked computers: Servers that do not have network connectivity at the time of installation

# About Assigning Global Database Names During Installation

The database name input field is used to set the DB\_NAME, DB\_UNIQUE\_NAME, and DB\_DOMAIN Oracle initialization parameter values.

The Oracle Database software identifies a database by its global database name. A global database name consists of the database name and database domain. Usually, the database domain is the same as the network domain, but it need not be. The global database name uniquely distinguishes a database from any other database in the same network. You specify the global database name when you create a database during the installation or using the Oracle Database Configuration Assistant.

sales.us.example.com

#### Here:

- sales.us is the name of the database. The database name, DB\_UNIQUE\_NAME, portion is a string of no more than 30 characters that can contain alphanumeric characters, underscore (\_), dollar sign (\$), and pound sign (#) but must begin with an alphabetic character. No other special characters are permitted in a database name.
- sales.us is also the DB\_NAME. The DB\_NAME initialization parameter specifies a database identifier of up to eight characters.
- example.com is the database domain in which the database is located. In this example, the database domain equals the network domain. Together, the database name and the database domain make the global database name unique. The domain portion is a string of no more than 128 characters that can contain alphanumeric characters, underscore (\_), and pound sign (#). The DB\_DOMAIN initialization parameter specifies the database domain name.

However, the DB\_NAME parameter need not necessarily be the first eight characters of DB\_UNIQUE\_NAME.

The DB\_NAME parameter and the DB\_DOMAIN parameter combine to create the global database name value.

The system identifier (SID) identifies a specific database instance. The SID uniquely distinguishes the instance from any other instance on the same computer. Each database instance requires a unique SID and database name. In most cases, the SID equals the database name portion of the global database name.

#### **Related Topics**

• Oracle Database Reference



Oracle Database Administrator's Guide

# Network Configuration for Computers Completed After Installation

You must confirm that a non-networked computer can connect to itself to ensure that you can configure client network resolution after installation. A non-networked computer is a computer that does not have a fixed network address, such as a computer using DHCP.

You can install Oracle Database on a non-networked computer. If the computer, such as a laptop, is configured for DHCP and you plan to connect the computer to the network after the Oracle Database installation, then use the ping command on the computer on which you want to install the database to check if the computer can connect to itself. Perform this step by first using only the host name and then using the fully qualified name, which should be in the /etc/ hosts file.

If you connect the computer to a network after installation, then the Oracle Database instance on the computer can work with other instances on the network. The computer can use a static IP or DHCP, depending on the network to which you are connected.

When you run the ping command on the computer itself, the ping command should return the IP address of the computer. If the ping command fails, then contact your network administrator.

# Network Configuration for Multihome Computers

You must set the ORACLE\_HOSTNAME environment variable to install Oracle Database on a multihomed computer. A multihomed computer is associated with multiple IP addresses.

Typically, a server configured to run multiple Oracle Database Oracle homes is configured with multiple network interface cards. A host name resolves to an IP address configured for one network card for each Oracle Database. You can also set up aliases for host names. By default, during installation, Oracle Universal Installer uses the value set for the environment variable ORACLE\_HOSTNAME set for the Oracle installation user account running the installation to find the host name. If the user environment variable ORACLE\_HOSTNAME is not set for the Oracle user, and you are installing on a computer that has multiple network cards, then Oracle Universal Installer determines the host name from the /etc/hosts file and the information you provide during the installation session.

Oracle Database clients connecting to the database must be able to access the computer by using either the alias for the host name, or by using the host name associated with that instance. To verify that the client can resolve to the database using both alias and host name, use the ping command to check connectivity to the host name both for the database on the server (host name only), and for the fully qualified domain name (host name and domain name).

#### Note:

Clients must be able to obtain a response using the ping command both for the host name and for the fully qualified domain name. If either test fails, then contact your network administrator to resolve the issue.



# Setting the ORACLE\_HOSTNAME Environment Variable

Run the commands shown in this example as the Oracle user account to set the ORACLE HOSTNAME environment variable.

The following example shows the commands to run on the Oracle user account to set the ORACLE\_HOSTNAME environment variable. In this example, the fully qualified host name is somehost.example.com.

#### Bourne, Bash or Korn Shell

- \$ ORACLE\_HOSTNAME=somehost.example.com
- \$ export ORACLE HOSTNAME

#### C Shell

% setenv ORACLE HOSTNAME somehost.example.com

# Network Configuration for Computers with Multiple Aliases

You must set the ORACLE\_HOSTNAME environment variable to install Oracle Database on a multialias computer. A multialias computer is one to which multiple aliases resolve.

A computer with multiple aliases is a computer that is registered with the naming service under a single IP address, but which resolves multiple aliases to that address. The naming service resolves any of those aliases to the same computer. Before installing Oracle Database on such a computer, set the Oracle installation owner environment variable <code>ORACLE\_HOSTNAME</code> to the computer whose host name you want to use.



# Supported Storage Options for Oracle Database and Oracle Grid Infrastructure

Review supported storage options as part of your installation planning process.

- Supported Storage Options for Oracle Database The following table shows the storage options supported for Oracle Database binaries and files:
- About Oracle Grid Infrastructure for a Standalone Server If you plan to use Oracle Automatic Storage Management (Oracle ASM), then you must install Oracle Restart before installing your database.
- About Upgrading Existing Oracle Automatic Storage Management Instances Oracle Automatic Storage Management (Oracle ASM) upgrades are carried out during an Oracle Grid Infrastructure upgrade.
- About Managing Disk Groups for Older Database Versions When you install earlier Oracle Database releases on Oracle Grid Infrastructure, use Oracle ASM Configuration Assistant (Oracle ASMCA) to create and modify disk groups.
- Oracle ACFS and Oracle ADVM
   Oracle Automatic Storage Management Cluster File System (Oracle ACFS) extends
   Oracle ASM technology to support of all of your application data in both single instance and cluster configurations.
- File System Options for Oracle Database
   If you install Oracle Database files on a file system, then Oracle Database Configuration
   Assistant creates the database files in a directory on a file system mounted on the computer.
- Guidelines for Placing Oracle Database Files On a File System or Logical Volume If you choose to place the Oracle Database files on a file system, then use the following guidelines when deciding where to place them:
- About NFS Storage for Data Files Review this section for NFS storage configuration guidelines.
- About Direct NFS Client Mounts to NFS Storage Devices
   Direct NFS Client integrates the NFS client functionality directly in the Oracle software to
   optimize the I/O path between Oracle and the NFS server. This integration can provide
   significant performance improvements.

# Supported Storage Options for Oracle Database

The following table shows the storage options supported for Oracle Database binaries and files:

#### Note:

The ACFS storage option on IBM AIX is deprecated in Oracle Database 19c.



Storage Option	Oracle Database Binaries	Oracle Database Data Files	Oracle Database Recovery Files
Oracle Automatic Storage Management (Oracle ASM)	No	Yes	Yes
<b>Note</b> : Loopback devices are not supported for use with Oracle ASM			
Oracle Automatic Storage Management Cluster File System (Oracle ACFS)	Yes	Yes (Oracle Database 12 <i>c</i> Release 1 (12.1) and later)	Yes (Oracle Database 12c Release 1 (12.1) and later
Local file system	Yes	Yes, but not recommended	Yes, but not recommended
NVMe over Fabrics (NVMe-oF) storage devices	Yes	Yes	Yes Note: In Oracle Database 19c, NVMe-oF uses the kernel initiator, which exposes the disks as block devices.
Network file system (NFS) on a certified network-attached storage (NAS) filer	Yes	Yes	Yes
Oracle Memory Speed	No	Yes	Yes

#### Table 7-1 Supported Storage Options for Oracle Database

#### **Guidelines for Storage Options**

Use the following guidelines when choosing storage options:

- Oracle strongly recommends that you use a dedicated set of disks for Oracle ASM.
- You can choose any combination of the supported storage options for each file type provided that you satisfy all requirements listed for the chosen storage options.
- You can use Oracle ASM to store Oracle Clusterware files.
- Direct use of raw or block devices is not supported.

#### **Related Topics**

Oracle Database Upgrade Guide

# About Oracle Grid Infrastructure for a Standalone Server

If you plan to use Oracle Automatic Storage Management (Oracle ASM), then you must install Oracle Restart before installing your database.

Oracle Grid Infrastructure for a standalone server is a version of Oracle Grid Infrastructure that supports single instance databases. This support includes volume management, file system, and automatic restart capabilities. Oracle Grid Infrastructure for a standalone server includes Oracle Restart and Oracle Automatic Storage Management. Oracle combined the two infrastructure products into a single set of binaries that is installed into an Oracle Restart home.



Oracle Restart is a feature provided as part of Oracle Grid Infrastructure. Oracle Restart monitors and can restart Oracle Database instances, Oracle Net Listeners, and Oracle ASM instances. Oracle Restart is currently restricted to manage single instance Oracle Databases and Oracle ASM instances only.

Oracle Automatic Storage Management is a volume manager and a file system for Oracle Database files that supports single-instance Oracle Database and Oracle Real Application Clusters (Oracle RAC) configurations. Oracle Automatic Storage Management also supports a general purpose file system for your application needs, including Oracle Database binaries. Oracle Automatic Storage Management is Oracle's recommended storage management solution that provides an alternative to conventional volume managers, and file systems.

Oracle Restart improves the availability of your Oracle database by providing the following services:

- When there is a hardware or a software failure, Oracle Restart automatically starts all Oracle components, including the Oracle database instance, Oracle Net Listener, database services, and Oracle ASM.
- Oracle Restart starts components in the proper order when the database host is restarted.
- Oracle Restart runs periodic checks to monitor the status of Oracle components. If a check operation fails for a component, then the component is shut down and restarted.

Note the following restrictions for using Oracle Restart:

- You can neither install Oracle Restart on an Oracle Grid Infrastructure cluster member node, nor add an Oracle Restart server to an Oracle Grid Infrastructure cluster member node. Oracle Restart supports single-instance databases on one server, while Oracle Grid Infrastructure for a Cluster supports single-instance or Oracle RAC databases on a cluster.
- If you want to use Oracle ASM or Oracle Restart, then you should install Oracle Grid Infrastructure for a standalone server before you install and create the database. Otherwise, you must install Oracle Restart, and then manually register the database with Oracle Restart.
- You can use the Oracle Restart implementation of Oracle Grid Infrastructure only in singleinstance (nonclustered) environments. Use Oracle Grid Infrastructure with Oracle Clusterware for clustered environments.

# About Upgrading Existing Oracle Automatic Storage Management Instances

Oracle Automatic Storage Management (Oracle ASM) upgrades are carried out during an Oracle Grid Infrastructure upgrade.

If you are upgrading from Oracle ASM 11g Release 2 (11.2.0.4) or later, then Oracle ASM is always upgraded with Oracle Grid Infrastructure as part of the upgrade, and Oracle Automatic Storage Management Configuration Assistant (Oracle ASMCA) is started by the root scripts during upgrade. Subsequently, you can use Oracle ASMCA (located in Grid\_home/bin) to configure failure groups, Oracle ASM volumes, and Oracle Automatic Storage Management Cluster File System (Oracle ACFS).

Oracle ASMCA cannot perform a separate upgrade of Oracle ASM from a prior release to the current release.

Upgrades of Oracle ASM from releases prior to 11g Release 2 (11.2) are not supported.



#### **Related Topics**

- Oracle Automatic Storage Management Administrator's Guide
- Oracle Database Upgrade Guide

# About Managing Disk Groups for Older Database Versions

When you install earlier Oracle Database releases on Oracle Grid Infrastructure, use Oracle ASM Configuration Assistant (Oracle ASMCA) to create and modify disk groups.

Releases prior to Oracle Database 11g Release 2 used Oracle Database Configuration Assistant (Oracle DBCA) to perform administrative tasks on Oracle ASM. Starting with Oracle Database 11g Release 2 (11.2), Oracle ASM is installed as part of an Oracle Grid Infrastructure installation. You can no longer use Oracle DBCA to perform administrative tasks on Oracle ASM.

#### See Also:

*Oracle Automatic Storage Management Administrator's Guide* for details about configuring disk group compatibility for databases using Oracle Database 11*g* software with this release of Oracle Grid Infrastructure.

# Oracle ACFS and Oracle ADVM

Oracle Automatic Storage Management Cluster File System (Oracle ACFS) extends Oracle ASM technology to support of all of your application data in both single instance and cluster configurations.

#### Note:

The ACFS storage option on IBM AIX is deprecated in Oracle Database 19c.

To align the support for the IBM AIX platform, Oracle Automatic Storage Management Cluster File System (ACFS) on IBM AIX (called Oracle Advanced Cluster File System starting with Oracle Database 21c) is deprecated in Oracle Database 19c. For data or files currently stored on an ACFS file system that cannot be stored in the Oracle database, the IBM General Parallel File System (GPFS) can be used.

Oracle Automatic Storage Management Dynamic Volume Manager (Oracle ADVM) provides volume management services and a standard disk device driver interface to clients. Oracle ACFS communicates with Oracle ASM through the Oracle ADVM interface.

- Oracle ACFS and Oracle ADVM Support on Linux x86–64
   Oracle ACFS and Oracle ADVM are supported on Oracle Linux, Red Hat Enterprise Linux, and SUSE Linux Enterprise Server.
- Restrictions and Guidelines for Oracle ACFS Review these topics as part of your storage plan for using Oracle ACFS for single instance and cluster configurations.



#### **Related Topics**

•

Oracle Automatic Storage Management Administrator's Guide

### Oracle ACFS and Oracle ADVM Support on Linux x86–64

Oracle ACFS and Oracle ADVM are supported on Oracle Linux, Red Hat Enterprise Linux, and SUSE Linux Enterprise Server.

Table 7-2 Platforms That Support Oracle ACFS and Oracle ADVM

Platform / Operating System	Kernel
Oracle Linux 9	Starting with Oracle Database 19c (19.21), all Oracle Linux 9.2 and later compatible kernels
Oracle Linux 8	All Oracle Linux 8 compatible kernels
Oracle Linux 7	All Oracle Linux 7 compatible kernels, except Unbreakable Enterprise Kernel 6 (UEK 6) and later UEK kernels.
Red Hat Enterprise Linux 9	Starting with Oracle Database 19c (19.21), all Red Hat Enterprise Linux 9.2 and later compatible kernels
Red Hat Enterprise Linux 8	All Red Hat Enterprise Linux 8 compatible kernels
Red Hat Enterprise Linux 7	All Red Hat Enterprise Linux 7 compatible kernels
SUSE Linux Enterprise Server 12	All SUSE Linux Enterprise Server 12 compatible kernels
SUSE Linux Enterprise Server 15	All SUSE Linux Enterprise Server 15 compatible kernels
Linux Containers	Not supported

#### Note:

If you use Security Enhanced Linux (SELinux) in enforcing mode with Oracle ACFS, then ensure that you mount the Oracle ACFS file systems with an SELinux default context. Refer to your Linux vendor documentation for information about the context mount option.

#### Important:

You must apply patches to some of the Linux kernel versions for successful Oracle Grid Infrastructure installation. Refer to the following notes for more information:

 My Oracle Support Note 1369107.1 for more information and a complete list of platforms and releases that support Oracle ACFS and Oracle ADVM:

https://support.oracle.com/rs?type=doc&id=1369107.1

• Patch Set Updates for Oracle Products (My Oracle Support Note 854428.1) for current release and support information:

https://support.oracle.com/rs?type=doc&id=854428.1

## Restrictions and Guidelines for Oracle ACFS

Review these topics as part of your storage plan for using Oracle ACFS for single instance and cluster configurations.

Note: The ACFS storage option on IBM AIX is deprecated in Oracle Database 19c. Oracle Automatic Storage Management Cluster File System (Oracle ACFS) provides a general purpose file system. You can only use Oracle ACFS when Oracle ASM is configured. Note the following general guidelines and restrictions for placing Oracle Database and • Oracle Grid Infrastructure files on Oracle ACFS: You can place Oracle Database binaries, data files, and administrative files (for example, trace files) on Oracle ACFS. Oracle ACFS does not support encryption or replication with Oracle Database data files, tablespace files, control files, redo logs, archive logs, RMAN backups, Data Pump dumpsets, and flashback files. You can place Oracle Database homes on Oracle ACFS only if the database release is Oracle Database 11g Release 2, or more recent releases. You cannot install earlier releases of Oracle Database on Oracle ACFS. For installations on Oracle Clusterware, you cannot place Oracle Clusterware files on Oracle ACES. Oracle Restart does not support root-based Oracle Clusterware resources. For this reason, the following restrictions apply if you run Oracle ACFS on an Oracle Restart Configuration: Starting with Oracle Database 18c, configuration assistants do not allow the creation of Oracle Database homes on Oracle ACFS in an Oracle Restart configuration. Oracle Restart does not support Oracle ACFS resources on all platforms. Starting with Oracle Database 12c, Oracle Restart configurations do not support the Oracle ACFS registry. On Linux. Oracle ACFS provides an automated mechanism to load and unload drivers and mount and unmount Oracle ACFS file systems on system restart and shutdown. However, Oracle ACFS does not provide automated recovery of mounted file systems when the system is running. Other than Linux, Oracle ACFS does not provide this automated mechanism on other operating systems. Creating Oracle data files on an Oracle ACFS file system is not supported in Oracle Restart configurations. Creating Oracle data files on an Oracle ACFS file system is supported on Oracle Grid Infrastructure for a cluster configurations.

 Oracle ACFS and Oracle ADVM are not supported on IBM AIX Workload Partitions (WPARs).

#### **Related Topics**

Oracle Automatic Storage Management Administrator's Guide



# File System Options for Oracle Database

If you install Oracle Database files on a file system, then Oracle Database Configuration Assistant creates the database files in a directory on a file system mounted on the computer.

Oracle recommends that the file system be separate from the file systems used by the operating system or the Oracle Database software.

The file system can be any of the following:

#### **Standard Oracle Database Creation Options**

• A file system on a disk that is physically attached to the system.

If you are creating a database on basic disks that are not logical volumes or RAID devices, then Oracle recommends that you follow the Optimal Flexible Architecture (OFA) recommendations and distribute the database files over many disks.

• A file system on a logical volume manager (LVM) volume or a RAID device.

If you are using multiple disks in an LVM or RAID configuration, then Oracle recommends that you use the Stripe and Mirror Everything (S.A.M.E) methodology to increase performance and reliability. Using this methodology, you do not have to specify multiple file system mount points for the database storage.

 A network file system (NFS) mounted from a certified network-attached storage (NAS) device. You also have the option to use Direct NFS Client, which simplifies the administration of NFS configurations and also improves performance.

#### **Advanced Oracle Database Creation Options**

- The three file system options available to standard Oracle Database installations.
- With Oracle Managed Files, you specify file system directories in which the database automatically creates, names, and manages files at the database object level.

If you use the Oracle Managed Files feature, then you must specify only the database object name instead of file names when creating or deleting database files.

#### **Related Topics**

- Oracle RAC Technologies Matrix for Linux Platforms
- Oracle Database Administrator's Guide

# Guidelines for Placing Oracle Database Files On a File System or Logical Volume

If you choose to place the Oracle Database files on a file system, then use the following guidelines when deciding where to place them:

- The default path suggested by Oracle Universal Installer for the database file directory is a subdirectory of the Oracle base directory.
- You can choose either a single file system or more than one file system to store the database files:
  - If you want to use a single file system, then choose a file system on a physical device that is dedicated to the database.



For best performance and reliability, choose a RAID device or a logical volume on more than one physical device, and implement a stripe-and-mirror-everything (SAME) storage policy.

 If you want to use more than one file system, then choose file systems on separate physical devices that are dedicated to the database.

This method enables you to distribute physical input-output operations and create separate control files on different devices for increased reliability. It also enables you to fully implement Oracle Optimal Flexible Architecture (OFA) guidelines. Choose the Advanced database creation option to implement this method.

• If you intend to create a preconfigured database during the installation, then the file system (or file systems) that you choose must have at least 2 GB of free disk space.

For production databases, you must estimate the disk space requirement depending on the use of the database.

- For optimum performance, the file systems that you choose must be on physical devices that are used only by the database.
- The Oracle user running the Oracle Database installation must have write permissions to create the files in the path that you specify.

# About NFS Storage for Data Files

Review this section for NFS storage configuration guidelines.

#### Network-Attached Storage and NFS Protocol

Network-attached storage (NAS) systems use the network file system (NFS) protocol to to access files over a network, which enables client servers to access files over networks as easily as to storage devices attached directly to the servers. You can store data files on supported NFS systems. NFS is a shared file system protocol, so NFS can support both single instance and Oracle Real Application Clusters databases.

#### Note:

The performance of Oracle software and databases stored on NAS devices depends on the performance of the network connection between the servers and the networkattached storage devices.For better performance, Oracle recommends that you connect servers to NAS devices using private dedicated network connections. NFS network connections should use Gigabit Ethernet or better.

Refer to your vendor documentation to complete NFS configuration and mounting.

#### **Requirements for Using NFS Storage**

Before you start installation, NFS file systems must be mounted and available to servers.

# About Direct NFS Client Mounts to NFS Storage Devices

Direct NFS Client integrates the NFS client functionality directly in the Oracle software to optimize the I/O path between Oracle and the NFS server. This integration can provide significant performance improvements.



Direct NFS Client supports NFSv3, NFSv4, NFSv4.1, and pNFS protocols to access the NFS server. Direct NFS Client also simplifies, and in many cases automates, the performance optimization of the NFS client configuration for database workloads.

Starting with Oracle Database 12c Release 2, when you enable Direct NFS, you can also enable the Direct NFS dispatcher. The Direct NFS dispatcher consolidates the number of TCP connections that are created from a database instance to the NFS server. In large database deployments, using Direct NFS dispatcher improves scalability and network performance. Parallel NFS deployments also require a large number of connections. Hence, the Direct NFS dispatcher is recommended with Parallel NFS deployments too.

Direct NFS Client can obtain NFS mount points either from the operating system mount entries, or from the oranfstab file.

#### **Direct NFS Client Requirements**

- NFS servers must have write size values (wtmax) of 32768 or greater to work with Direct NFS Client.
- NFS mount points must be mounted both by the operating system kernel NFS client and Direct NFS Client, even though you configure Direct NFS Client to provide file service.

If Oracle Database cannot connect to an NFS server using Direct NFS Client, then Oracle Database connects to the NFS server using the operating system kernel NFS client. When Oracle Database fails to connect to NAS storage though Direct NFS Client, it logs an informational message about the Direct NFS Client connect error in the Oracle alert and trace files.

 Follow standard guidelines for maintaining integrity of Oracle Database files mounted by both operating system NFS and by Direct NFS Client.

#### **Direct NFS Mount Point Search Order**

Direct NFS Client searches for mount entries in the following order:

- 1. \$ORACLE HOME/dbs/oranfstab
- 2. /etc/oranfstab
- 3. /etc/mtab

Direct NFS Client uses the first matching entry as the mount point.

#### Note:

You can have only one active NFS Client implementation for each instance. Enabling Direct NFS Client on an instance prevents you from using another NFS Client implementation, such as kernel NFS Client.

#### **Related Topics**

- Creating an oranfstab File for Direct NFS Client
   Direct NFS uses a configuration file, oranfstab, to determine the available mount points.
- Configuring NFS Buffer Size Parameters for Oracle Database Set the values for the NFS buffer size parameters rsize and wsize to at least 32768.



### See Also:

- Oracle Database Reference for information about setting the enable\_dnfs\_dispatcher parameter in the initialization parameter file to enable Direct NFS dispatcher
- Oracle Database Performance Tuning Guide for performance benefits of enabling Parallel NFS and Direct NFS dispatcher
- Oracle Automatic Storage Management Administrator's Guide for guidelines about managing Oracle Database data files created with Direct NFS Client or kernel NFS



# 8

# Configuring File System Storage for Oracle Database

Complete these procedures to use file system storage for Oracle Database.

For optimal database organization and performance, Oracle recommends that you install data files and the Oracle Database software in different disks.

- Deploying Oracle Direct NFS If you plan to place storage on Network File System (NFS) protocol devices, then Oracle recommends that you use Oracle Direct NFS (dNFS) to take advantage of performance optimizations built into the Oracle Direct NFS client.
- Deploying the Oracle Memory Speed File System
   Learn how to deploy the Oracle Memory Speed (OMS) file system on your persistent memory (PMEM) storage devices with a single-instance Oracle Database.
- Migrating Oracle Database to Oracle Memory Speed Starting with Oracle Database 19c Release Update (19.12) you can migrate your database files to Oracle Memory Speed (OMS) storage using SQL and RMAN commands.

# **Deploying Oracle Direct NFS**

If you plan to place storage on Network File System (NFS) protocol devices, then Oracle recommends that you use Oracle Direct NFS (dNFS) to take advantage of performance optimizations built into the Oracle Direct NFS client.

- Configuring NFS Buffer Size Parameters for Oracle Database Set the values for the NFS buffer size parameters rsize and wsize to at least 32768.
- Checking TCP Network Protocol Buffer for Direct NFS Client
   Check your TCP network buffer size to ensure that it is adequate for the speed of your
   servers.
- Creating an oranfstab File for Direct NFS Client Direct NFS uses a configuration file, oranfstab, to determine the available mount points.
- Enabling and Disabling Direct NFS Client Control of NFS By default, Direct NFS Client is installed in a disabled state with single-instance Oracle Database installations. Before enabling Direct NFS, you must configure an oranfstab file.
- Enabling Hybrid Columnar Compression on Direct NFS Client Perform these steps to enable Hybrid Columnar Compression (HCC) on Direct NFS Client:

#### **Related Topics**

• My Oracle Support note 1496040.1



## Configuring NFS Buffer Size Parameters for Oracle Database

Set the values for the NFS buffer size parameters rsize and wsize to at least 32768.

For example, to use rsize and wsize buffer settings with the value 32768 for an Oracle Database data files mount point, set mount point parameters to values similar to the following:

```
nfs_server:/vol/DATA/oradata /home/oracle/netapp nfs\
rw,bg,hard,nointr,rsize=32768,wsize=32768,tcp,actimeo=0,vers=3,timeo=600
```

Direct NFS Client issues writes at wtmax granularity to the NFS server.

#### **Related Topics**

My Oracle Support note 359515.1

### Checking TCP Network Protocol Buffer for Direct NFS Client

Check your TCP network buffer size to ensure that it is adequate for the speed of your servers.

By default, the network buffer size is set to 1 MB for TCP, and 2 MB for UDP. The TCP buffer size can set a limit on file transfers, which can negatively affect performance for Direct NFS Client users.

To check the current TCP buffer size, enter the following command:

```
# sysctl -a |grep -e net.ipv4.tcp [rw]mem
```

The output of this command is similar to the following:

<pre>net.ipv4.tcp_rmem =</pre>	4096	87380	1056768
<pre>net.ipv4.tcp wmem =</pre>	4096	16384	1056768

Oracle recommends that you set the value based on the link speed of your servers. For example, perform the following steps:

1. As root, use a text editor to open /etc/sysctl.conf, and add or change the following:

<pre>net.ipv4.tcp_rmem =</pre>	4096	87380	4194304
<pre>net.ipv4.tcp wmem =</pre>	4096	16384	4194304

2. Apply your changes by running the following command:

# sysctl -p

- 3. Restart the network:
  - # /etc/rc.d/init.d/network restart

# Creating an oranfstab File for Direct NFS Client

Direct NFS uses a configuration file, oranfstab, to determine the available mount points.

Create an oranfstab file with the following attributes for each NFS server that you want to access using Direct NFS Client:

• server

The NFS server name.

For NFS setup with Kerberos authentication, the server attribute name must be the fullyqualified name of the NFS server. This server attribute name is used to create service principal for Ticket Granting Service (TGS) request from the Kerberos server. If you are configuring external storage snapshot cloning, then the NFS server name should be a valid host name. For all other scenarios, the NFS server name can be any unique name.

• local

Up to four paths on the database host, specified by IP address or by name, as displayed using the *ifconfig* command run on the database host.

• path

Up to four network paths to the NFS server, specified either by IP address, or by name, as displayed using the *ifconfig* command on the NFS server.

• export

The exported path from the NFS server.

• mount

The corresponding local mount point for the exported volume.

mnt\_timeout

Specifies (in seconds) the time Direct NFS Client should wait for a successful mount before timing out. This parameter is optional. The default timeout is 10 minutes (600).

nfs\_version

Specifies the NFS protocol version used by Direct NFS Client. Possible values are NFSv3, NFSv4, NFSv4.1, and pNFS. The default version is NFSv3. If you select NFSv4.x, then you must configure the value in oranfstab for nfs version.

Specify <code>nfs\_version</code> as <code>pNFS</code>, if you want to use Direct NFS with Parallel NFS. Direct NFS supports only the default <code>sys</code> security authentication with Parallel NFS. Direct NFS does not support Parallel NFS when combined with any of the Kerberos authentication parameters.

security\_default

Specifies the default security mode applicable for all the exported NFS server paths for a server entry. This parameter is optional. sys is the default value. See the description of the security parameter for the supported security levels for the security\_default parameter.

security

Specifies the security level, to enable security using Kerberos authentication protocol with Direct NFS Client. This optional parameter can be specified per export-mount pair. The supported security levels for the security default and security parameters are:



sys: UNIX level security AUTH\_UNIX authentication based on user identifier (UID) and group identifier (GID) values. This is the default value for security parameters. krb5: Direct NFS runs with plain Kerberos authentication. Server is authenticated as

the real server which it claims to be.

krb5i: Direct NFS runs with Kerberos authentication and NFS integrity. Server is authenticated and each of the message transfers is checked for integrity.

krb5p: Direct NFS runs with Kerberos authentication and NFS privacy. Server is authenticated, and all data is completely encrypted.

The security parameter, if specified, takes precedence over the security\_default parameter. If neither of these parameters are specified, then sys is the default authentication.

For NFS server Kerberos security setup, review the relevant NFS server documentation. For Kerberos client setup, review the relevant operating system documentation.

dontroute

Specifies that outgoing messages should not be routed by the operating system, but instead sent using the IP address to which they are bound.

#### Note:

The dontroute option is a POSIX option, which sometimes does not work on Linux systems with multiple paths in the same subnet.

management

Enables Direct NFS Client to use the management interface for SNMP queries. You can use this parameter if SNMP is running on separate management interfaces on the NFS server. The default value is the server parameter value.

community

Specifies the community string for use in SNMP queries. Default value is public.

The following examples show three possible NFS server entries in oranfstab. A single oranfstab can have multiple NFS server entries.

#### Example 8-1 Using Local and Path NFS Server Entries

The following example uses both local and path. Because they are in different subnets, you do not have to specify dontroute.

```
server: MyDataServer1
local: 192.0.2.0
path: 192.0.2.1
local: 192.0.100.0
path: 192.0.100.1
export: /vol/oradata1 mount: /mnt/oradata1
```

#### Example 8-2 Using Local and Path in the Same Subnet, with dontroute

Local and path in the same subnet, where dontroute is specified:

```
server: MyDataServer2
local: 192.0.2.0
```



```
path: 192.0.2.128
local: 192.0.2.1
path: 192.0.2.129
dontroute
export: /vol/oradata2 mount: /mnt/oradata2
```

# Example 8-3 Using Names in Place of IP Addresses, with Multiple Exports, management and community

```
server: MyDataServer3
local: LocalPath1
path: NfsPath1
local: LocalPath2
path: NfsPath2
local: LocalPath3
path: NfsPath3
local: LocalPath4
path: NfsPath4
dontroute
export: /vol/oradata3 mount: /mnt/oradata3
export: /vol/oradata4 mount: /mnt/oradata4
export: /vol/oradata5 mount: /mnt/oradata5
export: /vol/oradata6 mount: /mnt/oradata6
management: MgmtPath1
community: private
```

#### Example 8-4 Using Kerberos Authentication with Direct NFS Export

The security parameter overrides security default:

```
server: nfsserver
local: 192.0.2.0
path: 192.0.2.2
local: 192.0.2.3
path: 192.0.2.4
export: /private/oracle1/logs mount: /logs security: krb5
export: /private/oracle1/data mount: /data security: krb5p
export: /private/oracle1/archive mount: /archive security: sys
export: /private/oracle1/data1 mount: /data1
security_default: krb5i
```

### Enabling and Disabling Direct NFS Client Control of NFS

By default, Direct NFS Client is installed in a disabled state with single-instance Oracle Database installations. Before enabling Direct NFS, you must configure an oranfstab file.

Use these procedures to enable or disable Direct NFS Client Oracle Disk Manager Control of NFS

#### **Enabling Direct NFS Client Control of NFS**

1. Change the directory to \$ORACLE HOME/rdbms/lib.

2. Enter the following command:

```
make -f ins_rdbms.mk dnfs_on
```

**Disabling Direct NFS Client Control of NFS** 

1. Log in as the Oracle software installation owner, and disable Direct NFS Client using the following commands:

```
cd $ORACLE_HOME/rdbms/lib
make -f ins rdbms.mk dnfs off
```

2. Remove the oranfstab file.

#### Note:

If you remove an NFS path that an Oracle Database is using, then you must restart the database for the change to take effect.

# Enabling Hybrid Columnar Compression on Direct NFS Client

Perform these steps to enable Hybrid Columnar Compression (HCC) on Direct NFS Client:

1. Ensure that SNMP is enabled on the ZFS storage server. For example:

```
$ snmpget -v1 -c public server_name .1.3.6.1.4.1.42.2.225.1.4.2.0
SNMPv2-SMI::enterprises.42.2.225.1.4.2.0 = STRING: "Sun Storage 7410"
```

- 2. If SNMP is enabled on an interface other than the NFS server, then configure oranfstab using the management parameter.
- 3. If SNMP is configured using a community string other than public, then configure oranfstab file using the community parameter.
- 4. Ensure that libnetsnmp.so is installed by checking if snmpget is available.

# Deploying the Oracle Memory Speed File System

Learn how to deploy the Oracle Memory Speed (OMS) file system on your persistent memory (PMEM) storage devices with a single-instance Oracle Database.

To use your single-instance Oracle Database with OMS, perform the following steps:

- 1. Set-up the hardware and operating system components.
- 2. Set-up the OMS file system.
- 3. Deploy Oracle Database with OMS.
- About Oracle Memory Speed

Oracle recommends that you use Oracle Database with the Oracle Memory Speed (OMS) file system to fully utilize the potential of persistent memory (PMEM) devices safely in data centers.



- Requirements and Guidelines for Oracle Memory Speed Review these requirements and guidelines before you deploy Oracle Memory Speed (OMS) as your file system.
- Setting-Up Hardware and Operating System Components for OMS Verify if HugePages is available, configure the PMEM device, and create and mount a DAX-capable file system on the device.
- Setting-Up the Oracle Memory Speed File System After configuring the system components, set up the Oracle Memory Speed (OMS) file system by creating and mounting the file system.
- Deploying Oracle Database with Oracle Memory Speed Learn the steps to use Oracle Memory Speed (OMS) in Oracle Database.
- omsfscmds Command Reference Use the various omsfscmds commands to perform basic file system operations, such as mkfs, mount, and umount.

## About Oracle Memory Speed

Oracle recommends that you use Oracle Database with the Oracle Memory Speed (OMS) file system to fully utilize the potential of persistent memory (PMEM) devices safely in data centers.

Persistent memory is a new tier in the computer system memory hierarchy. PMEM performance and access characteristics are similar to volatile memory. However, unlike volatile memory and similar to existing storage systems, the data is not lost on system restarts and power failures.

PMEM devices are usually deployed on a DAX-enabled file system. The files placed directly on DAX-enabled file systems backed by PMEM devices may become corrupt in certain scenarios. Applications accessing these files through the file-system kernel interface may also experience higher overhead and lower performance. To avoid these pitfalls, Oracle recommends that you deploy Oracle Database with OMS to eliminate data corruption that may occur when writing to files on a DAX-enabled file system on a raw PMEM device. An Oracle Database deployed on OMS will exhibit I/O performance close to that of the underlying hardware. Also, OMS uses advanced techniques to reduce TLB misses and reduce CPU cache usage and misses.

With PMEM as the backing device, OMS utilizes a memory-mapped file hosted on an XFSbased, DAX-enabled file system to perform I/O operations. You must export the PMEM device as a file using a DAX-enabled file system, such as XFS.

#### Benefits of the Oracle Memory Speed File System

- Supports control files, redo log files, data files, and temporary files
- Enables applications to take advantage of the speed and persistence of PMEM devices
- Eliminates the inherent corruption hazard that arises from the lower atomic write size
- OMS is a user-space file system that eliminates the user space to kernel context switch overhead
- Avoids multiple data copies
- OMS takes advantage of HugePages to reduce TLB misses and improve performance
- Bypasses the CPU cache for I/O through non-temporal stores. This enables applications to take advantage of the local cache
- Allows you to examine files even when the database instance is not running



Provides rich diagnostic data

# Requirements and Guidelines for Oracle Memory Speed

Review these requirements and guidelines before you deploy Oracle Memory Speed (OMS) as your file system.

#### Requirements

- An Intel Cascade Lake or Intel Ice Lake based server or later. Ice Lake based servers implement enhanced CPU cache flushing algorithms that may potentially improve PMEM performance.
- Persistent Memory Devices (PMEM) in each socket capable of memory interleaving. You should populate the PMEM DIMMs and the DRAM DIMMs in the memory channels per Intel guidelines.
- Oracle Linux with HugePages support starting with kernel UEK5.
- A Direct Access (DAX-capable) file system such as XFS.

#### Guidelines

 Oracle supports the OMS file system only for single instance Oracle Database deployments. To protect the data created by your single-instance Oracle Database, Oracle recommends that you configure Oracle Data Guard. Oracle Data Guard ensures that if there is any error in the primary instance, the database can fail over to the standby database. See the Oracle Data Guard Concepts and Administration for more information.

#### **Related Topics**

Oracle Data Guard Concepts and Administration

### Setting-Up Hardware and Operating System Components for OMS

Verify if HugePages is available, configure the PMEM device, and create and mount a DAXcapable file system on the device.

- Verifying HugePages Availability Ensure that the underlying Linux kernel supports HugePages.
- Configuring PMEM Devices
   On your Intel Persistent Memory (PMEM) device, use the ipmctl utility to configure the
   PMEM mode and the ndctl utility for namespace management.
- Setting-Up a DAX-Capable File System Learn how to create and mount a DAX-capable file system.
- Create an Uber File for Oracle Memory Speed After mounting the DAX file system, create an uber file for the Oracle Memory Speed (OMS) file system.

### Verifying HugePages Availability

Ensure that the underlying Linux kernel supports HugePages.

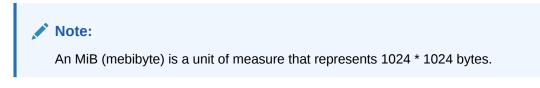
HugePages not only reduces TLB misses but also substantially reduces the memory footprint for virtual to physical address translation.



To determine the HugePages size on your system, run:

```
$grep Hugepagesize /proc/meminfo
Hugepagesize: 2048 kB
```

In this example, the HugePages size is 2 MiB (mebibyte).



Oracle recommends Oracle Linux 7 with the Unbreakable Enterprise Kernel 5 or later for HugePages support.

### **Configuring PMEM Devices**

On your Intel Persistent Memory (PMEM) device, use the ipmctl utility to configure the PMEM mode and the ndctl utility for namespace management.

A PMEM device can operate in App Direct mode, Memory Mode, or Mixed Mode. To use OMS, you should configure your PMEM device in the app direct mode by using the BIOS.

