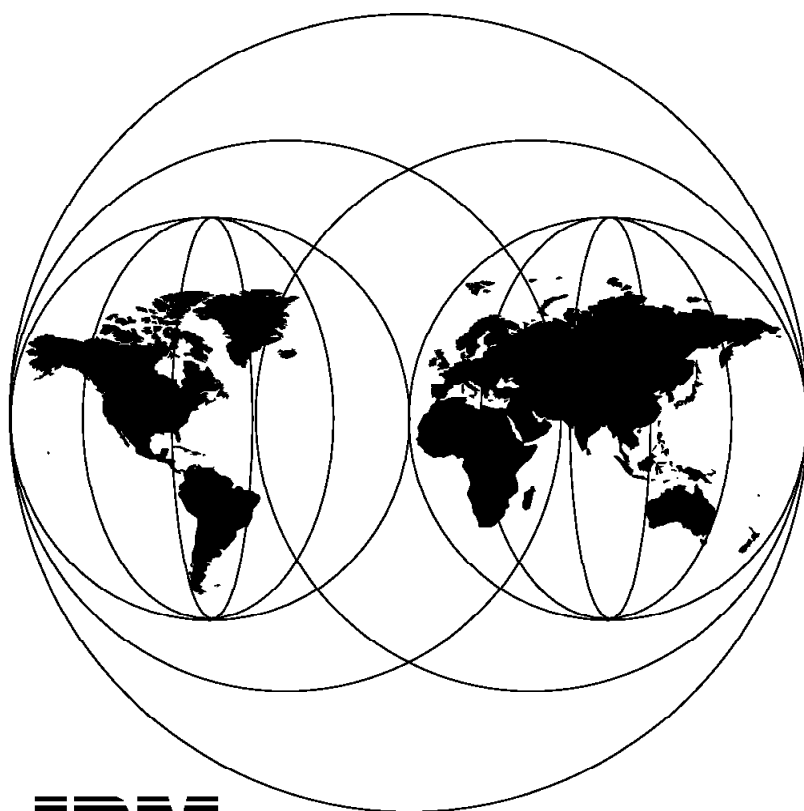


Bullet-Proofing Your Oracle Database with HACMP: A Guide to Implementing AIX Databases with HACMP

December 1996



**International Technical Support Organization
Austin Center**



International Technical Support Organization

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A Guide to Implementing AIX Databases with HACMP**

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Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix G, "Special Notices" on page 155.

First Edition (December 1996)

This edition applies to Version 4.1.1 of High Availability Cluster Multi-Processing (HACMP) for AIX, Program Number 5696-933 for use with the AIX for RS/6000 Operating System Version AIX 4.1.4. Programs and descriptions may also be compatible with later releases, but should be tested by the user.

Comments may be addressed to:

IBM Corporation, International Technical Support Organization
Dept. JN9B Building 045 Internal Zip 2834
11400 Burnet Road
Austin, Texas 78758-3493

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Contents

Figures	ix
Tables	xi
Preface	xiii
How This Redbook Is Organized	xiii
The Team That Wrote This Redbook	xiv
Comments Welcome	xv
Chapter 1. Relational Database Concepts	1
1.1 Relational Databases	1
1.2 Database Structure	2
1.3 Structured Query Language (SQL)	2
1.3.1 SQL Statements	2
1.3.2 Context Areas and Cursors	3
1.3.3 Statement Parsing	3
1.4 Client/Server Architecture	4
1.4.1 Client/Server Connection	4
1.4.2 Network Connections	4
1.4.3 Shared-Memory Connections	4
1.5 Filesystems and Raw Logical Volumes	5
1.5.1 Filesystems	5
1.5.2 Raw Logical Volumes	5
Chapter 2. Oracle Concepts	7
2.1 Oracle Files	7
2.1.1 Data Files	7
2.1.2 Redo Log Files	8
2.1.3 Control File	9
2.1.4 The init.ora File	9
2.2 Oracle Memory Structure	9
2.2.1 System Global Area or Shared Global Area (SGA)	10
2.2.2 Program Global Area (PGA)	10
2.3 Oracle Processes	10
2.3.1 Database Writer (DBWR)	12
2.3.2 Log Writer (LGWR)	12
2.3.3 System Monitor (SMON)	12
2.3.4 Process Monitor (PMON)	12
2.3.5 Checkpoint (CKPT)	13
2.3.6 Recover (RECO) Process	13
2.3.7 Archiver (ARCH) Process	13
2.3.8 Parallel Server Lock Processes (LCKn)	13
Chapter 3. Database Planning, System Requirements, and Sizing	15
3.1 Planning Your Database	15
3.1.1 First Considerations	15
3.1.2 Database Application Type	15
3.1.3 Database Size	17
3.1.4 File Locations	17
3.2 System Requirements	17
3.2.1 Requirements for Oracle Product Installation on a Single Server ..	17

3.2.2	Requirements for Concurrent or Parallel Server Installation	18
3.2.3	Requirements for Oracle Optional Products	18
3.3	Disk Space and Memory Sizing for Oracle	19
3.3.1	Required Calculations	19
3.3.2	Disk Space Requirements	20
3.3.3	Final Calculation of Disk Requirement	29
Chapter 4.	Sample Configurations for Highly Available Databases	31
4.1	Preinstallation Activities and Considerations for HACMP	31
4.2	Rotating Configuration for Highly Available Databases	32
4.2.1	Rotating Cluster Description	32
4.3	Cascading Configuration for Highly Available Databases	39
4.3.1	Cascading Cluster Description	39
4.4	Concurrent Configuration for Highly Available Databases	45
4.4.1	Creating the Concurrent Volume Group	45
4.4.2	Concurrent Cluster Description	48
Chapter 5.	Oracle Nonparallel Database Installation	55
5.1	Planning for Oracle Installation	55
5.1.1	Oracle Products Installed	55
5.1.2	Disk Space Sizing for Selected Oracle Products	56
5.2	Preinstallation Tasks	59
5.2.1	Preinstallation Considerations	59
5.2.2	Preinstallation Tasks Performed by root	60
5.2.3	Preinstallation Tasks Performed as the Oracle Software Owner	62
5.2.4	Preinstallation Tasks for the Selected Products	63
5.3	Installation Tasks	63
5.3.1	Loading the Installer from the Distribution Media	63
5.3.2	Running the rootpre.sh Script	64
5.3.3	Running the Installer	65
5.3.4	Entering the ORACLE_HOME Pathname	65
5.3.5	Entering the Oracle Software Owner's Name	65
5.3.6	Choosing the Installer Action	66
5.3.7	Specifying Parameters to the Installer	66
5.3.8	Selecting Products for Installation	67
5.3.9	Database Creation Prompts	67
5.3.10	Product Installation Prompts	70
5.4	Postinstallation Tasks	70
5.4.1	Tasks Performed as root	71
5.4.2	Tasks Performed as the Oracle Software Owner	72
5.4.3	Tasks Performed for Other Selected Oracle Products	73
Chapter 6.	Client Installation and Setup	75
6.1	Client/Server Configuration	75
6.1.1	Configuration A	75
6.1.2	Configuration B	76
6.1.3	Configuration C	77
6.2	Installation and Setup	78
6.2.1	Preinstallation Tasks	79
6.2.2	Installation Tasks	80
6.2.3	Postinstallation Tasks	84
Chapter 7.	Testing the Oracle Server Database	87
7.1	Stopping and Starting the Oracle Database	87
7.1.1	The oracle.vars File	87

