IBM

Installing Oracle 11gR2 RAC on Linux on System z

- Install Oracle Grid Infrastructure and Real Application Clusters
- Configure disk storage on FCP/SCSI and ECKD/DASD
- Install Oracle 11gR2 on Linux on System z

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Redpaper

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Contents

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Preface

This IBM® Redpaper publication describes experiences gained while installing Oracle Database 11gR2 with Grid Infrastructure (GI). It covers the set up and installation process for these environments:

- Setting up Red Hat Enterprise Linux 5 with DASD
- Setting up Red Hat Enterprise Linux 5 with FCP/SCSI
- Setting up SLES11 with DASD
- Setting up SLES11 with FCP/SCSI disks

Examples include the installation of the Grid Infrastructure, installation of a single instance database and installation of a two-node Real Application Cluster (RAC) database.

In all cases, we use UDEV rules for DASD and single path SCSI, and multipathing for multi-path SCSI to provide device persistency for ASM storage, not ASMLib.

Interested readers would include database consultants, installers, administrators, and system programmers. This is not meant to replace Oracle documentation, but to supplement it with our experiences while installing and using Oracle Database products. We made extensive uses of My Oracle Support notes.

The team who wrote this paper

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1

General information

This section covers information common to an installation on Red Hat Enterprise Linux (RHEL) or Novell SUSE Linux Enterprise Server (SLES).

1. Reference notes:

   The following My Oracle Support Notes (MOS) are the most useful, and are updated with the latest tips and information:

1306465.1	Getting Started 11gR2 on System z Linux
1306889.1	11gR2 RHEL 5 on System z Linux Requirements
1290644.1	Requirements for Installing Oracle 11gR2 on SLES 11 on IBM: Linux on System z
1308859.1	Requirements for Installing Oracle 11gR2 on SLES 10 SP3 on IBM: Linux on System z
1350008.1	How to Manually Configure Disk Storage devices for use with Oracle ASM 11.2 on IBM: Linux on System z under SLES
1351746.1	How to Manually Configure Disk Storage devices for use with Oracle ASM 11.2 on IBM: Linux on System z under Red Hat 5

   If doing an Oracle ASM / Oracle Grid Install, the Oracle Grid Infrastructure Installation Guide 11g Release 2 (11.2) for Linux document E17212-10 provides more detailed information about the install, and has been updated for System z Linux.

2. System environment:

   The minimum hardware requirements for running Oracle on any Linux platform is:

   a. Memory

      Oracle recommends 4.0 GB (4096 MB) of virtual RAM for any Linux platform. Testing at IBM has shown that 1 GB is definitely too small, with excessive Linux swapping occurring. Hence, 2 GB of virtual memory is the smallest for an 11gR2 database.

      To determine the virtual RAM size, you can run the following command:

      `cat /proc/meminfo | grep MemTotal`

      An example of this command can be seen in Example 1-1.

      Example 1-1 Checking the virtual RAM size

      ```
      # cat /proc/meminfo | grep MemTotal
      ```

```
MemTotal:       4054900 kB
```

b. Swap space

Oracle's recommendation for swap disk space proportional to the system's physical memory is shown in Table 1-1.

Table 1-1 Oracle RAM to swap space recommendations

RAM	Swap space
Between 4 GB and 8 GB	2xRAM
Between 8 GB and 32 GB	1.5xRAM
Greater than 32 GB	32 GB

This may be more swap disk space than is necessary and is just a guideline. With Linux on System z, it is advantageous to define multiple swap devices, with an initial smaller virtual disk (VDISK) as the primary or highest priority swap device, and another physical disk as the secondary swap device. You can check your current swap usage as the root user with the following command:

```
swapon -s
```

Example 1-2 provides a two VDISK solution with higher priority (virtual swap devices to memory), backed by a physical disk (in this case an open storage multipath SCSI device) with a lower priority.

If you start seeing excessive swap usage for the physical disk device, investigate the workload, the Oracle memory settings, and the Linux virtual memory size for the reason.

Example 1-2 Two VDISKs with higher priority

```
# swapon -s
Filename                                Type            Size    Used
Priority
/dev/dasdo1                             partition       131000  0
10
/dev/dasdp1                             partition       524216  0         5
/dev/mapper/u603_swap3                  partition       6291448 0         1
```

You need to plan disk space for the following software:

i. Approximately 5.5 GB of disk space is required for Oracle Grid Infrastructure (RAC) or a Single Instance Grid Cluster ASM Home.

ii. Approximately 4.6 GB of disk space is required for the database software.

iii. 1.0 GB of disk space is recommended for the /tmp directory (or another temporary directory if environment

c. Software download

The Oracle 11gR2 software can be downloaded and staged from Oracle's Technology Network:

http://www.oracle.com/technetwork/database/enterprise-edition/downloads/112020-zlinux64-352074.html

You will need the following compressed files for a database install:

- Oracle Database 11g Release 2 (11.2.0.2.0) for zLinux64

- linux.zseries64_11gR2_database_1of2.zip (1,441,455,828 bytes) (cksum - 3912266884)
- linux.zseries64_11gR2_database_2of2.zip (1,009,427,871 bytes) (cksum - 2311586783)

You will need the following for a ASM or Oracle Grid/Real Application Cluster (RAC):

- Oracle Database 11g Release 2 Grid Infrastructure (11.2.0.2.0) for zLinux64
- linux.zseries64_11gR2_grid.zip (756,155,780 bytes) (cksum - 426666400)

You should plan to install the latest Patch Set Updates (PSU) that come out quarterly. As of September 2011 the current PSUs are:

```
Patch 12419331  - 11.2.0.2.3  DB  Patch Set Update
Patch 12419353  - 11.2.0.2.3  GI  Patch Set Update
```

Tip: Based on the information in Oracle support note, Oracle ASMLIB-Support for Red Hat Enterprise Linux 5 AS on IBM zSeries® zSeries [ID 821652.1], ASMLib will not be available in future releases with Red Hat. This paper documents the option of using UDEV rules to configure ASM disk permission's and device persistence.

Refer to Oracle Notes - 1350008.1 and 1351746.1 for further details about how to setup device persistence and device permissions if using Oracle ASM.

2

Installing Oracle 11g R2 on a Red Hat 5 Linux guest

The following chapter discusses installing Oracle 11g R2 on a Red Hat 5 Linux guest only. If you are using Novell Suse Linux Enterprise Server, see Chapter 3, “Installing Oracle 11gR2 on Novell SUSE Linux Enterprise Server guest” on page 11.

There is a detailed chapter in the *Experiences with Oracle Solutions on Linux for IBM System z*, SG24-7634, that describes how to install Red Hat Enterprise Linux 5 for an Oracle Database.

For Oracle Database 11gR2, the minimum version is Red Hat Enterprise Linux Server (RHEL) 5.4, Kernel -**2.6.18-164** or newer. RHEL6.0 is currently NOT certified for Oracle 11gR2.

To check the version of RHEL you have installed, use the following command:

```
# cat /proc/version
Linux version 2.6.18-238.1.1.el5 (mockbuild@s390-011.build.bos.redhat.com) (gcc
version 4.1.2 20080704 (Red Hat 4.1.2-50)) #1 SMP Tue Jan 4 13:35:45 EST 2011
```

Level **2.6.18-238** is later than **2.6.18-164** in this example so we are OK from a minimum kernel level perspective.

Because of sporadic reboots with a lower kernel version and 10gR2 CRS., use 2.6.18-238 or greater for Oracle RAC environments.

2.1 Verify SELinux is Permissive or Disabled.

Oracle 11gR2 on a Red Hat 5 system must have SELinux disabled or set to permissive or else sqlplus will not work properly. To verify your SELinux setting, check the `/etc/selinux/config` file (see Example 2-2) and ensure the SELinux setting is not set to `Enforcing`. Otherwise, change the line as shown here:

```
SELINUX=Permissive
```

A reboot is required for the change to take effect. To change dynamically you can run the commands shown in Example 2-1, as root, to change the SELinux security mode:

Example 2-1 Changing the security mode

```
getenforce     (returns "Enforcing")
setenforce 0
getenforce     (returns "Permissive")
```

Verify the security mode by running the command shown in Example 2-2.

Example 2-2 Checking the security mode

```
# cat /etc/selinux/config
# This file controls the state of SELinux on the system.
# SELINUX= can take one of these three values:
#       enforcing - SELinux security policy is enforced.
#       permissive - SELinux prints warnings instead of enforcing.
#       disabled - SELinux is fully disabled.
SELINUX=permissive
# SELINUXTYPE= type of policy in use. Possible values are:
#       targeted - Only targeted network daemons are protected.
#       strict - Full SELinux protection.
SELINUXTYPE=targeted
```

Remember: Disabling SELinux or setting it to “permissive” mode, can have security considerations. It is possible to keep SELinux enabled, and add manual exclusion rules. Refer to Oracle note [457458.1], “How to disable or set SELinux to permissive mode” for more information.

2.2 Linux required RPMs for RHEL Installs

This section lists required RPMs for Red Hat Enterprise Linux installs.

1. Red Hat Linux Base Install

   When Installing Red Hat Enterprise Linux 5, select the majority of the rpms required at installation time to help prevent issues with rpm dependencies. In Appendix E, we have included a step by step Red Hat Install Operating System Install, selecting the required packages at Linux operating system install time as a reference.

2. RPM checker

   For Red Hat systems the Linux on System z Oracle 11gR2, you should use rpm checker to verify your system configuration before installing Oracle software.

Download the “rpm checker” from the bottom of My Oracle Support (MOS) Note **1306465.1**. The rpm checker checks that the required rpms for Oracle Grid and Database installs. This prevents problems with the installation of Oracle. You will have to log on to the Oracle support site found at the following URL:

https://support.oracle.com/CSP/main/article?cmd=show&type=ATT&id=1306465.1:RHEL5_11202

Download the file for single instance high availability (SIHA) named:

RHEL5 - 11.2 Grid Infrastructure, SIHA, DB Install (1.68 KB)

Unzip the download file and install the extracted rpm to verify your Linux rpm requirements. The rpm checker does not actually install anything. The checker uses the dependencies of rpm to check your system. The **rpm checker** command (Example 2-3) is best run as the root user.

Example 2-3 Using the RPM checker

```
# rpm -ivh ora-val-rpm-EL5-DB-11.2.0.2-1.s390x.rpm
Preparing...                ########################################### [100%]
 1:ora-val-rpm-EL5-DB     ########################################### [100%]
******************************************************************************
*     Validation complete - please install any missing rpms                  *
*   The following output should display both (s390) - 31-bit and             *
*       (s390x) 64-bit rpms - Please provide the output to Oracle            *
*            Support if you are still encountering problems.                 *
******************************************************************************
Found          glibc-dev (s390)
Found          glibc-dev (s390x)
Found          libaio (s390)
Found          libaio (s390x)
Found          compat-libstdc++-33 (s390)
Found          compat-libstdc++-33 (s390x)
Found          glibc (s390)
Found          glibc (s390x)
Found          libgcc (s390)
Found          libgcc (s390x)
Found          libstdc++ (s390)
Found          libstdc++ (s390x)
Found          libaio-devel (s390)
Found          libaio-devel (s390x)
```

2.3 Required Linux RPMs specifically for RHEL 5

The following is the list of the required Linux rpm packages (rpm release numbers can be higher than the minimum versions listed below). Note that certain packages require BOTH the 31 bit (s390) and the 64 bit version (s390x) of the rpm to be installed.

- binutils-2.17.50.0.6-12.el5.s390x.rpm
- compat-libstdc++-33-3.2.3-61.s390x.rpm
- compat-libstdc++-33-3.2.3-61.s390.rpm
- elfutils-libelf-0.137-3.el5.s390x.rpm
- glibc-2.5-42.s390x.rpm
- glibc-2.5-42.s390.rpm

- glibc-common-2.5-42.s390x.rpm
- ksh-20080202-14.el5.s390x.rpm
- libaio-0.3.106-3.2.s390x.rpm
- libaio-0.3.106-3.2.s390.rpm
- libgcc-4.1.2-46.el5.s390x.rpm
- libgcc-4.1.2-46.el5.s390.rpm
- libstdc++-4.1.2-46.el5.s390x.rpm
- libstdc++-4.1.2-46.el5.s390.rpm
- make-3.81-3.el5.s390x.rpm
- elfutils-libelf-devel-0.137-3.el5.s390x.rpm
- elfutils-libelf-devel-static-0.137-3.el5.s390x.rpm
- glibc-headers-2.5-42.s390x.rpm
- kernel-headers-2.6.18-164.el5.s390x.rpm
- glibc-devel-2.5-42.s390x.rpm
- glibc-devel-2.5-42.s390.rpm
- gcc-4.1.2-46.el5.s390x.rpm
- libstdc++-devel-4.1.2-46.el5.s390.rpm
- gcc-c++-4.1.2-46.el5.s390x.rpm
- libaio-devel-0.3.106-3.2.s390x.rpm
- libaio-devel-0.3.106-3.2.s390.rpm
- sysstat-7.0.2-3.el5.s390x.rpm

Some of the ELF-Util rpms might be required to be installed together due to dependencies. For example:

```
rpm -ivh elfutils-libelf-devel-0.137-3.el5.s390x.rpm
elfutils-libelf-devel-static-0.137-3.el5.s390x.rpm
```

At this point, you should have a Linux guest (RHEL 5) ready for customization.

Optional X Software Components required for an X Windows GUI Interface such as netca, vipca, dbca, or the GUI runInstaller (non silent mode) are:

- mesa-libGLU-devel-6.5.1-7.5.el5.s390x.rpm
- mesa-lib-GLw-devel-6.5.1-7.5.el5.s390x.rpm
- openmotif-devel-2.3.0-0.5.el5.s390x.rpm

2.4 Optional ODBC Components

The following are the optional rpms needed if the unix/ODBC option will be installed.

- unixODBC-2.2.11-7.1.s390x.rpm
- unixODBC-2.2.11-7.1.s390.rpm
- unixODBC-devel-2.2.11-7.1.s390x.rpm
- unixODBC-devel-2.2.11-7.1.s390x.rpm

You can use the following **rpm** command to verify the full extensions of the rpms because some require the s390 (31 bit) and some the s390x (64 bit) version of the rpm.

```
rpm -qa --queryformat="%{n}-%{v}-%{r}.%{arch}.rpm" | grep <package>
```

2.5 Setting NTP TIME for RHEL (optional only for Oracle Grid installations)

Oracle Grid / ASM does a system check to verify that the Cluster Time Synchronization Service is set in such a way so to prevent the system time from being adjusted backward.

If you are installing Oracle Grid for Single Instance ASM or Oracle RAC, you should modify the NTP configuration to including the slewing option with the **–x** parameter.

To do this on Red Hat Linux, edit the `/etc/sysconfig/ntpd` file and add the **-x** flag, as in Example 2-4.

Example 2-4 Modifying the NTP configuration file

```
# Drop root to id 'ntp:ntp' by default.
OPTIONS="-x -u ntp:ntp -p /var/run/ntpd.pid"
# Set to 'yes' to sync hw clock after successful ntpdate
SYNC_HWCLOCK=no
# Additional options for ntpdate
NTPDATE_OPTIONS=""
```

Restart the network time protocol daemon after you complete this task, as the root user, with the command:

```
/sbin/service ntpd restart
```

Next, configure the system so that the ntp daemon is started on reboot using the following command:

```
# chkconfig --level 35 ntpd on
```

Proceed to Chapter 4, “Required Kernel Parameters for Oracle (SLES and Red Hat)” on page 17.

3

Installing Oracle 11gR2 on Novell SUSE Linux Enterprise Server guest

The minimum requirement to install Oracle 11gR2 on a Novell SUSE Linux Enterprise Server (SLES) guest is SLES 10 SP3 (or later). Kernel -2.6.16.60-0.54.5 or later is required for an 11gR2 SLES installation. SLES 11.0 SP1 (2.6.32.12-0.7) + is currently available and is preferable for 11gR2 because it incorporates various features of System z hardware. To verify your release, use the commands shown in Example 3-1.

Example 3-1 Verifying the Linux version

```
# cat /proc/version
Linux version 2.6.32.12-0.7-default (geeko@buildhost) (gcc version 4.3.4
[gcc-4_3-branch revision 152973] (SUSE Linux) ) #1 SMP 2010-05-20 11:14:20 +0200
```

In this example, 2.6.32.12 meets the minimum kernel level requirement for SLES 11 SP1.

3.1 Linux required RPMs for SLES 11

This section outlines the RPMs required to install Oracle on a SLES 11 guests.

1. Linux Base Install

   When installing on a SLES system, select the majority of the rpms required at installation time to help prevent issues with rpm dependencies. For example, selecting the “C” Libraries and functions contains the majority of the “C” library rpm packages.

2. RPM checker

   For SLES systems on System z Oracle 11gR2, you should use rpm checker to verify your system configuration before installing Oracle software.

   Download the appropriate RPM checker from the bottom of the My Oracle Support (MOS) Note 1306465.1. The rpm checker checks that the required rpms for Oracle Grid and database installs. This prevents problems with the installation of Oracle. You will have to logon to the Oracle secure website and select one of the following RPM checkers

   – S10 Grid Infrastructure/Database RPM checker (1.33 KB) (SLES 10 Checker) https://support.oracle.com/CSP/main/article?cmd=show&type=ATT&id=1086769.1:DB_S10_11202_ZLINUX
   – S11 Grid Infrastructure/Database RPM checker 11.2.0.2 (1.38 KB) (SLES 11 Checker) https://support.oracle.com/CSP/main/article?cmd=show&type=ATT&id=1086769.1:DB_S11_11202_ZLINUX

   Unzip the download file and then install the extracted rpm to verify your Linux rpm requirements. The rpm checker does not actually install anything. The checker uses the dependencies of rpm to check your system. Run the RPM checker command as the root user if possible. Examples of the results of each rpm checker can be found in Example 3-2 and Example 3-3.

Example 3-2 SLES 11 rpm checker results

```
# rpm -i ora-val-rpm-S11-DB-11.2.0.2-1.s390x.rpm
********************************************************************************
* Validation complete - Your sles11 OS has required rpms for Oracle 11.2   *
********************************************************************************
```

In Example 3-3, the SLES 10 Oracle 10gR2 rpm checker reported that there are rpms that are still required to be updated before he 10gR2 system can be upgraded to 11gR2 for the grid infrastructure.

Example 3-3 SLES 10 10gR2 rpm checker results

```
# rpm -i ora-val-rpm-S10-DB-11.2.0.2-1.s390x.rpm
error: Failed dependencies:
binutils-32bit >= 2.16.91.0.5-23.34.33 is needed by
ora-val-rpm-S10-DB-11.2.0.2-1.s390x
binutils >= 2.16.91.0.5-23.34.33 is needed by
ora-val-rpm-S10-DB-11.2.0.2-1.s390x
libstdc++33 >= 3.3.3-7.8.1 is needed by ora-val-rpm-S10-DB-11.2.0.2-1.s390
glibc >= 2.4-31.74.1 is needed by ora-val-rpm-S10-DB-11.2.0.2-1.s390x
glibc-32bit >= 2.4-31.74.1 is needed by ora-val-rpm-S10-DB-11.2.0.2-1.s390x
libgcc >= 4.1.2_20070115-0.29.6 is needed by
ora-val-rpm-S10-DB-11.2.0.2-1.s390x
libstdc++ >= 4.1.2_20070115-0.29.6 is needed by
ora-val-rpm-S10-DB-11.2.0.2-1.s390x
glibc-devel >= 2.4-31.74.1 is needed by ora-val-rpm-S10-DB-11.2.0.2-1.s390x
```

```
glibc-devel-32bit >= 2.4-31.74.1 is needed by
ora-val-rpm-S10-DB-11.2.0.2-1.s390xlibstdc++-devel >= 4.1.2_20070115-0.29.6 is
needed ora-val-rpm-S10-DB-11.2.0.2-1.s390x
gcc >= 4.1.2_20070115-0.29.6 is needed by ora-val-rpm-S10-DB-11.2.0.2-1.s390x
libmudflap >= 4.1.2_20070115-0.29.6 is needed by
ora-val-rpm-S10-DB-11.2.0.2-1.s390x
gcc-c++ >= 4.1.2_20070115-0.29.6 is needed by
ora-val-rpm-S10-DB-11.2.0.2-1.s390x
ksh >= 93s-59.11.35 is needed by ora-val-rpm-S10-DB-11.2.0.2-1.s390x
sysstat >= 8.0.4-1.7.27 is needed by ora-val-rpm-S10-DB-11.2.0.2-1.s390x
```

3. Required RPMs for SLES

   The following is the list of the rpm packages that are required for each version of Linux. The RPM release numbers can be higher than the minimum versions listed below.

   Important: Certain packages require BOTH the 31 bit (s390) and the 64 bit version (s390x) of the rpm to be installed.

   The following should be installed as part of a base Novell SUSE Linux Enterprise Server 11 install:

```
binutils-2.20.0-0.7.9.s390x.rpm
glibc-2.11.1-0.17.4.s390x.rpm
glibc-32bit-2.11.1-0.17.4.s390x.rpm
ksh-93t-9.9.8.s390x.rpm
libaio-0.3.109-0.1.46.s390x.rpm
libaio-32bit-0.3.109-0.1.46.s390x.rpm
libstdc++33-3.3.3-11.9.s390x.rpm
libstdc++33-32bit-3.3.3-11.9.s390x.rpm
libstdc++43-4.3.4_20091019-0.7.35.s390x.rpm
libstdc++43-32bit-4.3.4_20091019-0.7.35.s390x.rpm
libgcc43-4.3.4_20091019-0.7.35.s390x.rpm
make-3.81-128.20.s390x.rpm
```

   The remaining rpm requirements can be installed by selecting all the “C” Libraries and extensions or by manually installing each of these rpms:

```
libaio-devel-0.3.109-0.1.46.s390x.rpm
libaio-devel-32bit-0.3.109-0.1.46.s390x.rpm
sysstat-8.1.5-7.9.56.s390x.rpm
glibc-devel-2.11.1-0.17.4.s390x.rpm (requires
linux-kernel-headers-2.6.32-1.4.13.noarch.rpm)
gcc-4.3-62.198.s390x.rpm (requires gcc43-4.3.4_20091019-0.7.35.s390x.rpm)
glibc-devel-32bit-2.11.1-0.17.4.s390x.rpm
gcc-32bit-4.3-62.198.s390x.rpm (requires
gcc43-32bit-4.3.4_20091019-0.7.35.s390x.rpm and
libgomp43-32bit-4.3.4_20091019-0.7.35.s390x.rpm)
libstdc++43-devel-4.3.4_20091019-0.7.35.s390x.rpm
gcc-c++-4.3-62.198.s390x.rpm (requires
gcc43-c++-4.3.4_20091019-0.7.35.s390x.rpm)
libstdc++43-devel-32bit-4.3.4_20091019-0.7.35.s390x.rpm
libstdc++-devel-4.3-62.198.s390x.rpm
libcap1-1.10-6.10.s390x.rpm
```

The following should be installed as part of a base SLES 10 SP 3+ install:

```
binutils-32bit-2.16.91.0.5-23.34.33 (s390x)
libstdc++33-3.3.3-7.8.1(s390x)
glibc-2.4-31.74.1 (s390x)
libaio-0.3.104-14.2 (s390x)
libaio-32bit-0.3.104-14.2 (s390x)
libgcc-4.1.2_20070115-0.29.6 (s390x)
libstdc++-4.1.2_20070115-0.29.6 (s390x)
make-3.80-202.2 (s390x)
```

The remaining rpm requirements can be installed by selecting all the “C” Libraries and extensions or by manually installing each of the following rpms:

```
glibc-devel-2.4-31.74.1 (s390x)
glibc-devel-32bit-2.4-31.74.1 (s390x)
libstdc++-devel-4.1.2_20070115-0.29.6 (s390x)
libelf-0.8.5-47.2 (s390x)
libmudflap-4.1.2_20070115-0.29.6 (s390x)
gcc-4.1.2_20070115-0.29.6 (s390x)
gcc-c++-4.1.2_20070115-0.29.6 (s390x)
libaio-devel-0.3.104-14.2 (s390x)
libaio-devel--32-bit-0.3.104-14.2 (s390x)
ksh-93s-59.11.35 (s390x)
sysstat-8.0.4-1.7.27 (s390x)
```

The following rpm command is used to verify the full extensions of the rpms. Some of the requirements require the s390 (31 bit), and some the s390x (64 bit) version of the rpm.

```
rpm -qa --queryformat="%{n}-%{v}-%{r}.%{arch}.rpm" | grep <package>
```

3.2 NTP TIME (optional step for ASM / Oracle Grid installations)

If performing an Oracle Grid / ASM install, the grid install does a system check to verify that the Cluster Time Synchronization Service is set to prevent the system time from being adjusted backward.

If you are installing Oracle Grid for Single Instance ASM, or Oracle RAC you should modify the NTP configuration to including the **"slueing:** option with the **-x** parameter.

To do this on SLES systems, edit the `/etc/sysconfig/ntp` file and add the **-x** flag, as shown in Example 3-4.

Example 3-4 Modifying the NTP configuration

```
#NTPD_OPTIONS="-g -u ntp:ntp"
NTPD_OPTIONS="-x -g -u ntp:ntp"
```

Restart the network time protocol daemon after you complete this task by issuing the following command as the root user:

```
/sbin/service ntp restart
Shutting down network time protocol daemon (NTPD)                    done
Starting network time protocol daemon (NTPD)                         done
# ps -ef | grep ntp | grep -v grep
```

```
ntp  56945 1  0 11:06 00:00:00 /usr/sbin/ntpd -p /var/run/ntp/ntpd.pid -x -g -u
ntp:ntp -i /var/lib/ntp -c /etc/ntp.conf
```

Next, we need to configure the system using the command shown in Example 3-5 so that the ntp daemon is started on reboot.

Example 3-5 Configuring the system

```
# chkconfig --level 35 ntp on
```

On SLES 11 systems, you might encounter the problem shown in Example 3-6 when Oracle runs its system pre-checks.

Example 3-6 Clock synchronization error

```
PRVE-0029 : Hardware clock synchronization check could not run on node xxxxx"
```

To resolve this problem, add the following lines to the `/etc/init.d/halt.local` file:

```
CLOCKFLAGS="$CLOCKFLAGS --systohc"
#/sbin/hwclock --systohc
```

You can now proceed to Chapter 4, “Required Kernel Parameters for Oracle (SLES and Red Hat)” on page 17.

4

Required Kernel Parameters for Oracle (SLES and Red Hat)

As the root user, ensure that the required Kernel Parameters are set. You should first make a copy of the `/etc/sysctl.conf` files if you are making any changes. Use the **-p** option to preserve the date:

```
#cp -p  /etc/sysctl.conf  /etc/sysctl.conf.old
#cat /etc/sysctl.conf
```

Example 4-1 Sample /etc/sysctl.con

```
# Oracle Kernel Specific parameters
#
#fs.file-max = 512 x oracle processes (for example 6815744 for 13312 processes)
fs.file-max = 6815744
# fs.aio-max-nr = 3145728 (use for really large concurrent I/O databases
fs.aio-max-nr = 1048576
#kernel.shmall = set to (sum of all sga's on  system)  / 4096   or  a default of
2097152
kernel.shmall = 2097152
#kernel.shmmax=MAX (1/2 the virtual RAM , largest SGA_MAX_SIZE/SGA_TARGET on
system)
kernel.shmmax =  4218210304
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
kernel.spin_retry = 2000
#vm.nr_hugepages = 4000 (Use for large SGA's > 10 GB)
```

To change these values modify the `/etc/sysctl.conf` file (as shown in Example 4-1), then run **`sysctl -p`** for the kernel parameter changes to take effect.

4.1 Verify /etc/hosts and Network Configuration

You should comment out any IPV6 (for example, number 2 in Example 4-2) entries from your /etc/hosts file. If you are not using IPv6 IP addresses. In addition, the first line of the /etc/hosts should contain localhosts, as shown in number 1 in Example 4-2.

Example 4-2 The hosts file in the lab environment

```
# cat /etc/hosts
127.0.0.1 localhost.localdomain localhost 1
# special IPv6 addresses
#localhost ipv6-localhost ipv6-loopback 2

9.82.34.164             ora1.wsclab.washington.ibm.com  ora1
# Additional Required Only for Oracle RAC install
9.82.34.165             ora2.wsclab.washington.ibm.com  ora2
10.0.0.164              ora1-priv.wsclab.washington.ibm.com ora1-priv
10.0.0.165              ora2-priv.wsclab.washington.ibm.com ora2-priv
9.82.34.167             ora1-vip.wsclab.washington.ibm.com  ora1-vip
9.82.34.168             ora2-vip.wsclab.washington.ibm.com ora2-vip
#
#  If Not using Oracle SCAN IP's for Oracle then setup 2 DNS entries as below
#
#9.82.34.166           ora-cluster.wsclab.washington.ibm.com ora-cluster crs
#9.82.34.169           ora-cluster-scan.wsclab.washington.ibm.com ora-cluster-scan
9.82.34.167             ora1-vip.wsclab.washington.ibm.com  ora1-vip
9.82.34.168             ora2-vip.wsclab.washington.ibm.com
ora2-vip
```

Oracle also requires that the host name be the fully qualified domain name, with a corresponding entry in the /etc/hosts file:

```
# hostname
ora1.wsclab.washington.ibm.com
```

4.1.1 Oracle RAC installations only

For Oracle RAC installations, additional IP addresses are required (Example 4-3) for the additional nodes in the RAC cluster (ora2), the Private Interconnect (-priv), and the variable IPs (-vip) which get plummed (created) when the Oracle Grid starts.

Tip: See Appendix B, “Oracle RAC Network Configuration” on page 121, for additional steps and requirements.

You will require one additional network interface on each server to be created, such as hsi0 - virtual hipersocket. This network interface is between the Linux Guests for Oracle's Interconnect and should be on a private non-routable interface (192.x.x.x or 10.x.x.x). Only the nodes in the RAC cluster should be able to contact the private interface.

Example 4-3 Additional IP addresses identified in the lab environment

```
10.0.0.164              ora1-priv.wsclab.washington.ibm.com ora1-priv
10.0.0.165              ora2-priv.wsclab.washington.ibm.com ora2-priv
```

You will require two additional IP addresses for the Oracle Variable IPs (VIPs) that need to be on the same subnet as the public eth0 interface (Example 4-4).

Example 4-4 Oracle VIPs

```
9.82.34.167             ora1-vip.wsclab.washington.ibm.com  ora1-vip
9.82.34.168             ora2-vip.wsclab.washington.ibm.com ora2-vip
```

Finally, you will need three SCAN IP addresses to be defined as Class A DNS entries as shown in Example 4-5 (there are three IP addresses for each DNS entry) for the new 11gR2 Oracle RAC systems. These should also be on the same subnet as the public interface.

Example 4-5 DNS SCAN entries

```
rac-scan IN A 9.82.34.166
rac-scan IN A 9.82.34.167
rac-scan IN A 9.82.34.168

# Note 3 IPs to one DNS (host file entry, but we require DNS entries for this to
work)
#
9.82.34.166rac-scan.<domain name>rac-scan
9.82.34.167rac-scan.<domain name>  rac-scan
9.82.34.168rac-scan.<domain name>  rac-scan
```

If you cannot set up DNS SCAN entries at this time, you can define two `/etc/host` entries on each of the nodes, but you will receive a warning that can be ignored during the installation (Example 4-6).

Example 4-6 non-SCAN Oracle RAC configuration

```
9.82.34.166           ora-cluster.wsclab.washington.ibm.com ora-cluster crs
9.82.34.169           ora-cluster-scan.wsclab.washington.ibm.com ora-cluster-scan
```

Important: When configuring the two Network interfaces for Oracle RAC (public and private interfaces), you MUST have ARP enabled (i.e. NOARP must NOT be configured). The `root.sh` script will fail on the first node if NOARP is configured.

Example 4-7 shows the command **`ifconfig -a`** run as though root user.

Example 4-7 ifconfig output

```
eth0      Link encap:Ethernet  HWaddr 02:00:00:00:00:05
          inet addr: 9.82.34.164  Bcast: 9.82.63.255 Mask:255.255.255.224
          inet6 addr: fe80::200:0:100:5/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1492  Metric:1
          RX packets:6503 errors:0 dropped:0 overruns:0 frame:0
          TX packets:199 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:697138 (680.7 Kb)  TX bytes:24804 (24.2 Kb)

hsi0      Link encap:Ethernet  HWaddr 02:00:00:00:00:06
          inet addr:10.0.0.164  Bcast:10.0.0.255  Mask:255.255.255.0
          inet6 addr: fe80::ff:fe00:6/64 Scope:Link
          UP BROADCAST RUNNING NOARP MULTICAST  MTU:8192  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
```

```
TX packets:5 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:0 (0.0 b)  TX bytes:390 (390.0 b)
```

4.2 Create and verify required UNIX groups and Oracle user accounts

When Installing Oracle 11gR2, Oracle recommends that two groups be created: one for the group named *dba*, and another group called *oinstall*. It is possible to install with one group (for example, just dba) as well.

If installing just database executables, typically one user account called *oracle* is created.

If installing Oracle Grid for Oracle ASM or a Real Application Cluster (RAC) system, an additional user account grid should be created to manage the grid infrastructure components.

As part of a grid infrastructure install, Oracle changes certain directories and files to have root access privileges. Having separate user IDs (one for *grid*, and one for *oracle*) makes it easier to configure the environment variables required to maintain each environment.

To verify that the Linux groups and users have been created, you can view the group and password files using the following commands:

```
cat /etc/passwd | grep oracle
cat /etc/group
```

If your users and groups have not been created, run the commands shown in Example 4-8 to create users. Having consistent group IDs (e.g. 501) and user IDs (e.g. 502) across nodes is required, particularly if you will share storage or files between systems.

Example 4-8 Commands to create users

```
/usr/sbin/groupadd -g 501 oinstall
 /usr/sbin/groupadd -g 502 dba
 /usr/sbin/useradd -u 501 -g oinstall -G dba -s /bin/ksh -m grid
 /usr/sbin/useradd -u 502 -g oinstall -G dba -s /bin/ksh -m oracle
```

Use the following commands to set the passwords for the *grid* and *oracle* users:

```
passwd grid
passwd oracle
```

Tip: If you encounter INS-06101 errors, verify the host name is correct in the `/etc/hosts` file and host name is fully qualified.

4.3 Setting file descriptors limits for the *oracle* and *grid* users

As the root user, edit or verify the `/etc/security/limits.conf` file. If you have created a separate user for the Oracle Grid user, then file descriptor limit or ulimit entries for the grid user should be created as shown in Example 4-9 on page 21.

Example 4-9 ulimit entries

```
#vi  /etc/security/limits.conf
grid            soft            nofile  1024
grid            hard            nofile  65536
grid            soft            nproc   2047
grid            hard            nproc   16384
#
oracle          soft            nofile  1024
oracle          hard            nofile  65536
oracle          soft            nproc   2047
oracle          hard            nproc   16384
#
# Use memlock for Huge Pages  support (commented out)
#*              soft              memlock   3145728
#*              hard              memlock   3145728
```

Ensure that the /etc/pam.d/login file has an entry for `pam_limits.so`. Also, you should make a backup if changes are made to `/etc/pam.d/login` and to test any changes with a superuser or login before logging off, as a typo can make future logins problematic. See Example 4-10.

Example 4-10 Making a backup and verification

```
#cp /etc/pam.d/login /etc/pam.d/login.old
cat /etc/pam.d/login
#%PAM-1.0
auth     required       pam_nologin.so
…
session  optional       pam_mail.so standard
session  required       /lib/security/pam_limits.so
session  required       pam_limits.so
session  optional       pam_mail.so standard
```

To increase the limits at *oracle* logon, as the Oracle User, verify the *oracle* user's .profile (e.g. `/home/oracle/.profile` for ksh users) and ensure the following lines have been added:

```
#vi .profile
ulimit -n 65536
ulimit -u 16384
```

Another method is to modify the main system profile by adding the following lines to the file called `/etc/profile`. Change this if the *oracle* user is using a separate user shell program such as csh or bash.

Example 4-11 Modifying the main system profile

```
If [ $USER = "oracle" ]; then
  ulimit -u 16384
  ulimit -n 65536
fi
# Optional Grid User
If [ $USER = "grid" ]; then
  ulimit -u 16384
  ulimit -n 65536
fi
```

You should then log in as the *oracle* user and run the command, **ulimit -a** to verify everything is configured correctly as shown in Example 4-12.

Example 4-12 Verifying the configuration

```
#  su - oracle
$  ulimit -a
address space limit (kbytes)   (-M)  unlimited
core file size (blocks)        (-c)  0
cpu time (seconds)             (-t)  unlimited
data size (kbytes)             (-d)  unlimited
file size (blocks)             (-f)  unlimited
locks                          (-L)  unlimited
locked address space (kbytes)  (-l)  unlimited
nice                           (-e)  0
nofile                         (-n)  65536
nproc                          (-u)  16384
pipe buffer size (bytes)       (-p)  4096
resident set size (kbytes)     (-m)  unlimited
rtprio                         (-r)  0
socket buffer size (bytes)     (-b)  4096
stack size (kbytes)            (-s)  10240
threads                        (-T)  not supported
process size (kbytes)          (-v)  unlimited
```

4.4 Pre-Create user directories for product installs

If you are installing Oracle Grid, the GRID_BASE directory must be different from the grid's product directory (where the executables are installed). In Example 4-13, `/oracle` is the logical volume for installing the Oracle executables.

Example 4-13 Creating directories for Oracle Grid

```
#  Make Directories for Oracle Grid
mkdir -p /u01/grid/base
mkdir -p /u01/grid/11.2
chown -R grid:oinstall /u01/grid
chmod -R 775 /u01/grid
#  Make Directories for Oracle User (database)
mkdir -p /u01/oracle/11.2
chown -R oracle:oinstall /u01/oracle
chmod -R 775 /u01/oracle
```

Do not set any of the standard environment variables. If standard environment variables are already set, unset the standard ORACLE_HOME and LD_LIBRARY_PATH with a comment as shown in lines 1 and 2 in Example 4-14 and Example 4-15 on page 23.

*Example 4-14 $cat /home/**grid**/.profile*

```
$ cat .profile
export ORACLE_BASE=/u01/grid/base
export GRID_BASE=/u01/grid
#export ORACLE_HOME=$GRID_BASE/11.2
#
# comment out the following lines for use later,  do not have set for runInstaller
```

```
#
#export PATH=$ORACLE_HOME/bin:$ORACLE_HOME/OPatch:$PATH:. 1
#export LD_LIBRARY_PATH=$ORACLE_HOME/lib:$LD_LIBRARY_PATH 2
umask 022
#defaults for shell startup for ulimits of oracle user
ulimit -u 16384
ulimit -n 65536
```

Example 4-15 $cat /home/oracle/.profile

```
$cat .profile

export ORACLE_BASE=/u01/oracle
#export ORACLE_HOME=$ORACLE_BASE/11.2
#
# comment out the following lines for use later,  do not have set for runInstaller
#
#export PATH=$ORACLE_HOME/bin:$ORACLE_HOME/OPatch:$PATH:. 1
#export LD_LIBRARY_PATH=$ORACLE_HOME/lib:$LD_LIBRARY_PATH 2
umask 022
#defaults for shell startup for ulimits of oracle user
ulimit -u 16384
ulimit -n 65536
```

4.5 Additional rpm for grid installs for SLES and RHEL

If performing an Oracle RAC install, you will need to install the `cvudisk-1.0.9-1` rpm package from the Oracle 11gR2 distribution media as shown in Figure 4-1.

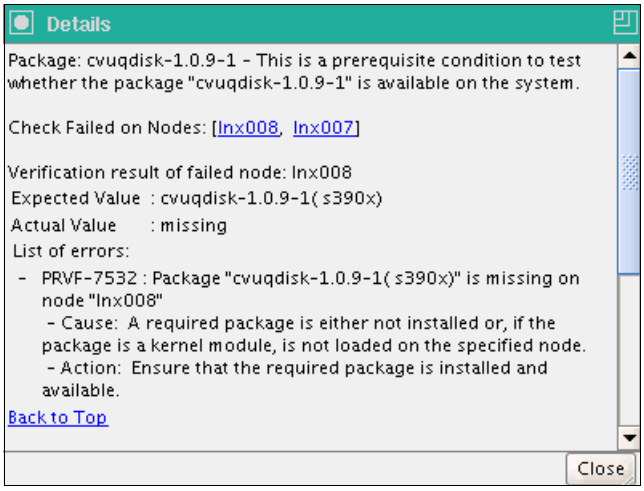

Figure 4-1 Installing additional RPMs

You can create a fix up script, or install the RPM from the software distribution on each of the nodes in the RAC cluster.

To execute the fixup scripts, perform the following steps:

1. Open a terminal window.

2. Log in as the root user.
3. Run the scripts.
4. Return to the window in Figure 4-2 and click **OK**.

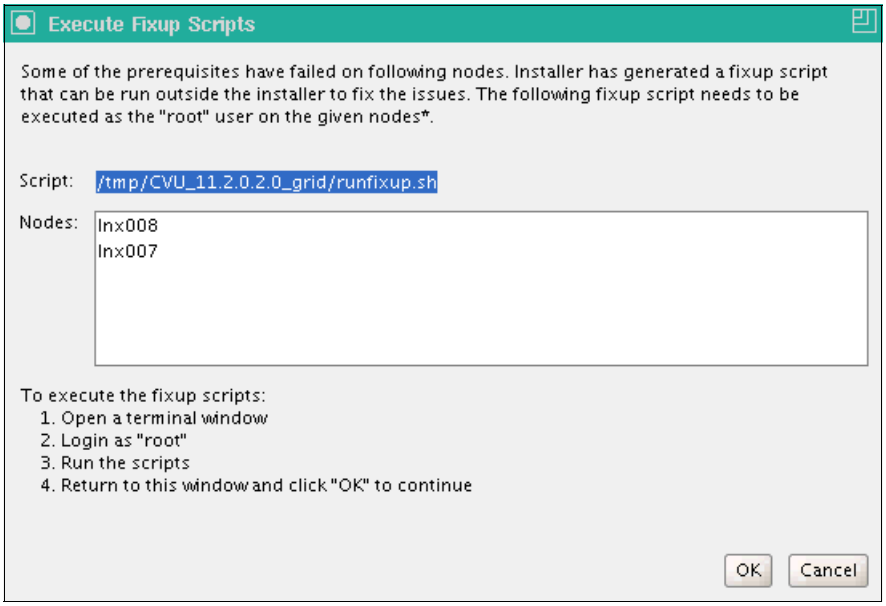

Figure 4-2 Executing fixup scripts

Example 4-16 shows running the fixup script.

Example 4-16 Running the fixup script

```
root@lnx007 CVU_11.2.0.2.0_grid]# ./runfixup.sh
/usr/bin/id
Response file being used is :./fixup.response
Enable file being used is :./fixup.enable
Log file location: ./orarun.log
Installing Package /tmp/CVU_11.2.0.2.0_grid//cvuqdisk-1.0.9-1.rpm
Preparing...                ########################################### [100%]
   1:cvuqdisk               ########################################### [100%]
```

The RPM can also be found in the `<Grid CD Home>/cvu/cv/remenv/cvuqdisk-1.0.9-1.rpm` directory, and installed ahead of time.

5

Installing Oracle grid for a single instance ASM system

In this optional step, the Oracle Grid and Database software can be installed using a graphical GUI interface, or by using the silent install option where all the graphical responses are provided in a response file. In this section, we will install with the graphical X-windows interface.

Log on as the grid user, and start a vnc X-windows session for the graphical Oracle installer with the **vncserver** command. You might be prompted for a password for vnc if this is the first time that you have started the vncserver (Example 5-1).

Example 5-1 Starting the vnc server for the first time

```
$ vncserver
You will require a password to access your desktops.
Password:
Verify:
xauth:  creating new authority file /home/grid/.Xauthority
New 'orausr07.dmz:1 (grid)' desktop is orausr07.dmz:1 1
Creating default startup script /home/grid/.vnc/xstartup
Starting applications specified in /home/grid/.vnc/xstartup
Log file is /home/grid/.vnc/orausr07.dmz:1.log
```

After the vncserver is started, take note of the port that it was started on. In this example, the connection information with the port number is `orausr07.dmz:1` (labeled number 1 in Example 5-1).

To install the Oracle Grid Infrastructure, perform the following steps:

1. Start a vnc client session by starting your desired X-windows interface program such as Exceed, Tight VNC, or RealVNC. Enter the connection information with the port number.
2. After logged onto the server, extract the staged Oracle Grid compressed file (linux.zseries64_11gR2_grid.zip) and the CD into the extracted install directory and start the Oracle installer, using the **runInstaller** command.

The window shown in Figure 5-1 on page 26 should then be displayed after the text shown in Example 5-2.

Example 5-2 runInstaller

```
   $ ./runInstaller
   Starting Oracle Universal Installer…

   Checking Temp space: must be greater than 80 MB. Actual 728 MB Passed
   Checking Temp space: must be greater than 150 MB. Actual 299 MB Passed
Preparing to launch Oracle Universal iInstaller from
/tmp/OraInstall2011-06-01_03-56-11PM. Please wait… $
```

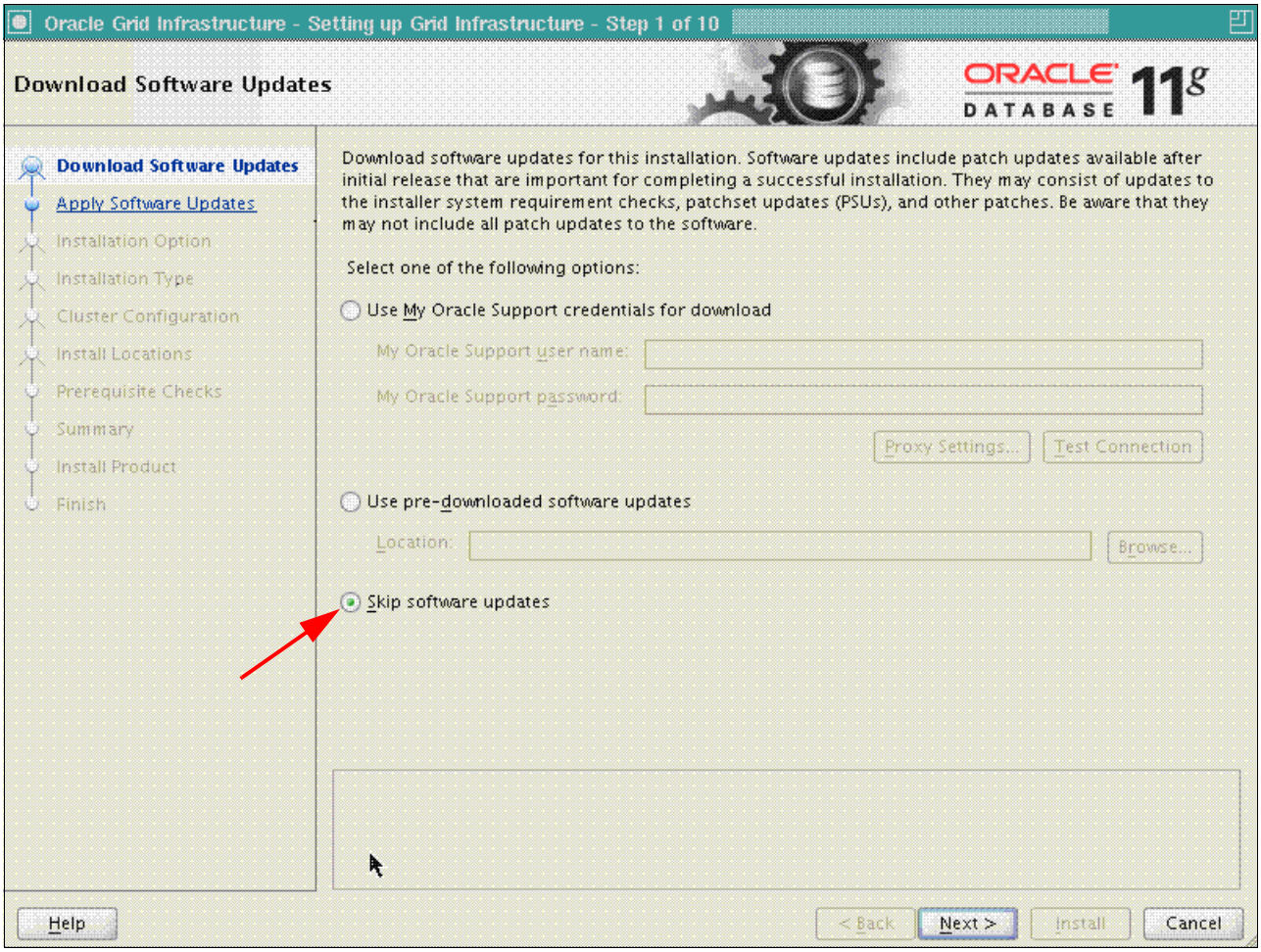

Figure 5-1 Starting the Oracle Universal Installer

3. At this point, you can decide if you want to configure patch management with the Oracle support site. To skip this, select **Skip software updates** and click **Next** to continue the install. The Grid Infrastructure window will display as shown in Figure 5-2.

