

MIGRATION



MIGRATING FROM
SOLARIS™ 9 ENTERPRISE ON SUN FIRE™ V440
WITH ORACLE® 9i ENTERPRISE EDITION
TO
SOLARIS™ 10 ENTERPRISE ON DELL™ R900
WITH ORACLE® 10g R2 ENTERPRISE EDITION

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Introduction



Dell PowerEdge R900

The Dell™ PowerEdge™ R900 is an excellent server for upgrading critical database applications from Oracle® 9i running on Solaris™ 9 to Oracle 10g R2, the latest release of Oracle's data management platform, running on Solaris 10. This Migration Guide reviews the approach that Principled Technologies® (PT) and Dell recommend for a tested and validated migration of Oracle 9i databases to Oracle 10g R2 on the Dell PowerEdge R900 server and Solaris 10.

PT has performed hands-on testing and research and drawn on real-world experiences to document best practices and help systems administrators and database administrators simplify operations and take advantage of new features in Solaris 10 and Oracle 10g R2. For our test data, we migrated a 20GB Oracle database that we generated using the DVD Store™ Version 2 (DS2) test tool. (For more information about DS2, see <http://www.delltechcenter.com/page/DVD+Store>.)

As a migration solution, the PowerEdge R900 provides a much more expandable and capable platform. For example, it can support 256 GB of RAM, as opposed to 32 GB in the Sun Fire v440, and eight internal drives instead of four. It also provides a much more capable RAID controller.

The PowerEdge R900 will also deliver far greater performance. In some of our testing, the PowerEdge R900 delivered over 14 times the performance of the Sun Fire V440.

Scope of this Guide

This Migration Guide reviews the approach that Principled Technologies and Dell recommend for migrating databases from Oracle 9i Enterprise Edition Release 9.2.0.1.0 for Solaris on SPARC™-based systems (64-bit) (Oracle 9i) running on Solaris 9 9/05 Operating System for SPARC-based systems (64-bit) (Solaris 9) to Oracle 10g R2 Enterprise Edition Release 10.2.0.1.0 for Solaris on x86_64-based systems (Oracle 10g R2), running on Solaris 10 5/08 Operating System for x86-based systems (64-bit) (Solaris 10). We cover installing Solaris 10 and Oracle 10g R2 on the PowerEdge R900 and migrating user databases from the Sun Fire v440 to the PowerEdge R900.

New features of Solaris 10

Solaris 10 introduces a wide variety of new features. While there are far too many to discuss in this Guide, the following list mentions some of the more significant ones:

- **DTrace.** DTrace provides a comprehensive view of application and operating system and activity. In a single scriptable tool, DTrace allows you to examine both kernel and user-level activity. Sun designed DTrace to run on live production servers with often negligible impact on performance. Per Sun's documentation, for disabled probes, there is no performance impact at all.
- **Solaris Containers.** Solaris 10 provides operating system-level virtualization. Solaris Containers combine the isolation of Solaris Zones with resource controls.
- **Solaris ZFS.** The zetabyte file system combines enormous storage capacity, snapshots, integrity checking and repair, volume management, built-in copy-on-write support, and an integrated redundancy capability, RAID-Z.
- **Predictive Self Healing.** Solaris 10 can diagnose and help you recover from many hardware and software problems. The Solaris Fault Manager can automatically detect many hardware and application problems, while the Solaris Service Manager gives administrators a uniform interface for managing application services.
- **Solaris Trusted Extensions.** Solaris 10 includes security capabilities that were formerly available only in the Trusted Solaris product. These allow you to combine mandatory access control with fine-grained control of user privileges.
- **Service Management Facility.** A replacement for UNIX init.d scripts, the Service Management Facility gives administrators a single interface for managing software services. Among the features it provides is the ability to limit the privileges available to a service, thus allowing non-root users to do more tasks.

New features of Oracle 10g R2

Oracle 10g R2 introduces a wide variety of new features. While there are far too many to discuss in this Guide, the following list mentions some of the more significant ones of particular interest to administrators:

- **Automated Storage Management.** Storage allocation is one of the most significant issues for any administrator. Oracle 10g R2 can manage the storage for you by, for example, integrating new storage arrays and rebalancing the data. We use ASM in this Guide.
- **Flashback features.** While Oracle 9i provided some flashback capabilities, Oracle 10g R2 expands them considerably. In Oracle 10g, you can flashback the whole database, or you can recover a table you have accidentally dropped using only a few SQL statements. (While the earlier Flash Query option could retrieve data, restoring the table itself was cumbersome.)
- **Help with SQL tuning.** Oracle 10g R2 comes with the Automatic Workload Repository, which automatically takes snapshots of performance metrics, and the Automatic Database Diagnostic Monitor, which can analyze those metrics and make recommendations to improve performance.
- **Improved data movement.** Oracle 10g R2's Data Pump is a faster, enhanced import and export utility. Its Transportable Tablespaces feature allows you to move data using OS file copy operations, which are typically much faster than importing and exporting.



NOTE: The Data Pump does not support data exported from Oracle 9i. While Oracle 9i had a version of transportable tablespaces, you cannot use it when moving data to a system with different byte ordering. (The PowerEdge R900 and the Sun Fire v440 have different byte ordering.) Therefore, neither of these technologies was an option for this Guide.

Pre-migration considerations



This section reviews some of the topics you should consider prior to migrating your databases.

Considerations for moving your applications

Whether an application is one you have developed in house or one you purchased, you have several choices when moving it from Solaris 9 on SPARC-based systems to Solaris 10 on x86 (64-bit) systems.

Java-based applications

These applications should run as is in the new Solaris 10 x86 (64-bit) environment. Sun developed the original Java language in the 1990s and has maintained a strong commitment to Java ever since. Because Java applications run in a Java Virtual Machine, they are largely machine-independent.

When you have the source code for the application

Frequently, applications for which you have source code are those your organization developed. In this case, all you will likely need to do is recompile them for the Solaris 10 x86 (64-bit) environment using Sun Studio. According to Sun, the vast majority of applications will run after a simple recompile. For those applications that directly depend on low-level, architectural features of the host system, such as one that counts on the order of bits in an integer, you may need to do some porting work. For a detailed discussion of these issues, see the article "64-bit x86 Migration, Debugging, and Tuning, With the Sun Studio 10 Toolset," available at

http://developers.sun.com/solaris/articles/amd64_migration.html

When you do not have the source code for the application

You will not typically have the source code for an application you purchased. If such an application is available in an x86 (64-bit) version, you have the option of moving to the native version. Sun maintains a list of applications for Solaris 9 and Solaris 10:

http://www.sun.com/bigadmin/apps/data/views/all_applications_sparc.SPARC.page1.html

Oracle, of course, is a prime example of an application that both Solaris 9 (SPARC) and Solaris 10 (x86 [64-bit]) support. The bulk of this Guide focuses on how to migrate an Oracle installation from the Solaris 9 SPARC environment to the Solaris 10 x86 (64-bit) environment.

If the vendor of your commercial legacy application provides an x86 version but does not support it on Solaris 10 (x86 [64-bit]), you can use Solaris Containers to run it using an older version of Solaris. Solaris Containers allow you to run both Solaris 8 and Solaris 9 applications in their own virtual machines. You can read more about Solaris Containers at

<http://www.sun.com/software/solaris/containers/features.jsp>

When Solaris Containers are not appropriate for your situation, such as when the vendor does not provide an x86 version, you may be able to run your application using QuickTransit from Transitive (<http://www.transitive.com>). QuickTransit Server can transparently run many Solaris SPARC applications on Solaris 10 (x86 [64-bit]). If you have applications older than Solaris 8, Transitive also offers QuickTransit Legacy. You should verify first that the application vendor supports the application running in this configuration.

A note about application data

You should never simply copy the raw data files from one system to another system of a different architecture. The data formats that applications write to disk are not generally portable. Bit orders, padding, and alignment are examples of elements that can differ as you move from one system to another. Most applications, however, provide some ability to back up or export data to portable formats. The restore/import process on the target system is likely to resolve any issues with the data layout.

Migration path

In this Guide, we discuss a migration that crosses different processor architectures, different versions of the operating systems, and different versions of the database software. Therefore, we selected the export-and-import method as a safe and effective approach to moving databases between the systems.

An alternative would have been to install Oracle 10g R2 on the source server and run the Database Upgrade Assistant (DBUA) to migrate the database to Oracle 10g R2 before moving it to the target server. The DBUA is outside the scope of this Guide. Information on using the DBUA is available in Configuring Oracle Products on UNIX at http://download.oracle.com/docs/html/B10812_06/chapter3.htm

Installing and setting up Solaris 10 and Oracle 10g R2 in this environment



In this section, we focus on installing and setting up Solaris 10 and Oracle 10g R2 on the Dell PowerEdge R900 server. We begin by defining our environment. Next, we present an overview of the steps we took to configure the drives and to install and configure both Solaris 10 and Oracle 10g R2.