7.1.2 Starting Oracle	87
7.1.3 Modifying the Oracle dbstart Script for Concurrent Access	89
7.1.4 Stopping Oracle	89
Chapter 8. Oracle Parallel Server Database Installation	91
8.1 Planning for Oracle Installation	91
8.1.1 Selecting the Oracle Products to be Installed	91
8.1.2 Disk Space Sizing for Selected Oracle Products	92
8.2 Preinstallation Tasks for Oracle Parallel Server Databases	95
8.2.1 Creating the dba Group	96
8.2.2 Creating the Oracle Software Owner Login	96
8.2.3 Setting Up User Equivalence	96
8.2.4 Creating the ORACLE_HOME Directory	96
8.2.5 Creating Raw Logical Volumes	97
8.2.6 Checking That Distributed Lock Manager is Running	97
8.2.7 Preinstallation Tasks for Optional Oracle Products	98
8.3 Installation Tasks for Oracle Parallel Server Database	98
8.3.1 Loading the Installer from the Distribution Media	98
8.3.2 Running rootpre.sh	99
8.3.3 Running the Installer	100
8.3.4 Entering the ORACLE_HOME Pathname	100
8.3.5 Entering the Oracle Software Owner's Name	100
8.3.6 Choosing the Installer Action	101
8.3.7 Oracle Parallel Server Installation Prompts	101
8.3.8 Specifying Parameters to the Installer	101
8.3.9 Selecting Products for Installation	102
8.3.10 Database Creation Prompts	103
8.3.11 Product Installation Prompts	105
8.4 Postinstallation Tasks for Oracle Parallel Server Database	106
8.4.1 Tasks Performed as root	106
8.4.2 Tasks Performed as Oracle Software Owner	108
8.4.3 Tasks Performed for Other Selected Oracle Products	109
Chapter 9. Testing the Parallel Server Database	111
9.1 Stopping and Starting the Oracle Database	111
9.1.1 Oracle.vars File	111
9.1.2 Starting Oracle	111
9.1.3 Stopping Oracle	112
Chapter 10. Common Errors, Problems, and Recommendations	115
10.1 Common Errors and Problems	115
10.1.1 Errors and Problems During the Installation Process	115
10.1.2 SQL*Net Errors and Problems	116
10.2 Recommendations	118
Appendix A. System Configuration Files	119
A.1 System Files	119
A.1.1 File: /etc/hosts	119
A.1.2 File: /.rhosts	120
A.1.3 File: /etc/filesystems	120
A.1.4 File: /etc/inittab	121
Appendix B. Oracle Configuration Files for Rotating Resources	123
B.1 Customized Files	123
B.1.1 File: /etc/services	123

B.1.2 File: /home/oracle/.profile	123
B.1.3 File: /etc/oratab	124
B.1.4 File: /home/oracle/tns_admin/listener.ora	124
B.1.5 File: /home/oracle/tns_admin/tnsnames.ora	125
B.1.6 File: /home/oracle/tns_admin/sqlnet.ora	125
Appendix C. Oracle Configuration Files for Cascading Resources	127
C.1 Customized Files	127
C.1.1 File: /etc/services	127
C.1.2 File: /home/oracle/.profile	127
C.1.3 File: /etc/oratab	128
C.1.4 File: /home/oracle/tns_admin/listener.ora	130
C.1.5 File: /home/oracle/tns_admin/tnsnames.ora	131
C.1.6 File: /home/oracle/tns_admin/sqlnet.ora	131
Appendix D. Oracle Configuration Files for Concurrent Resources	133
D.1 Customized Files	133
D.1.1 File: /etc/services	133
D.1.2 File: /home/oracle/.profile	133
D.1.3 File: /etc/oratab	134
D.1.4 File: /home/oracle/tns_admin/listener.ora	136
D.1.5 File: /home/oracle/tns_admin/tnsnames.ora	137
D.1.6 File: /home/oracle/tns_admin/sqlnet.ora	137
D.2 Sample C Program for Testing the Lock Manager	137
D.2.1 Lock Manager Test File: /home/oracle/testlm.c	138
Appendix E. Oracle Configuration Files for the Client	141
E.1 Customized Files	141
E.1.1 File: /etc/services	141
E.1.2 File: /home/oracle/.profile	141
E.1.3 Client /etc/tnsnames.ora File	142
E.1.4 Client /etc/sqlnet.ora File	143
Appendix F. Scripts Used in Our Examples	145
F.1 Oracle Startup Script: /usr/HACMP_ANSS/script/ora_start	145
F.2 Oracle Shutdown Script: /usr/HACMP_ANSS/script/ora_stop	149
F.3 Rotating Resources: /usr/HACMP_ANSS/script/oracle.vars	152
F.3.1 File: /usr/HACMP_ANSS/script/oracle.vars	152
F.4 Cascading Resources: /usr/HACMP_ANSS/script/oracle.vars	153
F.4.1 File: /usr/HACMP_ANSS/script/oracle.vars	153
F.5 Concurrent Resources: /usr/HACMP_ANSS/script/oracle.vars	154
F.5.1 File: /usr/HACMP_ANSS/script/oracle.vars	154
Appendix G. Special Notices	155
Appendix H. Related Publications	157
H.1 International Technical Support Organization Publications	157
H.2 Redbooks on CD-ROMs	157
H.3 Other Publications	157
How To Get ITSO Redbooks	159
How IBM Employees Can Get ITSO Redbooks	159
How Customers Can Get ITSO Redbooks	160
IBM Redbook Order Form	161