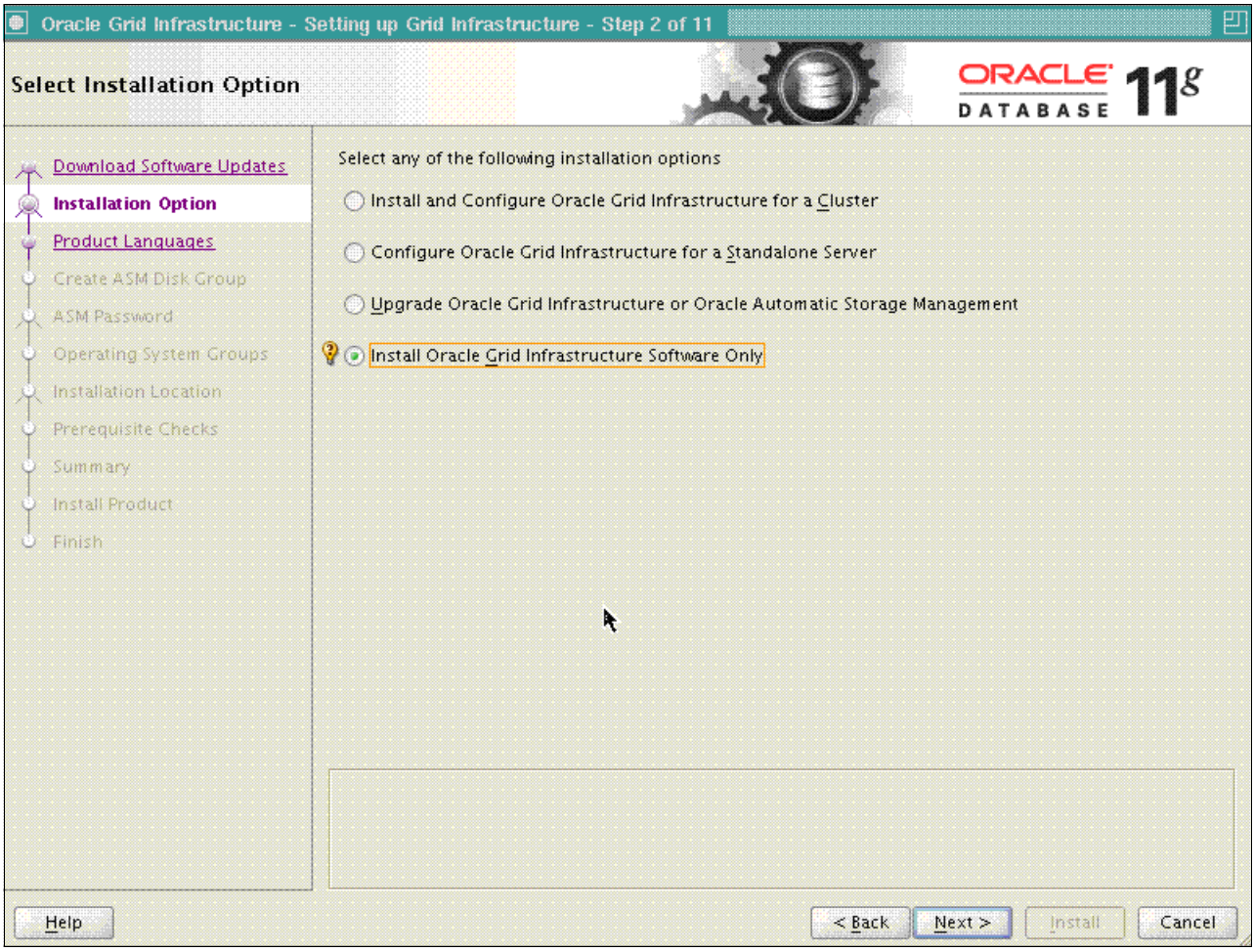

Figure 5-2 Grid Infrastructure window

4. Select **Install Oracle Grid Infrastructure Software Only** to install the software. The ASM will be configured later. Click **Next** to continue the install.

5. Select your preferred languages (Figure 5-3), and click **Next** to continue.

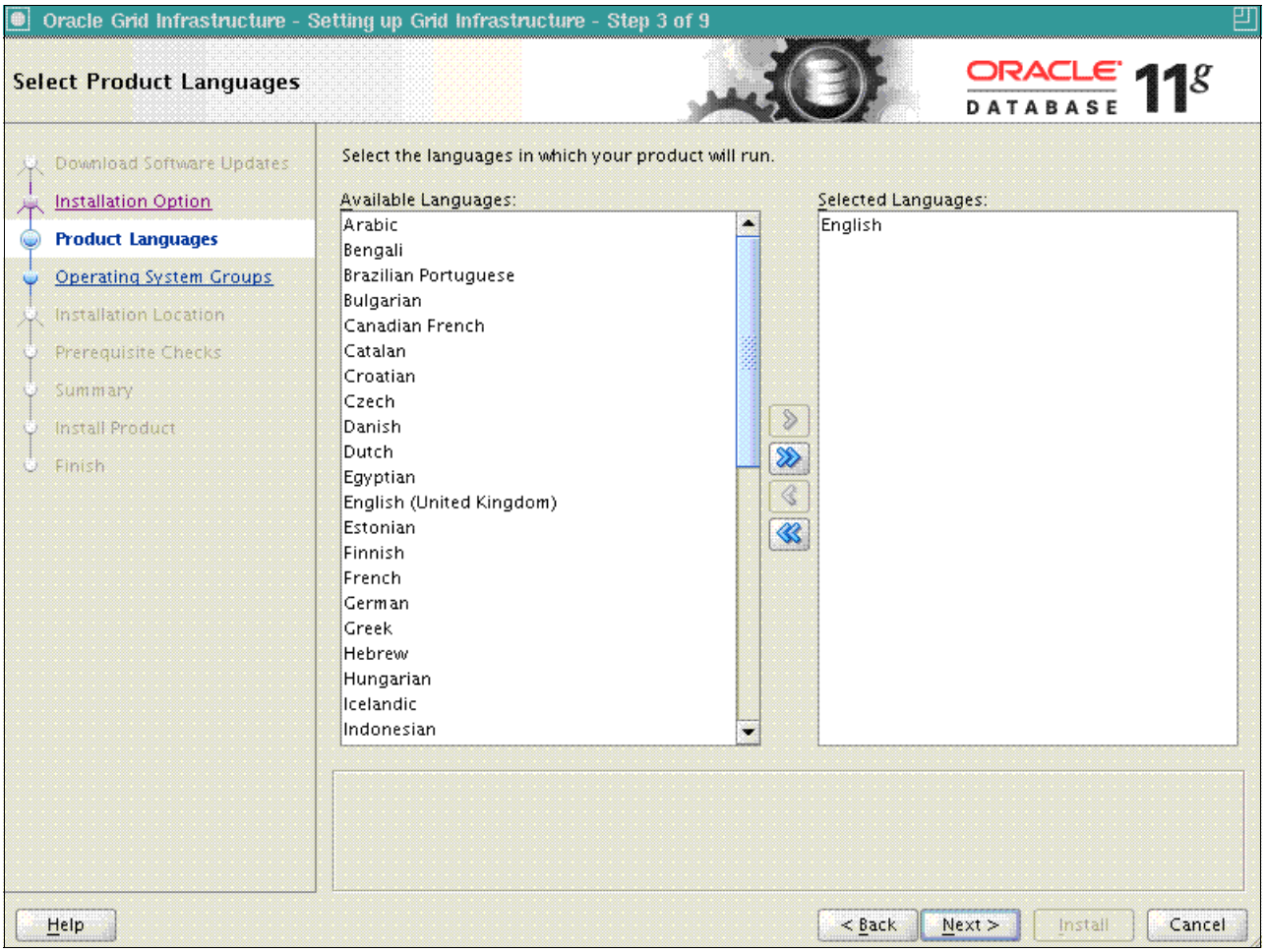

Figure 5-3 Selecting preferred languages

6. The privileged operating system groups panel will be displayed as shown in Figure 5-4. Select the appropriate Oracle ASM groups and click **Next** to continue.

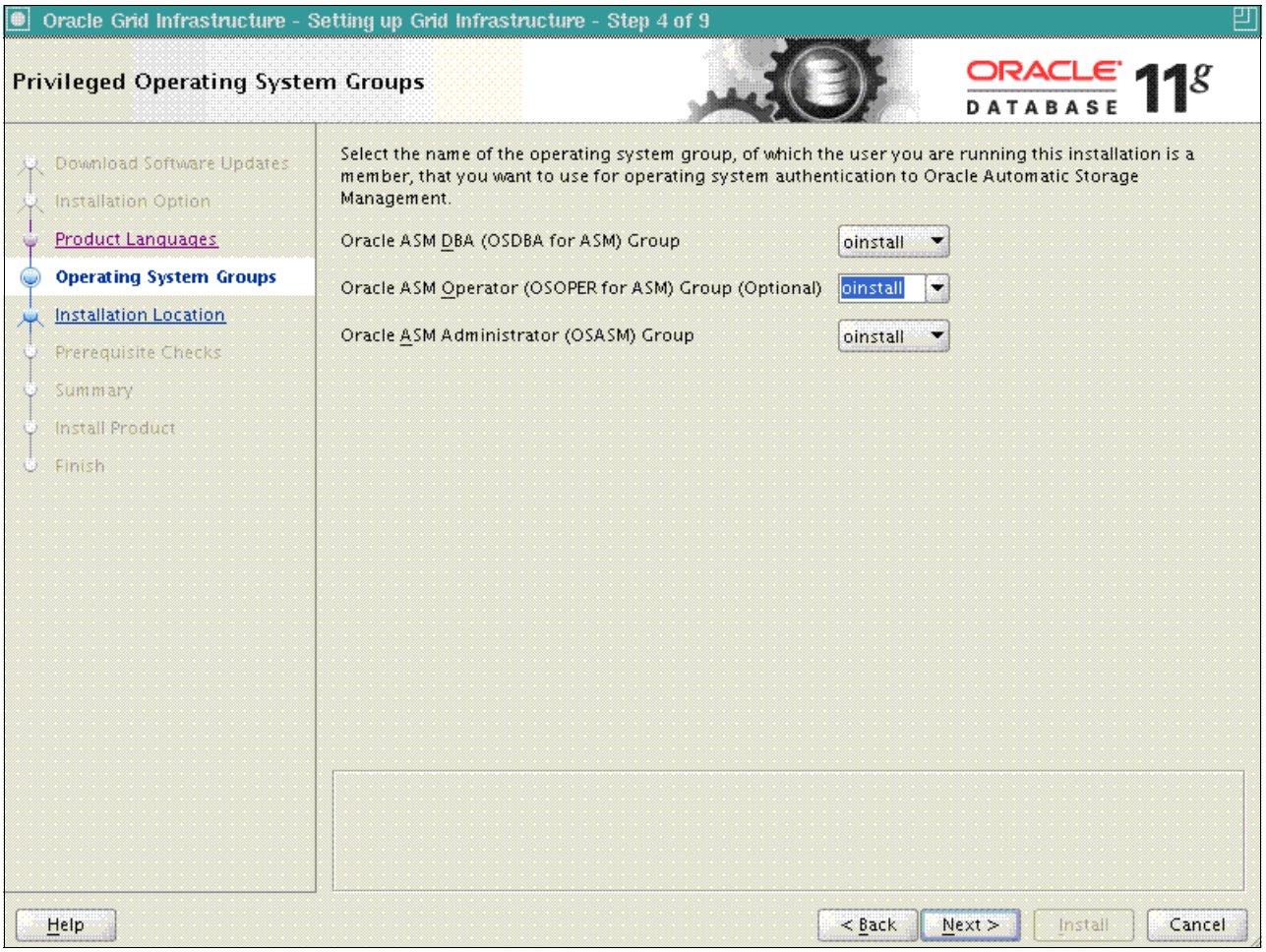

Figure 5-4 The privileged operating system groups

7. You might see the window shown in Figure 5-5 if you decide to use the same Linux operating system groups for the ASM, OSOPER and OSASM security groups. Click **Yes** to continue.

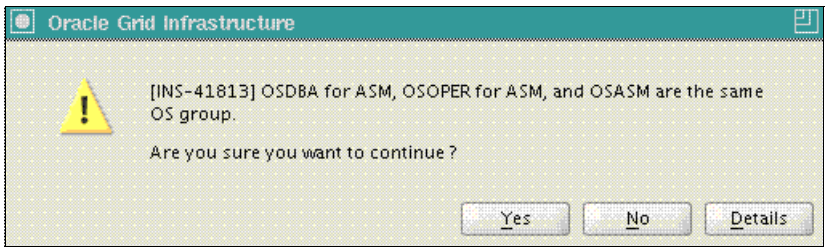

Figure 5-5 Warning message

8. The Installation Location window displays as shown in Figure 5-6.

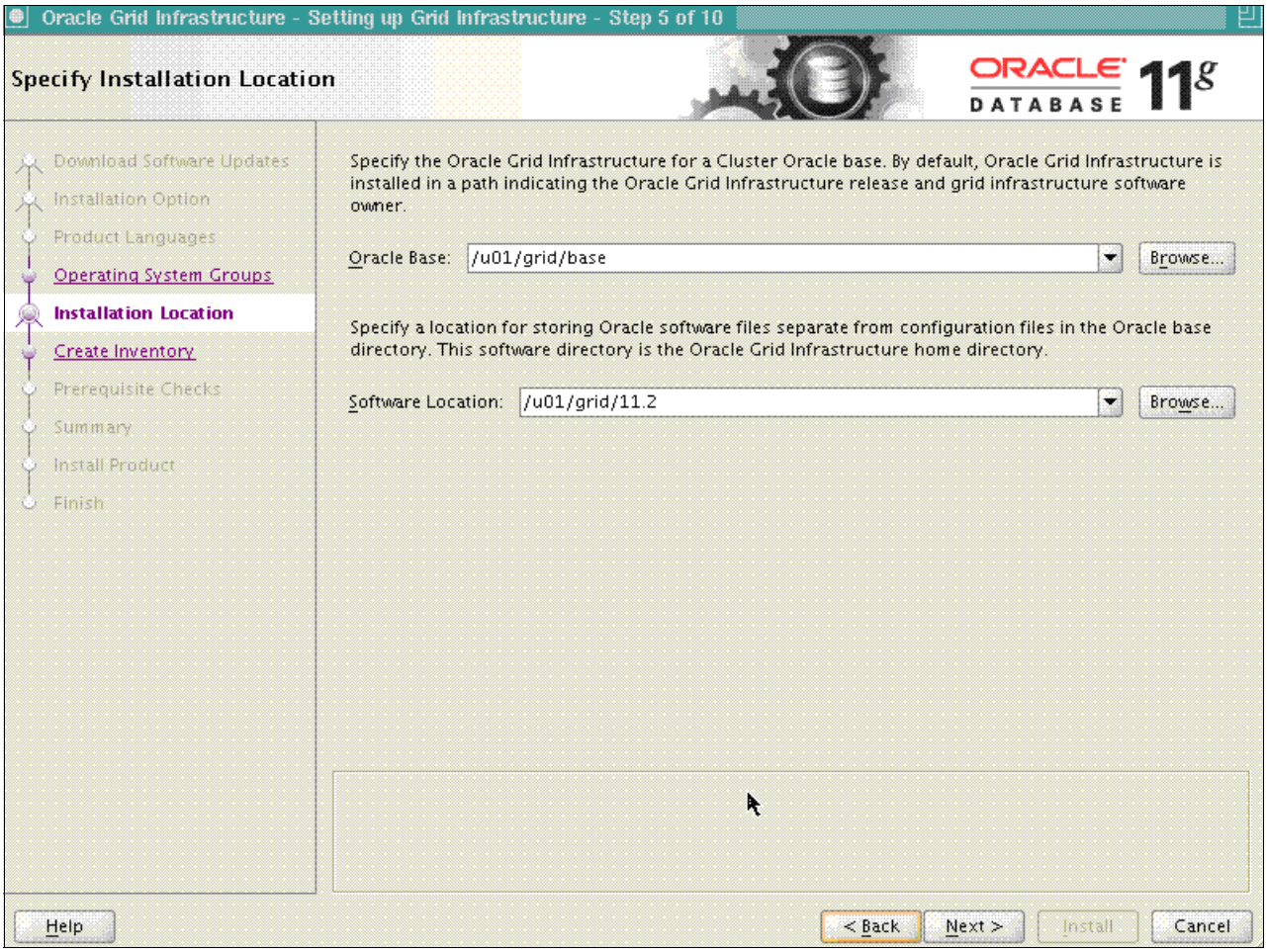

Figure 5-6 Specifying the installation location

Exception: ORACLE_HOME cannot be a subdirectory of the ORACLE_BASE. This is because the Grid Install requires certain files and directories to have root access. The Oracle Installer is particular about this, so use directory structures like the ones we have illustrated.

9. Specify the ORACLE_BASE and the ORACLE_HOME for the Grid Infrastructure software, then click **Next** to continue. The Create Inventory window displays as shown in Figure 5-7.

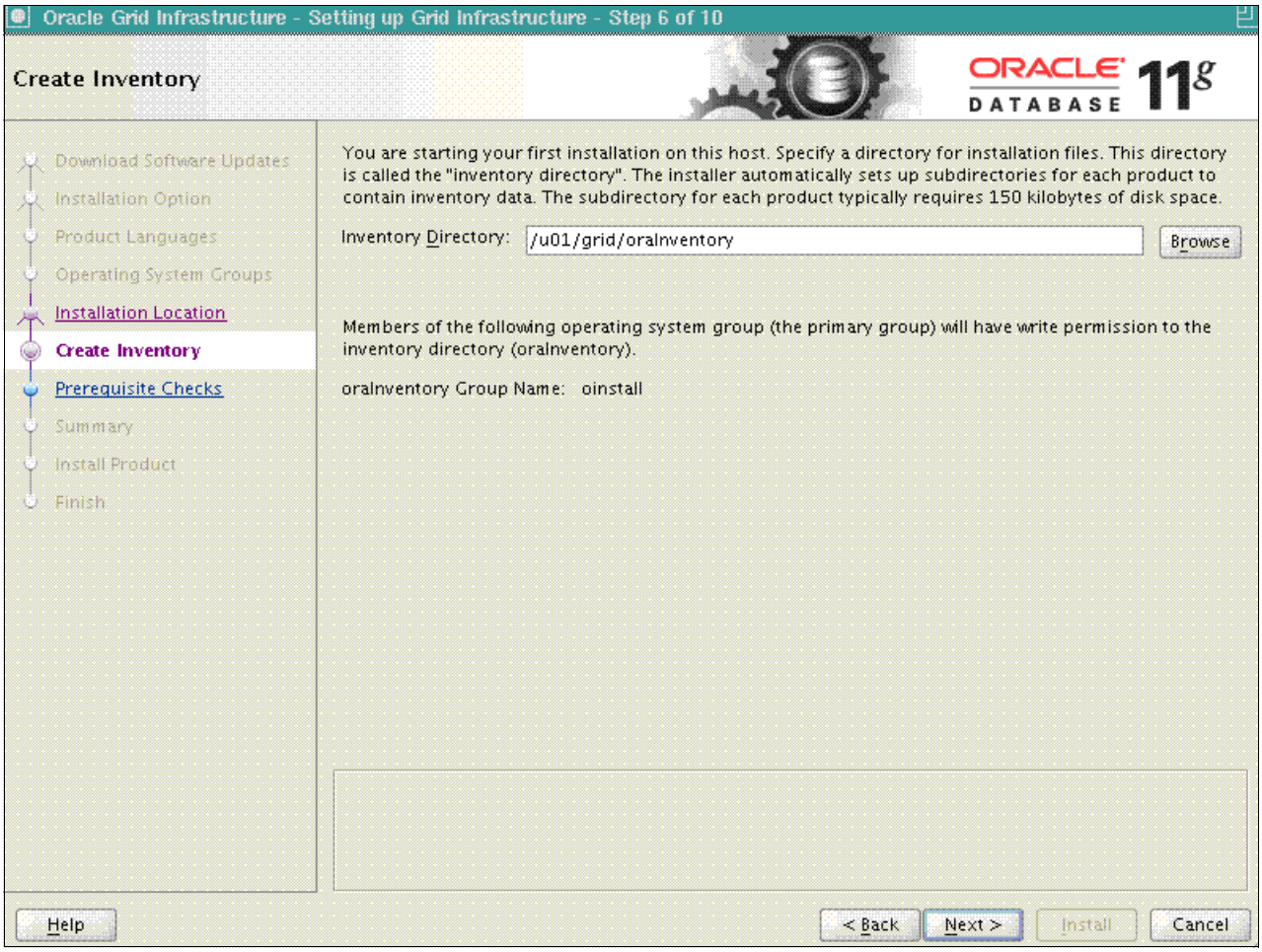

Figure 5-7 Specifying the Oracle inventory directory

10. Specify the Oracle Inventory Directory for the install and click **Next** to continue.

> **Remember:** This will be the oraInventory location for subsequent installs such as the database binaries and the Oracle Grid Agent, unless `/var/opt/oracle/oraInst.loc` is modified before running runInstaller.

The installer will do a system pre-check, and display a window similar to Figure 5-8 based on your particular system. In this example, the Oracle installer detected not enough memory for both the Physical Memory and Swap Size configuration.

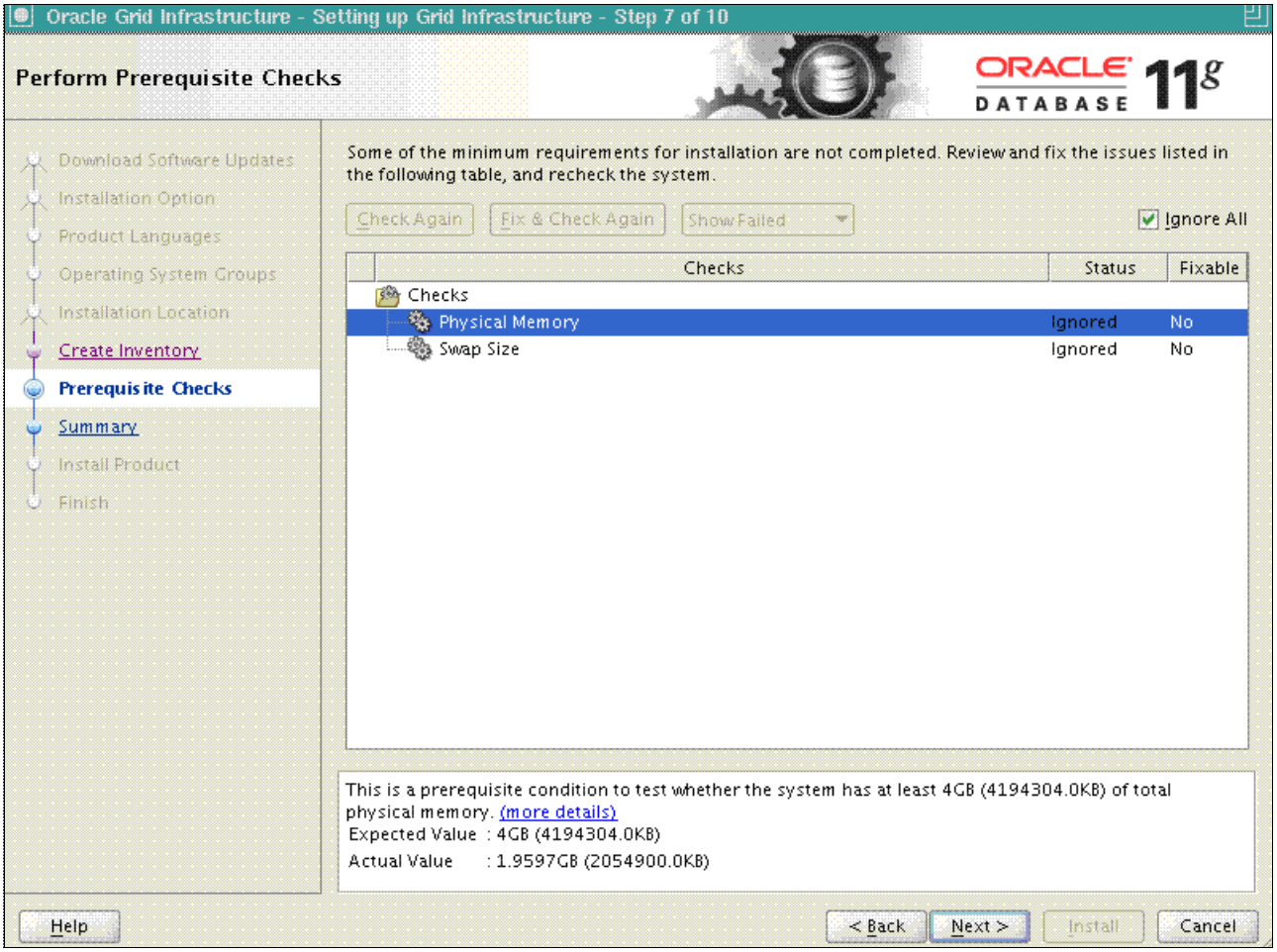

Figure 5-8 Performing prerequisite checks shows insufficient memory

This is fairly typical for a Linux on System z installation. Oracle recommends 4 GB of memory for any Linux systems. This test system has just under 2 GB of memory after the Linux kernel is loaded and, in the lab environment, Oracle 11gR2 ran fine for a test system.

For larger production environments, provide enough storage and memory based on the requirements of the database. These requirements can be determined by running either a Stats Pack or Automatic Workload Repository (AWR) report.

The other issue is with the amount of swap configured. This is not a mandatory requirement for installing Oracle 11gR2.

11. Verify that all your system requirements are met, and run any applicable fix-up scripts. Then select the **Ignore All** check box and click **Next** to continue the installation.

12. The Summary window displays as shown in Figure 5-9. Verify the install settings, then click **Next** to start the installation.

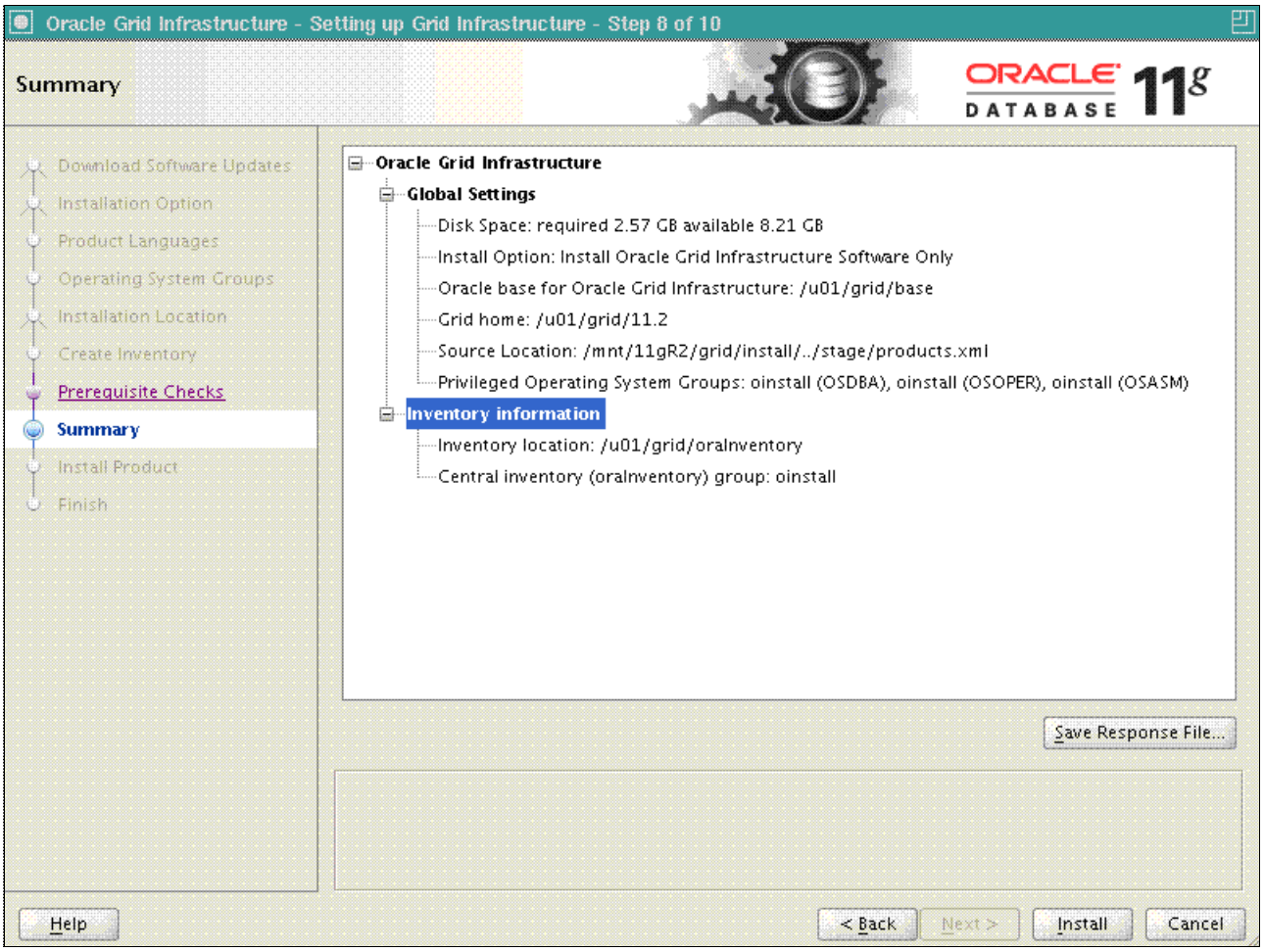

Figure 5-9 Summary panel

The installation will start as shown in Figure 5-10.

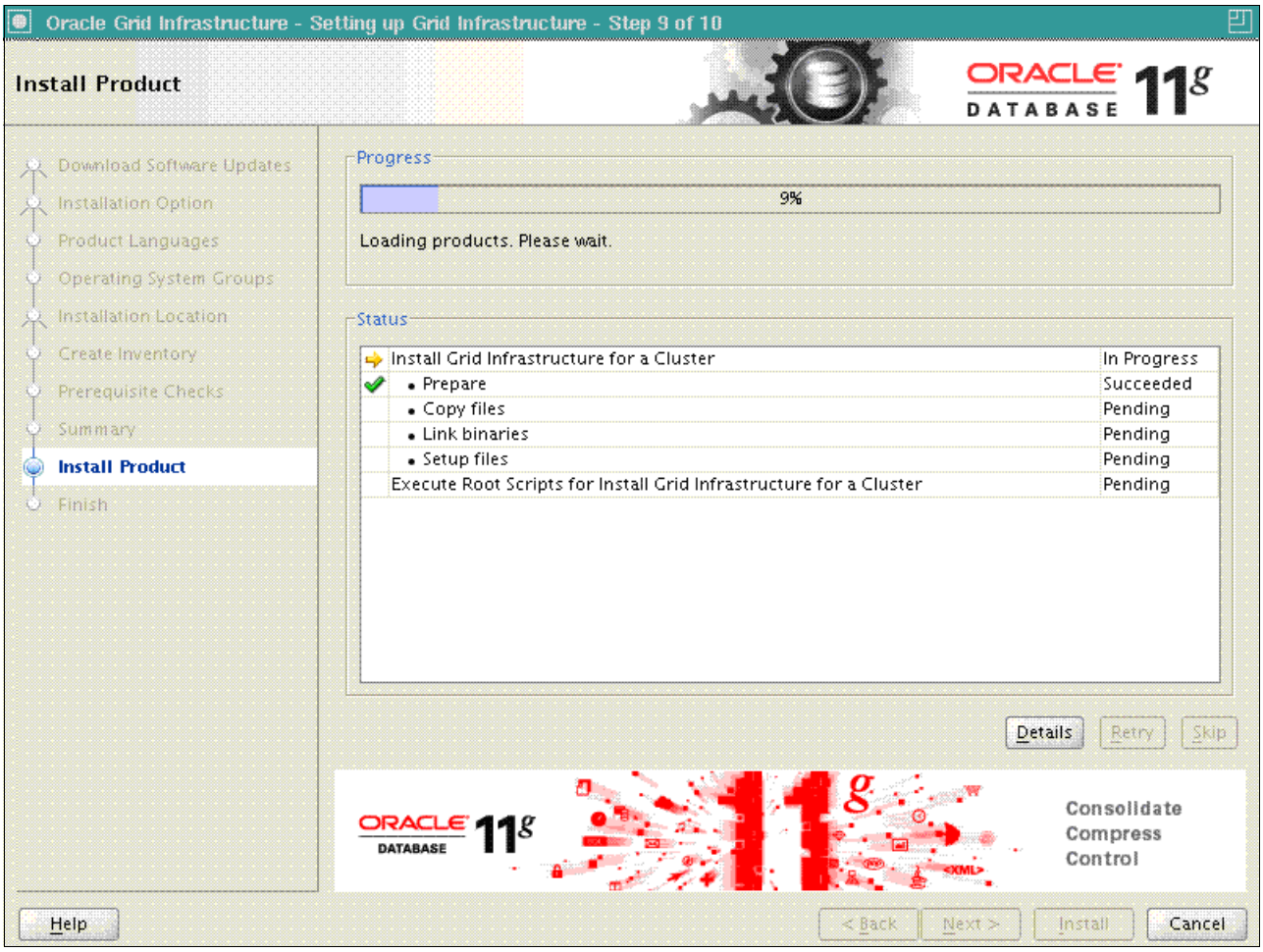

Figure 5-10 Installation in progress

The installer will then begin to install the Oracle Grid executables. If everything is successful, the Execute Configuration scripts window should be displayed. See Figure 5-11.

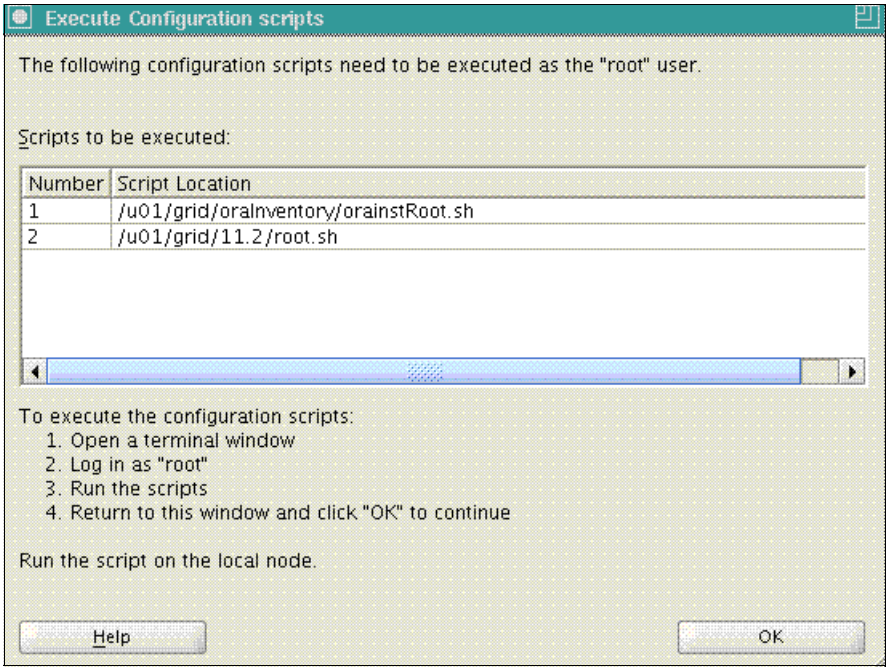

Figure 5-11 Executing configuration scripts

13. Open an SSH session window. As the root user, run the **orainstRoot.sh** script. Then run the **root.sh** installation scripts as specified by the Oracle Installer and shown in Example 5-3.

Example 5-3 Running scripts as specified by the Oracle Installer

```
[root@orausr07 oraInventory]# /u01/grid/oraInventory/orainstRoot.sh
Changing permissions of /u01/grid/oraInventory.
Adding read,write permissions for group.
Removing read,write,execute permissions for world.
Changing groupname of /u01/grid/oraInventory to oinstall.
The execution of the script is complete.


[root@orausr07 11.2]# ./root.sh
Running Oracle 11g root script...


The following environment variables are set as:
    ORACLE_OWNER= grid
    ORACLE_HOME=  /u01/grid/11.2

Enter the full pathname of the local bin directory: [/usr/local/bin]:
Copying dbhome to /usr/local/bin ...
   Copying oraenv to /usr/local/bin ...
   Copying coraenv to /usr/local/bin ...

Creating /etc/oratab file...
Entries will be added to the /etc/oratab file as needed by
```

```
Database Configuration Assistant when a database is created
Finished running generic part of root script.
Now product-specific root actions will be performed.

To configure Grid Infrastructure for a Stand-Alone Server run the following
command as the root user:
/u01/grid/11.2/perl/bin/perl  -I/u01/grid/11.2/perl/lib
-I/u01/grid/11.2/crs/install  /u01/grid/11.2/crs/install/roothas.pl

To configure Grid Infrastructure for a Cluster execute the following command:
/u01/grid/11.2/crs/config/config.sh
This command launches the Grid Infrastructure Configuration Wizard. The wizard
also supports silent operation, and the parameters can be passed through the
response file that is available in the installation media.
```

14. After you have recorded the script to run (cut and paste this into a shell script file using x with vi so that the command can easily be run), go back to the X-window Oracle Installer window and click **OK** to verify that the Oracle root configuration scripts have been successfully run on the server as shown in Figure 5-12.

Figure 5-12 Successful completion of the installation

15. Click **Close** to complete the installation of the Oracle Grid executables. The Oracle installer will then complete and exit to completion.

16. Open another SSH session window and log on as the root user. Run the ASM single instance configuration script shown in Example 5-4. In this example, we create a script called x and did a chmod u+x as root, and then ran the “x” script.

Example 5-4 ASM single instance configuration script

```
[root@orausr07 11.2]# cat x
/u01/grid/11.2/perl/bin/perl -I/u01/grid/11.2/perl/lib
-I/u01/grid/11.2/crs/install /u01/grid/11.2/crs/install/roothas.pl
[root@orausr07 11.2]# ./x
Using configuration parameter file: /u01/grid/11.2/crs/install/crsconfig_params
Creating trace directory
LOCAL ADD MODE
Creating OCR keys for user 'grid', privgrp 'oinstall'..
Operation successful.
LOCAL ONLY MODE
Successfully accumulated necessary OCR keys.
Creating OCR keys for user 'root', privgrp 'root'..
Operation successful.
CRS-4664: Node orausr07 successfully pinned.
Adding daemon to inittab

orausr07     2011/06/01 18:38:50
/u01/grid/11.2/cdata/orausr07/backup_20110601_183850.olr
Successfully configured Oracle Grid Infrastructure for a Standalone Server
```

This completes the installation of a Single Instance Oracle Grid.

6

Installing Oracle database binaries

The first step in installing the Oracle binaries is to log on to the Linux system as the *oracle* user and start a VNC server session to run the graphical Oracle Installer.

Example 6-1 Starting the VNC server and to determining support number

```
$ vncserver

New 'orausr07.dmz:1 (oracle)' desktop is orausr07.dmz:1 1

Starting applications specified in /home/oracle/.vnc/xstartup
Log file is /home/oracle/.vnc/orausr07.dmz:1.log
```

Take note of the port number that was started, as shown in Example 6-1 number 1. Start the VNC or Exceed X-windows client to log on to the Linux system as the *oracle* user.

Ensure that both the 11gR2 database CDs that were staged before are unzipped into a separate temporary staging folder so that the install can be started.

The following are the CDs required:

- `linux.zseries64_11gR2_database_1of2.zip` (1,441,455,828 bytes) (cksum - 3912266884)
- `linux.zseries64_11gR2_database_2of2.zip` (1,009,427,871 bytes) (cksum - 2311586783)

When unzipped, move these files into the database folder. To install the Oracle database binaries, perform the following steps:

1. Run the **`runInstaller`** command from the *oracle* user X-window. You will see output that shows the Oracle Universal Installer is starting (Example 6-2).

   Example 6-2 Starting the Oracle Universal Installer

   ```
   $ls
   doc install response rpm runInstaller sshsetup stage welcome.html
   $./runInstaller
   ```

```
Starting Oracle Universal Installer…

Checking Temp space: must be greater than 80 MB. Actual 728 MB Passed
Checking Temp space: must be greater than 150 MB. Actual 299 MB Passed
Preparing to launch Oracle Universal iInstaller from
/tmp/OraInstall2011-06-01_03-56-11PM. Please wait… $
```

The Configure Security Updates window displays as shown in Figure 6-1. You might need to move the window to the fore ground of your X-window by selecting the installer window.

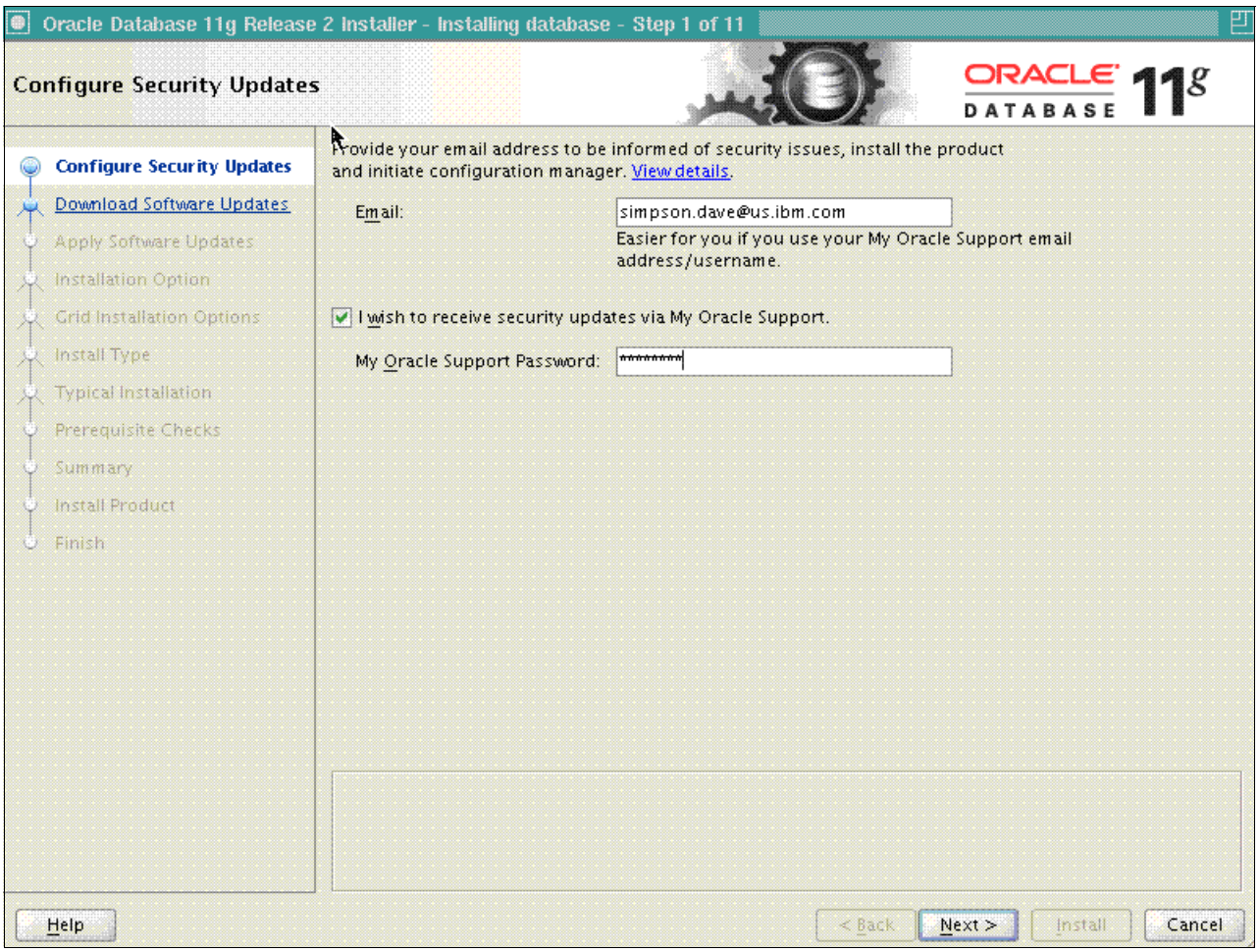

Figure 6-1 Configuring security updates

2. In this example, we have configured Oracle to connect to My Oracle Support (MOS) with our MOS username and password for automated software updates. This is optional and not required. Click **Next** to continue the install. The Download Software Updates window displays as shown in Figure 6-2.