Defining our environment

Our legacy server was a Sun Fire™ V440 running Solaris 9 9/05 Operating System for SPARC-based systems (64-bit) and Oracle 9i Enterprise Edition Release 9.2.0.1.0 for Solaris on SPARC-based systems (64-bit). Our destination server was a PowerEdge R900 running Solaris 10 5/08 Operating System for x86-based systems (64-bit) and Oracle 10g R2 Enterprise Edition Release 10.2.0.1.0 for Solaris on x86_64-based systems. We connected all components via a gigabit switch. Figure 1 illustrates our setup.

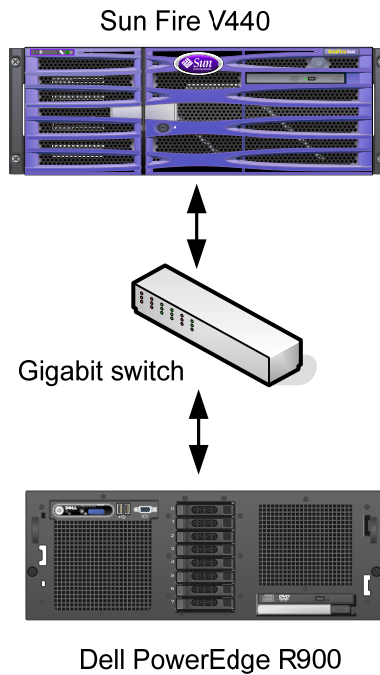


Figure 1. The setup we used in our hands-on testing and research for this Migration Guide.

Figures 2 and 3 present the hardware and software we used in our Oracle 9i and Oracle 10g R2 database servers.

Server	Processor	Memory	Disk
Sun V440 (legacy database server)	4 x UltraSparc™ IIIi 1.59 GHz	32 GB	4 x Fujitsu® Ultra320 SCSI, 73GB
Dell R900 (migration database server)	4 x 6-Core E7450 Intel® Xeon®	64 GB	8 x Seagate® SAS, 15K RPM, 73GB

Figure 2. Servers we used in our hands-on testing and research for this Guide.

Server	Server operating system	Oracle version
Sun V440 (legacy database server)	Sun™ Solaris™ 9 9/05 Operating System for SPARC™-based systems (64-bit)	Oracle 9i Enterprise Edition Release 9.2.0.1.0 for Solaris on SPARC-based systems (64-bit)
Dell R900 (migration database server)	Solaris 10 5/08 Operating System for x86-based systems (64-bit)	Oracle 10g R2 Enterprise Edition Release 10.2.0.1.0 for Solaris on x86_64-based systems

Figure 3. Software we used in our hands-on testing and research for this Guide.

We also used a 16-port gigabit switch.



BEST PRACTICE: Use the latest tested and validated software, firmware, and driver versions for NICs, storage arrays, and other components. You can find these software components at <http://support.dell.com/support/downloads/index.aspx?c=us&l=en&s=gen>

Configuring the RAID drives

Overview

Oracle 10g R2's Automatic Storage Management, or ASM, relieves administrators of much of the responsibility for allocating and managing the storage.

We had eight internal disk drives in our PowerEdge R900. We configured them as four RAID 1 arrays of two drives each, as Figure 4 shows.



NOTE: Plan on at least 10 minutes for drive configuration.

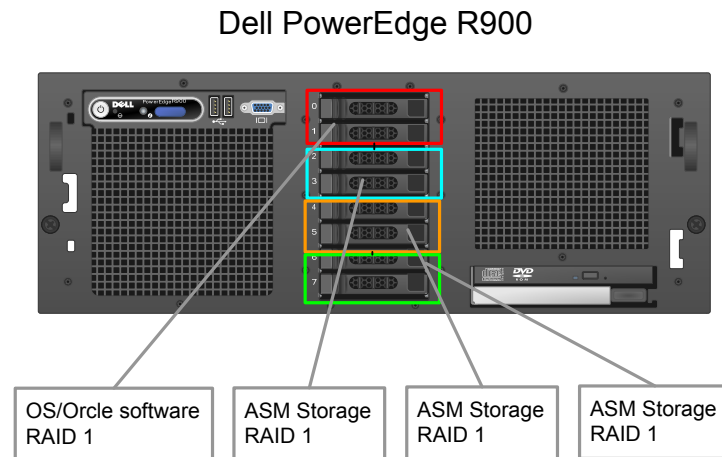


Figure 4. The drive configuration we used in our hands-on testing and research for this Guide.

The first array holds the OS and Oracle software.

We used the next two RAIDs to create an ASM disk group.

We reserved the remaining RAID to hold the dump file from our Oracle 9i server. After we imported our 20GB database into an Oracle 10g R2 database, we unmounted the array and added it to the ASM diskgroup.



NOTES: Oracle recommends that you allocate an amount of swap space equal to three-quarters of the RAM for servers with more than 8 GB of RAM. In our case, that was 48GB. Given the size of our disks, not enough space remained on this array to hold the data dump file, so we reserved the remaining RAID for the dump file.

When you add a new disk to an ASM disk group, Oracle automatically rebalances the data to redistribute it across the drives.

Installing Solaris 10

This section provides an overview of the operating system installation process. We include approximate wait times for each step. ([Appendix B](#) provides complete, detailed installation instructions.) We downloaded the operating system from <http://www.sun.com/software/solaris/get.jsp> and burned DVDs from which we installed.



NOTE: Plan on at least 40 minutes for installing Solaris 10 on the Dell PowerEdge R900 server. Each step below takes at least 1 minute. We provide the approximate amount of time each step takes in parentheses. These times exclude data entry time.

1. Insert the Solaris 10 DVD into the DVD drive, and reboot the system. When the GNU GRUB screen appears, type `e` to edit the boot command line. Add the `-kd` switch to the boot command line. This will cause the system to boot into the kernel debugger. While in the debugger, turn off the Computer Module Implementation (CMI) checking and continue with the boot process. (2 minutes)

```
ing kadb...
ome to kadb
cmi_no_init/wl
no_init: 0
:c_
```

Figure 5. The kernel editor.

2. Apply the drivers for the PERC 6/i RAID controller, and continue. Solaris tries to initialize the NICs. (1 minute)

```
Insert Driver Update media and press Return, or
press one of the following and press Return:
1 CD/DVD devices
2 Legacy, non-USB diskettes
3 All other removable mass-storage devices
4 Search all of the above
5 End
Enter choice and press Return: 1
Searching for Driver Updates on CD/DVD devices.

Extracting Driver Updates from /dev/dsk/c0t0d0p0 (TSSTcorp DVD-ROM TS-L333A D100)
Installing Driver Updates onto miniroot.
Installing package megasas
Installing MegaRAID SAS HBA driver as <megasas>
Installation of <megasas> was successful.

Insert Driver Update media and press Return, or
press one of the following and press Return:
1 CD/DVD devices
2 Legacy, non-USB diskettes
3 All other removable mass-storage devices
4 Search all of the above
5 End
Enter choice and press Return:
```

Figure 6. Installing drivers.

3. Select English as the language, and respond to the tests for screen legibility. These tests time out after 30 seconds, at which point Solaris reverts to a command-line installation. Then configure your network information, as well as time and date.



Figure 7. Confirming time and date.

4. Set the root password, and then verify and confirm all your information. Accept the license agreement, and choose to perform an initial, custom install. Select the character set and products you want to install.
5. Select and customize your disk layout. When you are done, review your information, and start the installation.

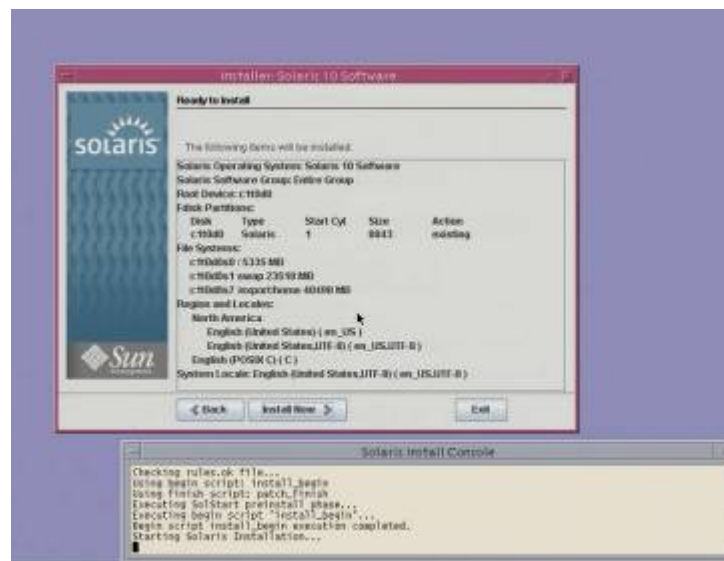


Figure 8. Ready to install

6. When the system reboots, remember to eject the disk. Otherwise, Solaris will try to install itself again.
7. During the reboot, remember to edit the GRUB command line and enter the Kernel debugger again. Once you've disabled CMI checking, continue with the boot.
8. After the system finishes booting, log on as root, and select your desktop. You may edit the /etc/system file following the instructions in [Appendix B](#). Once you've made this change, you will no longer have to edit the GRUB command line.
9. As we describe in [Appendix B](#), apply the drivers for the Broadcom NICs, and configure your networking.