List of Abbreviations	163
Index	165

Figures

1.	Relationship between Two Tables	1
2.	Logical Structure of a Typical Oracle Database	7
3.	Oracle Architecture	11
4.	Cluster Configuration for Rotating Resources	32
5.	Cluster Configuration for Cascading Resources	39
6.	Cluster Configuration for Concurrent Resources	45
7.	Logical Volumes for Concurrent Oracle Access	46
8.	Preinstallation Tasks Performed as root for Nonparallel Databases	60
9.	Preinstallation Tasks Performed as oracle for Nonparallel Databases	62
10.	Postinstallation Tasks Performed as root for Nonparallel Databases	71
11.	Postinstallation Tasks Performed as oracle for Nonparallel Databases	72
12.	Configuration A	76
13.	Configuration B	77
14.	Configuration C	78
15.	Preinstallation Tasks Performed as root for Client Installation	79
16.	Preinstallation Tasks Performed as the oracle for Client Installations	80
17.	Postinstallation Tasks Performed as root for Client Installations	84
18.	Oracle Start Script Schema	88
19.	Modification to be Made to Oracle dbstart Script	89
20.	Oracle Stop Script Schema	90
21.	Preinstallation Tasks for Installing Oracle Parallel Server Database	95
22.	Postinstallation Tasks Performed as root for a Parallel Server Database	106
23.	Postinstallation Tasks Performed as oracle for a Parallel Server Database	108
24.	Oracle Start Script Schema	111
25.	Oracle Stop Script Schema	113
26.	/etc/hosts File	119
27.	/.rhosts File	120
28.	Part of Our /etc/filesystems File	120
29.	/etc/inittab File	121
30.	Entry Needed in /etc/services for the Listener	123
31.	/home/oracle/.profile File	123
32.	/etc/oratab File for Rotating Resources	124
33.	listener.ora File for Rotating Resources	124
34.	tnsnames.ora File for Rotating Resources	125
35.	sqlnet.ora File for Rotating Resources	125
36.	Entry Needed in /etc/services File for the Listener	127
37.	/home/oracle/.profile File on First Node	127
38.	/home/oracle/.profile File on Second Node	128
39.	Node 1 oratab Entry for the Database	129
40.	Node 2 oratab Entry for the Database	129
41.	oratab Entries for Both Databases Running on One Node	129
42.	listener.ora File for Cascading Resources, Node 1	130
43.	listener.ora File for Cascading Resources, Node 2	130
44.	tnsnames.ora File for Cascading Resources	131
45.	sqlnet.ora File for Cascading Resources	131
46.	Entry Needed in /etc/services for the Listener	133
47.	/home/oracle/.profile File on Node mickey	133
48.	/home/oracle/.profile File on Node goofy	134
49.	oratab Entry for Concurrent Database on Node mickey	135

50.	oratab Entry for Concurrent Database on Node goofy	135
51.	oratab Entries for Both Databases Running on One Node	135
52.	listener.ora File for Concurrent Resources on Node mickey	136
53.	listener.ora File for Concurrent Resources on Node goofy	136
54.	tnsnames.ora File for Concurrent Resources	137
55.	sqlnet.ora File for Concurrent Resources	137
56.	Lock Manager Test Program - page 1 of 2	138
57.	Lock Manager Test Program - page 2 of 2	139
58.	Client /etc/services Entry	141
59.	Client .profile File	141
60.	Client /etc/tnsnames.ora File - page 1 of 2	142
61.	Client /etc/tnsnames.ora File - page 2 of 2	143
62.	Client /etc/sqlnet.ora File	143
63.	Common ora_start Script - page 1 of 4	145
64.	Common ora_start Script - page 2 of 4	146
65.	Common ora_start Script - page 3 of 4	147
66.	Common ora_start Script - page 4 of 4	148
67.	Common ora_stop Script - page 1 of 3	149
68.	Common ora_stop Script - page 2 of 3	150
69.	Common ora_stop Script - page 3 of 3	151
70.	Oracle.vars for a Rotating Configuration.	152
71.	Oracle.vars for a Cascading Configuration	153
72.	Oracle.vars for a Concurrent Configuration	154

Tables

1.	Hardware Requirements for Oracle Product Installation on a Single Server	17
2.	Software Requirements for Oracle Product Installation on a Single Server	18
3.	Hardware and Software Requirements for Oracle Parallel Server Installation	18
4.	Prerequisites for PL/SQL Release 2.1	18
5.	Prerequisites for SQL*Plus Release 3.1	19
6.	Prerequisite for SQL*Net Release 2.1	19
7.	Prerequisites for Oracle TCP/IP Adapter Release 2.1	19
8.	Disk Sizing Sheet for Oracle Server Products	21
9.	Disk Sizing Sheet for Oracle Networking Products	22
10.	Disk Sizing Sheet for Oracle Tools Products	24
11.	Disk Sizing Sheet for Oracle CASE Products	26
12.	First-Phase Disk Sizing Sheet for Oracle Precompiler Products	27
13.	Second-Phase Disk Sizing Sheet for Oracle Precompiler Product	28
14.	Total Disk Sizing Summary Sheet	29
15.	Disk Sizing Result Sheet for Oracle Server Products	56
16.	Disk Sizing Result Sheet for Oracle Tools Products	57
17.	Disk Sizing Result Sheet for Oracle Networking Products	58
18.	Total Disk Sizing Result Sheet	59
19.	Recommended Sizes Database File Sizes	69
20.	Disk Requirement Summary Sheet for Oracle Server Products	92
21.	Disk Requirement Summary Sheet for Oracle Tools Products	93
22.	Disk Requirement Summary Sheet for Oracle Networking Products	94
23.	Total Disk Requirement Summary Sheet	95
24.	Common Errors During the Installation Stage	116

Preface

This redbook describes the implementation of the Oracle database products in a highly available AIX cluster using HACMP.

This redbook was written for those who are planning to implement an Oracle database installation in a highly available HACMP cluster. The book covers a variety of configurations, including concurrent and non-concurrent access.

Several scripts and configuration files are provided with the book to make the configuration of the database and the cluster easier.

Some knowledge of AIX, the RISC System/6000, and HACMP for AIX is assumed.

