Oracle8*i* ™

Administrator’s Reference

Release 2 (8.1.6) for Sun SPARC Solaris

December 1999

Part No. A77184-01

Topics Include:
Administering Oracle8i
Tuning Oracle8i
Administering SQL*Plus
Using Oracle Precompilers and the Oracle Call Interface
Configuring Net8
Running Oracle Data Option Demos
Optimal Flexible Architecture

Oracle8*i* Administrator’s Reference, Release 2 (8.1.6) for Sun SPARC Solaris

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Preface

Purpose

This reference and the *Oracle8i Installation Guide* provide instructions for installing and configuring Oracle8*i* Release 2 (8.1.6) on Sun SPARC Solaris systems. Product-specific documentation is in the Oracle8*i* Generic Documentation Set.

Audience

This document is intended for anyone responsible for administering Oracle8*i* Release 2 (8.1.6) on Sun SPARC Solaris systems.

Oracle8*i* and Oracle8*i* Enterprise Edition

Unless noted otherwise, features and functionality described in this document are common to both Oracle8*i* and Oracle8*i* Enterprise Edition.

Typographic Conventions

`monospace` Monospace type indicates UNIX commands, directory names, usernames, pathnames, and filenames.

brackets [ ] Words enclosed in brackets indicate key names (for example, Press [Return]). Note that brackets have a different meaning when used in command syntax.

italics Italic type indicates a variable, including variable portions of filenames. It is also used for emphasis.

UPPERCASE Uppercase letters indicate Structured Query Language (SQL) reserved words, initialization parameters, and environment variables.

Command Syntax

UNIX command syntax appears in `monospace` font and assumes the use of the Bourne shell. The "`$`" character at the beginning of UNIX command examples should not be entered at the prompt. Because UNIX is case-sensitive, conventions in this document may differ from those used in other Oracle documentation.

backslash \ A backslash indicates a command that is too long to fit on a single line. Enter the line as printed (with a backslash) or enter it as a single line without a backslash:

```
dd if=/dev/rdsk/c0t1d0s6 of=/dev/rst0 bs=10b \
count=10000
```

braces { } Braces indicate required items: `.DEFINE {macro1}`

brackets [ ] Brackets indicate optional items: `cvtcrt` ***`termname`*** [***`outfile`***]

Note that brackets have a different meaning when used in regular text.

ellipses ... Ellipses indicate an arbitrary number of similar items:
`CHKVAL fieldname` *`value1 value2 ... valueN`*

italics Italic type indicates a variable. Substitute a value for the variable:
`library_name`

vertical line | A vertical line indicates a choice within braces or brackets:
`SIZE filesize [K|M]`

Accessing Online Documentation

Oracle8*i* for Sun SPARC Solaris Documentation

Oracle8*i* for Sun SPARC Solaris documentation includes this reference and the *Oracle8i Installation Guide for Sun SPARC Solaris*.

To access the documentation in HTML and PDF formats, use a UNIX browser to open the `index.htm` file at the top level of the Oracle8*i* CD-ROM. This file contains links to product and Solaris-specific documentation.

Oracle Product Documentation

Oracle8*i* product documentation is on the Oracle8*i* Generic Documentation CD-ROM. Instructions for accessing and installing the documents on the CD-ROM are found in the README file on the top level directory of the CD-ROM.

Related Documentation

If you are unfamiliar with the concepts or terminology associated with relational database management systems, read Chapter 1 in *Oracle8i Concepts* before beginning your installation.

Information about system administration and tuning for a production database system is provided in these documents:

- *Oracle8i System Administrator's Guide*
- *Net8 Administrator's Guide*
- *Oracle8i Designing and Tuning for Performance*

Information about migrating or upgrading from a previous release of the Oracle Server is provided in *Oracle8i Migration*.

Oracle Services and Support

A wide range of information about Oracle products and global services is available on the Internet, from:

```
http://www.oracle.com
```

The sections below provide URLs for selected services.

Oracle Support Services

Technical Support contact information worldwide is listed at:

`http://www.oracle.com/support`

Templates are provided to help you prepare information about your problem before you call. You will also need your CSI number (if applicable) or complete contact details, including any special project information.

Products and Documentation

For U.S.A. customers, Oracle Store is at:

`http://store.oracle.com`

Links to Stores in other countries are provided from this site.

Product documentation can be found at:

`http://docs.oracle.com`

Customer Service

Global Customer Service contacts are listed at:

`http://www.oracle.com/support/`

Education and Training

Training information and worldwide schedules are available from:

`http://education.oracle.com`

Oracle Technology Network

Register with the Oracle Technology Network (OTN) at:

`http://technet.oracle.com`

OTN delivers technical papers, code samples, product documentation, self-service developer support, and Oracle's key developer products to enable rapid development and deployment of applications built on Oracle technology.

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Administering Oracle8*i*

Setting the Environment

This section describes how to establish a common environment for your Oracle8*i* system.

Displaying Environment Variables

To display the current value of an environment variable, use the `env` command. For example, to display the value of `ORACLE_SID`, enter:

```
$ env | grep ORACLE_SID
```

> **Note:** The command `env` should be used to show what has been exported to the environment. Bourne shell and Korn shell can set values without exporting.

Setting and Exporting the Value of a Variable in a Current Session

For the Bourne or Korn shell, enter:

```
$ ORACLE_SID=test
$ export ORACLE_SID
```

For the C shell, enter:

```
% setenv ORACLE_SID test
```

where *`test`* is the value of the variable ORACLE_SID.

Setting a Common Environment

Oracle8*i* allows a DBA to set a common environment for all users. A common environment makes it easier for system administrators and database administrators to make changes to the physical Oracle8*i* system.

The oraenv Command File

The `oraenv` (`coraenv` for the C shell) command file is created during installation. It contains values for Oracle environment variables and provides:

- a central means of updating all user accounts with database changes
- a mechanism for switching back and forth between Oracle8*i* databases

For example, you may find yourself frequently adding and removing databases from your development system or your users may be switching between several different Oracle databases installed on the same system. With oraenv, each user profile calls the oraenv command file.

Local bin Directory

Placing oraenv (or coraenv) and dbhome in a local bin directory, separate from the Oracle software home directory, ensures that these files are accessible to all users. It also ensures that oraenv (coraenv) continues to work even if you change the path to point to a different ORACLE_HOME. The local bin directory is specified by the root.sh script, which is run following installation. The default location for the local bin directory on Solaris is /usr/local/bin.

Moving Between Databases

To switch from one database or instance to another, call the oraenv routine, and reply to the prompt with the *sid* of the desired database. Always provide the full path of the oraenv command file. For example:

```
$ . /usr/local/bin/oraenv
ORACLE_SID= [default]? sid
```

Database Examples

In the following examples, it is assumed your local bin directory is called /usr/local/bin and your production database is called PROD. If you prefer not to be prompted for the ORACLE_SID at startup, set the ORAENV_ASK environment variable to no.

In the following examples, ORAENV_ASK is reset to the default, Yes, after oraenv is executed. This ensures that the system prompts you for a different ORACLE_SID the next time oraenv is executed.

If you have created a database manually instead of using Oracle Database Configuration Assistant, you must ensure the system configuration is reflected in the /var/opt/oracle/oratab file.

Add an entry for each server instance in the following format:

```
ORACLE_SID:ORACLE_HOME:{Y|N}
```

Y or N indicates whether you want to activate the dbstart and dbshut scripts. The Oracle Database Configuration Assistant automatically adds an entry for each database it creates.

Single Instance

For the Bourne or Korn shell, add or replace the following line in the `.profile` file:

```
. local_bin_directory/oraenv
```

with the following lines:

```
PATH=${PATH}:/usr/local/bin
ORACLE_SID=PROD
export PATH ORACLE_SID
ORAENV_ASK=NO
. oraenv
ORAENV_ASK=
```

For the C shell, add or replace the following line in the `.cshrc` file:

```
source local_bin_directory/coraenv
```

with the following lines:

```
setenv PATH ${PATH}:/usr/local/bin
setenv ORACLE_SID PROD
setenv ORAENV_ASK NO
source /usr/local/bin/coraenv
unset ORAENV_ASK
```

Multiple Instances

For multiple instances, define the *sid* at startup.

For the Bourne or Korn shell:

```
#!/usr/bin/sh
echo "The SIDs on this machine are:"
cat /var/opt/oracle/oratab | awk -F: '{print $1}' | grep -v "#"
ORAENV_ASK="YES"
.  /usr/local/bin/oraenv
```

For the C shell:

```
#!/usr/bin/csh
echo "The SIDs on this machine are:"
cat /var/opt/oracle/oratab | awk -F: '{print $1}' | grep -v "#"
set ORAENV_ASK="YES"
source /usr/local/bin/coraenv
```

Environment Variables for Oracle8*i*

This section describes the most commonly-used Oracle8*i* and UNIX environment variables.

Some of these variables must be defined before you install Oracle8*i*. They are listed in your *Oracle8i Installation Guide*.

Oracle Environment Variables on UNIX

Table 1–1 provides the syntax and examples for Oracle8*i* variables.

Table 1–1 Oracle8i Environment Variables on UNIX

Variable	Detail	Definition
EPC_DISABLED	Function	Disables Oracle Trace
	Syntax	`true` or `false`
NLS_LANG	Function	Specifies the language and character set used for output. See the *Oracle8i National Language Support Guide* for a list of values.
	Syntax	*`language_territory.characterset`*
	Example	`french_france.we8dec`
ORA_NLS33	Function	Points to the directory where languages and character sets are stored.
	Set to	`$ORACLE_HOME/ocommon/nls/admin/data`
ORACLE_BASE	Function	Specifies the base of the Oracle directory structure for OFA-compliant databases.
	Syntax	*`directory_path`*
	Example	`/u01/app/oracle`
ORACLE_HOME	Function	Specifies the directory containing the Oracle software.
	Syntax	*`directory_path`*
	Example	`$ORACLE_BASE/product/8.1.6`

Table 1–1 Oracle8i Environment Variables on UNIX

Variable	Detail	Definition
ORACLE_PATH	Function	Specifies the search path for files used by Oracle applications, such as `*.sql` (SQL*Plus), `*.frm` (Oracle Forms), and `*.rpt` (Oracle Reports). If the full path to the file is not specified, or is not in the current directory, then the Oracle application will use `ORACLE_PATH` to locate the file.
	Syntax	colon-separated list of directories: *`directory1:directory2:directory3`*
	Example	`/u01/oracle/adhoc/8.1.6/bin:.` **Note:** The period adds the current working directory to the search path.
ORACLE_SID	Function	Specifies the Oracle System Identifier.
	Syntax	The string of numbers and characters that must begin with a letter. A maximum of eight characters is recommended. For more information, see the *Oracle8i Installation Guide for Sun SPARC Solaris*.
	Example	`SAL1`
ORACLE_TRACE	Function	Turns on tracing of Bourne shell scripts during install. If set to `T`, many Oracle shell scripts run with `set -x` flag on.
	Range of Values	`T` or anything else.
ORAENV_ASK	Function	Controls whether `(c)oraenv` prompts for ORACLE_SID or ORACLE_HOME. If set to `NO`, `(c)oraenv` does not prompt and, if set to anything else, it does.
	Syntax	*`string`*
	Range of Values	`NO` or anything else.
SQLPATH	Function	Sets the directory or list of directories that SQL*Plus will search for a `login.sql` file.
	Syntax	Colon-separated list of directories *directory:directory:directory*
	Example	`/home:/home/oracle:/u01/oracle`
TNS_ADMIN	Function	Sets the directory containing the Net8 configuration files.
	Syntax	*`directory_path`*
	Range of Values	Any directory; for more information, see the *Oracle8i Installation Guide for Sun SPARC Solaris.*
	Example	`$ORACLE_HOME/network/admin`

Table 1–1 Oracle8i Environment Variables on UNIX

Variable	Detail	Definition
TWO_TASK	Function	Sets the default Net8 connect string descriptor alias defined in the `tnsnames.ora` file.
	Syntax	Available network alias.
	Range of Values	Any valid Net8 alias defined in the `tnsnames.ora` file.
	Example	PRODDB_TCP

> **Note:** Do not define environment variables with values that are identical to names of Oracle Server processes, for example: `arch`, `pmon`, and `dbwr`.

Abbreviations for ORACLE_HOME and ORACLE_SID

In Oracle8*i* files and programs, a question mark (?) represents the value of ORACLE_HOME. For example, Oracle8*i* expands the question mark in the following SQL statement to the full pathname of ORACLE_HOME:

```
alter tablespace TEMP add datafile '?/dbs/dbs2.dbf' size 2M
```

The @ sign represents `$ORACLE_SID`. For example, to indicate a file belonging to the current instance, enter:

```
alter tablespace tablespace_name add datafile 'dbsfile@.dbf'
```

UNIX Environment Variables Used with Oracle8*i*

Table 1–2 provides the syntax and examples for UNIX environment variables used with Oracle8*i*.

Table 1–2 UNIX Environment Variables Used with Oracle8i

Variable	Detail	Definition
ADA_PATH	Function	Specifies the directory containing the Ada compiler.
CLASSPATH	Function	Used for Java Functionality. This variable differs for various Java applications. Refer to the product documentation for your Java application for more information.
	Syntax	*`directory_path`*

Table 1–2 UNIX Environment Variables Used with Oracle8i

Variable	Detail	Definition
	Example	There is no default setting, and CLASSPATH must include the following: `JRE_Location`, `$ORACLE_HOME/product/jlib`, `$ORACLE_HOME/product/jlib`. **Note:** `JRE_Location` is defined as `$ORACLE_HOME/JRE`
DISPLAY	Function	Used by X-based tools. Specifies the display device used for input and output. See vendor's X Windows documentation for details.
	Syntax	`hostname:display` The `hostname` is your machine name (either IP address or alias); `display` is the monitor number. If you have single monitor, the number is 0.

	Example	`135.287.222.12:0`
		`bambi:0`

HOME	Function	The user's home directory.
LANG or LANGUAGE	Function	Specifies the language and character set used by the operating system for messages and other output. See the operating system documentation and your *Oracle8i Installation Guide for Sun SPARC Solaris*.
LD_OPTIONS	Function	Specifies the default linker options on Solaris. See `man` pages on `ld` for details.
LPDEST	Function	Specifies the user's default printer for Solaris systems.
	Syntax	`printer_name`
	Example	`docqms`
LDPATH	Function	Default directories used by the linker to find shared object libraries. See `man` pages on `ld` for details.
LD_LIBRARY_PATH	Function	Used by the shared library loader (`ld.so.1`) at runtime to find shared object libraries. See `man` pages on `ld.so.1` for details.
	Syntax	Colon-separated list of directories: `directory1:directory2:directory3`
	Example	`/usr/dt/lib:$ORACLE_HOME/lib`
PATH	Function	Used by the shell to locate executable programs; must include `$ORACLE_HOME/bin`.

Table 1–2 UNIX Environment Variables Used with Oracle8i

Variable	Detail	Definition
	Syntax	Colon-separated list of directories: *`directory1:directory2:directory3`*
	Example	`/bin:/usr/bin:/usr/local/bin:` `/usr/bin/X11:$ORACLE_HOME/bin:$HOME/bin`:. **Note**: The period adds the current working directory to the search path
PRINTER	Function	Selects the default printer for Solaris systems.
	Syntax	*`printer_name`*
	Example	`docqms`
SHELL	Function	Specifies the command interpreter used during a host command.
	Syntax	*`shell_path`*
	Range of Values	`/bin/sh` or `/bin/csh` or `/bin/ksh` or any other command interpreter supplied with Sun SPARC Solaris
	Example	`/bin/sh`
TERM	Function	Used by Oracle Toolkit II character mode tools and other UNIX tools to determine terminal types.
	Example	`vt100`
TMPDIR	Function	Specifies the default directory for temporary disk files; if set, tools that create a temporary files do so in this directory.
	Syntax	*`directory_path`*
	Example	`/u02/oracle/tmp`
XENVIRONMENT	Function	Specifies a file containing X Windows system resource definitions. See your X Windows documentation for more information.

Setting the System Time

The TZ variable sets your time zone. It allows you to adjust the clock for daylight saving time changes or different time zones. The adjusted time is used to time-stamp files, produce the output of the `date` command, and obtain the current SYSDATE.

WARNING: You are discouraged from changing your personal TZ value. Using different values of TZ such as GMT+24 may change the day a transaction is recorded. This affects Oracle applications that use SYSDATE, such as Oracle Financials. To avoid this problem, use sequence numbers to order a table instead of date columns.

Initialization Parameters

Initialization parameters allow you to configure and tune your system. This section describes:

- customizing initialization parameters in the `init`*`sid`*`.ora` file for the Oracle8*i* instance
- pre-set default initialization parameters

There are many optional initialization parameters described in the generic Oracle8*i* documentation.

See Also: *Oracle8i Administrator's Guide* and *Oracle8i Tuning*.

Customizing the init*sid*.ora File

This section documents the default `init`*`sid`*`.ora` file provided with the Oracle8*i* software. The Oracle Universal Installer (OUI) creates it in the `$ORACLE_BASE/admin/`*`sid`*`/pfile` directory. You can modify it to customize your Oracle8*i* installation.

Sample init*sid*.ora File

For a sample `init`*`sid`*`.ora` file, look in the `$ORACLE_HOME/dbs` directory. This file is provided by Oracle Corporation to assist in customizing your Oracle8*i* installation.

Default Initialization Parameter Values

Table 1–3 on page 1-11 lists default initialization parameter values on Solaris. All Oracle8*i* instances assume these values if you do not specify different values for them in the `init`*`sid`*`.ora` file. Oracle Corporation recommends that you include in the `init`*`sid`*`.ora` file only those parameters that differ from the default initialization parameter values.

To display the current values of these parameters on the system, use SQL*Plus to execute the statement SHOW PARAMETERS.

See Also: *Oracle8i Server Reference.*

Table 1–3 Initialization Parameters

Parameter	Default Value	Range Value
BACKGROUND_DUMP_DEST	?/rdbms/log	Valid directory names
BITMAP_MERGE_AREA_SIZE	1048576	65536 - unlimited
COMMIT_POINT_STRENGTH	1	0-255
CONTROL_FILES	?/dbs/cntrloracle_sid.dbf	Valid file names
CREATE_BITMAP_AREA_SIZE	8388608	65536 - unlimited
DB_BLOCK_BUFFERS	48MB of buffers	50MB - unlimited
DB_BLOCK_SIZE	2048	2KB - 16KB
DB_FILES	200	1 - 2000000
DB_FILE_DIRECT_IO_COUNT	64 (maximum of 1048576)	0 - 1048576 / block size
DB_FILE_MULTIBLOCK_READ_COUNT	8	1 - min(DB_BLOCK_BUFFERS / 4, 1048576 / DB_BLOCK_SIZE)
DISTRIBUTED_TRANSACTIONS	1 / 4 TRANSACTIONS	0 - unlimited
HASH_AREA_SIZE	2*SORT_AREA_SIZE	0 - unlimited
HASH_MULTIBLOCK_IO_COUNT	0 (self-tuned)	0 - min(127, DB_BLOCK_BUFFERS / 4, 1048576 / DB_BLOCK_SIZE)
JAVA_POOL_SIZE	20000000	between 1000000 and 1000000000
LOCK_SGA	FALSE	TRUE, FALSE
LOG_ARCHIVE_DEST	null	Valid directory names
LOG_ARCHIVE_FORMAT	"%t_%s.dbf"	Valid file names
LOG_BUFFER	max (512KB, 128KB*CPU_COUNT)	66560 - unlimited
LOG_CHECKPOINT_INTERVAL	0	0 - unlimited
MTS_MAX_DISPATCHERS	5	between MTS_DISPATCHERS and PROCESSES
MTS_MAX_SERVERS	2*MTS_SERVERS, if MTS_SERVERS > 20, else 20	between MTS_SERVERS and PROCESSES

Table 1–3 Initialization Parameters

Parameter	Default Value	Range Value
MTS_SERVERS	1, if MTS_DISPATCHERS is specified, else 0	between 1 and PROCESSES
MTS_LISTENER_ADDRESS	ADDRESS=*address*	
NLS_LANGUAGE	AMERICAN	Valid language names
NLS_TERRITORY	AMERICA	Valid territory names
OBJECT_CACHE_MAX_SIZE_PERCENT	10	0 - unlimited
OBJECT_CACHE_OPTIMAL_SIZE	100KB	10KB - unlimited
OPEN_CURSORS	50	1 - unlimited
OS_AUTHENT_PREFIX	ops$	Arbitrary string
PROCESSES	30, if not PARALLEL_AUTOMATIC_TUNING	6 - unlimited
SHARED_POOL_SIZE	64MB on 64-bit, 8MB on 32-bit	300000 - unlimited
SORT_AREA_SIZE	65536	0 - unlimited

Database Limits

Table 1–4 lists the maximum and default values for parameters in a CREATE DATABASE or CREATE CONTROL FILE statement.

Note: Interdependencies among these parameters may affect allowable values.

Table 1–4 Create Control File Parameters

Parameter	Default Value	Maximum Value
MAXDATAFILES	30	65534
MAXINSTANCES	1	63
MAXLOGFILES	16	255
MAXLOGMEMBERS	2	5
MAXLOGHISTORY	100	65534

Managing Special Accounts and Groups

The DBA should be familiar with special accounts required by the Oracle server and should make sure these accounts belong to the appropriate groups. UNIX accounts are described in Table 1–6; Oracle server accounts are described in Table 1–7. Special group accounts are described in Table 1–8.