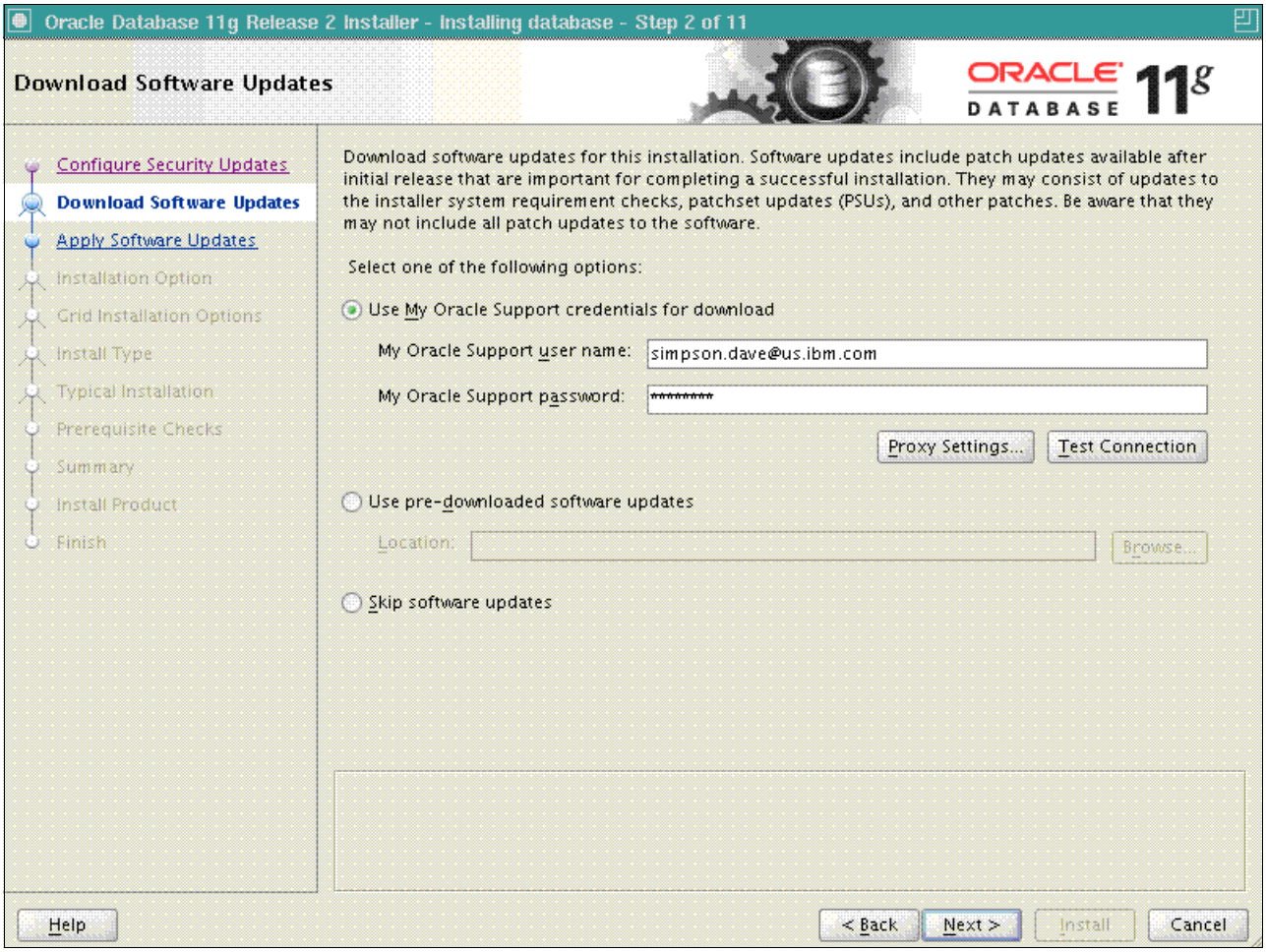

Figure 6-2 Download software updates

3. Enter your Oracle MOS credentials or select **Skip Software updates**, then click **Next** to continue.
4. If you configured the software updates option using MOS, Oracle will connect to MOS and check for any updates and if no updates are found, the dialogue box shown in Figure 6-3 will display. Click **OK**.

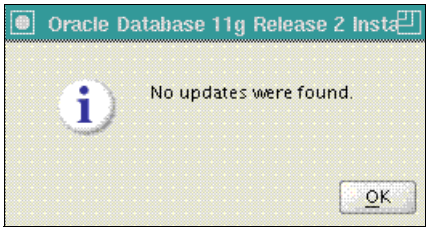

Figure 6-3 Checking for software updates

The Select Installation Option window displays as shown in Figure 6-4.

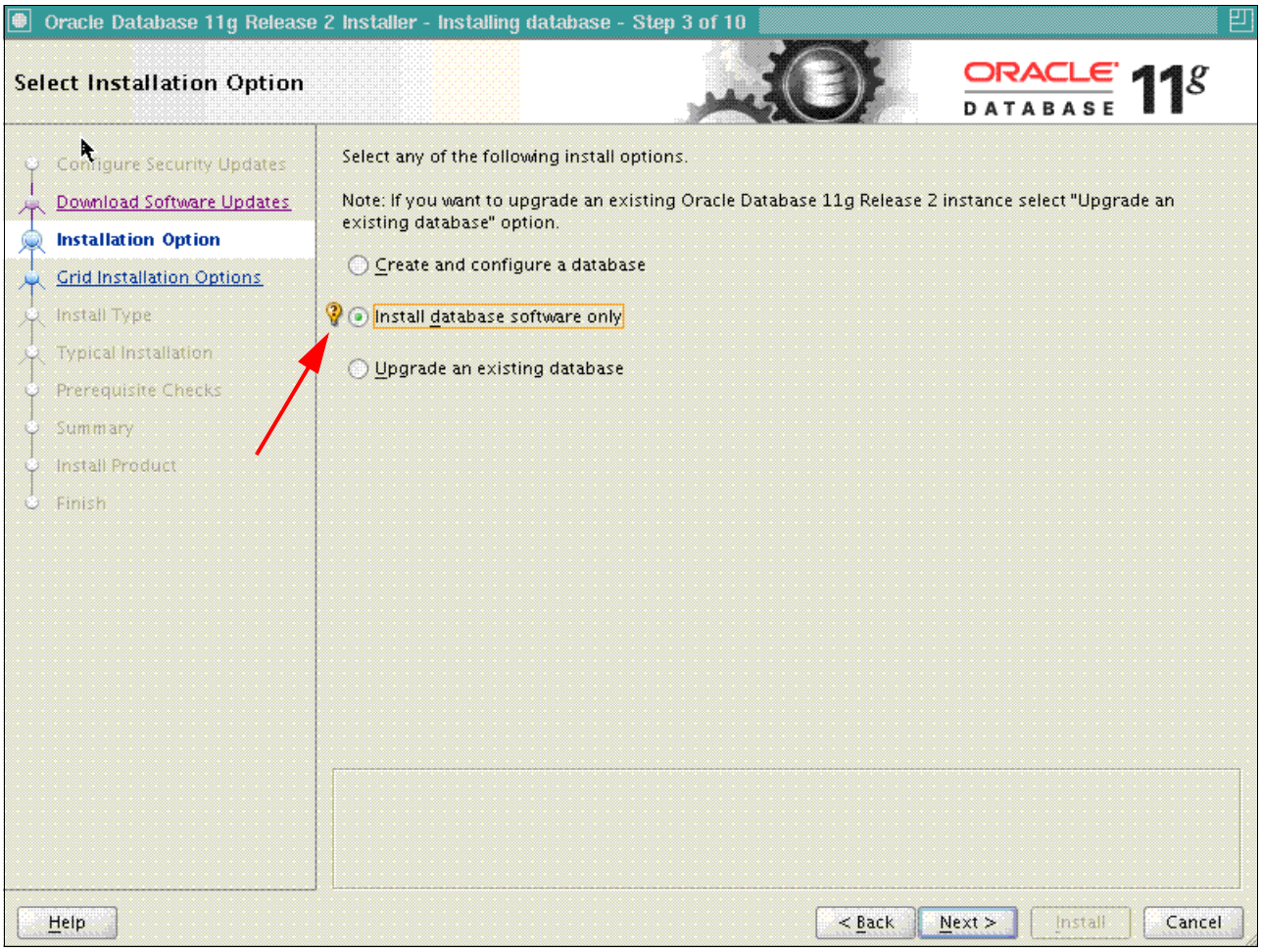

Figure 6-4 Selecting installation options

5. In this example, because this is a fresh install, select **Install database software only** and click **Next** to continue. The Grid Installation Options window displays as shown in Figure 6-5.

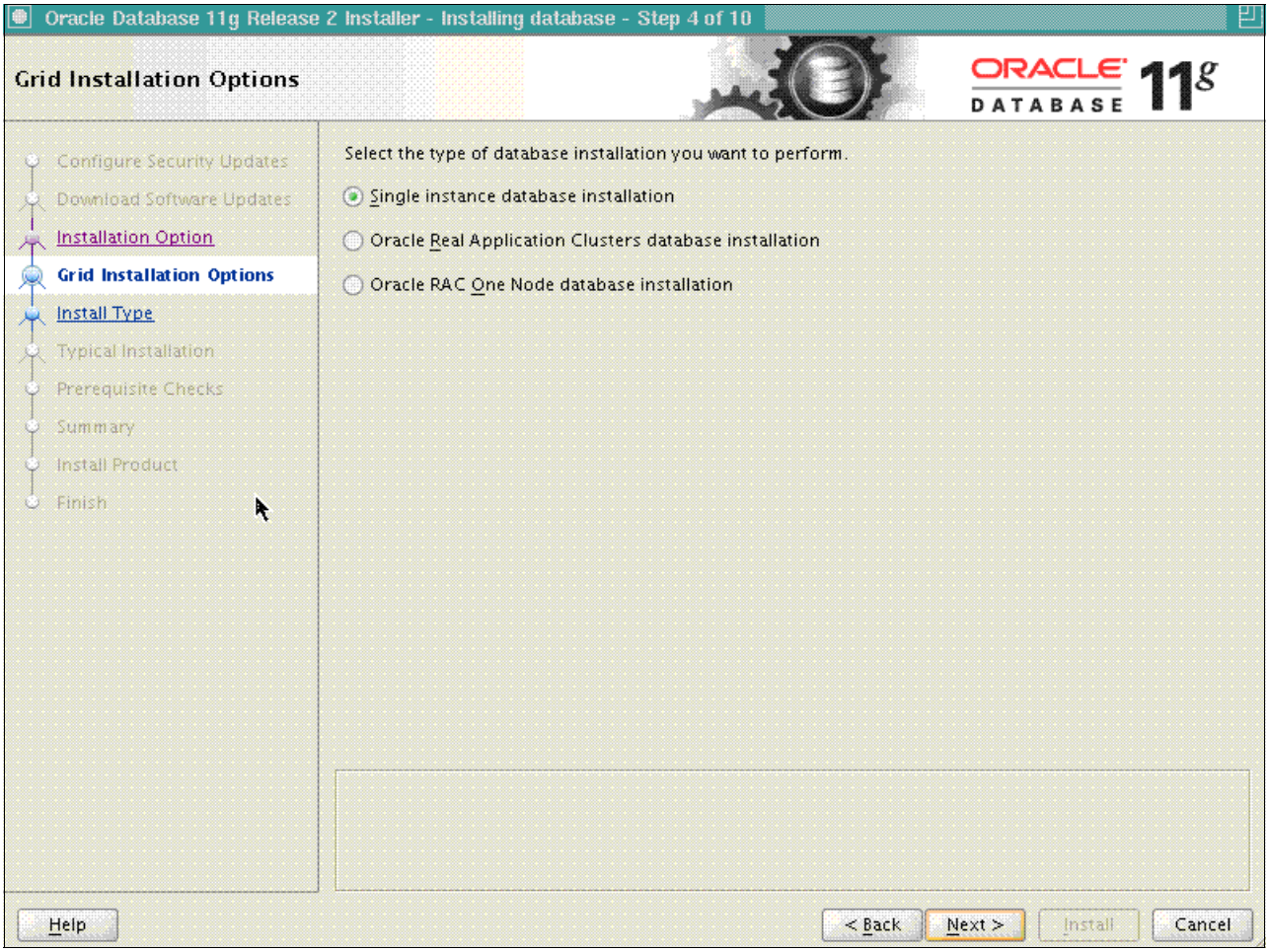

Figure 6-5 the Grid Installation Options window

6. Select **Single instance database installation**, then select **Next** to continue. The Select Product Languages window displays as shown in Figure 6-6.

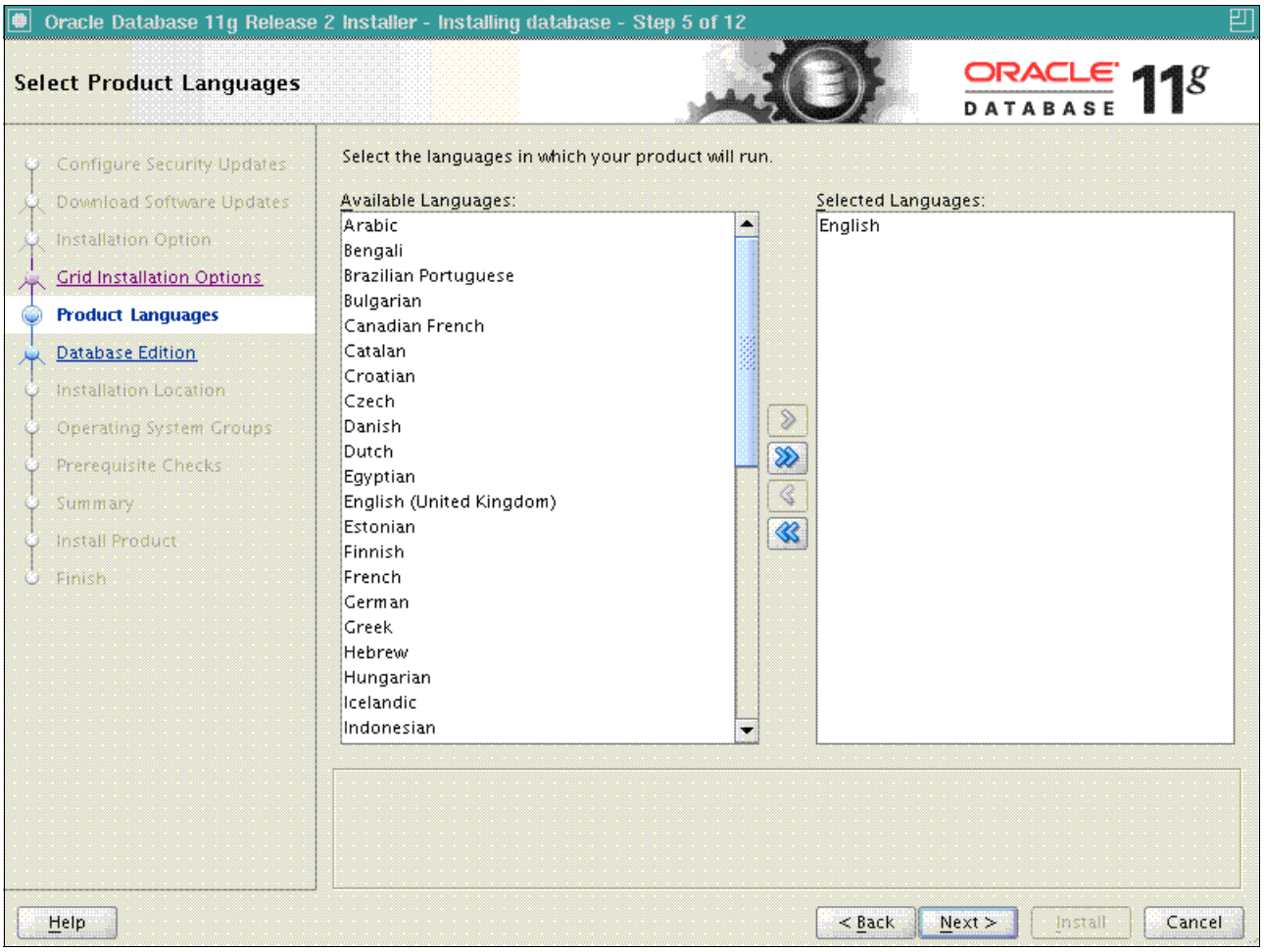

Figure 6-6 Select required product languages

7. Select your required product languages, and then click **Next** to continue.

8. The Database Edition install window is displayed next (see Figure 6-7). Select the install option appropriate for your Oracle license environment. In most cases, select **Enterprise Edition** to take advantage of the full suite of 11gR2 functionality. Then click **Next** to continue the installation.

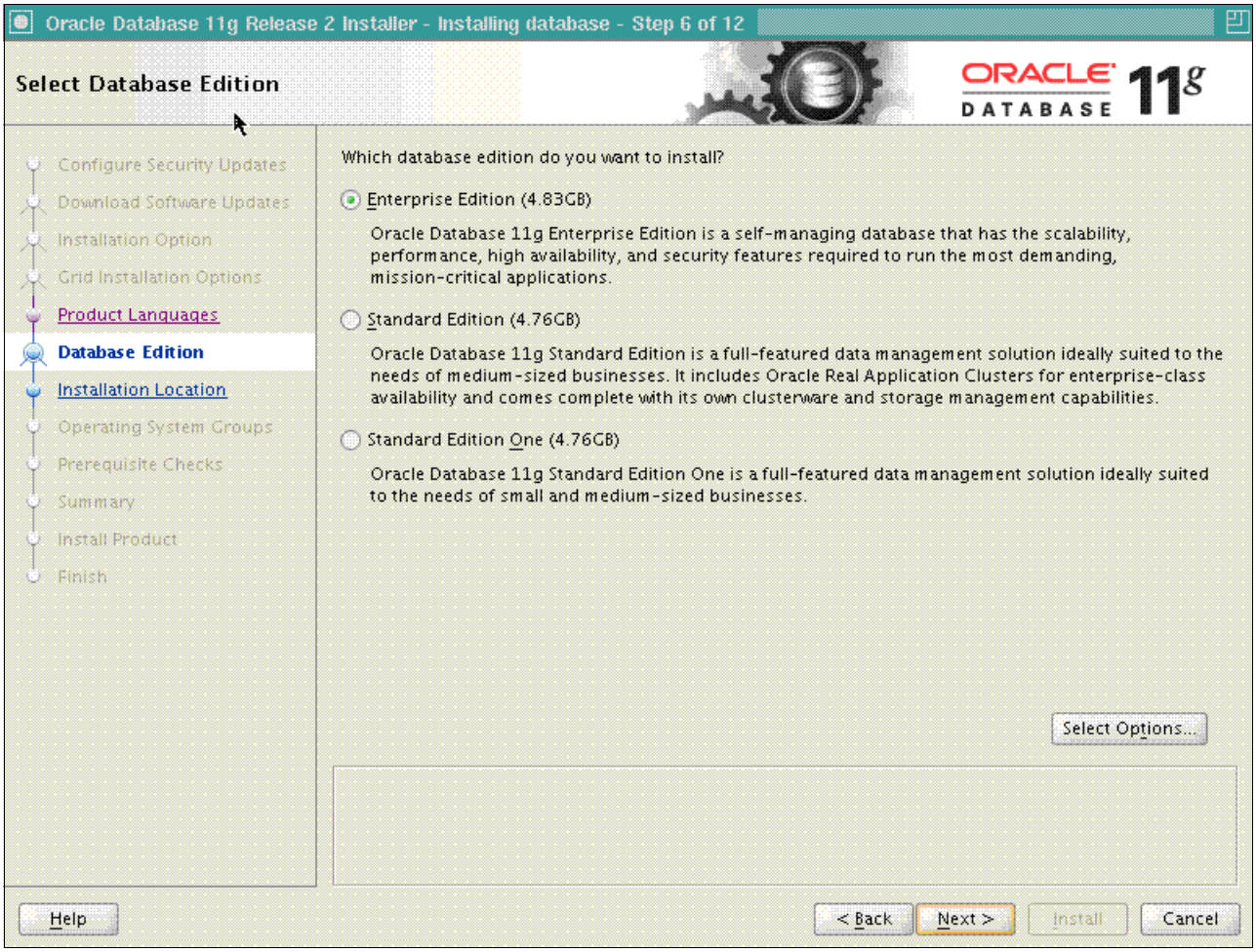

Figure 6-7 Selecting the database edition

The Specify Installation Location window displays as shown in Figure 6-8.

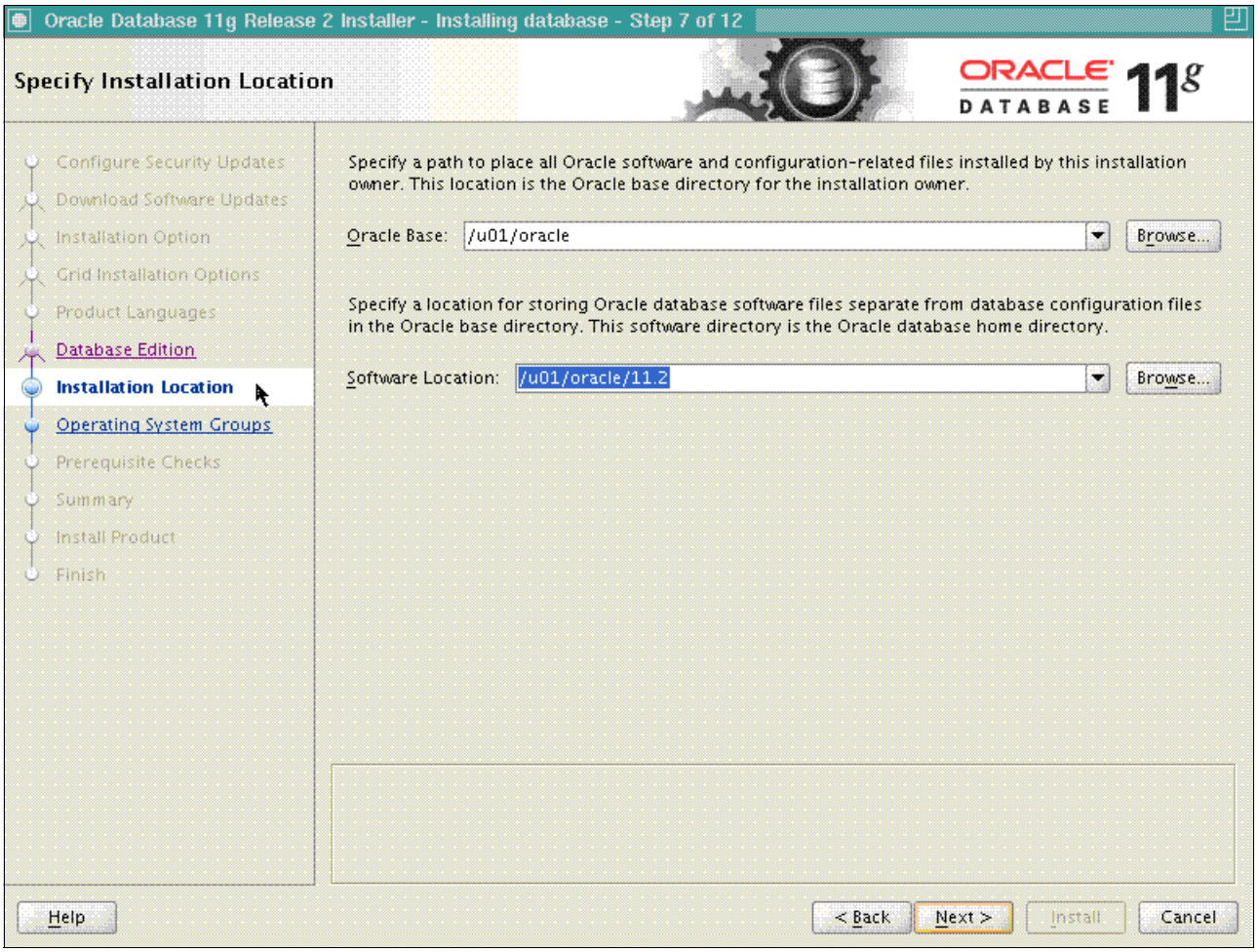

Figure 6-8 Specifying installation locations

9. Specify your ORACLE_BASE and ORACLE_HOME for your Oracle instance, then click **Next** to continue. The Privileged Operating System Groups window displays as shown in Figure 6-9.

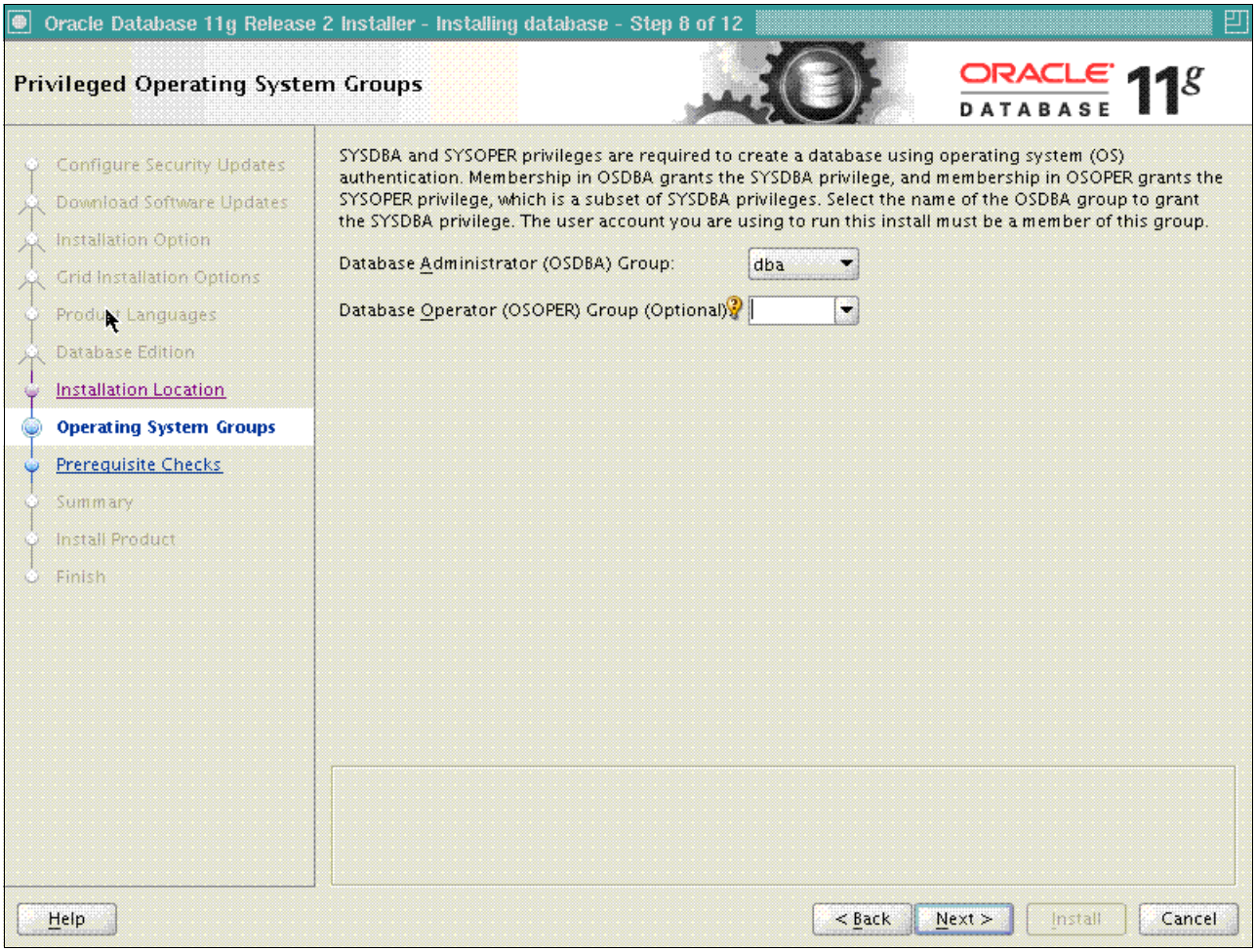

Figure 6-9 Specifying the name of the operating system groups

10. Select the operating system group for the Oracle Database user (oracle) and optionally the OSOPER group. Then click **Next** to continue.

The installer with then do series of system checks to verify that all the System Pre-checks have been verified (Figure 6-10).

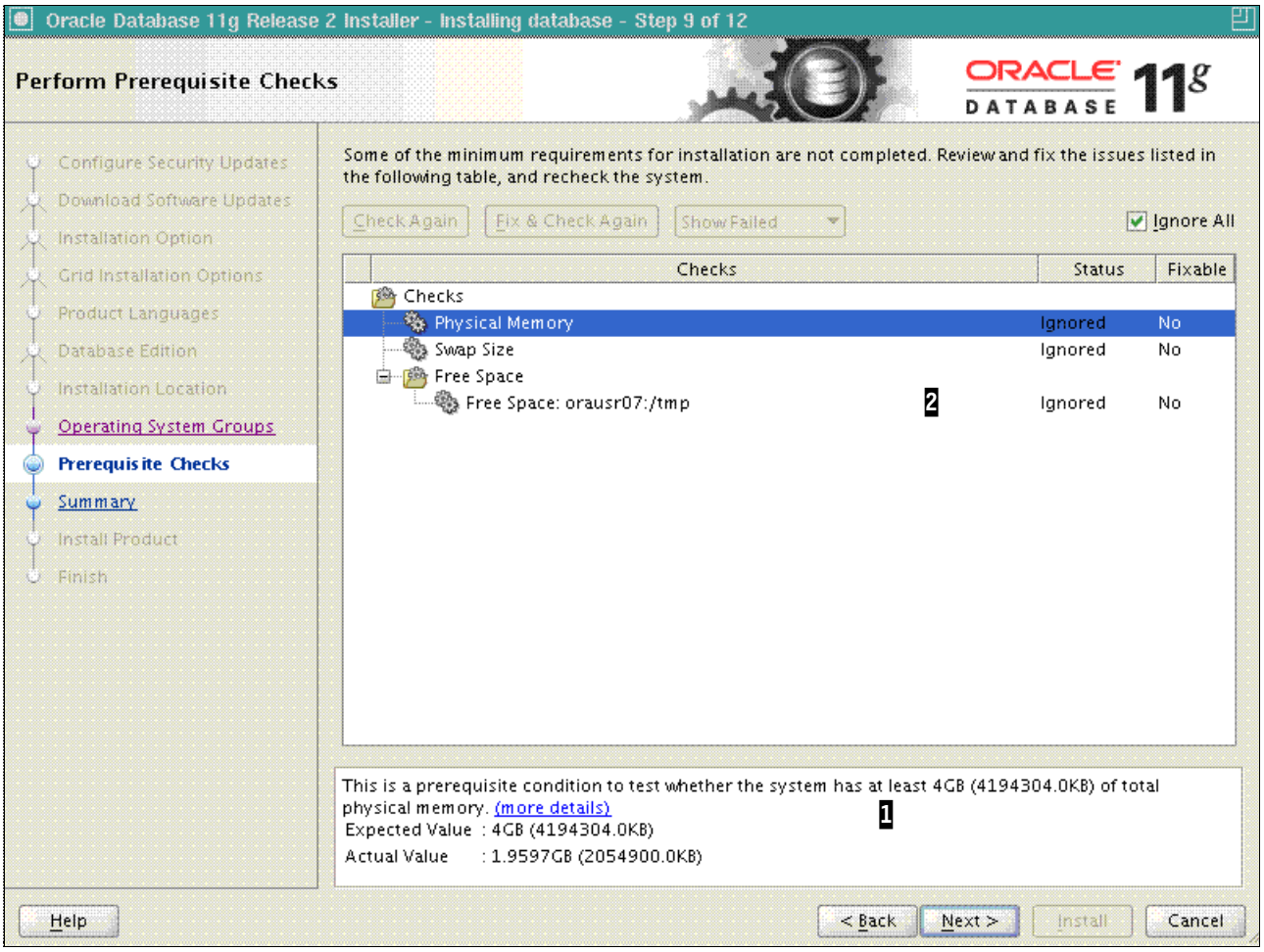

Figure 6-10 Performing prerequisite checks

Similar to the Oracle Grid Install (Figure 5-8 on page 32), you might encounter system check warnings.

Oracle recommends 4 GB for Linux environments and it is possible to install with less virtual memory. The swap warning labeled 1 in Figure 6-10 can be safely ignored provided it is carefully monitored.

In this example we are also alerted to disk space under `/tmp` as shown in a label 2 of Figure 6-10. Oracle checks for about 1 GB of temp space, and this can be redirected by setting the TMP and TEMP environment variables to a file system with sufficient space. If you have at least 400 Mb you can typically ignore this check as well.

11. After all the prerequisite checks have been verified, select the **Ignore all** check box (if required) and then **Next** to continue the install. The Summary window displays (Figure 6-11).

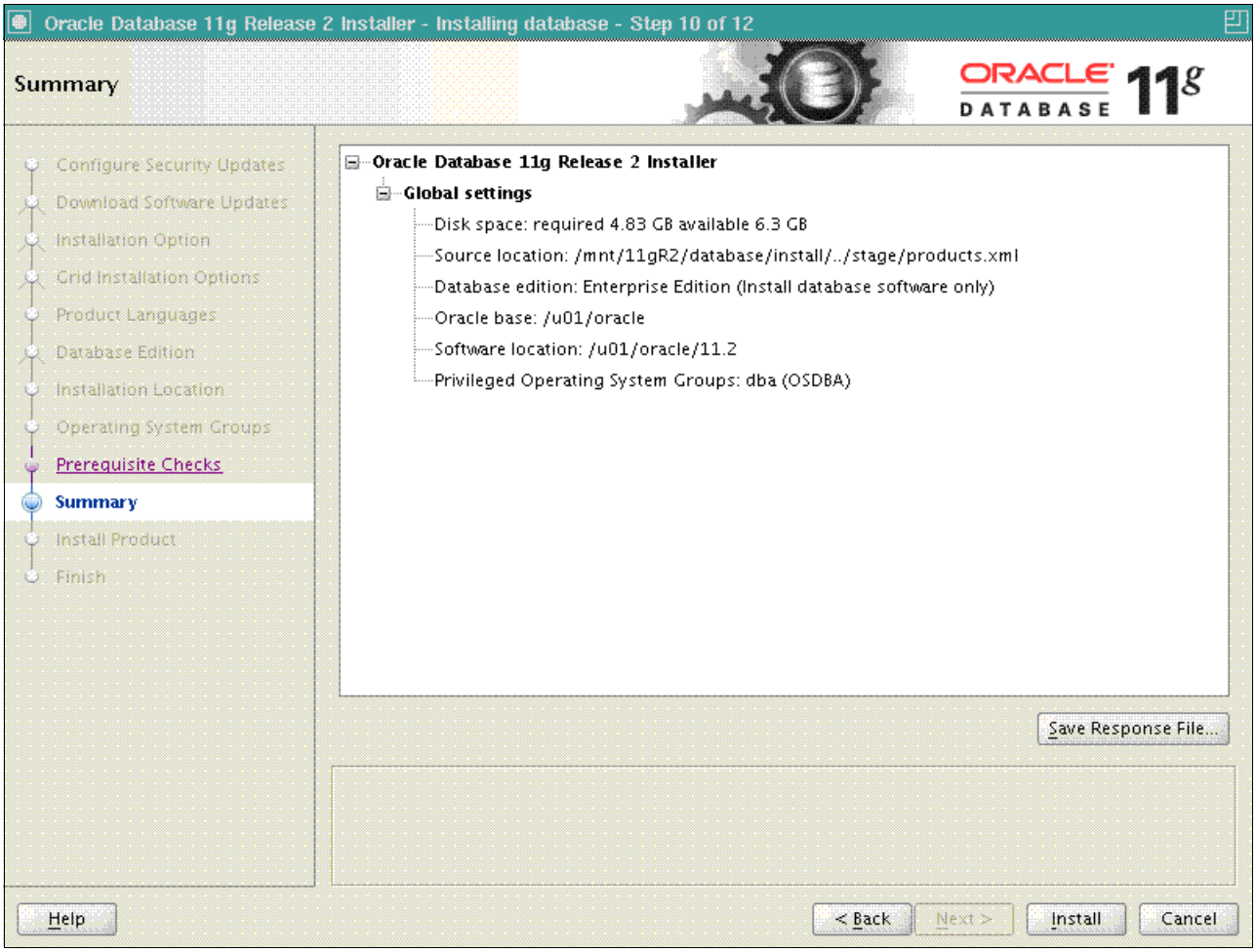

Figure 6-11 Summary window

12. Verify the installation settings and then click **Next** to start the installation (Figure 6-12).

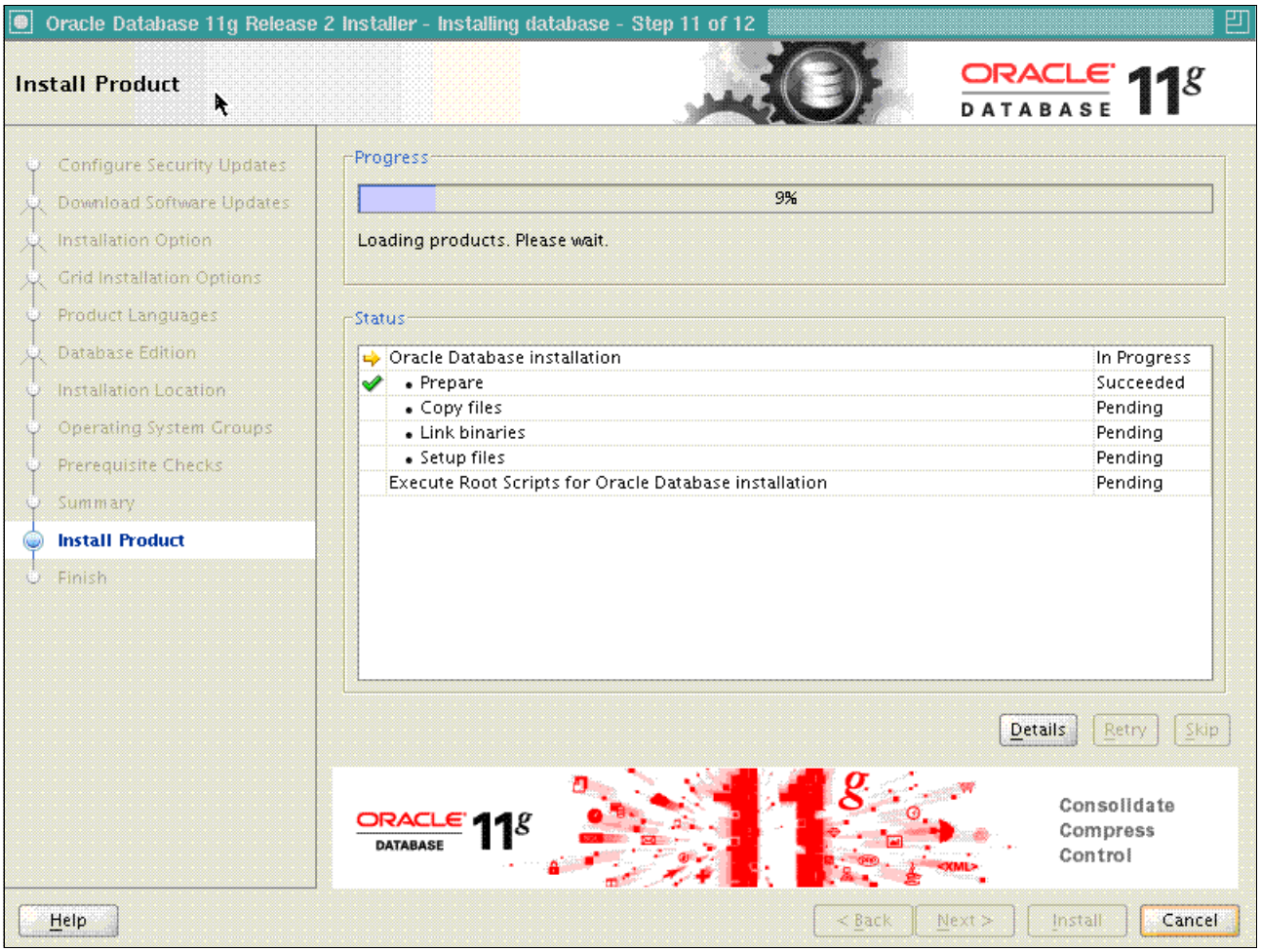

Figure 6-12 Installing the product

The installer will then start copying the executables. If successful, the Execute Configuration scripts window will be displayed (Figure 6-13).

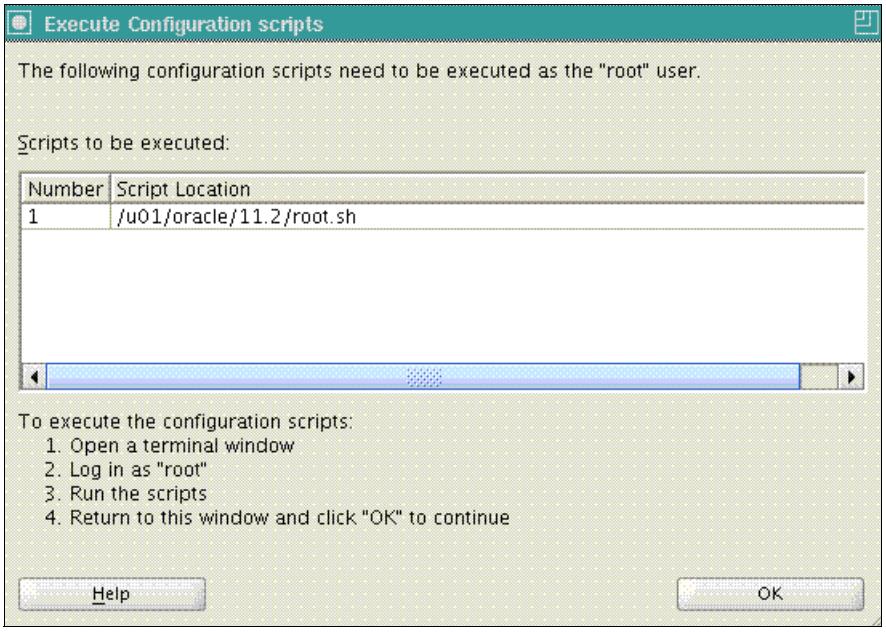

Figure 6-13 Execute configuration scripts reminder

13. Open another SSH window, log in as the root user, and execute the **root.sh** script as shown in Example 6-3.

Example 6-3 Executing root.sh script

```
[root@orausr07 11.2]# /u01/oracle/11.2/root.sh
Running Oracle 11g root script...

The following environment variables are set as:
    ORACLE_OWNER= oracle
    ORACLE_HOME=  /u01/oracle/11.2

Enter the full pathname of the local bin directory: [/usr/local/bin]:
The contents of "dbhome" have not changed. No need to overwrite.
The contents of "oraenv" have not changed. No need to overwrite.
The contents of "coraenv" have not changed. No need to overwrite.

Entries will be added to the /etc/oratab file as needed by
Database Configuration Assistant when a database is created
Finished running generic part of root script.
Now product-specific root actions will be performed.
Finished product-specific root actions.
```

14. Go back to the *oracle* user X-window session, and complete the install by clicking **OK**. The final Install Confirmation window should then be displayed (Figure 6-14).

Figure 6-14 Successful completion of the installation

15. Click **Close** to complete the Oracle executables installation. The installer will then complete and exit.

7

Creating Oracle ASM disk groups

To create an Oracle database using ASM storage, the ASM disk groups must be configured and created. The **asmca** utility can be used to perform this task.

1. Log on with a ssh window as the Oracle Grid user. If configuring a single user install, re-configure your environment variables to ensure that the grid environment variables are in place.
2. After the grid environment is configured, start a X-windows session. Connect to the X-windows session and start the **asmca** utility from the `$GRID_HOME/bin` directory.

   The ASM configuration window will then be displayed (Figure 7-1 on page 54).

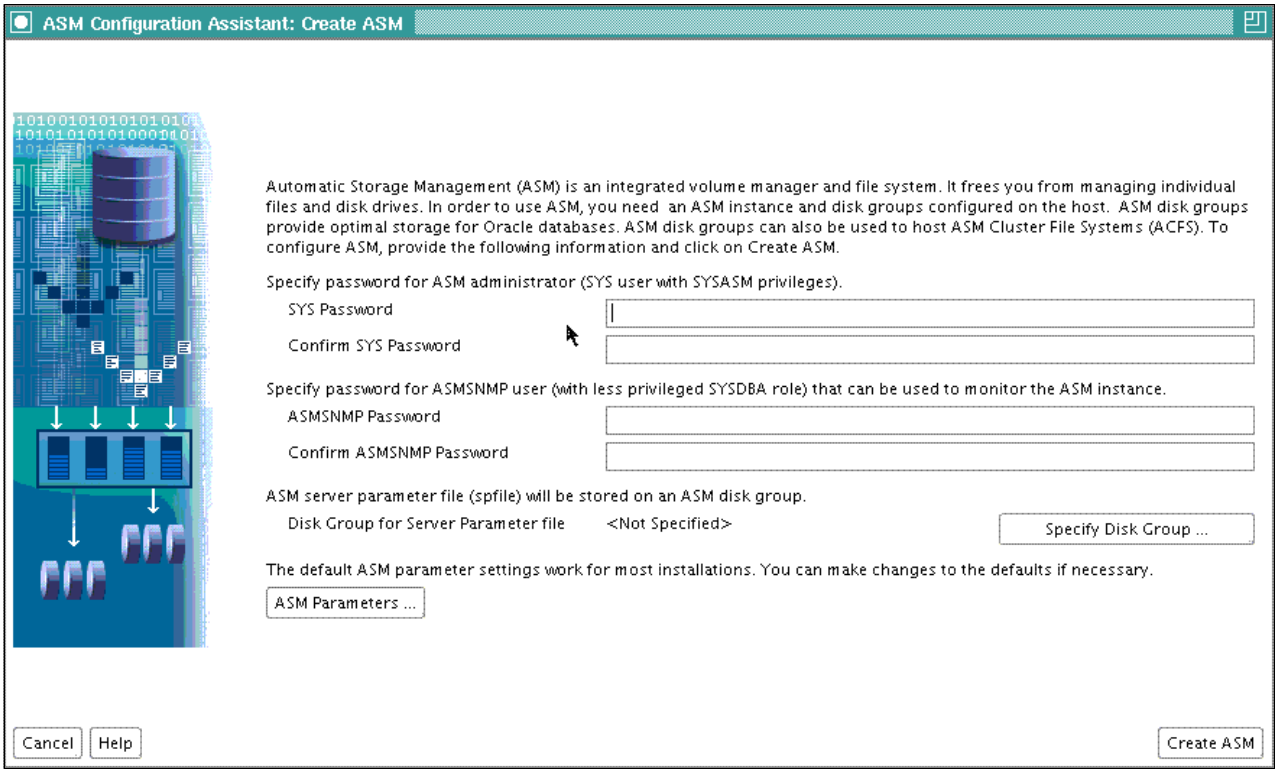

Figure 7-1 Create ASM

3. If this is the first time running **asmca** on this system, you will be required to enter the *SYS* password and the *ASMSMP* monitoring password. Click the **Specify Disk Group** button to create any ASM disk groups for the system.
4. Follow the ASM disk configuration steps detailed in Appendix A, “Configuring Linux storage using DASD or FCP/SCSI” on page 117.
5. Specify the correct ASM Disk string using the **Change Disk Discovery Path** button. In this example we are using ECKD DASD Disk. Enter `/dev/ASM*` (Figure 7-2).