How This Redbook Is Organized

This redbook is organized as follows:

- Chapter 1, “Relational Database Concepts” on page 1
This provides a description of terms and concepts generally applicable across relational database products in the marketplace.
- Chapter 2, “Oracle Concepts” on page 7
This provides an overview of the files (database and log) and the processes that make up an Oracle database instance. The information in this overview can be explored in more detail through the official Oracle documentation.
- Chapter 3, “Database Planning, System Requirements, and Sizing” on page 15
This provides a set of guidelines and planning sheets to estimate the required disk and memory for your database installation.
- Chapter 4, “Sample Configurations for Highly Available Databases” on page 31
This chapter provides a description of the HACMP cluster configuration settings for an Oracle installation. The types of HACMP configurations described are cascading, rotating, and concurrent.
- Chapter 5, “Oracle Nonparallel Database Installation” on page 55
This chapter describes the preparation, installation, and configuration of a nonparallel server (non-concurrent access in HACMP terms) Oracle database for an HACMP cluster. The tasks are divided into preinstallation, installation, and postinstallation tasks.
- Chapter 6, “Client Installation and Setup” on page 75
This chapter presents three possible Oracle client system configurations, and gives detailed descriptions of how to install and set up one of them.
- Chapter 7, “Testing the Oracle Server Database” on page 87
This chapter mainly describes how to start and stop the nonparallel server Oracle database we have installed in the previous chapters.
- Chapter 8, “Oracle Parallel Server Database Installation” on page 91

This chapter describes the preparation, installation, and configuration of an Oracle Parallel Server (concurrent access in HACMP terms) database for an HACMP cluster. The tasks are divided into preinstallation, installation, and postinstallation tasks.

- Chapter 9, “Testing the Parallel Server Database” on page 111

This chapter mainly describes how to start and stop the parallel server Oracle database we have installed in the previous chapter.

- Chapter 10, “Common Errors, Problems, and Recommendations” on page 115

This chapter presents some common errors experienced during the setup of an Oracle database, and gives suggested solutions. A number of general installation recommendations are also given here.

- Appendix A, “System Configuration Files” on page 119

This appendix provides sample AIX system file configurations that are used in the Oracle installations described.

- Appendix B, “Oracle Configuration Files for Rotating Resources” on page 123

This appendix provides sample Oracle configuration files that are used in an HACMP rotating resources configuration.

- Appendix C, “Oracle Configuration Files for Cascading Resources” on page 127

This appendix provides sample Oracle configuration files that are used in an HACMP cascading resources configuration.

- Appendix D, “Oracle Configuration Files for Concurrent Resources” on page 133

This appendix provides sample Oracle configuration files that are used in an HACMP concurrent resources configuration. A sample C program for testing the operation of the HACMP Cluster Lock Manager is also provided.

- Appendix E, “Oracle Configuration Files for the Client” on page 141

This appendix provides samples of the necessary Oracle configuration files on the client system. These files are applicable to any of the HACMP configurations described.

- Appendix F, “Scripts Used in Our Examples” on page 145

This appendix provides listings of shell scripts that were created for use with the configurations described in this book. These scripts are designed to startup and shutdown the database in an orderly way. They are also designed to be portable, through the extensive use of environment variables. This allows them to be used with other Oracle configurations, or with different HACMP applications.

The Team That Wrote This Redbook

This redbook was produced by a team of specialists from around the world working at the International Technical Support Organization Austin Center.

David Thiessen is an Advisory Software Engineer at the International Technical Support Organization, Austin Center. He writes extensively and teaches IBM

classes worldwide on all areas of high availability on AIX systems. Before joining the ITSO four years ago, David worked in the Vancouver office of IBM Canada Ltd. as an AIX systems engineer.

Nadim Tabassum is an HACMP specialist, working on many customer installations for IBM France. He was instrumental in the production of a precious redbook, "An HACMP Cookbook". His broad experience in customer installations has produced many ideas for configuration and customization tools to make the job easier.

Yugi Edison is a systems engineer working for an IBM Business Partner company, Multipolar, in Jakarta, Indonesia. He has participated in several HACMP cluster installations in Indonesia.

Thanks to the following people for their invaluable contributions to this project:

Stephen Riggs
International Technical Support Organization, Austin Center

Marcus Brewer
International Technical Support Organization, Austin Center

Comments Welcome

We want our redbooks to be as helpful as possible. Should you have any comments about this or other redbooks, please send us a note at the following address:

redbook@vnet.ibm.com

Your comments are important to us!

Chapter 1. Relational Database Concepts

A database is a means of organizing a collection of data. The basic tasks that you would require of a database are:

- Entering data
- Storing data
- Manipulating data

This chapter provides an overview of the features that are common to all of the databases referred to in this redbook. The following topics are discussed:

- Relational databases
- Database structure
- Structured Query Language
- Client/Server architecture
- File systems and raw logical volume

1.1 Relational Databases

All of the database management systems discussed in this redbook are relational. In this type of database, the information is stored in tables. Each table has a name and is logically represented as being made up of rows and columns. Tables can be related to each other if they contain columns with common types of information.