BEST PRACTICES: Configure all database servers with static IP addresses. Doing so assures that Oracle resources remain available even in the event of a DHCP server failure. It also increases the stability of your networking and DNS environments.

Oracle pre-installation tasks

Before you can install Oracle, you must first perform a number of preliminary tasks. For further details, see *Oracle® Database Installation Guide 10g Release 2 (10.2) for Solaris Operating System (x86-64)*, Chapter 2 Preinstallation tasks at http://download.oracle.com/docs/cd/B19306_01/install.102/b15704/pre_install.htm#BHCGGEFF.

We provide an overview of these tasks here and give detailed instructions for each in [Appendix C](#).

Our server met many of the prerequisites for installing Oracle 10g R2, so we do not discuss checking those prerequisites here. The Oracle document we cite above covers that topic in detail.

1. Use the `xhosts` command to make sure that Oracle has access to the X server.
2. Install operating system packages that were not part of the default install.
3. Verify that the installation configured networking correctly and is working.
4. Create the Oracle account and its related groups.
5. Create the Oracle home directory and login script.
6. Create the Oracle project and increase the amount of shared memory it can have.

Configuring the data drives

The next step is to prepare the data drives for Oracle to use. We used the Solaris `format` utility to do the following to each disk:

1. Use `format`'s `fdisk` command to create a Solaris partition on the disk.
2. Use `format`'s `partition` command to edit the partition table. Note: We gave slice 6 all of the disk's available space.
3. Label the disk to make the changes permanent.

Once the `format` utility finishes, use the Solaris `chown` and `chmod` commands to give the Oracle account rights and ownership to slice 6 on each disk, effectively giving the Oracle account control of all the space on the disk.

Installing Oracle 10g R2 on the PowerEdge R900 running Solaris 10

We provide an overview of installing Oracle here. For detailed instructions, see [Appendix C](#). We downloaded the 10201_database_solx86.zip file from <http://www.oracle.com/technology/software/products/database/index.html>, copied it to the PowerEdge R900, and unzipped it locally.

1. Working as the Oracle user, go to the directory where you unzipped the Oracle 10g R2 distribution and type `./runInstaller` to start the Oracle Universal Installer.



NOTES: The command is case-sensitive, and the `./` prefix is necessary. You are doing an Advanced installation, but you are not creating a starter database.



Figure 9. Select Advanced Installation.

2. Accept the defaults on the next few screens.



NOTE: On the Product-Specific Prerequisite Checks screen, we received one warning that some of our kernel settings were above, rather than at, the values Oracle checked for. If you receive such a message, ignore it.

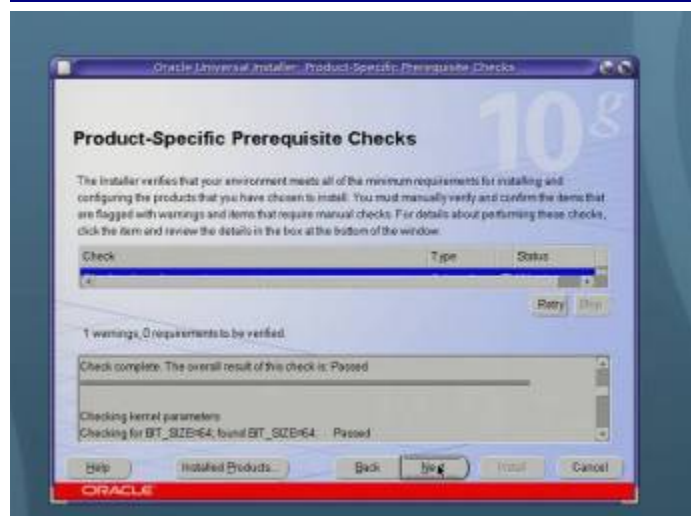


Figure 10. Checking the prerequisites.

3. Next choose to configure Automatic Storage Management (ASM), enter the ASM password, and configure your diskgroup.

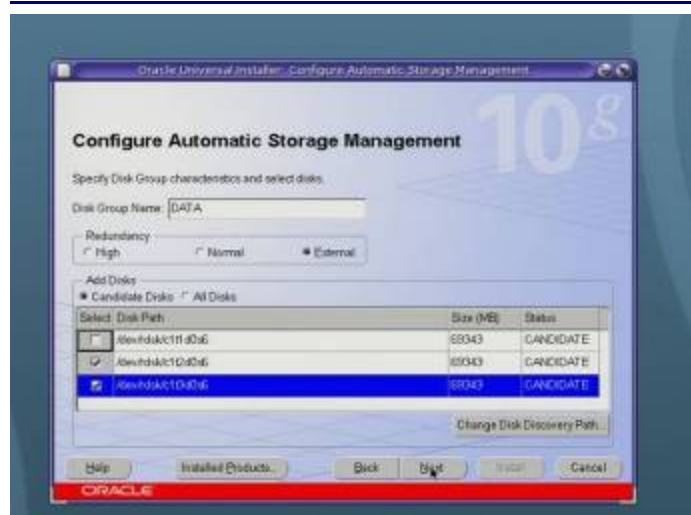


Figure 11. Configuring ASM.

4. Review your settings and start the installation. (15 minutes)
5. When the progress bar completes, Oracle asks you to run two scripts as root. Open a terminal as root, then cut and paste the paths to the scripts into the command line terminal. Click OK.
6. The Configuration Assistants screen appears next. The three configuration assistants should start

successfully, and you will automatically advance to the next screen.

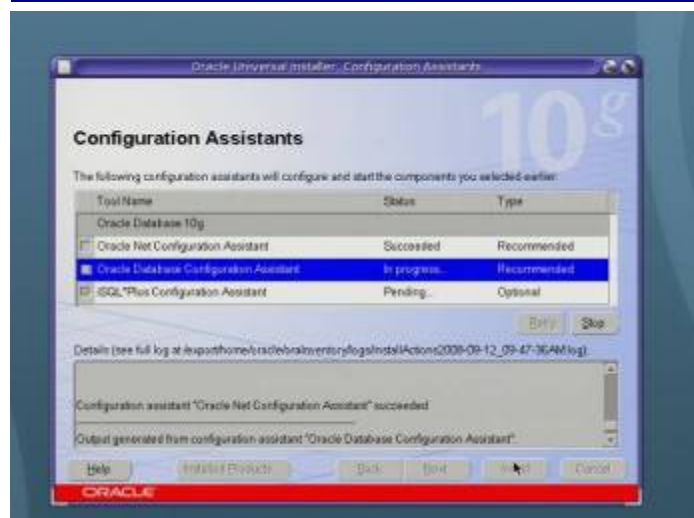


Figure 12. Installing the Configuration Assistants.

7. At the End of Installation screen, click Exit, and then click Yes to confirm that you really want to exit.

Creating an empty database

1. After exiting, set your Oracle environment variables as we describe in [Appendix C](#), and type dbca to launch the Database Configuration Assistant.



Figure 13. The Database Configuration Assistant.

2. When the Welcome screen appears, click Next. Create a custom database and give it a name.

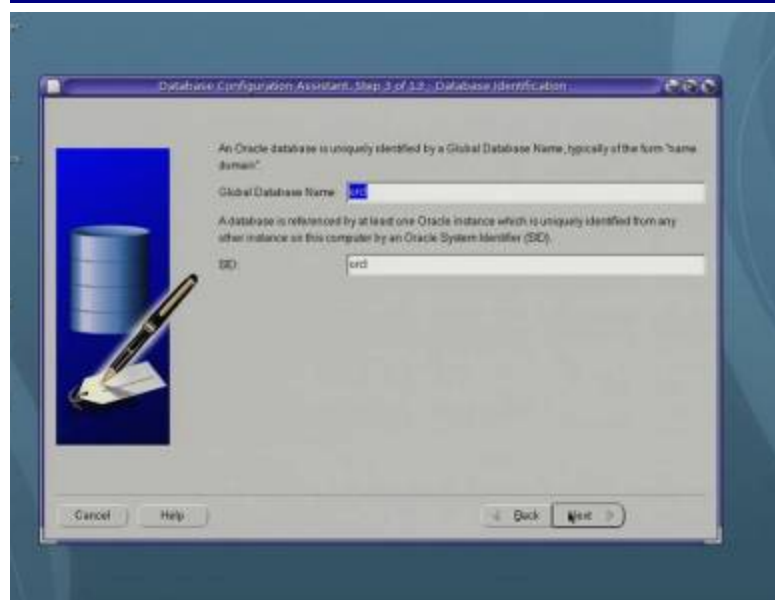


Figure 14. Naming the database.