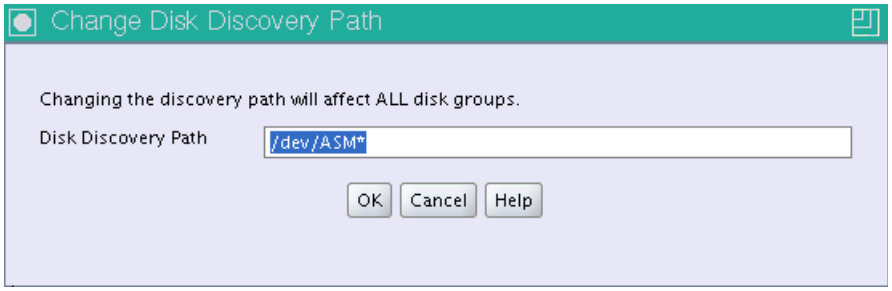

Figure 7-2 Changing the disk discovery path

6. Next, select the ASM disk that you will be using (Figure 7-3).

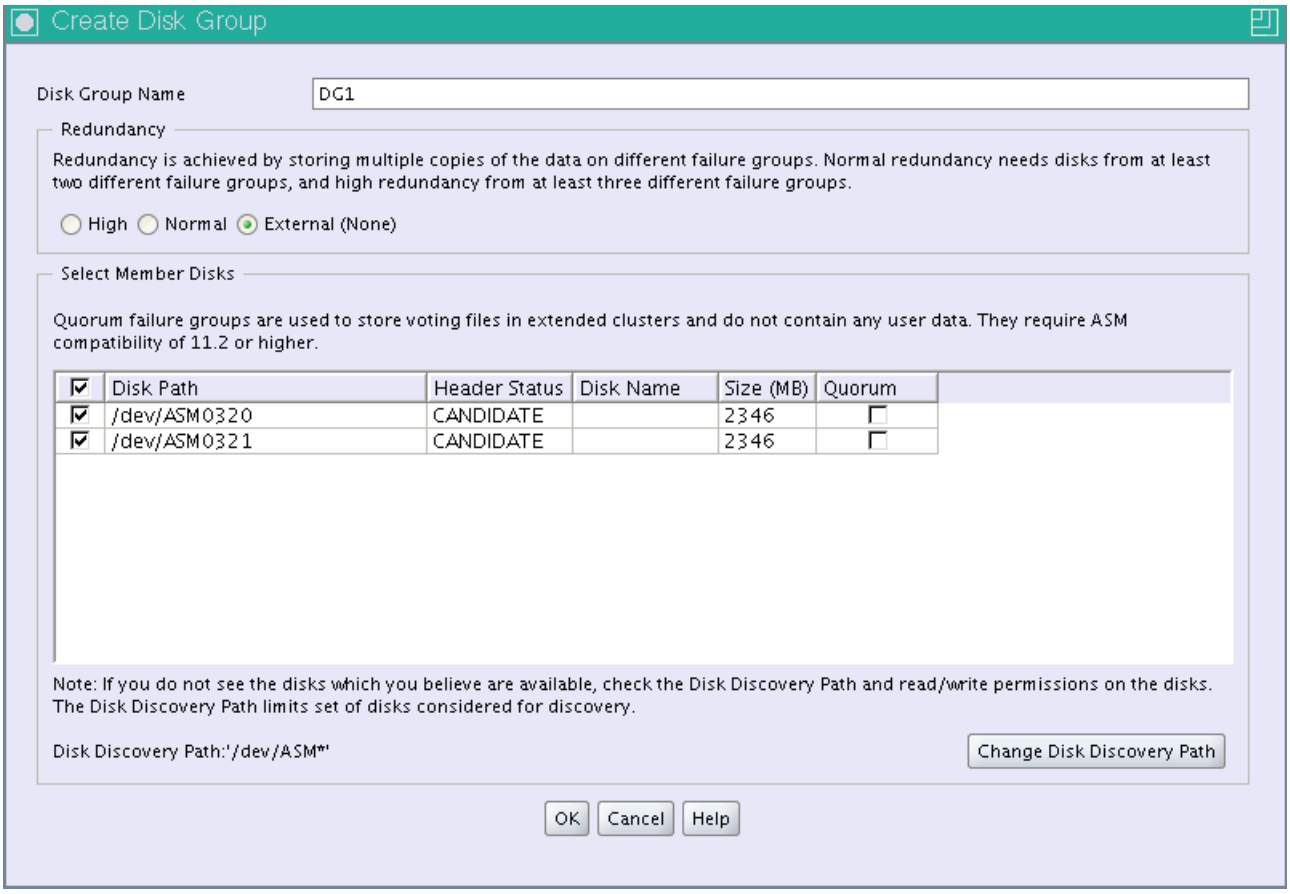

Figure 7-3 Creating disk groups

7. Specify a **Disk Group Name**. Most sites use external SANs that take care of redundancy, so select **External (None)** Redundancy, and then select the disks that you would like to add to the first disk group. Click the **OK** button to return to the ASM Creation window.

Clarification: Oracle has strict passwords enabled. The Oracle Installer recommends at least 8 characters, one upper case and one numeric for the password.

8. Figure 7-4 shows the Create ASM page. Click the **ASM Parameters** button to modify the ASM parameters (circled).

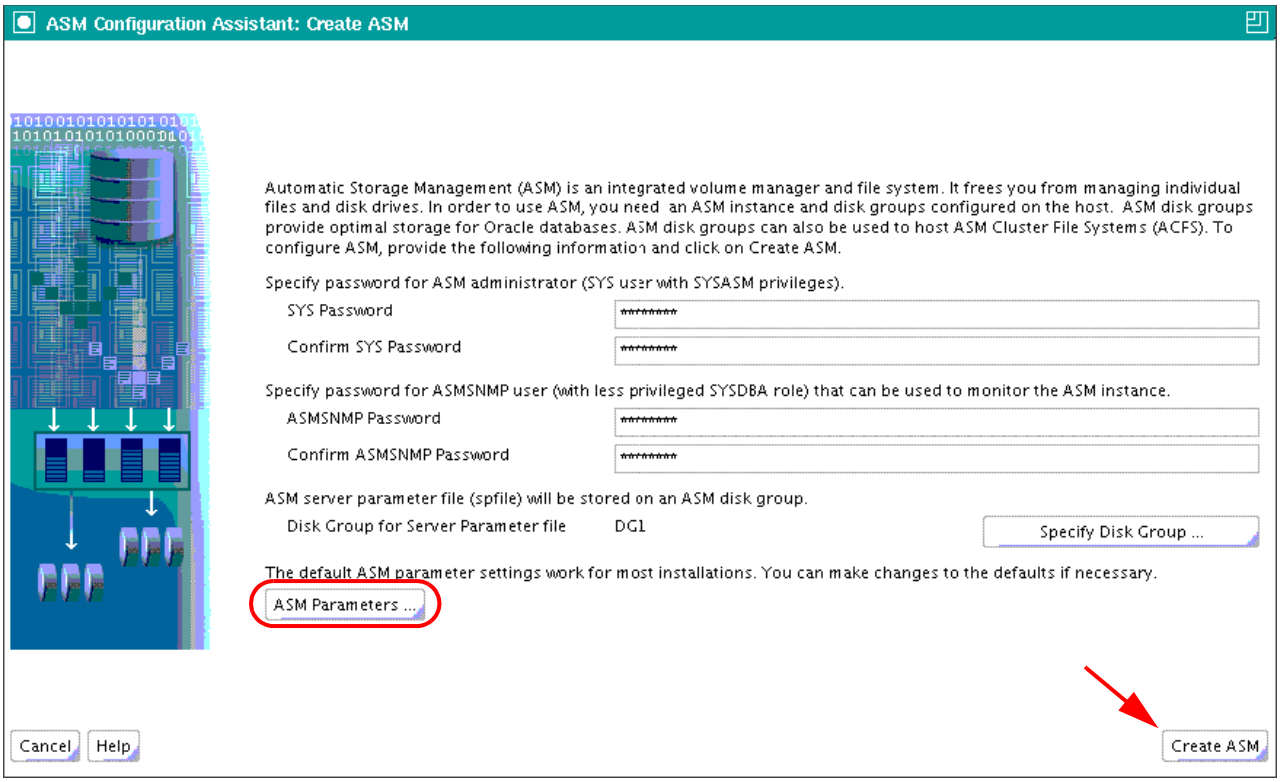

Figure 7-4 Selecting the ASM parameters button

9. In this case, we set the `asm_power_limit` to `0` to make ASM rebalance operations manually. The ASM rebalance operations will not start automatically when disks are added to a disk group if the disk is added during the day. This way a scheduled job can do the rebalance during non-peak hours. Click **Close** to return to the ASM Configuration window
10. Click the **Create ASM** button indicated by the arrow in Figure 7-4 to configure ASM and create the ASM disk group. The window shown in Figure 7-5 will be displayed.

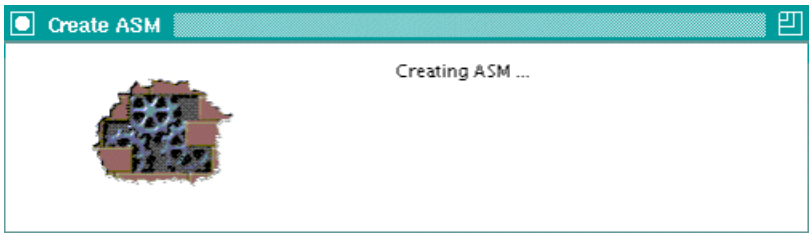

Figure 7-5 Creating the ASM

When complete, a dialog box indicating success will be displayed as shown in Figure 7-6 on page 57.

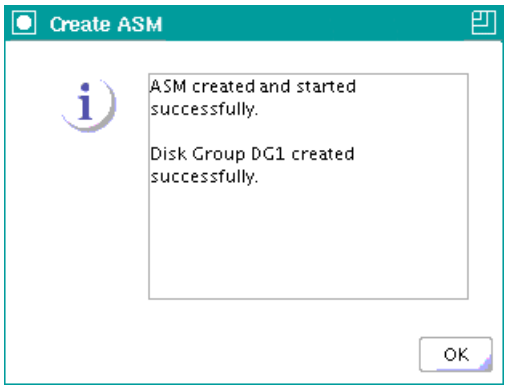

Figure 7-6 Successful completion dialog box

11. Click **OK** to continue. The Configure Disk Groups window will be displayed as shown in Figure 7-7.

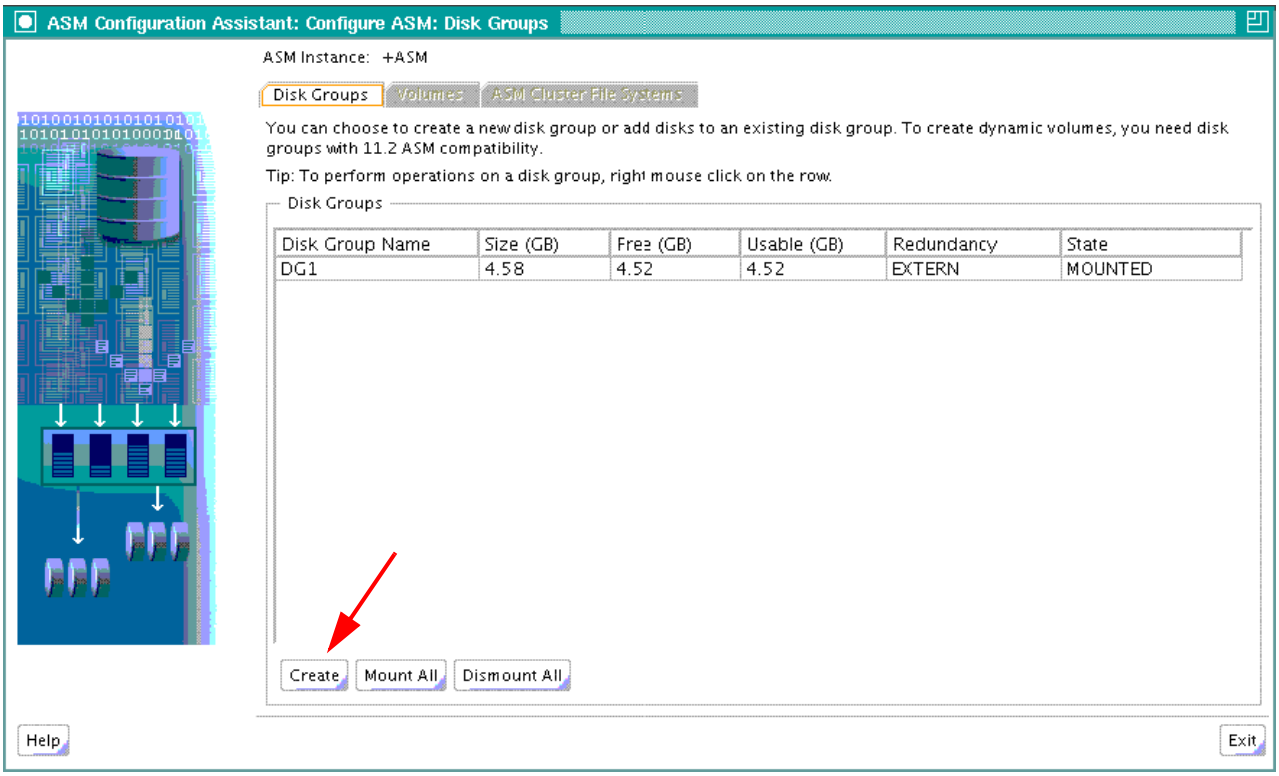

Figure 7-7 Configuring disk groups

12. A flash recovery area (FRA) allows a mirror to redo logs, control files, archive logs and to store rman backups. To create an additional disk group for an FRA, click the **Create** button, indicated by the arrow in Figure 7-7. Alternatively, click the **Exit** button to complete the ASM creation assistant.
13. If you are creating a very large database (greater than 1 TB), click the **Show Advanced Options** button and create an allocation unit (AU) size that is larger than the default of 1 MB. This must be done at ASM disk group creation time.

Figure 7-8 shows an example of creating the FRA and using the **Show Advanced Options**.

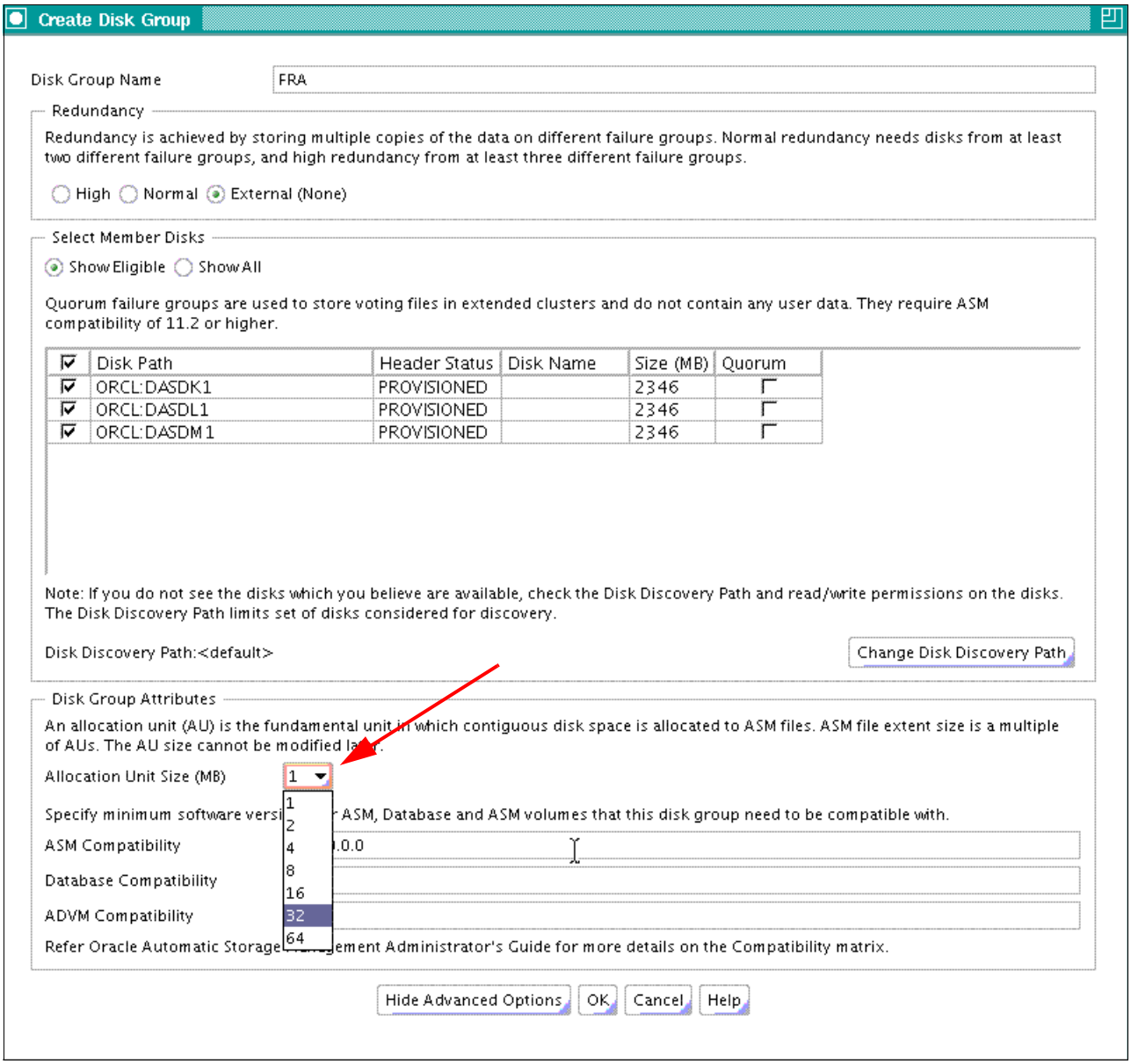

Figure 7-8 Creating the FRA disk group

14. With the desired allocation unit size selected (as indicated by the arrow in Figure 7-8), click **OK** to create the new ASM disk group.

Upon successful disk group creation, the window shown in Figure 7-9 will be displayed.

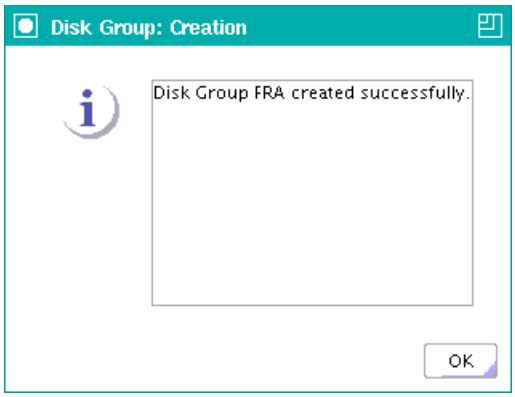

Figure 7-9 Disk group FRA created successfully

15. Click **OK**, and the ASM Disk Summary window, shown in Figure 7-10, will be displayed.

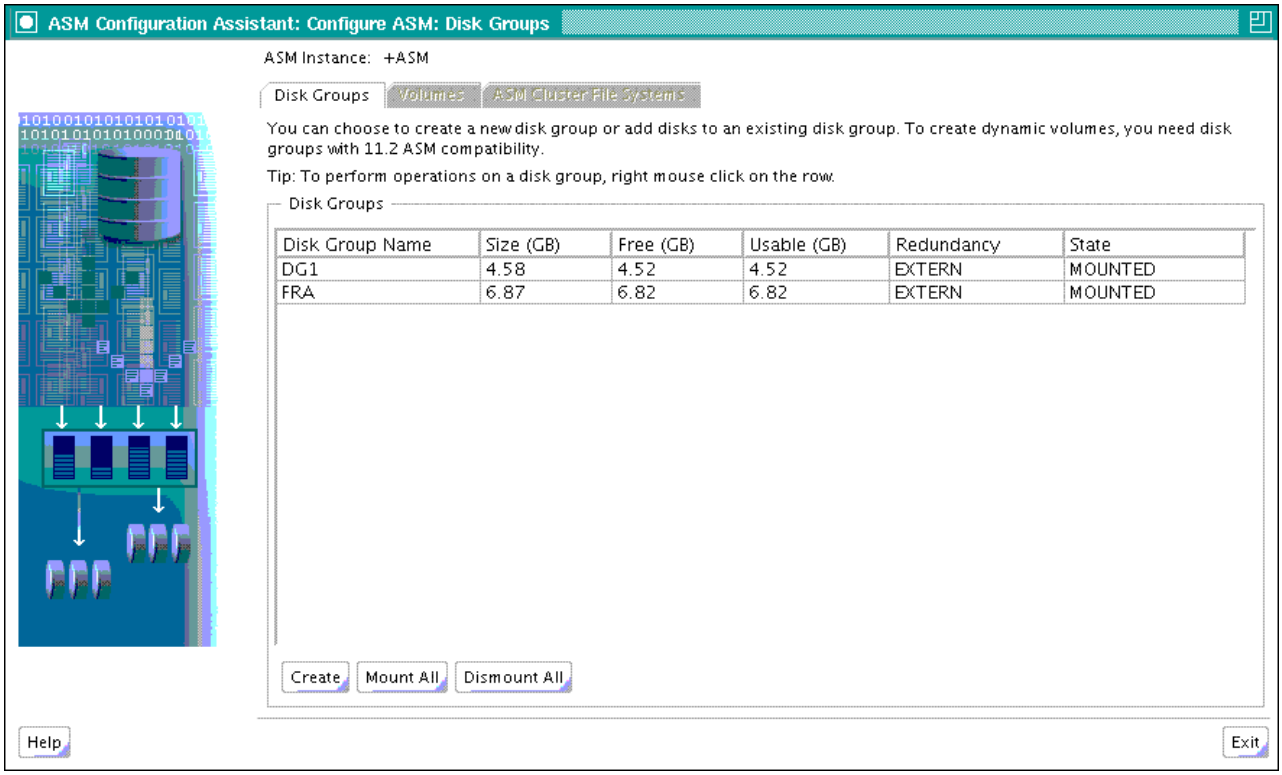

Figure 7-10 ASM disk summary window

16. After all disk groups have been created, click **Exit** and then **Yes** to leave ASM creation.

8

Installing SQL*NET Client (netca)

The next step is to create an Oracle Listener using *netca*. A listener name is required before using the database creation assistant to configure the Oracle Enterprise Manager with a database.

Remember: If you are installing a database using ASM, the listener should be created in the Oracle Grid user home directory, not the database Oracle user home. Otherwise you will receive the message shown in Figure 8-1.

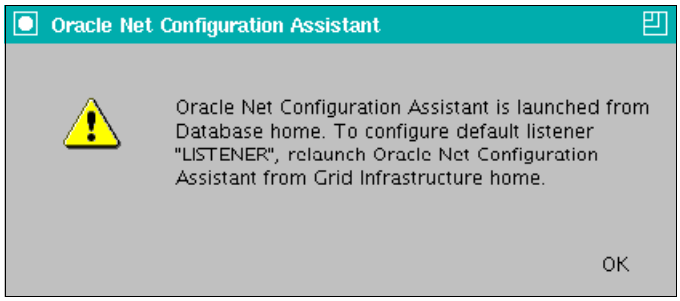

Figure 8-1 Oracle Net Configuration Assistant warning

If you are installing an Oracle Enterprise Manager Grid Control agent, it can be installed at this time or it can be installed later.

To install a SQL*Net listener, perform the following steps:

1. Start a VNC X-window session as the grid user (or if this is a single user install, ensuring environment variables are set for the ASM grid environment).
2. From the VNC client, change directories to the ORACLE_HOME/bin directory of the oracle user from the database install executables. Run **`netca`** to start the Oracle Net Configuration Assistant as shown in Example 8-1.

Example 8-1 Starting the configuration assistant

```
cd $ORACLE_HOME/bin
```

```
./netca
```

The Oracle Net Configuration Assistant starts (Figure 8-2).

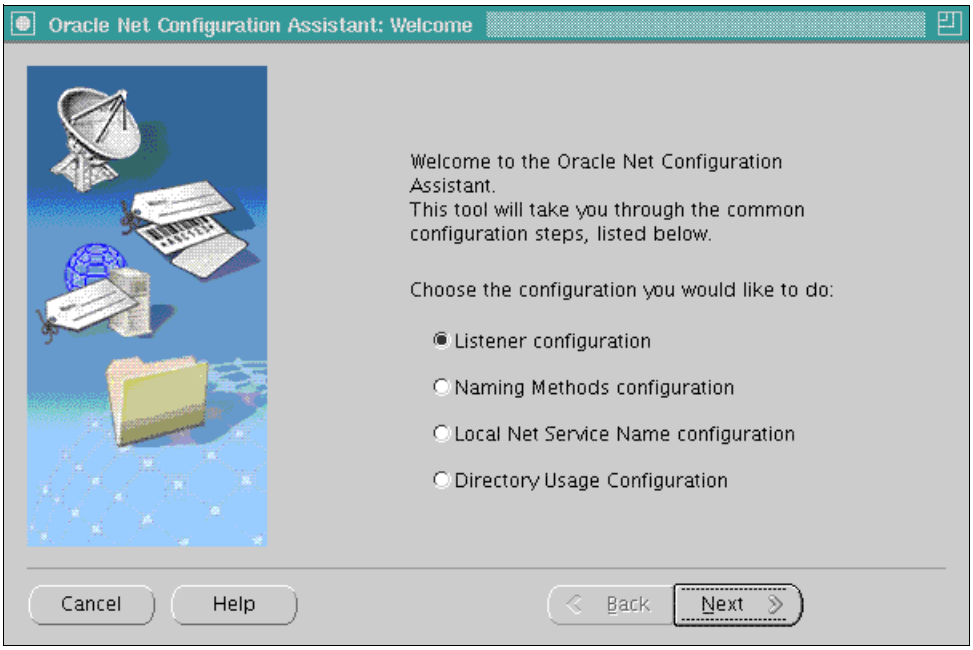

Figure 8-2 Selecting listener configuration

3. After selecting **Listener configuration**, click **Next**. Figure 8-3 displays.

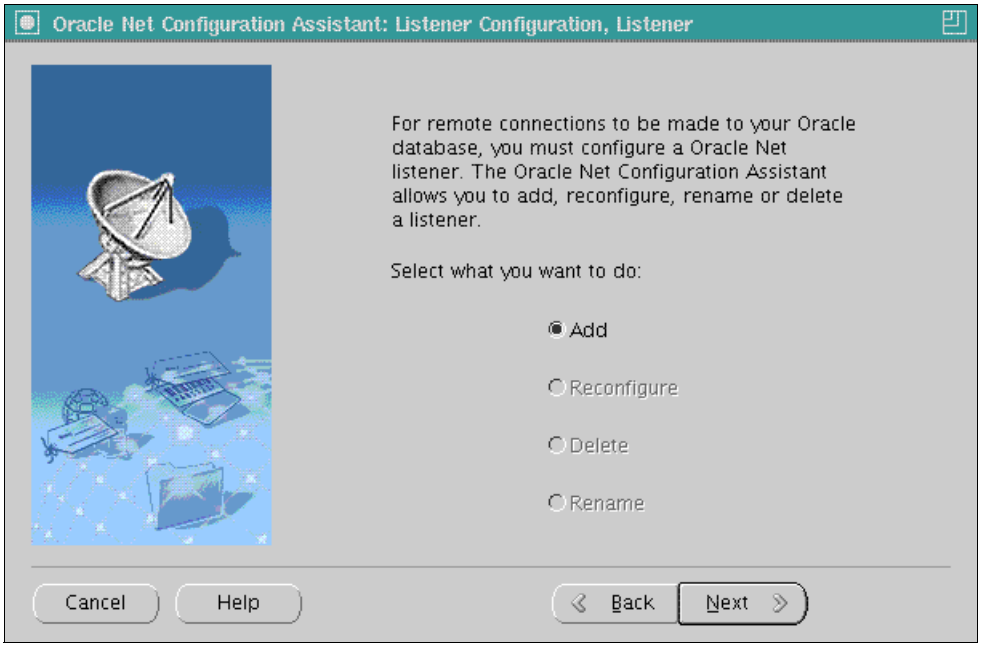

Figure 8-3 Adding the listener

4. Click **Add**.

5. Click **Next** to name the listener (Figure 8-4 on page 63).

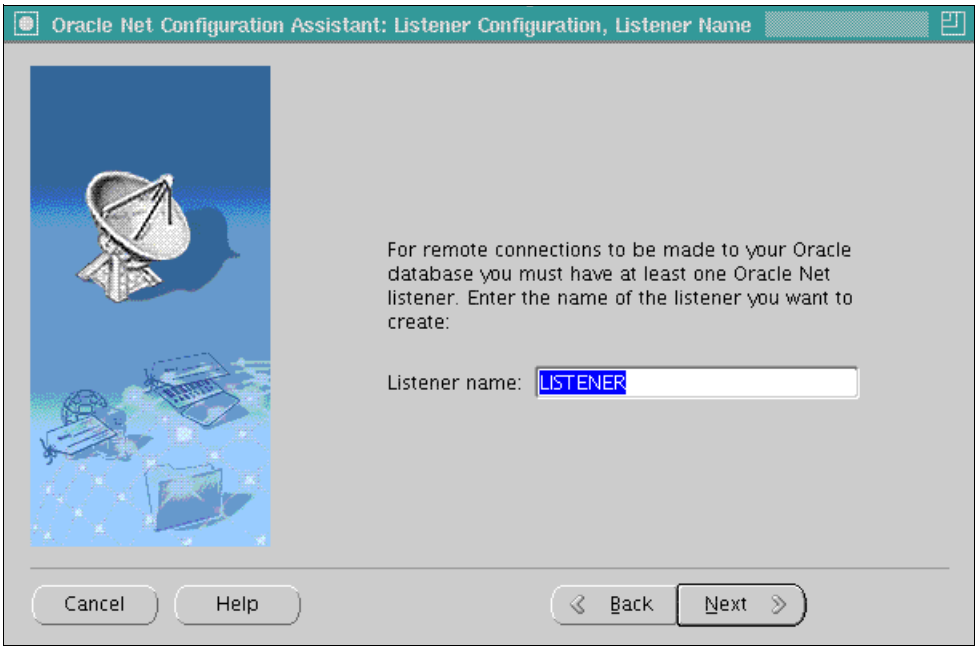

Figure 8-4 Naming the listener

6. Click **Next** to select protocols (Figure 8-5).

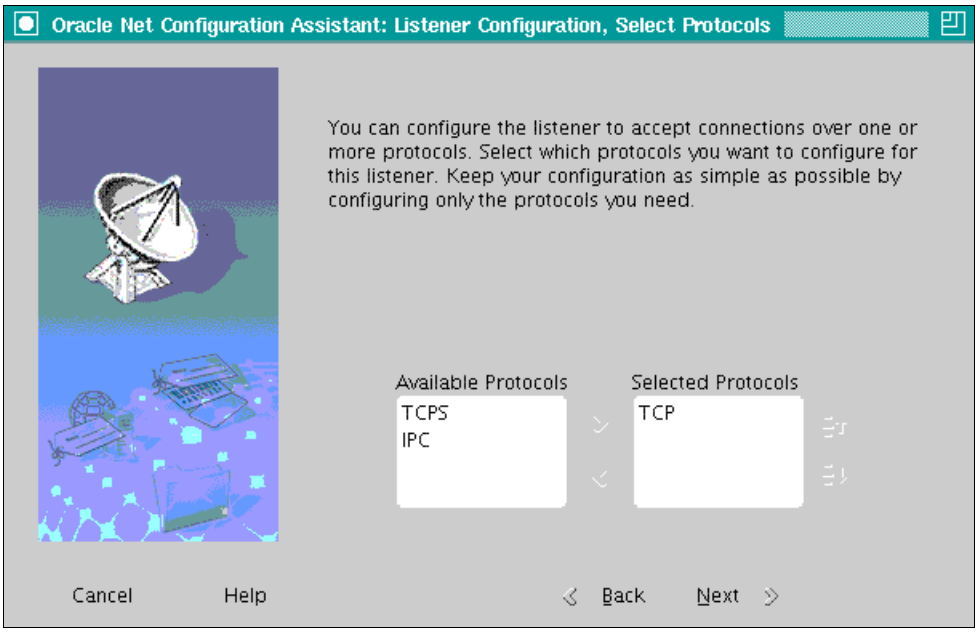

Figure 8-5 Selecting protocols

7. At the least, TCP must be selected. Click **Next** to continue to Figure 8-6 and identify the TCP/IP port number.

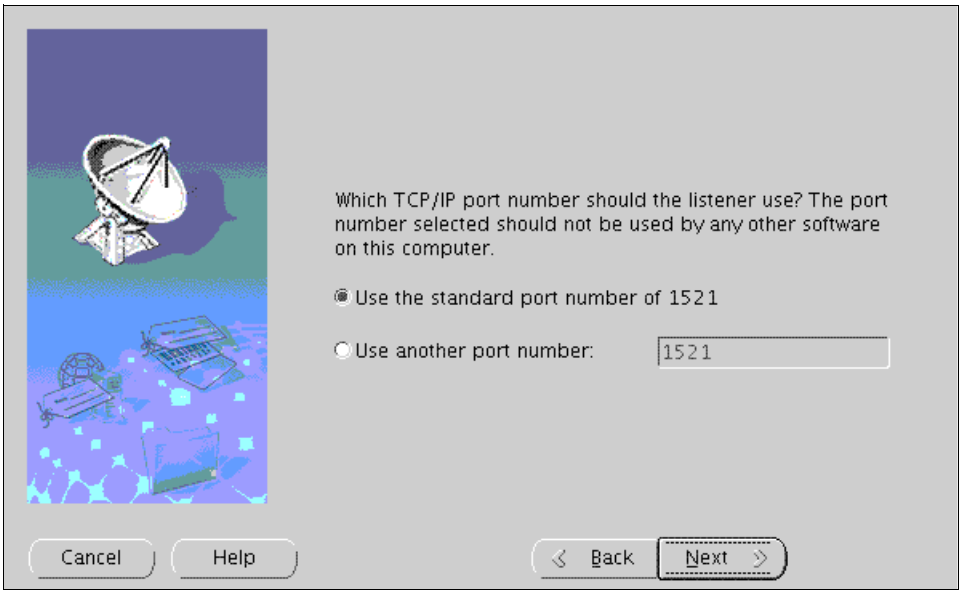

Figure 8-6 Selecting the port number

8. After selecting the port number, click **Next**. You will be asked if you would like to configure another listener. Select **No** at this time (Figure 8-7).

Figure 8-7 Listener configuration, more listeners?

9. Select **Next** to continue. The listener will then attempt to start. If successful, a listener complete message will be displayed (Figure 8-8).

```
/u01/grid/11.2/bin
$ ./asmca
$ ./netca

Oracle Net Services Configuration:
Configuring Listener: LISTENER
Listener configuration complete.
Oracle Net Listener Startup:
   Listener started successfully.
```

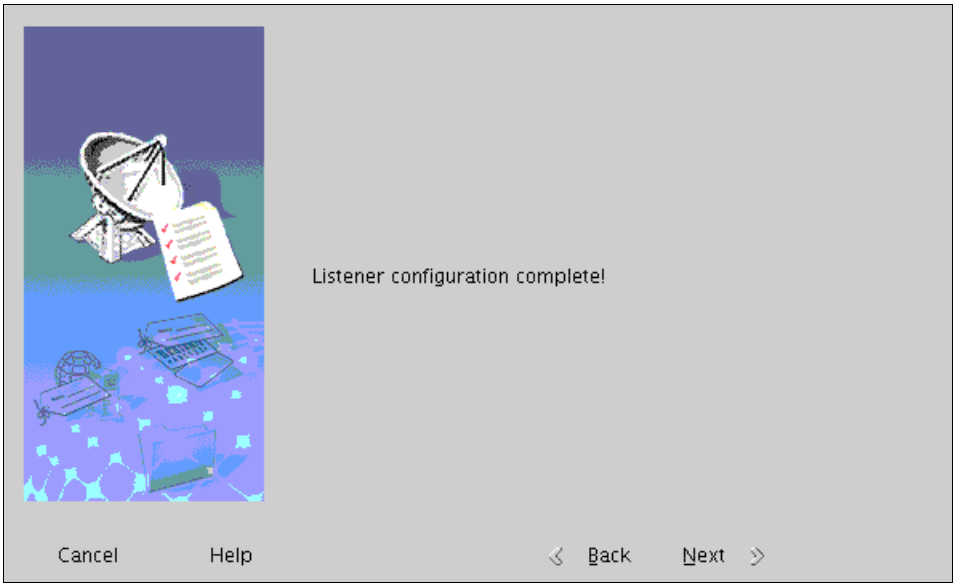

Figure 8-8 Listener configuration complete

10. Click **Next** and then **Finish**.

9

Creating an Oracle database using DBCA

This next step creates a single instance database by means of the Database Configuration Assistant (DBCA) for Oracle databases. The Oracle DBCA is a wizard to create, configure, and administer databases. DBCA template files predefine attributes for creating databases, creating table spaces, and configuring database features.

To create a database, perform the following steps:

1. Start a VMC X-window session as the Oracle user (or if this is a single user install, ensure environment variables are set for the Oracle database). Change to the `ORACLE_HOME/bin` directory. From there, run the command **`dbca`**. The Oracle Database Configuration Assistant will start (Example 9-1).

Example 9-1 Running the dbca command

```
cd $ORACLE_HOME/bin
./dbca
```

The Database Configuration Assistant welcome window opens as shown in Figure 9-1.

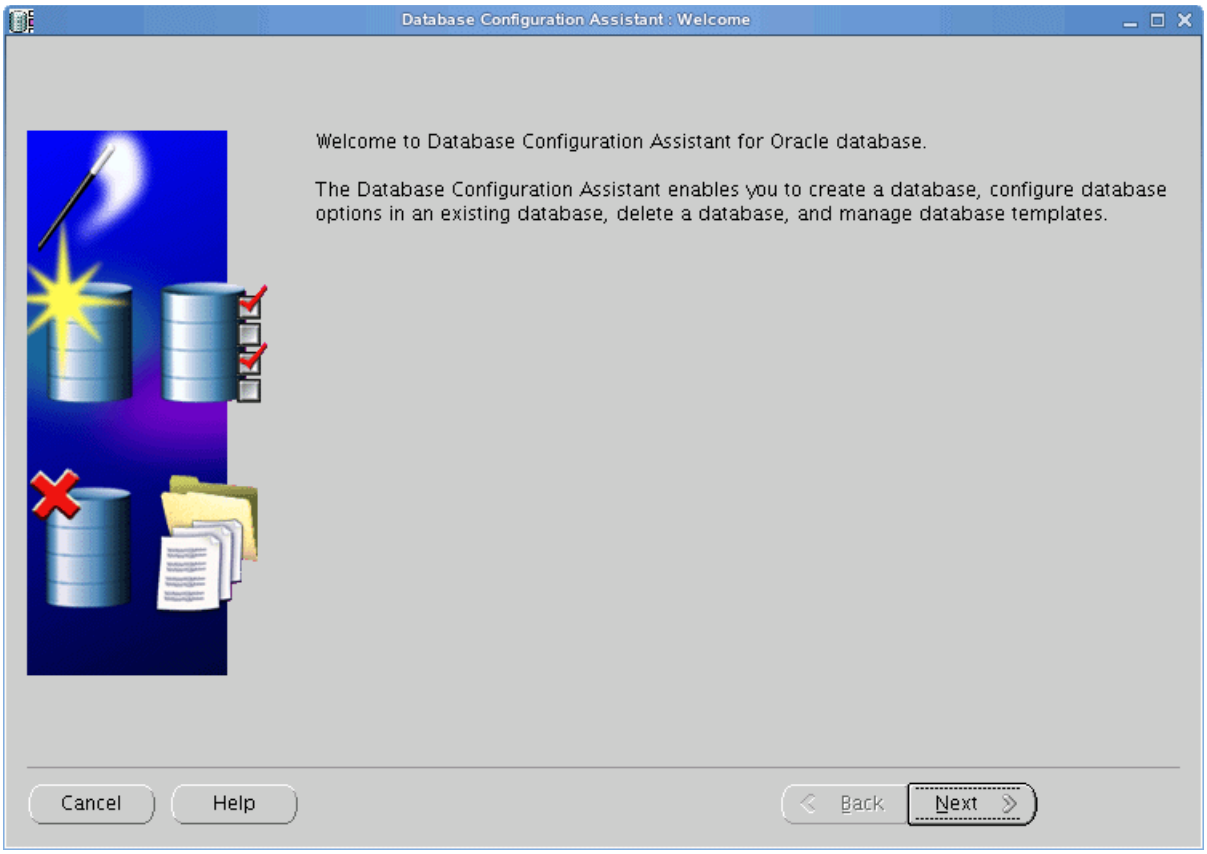

Figure 9-1 The dbca welcome window

2. Click **Next** to get to the Create Database window as shown in Figure 9-2.

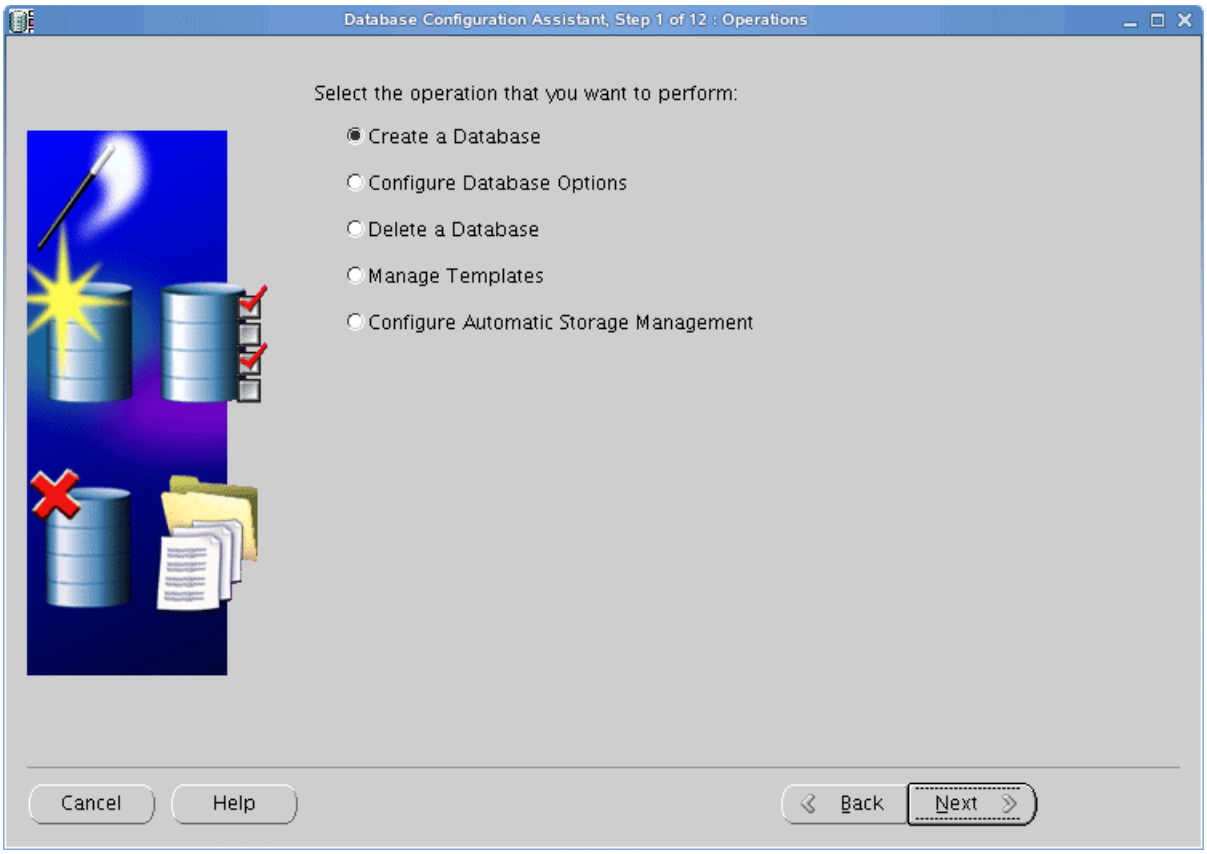

Figure 9-2 DBCA Select Operations

3. Select **Create a Database** and click the **Next** button. The Database Templates window is now displayed.

4. Select **General Purpose or Transaction Processing** and click the **Next** button (Figure 9-3**).**

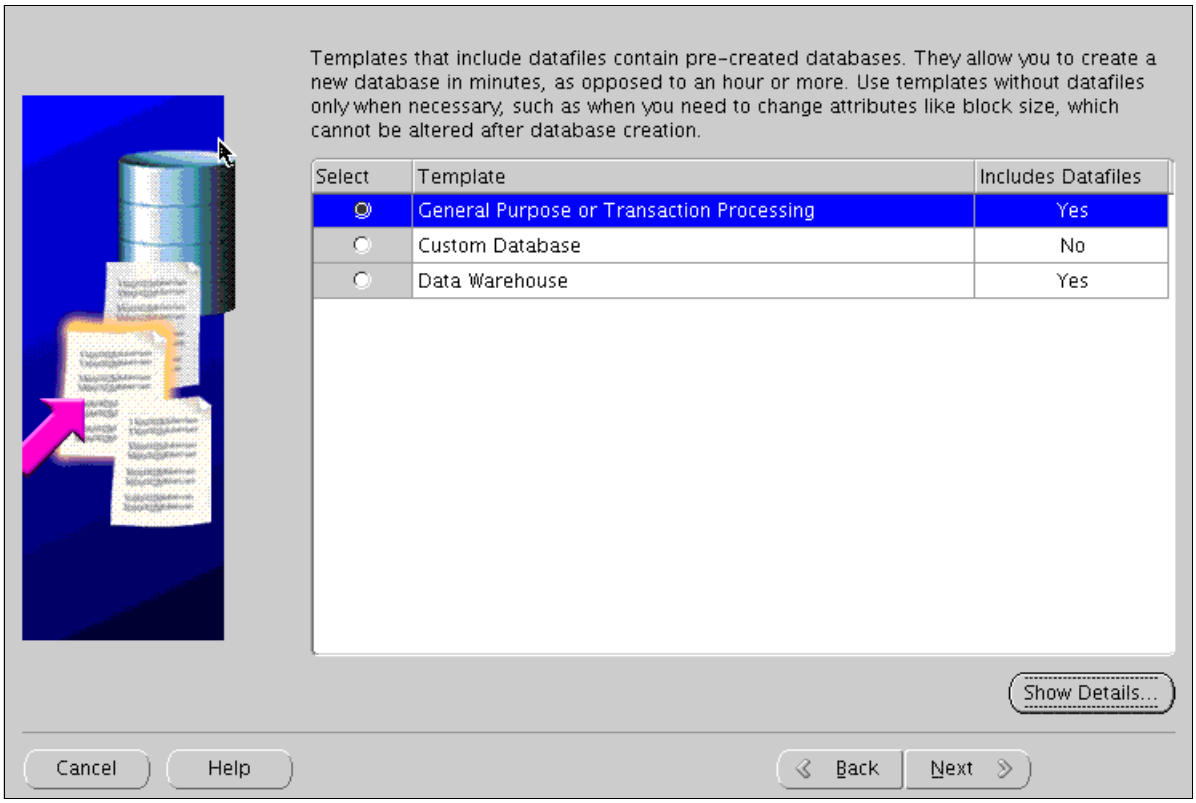

Figure 9-3 DBCA Database Templates

5. Specify a Global Database Name, and then click **Next** to continue (Figure 9-4).

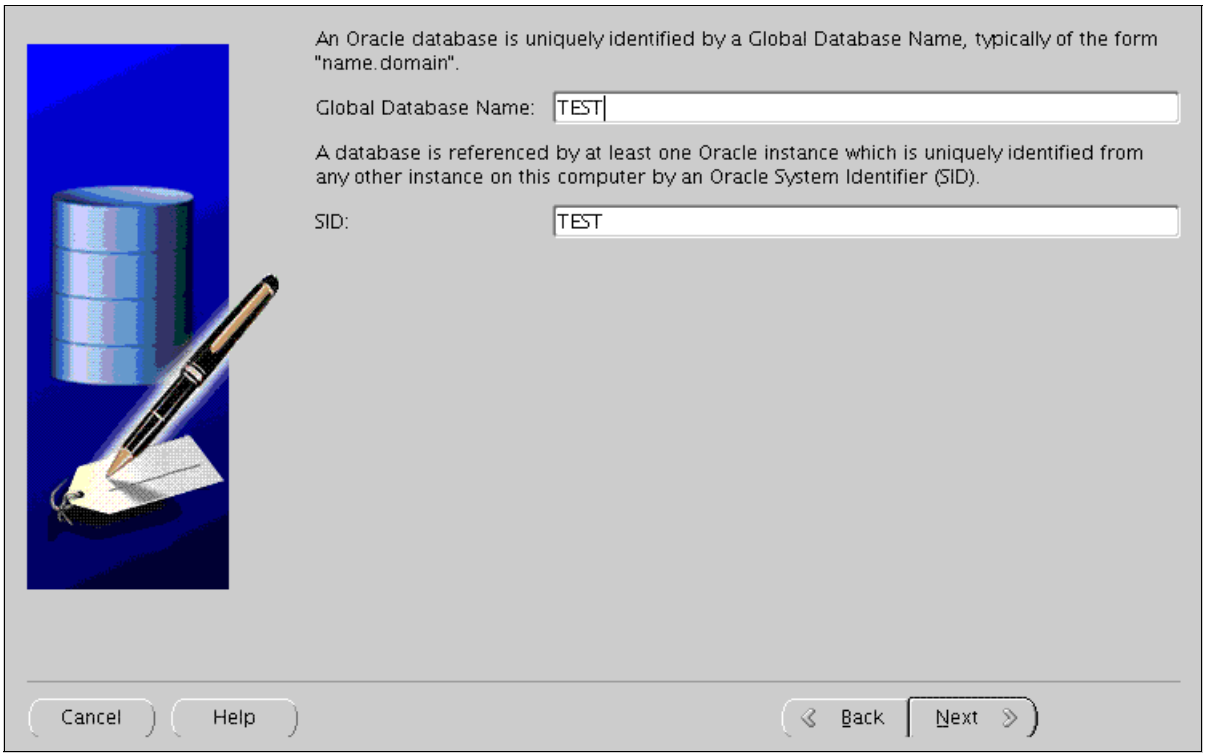

Figure 9-4 DBCA Database Identification

6. if you would like to configure the Enterprise Manager, you can do so at this time by selecting **Configure Enterprise Manager** as shown in Figure 9-5.