Oracle8*i* release 8.1.6 includes native support for files greater than 2 GB on Solaris 2.6 and higher. Please see Table 1–5 for Oracle-specific file size limits.

Table 1–5 Oracle-Specific File Size Limits

File Type	Maximum Size
datafiles db_block_size = 2048	8,589,932,544
datafiles db_block_size = 4096	17,179,865,088
datafiles db_block_size = 8192	34,359,730,176
datafiles db_block_size = 16384	68,719,460,352
Import/Export file	2,147,483,647
SQL*Loader	2,147,483,647

Table 1–6 UNIX Accounts

oracle	The *oracle* software owner represents the account that owns the Oracle8*i* software. This maintenance account requires DBA privileges in order to CREATE, STARTUP, SHUTDOWN, and CONNECT as INTERNAL to the database. The *oracle* software owner must never be the superuser.
root	The root user is a special UNIX account with maximum privileges (called superuser privileges). This account is used to configure the UNIX kernel, configure and install networking software, and create user accounts and groups.

Table 1–7 Oracle Server Accounts

SYS	This is a standard Oracle8*i* account with DBA privileges automatically created during installation. The SYS account owns all the base tables for the data dictionary. This account is used by the DBA.
SYSTEM	This account is also a standard Oracle8*i* account, with DBA privileges automatically created during installation. Additional tables or views can be created by the SYSTEM user. DBAs may log in as SYSTEM to monitor or maintain databases.

Table 1–8 Special UNIX Group Accounts

`dba` group	The *`oracle`* software owner is the only required member of the `dba` group. You can add any other UNIX user to the `dba` group. Members of this group have access to SQL*Plus specially privileged functions. If your account is not a member of the `dba` group, you must enter a password in order to connect as INTERNAL or gain access to the other administrative functions of SQL*Plus. The default `OSDBA` group is `dba`.
`oinstall` group	All users installing Oracle8*i* in any ORACLE_HOME must belong to the same UNIX group. The OUI inventory is shared by all Oracle8*i* ORACLE_HOMEs on a machine and is group writable. Oracle recommends installing with `oinstall` as the primary group.
`oper` group	This is an optional UNIX group you can create. Members have database OPERATOR privileges. OPERATOR privileges are a restricted set of `dba` privileges.
`root` group	Only the `root` user should be a member of the `root` group.

Managing Security

Oracle8*i* uses several features of the UNIX operating system to provide a secure environment for users. These features include file ownership, group accounts, and the ability of a program to change its user ID upon execution.

The two-task architecture of Oracle8*i* improves security by dividing work (and address space) between the user program and the `oracle` program. All database access is achieved through the shadow process and special authorizations on the `oracle` program.

See Also: Security issues are dealt with extensively in the *Oracle 8i Administrator's Guide*, "The Oracle Database Administrator" chapter.

Groups and Security

To ensure greater security for an Oracle8*i* database, create user groups at the operating system level. Groups are controlled by the UNIX file `/etc/group`. Oracle programs are divided into two sets for security purposes: those executable by all (*other*, in UNIX terms), and those executable by DBAs only. A recommended approach to security is:

- Before installing Oracle8*i*, create a database administrators' UNIX group which will have special database privileges. You can name the group anything, but this document refers to it as the `dba` group. The *`oracle`* account must have the `dba` group as a secondary group. The primary group for the `oracle` account should be the `oinstall` group. Use the Solaris `groupadd` or `admintool` utilities to create the `dba` group.
- Create a group named `oinstall`. The `oinstall` group will own the OUI `oraInventory` and is responsible for installing and upgrading the Oracle8*i* system. You can name the group anything, but this document refers to it as the `oinstall` group. All *`oracle`* accounts must have the `oinstall` group as their primary group. Use the Solaris `groupadd` or `admintool` utilities to create the `oinstall` group.
- Although any user account which requires `dba` privileges can belong to the `dba` group, the only user account which should belong to the `oinstall` group is the `oracle` account.

Security for Server Manager Commands

If you do not have SQL*Plus, you can use Server Manager to make SQL queries. However, be careful how you assign access to Server Manager. The following system-privileged statements should not be accessible to anyone but the *`oracle`* software owner and the `dba` group users, as they grant special operating system privileges:

- STARTUP
- SHUTDOWN
- CONNECT INTERNAL

WARNING: System-privileged statements can damage your database if used incorrectly. Note that non-dba group users can connect as internal if they have the necessary password.

Security for Database Files

The user ID used to install Oracle8*i* should own the database files. The default user ID is the *oracle* software owner. Set the authorizations on these files to 0600: read / write (rw) by owner only, with no write authorizations for group or other users.

The *oracle* software owner should own the directories containing the database files. For added security, revoke read permission from *group* and *other* users.

To access the protected database files, the `oracle` program must have its set user ID (`setuid`) bit on.

The Oracle Universal Installer automatically sets the permissions of the `oracle` executable to:

```
-rwsr-s--x 1 oracle dba  443578 Mar 10 23:03 oracle
```

The `s` in the user execute field means that when you execute the `oracle` program, it has an effective user ID of *oracle*, regardless of the actual user ID of the person invoking it.

If you need to set this manually, enter:

```
$ chmod 6751 $ORACLE_HOME/bin/oracle
```

Security and Remote Passwords

You can administer a database from a remote machine, such as a personal computer, without operating system accounts. User validation is accomplished by using an Oracle8*i* password file, created and managed by the `orapwd` utility. You can also use password file validation on systems that support operating system accounts.

Local password files are in the `$ORACLE_HOME/dbs` directory and contain the username and password information for a single database. If there are multiple `$ORACLE_HOME` directories on a machine, each has a separate password file. To allow the database to use the password file, set the `init`*`sid`*`.ora` parameter `remote_login_passwordfile` to exclusive.

Running orapwd

The `orapwd` utility exists in `$ORACLE_HOME/bin` and is run by the *`oracle`* software owner. Invoke `orapwd` by entering:

```
$ orapwd file=filename password=password entries=max_users
```

This syntax is described in Table 1–9:

Table 1–9 Syntax for Executing orapwd

`filename`	is the name of the file where password information is written. The name of the file must be `orapw`*sid*, and you must supply the full pathname. Its contents are encrypted and not user-readable. This parameter is mandatory.
`password`	is the initial password you selected for INTERNAL and SYS. You can change this password after you create the database using an ALTER USER statement. This parameter is mandatory.
`max_users`	is the maximum number of users allowed to connect to the database as SYSDBA or SYSOPER. This parameter is mandatory only if you want this password file to be EXCLUSIVE. Set *max_users* to a higher number than you expect to require because if you need to exceed this value, you must create a new password file.

orapwd Example

```
$ orapwd file=/u01/app/oracle/product/8.1.6/dbs/orapwV816
password=V816pw entries=30
```

See Also: *Oracle8i Administrator's Guide*.

Access to a Database from a Remote PC

When there is an Oracle8*i* password file, networked PC users with DBA privileges can access this database as INTERNAL. Privileged users, who want to perform DBA functions on the database, can enter the appropriate SQL*Plus command from their PC, adding the `dba` user password. For example:

```
SQL> connect internal/dba_password@alias as {sysdba|sysoper}
```

Remote Authentication

The following `init`*`sid`*`.ora` parameters, shown in Table 1–10, control the behavior of remote connections through non-secure protocols:

Table 1–10 Parameters for Controlling Remote Connections

REMOTE_OS_AUTHENT	enables or disables `ops$` connection
OS_AUTHENT_PREFIX	used by `ops$` accounts
REMOTE_OS_ROLES	enables or disables roles through remote connections

Estimating Oracle8*i* Memory Usage

You need to know Oracle8*i*’s memory usage requirements before starting. Knowing the these requirements helps you determine the number of users you can have on your system, and helps you determine your physical memory and swap space requirement. To calculate the memory requirements, use the following formula:

```
        <size of the oracle executable text>
+       <size of the SGA>
+       n * (    <size of tool executables private data section>
              +  <size of oracle executables uninitialized data section>
              +  <8192 bytes for the stack>
              +  <2048 bytes for the processes user area>)
```

where *n* = number of background processes.

To determine the SGA size, see "Calculating the Size of the SGA" on page 1-25.

For each client-server connection, use the following formula to estimate virtual memory requirements:

```
        <size of oracle executable data section>
+       <size of oracle executables uninitialized data section>
+       <8192 bytes for the stack>
+       <2048 bytes for processes user area>
+       <cursor area needed for the application>
```

Use the `size` command to estimate an executable’s text size, private data section size, and uninitialized data section size (or DSS). Program text is only counted once, no matter how many times the program is invoked, because all Oracle executable text is always shared.

To compute actual Oracle physical memory (background and shadow processes) usage while the database is up and users are connected to it, use the `pmap` command. Sum the shared sections (indicated by `read/write/exec/shared` and `read/exec`) for just the `pmon` process. Sum the private section (indicated by `read/write/exec`) for each shadow and background process, including `pmon`. Background process names begin with ora_, and end with the SID, i.e. ora_pmon_TEST. Shadow process names begin with oracleSID, i.e. oracleTEST.

Calculate actual memory usage

Use the following script to show actual memory usage.

```
#!/usr/bin/sh

# Copyright 1999 Oracle Corporation
#
# modification history:
# date        by        comments
# ----------  --------  ----------------
# 11/15/1999  rgulledg  original program
#

usage()
{
echo "Usage: $0 [ SB ]"
echo "Usage: $0 [ P <pid> ]"
echo "Usage: $0 [ h ]"
echo " "
echo "specify ’S’ for Oracle shadow processes"
echo "specify ’B’ for Oracle background processes (includes shared
memory SGA)"
echo "specify ’h’ for help"
echo " "
}

echo " "

#
# check usage
#
if [ $# = "0" ];then
  usage;exit 1
fi
if [ $1 = "h" ];then
  echo "This script uses the Sun Solaris pmap command to determine
memory usage"
  echo "for Oracle server [B]ackground processes and/or [S]hadow
processes."
  echo "An individual [P]rocess can also be specified."
  echo " "
  echo "Although the Oracle server background processes memory usage
should"
  echo "remain fairly constant, the memory used by any given shadow
process"
  echo "can vary greatly.  This script shows only a snapshot of the
current"
  echo "memory usage for the processes specified."
  echo " "
  echo "The ’B’ option shows the sum of memory usage for all Oracle
server"
  echo "background processes, including shared memory like the SGA."
  echo " "
  echo "The ’S’ option shows the sum of private memory usage by all"
  echo "shadow processes.  It does not include any shared memory like
the"
  echo "SGA since these are part of the Oracle server background
processes."
  echo " "
  echo "The ’P’ option shows memory usage for a specified process,
broken"
  echo "into two categories, private and shared.  If the same
executable"
  echo "for this process was invoked again, only the private memory"
  echo "would be allocated, the rest is shared with the currently
running"
  echo "process."
  echo " "
  usage;exit 1
fi
echo $1|grep [SBP] > /dev/null
ParmFound=$?
if [ $ParmFound != "0" ];then
  usage;exit 1
fi
echo $1|grep P > /dev/null
ParmFound=$?
if [ $ParmFound = "0" ];then
  if [ $1 != "P" ];then
    usage;exit 1
  fi
  if [ "X$2" = "X" ];then
    usage;exit 1
  fi
  echo $2|grep [0-9] > /dev/null
  ParmFound=$?
  if [ $ParmFound != "0" ];then
    usage;exit 1
  fi
  PidOwner=‘ps -ef | grep -v grep | grep $2 | grep -v $0 | awk ’{print
$1}’‘
  CurOwner=‘/usr/xpg4/bin/id -un‘
  if [ "X$PidOwner" != "X$CurOwner" ];then
    echo "Not owner of pid $2, or pid $2 does not exist"
    echo " "
    usage;exit 1
  fi
else
  if [ "X${ORACLE_SID}" = "X" ];then
    echo "You must set ORACLE_SID first"
    usage;exit1
  fi
fi

#
# initialize variables
#
Pmap="/usr/proc/bin/pmap"
SharUse="/tmp/omemuseS$$"
PrivUse="/tmp/omemuseP$$"
ShadUse="/tmp/omemuseD$$"
PidPUse="/tmp/omemusePP$$"
PidSUse="/tmp/omemusePS$$"
TotalShad=0
TotalShar=0
TotalPriv=0
PidPriv=0
PidShar=0

#
# shadow processes
#
echo $1|grep S > /dev/null
ParmFound=$?
if [ $ParmFound = "0" ];then
  ShadPrc="‘ps -ef|grep -v grep|grep oracle$ORACLE_SID|awk ’{print
$2}’‘"
  echo "" > $ShadUse
  for i in $ShadPrc;do
    $Pmap $i | grep "read/write" | grep -v shared | \
      awk ’{print $2}’ | awk -FK ’{print $1}’ >> $ShadUse
  done
  for i in ‘cat $ShadUse‘;do
    TotalShad=‘expr $TotalShad + $i‘
  done
  TotalShad=‘expr $TotalShad "*" 1024‘
  echo "Total Shadow  (bytes) : $TotalShad"
  /bin/rm $ShadUse
fi

#
# non-shared portion of background processes
#
echo $1|grep B > /dev/null
ParmFound=$?
if [ $ParmFound = "0" ];then
  OrclPrc="‘ps -ef|grep -v grep|grep ora_|grep $ORACLE_SID|awk ’{print
$2}’‘"
  BkgdPrc="‘echo $OrclPrc|awk ’{print $1}’‘"
  echo "" > $PrivUse
  for i in $OrclPrc;do
    $Pmap $i | grep "read/write" | grep -v shared | \
      awk ’{print $2}’ | awk -FK ’{print $1}’ >> $PrivUse
  done
  for i in ‘cat $PrivUse‘;do
    TotalPriv=‘expr $TotalPriv + $i‘
  done
  TotalPriv=‘expr $TotalPriv "*" 1024‘
  echo "Total Private (bytes) : $TotalPriv"

#
# shared portion of background processes
#
  echo "" > $SharUse
  $Pmap $BkgdPrc | grep "read/exec" | \
    awk ’{print $2}’ | awk -FK ’{print $1}’ >> $SharUse
  $Pmap $BkgdPrc | grep "shared" | \
    awk ’{print $2}’ | awk -FK ’{print $1}’ >> $SharUse
  for i in ‘cat $SharUse‘;do
    TotalShar=‘expr $TotalShar + $i‘
  done
  TotalShar=‘expr $TotalShar "*" 1024‘
  echo "Total Shared  (bytes) : $TotalShar"
  /bin/rm $SharUse $PrivUse
fi
```

```
#
# non-shared portion of pid
#
echo $1|grep P > /dev/null
ParmFound=$?
if [ $ParmFound = "0" ];then
  echo "" > $PidPUse
  $Pmap $2 | grep "read/write" | grep -v shared | \
    awk '{print $2}' | awk -FK '{print $1}' >> $PidPUse
  for i in `cat $PidPUse`;do
    PidPriv=`expr $PidPriv + $i`
  done
  PidPriv=`expr $PidPriv "*" 1024`
  echo "Total Private (bytes) : $PidPriv"

#
# shared portion of pid
#
  echo "" > $PidSUse
  $Pmap $2 | grep "read/exec" | awk '{print $2}' | \
    awk -FK '{print $1}' >> $PidSUse
  $Pmap $2 | grep "shared" | awk '{print $2}' | \
    awk -FK '{print $1}' >> $PidSUse
  for i in `cat $PidSUse`;do
    PidShar=`expr $PidShar + $i`
  done
  PidShar=`expr $PidShar "*" 1024`
  echo "Total Shared  (bytes) : $PidShar"
  /bin/rm $PidPUse $PidSUse
fi

#
# Display grand total
#
Gtotal="`expr $TotalShad + $TotalPriv + $TotalShar + $PidPriv +
$PidShar`"
echo "                  -----"
echo "Grand Total   (bytes) :   $Gtotal"
echo " "
```

Do not use the `ps -elf` command as the SZ column repeats the shared portion of memory for each process shown, and makes it appear that Oracle is using much more memory than it actually is.

> **See Also:** Refer to your Sun SPARC Solaris `man` pages or documentation for a list of available switches for the `ps` command.

The `ps` command returns process size in pages; your system page size is architecture-dependent. Use the `pagesize` command to determine whether the size is 4096 or 8192 bytes. For each process, multiply the SZ value by the page size.

Finally, add the text size for the Oracle executable and every other Oracle tool executable running on the system to that subtotal. Remember to count executable sizes only once, regardless of how many times the executable was invoked.

Server Resource Limits

Solaris inherits resource limits from the parent process (see `getrlimit(2)` in your operating system documentation). These limits apply to the Oracle8*i* shadow process that executes for user processes. The Solaris default resource limits are high enough for any Oracle8*i* shadow or background process. However, if these limits are lowered, the Oracle8*i* system could be affected. Discuss this with your Solaris system manager.

Disk quotas established for the *`oracle`* user can hinder the operation of the Oracle8*i* system. Confer with your Oracle8*i* database administrator and the Solaris system manager before establishing disk quotas.

Controlling the System Global Area

The System Global Area (SGA) is the Oracle structure that resides in shared memory. It contains static data structures, locks, and data buffers. Sufficient shared memory must be available to each `oracle` process to address the entire SGA.

Size Limits of the SGA

The maximum size of a single shared memory segment is specified by the Solaris parameter SHMMAX. The recommended value for SHMMAX is 4294967296 regardless of the actual memory installed on the system.

If the size of the SGA exceeds the maximum size of a shared memory segment (SHMMAX), Oracle8*i* attempts to attach more contiguous segments to fulfill the requested SGA size. SHMSEG is the maximum number of segments that can be attached by a process.

Note: Intimate Shared Memory (ISM) may cause problems when SHMMAX is smaller than the database SGA size.

The following `init`*`sid`*`.or`a parameters control the size of the SGA:

- `DB_BLOCK_BUFFERS`
- `DB_BLOCK_SIZE`
- `SORT_AREA_SIZE`
- `SHARED_POOL_SIZE`
- `JAVA_POOL_SIZE`

Use caution when setting values for these parameters. When values are set too high, too much of the machine's physical memory is devoted to shared memory, resulting in poor performance.

Calculating the Size of the SGA

You can determine the SGA size in one of these ways:

- The approximate size of an SGA per instance can be calculated with this formula:

  ```
  (DB_BLOCK_BUFFERS x DB_BLOCK_SIZE)
  + SORT_AREA_SIZE
  + SHARED_POOL_SIZE
  + LOG_BUFFER
  + JAVA_POOL_SIZE
  ```

- To display the size of the SGA for a running database, in bytes, use the SQL*Plus `show sga` command.
- You can also find the size of the SGA when you start your database system. The SGA size is displayed next to the heading Total System Global Area.

Relocating the SGA

The address at which the SGA is attached affects the amount of virtual address space available for such things as database buffers in the SGA and cursors in the user's application data area.

1. Determine the valid virtual address range for attaching shared memory segments. Use the tstshm executable included in this release of Oracle8*i*:

   ```
   $ tstshm
   ```

   In the output from tstshm, the lines "Lowest shared memory address" and "Highest shared memory address" indicate the valid address range.

2. Check the "Segment boundaries" output of tstshm to determine the valid virtual address boundaries at which a shared memory segment can be attached.

3. Move to the $ORACLE_HOME/rdbms/lib directory, and run genksms to generate the file ksms.s:

   ```
   $ cd $ORACLE_HOME/rdbms/lib
   $ $ORACLE_HOME/bin/genksms -b sgabeg > ksms.s
   ```

   where *sgabeg* is the starting address of the SGA (which defaults to 0x80000000) and should fall within the range determined in step 2.

   Never set sgebeg below 0x01000000. On most systems, this leaves about 7Mb for data segments. This amount must allow enough memory for such things as SORT_AREA_SIZE, etc.

   With a start address of 0x1000000 you can achieve an overall SGA size of about 3.5GB.

   You may receive the following error messages if you reduced the value of sgabeg:

   > ORA-4030: out of process memory when trying to allocate %s bytes (%s,%s)

   or

   > ORA-7324: smpall: malloc error while allocating pga.

   If this is the case, then you probably lowered the start address into an area which the PGA needs to extend into. Raise sgabeg, and try again.

4. Shut down the existing Oracle database.

5. Rebuild the oracle executable in the $ORACLE_HOME/rdbms/lib directory:

   ```
   $ make -f ins_rdbms.mk ksms.o
   $ make -f ins_rdbms.mk ioracle
   ```

   Using ioracle:

- backs up the old executable (`oracle0`)
- assigns the correct privileges to the new `oracle` executable
- moves the new executable into the `$ORACLE_HOME/bin` directory

The result is a new Oracle kernel that loads the SGA at the address specified by `sgabeg`.

> **See Also:** For more information about how the use of Java in the database affects SGA calculations, see the `README` file in `$ORACLE_HOME/javavm/doc`.

Building and Running Demonstrations

SQL*Loader Demonstrations

SQL*Loader demonstrations require that:

- the user `scott/tiger` has CONNECT and RESOURCE privileges
- the EMP and DEPT tables exist and are empty

To create and run a demonstration:

1. Run the `ulcase`*`n`*`.sql` script corresponding to the demonstration you want to run. As `scott/tiger`, invoke SQL*Plus from the command line:

```
$ sqlplus scott/tiger @ulcasen.sql
```

This step creates the objects used by this demonstration.