3. Accept the defaults for the Management Options, enter a password for the database, and select ASM for the storage. Enter the ASM password, and then select the diskgroup you selected earlier.

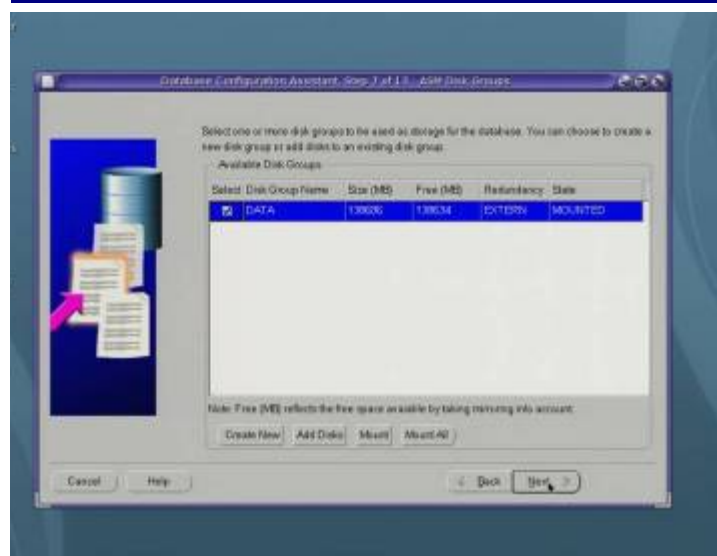


Figure 15. Choosing the diskgroup.

4. Accept the default for the remaining screens, and then click Finish. The Database Configuration Assistant screen appears and shows a progress bar. (30 minutes)

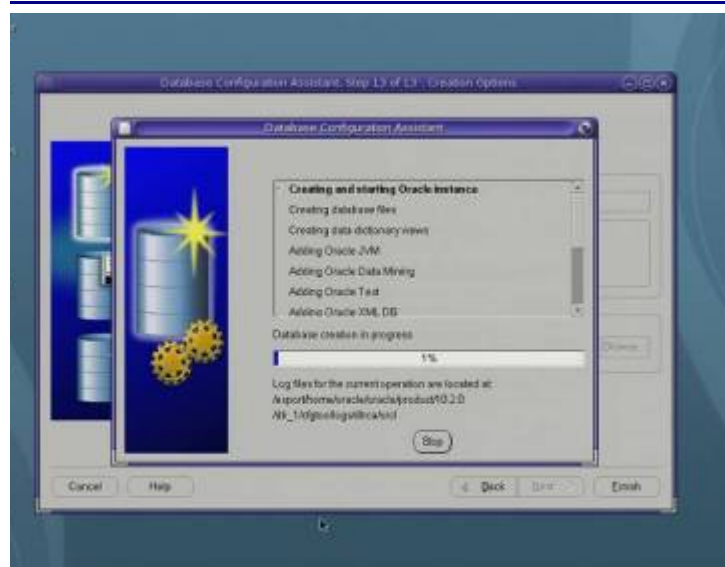


Figure 16. Installing the database.

5. When the Database creation complete screen appears, click Exit.

Migrating to Oracle 10g R2



In this section we provide specific details about migrating user databases from Oracle 9i to Oracle 10g R2. We give an overview of the processes of migrating your database from Solaris 9 and Oracle 9i on the Sun Fire V440 to Solaris 10 and Oracle 10g R2 on the Dell PowerEdge R900.

Migrating your data using export and import

In this section, we provide an overview of the processes involved in migrating your database to Solaris 10 and Oracle 10g R2 on the Dell PowerEdge R900. We provide detailed instructions in [Appendix E](#).

We migrated 20 GB of data we generated using the DVD Store™ Version 2 (DS2) test tool. For more information about DS2, see <http://www.delltechcenter.com/page/DVD+Store>.

Note: Oracle refers to the user data and its associated metadata as a schema. We use that term where appropriate.

Exporting your Oracle 9i database

Using the Sun Fire V440 server, export the schema using the command line utility exp. Figure 17 shows a sample portion of its output. See [Appendix E](#) for details.

Export times vary. Exporting our 20GB schema on our Sun Fire V440 took 42 minutes.

```
Connected to: Oracle9i Enterprise Edition Release
9.2.0.1.0 - 64bit Production
With the Partitioning, OLAP and Oracle Data Mining
options
JServer Release 9.2.0.1.0 - Production
Export done in US7ASCII character set and AL16UTF16
NCHAR character set
server uses WE8ISO8859P1 character set (possible charset
conversion)
. exporting pre-schema procedural objects and actions
. exporting foreign function library names for user DS2
. exporting PUBLIC type synonyms
. exporting private type synonyms
. exporting object type definitions for user DS2
About to export DS2's objects ...
. exporting database links
. exporting sequence numbers
. exporting cluster definitions
. about to export DS2's tables via Conventional Path ...
. . exporting table                CATEGORIES
16 rows exported
. . exporting table                CUSTOMERS
. . exporting partition            US_PART
20000000 rows exported
. . exporting partition            ROW_PART
20000000 rows exported

.....

Export terminated successfully without warnings.
```

Figure 17. Truncated sample output from an Oracle 9i export.

Importing the database into Oracle 10g R2 server

On the Solaris 10, PowerEdge R900 server, take the following steps:

1. In the empty database you created earlier, create the database user for the schema you will import.
2. Create the tablespaces, storing them in ASM managed storage.
3. Run the import utility. Import times vary. Importing our 20GB schema on our Dell PowerEdge 900 took 75 minutes.


```
Connected to: Oracle Database 10g Enterprise Edition
Release 10.2.0.1.0 - Production
With the Partitioning, OLAP and Data Mining options

Export file created by EXPORT:V09.02.00 via conventional
path
import done in US7ASCII character set and AL16UTF16
NCHAR character set
import server uses WE8ISO8859P1 character set (possible
charset conversion)
. importing DS2's objects into DS2
. . importing table                "CATEGORIES"
16 rows imported
. . importing partition            "CUSTOMERS": "US_PART"
20000000 rows imported
. . importing partition            "CUSTOMERS": "ROW_PART"
20000000 rows imported
. . importing partition            "CUSTOMERS": "MAXVAL"
0 rows imported
. . importing table                "CUST_HIST"
119990751 rows imported
. . importing table                "INVENTORY"
200000 rows imported
. . importing partition            "ORDERLINES": "JAN2004"
9994988 rows imported
. . importing partition            "ORDERLINES": "FEB2004"
10001088 rows imported
. . importing partition            "ORDERLINES": "MAR2004"
9997816 rows imported
. . importing partition            "ORDERLINES": "APR2004"
10001861 rows imported
. . importing partition            "ORDERLINES": "MAY2004"
10005091 rows imported
. . importing partition            "ORDERLINES": "JUN2004"
9998739 rows imported
. . importing partition            "ORDERLINES": "JUL2004"
10003418 rows imported
. . importing partition            "ORDERLINES": "AUG2004"
9998633 rows imported
. . importing partition            "ORDERLINES": "SEP2004"
9995732 rows imported

.....

About to enable constraints...
Import terminated successfully without warnings.
```

Figure 18. Truncated sample output from Oracle 10g R2 import.



Once your import is complete, check your database, and verify that all the components imported correctly. You may have to correct some problems. For example, we had to recompile some of our procedures.

Post-migration considerations



After you have completed your side-by-side migration, you will typically need to perform some additional tasks. Your specific list of post-migration tasks will depend heavily on your pre-migration research and planning. In this section, we briefly discuss a couple of the most common tasks, but this list is not comprehensive. For more information, see http://download.oracle.com/docs/cd/B19306_01/server.102/b14238/afterup.htm

Environmental and configuration changes

Updating environment variables. In the Solaris environment, you'll need to make sure that the following environment variables point to the new Oracle directories:

- ORACLE_HOME
- PATH
- ORA_NLS10
- LD_LIBRARY_PATH

Updating SSL users. If you have externally authenticated SSL users, you must upgrade them as well. Do so with the following command:

```
$ORACLE_HOME/rdbms/bin/extusrupgrade --dbconnectstring  
<hostname:port_no:sid> --dbuser <db admin> --  
dbuserpassword <password> -a
```

Changing passwords on DBA accounts. Oracle recommends you change the passwords on all Oracle-supplied accounts. One

good way to make sure this happens is to lock all those accounts, except for SYS and SYSTEM, and then set their passwords to expire immediately. This technique forces users to change those passwords the next time they log into those accounts.