- In your BIOS, select EDKII, Socket Config, Memory Config, Memory Map, Volatile Mode and set it to 1LM.
- 2. Log in as root and check the currently configured capacity:

```
$ su -
# ipmctl show -memoryresources
```

The output is similar to the following:

```
Capacity=3029.4 GiB
MemoryCapacity=0.0 GiB
AppDirectCapacity=3024.0 GiB
UnconfiguredCapacity=0.0 GiB
InaccessibleCapacity=5.4 GiB
ReservedCapacity=0.0 GiB
```

In this example, the system has an aggregate capacity of 3024 GiB (3247 GB).



A GiB (gibibyte) is a unit of measure that represents 1024 MiB (mebibytes), equivalent to  $2^{30}$  bytes.

3. Verify if the regions are configured in app direct mode.

```
# ipmctl show -region
```



The output is similar to the following:

In this example, there are two PMEM devices; one per socket. Each PMEM device or region has a capacity of 1512 GiB and supports AppDirect mode.

4. Create the namespace by running the ndctl command for each region. In this example, run the command twice as there are two regions in the preceding example.

```
# ndctl create-namespace
# ndctl create-namespace
```

5. Check if the namespaces are created.

```
# ndctl list -u
```

The output is similar to the following:

```
[
  {
    "dev":"namespace1.0",
    "mode":"fsdax",
    "map":"dev",
    "size":"1488.37 GiB (1598.13 GB)",
    "uuid":"f8ec094d-5a69-4f87-9198-fb9117f2ea8e",
    "sector size":512,
    "align":2097152,
    "blockdev":"pmem1"
  },
  {
    "dev": "namespace0.0",
    "mode":"fsdax",
    "map":"dev",
    "size":"1488.37 GiB (1598.13 GB)",
    "uuid":"8924aa35-701f-40cc-ba08-654aa5729611",
    "sector size":512,
    "align":2097152,
    "blockdev":"pmem0"
  }
1
```

In this example, two namespaces namespace0.0 and namespace1.0 are now available for NUMA nodes 0 and node 1 respectively. The block device paths for namespaces namespace0.0 and namespace1.0 are /dev/pmem0 and /dev/pmem1 respectively.

Ensure that the PMEM device starts at a 2 MiB aligned physical address.

To determine the alignment of the persistent memory namespaces, view the /proc/ iomem file.

```
# cat /proc/iomem | grep namespace
3060000000-laa5fffffff : namespace0.0
lda00000000-353ffffffff : namespace1.0
```

Check if the hexadecimal addresses are aligned at a 2 MiB boundary.

0x3060000000 = 198144 MiB 0x1da00000000 = 1941504 MiB

In this example, both addresses are aligned at a 2 MiB boundary.

Create two partitions on your PMEM storage device. One small partition of approximately 5
percent for metadata and the rest for the data.

On /dev/pmem0 create 2 partitions pmem0p1 and pmem0p2.

Here pmem0p1 is the smaller metadata partition and pmem0p2 is the larger data partition.

In the following example, 5 percent of the total space of 1488.37 GiB would be approximately 75 GiB. Partition the device as follows:

a. Launch parted and select the device.

```
# parted /dev/pmem0
GNU Parted 3.2
Using /dev/pmem0
Welcome to GNU Parted! Type 'help' to view a list of commands.
```

b. Create the first new 75 GiB partition using the mkpart command.

```
(parted) mkpart
Partition type? primary/extended? p
File system type? [ext2]? xfs
Start? 2MiB
End? 75GiB
```

c. Create the second new partition using the mkpart command.

```
(parted) mkpart
Partition type? primary/extended? p
File system type? [ext2]? xfs
Start? 75GiB
End? -2MiB
```

d. Quit parted and return to the shell prompt.

```
(parted) q
Information: You may need to update /etc/fstab.
```

Similarly, partition the /dev/pmem1 device.



8. Ensure that you align the starting sector of the data partition at 2 MiB.

The starting sector number of the data partition should be a multiple of 4096 when you run the fdisk -1 command.

Run the fdisk -1 command on /dev/pmem0 and /dev/pmem1 to check if the sector is aligned properly.

# fdisk -l /dev/pmem0

Disk /dev/pmem1: 1598.1 GB, 1598128390144 bytes, 3121344512 sectors Units = sectors of 1 \* 512 = 512 bytes Sector size (logical/physical): 512 bytes / 4096 bytes I/O size (minimum/optimal): 4096 bytes / 4096 bytes Disk label type: dos Disk identifier: 0xc1d8d265

Device Bo	oot Start	End	Blocks	Id	System
/dev/pmem0p1	4096	157286399	78641152	83	Linux
/dev/pmem0p2	157286400	3121340415	1482027008	83	Linux

# fdisk -1 /dev/pmem1

Disk /dev/pmem1: 1598.1 GB, 1598128390144 bytes, 3121344512 sectors Units = sectors of 1 \* 512 = 512 bytes Sector size (logical/physical): 512 bytes / 4096 bytes I/O size (minimum/optimal): 4096 bytes / 4096 bytes Disk label type: dos Disk identifier: 0x0003b5eb

Device Boo	t Start	End	Blocks	Id	System
/dev/pmem1p1	4096	157286399	78641152	83	Linux
/dev/pmem1p2	157286400	3121340415	1482027008	83	Linux

In these examples the starting sector of the data partitions are multiples of 4096, which confirms that the data partition is aligned at 2 MiB.

157286400 / 4096 = 38400

### Setting-Up a DAX-Capable File System

Learn how to create and mount a DAX-capable file system.

The XFS file system features DAX-capable mounts. Ensure that XFS creates mappings from the physical pages in the PMEM device to virtual pages using HugePages mappings.

 Create an XFS file system with the data partition as the real time device and an extent size of 2 MiB. Configuring the data partition as a real time device guarantees 2 MiB aligned extents.



```
finobt=0, sparse=0,
                               crc=0
rmapbt=0, reflink=0
                               bsize=4096 blocks=8388608, imaxpct=25
data
        =
        =
                               sunit=0 swidth=0 blks
                               bsize=4096 ascii-ci=0 ftype=1
naming =version 2
                               bsize=4096 blocks=4096, version=2
        =internal log
log
                               sectsz=4096 sunit=1 blks, lazy-count=1
        =
realtime =/dev/pmem0p2
                               extsz=2097152 blocks=381771264,
rtextents=745647
```

 Mount the Persistent Memory (PMEM) device with DAX option using the following real time device mount options.

# mount /dev/pmem0p1 /mnt/pmem0 -o dax,rtdev=/dev/pmem0p2

3. Verify if the file system is mounted with the dax option.

# mount | grep dax

/dev/pmem0p1 on /mnt/pmem0 type xfs
(rw,relatime,attr2,dax,inode64,rtdev=/dev/pmem0p2,noquota)

4. Format the /dev/pmem1 device and mount and verify the dax option in the mount point.

```
# mkfs.xfs -f -m rmapbt=0,reflink=0 -d rtinherit=1 -r rtdev=/dev/
pmem1p2,extsize=2m /dev/pmem1p1
# mount /dev/pmem1p1 /mnt/pmem1 -o dax,rtdev=/dev/pmem1p2
# mount | grep dax
/dev/pmem0p1 on /mnt/pmem0 type xfs
(rw,relatime,attr2,dax,inode64,rtdev=/dev/pmem0p2,noquota)
/dev/pmem1p1 on /mnt/pmem1 type xfs
(rw,relatime,attr2,dax,inode64,rtdev=/dev/pmem1p2,noquota)
```

### Create an Uber File for Oracle Memory Speed

After mounting the DAX file system, create an uber file for the Oracle Memory Speed (OMS) file system.

An uber file is similar to a volume in a traditional kernel-based file system. The uber file stores all the metadata and data for OMS.

1. Use fallocate to create uber files in the DAX-mounted file systems.

# fallocate -1 800G /mnt/pmem0/omsuberfile.\$ORACLE\_SID
# fallocate -1 800G /mnt/pmem1/omsuberfile.\$ORACLE\_SID

In this example, fallocate creates two 800 GiB files in each of the DAX-mounted file systems. Ensure that the size of the file is an exact multiple of 2 MiB. This aligns the file extents on 2 MiB boundaries and enables access through HugePages virtual memory mappings.



2. Change the ownership of the OMS uber file to the software owner user (oracle) and the Oracle Inventory group (oinstall), with read/write permissions.

```
# chown oracle:oinstall /mnt/pmem0/omsuberfile.$ORACLE_SID
# chmod 644 /mnt/pmem0/omsuberfile.$ORACLE SID
```

3. Use the xfs\_bmap command to ensure that the extents are correctly aligned on 2 MiB boundaries.

The output from the xfs bmap command is in the following format:

Extent Num: [Start Offset..End Offset]:Start block..End Block

Offset and blocks are in units of 512 bytes. The file /mnt/pmem0/ omsuberfile.\$ORACLE SID has 3 contiguous extents numbered 0-2.

Extent	Start Offset	Start Offset Mod 2 M	Start Block	Start Block Mod 2 M	Number of 2 MiB Blocks
0	0H	ОH	D285600000H	ОH	1H
1	20000H	0H	D285800000H	ОН	FFEH
2	0x1FFF00000H	ОH	D485400000H	ОН	401H

 Table 8-1
 Size and Alignment of Extents in the Uber File (in Bytes)

This table shows the Start Offset and Start Block converted into bytes and represented in hexadecimals. The Starts Offsets are all aligned on 2 MiB boundaries (Start Offset Mod 2 MiB is 0). The Start Block of each extent lies on a 2 MiB boundary (Start Block Mod 2 M is 0). Similarly, the size of the extents are exact multiples of 2 MiB.

The OMS uber file has a one-to-one relationship with an Oracle instance. You formalize the association by ending the uber file name with the Oracle instance identifier (SID). In the preceding example, the SID is test. Two uber files are /mnt/pmem0/omsuberfile.test and /mnt/pmem1/omsuberfile.test.

#### **Related Topics**

Verifying HugePages Behavior in XFS Files

For best performance, map the data files placed in DAX-enabled storage in to the virtual address space using HugePages mappings. For a memory-mapped file, set up the virtual-to-physical address translations when the pages are first touched.

### Setting-Up the Oracle Memory Speed File System

After configuring the system components, set up the Oracle Memory Speed (OMS) file system by creating and mounting the file system.



- About the OMS Daemon OMS is a user-space file system. The OMS daemon handles management and CLI operations for OMS.
- Creating and Mounting the Oracle Memory Speed File System Learn how to create an Oracle Memory Speed (OMS) file system and mount it.

### About the OMS Daemon

OMS is a user-space file system. The OMS daemon handles management and CLI operations for OMS.

You should run the OMS daemon at start up. At start up, the OMS daemon creates a shared memory segment for the exclusive use of OMS. There is one daemon per instance. Set the instance identifier (SID) before you start the OMS daemon.

Start the OMS daemon by running the <code>\$ORACLE\_HOME/bin/oms\_daemon</code>.

```
$ whoami
oracle
$ export ORACLE SID="test"
$ $ORACLE HOME/bin/oms daemon
Starting daemon as a detached background.
OMS binary located at /mnt/data/ssd0/obase/test/bin/oms daemon
OMS daemon startup: oms test successfully created
OMS daemon creating tracefile
/mnt/data/ssd0/obase/diag/oms/test oms 20758.trc
$ ipcs
----- Message Queues -----
key msqid owner perms used-bytes messages
----- Shared Memory Segments ------
key shmid owner perms bytes nattch status
0x00000000 32047104 oracle 640 135266304 1
$ ls -1 $ORACLE HOME/dbs/*.ora
-rwx----- 1 oracle dba 93 Feb 23 20:10
/mnt/data/ssd0/oracle/test/dbs/oms test.ora
```

In this example, the daemon creates a shared memory segment with shared memory id 32047104. It also creates a configuration file <code>\$ORACLE\_HOME/dbs/oms\_test.ora</code>.

Oracle recommends that you should not delete the shared segment manually. Similarly, you should not edit or delete the configuration file. If you accidentally kill the daemon, you can restart it by running the command <code>\$ORACLE\_HOME/bin/oms\_daemon</code>.

Daemon traces are available in the <code>\$ORACLE\_BASE/diag/oms</code> directory.

#### **Related Topics**

Daemon Control Command Reference
 Use the daemon command to control the OMS daemon process.

### Creating and Mounting the Oracle Memory Speed File System

Learn how to create an Oracle Memory Speed (OMS) file system and mount it.

1. Create the mount directories and remove the write and execute permissions:

```
$ mkdir /oracle/omsfs_1
$ chmod -wx /oracle/omsfs_1
$ mkdir /oracle/omsfs_2
$ chmod -wx /oracle/omsfs_2
$ ls -1 /oracle
dr--r--r-- 2 oracle dba 6 Feb 23 21:36 omsfs_1
dr--r--r-- 2 oracle dba 6 Feb 23 21:36 omsfs_2
```

2. Start the omsfscmds utility and create and mount the file systems using the mkfs and mount commands respectively.

```
$ $ORACLE HOME/bin/omsfscmds
OMS> mkfs /mnt/pmem0/omsuberfile.test
OMS:mkfs:No blocksize specified, using 4K
OMS:mkfs: Device /mnt/pmem0/omsuberfile.test formatted with
blocksize 4096
OMS> mount /mnt/pmem0/omsuberfile.test /oracle/omsfs 1
OMS:mount: Mounted /mnt/pmem0/omsuberfile.test at
/oracle/omsfs 1
OMS> mkfs /mnt/pmem1/omsuberfile.test
OMS:mkfs:No blocksize specified, using 4K
OMS:mkfs: Device /mnt/pmem1/omsuberfile.test formatted with
blocksize 4096
OMS> mount /mnt/pmem1/omsuberfile.test /oracle/omsfs 2
OMS:mount: Mounted /mnt/pmem1/omsuberfile.test at
/oracle/omsfs 2
OMS> lsmount
fsindex : 0
Mountpt : /oracle/omsfs 1
Deviceid: /mnt/pmem0/omsuberfile.test
fsindex : 1
Mountpt : /oracle/omsfs 2
Deviceid: /mnt/pmem1/omsuberfile.test
```

Currently, the only supported block size for OMS file systems is 4 KB. In this example, the two OMS file systems are mounted and available for use. /dev/pmem0 resides on socket 0, hence files placed in /oracle/omsfs\_1 reside in socket 0. Similarly, /dev/pmem1 resides in socket 1, hence files placed in /oracle/omsfs\_2 are in socket 1.

You can mount a maximum of two file systems simultaneously. This enables OMS to use PMEM devices on two socket servers.

OMS mount points are automatically remounted if you reboot the node and restart the daemon.

#### **Related Topics**

mkfs and forcemkfs Command Reference
 Use mkfs and forcemkfs to format the OMS uber file placed in a PMEM DAX mount point.



mount, unmount and Ismount Command Reference
Use mount, umount and, 1smount to manage and query the Oracle Memory Speed file
system mount points.

## Deploying Oracle Database with Oracle Memory Speed

Learn the steps to use Oracle Memory Speed (OMS) in Oracle Database.

- Enabling the OMS ODM Library Oracle routes I/O requests to the Oracle Memory Speed (OMS) file system through the Oracle Disk Manager (ODM) library.
- Turning-Off the OMS ODM Library Learn how to turn off the ODM library.
- Verifying HugePages Behavior in XFS Files
   For best performance, map the data files placed in DAX-enabled storage in to the virtual
   address space using HugePages mappings. For a memory-mapped file, set up the virtual
   to-physical address translations when the pages are first touched.

### Enabling the OMS ODM Library

Oracle routes I/O requests to the Oracle Memory Speed (OMS) file system through the Oracle Disk Manager (ODM) library.

1. To enable the OMS ODM library:

```
$ cd $ORACLE_HOME/rdbms/lib
$ make -f ins rdbms.mk oms on
```

2. Start the instance. Verify that the Oracle instance is using the OMS file system by searching for the following message in the alert log:

```
Oracle instance running with ODM: OMS (Oracle memory speed)
ODM Library, Version: 2.0
```

Oracle creates files that have a path prefix starting with /oracle/omsfs\_1 and /oracle/ omsfs 2 in the OMS file system.

### Turning-Off the OMS ODM Library

Learn how to turn off the ODM library.

1. To turn off the ODM library:

```
$ cd $ORACLE_HOME/rdbms/lib
$ make -f ins rdbms.mk oms off
```

2. Recycle the instance and ensure that the following message is not present in the alert log after instance startup

```
Oracle instance running with ODM: OMS (Oracle memory speed) ODM Library, Version: 2.0
```



### Verifying HugePages Behavior in XFS Files

For best performance, map the data files placed in DAX-enabled storage in to the virtual address space using HugePages mappings. For a memory-mapped file, set up the virtual-to-physical address translations when the pages are first touched.

If you map pages through DAX using HugePages mappings, then the pages will not use pagecache pages.

You can enable a trace to determine if the page-fault handler granularity is 2 MB or lower, and if it bypasses the page cache.

**1.** To view this trace, log in as root and run the following trace enabling command:

```
# echo 1 >
/sys/kernel/debug/tracing/events/fs_dax/dax_pmd_fault_done/
enable
```

- Log out from root and create a file in the DAX-mounted XFS file system and run mkfs on it using the omsfscmds utility.
- 3. Log in again as root and run the following command to look at the generated trace:

# cat /sys/kernel/debug/tracing/trace

Regular 2 MB page faults that bypass the page cache will show the following trace with NOPAGE at the end of the trace:

oms\_test-21456 [024] .... 13566209.645007: dax\_pmd\_fault\_done: dev 259:10 ino 0x2005 shared ALLOW\_RETRY|KILLABLE|USER address 0x7fb717e01000 vm\_start 0x7fb717e00000 vm\_end 0x7fb997e00000 pgoff 0x1 max\_pgoff 0x280000 NOPAGE

If the page fault occurs at a lower granularity of 4 KB, then you will see a FALLBACK in the page fault handler trace. This indicates that 2 MB granularity page fault handlers failed and the fallback path through the page cache is executed. Systems showing a FALLBACK trace must not be used to run OMS.

oms\_test-21456 [024] .... 13566209.646801: dax\_pmd\_fault\_done: dev 259:9 ino 0xc3 shared WRITE|ALLOW\_RETRY|KILLABLE|USER address 0x7fb717e0c000 vm\_start 0x7fb717e00000 vm\_end 0x7fb997e00000 pgoff 0xc max pgoff 0x280000 FALLBACK

4. Tracing substantially impinges on performance. You must disable tracing before running workloads. To disable the trace, log in as root and run the following command:

```
# echo 0 >
/sys/kernel/debug/tracing/events/fs_dax/dax_pmd_fault_done/
enable
```

#### **Related Topics**

Configuring HugePages



### omsfscmds Command Reference

Use the various  ${\tt omsfscmds}$  commands to perform basic file system operations, such as mkfs, mount, and umount.

#### Purpose

omsfscmds is a command line utility for administering Oracle Memory Speed (OMS). To use omsfscmds, ensure that the OMS daemon is running.

#### Example 8-5 omsfscmds for Mounting the File System

Set the \$ORACLE SID to the same SID as the daemon and run omsfscmds.

```
$ $ORACLE_HOME/bin/omsfscmds
OMS> mount /mnt/pmem0/omsuberfile.test /oracle/omsfs 1
```

In this example, the PMEM device /mnt/pmem0/omsuberfile.test is mounted in the Oracle Database path /oracle/omsfs 1.

#### Parameters

Command	Description	
help	Use the help command to learn more about each command.	
mkfs <i>pmem_device block_size</i>	Use this command to format a persistent memory (PMEM) device <i>pmem_device</i> with block size <i>block_size</i> .	
forcemkfs <i>pmem_device block_size</i>	Use this command to format the existing file system and create a new file system with persistent memory (PMEM) device <i>pmem_device</i> with block size <i>block_size</i> .	
mount pmem_device mount_path	Use this command to mount a PMEM device pmem_device in the mount path mount_path.	
umount <i>mount_path</i>	Use this command to unmount a PMEM device from the mount path <i>mount_path</i> .	
lsmount	Use this command to list all mounted file systems.	
df mount_path	Display the amount of disk space available on the file system in the <i>mount_path</i> .	
cp <b>source_filepath dest_filepath</b>	Use this command to copy from the source file store <i>source_filepath</i> to the destination file store <i>dest_filepath</i> .	
ls mount_path	Use this command to list all files in the mount path mount_path.	
lls mount_path	Use this command to list detailed information about all files in the mount path <i>mount_path</i> .	
rm file_path	Use this command to delete a file in the path <i>file_path</i> .	
cd <i>dir_path</i>	Use this command to change the current working directory to the path <i>dir_path</i> .	
pwd	Use this command to print the current directory.	



Command	Description
<pre>dump module_option pmem_device/mount_point/ absolute_file_path dump_file_name</pre>	Use this command to dump diagnostic information to dump_file_name.
	Available module_option values are dalog, malog, dftbl, oftbl, lsom, lsof, and heap.
	pmem_device values can be dalog or dftbl.
	<pre>mount_point values can be malog, heap, lsom, or oftbl.</pre>
	absolute_file_path value can be lsof.
trace <pre>pmem_device trace_option_file</pre>	Use this command to enabling tracing for omsdaemon and omsfscmds.
daemon daemon_action	Use this command to set the OMS daemon trace level.
	exit will shutdown the daemon.
	trace lvl sets the daemon trace lvl to low, medium, or high.
exit	Exit the omsfscmds command prompt.

#### **Related Topics**

- Oracle Memory Speed CLI Commands omsfscmds is a command line utility for administering Oracle Memory Speed (OMS). To use omsfscmds, ensure that the OMS daemon is running.
- Oracle Memory Speed CLI Commands omsfscmds is a command line utility for administering Oracle Memory Speed (OMS). To use omsfscmds, ensure that the OMS daemon is running.

# Migrating Oracle Database to Oracle Memory Speed

Starting with Oracle Database 19c Release Update (19.12) you can migrate your database files to Oracle Memory Speed (OMS) storage using SQL and RMAN commands.

Before you start the migration of the database files, create an OMS file system, mount it, and enable OMS on the database instance.

• Preparing for the OMS Migration

Create and mount an Oracle Memory Speed (OMS) file system before you start the migration.

Adding Redo Log Files to OMS

To achieve best redo performance, Oracle recommends that you add all members of a redo group to storage with similar characteristics. For Oracle Memory Speed (OMS) file system, adding all the members of the redo group to OMS provides efficient redo log write times.

- Moving Data Files to OMS Use this procedure if you want to move selected data files to Oracle Memory Speed (OMS) storage.
- Moving the Entire Database to OMS
  Use RMAN to move the entire database to Oracle Memory Speed (OMS) if the number of
  data files are large or if you want to move root PDB files.



### Preparing for the OMS Migration

Create and mount an Oracle Memory Speed (OMS) file system before you start the migration.

L. Start the OMS daemon by running <code>\$ORACLE\_HOME/bin/oms\_daemon</code>.

```
#export ORACLE_SID="test"
#$ORACLE HOME/bin/oms daemon
```

- 2. Identify the DAX-capable XFS file system. Create an OMS file system on this DAX-capable PMEM storage using the omsfscmds utility.
- Mount the OMS file system you created in a unique database mount point directory such as \$ORACLE BASE/oradata/\$ORACLE SID.
- 4. Shut down the instance.
- 5. Enable the OMS ODM library on the database instance.

```
$ cd $ORACLE_HOME/rdbms/lib
$ make -f ins rdbms.mk oms on
```

6. If Oracle Managed File (OMF) is in use, then set the DB\_CREATE\_FILE\_DEST parameter to the OMS mount directory. DB\_CREATE\_FILE\_DEST specifies the default location for the Oracle Managed data files. If an Oracle parameter file is in use, then set DB\_CREATE\_FILE\_DEST in the parameter file.

If you want to create an online redo log files on OMS, then set the db\_create\_online\_log\_dest\_1 parameter to the OMS mount directory. This allows any new redo log file that you add to the database to be created on OMS storage.

7. Start the database instance. If spfile is in use, then set the db\_create\_file\_dest and db\_create\_online\_log\_dest\_n in the SP file:

```
SQL> alter system set db_create_file_dest='OMS_MOUNT_DIR' scope=both;
SQL> alter system set db_create_online_log_dest_1='OMS_MOUNT_DIR'
scope=both;
```

Here, OMS\_MOUNT\_DIR is the directory path where you mounted the OMS file system.

#### **Related Topics**

- About the OMS Daemon OMS is a user-space file system. The OMS daemon handles management and CLI operations for OMS.
- Deploying Oracle Database with Oracle Memory Speed Learn the steps to use Oracle Memory Speed (OMS) in Oracle Database.

### Adding Redo Log Files to OMS

To achieve best redo performance, Oracle recommends that you add all members of a redo group to storage with similar characteristics. For Oracle Memory Speed (OMS) file system, adding all the members of the redo group to OMS provides efficient redo log write times.

To add new redo log file members in OMS and drop the existing non-OMS redo files, perform these steps:



1. Identify all the existing redo group numbers configured by querying v\$log.

SQL> SELECT GROUP#, ARCHIVED, STATUS FROM V\$LOG;

2. Add a new log group with a new log member in the OMS location.

SQL> ALTER DATABASE ADD LOGFILE 'OMS MOUNT PATH/oms redolog 2.rdo';

This statement adds a new log group number, which can be verified by querying v\$log.

3. If your database is set up with OMF and db\_create\_online\_log\_dest\_1 parameter is already set to point to OMS, then add the log file without specifying a log file name.

SQL> ALTER DATABASE ADD LOGFILE;

Query v\$logfile to identify the new group number and log file added to the database. The block size for new members located on OMS will be 4k.

 (Optional) If Oracle Managed Files (OMF) for redo log is enabled in your database, then change db\_create\_online\_log\_dest\_1 to point to the OMS mount path specified in step 3.

```
SQL> alter system set db_create_online_log_dest_1='OMS_MOUNT_DIR'
scope=both;
```

 After you add the new redo log file in OMS, drop the non-OMS redo log file from the list in V\$LOG.



Before you drop the log file, ensure that the status is set to INACTIVE.

#### Example 8-6 Script for Moving Online Redo Logs

```
SET SERVEROUTPUT ON;

DECLARE

CURSOR rlc IS

SELECT GROUP# GRP, THREAD# THR, BYTES, 'NO' SRL

FROM V$LOG

UNION

SELECT GROUP# GRP, THREAD# THR, BYTES, 'YES' SRL

FROM V$STANDBY_LOG

ORDER BY 1;

stmt VARCHAR2(2048);

BEGIN

FOR rlcRec IN rlc LOOP
```



```
IF (rlcRec.srl = 'YES') THEN
stmt := 'ALTER DATABASE ADD STANDBY LOGFILE THREAD ' ||
rlcRec.thr || ' SIZE ' || rlcRec.bytes;
EXECUTE IMMEDIATE stmt;
stmt := 'ALTER DATABASE DROP STANDBY LOGFILE GROUP ' || rlcRec.grp;
EXECUTE IMMEDIATE stmt;
ELSE
stmt := 'ALTER DATABASE ADD LOGFILE THREAD ' ||
rlcRec.thr || ' SIZE ' || rlcRec.bytes;
EXECUTE IMMEDIATE stmt;
BEGIN
stmt := 'ALTER DATABASE DROP LOGFILE GROUP ' || rlcRec.grp;
DBMS OUTPUT.PUT LINE(stmt);
EXECUTE IMMEDIATE stmt;
EXCEPTION
WHEN OTHERS THEN
EXECUTE IMMEDIATE 'ALTER SYSTEM SWITCH LOGFILE';
EXECUTE IMMEDIATE 'ALTER SYSTEM CHECKPOINT GLOBAL';
EXECUTE IMMEDIATE stmt;
END;
END IF;
END LOOP;
END;
/
```

See Oracle Database Administrator's Guide for more information about managing redo logs.

### Moving Data Files to OMS

Use this procedure if you want to move selected data files to Oracle Memory Speed (OMS) storage.

### Note:

If you are connected to a CDB, ensure that you switch to the PDB before you move the data file that belongs to the PDB.

- 1. Choose the data file that needs to be moved to OMS by querying v\$datafile.
- 2. Select name, file# from v\$datafile.
- 3. To move file#=3 to OMS:

SQL> alter database move datafile 3 to `OMS\_FILE\_NAME';



4. If you have already set db\_create\_file\_dest to point to the OMS mount directory, then move the data file.

```
SQL> alter database move datafile 3;
```

The online data file move command copies the data file contents from the original location and updates the control file with the new OMS file name location.

5. Use v\$datafile to verify if the move has completed.

SQL> select file#, name from v\$datafile where file#=3;

### Moving the Entire Database to OMS

Use RMAN to move the entire database to Oracle Memory Speed (OMS) if the number of data files are large or if you want to move root PDB files.

To migrate your entire database:

- 1. Backup your database.
- 2. Restore the file on OMS and recover the database.

Before you start the database backup:

- If you have any read-only transportable tablespaces with the COMPATIBLE initialization parameter set to less than 11.0.0, then make any read-only transportable tablespaces read/write for RMAN backup to work on the tablespaces.
- If you have a physical standby database, then stop any running managed recovery:

SQL> ALTER DATABASE RECOVER MANAGED STANDBY DATABASE CANCEL;

**1.** Start the RMAN session and connect to the database that you want to migrate. Perform a level 0 copy of the database in OMS storage.

```
RUN {
ALLOCATE CHANNEL dev1 DEVICE TYPE DISK;
ALLOCATE CHANNEL dev2 DEVICE TYPE DISK;
ALLOCATE CHANNEL dev3 DEVICE TYPE DISK;
ALLOCATE CHANNEL dev4 DEVICE TYPE DISK;
BACKUP AS COPY
INCREMENTAL LEVEL 0
DATABASE
FORMAT 'oms_mount_path/%U'
TAG 'ORA_OMS_MIGRATION';
}
```

The format clause specifies *oms\_mount\_path/%U*, which corresponds to the OMS file system that you will use for storing the database.

2. If you are not using an SPFILE, then create an SPFILE in the OMS storage using the current PFILE.

```
SQL> CREATE SPFILE='oms_mount_path/spfilesid.ora' FROM PFILE='?/dbs/
initsid.ora';
```

3. Archive the current online redo logs and back up the server parameter file SPFILE.

```
RMAN> SQL "ALTER SYSTEM ARCHIVE LOG CURRENT";
RMAN> BACKUP AS BACKUPSET SPFILE;
RMAN> SHUTDOWN IMMEDIATE;
```

 If the database uses change tracking or Flashback Database, then disable these features before you shut down the database instance.

```
RMAN> SQL "ALTER DATABASE DISABLE BLOCK CHANGE TRACKING";
RMAN> SQL "ALTER DATABASE FLASHBACK OFF";
```

You have now created a full copy of the database and the instance is shut down.

5. To start the database instance and switch to the RMAN copy in OMS storage, create a SPFILE in the OMS storage area.

```
RMAN> STARTUP MOUNT;
RMAN> RESTORE SPFILE TO 'oms_mount_path/spfilesid.ora';
RMAN> SHUTDOWN IMMEDIATE;
```

Where *oms\_mount\_path* is the mount path to the OMS storage and *sid* is the SID of the instance.

6. Set the Oracle Managed Files (OMF) parameters to point to the OMS mount path.

```
SQL> STARTUP FORCE NOMOUNT;
SQL> ALTER SYSTEM SET DB_CREATE_FILE_DEST='oms_mount_path' SID='*';
SQL> ALTER SYSTEM SET DB RECOVERY FILE DEST='oms_mount_path' SID='*';
```

 Migrate the control files to OMS, set the control file location to the OMS path, and restore the control file from the original non-OMS location.

SQL> STARTUP FORCE NOMOUNT; SQL> ALTER SYSTEM SET CONTROL FILES='oms mount path' SCOPE=SPFILE SID='\*';

8. Restore the control file.

```
RMAN> STARTUP FORCE NOMOUNT;
RMAN> RESTORE CONTROLFILE FROM 'original_cf_name';
RMAN> ALTER DATABASE MOUNT;
```

In this example, *original\_cf\_name* is a control file name in the initialization parameter file before migration.

9. Migrate the data files to the OMS copy using RMAN SWITCH DATABASE.

```
SWITCH DATABASE TO COPY;
RUN
```



```
{
ALLOCATE CHANNEL dev1 DEVICE TYPE DISK;
ALLOCATE CHANNEL dev2 DEVICE TYPE DISK;
ALLOCATE CHANNEL dev3 DEVICE TYPE DISK;
ALLOCATE CHANNEL dev4 DEVICE TYPE DISK;
RECOVER DATABASE;
}
```

**10.** Enable change tracking or Flashback Database, if the database uses these features.

```
SQL> ALTER DATABASE ENABLE BLOCK CHANGE TRACKING USING FILE
'oms_mount_path';
SQL> ALTER DATABASE FLASHBACK ON;
```

- **11**. Place the database in its normal operation mode to use OMS.
  - If the database is a primary database, then open it using:

SQL> ALTER DATABASE OPEN;

If the database is a standby database, then resume managed recovery mode:

SQL> ALTER DATABASE RECOVER MANAGED STANDBY DATABASE;

**12.** If you want to migrate any tempfiles to OMS, then drop the existing tempfiles and add a new temp file in the OMS mount path.

SQL> ALTER DATABASE TEMPFILE 'tempfile\_name' DROP; SQL> ALTER TABLESPACE temp tbs name ADD TEMPFILE;

In this example, the name of the tempfile in the original storage is *tempfile\_name*. The name of the temporary tablespace is *temp\_tbs\_name*.

To migrate online redo logs to the OMS location, see Adding Redo Log Files to OMS

# Configuring Storage for Oracle Grid Infrastructure for a Standalone Server

Complete these procedures to use Oracle Grid Infrastructure for a standalone server, which includes Oracle Automatic Storage Management (Oracle ASM).

Oracle Grid Infrastructure for a standalone server, also known as Oracle Restart, provides system support for a single-instance Oracle Database. Oracle ASM is a volume manager and a file system for Oracle database files that supports single-instance Oracle Database and Oracle Real Application Clusters (Oracle RAC) configurations. Oracle Automatic Storage Management also supports a general purpose file system for your application needs, including Oracle Database binaries. Oracle Automatic Storage Management is Oracle's recommended storage management solution. It provides an alternative to conventional volume managers and file systems.

### Note:

- If you want to use Oracle ASM or Oracle Restart, then you must install Oracle Grid Infrastructure for a standalone server before you install and create the database. Otherwise, you must manually register the database with Oracle Restart.
- You can neither install Oracle Restart on an Oracle Grid Infrastructure cluster member node, nor add an Oracle Restart server to an Oracle Grid Infrastructure cluster member node. Oracle Restart supports single-instance databases on one server, while Oracle Grid Infrastructure for a Cluster supports single-instance or Oracle RAC databases on a cluster.
- Configuring Storage for Oracle Automatic Storage Management Identify storage requirements and Oracle ASM disk group options.
- Configuring Storage Device Path Persistence Using Oracle ASMLIB To use Oracle ASMLIB to configure Oracle ASM devices, complete the following tasks:
- Migrating from Oracle ASM Filter Driver to Oracle ASMLib for Oracle Restart Oracle ASMFD is deprecated and Oracle ASM filtering is disabled starting with kernel version 5.14. To avail the filtering functionality, migrate from Oracle ASMFD to Oracle ASMLIB 3.1 in rolling mode.
- Deconfiguring Oracle ASM Filter Driver
   If Oracle ASM Filter Driver (Oracle ASMFD) is installed but you do not use it for device path persistence, then deconfigure Oracle ASMFD.
- Creating DAS or SAN Disk Partitions for Oracle Automatic Storage Management You can use direct-attached storage (DAS) and storage area network (SAN) disks with Oracle ASM.
- Creating Directories for Oracle Database Files You can store Oracle Database and recovery files on a separate file system from the configuration files.



• Creating Files on a NAS Device for Use with Oracle Automatic Storage Management If you have a certified NAS storage device, then you can create zero-padded files in an NFS mounted directory and use those files as disk devices in an Oracle ASM disk group.

# Configuring Storage for Oracle Automatic Storage Management

Identify storage requirements and Oracle ASM disk group options.

### Note:

Oracle ASM Filter Driver (ASMFD) is deprecated on both Linux and Oracle Solaris beginning with Oracle Database 19c. It will be desupported in a future release. On Linux systems running kernel 5.14 or higher (including Oracle Linux, RedHat Enterprise Linux, and SUSE Linux Enterprise Server), ASMFD filtering is already disabled and will not be supported going forward. Oracle recommends moving to ASMlib v3 for those environments, as it provides equivalent functionality. For details, see My Oracle Support Note Document 2806979.1. Migration steps are available. On Oracle Solaris, ASMFD is deprecated, but remains fully supported. No immediate action is required until a formal desupport notice is issued.

- Identifying Storage Requirements for Oracle Automatic Storage Management To identify the storage requirements for using Oracle ASM, you must determine the number of devices and the amount of free disk space that you require.
- Oracle ASM Disk Space Requirements
   Determine the total amount of Oracle Automatic Storage Management (Oracle ASM) disk
   space that you require for the database files and recovery files.
- ASM Disk Group Options for Installation
   Plan how you want to configure Oracle ASM disk groups for deployment.
- Using an Existing Oracle ASM Disk Group
  Use Oracle Enterprise Manager Cloud Control or the Oracle ASM command line tool
  (asmcmd) to identify existing disk groups, and to determine if sufficient space is available in
  the disk group.

### **Related Topics**

- Migrating from Oracle ASM Filter Driver to Oracle ASMLib
- Oracle Automatic Storage Management Filter Driver (ASMFD) (Doc ID 2806979.1)
- Oracle Automatic Storage Management Administrator's Guide

# Identifying Storage Requirements for Oracle Automatic Storage Management

To identify the storage requirements for using Oracle ASM, you must determine the number of devices and the amount of free disk space that you require.

To complete this task, perform the following steps:

1. Determine whether you want to use Oracle ASM for Oracle Database files, recovery files, or both. Oracle Database files include data files, control files, redo log files, the server parameter file, and the password file.



During the database installation, you have the option to select either a file system or Oracle ASM as the storage mechanism for Oracle Database files. Similarly, you also have the option to select either a file system or Oracle ASM as the storage mechanism for your recovery files.

### Note:

You do not have to use the same storage mechanism for both Oracle Database files and recovery files. You can use a file system for one file type and Oracle ASM for the other.

If you select Oracle ASM as your storage option for Oracle Database files, then depending on your choice in the Specify Recovery Options screen, you have the following recovery options:

- If you select the Oracle ASM option for your recovery files, then Oracle Universal Installer provides you with only the option to use the same disk group for both Oracle Database files and recovery files.
- If you decide not to enable recovery during the database installation, then, after the database installation, you can modify the DB\_RECOVERY\_FILE\_DEST parameter to enable the fast recovery area.
- 2. Choose the Oracle ASM redundancy level to use for each Oracle ASM disk group that you create.

The redundancy level that you choose for the Oracle ASM disk group determines how Oracle ASM mirrors files in the disk group and determines the number of disks and amount of disk space that you require, as follows:

### External redundancy

This option does not allow Oracle ASM to mirror the contents of the disk group. Oracle recommends that you select this redundancy level either when the disk group contains devices, such as RAID devices, that provide their own data protection or when the database does not require uninterrupted access to data.