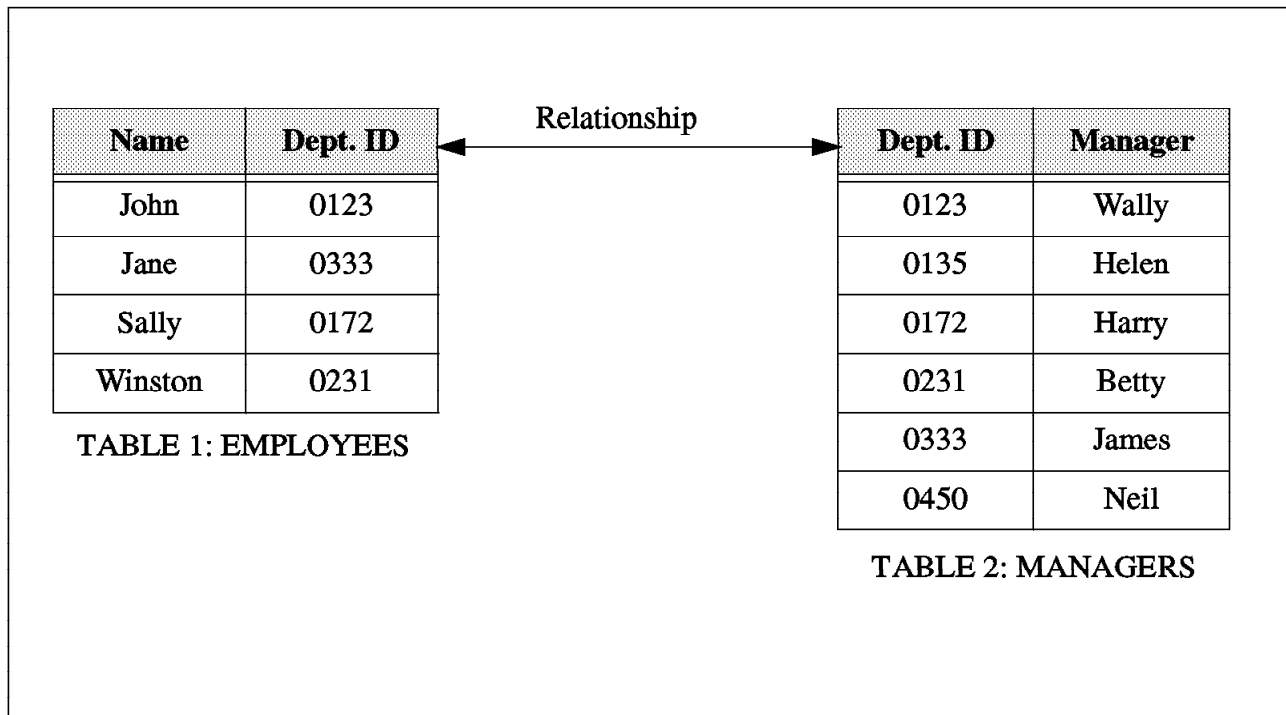


Figure 1. Relationship between Two Tables

Although the information stored in each table may be independent, there is obviously a link between the two tables shown. The department ID in the Employees table is “related” to the department ID in the Managers table. In order to find the name of the manager of a particular employee, you look up his/her department ID (in the Employees table) and then find the manager of this department (in the Managers table).

Relational databases are data driven; that is, the tables and relationships between them are defined once, and then only the data changes over time. Data changes have no impact on the applications using them.

1.2 Database Structure

The structure of a relational database can be divided into three parts:

- Physical
- Logical
- External

The physical part is made up of the files, the directories, and the physical storage elements. The logical part is made up of the objects that are referenced by the database. These include tables, tablespaces, and other elements that make up the relational database model. The boundaries of logical structures are independent of physical space allocation. The external part represents the data as seen by the users. This includes views of the data, the clustering of the information, and accessibility to the various tables.

This three-tiered approach allows for an independence between the data and the means of storage of the data, and it allows for different types of access to the data depending upon the needs of the user.

1.3 Structured Query Language (SQL)

SQL (pronounced sequel or S.Q.L.) is an “English-like” non-procedural language that is used for most database actions. It was developed by IBM research and has since been refined by ANSI.

1.3.1 SQL Statements

The SQL language consists of about 30 statements. Each SQL statement begins with a *verb* (which describes what the statement does) followed by one or more *clauses*.

The main types of SQL statements are:

- Queries
- Data Manipulation
- Data Definition
- Access Control
- Transaction Control

Queries are statements that retrieve (but do not change) data and begin with the reserved word SELECT.

Data Manipulation statements are used to change data by using instructions such as:

- INSERT—to add new rows of data
- DELETE—to delete rows of data
- UPDATE—to change column values in existing rows

Data Definition statements are used to create, alter and drop database objects. They differ from the previous two types of statements because they require a write access to the data dictionary. Typical reserved words are CREATE TABLE, DROP TABLE, and ALTER TABLE.

Access Control statements are used for two types of access:

- Access to the database system
- Access to the database data

Access control statements like GRANT and REVOKE can control user access privileges.

Transaction Control statements are of two types:

- COMMIT—to end the current transaction
- ROLLBACK—to abort the current transaction

1.3.2 Context Areas and Cursors

Each SQL statement is associated with a cursor or context area. This is a memory buffer created on the server that contains the current status of one SQL statement.

A cursor can be thought of as a file handle (or name of the context area) that is opened to gain access to the SQL statement results. The statement is processed or parsed within the cursor, and as long as the cursor remains open, the statement can be reexecuted without being reparsed.

Just as a file handle keeps track of the program's current position within a file, the cursor keeps track of the state or phase of the statement. Cursors are only capable of forward sequential processing. When the statement has been fully parsed and no longer needs to be executed, the cursor is closed either explicitly or by the client's terminating the connection to the server.

1.3.3 Statement Parsing

An SQL statement is parsed (processed), and a representation of the statements is loaded into the cursor. Parsing consists of:

- Translating the SQL statement
- Loading it into a cursor
- Verifying user access privileges (access control)
- Determining access paths to be used when executing the statement
- Determining resource requirements
- Reserving the resources required

1.4 Client/Server Architecture

In a database using client/server architecture, the database application is divided into two parts:

1. A front-end or *client* portion
2. A back-end or *server* portion

The client part executes the database front-ends, such as interactive query tools or report writers or the application that accesses the database. It often interacts with the user via a graphical user interface. The clients make SQL requests to the server.

The server part executes the database-management-system software and handles all of the functions required for data access and storage. The server processes the request sent to it by the client, calculates the result, and sends the data back to the client.

Although both the client and server parts can execute on the same machine, it is more efficient when client and server are separated in a networked environment.

1.4.1 Client/Server Connection

The client/server connection can be made in various ways. A connection here means the logical association between two applications, such as a client application and the database server. The connection must be established before data transfer and must be maintained for the duration of the transfer.

Most databases use two types of connections:

1. Network connections
2. Shared memory connections

1.4.2 Network Connections

Network connections themselves may be of two types.

1.4.2.1 Remote Network Connections

Remote network connections are used generally when the client and server are on different computers. In this case, the connection is made across a physical network linking the two machines.

1.4.2.2 Local Loopback Network Connections

When the client and server are on the same machine, the setup is called a local loopback connection. The connection is established using the networking facilities of the machine and behaves as though the client and server are on two separate machines.

1.4.3 Shared-Memory Connections

Shared-memory connections can only be established when the client and the server are on the same machine. The client and server share the system memory for very fast data transfer. This type of connection can be more prone to data integrity problems if the shared-memory communication between client and server is badly managed. There may also be problems arising from memory being overwritten by nondatabase applications.

1.5 Filesystems and Raw Logical Volumes

The files of a database provide the actual physical storage for database information. All of the databases used allow data to be stored either as files within a filesystem or directly on the disk via the raw device interface in logical volumes.

1.5.1 Filesystems

Using filesystem files is easier than using raw devices. In this case, the database simply creates a file in the filesystem. However, when using the filesystem, the database must contend with the disk caching that is inherent in block devices. Block devices do buffered I/O, where data is collected in a buffer until an entire block can be transferred at one time. Generally, writes need to be done synchronously in order to ensure coherency.

On reads, there are overheads due to the data being read into the disk cache before becoming exploitable by the database. There is also the problem that the files in the filesystem may not be placed contiguously on the disk, and additional overheads will be incurred due to disk seek times.

1.5.2 Raw Logical Volumes

A raw logical volume is an area of contiguous physical and logical disk space that is under the direct control of an application rather than under control of the operating system and filesystem.

The applications use character (raw) input and output, carrying out a data transfer with every read or write rather than the block input and output of filesystems. As data is written directly to the disk, bypassing all disk caching and filesystem overheads, performance is generally improved.

Backup and recovery of raw devices is more complicated because file copies do not work. Backups are carried out by using either the UNIX `dd` command or a third-party backup utility.