You can use following SQL statement to check the status of the accounts:

```
SQL> SELECT username, account_status  
       FROM dba_users ORDER BY username;
```

To cause passwords to expire, issue the following SQL statement:

```
SQL> ALTER USER username PASSWORD EXPIRE ACCOUNT LOCK;
```

Updating the initialization parameter file. Oracle 10g R2 introduces new initialization parameters and deprecates others. You will need to review your parameter file and make any changes necessary to support your particular system.

Backing up your database

Having successfully migrated to Solaris 10 and Oracle 10g R2, you should make a full backup of your production database. This will ensure that you do not have to repeat the import should any problems occur. It will also serve as a baseline for all future backups.

Summing up

Solaris 10 and Oracle 10g R2 introduce many new features and enhancements. As this Guide has explained, the process of deploying these products on a Dell PowerEdge Server and migrating your Oracle 9i databases to the new environment is relatively straightforward; you can perform a basic installation and migration in less than a day. Spending some up-front time planning can help you avoid potential problems during your migration.

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Appendix A. Methodology: Creating the RAID disk groups

For our installation, we decided to use four RAID groups, which we allocated as follows:

- operating system files and Oracle files
- storage for dump file, later added to ASM storage
- ASM storage
- ASM storage

We explain below how we configured these four disk groups. The directions in this appendix assume you have not configured any virtual disks on your RAID controllers.

Allow at least 10 minutes to complete the installation.

- 1.** During the boot sequence, the message "Press <Ctrl><R> to Run Configuration Utility" Appears. Press <Ctrl><R>. Note: You have only a few seconds to do this.
- 2.** First configure the mirrored RAID for the OS.
- 3.** While Controller 0 is highlighted, press F2, and select Create New VD.
- 4.** With the RAID level field highlighted, press Enter to open the drop-down list, and select RAID 1.
- 5.** Using the Tab key for navigation, move to the Physical Disks section, and use the space bar to select the first two drives (Drives 0 and 1). Then tab to highlight OK, and press Enter.
- 6.** A message box appears telling you that initializing the RAID is highly recommended, but destructive. Press Enter to clear the message.
- 7.** Highlight Controller 0, press F2, and select Create New VD.
- 8.** With the RAID level field highlighted, press Enter to open the drop-down list, and select RAID 1.
- 9.** Using the Tab key for navigation, move to the Physical Disks section, and use the space bar to select the first two drives (Drives 2 and 3). Note that the drives you allocated earlier no longer appear in the available list. Then tab to highlight OK, and press Enter.
- 10.** A message box appears telling you that initializing the RAID is highly recommended, but destructive. Press Enter to clear the message.

- 11.** Highlight Controller 0, press F2, and select Create New VD.
- 12.** With the RAID level field highlighted, press Enter to open the drop-down list, and select RAID 1.
- 13.** Using the Tab key for navigation, move to the Physical Disks section, and use the space bar to select the first two drives (Drives 4 and 5). Note that the drives you allocated earlier no longer appear in the available list. Then tab to highlight OK, and press Enter.
- 14.** A message box appears telling you that initializing the RAID is highly recommended, but destructive. Press Enter to clear the message.
- 15.** Highlight Controller 0, press F2, and select Create New VD.
- 16.** With the RAID level field highlighted, press Enter to open the drop-down list, and select RAID 1.
- 17.** Using the Tab key for navigation, move to the Physical Disks section. Note that only two drives remain on the available list. Select these, then tab to highlight OK, and press Enter.
- 18.** A message box appears telling you that initializing the RAID is highly recommended, but destructive. Press Enter to clear the message.
- 19.** Highlight Virtual Disk 0, and press F2.
- 20.** Select Initialization, and then select Fast Init. Highlight OK, and when the system prompts you with any warnings, press Enter.
- 21.** Highlight Virtual Disk 1, and press F2.
- 22.** Select Initialization, and then select Fast Init. Highlight OK, and when the system prompts you with any warnings, press Enter.
- 23.** Highlight Virtual Disk 2, and press F2.
- 24.** Select Initialization, and then select Fast Init. Highlight OK, and when the system prompts you with any warnings, press Enter.
- 25.** Highlight Virtual Disk 3, and press F2.
- 26.** Select Initialization, and then select Fast Init. Highlight OK, and when the system prompts you with any warnings, press Enter.
- 27.** Exit the RAID utility, and reboot the server.

Appendix B. Methodology: Installing Solaris 10 on the PowerEdge R900

Install Solaris 10 by following these steps. We provide approximate times for each group of steps in the first step of that group.

Allow at least 60 minutes to complete the installation. We used version Solaris 10 5/08 Operating System for x86-based systems (64-bit), which we downloaded from <http://www.sun.com/software/solaris/get.jsp> and burned to a DVD.

Note: In this appendix, we use the primary network interface name, which in our case was bnx0. You should use the name of the primary network interface that you encounter, which may differ slightly from what we present here.

To complete this installation, you will need to download the driver for the RAID controller and burn it to a CD. Assuming that your server also uses a MegaRAID SAS 8888ELP RAID controller, you can select the correct driver and download it from http://www.lsi.com/storage_home/products_home/internal_raid/megaraid_sas/megaraid_sas_8888elp/index.html?remote=1&locale=EN

1. Reboot and wait for the GNU GRUB boot screen to appear. (1 minute)
2. "Solaris" should be highlighted as the default choice. However, you must edit the boot command. As we discuss above, our PowerEdge R900 has more than 16 cores, so we need to disable the cmi check. On the GNU GRUB screen, press `e` while Solaris is highlighted, then press `e` again to edit the boot command. Using the arrow keys, add the switch `-kd` just before the switch `-B`. Then press Enter.
3. Press `b` to boot the system.
4. When you reach the prompt for the kernel debugger, enter `cmi_no_init/W1`, and press Enter. This is the command to disable the cmi check. You should see the following message:

```
cmi_no_init: 0      =      0x1
```
5. Type `:c`, and press Enter to continue the installation. (1 minute)
6. After the Configuring devices message, select 5, Apply driver updates, because our Solaris 10 does not come with the drivers for our PERC 6i. **Note: If you do not apply the drivers at this step, Solaris will fail much later in the installation.**

- 7.** Put the driver CD in the system and select menu item 1, CD/DVD devices and press Enter.
- 8.** After the driver installs, replace the Solaris installation CD in the system, and then select menu item e, End and press Enter.
- 9.** At the next menu, select menu item 1, "Solaris interactive (default)". This is the default and the system automatically uses it after 30 seconds. The system then continues its initialization.
- 10.** Although the Solaris install DVD does not support the Broadcom NetExtreme II NICs in the PowerEdge R900, it tries to configure the NICs anyway. Then it sets up Java and does other initialization. (7 minutes)
- 11.** At the Configure Keyboard Layout Screen, select US-English. This is the default, and there is no timeout. Press function key 2 (F2) to continue.
- 12.** When the screen says, Starting Solaris Interactive (graphical user interface) Installation, press Enter.
- 13.** When the screen says, "If the screen is legible, press ENTER in this window," move the mouse inside the box, and press Enter. You have 30 seconds, after which the system reverts to a command-line based install.
- 14.** At the Select a Language prompt, select choice 0, English and press Enter. After this, a Please Wait While the System Information is Loaded screen appears. (less than 1 minute)
- 15.** After a few seconds, a Welcome message appears. Click Next.
Note: A Solaris Install Console message screen appears during many of these steps. It presents messages, but you do not interact with it.
- 16.** On the Network Connectivity screen, select Networked, and click Next.
- 17.** On the Configure Multiple Network Interfaces screen, select bnx0, and click Next. Note: Although the install did not support our NICs, we had to configure one NIC to have Solaris install networking. We reconfigure this NIC later in the process, when we can add the drivers.
- 18.** On the DHCP for bnx0 screen, accept the default of No. The default agrees with the best practice of using hard-coded addresses for database servers. Click Next.