### Normal redundancy

To optimize performance and reliability in a normal redundancy disk group, Oracle ASM uses two-way mirroring for data files and three-way mirroring for control files, by default. In addition, you can choose the mirroring characteristics for individual files in a disk group.

A normal redundancy disk group requires a minimum of two failure groups (or two disk devices) if you are using two-way mirroring. The effective disk space in a normal redundancy disk group is half the sum of the disk space of all of its devices.

For most installations, Oracle recommends that you use normal redundancy disk groups. On Oracle Exadata, Oracle recommends that you use high redundancy disk groups for added protection against failure.

### High redundancy

The contents of the disk group are three-way mirrored by default. To create a disk group with high redundancy, you must specify at least three failure groups (a minimum of three devices).

Although high-redundancy disk groups provide a high level of data protection, you must consider the higher cost of additional storage devices before deciding to use this redundancy level.

### Flex redundancy

A flex redundancy disk group is a new disk group type with features such as flexible file redundancy, mirror splitting, and redundancy change. A flex disk group can consolidate files with different redundancy requirements into a single disk group. It also provides the capability for databases to change the redundancy of its files.

For database data, you can choose no mirroring (unprotected), two-way mirroring (mirrored), or three-way mirroring (high). A flex redundancy disk group requires a minimum of three disk devices (or three failure groups).

### Extended redundancy

Extended redundancy disk group has features similar to the flex redundancy disk group. Extended redundancy is available when you configure an Oracle Extended Cluster. Extended redundancy extends Oracle ASM data protection to cover failure of sites by placing enough copies of data in different failure groups of each site.

3. Determine the total amount of disk space that you require for the database files and recovery files.

If an Oracle ASM instance is running on the system, then you can use an existing disk group to meet these storage requirements. If necessary, you can add disks to an existing disk group during the database installation.

See, "Oracle ASM Disk Space Requirements" in *Oracle Database Installation Guide* for the Oracle ASM disk space requirements.

### Note:

• The disk devices must be owned by the user performing the grid installation.

Check with your system administrator to determine if the disks used by Oracle ASM are mirrored at the storage level. If so, select External for the redundancy. If the disks are not mirrored at the storage level, then select Normal for the redundancy.

- Every Oracle ASM disk is divided into allocation units (AU). An allocation unit is the fundamental unit of allocation within a disk group. You can select the AU Size value from 1, 2, 4, 8, 16, 32 or 64 MB, depending on the specific disk group compatibility level. The default value is 4 MB for flex disk group and 1 MB for all other disk group types. On engineered systems, the default value is 4 MB.
- 4. Optionally, identify failure groups for the Oracle ASM disk group devices.

If you intend to use a normal, high or flex redundancy disk group, then you can further protect your database against hardware failure by associating a set of disk devices in a custom failure group. By default, each device comprises its own failure group. However, if two disk devices in a normal redundancy disk group are attached to the same Host Bus Adapter (HBA), then the disk group becomes unavailable if the controller fails. The controller in this example is a single point of failure.

To protect against failures of this type, use two HBAs, each with two disks, and define a failure group for the disks attached to each controller. This configuration enables the disk group to tolerate the failure of one HBA.



Consider the following guidelines while defining custom failure groups:

- You can specify custom failure groups in the **Create ASM Disk Group** screen during an Oracle Grid Infrastructure installation.
- You can also define custom failure groups after installation, using the GUI tool ASMCA, the command line tool asmcmd, or SQL commands.
- If you define custom failure groups, then for failure groups containing database files only, you must specify a minimum of two failure groups for normal redundancy disk groups and three failure groups for high redundancy disk groups.
- 5. If you are sure that a suitable disk group does not exist on the system, then install or identify appropriate disk devices to add to a new disk group.

Use the following guidelines when identifying appropriate disk devices:

- The disk devices must be owned by the user performing the Oracle Grid Infrastructure installation.
- All the devices in an Oracle ASM disk group must be the same size and have the same performance characteristics.
- Do not specify multiple partitions on a single physical disk as a disk group device. Oracle ASM expects each disk group device to be on a separate physical disk.
- Although you can specify a logical volume as a device in an Oracle ASM disk group, Oracle does not recommend their use because it adds a layer of complexity that is unnecessary with Oracle ASM. Oracle recommends that if you choose to use a logical volume manager, then use the logical volume manager to represent a single logical unit number (LUN) without striping or mirroring, so that you can minimize the effect on storage performance of the additional storage layer.

### **Related Topics**

- Oracle ASM Disk Space Requirements
   Determine the total amount of Oracle Automatic Storage Management (Oracle ASM) disk
   space that you require for the database files and recovery files.
- Oracle Automatic Storage Management Administrator's Guide

### Oracle ASM Disk Space Requirements

Determine the total amount of Oracle Automatic Storage Management (Oracle ASM) disk space that you require for the database files and recovery files.

# Table 9-1Oracle ASM Disk Number and Minimum Space Requirements for an Oracledatabase (non-CDB)

Redundancy Level	Minimum Number of Disks	Data Files	Recovery Files	Both File Types
External	1	2.5 GB	7.5 GB	10 GB
Normal or Flex with two-way mirroring	2	5.2 GB	15.6 GB	20.8 GB
High or Flex with three-way mirroring	3	7.6 GB	22.8 GB	30.4 GB



Redundancy Level	Minimum Number of Disks	Data Files	Recovery Files	Both File Types
External	1	4 GB	12 GB	16 GB
Normal or Flex with two-way mirroring	2	8 GB	24 GB	32 GB
High or Flex with three-way mirroring	3	12 GB	36 GB	48 GB

# Table 9-2Oracle ASM Disk Number and Minimum Space Requirements for amultitenant container database (CDB) with one pluggable database (PDB)

### Note:

- If an Oracle ASM instance is running on the system, then you can use an existing disk group to meet these storage requirements. If necessary, you can add disks to an existing disk group during the database installation.
- The disk devices must be owned by the user performing the grid installation.

Check with your system administrator to determine if the disks used by Oracle ASM are mirrored at the storage level. If so, select External for the redundancy. If the disks are not mirrored at the storage level, then select Normal for the redundancy.

• Every Oracle ASM disk is divided into allocation units (AU). An allocation unit is the fundamental unit of allocation within a disk group. You can select the AU Size value from 1, 2, 4, 8, 16, 32 or 64 MB, depending on the specific disk group compatibility level. The default value is 4 MB for flex disk group and 1 MB for all other disk group types. On engineered systems, the default value is 4 MB.

# ASM Disk Group Options for Installation

Plan how you want to configure Oracle ASM disk groups for deployment.

During Oracle Grid Infrastructure installation, you can create one Oracle ASM disk group. After the Oracle Grid Infrastructure installation, you can create additional disk groups using Oracle Automatic Storage Management Configuration Assistant (Oracle ASMCA), SQL\*Plus, or Automatic Storage Management Command-Line Utility (ASMCMD).

### **Related Topics**

Oracle Automatic Storage Management Administrator's Guide

# Using an Existing Oracle ASM Disk Group

Use Oracle Enterprise Manager Cloud Control or the Oracle ASM command line tool (asmcmd) to identify existing disk groups, and to determine if sufficient space is available in the disk group.



1. Connect to the Oracle ASM instance and start the instance if necessary:

```
$ $ORACLE_HOME/bin/asmcmd
ASMCMD> startup
```

2. Enter one of the following commands to view the existing disk groups, their redundancy level, and the amount of free disk space in each one:

ASMCMD> lsdg

or

```
$ORACLE HOME/bin/asmcmd -p lsdg
```

The lsdg command lists information about mounted disk groups only.

- 3. From the output, identify a disk group with the appropriate redundancy level and note the free space that it contains.
- 4. If necessary, install or identify the additional disk devices required to meet the storage requirements for your installation.

### Note:

If you are adding devices to an existing disk group, then Oracle recommends that you use devices that have the same size and performance characteristics as the existing devices in that disk group.

# Configuring Storage Device Path Persistence Using Oracle ASMLIB

To use Oracle ASMLIB to configure Oracle ASM devices, complete the following tasks:

### Note:

To create a database during the installation using the Oracle ASM library driver, you must choose an installation method that runs ASMCA in interactive mode. You must also change the disk discovery string to ORCL:\*.

Oracle ASMLIB is not supported on IBM:Linux on System z and Linux for Arm (aarch64).

- About Oracle ASM with Oracle ASMLIB
   Oracle ASMLIB maintains permissions and disk labels that are persistent on the storage device, so that the label is available even after an operating system upgrade.
- Installing and Configuring Oracle ASMLIB Software Review this information to install and configure the Oracle Automatic Storage Management library driver software manually.



- Configuring Disk Devices to Use Oracle ASMLIB Configure disk devices to use in an Oracle Automatic Storage Management disk group.
- Administering Oracle ASMLIB and Disks Review this information to administer the Oracle Automatic Storage Management library driver and disks.
- Deinstalling Oracle ASMLIB On Oracle Database
   If Oracle ASM library driver (Oracle ASMLIB) is installed but you do not use it for device path persistence, then deinstall Oracle ASMLIB:

### About Oracle ASM with Oracle ASMLIB

Oracle ASMLIB maintains permissions and disk labels that are persistent on the storage device, so that the label is available even after an operating system upgrade.

The Oracle Automatic Storage Management library driver simplifies the configuration and management of block disk devices by eliminating the need to rebind block disk devices used with Oracle Automatic Storage Management (Oracle ASM) each time the system is restarted.

With Oracle ASMLIB, you define the range of disks you want to have made available as Oracle ASM disks. Oracle ASMLIB maintains permissions and disk labels that are persistent on the storage device, so that the label is available even after an operating system upgrade.

### Note:

If you configure disks using Oracle ASMLIB, then you must change the disk discovery string to ORCL:\*. If the diskstring is set to ORCL:\*, or is left empty (""), then the installer discovers these disks.

## Installing and Configuring Oracle ASMLIB Software

Review this information to install and configure the Oracle Automatic Storage Management library driver software manually.

Oracle ASMLIB is included with the Oracle Linux packages, and with SUSE Linux Enterprise Server. If you are a member of the Unbreakable Linux Network, then you can install the Oracle ASMLIB RPMs by subscribing to the Oracle Linux channel, and using yum to retrieve the most current package for your system and kernel. For additional information, see the following URL:

http://www.oracle.com/technetwork/topics/linux/asmlib/index-101839.html

### Note:

- You must install Oracle ASMLib v3 (oracleasmlib-3.0.0 or later and oracleasm-support-3.0.0 or later) on all Oracle Database servers with Oracle Linux 8 and later kernels.
- You must install Oracle ASMLib v2 (oracleasmlib-2.0.17 or later and oracleasm-support-2.1.3 or later) on all Oracle Database servers with Oracle Linux 7 and earlier kernels
- You can also use  ${\tt dnf}$  instead of  ${\tt yum}.$  For more information, see Comparing Yum Version with DNF
- **1.** Enter the following command to determine the kernel version and architecture of the system:

```
# uname -rm
```

2. Depending on your operating system version, download the required Oracle Automatic Storage Management library driver packages and driver:

http://www.oracle.com/technetwork/server-storage/linux/asmlib/index-101839.html

See Also:

My Oracle Support note 1089399.1 for information about Oracle ASMLIB support with Red Hat distributions:

https://support.oracle.com/rs?type=doc&id=1089399.1

3. Switch to the root user:

```
$ su -
```

4. Depending on your operating system, you must install the oracleasmlib and oracleasmsupport packages for all Oracle ASMLIB installations.

### Note:

- For Oracle Linux 9.2 UEK7, additionally also install the libbpf and libbpf-devel packages.
- Oracle Unbreakable Enterprise Kernel includes driver module, so you do not need to install kmod-oracleasm.

**Method 1 (recommended):** If you have subscribed to Unbreakable Linux Network (ULN), then you can install the Oracle Automatic Storage Management library driver packages using a single yum command.



#### For Unbreakable Enterprise Kernel

```
# yum install oracleasm-support
# yum install oracleasmlib
# yum install libbpf
# yum install libbpf-devel
```

### For Red Hat Compatible Kernel

```
# yum install oracleasm-support
# yum install oracleasmlib
```

**Method 2:** Alternatively, download the Oracle Automatic Storage Management library driver packages as described in Step 2 and run the following rpm -ivh commands to install the packages in sequence.

For Unbreakable Enterprise Kernel

# rpm -ivh oracleasm-support-version.arch.rpm
# rpm -ivh oracleasmlib-version.arch.rpm
# rpm -ivh libbpf-version.arch.rpm
# rpm -ivh libbpf-devel-version.arch.rpm

For Red Hat Compatible Kernel

```
# rpm -ivh oracleasm-support-version.arch.rpm
# rpm -ivh oracleasmlib-version.arch.rpm
```

Where *version* is the version of the Oracle Automatic Storage Management library driver, *arch* is the system architecture, and *kernel* is the version of the kernel that you are using.

For example, if you are using Oracle Linux 9 on an x86\_64 system, then enter a command similar to the following:

 For SUSE Linux Enterprise Server 15, install the latest oracleasmlib and oracleasmsupport RPM from:

https://www.oracle.com/linux/downloads/linux-asmlib-sles15-downloads.html



ASMLib v3 is not supported for SUSE Linux Enterprise Server.

Install the latest oracleasm driver module from the refreshed SUSE Linux Enterprise Server repository. The package name is oracleasm-kmp-default. For example, oracleasm-kmp-default-2.0.8 k5.14.21 150500.55.36-150500.7.3.1.x86 64



6. Enter the following command to run the oracleasm initialization script with the configure option:

# /usr/sbin/oracleasm configure -i

### Note:

The oracleasm command in /usr/sbin is the command you should use. The /etc/init.d path is not deprecated, but the oracleasm binary in that path is now used typically for internal commands.

7. Enter the following information in response to the prompts that the script displays:

Prompt	Suggested Response
Default user to own the driver interface:	Standard groups and users configuration: Specify the Oracle software owner user (for example, oracle)
	Job role separation groups and users configuration: Specify the Grid Infrastructure software owner (for example, grid)
Default group to own the driver interface:	Standard groups and users configuration: Specify the OSDBA group for the database (for example, dba).
	Job role separation groups and users configuration: Specify the OSASM group for storage administration (for example, asmadmin).
Start Oracle ASM Library driver on boot (y/n):	Enter $\underline{y}$ to start the Oracle Automatic Storage Management library driver when the system starts.
Scan for Oracle ASM disks on boot (y/n)	Enter $\underline{y}$ to scan for Oracle ASM disks when the system starts.

The script completes the following tasks:

- Creates the /etc/sysconfig/oracleasm configuration file
- Mounts the ASMLIB driver file system

### Note:

The Oracle ASMLIB file system is not a regular file system. It is used only by the Oracle ASM library to communicate with the Oracle ASMLIB.

8. Enter the following command to enable the Oracle ASMLIB file system:

# systemctl enable oracleasm

- 9. Enter the following command to start the Oracle ASMLIB file system:
  - # systemctl start oracleasm



# Configuring Disk Devices to Use Oracle ASMLIB

Configure disk devices to use in an Oracle Automatic Storage Management disk group.

To configure the disk devices to use in an Oracle Automatic Storage Management disk group, perform the following steps:

- 1. If you intend to use IDE, SCSI, or RAID devices in the Oracle Automatic Storage Management disk group, then perform the following steps:
  - a. Install or configure the disk devices that you intend to use for the disk group and restart the system.
  - **b.** Enter the following command to identify the device name for the disks to use:

# /sbin/fdisk -1

Depending on the type of disk, the device name can vary.

Disk Type	Device Name Format	Description
IDE disk	/dev/hd <i>xn</i>	In this example, x is a letter that identifies the IDE disk, and n is the partition number. For example, $/dev/hda$ is the first disk on the first IDE bus.
SCSI disk	/dev/sd <i>xn</i>	In this example, x is a letter that identifies the IDE disk, and n is the partition number. For example, $/dev/hda$ is the first disk on the first IDE bus.
RAID disk	/dev/rd/c <i>x</i> d <i>y</i> p <i>z</i> /dev/ida/c <i>x</i> d <i>y</i> p <i>z</i>	Depending on the RAID controller, RAID devices can have different device names. In the examples shown, $x$ is a number that identifies the controller, $y$ is a number that identifies the disk, and $z$ is a number that identifies the partition. For example, /dev/ida/c0d1 is the second logical drive on the first controller.

Table 9-3 Device Name Formats Based on Disk Type

To include devices in a disk group, you can specify either whole-drive device names or partition device names.

### Note:

Oracle recommends that you create a single whole-disk partition on each disk to use.

- c. Use either fdisk or parted to create a single whole-disk partition on the disk devices.
- 2. Enter a command similar to the following to mark a disk as an Oracle Automatic Storage Management disk:
  - # /usr/sbin/oracleasm createdisk DISK1 /dev/sdb1

In this example, DISK1 is a name assigned to the disk.

### Note:

- The disk names you specify can contain uppercase letters, numbers, and the underscore character. They must start with an uppercase letter.
- To create a database during the installation using the Oracle Automatic Storage Management library driver, you must change the disk discovery string to ORCL:\*.
- If you are using a multi-pathing disk driver with Oracle ASM, then make sure that you specify the correct logical device name for the disk.
- 3. To make the disk available on the other nodes in the cluster, enter the following command as root on each node:

# /usr/sbin/oracleasm scandisks

This command identifies shared disks attached to the node that are marked as Oracle ASM disks.

# Administering Oracle ASMLIB and Disks

Review this information to administer the Oracle Automatic Storage Management library driver and disks.

To administer the Oracle Automatic Storage Management library driver and disks, use the /usr/sbin/oracleasm initialization script with different options, as described in the following table:

#### Table 9-4 Disk Management Tasks Using ORACLEASM

Task	Command Example	Description
Configure or reconfigure ASMLIB	oracleasm configure -i	Use the configure option to reconfigure the Oracle Automatic Storage Management library driver, if necessary.
		<b>To see command options, enter</b> oracleasm configure <b>without the -</b> i <b>flag</b> .
Change system restart load	oracleasm configure -e	Options are -e to enable and -d to disable.
options for ASMLIB		Use the $-e$ and $-d$ options to change the actions of the Oracle Automatic Storage Management library driver when the system starts. The $-e$ option causes the Oracle Automatic Storage Management library driver to load when the system starts.

Task	Command Example	Description
Load or unload ASMLIB	oracleasm init	Options are init to load and exit to unload.
without restarting the system		Use the init and exit options to load or unload the Oracle Automatic Storage Management library driver without restarting the system.
Mark a disk for use with ASMLIB	oracleasm createdisk VOL1 /dev/sda1	Use the createdisk option to mark a disk device for use with the Oracle Automatic Storage Management library driver and give it a name, where <i>labelname</i> is the name you want to use to mark the device, and <i>devicepath</i> is the path to the device:
		oracleasm createdisk labelname devicepath
Unmark a named disk device	oracleasm deletedisk VOL1	Use the deletedisk option to unmark a named disk device, where <i>diskname</i> is the name of the disk:
		oracleasm deletedisk diskname
		<b>Caution:</b> Do not use this command to unmark disks that are being used by an Oracle Automatic Storage Management disk group. You must delete the disk from the Oracle Automatic Storage Management disk group before you unmark it.
Determine if ASMLIB is using a disk device	oracleasm querydisk	Use the querydisk option to determine if a disk device or disk name is being used by the Oracle Automatic Storage Management library driver, where diskname_devicename is the name of the disk or device that you want to query:
		oracleasm querydisk diskname_devicename
List Oracle ASMLIB disks	oracleasm listdisks	Use the listdisks option to list the disk names of marked Oracle ASM library driver disks.
Identify disks marked as ASMLIB disks	oracleasm scandisks	Use the scandisks option to enable cluster nodes to identify which shared disks have been marked as ASMLIB disks on another node.
Rename ASMLIB disks	oracleasm renamedisk VOL1 VOL2	Use the renamedisk option to change the label of an Oracle ASM library driver disk or device by using the following syntax, where <i>manager</i> specifies the manager device, <i>label_device</i> specifies the disk you intend to rename, as specified either by OracleASM label name or by the device path, and <i>new_label</i> specifies the new label you want to use for the disk:
		oracleasm renamedisk [-l manager] [-v] label_device new_label
		Use the $-v$ flag to provide a verbose output for debugging.
		<b>Caution:</b> You must ensure that all Oracle Database and Oracle ASM instances have ceased using the disk before you relabel the disk. If you do not do this, then you may lose data.

### Table 9-4 (Cont.) Disk Management Tasks Using ORACLEASM



## Deinstalling Oracle ASMLIB On Oracle Database

If Oracle ASM library driver (Oracle ASMLIB) is installed but you do not use it for device path persistence, then deinstall Oracle ASMLIB:

- 1. Log in as root.
- 2. Stop Oracle ASM and any running database instance:

```
# srvctl stop database
```

- # srvctl stop asm
- 3. Stop the Oracle Restart stack:
  - # cd Grid home/bin
  - # crsctl stop has

Where, *Grid\_home* is the Oracle Grid Infrastructure home directory path.

- 4. Unload Oracle ASMLIB without restarting the system.
  - # /usr/sbin/oracleasm exit
- 5. Stop Oracle ASMLIB:
  - # /usr/sbin/oracleasm configure -d
- 6. Remove the oracleasm library and tools RPMs:
  - # rpm -e oracleasm-support
  - # rpm -e oracleasmlib
- 7. Check if any oracleasm RPMs are remaining:
  - # rpm -qa| grep oracleasm
- 8. If any oracleasm configuration files are remaining, remove them:

# rpm -qa| grep oracleasm | xargs rpm -e

Oracle ASMLIB and associated RPMs are now removed.

Start the Oracle Restart stack.



# Migrating from Oracle ASM Filter Driver to Oracle ASMLib for Oracle Restart

Oracle ASMFD is deprecated and Oracle ASM filtering is disabled starting with kernel version 5.14. To avail the filtering functionality, migrate from Oracle ASMFD to Oracle ASMLIB 3.1 in rolling mode.

### Prerequisites

- If Oracle ASM Filter Driver (Oracle ASMFD) is installed and configured for an existing Oracle ASM installation, then you must explicitly disable Oracle ASMFD filtering before installing and configuring Oracle ASMLib.
- These steps apply to Oracle Linux 8 or later version servers that are running UEK6 or kernel version 5.4.17-2136.342.1 or later.
- **1**. Confirm if Oracle ASMFD is configured and running.

```
# asmcmd lsdsk
Path
AFD:DATA1
AFD:DATA2
```

The AFD in the results indicate that the disks are configured using Oracle ASMFD.

- 2. Apply the one-off patches for the following bugs:
  - a. 37347369
  - b. 37214236
  - **c.** 37230154
  - **d.** 37405185
- 3. Shut down the Oracle Restart stack.

```
# crsctl stop has
```

4. Depending on your operating system, install the latest versions (3.1.x or later) of the oracleasmlib and oracleasm-support packages.

```
# rpm -ihv oracleasm-support-3.1.x.rpm
# rpm -ihv oracleasmlib-3.1.x.rpm
```

### Note:

Oracle Unbreakable Enterprise Kernel (UEK) includes driver module, so you do not need to install kmod-oracleasm. For more information about installing the Oracle ASMLib packages, refer to *Installing and Configuring Oracle ASMLib v3*.



5. Run the Oracle ASM initialization script and configure Oracle ASMLib.

```
# /etc/init.d/oracleasm init
# /etc/init.d/oracleasm configure -i
```

6. Scan for Oracle ASM labeled disks using the following command as root.

# /etc/init.d/oracleasm scandisks

- 7. List the Oracle ASMLib disks.
  - # /etc/init.d/oracleasm listdisks
- 8. Verify the status of the Oracle ASMLib disks.

# /etc/init.d/oracleasm status

- 9. Disable Oracle ASMFD filtering.
  - # \$ORACLE HOME/bin/asmcmd afd filter -d
- 10. Start the Oracle Restart stack.

```
# crsctl start has
```

11. Confirm if Oracle ASMLib is configured and running.

```
# asmcmd lsdsk
Path
ORCL:DATA1
ORCL:DATA2
```

The ORCL in the results indicate that the disks are configured using Oracle ASMLib.

#### **Related Topics**

- Installing and Configuring Oracle ASMLIB Software Review this information to install and configure the Oracle Automatic Storage Management library driver software manually.
- Deconfiguring Oracle ASM Filter Driver
   If Oracle ASM Filter Driver (Oracle ASMFD) is installed but you do not use it for device path persistence, then deconfigure Oracle ASMFD.

# Deconfiguring Oracle ASM Filter Driver

If Oracle ASM Filter Driver (Oracle ASMFD) is installed but you do not use it for device path persistence, then deconfigure Oracle ASMFD.

- 1. Log in as root.
- 2. Set the environment variable <code>\$ORACLE\_BASE</code> to a temporary location.

```
# export ORACLE BASE=/tmp
```



3. Shut down the Oracle Restart stack.

# crsctl stop has

4. Stop Oracle ACFS kernel modules.

# \$ORACLE HOME/bin/acfsload stop

- 5. Deconfigure Oracle ASMFD filtering.
  - # \$ORACLE\_HOME/bin/asmcmd afd\_deconfigure
- 6. Start Oracle ACFS kernel modules.
  - # \$ORACLE HOME/bin/acfsload start

### Note:

This step is required even if you do not use Oracle ACFS.

7. Start the Oracle Restart stack.

# crsctl start has

# Creating DAS or SAN Disk Partitions for Oracle Automatic Storage Management

You can use direct-attached storage (DAS) and storage area network (SAN) disks with Oracle ASM.

To use a DAS or SAN disk in Oracle ASM, Oracle recommends that the disk have a partition table. Oracle recommends creating exactly one partition for each disk.

# Creating Directories for Oracle Database Files

You can store Oracle Database and recovery files on a separate file system from the configuration files.

Perform this procedure to place the Oracle Database or recovery files on a separate file system from the Oracle base directory:

1. Use the following command to determine the free disk space on each mounted file system:

# df -h

2. Identify the file systems to use, from the display:

Option	Description	
Database Files	Select one of the following:	
	<ul> <li>A single file system with at least 1.5 GB of free disk space</li> </ul>	
	<ul> <li>Two or more file systems with at least 3.5 GB of free disk space in total</li> </ul>	
Recovery Files	Choose a file system with at least 2 GB of free disk space	

If you are using the same file system for multiple file types, then add the disk space requirements for each type to determine the total disk space requirement.

- 3. Note the names of the mount point directories for the file systems that you identified.
- 4. If the user performing installation has permissions to create directories on the disks where you plan to install Oracle Database, then Oracle DBCA creates the Oracle Database file directory, and the Recovery file directory. If the user performing installation does not have write access, then you must create these directories manually.

For example, given the user oracle and Oracle Inventory Group oinstall, and using the paths /u03/oradata/wrk\_area for Oracle Database files, and /u01/oradata/ rcv\_area for the recovery area, these commands create the recommended subdirectories in each of the mount point directories and set the appropriate owner, group, and permissions on them:

Database file directory:

```
# mkdir -p /u01/oradata/
# chown oracle:oinstall /u01/oradata/
# chmod 775 /u01/oradata
```

The default location for the database file directory is <code>\$ORACLE BASE/oradata</code>.

- Recovery file directory (fast recovery area):
  - # mkdir -p /u01/oradata/rcv\_area
    # chown oracle:oinstall /u01/oradata/rcv area
  - # chmod 775 /u01/oradata/rcv area

The default fast recovery area is \$ORACLE BASE/fast recovery area.

Oracle recommends that you keep the fast recovery area on a separate physical disk than that of the database file directory. This method enables you to use the fast recovery area to retrieve data if the disk containing oradata is unusable for any reason.

# Creating Files on a NAS Device for Use with Oracle Automatic Storage Management

If you have a certified NAS storage device, then you can create zero-padded files in an NFS mounted directory and use those files as disk devices in an Oracle ASM disk group.

Ensure that you specify the ASM discovery path for Oracle ASM disks.

During installation of Oracle Grid Infrastructure, Oracle Universal Installer (OUI) can create files in the NFS mounted directory you specify. The following procedure explains how to



manually create files in an NFS mounted directory to use as disk devices in an Oracle ASM disk group:

- 1. If necessary, create an exported directory for the disk group files on the NAS device.
- 2. Switch user to root.
- 3. Create a mount point directory on the local system.

For example:

# mkdir -p /mnt/oracleasm

- 4. To ensure that the NFS file system is mounted when the system restarts, add an entry for the file system in the mount file /etc/fstab.
- 5. Enter a command similar to the following to mount the NFS on the local system:

# mount /mnt/oracleasm

Choose a name for the disk group to create, and create a directory for the files on the NFS file system, using the disk group name as the directory name.

For example, if you want to set up a disk group for a sales database:

```
# mkdir /mnt/oracleasm/sales1
```

 Use commands similar to the following to create the required number of zero-padded files in this directory:

```
# dd if=/dev/zero
of=/mnt/oracleasm/sales1/disk1 bs=1024k
count=1000
```

This example creates 1 GB files on the NFS file system. You must create one, two, or three files respectively to create an external, normal, or high redundancy disk group.

### Note:

Creating multiple zero-padded files on the same NAS device does not guard against NAS failure. Instead, create one file for each NAS device and mirror them using the Oracle ASM technology.

8. Enter commands similar to the following to change the owner, group, and permissions on the directory and files that you created:

# chown -R grid:asmadmin /mnt/oracleasm

# chmod -R 660 /mnt/oracleasm

In this example, the installation owner is grid and the OSASM group is asmadmin.

**9.** During Oracle Database installations, edit the Oracle ASM disk discovery string to specify a regular expression that matches the file names you created.



### For example:

```
/mnt/oracleasm/sales1/
```

### **Related Topics**

• My Oracle Support Note 359515.1

# 10

# Installing and Configuring Oracle Grid Infrastructure for a Standalone Server

Oracle Grid Infrastructure for a standalone server includes Oracle Restart and Oracle Automatic Storage Management.

If you install Oracle Grid Infrastructure for a standalone server and then create your database, then the database is automatically added to the Oracle Restart configuration. Oracle Restart automatically restarts the database when required.

If you install Oracle Grid Infrastructure for a standalone server on a host computer on which a database already exists, then you must manually add the database, the listener, the Oracle ASM instance, and other components to the Oracle Restart configuration before you are able to configure automatic database restarts.

### Note:

Oracle Grid Infrastructure for a standalone server can support multiple singleinstance databases on a single host computer.

- About Image-Based Oracle Grid Infrastructure Installation Installation and configuration of Oracle Grid Infrastructure software is simplified with image-based installation.
- Setup Wizard Installation Options for Creating Images Before you start the setup wizards for your Oracle Database or Oracle Grid Infrastructure installation, decide if you want to use any of the available image-creation options.
- Installing Oracle Grid Infrastructure for a Standalone Server with a New Database Installation
   Complete these stands to install Oracle Crid Infrastructure for a standalone server and

Complete these steps to install Oracle Grid Infrastructure for a standalone server and then create a database that is managed by Oracle Restart.

- Installing Oracle Grid Infrastructure for a Standalone Server for an Existing Database Follow the high-level instructions in this section to install Oracle Grid Infrastructure for a standalone server and configure it for an existing Oracle Database.
- Installing Oracle Grid Infrastructure for a Standalone Server Using a Software-Only Installation

A software-only installation only installs the Oracle Grid Infrastructure for a standalone server binaries at the specified location. You must complete a few manual configuration steps to enable Oracle Restart after you install the software.

- Testing the Oracle Automatic Storage Management Installation After installing Oracle Grid Infrastructure for a single instance, use the ASMCMD command-line utility to test the Oracle ASM installation.
- Relinking Oracle Restart and Oracle ASM Binaries Relink the Oracle Restart and Oracle ASM binaries every time you apply an operating system patch or after an operating system upgrade.



- Configuring Oracle ASM Disk Groups Manually using Oracle ASMCA
   After installing Oracle Grid Infrastructure for a standalone server, you can also use Oracle
   ASMCA to create and configure disk groups, Oracle ADVM, and Oracle ACFS.
- Enabling Oracle ACFS on Oracle Restart Configurations You must enable root access to use Oracle ACFS.
- Applying Patches During an Oracle Grid Infrastructure Installation or Upgrade Starting with Oracle Grid Infrastructure 18c, you can download and apply Release Updates (RUs) and one-off patches during an Oracle Grid Infrastructure installation or upgrade.
- Patching and Switching Oracle Grid Infrastructure Homes Perform an out-of-place Oracle Restart patching by switching from the current Oracle Grid Infrastructure home to a patched Oracle Grid Infrastructure home.

# About Image-Based Oracle Grid Infrastructure Installation

Installation and configuration of Oracle Grid Infrastructure software is simplified with imagebased installation.

To install Oracle Grid Infrastructure, create the new Grid home with the necessary user group permissions, and then extract the image file into the newly-created Grid home, and run the setup wizard to register the Oracle Grid Infrastructure product.

Using image-based installation, you can do the following:

- Configure Oracle Grid Infrastructure for a new cluster.
- Configure Oracle Grid Infrastructure for a standalone server (Oracle Restart).
- Upgrade Oracle Grid Infrastructure.
- Setup software only.
- Add or remove nodes from your existing cluster, if the Oracle Grid Infrastructure software is already installed or configured.

This installation feature streamlines the installation process and supports automation of largescale custom deployments. You can also use this installation method for deployment of customized images, after you patch the base-release software with the necessary Release Updates (RUs) or Release Update Revisions (RURs).

### Note:

You must extract the image software into the directory where you want your Grid home to be located, and then run the <code>ORACLE\_HOME\gridSetup.sh</code> script to start the Oracle Grid Infrastructure Setup Wizard. Ensure that the Grid home directory path you create is in compliance with the Oracle Optimal Flexible Architecture recommendations.

# Setup Wizard Installation Options for Creating Images

Before you start the setup wizards for your Oracle Database or Oracle Grid Infrastructure installation, decide if you want to use any of the available image-creation options.

In image-based installations, you can start your Oracle Database installation or Oracle Grid Infrastructure installations by running the setup wizards runInstaller and gridSetup.sh respectively. Both these wizards come with the following image-creation options.



# Option Description -createGoldImage Creates a gold image from the current Oracle home. -destinationLocation Specify the complete path, or location, where the gold image will be created. -exclFiles Specify the complete paths to the files to be excluded from the newly created gold image. -help Displays help for all the available options.

### Table 10-1 Image-Creation Options for Setup Wizard

### For example:

./runInstaller -createGoldImage -destinationLocation /tmp/my db images

./gridSetup.sh -createGoldImage -destinationLocation /tmp/my grid images

### Where:

/tmp/my db images is a temporary file location where the image zip file is created.

/tmp/my grid images is a temporary file location where the image zip file is created.

/u01/app/oracle/product/19.0.0/dbhome\_1/relnotes is the file to be excluded in the newly created gold image.

# Installing Oracle Grid Infrastructure for a Standalone Server with a New Database Installation

Complete these steps to install Oracle Grid Infrastructure for a standalone server and then create a database that is managed by Oracle Restart.

### Note:

Oracle ASM Filter Driver (ASMFD) is deprecated on both Linux and Oracle Solaris beginning with Oracle Database 19c. It will be desupported in a future release.

Install Oracle Grid Infrastructure for a standalone server, which installs Oracle Restart and Oracle ASM, and creates one disk group.

You should have your network information, storage information, and operating system users and groups available to you before you start the installation. You should also be prepared to run root scripts or provide information to automate root scripts.

1. Log in as the Oracle Restart software owner user (oracle).

2. If this is the first time you are installing Oracle software, then create the Oracle base and the Oracle inventory directories as per the Oracle Optimal Flexible Architecture (OFA) recommendations. Specify the correct owner, group, and permissions for these directories.

```
# mkdir -p /u01/app/oracle
# mkdir -p /u01/app/oraInventory
# chown -R oracle:oinstall /u01/app/oracle
# chown -R oracle:oinstall /u01/app/oraInventory
# chmod -R 775 /u01/app
```

3. Download the Oracle Grid Infrastructure for a standalone server installation image files, create the grid home directory, and extract the image files in this grid home directory.

### For example:

```
$ mkdir -p /u01/app/oracle/product/19.0.0/grid
$ cd /u01/app/oracle/product/19.0.0/grid
$ unzip -q /tmp/grid_home.zip
```

### Note:

- Ensure that the Grid home directory path you create is in compliance with the Oracle Optimal Flexible Architecture recommendations. Also, unzip the installation image files only in this Grid home directory that you created.
- Oracle home or Oracle base cannot be symlinks, nor can any of their parent directories, all the way to up to the root directory.
- 4. Log in as the Oracle Restart software owner user amd run gridSetup.sh to start the Oracle Grid Infrastructure setup wizard:

```
$ Grid home/gridSetup.sh
```

Where Grid\_home is the Oracle Grid Infrastructure home directory.

### Note:

You can use the gridSetup.sh command with the -applyRU and - applyOneOffs options to install Release Updates (RUs) and one-off patches during an Oracle Grid Infrastructure installation or upgrade.

- In the Select Configuration Option screen, select the Configure Oracle Grid Infrastructure for a Standalone Server (Oracle Restart) option to install and configure Oracle Restart and Oracle ASM. Click Next.
- 6. During installation, disk paths mounted on Oracle ASM and registered on Oracle ASMLib with the string ORCL:\* are listed as default database storage candidate disks.
- 7. Configure Oracle ASM as needed with additional disk groups.
  - The default Disk Group Name is DATA. You can enter a new name for the disk group, or use the default name.



- Any additional disk devices that you create must be owned by the user performing the grid installation.
- 8. Respond to the configuration prompts as needed to configure Oracle Grid Infrastructure. Click **Help** for information.
- 9. Provide information to automate root scripts, or run scripts as root when prompted by OUI.

If you configure automation for running root scripts, and a root script fails, then you can fix the problem manually, and click **Retry** to run the root script again.

 Start the Oracle Database installation, and select Oracle ASM disk groups for Oracle Database files storage. For assistance during installation, click Help on the Oracle Universal Installer page where you need more information.

### **Related Topics**

- Optimal Flexible Architecture Oracle Optimal Flexible Architecture (OFA) rules are a set of configuration guidelines created to ensure well-organized Oracle installations, which simplifies administration, support and maintenance.
- Deinstalling Oracle ASMLIB On Oracle Database
   If Oracle ASM library driver (Oracle ASMLIB) is installed but you do not use it for device path persistence, then deinstall Oracle ASMLIB:

### **Related Topics**

- Applying Patches During an Oracle Grid Infrastructure Installation or Upgrade Starting with Oracle Grid Infrastructure 18c, you can download and apply Release Updates (RUs) and one-off patches during an Oracle Grid Infrastructure installation or upgrade.
- Oracle Automatic Storage Management Administrator's Guide

# Installing Oracle Grid Infrastructure for a Standalone Server for an Existing Database

Follow the high-level instructions in this section to install Oracle Grid Infrastructure for a standalone server and configure it for an existing Oracle Database.

Oracle Restart can manage resources from the same release and releases up to one version lower than Oracle Restart. For instance, you can install Oracle Grid Infrastructure for a standalone server 19c (Oracle Restart) to provide services for Oracle Database 19c and Oracle Database 18c. Earlier Oracle Database releases can coexist on the same server without being managed by Oracle Restart.

To install Oracle Grid Infrastructure for a standalone server for a database that is already installed:

- 1. Log in as the Oracle Database software owner user.
- 2. Set the ORACLE\_HOME and ORACLE\_SID environment variables.