2. As `scott/tiger`, invoke the demonstration from the command line:

```
$ sqlldr scott/tiger ulcasen.ctl
```

This step loads the demonstration data into the objects created in step 1, but does not run the demonstration.

As `scott/tiger`, run the SQL*Loader demonstrations in the following order:

- `ulcase1`: Follow steps 1 - 2.
- `ulcase2`: Follow step 2 to invoke the demonstration (you do not have to run the `ulcase2.sql` script).
- `ulcase3`: Follow steps 1 - 2.

- `ulcase4`: Follow steps 1 - 2.
- `ulcase5`: Follow steps 1 - 2.
- `ulcase6`: Run the `ulcase6.sql` script as `scott/tiger`, then enter the following at the command line:

  ```
  $ sqlldr scott/tiger ulcase6 DIRECT=true
  ```

- `ulcase7`: Run the `ulcase7s.sql` script as `scott/tiger`, then enter the following at the command line:

  ```
  $ sqlldr scott/tiger ulcase7
  ```

  After running the example, run `ulcase7e.sql` to drop the insert trigger and global variable package.

Administering SQL*Loader

Oracle8*i* incorporates SQL*Loader functionality. Demonstration and message files are in the `rdbms` directory.

File Processing Option

The SQL*Loader control file includes the following additional file processing option strings, the default being `str`, which takes no argument:

```
[ "str" | "fix n" | "var n" ]
```

Table 1–11 File Processing Option

`str`	(the default). Specifies a stream of records, each terminated by a newline character, which are read in one record at a time.
`fix`	Indicates that the file consists of fixed-length records, each of which is *n* bytes long, where *n* is an integer value.
`var`	Indicates that the file consists of variable-length records, each of which is *n* bytes long, where *n* is an integer value specified in the first five characters of the record.

If the file processing options are not selected, the information is processed by default as a stream of records (`str`). You might find that `fix` mode yields faster performance than the default `str` mode because it does not need to scan for record terminators.

Newlines in Fixed Length Records

When using the `fix` option to read a file containing fixed-length records, where each record is terminated by a newline, include the length of the newline (one character) when specifying the record length to SQL *Loader.

For example, to read the following file:

```
AAA newline
BBB newline
CCC newline
```

specify `fix 4` instead of `fix 3` to account for the additional newline character.

If you do not terminate the last record in a file of fixed records with a newline character, do not terminate the other records with a newline character either. Similarly, if you terminate the last record with a newline, terminate all records with a newline.

Caution: Certain text editors, such as `vi`, automatically terminate the last record of a file with a newline character. This leads to inconsistencies if the other records in the file are not terminated with newline characters.

Removing Newlines

Use the `position(x:y)` function in the control file to discard the newlines from fixed length records rather than loading them. To do this, enter the following in your control file:

```
load data
infile xyz.dat "fix 4"
into table abc
( dept position(01:03) char )
```

When this is done, newlines are discarded because they are in the fourth position in each fixed-length record.

Loading PL/SQL Demonstrations

PL/SQL includes a number of sample programs you can load. Demonstration and message files are in the `rdbms` directory. Perform these steps with the Oracle8*i* database open and mounted:

1. Invoke SQL*Plus and connect with the user/password `scott/tiger`:

```
$ cd $ORACLE_HOME/plsql/demo
$ sqlplus scott/tiger
```

2. To load the demonstrations, invoke `exampbld.sql` from SQL*Plus:

```
SQL> @exampbld
```

> **Note:** Build the demonstrations under any Oracle account with sufficient permissions. Run the demonstrations under the same account you used to build them.

Running PL/SQL Demonstrations

Table 1–12 lists the kernel demonstrations.

Table 1–12 Kernel Demonstrations

examp1.sql	examp5.sql	examp11.sql	sample1.sql
examp2.sql	examp6.sql	examp12.sql	sample2.sql
examp3.sql	examp7.sql	examp13.sql	sample3.sql
examp4.sql	examp8.sql	examp14.sql	sample4.sql
extproc.sql			

Table 1–13 lists the precompiler demonstrations.

Table 1–13 Precompiler Demonstrations

examp9.pc	examp10.pc	sample5.pc	sample6.pc

To run the PL/SQL demonstrations, invoke SQL*Plus to connect to the database, using the same user/password you used to create the demonstrations. Start the demonstration by typing an "at" sign (@) or the word `start` before the demonstration name. For example, to start the `examp1` demonstration, enter:

```
$ sqlplus scott/tiger
SQL> @examp1
```

To build the precompiler PL/SQL demonstrations, enter:

```
$ cd $ORACLE_HOME/plsql/demo
$ make  -f demo_plsql.mk demos
```

If you want to build a single demonstration, enter its name as the argument in the `make` command. For example, to make the `examp9.pc` executable, enter:

```
$ make  -f demo_plsql.mk examp9
```

To start the `examp9` demonstration from your current shell, enter:

```
$ ./examp9
```

To run the `extproc` demo, first add the following line to the file, `tnsnames.ora`:

```
(DESCRIPTION=(ADDRESS=(PROTOCOL=ipc)(KEY=plsff))(CONNECT_DATA=(SID=extproc)))
```

and the following line to the file, `listener.ora`:

```
SC=(SID_NAME=extproc)(ORACLE_HOME=/u01/app/oracle/product/8.1.6)
(PROGRAM=extproc))
```

then from your SQL*Plus session, enter:

```
SQL> connect system/manager
Connected.
SQL> grant create library to scott;
Grant succeeded.
SQL> connect scott/tiger
Connected.
SQL> create library demolib as
'$ORACLE_HOME/plsql/demo/extproc.so';
Library created.
```

Finally, to run the tests:

```
SQL> connect scott/tiger
Connected.
SQL> @extproc
```

Relinking Network Executables

You can manually relink your product executables with a relink shell script located in the `$ORACLE_HOME/bin` directory. Relinking is necessary after applying any operating system patches or after an operating system upgrade.

The relink script performs manual relinking of Oracle product executables based on what has been installed in the ORACLE_HOME.

To relink, enter the following:

```
$ relink parameter
```

Table 1–14 Relink Script Parameters

Parameter	Value
`all`	everything which has been installed
`oracle`	Oracle database executable only
`network`	`net_client`, `net_server`, `nau`, `cman`, `cnames`
`client`	`net_client`, `otrace`, `plsql`, `client_sharedlib`
`interMedia`	`ctx`, `ordimg`, `ordaud`, `ordvir`, `md`
`precomp`	all precompilers which have been installed
`utilities`	utilities
`oemagent`	`oemagent`, `odg`

Note: Shut down Oracle Intelligent Agent, Oracle WebDB Listener, and other Oracle programs under this `ORACLE_HOME` when relinking databases.

2

Tuning Oracle8*i*

- The Importance of Tuning
- Solaris Tools
- SQL Scripts
- Tuning Memory Management
- Tuning Disk I/O
- Monitoring Disk Performance
- Tuning CPU Usage
- Tuning Oracle Resource Contention
- Tuning Block Size and File Size
- Tuning the Solaris Buffer Cache Size
- Using Trace and Alert Files
- Raw Devices/Volumes

The Importance of Tuning

Oracle8*i* is a highly optimizable software product. Frequent tuning optimizes system performance and prevents data bottlenecks. Although this chapter is written from the perspective of single-processor systems, most of the performance tuning tips provided here are also valid when using the parallel options and features available with Oracle8*i*.

Before tuning the system, observe its normal behavior using the Solaris tools described in "Solaris Tools" in the next section.

> **See Also:** *Oracle8i Parallel Server Concepts and Administration* and *Oracle8i Designing and Tuning for Performance*.

Solaris Tools

Solaris provides performance monitoring tools that can be used to assess database performance and determine database requirements. In addition to providing statistics for `oracle` processes, these tools provide statistics for CPU usage, interrupts, swapping, paging, and context switching for the entire system.

> **See Also:** Solaris tools are described in the operating system documentation.

vmstat

The `vmstat` utility reports process, virtual memory, disk, paging, and CPU activity on Solaris, depending on the switches you supply with the command. The following command displays a summary of system activity 8 times, at 5 second intervals:

```
$ vmstat -S 5 8
```

Sample output from the `vmstat` command is shown in Figure 2–1.

Figure 2–1 Output from vmstat Command

```
 procs     memory            page            disk          faults      cpu
 r b w   swap  free  si  so pi po fr de sr f0 s0 s1 s3   in   sy   cs us sy id
 0 0 0   1892  5864   0   0  0  0  0  0  0  0  0  0  0   90   74   24  0  0 99
 0 0 0  85356  8372   0   0  0  0  0  0  0  0  0  0  0   46   25   21  0  0 100
 0 0 0  85356  8372   0   0  0  0  0  0  0  0  0  0  0   47   20   18  0  0 100
 0 0 0  85356  8372   0   0  0  0  0  0  0  0  0  0  2   53   22   20  0  0 100
 0 0 0  85356  8372   0   0  0  0  0  0  0  0  0  0  0   87   23   21  0  0 100
 0 0 0  85356  8372   0   0  0  0  0  0  0  0  0  0  0   48   41   23  0  0 100
 0 0 0  85356  8372   0   0  0  0  0  0  0  0  0  0  0   44   20   18  0  0 100
 0 0 0  85356  8372   0   0  0  0  0  0  0  0  0  0  0   51   71   24  0  0 100
```

The `w` column (under `procs`) shows the number of potential processes that have been swapped out (written to disk). If the value is not zero, swapping is occurring and your system has a memory shortage problem. The `si` and `so` columns indicate the number of swap-ins and swap-outs per second, respectively. Swap-outs should always be zero.

sar

The `sar` command is used to monitor swapping, paging, disk, and CPU activity, depending on the switches you supply with the command. The following statement displays a summary of paging activity ten times, at 10 second intervals:

```
$ sar -p 10 10
```

Sample output from the `sar -p` command is shown in Figure 2–2.

Figure 2–2 Output from the sar -p Command

```
14:14:55  atch/s  pgin/s ppgin/s  pflt/s  vflt/s slock/s
14:15:05    0.00    0.00    0.00    0.60    1.00    0.00
14:15:15    0.00    0.00    0.00    0.10    0.60    0.00
14:15:25    0.00    0.00    0.00    0.00    0.00    0.00
14:15:35    0.00    0.00    0.00    0.00    0.00    0.00
14:15:45    0.00    0.00    0.00    0.00    0.00    0.00
14:15:55    0.00    0.00    0.00    0.00    0.00    0.00
14:16:05    0.00    0.00    0.00    0.00    0.00    0.00
14:16:15    0.00    0.00    0.00    0.00    0.00    0.00
14:16:25    0.00    0.00    0.00    0.00    0.00    0.00
14:16:35    0.00    0.00    0.00    0.00    0.00    0.00

Average     0.00    0.00    0.00    0.07    0.16    0.00
```

iostat

The `iostat` utility reports terminal and disk activity depending on the switches you supply with the command. The report from `iostat` does not include disk request queues, but it shows which disks are busy. This information is valuable when you need to balance I/O loads.

The following statement displays terminal and disk activity five times, at 5 second intervals:

```
$ iostat 5 5
```

Sample output from the `iostat` command is shown in Figure 2–3.

Figure 2–3 Output from the iostat Command

```
tty          fd0           sd0           sd1           sd3          cpu
 tin tout Kps tps serv  Kps tps serv  Kps tps serv  Kps tps serv  us sy wt id
   0    1   0   0    0    0   0   31    0   0   18    3   0   42    0  0  0 99
   0   16   0   0    0    0   0    0    0   0    0    1   0   14    0  0  0 100
   0   16   0   0    0    0   0    0    0   0    0    0   0    0    0  0  0 100
   0   16   0   0    0    0   0    0    0   0    0    0   0    0    0  0  0 100
   0   16   0   0    0    0   0    0    2   0   14   12   2   47    0  0  1 98
```

swap

The `swap -l` utility reports information about swap space usage. A shortage of swap space can result in the system hanging and slow response time. Sample output from the `swap -l` command is shown in Figure 2–4.

Figure 2–4 Output from the swap -l Command

```
swapfile             dev  swaplo blocks   free
/dev/dsk/c0t3d0s1   32,25      8 197592 162136
```

mpstat

The `mpstat` utility reports per-processor statistics. Each row of the table represents the activity of one processor. The first row summarizes all activity since the last system re-boot; each subsequent row summarizes activity for the preceding interval. All values are events per second unless otherwise noted. The arguments are for time interval between statistics and number of iterations. Sample output from the `mpstat` command is shown in Figure 2–5.

Figure 2–5 Output from mpstat command

```
CPU minf mjf xcal  intr ithr  csw icsw migr smtx  srw syscl  usr sys  wt idl
  0    0   0    1    71   21   23    0    0    0    0    55    0   0   0  99
  2    0   0    1    71   21   22    0    0    0    0    54    0   0   0  99
CPU minf mjf xcal  intr ithr  csw icsw migr smtx  srw syscl  usr sys  wt idl
  0    0   0    0    61   16   25    0    0    0    0    57    0   0   0 100
  2    1   0    0    72   16   24    0    0    0    0    59    0   0   0 100
```

SQL Scripts

The `utlbstat` and `utlestat` SQL scripts are used to monitor Oracle database performance and tune the System Global Area (SGA) data structures. For information regarding these scripts, see *Oracle8i Designing and Tuning for Performance*. On Solaris, the scripts are located in `$ORACLE_HOME/rdbms/admin/`.

Tuning Memory Management

Start the memory tuning process by tuning paging and swapping space to determine how much memory is available.

The Oracle buffer manager ensures that the more frequently accessed data is cached longer. Monitoring the buffer manager and tuning the buffer cache can have a significant influence on Oracle performance. The optimal Oracle buffer size for your system depends on the overall system load and the relative priority of Oracle over other applications.

Allocate Sufficient Swap Space

Swapping causes significant UNIX overhead and should be minimized. Use `sar -w` or `vmstat -S` on Solaris to check for swapping.

If your system is swapping and you need to conserve memory:

- avoid running unnecessary system daemon processes or application processes
- decrease the number of database buffers to free some memory
- decrease the number of UNIX file buffers, especially if you are using raw devices

On Solaris use `swap -l` to determine how much swap space is currently in use. Use `swap -a` to add swap space to your system. Consult your Sun SPARC Solaris documentation for further information.

Start with swap space two to four times your system's random access memory (RAM). Use a higher value if you plan to use Oracle Developer, Oracle Applications, or Oracle InterOffice. Monitor the use of swap space and increase it as necessary.

Control Paging

Paging may not present as serious a problem as swapping, because an entire program does not have to reside in memory in order to run. A small number of page-outs may not noticeably affect the performance of your system.

To detect excessive paging, run measurements during periods of fast response or idle time to compare against measurements from periods of slow response.

Use `vmstat` or `sar -p` to monitor paging. The following columns from `sar -p` output are important:

- `vflt/s` indicates the number of address translation page faults. Address translation faults occur when a process references a valid page not in memory.
- `rclm/s` indicates the number of valid pages that have been reclaimed and added to the free list by page-out activity. This value should be zero.

If your system consistently has excessive page-out activity, consider the following solutions:

- install more memory
- move some of the work to another system
- configure your kernel to use less memory

Hold the SGA in a Single Shared Memory Segment

You will not be able to start the database without sufficient shared memory. You can reconfigure the UNIX kernel to increase shared memory. For more information, see "Controlling the System Global Area" in Chapter 1.

> **See Also:** "Configure UNIX Kernel for Oracle8*i*" in Chapter 2 of the *Oracle8i Installation Guide for Sun SPARC Solaris*.

Tuning Disk I/O

I/O bottlenecks are the easiest performance problems to identify. Balance I/O evenly across all available disks to reduce disk access times. For smaller databases and those not using the Parallel Query option, ensure that different datafiles and tablespaces are distributed across the available disks.

Tune the Database Writer to Increase Write Bandwidth

Oracle offers solutions to prevent database writer (DBWR) activity from becoming a bottleneck:

- use asynchronous I/O
- use I/O slaves

Asynchronous I/O

Asynchronous I/O allows processes to proceed with the next operation without having to wait after issuing a write and therefore improves system performance by minimizing idle time. Solaris supports Asynchronous I/O to both raw and filesystem datafiles.

I/O Slaves

I/O Slaves are specialized processes whose only function is to perform I/O. They replace the Oracle7 feature, Multiple DBWRs (in fact, they are a generalization of Multiple DBWRs and can be deployed by other processes as well), and they can operate whether or not asynchronous I/O is available. They are allocated from LARGE_POOL_SIZE if set, otherwise they are allocated from shared memory buffers. I/O Slaves come with a set of initialization parameters that allow a degree of control over the way they operate, shown in Table 2–1.

Table 2–1 Initialization Parameters for I/O Slaves

Parameter	Range of Values	Default Value
DISK_ASYNCH_IO	TRUE/FALSE	TRUE
TAPE_ASYNCH_IO	TRUE/FALSE	TRUE
BACKUP_TAPE_IO_SLAVES	TRUE/FALSE	FALSE
DBWR_IO_SLAVES	0 - 999	0
DB_WRITER_PROCESSES	1-10	1

There may be times when the use of asynchronous I/O is not desirable or not possible. The first two parameters in Table 2–1, DISK_ASYNCH_IO and TAPE_ASYNCH_IO, allow asynchronous I/O to be switched off respectively for disk and tape devices. Because the number of I/O Slaves for each process type defaults to zero, no I/O Slaves will be deployed unless specifically set.

DBWR_IO_SLAVES should only be set to greater than 0 if DISK_ASYNCH_IO, or TAPE_ASYNCH_IO has been disabled, otherwise DBWR will become a bottleneck. In this case, the optimal value on Solaris for DBWR_IO_SLAVES is 4.

DB_WRITER_PROCESSES replaces the Oracle7 parameter DB_WRITERS and specifies the initial number of database writer processes for an instance. If you use DBWR_IO_SLAVES, only one database writer process will be used, regardless of the setting for DB_WRITER_PROCESSES.

Look for Large Disk Request Queues Using IOSTAT

A request queue shows how long the I/O requests on a particular disk device must wait to be serviced. Request queues are caused by a high volume of I/Os to that disk or by I/Os with long average seek times. Ideally, disk request queues should be at or near zero.

Choose the Appropriate File System Type

Sun SPARC Solaris allows a choice of file systems. File systems have different characteristics, and the techniques they use to access data can have a substantial impact on database performance. Typical file system choices are:

- `s5`: the UNIX System V File System
- `ufs`: the UNIX File System, derived from BSD UNIX
- `vxfs`: the Veritas File System
- raw device: no file system

The suitability of a file system to an application is usually undocumented. Even different `ufs` file systems are hard to compare because implementations differ. Although `ufs` is often the high-performance choice, performance differences vary from 0 to 20 percent, depending on the file system chosen.

Monitoring Disk Performance

To monitor disk performance, use `sar -b` and `sar -u`.

Important `sar -b` columns for disk performance are listed in Table 2–2.

Table 2–2 Important sar -b Columns for Disk Performance

`bread/s, bwrit/s`	blocks read and blocks written (important for file system databases)
`pread/s, pwrit/s`	partition reads and partition writes (important for raw partition database systems)

An important `sar -u` column for disk performance is `%wio`, the percentage of CPU time waiting on blocked I/O.

Key indicators are:

- The sum of `bread, bwrit, pread`, and `pwrit` indicates the state of the disk I/O subsystem. The higher the sum, the greater the potential for disk I/O bottlenecks. The larger the number of physical drives, the higher the sum threshold number can be. A good default value is no more than 40 for two drives and no more than 60 for four to eight drives.

- The `%rcache` should be greater than 90 and `%wcache` should be greater than 60. Otherwise, the system may be disk I/O bound.
- If `%wio` is consistently greater than 20, the system is I/O bound.

Disk Performance Issues

Oracle block sizes should either match disk block sizes or be a multiple of disk block sizes.

If possible, do a file system check on the partition before using it for database files. Then make a new file system to ensure that it is clean and unfragmented. Distribute disk I/O as evenly as possible, and separate log files from database files.

Tuning CPU Usage

Keep All Oracle Users/Processes at the Same Priority

Oracle is designed to operate with all users and background processes operating at the same priority level. Changing priorities causes unexpected effects on contention and response times.

For example, if the log writer process (LGWR) gets a low priority, it is not executed frequently enough and LGWR becomes a bottleneck. On the other hand, if LGWR has a high priority, user processes may suffer poor response time.

Use Processor Affinity/Binding on Multi-Processor Systems

In a multi-processor environment, use processor affinity/binding if it is available on your system. Processor binding prevents a process from migrating from one CPU to another, allowing the information in the CPU cache to be better utilized. You can bind a server shadow process to make use of the cache since it is always active, and let background processes flow between CPUs.

Use Single-Task Linking for Large Exports/Imports and SQL*Loader Jobs

If you need to transfer large amounts of data between the user and Oracle8*i* (for example, using `export/import`), it is efficient to use single-task architecture. To make the single-task import (`impst`), export (`expst`), and SQL*Loader (`sqlldrst`) executables, use the `ins_rdbms.mk` makefile in the `$ORACLE_HOME/rdbms/lib` directory.

The following example makes the `impst`, `expst`, and `sqlldrst` executables:

```
$ cd $ORACLE_HOME/rdbms/lib
$ make -f ins_rdbms.mk singletask
```

Note: Linking Oracle executables as a single-task allows a user process to directly access the entire SGA. In addition, running single-task requires more memory because the `oracle` executable text is no longer shared between the front-end and background processes.