- 19.** On the Host Name for bnx0 screen, enter a valid name for the interface. **DO NOT use any upper-case letters. An upper-case or mixed-case host name can cause the Oracle installation to fail.** Click Next.
- 20.** On the IP Address for bnx0, enter a valid IP address, and click Next.
- 21.** On the Netmask for bnx0, enter the correct netmask for your network. The default is 255.255.255.0, which may not be correct for you. Click Next.
- 22.** On the IPv6 for bnx0 screen, accept the default of No, and click Next.
- 23.** On the Set the Default Route for bnx0, select Specify One, and click Next.
- 24.** On the Set the Default Route for bnx0, fill in the appropriate address for your network, and click Next.
- 25.** For the remaining network interfaces, specify the network information as you did for the primary interface. This may be similar or different from the primary interface information, depending on your situation. (In our case, only the IP addresses differed.) Click Next.
- 26.** On the Kerberos screen, accept the default of No. Note: Because this choice affects network security, check with your administrator regarding this setting. Click Next.
- 27.** On the Name Service screen, select None. Because you have to enable your NICs later, you will add your DNS information then as well. Click Next.
- 28.** On the NFSv4 Domain Name screen, accept the default of Use the NFSv4 domain derived by the system, and click Next.
- 29.** On the Time Zone screen, accept the default of Geographic Continent/Country/Region, and click Next.
- 30.** On the Continent and Country screen, select Americas → United States → Eastern Time, and click Next.
- 31.** On the Date and Time screen, accept the date and time displayed, and click Next.
- 32.** On the Root Password screen, enter the root password for your server, confirm it, and click Next.
- 33.** On the Enabling Remote Services screen, accept the default of Yes, and click Next.
- 34.** On the Confirm Information screen, verify that all the information for your interfaces is correct. Resize the window to view all the information if necessary. Click

Confirm. A message then appears telling you to "Please wait while the system is configured with these settings."

- 35.**The dialog disappears and the screen is blank for a few seconds before a Welcome screen appears. On the Welcome screen, click Next.
- 36.**On the Installer Options screen, accept the default of Yes for "Reboot automatically after software installation?" and "Eject additional CDs/DVDs automatically after software installation?" Click Next. Note: We received a notice saying "You must also manually eject the CD/DVD or select a different boot device after reboot to avoid repeating the installation process." We clicked OK.
- 37.**On the Specify Media Screen, accept the default of CD/DVD, and click Next.
- 38.**On the License screen, select Accept to accept the license agreement, and click Next.
- 39.**On the Select Upgrade or Initial Install screen, select Initial Install, and click Next.
- 40.**On the Select Type of Install screen, select Custom Install, and click Next.
- 41.**On the Select Software Localizations screen, select North America (or the appropriate selection for your location), and click Next.
- 42.**On the Select System Locale screen, select English(United States,UTF-8)(en_US.UTF-8) (or the appropriate language), and click Next.
- 43.**On the Additional Products Screen, select None, and click Next.
- 44.**On the Select Solaris Software Group screen, select Default Packages Entire Group, and click Next.
- 45.**On the Disk Selection screen, accept the default, and click Next. Note: In our case, the default was c1t0d0, which we use in the examples below.
- 46.**On the Select Disks for fdisk Partition Customization, select c1t0d0, and click Next.
- 47.**On the Customize fdisk Partitions – Disk c1t0d0, accept the default, and click Next.
- 48.**On the Preserve Data screen, select No.
- 49.**On the layout File systems screen, click Modify.
- 50.**On the Disk c1t0d0 screen, increase the swap to Oracle's recommended level, and click Apply. Oracle recommends three-quarters of RAM for systems with more than 8 GB of RAM. Since our server had 64GB of

RAM, we allocated 48GB. We took the space from /export/home. Click OK to exit the layout File systems screen. Click Next to continue.

- 51.** On the Ready to Install screen, review the information, and click Install Now. (40 minutes)
- 52.** The Installing... screen appears, with a progress bar. After the installation completes, the system pauses for 90 seconds. You can skip the pause by clicking Continue in the Pausing dialog box.
- 53.** After installing any additional software, the system again pauses, this time for 30 seconds. You can skip the pause by clicking Continue in the Pausing dialog box.
- 54.** Before rebooting, the system pauses for 90 seconds. You can skip the pause by clicking Continue in the Pausing dialog box. Note: Remember to eject the DVD during the reboot, or Solaris will start installing itself again.
- 55.** When the reboot reaches the GNU GRUB screen, you must again type `e` to edit the boot command line and add `-kd`. Use the Enter key to exit the editor, and then type `b` to boot the system.
- 56.** In the kernel debugger, enter the `cmi_no_init/W1` command and press Enter.
- 57.** Type `:c`, and then press Enter to continue the boot.
- 58.** After the system has booted, log in as root.
- 59.** Select your desktop. We accepted the default of Sun Java Desktop System Release 3.
- 60.** When a message with the follow text appears, click Log in anyway: "Could not look-up Internet address for <hostname>. This will prevent GNOME from operating correctly. It may be possible to correct the problem by adding <hostname> to /etc/hosts." Note: You will fix the /etc/hosts file below.
- 61.** On the Welcome to the Sun Java Desktop System splash screen, click Close.
- 62.** Right-click the wallpaper and select Open Terminal.
- 63.** We need to change the /etc/system file to stop CMI checking from causing the system to continually reboot. Type `gedit /etc/system` to edit the file.
- 64.** Scroll to the end of the file and type `set`
`cpu\.generic:gcpu_mca_poll_interval=0`
- 65.** Save your changes and close the editor. You no longer need to use the kernel debugger to reboot. However, on reboot, you may see messages of the

form "WARNING: There will be no MCA support on
chip <#> core <#> strand 0 (cmi_hdl_create
returned NULL" where # is the chip or core number.
You may ignore these.

Configuring the NICs, setting the IP address and subnet mask

We used Broadcom NeteXtreme II NICs in our system. Because the Solaris version we used did not recognize these NICs, it booted into maintenance mode. To correct this issue, we followed the process below.

Your server may use different NICs. If the Solaris version you use recognizes your NICs, you can configure them during the installation. If it does not recognize them, adapt the steps below as appropriate.

Note: To complete this configuration, we downloaded the driver for the NICs from http://www.broadcom.com/support/ethernet_nic/netxtremeii.php and burned it to a CD.

Configuring the NICs takes roughly 30 minutes.

1. Log in as root.
2. When prompted to select a default desktop, accept the default, the Java Desktop System, Release 3.
3. On the Welcome to the Sun Java Desktop System screen, click Close.
4. Right-click the background, and select Open Terminal.
5. Insert the CD with the NIC drivers, and wait for it to mount.
6. Once the CD mounts, use the terminal to cd to the directory containing the package. (In our case, it was /cdrom/080812_1629/Solaris.)
7. As per the readme.txt file from Broadcom, install the drivers with this command: `pkgadd -d brcmbnx.pkg`, and press Enter.
Note: Only one package was available, so we accepted the default of installing all packages.
8. A message appears saying that some of the files you are about to install conflict with files installed earlier by Solaris. We selected y to install the conflicting files.
9. A warning appears saying that the installation requires running scripts with super-user privileges. Select y. A message saying that the installation was successful appears.
10. Activate each NIC with this pair of commands, replacing <NIC> with the name of your NIC:

- To activate the NIC, use this command:
`ifconfig <NIC> plumb` and press Enter. For example:

```
# ifconfig bnx0 plumb
```

Note: For bnx0, the NIC that you used as the primary interface when installing Solaris, you will see the following message: `ifconfig: SIOCSLIFNAME for ip: bnx0: already exists.` You should not see this for the other NICs.

- To configure the NIC, use this command:
`ifconfig <NIC> <ip address> netmask <netmask> up`. For example:

```
# ifconfig bnx0 11.14.4.240 netmask  
255.255.255.0 up
```

11. To make the changes permanent, edit the `/etc/hosts`, and `/etc/netmasks` files, and create the appropriate `/etc/hostname.<NIC>` files. Example, using "solarisx64" as the hostname:

- Edit `/etc/hosts` and add the line
`11.14.4.240 solarisx64`
- Edit `/etc/netmasks` and add the uncommented line `11.14.4.240
255.255.255.0`

12. Use `gedit` to edit the `/etc/hostname.bnx0` file. Accept the option to create it if it does not exist.

13. Add a line containing your hostname

14. Save and exit.

15. Set the DNS information.

16. Edit the `/etc/nsswitch.conf` file. Find the line beginning `hosts:`, and append `dns` after `files`. For example `hosts: Files dns`

17. Create `/etc/resolv.conf`, and put a line for each DNS server of the form `nameserver <IP address of DNS server>`

18. Open `gedit`. Type `nameserver`. Click `File→Save As→<resolv.conf>` in the `Filesystem/etc` directory.

19. Reboot to get DNS working.

Appendix C. Methodology: Installing Oracle 10g R2 on the PowerEdge R900

Oracle pre-installation tasks

Before you can install Oracle, you must first perform a number of preliminary tasks. For further details, see *Oracle® Database Installation Guide 10g Release 2 (10.2) for Solaris Operating System (x86-64)*, Chapter 2 Preinstallation tasks at http://download.oracle.com/docs/cd/B19306_01/install.102/b15704/pre_install.htm#BHCGGEFF

Please note that our server met many of the prerequisites for installing Oracle 10g R2, so we do not discuss checking those prerequisites here. The Oracle document we cite above covers this topic in detail.