Bourne, Bash or Korn shell:

```
$ ORACLE_SID=orcl
```

- \$ export ORACLE\_SID
- \$ ORACLE HOME=/u01/app/oracle/product/19.0.0/dbhome 1
- \$ export ORACLE HOME



### C shell:

```
% setenv ORACLE_SID orcl
% setenv ORACLE HOME /u01/app/oracle/product/19.0.0/dbhome 1
```

3. Go to the Oracle home and stop any existing database listeners.

```
$ $ORACLE HOME/lsnrctl stop listener name
```

### Note:

If this command throws an error, reload the listener using  $\verb"lsnrctl" reload"$  LISTENER

4. On the same host computer as the database, install Oracle Grid Infrastructure for a standalone server, and select Configure Oracle Grid Infrastructure for a Standalone Server (Oracle Restart) as the installation option. See, "Installing Oracle Grid Infrastructure for a Standalone Server with a New Database Installation" in Oracle Database Installation Guide.

The Oracle Grid Infrastructure for a standalone server components are installed in an Oracle Grid Infrastructure Oracle home (Grid home), which is in a different location from existing Oracle Database homes.

5. If you have an existing Oracle Database, then register it for High Availability with Oracle Restart using the srvctl command:

```
$ cd $ORACLE_HOME/bin
$ srvctl add database -db dbname -o oracle home path
```

### **Related Topics**

• Installing Oracle Grid Infrastructure for a Standalone Server with a New Database Installation

Complete these steps to install Oracle Grid Infrastructure for a standalone server and then create a database that is managed by Oracle Restart.

• Oracle Database Administrator's Guide

# Installing Oracle Grid Infrastructure for a Standalone Server Using a Software-Only Installation

A software-only installation only installs the Oracle Grid Infrastructure for a standalone server binaries at the specified location. You must complete a few manual configuration steps to enable Oracle Restart after you install the software.

- About Oracle Grid Infrastructure Software-Only Installations Manually installing and configuring the software binaries for Oracle Grid Infrastructure.
- Installing Software Binaries for Oracle Grid Infrastructure for a Standalone Server Use this procedure to do a software-only installation of Oracle Grid Infrastructure for a standalone server.

• Configuring Software Binaries for Oracle Grid Infrastructure for a Standalone Server Use these steps to configure and activate a software-only Oracle Grid Infrastructure for a standalone server installation for Oracle Restart.

# About Oracle Grid Infrastructure Software-Only Installations

Manually installing and configuring the software binaries for Oracle Grid Infrastructure.

Oracle recommends that only advanced users perform software-only installations, because this installation method provides no validation of the installation, and this installation option requires manual postinstallation steps to enable the Oracle Grid Infrastructure for a standalone server software.

Performing a software-only installation requires the following steps:

- 1. Installing the software binaries.
- 2. Configuring the software binaries.

# Installing Software Binaries for Oracle Grid Infrastructure for a Standalone Server

Use this procedure to do a software-only installation of Oracle Grid Infrastructure for a standalone server.

- 1. Log in as the Oracle Restart software owner user (oracle).
- 2. Download the Oracle Grid Infrastructure for a standalone server installation image files, create the Grid home directory, and extract the image files in this Grid home directory.

For example:

```
$ mkdir -p /u01/app/oracle/product/19.0.0/grid
$ chown oracle:oinstall /u01/app/oracle/product/19.0.0/grid
$ cd /u01/app/oracle/product/19.0.0/grid
$ unzip -q /tmp/grid_home.zip
```

### Note:

Ensure that the Grid home directory path you create is in compliance with the Oracle Optimal Flexible Architecture recommendations. Also, unzip the installation image files only in this Grid home directory that you created.

**3.** Ensure that you complete all the storage and server preinstallation requirements. Verify that your server meets the installation requirements using the following command:

```
$ cd /u01/app/oracle/product/19.0.0/grid
$ runcluvfy.sh stage -pre hacfg
```

4. Run gridSetup.sh to start the Oracle Grid Infrastructure setup wizard:

```
$ Grid home/gridSetup.sh
```

Where, *Grid\_home* is the Oracle Grid Infrastructure home directory.



### Note:

You must install Oracle Grid Infrastructure for a standalone server from the Oracle Grid Infrastructure media.

- In the Select Configuration Option screen, select the Set Up Software Only option to perform a software-only installation of Oracle Grid Infrastructure for a standalone server. Click Next.
- 6. Respond to the prompts as needed to set up Oracle Grid Infrastructure. Click **Help** for information.
- 7. The Oracle Grid Infrastructure setup wizard prompts you to run the root.sh script and, if required, the orainstRoot.sh script.
- 8. The root.sh script output provides information about how to proceed, depending on the configuration you plan to complete in this installation. Note this information.

# Configuring Software Binaries for Oracle Grid Infrastructure for a Standalone Server

Use these steps to configure and activate a software-only Oracle Grid Infrastructure for a standalone server installation for Oracle Restart.

### **Configuring With Oracle Automatic Storage Management**

- 1. Install the software binaries. See, "Installing Software Binaries for Oracle Grid Infrastructure for a Standalone Server" in *Oracle Database Installation Guide*.
- 2. Run gridSetup.sh to start the Oracle Grid Infrastructure setup wizard.

See, "Installing Oracle Grid Infrastructure for a Standalone Server with a New Database Installation" in *Oracle Database Installation Guide*.

### **Configuring Without Oracle Automatic Storage Management**

1. Log in as root and run the roothas.sh script located in the *Grid\_home* path, using the following syntax:

```
# cd Grid_home/crs/install
# ./roothas.sh
```

### Where, Grid\_home is the Oracle Grid Infrastructure home directory.

### For example:

```
# cd /u01/app/oracle/product/19.0.0/grid/crs/install
```

- # ./roothas.sh
- 2. Change directory to the path Grid\_home/oui/bin.



 Log in as the Oracle Restart software owner user and use the following command syntax, where Grid\_home is the path of the Oracle Grid Infrastructure for a standalone server home.

```
$ ./runInstaller -updateNodeList ORACLE_HOME=Grid_home -defaultHomeName
CLUSTER NODES= CRS=TRUE
```

### For example:

```
$ ./runInstaller -updateNodeList ORACLE_HOME=/u01/app/oracle/product/
19.0.0/grid
-defaultHomeName CLUSTER NODES= CRS=TRUE
```

 Use the SRVCTL utility along with Oracle Network Configuration Assistant to add the listener to the Oracle Restart configuration.

### Note:

This procedure does not work for Oracle Restart upgrades from previous releases.

#### **Related Topics**

- Installing Software Binaries for Oracle Grid Infrastructure for a Standalone Server Use this procedure to do a software-only installation of Oracle Grid Infrastructure for a standalone server.
- Installing Oracle Grid Infrastructure for a Standalone Server with a New Database Installation

Complete these steps to install Oracle Grid Infrastructure for a standalone server and then create a database that is managed by Oracle Restart.

# Testing the Oracle Automatic Storage Management Installation

After installing Oracle Grid Infrastructure for a single instance, use the ASMCMD commandline utility to test the Oracle ASM installation.

 Open a shell window, and temporarily set the ORACLE\_SID and ORACLE\_HOME environment variables to specify the appropriate values for the Oracle ASM instance to use.

For example, if the Oracle ASM SID is named +ASM and the Oracle home is located in the grid subdirectory of the ORACLE\_BASE directory, then enter the following commands to create the required settings:

Bourne, Bash or Korn shell:

```
$ ORACLE SID=+ASM
```

```
$ export ORACLE SID
```

- \$ ORACLE HOME=/u01/app/oracle/product/19.0.0/grid
- \$ export ORACLE HOME



### C shell:

```
% setenv ORACLE_SID +ASM
% setenv ORACLE HOME /u01/app/oracle/product/19.0.0/grid
```

Use ASMCMD to list the disk groups for the Oracle ASM instance:

```
$ORACLE HOME/bin/asmcmd lsdg
```

If the Oracle ASM instance is running, then ASMCMD connects by default as the SYS user with SYSASM privileges, and is available.

 If the Oracle ASM instance is not running, then start the Oracle ASM instance using the following command:

```
$ORACLE HOME/bin/srvctl start asm
```

#### **Related Topics**

Oracle Automatic Storage Management Administrator's Guide

# **Relinking Oracle Restart and Oracle ASM Binaries**

Relink the Oracle Restart and Oracle ASM binaries every time you apply an operating system patch or after an operating system upgrade.

### Caution:

Before relinking executables, you must shut down all executables that run in the Oracle home directory that you are relinking. In addition, shut down applications linked with Oracle shared libraries.

- 1. Log in as root and unlock the grid home:
  - # cd Grid home/crs/install
  - # roothas.sh -unlock
- 2. Log in as the grid user and relink the binaries:

```
$ export ORACLE_HOME=Grid_home
$ Grid home/bin/relink
```

- 3. Log in as root again and perform the following steps:
  - # cd Grid home/rdbms/install/
  - # ./rootadd rdbms.sh
  - # cd Grid home/crs/install
  - # roothas.sh -lock



# Configuring Oracle ASM Disk Groups Manually using Oracle ASMCA

After installing Oracle Grid Infrastructure for a standalone server, you can also use Oracle ASMCA to create and configure disk groups, Oracle ADVM, and Oracle ACFS.

During Oracle Grid Infrastructure for a standalone server installation, Oracle Automatic Storage Management Configuration Assistant (Oracle ASMCA) utility creates a new Oracle Automatic Storage Management instance if there is no Oracle ASM instance currently configured on the computer. After installation, you can create and configure additional disk groups, and you can configure Oracle ADVM and Oracle ACFS.

To create disk groups or manually configure Oracle ASM disks, start Oracle ASMCA, where *Grid\_home* is the path to the Oracle Grid Infrastructure home:

```
$ cd Grid_home/bin
$ ./asmca
```

#### **Related Topics**

Oracle Automatic Storage Management Administrator's Guide

## Enabling Oracle ACFS on Oracle Restart Configurations

You must enable root access to use Oracle ACFS.

#### Note:

The ACFS storage option on IBM AIX is deprecated in Oracle Database 19c.

To enable root access, log in as root, navigate to the path *Grid\_home/crs/install*, and run the script roothas.sh -lockacfs.

Where, *Grid\_home* is the Oracle Grid Infrastructure home directory path.

For example:

```
# cd /u01/app/oracle/product/19.0.0/grid/crs/install
# roothas.sh -lockacfs
```

#### Note:

Starting with Oracle Database 12c Release 1 (12.1.0.2), the roothas.sh script replaces the roothas.pl script in the Oracle Grid Infrastructure home.



# Applying Patches During an Oracle Grid Infrastructure Installation or Upgrade

Starting with Oracle Grid Infrastructure 18c, you can download and apply Release Updates (RUs) and one-off patches during an Oracle Grid Infrastructure installation or upgrade.

1. Download the patches you want to apply from My Oracle Support:

https://support.oracle.com

2. Select the Patches and Updates tab to locate the patch.

Oracle recommends that you select **Recommended Patch Advisor**, and enter the product group, release, and platform for your software.

- 3. Move the patches to an accessible directory like /tmp.
- 4. Change to the Oracle Grid Infrastructure home directory:

```
$ cd /u01/app/oracle/product/19.0.0/grid
```

 Apply Release Updates (RUs) and any one-off patches during the installation or upgrade process:

```
$ ./gridSetup.sh -applyRU patch_directory_location -applyOneOffs
comma_seperated_list_of_patch_directory_locations
```

#### Note:

You can apply RUs and one-off patches separately or together in the same command.

6. Complete the remaining steps in the Oracle Grid Infrastructure configuration wizard to complete the installation or upgrade.

#### **Related Topics**

 Oracle Grid Infrastructure Upgrading Oracle Restart for Linux and Unix-Based Operating Systems

## Patching and Switching Oracle Grid Infrastructure Homes

Perform an out-of-place Oracle Restart patching by switching from the current Oracle Grid Infrastructure home to a patched Oracle Grid Infrastructure home.

1. Download the 19.3 Oracle Grid Infrastructure base release image files.

https://www.oracle.com/database/technologies/oracle-database-softwaredownloads.html#19c

2. As the grid user, extract the downloaded image files into a new Oracle Grid Infrastructure home directory.

```
$ mkdir -p /u01/app/oracle/product/19.17.0/grid
```

\$ chown grid:oinstall /u01/app/oracle/product/19.17.0/grid



```
$ cd /u01/app/oracle/product/19.17.0/grid
$ unzip -q download location/grid.zip
```

#### Here:

- /u01/app/oracle/product/19.17.0/grid is the new Grid home.
- /u01/app/oracle/product/19.16.0/grid is the old Grid home.
- 3. As the grid user, download and install the latest version of the OPatch utility in the new Grid home.

https://updates.oracle.com/download/6880880.html

```
$ mv /u01/app/oracle/product/19.17.0/grid/OPatch /u01/app/oracle/product/
19.17.0/grid/bak_OPatch
$ unzip latest Opatch.zip -d /u01/app/oracle/product/19.17.0/grid/
```

 Download the Oracle Database RU version that you want to apply from My Oracle Support. In this example, Oracle Database 19.17 RU.

For more information, see, Downloading Release Update Patches

5. Download and install the latest OPatch version.

For more information, see My Oracle Support note 274526.1.

6. Start the Oracle Grid Infrastructure installer to perform a software-only Oracle Restart installation. You can apply the optional <code>-applyRU</code> or <code>-applyOneOff</code> flags to apply Release Updates (RUs) during the installation.

```
$ /u01/app/oracle/product/19.17.0/grid/gridSetup.sh [-applyRU
patch_directory_location]
[-applyOneOffs comma separated list of patch directory locations]
```

- Follow the steps in the configuration wizard to complete the Oracle Grid Infrastructure installation.
- 8. As the root user, perform the following steps:
  - a. Relink the Oracle Grid Infrastructure binaries:
    - # /u01/app/oracle/product/19.17.0/grid/rdbms/install/rootadd rdbms.sh
  - b. Prepare the new home for the out-of-place patching:

```
# /u01/app/oracle/product/19.17.0/grid/crs/install/roothas.sh -prepatch
-dstcrshome
/u01/app/oracle/product/19.17.0/grid
```

This command does not shut down any services.

9. As the grid user, run the following command to switch to the new Oracle Grid Infrastructure home and perform the out of place patching:

```
$ /u01/app/oracle/product/19.17.0/grid/crs/install/roothas.sh -postpatch -
dstcrshome
/u01/app/oracle/product/19.17.0/grid
```



This command shuts down the old Oracle Grid Infrastructure home and starts resources from the new Oracle Grid Infrastructure home. All Oracle Grid Infrastructure services start running from the new Grid home.

**10.** Update the Oracle central inventory (oralnventory).

```
$ /u01/app/oracle/product/19.17.0/grid/oui/bin/runInstaller -
updateNodeList ORACLE_HOME=/u01/app/oracle/product/19.17.0/grid CRS=TRUE
$ /u01/app/oracle/product/19.16.0/grid/oui/bin/runInstaller -
updateNodeList ORACLE HOME=/u01/app/oracle/product/19.16.0/grid CRS=FALSE
```

- **11.** To switch back to the old Grid home:
  - a. As the root user, run the prepatch script.
    - # Old\_GI\_Home/crs/install/roothas.sh -prepatch -dstcrshome Old\_GI\_Home
  - b. As the grid user, run the postpatch script.
    - # Old\_GI\_Home/crs/install/roothas.sh -postpatch -dstcrshome Old\_GI\_Home
  - c. Update the Oracle central inventory (oralnventory).

\$ /u01/app/oracle/product/19.16.0/grid/oui/bin/runInstaller updateNodeList ORACLE\_HOME=/u01/app/oracle/product/19.16.0/grid CRS=TRUE \$ /u01/app/oracle/product/19.17.0/grid/oui/bin/runInstaller updateNodeList ORACLE\_HOME=/u01/app/oracle/product/19.17.0/grid CRS=FALSE

# 11 Installing Oracle Database

Oracle Database and Oracle Grid Infrastructure installation software is available as imagebased zip files and can be installed using several options.

You can download Oracle Database software from the Oracle website or the Oracle Software Delivery Cloud portal. In most cases, you use the graphical user interface (GUI) provided by Oracle Universal Installer to install the software. However, you can also run silent mode installations, without using the GUI. You can also use Oracle Fleet Patching and Provisioning for Oracle Database and Oracle Grid Infrastructure (clusterware) deployments.

Oracle Database software may be available on installation media on-demand.

#### Note:

To install Oracle Database files on Oracle Automatic Storage Management (Oracle ASM), you must first complete an Oracle Grid Infrastructure for a standalone server installation. Oracle Grid Infrastructure for a standalone server includes Oracle Restart and Oracle ASM.

To upgrade an existing Oracle ASM installation, upgrade Oracle ASM by running an Oracle Grid Infrastructure upgrade. If you do not have Oracle ASM installed and you want to use Oracle ASM as your storage option, then you must complete an Oracle Grid Infrastructure for a standalone server installation before you start your Oracle Database installation.

You cannot use Oracle Universal Installer from an earlier Oracle release to install components from this release.

- About Image-Based Oracle Database Installation Understand image-based installation to simplify installation and configuration of Oracle Database software.
- About Deploying Oracle Database Using Oracle Fleet Patching and Provisioning You can use Oracle Fleet Patching and Provisioning (Oracle FPP) to provision Oracle Database software.
- Downloading Oracle Software
   Select the method you want to use to download the software.
- About Character Set Selection During Installation Before you create the database, decide the character set that you want to use.
- About Automatic Memory Management Installation Options
   Decide if you want to configure Automatic Memory Management during installation.
- Running the Installer in a Different Language Describes how to run the installer in other languages.
- Installing the Oracle Database Software These topics explain how to run Oracle Universal Installer to perform most database installations.



- Installing Oracle Database Using RPM Packages
  Learn how to leverage and take advantage of an RPM framework to easily deploy Oracle
  Database.
- Installing Standard Edition High Availability Learn how to Install high availability on Oracle Database Standard Edition 2.

# About Image-Based Oracle Database Installation

Understand image-based installation to simplify installation and configuration of Oracle Database software.

To install Oracle Database, create the new Oracle home, extract the image file into the newlycreated Oracle home, and run the setup wizard to register the Oracle Database product.

Using image-based installation, you can install and upgrade Oracle Database for singleinstance and cluster configurations. If you install or clone an Oracle Database image, then all Oracle Database options such as Oracle OLAP (olap) and Oracle Real Application Testing (rat) are enabled by default.

This installation feature streamlines the installation process and supports automation of largescale custom deployments. You can also use this installation method for deployment of customized images, after you patch the base-release software with the necessary Release Updates (Updates) or Monthly Recommended Patches (MRPs).

#### Note:

You must extract the image software (db\_home.zip) into the directory where you want your Oracle Database home to be located, and then run the Oracle Database Setup Wizard to start the Oracle Database installation and configuration. Oracle recommends that the Oracle home directory path you create is in compliance with the Oracle Optimal Flexible Architecture recommendations.

# About Deploying Oracle Database Using Oracle Fleet Patching and Provisioning

You can use Oracle Fleet Patching and Provisioning (Oracle FPP) to provision Oracle Database software.

Starting with Oracle Database 19c, Rapid Home Provisioning is renamed to Oracle Fleet Patching and Provisioning (Oracle FPP).

With Oracle Fleet Patching and Provisioning, you create, store, and manage templates of Oracle homes as images (called gold images) of Oracle software, such as databases, middleware, and applications. You can make a working copy of any gold image and then you can provision that working copy to any node in the data center or cloud computing environment.

You can use Oracle Fleet Patching and Provisioning to provision, patch, and upgrade singleinstance databases running on Oracle Restart, on clusters, or on single, standalone nodes. These may be on nodes with or without Oracle Grid Infrastructure installed.



Oracle Fleet Patching and Provisioning is not supported on Microsoft Windows and HP-UX Itanium systems.

#### **Related Topics**

Oracle Fleet Patching and Provisioning Administrator's Guide

# **Downloading Oracle Software**

Select the method you want to use to download the software.

You can download Oracle Database software from the Oracle website or the Oracle Software Delivery Cloud portal and extract them to the Oracle home. Ensure that you review and understand the terms of the license.

- Downloading the Installation Archive Files from Oracle Website Download installation archive files from the Oracle website.
- Downloading the Software from Oracle Software Delivery Cloud Portal You can download the software from Oracle Software Delivery Cloud.

## Downloading the Installation Archive Files from Oracle Website

Download installation archive files from the Oracle website.

- Use any browser to access the software download page on the Oracle website: http://www.oracle.com/technetwork/indexes/downloads/index.html
- 2. Go to the download page for the product to install.
- **3.** On the download page, identify the required disk space by adding the file sizes for each required file.

The file sizes are listed next to the file names.

4. Select a file system with enough free space to store and expand the archive files.

In most cases, the available disk space must be at least twice the size of all of the archive files.

- 5. On the file system, create a parent directory for each product (for example, OraDB19c) to hold the installation directories.
- 6. Download all of the installation archive files to the directory you created for the product.

#### Note:

For Oracle Database Client installations, there are two installation archive files available for download. The first file is the client installation binary and the second file is a client gold image file. Download the appropriate zip file based on the type of installation you want to perform.

7. Verify that the files you downloaded are the same size as the corresponding files on the Oracle website. Also verify the checksums are the same as noted on the Oracle website



using a command similar to the following, where *filename* is the name of the file you downloaded:

```
cksum filename.zip
```

8. Extract the files in each directory that you just created.

## Downloading the Software from Oracle Software Delivery Cloud Portal

You can download the software from Oracle Software Delivery Cloud.

1. Use a browser to access the Oracle Software Delivery Cloud portal:

https://edelivery.oracle.com/

- 2. Click Sign In and enter your Oracle account username and password.
- 3. Type **Oracle Database** in the search bar. Click the **Add to Cart** button corresponding to the Oracle Database version that you want to download
- In the Checkout page, click Checkout and deselect any products that you do not want to download.
- 5. Select the operating system platform on which you want to install the software from the **Platform/Languages** column.
- 6. Click Continue.
- 7. Review the license agreement.
- 8. Select the I reviewed and accept the Oracle License Agreement checkbox. Click Continue.
- 9. Click Download to start downloading the software.
- **10.** After you download the files, click **View Digest** to verify that the checksum matches the value listed on the download page.

# About Character Set Selection During Installation

Before you create the database, decide the character set that you want to use.

After a database is created, changing its character set is usually very expensive in terms of time and resources. Such operations may require converting all character data by exporting the whole database and importing it back. Therefore, it is important that you carefully select the database character set at installation time.

Oracle Database uses character sets for the following:

- Data stored in SQL character data types (CHAR, VARCHAR2, CLOB, and LONG).
- Identifiers such as table names, column names, and PL/SQL variables.
- Stored SQL and PL/SQL source code, including text literals embedded in this code.

Starting with Oracle Database 12c Release 2 (12.2), the default database character set of a database created from the General Purpose/Transaction Processing or the Data Warehousing template is Unicode AL32UTF8.

Unicode is the universal character set that supports most of the currently spoken languages of the world. It also supports many historical scripts (alphabets). Unicode is the native encoding



of many technologies, including Java, XML, XHTML, ECMAScript, and LDAP. Unicode is ideally suited for databases supporting the Internet and the global economy.

Because AL32UTF8 is a multibyte character set, database operations on character data may be slightly slower when compared to single-byte database character sets, such as WE8ISO8859P1 or WE8MSWIN1252. Storage space requirements for text in most languages that use characters outside of the ASCII repertoire are higher in AL32UTF8 compared to legacy character sets supporting the language. English data may require more space only if stored in CLOB (character large object) columns. Storage for non-character data types, such as NUMBER or DATE, does not depend on a character set. The universality and flexibility of Unicode usually outweighs these additional costs.

Consider legacy character sets only when the database needs to support a single group of languages and the use of a legacy character set is critical for fulfilling compatibility, storage, or performance requirements. The database character set to be selected in this case is the character set of most clients connecting to this database.

The database character set of a multitenant container database (CDB) determines which databases can be plugged in later. Ensure that the character set you choose for the CDB is compatible with the database character sets of the databases to be plugged into this CDB. If you use Unicode AL32UTF8 as your CDB character set, then you can plug in a pluggable database (PDB) in any database character set supported by Oracle Database (with the exception of EBCDIC-based character sets).

#### See Also:

*Oracle Database Globalization Support Guide* for more information about choosing a database character set for a multitenant container database (CDB)

# About Automatic Memory Management Installation Options

Decide if you want to configure Automatic Memory Management during installation.

During a **Typical** installation, you create your database with Oracle Database Configuration Assistant (DBCA), and automatic memory management is enabled. If you choose **Advanced** installation, then you can either specify memory allocation manually, or enable automatic memory management.

If the total physical memory of your database instance is greater than 4 GB, then you cannot select the Oracle Automatic Memory Management option during database installation and creation. Instead, use automatic shared memory management. Automatic shared memory management automatically distributes the available memory among the various components as required, allowing the system to maximize the use of all available SGA memory.

With automatic memory management, the Oracle Database instances automatically manage and tune memory for you. With automatic memory management, you choose a memory target, and the instance automatically distributes memory between the system global area (SGA) and the instance program global area (instance PGA). As memory requirements change, the instance dynamically redistributes memory between the SGA and instance PGA.

You can enable automatic memory management either during, or after the database installation. Enabling automatic memory management after installation involves a shutdown and restart of the database.



By default, automatic memory management is disabled when you perform typical installation on a node that has more than 4 GB of RAM.

#### **Related Topics**

Oracle Database Administrator's Guide

# Running the Installer in a Different Language

Describes how to run the installer in other languages.

Your operating system locale determines the language in which the database installer runs. You can run the installer in one of these languages:

- Brazilian Portuguese (pt\_BR)
- French (fr)
- German (de)
- Italian (it)
- Japanese (ja)
- Korean (ko)
- Simplified Chinese (zh\_CN)
- Spanish (es)
- Traditional Chinese (zh\_TW)

To run the database installer in a supported language, change the locale in which your operating system session is running before you start the installer.

If the selected language is not one of the supported languages, then the installer runs in English.

## Installing the Oracle Database Software

These topics explain how to run Oracle Universal Installer to perform most database installations.

#### Note:

- If you plan to use Oracle Restart or Oracle ASM, then you must install Oracle Grid Infrastructure for a standalone server before you install and create the database. Otherwise, you must manually register the database with Oracle Restart.
- You can install Oracle Database by using the silent or response file installation method, without the GUI. This method is useful to perform multiple installations of Oracle Database.



- Setup Wizard Installation Options for Creating Images
- Applying Patches During an Oracle Database Installation or Upgrade Starting with Oracle Database 18c, you can download and apply Release Updates (RUs) during an Oracle Database installation or upgrade.
- Running Oracle Database Setup Wizard to Install Oracle Database Extract the database image files and use the runInstaller command to start the installation.

## Setup Wizard Installation Options for Creating Images

Before you start the setup wizards for your Oracle Database or Oracle Grid Infrastructure installation, decide if you want to use any of the available image-creation options.

In image-based installations, you can start your Oracle Database installation or Oracle Grid Infrastructure installations by running the setup wizards runInstaller and gridSetup.sh respectively. Both these wizards come with the following image-creation options.

Table 11-1 Image-Creation Options for Setup Wizard

Option	Description
-createGoldImage	Creates a gold image from the current Oracle home.
-destinationLocation	Specify the complete path, or location, where the gold image will be created.
-exclFiles	Specify the complete paths to the files to be excluded from the newly created gold image.
-help	Displays help for all the available options.

#### For example:

./runInstaller -createGoldImage -destinationLocation /tmp/my db images

./gridSetup.sh -createGoldImage -destinationLocation /tmp/my grid images

#### Where:

/tmp/my db images is a temporary file location where the image zip file is created.

/tmp/my grid images is a temporary file location where the image zip file is created.

/u01/app/oracle/product/19.0.0/dbhome\_1/relnotes is the file to be excluded in the newly created gold image.

## Applying Patches During an Oracle Database Installation or Upgrade

Starting with Oracle Database 18c, you can download and apply Release Updates (RUs) during an Oracle Database installation or upgrade.

1. Download the patches you want to apply from My Oracle Support:

https://support.oracle.com

2. Select the Patches and Updates tab to locate the patch.



Oracle recommends that you select **Recommended Patch Advisor**, and enter the product group, release, and platform for your software.

- 3. Move the patches to an accessible directory like /tmp.
- 4. Change to the Oracle Database home directory:

\$ cd \$ORACLE HOME

5. Apply Release Updates (RUs) during the installation or upgrade process:

```
$ ./runInstaller -applyRU patch directory location
```

6. Complete the remaining steps in the Oracle Database configuration wizard to complete the installation or upgrade.

## Running Oracle Database Setup Wizard to Install Oracle Database

Extract the database image files and use the runInstaller command to start the installation.

Have all the information you need to provide regarding users groups, and storage paths before you start installation. Oracle recommends that you have your My Oracle Support credentials available during installation. You should also be prepared to run root scripts or provide information to automate root scripts.

- 1. Log in as the Oracle installation owner user account (oracle) that you want to own the software binaries.
- 2. If this is the first time you are installing Oracle software, then create the Oracle base and the Oracle inventory directories as per the Oracle Optimal Flexible Architecture (OFA) recommendations. Specify the correct owner, group, and permissions for these directories.

```
# mkdir -p /u01/app/oracle
# mkdir -p /u01/app/oraInventory
# chown -R oracle:oinstall /u01/app/oracle
# chown -R oracle:oinstall /u01/app/oraInventory
# chmod -R 775 /u01/app
```

- 3. Download the Oracle Database installation image files (db\_home.zip) to a directory of your choice. For example, you can download the image files to the /tmp directory.
- 4. Create an OFA-compliant Oracle home directory and extract the image files that you have downloaded in to this Oracle home directory. For example:

```
$ mkdir -p /u01/app/oracle/product/19.0.0/dbhome_1
$ cd /u01/app/oracle/product/19.0.0/dbhome_1
$ unzip -q /tmp/db home.zip
```



- Ensure that the Oracle home directory path you create is in compliance with the Oracle Optimal Flexible Architecture recommendations. Also, unzip the installation image files only in this Oracle home directory that you created.
- Oracle home or Oracle base cannot be symlinks, nor can any of their parent directories, all the way to up to the root directory.
- 5. From the Oracle home directory, run the runInstaller command to start the Oracle Database Setup Wizard.

```
$ cd /u01/app/oracle/product/19.0.0/dbhome_1
$ ./runInstaller
```

#### Note:

- Run the runInstaller command from the Oracle home directory only. Do not use the runInstaller command that resides at \$ORACLE\_HOME/oui/bin/, or any other location, to install Oracle Database, Oracle Database Client, or Oracle Grid Infrastructure.
- Use the runInstaller command with the -applyRU option to install Release Updates (RUs) during an Oracle Database installation or upgrade.
- 6. In the Select Configuration Option screen, select **Create and configure a single instance** database.
- 7. Select your installation type.

Installation screens vary depending on the installation option you select. Respond to the configuration prompts as needed.

8. Provide information to automate root scripts, or run scripts as root when prompted by the setup wizard.

If you configure automation for running root scripts, and a root script fails, then you can fix the problem manually, and click **Retry** to run the root script again.

#### Note:

Click **Help** if you have any questions about the information you are asked to submit during installation.

#### **Related Topics**

 Downloading Oracle Software Select the method you want to use to download the software.



# Installing Oracle Database Using RPM Packages

Learn how to leverage and take advantage of an RPM framework to easily deploy Oracle Database.

- About RPM-Based Oracle Database Installation
   Starting with Oracle Database 18c, you can install a single-instance Oracle Database or an
   Oracle Database Instant Client software using RPM packages.
- Restrictions and Guidelines for RPM-Based Installations Review these guidelines before you start your RPM-based Oracle Database installation.
- RPM Packages Naming Convention The RPM packages naming convention includes information such as the version, release, and architecture.
- Running RPM Packages to Install Oracle Database
   Perform the following steps to install and configure Oracle Database using RPM packages.

## About RPM-Based Oracle Database Installation

Starting with Oracle Database 18c, you can install a single-instance Oracle Database or an Oracle Database Instant Client software using RPM packages.

An RPM-based installation performs preinstallation checks, extracts the database software, reassigns ownership of the extracted software to the preconfigured user and groups, maintains the Oracle inventory, and runs all root operations required to configure the Oracle Database software for a single-instance Oracle Database creation and configuration.

The RPM–based installation process detects when the minimum requirements for an installation are not met and prompts you to finish these minimum preinstallation requirements.

An RPM-based installation performs a software-only Oracle Database installation and creates an Oracle home. After the Oracle home is created, you can then use Oracle Database Configuration Assistant (Oracle DBCA) to create an Oracle Database.

The RPM-based installation process provides you with the option to create a database with the default settings using the /etc/init.d/oracledb\_ORCLCDB-19c service configuration script.

## Restrictions and Guidelines for RPM-Based Installations

Review these guidelines before you start your RPM-based Oracle Database installation.

- Patching Oracle Database software using RPMs is not supported. Please use the OPatch utility and follow the regular patching process to apply Oracle Database patches.
- An RPM-based Oracle Database installation is not available for Standard Edition 2.
- RPM-based database upgrades using rpm -Uvh is not supported. For Oracle Database upgrades, follow the regular upgrade process.
- An RPM-based installation supports the installation of multiple Oracle Database software versions into different Oracle homes on the same machine.



## **RPM Packages Naming Convention**

The RPM packages naming convention includes information such as the version, release, and architecture.

The naming convention for RPM packages is name-version-release.architecture.rpm

The following table describes the variables used in the RPM oracle-databaseee-19c-1.0-1.x86\_64.rpm

#### Table 11-2 RPM Packages Naming Convention Example

Variable	Example	Description
name	oracle-database-ee-19c	The name of the Oracle Database edition and release.
version	1.0	The version number of the RPM package.
release	1	The release number of the RPM package.
architecture	x86_64	The architecture of the RPM package.

#### **Related Topics**

- RPM Packaging Guide
- Format of the RPM File

## Running RPM Packages to Install Oracle Database

Perform the following steps to install and configure Oracle Database using RPM packages.

#### Installing Oracle Database RPM using yum

- 1. Log in as root.
- 2. If you are using Oracle Linux and have subscribed to Unbreakable Linux Network (ULN), you can install Oracle Database via a single yum command.

# yum -y install oracle-database-ee-19c

This command downloads and installs the Oracle Database Preinstallation RPM and the Oracle Database RPM packages.

The installation of Oracle Database software is now complete, continue to the "Creating and Configuring an Oracle Database" section.

#### Installing Oracle Database RPM Manually

- 1. Log in as root.
- 2. Download and install the Oracle Database Preinstallation RPM:
  - a. On Oracle Linux
    - # yum -y install oracle-database-preinstall-19c



b. On Red Hat Enterprise Linux

```
# curl -o oracle-database-preinstall-19c-1.0-1.el7.x86_64.rpm https://
yum.oracle.com/repo/OracleLinux/OL7/latest/x86_64/getPackage/oracle-
database-preinstall-19c-1.0-1.el7.x86_64.rpm
# yum -y localinstall oracle-database-
preinstall-19c-1.0-1.el7.x86_64.rpm
```

After successful installation, you can delete the downloaded RPM file:

# rm oracle-database-preinstall-19c-1.0-1.el7.x86 64.rpm

 Access the software download page for Oracle Database RPM-based installation from Oracle Technology Network:

https://www.oracle.com/database/technologies/oracle-database-software-downloads.html

- 4. Download the .rpm file required for performing an RPM-based installation to a directory of your choice. For example, download the oracle-databaseee-19c-1.0-1.x86 64.rpm file to the /tmp directory.
- 5. Install the database software using the yum localinstall command.

```
# cd /tmp
# yum -y localinstall oracle-database-ee-19c-1.0-1.x86_64.rpm
```

Where, oracle-database-ee-19c-1.0-1.x86\_64.rpm is the fully qualified name of the Oracle Database RPM.

The installation of Oracle Database software is now complete.

#### Creating and Configuring an Oracle Database

To create a sample database with the default settings, perform the following steps:

- 1. Log in as root.
- To configure a sample Oracle Database instance, run the following service configuration script:
  - # /etc/init.d/oracledb ORCLCDB-19c configure

#### Note:

You can modify the configuration parameters by editing the /etc/sysconfig/ oracledb ORCLCDB-19c.conf file.

This script creates a container database (ORCLCDB) with one pluggable database (ORCLPDB1) and configures the listener at the default port (1521).

Review the status information that is displayed on your screen.

#### Related Topics

- Automatically Configuring Oracle Linux with Oracle Database Preinstallation RPM Use Oracle Database Preinstallation RPM to simplify operating system configuration in preparation for Oracle software installations.
- Downloading Oracle Software Select the method you want to use to download the software.
- Removing an RPM-based Oracle Database Installation Use this procedure to remove and deinstall a database installed using the yum command.

# Installing Standard Edition High Availability

Learn how to Install high availability on Oracle Database Standard Edition 2.

- About Standard Edition High Availability Starting with Oracle Database 19c, you can install Oracle Database Standard Edition 2 in high availability mode.
- Requirements for Installing Standard Edition High Availability Review these requirements before you install and deploy the Standard Edition High Availability feature.
- Deploying Standard Edition High Availability Learn the process and options to deploy high availability on Oracle Database Standard Edition 2.

## About Standard Edition High Availability

Starting with Oracle Database 19c, you can install Oracle Database Standard Edition 2 in high availability mode.

#### Note:

The ACFS storage option on IBM AIX is deprecated in Oracle Database 19c.

Standard Edition High Availability provides cluster-based failover for single-instance Standard Edition Oracle Databases using Oracle Clusterware.

Oracle Standard Edition High Availability benefits from the cluster capabilities and storage solutions that are already part of Oracle Grid Infrastructure, such as Oracle Clusterware, Oracle Automatic Storage Management (Oracle ASM) and Oracle ASM Cluster File System (Oracle ACFS).

Using integrated, shared, and concurrently mounted storage, such as Oracle ASM and Oracle ACFS for database files as well as for unstructured data, enables Oracle Grid Infrastructure to restart an Oracle Database on a failover node much faster than any cluster solution that relies on failing over and remounting volumes and file systems.

Starting with Oracle Database 19c Release Update (19.7), Standard Edition High Availability is supported on Linux x86-64, Oracle Solaris on SPARC (64-bit), and Microsoft Windows.

Starting with Oracle Database 19c Release Update (19.13), Standard Edition High Availability is supported on IBM AIX on POWER Systems (64-bit) and HP-UX Itanium.



This section is specific to Standard Edition High Availability, which provides clusterbased database failover for Standard Edition Oracle Databases 19c. For more information about high availability options for Oracle Database, see *Oracle Clusterware Administration and Deployment Guide*.

## Requirements for Installing Standard Edition High Availability

Review these requirements before you install and deploy the Standard Edition High Availability feature.

- You must configure Standard Edition High Availability using at least two nodes of a cluster running Oracle Grid Infrastructure 19.7 or later for Standalone Cluster.
- You must configure Standard Edition High Availability using an Oracle Database home of version 19.7 or later.

#### Note:

When updating your Oracle Database home using Release Update (RU) 19.7 or later, ensure that you apply the Oracle Clusterware (OCW) RU of the same version to the Oracle Database home.