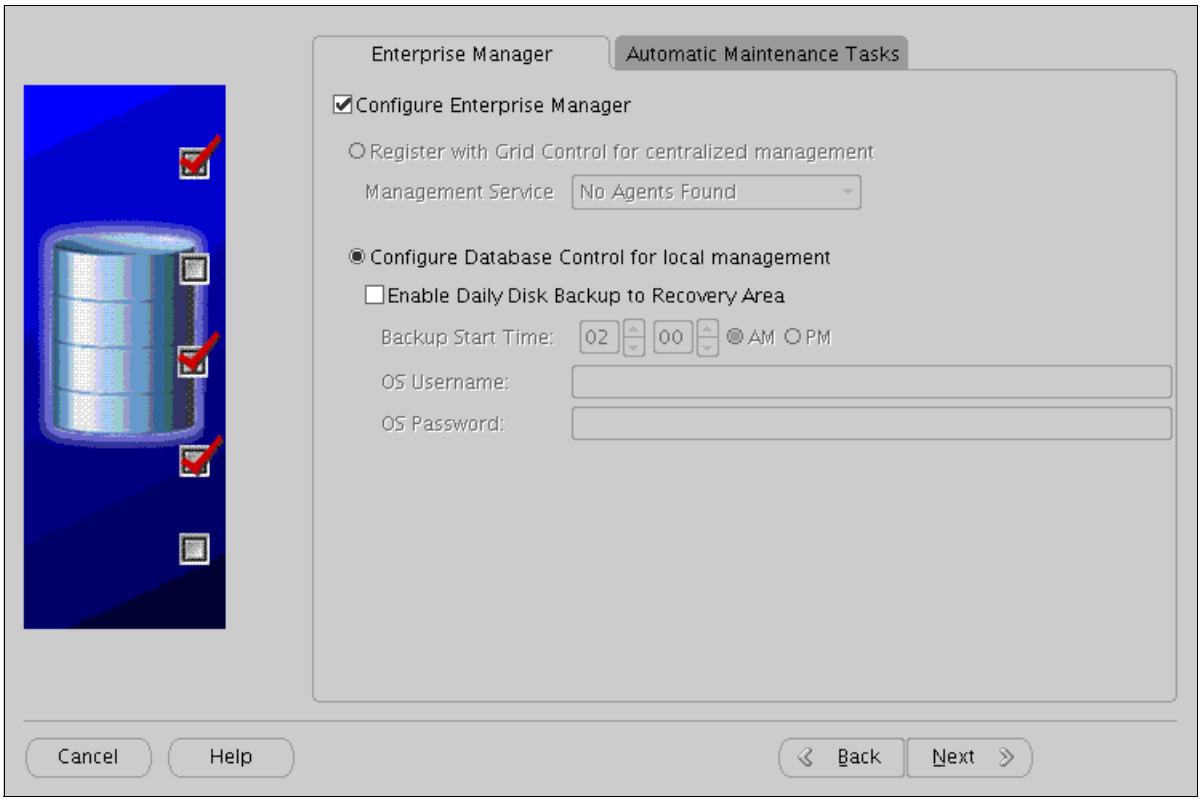

Figure 9-5 Configuring Enterprise Manager

7. You can monitor Oracle 11gR2 databases using version 10.2.0.5 of the grid agent according to Oracle Support Note 412431.1. Additionally, if you would like to disable the Automated maintenance tasks, you can do this from the Automatic Maintenance Tasks tab by deselecting the check box labeled **Enable Automatic Maintenance Tasks** as shown in Figure 9-6 on page 73. You would do this in a virtualized environment when running all the maintenance tasks at the same time could impact optimal system usage.

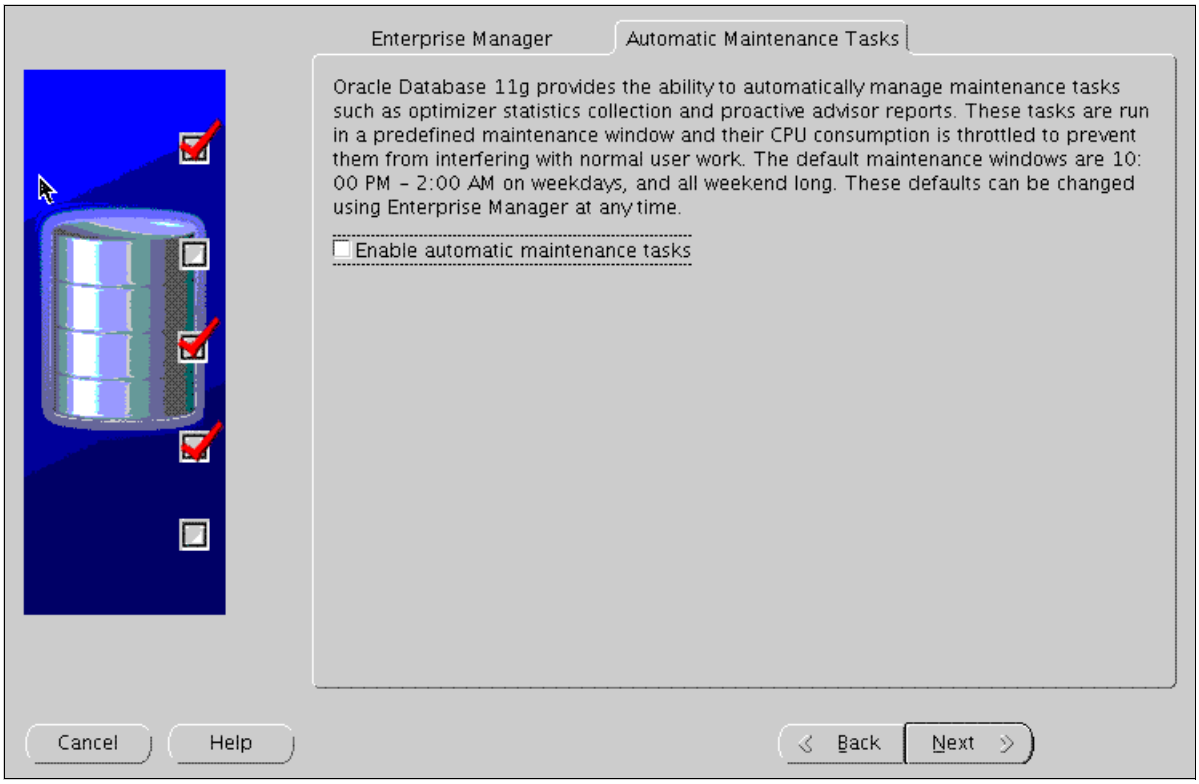

Figure 9-6 Disabling automatic maintenance tasks

8. Maintenance tasks can be scheduled later using the Oracle enterprise manager. Click **Next** to continue to the Database Credentials window (Figure 9-7).

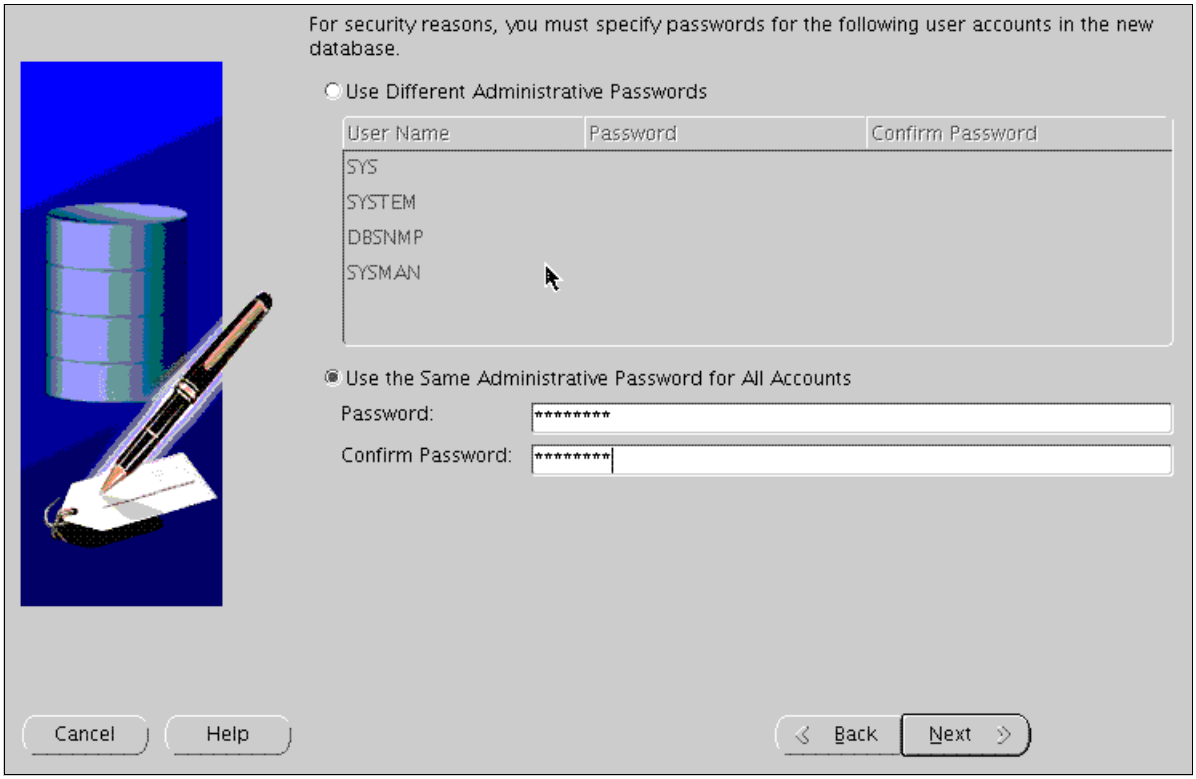

Figure 9-7 Entering database credentials

9. Specify the passwords for SYS and SYSTEM and then click **Next** to continue.
10. Specify the storage type to be used. If configuring for ASM, select **Use Oracle-Managed Files** and specify the data disk group (Figure 9-8).

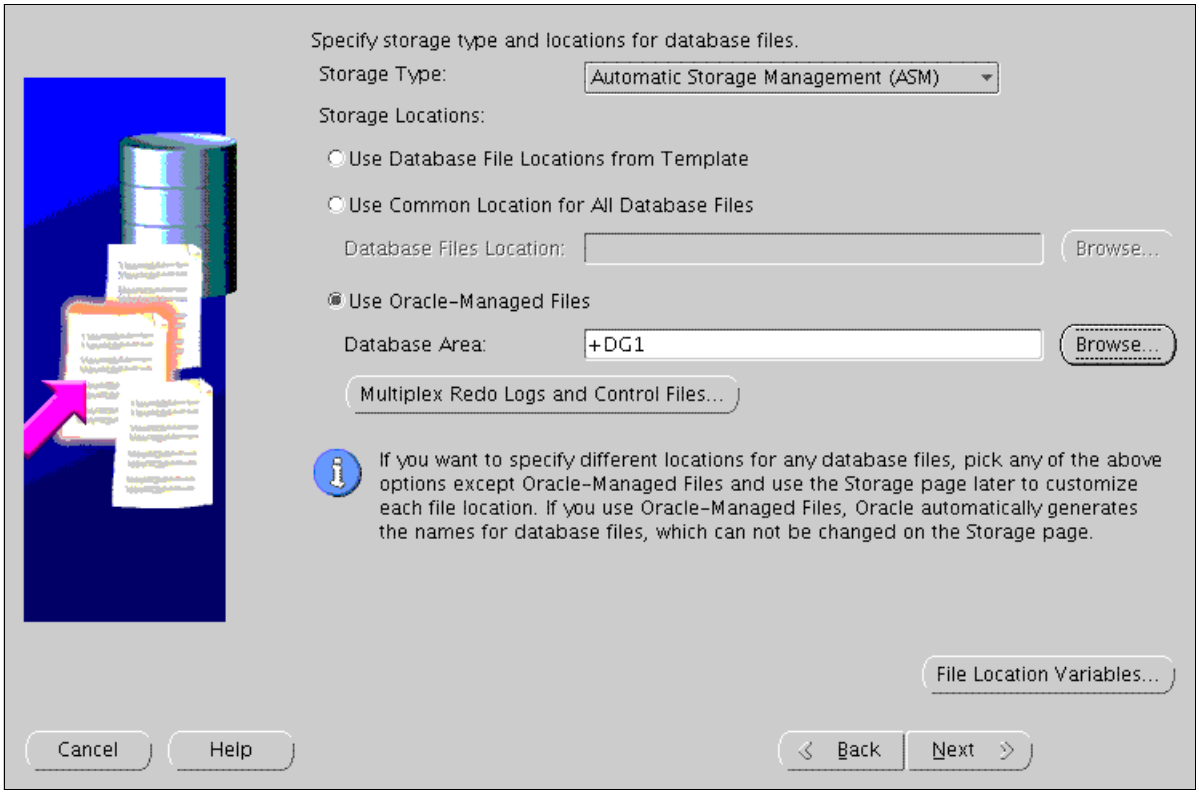

Figure 9-8 Specifying the storage type and data disk group

11. Click **Next** to continue. A prompt for the ASM Credentials displays. Enter a password and click **OK** to continue (Figure 9-9).

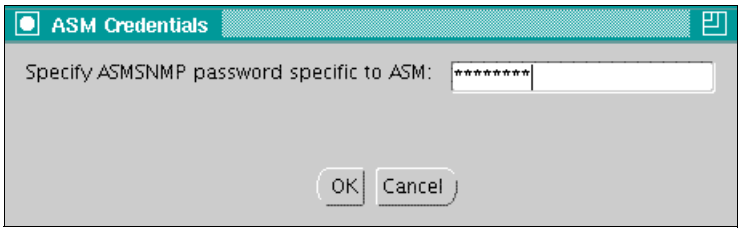

Figure 9-9 Setting the ASMSNMP password

12. Figure 9-10 is the Recovery Configuration window. Here, you will choose the recovery options for the database. As shown in this example, the Fast Recovery Area is used as the default for all disk-based backup and recovery operations.

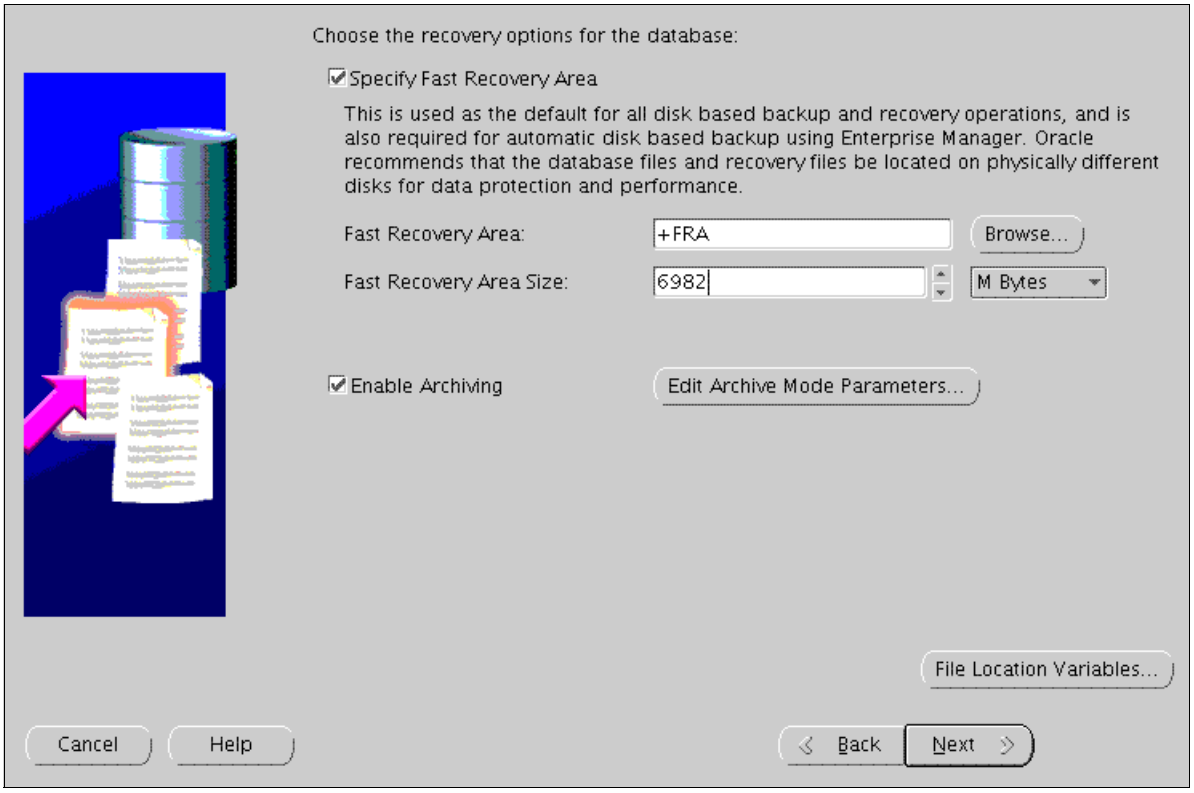

Figure 9-10 Choosing recovery options

13. To enable archiving, select the box labeled **Enable Archiving**, and click **Edit Archive Mode Parameters**. Click the browse button to select the disk group, as shown in Figure 9-11. Note the FRA size to create.

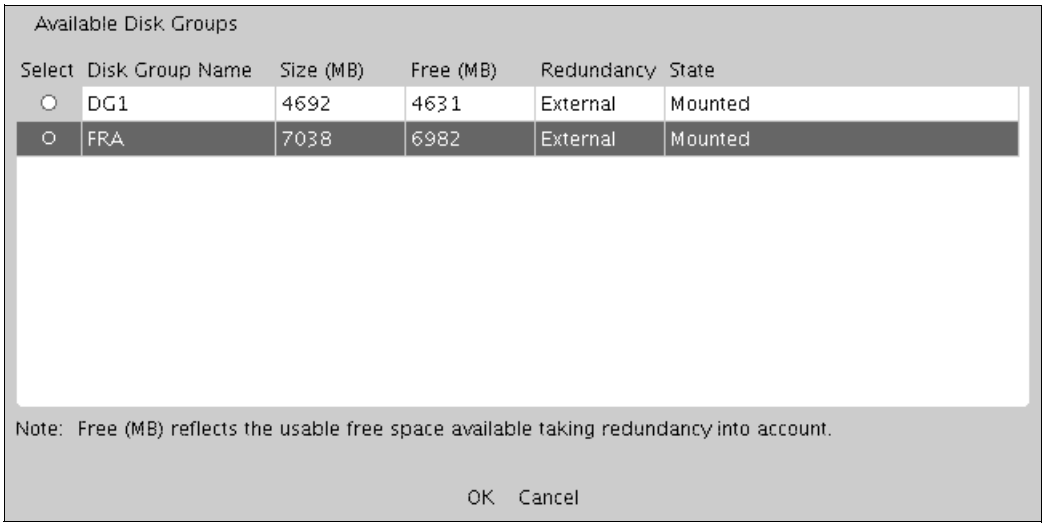

Figure 9-11 Selecting the disk group

14. Select the FRA disk group and click **OK** to close the Select Disk Group window.

15. Verify the Fast Recovery Size is what is required. In Figure 9-11 on page 75, there is 6982 MB free, so that is what can be specified for the Fast Recovery Size.
16. Click **Next**. The Database Content window is presented (Figure 9-12).

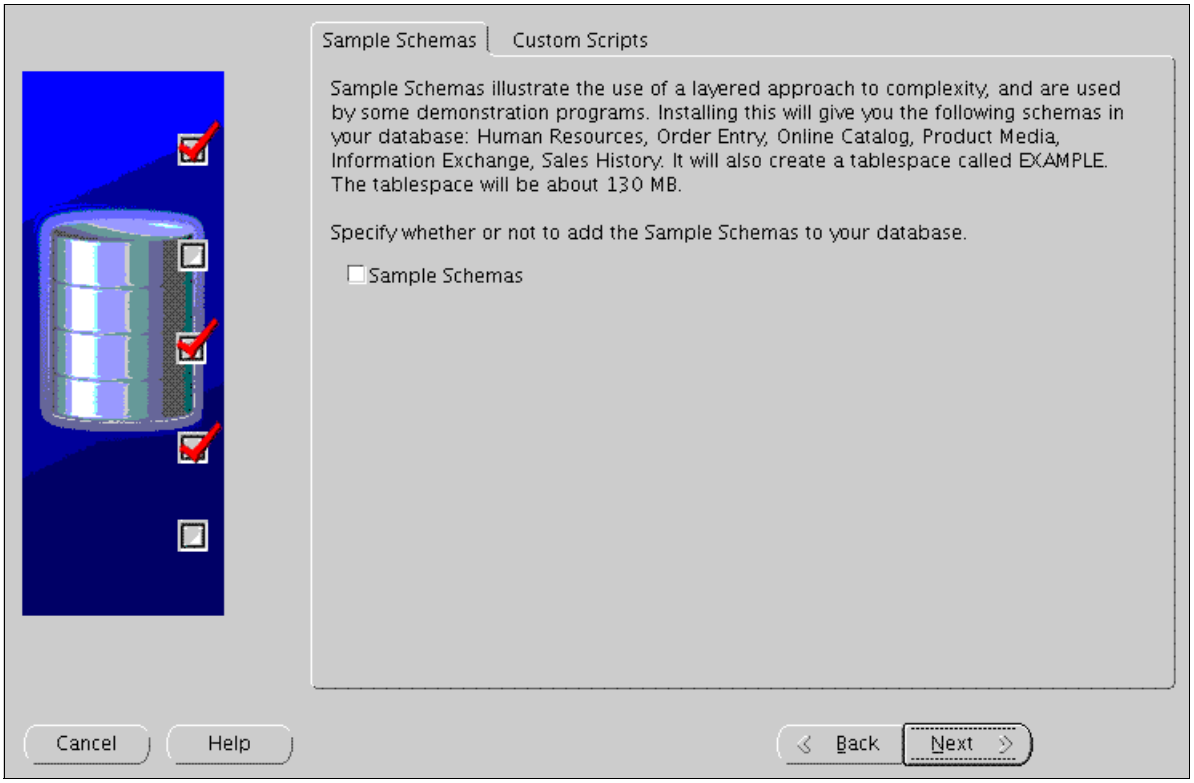

Figure 9-12 Selecting database content

17. Choose either the Sample or Custom schema tab, and click **Next** to continue. The Initialization Parameters window shown in Figure 9-13 is displayed.

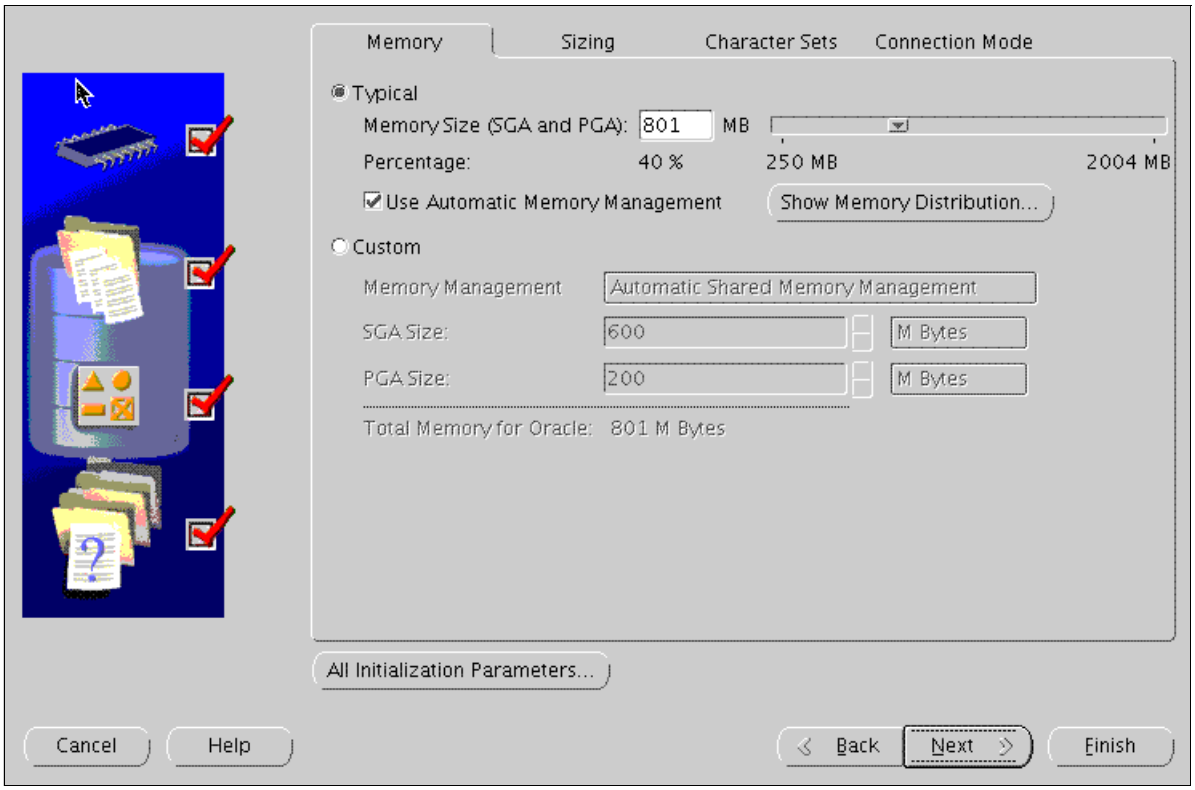

Figure 9-13 Initialization parameters

18. Specify and review the various Oracle install parameters. Pay special attention to the character set window. Click the Character Sets tab as shown in Figure 9-14 to review the character sets. This example shows the change from Use the default to Use Unicode (AL32UTF8) character set mode. these values are difficult to change later, so pay special attention when installing a new database using the DBCA. Click **Next** to continue.

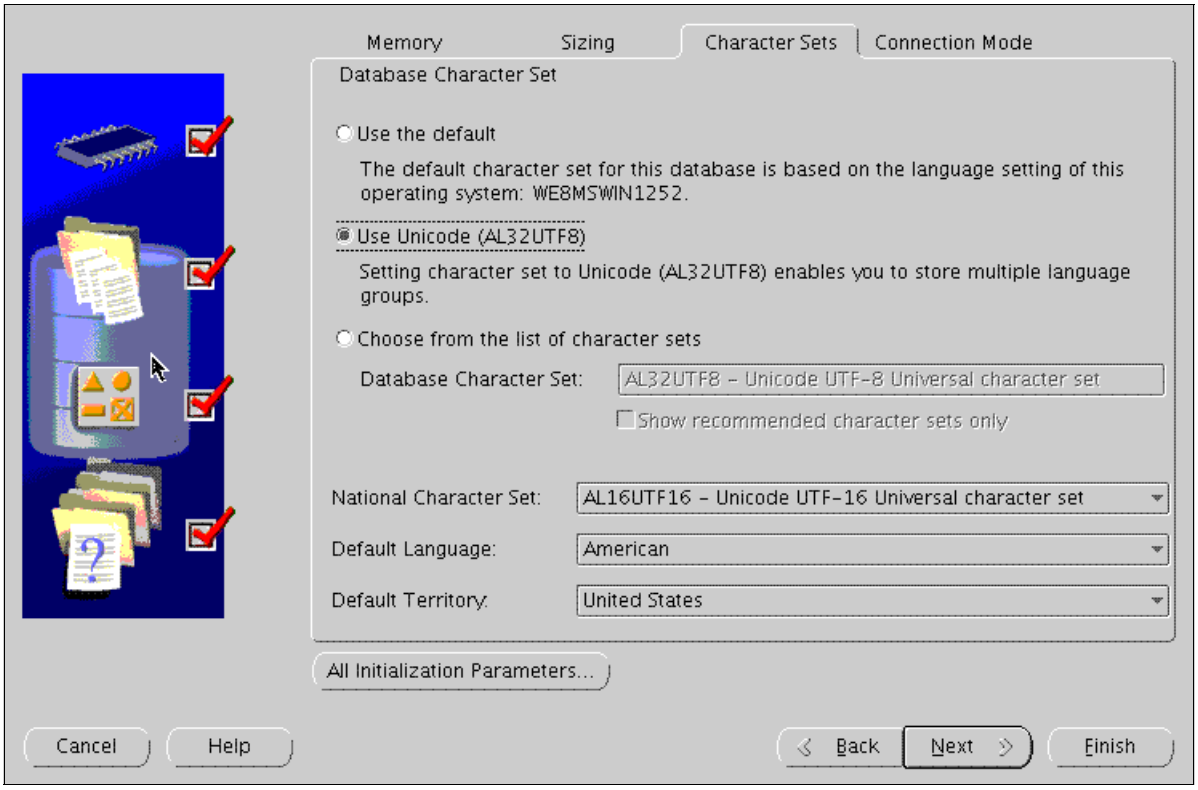

Figure 9-14 Viewing the character sets

19. Verify the database storage, as shown in Figure 9-15, and click **Next** to continue.

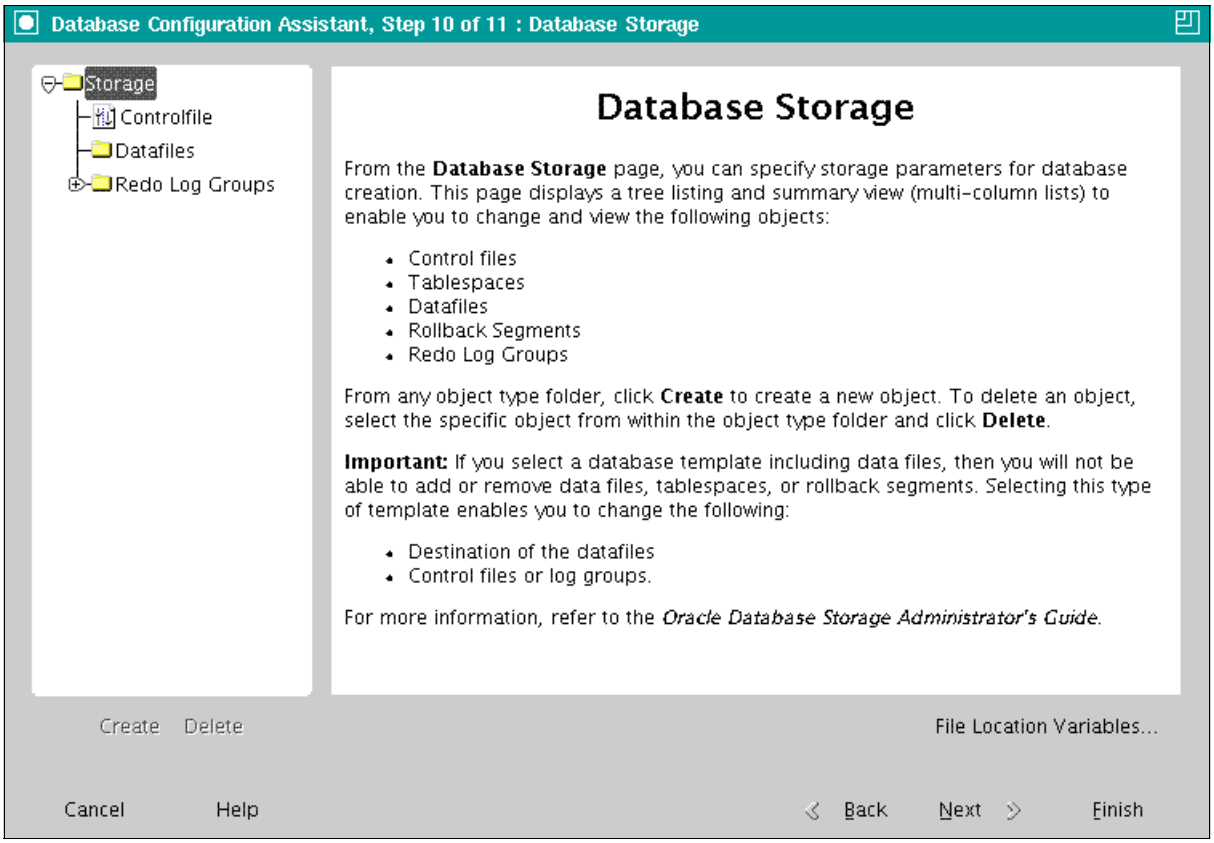

Figure 9-15 Verify the database storage

The Creation Options install window displays (Figure 9-16).

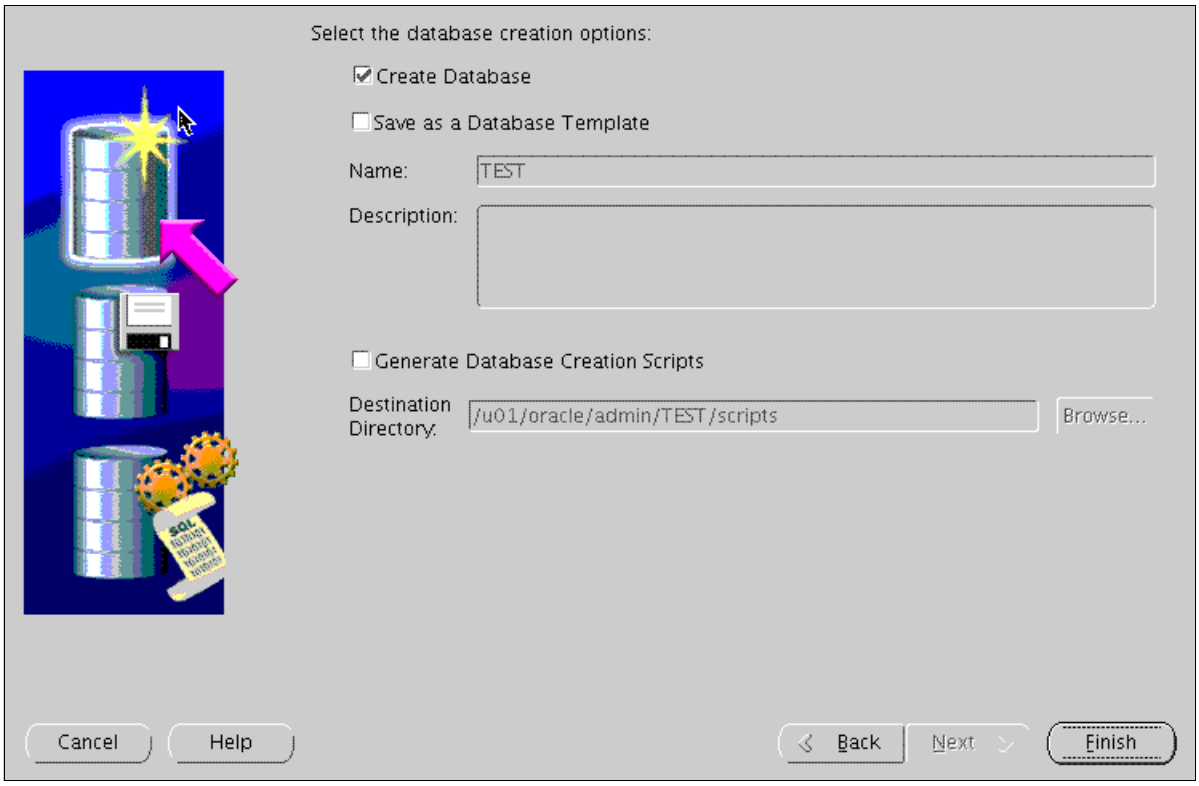

Figure 9-16 Creation options

20. A Create Database Summary is displayed as shown in Figure 9-17.

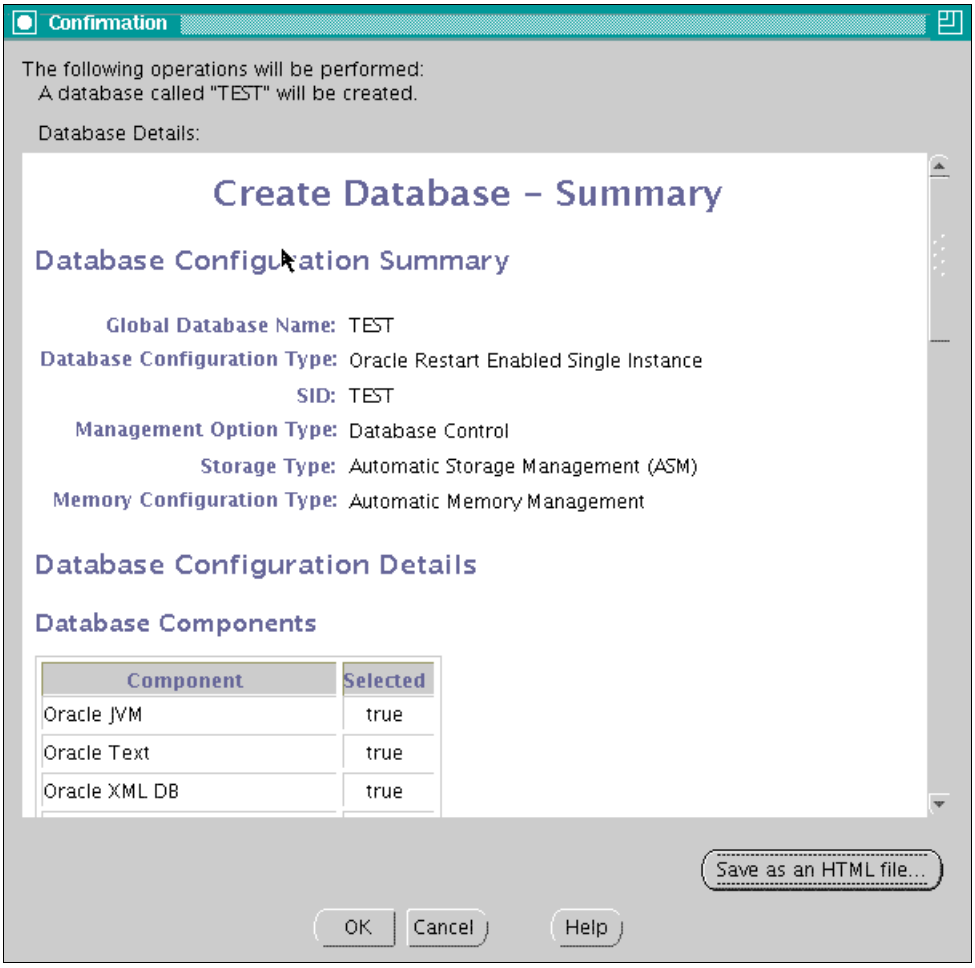

Figure 9-17 Create database summary

21. Click **OK** to start creating the database (Figure 9-18).

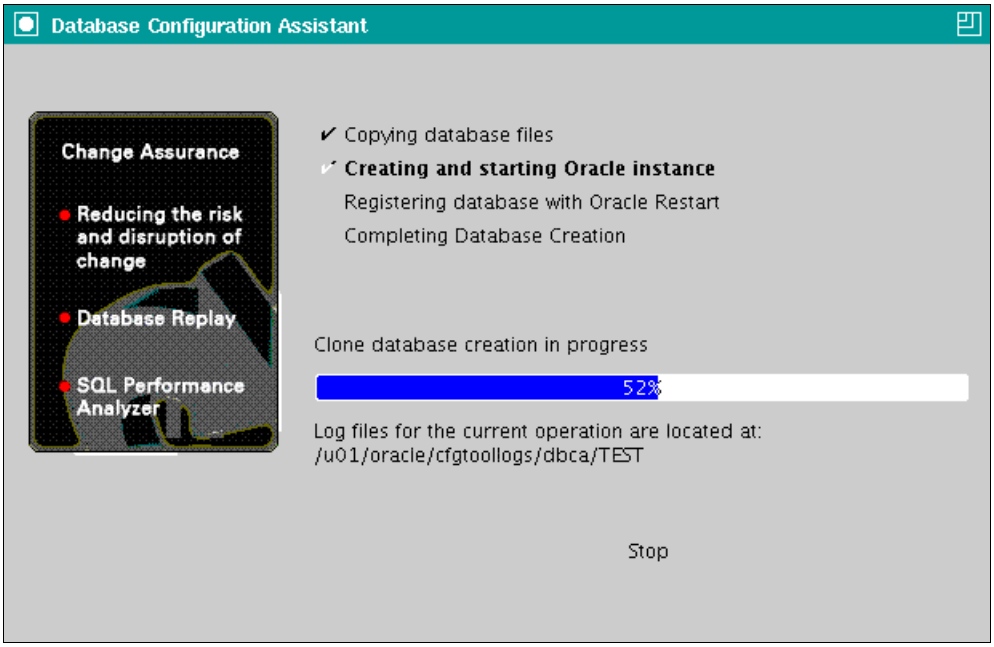

Figure 9-18 Database creation

Figure 9-19 indicates a successful completion.

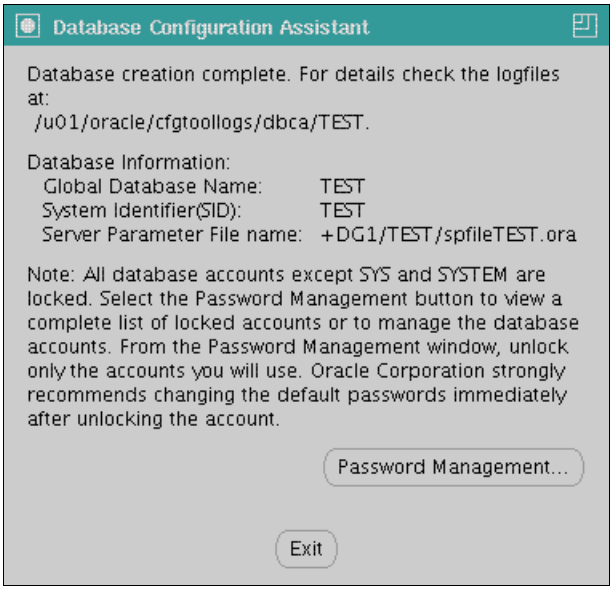

Figure 9-19 Database summary panel upon successful completion

An Oracle 11gR2 database has now been successfully installed. The remainder of this IBM Redpaper provides additional details material and an example of the creation of a RAC 11gR2 database.

10

Oracle 11gR2 Real Application Cluster database installation on Red Hat Enterprise Linux v5

In this chapter, an example installation of Oracle 11gR2 Real Application Cluster (RAC) database installation on Red Hat Enterprise Linux (RHEL) v5 is provided.

10.1 Network considerations

In this example, the private interconnect uses hypersockets and the /etc/hosts entries on both nodes contain the following:

```
192.0.1.16      pazxxt16-pr.us.oracle.com pazxxt16-pr
192.0.1.17      pazxxt17-pr.us.oracle.com pazxxt17-pr
```

The VIPs are in a domain name server (DNS). Example 10-1 shows the output after running the command **nslookup**.

Example 10-1 Output from nslookup

```
Name:   pazxxt16-vip.us.oracle.com
Address: 130.35.52.204
Name:   vip-pazxxt17.us.oracle.com
Address: 130.35.52.45
```

Notice that the names are in slightly different formats in the DNS. There is no particular reason behind this. The important point is that the VIPs are on the same subnet as the public IPs for `pazxxt16` (`130.35.55.234`) and `pazxxt17` (`130.35.55.235`) in the Single Client Access Name (SCAN) IPs.

Example 10-2 shows the output from the **nslookup** command for SCAN name `pazxxt17-r`.

Example 10-2 Output from nslookup

```
Name:   pazxxt1617-r.us.oracle.com
Address: 130.35.54.224
Name:   pazxxt1617-r.us.oracle.com
Address: 130.35.54.225
Name:   pazxxt1617-r.us.oracle.com
Address: 130.35.54.223
```

10.2 Miscellaneous

The first four sections of the Oracle Grid Infrastructure Installation Guide has details about the hardware and software prerequisites for installing Oracle Grid Infrastructure and ASM. It is available at the following URL:

http://download.oracle.com/docs/cd/E11882_01/install.112/e10812/toc.htm

In order for the Oracle Cluster Verification Utility to discover shared disks, the `cvuqdisk rpm` for your hardware (for example, s390x) must be installed. This package is located in the `grid/rpm` directory. Directions on how to verify whether or not all the RPM dependencies have been met for a grid infrastructure can be found in 2.2, “Linux required RPMs for RHEL Installs” on page 6.

10.3 Verify prerequisites

After all of the rpm dependencies have been satisfied, run the Cluster Verification Utility to ensure the system is ready for the infrastructure install. The Cluster Verification Utility can be found in the `/grid` directory after `linux.zseries64_11gR2_grid.zip` has been uncompressed.

Figure 10-3 shows output seen while running the Cluster Verification Utility, including two error messages.