Allow at least 30 minutes to complete the preparation.

1. Log in as root.
2. The server needs to display X applications. To work locally, you can use the command `xhost local:`
3. You need to install the SUNWi1cs and the SUNWi15cs packages. The pathname in the commands below is the path name of the patch files on our Solaris distribution DVD.
 - `pkgadd -d /cdrom/sol_10_508_x86/Solaris_10/Product SUNWi1cs`
 - `pkgadd -d /cdrom/sol_10_508_x86/Solaris_10/Product SUNWi15cs`
4. When asked about running scripts using super-user permissions, reply `y` for yes.
5. Verify that networking is set up correctly, using the following set of commands:
 - `cat /etc/nsswitch.conf | grep hosts` The output should contain an entry for "files".
 - `hostname` should list a hostname for this system.
 - `domainname` should not return any results.
 - `cat /etc/hosts | grep <hostname>` should have an entry for the fully qualified host name.

Note: If you install Oracle on a system using DHCP or on a multihomed system, you will need to take additional steps. Please see the Oracle 10g R2 Preinstallation tasks document for further details.

- 6.** Create the Oracle inventory group with this command: `/usr/sbin/groupadd oinstall`
- 7.** Create the Oracle dba group with this command: `/usr/sbin/groupadd dba`
- 8.** Create the Oracle software owner user with this command: `/usr/sbin/useradd -g oinstall -G dba oracle`
- 9.** Set the password of the oracle user with this command: `passwd -r files oracle`
- 10.** The command prompts you for the new password.
- 11.** Create and set the home directory of the oracle user with these commands:
 - `mkdir /export/home/oracle`
 - `chown -R oracle:oinstall /export/home/oracle`
 - `chmod -R 775 /export/home/oracle`
 - `usermod -d /export/home/oracle oracle`
- 12.** Oracle requires that the nobody account exist. In our installation, Solaris 10 created it by default. You can verify the account exists with this command: `id nobody`
- 13.** Because this is a fresh install, we would not expect an Oracle project to exist. Create one with this command: `projadd -U oracle user.oracle`
- 14.** Verify the oracle user's project ID with this command: `id -p oracle`
You should see output of the form `uid=100(oracle) gid=100(oinstall) projid=100(user.oracle)`.
- 15.** You now need to set the kernel parameters. Type `projmod`. See the Oracle documentation for a fuller explanation. You will use the `projmod` command instead of the `prctl` command because you want the changes to persist across reboots.
- 16.** Increase the amount of shared memory available to the oracle user. (Note: We found that dbca, when creating a database, would, by default, attempt to obtain 40 percent of RAM, so to be safe we gave the project a maximum shared memory segment size of 50 percent of RAM.) Use this command to do that:


```
projmod -s -K "project.max-shm-  
memory=(priv,32gb,deny) " user.oracle
```

17. Create the Oracle base directory with these commands:

- `mkdir -p /export/home/app/oracle`
- `chown -R oracle:oinstall /export/home/app/oracle`
- `chmod -R 775 /export/home/app/oracle`

18. Using a text editor, create the file ".profile" in /export/home/oracle. Enter the following lines and save the file:

- `umask 022`
- `DISPLAY=:0.0`
- `export DISPLAY`

19. Give the oracle user ownership of the file with these commands:

- `chown -R oracle:oinstall /export/home/oracle/.profile`
- `chmod -R 770 /export/home/oracle/.profile`

Preparing Disks for Automatic Storage Management

Allow at least 15 minutes to prepare the disks.

- 1.** Type `format` at the command line prompt, and select 1. If you configured the drives as described in section [Appendix A](#), you will see four choices. The operating system will be on choice 0, so configure only drives 1, 2, and 3. Repeat the steps below for each of the drives.
- 2.** Type `fdisk` to create the Solaris partition.
- 3.** Type `partition` and type `print` to see the partition table. Slice 2 will contain the entire drive. Do not modify slice 2, as this can destroy the partition table on your drive. However, look at its entry to get the number of cylinders on the disk. (In our case, it was 8,840.)
- 4.** You will be updating partition 6, so type `6`, and then press Enter.
- 5.** Accept the default of unassigned for the id tag.
- 6.** Accept the default of `wm` for the permission flags.

- 7.** Enter 1 for the starting cylinder. Never start at cylinder 0, as you would overwrite the partition table.
- 8.** Enter 8840c, and then take all the space on the disk except for cylinder 0.
- 9.** Next, type `label` to make the partition table changes permanent. When prompted, choose `y`.
- 10.** Exit the format utility, and repeat the steps above for disk 2 and disk 3.
- 11.** For ASM, Oracle must own the candidate drives. To give Oracle ownership, use these commands:
 - `chown oracle:dba /dev/rdisk/c1t1d0s6`
 - `chown oracle:dba /dev/rdisk/c1t2d0s6`
 - `chown oracle:dba /dev/rdisk/c1t3d0s6`
 - `chmod 660 / dev/rdisk/c1t1d0s6`
 - `chmod 660 / dev/rdisk/c1t2d0s6`
 - `chmod 660 / dev/rdisk/c1t3d0s6`
 - `chown -h oracle:dba /dev/rdisk/c1t1d0s6`
 - `chown -h oracle:dba /dev/rdisk/c1t2d0s6`
 - `chown -h oracle:dba /dev/rdisk/c1t3d0s6`

Appendix D. Methodology: Installing Sun Oracle 10g R2 on the PowerEdge R900 running Solaris 10

We downloaded Oracle 10g R2 from <http://www.oracle.com/technology/software/products/database/index.html>. We copied the 10201_database_solx86.zip file to the PowerEdge R900, and unzipped it locally by right clicking the file and choosing Extract Here.

Allow at least 30 minutes to complete the installation.

1. Use the command `su oracle` to become the oracle user. You cannot run the Oracle Universal Installer when logged in as root.
2. From the oracle user's home directory, type `./profile` to set up your environment. The `./` (dot-space-dot-slash) is necessary.
3. Change your directory to the top level directory of the Oracle distribution you unzipped.
4. Type `./runInstaller`. The name is case sensitive and the leading `./` is required.
5. On the Select Installation Method screen, deselect Create Starter Database.
6. Click Advanced Installation. The fields under Basic Installation turn gray, but their values hold.
7. Click Next.
8. The OUI dialog disappears for few seconds, and then reappears. In the Specify Inventory Directory and credentials screen, accept the default, and click Next.
9. In the Select Installation Type screen, accept the default, Enterprise Edition, and click Next.
10. On the Specify Home Details Screen, accept the default, and click Next.
Note: On the Product-Specific Prerequisite Checks screen, you might see one warning. Some of the kernel settings we specified earlier were above, rather than at, the values Oracle expected. If you receive this warning, you can ignore it.
11. Click Next. When the warning appears, click Yes.
12. On the Select configuration Option Screen, select Configure Automatic Storage Management (ASM), and enter the ASM password. Click Next.
13. On the Configure Automatic Storage Management screen, accept the default Disk Group Name of DATA, choose External for the type of Redundancy, and

select all available disks except the first. You will add the first disk to the diskgroup after you import the data. Note: Since you configured your storage as a set of RAID5s earlier, the RAID controller provides the redundancy. Click Next.

- 14.** On the Summary screen, review your settings, and click Install. The Install screen, which shows a progress bar, appears. (15 minutes)
- 15.** When the progress bar completes, Oracle asks you to run two scripts as root. Open a terminal by right-clicking the desktop and selecting Open Terminal. You can cut and paste the paths to the scripts into the command line terminal.
- 16.** The first script is `orainstRoot.sh`. You only see this script the first time you install Oracle on a system. Should you need to reinstall Oracle, you will not run it again.
- 17.** The second script is `root.sh`. It asks you to type in the name of the local bin directory, which is `/usr/bin`. Before this script completes, it starts the CSS service. Once you see the message "Oracle CSS service is installed and running under init(1M)", you may close the terminal Window.
- 18.** In the Execute Configuration scripts dialog, click OK.
- 19.** Next, the Configuration Assistants screen appears. The three assistants should start successfully, and you will automatically advance to the next screen.
- 20.** On the End of Installation screen, click Exit, then click Yes to confirm that you really want to exit.

Creating an empty database

Allow at least 45 minutes to create the database.

- 1.** After exiting, set the `ORACLE_HOME` environment variable. (In our case, the correct command was `ORACLE_HOME=/export/home/oracle/oracle/product/10.2.0/db_1; export ORACLE_HOME`)
- 2.** Set your `PATH` variable by typing `PATH=$ORACLE_HOME/bin:$PATH`
- 3.** Type `dbca` to launch the Database Configuration Assistant.
- 4.** When the Database Configuration Assistant: Welcome screen appears, click Next.