- Ensure that all cluster nodes on which you plan to install Oracle Database have the same operating system users, groups, and resource limits for the database software owner.
- You must store the Oracle Database binaries only on local storage or Oracle Automatic Storage Management Cluster File System (Oracle ACFS).
- You must store the Oracle Database data files only on Oracle ASM or Oracle ACFS.
- If you are using Oracle ACFS for storing data files, then you must register Oracle ACFS as a clusterware resource. The Oracle Database software owner user (oracle) must be the mount owner of the Oracle ACFS volume. When using an Oracle home on Oracle ACFS, Oracle recommends that you have Oracle base on the local file system.
- If you are using a local file system, then you must have the same single-instance Standard Edition 2 installation and updates on each node. You must also use the same Oracle base and Oracle home directory structure on each node.
- You must perform the same Oracle home operations on all the nodes.
- You must use an SPFILE for the database instance initialization parameters and a database password file stored for the database instance initialization parameters in Oracle ASM or Oracle ACFS. This approach ensures that the parameters are consistent across all nodes and the password file is available after a failover or a relocation.
- You must register the Standard Edition 2 single-instance database with SCAN listeners as remote listener and node listeners as local listener.

## Deploying Standard Edition High Availability

Learn the process and options to deploy high availability on Oracle Database Standard Edition 2.



After installing Oracle Clusterware, as described in Oracle Grid Infrastructure Installation and Upgrade Guide for your platform, install single instance Standard Edition 2 Oracle Database software on the cluster nodes on which you want to configure Standard Edition High Availability.

- Installing Standard Edition High Availability Database Software on Local File System You can install Oracle Database software binaries on a local file system to enable the Oracle Database Standard Edition high availability feature.
- Installing Standard Edition High Availability Database Software on Oracle ACFS You can install Oracle Database software binaries on an Oracle ASM Cluster File System (Oracle ACFS) volume to enable the Oracle Database Standard Edition High Availability feature.

#### **Related Topics**

Oracle Grid Infrastructure Installation and Upgrade Guide for Linux

Installing Standard Edition High Availability Database Software on Local File System

You can install Oracle Database software binaries on a local file system to enable the Oracle Database Standard Edition high availability feature.

Ensure that all the cluster nodes, on which you plan to configure Standard Edition High Availability, have the same operating system configuration, users, groups, resource limits, and SSH equivalence for the Oracle Database software owner user (oracle).

Before you start the installation, have all the information you need about users, groups, and storage paths. You should also be prepared to run root scripts or provide information to automate root scripts.

1. As the root user, log into the first cluster node on which you want to configure Standard Edition High Availability and create the Oracle base directory on the local file system. Follow the Oracle Optimal Flexible Architecture (OFA) recommendations and specify the correct owner, group, and permissions for this directory.

```
# mkdir -p /u01/app/oracle
# chown oracle:oinstall /u01/app/oracle
```

- 2. Log in to the first cluster node as the Oracle Database software owner user (oracle).
- Download the Oracle Database 19c release 19.3 installation image file (db home.zip) 3. from Oracle Software Delivery Cloud website to a directory of your choice.

https://edelivery.oracle.com/

Download the Oracle Database Release Update 19.7 or later patch from My Oracle 4. Support to a directory of your choice and unzip it.

https://support.oracle.com/

5. Create an OFA-compliant Oracle home directory on the local file system and extract the image files that you have downloaded in to this Oracle home directory. For example:

```
$ mkdir -p /u01/app/oracle/product/19.0.0/dbhome 1
$ cd /u01/app/oracle/product/19.0.0/dbhome 1
$ unzip -q /tmp/db home.zip
```





- 6. From the Oracle home directory, run the runInstaller command with the -applyRU flag to start the Oracle Database Setup Wizard and apply the Oracle Database Release Update 19.7 or later patch during installation.
  - \$ ./runInstaller -applyRU patch\_directory\_location/patch\_ID

Run the runInstaller command from the Oracle home directory only. Do not use the runInstaller command that resides at <code>\$ORACLE\_HOME/oui/bin/</code>, or any other location, to install Oracle Database.

- 7. In the Select Configuration Option screen, select Set Up Software Only.
- In the Select Database Installation Option screen, select Single instance database installation.
- 9. In the Select Database Edition screen, select Standard Edition 2.
- Respond to the configuration prompts as needed.
- **11.** Provide information to automate root scripts, or run scripts as root when prompted by the setup wizard.

If you configure automation for running root scripts, and a root script fails, then you can fix the problem manually, and click **Retry** to run the root script again.

#### Note:

Click **Help** if you have any questions about the information you are asked to submit during installation.

**12.** Optional: As the oracle user, enable read-only Oracle home on the first cluster node.

```
$ $ORACLE HOME/bin/roohctl -enable
```

**13.** As the root user, create the Oracle base directory on all of the other cluster nodes on which you want to configure Standard Edition High Availability.

```
# mkdir -p /u01/app/oracle
# chown oracle:oinstall /u01/app/oracle
```

- 14. As the oracle user, run the addnode.sh script from the first node to perform the following operations on the other nodes on which you want to configure Standard Edition High Availability:
  - Copy the Oracle home directory from the first node to the other nodes.
  - Setup Oracle base and Oracle inventory directories on the other nodes.

```
$ $ORACLE_HOME/addnode/addnode.sh -silent
CLUSTER NEW NODES=comma separated list of other nodes
```

**15.** As the root user, run the root.sh script on all the other cluster nodes on which you are configuring Standard Edition High Availability.

# /u01/app/oracle/product/19.0.0/dbhome 1/root.sh

After the Oracle Database software installation is complete, use Oracle Database Configuration Assistant (Oracle DBCA), in either interactive or silent mode, to create a Standard Edition database on the first cluster node on which you installed the Oracle Database software.

For more information about the requirements for creating a database, and the procedure for enabling and configuring Standard Edition High Availability for Oracle Databases, refer to *Oracle Database Administrator's Guide*.

#### **Related Topics**

- Response Files
   Review the following topics to install and configure Oracle Database, Oracle Grid
   Infrastructure, and other Oracle products using response files.
- Oracle Grid Infrastructure Installation and Upgrade Guide for Linux
- Creating a Database with Oracle DBCA

#### Installing Standard Edition High Availability Database Software on Oracle ACFS

You can install Oracle Database software binaries on an Oracle ASM Cluster File System (Oracle ACFS) volume to enable the Oracle Database Standard Edition High Availability feature.

Ensure that all the cluster nodes, on which you plan to configure Standard Edition High Availability, have the same operating system configuration, users, groups, resource limits, and SSH equivalence for the Oracle Database software owner user (oracle) between the nodes.

Before you start the installation, have all the information you need about users groups, and storage paths. You should also be prepared to run root scripts or provide information to automate root scripts.

1. As the root user, register Oracle ACFS as an Oracle Clusterware resource specifying the Oracle Database software owner user (oracle) as the mount owner.

```
# Grid_home/bin/srvctl add filesystem -volume acfs_volume_name -diskgroup
diskgroup_name -path mount_point -fstype ACFS -autostart ALWAYS -user
oracle
```

#### Note:

Mount Oracle ACFS to a mount point where you plan to create Oracle base and Oracle home directories for this installation. For example, /u01/app/oracle.

2. As the oracle user, mount the Oracle ACFS file system on all of the cluster nodes on which you want to configure Standard Edition High Availability.

```
$ Grid_home/bin/srvctl start filesystem -volume acfs_volume_name -
diskgroup diskgroup name
```



 As the root user, create the Oracle base directory in an Oracle ACFS volume on the first cluster node on which you want to configure Standard Edition High Availability. Follow the Oracle Optimal Flexible Architecture (OFA) recommendations and specify the correct owner, group, and permissions for this directory.

```
# mkdir -p /u01/app/oracle
# chown oracle:oinstall /u01/app/oracle
```

#### Note:

If you have configured the Oracle ACFS file system with the <code>oracle</code> user as the mount owner and the /u01/app/oracle directory as the mount point, then this step is not required.

- 4. Log in to the first cluster node as the Oracle Database software owner user (oracle).
- 5. Download the Oracle Database 19c release 19.3 installation image file (db\_home.zip) from Oracle Software Delivery Cloud website to a directory of your choice.

https://edelivery.oracle.com/

6. Download the Oracle Database Release Update 19.7 or later patch from My Oracle Support to a directory of your choice and unzip it.

https://support.oracle.com/

7. Create an OFA-compliant Oracle home directory in an Oracle ACFS volume and extract the image files that you have downloaded in to this Oracle home directory. For example:

```
$ mkdir -p /u01/app/oracle/product/19.0.0/dbhome_1
$ cd /u01/app/oracle/product/19.0.0/dbhome_1
$ unzip -q /tmp/db_home.zip
```

- 8. From the Oracle home directory, run the runInstaller command with the -applyRU flag to start the Oracle Database Setup Wizard and apply the Oracle Database Release Update 19.7 or later patch during installation.
  - \$ ./runInstaller -applyRU patch\_directory\_location/patch\_ID

#### Note:

Run the runInstaller command from the Oracle home directory only. Do not use the runInstaller command that resides at <code>\$ORACLE\_HOME/oui/bin/</code>, or any other location, to install Oracle Database.

- 9. In the Select Configuration Option screen, select Set Up Software Only.
- **10.** In the Select Database Installation Option screen, select **Single instance database installation**.
- **11.** In the Select Database Edition screen, select **Standard Edition 2**.
- **12.** Respond to the configuration prompts as needed.
- **13.** Provide information to automate root scripts, or run scripts as root when prompted by the setup wizard.



If you configure automation for running root scripts, and a root script fails, then you can fix the problem manually, and click **Retry** to run the root script again.

#### Note:

Click **Help** if you have any questions about the information you are asked to submit during installation.

- **14.** Optional: As the oracle user, enable read-only Oracle home on the first cluster node.
  - \$ \$ORACLE HOME/bin/roohctl -enable
- **15.** Attach the Oracle home on the first node to the other cluster nodes on which you want to configure Standard Edition High Availability.

```
$ $ORACLE_HOME/addnode/addnode.sh -silent
CLUSTER NEW NODES=comma separated list of other nodes
```

**16.** As the root user, run the root.sh script on all the other cluster nodes on which you are configuring Standard Edition High Availability.

```
# /u01/app/oracle/product/19.0.0/dbhome 1/root.sh
```

After the Oracle Database software installation is complete, use Oracle Database Configuration Assistant (Oracle DBCA), in either interactive or silent mode, to create a Standard Edition database on the first cluster node on which you installed the Oracle Database software.

For more information about the requirements for creating a database, and the procedure for enabling and configuring Standard Edition High Availability for Oracle Databases, refer to *Oracle Database Administrator's Guide*.

#### **Related Topics**

- Oracle Grid Infrastructure Installation and Upgrade Guide for Linux
- Configuring Oracle Automatic Storage Management Cluster File System
- Creating a Database with Oracle DBCA



12

# **Oracle Database Postinstallation Tasks**

Complete configuration tasks after you install Oracle Database.

You are required to complete some configuration tasks after Oracle Database is installed. In addition, Oracle recommends that you complete additional tasks immediately after installation. You must also complete product-specific configuration tasks before you use those products.

#### Note:

This chapter describes basic configuration only. Refer to product-specific administration and tuning guides for more detailed configuration and tuning information.

#### Required Postinstallation Tasks

Download and apply required patches for your software release after completing your initial installation.

- Recommended Postinstallation Tasks
   Oracle recommends that you complete these tasks after installation.
- About Changes in Default SGA Permissions for Oracle Database Starting with Oracle Database 12c Release 2 (12.2.0.1), by default, permissions to read and write to the System Global Area (SGA) are limited to the Oracle software installation owner.
- Checking Installed Oracle Database Contents and Directory Location Use these steps to check the contents and directory location of an Oracle Database installation:
- Enabling and Disabling Oracle Database Options After Installation The chopt tool changes your database options after installation.
- Starting Oracle Enterprise Manager Database Express Use these steps to log in to Oracle Enterprise Manager Database Express (EM Express).
- Creating a Fast Recovery Area
   During an Oracle Restart installation, you can create only one disk group. During an Oracle
   Clusterware installation, you can create multiple disk groups. If you plan to add an Oracle
   Database for a standalone server or an Oracle RAC database, then you should create the
   fast recovery area for database files.
- Cloning an Oracle Database Home Cloning an Oracle home involves creating a copy of the Oracle home and then configuring it for a new environment.

## **Required Postinstallation Tasks**

Download and apply required patches for your software release after completing your initial installation.



- Downloading Release Update Patches
   Download and install Release Updates (RU) and Monthly Recommended Patches (MRPs)
   patches for your Oracle software after you complete installation.
  - Unlocking and Resetting Oracle Database User Passwords
     Passwords for all Oracle system administration accounts except SYS, SYSTEM, and
     DBSMP are revoked after installation. Before you use a locked account, you must unlock it
     and reset its password.

## Downloading Release Update Patches

Download and install Release Updates (RU) and Monthly Recommended Patches (MRPs) patches for your Oracle software after you complete installation.

Oracle provides quarterly updates in the form of Release Updates (RU) and Monthly Recommended Patches (MRPs). Oracle no longer releases patch sets. For more information, see My Oracle Support Note 2285040.1.

Check the My Oracle Support website for required updates for your installation.

1. Use a web browser to view the My Oracle Support website:

https://support.oracle.com

2. In the sign in to other Oracle Support portals section, click Support for Oracle Hardware, Software, and Managed Cloud services to log in to My Oracle Support.

#### Note:

If you are not a My Oracle Support registered user, then click **Register for My Oracle Support** and register.

- 3. On the main My Oracle Support page, click Patches & Updates.
- 4. In the Patch Search region, select Product or Family (Advanced).
- 5. On the **Product or Family (Advanced)** display, provide information about the product, release, and platform for which you want to obtain patches, and click **Search**.

The Patch Search pane opens, displaying the results of your search.

6. Select the patch number and click **ReadMe**.

The README page is displayed. It contains information about the patch and how to apply the patches to your installation.

7. Uncompress the Oracle patch updates that you downloaded from My Oracle Support.

#### **Related Topics**

- My Oracle Support note 888.1
- Patch Delivery Methods for Oracle Database

## Unlocking and Resetting Oracle Database User Passwords

Passwords for all Oracle system administration accounts except SYS, SYSTEM, and DBSMP are revoked after installation. Before you use a locked account, you must unlock it and reset its password.



If you created a preconfigured database during the installation, but you did not unlock accounts required to use the database, then you must unlock and reset those accounts using these procedures.

- Requirements for Database Passwords
   To secure your database, use passwords that satisfy the Oracle recommended password
   requirements, even the passwords for predefined user accounts.
- Oracle Database System Privileges Accounts and Passwords Review these system privileges accounts after installation in preparation for unlocking accounts and changing passwords.
- Guidelines for Changing System Privileges Account Passwords
   Follow these rules for changing Oracle Database system privileges account passwords.
- Locking and Unlocking User Accounts
- Using SQL\*Plus to Unlock Accounts and Reset Passwords Use this SQL\*Plus procedure to unlock and reset user account passwords.

## Requirements for Database Passwords

To secure your database, use passwords that satisfy the Oracle recommended password requirements, even the passwords for predefined user accounts.

Oracle Database provides a set of predefined user accounts. Create passwords in a secure fashion. If you have default passwords, change these passwords to secure passwords.

You can manage the security for Oracle Database users in various ways:

- Enforce restrictions on the way that passwords are created
- Create user profiles
- · Use user resource limits to further secure user accounts

#### **Related Topics**

Oracle Database Security Guide

### Oracle Database System Privileges Accounts and Passwords

Review these system privileges accounts after installation in preparation for unlocking accounts and changing passwords.

All databases created by the Database Configuration Assistant (DBCA) include the SYS, SYSTEM, and DBSNMP database accounts. In addition, Oracle Database provides several other administrative accounts. Before using these accounts, you must unlock them and reset their passwords.

Starting with Oracle Database 12c Release 2 (12.2), only the HR sample schema is automatically installed after a database installation. All sample schemas, including HR, are distributed on GitHub:

https://github.com/oracle/db-sample-schemas



This list contains some of the important system privileges user accounts, but it is not complete. Use Oracle Enterprise Manager Database Express 12*c* to view the complete list of database accounts.

# Table 12-1 Partial List of Oracle Database System Privileges Accounts Locked After Installation Installation

User Name	Description	For More Information
ANONYMOUS	Enables HTTP access to Oracle XML DB.	Oracle XML DB Developer's Guide
APEX_050100	The account that owns the Oracle Application Express schema and metadata.	Oracle Application Express App Builder User's Guide
APEX_PUBLIC_USER	The minimally privileged account used for Oracle Application Express configuration with Oracle Application Express Listener or Oracle HTTP Server and mod_plsql.	Oracle Application Express App Builder User's Guide
APPQOSSYS	Used for storing and managing all data and metadata required by Oracle Quality of Service Management.	None
AUDSYS	The account where the unified audit data trail resides.	Oracle Database Security Guide
CTXSYS	The Oracle Text account.	Oracle Text Application Developer's Guide
DBSFWUSER	The account used to run the DBMS_SFW_ACL_ADMIN package.	Oracle Database PL/SQL Packages and Types Reference
DBSNMP	The account used by the Management Agent component of Oracle Enterprise Manager to monitor and manage the database.	Oracle Enterprise Manager Cloud Control Administrator's Guide
DIP	The account used by the Directory Integration Platform (DIP) to synchronize the changes in Oracle Internet Directory with the applications in the database.	None
DVSYS	There are two roles associated with this account. The Database Vault owner role manages the Database Vault roles and configurations. The Database Vault Account Manager is used to manage database user accounts.	Oracle Database Vault Administrator's Guide
	Note: Part of Oracle Database Vault user interface text is stored in database tables in the DVSYS schema. By default, only the English language is loaded into these tables. You can use the DVSYS.DBMS_MACADM.ADD_NLS_DATA procedure to add other languages to Oracle Database Vault.	
DVF	The account owned by Database Vault that contains public functions to retrieve the Database Vault Factor values.	Oracle Database Vault Administrator's Guide

User Name	Description	For More Information
FLOWS_FILES	The account owns the Oracle Application Express uploaded files.	Oracle Application Express App Builder User's Guide
GGSYS	The internal account used by Oracle GoldenGate. It should not be unlocked or used for a database login.	None
GSMADMIN_INTERN AL	The internal account that owns the Global Data Services schema. It should not be unlocked or used for a database login.	Oracle Database Global Data Services Concepts and Administration Guide
GSMCATUSER	The account used by Global Service Manager to connect to the Global Data Services catalog.	Oracle Database Global Data Services Concepts and Administration Guide
GSMUSER	The account used by Global Service Manager to connect to the database.	Oracle Database Global Data Services Concepts and Administration Guide
HR	The account that owns the Human Resources schema included in the Oracle Sample Schemas.	Oracle Database Sample Schemas
LBACSYS	The Oracle Label Security administrator account. Starting with Oracle Database 18c, the LBACSYS user account is created as a schema-only account.	Oracle Label Security Administrator's Guide
MDDATA	The schema used by Oracle Spatial and Graph for storing geocoder and router data.	Oracle Spatial and Graph Developer's Guide
MDSYS	The Oracle Spatial and Graph administrator account.	Oracle Spatial and Graph Developer's Guide
OUTLN	The account that supports plan stability. Plan stability enables you to maintain the same execution plans for the same SQL statements. OUTLN acts as a role to centrally manage metadata associated with stored outlines.	None
ORACLE_OCM	This account contains the instrumentation for configuration collection used by the Oracle Configuration Manager.	None
REMOTE_SCHEDUL ER_AGENT	The account to disable remote jobs on a database. This account is created during the remote scheduler agent configuration. You can disable the capability of a database to run remote jobs by dropping this user.	Oracle Database Administrator's Guide
SYS	The account used to perform database administration tasks.	Oracle Database Administrator's Guide
SYSTEM	Another account used to perform database administration tasks.	Oracle Database Administrator's Guide
SYSBACKUP	The account used to perform backup and recovery tasks.	Oracle Database Administrator's Guide
SYSKM	The account used to perform encryption key management.	Oracle Database Administrator's Guide
SYSDG	The account used to administer and monitor Oracle Data Guard.	Oracle Database Administrator's Guide

Table 12-1 (Cont.) Partial List of Oracle Database System Privileges Accounts LockedAfter Installation



User Name	Description	For More Information
SYSRAC	The account used to administer Oracle Real Application Clusters (RAC).	Oracle Database Administrator's Guide
SYS\$UMF	The account used to administer Remote Management Framework, including the remote Automatic Workload Repository (AWR).	Oracle Database Performance Tuning Guide
WMSYS	The account used to store the metadata information for Oracle Workspace Manager.	Oracle Database Workspace Manager Developer's Guide
XDB	The account used for storing Oracle XML DB data and metadata.	Oracle XML DB Developer's Guide
XS\$NULL	The internal account that represents the absence of a database schema user in a session, and indicates an application user session is in use. XS\$NULL cannot be authenticated to a database, nor can it own any database schema objects, or possess any database privileges.	Oracle Database Real Application Security Administrator's and Developer's Guide

# Table 12-1 (Cont.) Partial List of Oracle Database System Privileges Accounts LockedAfter Installation

Except for the accounts provided with the Oracle Sample Schemas, most of these database accounts are locked by default and created without passwords as schema only. This prevents malicious users from logging into these accounts using the default password set during catalog creation. To find the status of an account, query the AUTHENTICATION\_TYPE column of the DBA\_USERS data dictionary view. If AUTHENTICATION\_TYPE is schema only, then the status is NONE.

Many of these accounts are automatically created when you run standard scripts such as the various cat\*.sql scripts. To find user accounts that are created and maintained by Oracle, query the USERNAME and ORACLE\_MAINTAINED columns of the ALL\_USERS data dictionary view. If the output for ORACLE\_MAINTAINED is Y, then you must not modify the user account except by running the script that was used to create it.

#### **Related Topics**

- Oracle Database Security Guide
- Oracle Database Sample Schemas

## Guidelines for Changing System Privileges Account Passwords

Follow these rules for changing Oracle Database system privileges account passwords.

Before you use a locked account, you must unlock it and reset its password. Passwords for all Oracle system administration accounts except SYS, SYSTEM, and DBSNMP are revoked after installation. If you created a starter database during the installation, Oracle Database Configuration Assistant displays a screen with your database information and the Password Management button. Use the Password Management button to unlock only the user names you use.

For more information about how to create a secure password, see:

Oracle Database Security Guide



## Locking and Unlocking User Accounts

To temporarily deny access to the database for a particular user account, you can lock the user account. If the user then attempts to connect, then the database displays an error message and does not allow the connection. You can unlock the user account when you want to permit database access again for that user. You can use Oracle Enterprise Manager Database Express (EM Express) to lock and unlock user accounts.

#### To lock or unlock a user account:

- 1. In EM Express, go to the Users page.
- 2. Click the desired user account.
- 3. From the Actions menu, select Alter Account.

The Alter Account page appears.

- 4. Do one of the following:
  - To lock the account, enable the Account Locked option, and then click OK.
  - To unlock the account, disable the Account Locked option, and then click OK.

#### Using SQL\*Plus to Unlock Accounts and Reset Passwords

Use this SQL\*Plus procedure to unlock and reset user account passwords.

- 1. Log in as the Oracle Database software owner user.
- 2. Set the ORACLE\_HOME and ORACLE\_SID environment variables.

Bourne, Bash or Korn shell:

```
$ ORACLE_SID=orcl
$ export ORACLE_SID
$ ORACLE_HOME=/u01/app/oracle/product/19.0.0/dbhome_1
$ export ORACLE HOME
```

#### C shell:

```
% setenv ORACLE_SID orcl
% setenv ORACLE HOME /u01/app/oracle/product/19.0.0/dbhome 1
```

3. Start SQL\*Plus and log in as the SYS user, connecting as SYSDBA:

```
$ $ORACLE_HOME/bin/sqlplus
SQL> CONNECT SYS as SYSDBA
Enter password: sys password
```

4. To unlock an account:

ALTER USER account ACCOUNT UNLOCK;

5. To reset the password:

ALTER USER user name IDENTIFIED BY new password;



If you unlock an account but do not reset the password, then the password remains expired. The first time someone connects as that user, they must change the user's password.

#### **Related Topics**

Oracle Database Administrator's Guide

## **Recommended Postinstallation Tasks**

Oracle recommends that you complete these tasks after installation.

- Creating a Backup of the root.sh Script Oracle recommends that you back up the root.sh script after you complete an installation.
- Setting Language and Locale Preferences for Client Connections Configure client applications connecting to an Oracle Database according to your locale preferences and your I/O device character set.
- Recompile Invalid Objects in the Database After you install, patch, or upgrade a database, recompile invalid objects on the CDB and PDBs with a recompilation driver script.
- About Installing Oracle Autonomous Health Framework Install the latest version of Oracle Autonomous Health Framework to perform proactive heath checks and collect diagnostics data for the Oracle software stack.

## Creating a Backup of the root.sh Script

Oracle recommends that you back up the root.sh script after you complete an installation.

If you install other products in the same Oracle home directory subsequent to this installation, then Oracle Universal Installer updates the contents of the existing root.sh script during the installation. If you require information contained in the original root.sh script, then you can recover it from the backed up root.sh file.

## Setting Language and Locale Preferences for Client Connections

Configure client applications connecting to an Oracle Database according to your locale preferences and your I/O device character set.

You must configure client applications connecting to an Oracle Database according to your locale preferences and your I/O device character set. If your applications do not have their own specific methods to configure locale preferences, then the method you use to configure an Oracle database client connection depends on the access API you use to connect to the database. Check your application documentation, before you configure locale preferences for your applications.

For applications that connect to Oracle Databases using Oracle Call Interface (OCI) use NLS\_LANG and other client settings with names that start with NLS\_ to set the locale conventions and client character set for Oracle Database sessions. It is important that you set the character set part of the NLS\_LANG value properly. The character set you set must correspond to the character set used by your I/O devices, which in case of Microsoft Windows



is either the ANSI Code Page (for GUI applications), such as WE8MSWIN1252, or the OEM Code Page (for Console mode applications), such as US8PC437. By doing this, the OCI API is notified about the character set of data that it receives from the application. OCI can then convert this data correctly to and from the database character set.

NLS\_LANG and the other NLS settings can be specified either as environment variables or as Windows Registry settings. Environment variable values take precedence over Registry values.

Oracle Universal Installer sets a default value for the NLS\_LANG setting in Registry when it creates a new Oracle home on Microsoft Windows. The NLS\_LANG value is based on the language of the Windows user interface, which is the language of Windows menu items and dialog box labels.

#### Caution:

Failure to set the client character set correctly can cause data loss.

Java applications that connect to Oracle Databases by using Oracle JDBC do not use NLS\_LANG. Instead, Oracle JDBC maps the default locale of the Java VM in which the application runs to the Oracle Database language and territory settings. Oracle JDBC then configures the connected database session using these settings. Because Java works internally in Unicode, the client character set is always set to Unicode. Unless an application explicitly changes it, the default locale of the Java VM is set based on the locale of the user operating system on which the Java VM runs. Check your Java VM documentation for information about configuring the Java VM default locale.

#### Note:

In 3-tier architecture deployments, application servers that are database clients can have settings in their configuration files that specify the NLS\_LANG value or the Java VM locale. Check the documentation accompanying these servers.

#### 💉 See Also:

*Oracle Database Globalization Support Guide* for more information about configuring user locale preferences

## Recompile Invalid Objects in the Database

After you install, patch, or upgrade a database, recompile invalid objects on the CDB and PDBs with a recompilation driver script.

By default, AutoUpgrade performs a recompilation of invalid Oracle objects, which is controlled by the configuration file run\_utlrp local parameter (default: *prefix.run\_utlrp=yes*). In addition, Oracle provides the recompilation scripts utlrp.sql and utlprp.sql. These scripts are located in the *Oracle\_home*/rdbms/admin directory.



Starting with AutoUpgrade 23.1, when you run the AutoUpgrade utility, AutoUpgrade runs the utlprpom.sql script, and does not run utlrp.sql. When AutoUpgrade is used for upgrades to Oracle Database 12c Release 2 (12.2.0.1) and later releases, AutoUpgrade only recompiles invalid objects owned by Oracle-maintained schemas. Because database upgrades do not need to touch user objects, AutoUpgrade maintains this policy when it recompiles invalid objects.

After installing a database, recomplile all invalid objects;

- 1. Change directory to Oracle home/rdbms/admin. For example
  - \$ cd \$ORACLE HOME/rdbms/admin
- 2. Use the catcon.pl script in the Oracle home to run utlrp.sql. For example:

```
$ORACLE_HOME/perl/bin/perl catcon.pl --n 1 --e --b utlrp --d '''.'''
utlrp.sql
```

Note the following conditions of this use case:

- --n parameter: is set to 1, so the script runs each PDB recompilation in sequence.
- --e parameter: turns echo on.
- --b parameter: Sets the log file base name. It is set to utlrp.

Expect a time delay for the serial recompilation of PDBs to complete. Depending on the number of PDBs that you are upgrading, the recompilation can extend significantly beyond the time required for the upgrade scripts to complete.

The utlrp.sql script automatically recompiles invalid objects in either serial or parallel recompilation, based on both the number of invalid objects, and on the number of CPUs available. CPUs are calculated using the number of CPUs (*cpu\_count*) multiplied by the number of threads for each CPU (*parallel\_threads\_per\_cpu*). On Oracle Real Application Clusters (Oracle RAC), this number is added across all Oracle RAC nodes.

After patching or upgrading a database, there is more than one approach you can use to recompile invalid Oracle-owned and user-owned objects:

Recompile all invalid objects (the invalid objects in both Oracle and user schemas) by using utlrp.sql or utlprp.sql.

If time is a factor and the type of invalid objects is predominately application owned, then you can recompile Oracle-owned invalid objects first, and defer recompiling application-owned invalid objects to a later time. To recompile invalid objects in Oracle schemas, use utlprpom.sql. To recompile the remaining invalid objects, use utlprp.sql or utlprp.sql.

#### Note:

When you use either utlprp.sql or utlprpom.sql, note that both scripts require you to define the degree of parallelism that the script should use, or determine the number of parallel recompile jobs to use.



The script uses syntax as follows, where *base* is the base name you want to have given to log files, *N* is the number of PDBs on which you want to run recompilation jobs in parallel (degrees of parallelism), *script.sql* is the Oracle recompilation script you chose to use, and *P* is the number of PDBs on which you want to run in parallel:

Suppose you are running recompilation in a CDB using the log file base name recomp, with a degrees of parallelism setting of 3 jobs per PDB container, the script you choose to use is utlprp.sql, and you want to recompile across at most 10 PDBs at a time. In that case, the syntax you use to run the recompile operation is similar to the following,

```
$ORACLE_HOME/perl/bin/perl $ORACLE_HOME/rdbms/admin/catcon.pl -b recomp -
d $ORACLE HOME/rdbms/admin -n 10 -l /tmp utlprp.sql '--p3'
```

#### **Related Topics**

Syntax and Parameters for catcon.pl

## About Installing Oracle Autonomous Health Framework

Install the latest version of Oracle Autonomous Health Framework to perform proactive heath checks and collect diagnostics data for the Oracle software stack.

Oracle Autonomous Health Framework includes the functionality from Oracle ORAchk, Oracle EXAchk, and Oracle Trace File Analyzer (TFA). Oracle Autonomous Health Framework extends health check coverage to the entire Oracle software stack, based on critical and reoccurring problems. Oracle Autonomous Health Framework proactively scans for known problems with Oracle products and deployments, including the following:

- Standalone Oracle Database
- Oracle Grid Infrastructure
- Oracle Real Application Clusters
- Maximum Availability Architecture (MAA) Validation
- Upgrade Readiness Validations
- Oracle GoldenGate

Oracle Autonomous Health Framework is pre-installed with Oracle Database. However, Oracle recommends that you update to the latest version of Oracle Autonomous Health Framework by downloading and installing it from My Oracle Support Note 2550798.1.

https://support.oracle.com/epmos/faces/DocContentDisplay? id=2550798.1&parent=DOCUMENTATION&sourceId=USERGUIDE

## About Changes in Default SGA Permissions for Oracle Database

Starting with Oracle Database 12c Release 2 (12.2.0.1), by default, permissions to read and write to the System Global Area (SGA) are limited to the Oracle software installation owner.

In previous releases, both the Oracle installation owner account and members of the OSDBA group had access to shared memory. The change in Oracle Database 12c Release 2 (12.2)



and later releases to restrict access by default to the Oracle installation owner account provides greater security than previous configurations. However, this change may prevent DBAs who do not have access to the Oracle installation owner account from administering the database.

The Oracle Database initialization parameter ALLOW\_GROUP\_ACCESS\_TO\_SGA determines if the Oracle Database installation owner account (oracle in Oracle documentation examples) is the only user who can read and write to the database System Global Area (SGA), or if members of the OSDBA group can read the SGA. In Oracle Database 12c Release 2 (12.2) and later releases, the default value for this parameter is FALSE, so that only the Oracle Database installation owner has read and write permissions to the SGA. Group access to the SGA is removed by default. This change affects all Linux and UNIX platforms.

If members of the OSDBA group require read access to the SGA, then you can change the initialization parameter ALLOW\_GROUP\_ACCESS\_TO\_SGA setting from FALSE to TRUE. Oracle strongly recommends that you accept the default permissions that limit access to the SGA to the oracle user account.

#### **Related Topics**

• Oracle Database Reference

# Checking Installed Oracle Database Contents and Directory Location

Use these steps to check the contents and directory location of an Oracle Database installation:

- 1. Go to \$ORACLE HOME/oui/bin.
- 2. Start Oracle Universal Installer.
  - \$ ./runInstaller
- 3. Click Installed Products to display the Inventory dialog box on the Welcome screen.
- 4. Select an Oracle Database product from the list to check the installed contents.
- 5. Click **Details** to find additional information about an installed product.
- 6. Click **Close** to close the Inventory dialog box.
- 7. Click **Cancel** to close Oracle Universal Installer, and then click **Yes** to confirm.

# Enabling and Disabling Oracle Database Options After Installation

The chopt tool changes your database options after installation.

When you install Oracle Database, some options are enabled and others are disabled. To enable or disable a particular database feature for an Oracle home, shut down the database and use the <code>chopt</code> tool.

Chopt Tool

Use the chopt tool after installation to add or remove Oracle Database options.



## **Chopt Tool**

Use the  ${\tt chopt}$  tool after installation to add or remove Oracle Database options.

#### Purpose

The chopt tool is a command-line utility that enables and disables database options.

### Note:

If you install or clone an Oracle Database image, then all Oracle Database options are enabled by default.

#### Prerequisites

You must complete installation before you can use the chopt tool.

#### File Path

The tool is located in the ORACLE HOME/bin directory

#### Syntax

chopt [enable | disable] db\_option

#### Options

Command Option	Description
olap	Oracle OLAP
partitioning	Oracle Partitioning
rat	Oracle Real Application Testing

#### Note:

- When you enable or disable OLAP, you must run the SYS.XOQ\_VALIDATE and SYS.APS\_VALIDATE procedures to update the database registry. When you disable OLAP, its status in the database registry should be OPTION OFF and when you enable OLAP, its status in the database registry should be VALID.
- The Oracle Advanced Analytics (OAA) feature is enabled by default for Oracle Database. You cannot disable it using the chopt tool.

#### Examples

To use the chopt tool to modify your Oracle Database, you must shut down the database before you run the chopt tool, and then start up the database after you add or remove database options.



### Example 12-1 Enabling Oracle Real Application Testing Using chopt

The following example shows how to use the chopt tool to enable the Oracle Real Application Testing option in an Oracle Database called Sales:

```
cd $ORACLE_HOME/bin
srvctl stop database -d Sales
chopt enable rat
srvctl start database -d Sales
```

# Starting Oracle Enterprise Manager Database Express

Use these steps to log in to Oracle Enterprise Manager Database Express (EM Express).

To start Oracle Enterprise Manager Database Express, use the EM Express URL provided by Oracle Database Configuration Assistant (Oracle DBCA) during the database installation and creation. For information about logging in to Oracle Enterprise Manager Database Express see *Oracle Database 2 Day DBA*.

If Oracle DBCA did not provide the EM Express URL during the database installation and creation, or if you need to change the EM Express port later on, then see *Oracle Database 2 Day DBA*.

#### **Related Topics**

- Oracle Database 2 Day DBA
- Configuring the HTTPS Port for EM Express

### Creating a Fast Recovery Area

During an Oracle Restart installation, you can create only one disk group. During an Oracle Clusterware installation, you can create multiple disk groups. If you plan to add an Oracle Database for a standalone server or an Oracle RAC database, then you should create the fast recovery area for database files.

- About the Fast Recovery Area and the Fast Recovery Area Disk Group
   The fast recovery area is a unified storage location for all Oracle Database files related to
   recovery. Enabling rapid backups for recent data can reduce requests to system
   administrators to retrieve backup tapes for recovery operations.
- Creating the Fast Recovery Area Disk Group
   Procedure to create the fast recovery area disk group.

### About the Fast Recovery Area and the Fast Recovery Area Disk Group

The fast recovery area is a unified storage location for all Oracle Database files related to recovery. Enabling rapid backups for recent data can reduce requests to system administrators to retrieve backup tapes for recovery operations.

Database administrators can define the DB\_RECOVERY\_FILE\_DEST parameter to the path for the fast recovery area to enable on disk backups and rapid recovery of data. When you enable fast recovery in the init.ora file, Oracle Database writes all RMAN backups, archive logs, control file automatic backups, and database copies to the fast recovery area. RMAN automatically manages files in the fast recovery area by deleting obsolete backups and archiving files no longer required for recovery.



Oracle recommends that you create a fast recovery area disk group. Oracle Clusterware files and Oracle Database files can be placed on the same disk group, and you can also place fast recovery files in the same disk group. However, Oracle recommends that you create a separate fast recovery disk group to reduce storage device contention.

The fast recovery area is enabled by setting the DB\_RECOVERY\_FILE\_DEST parameter. The size of the fast recovery area is set with DB\_RECOVERY\_FILE\_DEST\_SIZE. As a general rule, the larger the fast recovery area, the more useful it becomes. For ease of use, Oracle recommends that you create a fast recovery area disk group on storage devices that can contain at least three days of recovery information. Ideally, the fast recovery area is large enough to hold a copy of all of your data files and control files, the online redo logs, and the archived redo log files needed to recover your database using the data file backups kept under your retention policy.

Multiple databases can use the same fast recovery area. For example, assume you have created a fast recovery area disk group on disks with 150 GB of storage, shared by 3 different databases. You can set the size of the fast recovery for each database depending on the importance of each database. For example, if database1 is your least important database, database2 is of greater importance, and database3 is of greatest importance, then you can set different DB\_RECOVERY\_FILE\_DEST\_SIZE settings for each database to meet your retention target for each database: 30 GB for database1, 50 GB for database2, and 70 GB for database3.

### Creating the Fast Recovery Area Disk Group

Procedure to create the fast recovery area disk group.

1. Go to the Oracle Grid Infrastructure home bin directory, and start Oracle ASM Configuration Assistant (ASMCA).

For example:

```
$ cd /u01/app/oracle/product/19.0.0/grid/bin
$ ./asmca
```

ASMCA opens the home window.

- 2. Click **Disk Groups** in the left panel to open the Disk Groups tab.
- 3. Click Create to create a new disk group.

The Create Disk Groups window opens.

4. Provide configuration information for the fast recovery area as prompted:

In the Disk Group Name field, enter a descriptive name for the fast recovery area group. For example: FRA.