Chapter 2. Oracle Concepts

The Oracle database follows the three-tiered database structure outlined in Chapter 1, “Relational Database Concepts” on page 1. An Oracle database is generally divided into tablespaces and schema objects such as tables, views, and indexes. A description of the three levels as well as the relationship between them is stored in the *data dictionary*.

This chapter describes the more important Oracle files that will be installed on your system and also gives an outline of the architecture of an Oracle instance.

2.1 Oracle Files

An installation of Oracle on your system will consist of the following sets of files:

- Data Files
- Redo Log Files (online and archive)
- Control Files
- Initialization Parameter File (INIT.ORA)

2.1.1 Data Files

An Oracle database contains one or more data files. The data files make up the physical repository for all information stored in the database. Two main groups of information are stored in the data files:

- User-created objects (tables, indexes, clusters)
- The data dictionary that is found in the SYSTEM data file created during the Oracle installation process

Figure 2 shows the logical structure of a sample Oracle database.

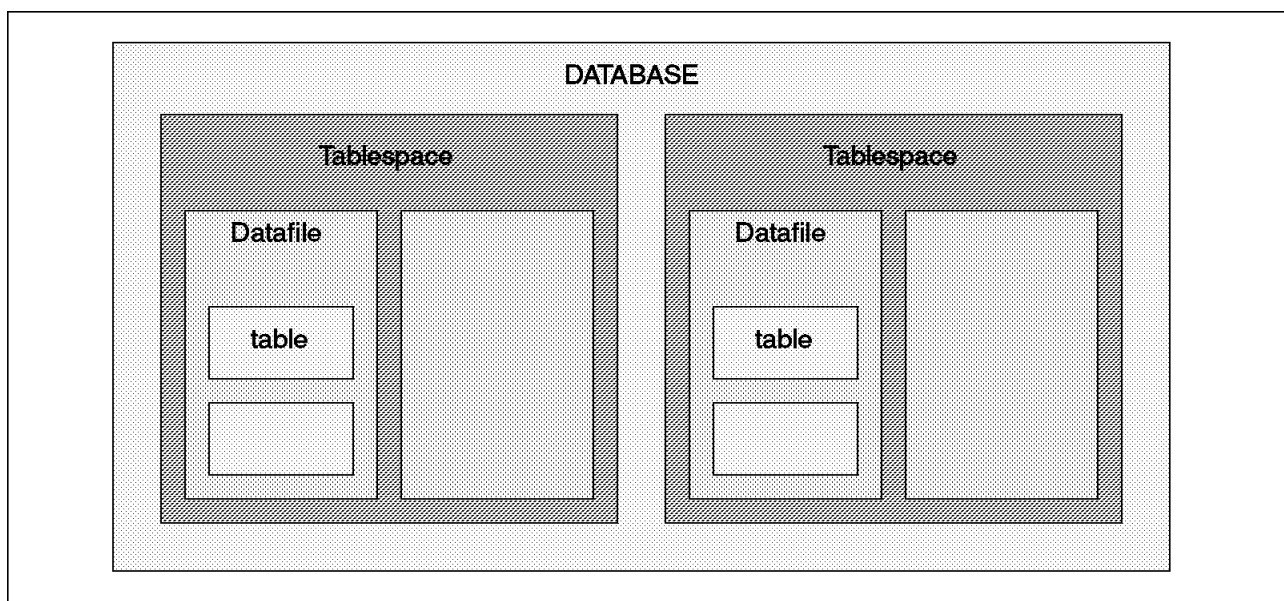


Figure 2. Logical Structure of a Typical Oracle Database

Database files have the following characteristics:

- A data file is only associated with one database.
- The size of a data file cannot be changed after its creation.
- One or more data files can be grouped together to form a tablespace.

2.1.1.1 Tablespaces

A database is made up of one or more tablespaces. Tablespaces are useful in helping you to organize your data for ease of management, security, and performance.

System Tablespace is used to store the data dictionary. This holds information such as names of tablespaces and what datafiles are contained in each one.

User Tablespace(s) are used to hold personal data.

2.1.1.2 Segments

A segment is a generic name given to any object that occupies storage in the database. A segment is made up of a group of extents (contiguous blocks) that are in the same tablespace (but not necessarily in the same data file).

Extents are used to minimize the amount of wasted storage and can grow or shrink as required. Extents themselves are made up of data blocks, which are the smallest pieces that make up an Oracle database and are physically related to the disk partition size. An Oracle database has the following types of segments:

Rollback Segment: Whenever data is altered, this change must either be committed or rolled back. The rollback segment holds the previous version of the data being modified; this allows for recovery from aborted or incomplete transactions.

Temporary Segment: This is used by Oracle when an SQL statement needs a temporary work area. It is destroyed upon completion of the statement.

Data and Index Segments: Data segments store user data within the database. Index segments store indexes used by Oracle to look up data quickly. An index scan of the database is much quicker than a full table scan, where Oracle would look at every row in the database.

2.1.2 Redo Log Files

The redo log files are journal files that record all changes made to the database. These files are in memory (for performance reasons - disk I/O is roughly a thousand times slower than actions in memory), and Oracle can then write the changes to the data files (on disk) at its leisure. Every Oracle database has a set of two or more log files.

These files are used in case a failure (machine, disk, etc.) prevents modified data from being permanently written to the data files. During recovery, Oracle will apply the data in these files to bring the database to a consistent state without losing any committed transactions.

2.1.2.1 Online Redo Logs

Since these files are open or online during normal operation, they are referred to as the online redo log files. The online redo logs work in a circular fashion. As transactions take place, they are recorded in the first redo log. When this is full, a log switch occurs. Now, transactions are recorded in the second redo log. When this is full, another log switch occurs. All new transactions are once again recorded in the first log, overwriting the previous contents.

2.1.2.2 Archived Redo Logs

Oracle offers the possibility of running in either ARCHIVELOG mode or NOARCHIVELOG mode.

In ARCHIVELOG mode, the contents of the redo logs are copied to an archive area (on disk) before they are overwritten. These archive files are known as the archived redo log files. As they are not open during normal operation of the database and are only required during data recovery. They are also known as the offline redo logs.

In NOARCHIVELOG mode, old redo logs are not kept, and the redo logs are simply overwritten.

2.1.3 Control File

Every Oracle database has a control file. It is highly recommended to have more than one copy to guard against data loss. This file records the physical structure of the database and contains the following types of information:

- Name of the database
- Creation date and time
- Location of the database
- Status and state of all the data files
- Location of the redo logs

Whenever there is a change to the structure of the database, the control file is updated.