Tuning Oracle Resource Contention

Tune UNIX Kernel Parameters

You can improve performance by keeping the UNIX kernel as small as possible. The UNIX kernel typically pre-allocates physical RAM, leaving less memory available for other processes such as `oracle`.

Traditionally, kernel parameters such as NBUF, NFILE, and NOFILES were used to adjust kernel size. However, most UNIX implementations dynamically adjust those parameters at run time, even though they are present in the UNIX configuration file.

Look for memory-mapped video drivers, networking drivers, and disk drivers. They can often be de-installed, yielding more memory for use by other processes.

Note: Remember to make a backup copy of your UNIX kernel. See your hardware vendor documentation for additional details.

Tuning Block Size and File Size

Note: To change block size, you must create a new database. Experiment with block size before transferring your data to the new database, to determine the most efficient configuration.

Specifying Oracle Block Size

On Solaris, the default Oracle block size is 2 KB and the maximum block size is 16 KB. You can set the actual block size to any multiple of 2 KB up to 16 KB, inclusive.

The optimal block size is typically the default but varies with the applications. To create a database with a different Oracle block size, add the following line to the `init`*`sid`*`.ora` file before creating the database:

```
db_block_size=new_block_size
```

Note: The value you choose for `db_block_size` determines the maximum size of certain types Oracle files. See Table 1–5, "Oracle-Specific File Size Limits" on page 1-13.

Tuning the Solaris Buffer Cache Size

To take full advantage of raw devices, adjust the size of the Oracle8*i* buffer cache and, if memory is limited, the Solaris buffer cache.

The Solaris buffer cache is provided by the operating system. It holds blocks of data in memory while they are being transferred from memory to disk, or vice versa.

The Oracle8*i* buffer cache is the area in memory that stores the Oracle database buffers. Since Oracle8*i* can use raw devices, it does not need to use the Solaris buffer cache.

When moving to raw devices, increase the size of the Oracle8*i* buffer cache. If the amount of memory on the system is limited, make a corresponding decrease in the Solaris buffer cache size. It is possible to increase or decrease the Oracle8*i* Buffer

Cache by modifying the `db_block_buffers` parameter in the `init`*`sid`*`.ora` file and restarting the instance.

The Solaris command `sar` can help you determine which buffer caches should be increased or decreased. The `sar` command options are shown in Table 2–3.

Table 2–3 sar Command Syntax

`sar -b`	reports the Solaris buffer cache activity
`sar -w`	reports the Solaris swapping activity
`sar -u`	reports CPU utilization
`sar -r`	reports memory utilization
`sar -p`	reports the Solaris paging activity

Adjusting Cache Size

- Increase Oracle8*i* cache size as long as the cache hit ratio goes up.
- Decrease cache sizes if the swapping/paging activity becomes high.

Using Trace and Alert Files

This section describes the trace (or dump) and alert files Oracle8*i* creates to diagnose and resolve operating problems.

Trace File Names

The format of a trace file name is *`processname_sid_unixpid`*`.trc`, where:

Table 2–4 Format Key to Process Name

`processname`	is a three- or four-character process name showing which Oracle8*i* process the trace file is from (for example, pmon, dbwr, ora, or reco)
`sid`	is the instance system identifier
`unixpid`	is the UNIX process ID number
`.trc`	is a filename extension appended to all trace file names

A sample trace file name is `lgwr_TEST_1237.trc`.

Alert Files

The `alert_`*`sid`*`.log` file is associated with a database and is located in the directory specified by the `init`*`sid`*`.ora` parameter BACKGROUND_DUMP_DEST. The default directory is `$ORACLE_HOME/rdbms/log`.

Raw Devices/Volumes

Disadvantages of Raw Devices/Volumes

Raw devices/volumes have the following disadvantages when used on Solaris:

- They may not solve problems with ULIMIT that can arise when exporting tables larger than 1MB (such as another disk partition).
- When raw devices and operating system files are mixed within an Oracle8*i* database, the operating system files must still be within the value of the ULIMIT parameter.
- They may not solve problems with ULIMIT that can arise when reading the contents of the Oracle distribution media onto the disk.
- Small client systems usually cannot use sufficiently large raw device/volume partitions. Disk partitions usually come in odd sizes that do not lend themselves to good database architecture.
- If a particular disk drive has intense I/O activity and performance would benefit from movement of an Oracle data file to another drive, it is likely that no acceptably sized section exists on a drive with less I/O activity. Moving data files around, a common advantage of UNIX, may not be possible with raw devices/volumes.
- Adding space to a tablespace can be a difficult process in a raw device/volume environment. Occasionally, all raw partitions are assigned data files at initial configuration time, leaving no raw storage to accommodate normal tablespace growth.

Note: On Solaris 2.6 and Solaris 7, `ULIMIT` is set to unlimited by default. To check the values, enter:

```
$ ulimit -a
```

Guidelines for Using Raw Devices/Volumes

In addition to the factors discussed under "Disadvantages of Raw Devices/Volumes", you should consider the following issues when deciding whether to use raw devices/volumes.

- Oracle8i Parallel Server Installation
- Raw Disk Partition Availability
- Logical Volume Manager
- Dynamic Performance Tuning
- Mirroring and Online Disk Replacement

Oracle8*i* Parallel Server Installation

Each instance of OPS has individual log files. Therefore, in addition to the partitions required for the tablespaces and control files, each instance requires a minimum of three partitions for the log files. All the files must be on disks that can be shared by all nodes of a Solaris cluster.

UNIX clusters do not provide access to a shared file system between all nodes of a cluster. As a result, all files associated with a database must be built on raw devices/volumes.

Raw Disk Partition Availability

Use raw devices/volumes for Oracle files only if your site has at least as many raw disk partitions as Oracle datafiles. If the raw disk partitions are already formatted, match datafile size to partition size as closely as possible to avoid wasting space.

If the raw disk partitions are already formatted, match tablespace size to partition size as closely as possible to avoid wasting space.

Logical Volume Manager

With logical volumes, you can create logical disks based on raw partition availability. Because logical disks can be moved to more than one disk, the disk drives do not have to be reformatted to obtain logical disk sizes.

Dynamic Performance Tuning

Disk performance can be optimized when the database is online by moving hot spots to cooler drives. Most hardware vendors who provide the logical disk facility also provide a graphical user interface that can be used for tuning.

Mirroring and Online Disk Replacement

You can mirror logical volumes to protect against loss of data. If one copy of a mirror fails, dynamic re-synchronization is possible. Some vendors also provide the ability to replace drives online in conjunction with the mirroring facility.

For Oracle Parallel Server, you can use logical volumes for drives associated with a single UNIX machine, as well as those that can be shared with more than one machine of a UNIX cluster. The latter allows for all files associated with the Oracle Parallel Server to be placed on these shared logical volumes.

Raw Device Setup

Keep in mind the following items when creating raw devices:

- When creating the volumes, ensure that the owner and group are `oracle` and `oinstall`, respectively.
- The size of an Oracle datafile created in a raw partition must be at least two Oracle block sizes smaller than the size of the raw partition.
- There are several methods that can be used to create raw devices on Solaris, including the Solaris command format, Solstice DiskSuite, and Veritas Volume Manager products. Please contact the products vendor for more information on creating raw devices.

3

Administering SQL*Plus

Administering SQL*Plus

Setup Files

The setup files for SQL*Plus are glogin.sql, the global setup file that defines the site profile, and login.sql, which defines the user profile. The glogin.sql and login.sql files contain SQL*Plus commands that you choose to execute at the beginning of each SQL*Plus session. When you invoke SQL*Plus, glogin.sql is read first, followed by login.sql.

The Site Profile

The Site Profile file is $ORACLE_HOME/sqlplus/admin/glogin.sql. SQL*Plus runs this command file when any user starts SQL*Plus. The default Site Profile is placed in $ORACLE_HOME/sqlplus/admin when SQL*Plus is installed. If a Site Profile already exists, it will be overwritten. An existing Site Profile is deleted when SQL*Plus is de-installed.

The User Profile

The User Profile file is login.sql. SQL*Plus runs this command file, after the Site Profile file has run, when any user starts SQL*Plus. SQL*Plus always searches the current directory first for the User Profile. The environment variable SQLPATH may be set to a colon-separated list of directories that SQL*Plus will search for a login.sql file.

For example, if the current directory is /u02/oracle and SQLPATH is set as follows:

```
/home:/home/oracle:/u01/oracle
```

SQL*Plus first looks for login.sql in the current directory /u02/oracle. If it is not found there, SQL*Plus will then look in /home, /home/oracle, and /u01/oracle, respectively. SQL*Plus runs only the first login.sql file found.

Since login.sql is run last, options set in login.sql override those set in glogin.sql.

See Also: Chapter 3 in the *SQL*Plus User's Guide and Reference*.

The PRODUCT_USER_PROFILE Table

During a [Typical] installation, the PRODUCT_USER_PROFILE table (PUP) is created automatically. The PUP table is used to disable certain SQL and SQL*Plus commands. If you need to recreate this table, run the `$ORACLE_HOME/sqlplus/admin/pupbld.sql` script in the SYSTEM schema.

For example:

```
$ sqlplus system/manager
SQL> @?/sqlplus/admin/pupbld.sql
```

SQL*Plus will use the value of `$ORACLE_HOME` wherever "?" appears.

Demonstration Tables

SQL*Plus is shipped with demonstration tables that may be used for testing.

Typical Install

During a [Typical] installation, the user SCOTT and the demonstration tables are created automatically.

Creating Demonstration Tables Manually

Use the SQL script `$ORACLE_HOME/sqlplus/demo/demobld.sql` to create the demonstration tables. The file `demobld.sql`, may be run in SQL*Plus as any user to create the demonstration tables in that schema. For example:

```
$ sqlplus scott/tiger
SQL> @?/sqlplus/demo/demobld.sql
```

`$ORACLE_HOME/sqlplus/demo/demobld.sql` may also be run using the shell script `$ORACLE_HOME/bin/demobld` as follows:

```
$ demobld scott tiger
```

Deleting Demonstration Tables

The SQL script `$ORACLE_HOME/sqlplus/demo/demodrop.sql` is used to drop the demonstration tables. The file `demodrop.sql` may be run in SQL*Plus as any user to drop the demonstration tables from that user's schema. For example:

```
$ sqlplus scott/tiger
```

```
SQL> @?/sqlplus/demo/demodrop.sql
```

`$ORACLE_HOME/sqlplus/demo/demodrop.sql` may also be run using the shell script `$ORACLE_HOME/bin/demodrop` as follows:

```
$ demodrop scott tiger
```

> **Note:** Both SQL scripts `demobld.sql` and `demodrop.sql` drop the tables EMP, DEPT, BONUS, SALGRADE, and DUMMY. Make sure that no table with any of these names exists in the desired schema prior to running either script, or the table data will be lost.

Help Facility

Typical Install

When you copy a starter database with pre-built datafiles as part of the Typical installation or as an option in Oracle Database Configuration Assistant, the Help Facility is installed automatically.

Database Configuration Assistant

Oracle Database Configuration Assistant gives you the option to create help tables when creating a database.

Installing the Help Facility Manually

The Help Facility may be installed manually using the shell script `$ORACLE_HOME/bin/helpins`. Before you run the script, the SYSTEM_PASS environment variable should be set to the SYSTEM schema name and password. For example:

```
$ setenv SYSTEM_PASS SYSTEM/MANAGER
$ helpins
```

If the `SYSTEM_PASS` variable is not set, `helpins` prompts you for the `SYSTEM` password and loads the help data into the `SYSTEM` schema. You can also run `$ORACLE_HOME/sqlplus/help/helpbld.sql helpus.sql` to install the Help Facility. The system user can run the file `helpbld.sql` and its argument, `helpus.sql`, in SQL*Plus to create Help Facility Tables. For example:

```
$ sqlplus system/manager
```

```
SQL> @?/sqlplus/admin/help/helpbld.sql helpus.sql
```

Note: Both the shell script, `helpins`, and the SQL*Plus script, `helpbld.sql`, drop any existing Help Facility tables before creating new tables.

You can also run `$ORACLE_HOME/sqlplus/help/helpdrop.sql` in SQL*Plus to manually drop the Help Facility tables in that schema. For example:

```
$ sqlplus system/manager
SQL> @?/sqlplus/admin/help/helpdrop.sql
```

See Also: Refer to the *SQL*Plus User's Guide and Reference*.

Using SQL*Plus

Using a System Editor from SQL*Plus

An `edit` command entered at the SQL*Plus prompt invokes an operating system editor, such as `ed, emacs, ned`, or `vi`. Your PATH variable must include the directory of the editor.

When you invoke the editor the current SQL buffer is placed in the editor. When you exit the editor, the changed SQL buffer is returned to SQL*Plus.

You can specify which editor will be invoked by defining the SQL*Plus `_editor` variable. This variable can be set in `glogin.sql`, `login.sql` or entered during a SQL*Plus session.

For example, to set the default editor to `vi`, enter:

```
define_editor=vi
```

If you do not set the `_editor` variable, then the value of either the EDITOR or VISUAL environment variables is used. If both are set, the EDITOR variable value is used.

When `_editor`, EDITOR and VISUAL are not specified, the default editor is `ed`.

When you invoke the editor, SQL*Plus uses a temporary file called `afiedt.buf` to pass text to the editor. You can rename this file, using the `SET EDITFILE` command. For example:

```
SQL>SET EDITFILE/tmp/myfile.sql
```

SQL*Plus does not delete the temporary file.

Running Operating System Commands from SQL*Plus

The HOST command or an exclamation point (!) as the first character after the SQL*Plus prompt indicates subsequent characters are passed to a sub-shell. The SHELL environment variable sets the shell used to execute operating system commands. The default shell is /bin/sh(sh). If the shell cannot be executed, an error message is displayed.

You can perform operating system commands without leaving SQL*Plus by entering the HOST or (!) commands.

For example, to enter one command, enter:

```
SQL>! command
```

where command represents the operating system command you wish to execute. Once the command has executed, control is returned to SQL*Plus.

To execute more than one operating system command, press [Enter] after the [!] or HOST command.

Interrupting SQL*Plus

While running SQL*Plus you can stop the scrolling record display and terminate a SQL statement by pressing [Ctrl]+[c] on Solaris machines.

Using the SPOOL Command

The default filename extension for files generated by the SPOOL command is .lst. To change the extension, specify a spool file containing a period (.).

For example:

```
SQL> SPOOL query.lis
```

Restrictions

Resizing Windows

The default value for SQL*Plus LINESIZE and for PAGESIZE do not automatically adjust for window size.

Return Codes

UNIX return codes use only one byte, which is not enough space to return an Oracle error code. The range for a return code is 0 to 255.

4

Using Oracle Precompilers and the Oracle Call Interface

Overview of Oracle Precompilers

Oracle precompilers are application design tools used to combine SQL statements from an Oracle database with programs written in a high-level language. Oracle precompilers are compatible with ANSI SQL and are used to develop open, customized applications that run with Oracle8*i* or any other ANSI SQL DBMS.

Precompiler Configuration Files

The `.cfg` system configuration files in `$ORACLE_HOME/precomp/admin` are described in Table 4–1.

Table 4–1 System Configuration Files

Product	Configuration File
Pro*C/C++ 8.1.6	`pcscfg.cfg`
Pro*COBOL 8.1.6	`pcbcfg.cfg`
Pro*COBOL 1.8.50	`pcccob.cfg`
Pro*FORTRAN 1.8.50.0	`pccfor.cfg`
Oracle SQL*Module for Ada 8.1.6	`pmscfg.cfg`
Object Type Translator 8.1.6	`ottcfg.cfg`

Issues Common to All Precompilers

Note: To run Oracle Precompiler demonstrations, you must already have installed Oracle8*i*.

Uppercase to Lowercase Conversion

In languages other than C, your compiler converts an uppercase function or subprogram name to lowercase. This can cause "No such user exit" errors. Verify that the function or subprogram name in your option file matches the case in the `iapxtb` table.

Vendor Debugger Programs

Precompilers and vendor-supplied debuggers can be incompatible. Oracle Corporation does not guarantee that a program run under a debugger will run the same way under an operating system.

Value of ireclen and oreclen

The `ireclen` and `oreclen` parameters do not have maximum values.

Additional Documentation

The following documents provide additional information about precompiler and interface features:

- *Programmer's Guide to the Pro*C/C++ Precompiler*
- *Programmer's Guide to the Pro*COBOL Precompiler*
- *Programmer's Guide to the Oracle Call Interface*
- *Programmer's Guide to SQL*Module for Ada*
- *Oracle8i Server Application Developer's Guide*

Pro*C/C++

For additional information regarding Pro*C/C++ version 8.1.6, see the README file, `$ORACLE_HOME/precomp/doc/proc2/readme.doc`.

Administering Pro*C/C++

System Configuration File

The system configuration file for Pro*C/C++ is `$ORACLE_HOME/precomp/admin/pcscfg.cfg`.

> **See Also:** For further information, see the *Programmer's Guide to the Pro*C/C++ Precompiler*.

Using Pro*C/C++

Before you use Pro*C/C++, verify that the correct version of the operating system compiler is properly installed. The required version is documented in the *Oracle8i Installation Guide for Sun SPARC Solaris*.

Demonstration Programs

Demonstration programs are provided to show the varied functionality of the Pro*C/C++ precompiler. There are three types of demonstration programs: C, C++, and Object programs. The latter demonstrate the new Oracle8*i* Object features. All the demonstration programs are in the directory `$ORACLE_HOME/precomp/demo/proc` and all of them assume that the demonstration tables created by `$ORACLE_HOME/sqlplus/demo/demobld.sql` are in the SCOTT schema with the password TIGER.

For further information on building the demonstration programs using SQL*Plus, see "Demonstration Tables" on page 3-3 of this book.

> **See Also:** For further information on using demonstration programs, see the *Programmer's Guide to the Pro*C/C++ Precompiler.*

Use the makefile, `$ORACLE_HOME/precomp/demo/proc/demo_proc.mk`, to create the demonstration programs. For example, to precompile, compile, and link the `sample1` demonstration program, enter the following command:

```
$ make -f demo_proc.mk sample1
```

Alternatively, use the following command, which achieves the same result, with more explicit syntax:

```
$ make -f demo_proc.mk build OBJS=sample1.o EXE=sample1
```

By default, all programs are dynamically linked with the client shared library, `$ORACLE_HOME/lib/libclntsh.so`.

To create all C demonstration programs for Pro*C/C++, enter the following command:

```
$ make -f demo_proc.mk samples
```

To create all C++ demonstration programs for Pro*C/C++, enter this command:

```
$ make -f demo_proc.mk cppsamples
```

To create all Object demonstration programs for Pro*C/C++, enter this command:

```
$ make -f demo_proc.mk object_samples
```

Some demonstration programs require you to run a SQL script from `$ORACLE_HOME/precomp/demo/sql.` To build a demonstration program and run the corresponding SQL script, include the `make` macro argument, `RUNSQL=run`, on the command line. For example, to create the `calldemo` demonstration program and run the required `$ORACLE_HOME/precomp/demo/sql/calldemo.sql` script, use the following command syntax:

```
$ make -f demo_proc.mk calldemo RUNSQL=run
```

To create all Object demonstration programs and run all corresponding required SQL scripts, enter the following command:

```
$ make -f demo_proc.mk object_samples RUNSQL=run
```

The SQL scripts can also be run manually.

User Programs

The makefile, `$ORACLE_HOME/precomp/demo/proc/demo_proc.mk`, can be used to create user programs. The general syntax for linking a user program with `demo_proc.mk` is as follows:

```
$ make -f demo_proc.mk target OBJS="objfile1 objfile2 ..." \
 EXE=exename
```

For example, to create the program, `myprog`, from the Pro*C/C++ source `myprog.pc`, use one of the following commands, depending on the source and type of executable desired:

For C source, dynamically linked with client shared library:

```
$ make -f demo_proc.mk build OBJS=myprog.o EXE=myprog
```

For C source, statically linked:

```
$ make -f demo_proc.mk build_static OBJS=myprog.o EXE=myprog
```

For C++ source, dynamically linked with client shared library:

```
$ make -f demo_proc.mk cppbuild OBJS=myprog.o EXE=myprog
```

For C++ source, statically linked:

```
$ make -f demo_proc.mk cppbuild_static OBJS=myprog.o EXE=myprog
```

For Solaris restrictions on the use of shared libraries, refer to the Solaris documentation from Sun Microsystems.

Pro*COBOL

There are two versions of Pro*COBOL included with this release: Pro*COBOL 8.1.6 and Pro*COBOL 1.8.50. Table 4–2 shows the naming differences between these two versions.

Table 4–2 Pro*COBOL Naming Differences

	Pro*COBOL 8.1.6	Pro*COBOL 1.8.50
Executable	`procob`	`procob18`
Demo Directory	`procob2`	`procob`
Makefile for MicroFocus COBOL	`demo_procob.mk`	`demo_procob18.mk`
Makefile for SUN Nihongo COBOL	`demo_procob.mk.nsun`	`demo_procob18.mk.nsun`

Pro*COBOL supports statically linked, dynamically linked, or dynamically loadable programs. Dynamically linked programs use the Oracle client shared library, `$ORACLE_HOME/lib/libclntsh.so`. Dynamically loadable programs use the `rtsora` executable.

For additional information on Pro*COBOL 8.1.6, see the README file `$ORACLE_HOME/precomp/doc/procob2/readme.doc`.