- 5.** On the Database Configuration Assistant, step 1 of 12: Operations screen, select Create a Database, and click Next.
- 6.** On the Database Configuration Assistant, step 2 of 12: Database Templates screen, select Custom Database, and click Next.
- 7.** On the Database Configuration Assistant, step 3 of 12: Database Identification screen, enter the Global Database Name. By default, Oracle uses this name for the SID as well.
- 8.** On the Database Configuration Assistant, step 4 of 12: Management Options screen, accept the defaults, and click Next.
- 9.** On the Database Configuration Assistant, step 5 of 12: Database Credentials screen, enter a password. We accepted the default of using the same password for the listed accounts, and click Next.
- 10.** On the Database Configuration Assistant, step 6 of 12: Storage Options, select Automatic Storage Management (ASM), and click Next.
- 11.** When the ASM Credentials screen pops up, enter the ASM password, and click OK. Note: When you select ASM, the title of the Window changes from "step 6 of 12" to "step 6 of 13".
- 12.** On the Database Configuration Assistant, step 7 of 13: ASM Disk Groups, select the group you created during ASM installation. Then click Next.
- 13.** On the Database Configuration Assistant, step 8 of 13: Database File Locations, accept the default, and click Next.
- 14.** On the Database Configuration Assistant, step 9 of 13: Recovery Configuration screen, accept the default, and click Next.
- 15.** On the Database Configuration Assistant, step 10 of 13: Database Content screen, accept the default, and click Next.
- 16.** On the Database Configuration Assistant, step 11 of 13: Initialization Parameters, accept the default, and click Next.
- 17.** On the Database Configuration Assistant, step 12 of 13: Database Storage, click Next.
- 18.** On the Database Configuration Assistant, step 13 of 13: Creation Options screen, click Finish.
- 19.** On the Confirmation screen, click OK.

The Database Configuration Assistant screen appears and shows a progress bar. (30 minutes)

20. When the Database creation complete screen appears, click Exit.

Appendix E. Methodology: Migrating the DS2 data

Exporting data on the Sun Fire V440 running Solaris 9 and Oracle 9i

In our examples, we used a sample schema called DS2, which contained four tablespaces. The total size of our schema objects was about 20GB. Exporting the 20GB schema on the Sun Fire V440 system was very simple.

In this example, the directory /u02 is an example. You may store the dump file where ever you wish.

Allow at least an hour to complete the export.

1. You must run the catexp.sql script before using the import and export utilities. Depending on your current directory, you may have to specify the path to the script, which is in the rdbms/admin directory in your Oracle home directory.
2. To export the database, use this command: `exp ds2/<PASSWORD> FILES=/u02/ds2.dmp LOG=ds2.log STATISTICS=none OWNER=ds2 (42 minutes)`

This command logs into the database as the user ds2 and exports the ds2 user's schema objects out to a file called ds2.dmp located at /u02.

Importing data on the PowerEdge R900 running Solaris 10 and Oracle 10g R2

Note: You created the empty database previously.

Allow at least an hour and 45 minutes to complete the import.

1. First you need to create a file system to hold the dump file. Remember that you left one disk out of your ASM group, and that you changed the partition table so that all your space was on slice 6. That is where you create the file system. In our case, the raw device was c1t1d0s6, so we used this command:
`newfs /dev/rdisk/c1t1d0s6`
2. Create a directory to use as a mount point. We created the directory "space" under /export using this command: `mkdir /export/space`

- 3.** Edit the file `/etc/vfstab`. And add an entry like this one:
`/dev/dsk/ct1t1d0s6 /dev/rdsk/ct1t1d0s6
/export/space - ufs 2 yes -`
- 4.** Use the command `mount /export/space` to make the space usable.
- 5.** Change permissions on the space directory using this command: `chmod 755 /export/space`
- 6.** Copy the dump file to `/export/space`. We used the `scp` command on the R900 to do this: `scp <Old Server Host name>:/u02/ds2.dmp /export/space/ds2.dmp`. (12 minutes)
- 7.** Edit the file `$ORACLE_HOME/dbs/initiorcl.ora`. (Assuming you accepted the default name of "orcl" for your database.) Add the line `SESSIONS=750`. In our experiments, we exceeded the default value of 170 concurrent sessions during our import.
- 8.** As the Oracle user, start `sqlplus` with this command at a shell: `sqlplus`. When prompted for username, use `sys as sysdba`. When prompted for a password, use the one you selected earlier.
- 9.** You need to restart the database to get the sessions parameter to take effect. Type `shutdown immediate;`. (2 minutes)
- 10.** Type `startup;` (3 minutes).
- 11.** Type `show parameter sessions;` make sure sessions has the new value of 750.
- 12.** As we note above, you need to run the `catexp.sql` script. Use the script `@catexp.sql` for this. Depending on your current directory, you may have to specify the path to the script, which is in the `rdbms/admin` directory in your Oracle home directory.
- 13.** We are calling the owner of this database `ds2`. Create the user for the database using this command:
`create user ds2 identified by <PASSWORD>;`
- 14.** Because `ds2` is a user we are creating to manage the data for the DS2 database, we grant him all privileges using this command: `grant all privileges to ds2;` (Obviously, you should carefully consider the privileges you grant each new user account.)
- 15.** Our schema has four tablespaces: `custtbs`, `ds_misc`, `indxtbs`, and `ordertbs`. Create them using the following commands:
 - `CREATE TABLESPACE "CUSTTBS"
LOGGING DATAFILE '+DATA' SIZE 18000M`


```
REUSE AUTOEXTEND ON NEXT 500M MAXSIZE  
32767M EXTENT MANAGEMENT LOCAL  
SEGMENT SPACE MANAGEMENT AUTO;(3  
minutes)
```

- CREATE TABLESPACE "DS_MISC"
LOGGING DATAFILE '+DATA' SIZE 1000M
REUSE AUTOEXTEND ON NEXT 500M MAXSIZE
32767M EXTENT MANAGEMENT LOCAL
SEGMENT SPACE MANAGEMENT AUTO; (2
minutes)
- CREATE TABLESPACE "INDXTBS"
LOGGING DATAFILE '+DATA' SIZE 12000M
REUSE AUTOEXTEND ON NEXT 500M MAXSIZE
32767M EXTENT MANAGEMENT LOCAL
SEGMENT SPACE MANAGEMENT AUTO;(2
minutes)
- CREATE TABLESPACE "ORDERTBS"
LOGGING DATAFILE '+DATA' SIZE 12000M
REUSE AUTOEXTEND ON NEXT 500M MAXSIZE
32767M EXTENT MANAGEMENT LOCAL
SEGMENT SPACE MANAGEMENT AUTO; (2
minutes)

Notice the +DATA syntax, which tells Oracle to put the tablespaces in ASM storage. Note: We created the tables using the parameters from the DS2 scripts.

16.Type EXIT; to exit sqlplus.

17.Import the ds2 data with this command:

```
imp ds2/<PASSWORD>  
FILE=/export/space/<NAME>.dmp LOG=<NAME>.log  
FROMUSER=ds2 STATISTICS=recalculate (75  
minutes)
```

18.The import is complete. Check the log when imp finishes to verify a successful installation.

Adding the final RAID array to ASM

Allow at least 20 minutes to complete the configuration.

1. Unmount the /export space directory using the umount command: `umount /export/space` (Note the spelling; it's **not** unmount.)
2. Edit /etc/vfstab and comment out, or delete, the line we added earlier when creating the mount point for the dump files. Note: This is very important. If you

leave the line in `/etc/vfstab`, Solaris will try to mount it the next time it boots.

- 3.** Earlier, we set the ownership and permissions for `c1t1d0s6`. However, we should verify that nothing has changed. Check the ownership by using this command: `ls -l /dev/rdisk/c1t1d0s6`
You should see that the owner is still Oracle.
- 4.** Start `dbca`, and click Next on the welcome screen.
- 5.** On the Database Configuration Assistant step 1 of 13: Operations, Select Configure Automatic Storage Management.
- 6.** On the Database Configuration Assistant step 2 of 13: ASM Disk Groups screen, Select Add Disks.
- 7.** On the Add Disks screen, select the remaining disk. In our case, it showed up as `/dev/rdisk/c1t1d0s6`. Click OK.
- 8.** When you return to the Database Configuration Assistant step 2 of 13: ASM Disk Groups screen, click Finish.
- 9.** When the installation software asks if you want to perform another operation, click No.

ASM automatically rebalances the data across all drives, including the one you just added.

(Approximately 13 minutes, an estimate we based on the activity of the disk lights)

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