2.1.4 The init.ora File

The init.ora file is a parameter file (text) containing Oracle system parameters. It is provided by Oracle and should be customized for your site. This file is read during database startup to determine the size of the system global area (see 2.2.1, “System Global Area or Shared Global Area (SGA)” on page 10) and to locate the control files. The actual name of the init.ora file has the Oracle instance identifier appended to it.

2.2 Oracle Memory Structure

Oracle uses system memory to run user processes, cache data, and indexes, and to store shared program code. Oracle has two types of memory structures:

1. The system global area
2. The program global area

2.2.1 System Global Area or Shared Global Area (SGA)

The SGA is an area of shared memory used by Oracle to store data and control information for one Oracle instance. All of the information contained within the SGA is shared by all of the users connected to the instance. The SGA is allocated when the instance starts up and is automatically deallocated when the instance shuts down. The SGA is made up of the following key components:

2.2.1.1 Data Buffer Cache

The data buffer cache stores the most recently used data blocks; that is, those blocks which have been modified but not yet written to disk (dirty blocks) as well as those which have been written to disk (clean blocks).

Before a user process can access a piece of data, it has to be in the data buffer cache. A least recently used algorithm is used to free up space when new data is requested by a user.

2.2.1.2 Redo Log Buffer

Before any transactions can be recorded into the redo logs, they must first reside in the redo log buffer. They are then written to the redo logs by a database background process (log writer).

2.2.1.3 Shared Pool

The shared pool is a cache containing all the parsed SQL statements that are ready to run. This is useful for reducing overheads (memory, processing time, execution planning time) when multiple applications issue the same SQL statement.

2.2.2 Program Global Area (PGA)

A PGA is allocated when a user connects to the database. The PGA is not shared and contains data and control information for single Oracle server processes or for Oracle background processes. The PGA is made up of the following components:

- Stack space: memory holding session variables
- Session information: stored here for dedicated servers and in the SGA for multithreaded servers
- Private SQL area: information on binding variables and run-time buffers

2.3 Oracle Processes

An Oracle instance consists of:

- User processes
- Oracle server processes (shadow processes)
- Oracle background processes
- Shared memory used by these processes

The database can be organized further to run with a dedicated server or with a multithreaded server. In the dedicated server configuration, each user process has a dedicated server process. In the multithreaded server configuration, multiple user processes are serviced by a few shared server processes.

Figure 3 on page 11 provides a graphical depiction of the Oracle architecture.

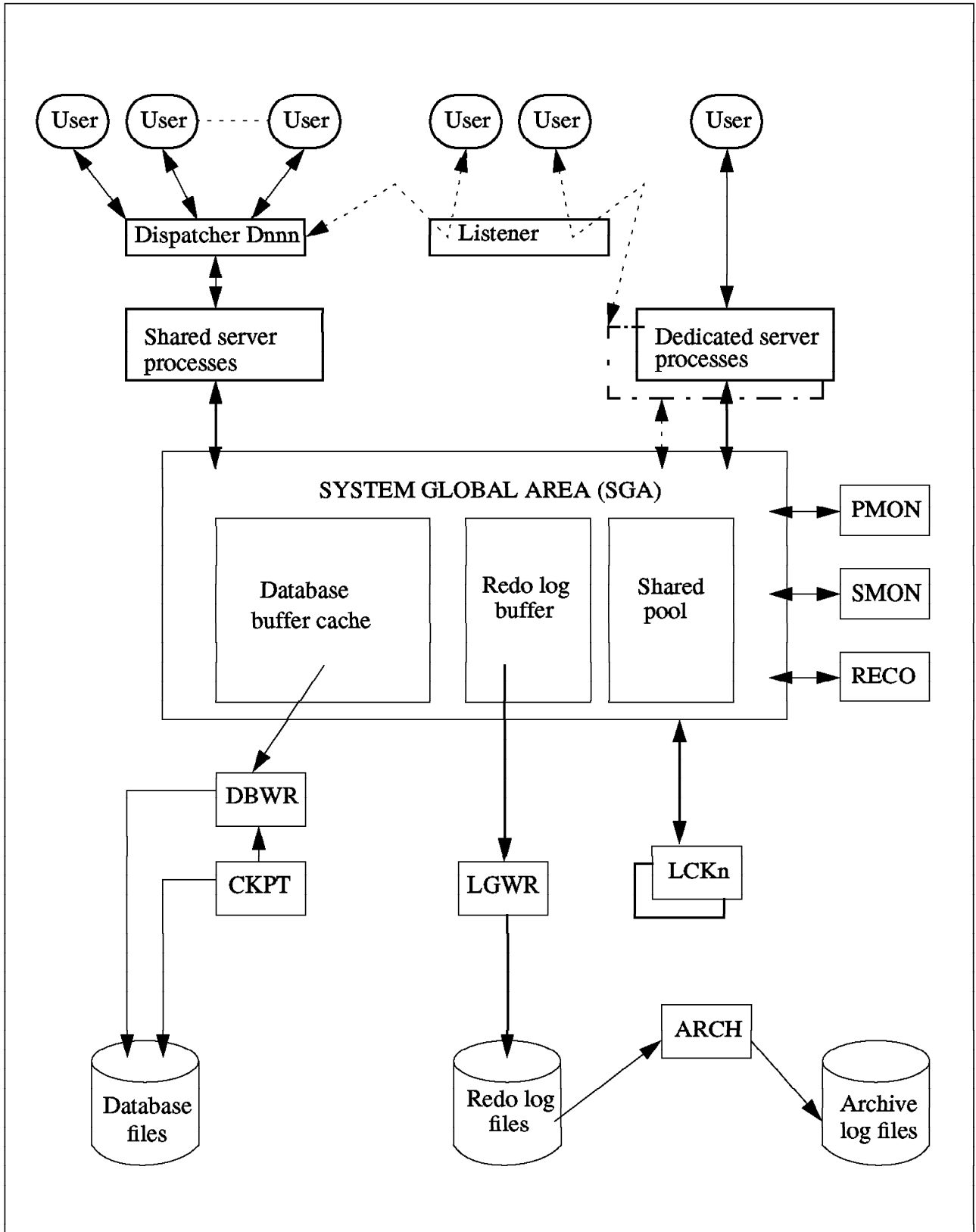


Figure 3. Oracle Architecture

There are four Oracle system background processes that must always be up and running for the database to be usable. They are the following:

1. Database Writer (DBWR)
2. Log Writer (LGWR)
3. System Monitor (SMON)
4. Process Monitor (PMON)

2.3.1 Database Writer (DBWR)

The database writer process is responsible for writing modified (dirty) data blocks from the database buffer cache to the database files. The DBWR only does a write when buffers are needed for data to be read in. There may be more than one DBWR process.