In the Redundancy section, select the level of redundancy you want to use. For example: Normal

In the Select Member Disks field, select eligible disks you want to add to the fast recovery area, and click **OK**.

5. When the Fast Recovery Area disk group creation is complete, click **Exit** and click **Yes** to confirm closing the ASMCA application.



# Cloning an Oracle Database Home

Cloning an Oracle home involves creating a copy of the Oracle home and then configuring it for a new environment.

If you are performing multiple Oracle Database installations, then you may want to use cloning to create each Oracle home, because copying files from an existing Oracle Database installation takes less time than creating a new version of them. This method is also useful if the Oracle home that you are cloning has had patches applied to it. When you clone the Oracle home, the new Oracle home has the patch updates.

Perform these steps to clone an Oracle home.

### Note:

During cloning, Oracle Universal Installer (OUI) prompts you to run scripts that require root privileges.

1. Verify that the installation of Oracle Database that you want clone is successful.

You can do this by reviewing the <code>installActionsdate\_time.log</code> file for the installation session, which is typically located in the <code>/u01/app/oracle/oraInventory/logs</code> directory.

If you install patches, then check their status using the following:

\$ cd \$ORACLE HOME/OPatch

Include \$ORACLE HOME/OPatch in \$PATH

```
$ opatch lsinventory
```

- 2. Stop all processes related to the Oracle home.
- 3. Create a ZIP or TAR file with the Oracle home (but not the Oracle base) directory.

For example, if the source Oracle installation is in the path /u01/app/oracle/ product/19.0.0/dbhome\_1, then you zip the dbhome\_1 directory by using the following command:

# zip -r dbhome\_1.zip /u01/app/oracle/product/19.0.0/dbhome\_1

You can also use the TAR command. For example:

# tar -cvf dbhome 1.tar /u01/app/oracle/product/19.0.0/dbhome 1

Do not include the admin, fast\_recovery\_area, and oradata directories that are under the Oracle base directory. These directories are created in the target installation later, when you create a new database there.

4. Copy the ZIP or TAR file to the root directory of the target computer. If you use File Transfer Protocol (FTP), then transfer the ZIP or TAR file in binary mode only.



5. Extract the ZIP or TAR file content using the following command:

```
# unzip -d / dbhome_1.zip
# tar -xvf dbhome 1.tar
```

6. If necessary, change the ownership of the Oracle Database home to the Oracle Database installation owner user (oracle) belonging to the Oracle Inventory group (oinstall).

```
# chown -R oracle:oinstall /u01/app/oracle/product/19.0.0/dbhome 1
```

- 7. On the target computer, change the directory to the unzipped Oracle home directory, and remove all the .ora (\*.ora) files present in the unzipped \$ORACLE\_HOME/network/ admin directory.
- 8. Delete unnecessary files from the unzipped Oracle home directory.

The unzipped Oracle home directory contains files that are relevant only to the source Oracle home. The following example shows how to remove these unnecessary files from the unzipped Oracle home directory:

Remove the .ora files from the network/admin directory, and remove the old database entries from the dbs directory.

# cd \$ORACLE\_HOME
# rm -rf network/admin/\*.ora
# rm dbs/old database entries

9. From the <code>\$ORACLE\_HOME/clone/bin</code> directory, run the <code>clone.pl</code> file for the unzipped Oracle home.

Use the following syntax (you can also include one or more of the extended Oracle Database groups in the syntax):

```
$ORACLE_HOME/perl/bin/perl $ORACLE_HOME/clone/bin/clone.pl
ORACLE_BASE="target_oracle_base" ORACLE_HOME="target_oracle_home"
OSDBA_GROUP=OSDBA_privileged_group
OSDPER_GROUP=OSDPER_privileged_group
OSDGDBA_GROUP=OSDGDBA_privileged_group
OSKMDBA_GROUP=OSKMDBA_privileged_group
OSRACDBA_GROUP=OSRACDBA_privileged_group -defaultHomeName
```

#### For example:

```
$ORACLE_HOME/perl/bin/perl $ORACLE_HOME/clone/bin/clone.pl
ORACLE_BASE="/u01/app/oracle" ORACLE_HOME="/u01/app/oracle/product/19.0.0/
dbhome_1"
OSDBA_GROUP=dba OSOPER_GROUP=oper OSBACKUPDBA_GROUP=backupdba
OSDGDBA_GROUP=dgdba OSKMDBA_GROUP=kmdba OSRACDBA_GROUP=racdba -
defaultHomeName
```





- In this command, if you do not provide the parameters for the operating system groups, then clone.pl uses the operating system group values from the source home.
- Run the \$ORACLE\_HOME/perl/bin/perl \$ORACLE\_HOME/clone/bin/ clone.pl -help command for more information about the command option flags.
- The clone.pl script is deprecated in Oracle Database 19c and can be removed in a future release. Hence, Oracle recommends that you use the software-only installation option, available in the database installer, instead of clone.pl to clone your database.

OUI starts, and then records the cloning actions in the cloneActionstimestamp.log file. This log file is typically located in /u01/app/oracle/oraInventory/logs directory.

**10.** Use the following commands to run Net Configuration Assistant to configure the connection information for the new database:

```
$ cd $ORACLE_HOME/bin
$ ./netca
```

**11.** Use the following commands to run Database Configuration Assistant to create a new Oracle Database for the newly-cloned oracle home:

```
$ cd $ORACLE_HOME/bin
$ ./dbca
```

#### **Related Topics**

- Oracle Clusterware Administration and Deployment Guide
- Oracle Database Administrator's Guide



# **Removing Oracle Database Software**

These topics describe how to remove Oracle software and configuration files.

Use the deinstall command that is included in Oracle homes to remove Oracle software. Oracle does not support the removal of individual products or components.

### Caution:

If you have a standalone database on a node in a cluster, and if you have multiple databases with the same global database name (GDN), then you cannot use the deinstall command to remove one database only.

### About Oracle Deinstallation Options

You can stop and remove Oracle Database software and components in an Oracle Database home with the deinstall command.

- Oracle Deinstallation (Deinstall) You can run the deinstall command from an Oracle home directory after installation.
- Deinstallation Examples for Oracle Database Use these examples to help you understand how to run the deinstall command.
- Downgrading Oracle Restart
   Use this procedure to deconfigure and downgrade Oracle Restart, or to troubleshoot
   Oracle Restart installation errors.
- Removing an RPM-based Oracle Database Installation Use this procedure to remove and deinstall a database installed using the yum command.
- Deinstalling Previous Release Grid Home Use this procedure to deinstall the previous release Grid home.

# About Oracle Deinstallation Options

You can stop and remove Oracle Database software and components in an Oracle Database home with the deinstall command.

You can remove the following software using deinstall:

- Oracle Database
- Oracle Grid Infrastructure, which includes Oracle Clusterware and Oracle Automatic Storage Management (Oracle ASM)
- Oracle Real Application Clusters (Oracle RAC)
- Oracle Database Client

The deinstall command is available in Oracle home directories after installation. It is located in the <code>\$ORACLE HOME/deinstall directory</code>.



deinstall creates a response file by using information in the Oracle home and using the information you provide. You can use a response file that you generated previously by running the deinstall command using the -checkonly option. You can also edit the response file template.

If you run deinstall to remove an Oracle Grid Infrastructure installation, then the deinstaller prompts you to run the deinstall command as the root user. For Oracle Grid Infrastructure for a cluster, the script is rootcrs.sh, and for Oracle Grid Infrastructure for a standalone server (Oracle Restart), the script is roothas.sh.

### Note:

- You must run the deinstall command from the same release to remove Oracle software. Do not run the deinstall command from a later release to remove Oracle software from an earlier release. For example, do not run the deinstall command from the 19c Oracle home to remove Oracle software from an existing 11.2.0.4 Oracle home.
- Starting with Oracle Database 12c Release 1 (12.1.0.2), the roothas.sh script replaces the roothas.pl script in the Oracle Grid Infrastructure home for Oracle Restart, and the rootcrs.sh script replaces the rootcrs.pl script in the Grid home for Oracle Grid Infrastructure for a cluster.

If the software in the Oracle home is not running (for example, after an unsuccessful installation), then deinstall cannot determine the configuration, and you must provide all the configuration details either interactively or in a response file.

In addition, before you run deinstall for Oracle Grid Infrastructure installations:

- Dismount Oracle Automatic Storage Management Cluster File System (Oracle ACFS) and disable Oracle Automatic Storage Management Dynamic Volume Manager (Oracle ADVM).
- If Grid Naming Service (GNS) is in use, then notify your DNS administrator to delete the subdomain entry from the DNS.

### Files Deleted by deinstall

When you run deinstall, if the central inventory (oraInventory) contains no other registered homes besides the home that you are deconfiguring and removing, then deinstall removes the following files and directory contents in the Oracle base directory of the Oracle Database installation owner:

- admin
- cfgtoollogs
- checkpoints
- diag
- oradata
- fast\_recovery\_area

Oracle strongly recommends that you configure your installations using an Optimal Flexible Architecture (OFA) configuration, and that you reserve Oracle base and Oracle home paths for



exclusive use of Oracle software. If you have any user data in these locations in the Oracle base that is owned by the user account that owns the Oracle software, then deinstall deletes this data.

### Caution:

deinstall deletes Oracle Database configuration files, user data, and fast recovery area (FRA) files even if they are located outside of the Oracle base directory path.

# Oracle Deinstallation (Deinstall)

You can run the deinstall command from an Oracle home directory after installation.

#### Purpose

deinstall stops Oracle software, and removes Oracle software and configuration files on the operating system for a specific Oracle home.

#### Syntax

The deinstall command uses the following syntax:

```
(./deinstall [-silent] [-checkonly] [-paramfile complete path of input
response file]
[-params namel=value name2=value . . ]
[-o complete path of directory for saving files]
[-tmpdir complete path of temporary directory to use]
[-logdir complete path of log directory to use] [-local] [-
skipLocalHomeDeletion] [-skipRemoteHomeDeletion] [-help]
```

### Parameters

Parameter	Description
-silent	Use this flag to run deinstall in noninteractive mode. This option requires one of the following:
	<ul> <li>A working system that it can access to determine the installation and configuration information. The -silent flag does not work with failed installations.</li> </ul>
	<ul> <li>A response file that contains the configuration values for the Oracle home that is being deinstalled or deconfigured.</li> </ul>
	You can generate a response file to use or modify by running deinstall with the -checkonly flag. deinstall then discovers information from the Oracle home to deinstall and deconfigure. It generates the response file that you can then use with the -silent option.
	You can also modify the template file deinstall.rsp.tmpl, located in the \$ORACLE_HOME/deinstall/respons- directory.



Parameter	Description
-checkonly	Use this flag to check the status of the Oracle software home configuration. Running deinstall with the -checkonly flag does not remove the Oracle configuration. The - checkonly flag generates a response file that you can then use with the deinstall command and -silent option.
-paramfile complete path of input response file	Use this flag to run deinstall with a response file in a location other than the default. When you use this flag, provide the complete path where the response file is located. The default location of the response file
	is \$ORACLE_HOME/deinstall/response.
-params [ <i>name1=value name2=value name3=value</i> ]	Use this flag with a response file to override one or more values to change in a response file you have created.
-o complete path of directory for saving response files	Use this flag to provide a path other than the default location where the response file (deinstall.rsp.tmpl) is saved.
	The default location of the response file is $\$ , , , , , , , , , , , , , , , , , , ,
-tmpdir complete path of temporary directory to use	Use this flag to specify a non-default location where deinstall writes the temporary files for the deinstallation.
-logdir complete path of log directory to use	Use this flag to specify a non-default location where deinstall writes the log files for the deinstallation.
-local	Use this flag on a multinode environment to deinstall Oracle software in a cluster.
	When you run deinstall with this flag, it deconfigures and deinstalls the Oracle software on the local node (the node where deinstall is run). On remote nodes, it deconfigures Oracle software, but does not deinstall the Oracle software.
-skipLocalHomeDeletion	Use this flag in Oracle Grid Infrastructure installations on a multinode environment to deconfigure a local Grid home without deleting the Grid home.
-skipRemoteHomeDeletion	Use this flag in Oracle Grid Infrastructure installations on a multinode environment to deconfigure a remote Grid home without deleting the Grid home.
-help	Use this option to obtain additional information about the command option flags.

# Deinstallation Examples for Oracle Database

Use these examples to help you understand how to run the deinstall command.

Run deinstall from the <code>\$ORACLE\_HOME/deinstall</code> directory. The deinstallation starts without prompting you for the Oracle home path.

\$ ./deinstall

You can generate a deinstallation response file by running deinstall with the -checkonly flag. Alternatively, you can use the response file template located at <code>\$ORACLE\_HOME/</code> deinstall/response/deinstall.rsp.tmpl. If you have a response file, then use the optional flag -paramfile to provide a path to the response file.

In the following example, the deinstall command is in the path/u01/app/oracle/product/ 19.0.0/dbhome\_1/deinstall. It uses a response file called my\_db\_paramfile.tmpl in the software owner location /home/usr/oracle:

```
$ cd /u01/app/oracle/product/19.0.0/dbhome_1/deinstall
$ ./deinstall -paramfile /home/usr/oracle/my db paramfile.tmpl
```

To remove the Oracle Grid Infrastructure home, use the deinstall command in the Oracle Grid Infrastructure home.

In this example, the Oracle Grid Infrastructure home is /u01/app/oracle/product/ 19.0.0/grid

```
$ cd /u01/app/oracle/product/19.0.0/grid/deinstall
$ ./deinstall -paramfile /home/usr/oracle/my grid paramfile.tmpl
```

### **Downgrading Oracle Restart**

Use this procedure to deconfigure and downgrade Oracle Restart, or to troubleshoot Oracle Restart installation errors.

Running roothas.sh with the command flags -deconfig -force enables you to deconfigure Oracle Restart without removing the installed binaries. This feature is useful if you encounter an error during an Oracle Grid Infrastructure for a standalone server installation. For example, when you run the root.sh command, and find a missing operating system package. By running roothas.sh -deconfig -force, you can deconfigure Oracle Restart, correct the cause of the error, and then run root.sh again.

1. As the oracle user, create a backup of the SPFILE to a PFILE.

```
CREATE PFILE='/u01/app/oracle/product/19.0.0/dbhome_1/dbs/test_init.ora'
FROM SPFILE='/u01/oracle/dbs/test spfile.ora';
```



2. List all the Oracle Databases on the server with their version, unique name of the database, and Oracle home information.

\$ srvctl config database -home

 Downgrade Oracle Database. Refer to Oracle Database Upgrade Guide for more information about required pre-downgrade tasks, downgrade tasks, post-downgrade tasks, and compatibility information.

### Note:

Downgrade Oracle Database only if the Oracle Database version is higher than the Oracle Restart version to which you are downgrading Oracle Restart.

4. As the oracle user, downgrade the Oracle Restart resources corresponding to the Oracle Database, only if you have downgraded your Oracle Database.

```
$ srvctl downgrade database -d db_unique_name -oraclehome $ORACLE_HOME -t
to version
```

5. Inspect the Oracle Restart configuration of each database, service, and listener.

```
$ srvctl config database -db db_unique_name
$ srvctl config service -db db_unique_name
$ srvctl config listener -listener listener name
```

Make a note of the configuration information and use this information when adding the components back to Oracle Restart.

6. Stop all databases and listeners that are running before you deconfigure or downgrade Oracle Restart.

```
$ srvctl stop database -db db_unique_name
$ srvctl stop listener [-listener listener name]
```

7. As the root user, run roothas.sh with the -deconfig -force flags to deconfigure Oracle Restart.

# /u01/app/oracle/product/19.0.0/grid/crs/install/roothas.sh -deconfig force

8. As the grid user, update the Oracle central inventory (oraInventory).

\$ /u01/app/oracle/product/19.0.0/grid/oui/bin/runInstaller -updateNodeList -silent ORACLE HOME=upgraded Grid home -local CRS=false

9. As the root user, run roothas.sh with the -unlock flag to unlock the previous release Oracle Restart home.

# /u01/app/oracle/product/18.0.0/grid/crs/install/roothas.sh -unlock dstcrshome previous release Grid home



**10.** As the grid user, reconfigure the previous release Oracle Restart home using the gridSetup.sh command.

\$ /u01/app/oracle/product/18.0.0/grid/gridSetup.sh

- **11.** As the oracle user, add the components back to Oracle Restart with the same attributes that you noted down before deconfiguring Oracle Restart.
  - a. Add Oracle Database to the Oracle Restart configuration.

\$ srvctl add database -db db unique name -oraclehome Oracle home

**b.** Add the listener to the Oracle Restart configuration.

\$ srvctl add listener -listener listener name -oraclehome Oracle home

For the -oraclehome parameter, provide the Oracle home path from which the listener was running before the downgrade.

c. Add each service to the database, using the srvctl add service command.

\$ srvctl add service -db db unique name -service service name list

#### **Related Topics**

Oracle Database Upgrade Guide

### Removing an RPM-based Oracle Database Installation

Use this procedure to remove and deinstall a database installed using the yum command.

- 1. Log in as root.
- 2. Run the following command to remove the RPM-based database installation:

# yum -y remove oracle-database-ee-19c

The yum command detects the default configured components in the Oracle home such as the database (ORCLCDB) and the listener (LISTENER) and removes these components for you. Apart from the default database (ORCLCDB) and the listener (LISTENER), if the yum command detects other configured components in the Oracle home such as additional databases or listeners, then it stops the deinstallation process. A message is displayed that instructs you to remove these configured components manually. To remove these configured components:

- 1. Login as the Oracle Database installation owner user (oracle).
- 2. To remove any database associated with your installation, use Oracle Database Configuration Assistant (Oracle DBCA).
  - \$ cd \$ORACLE HOME/bin
  - \$ ./dbca



 To remove any listeners associated with your installation, run Oracle Net Configuration Assistant (Oracle NETCA).

```
$ cd $ORACLE_HOME/bin
$ ./netca
```

4. Log in as root and run the yum command again to remove the rpm-based database installation.

# yum -y remove oracle-database-ee-19c

#### **Related Topics**

- Deleting a Database Using Oracle DBCA
- Using Oracle Net Configuration Assistant

# **Deinstalling Previous Release Grid Home**

Use this procedure to deinstall the previous release Grid home.

For upgrades from previous releases, if you want to deinstall the previous release Grid home, then perform the following steps:

- 1. Log in as the root user.
- 2. Manually change the permissions of the previous release Grid home.
  - # chmod -R 775 /u01/app/oracle/product/18.0.0/grid
  - # chown -R oracle:oinstall /u01/app/oracle/product/18.0.0/grid
  - # chown oracle /u01/app/oracle/product/18.0.0

#### In this example:

- /u01/app/oracle/product/18.0.0/grid is the previous release Oracle Grid Infrastructure for a standalone server home
- oracle is the Oracle Grid Infrastructure installation owner user
- oinstall is the name of the Oracle Inventory group (OINSTALL group)
- /u01/app/oracle/product/18.0.0 is the parent directory of the previous Grid home.
- 3. Log in as the Oracle Grid Infrastructure software owner user (oracle) and run the deinstall command.



# **Completing Preinstallation Tasks Manually**

You can complete the preinstallation configuration tasks manually.

Oracle recommends that you use Oracle Universal Installer and Cluster Verification Utility fixup scripts to complete minimal configuration settings. If you cannot use fixup scripts, then complete minimum system settings manually.

- Configuring Kernel Parameters for Linux These topics explain how to configure kernel parameters manually for Linux if you cannot complete them using the fixup scripts.
- Configuring Default Thread Limits Value for SUSE Linux If you are on SUSE Linux Enterprise Server 12 SP2 or later, or SUSE Linux Enterprise Server 15 or later, then set the DefaultTasksMax parameter value to 65535.
- Configuring Storage Device Path Persistence Manually You can maintain storage file path persistence by creating a rules file.

# **Configuring Kernel Parameters for Linux**

These topics explain how to configure kernel parameters manually for Linux if you cannot complete them using the fixup scripts.

- Minimum Parameter Settings for Installation
   Use this table to set parameters manually if you cannot use the fixup scripts.
- Changing Kernel Parameter Values Use these instructions to display and change the kernel parameter values if they are different from the minimum recommended value.
- Configuring Additional Kernel Settings for SUSE Linux Additional kernel parameter settings configuration is required on SUSE Linux Enterprise Server systems.
- Setting UDP and TCP Kernel Parameters Manually
   If you do not use a Fixup script or CVU to set ephemeral ports, then set TCP/IP ephemeral
   port range parameters to provide enough ephemeral ports for the anticipated server
   workload.

### Minimum Parameter Settings for Installation

Use this table to set parameters manually if you cannot use the fixup scripts.



### Note:

- Unless otherwise specified, the kernel parameter and shell limit values shown in the following table are minimum values only. For production database systems, Oracle recommends that you tune these values to optimize the performance of the system. See the operating system documentation for more information about tuning kernel parameters.
- If the current value for any parameter is greater than the value listed in this table, then the Fixup scripts do not change the value of that parameter.

Parameter	Value	File
semmsl	250	/proc/sys/kernel/sem
semmns	32000	
semopm	100	
semmni	128	
shmall	Greater than or equal to the value of shmmax, in pages.	/proc/sys/kernel/ shmall
shmmax	Half the size of physical memory in bytes	/proc/sys/kernel/ shmmax
	See My Oracle Support Note 567506.1 for additional information about configuring shmmax.	
shmmni	4096	/proc/sys/kernel/ shmmni
panic_on_oops	1	/proc/sys/kernel/ panic_on_oops
file-max	6815744	/proc/sys/fs/file-max
aio-max-nr	1048576	/proc/sys/fs/aio-max-
	Note: This value limits concurrent outstanding requests and should be set to avoid I/O subsystem failures.	nr
<pre>ip_local_port_range</pre>	Minimum: 9000	/proc/sys/net/ipv4/
	Maximum: 65500	<pre>ip_local_port_range</pre>
rmem_default	262144	/proc/sys/net/core/ rmem_default
rmem_max	4194304	/proc/sys/net/core/ rmem_max
wmem_default	262144	/proc/sys/net/core/ wmem_default
wmem_max	1048576	/proc/sys/net/core/ wmem_max

### Table A-1 Minimum Operating System Resource Parameter Settings



### **Related Topics**

### Setting UDP and TCP Kernel Parameters Manually

If you do not use a Fixup script or CVU to set ephemeral ports, then set TCP/IP ephemeral port range parameters to provide enough ephemeral ports for the anticipated server workload.

### **Changing Kernel Parameter Values**

Use these instructions to display and change the kernel parameter values if they are different from the minimum recommended value.

Use the following commands to display the current values of the kernel parameters:

Parameter	Command
semmsl, semmns, semopm, <b>and</b> semmni	<pre># /sbin/sysctl -a   grep sem This command displays the value of the semaphore parameters in the order listed.</pre>
shmall, shmmax, <b>and</b> shmmni	# /sbin/sysctl -a   grep shm This command displays the details of the shared memory segment sizes.
file-max	<pre># /sbin/sysctl -a   grep file-max This command displays the maximum number of file handles.</pre>
<pre>ip_local_port_range</pre>	<pre># /sbin/sysctl -a   grep ip_local_port_range This command displays a range of port numbers.</pre>
rmem_default	<pre># /sbin/sysctl -a   grep rmem_default</pre>
rmem_max	# /sbin/sysctl -a   grep rmem_max
wmem_default	<pre># /sbin/sysctl -a   grep wmem_default</pre>
wmem_max	# /sbin/sysctl -a   grep wmem_max
aio-max-nr	# /sbin/sysctl -a   grep aio-max-nr

If you used the Oracle Database Preinstallation RPM to complete you preinstallation configuration tasks, then the Oracle Database Preinstallation RPM sets these kernel parameters for you. However, if you did not use the Oracle Database Preinstallation RPM or the kernel parameters are different from the minimum recommended value, then to change these kernel parameter values:

 Using any text editor, create or edit the /etc/sysctl.d/97-oracle-databasesysctl.conf file, and add or edit lines similar to:

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



```
net.core.wmem_default = 262144
net.core.wmem_max = 1048576
```

By specifying the values in the /etc/sysctl.d/97-oracle-database-sysctl.conf file, the values persist on system restarts.

2. To change the current values of the kernel parameters:

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

Review the output. If the values are incorrect, edit the /etc/sysctl.d/97-oracle-database-sysctl.conf file, then enter this command again.

3. Confirm that the values are set correctly:

```
# /sbin/sysctl -a
```

4. Restart the computer, or run sysctl --system to make the changes in the /etc/ sysctl.d/97-oracle-database-sysctl.conf file available in the active kernel memory.

#### **Guidelines for Setting Kernel Parameter Values**

- If you used the Oracle Database Preinstallation RPM, then your kernel parameter settings reside in the /etc/sysctl.d/99-oracle-database-server-19c-preinstall-sysctl.conf file.
- Include lines only for the kernel parameter values to change. For the semaphore parameters (kernel.sem), you must specify all four values. If any of the current values are larger than the minimum value, then specify the larger value.
- The /etc/sysctl.conf file has been deprecated.
- Avoid setting kernel parameter values in multiple files under /etc/sysctl.d/. The file with a lexically later name under /etc/sysctl.d/ takes precedence, followed by /etc/sysctl.conf. Oracle recommends that you use the Oracle Database Preinstallation RPM which, among other preinstallation tasks, also sets the kernel parameter values for your database installation.

### See Also:

sysctl.conf (5) and sysctl.d(5) man pages for more information

### Configuring Additional Kernel Settings for SUSE Linux

Additional kernel parameter settings configuration is required on SUSE Linux Enterprise Server systems.

Perform these steps on SUSE Linux Enterprise Server systems only:

- 1. Enter the following command to enable the system to read the /etc/sysctl.conf file when it restarts:
  - # /sbin/chkconfig boot.sysctl on



2. Enter the GID of the oinstall group as the value for the parameter /proc/sys/vm/ hugetlb shm group.

For example, where the oinstall group GID is 501:

# echo 501 > /proc/sys/vm/hugetlb shm group

Use vi to add the following text to /etc/sysctl.conf, and enable the boot.sysctl script to run on system restart:

vm.hugetlb shm group=501

### Note:

Only one group can be defined as the vm.hugetlb shm group.

### Setting UDP and TCP Kernel Parameters Manually

If you do not use a Fixup script or CVU to set ephemeral ports, then set TCP/IP ephemeral port range parameters to provide enough ephemeral ports for the anticipated server workload.

Ensure that the lower range is set to at least 9000 or higher, to avoid Well Known ports, and to avoid ports in the Registered Ports range commonly used by Oracle and other server ports. Set the port range high enough to avoid reserved ports for any applications you may intend to use. If the lower value of the range you have is greater than 9000, and the range is large enough for your anticipated workload, then you can ignore Oracle Universal Installer warnings regarding the ephemeral port range.

For example, with IPv4, use the following command to check your current range for ephemeral ports:

```
$ cat /proc/sys/net/ipv4/ip_local_port_range
32768 61000
```

In the preceding example, the lowest port (32768) and the highest port (61000) are set to the default range.

If necessary, update the UDP and TCP ephemeral port range to a range high enough for anticipated system workloads, and to ensure that the ephemeral port range starts at 9000 and above. For example:

# echo 9000 65500 > /proc/sys/net/ipv4/ip\_local\_port\_range

Oracle recommends that you make these settings permanent. For example, as root, use a text editor to open /etc/sysctl.conf, and add or change to the following: net.ipv4.ip\_local\_port\_range = 9000 65500, and then restart the network:

```
# /etc/rc.d/init.d/network restart
```

Refer to your Linux distribution system administration documentation for information about automating ephemeral port range alteration on system restarts.



# Configuring Default Thread Limits Value for SUSE Linux

If you are on SUSE Linux Enterprise Server 12 SP2 or later, or SUSE Linux Enterprise Server 15 or later, then set the DefaultTasksMax parameter value to 65535.

Increase the default thread limits, DefaultTasksMax value from 512 to 65535 to avoid running into service failures.

1. View the contents of /etc/systemd/system.conf to know the current DefaultTasksMax value. Alternatively, run the following command:

```
$ systemctl show --property DefaultTasksMax
```

- 2. If your DefaultTasksMax value is not 65535, then uncomment the line in /etc/ systemd/system.conf and set the value to 65535.
- 3. To enable the new settings, reboot your system or run the following command:

```
$ systemctl daemon-reload
```

# Configuring Storage Device Path Persistence Manually

You can maintain storage file path persistence by creating a rules file.

By default, the device file naming scheme udev dynamically creates device file names when the server is started, and assigns ownership of them to root. If udev applies default settings, then it changes Oracle device file names and owners for the disks, making the disks inaccessible when the server is restarted. For example, a voting disk on a device named /dev/sdd owned by the user grid may be on a device named /dev/sdf owned by root after restarting the server.

If you do not use Oracle ASMLib, then you must create a custom rules file. Linux vendors customize their udev configurations and use different orders for reading rules files. For example, on some Linux distributions when udev is started, it sequentially carries out rules (configuration directives) defined in rules files. These files are in the path /etc/udev/ rules.d/. Rules files are read in lexical order. For example, rules in the file 10-wacom.rules are parsed and carried out before rules in the rules file 90-ib.rules.

When specifying the device information in the udev rules file, ensure that the OWNER, GROUP, and MODE are specified before all other characteristics in the order shown. For example, to include the characteristic ACTION on the UDEV line, specify ACTION after OWNER, GROUP, and MODE.

Where rules files describe the same devices, on the supported Linux kernel versions, the last file read is the one that is applied.

 Configuring Device Persistence Manually for Oracle ASM Complete these tasks to create device path persistence manually for Oracle ASM.

### Configuring Device Persistence Manually for Oracle ASM

Complete these tasks to create device path persistence manually for Oracle ASM.

1. On existing systems (single instance or clustered), to obtain current mount paths, run the command scsi\_id (/sbin/scsi\_id) on storage devices on a server to obtain their



unique device identifiers. When you run the command <code>scsi\_id</code> with the <code>-s</code> argument, the device path and name you provide should be relative to the <code>sysfs</code> directory <code>/sys</code> (for example, <code>/block/device</code>) when referring to <code>/sys/block/device</code>.

For example, as the root user:

# /sbin/scsi\_id -g -s /block/sdb/sdb1
360a98000686f6959684a453333524174

# /sbin/scsi\_id -g -s /block/sde/sde1
360a98000686f6959684a453333524179

Record the unique SCSI identifiers, so you can provide them when required.

### Note:

The command scsi\_id should return the same device identifier value for a given device, regardless of which node the command is run from.

 Configure SCSI devices as trusted devices, by editing the /etc/scsi\_id.config file and adding options=-g to the file.

```
# cat > /etc/scsi_id.config
vendor="ATA",options=-p 0x80
options=-g
```

3. Using a text editor, create a UDEV rules file for the Oracle ASM devices, setting permissions to 0660 for the installation owner and the operating system group you have designated the OSDBA group, whose members are granted access privileges to Oracle ASM. For example, on Oracle Linux, to create a role-based configuration rules.d file where the installation owner is grid and the OSDBA group for asmdba, enter commands similar to the following:

# vi /etc/udev/rules.d/99-oracle-asmdevices.rules

```
KERNEL=="sdb1, OWNER="grid", GROUP="asmdba", MODE="0660",
BUS=="scsi", PROGRAM=="/sbin/scsi_id", RESULT=="14f70656e66696c00000000"
KERNEL=="sdc1", OWNER="grid", GROUP="asmdba", MODE="0660",
BUS=="scsi", PROGRAM=="/sbin/scsi_id", RESULT=="14f70656e66696c00000001"
KERNEL=="sdd1", OWNER="grid", GROUP="asmdba", MODE="0660",
BUS=="scsi", PROGRAM=="/sbin/scsi_id", RESULT=="14f70656e66696c0000002"
```

4. On clustered systems, copy the rules.d file to all other nodes on the cluster. For example:

```
# sftp 99-oracle-asmdevices.rules root@node2:/etc/udev/rules.d/99-oracle-
asmdevices.rules
```

5. Run the partprobe command using the syntax /sbin/partprobe devicename.

#### For example:

```
# /sbin/partprobe /dev/sdc1
```

# /sbin/partprobe /dev/sdd1



```
# /sbin/partprobe /dev/sde1
```

- # /sbin/partprobe /dev/sdf1
- 6. Run the command udevtest (/sbin/udevtest) to test the UDEV rules configuration you have created. The output should indicate that the devices are available and the rules are applied as expected. For example, for /dev/ssd1:

```
# udevtest /block/sdd/sdd1
main: looking at device '/block/sdd/sdd1' from subsystem 'block'
udev rules get name: add symlink
'disk/by-id/scsi-360a98000686f6959684a453333524174-part1'
udev rules get name: add symlink
'disk/by-path/ip-192.168.1.1:3260-iscsi-iqn.1992-08.com.netapp:sn.887085-
part1'
udev node mknod: preserve file '/dev/.tmp-8-17', because it has correct
dev t
run program: '/lib/udev/vol id --export /dev/.tmp-8-17'
run program: '/lib/udev/vol id' returned with status 4
run program: '/sbin/scsi id'
run program: '/sbin/scsi id' (stdout) '360a98000686f6959684a453333524174'
run program: '/sbin/scsi id' returned with status 0
udev rules get name: rule applied, 'sdd1' becomes 'data1'
udev device event: device '/block/sdd/sdd1' validate currently present
symlinks
udev node add: creating device node '/dev/data1', major = '8', minor =
'17',
mode = '0640', uid = '0', gid = '500'
udev node add: creating symlink
'/dev/disk/by-id/scsi-360a98000686f6959684a453333524174-part1' to '.././
data1'
udev node add: creating symlink
'/dev/disk/by-path/ip-192.168.1.1:3260-iscsi-
iqn.1992-08.com.netapp:sn.84187085
-part1' to '../../data1'
main: run: 'socket:/org/kernel/udev/monitor'
main: run: '/lib/udev/udev run devd'
main: run: 'socket:/org/freedesktop/hal/udev event'
main: run: '/sbin/pam console apply /dev/data1
/dev/disk/by-id/scsi-360a98000686f6959684a453333524174-part1
/dev/disk/by-path/ip-192.168.1.1:3260-iscsi-
iqn.1992-08.com.netapp:sn.84187085-
part1'
```

In the example output, note that applying the rules renames OCR device  $/{\tt dev/sdd1}$  to  $/{\tt dev/data1}.$ 

- 7. Load the rules and restart the UDEV service. For example:
  - Oracle Linux and Red Hat Enterprise Linux

# udevadm control --reload-rules && udevadm trigger

SUSE Linux Enterprise Server

# /etc/init.d boot.udev restart



Verify that the device permissions and ownerships are set correctly.



B Response Files

Review the following topics to install and configure Oracle Database, Oracle Grid Infrastructure, and other Oracle products using response files.

- How Response Files Work Response files can assist you with installing an Oracle product multiple times on multiple computers.
- Reasons for Using Silent Mode or Response File Mode Review this section for use cases for running the installer in silent mode or response file mode.
- Using Response Files
   Review this information to use response files.
- Preparing Response Files Review this information to prepare response files for use during silent mode or response file mode installations.
- Running Oracle Universal Installer Using a Response File After creating the response file, run Oracle Universal Installer at the command line, specifying the response file you created, to perform the installation.
- Running Configuration Assistants Using Response Files You can run configuration assistants in response file or silent mode to configure and start Oracle software after it is installed on the system. To run configuration assistants in response file or silent mode, you must copy and edit a response file template.
- Postinstallation Configuration Using Response File Created During Installation Use response files to configure Oracle software after installation. You can use the same response file created during installation to also complete postinstallation configuration.
- Postinstallation Configuration Using the ConfigToolAllCommands Script You can create and run a response file configuration after installing Oracle software. The configToolAllCommands script requires users to create a second response file, of a different format than the one used for installing the product.

# How Response Files Work

Response files can assist you with installing an Oracle product multiple times on multiple computers.

When you start Oracle Universal Installer (OUI), you can use a response file to automate the installation and configuration of Oracle software, either fully or partially. OUI uses the values contained in the response file to provide answers to some or all installation prompts.

Typically, the installer runs in interactive mode, which means that it prompts you to provide information in graphical user interface (GUI) screens. When you use response files to provide this information, you run the installer from a command prompt using either of the following modes:

Silent mode



If you include responses for all of the prompts in the response file and specify the – silent option when starting the installer, then it runs in silent mode. During a silent mode installation, the installer does not display any screens. Instead, it displays progress information in the terminal that you used to start it.

Response file mode

If you include responses for some or all of the prompts in the response file and omit the -silent option, then the installer runs in response file mode. During a response file mode installation, the installer displays all the screens, screens for which you specify information in the response file, and also screens for which you did not specify the required information in the response file.

You define the settings for a silent or response file installation by entering values for the variables listed in the response file. For example, to specify the Oracle home name, provide the Oracle home path for the ORACLE HOME environment variable:

ORACLE HOME=/u01/app/oracle/product/19.0.0/dbhome 1

# Reasons for Using Silent Mode or Response File Mode

Review this section for use cases for running the installer in silent mode or response file mode.

Mode	Uses
Silent	Use silent mode for the following installations:
	<ul> <li>Complete an unattended installation, which you schedule using operating system utilities such as at.</li> </ul>
	<ul> <li>Complete several similar installations on multiple systems without user interaction.</li> </ul>
	<ul> <li>Install the software on a system that does not have X Window System software installed on it.</li> </ul>
	The installer displays progress information on the terminal that you used to start it, but it does not display any of the installer screens.
Response file	Use response file mode to complete similar Oracle software installations on more than one system, providing default answers to some, but not all of the installer prompts.

# Using Response Files

Review this information to use response files.

Use the following general steps to install and configure Oracle products using the installer in silent or response file mode:

### Note:

You must complete all required preinstallation tasks on a system before running the installer in silent or response file mode.

- **1**. Prepare a response file.
- 2. Run the installer in silent or response file mode.



- 3. Run the root scripts as prompted by Oracle Universal Installer.
- 4. If you completed a software-only installation, then run Net Configuration Assistant and Oracle DBCA in silent or response file mode to create the database listener and an Oracle Database instance respectively.

# **Preparing Response Files**

Review this information to prepare response files for use during silent mode or response file mode installations.

- Editing a Response File Template Oracle provides response file templates for each product and each configuration tool.
- Recording Response Files

You can use OUI in interactive mode to record response files, which you can then edit and use to complete silent mode or response file mode installations. This method is useful for Advanced or software-only installations.

### Editing a Response File Template

Oracle provides response file templates for each product and each configuration tool.

### **About Response File Templates**

For Oracle Database, the response file templates are located in the <code>\$ORACLE\_HOME/</code> install/response directory. For Oracle Grid Infrastructure, the response file templates are located in the *Grid home/*install/response directory.

Where, *Grid\_home* is the Oracle Grid Infrastructure home directory path.

### Note:

If you copied the software to a hard disk, then the response files are located in the <code>\$ORACLE HOME/install/response</code> directory.

All response file templates contain comment entries, sample formats, examples, and other useful instructions. Read the response file instructions to understand how to specify values for the response file variables, so that you can customize your installation.

The following table lists the response files provided with this software:

Table B-1	Response Files for Oracle Database and Oracle Grid Infrastructure
-----------	---

Response File	Description
db_install.rsp	Silent installation of Oracle Database.
dbca.rsp	Silent creation and configuration of Oracle Database using Oracle DBCA.
netca.rsp	Silent configuration of Oracle Net using Oracle NETCA.
gridsetup.rsp	Silent configuration of Oracle Grid Infrastructure installations.