For additional information on Pro*COBOL 1.8.50, see the README file, `$ORACLE_HOME/precomp/doc/pro1x/readme.txt`.

Administering Pro*COBOL

System Configuration File

The system configuration file for Pro*COBOL 8.1.6 is `$ORACLE_HOME/precomp/admin/pcbcfg.cfg`.

The system configuration file for Pro*COBOL 1.8.50 is `$ORACLE_HOME/precomp/admin/pcccob.cfg`

> **See Also:** For further information, see the *Programmer's Guide to the Pro*COBOL Precompiler.*

Environment Variables

MicroFocus COBOL Compiler

The MicroFocus COBOL Compiler requires the environment variables COBDIR and LD_LIBRARY_PATH.

COBDIR must be set to the directory where the compiler is installed. For example:

```
$ set COBDIR /opt/cobol; export COBDIR
```

LD_LIBRARY_PATH must include the directory `$COBDIR/coblib`. For example, to append `$COBDIR/coblib` to LD_LIBRARY_PATH:

```
$ set LD_LIBRARY_PATH ${LD_LIBRARY_PATH}:$COBDIR/coblib
$ export LD_LIBRARY_PATH
```

If LD_LIBRARY_PATH does not contain `$COBDIR/coblib`, you receive the following error when compiling a program:

```
ld.so.1: rts32: fatal: libfhutil.so.2.0: can’t open file: errno=2
```

Sun Nihongo COBOL Compiler

The Sun Nihongo COBOL Compiler does not require the environment variable COBDIR. However, the PATH environment variable must include the directory `/opt/SUNWnsun/bin`. For example, to append `/opt/SUNWnsun/bin` to PATH:

```
$ set PATH ${PATH}:/opt/SUNWnsun/bin; export PATH
```

LD_LIBRARY_PATH must also include the directory `/opt/SUNWnsun/bin`. To append `/opt/SUNWnsun/bin` to LD_LIBRARY_PATH:

```
$ set LD_LIBRARY_PATH ${LD_LIBRARY_PATH}:/opt/SUNWnsun/bin
$ export LD_LIBRARY_PATH
```

If LD_LIBRARY_PATH does not contain `/opt/SUNWnsun/bin`, you will receive the following error when compiling a program:

```
ld.so.1: cobol: fatal: liblicense.so: can’t open file: errno=2
```

Using Pro*COBOL

Before you use Pro*COBOL, verify that the correct version of the COBOL compiler is properly installed. The required version for your operating system is documented in the *Oracle8i Installation Guide for Sun SPARC Solaris*.

The Oracle Run Time System

Oracle provides its own complete run time system, called `rtsora`, to run dynamically loadable Pro*COBOL programs use the `rtsora` runtime system in place of the MicroFocus provided `cobrun` run time system when you run dynamically loadable Pro*COBOL programs. If you attempt to run a Pro*COBOL program with `cobrun`, you receive the following error:

```
$ cobrun sample1.gnt
Load error : file ’SQLADR’
error code: 173, pc=0, call=1, seg=0
173     Called program file not found in drive/directory
```

Demonstration Programs

Demonstration programs have been provided that show the varied functionality of the Pro*COBOL precompiler. All programs are located in either `$ORACLE_HOME/precomp/demo/procob` or `$ORACLE_HOME/precomp/demo/procob2`, depending on the Pro*COBOL version. All programs assume that the demonstration tables created by `$ORACLE_HOME/sqlplus/demo/demobld.sql` are in the SCOTT schema with the password TIGER. For further information on building the demonstration programs using SQL*Plus, see "Demonstration Tables" on page 3-3 of this book.

> **See Also:** For further information on the demonstration programs, see the *Programmer’s Guide to the Pro*COBOL Precompiler.*

Use the demonstration makefile to create the sample programs. The demonstration makefile for Pro*COBOL 8.1.6 is `$ORACLE_HOME/precomp/demo/procob2/demo_procob.mk`.

The demonstration makefile for Pro*COBOL 1.8.50 is `$ORACLE_HOME/precomp/demo/procob/demo_procob18.mk`.

For example, to precompile, compile, and link the `sample1` demonstration program for Pro*COBOL 8.1.6, use the following command:

```
$ cd $ORACLE_HOME/precomp/demo/procob2
```

```
$ make -f demo_procob.mk sample1
```

Alternatively, the following command may be used, which achieves the same result, with more explicit syntax.

```
$ make -f demo_procob.mk build COBS=sample1.cob EXE=sample1
```

By default, all programs are dynamically linked with the client shared library, `$ORACLE_HOME/lib/libclntsh.so`.

To create all Pro*COBOL demonstration programs, enter the following command:

```
$ make -f demo_procob.mk samples
```

To create a dynamically loadable `sample1.gnt` program to be used with `rtsora`, enter this command:

```
$ make -f demo_procob.mk sample1.gnt
```

Then use `rtsora` to run the program as follows:

```
$ rtsora sample1.gnt
```

Some demonstration programs require a SQL script found in `$ORACLE_HOME/precomp/demo/sql` to be run. To build such a demonstration program and run the corresponding SQL script, include the make macro argument, `RUNSQL=run`, on the command line.

For example, to create the `sample9` demonstration program and run the required `$ORACLE_HOME/precomp/demo/sql/calldemo.sql` script, use the following command syntax:

```
$ make -f demo_procob.mk sample9 RUNSQL=run
```

The SQL scripts can also be run manually.

User Programs

The demonstration makefile can be used to create user programs. Be sure to use the appropriate makefile depending on the Pro*COBOL version and COBOL compiler used. The general syntax for linking a user program with the demonstration makefile is:

```
$ make -f demo_procob.mk target COBS="cobfile1 cobfile2 ..." \
 EXE=exename
```

For example, to create the program, `myprog`, from the Pro*COBOL source `myprog.pco`, use one of the following commands, depending on the type of executable and use of shared library resources desired.

For a dynamically linked executable with client shared library:

```
$ make -f demo_procob.mk build COBS=myprog.cob EXE=myprog
```

For a statically linked executable without client shared library:

```
$ make -f demo_procob.mk build_static COBS=myprog.cob EXE=myprog
```

For a dynamically loadable module usable with `rtsora:`

```
$ make -f demo_procob.mk myprog.gnt
```

FORMAT Precompiler Option

The FORMAT precompiler option specifies the format of input lines for COBOL. If you specify FORMAT=ANSI, the default, columns 1 to 6 contain an optional sequence number, column 7 indicates comments or continuation lines, paragraph names begin in columns 8 to 11, and statements begin in columns 12 to 72.

If you specify FORMAT=TERMINAL, columns 1 to 6 are dropped, making column 7 the leftmost column.

Sun Nihongo COBOL

If you are using Sun Nihongo COBOL, rename the makefile as follows:

For Pro*COBOL 8.1.6:

```
$ cd $ORACLE_HOME/precomp/demo/procob2
$ mv demo_procob.mk demo_procob.mk.mf
$ cp procob.mk.nsun procob.mk
```

For Pro*COBOL 1.8.50:

```
$ cd $ORACLE_HOME/precomp/demo/procob
$ mv demo_procob18.mk demo_procob.mk.mf
$ cp procob.mk.nsun procob.mk
```

Pro*FORTRAN

For additional information regarding Pro*FORTRAN 1.8.50, see the README file, $ORACLE_HOME/precomp/doc/pro1x/readme.txt.

Administering Pro*FORTRAN

System Configuration File

The system configuration file for Pro*FORTRAN is $ORACLE_HOME/precomp/admin/pccfor.cfg.

Using Pro*FORTRAN

Prior to using Pro*FORTRAN, verify that the correct version of the compiler is properly installed. The required version for your operating system is specified in Chapter 1 of the *Oracle8i Installation Guide for Sun SPARC Solaris*.

Demonstration Programs

Demonstration programs are provided to show the various functionality of the Pro*FORTRAN precompiler. All programs are located in

`$ORACLE_HOME/precomp/demo/profor`, and all of them assume that the demonstration tables created by `$ORACLE_HOME/sqlplus/demo/demobld.sql` exist in the SCOTT schema with the password TIGER.

For further information on building the demonstration programs using SQL*Plus, see "Demonstration Tables" on page 3-3 of this book.

> **See Also:** For further information on the demonstration programs see the *Pro*FORTRAN Supplement to Oracle Precompilers*.

The makefile, `$ORACLE_HOME/precomp/demo/profor/demo_profor.mk`, should be used to create the demonstration programs. For example, to precompile, compile, and link the `sample1` demonstration program, enter the following command:

```
$ make -f demo_profor.mk sample1
```

Alternatively, the following command may be used, which achieves exactly the same result, only with more explicit syntax:

```
$ make -f demo_profor.mk build FORS=sample1.pfo EXE=sample1
```

By default, all programs are dynamically linked with the client shared library, `$ORACLE_HOME/lib/libclntsh.so`.

To create all Pro*FORTRAN demonstration programs, enter the following command:

```
$ make -f demo_profor.mk samples
```

Some demonstration programs require a SQL script, found in `$ORACLE_HOME/precomp/demo/sql`, to be run. To build such a demonstration program and run the corresponding SQL script, the make macro argument, `RUNSQL=run`, must be included on the command line. For example, to create the `sample11` demonstration program and run the required

$ORACLE_HOME/precomp/demo/sql/sample11.sql script, use the following command syntax:

```
$ make -f demo_profor.mk sample11 RUNSQL=run
```

The SQL scripts can also be run manually.

User Programs

The makefile, $ORACLE_HOME/precomp/demo/profor/demo_profor.mk, can be used to create user programs. The general syntax for linking a user program with demo_profor.mk is as follows:

```
$ make -f demo_profor.mk target FORS="forfile1 forfile2 ..." \
 EXE=exename
```

For example, to create the program, myprog, from the Pro*FORTRAN source myprog.pfo, use one of the following commands, depending on the type of executable desired:

For dynamically linked executable with client shared library:

```
$ make -f demo_profor.mk build FORS=myprog.f EXE=myprog
```

For a statically linked executable:

```
$ make -f demo_profor.mk build_static FORS=myprog.f EXE=myprog
```

SQL*Module for Ada

Administering SQL*Module for Ada

System Configuration File

The system configuration file for Oracle SQL*Module is $ORACLE_HOME/precomp/admin/pmscfg.cfg.

Using SQL*Module for Ada

Prior to using SQL*Module for Ada, verify that the correct version of the compiler is properly installed. The required version for your operating system is specified in Chapter 1 of the *Oracle8i Installation Guide for Sun SPARC Solaris*.

Demonstration Programs

Demonstration programs have been provided that show various functionality of SQL*Module for Ada. All programs are located in `$ORACLE_HOME/precomp/demo/modada`.

The demonstration program `ch1_drv` assumes that the demonstration tables created by `$ORACLE_HOME/sqlplus/demo/demobld.sql` exist in the SCOTT schema with the password TIGER.

The demonstration programs `demcalsp` and `demohost` assume that the sample college database created by `$ORACLE_HOME/precomp/demo/sql/mktable.sql` exists in the MODTEST schema.

All programs assume that a Net8 connect string or instance-alias named INST1_ ALIAS has been defined and is capable of connecting to the database where the appropriate tables exist.

For further information on building the demonstration programs using SQL*Plus, see “Demonstration Tables” on page 3-3 of this book.

> **See Also:** For further information on the demonstration programs see the *Programmer’s Guide to SQL*Module for Ada*.

The makefile, `$ORACLE_HOME/precomp/demo/modada/demo_modada.mk`, should be used to create the demonstration programs. For example, to compile and link the `ch1_drv` demonstration program, use the following command:

```
$ make -f demo_modada.mk ch1_drv
```

Alternatively, the following command can be used, which achieves exactly the same result, only using more explicit syntax:

```
$ make -f demo_modada.mk ada OBJS="ch1_mod.ada ch1_drv.ada" \
 EXE=ch1_drv MODARAGS=user=modtest/yes
```

By default, all programs are dynamically linked with the client shared library, `$ORACLE_HOME/lib/libclntsh.so`.

To create all SQL*Module for Ada demonstration programs, enter the following command:

```
$ make -f demo_modada.mk samples
```

The sample programs `demcalsp` and `demohost` require the sample college database created by `$ORACLE_HOME/precomp/demo/sql/mktable.sql` in the MODTEST schema. The MODTEST user can be created by the running SQL script,

`$ORACLE_HOME/precomp/demo/sql/grant.sql`. To create the MODTEST user, create the sample college database, and build a demonstration program, use the make targets `makeuser` and `loaddb`. For example, to run the required SQL scripts and create the `demohost` program, use the following command syntax:

```
$ make -f demo_modada.mk makeuser loaddb demohost
```

The SQL scripts can also be run manually.

To create all SQL*Module for Ada demonstration programs, to run the necessary SQL scripts to create the MODTEST user, and to create the sample college database, enter the following command:

```
$ make -f demo_modada.mk all
```

User Programs

The makefile, `$ORACLE_HOME/precomp/demo/modada/demo_modada.mk`, may be used to create user programs. The general syntax for linking a user program with `demo_modada.mk` is:

```
$ make -f demo_modada.mk ada OBJS="module1 module2 ..." \
 EXE=exename MODARAGS=SQL*Module_arguments
```

Oracle Call Interface

Using the Oracle Call Interface

Before using the Oracle Call Interface (OCI), verify that the correct version of Pro*C/C++ is properly installed. The required version for your operating system is specified in Chapter 1 of the *Oracle8i Installation Guide for Sun SPARC Solaris*.

Demonstration Programs

Demonstration programs have been provided that show the varied functionality of the OCI. There are two types of demonstration programs: C and C++. All the demonstration programs are located in `$ORACLE_HOME/rdbms/demo`. Many of the demonstration programs assume that the demonstration tables created by `$ORACLE_HOME/sqlplus/demo/demobld.sql` are in the SCOTT schema with the password TIGER.

For further information on building the demonstration programs using SQL*Plus, see "Demonstration Tables" on page 3-3 of this book.

For further information on the demonstration programs see the *Programmer's Guide to the Oracle Call Interface* and the program source for details of each program.

Use the makefile, `$ORACLE_HOME/rdbms/demo/demo_rdbms.mk`, to create the demonstration programs. For example, to compile and link the `cdemo1` demonstration program, enter the following command:

```
$ make -f demo_rdbms.mk cdemo1
```

Alternatively, you can use the following command, which achieves the same result with more explicit syntax:

```
$ make -f demo_rdbms.mk build OBJS=cdemo1.o EXE=cdemo1
```

By default, all programs are dynamically linked with the client shared library, `$ORACLE_HOME/lib/libclntsh.so`.

To create all OCI C demonstration programs, enter this command:

```
$ make -f demo_rdbms.mk demos
```

To create all OCI C++ demonstration programs, enter this command:

```
$ make -f demo_rdbms.mk c++demos
```

Note: If you receive the following errors while linking a C++ program:

```
ld: fatal: library -lsunmath: not found
ld: fatal: library -lC: not found
ld: fatal: library -lC_mtstubs: not found
ld: fatal: library -lcx: not found
```

you must include in LD_LIBRARY_PATH the directory in which the specified libraries exist.

For example, if using SPARCompiler C++ 4.0 the directory is `/opt/SUNWspro/SC4.0/lib`. Enter these commands:

```
$ LD_LIBRARY_PATH=${LD_LIBRARY_PATH}:\
/opt/SUNWspro/SC4.0/lib
$ export LD_LIBRARY_PATH
```

Some demonstration programs require you to run a SQL script manually before you execute the program. All the scripts are in `$ORACLE_HOME/rbdms/demo`. In most cases, the SQL script name is the same as the program name with a `.sql` extension. For example, the SQL script for the program `oci02` is `oci02.sql`.

Read the comments at the beginning of the program to determine the required SQL script, if any.

User Programs

The makefile, `$ORACLE_HOME/rdbms/demo/demo_rdbms.mk`, can be used to create user programs. The general syntax for linking a user program with `demo_rdbms.mk` is:

```
$ make -f demo_rdbms.mk target OBJS="objfile1 objfile2 ..." \
 EXE=exename
```

For example, to create the program `myprog` from the C source `myprog.c`, use one of the following commands depending on the type of executable desired:

For C source, dynamically linked with client shared library:

```
$ make -f demo_rdbms.mk build OBJS=myprog.o EXE=myprog
```

For C source, statically linked:

```
$ make -f demo_rdbms.mk build_static OBJS=myprog.o EXE=myprog
```

To create the program `myprog` from the C++ source `myprog.cc`

For C++ source, dynamically linked with client shared library:

```
$ make -f demo_rdbms.mk buildc++ OBJS=myprog.o EXE=myprog
```

For C++ source, statically linked:

```
$ make -f demo_rdbms.mk buildc++_static OBJS=myprog.o EXE=myprog
```

Oracle Precompiler and Oracle Call Interface Linking and Makefiles

Custom Makefiles

It is recommended that you use the provided `demo_`*`product`*`.mk` makefiles to link user programs as described in the specific product sections of this chapter. You need to modify the provided makefile, or if you decide to use a custom written makefile, note the following:

- Do not modify the ordering of the Oracle libraries. Oracle libraries are included on the link line more than once so all symbols are resolved during linking. There are two reasons for this:
  - Oracle libraries are mutually referential, meaning that functions in library A call functions in library B, and functions in library B call functions in library A.
  - The Solaris linker is a one-pass linker, meaning that the linker searches a library exactly once at the point it is encountered in the link line.
- If you add your own library to the link line, add it to the beginning or to the end of the link line. User libraries should not be placed between the Oracle libraries.
- If you choose to use a make utility such as `nmake` or GNU `make`, be aware of how macro and suffix processing differs from the make utility provided with Solaris, `/usr/ccs/bin/make`. Oracle makefiles have been tested and are supported with the Solaris `make` utility.
- Oracle library names and the contents of those libraries are subject to change between releases. Always use the `demo_`*`product`*`.mk` makefile that ships with the current release as a guide to determine which libraries are necessary.

Undefined Symbols

A common error when linking a program is undefined symbols, similar to the following:

```
$ make -f demo_proc.mk sample1
Undefined                       first referenced
 symbol                             in file
sqlcex                              sample1.o
sqlglm                              sample1.o
ld: fatal: Symbol referencing errors. No output written to sample1
```

This error occurs when the linker cannot find a definition for a referenced symbol. Generally, the remedy for this type of problem is to ensure that the library or object file containing the definition exists on the link line and that the linker is searching the correct directories for the file.

Oracle provides a utility called `symfind` to assist in locating a library or object file where a symbol is defined. Here is example output of `symfind` locating the symbol `sqlcex`:

```
$ symfind sqlcex
```

```
SymFind - Find Symbol <sqlcex> in <**>.a, .o, .so
-------------------------------------------------------
Command:         /u01/app/oracle/product/8.1.6/bin/symfind sqlcex
Local Directory: /u01/app/oracle/product/8.1.6
Output File:     (none)
Note:            I do not traverse symbolic links
                 Use '-v' option to show any symbolic links

Locating Archive and Object files ...
[11645] |    467572|      44|FUNC |GLOB |0     |8      |sqlcex
^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^ ./lib/libclntsh.so
[35]    |         0|      44|FUNC |GLOB |0     |5      |sqlcex
^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^ ./lib/libsql.a
```

Thread Support

The Oracle libraries provided with this release are thread safe, allowing support for multi-threaded applications.

Static and Dynamic Linking with Oracle Libraries

You can link precompiler and Oracle Call Interface applications with Oracle Libraries either statically or dynamically. With static linking, the libraries and objects of the whole application are linked together into a single executable program. As a result, application executables can become fairly large.

With dynamic linking, the executing code partly resides in the executable program and also resides in libraries that are linked by the application dynamically at runtime. Libraries that are linked at runtime are called dynamic or shared libraries. There are two primary benefits of dynamic linking:

1. **Smaller disk requirements:**
   Different applications, or different invocations of the same application, can use the same shared or dynamic library. As a result, the overall disk requirements are reduced.

2. **Smaller main memory requirements:**
   The same shared or dynamic library image (for example, the in-memory copy), can be shared by different applications. This means that a library needs to be loaded only once into the main memory and then multiple applications can use the same library. As a result, main memory requirements are reduced.

Oracle Shared Library

The Oracle shared library is `$ORACLE_HOME/lib/libclntsh.so`. If you use the Oracle provided `demo_`*`product`*`.mk` makefile to link an application, the Oracle shared library is used by default.

It might be necessary to set the environment variable LD_LIBRARY_PATH so the runtime loader can find the Oracle shared library at process startup. If you receive the following error when starting an executable, LD_LIBRARY_PATH must be set to the directory where the Oracle shared library exists:

```
$ sample1
ld.so.1: sample1: fatal: libclntsh.so.1.0: can’t open file: errno=2
Killed
```

Set LD_LIBRARY_PATH as follows:

```
$ setenv LD_LIBRARY_PATH $ORACLE_HOME/lib
```

The Oracle shared library is created automatically during installation. If you need to re-create the Oracle shared library, exit **all** client applications using the Oracle shared library, including all Oracle client applications such as SQL*Plus and Recovery Manager, and run the following command logged in as the *oracle* user:

```
$ cd $ORACLE_HOME/rdbms/lib
$ make -f ins_rdbms.mk libclntsh.so
```

Using Signal Handlers

This section describes signals Oracle8*i* uses for two-task communication and explains how to set up your own signal handlers.

Signals

Signals are installed in a user process when you connect to the database and are de-installed when you disconnect.