Example 10-3 Running the Cluster Verification Utility

```
[oracle@pazxxt16 grid]$ ./runcluvfy.sh stage -pre crsinst -n pazxxt16,pazxxt17
Performing pre-checks for cluster services setup
Checking node reachability...
Node reachability check passed from node "pazxxt16"
Checking user equivalence...
User equivalence check passed for user "oracle"
Checking node connectivity...
Checking hosts config file...
Verification of the hosts config file successful
....
Total memory check failed 1
Check failed on nodes:
        pazxxt17,pazxxt16
Available memory check passed
Swap space check failed 2
Check failed on nodes:
        pazxxt17,pazxxt16
Free disk space check passed for "pazxxt17:/oracle/tmp"
Free disk space check passed for "pazxxt16:/oracle/tmp"
Check for multiple users with UID value 501 passed
User existence check passed for "oracle"
Group existence check passed for "oinstall"
Group existence check passed for "dba"
...
Starting check for Hardware Clock synchronization at shutdown ...
Check for Hardware Clock synchronization at shutdown passed
Pre-check for cluster services setup was unsuccessful on all the nodes
```

The two error messages are identified in Figure 10-3 as number 1 and number 2. There is less than the recommended 4 GB of memory, and less than the recommended 4 GB of swap space available on the nodes for the install. More detail on these messages will appear during the graphical user interface install in 10.4, “Oracle Grid Infrastructure install” on page 86. Continue with the install and ignore these messages for now, and again during the install.

10.4 Oracle Grid Infrastructure install

To install the Oracle Grid Infrastructure, perform the following steps after prerequisites have been satisfied or ignored:

1. Run the **runInstaller** command from the VNC viewer. This command can be found in the /grid directory. Figure 10-1 shows the start of the Oracle Grid Infrastructure install, which provides the option to download software updates for the install.

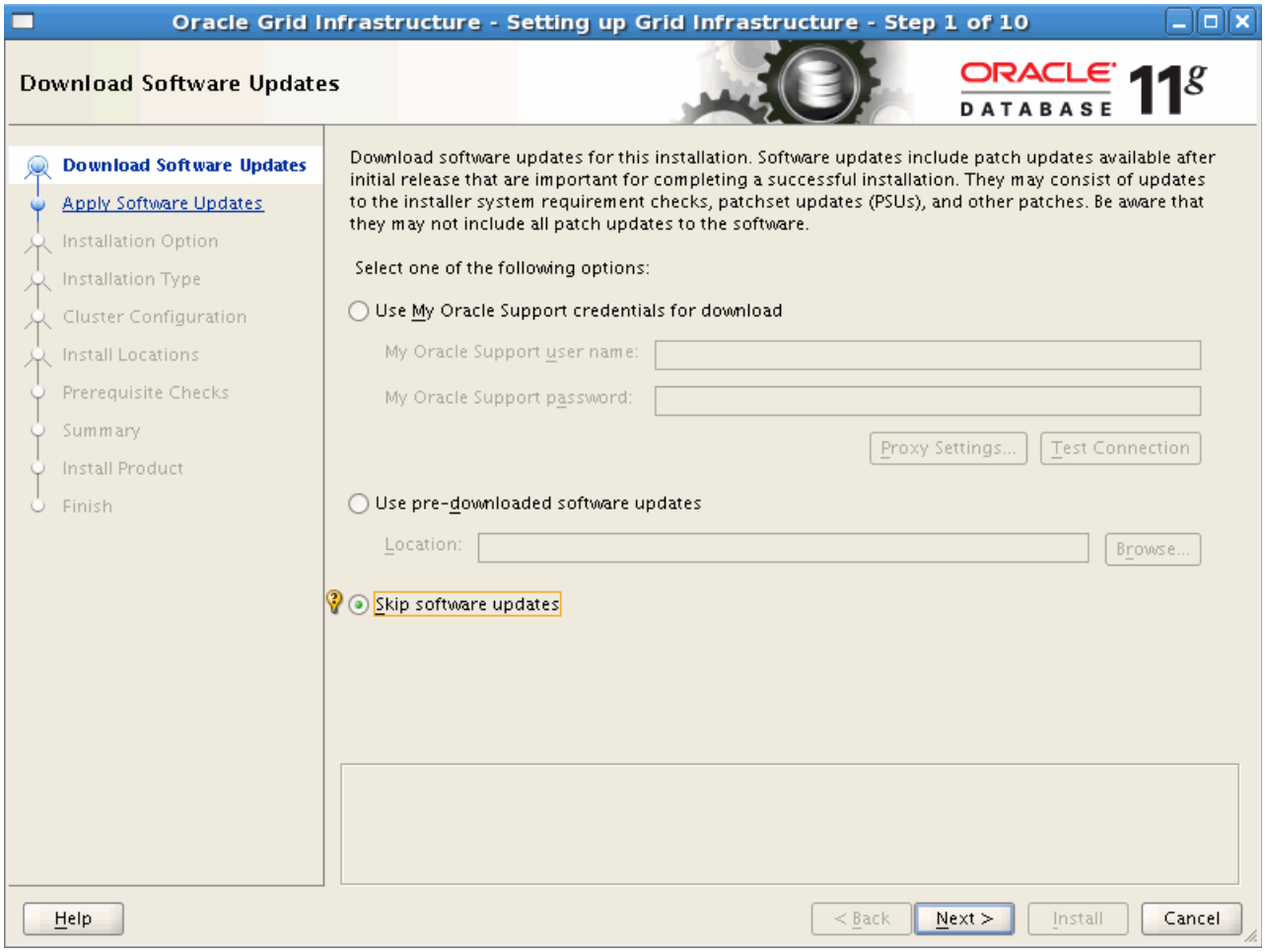

Figure 10-1 Grid Infrastructure install-initial window

2. In this example, software updates will be skipped. Click **Next**.

Figure 10-2 provides installation options. In this example, **Install and Configure Oracle Grid Infrastructure for a Cluster** has been selected. Click **Next**.

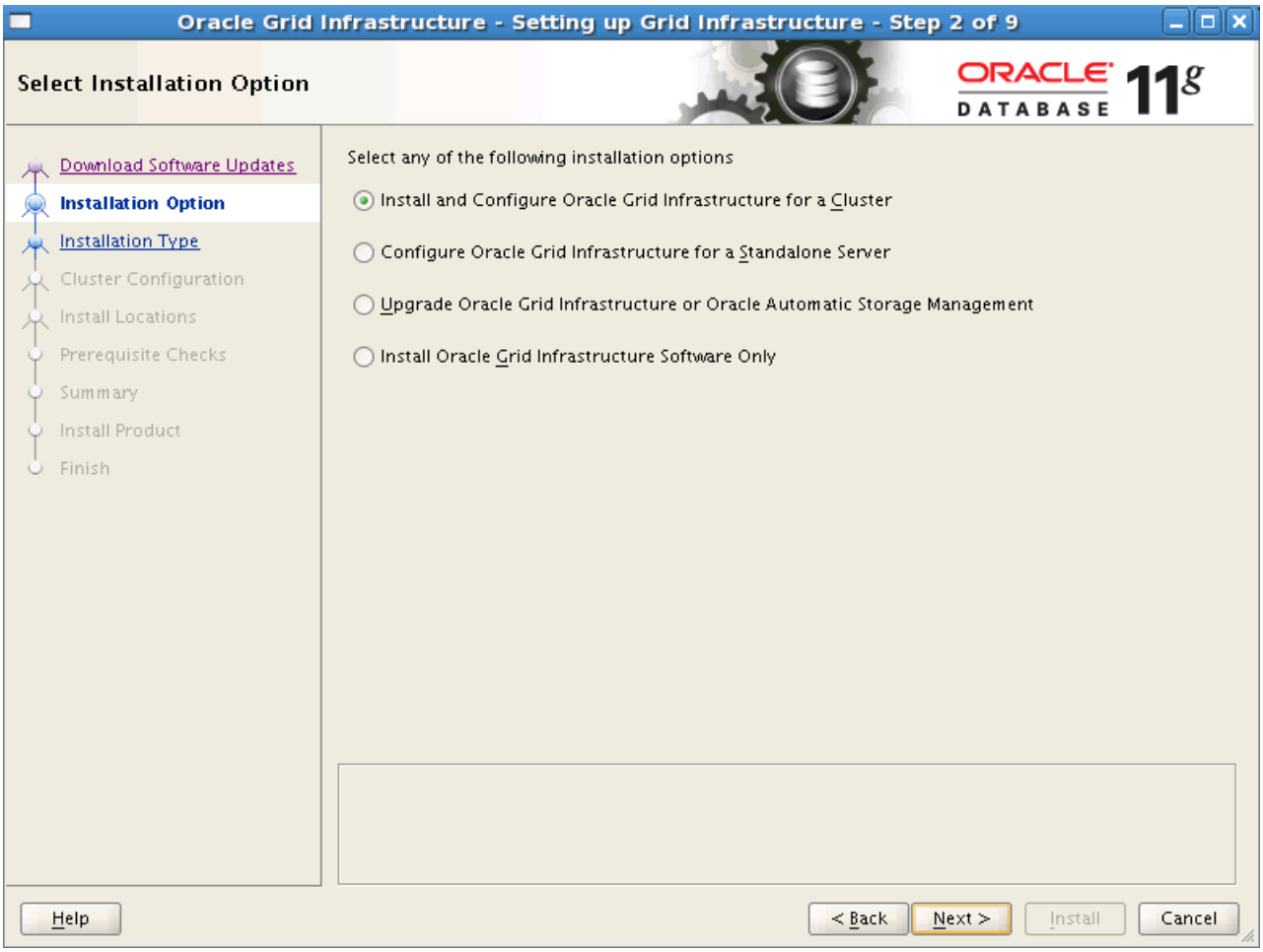

Figure 10-2 Grid Infrastructure Install-installation options

3. In the window shown in Figure 10-3, you can choose between a typical and advanced installation. Select **Typical Installation** and click **Next**.

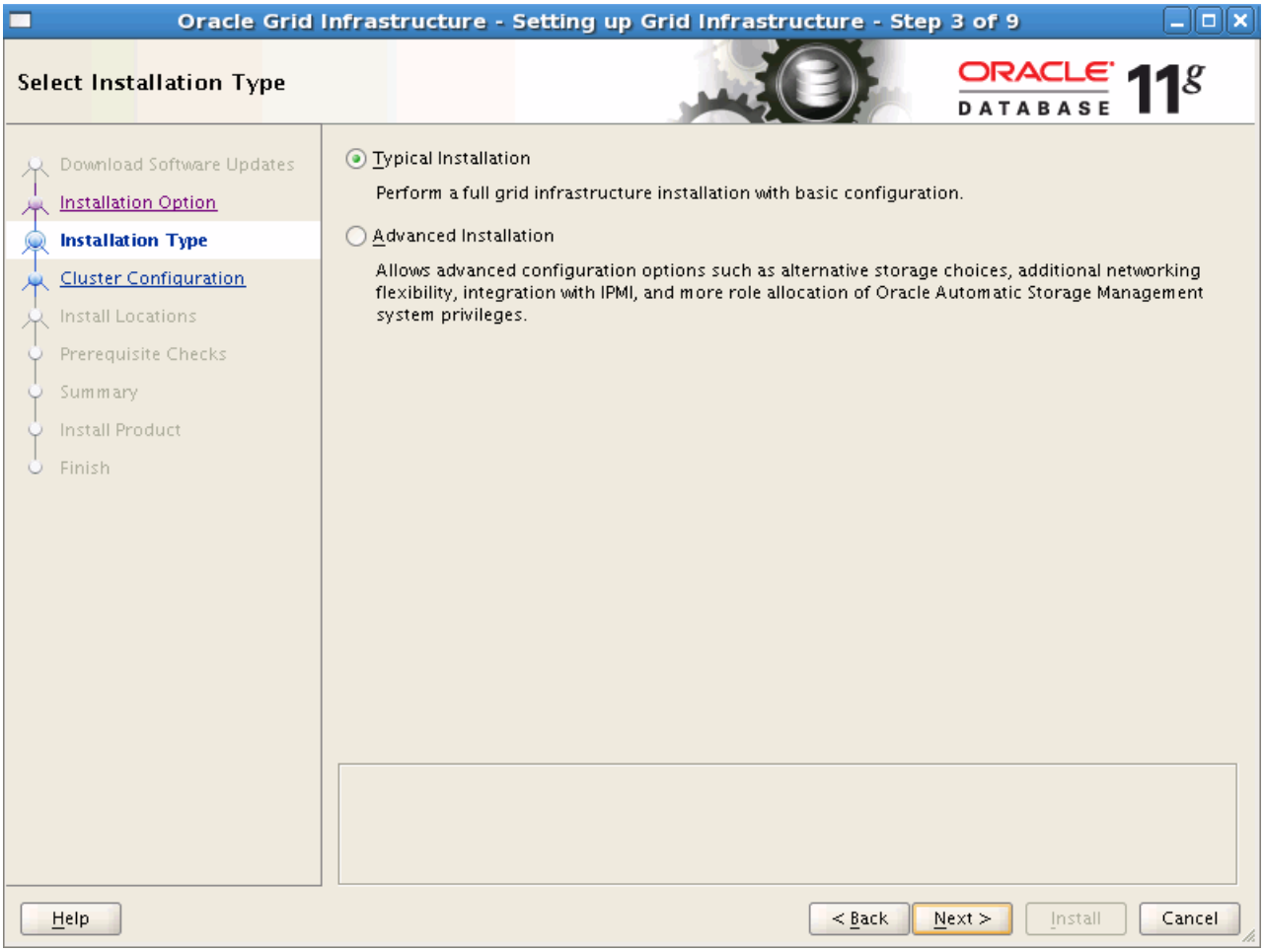

Figure 10-3 Selecting the type of installation

4. Specify Cluster Configuration window shown in Figure 10-4 allows specification of basic configuration information for the grid infrastructure. Note that SCAN name and node names are already identified. Click **Next** to continue.

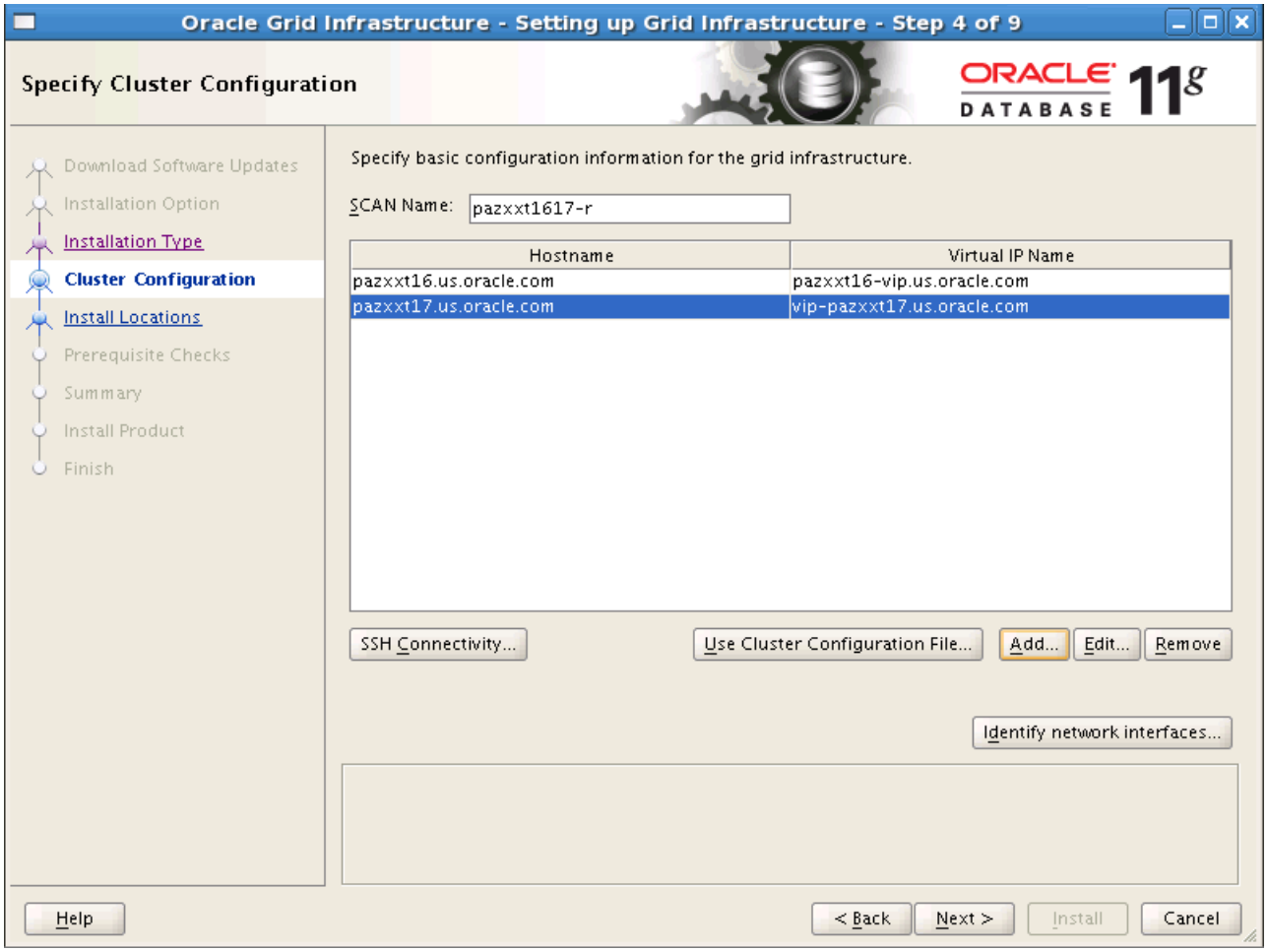

Figure 10-4 Basic configuration information

5. The Specify Install Locations window displays as shown in Figure 10-5 on page 90. The Oracle base directory for the grid installation owner is the location where diagnostic and administrative logs and other logs associated with Oracle ASM and Oracle clusterware are

stored. The Oracle Grid Infrastructure home cannot be placed under the base directory because the home owner gets changed to root during the infrastructure install, which will cause file permission errors. Click **Next** when you are ready to continue.

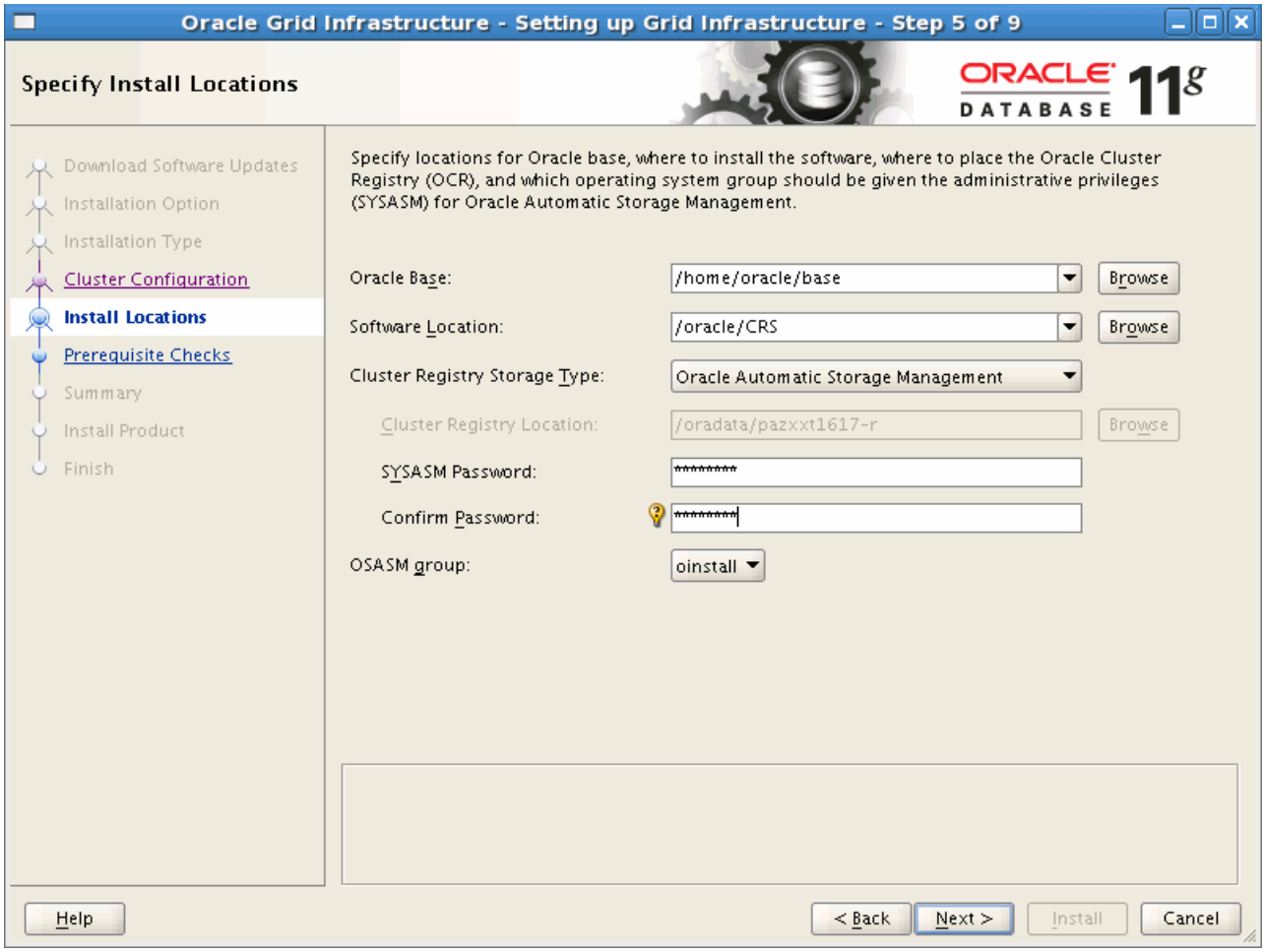

Figure 10-5 Specifying location

6. The Create ASM Disk Group window, shown in Figure 10-6, allows selection of disk group characteristics and disks. See Appendix A, “Configuring Linux storage using DASD or FCP/SCSI” on page 117 for details about how to set the correct disk permissions for the ASM disk. Click **Next** to continue.

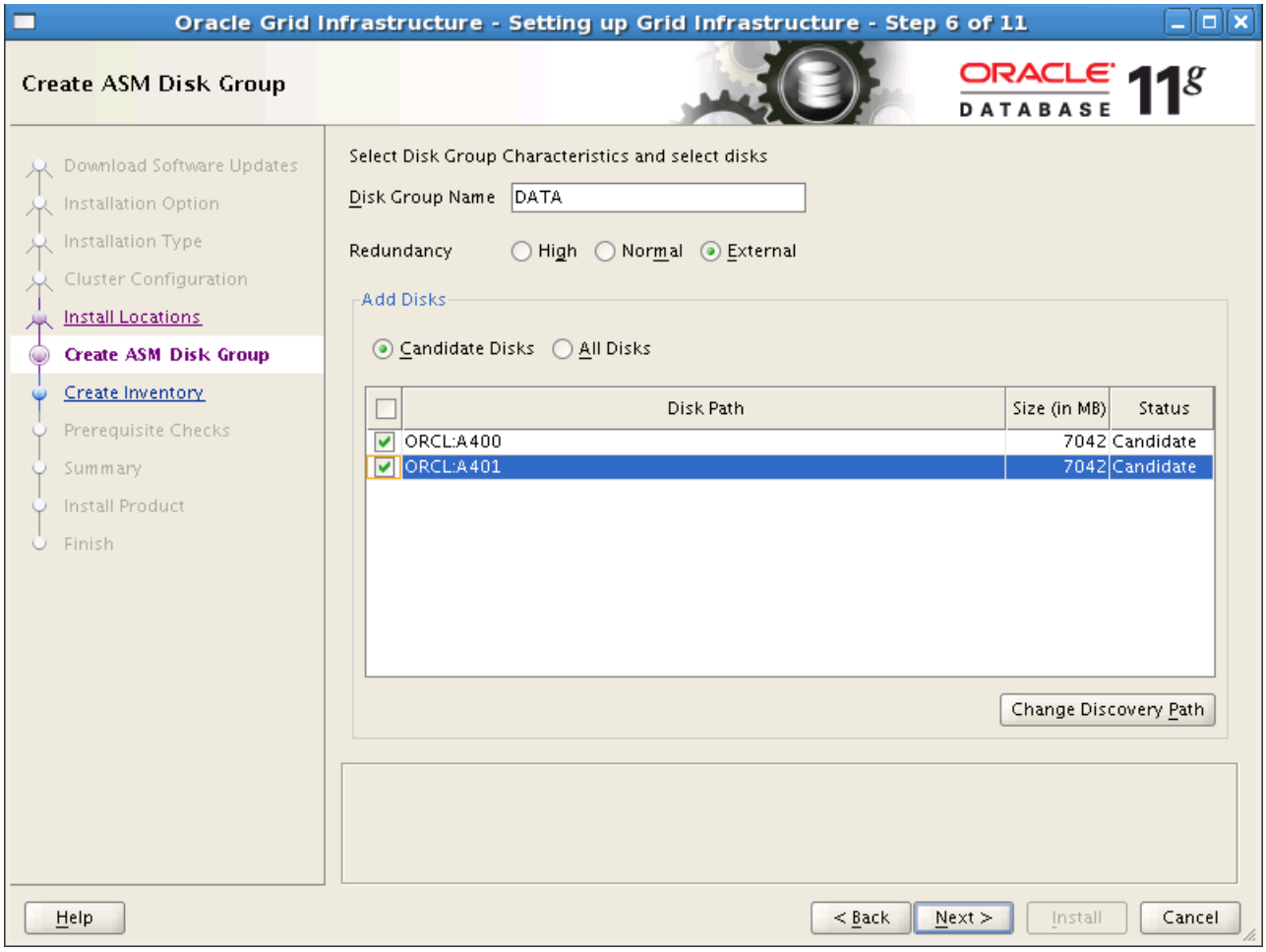

Figure 10-6 ASM configuration

7. The Create Inventory window is shown in Figure 10-7. Here you specify a directory for installation files. This directory is called the inventory directory. In this example, the inventory directory is `/home/oracle/orainventory`. Click **Next** to continue.

Figure 10-7 The Inventory Directory

8. The prerequisite check panel displays. In this example, some of the minimum requirements for installation were not completed. Select the **Ignore All** check box in the upper right corner of the panel (Figure 10-8).

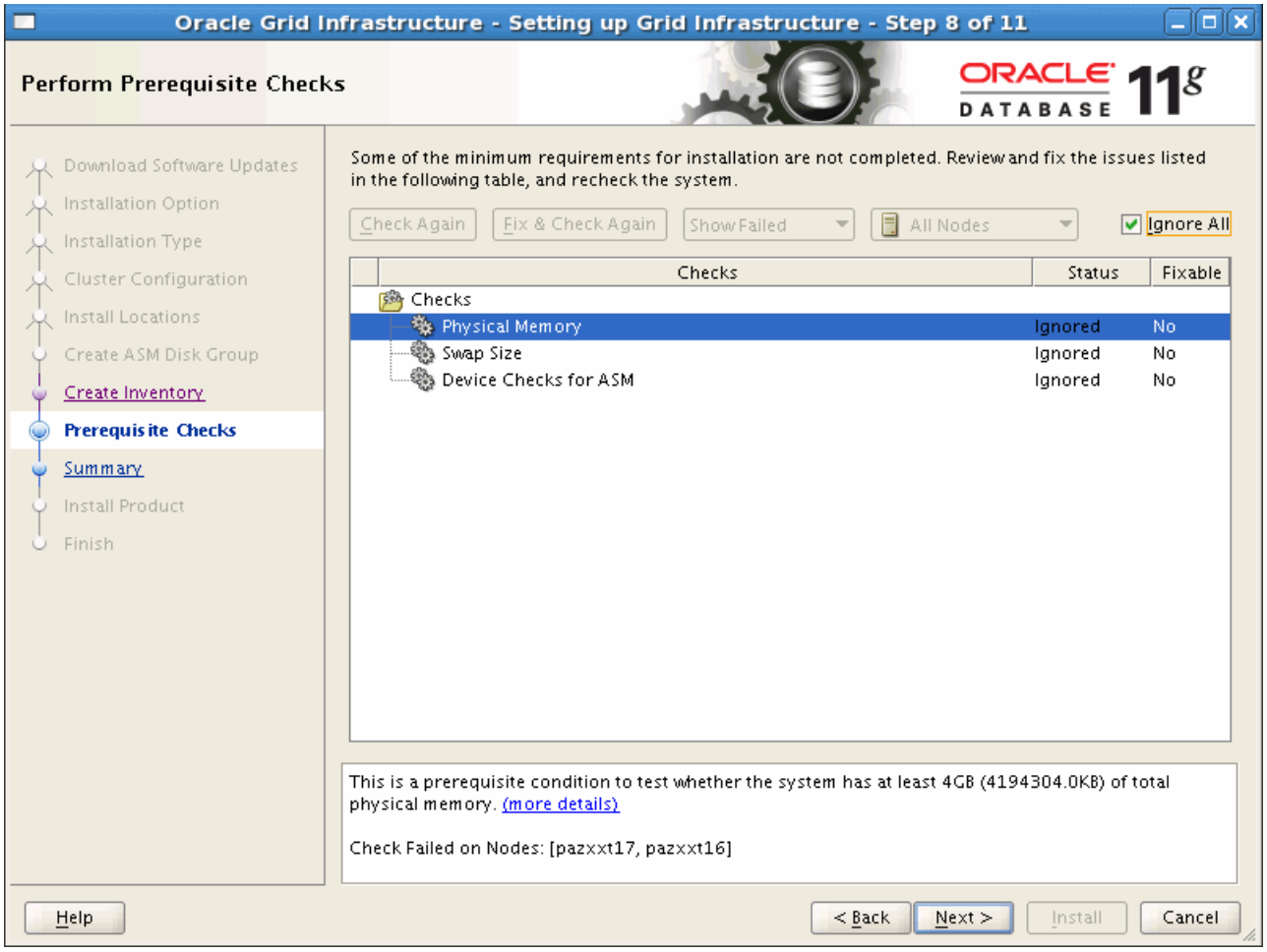

Figure 10-8 Prerequisite checking ignored

If you click the **More details** link in the information box, the windows shown in Figure 10-9 are displayed with details about the prerequisites error.

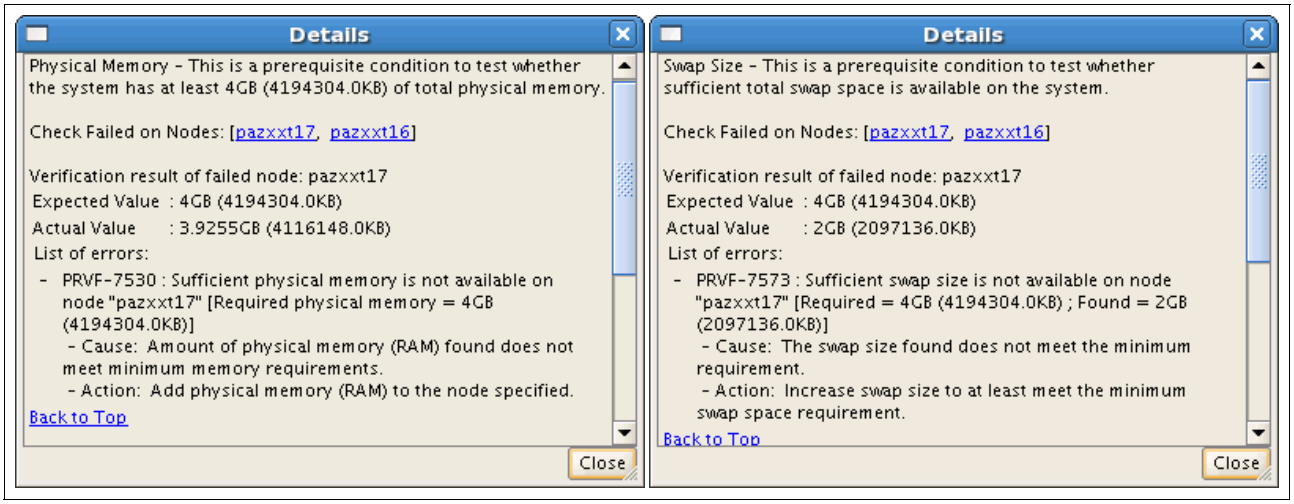

Figure 10-9 Physical memory and swap size prerequisite message details

The next details pop-up box displayed is shown in Figure 10-10. For this error message, see metalink note [ID 1210863.1] which can be found by searching at the following URL:

`https://support.oracle.com`

This note identifies the unpublished bug 10026970. According to this note, `if the ASM device passes manual verification, the message can be ignored`. Manual verifications include the ASMLIB status, the user setting in ASMLIB, and the disks have been verified. In this example, both ASM disks pass manual verification, so this message is ignored.

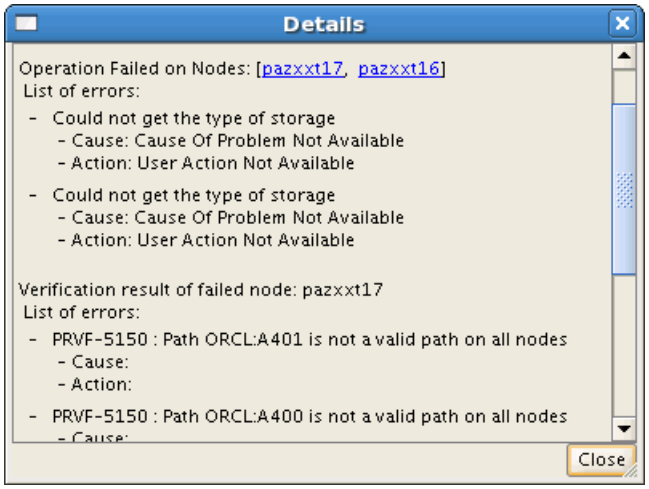

Figure 10-10 ASM device checks prerequisite message details

9. After all the pop-ups are closed, the Summary window displays as shown in Figure 10-11. This is page 1 of the Grid Infrastructure install summary page.

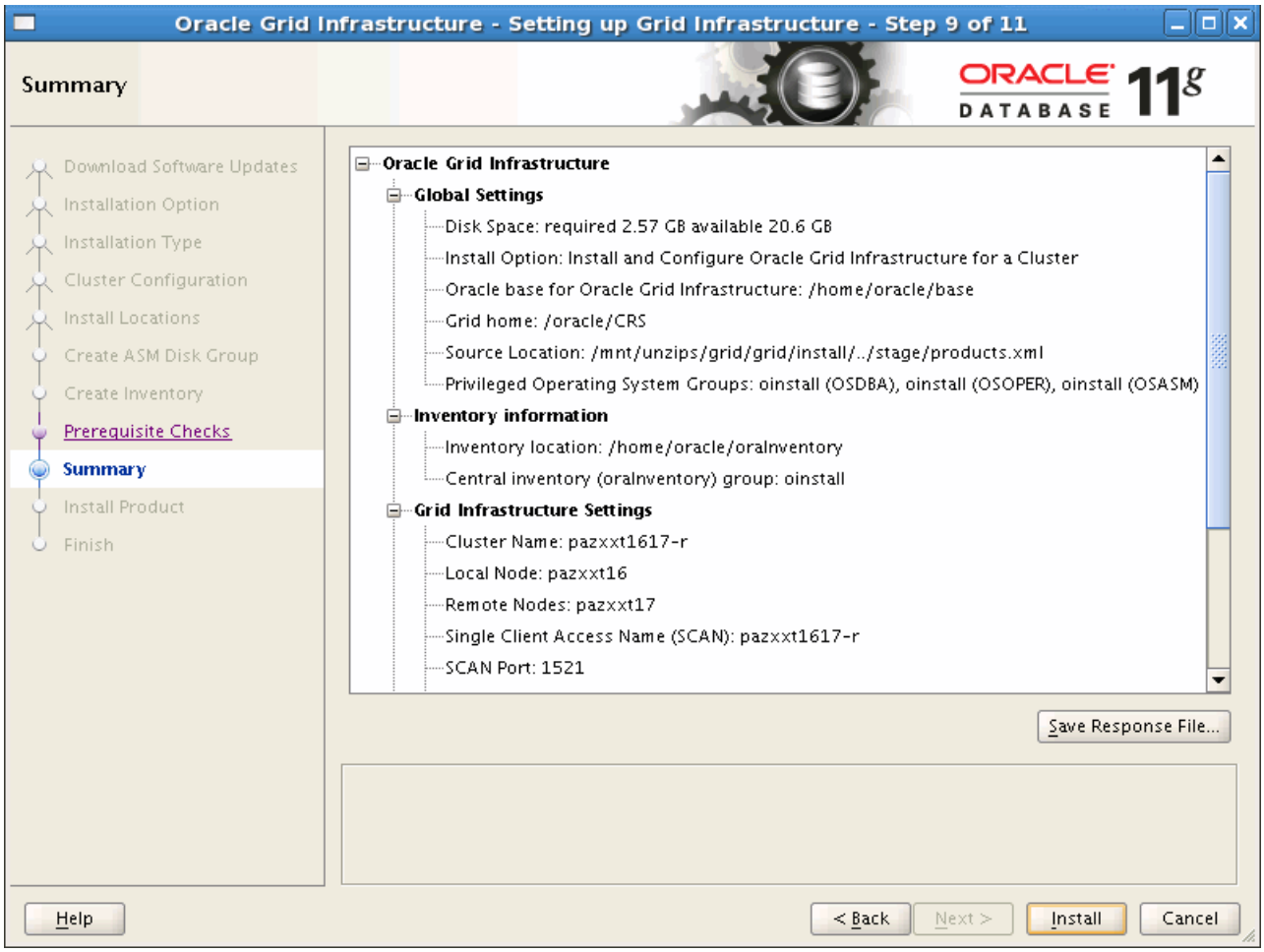

Figure 10-11 Grid Infrastructure install summary page 1

Page 2 of the Grid Infrastructure install summary page can be seen in Figure 10-12.

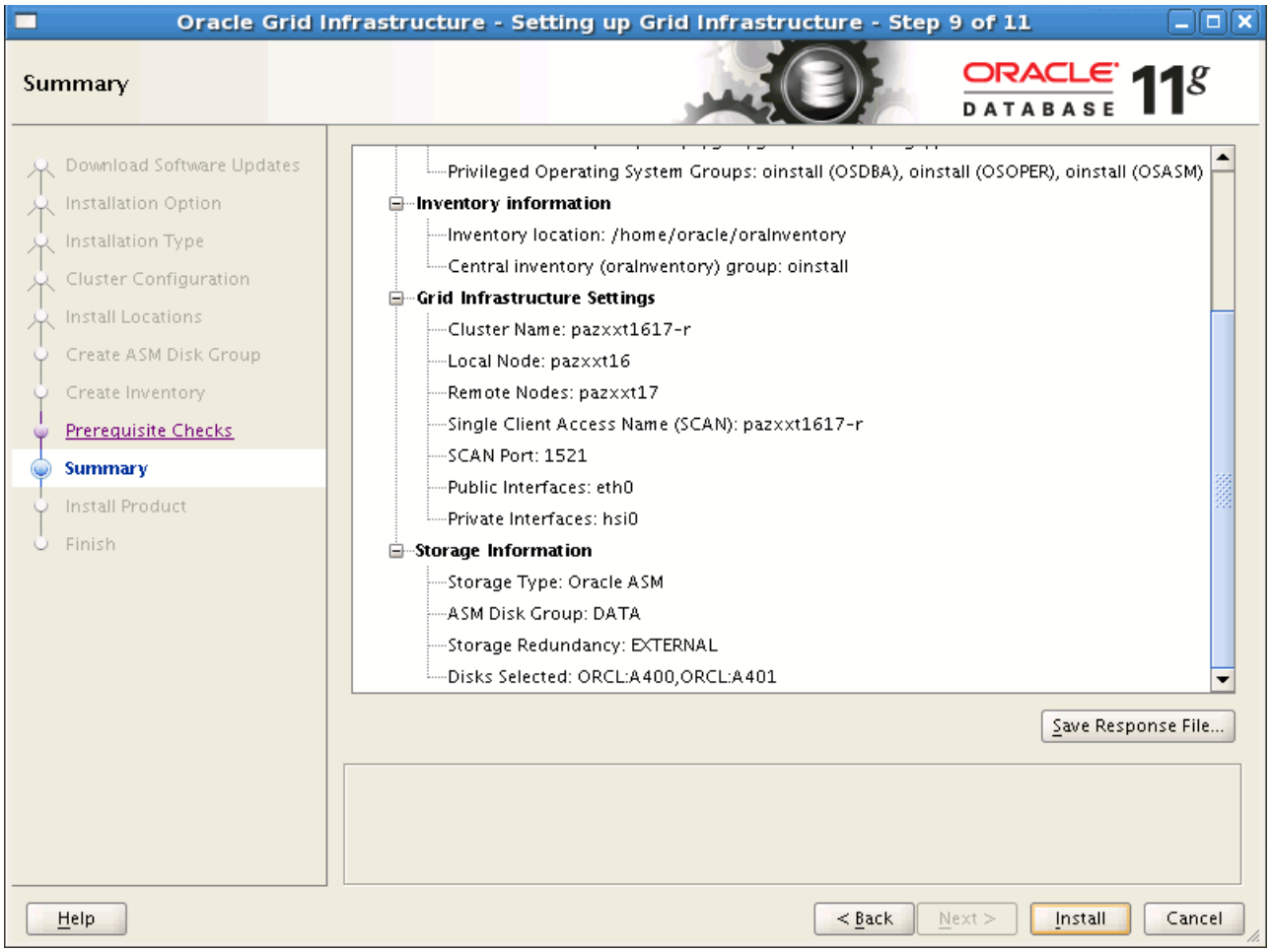

Figure 10-12 Grid Infrastructure install summary page 2

10. Click **Install**. A prompt to execute configuration scripts is presented as shown in Figure 10-13.

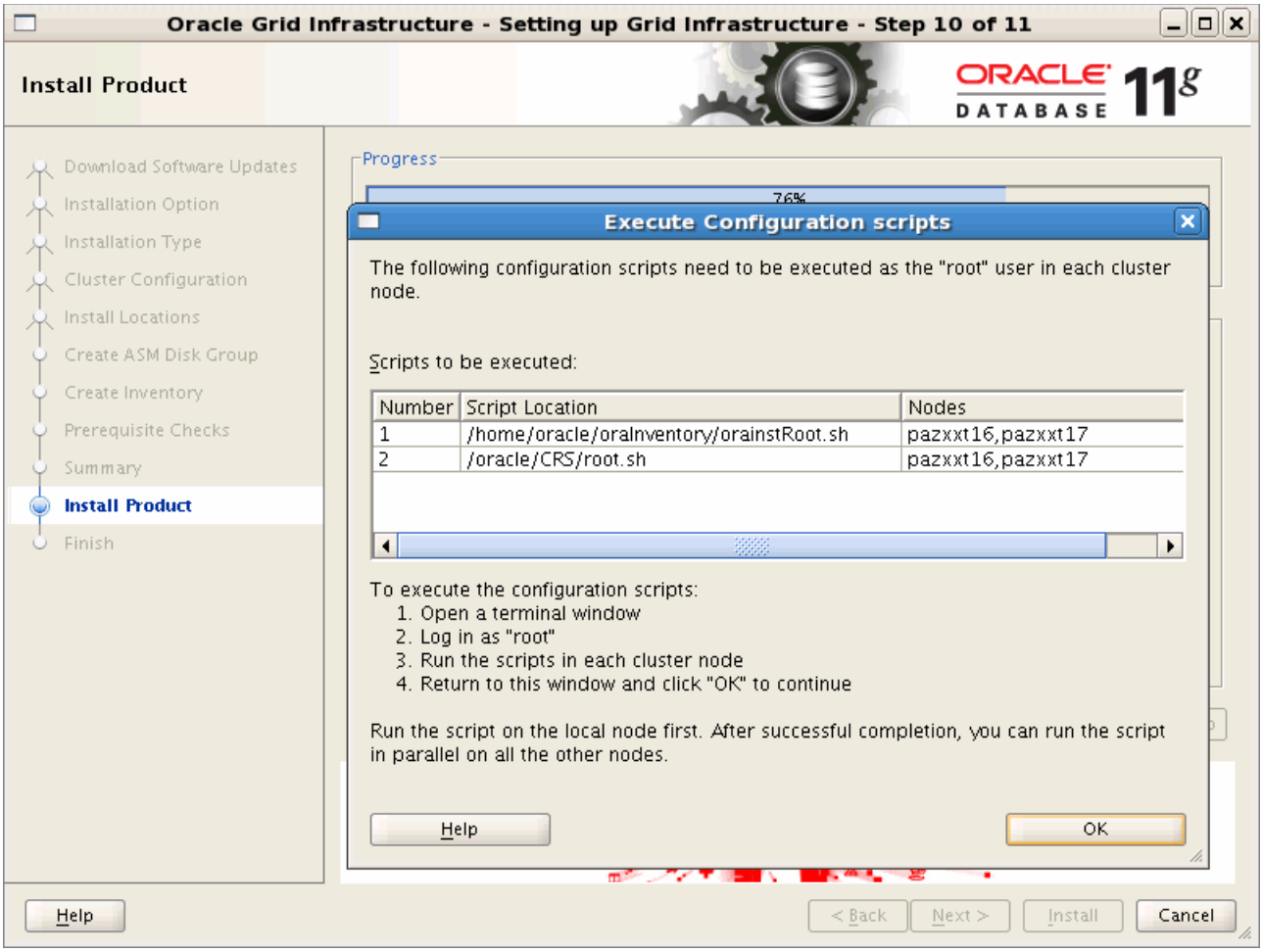

Figure 10-13 Prompt to execute configuration scripts

When the installation of the Oracle grid infrastructure for a cluster has completed successfully, Figure 10-14 will be displayed.