### Caution:

When you modify a response file template and save a file for use, the response file may contain plain text passwords. Ownership of the response file should be given to the Oracle software installation owner only, and permissions on the response file should be changed to 600. Oracle strongly recommends that database administrators or other administrators delete or secure response files when they are not in use.

To copy and modify a response file:

 Copy the response file from the response file directory to a directory on your system: For example, for Oracle Database:

\$ cp \$ORACLE\_HOME/install/response/db\_install.rsp local\_directory

2. Open the response file in a text editor:

\$ vi /local\_directory/db\_install.rsp

3. Follow the instructions in the file to edit it.

#### Note:

The installer or configuration assistant fails if you do not correctly configure the response file. Also, ensure that your response file name has the .rsp suffix.

4. Secure the response file by changing the permissions on the file to 600:

```
$ chmod 600 /local_dir/db_install.rsp
```

Ensure that only the Oracle software owner user can view or modify response files or consider deleting them after the installation succeeds.

### Note:

A fully-specified response file for an Oracle Database installation contains the passwords for database administrative accounts and for a user who is a member of the OSDBA group (required for automated backups).

### **Recording Response Files**

You can use OUI in interactive mode to record response files, which you can then edit and use to complete silent mode or response file mode installations. This method is useful for Advanced or software-only installations.

You can save all the installation steps into a response file during installation by clicking **Save Response File** on the Summary page. You can use the generated response file for a silent installation later.

When you record the response file, you can either complete the installation, or you can exit from the installer on the Summary page, before OUI starts to set up the software to the system.



If you use record mode during a response file mode installation, then the installer records the variable values that were specified in the original source response file into the new response file.

Note: OUI does not save passwords while recording the response file.

To record a response file:

**1**. Complete preinstallation tasks as for a standard installation.

When you run the installer to record a response file, it checks the system to verify that it meets the requirements to install the software. For this reason, Oracle recommends that you complete all of the required preinstallation tasks and record the response file while completing an installation.

- 2. Ensure that the Oracle software owner user (typically oracle) has permissions to create or write to the Oracle home path that you specify when you run the installer.
- 3. On each installation screen, specify the required information.
- 4. When the installer displays the Summary screen, perform the following steps:
  - a. Click **Save Response File**. In the window, specify a file name and location for the new response file. Click **Save** to write the responses you entered to the response file.
  - b. Click Finish to continue with the installation.

Click **Cancel** if you do not want to continue with the installation. The installation stops, but the recorded response file is retained.

### Note:

Ensure that your response file name has the .rsp suffix.

5. Before you use the saved response file on another system, edit the file and make any required changes. Use the instructions in the file as a guide when editing it.

# Running Oracle Universal Installer Using a Response File

After creating the response file, run Oracle Universal Installer at the command line, specifying the response file you created, to perform the installation.

Run Oracle Universal Installer at the command line, specifying the response file you created. The Oracle Universal Installer executables, runInstaller and gridSetup.sh, provide several options. For help information on the full set of these options, run the gridSetup.sh or runInstaller command with the -help option. For example:

- For Oracle Database:
  - \$ \$ORACLE HOME/runInstaller -help



For Oracle Grid Infrastructure:

```
$ /u01/app/oracle/product/19.0.0/grid/gridSetup.sh -help
```

The help information appears in a window after some time.

To run the installer using a response file:

- 1. Complete the preinstallation tasks for a normal installation.
- 2. Log in as the software installation owner user.
- **3.** If you are completing a response file mode installation, then set the operating system DISPLAY environment variable for the user running the installation.

### Note:

You do not have to set the DISPLAY environment variable if you are completing a silent mode installation.

- To start the installer in silent or response file mode, enter a command similar to the following:
  - For Oracle Database:

```
$ $ORACLE_HOME/runInstaller [-silent] \
    -responseFile responsefilename
```

For Oracle Grid Infrastructure:

```
$ /u01/app/oracle/product/19.0.0/grid/gridSetup.sh [-silent] \
    -responseFile responsefilename
```

### Note:

Do not specify a relative path to the response file. If you specify a relative path, then the installer fails.

In this example:

- -silent runs the installer in silent mode.
- responsefilename is the full path and file name of the installation response file that you configured.
- 5. If this is the first time you are installing Oracle software on your system, then Oracle Universal Installer prompts you to run the orainstRoot.sh script.

Log in as the root user and run the orainstRoot.sh script:

```
$ su root
password:
# /u01/app/oraInventory/orainstRoot.sh
```



Note: You do not have to manually create the oraInst.loc file. Running the orainstRoot.sh script is sufficient as it specifies the location of the Oracle Inventory directory.

6. When the installation completes, log in as the root user and run the root.sh script. For example:

```
$ su root
password:
# $ORACLE_HOME/root.sh
```

# Running Configuration Assistants Using Response Files

You can run configuration assistants in response file or silent mode to configure and start Oracle software after it is installed on the system. To run configuration assistants in response file or silent mode, you must copy and edit a response file template.

### Note:

If you copied the software to a hard disk, then the response file template is located in the <code>\$ORACLE\_HOME/install/response</code> directory.

- Running Net Configuration Assistant Using Response Files You can run NETCA in silent mode to configure and start an Oracle Net Listener on the system, and configure naming methods and Oracle Net service names.
- Running Oracle DBCA Using Response Files You can run Oracle Database Configuration Assistant (Oracle DBCA) in response file mode to configure and start an Oracle database on the system.

### Running Net Configuration Assistant Using Response Files

You can run NETCA in silent mode to configure and start an Oracle Net Listener on the system, and configure naming methods and Oracle Net service names.

To run Oracle Net Configuration Assistant (NETCA) in silent mode, you must copy and edit a response file template. Oracle provides a response file template named netca.rsp in the <code>\$ORACLE HOME/assistants/netca</code> directory.

To run Net Configuration Assistant using a response file:

 Copy the netca.rsp response file template from the response file directory to a directory on your system:

\$ cp \$ORACLE\_HOME/assistants/netca/netca.rsp local\_directory

- 2. Open the response file in a text editor:
  - \$ vi /local\_directory/netca.rsp
- Follow the instructions in the file to edit it.



Note:

Net Configuration Assistant fails if you do not correctly configure the response file.

- 4. Log in as the Oracle software owner user, and set the ORACLE\_HOME environment variable to specify the correct Oracle home directory.
- 5. Enter a command similar to the following to run Net Configuration Assistant in silent mode:

```
$ $ORACLE_HOME/bin/netca -silent -responsefile /local_directory/netca.rsp
```

In this command:

- The /silent option indicates to run Net Configuration Assistant in silent mode.
- *local\_directory* is the full path of the directory where you copied the netca.rsp response file template.

### Running Oracle DBCA Using Response Files

You can run Oracle Database Configuration Assistant (Oracle DBCA) in response file mode to configure and start an Oracle database on the system.

To run Oracle DBCA in response file mode, you must copy and edit a response file template. Oracle provides a response file template named dbca.rsp in the ORACLE\_HOME/ assistants/dbca directory. To run Oracle DBCA in response file mode, you must use the responseFile flag in combination with the -silent flag. You must also use a graphical display and set the DISPLAY environment variable.

To run Oracle DBCA in response file mode:

1. Copy the dbca.rsp response file template from the response file directory to a directory on your system:

\$ cp /directory path/assistants/dbca/dbca.rsp local directory

In this example, *directory\_path* is the path of the directory where you have copied the installation binaries.

As an alternative to editing the response file template, you can also create a database by specifying all required information as command line options when you run Oracle DBCA. For information about the list of options supported, enter the following command:

\$ \$ORACLE HOME/bin/dbca -help

2. Open the response file in a text editor:

\$ vi /local dir/dbca.rsp

**3.** Follow the instructions in the file to edit the file.



Note:

Oracle DBCA fails if you do not correctly configure the response file.

- 4. Log in as the Oracle software owner user, and set the ORACLE\_HOME environment variable to specify the correct Oracle home directory.
- 5. To run Oracle DBCA in response file mode, set the DISPLAY environment variable.
- 6. Use the following command syntax to run Oracle DBCA in silent or response file mode using a response file:

```
$ORACLE_HOME/bin/dbca [-silent] -createDatabase -responseFile /local_dir/
dbca.rsp
```

In this example:

- -silent option indicates that Oracle DBCA runs in silent mode.
- *local\_dir* is the full path of the directory where you copied the dbca.rsp response file template.

During configuration, Oracle DBCA displays a window that contains the status messages and a progress bar.

# Postinstallation Configuration Using Response File Created During Installation

Use response files to configure Oracle software after installation. You can use the same response file created during installation to also complete postinstallation configuration.

- Using the Installation Response File for Postinstallation Configuration Starting with Oracle Database 12c release 2 (12.2), you can use the response file created during installation to also complete postinstallation configuration.
- Running Postinstallation Configuration Using Response File You can use a response file to complete postinstallation tasks on one or more servers simultaneously.

### Using the Installation Response File for Postinstallation Configuration

Starting with Oracle Database 12c release 2 (12.2), you can use the response file created during installation to also complete postinstallation configuration.

Run the installer with the <code>-executeConfigTools</code> option to configure configuration assistants after installing Oracle Grid Infrastructure or Oracle Database. You can use the response file located at <code>\$ORACLE\_HOME/install/response/product\_timestamp.rsp</code> to obtain the passwords required to run the configuration tools. You must update the response file with the required passwords before running the <code>-executeConfigTools</code> command.

Oracle strongly recommends that you maintain security with a password response file:

- Permissions on the response file should be set to 600.
- The owner of the response file should be the installation owner user, with the group set to the central inventory (oraInventory) group.



Example B-1 Response File Passwords for Oracle Grid Infrastructure (grid user)

```
grid.install.crs.config.ipmi.bmcPassword=password
grid.install.asm.SYSASMPassword=password
grid.install.asm.monitorPassword=password
grid.install.config.emAdminPassword=password
```

If you do not have a BMC card, or you do not want to enable IPMI, then leave the ipmi.bmcPassword input field blank.

If you do not want to enable Oracle Enterprise Manager for management, then leave the emAdminPassword password field blank.

# Example B-2 Response File Passwords for Oracle Grid Infrastructure for a Standalone Server (oracle user)

```
oracle.install.asm.SYSASMPassword=password
oracle.install.asm.monitorPassword=password
oracle.install.config.emAdminPassword=password
```

If you do not want to enable Oracle Enterprise Manager for management, then leave the emAdminPassword password field blank.

#### Example B-3 Response File Passwords for Oracle Database (oracle user)

This example illustrates the passwords to specify for use with the database configuration assistants.

```
oracle.install.db.config.starterdb.password.SYS=password
oracle.install.db.config.starterdb.password.SYSTEM=password
oracle.install.db.config.starterdb.password.DBSNMP=password
oracle.install.db.config.starterdb.password.PDBADMIN=password
oracle.install.db.config.starterdb.emAdminPassword=password
oracle.install.db.config.starterdb.emAdminPassword=password
```

You can also specify oracle.install.db.config.starterdb.password.ALL=*password* to use the same password for all database users.

The database configuration assistants require the SYS, SYSTEM, and DBSNMP passwords for use with Oracle DBCA. You must specify the following passwords, depending on your system configuration:

- If the database uses Oracle Automatic Storage Management (Oracle ASM) for storage, then you must specify a password for the ASMSNMPPassword variable. If you are not using Oracle ASM, then leave the value for this password variable blank.
- If you create a multitenant container database (CDB) with one or more pluggable databases (PDBs), then you must specify a password for the PDBADMIN variable. If you are not using Oracle ASM, then leave the value for this password variable blank.



### Running Postinstallation Configuration Using Response File

You can use a response file to complete postinstallation tasks on one or more servers simultaneously.

Complete this procedure to run configuration assistants with the executeConfigTools command and a response file.

Edit the response file and specify the required passwords for your configuration. You can
use the response file created during installation, located at \$ORACLE\_HOME/install/
response/product\_timestamp.rsp. For example:

For Oracle Database (oracle user)

oracle.install.asm.SYSASMPassword=password
oracle.install.config.emAdminPassword=password

For Oracle Grid Infrastructure (grid user)

```
grid.install.asm.SYSASMPassword=password
grid.install.config.emAdminPassword=password
```

 Change directory to the Oracle home containing the installation software. For example: For Oracle Grid Infrastructure:

cd Grid home

Where, *Grid\_home* is the path to the Oracle Grid Infrastructure home directory /u01/app/ oracle/product/19.0.0/grid

For Oracle Database:

cd \$ORACLE HOME

3. Run the configuration script using the following syntax:

For Oracle Grid Infrastructure:

```
$ ./gridSetup.sh -executeConfigTools -responseFile Grid_home/install/
response/product_timestamp.rsp
```

### For Oracle Database:

\$ ./runInstaller -executeConfigTools -responseFile \$ORACLE\_HOME/install/
response/product\_timestamp.rsp

For Oracle Database, you can also run the response file located in the directory <code>\$ORACLE HOME/inventory/response/:</code>

\$ ./runInstaller -executeConfigTools -responseFile \$ORACLE\_HOME/inventory/ response/db\_install.rsp



The postinstallation configuration tool runs the installer in the graphical user interface mode, displaying the progress of the postinstallation configuration. Specify the [-silent] option to run the postinstallation configuration in the silent mode.

For example, for Oracle Grid Infrastructure:

```
$ ./gridSetup.sh -executeConfigTools -responseFile /u01/app/oracle/product/
19.0.0/grid/response/grid_2016-01-09_01-03-36PM.rsp [-silent]
```

#### For Oracle Database:

```
$ ./runInstaller -executeConfigTools -responseFile /u01/app/oracle/product/
19.0.0/dbhome_1/inventory/response/db_2016-01-09_01-03-36PM.rsp [-silent]
```

# Postinstallation Configuration Using the ConfigToolAllCommands Script

You can create and run a response file configuration after installing Oracle software. The configToolAllCommands script requires users to create a second response file, of a different format than the one used for installing the product.

Starting with Oracle Database 12c Release 2 (12.2), the configToolAllCommands script is deprecated and may be desupported in a future release.

- About the Postinstallation Configuration File When you run a silent or response file installation, you provide information about your servers in a response file that you otherwise provide manually during a graphical user interface installation.
- Creating a Password Response File You can create a password response file and use it with configuration assistants to perform silent installation.
- Running Postinstallation Configuration Using a Password Response File Complete this procedure to run configuration assistants with the configToolAllCommands script.

### About the Postinstallation Configuration File

When you run a silent or response file installation, you provide information about your servers in a response file that you otherwise provide manually during a graphical user interface installation.

However, the response file does not contain passwords for user accounts that configuration assistants require after software installation is complete. The configuration assistants are started with a script called configToolAllCommands. You can run this script in response file mode by using a password response file. The script uses the passwords to run the configuration tools in succession to complete configuration.

If you keep the password file to use for clone installations, then Oracle strongly recommends that you store the password file in a secure location. In addition, if you have to stop an installation to fix an error, then you can run the configuration assistants using configToolAllCommands and a password response file.

The configToolAllCommands password response file has the following syntax options:



- oracle.crs for Oracle Grid Infrastructure components or oracle.server for Oracle Database components that the configuration assistants configure
- variable\_name is the name of the configuration file variable
- *value* is the desired value to use for configuration.

The command syntax is as follows:

internal component name | variable name=value

For example:

oracle.crs|S\_ASMPASSWORD=PassWord

The database configuration assistants require the SYS, SYSTEM, and DBSNMP passwords for use with Oracle DBCA. You may need to specify the following additional passwords, depending on your system configuration:

- If the database is using Oracle Automatic Storage Management (Oracle ASM) for storage, then you must specify a password for the s\_ASMSNMPPASSWORD variable. If you are not using Oracle ASM, then leave the value for this password variable blank.
- If you create a multitenant container database (CDB) with one or more pluggable databases (PDBs), then you must specify a password for the s\_PDBADMINPASSWORD variable. If you are not using Oracle ASM, then leave the value for this password variable blank.

Oracle strongly recommends that you maintain security with a password response file:

- Permissions on the response file should be set to 600.
- The owner of the response file should be the installation owner user, with the group set to the central inventory (oraInventory) group.

### Creating a Password Response File

You can create a password response file and use it with configuration assistants to perform silent installation.

Perform the following steps to create a password response file:

1. Create a response file that has a name of the format *filename*.properties, for example:

```
$ touch pwdrsp.properties
```

- 2. Open the file with a text editor, and cut and paste the sample password file contents, as shown in the examples, modifying as needed.
- 3. Change permissions to secure the password response file. For example:

```
$ ls -al pwdrsp.properties
-rw----- 1 oracle oinstall 0 Apr 30 17:30 pwdrsp.properties
```

Example B-4 Password response file for Oracle Grid Infrastructure (grid user)

```
grid.crs|S_ASMPASSWORD=password
grid.crs|S_OMSPASSWORD=password
```



```
grid.crs|S_BMCPASSWORD=password
grid.crs|S_ASMMONITORPASSWORD=password
```

If you do not have a BMC card, or you do not want to enable IPMI, then leave the S BMCPASSWORD input field blank.

# Example B-5 Password response file for Oracle Grid Infrastructure for a Standalone Server (oracle user)

```
oracle.crs|S_ASMPASSWORD=password
oracle.crs|S_OMSPASSWORD=password
oracle.crs|S_ASMMONITORPASSWORD=password
```

#### Example B-6 Password response file for Oracle Database (oracle user)

This example provides a template for a password response file to use with the database configuration assistants.

```
oracle.server|S_SYSPASSWORD=password
oracle.server|S_SYSTEMPASSWORD=password
oracle.server|S_EMADMINPASSWORD=password
oracle.server|S_DBSNMPPASSWORD=password
oracle.server|S_PDBADMINPASSWORD=password
```

If you do not want to enable Oracle Enterprise Manager for management, then leave those password fields blank.

### Running Postinstallation Configuration Using a Password Response File

Complete this procedure to run configuration assistants with the configToolAllCommands script.

- 1. Create a password response file as described in Creating a Password File.
- 2. Change directory to \$ORACLE HOME/cfgtoollogs.
- 3. Run the configuration script using the following syntax:

configToolAllCommands RESPONSE FILE=/path/name.properties

For example:

```
$ ./configToolAllCommands RESPONSE FILE=/home/oracle/pwdrsp.properties
```

### **Related Topics**

Creating a Password Response File

You can create a password response file and use it with configuration assistants to perform silent installation.



# C Optimal Flexible Architecture

Oracle Optimal Flexible Architecture (OFA) rules are a set of configuration guidelines created to ensure well-organized Oracle installations, which simplifies administration, support and maintenance.

- About the Optimal Flexible Architecture Standard Oracle Optimal Flexible Architecture (OFA) rules help you to organize database software and configure databases to allow multiple databases, of different versions, owned by different users to coexist.
- About Multiple Oracle Homes Support
   Oracle Database supports multiple Oracle homes. You can install this release or earlier
   releases of the software more than once on the same system, in different Oracle home
   directories.
- About the Oracle Inventory Directory and Installation The directory that you designate as the Oracle Inventory directory (oraInventory) stores an inventory of all software installed on the system.
- Oracle Base Directory Naming Convention
   The Oracle Base directory is the database home directory for Oracle Database installation
   owners, and the log file location for Oracle Grid Infrastructure owners.
- Oracle Home Directory Naming Convention
   By default, Oracle Universal Installer configures Oracle home directories using these
   Oracle Optimal Flexible Architecture conventions.
- Optimal Flexible Architecture File Path Examples Review examples of hierarchical file mappings of an Optimal Flexible Architecturecompliant installation.

# About the Optimal Flexible Architecture Standard

Oracle Optimal Flexible Architecture (OFA) rules help you to organize database software and configure databases to allow multiple databases, of different versions, owned by different users to coexist.

In earlier Oracle Database releases, the OFA rules provided optimal system performance by isolating fragmentation and minimizing contention. In current releases, OFA rules provide consistency in database management and support, and simplifies expanding or adding databases, or adding additional hardware.

By default, Oracle Universal Installer places Oracle Database components in directory locations and with permissions in compliance with OFA rules. Oracle recommends that you configure all Oracle components in accordance with OFA guidelines.

Oracle recommends that you accept the OFA default. Following OFA rules is especially of value if the database is large, or if you plan to have multiple databases.



### Note:

OFA assists in identification of an ORACLE\_BASE with its Automatic Diagnostic Repository (ADR) diagnostic data to properly collect incidents.

# About Multiple Oracle Homes Support

Oracle Database supports multiple Oracle homes. You can install this release or earlier releases of the software more than once on the same system, in different Oracle home directories.

Careful selection of mount point names can make Oracle software easier to administer. Configuring multiple Oracle homes in compliance with Optimal Flexible Architecture (OFA) rules provides the following advantages:

- You can install this release, or earlier releases of the software, more than once on the same system, in different Oracle home directories. However, you cannot install products from one release of Oracle Database into an Oracle home directory of a different release.
- Multiple databases, of different versions, owned by different users can coexist concurrently.
- To install Oracle Database software in multiple Oracle homes, you must extract the image file in each Oracle home, and then run the setup wizard from the respective Oracle home.
- You must install a new Oracle Database release in a new Oracle home that is separate from earlier releases of Oracle Database.

You cannot install multiple releases in one Oracle home. Oracle recommends that you create a separate Oracle Database Oracle home for each release, in accordance with the Optimal Flexible Architecture (OFA) guidelines.

- In production, the Oracle Database server software release is the release number in the format of major and RU release number. For example, with the release number 19.3.0.0.0, the major release is 19 and the RU release number is 3.
- Later Oracle Database releases can access earlier Oracle Database releases. However, this access is only for upgrades. For example, Oracle Database 19c can access an Oracle Database 18c if the 18c database is started up in upgrade mode.
- Structured organization of directories and files, and consistent naming for database files simplify database administration.
- Login home directories are not at risk when database administrators add, move, or delete Oracle home directories.
- For information about release support timelines, refer to My Oracle Support Doc ID 742060.1

### **Related Topics**

My Oracle Support Note 742060.1

# About the Oracle Inventory Directory and Installation

The directory that you designate as the Oracle Inventory directory (oralnventory) stores an inventory of all software installed on the system.

All Oracle software installation owners on a server are granted the OINSTALL privileges to read and write to this directory. If you have previous Oracle software installations on a server,

ORACLE

then additional Oracle software installations detect this directory from the /etc/oraInst.loc file, and continue to use that Oracle Inventory. Ensure that the group designated as the OINSTALL group is available as a primary group for all planned Oracle software installation owners.

If you are installing Oracle software for the first time, then OUI creates an Oracle base and central inventory, and creates an Oracle inventory using information in the following priority:

- In the path indicated in the ORACLE\_BASE environment variable set for the installation owner user account
- In an Optimal Flexible Architecture (OFA) path (u[01–99]/app/owner where owner is the name of the user account running the installation), and that user account has permissions to write to that path
- In the user home directory, in the path /app/owner, where owner is the name of the user account running the installation

### For example:

If you are performing an Oracle Database installation, and you set ORACLE\_BASE for user oracle to the path /u01/app/oracle before installation, and grant 755 permissions to oracle for that path, then Oracle Universal Installer creates the Oracle Inventory directory one level above the ORACLE\_BASE in the path ORACLE\_BASE/../oraInventory, so the Oracle Inventory path is /u01/app/oraInventory. Oracle Universal Installer installs the software in the ORACLE\_BASE path. If you are performing an Oracle Grid Infrastructure for a Cluster installation, then the Grid installation path is changed to root ownership after installation, and the Grid home software location should be in a different path from the Grid user Oracle base.

If you create the OFA path /u01, and grant oracle 755 permissions to write to that path, then the Oracle Inventory directory is created in the path /u01/app/oraInventory, and Oracle Universal Installer creates the path /u01/app/oracle, and configures the ORACLE\_BASE environment variable for the Oracle user to that path. If you are performing an Oracle Database installation, then the Oracle home is installed under the Oracle base. However, if you are installing Oracle Grid Infrastructure for a cluster, then be aware that ownership of the path for the Grid home is changed to root after installation and the Grid base and Grid home should be in different locations, such as /u01/app/19.0.0/grid for the Grid home path, and /u01/app/grid for the Grid base. For example:

/u01/app/oraInventory, owned by grid:oinstall /u01/app/oracle, owned by oracle:oinstall /u01/app/oracle/product/19.0.0/dbhome\_1/, owned by oracle:oinistall /u01/app/grid, owned by grid:oinstall /u01/app/19.0.0/grid, owned by root

If you have neither set ORACLE\_BASE, nor created an OFA-compliant path, then the Oracle Inventory directory is placed in the home directory of the user that is performing the installation, and the Oracle software is installed in the path /app/owner, where owner is the Oracle software installation owner. For example:

```
/home/oracle/oraInventory
/home/oracle/app/oracle/product/19.0.0/dbhome 1
```



# **Oracle Base Directory Naming Convention**

The Oracle Base directory is the database home directory for Oracle Database installation owners, and the log file location for Oracle Grid Infrastructure owners.

Name Oracle base directories using the syntax /pm/h/u, where pm is a string mount point name, h is selected from a small set of standard directory names, and u is the name of the owner of the directory.

You can use the same Oracle base directory for multiple installations. If different operating system users install Oracle software on the same system, then you must create a separate Oracle base directory for each installation owner. For ease of administration, Oracle recommends that you create a unique owner for each Oracle software installation owner, to separate log files.

Because all Oracle installation owners write to the central Oracle inventory file, and that file mountpoint is in the same mount point path as the initial Oracle installation, Oracle recommends that you use the same *lpm/h* path for all Oracle installation owners.

Example	Description			
/u01/app/ oracle	Oracle Database Oracle base, where the Oracle Database software installation owner name is oracle. The Oracle Database binary home is located underneath the Oracle base path.			
/u01/app/grid	Oracle Grid Infrastructure Oracle base, where the Oracle Grid Infrastructure software installation owner name is grid.			
	<b>Caution</b> : The Oracle Grid Infrastructure Oracle base should not contain the Oracle Grid Infrastructure binaries for an Oracle Grid Infrastructure for a cluster installation. Permissions for the file path to the Oracle Grid Infrastructure binary home are changed to root during installation.			

### Table C-1 Examples of OFA-Compliant Oracle Base Directory Names

### Note:

Oracle home or Oracle base cannot be symlinks, nor can any of their parent directories, all the way to up to the root directory.

# **Oracle Home Directory Naming Convention**

By default, Oracle Universal Installer configures Oracle home directories using these Oracle Optimal Flexible Architecture conventions.

The directory pattern syntax for Oracle homes is *lpm/s/u/product/v/type\_[n*]. The following table describes the variables used in this syntax:

Variable	Description		
рт	A mount point name.		
S	A standard directory name.		



Variable	Description			
u	The name of the owner of the directory.			
V	The version of the software.			
type	The type of installation. For example: Database (dbhome), Client (client), or Oracle Grid Infrastructure (grid)			
n	An optional counter, which enables you to install the same product more than once in the same Oracle base directory. For example: Database 1 and Database 2 (dbhome_1, dbhome_2)			

For example, the following path is typical for the first installation of Oracle Database on this system:

/u01/app/oracle/product/19.0.0/dbhome 1

### Note:

Oracle home or Oracle base cannot be symlinks, nor can any of their parent directories, all the way to up to the root directory.

# **Optimal Flexible Architecture File Path Examples**

Review examples of hierarchical file mappings of an Optimal Flexible Architecture-compliant installation.

/u02/u03 /u04

### Note:

- The Grid homes are examples of Grid homes used for an Oracle Grid Infrastructure for a standalone server deployment (Oracle Restart), or a Grid home used for an Oracle Grid Infrastructure for a cluster deployment (Oracle Clusterware). You can have either an Oracle Restart deployment, or an Oracle Clusterware deployment. You cannot have both options deployed at the same time.
- Oracle Automatic Storage Management (Oracle ASM) is included as part of an Oracle Grid Infrastructure installation. Oracle recommends that you use Oracle ASM to provide greater redundancy and throughput.

Table C-2 O	ptimal Flexible Architecture Hierarchical File Path Examples
-------------	--

Directory	Description
/	Root directory



Directory	Description User data mount point 1		
/u01/			
/u01/app/	Subtree for application software		
/u01/app/ oraInventory	Central Oralnventory directory, which maintains information about Oracle installations on a server. Members of the group designated as the OINST/ group have permissions to write to the central inventory. All Oracle softwa installation owners must have the OINSTALL group as their primary group and be able to write to this group.		
/u01/app/oracle/	Oracle base directory for user oracle. There can be many Oracle Database installations on a server, and many Oracle Database software installation owners.		
	Oracle software homes that an Oracle installation owner owns should be located in the Oracle base directory for the Oracle software installation owner, unless that Oracle software is Oracle Grid Infrastructure deployed for a cluster.		
/u01/app/grid	Oracle base directory for user grid. The Oracle home (Grid home) for Oracle Grid Infrastructure for a cluster installation is located outside of the Grid user. There can be only one Grid home on a server, and only one Grid software installation owner.		
	The Grid home contains log files and other administrative files.		
/u01/app/oracle/ admin/	Subtree for database administration files		
/u01/app/oracle/ admin/TAR	Subtree for support log files		
/u01/app/oracle/ admin/db_sales/	Admin subtree for database named "sales"		
/u01/app/oracle/ admin/db_dwh/	Admin subtree for database named "dwh"		
/u01/app/oracle/ fast_recovery_are a/	Subtree for recovery files		

Table C-2 (Cont.) Optimal Flexible Architecture Hierarchical File Path Examples



Directory	Description		
/u01/app/oracle/ fast_recovery_are a/db_sales	Recovery files for database named "sales"		
/u01/app/oracle/ fast_recovery_are a/db_dwh	Recovery files for database named "dwh"		
/u02/app/oracle/ oradata /u03/app/oracle/ oradata /u04/app/oracle/ oradata	Oracle data file directories		
/u01/app/oracle/ product/	Common path for Oracle software products other than Oracle Grid Infrastructure for a cluster		
/u01/app/oracle/ product/19.0.0/ dbhome_1	Oracle home directory for Oracle Database 1, owned by Oracle Database installation owner account oracle		
/u01/app/oracle/ product/19.0.0/ dbhome_2	Oracle home directory for Oracle Database 2, owned by Oracle Database installation owner account oracle		
/u01/app/oracle2/ product/19.0.0/ dbhome_2	Oracle home directory for Oracle Database 2, owned by Oracle Database installation owner account oracle2		
/u01/app/oracle/ product/19.0.0/ grid	Oracle home directory for Oracle Grid Infrastructure for a standalone server owned by Oracle Database and Oracle Grid Infrastructure installation own oracle.		

### Table C-2 (Cont.) Optimal Flexible Architecture Hierarchical File Path Examples



Directory	Description Oracle home directory for Oracle Grid Infrastructure for a cluster (Grid home), owned by user grid before installation, and owned by root after installation.		
/u01/app/19.0.0/ grid			
/u01/app/oracle/ product/19.0.0/ client_1	Oracle home directory for Oracle Database Client 1, owned by Oracle Database installation owner account oracle		

### Table C-2 (Cont.) Optimal Flexible Architecture Hierarchical File Path Examples

# D

# **Configuring Read-Only Oracle Homes**

Understand how read-only Oracle homes work and how you can configure read-only Oracle homes.

• Evolution of Oracle Homes

Learn about read-only Oracle home concepts like Oracle base home, Oracle base config, and orabasetab.

- Enabling a Read-Only Oracle Home
   Configure your Oracle home as a read-only Oracle home after you have performed a software-only Oracle Database installation.
- Copying demo Directories to Oracle Base Home In a read-only mode ORACLE\_HOME, you must copy the demo directories listed in this topic from ORACLE\_HOME to ORACLE\_BASE\_HOME.
- Determining if an Oracle Home is Read-Only Run the orabasehome command to determine if your Oracle home is a read/write or readonly Oracle home.
- File Path and Directory Changes in Read-Only Oracle Homes Examples of hierarchical file mappings in a read-only Oracle home as compared to a read/ write Oracle home.

# **Evolution of Oracle Homes**

Learn about read-only Oracle home concepts like Oracle base home, Oracle base config, and orabasetab.

- About Read-Only Oracle Homes
   Starting with Oracle Database 18c, you can configure an Oracle home in read-only mode.
- About Oracle Base Homes
   Both, in a read-only ORACLE\_HOME and read/write ORACLE\_HOME, the user-specific files, instance-specific files, and log files reside in a location known as the ORACLE BASE HOME.
- About Oracle Base Config Both, in a read-only ORACLE\_HOME and read/write ORACLE\_HOME, the configuration files reside in a location known as ORACLE\_BASE\_CONFIG.
  - About orabasetab The orabasetab file is used to define fundamental directories based on \$ORACLE\_HOME, ORACLE\_BASE, ORACLE\_BASE\_HOME and ORACLE BASE CONFIG.
- Location of Networking Files in a Read-Only Oracle Home Learn about the search order and location of networking files like sqlnet.ora, tnsnames.ora, Or listener.ora in a read-only Oracle home.



## About Read-Only Oracle Homes

Starting with Oracle Database 18c, you can configure an Oracle home in read-only mode.

A read-only Oracle home simplifies provisioning by implementing separation of installation and configuration.

In a read-only Oracle home, all the configuration data and log files reside outside of the readonly Oracle home.

Apart from the traditional ORACLE\_BASE and ORACLE\_HOME directories, the following directories contain files that used to be in ORACLE\_HOME:

- ORACLE\_BASE\_HOME
- ORACLE\_BASE\_CONFIG

### Note:

This feature does not affect how database administrators monitor, diagnose, and tune their system performance.

## About Oracle Base Homes

Both, in a read-only ORACLE\_HOME and read/write ORACLE\_HOME, the user-specific files, instance-specific files, and log files reside in a location known as the ORACLE\_BASE\_HOME.

In a read/write ORACLE\_HOME, the ORACLE\_BASE\_HOME path is the same as the ORACLE\_HOME directory. However, in a read-only ORACLE\_HOME, the ORACLE\_BASE\_HOME directory is not co-located with ORACLE\_HOME but is located at ORACLE\_BASE/homes/HOME\_NAME.

Where, HOME\_NAME is the internal name for ORACLE\_HOME.

For example, the networking directories network/admin, network/trace, and network/log are located in the ORACLE\_BASE\_HOME directory. In a read/write ORACLE\_HOME the networking directories appear to be in ORACLE\_HOME because ORACLE\_BASE\_HOME is co-located with ORACLE\_HOME, whereas in a read-only ORACLE\_HOME the networking directories are located in ORACLE\_BASE/homes/HOME\_NAME.

To print the ORACLE\_BASE\_HOME path, run the orabasehome command from the <code>\$ORACLE HOME/bin directory</code>:

\$ ./orabasehome

#### For example:

```
$ ./orabasehome
/u01/app/oracle/homes/OraDB19Home1
```

Where, /u01/app/oracle is ORACLE\_BASE and OraDB19Home1 is HOME\_NAME



## About Oracle Base Config

Both, in a read-only ORACLE\_HOME and read/write ORACLE\_HOME, the configuration files reside in a location known as ORACLE\_BASE\_CONFIG.

In a read/write ORACLE\_HOME, the ORACLE\_BASE\_CONFIG path is the same as the ORACLE\_HOME path because it is located at \$ORACLE\_HOME. However, in a read-only ORACLE\_HOME, the ORACLE\_BASE\_CONFIG path is the same as ORACLE\_BASE.

ORACLE\_BASE\_CONFIG/dbs contains the configuration files for ORACLE\_HOME. Each file in the dbs directory contains \$ORACLE\_SID so that the directory can be shared by many different ORACLE\_SIDs.

To print the ORACLE\_BASE\_CONFIG path, run the orabaseconfig command from the <code>\$ORACLE HOME/bin directory</code>:

```
$ setenv ORACLE_HOME /u01/app/oracle/product/19.0.0/dbhome_1
```

- \$ cd \$ORACLE\_HOME/bin
- \$ ./orabaseconfig

### For example:

\$ ./orabaseconfig
/u01/app/oracle

Where, /u01/app/oracle is ORACLE\_BASE.

## About orabasetab

The orabasetab file is used to define fundamental directories based on \$ORACLE\_HOME, ORACLE\_BASE, ORACLE\_BASE\_HOME and ORACLE\_BASE\_CONFIG.

The orabasetab file resides in ORACLE\_HOME/install/orabasetab. To determine if an ORACLE\_HOME is read-only or read/write, you can check for the presence of the orabasetab file. The orabasetab file also defines the ORACLE\_BASE and the HOME\_NAME of the Oracle home. HOME\_NAME is the internal name for ORACLE\_HOME.

The last line in the orabasetab file, which starts with \$ORACLE\_HOME, defines the directories for \$ORACLE\_HOME. The last line consists of four fields, each separate by a colon delimiter (:).

- **1.** The first field matches the current \$ORACLE\_HOME.
- 2. The second field defines the ORACLE\_BASE for the current ORACLE\_HOME.
- 3. The third field defines the HOME\_NAME which is used in constructing the ORACLE\_BASE\_HOME path in a read-only ORACLE\_HOME.
- 4. The fourth field displays  $\mathbb{N}$  in a read/write ORACLE\_HOME and  $\mathbb{Y}$  in a read-only ORACLE\_HOME.

In a read-only ORACLE\_HOME, the ORACLE\_BASE\_HOME path is ORACLE\_BASE/homes/ HOME NAME and ORACLE\_BASE\_CONFIG is the same as ORACLE\_BASE.

In a read/write ORACLE\_HOME, ORACLE\_HOME, ORACLE\_BASE\_HOME and ORACLE\_BASE\_CONFIG are all the same.



### Viewing an orabasetab File

- 1. Log in as the Oracle installation owner user account (oracle).
- 2. Go to the <code>\$ORACLE\_HOME/install</code> directory.

```
$ cd /u01/app/oracle/product/19.0.0/dbhome 1/install
```

3. View the contents of the orabasetab file.

```
$ cat orabasetab
/u01/app/oracle/product/19.0.0/dbhome_1:/u01/app/oracle:OraDB19Home1:Y:
```

In this example, a  ${\tt Y}$  in the fourth field at the end of the line indicates you have a read-only Oracle home.

## Location of Networking Files in a Read-Only Oracle Home

Learn about the search order and location of networking files like sqlnet.ora, tnsnames.ora, or listener.ora in a read-only Oracle home.

The networking directories network/admin, network/trace, and network/log are located in the ORACLE\_BASE\_HOME directory. In a read/write ORACLE\_HOME the networking directories appear to be in ORACLE\_HOME because ORACLE\_BASE\_HOME is co-located with ORACLE\_HOME, whereas in a read-only ORACLE\_HOME the networking directories are located in ORACLE\_BASE/homes/HOME\_NAME.

#### tnsnames.ora

The order for checking the tnsnames.ora file in a read-only Oracle home is:

- 1. The directory specified by the TNS ADMIN environment variable.
- 2. The /etc directory.
- 3. The ORACLE BASE HOME/network/admin directory.
- 4. The ORACLE\_HOME/network/admin directory.

### sqlnet.ora

The order for checking the sqlnet.ora file in a read-only Oracle home is:

- 1. The directory specified by the TNS ADMIN environment variable.
- 2. The ORACLE\_BASE\_HOME/network/admin directory.
- 3. The ORACLE\_HOME/network/admin directory.