Oracle8*i* uses the following signals for two-task communications:

Table 4–3 Signals for Two-Task Communications

SIGCONT	used by the pipe two-task driver to send out-of-band breaks from the user process to the `oracle` process.
SIGINT	used by all two-task drivers to detect user interrupt requests. SIGINT is not caught by `oracle`; it is caught by the user process.
SIGPIPE	used by the pipe driver to detect end-of-file on the communications channel. When writing to the pipe, if no reading process exists, a SIGPIPE signal is sent to the writing process. SIGPIPE is caught by both the `oracle` process and the user process.
SIGCLD	used by the pipe driver. SIGCLD is similar to SIGPIPE, but only applies to user processes, not `oracle` processes. When an `oracle` process dies, the UNIX kernel sends a SIGCLD to the user process (**wait**() is used in the signal handler to see if the server process died). SIGCLD is not caught by `oracle`; it is caught by the user process.
SIGTERM	used by the pipe driver to signal interrupts from the user side to the `oracle` process. This occurs when the user presses the interrupt key [Ctrl]+[c]. SIGTERM is not caught by the user process; it is caught by `oracle`.
SIGIO	used by Net8 protocol methods to indicate incoming networking events.
SIGURG	used by the Net8 TCP/IP drivers to send out-of-band breaks from the user process to the `oracle` process.

The listed signals affect Pro*C or other precompiler applications. You can install one signal handler for `SIGCLD` (or `SIGCHLD`) and `SIGPIPE` when connected to the oracle process. You can have multiple signal handlers for `SIGINT` as long as the `osnsui()` routine is called to set this up. You can install as many signal handlers as you want for other signals. If you are not connected to the `oracle` process**,** you can have multiple signal handlers.

Sample Signal Routine

The following example shows how you can set up your own signal routine and the catching routine. For `SIGINT`, use `osnsui()` and `osncui()` to register and delete signal-catching routines.

```
/* user side interrupt set */
word osnsui( /*_ word *handlp, void (*astp), char * ctx, _*/)
/*
** osnsui: Operating System dependent Network Set
**User-side
** Interrupt. Add an interrupt handling procedure
```

```
**astp.
** Whenever a user interrupt(such as a ^C) occurs,
**call astp
** with argument ctx. Put in *handlp handle for this
**handler so that it may be cleared with osncui.
** Note that there may be many handlers; each should
** be cleared using osncui. An error code is
**returned if an error occurs.
*/

/* user side interrupt clear */
word osncui( /*_ word handle _*/ );
/*
** osncui: Operating System dependent Clear User-side
**Interrupt.
** Clear the specified handler. The argument is the
**handle obtained from osnsui. An error code is
** returned if an error occurs.
*/
```

The following is a template for using `osnsui()` and `osncui()` in an application program:

```
/*
** My own user interrupt handler.
*/
void sig_handler()
{
...
}

main(argc, argv)
int arc;
char **argv;
   {

   int handle, err;
   ...

   /* set up my user interrupt handler */
   if (err = osnsui(&handle, sig_handler, (char *) 0))
      {
      /* if the return value is non-zero, an error has occurred
      Do something appropriate here. */
      ...
      }
      ...
      /* clear my interrupt handler */
      if (err = osncui(handle))
      {
      /* if the return value is non-zero, an error has occurred
      Do something appropriate here. */
      ...
      }
      ...
      }
```

XA Functionality

When building a TP-monitor XA application, ensure that the TP-monitors libraries (that define the symbols `ax_reg` and `ax_unreg`) are placed in the link line before Oracle's client shared library. This link restriction is required only when using XA's dynamic registration (Oracle XA switch `xaoswd`).

Oracle8*i* does not support Oracle7 r7.1.6 XA calls (although it does support 7.3 XA calls), hence TP-monitor XA applications using r7.1.6 XA calls must be relinked with the Oracle8*i* XA library. The Oracle8*i* XA calls are defined in both the shared library `$ORACLE_HOME/lib/libclntsh.so` and the static library `$ORACLE_HOME/lib/libclient8.a`.

5

Configuring Net8

Supplementary Documentation

The following documents provide a full discussion of Net8 features:

- *Net8 Administrator's Guide*
- *Oracle Advanced Security Administrator's Guide*

Supplementary Information in README Files

Table 5–1 shows the location of `README` files for various bundled products. The `README` files describe changes since the last release.

Table 5–1 Location of README Files for Oracle Products

Product	README File
Net8	`$ORACLE_HOME/network/doc/README.Net8`
Advanced Security Option	`$ORACLE_HOME/network/doc/README.ASO`
Oracle Intelligent Agent	`$ORACLE_HOME/network/doc/README.oemagent`

Core Net8 Products and Features

> **See Also:** Sample configuration files can be found in the *Net8 Administrator's Guide*.

Net8 Files and Utilities

Location of Net8 Configuration Files

The default directory for Net8 configuration files is `/var/opt/oracle` on Solaris.

Net8 searches for global files in the following order:

1. The directory specified by the environment variable, `TNS_ADMIN`, if set.
2. The `/var/opt/oracle` directory.
3. `$ORACLE_HOME/network/admin`.

If your files are not in the default directory, use the TNS_ADMIN environment variable in the startup files of all network users to specify a different location:

For the C shell, enter:

```
% setenv TNS_ADMIN directory_name
```

For Bourne or Korn shell, enter:

```
$ TNS_ADMIN=directory_path
$ export TNS_ADMIN
```

For each system level configuration file, users may have a corresponding local private configuration file (stored in the user's home directory). The settings in the private file override the settings in the system level file. The private configuration file for `sqlnet.ora` is `$HOME/.sqlnet.ora`. The private configuration file for `tnsnames.ora` is `$HOME/.tnsnames.ora.` Syntax for these files is identical to that of the corresponding system files.

Sample Configuration Files

Examples of the `cman.ora`, `listner.ora`, `names.ora`, `sqlnet.ora`, and `tnsnames.ora` configuration files are located in `$ORACLE_HOME/network/admin/samples`.

The adapters Utility

Net8 provides support for various network protocols and naming methods. They are linked into particular executables and provide the interface between network protocols and Net8. To display installed Net8 protocols, enter:

```
$ adapters
```

To display adapters linked with a specific executable, enter:

```
$ adapters executable
```

For example, the following command displays the Net8 protocols linked with the `oracle` executable:

```
$ adapters oracle
Net8 Protocol Adapters linked with oracle are:
BEQ Protocol Adapter
IPC Protocol Adapter
TCP/IP Protocol Adapter
RAW Protocol Adapter
Net8 Naming Adapters linked with oracle are:
Oracle TNS Naming Adapter
Oracle Naming Adapter
Oracle Advanced Security/Networking Security products linked with oracle are:
```

Oracle Connection Manager

See Also: For information on the Oracle Connection Manager, see the *Net8 Administrator's Guide*.

Multi-Threaded Server

See Also: For information on the Multi-Threaded Server, see the *Net8 Administrator's Guide* and *Oracle8i Administrator's Guide*.

Oracle Names

See Also: For information on Oracle Names, see the *Net8 Administrator's Guide*.

Net8 Configuration Assistant

Oracle Java Runtime Environment is installed with Net8 Assistant (`$ORACLE_HOME/bin/netasst`). When the Net8 Assistant command script is executed, the JAVA command script supplied with JRE 1.1.6.2 is called explicitly, regardless of other Java installations on the system.

See Also: For information on the Net8 Assistant, see the *Net8 Administrator's Guide*.

Net8 Protocol Support

The supported protocols for Net8 version 8.1.6 on Solaris are BEQ protocol, IPC protocol, RAW protocol, TCP/IP protocol, SPX/IPX protocol, APPC/LU6.2 protocol.

Before installing the TCP/IP, APPC/LU6.2, or SPX/IPX protocols, the appropriate operating system software must be installed and configured. Refer to *Oracle8i Installation Guide for Sun SPARC Solaris* for requirements details. The BEQ and IPC Net8 protocols do not have any specific operating system requirements.

ADDRESS Specification

The IPC, TCP/IP, APPC/LU6.2, and SPX/IPX Net8 protocols each have a protocol-specific ADDRESS specification that is used for Net8 configuration files and for the MTS_LISTENER_ADDRESS database initialization parameter in the `initsid.ora` file. See the ADDRESS specification heading under each protocol section in this chapter for details.

Table 5–2 shows a summary of ADDRESS specifications for each protocol.

Table 5–2 ADDRESS Specification Summary

Supported Protocol	ADDRESS Specification

BEQ	(ADDRESS =
	    (PROTOCOL = BEQ)
	    (PROGRAM = ORACLE_HOME/bin/oracle)
	    (ARGV0 = oracleORACLE_SID)
	    (ARGS = ’(DESCRIPTION=(LOCAL=YES)(ADDRESS=(PROTOCOL=BEQ)))’)
	    (ENVS = ’ORACLE_HOME=ORACLE_HOME,ORACLE_SID=ORACLE_SID’)
	)

IPC	(ADDRESS =
	    (PROTOCOL=IPC)
	    (KEY=*key*)
	)

RAW	N/A

TCP/IP	(ADDRESS =
	    (PROTOCOL=TCP)
	    (HOST=*hostname*)
	    (PORT=*port_id*)
	)

SPX/IPX	(ADDRESS =
	    (PROTOCOL=SPX)
	    (SERVICE=*servicename*)
	)

APPC/LU6.2	(ADDRESS =
	    (PROTOCOL=LU62)
	    (TP_NAME=*transaction_program_name*)
	    (LU_NAME=*logical_unit_name*)
	    (MODE=*mode_name*)
	    (PLU=*partner_lu_name*)
	)

The BEQ Protocol

The BEQ protocol is both a communications mechanism and a process-spawning mechanism. It requires that the client and server be on the same machine. If a net service name is not specified, either directly by the user on the command line or the Login screen or indirectly through an environment variable such as TWO_TASK, then the BEQ protocol is used. In which case, a dedicated server will always be used, and the multi-threaded server is never used. This dedicated server is started automatically by the BEQ protocol, which waits for the server process to start and attach to an existing SGA. If the startup of the server process is successful, the BEQ protocol then provides inter-process communication via UNIX pipes.

An important feature of the BEQ protocol is that no listener is required for its operation, since the protocol is linked into the client tools and directly starts its own server process with no outside interaction. However, the BEQ protocol can only be used when the client program and Oracle8*i* reside on the same machine. The BEQ protocol is always installed and always linked to all client tools and to the Oracle8*i* server.

Specifying a BEQ ADDRESS

The BEQ protocol connection parameters are part of the ADDRESS keyword-value pair. You can enter the parameters in any order.

```
(ADDRESS =
    (PROTOCOL = BEQ)
    (PROGRAM = ORACLE_HOME/bin/oracle)
    (ARGV0 = oracleORACLE_SID)
    (ARGS = '(DESCRIPTION=(LOCAL=YES)(ADDRESS=(PROTOCOL=BEQ)))')
    (ENVS = 'ORACLE_HOME=ORACLE_HOME,ORACLE_SID=ORACLE_SID')
)
```

Syntax for BEQ protocol connection parameters is described in Table 5–3.

Table 5–3 Syntax for BEQ Protocol Connection Parameters

PROTOCOL	Specifies the protocol to be used The value is `beq` and may be specified in either uppercase or lowercase.
PROGRAM	The full path to the oracle executable
ARGV0	The name of the process as it appears in a `ps` listing. The recommended value is oracleORACLE_SID.
ARGS	`'(DESCRIPTION=(LOCAL=YES)(ADDRESS=(PROTOCOL=BEQ)))'`

Table 5–3 Syntax for BEQ Protocol Connection Parameters

ENVS	Environment specification where ORACLE_HOME is the full path to the ORACLE_HOME directory of the database to connect, and ORACLE_SID is the system identifier of the database to connect.

Example 5–1 BEQ ADDRESS Specifying a Client

The following is an example of a BEQ ADDRESS:

```
(ADDRESS =
    (PROTOCOL = BEQ)
    (PROGRAM = /u01/app/oracle/product/8.1.6/bin/oracle)
    (ARGV0 = oracleV815)
    (ARGS = '(DESCRIPTION=(LOCAL=YES)(ADDRESS=(PROTOCOL=BEQ)))')
    (ENVS = 'ORACLE_HOME=/u01/app/oracle/product/8.1.6,ORACLE_SID=V815')
)
```

The ADDRESS is commonly part of a larger construct such as a connect descriptor or configuration file.

The IPC Protocol

The IPC protocol is similar to the BEQ protocol in that it can only be used when the client program and the Oracle8*i* server reside on the same machine. The IPC protocol differs from the BEQ protocol in that it can be used with dedicated server and multi-threaded server configurations. The IPC protocol requires a listener for its operation. The IPC protocol is always installed and always linked to all client tools and to Oracle8*i*.

For the IPC protocol, the location of the UNIX Domain Socket (IPC) file on UNIX systems changed after Oracle7 r7.1. Thus, if you have Oracle7 r7.1 installed on the same machine as Oracle8*i* and you attempt to make an IPC connection between the two instances, the connection may fail. The solution to this problem is to make a symbolic link between the directory where the IPC file used to be (`/var/tmp/o`) and where it now resides (`/var/tmp/.oracle`).

Specifying an IPC ADDRESS

The IPC protocol connection parameters are part of the ADDRESS keyword-value pair. You can enter the parameters in any order.

```
(ADDRESS=
    (PROTOCOL=IPC)
    (KEY=key)
)
```

Syntax for IPC protocol connection parameters is described in Table 5–4.

Table 5–4 Syntax for IPC Protocol Connection Parameters

PROTOCOL	Specifies that the IPC protocol is to be used The value is `ipc` and may be specified in either uppercase or lowercase.
KEY	Service name of database or database identifier (ORACLE_SID).

Example 5–2 IPC ADDRESS Specifying a Client

The following is an example of an IPC ADDRESS:

```
(ADDRESS=
    (PROTOCOL=IPC)
    (KEY=PROD)
)
```

The ADDRESS is commonly part of a larger construct such as a connect descriptor or configuration file.

The RAW Protocol

When data is transferred between a client and a server, Net8 adds its own header information to every packet (a block of information sent over the network). Through the Raw Transport feature, Net8 can now minimize header information on each packet going over the network.

After the connection is established, two types of information flow over the network: data and break handling. The connection packets need the Net8 header information to establish the connection correctly. However, after the connection is established, all data packets are stripped of their Net8 header information and passed directly to the operating system, bypassing Net8's network and protocol layers. The performance of the connection is increased because of fewer protocol stack layers for the data to flow through and fewer bytes that are transmitted over the network.

This feature is transparently turned on when it is appropriate. That is, if no existing features require that header information be transmitted, the headers are stripped off. For example, encryption and authentication require certain information to be sent along with each packet of information, so Raw Transport would not be enabled.

This feature requires no configuration. Net8 determines if the conditions are met and then transparently switches to Raw Transport mode.

The TCP/IP Protocol

Oracle Corporation recommends that you reserve a port for your listener in the /etc/services file of each node on the network that defines the listener port. The port is commonly 1521. The entry list and the listener name and the port number; for example:

```
listener     1521/tcp
```

where *listener* is the name of the listener, as defined in listener.ora.

Reserve more than one port to start more than one listener.

Specifying a TCP/IP ADDRESS

The TCP/IP protocol connection parameters are part of the ADDRESS keyword-value pair. You can enter the three parameters in any order.

```
(ADDRESS=
    (PROTOCOL=TCP)
    (HOST=hostname)
    (PORT=port_id)
)
```

Syntax for TCP/IP protocol connection parameters is described in Table 5–5.

Table 5–5 Syntax for TCP/IP Protocol Connection Parameters

PROTOCOL	Specifies the protocol to be used The value can be uppercase or lowercase. The default is tcp.
HOST	The host name or the host IP address
PORT	The TCP/IP port. Either a number or the name specified in the /etc/services file. Oracle Corporation recommends a value of 1521.

Example 5–3 TCP/IP ADDRESS Specifying a Client

Following is an example of the TCP/IP ADDRESS specifying a client on the MADRID host:

```
(ADDRESS=
    (PROTOCOL=TCP)
    (HOST=MADRID)
    (PORT=1521)
)
```

The last field could be specified by name, for example, (PORT=listener)**.** The ADDRESS is commonly part of a larger construct such as a connect descriptor or configuration file.

The SPX/IPX Protocol

Oracle SPX/IPX protocol support provides a transparent, two-task communications interface between Oracle8*i* and client applications running on DOS, UNIX, OS/2, or Novell Netware OS.

The ntisbsdm Broadcast Daemon

A client uses a name and translates the name into an SPX address to identify a server and communicate with it. The netware bindery is a directory service that provides the translation mechanism. When a server is registered with the bindery, it periodically notifies the bindery of its address. This is done using the Server Advertising Protocol (SAP).

The server broadcasts a SAP packet in an IPX datagram every 60 seconds. This SAP packet contains all relevant addressing information. Any client can then query its nearest server for the address of the required server.

The Oracle SPX/IPX protocol broadcasts using the `ntisbsdm` broadcast daemon in `$ORACLE_HOME/bin`. The `ntspxctl` utility starts and stops `ntisbsdm`.

The ntspxctl Utility

The `ntspxctl` utility contains functions to register and remove names, and to query a bindery. It can also be used to stop and start the broadcast daemon. (The `listener` automatically uses the daemon to register service names in use.)

Example 5–4 demonstrates several uses of the `ntspxctl` utility.

Example 5–4 Using the ntspxctl Utility

The `ntspxctl` utility reads commands from the command line. If parameters are missing, it prompts for them.

To start `ntspxctl`, enter:

```
$ ntspxctl
```

Output similar to the following is displayed:

```
ntspxctl: Version 2.0.12.1 - on
Fri Jul 3 11:43:50 1998
```

To start the broadcast daemon, enter:

```
ntspxctl> startup
```

Output similar to the following is displayed:

```
ntisbsdm started at Fri Jul 3 11:43:47 1998
```

A system message is displayed if the daemon has already been started.

Startup of the broadcast daemon should be automated, so it is always started when the machine is started. Automate daemon startup by adding an entry to the `/etc/inittab` file. For example, to start the `ntisbsdm` on system startup add the following line to `/etc/inittab`:

```
ntspxctl:2:once:/u/oracle/bin/ntisbsdm &
```

where `/u/oracle` is the full path to `$ORACLE_HOME`.

To register a name for testing, enter `register` and the server name. For example:

```
ntspxctl> register YYY
```

This creates a socket owned by `ntisbsdm`, and registers it.

A message similar to the following is displayed:

```
Name YYY successfully registered
YYY address 00eee045:000000000001:4454
```

To check the status of `ntisbsdm`, enter:

```
ntspxctl> status
```

or

```
ntspxctl> summary
```

A message similar to the following is displayed:

```
ntisbsdm started at Fri Jul 3 11:43:47 1998
Tracing is off
Pid: 14784 YYY
```

SPX/IPX Protocol Command Summary

Table 5–6 shows the `help` command summary for the SPX/IPX protocol.

Table 5–6 help Command Summary

`register` *name*	Register entry.
`remove` *name*	Remove entry.
`shutdown` *[force]*	Shut down `ntisbsdm`.
`startup`	Get status summary.
`traceon`	Activate trace.
`traceoff`	Deactivate trace.
`status`	Get full status.
`getname` *name* | *hex_number*	Query name services.
`exit`	Exit program.
`help` *[command]*	Print command information.
`!`	Shell escape.

The `getname` Command

The `getname` command asks the Novell system for names. It does not involve the broadcast daemon.

Enter:

```
getname name servicetype
```

A message similar to the following is displayed:

```
getname name servicetype (address number_of_hops)
```

The syntax for the `getname` command is explained in Table 5–7.

Table 5–7 Syntax for the getname Command

name	The name you entered.

Table 5–7 Syntax for the getname Command

servicetype	A number assigned by Novell. Oracle has the number 103.
address	The address of the name you entered.
number_of_hops	The number of hops to the destination, displayed in hexadecimal. The value 10 means the name is deregistered. If SAP queries are not supported, the value is 0000.

To see all possible names, enter:

```
getname * *
```

Example 5–5 shows names obtained using the `getname` command.

Example 5–5 Using the getname Command

```
ntspxctl> getname YYY *
YYY  servertype x0103 address 00eee045:000000000001:
    4465 hops 0000
ntspxctl> getname * 103
LSNR servertype x0103 address 00eee053:000000000001:
    502c hops 0000
IBM6 servertype x0103 address 00eee058:000000000001:
    507f hops 0000
DESK servertype x0004 address 00eee055:000000000001:
    5451 hops 0000
DESK servertype x0107 address 00eee055:000000000001:
    5104 hops 0000
CXY4 servertype x009e address 00eee055:000000000001:
    5063 hops 0000
IBM2 servertype x0004 address 00eee057:000000000001:
    5451 hops 0000
```

To stop `ntisbsdm`, enter:

```
ntspxctl> shutdown
```

The daemon will not be stopped if names are still registered. A message similar to the following is displayed:

```
1 names are registered
ntisbsdm not stopped
```

To remove a name, enter `remove` and the name. Following is an example for the name YYY:

```
ntspxctl> remove YYY
```

A message similar to the following is displayed:

```
Name xxx removed.
ntspxctl> shutdown
ntisbsdm stopped
```

To force a stop, enter:

```
ntspxctl> shutdown force
```

A message similar to the following is displayed:

```
ntisbsdm stopped
```

Specifying the SPX/IPX ADDRESS

After the SPX/IPX protocol and Oracle SPX/IPX protocol are installed on your system, you can use the SPX/IPX parameters with the TNS connect descriptors to identify SPX/IPX community nodes.