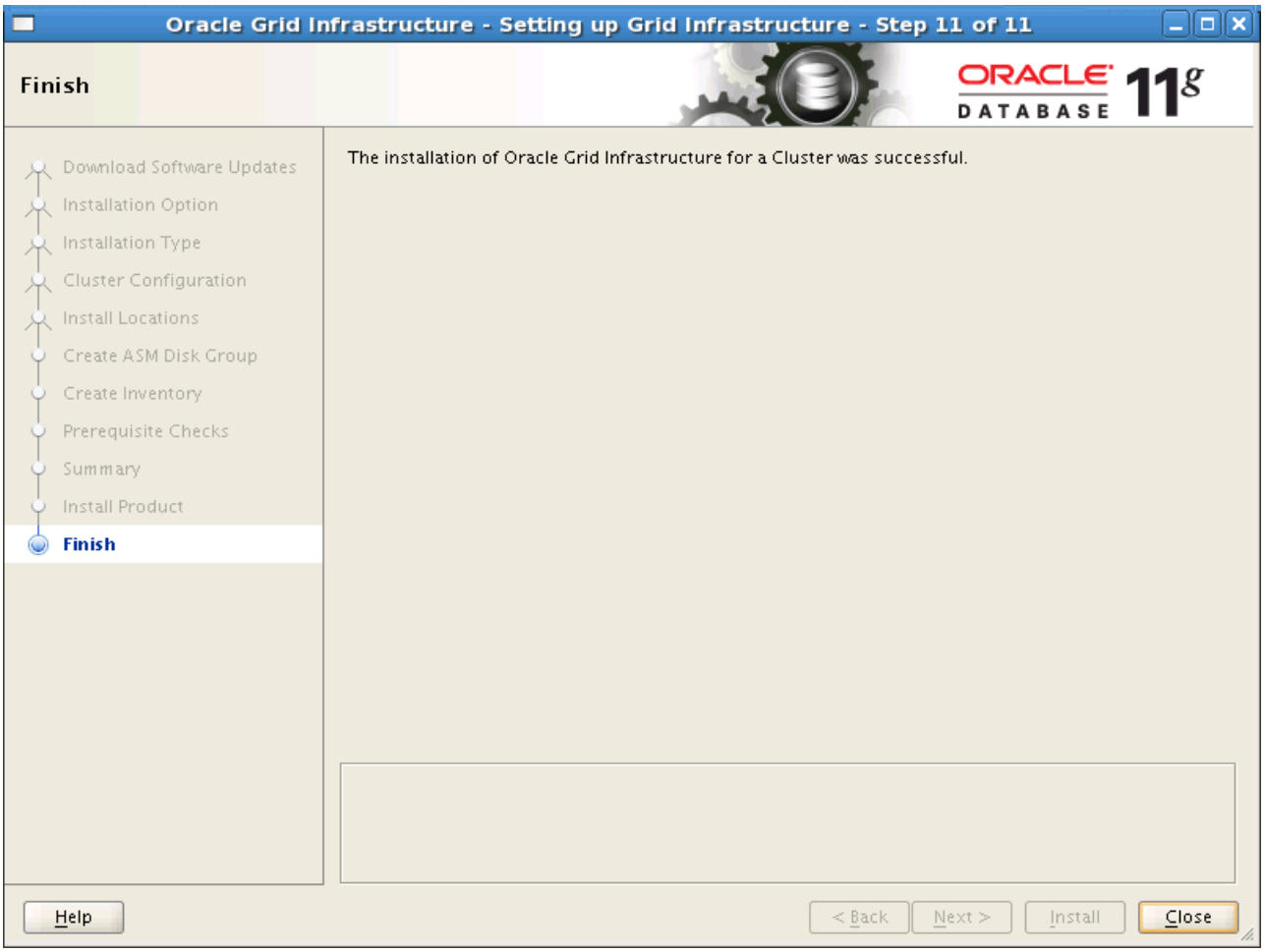

Figure 10-14 Grid Infrastructure install successful completion panel

Now that the Oracle Grid Infrastructure, including ASM, has been installed, we use the command **crsctl** to check the status of the CRS daemons on both nodes and use the command **srvctl** to check the status of ASM.

Example 10-4 shows the output of each and indicates CRS and ASM are running.

Example 10-4 Checking the status of CRS and ASM

```
[root@pazxxt16 ~]# /oracle/CRS/bin/crsctl check crs
CRS-4638: Oracle High Availability Services is online
CRS-4537: Cluster Ready Services is online
CRS-4529: Cluster Synchronization Services is online
CRS-4533: Event Manager is online

[root@pazxxt17 ~]# /oracle/CRS/bin/crsctl check crs
CRS-4638: Oracle High Availability Services is online
CRS-4537: Cluster Ready Services is online
CRS-4529: Cluster Synchronization Services is online
CRS-4533: Event Manager is online

[root@pazxxt16 grid]# /oracle/CRS/bin/srvctl status asm
```

```
ASM is running on pazxxt16,pazxxt17
```

10.5 Oracle RAC install

After the Grid Infrastructure is installed, run the Cluster Verification Utility, a portion of which is shown in Example 10-5, to ensure system readiness for a RAC database install.

Example 10-5 Cluster Verification Utility output

```
[oracle@pazxxt16 grid]$ ./runcluvfy.sh stage -pre dbinst -n pazxxt16,pazxxt17
Performing pre-checks for database installation
Checking node reachability...
Node reachability check passed from node "pazxxt16"
Checking user equivalence...
User equivalence check passed for user "oracle"
Checking node connectivity...
Checking hosts config file...
Verification of the hosts config file successful
Check: Node connectivity for interface "eth0"
Node connectivity passed for interface "eth0"
Check: Node connectivity for interface "hsi0"
Node connectivity passed for interface "hsi0"
Node connectivity check passed
Total memory check failed 1
Check failed on nodes:
        pazxxt17,pazxxt16
Available memory check passed
Swap space check failed 2
Check failed on nodes:
        pazxxt17,pazxxt16
Free disk space check passed for "pazxxt17:/oracle/CRS,pazxxt17:/oracle/tmp"
Free disk space check passed for "pazxxt16:/oracle/CRS,pazxxt16:/oracle/tmp"
Check for multiple users with UID value 501 passed
....
```

The same two error messages, `Total Memory check failed` and `Swap space check failed` (indicated by numbers 1 and 2 in Example 10-5) generated by the cluster verification utility during the CRS prerequisite check show up during the database (RAC) prerequisite check. There is less than the recommended 4 GB of memory and 4 GB of swap space available on the nodes for our install. We will continue with the RAC install and ignore these messages. In our example, a single instance was installed successfully with only 1 GB of memory available. The issue is performance and the sizing of the SGA, PGA, and buffers. Even 4 GB is probably too small except for the simplest of database systems. Similarly, swapping needs to be monitored and adjustments made as necessary.

To install Oracle RAC after the prerequisites have been satisfied or ignored, perform the following steps:

1. Run the **runInstaller** command from a VMC viewer. The Oracle Database 11gR2 Installer opens to step 1 of 11 as shown in Figure 10-15 on page 100.

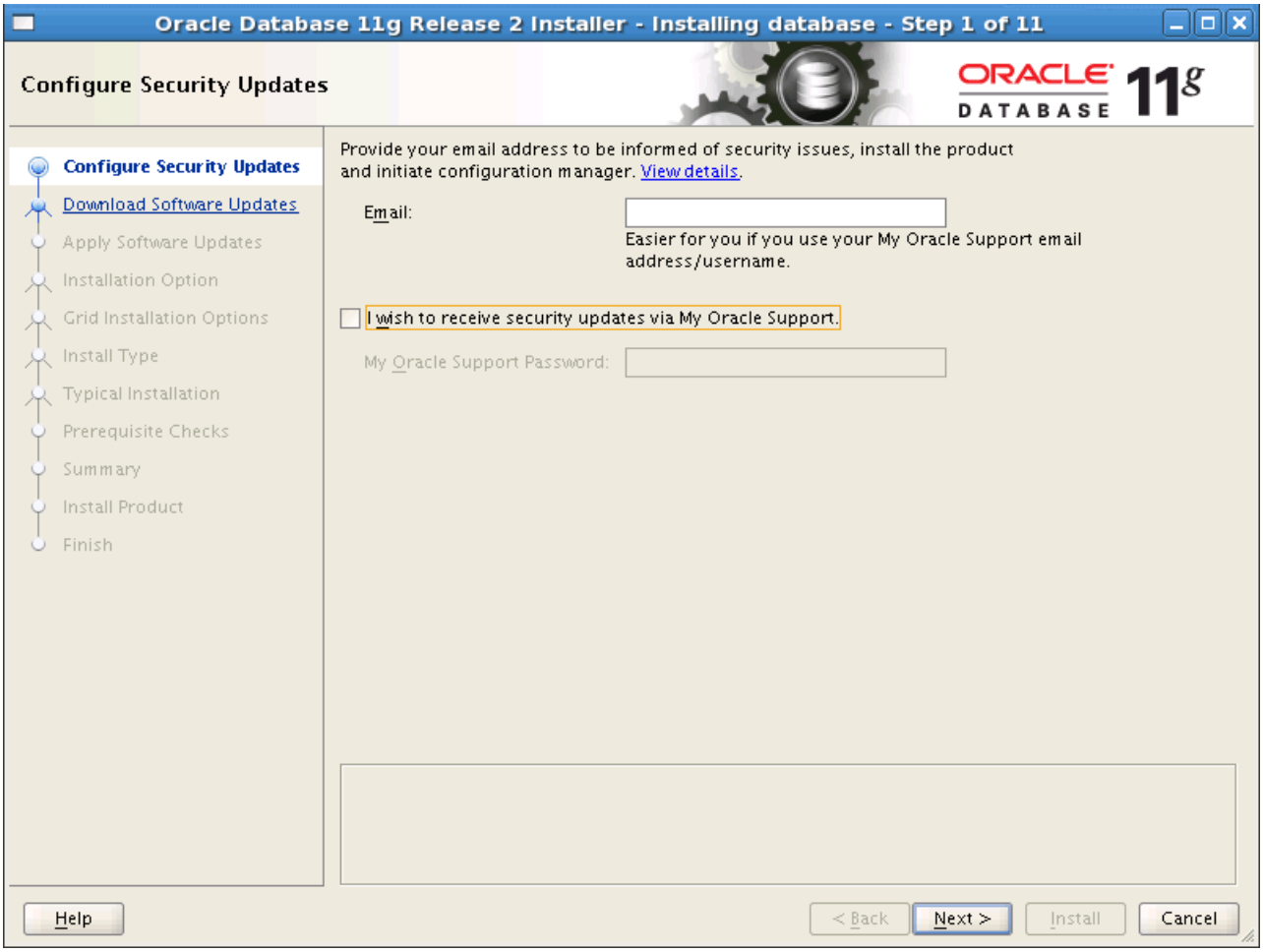

Figure 10-15 Step 1 of 11 - Providing an email address

2. Provide your email address and click **Next** to continue.

If you do not provide a valid email address, the message shown in Figure 10-16 is displayed. If you choose not to provide an email address, you will not receive information about critical security issues in your configuration. Click **Yes** or **No**, and then either enter your email address and click **Next** or just click **Next**.

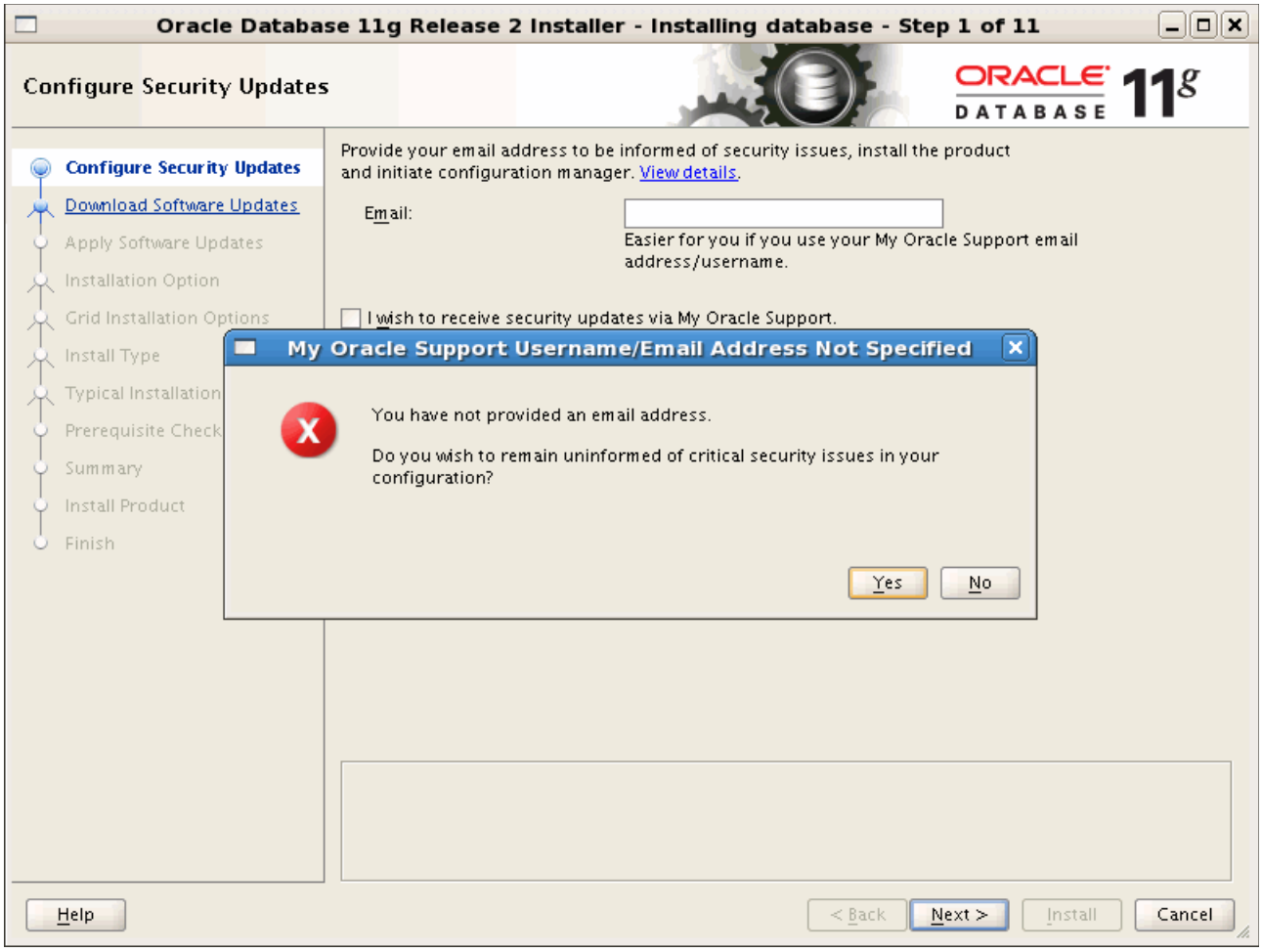

Figure 10-16 No support message

3. The Download Software Updates window, shown in Figure 10-17, provides the opportunity to download software updates for the installation. In our example, we choose to skip software updates. Click **Next** to continue.

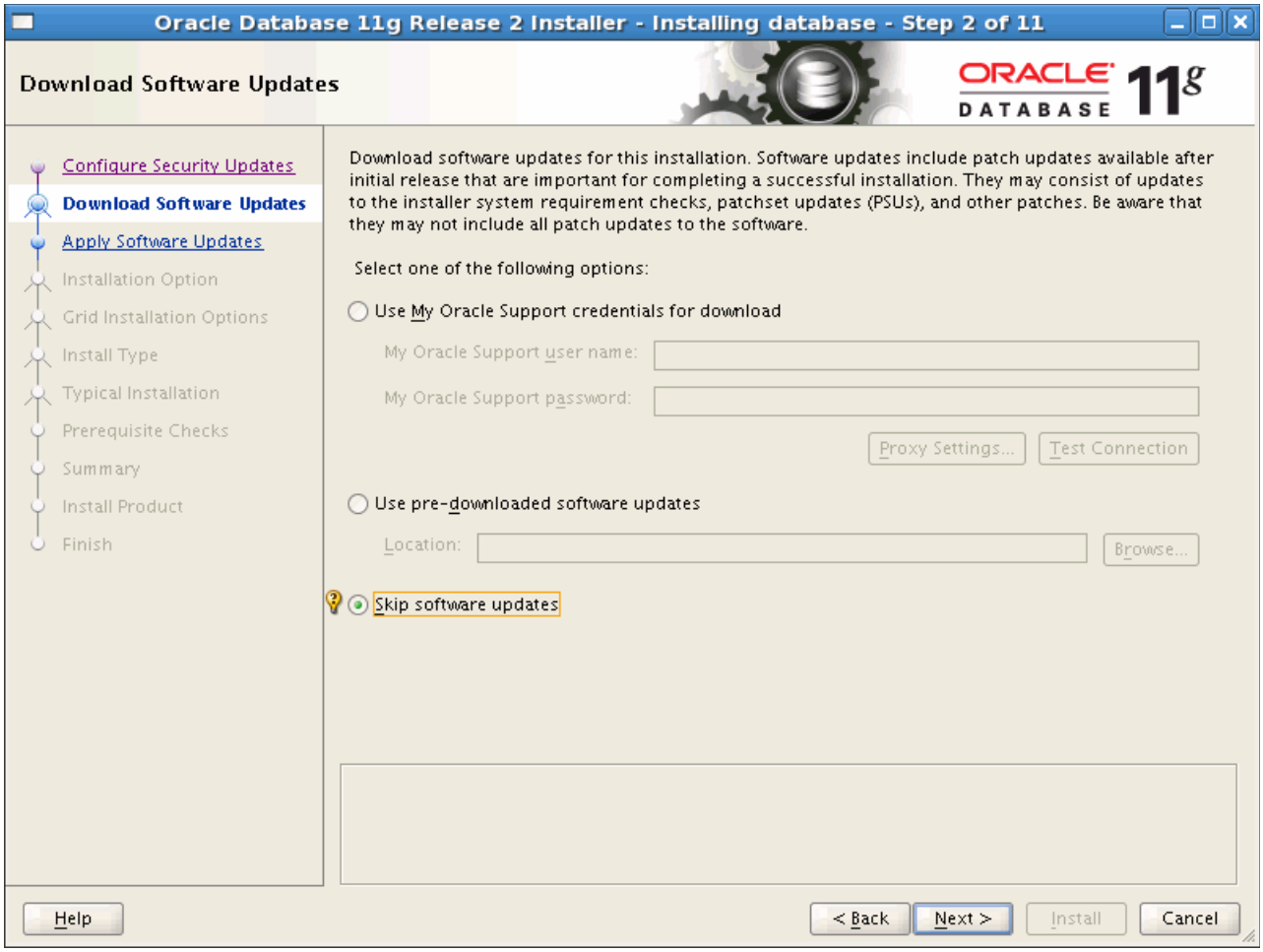

Figure 10-17 Download software update options

4. The Select Installation Option window (Figure 10-18) provides three installation options. In our example, we selected **Create and configure a database**. Click **Next** to continue.

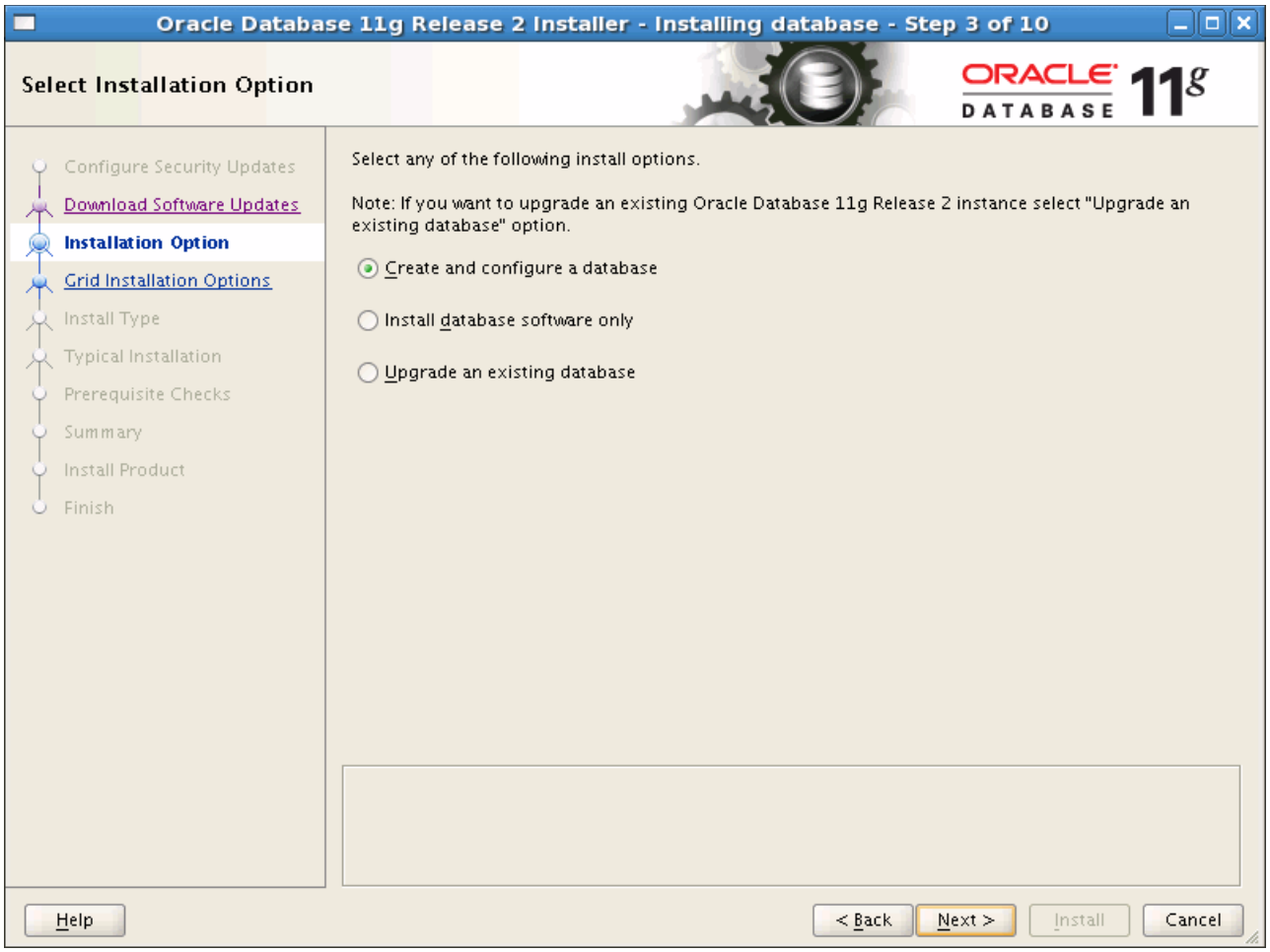

Figure 10-18 Installation options

5. The System Class window (Figure 10-19) allows you to select either a desktop class or server class system. In our example, we chose **Server Class**. Click **Next** to continue.

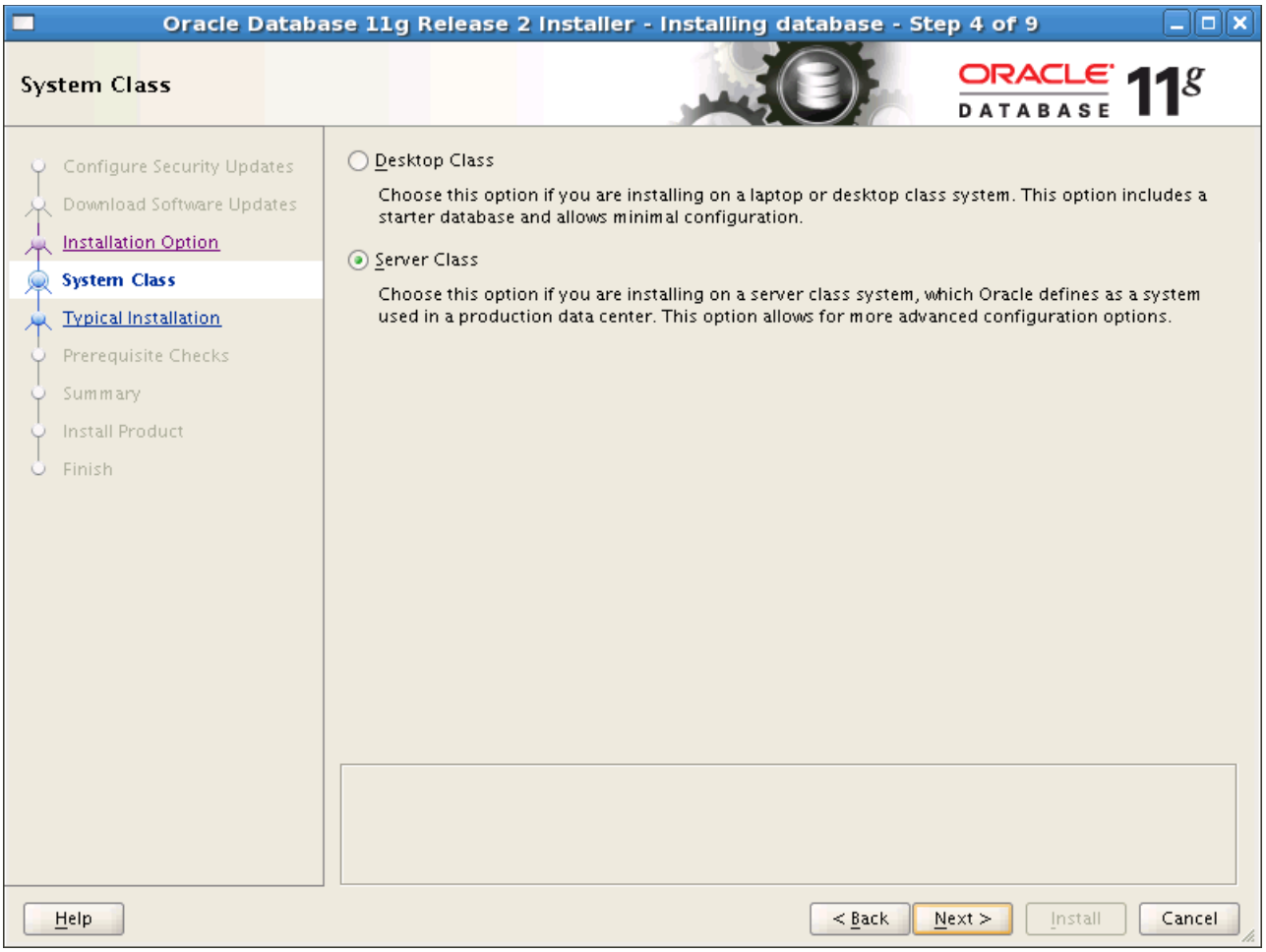

Figure 10-19 Selecting the server class system

6. The window shown in Figure 10-20 is displayed. Here, the type of database installation desired is selected. In this example, the **Oracle Real Application Clusters database installation** is selected. Note also the two nodes that are selected. This is for a two node cluster. Click **Next** to proceed.

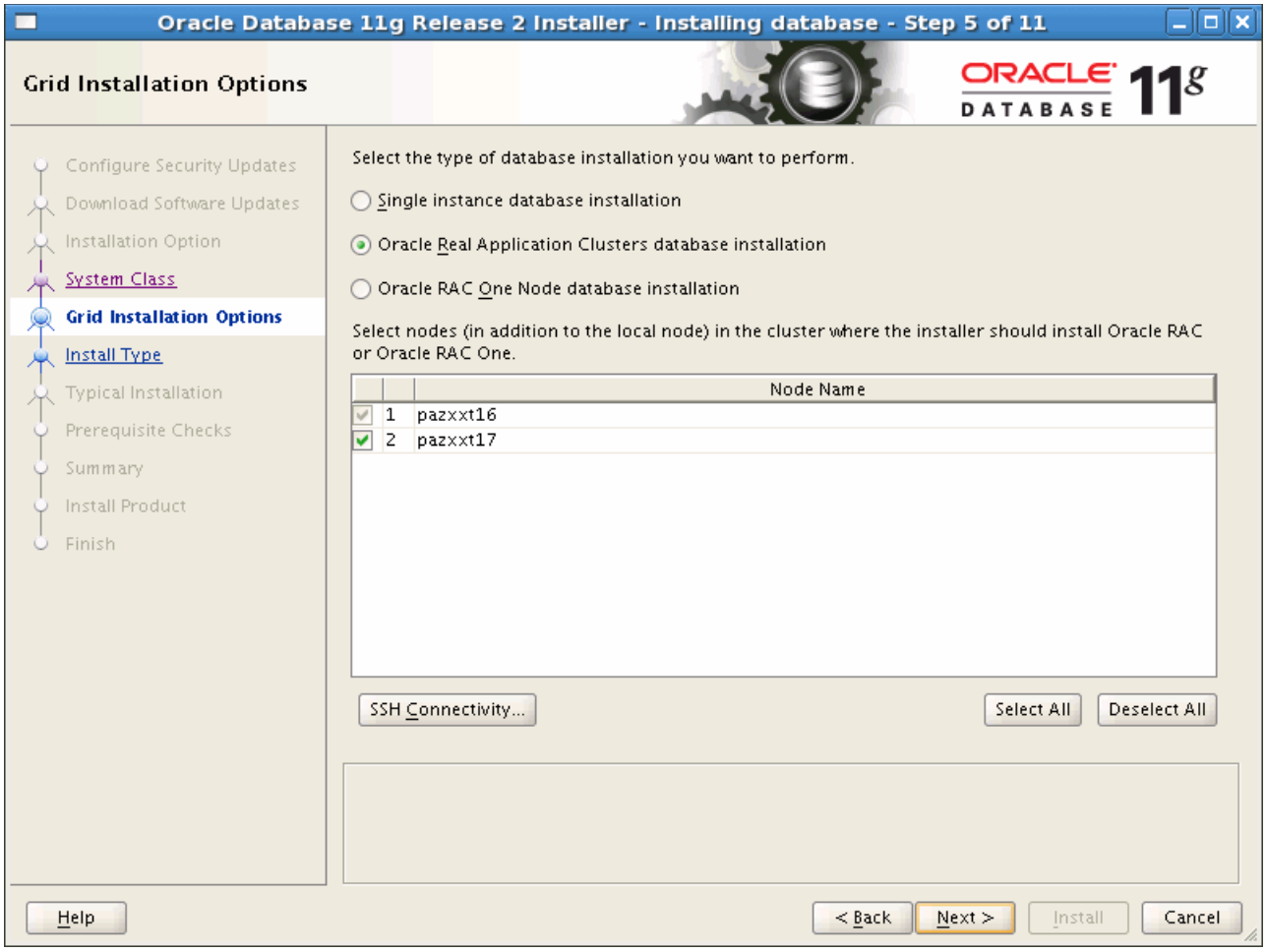

Figure 10-20 Choosing the type of database installation

7. A **Typical Install** is selected in Figure 10-21. Click **Next** to continue.

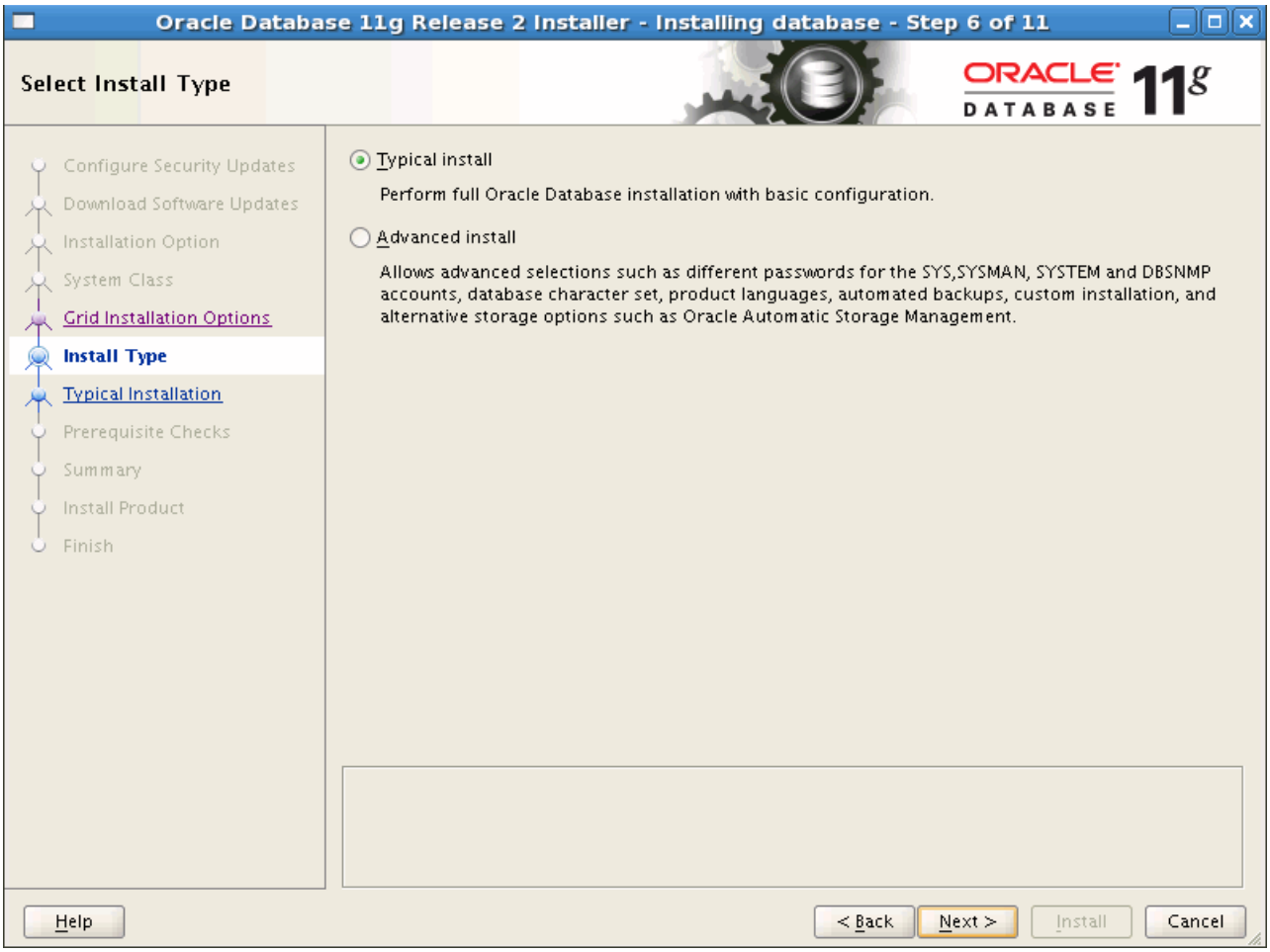

Figure 10-21 Perform a full Oracle database installation with basic configurations

8. The Typical Install Configuration window, shown in Figure 10-22, shows the basic configuration window for a full database installation. In this example, the owner user ID is `oracle` for both the Grid Infrastructure and RAC software. Due to file permission restrictions, the Grid Infrastructure home directory cannot be under the base directory. A separate RAC home directory was also created in this example. Click **Next** to continue.

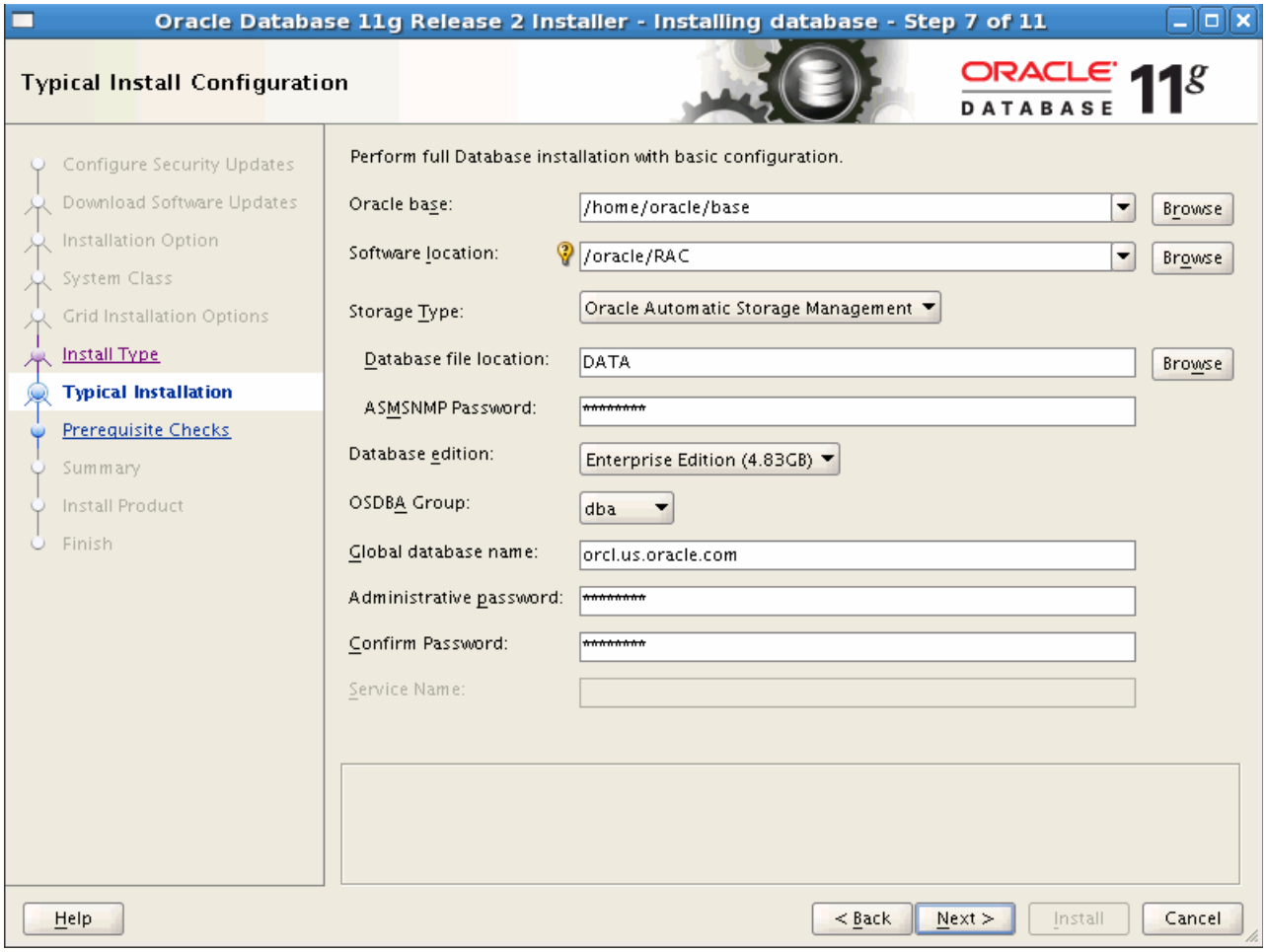

Figure 10-22 Basic configuration options

After installation of both the Grid and RAC, the diagnostic directory named `diag` appears as shown in Example 10-6.

Example 10-6 The diagnostic directory

```
[oracle@pazxxt16 ~]$ la $ORACLE_BASE/diag
total 44
drwxrwxr-x 11 oracle oinstall 4096 May  3 11:55 .
drwxr-xr-x  8 oracle oinstall 4096 May  3 12:09 ..
drwxrwxr-x  3 oracle oinstall 4096 May  3 08:34 asm
drwxrwxr-x  2 oracle oinstall 4096 May  3 11:55 clients
drwxrwxr-x  2 oracle oinstall 4096 May  3 11:55 crs
drwxrwxr-x  2 oracle oinstall 4096 May  3 11:55 diagtool
drwxrwxr-x  2 oracle oinstall 4096 May  3 11:55 lsnrctl
drwxrwxr-x  2 oracle oinstall 4096 May  3 11:55 netcman
drwxrwxr-x  2 oracle oinstall 4096 May  3 11:55 ofm
drwxrwxr-x  3 oracle oinstall 4096 May  3 12:09 rdbms
```

```
drwxrwxr-x  3 oracle oinstall 4096 May  3 11:16 tnslsnr
```

The diagnostic and administrative logs for the ASM on node `pazxxt16` will be in the directory named `asm` and for RAC on `pazxxt16`, in the directory named `rdbms`. It is set up identically on pazxxt17 for the instances that are running on that node.

9. A warning similar to Figure 10-23 is issued. This warning indicates that the RAC home is not under $ORACLE_BASE. This message can be safely ignored. Click **Yes**.

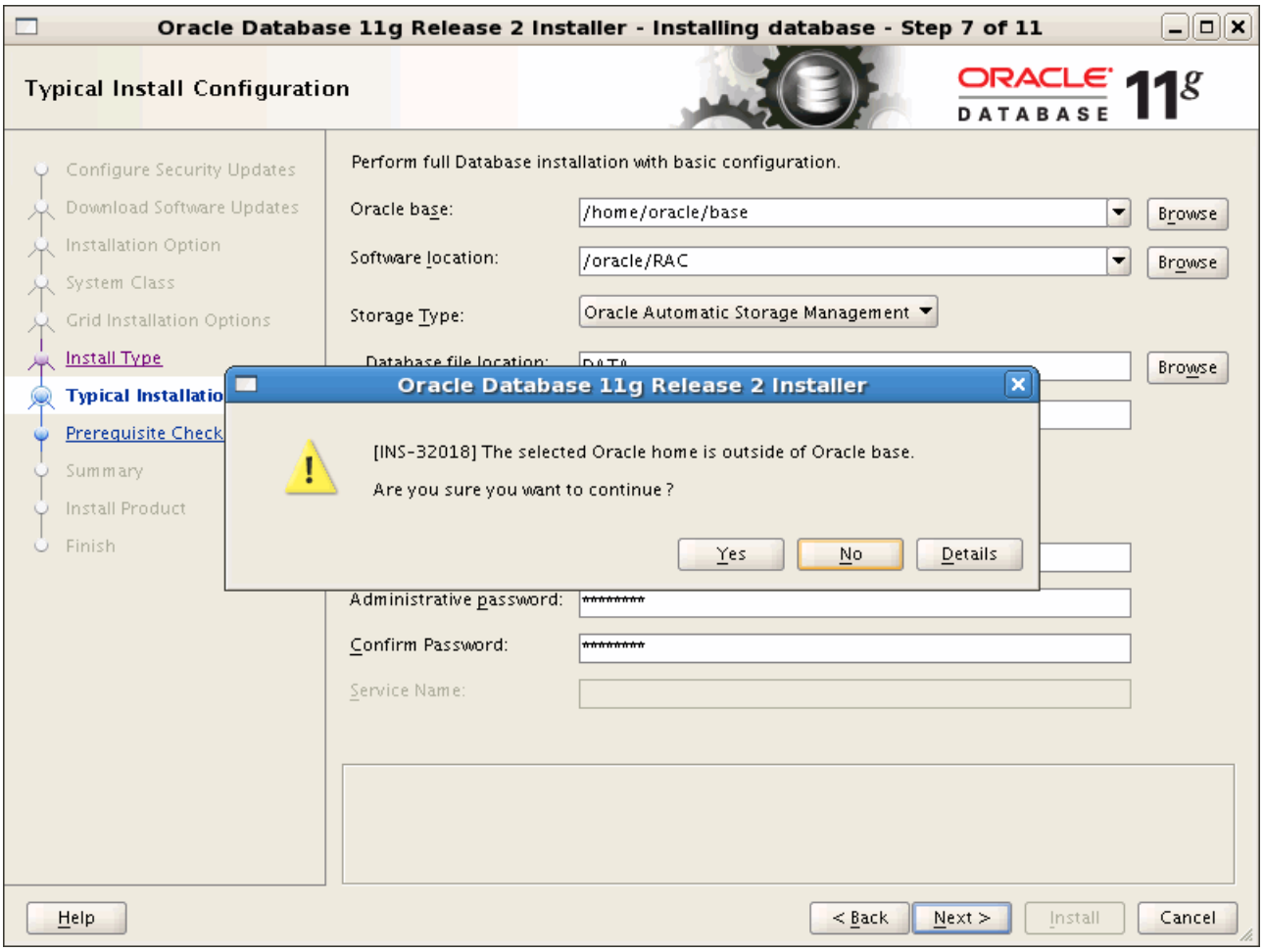

Figure 10-23 The selected Oracle home is outside of the Oracle base

10. Prerequisite checks will be performed as shown in Figure 10-24. A message stating that the check failed on the to nodes can be ignored at this time as well by selecting the **Ignore All** check box. Click **Next** to continue.

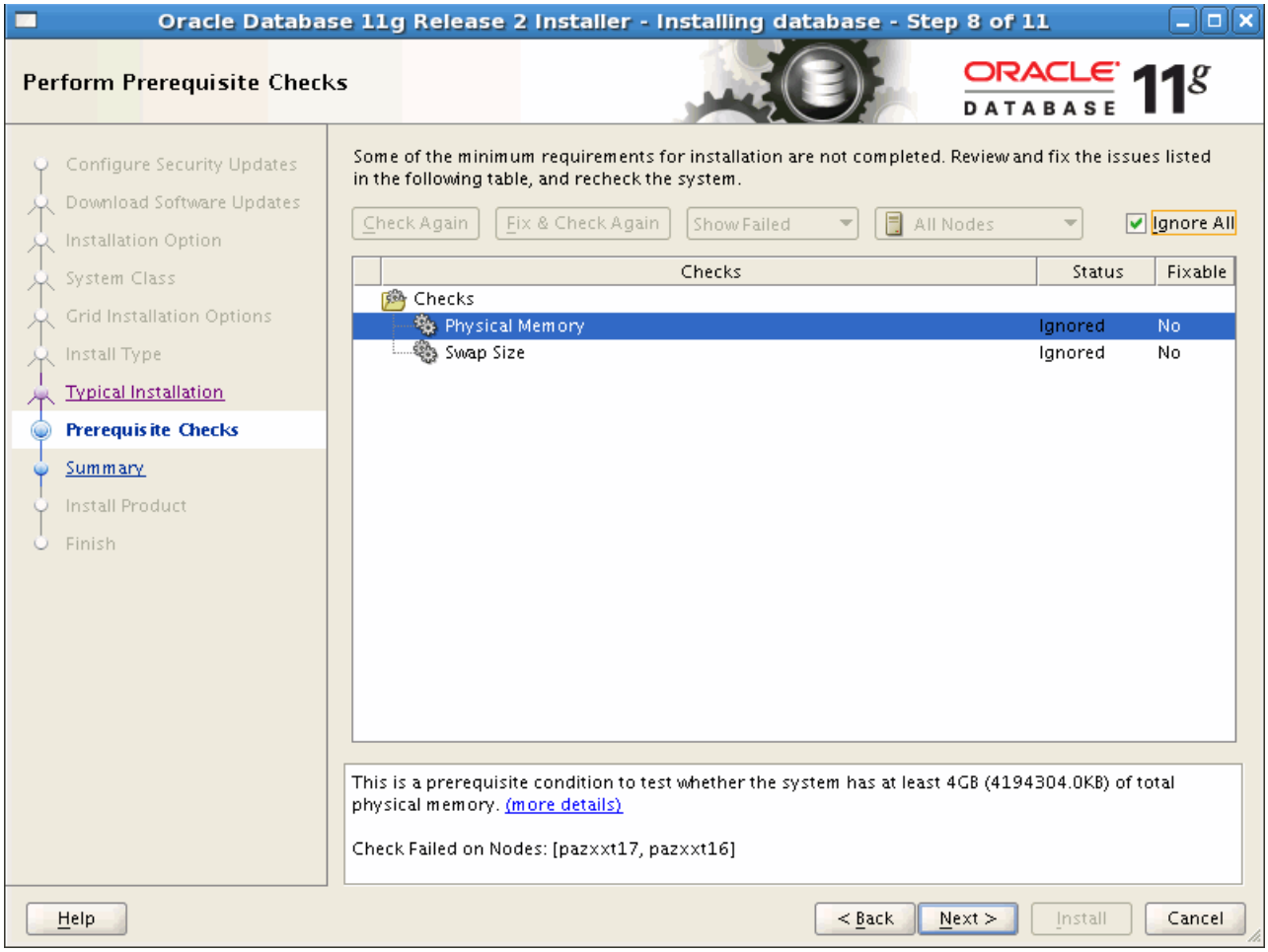

Figure 10-24 Prerequisite checks

11. The Install Summary windows display. Page 1 is shown in Figure 10-25.

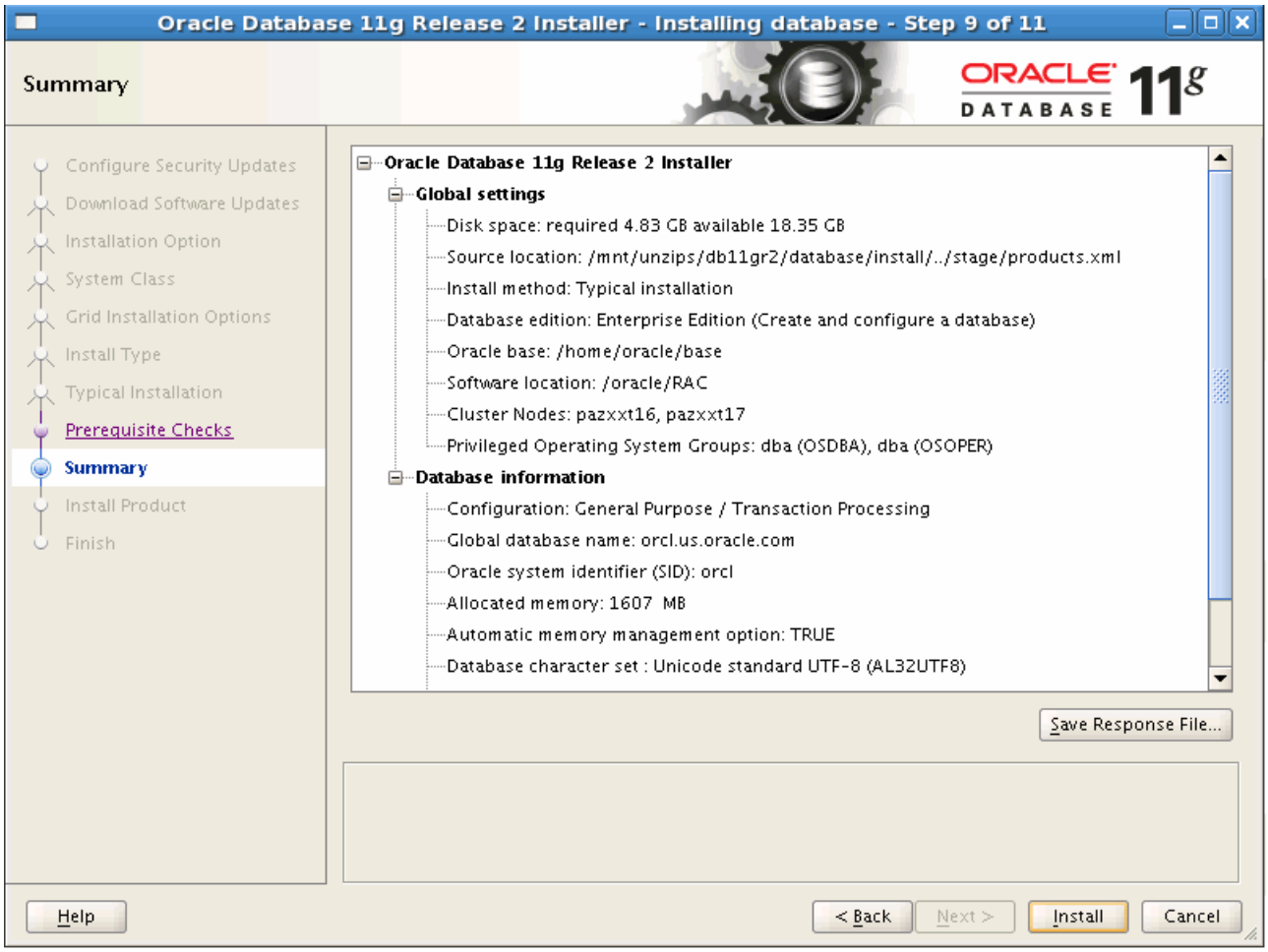

Figure 10-25 Install summary page 1

After scrolling, page 2 is shown in Figure 10-26.