#### **Password Files**

The search order for password files for Oracle homes is <code>ORACLE\_BASE\_CONFIG/dbs</code> followed by <code>ORACLE\_HOME/dbs</code>. This helps prioritize to search for the password file outside of <code>ORACLE\_HOME</code> when read-only Oracle home is enabled.

#### **Related Topics**

Overview of Local Naming Parameters



# Enabling a Read-Only Oracle Home

Configure your Oracle home as a read-only Oracle home after you have performed a softwareonly Oracle Database installation.

To enable a read-only Oracle home:

- 1. Perform a software-only Oracle Database installation.
- 2. Run the roohctl -enable script.
- 3. Run Oracle Database Configuration Assistant (Oracle DBCA) to create a database.

### Note:

Ensure that you enable read-only Oracle home before you create the database.

### Software-Only Database Installation

- 1. Log in as the Oracle installation owner user account (oracle) that you want to own the software binaries.
- 2. Download the Oracle Database installation image files (db\_home.zip) to a directory of your choice. For example, you can download the image files to the /tmp directory.
- 3. Create the Oracle home directory and extract the image files that you have downloaded in to this Oracle home directory. For example:

```
$ mkdir -p /u01/app/oracle/product/19.0.0/dbhome_1
$ chown oracle:oinstall /u01/app/oracle/product/19.0.0/dbhome_1
$ cd /u01/app/oracle/product/19.0.0/dbhome_1
$ unzip -q /tmp/db_home.zip
```

### Note:

Ensure that the Oracle home directory path you create is in compliance with the Oracle Optimal Flexible Architecture recommendations. Also, unzip the installation image files only in this Oracle home directory that you created.

- 4. From the Oracle home directory, run the runInstaller command to start the Oracle Database installer.
- 5. In the Select Configuration Option screen, select Set Up Software Only.
- 6. Select your installation type. Installation screens vary depending on the installation option you select. Respond to the configuration prompts as needed.

### Note:

Click **Help** if you have any questions about the information you are asked to submit during installation.



#### Run the roohctl Script

1. Go to the bin directory

\$ cd /u01/app/oracle/product/19.0.0/dbhome 1/bin

2. Run the roohctl script to enable read-only Oracle home.

\$ ./roohctl -enable

- 3. On Oracle Real Application Clusters (Oracle RAC) installations, run the preceding roohctl script on every node of the cluster. Alternatively, run the roohctl script with the nodelist option and provide the list of cluster nodes:
  - \$ ./roohctl -enable -nodelist comma separated list of nodes

#### **Run Oracle Database Configuration Assistant**

1. Ensure that you are still in the bin directory and run Oracle DBCA.

\$ ./dbca

- 2. In the Select Database Operation screen, select Create a Database.
- 3. The configuration screens vary depending on the options you select. Respond to the prompts as needed.

### Note:

Click **Help** if you have any questions about the information you are asked to submit during database creation.

#### **Related Topics**

- Running Oracle Database Setup Wizard to Install Oracle Database Extract the database image files and use the runInstaller command to start the installation.
- Oracle Database 2 Day DBA

# Copying demo Directories to Oracle Base Home

In a read-only mode ORACLE\_HOME, you must copy the demo directories listed in this topic from ORACLE\_HOME to ORACLE\_BASE\_HOME.

Oracle Database contains various demo directories that include a variety of examples and product demonstrations that you can use to learn about the products, options, and features of Oracle Database. In a read-only mode ORACLE\_HOME, you cannot use these demo directories in ORACLE\_HOME because writes are performed to these demo directories when they are used.

Many of the demo directories are not available by default. You must install Oracle Database Examples to view and use the examples and product demonstrations.



Copy the respective demo directory to the corresponding location in ORACLE\_BASE\_HOME. Now, you can use this copy of the demo directory.

You must copy the following demo directories from ORACLE\_HOME to ORACLE\_BASE\_HOME:

- jdbc/demo
- odbc/demo
- ord/http/demo
- precomp/demo
- rdbms/demo
- sqlj/demo
- sqlplus/demo
- xdk/demo

You must also create symbolic links for the odbc/demo, precomp/demo, rdbms/demo, and xdk/demo demo directories. See the "Creating Symbolic Links" section in this topic.

#### **Copying demo Directories**

For example, to copy the rdbms/demo directory from ORACLE\_HOME to ORACLE\_BASE\_HOME, perform the following:

- 1. Login as the Oracle software owner user (oracle).
- 2. Check if the rdbms/demo directory is copied to ORACLE\_BASE\_HOME.

```
$ ls -l -d $(orabasehome)/rdbms/demo
```

3. If the rdbms/demo directory has not been copied, then create it and copy it.

```
$ mkdir -p $(orabasehome)/rdbms
$ cp -r $ORACLE HOME/rdbms/demo $(orabasehome)/rdbms/demo
```

Similarly, copy all the demo directories listed earlier from ORACLE\_HOME to ORACLE\_BASE\_HOME.

#### **Creating Symbolic Links**

You must create symbolic links for the odbc/demo, precomp/demo, rdbms/demo, and xdk/ demo demo directories.

For rdbms/demo, replace \$ORACLE HOME/rdbms/demo with a symbolic link to the copy.

1. Ensure that the symbolic link does not already exist.

\$ ls -l -d \$ORACLE HOME/rdbms/demo



2. If <code>\$ORACLE\_HOME/rdbms/demo</code> is still the original demo directory, rename it and replace it with the symbolic link.

```
$ cd $ORACLE_HOME/rdbms
$ mv demo demo.installed
$ ln -s $(orabasehome)/rdbms/demo $ORACLE HOME/rdbms/demo
```

For odbc/demo, replace \$ORACLE HOME/odbc/demo with a symbolic link to the copy.

- 1. Ensure that the symbolic link does not already exist.
  - \$ ls -l -d \$ORACLE HOME/odbc/demo
- 2. If \$ORACLE\_HOME/odbc/demo is still the original demo directory, rename it and replace it with the symbolic link.

```
$ cd $ORACLE_HOME/odbc
$ mv demo demo.installed
$ ln -s $(orabasehome)/odbc/demo $ORACLE_HOME/odbc/demo
```

For precomp/demo, replace <code>\$ORACLE\_HOME/precomp/demo</code> with a symbolic link to the copy.

**1**. Ensure that the symbolic link does not already exist.

```
$ ls -l -d $ORACLE HOME/precomp/demo
```

- 2. If \$ORACLE\_HOME/precomp/demo is still the original demo directory, rename it and replace it with the symbolic link.
  - \$ cd \$ORACLE HOME/precomp
  - \$ mv demo demo.installed
  - \$ ln -s \$(orabasehome)/precomp/demo \$ORACLE HOME/precomp/demo

The xdk/demo directory requires a symbolic link at <code>\$ORACLE\_HOME/xdk/include</code> pointing to <code>\$(orabasehome)/xdk/include</code> after you copy the xdk/demo directory.

Ensure that the symbolic link does not already exist:

\$ ls -l -d \$ORACLE HOME/xdk/include

- 2. If the symbolic link does not exist, then, run the following command:
  - \$ ln -s \$ORACLE HOME/xdk/include \$(orabasehome)/xdk/include

### Note:

In the plsql/demo directory, ncmpdemo.sql is unusable in read-only mode.

### Copying the init.ora File

Copy the init.ora file from ORACLE\_HOME to ORACLE\_BASE\_HOME.



- 1. Login as the Oracle software owner user (oracle).
- 2. Check if the init.ora file exists in ORACLE\_BASE\_HOME.

```
$ ls $(orabasehome)/init.ora
```

If an init.ora file exists in ORACLE\_BASE\_HOME, then update this init.ora file to be in-sync with the <code>\$ORACLE HOME/init.ora</code> file.

 If the init.ora file does not exist in ORACLE\_BASE\_HOME, then copy it from ORACLE\_HOME.

```
$ cp $ORACLE HOME/init.ora $(orabasehome)/init.ora
```

#### **Related Topics**

Oracle Database Examples Installation Guide

# Determining if an Oracle Home is Read-Only

Run the orabasehome command to determine if your Oracle home is a read/write or read-only Oracle home.

If the output of the orabasehome command is the same as \$ORACLE\_HOME, then your Oracle home is in read/write mode. If the output displays the path ORACLE\_BASE/homes/ HOME NAME, then your Oracle home is in read-only mode.

1. Set the ORACLE\_HOME environment variable:

Bourne, Bash or Korn shell:

```
$ ORACLE_HOME=/u01/app/oracle/product/19.0.0/dbhome_1
```

\$ export ORACLE\_HOME

C shell:

% setenv ORACLE HOME /u01/app/oracle/product/19.0.0/dbhome 1

2. Go to the bin directory and run the orabasehome command:

```
$ cd $ORACLE_HOME/bin
$ ./orabasehome
/u01/app/oracle/homes/OraDB19Home1
```

In this example, the Oracle home is in read-only mode.

# File Path and Directory Changes in Read-Only Oracle Homes

Examples of hierarchical file mappings in a read-only Oracle home as compared to a read/ write Oracle home.

This example shows an Optimal Flexible Architecture-compliant Oracle Database installation, for the user oracle, with the ORACLE\_HOME, ORACLE\_BASE, ORACLE\_BASE\_HOME, and



ORACLE\_BASE\_CONFIG logical locations. The database files are mounted on /u01 and the HOME\_NAME is OraDB19Home1.

This example also shows the changes in the Oracle Database software defined paths of configuration files, log files, and other directories in a read-only Oracle home when compared to a read/write Oracle home.

Directory	Read/Write Oracle Home File Path	Read-Only Oracle Home File Path	
ORACLE_HOME	/u01/app/oracle/ product/19.0.0/ dbhome_1	/u01/app/oracle/ product/19.0.0/ dbhome_1	
ORACLE_BASE /u01/app/oracle/		/u01/app/oracle/	
ORACLE_BASE_HOME	ORACLE_HOME (or) /u01/app/oracle/ product/19.0.0/ dbhome 1	ORACLE_BASE/homes/ HOME_NAME (or) /u01/app/oracle/homes/ OraDB19Home1	
ORACLE_BASE_CONFIG	ORACLE_HOME (or) /u01/app/oracle/ product/19.0.0/ dbhome_1	ORACLE_BASE (or) /u01/app/oracle/	
network	ORACLE_HOME/network (or) /u01/app/oracle/ product/19.0.0/ dbhome_1/network	ORACLE_BASE_HOME/network (or) /u01/app/oracle/homes/ OraDB19Home1/network	
dbs ORACLE_HOME/dbs (or) /u01/app/oracle/ product/19.0.0/ dbhome_1/dbs		ORACLE_BASE/dbs (or) /u01/app/oracle/dbs	

### Table D-1 read/write and Read-Only Oracle Home File Path Examples

# Oracle Memory Speed CLI Commands

omsfscmds is a command line utility for administering Oracle Memory Speed (OMS). To use omsfscmds, ensure that the OMS daemon is running.

### Example E-1 Running omsfscmds

Set the \$ORACLE SID to the same SID as the daemon and run omsfscmds.

\$ \$ORACLE\_HOME/bin/omsfscmds
OMS>

mkfs and forcemkfs Command Reference

Use mkfs and forcemkfs to format the OMS uber file placed in a PMEM DAX mount point.

- mount, unmount and Ismount Command Reference
   Use mount, umount and, 1smount to manage and query the Oracle Memory Speed file system mount points.
- df Command Reference
   Use df to determine the total space, used space, and free space in a mounted Oracle
   Memory Speed (OMS) file system.
- cp Command Reference Use the copy command cp to copy files.
- Is and IIs Command Reference Use 1s to list files in the Oracle Memory Speed (OMS) mount point, and 11s to list files in the OMS mount point with additional information for each file.
- rm Command Reference
   Use the rm command to delete a file from an Oracle Memory Speed (OMS) mount point.
- cd and pwd Command Reference
   Use the current directory cd command to set the current working Oracle Memory Speed
   (OMS) mount point. Use the present working directory pwd command to display the current
   OMS mount point set by the previous cd command.
- Isom and Isof Command Reference
  Use the ls of mount point lsom command to list the Oracle process identifiers of all
  processes that have opened files in an Oracle Memory Speed (OMS) mount point.
- Daemon Control Command Reference
   Use the daemon command to control the OMS daemon process.
- Diagnostics and Tracing The dump command has many sub options to print diagnostic information.

# mkfs and forcemkfs Command Reference

Use mkfs and forcemkfs to format the OMS uber file placed in a PMEM DAX mount point.



#### Syntax

mkfs PMEM\_device blksz forcemkfs PMEM device blksz

In this example, *PMEM\_device* is the uber file.

Both mkfs and forcemks accept an optional block size *blksz* argument. Currently, 4 KB is the only supported block size. mkfs and forcemkfs will not format an uber file that is mounted as an OMS file system.

### **Usage Notes**

The uber file size must be an exact multiple of 2 MB. mkfs checks if the uber file includes a preexisting OMS file system. If mkfs finds a preexisting OMS file system, mkfs will print an error.

forcemkfs does not check for a preexisting OMS file system in the uber file and proceeds with laying out a new OMS file system in the uber file.

### Caution:

After you run forcemkfs, the data in the uber file cannot be restored.

# mount, unmount and Ismount Command Reference

Use mount, umount and, lsmount to manage and query the Oracle Memory Speed file system mount points.

### Syntax

mount Device mount\_path
umount mount\_path
lsmount

#### **Usage Notes**

mount creates a mount point for the uber file referred to as *Device* in the command syntax. mount does not allow a previously mounted uber file to be mounted again. mount supports a maximum of two mount points. The directory for the mount point must exist in the underlying POSIX file system and should not have write permissions.

umount unmounts a previously mounted OMS file system.

lsmount lists all the mount points.

# df Command Reference

Use df to determine the total space, used space, and free space in a mounted Oracle Memory Speed (OMS) file system.



#### Syntax

df mount\_path

#### Example

```
OMS> df /oracle/omsfs_1
Free (KB) : 10265748
Used (KB) : 218928
Total (KB): 10484676
OMS>
```

### **Usage Notes**

The OMS file system mounted at /oracle/omsfs\_1 has a total available space of 10 GB. Out of this 10 GB total space, 213 MB is in use and approximately 9.8 GB is free space.

# cp Command Reference

Use the copy command cp to copy files.

### Syntax

```
cp src filepath dst filepath
```

#### **Usage Notes**

You can copy the files from a POSIX mount point to an Oracle Memory Speed (OMS) mount point, an OMS mount point to a POSIX mount point, within a single OMS mount point, or between OMS mount points associated with the same SID.

You must use absolute paths for files residing in the OMS file system. The cp command is enabled only when the Oracle instance is down. Oracle recommends that you use SQL commands to copy files into and out of the OMS file system using the instance.

# Is and IIs Command Reference

Use 1s to list files in the Oracle Memory Speed (OMS) mount point, and 11s to list files in the OMS mount point with additional information for each file.

#### Syntax

```
ls mount_path
lls mount path
```

### **Usage Notes**

11s reports an accurate accounting of the total bytes allocated for the files. However, 1s may not always report an accurate accounting of the total bytes allocated for the files.



#### Example

```
ls /oracle/omsfs 1
OMS:ls: dirpath fixed to /oracle/omsfs 1/
OMS:ls: Files in /oracle/omsfs 1/:
OMS:ls: [blobno] blobname
OMS:ls cb: [4] /control01.ctl
OMS:ls cb: [5] /dfl.dbf
OMS:ls cb: [6] /tempfile
OMS:1st: Total bytes allocated: 212640K
OMS> lls /oracle/omsfs 1
OMS:ls: dirpath fixed to /oracle/omsfs 1/
OMS:lls: Files in /oracle/omsfs 1/:
OMS:lls cb: : Blob Name : /control01.ctl
OMS:lls cb: : Blob Num : 4
OMS:lls cb: : Size : 8011776
OMS:lls cb: : BlockSize : 4096
OMS:lls cb: : DB ID: : 0
OMS:lls cb: : Dir ID: : 0
OMS:lls cb: : Blob Name : /df1.dbf
OMS:lls cb: : Blob Num : 5
OMS:11s cb: : Size : 104865792
OMS:lls cb: : BlockSize : 4096
OMS:lls cb: : DB ID: : 0
OMS:lls cb: : Dir ID: : 0
OMS:lls cb: : Blob Name : /tempfile
OMS:lls cb: : Blob Num : 6
OMS:11s cb: : Size : 104865792
OMS:lls cb: : BlockSize : 4096
OMS:lls cb: : DB ID: : 0
OMS:lls cb: : Dir ID: : 0
OMS:1st: Total bytes allocated: 212640K
OMS>
```

# rm Command Reference

Use the rm command to delete a file from an Oracle Memory Speed (OMS) mount point.

#### Syntax

rm filepath

#### **Usage Notes**

The file path must be an absolute path to an OMS file. rm is enabled only when the Oracle instance is down. If you delete critical files, then it may cause the instance start-up to fail.

### Caution:

You cannot restore the files you delete.



# cd and pwd Command Reference

Use the current directory cd command to set the current working Oracle Memory Speed (OMS) mount point. Use the present working directory pwd command to display the current OMS mount point set by the previous cd command.

### Syntax

```
cd dirpath pwd
```

### **Usage Notes**

cd allows you to use other commands such as 1s without an explicit argument.

### Example

```
OMS> pwd
pwd: /
OMS> cd /oracle/omsfs_1
cd /oracle/omsfs_1 succeeded.
OMS> pwd
pwd: /oracle/omsfs_1
OMS> ls
OMS:ls: Files in /oracle/omsfs_1/:
OMS:ls: [blobno] blobname
OMS:ls cb: [4] /control01.ctl
OMS:ls cb: [5] /df1.dbf
OMS:ls cb: [6] /tempfile
OMS:lst: Total bytes allocated: 212640K
OMS>
```

# Isom and Isof Command Reference

Use the ls of mount point lsom command to list the Oracle process identifiers of all processes that have opened files in an Oracle Memory Speed (OMS) mount point.

### Syntax

```
dump lsom mount_point dump_file_name
dump lsof absolute file dump file name
```

### **Usage Notes**

Use the ls of file lsof to list the Oracle process identifiers of all processes that have the specified file open.

Browse the alert log to determine the OS pid of the process from the Oracle pid. lsom and lsof are available only when the Oracle instance is up-and-running.



#### Examples

```
OMS> dump lsom /oracle/omsfs 1 /tmp/lsom
OMS> exit
$ cat /tmp/lsom
18 /control01.ctl
18 /dfl.dbf
18 /tempfile
19 /dfl.dbf
20 /dfl.dbf
21 /dfl.dbf
22 /df1.dbf
23 /dfl.dbf
24 /dfl.dbf
25 /dfl.dbf
26 /dfl.dbf
27 /dfl.dbf
28 /dfl.dbf
29 /dfl.dbf
31 /control01.ctl
30 /control01.ctl
30 /dfl.dbf
32 /tempfile
43 /control01.ctl
8 /control01.ctl
47 /control01.ctl
OMS> dump lsof /oracle/omsfs_2/control02.ctl /tmp/lsof
OMS> exit
$ cat /tmp/lsof
18 /control02.ctl
31 /control02.ctl
30 /control02.ctl
43 /control02.ctl
8 /control02.ctl
```

```
47 /control02.ctl
```

# **Daemon Control Command Reference**

Use the daemon command to control the OMS daemon process.

#### **Syntax**

daemon exit trace *lvl* 

### **Usage Notes**

The  ${\tt exit}$  option marks the shared memory segment deleted and requests the daemon process to cleanly exit.



The trace option sets the verbosity of tracing to the daemon trace file. The verbosity levels are low, medium, and high. The default tracing verbosity is medium.

The daemon trace file is located at <code>\$ORACLE BASE/diag/oms/\$ORACLE SID oms \*.trc.</code>

### **Related Topics**

About the OMS Daemon

OMS is a user-space file system. The OMS daemon handles management and CLI operations for OMS.

# **Diagnostics and Tracing**

The dump command has many sub options to print diagnostic information.

The trace command allows you to trace the internal modules of Oracle Memory Speed (OMS). Contact Oracle technical support to use these options.



# Managing Oracle Database Port Numbers

Review default port numbers. If needed, use these steps to change assigned ports after installation.

- About Managing Ports
  - During installation, Oracle Universal Installer assigns port numbers to components from a set of default port numbers.
- Oracle Database Component Port Numbers and Protocols
   This table lists the port numbers and protocols configured for Oracle Database
   components during a single-instance installation. By default, the first port in the range is
   assigned to the component, if it is available.

## About Managing Ports

During installation, Oracle Universal Installer assigns port numbers to components from a set of default port numbers.

Many Oracle Database components and services use ports. As an administrator, it is important to know the port numbers used by these services, and to ensure that the same port number is not used by two services on your host. Enter the following command to identify the ports currently used on your computer:

\$/bin/netstat -a

Most port numbers are assigned during installation. Every component and service has an allotted port range, which is the set of port numbers Oracle Database attempts to use when assigning a port. Oracle Database starts with the lowest number in the range and performs the following checks:

Is the port used by another Oracle Database installation on the host?

The installation may be up or down at the time. Oracle Database can still detect if the port is used.

Is the port used by a process that is currently running?

This can be any process on the host, even a non-Oracle Database process.

Is the port listed in the /etc/services file?

If the answer to any of the preceding questions is yes, then Oracle Database moves to the next highest port in the allotted port range, and continues checking until it finds a free port.

# Oracle Database Component Port Numbers and Protocols

This table lists the port numbers and protocols configured for Oracle Database components during a single-instance installation. By default, the first port in the range is assigned to the component, if it is available.



Component	Description	Default Port Number	Port Range	Protocol
Oracle Net Services Listener	Enables Oracle client connections to the database over the Oracle Net Services protocol. You can configure it during installation. To reconfigure this port, use Net Configuration Assistant.	1521	Port number changes to the next available port. Modifiable manually to any available port.	TCP
Oracle Connection Manager	Listening port for Oracle client connections to Oracle Connection Manager. It is not configured during installation, but can be configured manually by editing the cman.ora parameter file. This file is located under the / network/admin directory.	1630	1630	TCP
Oracle XML DB	The Oracle XML DB HTTP port is used if web- based applications must access an Oracle database from an HTTP listener. You must configure this port manually.	0	Configured Manually	НТТР
Oracle XML DB	The Oracle XML DB FTP is used when applications must access an Oracle database from an FTP listener. You must configure this port manually.	0	Configured Manually	FTP

### Table F-1 Protocols and Default Port Numbers for Oracle Database Components

### **Related Topics**

- Using HTTP(S) on a Standard Port
- Using FTP on the Standard Port
- Oracle Real Application Clusters Installation Guide for Linux and UNIX



# Index

### Numerics

19c deprecated features, xvi

### A

aliases, multiple on computers, 6-4 apply patches during install apply patches during upgrade, 10-12, 11-7 asmdba groups creating, 5-8 asmoper group creating, 5-9 Automatic Diagnostic Repository (ADR), C-1 Automatic Memory Management, 11-5

### В

backupdba group creating, 5-10 Bash shell default user startup file, 5-12 binary files supported storage options for, 7-1 Bourne shell default user startup file, 5-12

### С

C shell default user startup file, 5-12 CDBs character sets, 11-4 central inventory, 1-5, C-5 See also Oracle inventory directory See also OINSTALL directory changing kernel parameter values, A-3 character sets, 11-4 checklists and installation planning, 1-1 client-server configurations, C-2 cloning. 12-16 command syntax conventions, xiii commands asmcmd, 9-6 df -h, 2-2

commands (continued) free, 2-2 grep MemTotal, 2-2 grep SwapTotal, 2-2 root.sh, 12-8 runcluvfy.sh, 10-7 setup.exe, 10-7 sysctl, 8-2 umask, 5-11 useradd, 5-11 computers with multiple aliases, 6-4 computers, non-networked, 6-3 copying demo directory, D-6 custom database failure groups for Oracle Automatic Storage Management, 9-2 requirements when using Oracle Automatic Storage Management, 9-2

### D

DAS (direct attached storage) disks, 9-18 data files minimum disk space for, 7-7 recommendations for file system, 7-7 supported storage options for, 7-1 data loss minimizing with Oracle ASM, 9-2 database cloning, 12-16 **Database Configuration Assistant** running in silent mode, **B-7** databases **Oracle Automatic Storage Management** requirements, 9-2 DB RECOVERY FILE DEST, 12-14 DB RECOVERY FILE DEST SIZE, 12-14 dba group creating, 5-9 description, 5-5 SYSDBA privilege, 5-5 dba groups creating, 5-10 DBCA configuring Automatic memory Management, 11-5



dbca.rsp file, B-3 **DBSNMP** user password requirements, 12-3 default file mode creation mask setting, 5-11 DefaultTasksMax, A-6 deinstall, 13-1, 13-3, 13-7 See also removing Oracle software deinstall command, 13-1 deinstallation, 13-1 examples, 13-5 previous releases, 13-8 upgrades. 13-8 deinstalling an rpm-based installation, 13-7 demo directory, D-6 deprecated features, xvi device names IDE disks, 9-12 RAID. 9-12 SCSI disks, 9-12 df command, 5-12 dgdba group creating, 5-10 diagnostic data, C-1 Direct NFS disabling, 8-5 enabling, 8-5 oranfstab file, 8-3 directory creating separate data file directories. 9-18 database file directory, 7-7 disk group Oracle ASM, 9-2 disk groups checking, 9-6 recommendations for. 9-2 disk space Oracle ASM, 9-5 requirements for preconfigured database in **Oracle Automatic Storage** Management, 9-2 disks checking availability for Oracle Automatic

Storage Management, 9-12 displaying attached disks, 9-12 supported for Oracle Automatic Storage Management, 9-18 display variable, 1-5

### Е

editing shell startup file, 5-12 EM Express, 12-14 enterprise.rsp file, B-3 environment variables ORACLE\_HOSTNAME, 6-3 errors X11 forwarding, 5-17 examples Oracle ASM failure groups, 9-2 executeConfigTools, *B-11* external redundancy Oracle Automatic Storage Management level, 9-2

### F

failure group characteristics of Oracle ASM failure group, 9-2 examples of Oracle Automatic Storage Management failure groups, 9-2 Oracle ASM, 9-2 fast recovery area, 12-15 filepath, C-5 Grid home filepath, C-5 fdisk command, 9-12 file mode creation mask setting, 5-11 file paths, D-9 file system using for data files, 7-7 file system options, 7-7 files bash profile, 5-12 dbca.rsp, B-3 enterprise.rsp, B-3 login, 5-12 profile, 5-12 response files, **B-3** filesets, 4-11

### G

globalization localization for client connections, 12-8 NLS LANG and client connections, 12-8 Grid user creating, 5-11 groups creating an Oracle Inventory Group, 5-2 creating the asmdba group, 5-8 creating the asmoper group, 5-9 creating the backupdba group, 5-10 creating the dba group, 5-9 creating the dgdba group, 5-10 creating the kmdba group, 5-10 creating the racdba group, 5-10 OINSTALL group, 1-3 OSBACKUPDBA (backupdba), 5-6

groups (continued) OSDBA (dba), 5-5 OSDBA group (dba), 5-5 OSDGDBA (dgdba), 5-6 OSKMDBA (kmdba), 5-6 OSOPER (oper), 5-5 OSOPER group (oper), 5-5

### Н

hardware requirements, 1-1 display, 1-1 host name resolution, 4-47 host name, setting before installation, 6-4 hugepages, 1-3 Hugepages,, 4-7

### I

IDE disks device names, 9-12 image install, 10-2, 11-2, 11-10 init.ora and SGA permissions, 12-11 installation computer aliases, multiple, 6-4 laptops, 6-3 Oracle Automatic Storage Management, 9-2 response files, **B-3** preparing, B-3, B-4 templates, **B-3** silent mode, **B-5** installation option Automatic Memory Management, 11-5 installation planning, 1-1 installation types and Oracle Automatic Storage Management, 9-2 installer supported languages, 11-6 Installing Oracle Restart, 10-3 invalid objects recompiling, 12-9

### J

JDK requirements, 4-11

### Κ

kernel parameters changing, A-3 displaying, A-3 kernel parameters *(continued)* SUSE Linux, *A-4* tcp and udp, *A-5* kernel parameters configuration, *A-1* kmdba group creating, *5-10* Korn shell default user startup file, *5-12* 

### L

laptops, installing Oracle Database on, 6-3 Linux kernel parameters, A-1 local device using for data files, 7-7 locking and unlocking users, 12-7 loopback adapters, 6-4 non-networked computers, 6-3 lsdev command, 9-12 LVM recommendations for Oracle Automatic Storage Management, 9-2

### Μ

mask setting default file mode creation mask, 5-11 mixed binaries, 4-11 mode setting default file mode creation mask, 5-11 multihomed computers, installing on, 6-3 multihomed Oracle servers resolving to,, 6-4 multiple aliases, computers with, 6-4 Multiple Oracle Homes Support advantages, C-2 multitenant container database character sets, 11-4 multiversioning, C-2 My Oracle Support credentials, 11-8

### Ν

Naming convention for RPM-based installation, 11-11Net Configuration Assistant (NetCA) response files, *B-7* running at command prompt, *B-7* netca.rsp file, *B-3* network adapters, 6-4 computers with multiple aliases, 6-4 non-networked computers, 6-3 primary, on computers with multiple aliases, 6-4See also loopback adapters network cards, multiple, 6-3

network setup computers with multiple aliases, 6-4 host name resolution, 4-47 network topics laptops, 6-3 multiple network cards, 6-3 non-networked computers, 6-3 NFS and data files, 7-8 buffer size requirements, 8-2 for data files, 7-8 NFS mounts **Direct NFS Client** requirements, 7-8 mtab, 7-8 oranfstab, 7-8 non-networked computers, 6-3 noninteractive installation Oracle ASM requirements, 9-6 noninteractive mode See response file mode

### 0

OFA. C-1 See also Optimal Flexible Architecture OINSTALL directory, C-5 oinstall group creating, 5-2 OINSTALL groupl. 1-5 See also Oracle Inventory directory oper group description, 5-5 operating system configuring, 4-1 different on cluster members, 4-11 parameters, A-1 requirements, 4-11 operating system privileges groups, 1-5 operating system requirements, 1-2 Optimal Flexible Architecture, C-1 about, C-1 orabasehome, D-9 orabasetab, D-3 **Oracle ACFS** enabling, 10-11 Installing Oracle RAC binaries not supported on Oracle Flex Cluster, 7-6 restrictions for Oracle Restart, 7-6 supported Linux x86-64 kernels, 7-5 Oracle ASM, 7-2, 9-2 disk groups, 9-2 disk space, 9-5 failure groups, 9-2 recommendations for disk groups, 9-2

Oracle ASM (continued) See also Oracle Automatic Storage Management Oracle ASM disk space, 9-5 Oracle ASM library driver (oracleasm) installing, 9-8 Oracle ASMLIB, 9-8 about, 9-8 configuring. 9-7 deinstalling on database, 9-15 Oracle Automatic Storage Management, 9-2 allocation units (AU) and ASM disks, 9-2 characteristics of failure groups, 9-2 checking disk availability, 9-12 DAS disks. 9-18 disk space, 9-5 disks, supported, 9-18 displaying attached disks, 9-12 failure groups examples. 9-2 identifying, 9-2 identifying available disks, 9-12 identifying disks, 9-12 part of Oracle Grid Infrastructure for a standalone server installation, 11-1 part of Oracle Grid Infrastructure installation. 7-3 partition creation, 9-18 redundancy levels, 9-2 SAN disks, 9-18 space required for preconfigured database. 9-2 Oracle Automatic Storage Management library driver See Oracle ASMLIB Oracle base, C-1, C-5 Oracle base config, D-3 Oracle base home, D-2 Oracle Connection Manager, F-1 **Oracle Database** minimum disk space requirements, 7-7 requirements with Oracle Automatic Storage Management, 9-2 Oracle Database Configuration Assistant, B-8 response file, **B-3** Oracle Database deployment, 1-11 Oracle DBCA, B-8 Oracle Disk Manager and Direct NFS, 8-5 Oracle Enterprise Manager Database Express, 12-14 Oracle Fleet Patching and Provisioning, xvii Databases, 11-2 **Oracle Flex Clusters Oracle Restart** restrictions for, 7-6

Oracle Flex Clusters (continued) restrictions for Oracle ACFS, 7-6 Oracle FPP, xvii, 11-2 **Oracle Grid Infrastructure** restrictions for Oracle ACFS, 7-6 Oracle Grid Infrastructure for a standalone server, 7-2 Oracle home ASCII path restriction for, 1-3 file path, C-5 Grid home filepath, C-5 naming conventions, C-4 Oracle home directory multiple homes, network considerations, 6-3 Oracle host name, setting before installation, 6-4 Oracle Inventory, 1-5 identifying existing, 5-2 **Oracle Inventory Directory** OINSTALL group, C-2 **Oracle Net Configuration Assistant** response file, B-3 Oracle Net Services Listener, F-1 **Oracle Optimal Flexible Architecture** See Optimal Flexible Architecture Oracle Restart, 7-2 deconfiguring, 13-5 downgrading, 13-5 gridSetup.sh, 10-3 Installing, 10-3 troubleshooting, 13-5 Oracle Software Owner user creating, 5-3, 5-11 Oracle Software Owner users, 5-12 **Oracle Universal Installer** response files list of, B-3 Oracle Upgrade Companion, 4-8 oracle user, 1-5 creating, 5-3 Oracle user modifying, 5-15 Oracle XML DB, F-1 ORACLE\_BASE\_CONFIG, D-3, D-9 ORACLE\_BASE\_HOME, D-2, D-9 ORACLE HOME, D-9 ORACLE HOSTNAME, 6-3 **ORACLE HOSTNAME environment variable** computers with multiple aliases, 6-4 multihomed computers, 6-3 setting before installation, 6-4 oracle-database-ee-19c-1.0-1.x86 64.rpm. 11-11 oracle-database-server preinstallation RPM, 3-3 oracleasm RPM installing, 9-8 oralnventory, C-5

oranfstab configuration file, 8-3 oranfstab file, 8-5 **OSBACKUPDBA** group creating, 5-10 OSBACKUPDBA group (backupdba), 5-6 OSDBA, 1-5 OSDBA for ASM creating for Oracle Grid Infrastructure, 5-8 **OSDBA** groups creating, 5-9 creating for Oracle Grid Infrastructure, 5-9 description for database, 5-5 SYSDBA privilege, 5-5 **OSDGDBA** group creating, 5-10 OSDGDBA group (dgdba), 5-6 **OSKMDBA** group creating, 5-10 OSKMDBA group (kmdba), 5-6 **OSOPER** group creating, 5-9 **OSOPER** groups description for database, 5-5 SYSOPER privilege, 5-5 OSRACDBA group creating, 5-10 other changes, xvii **OTN** website downloading installation software from, 11-3 out-of-place patching, 10-12

### Ρ

packages oracle-database-server preinstallation package, 3-3 parameter file and permissions to read and write the SGA, 12-11 partition using with Oracle Automatic Storage Management, 9-2 partitions creation for Oracle Automatic Storage Management disks, 9-18 passwords, 12-3, 12-6 change after install, 12-3 resetting with SQL\*Plus, 12-7 unlocking with SQL\*Plus, 12-7 patch updates, 12-2 PGA, 11-5 ports Oracle Connection Manager, F-1 Oracle Net Services Listener, F-1

ports (continued) Oracle XML DB, *F-1* postinstallation recommended tasks root.sh script, backing up, *12-8* postinstallation -executeConfigTools option, *B-9* postinstallation configToolAllCommands script, *B-12* preconfigured database Oracle Automatic Storage Management disk space requirements, *9-2* requirements when using Oracle Automatic Storage Management, *9-2* 

### R

racdba group creating, 5-10 RAID, 7-7 device names, 9-12 using for Oracle data files, 7-7 rapid home provisioning name change, xvii read only Oracle home, D-5 read-only oracle home, D-2, D-9 read-only Oracle home, D-1, D-3, D-6, D-9 read/write oracle home, D-9 recommendations on performing software-only installations, 10-6.10-7 recompiling invalid objects, 12-9 redundancy level and space requirements for preconfigured database, 9-2 for Oracle Automatic Storage Management, 9-2 redundant array of independent disks See RAID release update revisions, 12-2 release updates, 12-2 releases multiple, C-2 removing Oracle software, 13-1 examples, 13-5 requirements, 9-2 resource parameters, A-1 response file, **B-8** response file installation preparing, **B-3** response files templates, **B-3** silent mode, **B-5** response file mode, **B-1** about, **B-1** reasons for using, B-2 See also response files, silent mode

response files, B-1, B-8 about, **B-1** creating with template, **B-3** dbca.rsp, B-3 enterprise.rsp, B-3 general procedure, **B-2** Net Configuration Assistant, B-7 netca.rsp, B-3 passing values at command line, B-1 specifying with Oracle Universal Installer, B-5 See also silent mode. roohctl -enable, D-5 root user logging in as, 2-1 root.sh script backing up, 12-8 rootcrs.sh, 13-1 roothas.pl, 10-8, 10-11 roothas.sh, 10-10, 10-11, 13-1 rpm –ivh, <u>11-10</u> RPM-based database installation, 11-10, 11-11, 13-7 running multiple Oracle releases, C-2

### S

SAN (storage area network) disks, 9-18 SCSI disks device names, 9-12 seamless patching, D-2 security selecting passwords, 12-3 SELinux restrictions on Oracle ACFS, 7-5 SGA, 11-5 silent mode about, **B-1** reasons for using, B-2 silent mode installation, **B-5** software requirements, 4-11 software security updates, 11-8 ssh and X11 Forwarding, 5-17 starting, 12-14 storage area network disks, 9-18 stty suppressing to prevent installation errors, 5-18 supported languages installer, 11-6 swap space allocation, 1-3 SYS user password requirements, 12-3 SYSBACKUPDBA system privileges, 5-6

SYSDBA privilege associated group, 5-5 SYSDGDBA system privileges, 5-6 SYSKMDBA system privileges, 5-6 SYSOPER privilege associated group, 5-5 system global area permissions to read and write, 12-11 system privileges SYSBACKUPDBA, 5-6 SYSDGDBA, 5-6 SYSKMDBA, 5-6 system privileges accounts locked after install, 12-3 system requirements, 1-1 SYSTEM user password requirements, 12-3

### Т

tcp rmem, 8-2 tcp wmem, 8-2 terminal output commands suppressing for Oracle installation owner accounts, 5-18 **Transparent Hugepages** disable for Oracle Database servers, 4-7 troubleshooting disk space errors, 1-3 environment path errors, 1-3 garbage strings in script inputs found in log files, 5-18 host name resolution for multihomed servers, 6-3 installation owner environment variables and installation errors, 5-19 inventory corruption, 5-15 ssh errors, 5-18 stty errors, 5-18 unset environment variables, 1-3

### U

umask command, 5-11 uninstall See removing Oracle software UNIX commands fdisk, 9-12 Isdev, 9-12 xhost, 2-1 UNIX workstation installing from, 2-1 unset installation owners environment variables, 5-19 upgrade, 4-9 Oracle Automatic Storage Management, 7-3, 11-1 upgrades best practices, 4-8 upgrading options, 4-8 useradd command, 5-11 users creating the oracle user, 5-3 locking and unlocking, 12-7 utlrp.sgl, 12-9

### Х

X Window System enabling remote hosts, 2-1 X11 forwarding errors, 5-17 xhost command, 2-1 xtitle suppressing to prevent installation errors, 5-18

### Y

yum install, 11-11