The SPX/IPX protocol parameters are part of the ADDRESS keyword-value pairs.

```
(ADDRESS=
    (PROTOCOL=SPX)
    (SERVICE=servicename)
)
```

Table 5–8 explains the syntax for the SPX/IPX protocol connection.

Table 5–8 Syntax for SPX/IPX Protocol Connection

PROTOCOL	Specifies the protocol name. For SPX/IPX, the value is `spx`.
SERVICE	A unique name (up to 30 characters) identifying an application on the network. The service is named during startup and is available to the entire network. Client references to the service are made using lookup in the bindery, a network directory.

Example 5–6 shows an SPX/IPX ADDRESS specifying service MAILDB1 on a remote server.

Example 5–6 SPX/IPX Protocol Connection

```
(ADDRESS=
    (PROTOCOL=SPX)
    (SERVICE=MAILDB1)
)
```

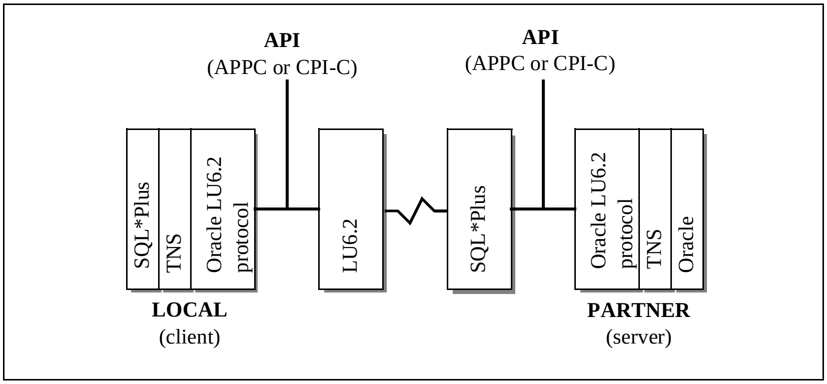
This ADDRESS is commonly part of a larger construct such as a connect descriptor or configuration file.

The APPC/LU6.2 Protocol

The Oracle APPC/LU6.2 protocol is available on networks that use LU6.2 services for communication between Oracle programs. For example, APPC/LU6.2 allows TNS applications to use API as a standard interface.

Figure 5–1 shows the communication layers between Oracle programs using the LU6.2 communications services and the Oracle APPC/LU6.2 protocol:

Figure 5–1 Communication Layers between Oracle programs and LU6.2



Solaris 2.x-Specific Listener

Solaris 2.x does not support the generic listener. To bring up the listener on the server side, run the `ntllsnr` command.

ntllsnr start|stop -l *luname* -t *tpname* -m *modename*

Syntax for the `ntllsnr` command is explained in Table 5–9.

Table 5–9 Syntax for the ntllsnr Command

`luname`	in `tnsnames.ora`, this specifies the name for the remote partner LU. When this keyword appears in `listener.ora`, it specifies the name of the local LU. LU_NAME can be ignored on many platforms or overridden by the values in other parameters. Due to the requirements of some APPC/LU6.2 implementations, *`luname`* should always specify the fully qualified LU_NAME (that is, `netid.luname`).
`tpname`	specifies the name of the transaction program to run at the target or the transaction program name to use when listening for incoming connection requests.
`modename`	Defines the characteristics of sessions between logical units. The mode, along with the partner LU and the transaction program name, is specified in the ALLOCATE segments. The *`modename`* must be common to both the local and partner LU.

Specifying an APPC/LU6.2 ADDRESS

The APPC/LU6.2 protocol parameters are defined in a connect descriptor for each node. Each connect descriptor contains several keyword=value pairs. The APPC/LU6.2-specific keywords can be entered in any order within the connect descriptor.

```
(ADDRESS=
    (PROTOCOL=LU62)
    (TP_NAME=tpname)
    (LU_NAME=luname)
    (MODE=modename)
    (PLU=partner_lu_name)
)
```

The syntax for the APPC/LU6.2 protocol connection is described in Table 5–10.

Table 5–10 Syntax for the APPC/LU6.2 Protocol

PROTOCOL	Specifies the protocol to be used. The value can be uppercase or lowercase. For APPC/LU6.2, the value is `lu62`.
TP_NAME	Specifies the name of the transaction program to run at the target or the transaction program name to use when listening for incoming connection requests. This value is required.

Table 5–10 Syntax for the APPC/LU6.2 Protocol

LU_NAME	With reference to `tnsnames.ora`, it specifies the name for the remote partner LU. When this keyword appears in `listener.ora`, it specifies the name of the local LU. LU_NAME can be ignored on many platforms or overridden by the values in other parameters. Due to the requirements of some APPC/LU6.2 implementations, LU_NAME should always specify the fully qualified LU_NAME (that is, `netid.lu_name`).
MODE	Defines the characteristics of sessions between logical units. The mode, along with the partner LU and the transaction program name, is specified in the ALLOCATE segments. The *`modename`* must be common to both the local and partner LU. This value is required.
PLU	Specifies the name of the partner LU. This value is required on Solaris, and can be set to the TP_NAME.

Net8 Naming Support

For details on configuring the NIS Naming Support, see the *Net8 Administrator's Guide*.

Oracle Enterprise Manager

Agent Service Discovery and Auto-Configuration

The Oracle Intelligent Agent requires no configuration, unless you want to integrate it with a Simple Network Management Protocol (SNMP) system (see "Configuring Oracle Intelligent Agent for Oracle SNMP".)

> **See Also:** For information on Oracle Names and the Net8 Assistant, see the *Net8 Administrator's Guide*.

Debugging Tcl Scripts

The executable `oratclsh` is provided for debugging your Tcl scripts. Before executing `oratclsh`, set the environment variable TCL_LIBRARY to point to `$ORACLE_HOME/network/agent/tcl`.

> **See Also:** The *Oracle Enterprise Manager Application Developer's Guide* for additional details.

Configuring Oracle Intelligent Agent for Oracle SNMP

Although Oracle Intelligent Agent does not require Simple Network Management Protocol (SNMP) to work, Oracle SNMP support can be configured before starting the Intelligent Agent. Note that all the configuration files for the following steps are located in the `$ORACLE_HOME/network/snmp/peer` directory.

Configure Master Agent

In the `CONFIG.master` file, make the following change:

1. Search for the line beginning with `MANAGER`.
2. Change the `ipaddr` field, coded as `130.35.10.210`, to the IP address or hostname of the machine where you want SNMP trap messages sent.

You can also make other changes to the `CONFIG.master` file as documented within the file.

Configure the Encapsulator

1. Add the following line to the `snmpd.conf` file:

   ```
   trap hostname_or_IP_address
   ```

   where *`hostname_or_IP_address`* represents the local machine's IP address.

2. In the `CONFIG.encap` file, you can optionally modify the port number, which is set to 1161 in the default file. If you modify the port number, you must also modify the port number for NEW_SNMPD_PORT in the `start_peer` script.

   NEW_SNMPD_PORT is the port on which the `snmpd` agent (the native Sun SPARC Solaris SNMP agent) listens. Make sure this is the same port as specified in the `CONFIG.encap` file. NEW_TRAPD_PORT is the PEER encapsulator port to which the `snmpd` agent sends traps.

   NEW_SNMPD_PORT and NEW_TRAPD_PORT in the `start_peer` script must have different port numbers. You may also modify the NEW_TRAPD_PORT port number.

Verify start_peer Script

The `start_peer` script contains a line like the following:

```
SNMPD = snmpd_executable_path
```

If the `snmpd` executable on your system is not in the location indicated by the `start_peer` script, edit *`snmpd_executable_path`* to the correct location of the `snmpd` executable.

Start the SNMP Components

Perform the following steps to start the SNMP components:

1. Verify that the SNMP components, `master_peer`, `encap_peer`, and `snmpd`, are *not* running:

```
$ ps -aef | grep peer
$ ps -aef | grep snmp
```

If any of the components are running, log in as the `root` user and use the `kill` command to terminate the processes before proceeding.

2. As the `root` user, run the `start_peer` script to start the PEER master agent, PEER encapsulator, and native Sun SPARC Solaris SNMP agent:

```
# cd $ORACLE_HOME/network/snmp/peer
# ./start_peer -a
```

> **Note:** If you do not have the native Sun SPARC Solaris SNMP agent on your system, you must *not* use the PEER encapsulator. To start the master agent only, run `start_peer -m`.

3. Verify that the SNMP components are running:

```
# ps -aef | grep peer
# ps -aef | grep snmp
```

Configure and Start the Database Subagent

Configuration and startup of the database subagent (the Oracle Intelligent Agent) is described in the *Oracle Enterprise Manager Configuration Guide*.

Oracle Advanced Security

`.bak` Files

During Oracle Advanced Security installation, three `.bak` files are created: `naeet.o.bak`, `naect.o.bak`, and `naedhs.o.bak`. They are located in

`$ORACLE_HOME/lib`. These files are required for relinking during Oracle Advanced Security de-install and should not be deleted.

Security and Single Sign-On

For more information about details on configuring Security and Single Sign-On, see the *Oracle Advanced Security Administrator's Guide*.

DCE Integration

For details on configuring DCE Integration, see the *Oracle Advanced Security Administrator's Guide.*

6

Running Oracle Data Option Demos

Additional Documentation

The following documents provide in-depth information about the Oracle options available in Oracle8*i* Release 2 (8.1.6):

- *Oracle8i interMedia Audio, Image, and Video User's Guide and Reference*
- *Oracle8i interMedia Audio, Image, and Video Java Client User's Guide and Reference*
- *Using Oracle8i interMedia with the Web*
- *Oracle8i interMedia Locator User's Guide and Reference*
- *Oracle8i interMedia Text Reference*
- *Oracle8i ConText to interMedia Text Migration*
- *Oracle8i Visual Information Retrieval User's Guide*
- *Oracle8i Visual Information Retrieval Java Client User's Guide*
- *Oracle8i Time Series User's Guide*
- *Oracle8i Spatial User's Guide and Reference*

Oracle8*i* interMedia

Oracle8*i* *inter*Media includes the following components:

- Text
- Audio, Video, and Image
- Locator
- Web Agent and Clipboard

Text

See Also: *Oracle8i interMedia Text Reference*, and *Oracle8i ConText interMedia Text Migration.*

There are no demos for Text in Oracle8*i*. However, *inter*Media Text now includes code samples. Point your browser at the following URL:

```
$ORACLE_HOME/ctx/sample/api/index.html
```

Audio, Video, and Image

See Also: *Oracle8i interMedia Audio, Image, and Video User's Guide and Reference* and *Oracle8i interMedia Audio, Image, and Video Java Client User's Guide and Reference.*

Oracle8*i inter*Media includes a number of scripts and sample programs in the following directories:

```
$ORACLE_HOME/ord/aud/demo/
$ORACLE_HOME/ord/img/demo/
$ORACLE_HOME/ord/vid/demo/
```

Sample Audio Scripts

The audio scripts consist of the following files:

- `auddemo.sql` - audio demonstration that shows features of the audio object including:
  - checking *inter*Media objects
  - creating a sample table with audio in it
  - inserting NULL rows into the audio table
  - checking the rows out
  - checking all the audio attributes directly
  - checking all the audio attributes by calling methods
  - installing your own format plug-in using the two files, `fplugins.sql` and `fpluginb.sql` described in the next two list items and in *Oracle8i interMedia Audio, Image, and Video User's Guide and Reference* on how to extend *inter*Media Audio to support a new audio data format
- `fplugins.sql` - demo format plug-in specification that you can use as a guideline to write any format plug-in you want to support.
- `fpluginb.sql` - demo format plug-in body that you can use as a guideline to write any format plug-in you want to support.

See the `README.txt` file in the `$ORACLE_HOME/ord/aud/demo` directory for requirements and instructions on running this SQL demo.

Sample Program for Modifying Images or Testing the Image Installation

Once you have installed Oracle8*i* *inter*Media Image, you can run the Oracle8*i* *inter*Media Image demonstration program. This program can also be used as a test to confirm successful installation.

This section contains the steps required to build and run the *inter*Media image demo.

The *inter*Media Image demo files are located in `$ORACLE_HOME/ord/img/demo`, where `$ORACLE_HOME` is the ORACLE_HOME directory.

Demonstration (Demo) Installation Steps

1. The Oracle8*i* *inter*Media Image demo uses the SCOTT/TIGER database user. If this user does not exist, you must create it:

   ```
   % svrmgrl
   SVRMGRL> connect internal;
   SVRMGRL> create user SCOTT identified by tiger;
   SVRMGRL> grant connect,resource to SCOTT;
   ```

2. Create the image demo directory where `$ORACLE_HOME` is the `$ORACLE_HOME` directory.

   ```
   % svrmgrl
   SVRMGRL> connect internal;
   SVRMGRL> create or replace directory imgdemodir as ‘$ORACLE_HOME/ord/img/
   demo’;
   ```

3. Grant privileges on the directory to PUBLIC:

   ```
   SVRMGRL> grant read on directory imgdemodir to public with grant option;
   ```

4. If needed, make the `imgdemo` program.

   ```
   % cd $ORACLE_HOME/ord/img/demo
   % make -f demo_ordimg.mk imgdemo
   ```

Running the Demo

The `imgdemo` file is a sample program that shows how Oracle8*i* *inter*Media Image can be used from within a program. The demo is written in C and uses OCI (Oracle Call Interface) to access the database and exercise Oracle8*i* *inter*Media Image.

The program operates on `imgdemo.dat`, which is a bitmap (BMP) image in the demo directory. Optionally, you can supply an image file name on the command line, provided the file resides in the same directory as the demo. In either case, once the image has been manipulated by Oracle8*i inter*Media Image, the resulting image is written to the file `imgdemo.out` and can then be viewed with common rendering tools that you supply.

When the demo is run, it deletes and re-creates a table named IMGDEMOTAB in the SCOTT/TIGER schema of the default database. This table is used to hold the demo data. Once the table is created, a reference to the image file is inserted into the table. The data is then loaded into the table and converted to JFIF using the processCopy( ) method of ORDImage.

The image properties are extracted within the database using the setProperties( ) method. An UPDATE command is issued after the setProperties( ) invocation. This is required because the setProperties( ) invocation has only updated a local copy of the type attributes.

Next, the Oracle8*i inter*Media Image process( ) method is used to cut and scale the image within the database. This is followed by an update that commits the change. The program cuts a portion of the image 100 pixels wide by 100 pixels high starting from pixel location (100,100). This sub-image is scaled to twice its original size and the resulting image is written to a file named `imgdemo.out` in the current directory.

Example 6–1 Execute the Demo from the Command Line

Execute the demo by typing `imgdemo` on the command line. Optionally, you can use a different image in the demo by first copying the file to the directory in which the demo resides and then specifying its file name on the command line as an argument to `imgdemo`.

Use the following command:

```
$ imgdemo optional-image-filename
```

The demo displays a number of messages describing its progress, along with any errors encountered if something was not set up correctly. Expect to see the following messages:

```
Dropping table IMGDEMOTAB...
Creating and populating table IMGDEMOTAB...
Loading data into cartridge...
Modifying image characteristics...
Writing image to file imgdemo.out...
Disconnecting from database...
Logged off and detached from server.
```

```
Demo completed successfully.
```

If the program encounters any errors, it is likely that either Oracle8*i* *inter*Media software has not been installed correctly or the database has not been started. If the program completes successfully, the original image and the resultant image, which has undergone the cutting and scaling described earlier, can be viewed with common image rendering tools.

Sample Video Scripts

The Video scripts consist of the following files:

- `viddemo.sql` - video demo that shows features of the video object including:
  - checking *inter*Media objects
  - creating a sample table with video in it
  - inserting NULL rows into the video table
  - checking the rows out
  - checking all the video attributes directly
  - checking all the video attributes by calling methods
  - installing your own format plug-in using the two files, `fplugins.sql` and `fpluginb.sql` described in the next two list items and in *Oracle8i interMedia Audio, Image, and Video User's Guide and Reference* on how to extend *inter*Media Video to support a new video data format
- `fplugins.sql` - demo format plug-in specification that you can use as a guideline to write any format plug-in you want to support
- `fpluginb.sql` - demo format plug-in body that you can use as a guideline to write any format plug-in you want to support

See the README.`txt` file in the `$ORACLE_HOME/ord/vid/demo directory` for requirements and instructions on how to run this SQL demo.

Java Demo

A Java demo has been provided to help you learn to use both the audio and video client-side Java classes so you can build your own applications. In these two demos, the audio and video object is instantiated at the client side and a number of accessor methods are invoked. The audio Java demo files are located in the `ORACLE_HOME/ord/aud/demo` directory and the video Java demo files are located in the

`$ORACLE_HOME/ord/vid/demo` directory. See the `README.txt` file in each directory for requirements and instructions on how to run each respective Java demo.

MediaAnnotator

The MediaAnnotator program is not contained on the Oracle8*i inter*Media CD. It (along with other free Oracle software) can be found at the following URL:

`http://www.oracle.com/products/free_software/`

Locator

Oracle8*i inter*Media Locator includes a number of scripts that you can modify and run.

> **See Also:** *Oracle8i interMedia Locator User's Guide and Reference*.

Sample Scripts

Sample Oracle8*i inter*Media Locator scripts are available in the following directory after you install this product:

`$ORACLE_HOME/md/demo/geocoder`

These scripts consist of the following files:

- `geohttp.sql`

  This file contains two parts. One part is for running a geocode function in interactive mode and the other is for running the geocode function in batch mode.

  – Interactive mode.

    See Example 1 in "GEOCODE1 Function (with lastline field)" in the *Oracle8i interMedia Locator User's Guide and Reference* for a listing of this part of the file.

  – Batch mode.

    You must update the setup tables in the `nh_cs.sql` file before you run the `geohttp.sql` in batch mode. See the *Oracle8i interMedia Locator User's Guide and Reference* for Example 2 in "GEOCODE1 Function (with lastline field)" or Example 3 in "GEOCODE1 Function (with lastline field)" for a listing of this part of the file.

- `geoindex.sql`

This file contains:

- A function named ESTIMATE_LEVEL to better estimate the index level for use with the spatial locator index for within-distance queries that use a radius distance greater than 100 miles. For a listing of this file, see the example in "ESTIMATE_LEVEL" in the *Oracle8i interMedia Locator User's Guide and Reference*.
- A procedure statement named SETUP_LOCATOR_INDEX that builds a setup spatial locator index on the location column that contains the spatial information within the `cust_table` table where the spatial information is stored. For a listing of this file, see the example in "SETUP_LOCATOR_INDEX" , Chapter 2 in *Oracle8i interMedia Locator User's Guide and Reference.*

- `geolocate.sql`

  This file contains a routine that dynamically creates a geometry of interest and then queries against the NH_COMPUTER_STORES table to find out how many stores are within a 10-mile radius of the office. For a listing of this file, see Example 2 in "LOCATOR_WITHIN_DISTANCE" the *Oracle8i interMedia Locator User's Guide and Reference.*

Web Agent and Clipboard

See Also: *Using Oracle8i interMedia with the Web*

For this release, two components of Oracle8*i inter*Media, the Clipboard and Web Agent, are not available on the Oracle8*i* media. You can download the components from the Oracle Technology Network web site:

`http://technet.oracle.com`

Choose products, then go to *inter*Media to find the *inter*Media free software downloads.

The documentation, which includes `README` files and the manual *Using Oracle8i interMedia with the Web*, is included in the download.

Oracle8*i* Time Series Demos

See Also: *Oracle8i Time Series User's Guide*

Table 6–1 shows the demos included with Oracle8*i* Time Series. This table includes a description of each demo and the default directory in which its files are installed.

The demo directory can be found at `$ORACLE_HOME/ord/ts`..

Table 6–1 Oracle8i Time Series Demos

Description	Directory
Quick-start demo: quick and easy start using Oracle8*i* Time Series (See Chapter 1 in *Oracle8i Time Series User's Guide*.)	`demo/tsquick`
Usage demo for end users and product developers who want to use existing Oracle8*i* Time Series features (See Chapter 1 in *Oracle8i Time Series User's Guide*.)	`demo/usage`
Electric utility application demonstrating how to compute peak and off-peak summaries of 15-minute data	`demo/usageutl`
Java-based retrieval of time series data, using the prototype Oracle8*i* Time Series Java API and designed to run in a Web browser (See Chapter 1 in *Oracle8i Time Series User's Guide*.)	`demo/applet`
Simple Java code segments that perform time series operations and print the results (See Chapter 1 in *Oracle8i Time Series User's Guide*.)	`demo/java`
Demo showing the use of administrative tools procedures to "retrofit" existing time series detail tables; also, how to support time series queries for multiple qualifier columns in the time series detail table.	`demo/retrofit`
Advanced-developer demo for those who want to extend Oracle8*i* Time Series features	`demo/extend`
OCI demo showing how to call Oracle8*i* Time Series functions using the Oracle Call Interface	`demo/oci`
PRO*C/C++ demo showing how to call Oracle8*i* Time Series functions in applications created using the Oracle Pro*C/C++ Precompiler	`demo/proc`
Oracle Developer demo showing how to call Oracle8*i* Time Series functions in an Oracle Forms application	`demo/dev2k`

The `README.txt` file in the demo directory introduces the demos. Also, the directory for each demo contains a `README.txt` file with a more detailed description of that demo.