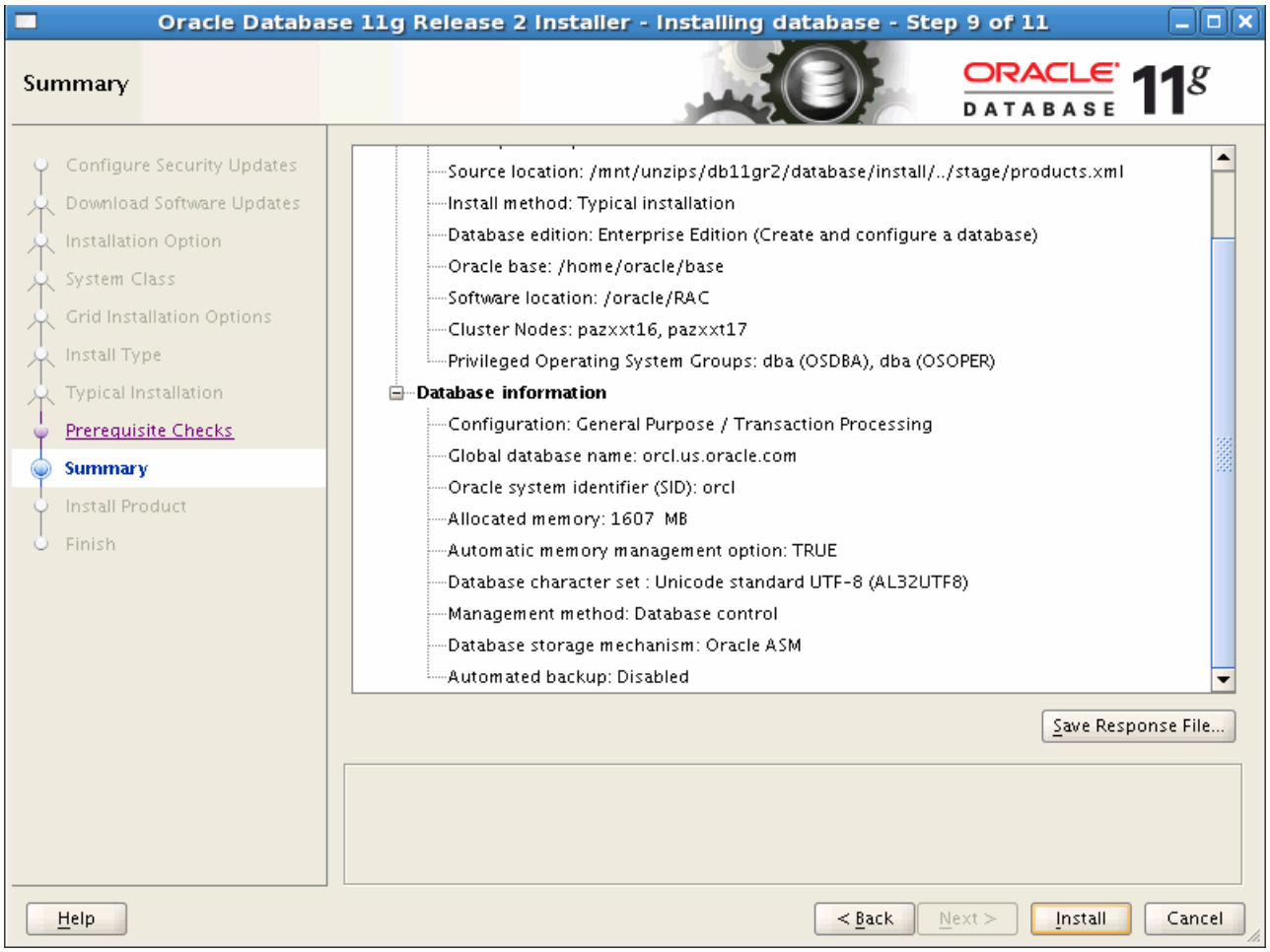

Figure 10-26 Install summary page 2

12. Click **Install** to continue. Upon successful completion, database configuration information will be displayed in a window similar to Figure 10-27.

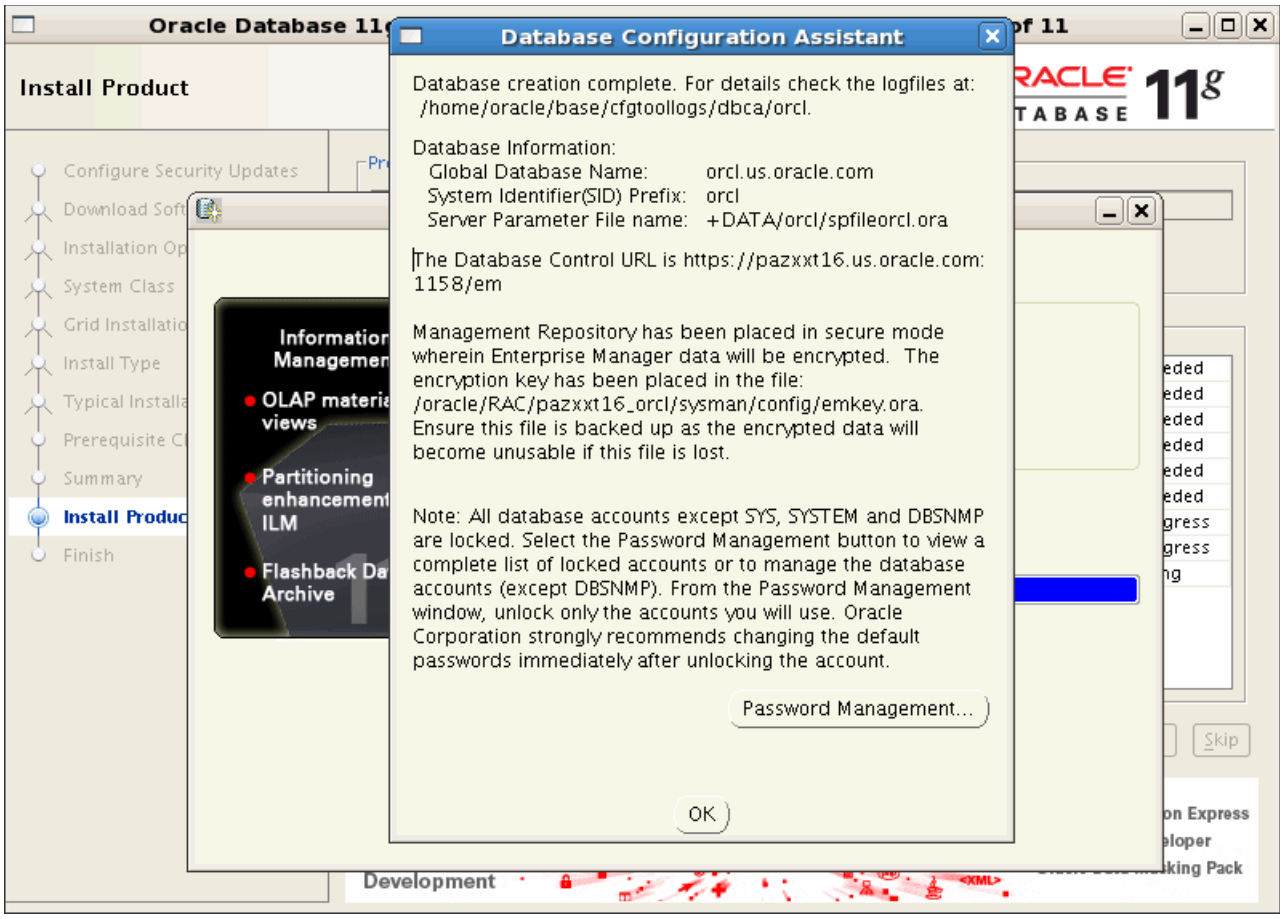

Figure 10-27 Database configuration information

13. Click **OK** to continue. A window similar to Figure 10-28 will prompt with configuration script(s) that will need to be executed as the root user in each cluster node.

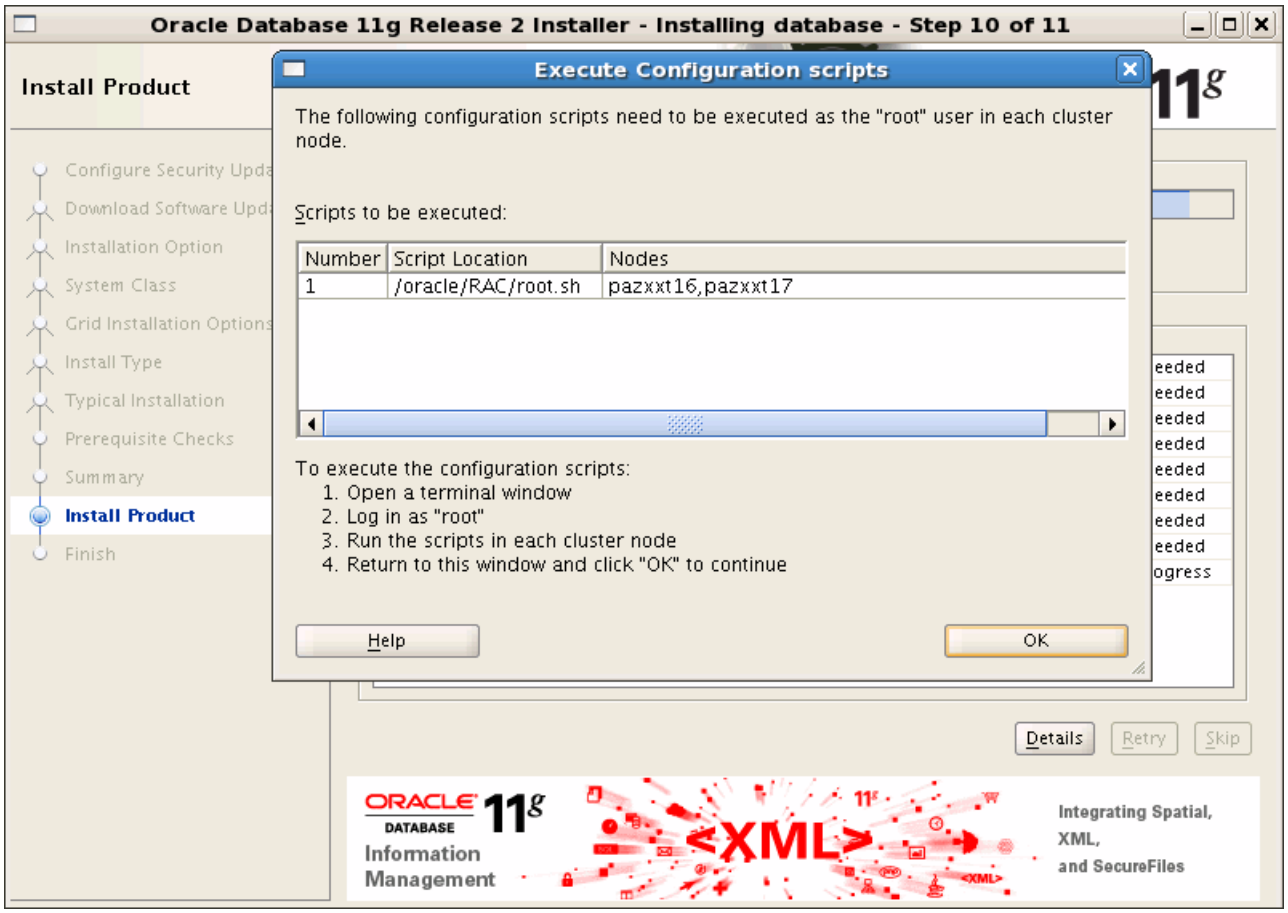

Figure 10-28 Database configuration scripts

14. After executing the scripts, a message panel indicating that the installation as completed successfully (Figure 10-29) will be displayed. To complete the installation, click the **Close** button.

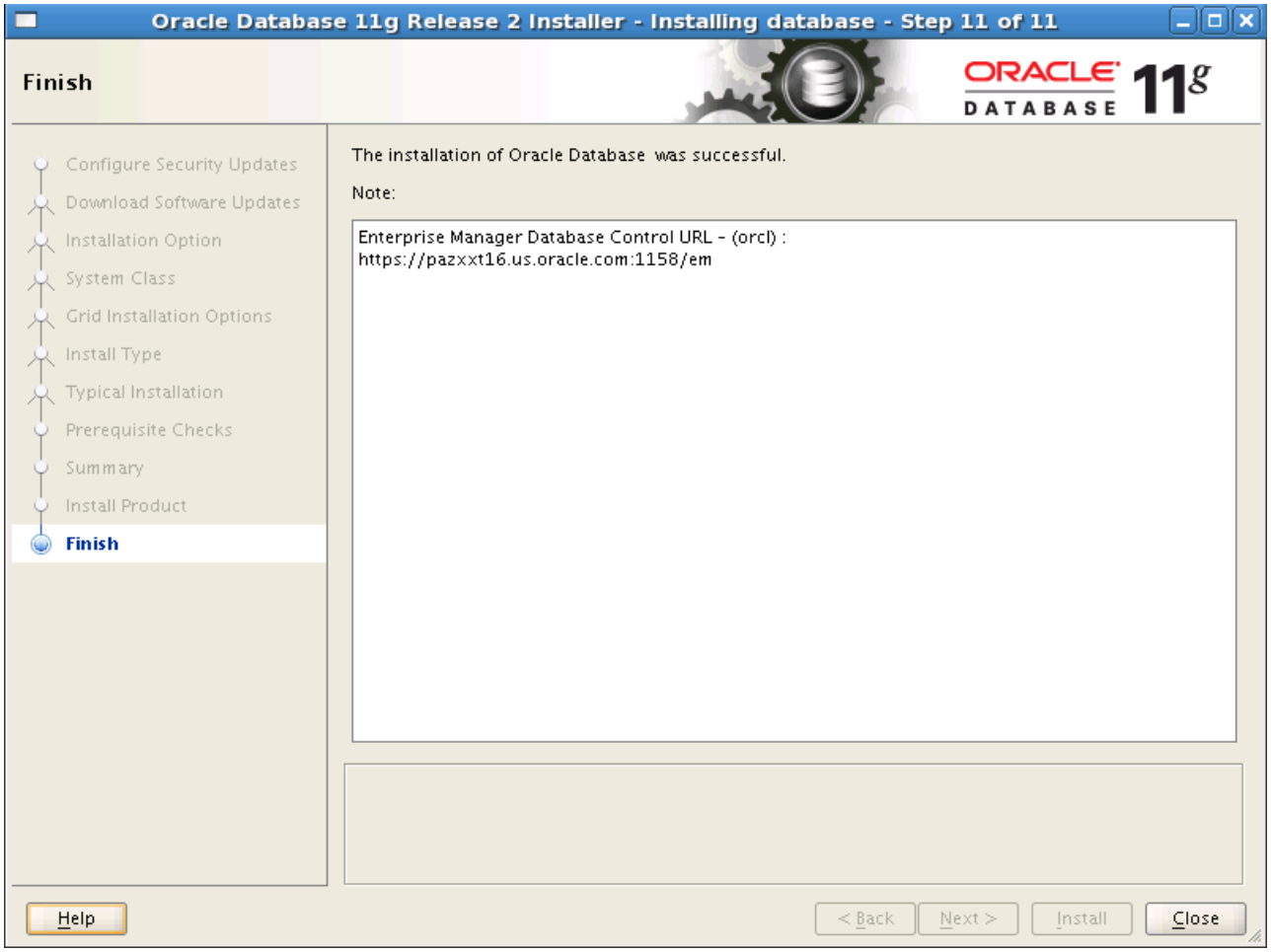

Figure 10-29 Install completed successfully

15. Run the command **srvctl** from the RAC home directory on node `pazxxt16` to check the status of the RAC database and verify that an instance is running on each node (Example 10-7) and to check the status of the local listeners (Example 10-8).

Example 10-7 Verify instances are running

```
[oracle@pazxxt16 bin]$ export ORACLE_HOME=/oracle/RAC
[oracle@pazxxt16 bin]$ srvctl status database -d orcl
Instance orcl1 is running on node pazxxt16
Instance orcl2 is running on node pazxxt17
```

Example 10-8 Checking the status of the local listener

```
[oracle@pazxxt16 bin]$ srvctl status listener
Listener LISTENER is enabled
Listener LISTENER is running on node(s): pazxxt16,pazxxt17
```

16. Check the status of SCAN and the scan listeners with the same command (**srvctl**) from the Grid Infrastructure home directory (Example 10-9).

Example 10-9 Checking the status of SCAN and the scanner listeners

```
[oracle@pazxxt16 bin]$ /oracle/CRS/bin/srvctl status scan
SCAN VIP scan1 is enabled
SCAN VIP scan1 is running on node pazxxt17
SCAN VIP scan2 is enabled
SCAN VIP scan2 is running on node pazxxt16
SCAN VIP scan3 is enabled
SCAN VIP scan3 is running on node pazxxt16

[oracle@pazxxt16 bin]$ /oracle/CRS/bin/srvctl status scan_listener
SCAN Listener LISTENER_SCAN1 is enabled
SCAN listener LISTENER_SCAN1 is running on node pazxxt17
SCAN Listener LISTENER_SCAN2 is enabled
SCAN listener LISTENER_SCAN2 is running on node pazxxt16
SCAN Listener LISTENER_SCAN3 is enabled
SCAN listener LISTENER_SCAN3 is running on node pazxxt16
[oracle@pazxxt16 bin]$
```

17. Using the Oracle Enterprise Manager Database Control URL shown in Figure 10-29 on page 114, log on to check the health of the RAC database. A web page similar to that shown in Figure 10-30 will be displayed.

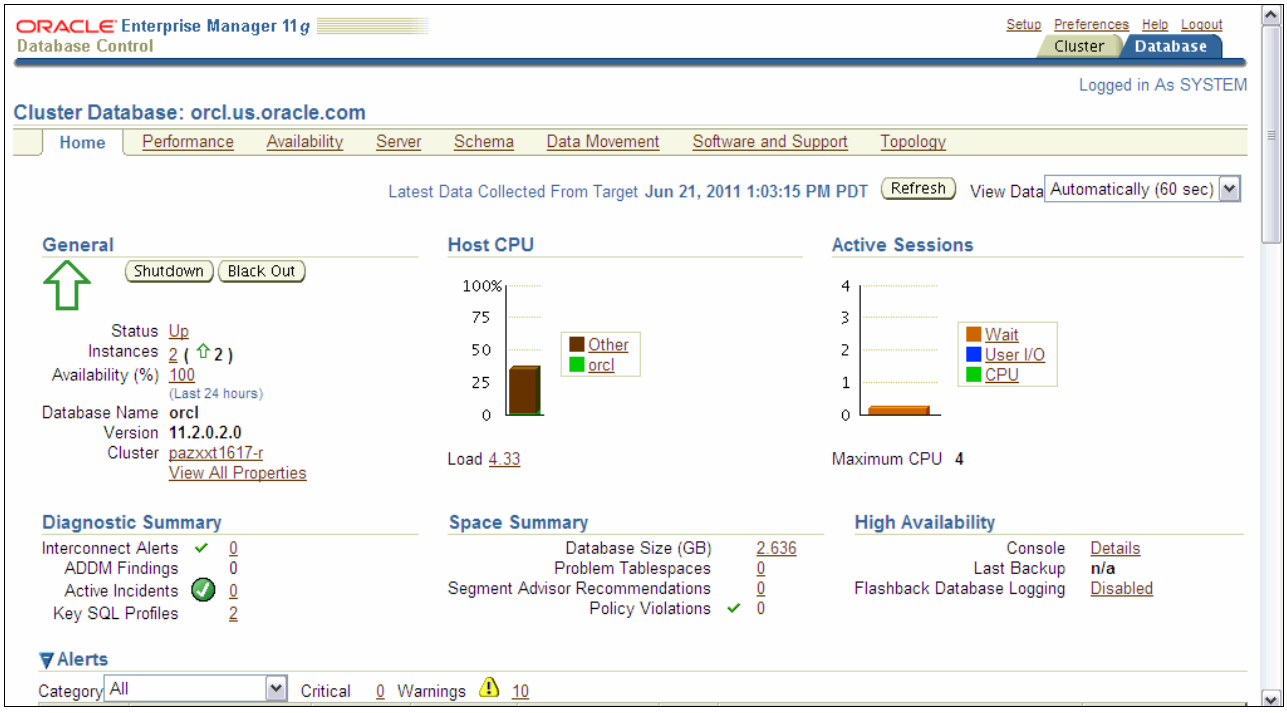

Figure 10-30 Oracle Enterprise Manager Database Control home page

18. Click the tab labeled Cluster in the upper right hand side of the page. This will bring you to the Oracle Enterprise Manager Database Control cluster home page. Our example is shown in Figure 10-31.

Figure 10-31 Oracle Enterprise Manager Database Control cluster home page

Oracle 11gR2 RAC cluster is now up and running.

A

Configuring Linux storage using DASD or FCP/SCSI

When installing Oracle on Linux on System z, there are many options for configuring storage. The first decision is whether to use mainframe-style storage with 4 K block size called DASD storage, or to use open Fibre Channel Protocol (FCP/SCSI) 512 byte storage.

In the past for performance reasons, it was recommended to use FCP/SCSI storage for the database files. With the advent of Parallel Access Volumes, (PAV), multiple sub-channels (paths) can now be created for mainframe style DASD storage. You can now put database files configured on DASD storage in PAV or FCP/SCSI storage.

If using FCP/SCSI storage, you should configure and use multipathing. When using multipathing, be sure to use the format `/dev/mapper/<device alias with partition name>` when specifying your database storage devices.

LVM or ASM

The next choice is to decide if you will be using ASM (Oracle's Automatic Storage Management) or Linux's Logical Volume Manager (LVM). If you are performing an Oracle Real Application Cluster install, use ASM. ASM can be utilized for single instance installs as well.

ASM provides benefits for dynamically adding storage to an Oracle database while it is running and other Oracle features for storage management. ASM and LVM typically perform the same when configured properly.

ASMLib or UDEV rules

When using Oracle ASM to manage disk devices, it is important to ensure that a utility is in place to maintain device persistence across reboots, and ensure that the disk devices have the correct file permissions.

As of Red Hat 6.0+ ASMLib will be deprecated. As a replacement, the following Oracle support notes are provided that do not utilize ASMLib.:

1350008.1	How to Manually Configure Disk Storage devices for use with Oracle ASM 11.2 on IBM: Linux on System z under SLES
1351746.1	How to Manually Configure Disk Storage devices for use with Oracle ASM 11.2 on IBM: Linux on System z under Red Hat 5

For this guide, `/etc/udev/rule.d/99-udev-oracle.rules` is provided as shown in Example A-1.

Example A-1 Rules

```
KERNEL=="dasd*1",ID=="0.0.0320",OWNER="grid",GROUP="oinstall",MODE="0660",SYMLINK+
="ASM0320"
KERNEL=="dasd*1",ID=="0.0.0321",OWNER="grid",GROUP="oinstall",MODE="0660",SYMLINK+
="ASM0321"
```

Then use either `/etc/init.d/boot.udev stop`, `/etc/init.d/boot.udev start` for Novell SUSE Linux Enterprise System or `udevcontrol reload_rules / start_udev` for Red Hat enterprise Linux to reload the UDEV rules.

Oracle RAC Shared Storage

If configuring an Oracle RAC system, you will need to ensure that the disk storage is configured in such a way to allow for sharing of the disks across Oracle RAC Nodes.

Oracle databases that utilize shared storage for Oracle RAC can either be configured with all Linux guests configured on the same LPAR, or across multiple LPARs on the same machine or separate System z machines.

If the storage is on the same LPAR, utilize multiple guests in the LPAR under one z/VM. The first Linux guest should own the disk in Read/Write Mode, and subsequent guests that require access should have LINKS to the storage device. You should also append a **V** to the primary access mode (read, write, multiple write, and so on) indicating that this minidisk can be shared between virtual machines. For example, we might define in the z/VM user directory:

```
MDISK 0350 3390 1 1669 LINORA1 MWV
```

Then for the user directory on the other nodes, a LINK statement is required.

```
LINK LINORA1 0350 0350 MW
```

If the storage is to be shared across multiple Linux guests in separate LPARs either on the same machine, or across separate System z machines, utilize dedicated storage devices. On the subsequent guests, use RDEVICE statements to let z/VM know that this storage device is shared. For example, you can define the following in an EXEC invoked by AUTOLOG1's PROFILE EXEC at IPL time:

```
'CP vary off 2E13-2E1C'
'CP SET RDEVICE 2E13-2E1C TYPE DASD SHARED YES MDC OFF'
'CP vary on 2E13-2E1C'
```

Then add a DEDICATE for the device in the user directory entry for the server:

```
DEDICATE 2E13 2E13
DEDICATE 2E14 2E14
…
```

```
DECICATE 2E1C 2E1C
```

Minidisk cache ON can cause issues with Oracle seeing System Change Numbers (SCNs) on different nodes in the RAC cluster, so for shared storage you should disable mini disk cache.

B

Oracle RAC Network Configuration

If installing Oracle Grid for an Oracle RAC system, the network requirements needed for a successful install are outlined in this appendix.

IP addresses

One public IP address for each node.

One virtual IP address for each node.

At least one interconnect IP address (two if utilizing the new redundant interconnect feature) on a separate private subnet. This interconnect IP address is usually a 10.X.X.X or 192.X.X.X style IP address.

Three single client access name (SCAN) addresses for the entire cluster (two if using host file SCAN IP addresses.

Oracle Grid IP Addresses for Oracle RAC

The IP address of the public network interface and the Oracle Variable IP addressee's (VIP) need to be in the same subnet range or problems can occur with the Oracle Grid installation.

Confirm that there is no network interface defined on the Oracle VIP interface. When Oracle Grid starts, it will create a new network interface with a ": 1" or ": 2" extension on top of the existing public interface. If this interface is already defined for something else, then an error will occur.

MTU Size

The network packet size should be close to or equal to the Oracle block size. This is for cache fusion related activity when Oracle transmits data blocks across the private interconnect.

Use an MTU size of 8192 if your network infrastructure can support "Jumbo Frames". Systems where the interconnect is using hyper sockets can utilize Jumbo Frames. A larger MTU size helps reduce CPU utilization with less network packets.

Oracle Grid SCAN IP Addresses for Oracle RAC Only

There are two ways to configure the Oracle SCAN IP addresses if Installing Oracle Real Application Cluster (RAC). The first method, shown in Example B-1, is to configure three IP addresses that are on the same subnet as the public network in DNS with the SCAN IP addresses. This is generally the best configuration.

Example: B-1 Preferred way to configure the Oracle SCAN IP addresses

```
129.40.178.161        ora1.pbm.ihost.com      ora1
129.40.178.162        ora2.pbm.ihost.com      ora2
129.40.178.168        ora1-vip.pbm.ihost.com ora1-vip
129.40.178.169        ora2-vip.pbm.ihost.com ora2-vip
#
# Note 3 IPs to one DNS entry for SCAN IP's
#
129.40.178.166        rac-scan.pbm.ihost.com  rac-scan
129.40.178.167        rac-scan.pbm.ihost.com  rac-scan
129.40.178.170        rac-scan.pbm.ihost.com  rac-scan
```

The other method is to create the SCAN IP entries in the `/etc/hosts` file. Example B-2 shows an excerpt from the `/etc/hosts` file on each node in the cluster with the SCAN IP's addressed defined opposed to using the DNS approach above.

Example: B-2 SCAN IP address entry in the /etc/hosts file

```
192.168.23.61 orainst-cluster orainst-cluster.dmz
```

When installing Oracle Grid for a RAC environment, you might see the errors shown in Example B-3 that are related to Oracle BUG – 10173295

Example: B-3 Errors related to Oracle bug 10173295

```
ERROR: PRVF-4664 : Found inconsistent name resolution entries for SCAN name
"ora-cluster"
  SCAN Name     IP Address                 Status                Comment
  ------------  ------------------------          ------------------------
----------
  ora-cluster  XX.82.34.166               failed                   NIS Entry
ERROR: PRVF-4657 : Name resolution setup check for "ora-cluster" (IP address:
XX.82.34.166) failed
ERROR:PRVF-4664 : Found inconsistent name resolution entries for SCAN name
"ora-cluster"
```

Important: Per Oracle Support, if you are using a Host file for SCAN IP's (as opposed to DNS entries) you can safely ignore this error.

Oracle RAC DO NOT Use NOARP for Interfaces

If your network interface card is set up using **NOARP**, the Oracle Grid will not work. The **`root.sh`** script will fail on any nodes with the interface set this way.

Example B-4 on page 123 shows the error that you might see when running the **`root.sh`** configuration script with a network interface set incorrectly with ARP disabled.

Example: B-4 Output when a network interface is set incorrectly

```
…
The ora.asm resource is not ONLINE
Did not succssfully configure and start ASM at
/opt/oracle/11gR2/crs/crs/install/crsconfig_lib.pm line 6470.
/u01/grid/11.2/perl/bin/perl -I/opt/oracle/11gR2/crs/perl/lib
-I/opt/oracle/11gR2/crs/crs/install /u01/grid/11.2/crs/install/rootcrs.pl
execution failed
```

The errors that are reported are not easily understandable. Example B-5 shows the `ocssd.log` file when **`root.sh`** was run incorrectly.

Example: B-5 Output displayed when root.sh is running incorrectly

```
CRS-1013:The OCR location in an ASM disk group is inaccessible. Details in
/opt/oracle/11gR2/crs/log/dhsora1/client/clscfg.log
Oracle Database 11g Clusterware Release 11.2.0.2.0 - Production Copyright 1996, 2010 Oracle. All
rights reser
2011-03-16 20:01:53.085: [  CLSCFG][53553008]clscfg_main: Configuration type [4]

ibctx: Failed to read the whole bootblock.
Oracle Database 11g Clusterware Release 11.2.0.2.0 - Production Copyright 1996, 2010 Oracle. All
rights reser
2011-03-16 20:01:52.989: [ OCRCONF][52016608]ocrconfig starts...
2011-03-16 20:01:52.989: [ OCRCONF][52016608]Upgrading OLR data
2011-03-16 20:01:52.989: [ OCRCONF][52016608]Verifying if OLR is already in latest version.
2011-03-16 20:01:52.990: [  OCRRAW][52016608]proprioini: all disks are not OCR/OLR formatted
2011-03-16 20:01:52.990: [  OCRRAW][52016608]proprinit: Could not open raw device
2011-03-16 20:01:52.990: [ default][52016608]a_init:7!: Backend init unsuccessful : [26]
2011-03-16 20:01:52.990: [ OCRCONF][52016608]OLR is not in latest version. Upgrade is required.
2011-03-16 20:01:52.990: [ OCRCONF][52016608]Exporting OLR data to [OCRUPGRADEFILE]
2011-03-16 20:01:52.990: [  OCRAPI][52016608]a_init:7!: Backend init unsuccessful : [33]
2011-03-16 20:01:52.990: [ OCRCONF][52016608]There was no previous version of OLR.
error:[PROCL-33: Oracle Local Registry is not configured]
2011-03-16 20:01:52.990: [ OCRCONF][52016608]Verifying if OLR is already in latest version.
2011-03-16 20:01:52.991: [  OCRRAW][52016608]proprioini: all disks are not OCR/OLR formatted
2011-03-16 20:01:52.991: [  OCRRAW][52016608]proprinit: Could not open raw device
2011-03-16 20:01:52.991: [ default][52016608]a_init:7!: Backend init unsuccessful : [26]
2011-03-16 20:01:52.991: [ OCRCONF][52016608]OLR was not previously formatted. OCRCONFIG will
now attempt to format OLR.
2011-03-16 20:01:52.991: [  OCRRAW][52016608]ibctx: Failed to read the whole bootblock.  Assumes
invalid format.
2011-03-16 20:01:52.991: [  OCRRAW][52016608]proprinit:problem reading the bootblock or
superbloc 22
2011-03-16 20:01:53.023: [  OCRAPI][52016608]a_init:6a: Backend init successful
2011-03-16 20:01:53.023: [ OCRCONF][52016608]The OLR was successfully formatted.
2011-03-16 20:01:53.054: [ OCRCONF][52016608]Successfully initialized DATABASE keys
2011-03-16 20:01:53.054: [ OCRCONF][52016608]The OLR was successfully populated.
2011-03-16 20:01:53.054: [ OCRCONF][52016608]The OLR was successfully upgraded.
2011-03-16 20:01:53.054: [ OCRCONF][52016608]Exiting [status=success]........
```

As the root user, use the command **`ifconfig –a`** to verify that your network configuration settings are set correctly, as shown in Example B-6 on page 124.

Example: B-6 Verifying network configuration settings

```
#  ifconfig –a
eth0      Link encap:Ethernet  HWaddr 02:00:00:00:00:1B
          inet addr:192.168.23.41  Bcast:192.168.23.95  Mask:255.255.255.224
          inet6 addr: fe80::200:0:100:1b/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1492  Metric:1
          RX packets:143963 errors:0 dropped:0 overruns:0 frame:0
          TX packets:93073 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:10906397 (10.4 Mb)  TX bytes:4550197 (4.3 Mb)

hsi0      Link encap:Ethernet  HWaddr 02:00:00:00:00:1C
          inet addr:10.1.1.4  Bcast:10.1.1.255  Mask:255.255.255.0
          inet6 addr: fe80::ff:fe00:1c/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:8192  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 b)  TX bytes:264 (264.0 b)
```

Clarification: eth0:1 is not defined here because Oracle Grid had not been started yet

Hang check timer and oprocd replaced

Oracle Grid (Clusterware) has replaced the **oprocd** and **hangcheck** processes with a cluster synchronization service daemon agent to help provide better recognition of hangs and to avoid false termination.

If you are upgrading from Oracle 10gR2, you can remove any lines in `/etc/init.d/rc.local` in regards to the hangcheck timer, as shown in Example B-7.

Example: B-7 Removing references to the hangcheck timer

```
# cat /etc/init.d/rc.local
#Make sure that the following entry is removed or commented out
#modprobe hangcheck-timer hangcheck_tick=30 hangcheck_margin=180
```

C

Oracle Grid and database cleanup script

In the event of a reinstall, you must ensure that all previous files are removed. In this appendix, examples of how to do this are provided. These examples must be customized for your environment. The purpose of these examples is to help in selecting all the directories that require cleaning.

Shut down grid services

If cleaning up an entire system, it is best to shut down all Oracle Grid services first on each node of the cluster as the grid user (Example C-1).

Example C-1 Shut down the grid services

```
$ORACLE_HOME/bin/crsctl stop  resource –all
$ORACLE_HOME/bin/crsctl stop  has
```

Utility to clean the Oracle Grid

One handy utility if your Oracle Grid install fails (**root.sh** script) when running an Oracle Grid install is to modify and run the **rootcrs.ps –deconfig** command as shown in Example C-2.

Example C-2 Modify and run

```
/u01/grid/crs/install/rootcrs.pl -deconfig -force
```

On the last node of the grid cluster you should add the **–lastnode** parameter to the **rootcrs.pl** command.

```
/u01/grid/crs/install/rootcrs.pl -deconfig –force -lastnode
```

Modify /etc/inittab

If the Oracle Grid **root.sh** script has been run on any of the nodes previously, then the Linux inittab file should be modified to remove the lines that were added. Then, as the root user, inittab should be re-initialized using the **init q** command (Example C-3).

Example C-3 Modify and run

```
tail /etc/inittab
#h1:35:respawn:/etc/init.d/init.ohasd run >/dev/null 2>&1 </dev/null
init q
```

Clean up files

The commands shown in Example C-4 are used to remove Oracle Grid and database software. You can also use the Oracle de-installer to remove the necessary software components.

Example C-4 Modify and run

```
#
# WARNING - You should verify this script before running this script as this
script # will remove everything for all Oracle systems on the Linux system where
the script # is ran.
#
rm -f /etc/init.d/init.ohasd
#
rm -f /etc/inittab.crs
rm -rf /etc/oracle
#
# Oracle Bug Note Note:429214.1
#
rm -f /usr/tmp/.oracle/*
rm -f /tmp/.oracle/*
rm -f /var/tmp/.oracle/*
#
#
#
rm -f /etc/oratab
rm -rf /var/opt/oracle
#
# Remove Oracle software directories *these may change based on your install env
#
rm -rf /u01/grid/base/*
rm -rf /u01/oraInventory
rm -rf /u01/oracle/*
rm -rf /u01/agent10g
```

D

Workarounds for known problems

The objective of this appendix is to make the reader aware of the workarounds for some known problems.

- When running the Grid Install for a RAC Install, the Perform Remote Operations step (which copies the ORACLE_HOME) seems to hang at 65% and nothing is copied to the remote node.

  This can be a port blocking problem, and temporarily turning off iptables can help to resolve this. We observed this on a Red Hat Enterprise Linux system. To turn iptables off, execute the following commands:

  ```
  service iptables stop
  chkconfig iptables off
  ```

  This issue can also be seen when running the **cluvfy** utility.

- **ASMCMD** is a command line interface that allows the DBA to look at Disk usage and files on raw disk volumes. Certain systems might see an error when running the Oracle **asmcmd** command as shown in Example D-1.

Example D-1 The asmcmd

```
$ asmcmd
      Can't load
'/u01/grid/11.2/perl/lib/site_perl/5.10.0/s390x-linux-thread-multi/auto/XML/Parser
/Expat/Expat.so' for module XML::Parser::Expat: libexpat.so.0: cannot open shared
object file: No such file or directory at
/u01/grid/11.2/perl/lib/5.10.0/s390x-linux-thread-multi/DynaLoader.pm line 203.
      at
/u01/grid/11.2/perl/lib/site_perl/5.10.0/s390x-linux-thread-multi/XML/Parser.pm
line 14
      Compilation failed in require at
/u01/grid/11.2/perl/lib/site_perl/5.10.0/s390x-linux-thread-multi/XML/Parser.pm
BEGIN failed--compilation aborted at /Compilation failed in require at
/u01/grid/11.2/lib/asmcmddisk.pm line 133.
```

```
      BEGIN failed--compilation aborted at /u01/grid/11.2/lib/asmcmddisk.pm line
133.
      Compilation failed in require at /u01/grid/11.2/bin/asmcmdcore line 186.
grid@cnsiorap:/home/grid> asmcmd
      Can't load
'/u01/grid/11.2/perl/lib/site_perl/5.10.0/s390x-linux-thread-multi/auto/XML/Parser
/Expat/Expat.so' for module XML::Parser::Expat: libexpat.so.0: cannot open shared
object file: No such file or directory at
/u01/grid/11.2/perl/lib/5.10.0/s390x-linux-thread-multi/DynaLoader.pm line 203.
       at
/u01/grid/11.2/perl/lib/site_perl/5.10.0/s390x-linux-thread-multi/XML/Parser.pm
line 14
      Compilation failed in require at
/u01/grid/11.2/perl/lib/site_perl/5.10.0/s390x-linux-thread-multi/XML/Parser.pm
BEGIN failed--compilation aborted at
/u01/grid/11.2/perl/lib/site_perl/5.10.0/s390x-linux-thread-multi/XML/Parser.pm
line 18.
      Compilation failed in require at /u01/grid/11.2/lib/asmcmddisk.pm line 133.
```

BEGIN failed--compilation aborted at /u01/grid/11.2/lib/asmcmddisk.pm line 133.

This is caused when the ASMCMD command calls libexpat.so.0 internally. With Suse 11 SP1(s390x) libexpat.so.0 is renamed to libexpat.so.1. This problem also occurs on Suse 10 SP3 system).

This problem has been reported in an Oracle Bug. The workaround is to create a symbolic link:

```
cd /oracle/app/11.2.0/grid/lib  ($GRID_HOME/lib)
   ln -s libexpat.so.1 libexpat.so.0
```

- Hipersockets for Oracle 11gR2 RAC Interconnect.

  Using any Layer 3 (IP) based network interface for the Oracle RAC Interconnect fails due to Oracle's new 11gR2 multicast IP functionality.

  To resolve this issue, configure the network interface in Layer 2 (MAC Address) mode. The network interface used for Oracle RAC interconnect must be defined with ARP enabled and be a certified network configuration (Table D-1).

Table D-1 Configured in Layer 2 mode

Function	OSA_ Layer 2	OSA_ Layer 3	Real Hipersocket Layer 2 *	Real Hipersocket Layer 3
Linux ARP	Yes	No	Yes**	No

* Guest LAN Virtual Hipersockets are not supported in Layer 2 mode

** IBM model z10 and later (z9 does not support Hipersockets in Layer 2 mode)

Oracle RAC 11.2.0.2 required that the interconnect network interface be configured to support multicast IPs. This created issues using hipersockets when running **root.sh** on the 2nd node of a RAC Cluster. For Oracle RAC 11.2.0.3, Oracle has changed the 11.2.0.2 Multicast Cast requirement to be less restrictive and allow for network interconnect interfaces to be configured without the multicast requirement.

- OHASD not Starting After Reboot on SLES [Oracle MOS Note: 1325718.1]

  When installing Oracle RAC on a 2 node cluster, you might encounter the following error warning when running **root.sh**, after which **root.sh** finishes successfully:

```
error: Inappropriate ioctl for device
```

On subsequent reboots, clusterware does not start correctly. To resolve the issue, as root user, run the following commands (Novell SUSE Linux Enterprise Systems only):

```
/sbin/chkconfig raw on
/sbin/chkconfig ohasd on
```

This issue is resolved with Oracle 11.2.0.3.

E

Reference materials

There are many documents that are useful in installing and operating an Oracle RAC system. The documents that are used to do the install described in this document are listed here. In Oracle 11gR2, both Oracle Automatic Storage Management (ASM) and Oracle Clusterware (CRS) are installed in the Oracle Grid Infrastructure home. Oracle real application clusters (RAC) is installed in its own home directory as in prior releases.

Installation

The first four sections in the Oracle Grid Infrastructure document provide a detailed description of procedures to install 11gR2 CRS and ASM.

Oracle Grid Infrastructure, Installation Guide 11g Release 2 (11.2) for Linux, E17212-11, March 2011

Similarly, the first three sections in the Oracle Real Application Clusters document provide a detailed description of procedures to install 11gR2 RAC.

Oracle Real Application Clusters Installation Guide 11g Release 2 (11.2) for Linux and UNIX, E17214-08, February 2011

Oracle Database Release Notes 11g Release 2 (11.2) for Linux, E16778-10, May 2011

Operation guides

*Oracle Clusterware Administration and Deployment Guide 11g Release 2 (11.2),*E16794-09, February 2011

Oracle Real Application Clusters Administration and Deployment Guide 11g Release 2 (11.2), E16795-08, October 2010

Oracle Automatic Storage Management Administrator's Guide 11g Release 2 (11.2), E16102-07, December 2010

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Installing Oracle 11gR2 RAC on Linux on System z

Redpaper™

Install Oracle Grid Infrastructure and Real Application Clusters

Configure disk storage on FCP/SCSI and ECKD/DASD

Install Oracle 11gR2 on Linux on System z

This IBM Redpaper publication describes experiences gained while installing Oracle Database 11gR2 with Grid Infrastructure (GI). It covers the set up and installation process for these environments:

- Setting up Red Hat Enterprise Linux 5 with DASD
- Setting up Red Hat Enterprise Linux 5 with FCP/SCSI
- Setting up SLES11 with DASD
- Setting up SLES11 with FCP/SCSI disks

Examples include the installation of the Grid Infrastructure, installation of a single instance database and installation of a two-node Real Application Cluster (RAC) database.

In all cases, we use UDEV rules for DASD and single path SCSI, and multipathing for multi-path SCSI to provide device persistency for ASM storage, not ASMLib.

Interested readers would include database consultants, installers, administrators, and system programmers. This is not meant to replace Oracle documentation, but to supplement it with our experiences while installing and using Oracle Database products. We made extensive uses of My Oracle Support notes.

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