Oracle8*i* Visual Information Retrieval

> **See Also:** *Oracle8i Visual Information Retrieval User's Guide and Reference* and *Oracle8i Visual Information Retrieval Java Client User's Guide and Reference*

A sample program is included with Visual Information Retrieval. The sample program demonstrates how to load two images into the database, generate their signatures, and then compare their signatures using a weighted similarity function.

This program uses two data files, `virdemo1.dat` and `virdemo2.dat`, as its input. No other input or parameters are required.

Environment

The following assumptions are made:

- Visual Information Retrieval has been installed and PUBLIC has EXECUTE privilege on it.
- The install script has been run. VIRDEMODIR directory has been created and granted PUBLIC READ access in order that the image data file can be read into the database.
- `virdemo1.dat` and `virdemo2.dat` are valid image files that reside in the VIRDEMODIR directory and the user has read / write access to the directory.
- User SCOTT has the default "TIGER" password. You may need to increase the tablespace allocated to SCOTT in order to successfully run this sample program.

Running the Sample Program

There are two ways to run the sample program: using the included sample images, or using your own images.

Example 6–2 runs the sample program using the included image files. The images are compared using equal attribute weights:

- Globalcolor = 1.0
- Localcolor = 1.0

- Texture = 1.0
- Structure = 1.0

Example 6–2 Run the Sample Program with Included Images

```
% virdemo
Image 1 and 2 have a similarity score of 0.0
```

Example 6–3 shows how to specify your own images on the command line. The images must reside in the `$ORACLE_HOME/ord/vir/demo` directory.

Example 6–3 Run the Sample Program with Your Own Images

```
% virdemo image1 image2 global_color local_color texture structure
```

You must specify all six parameters, the 2 file names and 4 attribute weights (ranging from 0.0 to 1.0) in this sample program. Note that when using the VIRScore( ) operator in your own applications, it is only necessary to provide at least one attribute weight.

The VIRDEMODIR directory provides several other sample image files to demonstrate the effects of emphasizing the different visual attributes. You can use an image viewer (such as xv) to display the images, and then compare them using the sample program, experimenting with different weights.

> **See Also:** Appendix B in the *Oracle8i Visual Information Retrieval User's Guide and Reference* for more information.

Oracle8*i* Spatial

> **See Also:** *Oracle8i Spatial User's Guide and Reference*

The reader should refer to `$ORACLE_HOME/md/demo/readme.txt` to find more information.

A

Optimal Flexible Architecture

Optimal Flexible Architecture (OFA)

Oracle Corporation recommends that the Optimal Flexible Architecture (OFA) standard be implemented when installing and configuring Oracle8*i*. The OFA standard is a set of configuration guidelines for fast, reliable Oracle databases that require little maintenance.

OFA is designed to:

- organize large amounts of complicated software and data on disk to avoid device bottlenecks and poor performance
- facilitate routine administrative tasks such as software and data backup functions, which are often vulnerable to data corruption
- alleviate switching among multiple Oracle databases
- adequately manage and administer database growth
- help eliminate fragmentation of free space in the data dictionary, isolate other fragmentation, and minimize resource contention

Characteristics of OFA-Compliant Database

An OFA-compliant database provides the following benefits.

File System Organization

The file system is organized to allow easy administration and accommodate scalability for issues such as:

- adding data into existing databases
- adding users
- creating databases
- adding hardware

Distributed I/O Loads

I/O loads are distributed across enough disk drives to prevent performance bottlenecks.

Hardware Support

In most cases, investment in new hardware is not required to take advantage of the Optimal Flexible Architecture (OFA) standard.

Safeguards Against Drive Failures

By spreading applications across more than one drive, drive failures impact as few applications as possible.

Distribution of Home Directories

The following items can be distributed across more than one disk drive:

- the collection of home directories
- the contents of an individual home directory

Integrity of Login Home Directories

It is possible to add, move, or delete login home directories without having to revise programs that refer to them.

Independence of UNIX Directory Subtrees

Categories of files are separated into independent UNIX directory subtrees so that files in one category are minimally affected by operations on files in other categories.

Supports Concurrent Execution of Application Software

You can execute multiple versions of applications software simultaneously, allowing the user to test and use a new release of an application before abandoning the previous version. Transferring to a new version after an upgrade is simple for the administrator and transparent for the user.

Distinguishes Administrative Information for each Database

The ability to separate administrative information about one database from that of another ensures a reasonable structure for the organization and storage of administrative data.

Uses Consistent Database File Naming

Database files are named so that:

- database files are easily distinguishable from all other files
- files of one database are easily distinguishable from files of another database
- control files, redo log files, and data files are identifiable as such

- the association of data file to tablespace is clearly indicated

Separation of Tablespace Contents

Tablespace contents are separated to:

- minimize tablespace free space fragmentation
- minimize I/O request contention
- maximize administrative flexibility

I/O Loads Tuning across all Drives

I/O loads are tuned across all drives, including drives storing Oracle data in raw devices.

Additional Benefits of OFA for Parallel Server

For Oracle Parallel Server Installations:

- administrative data is stored in a central place, accessible to all database administrators
- administrative data for an instance is associated with the instance by the file name

OFA Implemented on UNIX

A careful naming strategy for database files eliminates data administration problems. The OFA rules provided here correspond to the original OFA recommendations published in *The OFA Standard: Oracle8 for Open Systems*.

Mount Points

Create Mount Points

An installation of Oracle8*i* requires at least two mount points: one for the software and at least one for the database files. If implementing the recommended Optimal Flexible Architecture (OFA), at least four mount points are required: one for the software and at least three for database files.

Mount Point Syntax

Name all mount points using the syntax `/`*`pm`*, where *`p`* is a string constant and *`m`* is a unique fixed-length key (typically a two-digit number) used to distinguish each mount point. For example: `/u01` and `/u02`, or `/disk01` and `/disk02`.

Naming Mount Points for Very Large Databases (VLDBs)

If each disk drive contains database files from one application and there are enough drives for each database to ensure no I/O bottleneck, then use the syntax `/`*`q`*`/`*`dm`* for naming mount points, as explained in Table A–1.

Table A–1 Syntax for Naming Mount Points

q	a string denoting that Oracle data is stored here
dm	the value of the initialization parameter DB_NAME (synonymous with the instance *sid* for single-instance databases)

For example, mount points named `/u01/oradata/test` and `/u02/oradata/test` allocate two drives for the Oracle test database.

Naming Directories

Home Directory Syntax

Name home directories using the syntax `/`*`pm`*`/`*`h`*`/`*`u`*, as explained in Table A–2.

Table A–2 Syntax for Naming Home Directories

pm	a mount point name
h	a standard directory name
u	the name of the owner of the directory

For example, `/u01/app/oracle` is the Oracle server software owner home directory (also referred to as `ORACLE_BASE` and defaulted by the OUI) and `/u01/app/applmgr` is an Oracle applications software owner home directory.

Placing home directories at the same level in the UNIX file system is advantageous for the following reason: it allows the collection of applications owner login home directories on different mount points, to be referred to with the single pattern matching string, `/*/app/*`.

Referring to Pathnames

Refer to explicit pathnames only in files designed specifically to store them, such as `/etc/passwd` and the Oracle `oratab` file. Refer to group memberships only in the `/etc/group` file.

Software Directories

To help fulfill the OFA feature of simultaneously executing multiple versions of application software, store each version of the Oracle8*i* Server software in a directory matching the pattern */pm/h/*`product/`*v*, as explained in Table A–3.

Table A–3 Syntax for Naming Oracle8i Server Software Directories

h	a standard directory name
v	the version of the software

For example: `/u01/app/oracle/product/8.1.6` indicates the start of the directory structure where the Oracle8*i* Server files are located. Set the `ORACLE_HOME` environment variable to this directory.

Naming Files

Administration Files

To facilitate the organization of administrative data, it is recommended that you store database-specific administration files in subdirectories according to *h*`/admin/`*d*`/`*a*`/`, where *h* is the Oracle software owner's home directory, *d* is the database name (DB_NAME), and *a* is a subdirectory for each of the following database administration files described in Table A–4:

Table A–4 Subdirectories for Database Administration Files

`adhoc`	ad hoc SQL scripts for a given database
`arch`	archived redo log files
`adump`	audit files (Set AUDIT_FILE_DEST in `config`*db_name*`.ora` to point here. Clean out this subdirectory periodically).
`bdump`	background process trace files
`cdump`	core dump files
`create`	programs used to create the database

Table A–4 Subdirectories for Database Administration Files

`exp`	database export files
`logbook`	files recording the status and history of the database
`pfile`	instance parameter files
`udump`	user SQL trace files

As an example, the subdirectory `adhoc` would have the following pathname, `/u01/app/oracle/admin/sab/adhoc/` if it were part of the database named sab.

Database Files

The following naming convention for database files ensures that they are easily identifiable:

- for control files, use `/`*`pm`*`/`*`q`*`/`*`d`*`/control.ctl`
- for redo log files, use `/`*`pm`*`/`*`q`*`/`*`d`*`/redo`*`n`*`.log`
- for data files use, `/`*`pm`*`/`*`q`*`/`*`d`*`/`*`tn`*`.dbf`

This syntax is explained in Table A–5.

Table A–5 Syntax for Naming Database Files

pm	a mount point name described earlier in this chapter
q	a string distinguishing Oracle data from all other files (usually named ORACLE or oradata)
d	the DB_NAME of the database
t	an Oracle tablespace name
n	a two-digit string

Note: Do not store files other than a control, redo log, or data file associated with database *d* in the path /*pm*/*q*/*d*.

Following this convention could produce, for example, a data file with the name `/u03/oradata/sab/system01.dbf`, making it easy to see to which database the file belongs.

Separate Segments with Different Requirements

Separate groups of segments with different lifespans, I/O request demands, and backup frequencies across different tablespaces.

For each Oracle database, create the special tablespaces described in Table A–6. These tablespaces are in addition to those needed for application segments.

Table A–6 Special Tablespace

SYSTEM	data dictionary segments
TEMP	temporary segments
RBS	rollback segments
USERS	miscellaneous user segments
INDX	index associated with data in USERS tablespace
OEM_REPOSITORY	repository for Oracle Enterprise Manager
DRSYS	Oracle interMedia segment

This method is effective because dictionary segments are never dropped, and no other segments that can be dropped are allowed in the SYSTEM tablespace. This ensures that the SYSTEM tablespace does not require a rebuild due to tablespace free space fragmentation.

Because rollback segments are not stored in tablespaces holding applications data, the administrator is not blocked from taking an application's tablespace offline for maintenance. The segments are partitioned physically by type, and the administrator can record and predict data growth rates without complicated tools.

Naming Tablespaces

Name tablespaces descriptively using a maximum of eight characters. Although Oracle8*i* tablespace names can be 30 characters long, portable UNIX file names are restricted to 14 characters. The recommended standard for a data file basename is `*tn*.dbf`, where *t* is a descriptive tablespace name and *n* is a two-digit string. Because the extension plus the two-digit string occupy a total of six characters, only eight characters remain for the tablespace name.

Descriptive names allow the name of a data file to be associated with the tablespace that uses it. For example, the names `GLD` and `GLX` might be used for the tablespaces storing General Ledger data and indices, respectively.

Note: Do not embed reminders of the word "tablespace" in your tablespace names. Tablespaces are distinguishable by context, and names do not need to convey information about type.

Exploiting OFA Structure for Oracle Files

Table A–7 shows the syntax used for identifying classes of files.

Table A–7 Directory Structure Syntax for Identifying Classes of Files

`/u[0-9][0-9]`	user data directories
`/*/home/*`	user home directories
`/*/app/*`	user application software directories
`/*/app/applmgr`	Oracle apps software subtrees
`/*/app/oracle/product`	Oracle Server software subtrees
`/*/app/oracle/product/8.1.6`	Oracle Server 8.1.6 distribution files
`/*/app/oracle/admin/sab`	`sab` database administrative subtrees
`/*/app/oracle/admin/sab/arch/*`	`sab` database archived log files
`/*/oradata`	Oracle data directories
`/*/oradata/sab/*`	`sab` database files
`/*/oradata/sab/*.log`	`sab` database redo log files

OFA File Mapping

Table A–8 shows an hierarchical file mapping of a sample OFA-compliant database, including each file’s mount point, application, database, and tablespace. The file names indicate the file type (control, log, or data).

Table A–8 Hierarchical File Mapping for OFA Installation

`/`						root mount point
	`u01/`					’Oracle software’ mount point #1
		`app/`				subtree for app software
			`oracle/`			home for *oracle* software owner
				`admin/`		subtree for database admin files
					`TAR/`	subtree for Support logs
					`db_name1/`	admin subtree for *db_name1* database

Table A–8 Hierarchical File Mapping for OFA Installation

				`bdump/`	background_dump_dest
				`cdump/`	core_dump_dest
				`udump/`	user_dump_dest
				`create/`	database creation SQL scripts
				`pfile/`	database init parameter file
				`db_name2/`	admin subtree for *db_name2* database
			`doc/`		online documentation
			`local/`		subtree for local Oracle software
				`aps6/`	an Oracle6 admin package
				`aps7/`	an Oracle7 admin package
			`product/`		distribution files
				`7.3.3/`	ORACLE_HOME for 7.3.3 instances
				`8.0.4/`	ORACLE_HOME for 8.0.4 instances
				`8.1.6/`	ORACLE_HOME for 8.1.6 instances
		`oraInventory`			subtree for Oracle8*i* inventory
			`logs`		installation log files
	`home`				subtree for login home directories
		`ltb/`			home for a user
		`sbm/`			home for a user
`u02/`					’user data’ mount point #2
	`home/`				subtree for login home directories
		`cvm/`			home for a user
		`vrm`			home for a user
	`oradata/`				subtree for Oracle data
		`db_name1/`			subtree for *db_name1* database files
		`db_name2/`			subtree for *db_name2* database files
`u03/`					’user data’ mount point #3
	`oradata/`				subtree for Oracle data
		`db_name1/`			subtree for db_name1 database files
		`db_name2/`			subtree for db_name2 database files
`u04/`					’user data’ mount point #4
	`oradata/`				subtree for Oracle data
		`db_name1/`			subtree for *db_name1* database files
		`db_name2/`			subtree for *db_name2* database files
`/var`					
	`opt/`				

Table A–8 Hierarchical File Mapping for OFA Installation

		oracle/	location of oratab and oraInst.loc
/usr			
	local/		
		bin/	oraenv/coraenv/dbhome scripts

Raw Device Sizes

Choose a small set of standard sizes for all raw devices that can be used to store Oracle database files. In general, standardizing on a single size is recommended. If a single size is used, raw files can be moved from one partition to another safely. The size should be small enough so that a fairly large number can be created but large enough to be convenient.

For example, a 2 GB drive could be divided into 10 partitions of 200 MB each—a good balance between size and number. Any tablespace using raw devices should stripe them across several drives. If possible, do the striping should be done with a logical volume manager.

File Mapping for Multiple-Instance OFA Database

When using the Oracle Parallel Server, select one node to act as the Oracle *administrative home* for the cluster. The administrative home contains the administrative subtree. Create subdirectories for each instance accessing the database within the bdump, cdump, logbook, pfile, and udump directories of ~/admin/*d*/. Mount the admin directory for the administrative home as the admin directory for every instance. An example is shown in Table A–9.

Table A–9 Administrative Directory Structure for Dual-Instance Oracle Parallel Server

u01/	app/oracle/admin/sab/			administrative directory for **sab** database
	adhoc/			directory for miscellaneous scripts
	arch/			log archive dest for all instances
		redo001.arc		archived redo log file
	bdump/			directory for background dump files
		inst1/		background dump dest for *inst1* instance
		inst2/		background dump dest for *inst2* instance
	cdump/			directory for core dump files
		inst1/		core dump dest for *inst1* instance
		inst2/		core dump dest for *inst2* instance
	create/			directory for creation scripts
		1-rdbms.sql		SQL script to create *inst* database
	exp/			directory for exports
		19990120full.dmp		January 20, 1999 full export dump file
		export/		directory for export parfiles
		import/		directory for import parfiles
	logbook/			directory for *inst* logbook entries
		inst1/		directory for *inst1* instance reports
			params.lst	v$parameter report for *inst1* instance
		inst2/		directory for *inst2* instance reports
			params.lst	v$parameter report for *inst2* instance
		user.lst		dba_users report
	pfile/			directory for instance parameter files
		inst1/		directory for *inst1* instance parameters
			init	instance parameters for *inst1* instance
		inst2/		directory for *inst2* instance parameters
			init	instance parameters for *inst2* instance
	udump/			directory for user dump files
		inst1/		user dump dest for *inst1* instance
		inst2/		user dump dest for *inst2* instance

Directory Structure

ORACLE_BASE Directory

ORACLE_BASE is the root of the Oracle directory structure. ORACLE_BASE directory structure and content is described in Table A–10. When installing an OFA-compliant database using the Oracle Universal Installer, ORACLE_BASE is by default set to */pm/app/oracle*.

Table A–10 ORACLE_BASE Directory Structure and Content

admin	administrative files
doc	online documentation
local	subtree for local Oracle software
product	Oracle software

ORACLE_HOME Directory

If you install an OFA-compliant Oracle Server, the ORACLE_HOME directory is */pm/*app/oracle/product/*release_number*. The ORACLE_HOME directory structure and content are described in Table A–11. Under UNIX, the ORACLE_HOME directory contains the following subdirectories, as well as a subdirectory for each Oracle product selected. You will have directories only for the products you have installed.

Table A–11 ORACLE_HOME Directory Structure and Content

assistants	configuration Assistants
bin	binaries for all products
ctx	*inter*Media Text options
dbs	init*sid*.ora, lk*sid*
install	install related files
lib	Oracle product libraries
javavm	Java Virtual Machine
jdbc	JDBC drivers
jlib	Java classes
md	Spatial options
mlx	Xerox Stemmer (for *inter*Media Text options)
network	Net8
nlsrtl	NLS runtime loadable data
ocommon	common files for all products
odg	data gatherer
opsm	Parallel Server Manager Components
oracore	core libraries
orb	Object Request Broker

Table A–11 ORACLE_HOME Directory Structure and Content

`ord`	data options
`otrace`	Oracle TRACE
`plsql`	PL/SQL
`precomp`	precompilers
`rdbms`	server files and libraries required for the database
`slax`	SLAX parser
`sqlplus`	SQL*Plus
`svrmgr`	Server Manager
`sysman`	System Management

Contents of Product Subdirectories

Each product subdirectory contains the subdirectories described in Table A–12:

Table A–12 Contents of Product Subdirectories

`admin`	administrative SQL and shell scripts (for example, `catalog.sql`, `catexp.sql`, and `demo.sql`)
`admin/*`	special directories for other products
`admin/resource`	resource files
`admin/terminal`	runtime terminal files
`demo`	demonstration scripts and datafiles
`doc`	README files (for example, `readmeunix.doc`)
`install`	product installation scripts
`jlib`	product Java classes
`lib`	product libraries and distributed makefiles
`log`	trace files and log files (for example, `orasrv.log` and `*.trc` files)
`mesg`	U.S. message files and Multilingual Option (formerly National Language Support) message text and binary files (for example, `oraus.msg` and `oraus.msb`)

Examples of Product Subdirectories

Examples of product subdirectories and their contents are shown in Table A–13.

Table A–13 Examples of Product Subdirectories

rdbms	install, lib, admin, doc, mesg, log
sqlplus	install, demo, lib, admin, doc, mesg

File Naming Conventions in the admin Directory

The rdbms/admin directory contains the SQL scripts shown in Table A–14.

Table A–14 admin Directory, File Naming Conventions

cat*.sql	Creates catalog and data dictionary tables and views. The following files are run automatically during installation: catalog.sql (for all installations) catproc.sql (for all installations) catparr.sql (for Parallel Server option installations) catrep.sql (for all installations) catproc.sql in turn runs the scripts for creating the standard PL/SQL packages, such as DBMS_SQL and DBMS_OUTPUT.
d*.sql	downgrade scripts
dbms*.sql	additional database packages
u*.sql	upgrade scripts
utl*.sql	creates tables and views for database utilities

Filename Extensions

A description of filename extensions is shown in Table A–15.

Table A–15 Filename Extensions

.a	object file libraries; Ada runtime libraries
.aud	Oracle audit file
.bdf	X11 font description file
.bmp	X11 bitmap file
.c	C source file
.ctl	SQL*Loader control file; Oracle Server control file
.dat	SQL*Loader datafile

Table A–15 Filename Extensions

.dbf	Oracle Server tablespace file
.dmp	Export file
.doc	ASCII text file
.env	shell script file for setting environment
.h	C header file; also, sr.h is a SQL*Report Writer help file
.jar	Java class archive
.l	UNIX manual page
.lis	output of SQL*Plus scripts
.log	installation log files; Oracle Server redo log files
.mk	make files
.msb	NLS message file (binary)
.msg	NLS message file (text)
.o	object module
.ora	Oracle configuration files
.orc	installation prototype files
.pc	Pro*C source file
.pco	Pro*COBOL source file
.ppd	printer driver file
.sh	Bourne shell script file
.sql	SQL* script files
.sys	Bourne shell script file
.tab	SQL* script file
.trc	trace files
.tut	Bourne shell script file
.utd	Uniform Terminal Definitions
.zip	Zip file

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