When using the Oracle Parallel Server, the DBWR might be forced to do a write not because buffers are needed but because another user needs to modify the same buffers. This process is known as pinging and can be responsible for degrading database performance.

2.3.2 Log Writer (LGWR)

The log writer process writes redo log entries from the redo log buffer to the redo log files on disk.

2.3.3 System Monitor (SMON)

The system monitor process performs instance recovery at database startup time or, in the case of Oracle parallel server, when another instance belonging to the database has crashed or terminated abnormally.

SMON also releases temporary segments that are no longer needed, compacts the free space fragments in the database files, and detects deadlock situations.

2.3.4 Process Monitor (PMON)

The process monitor process keeps track of database processes. If a user process fails, PMON cleans up the cache and frees up any resources that the failed process was using.

PMON also monitors the dispatcher and shared server processes and restarts them if necessary.

Along with the four processes described above, there are a number of other optional system processes, such as:

- Checkpoint (CKPT)
- Recover (RECO)
- Archiver (ARCH)
- Parallel Server Lock Processes (LCKn)

2.3.5 Checkpoint (CKPT)

A checkpoint is an event in which all modified data blocks are written by the DBWR process to the data files. This usually occurs at a redo log switch. At a checkpoint, all of the database file headers and the redo log file headers are updated to record the fact that a checkpoint has occurred.

The CKPT is optional. If it is not present, the LGWR process performs the tasks of the CKPT process. It is recommended that the CKPT process is enabled when there are a large number of data files.

2.3.6 Recover (RECO) Process

The recover process is used when there is a failure in a distributed transaction. A distributed transaction is one where two or more locations of the data have to be kept synchronized. In this environment, there may be multiple databases on multiple interconnected servers and either a node or a network fails.

Any transaction that may have completed in one site but not in another is referred to as *in doubt*. The RECO process attempts to establish communication with the remote servers. When the connection is reestablished, the RECO process automatically resolves all the in doubt transactions.

The RECO process is optional and is only needed in instances that carry out distributed transactions.

2.3.7 Archiver (ARCH) Process

The archiver optional process is used when the data is running in ARCHIVELOG mode and automatic archiving is enabled. ARCH copies the redo entries from the online redo log files to the archive area.

2.3.8 Parallel Server Lock Processes (LCKn)

The lock processes are used only if running Oracle Parallel Server. LCKn uses the distributed lock manager for inter-instance locking to prevent simultaneous changes to the same data from different instances.

Chapter 3. Database Planning, System Requirements, and Sizing

This chapter provides information for planning different types of databases. It also discusses AIX-specific issues, including system hardware and software requirements. Included is disk sizing information for your database.

3.1 Planning Your Database

The following section provides information for planning different types of databases.

3.1.1 First Considerations

When planning database installations, you need to determine your processing priorities and the amount of system resources you have.

3.1.1.1 Priorities

Your priorities will decide the characteristics of your database. Things to consider are:

- Is transaction speed more important than data safety?
- Will the database be used for a large number of short transactions OR a small number of large transactions?
- Is the database to be accessed by a single application or multiple applications running on multiple nodes?

3.1.1.2 System Resources

The system resources available to you will also affect your database installation, usage and backup strategies. The following considerations are important:

- The number of users and applications running at one time will depend upon the physical memory available and the system running the database
- You need to know how many disk drives are available, their device names, the speeds of the various disks (are some faster than others), and the number of disk controllers available.
- For backup purposes, you should know the number and type of tape drives available.
- What UNIX kernel parameters need to be changed or added?
- What network resources are available?

3.1.2 Database Application Type

The type of database application you are planning is a primary criterion in determining how you will plan and structure the database. Depending on the purpose for which they will be used, there are four basic types of database applications:

- On Line Transaction Processing (OLTP)
- Decision Support
- Development
- Mixed

3.1.2.1 OLTP Database

An OLTP database, such as a bank automated teller machine or ATM, has a very high volume of transactions (measured in transactions per second). When planning a database for such purposes, you usually need to:

- Split database files so that disk I/O is shared between many disk subsystems
- Split the logical database design
- Implement redo log archiving
- Be available 7 days a week, 24 hours a day
- Use raw disk partitions
- Use high availability hardware (mirrored disks, for example)
- Institute performance tuning
- Set *initsid.ora* parameters larger than the default values to accommodate more users and increase performance

3.1.2.2 Decision Support Database

A decision support database, such as an inventory system, has a relatively low number of database updates (measured in transactions per hour). The users tend to make few queries, and they look at the results of these queries for many minutes at a time. They may prepare reports from these queries. A decision support database:

- Has less need to distribute I/O across multiple disks and controllers
- Has less need to split the logical database design
- Has less need to implement redo log archiving
- Can usually be brought down for maintenance or backups

3.1.2.3 Development Database

A development database is used to develop new applications. Such a database:

- Does not usually need to split I/O
- Can usually be brought down for maintenance or backups
- Has little need for backup more than once a day
- Has little need for performance tuning

3.1.2.4 Mixed Database

A mixed database combines various functions, such as decision support and transaction processing. Most databases fall within this category. Such a database:

- Has an even mixture of queries and updates
- Has some performance tuning needs, but not as much as an OLTP database

3.1.3 Database Size

When considering the size of a database, you must always consider it relative to the system upon which it will run. The basic considerations are:

- A machine with more physical memory can support a larger database
- A machine with more processors can support a larger database

3.1.4 File Locations

Several files that will be prompted for when you install and create your database or object database must be put in the external shared disk if you need a highly available database within an HACMP environment. The files to be put into the external shared disk are as follows:

- Control file
- Redo log
- System tablespace
- Rollback segment
- Tools tablespace
- User tablespace
- Temporary tablespace

3.2 System Requirements

This section lists the hardware and software requirements for installing your Oracle database.

3.2.1 Requirements for Oracle Product Installation on a Single Server

This section outlines the requirements for installing various Oracle products.

3.2.1.1 Hardware Requirements

Hardware Item	Requirement
CPU	IBM RISC System/6000.
Memory	Please refer to the disk space and memory requirement chart in the next section.
Tape Device	An 8 mm tape drive is required for the tape distribution of Oracle. The tape drive should be set to 512 blocsize.
CD-ROM	ISO 9660 format is supported.
Terminal	The following terminal types are supported: ANSI, HFT, LFT, 3151, VT100, WYSE50, and so on.
Controller	SQL*Net TCP/IP requires an adapter that will support TCP/IP.

Table 1. Hardware Requirements for Oracle Product Installation on a Single Server

3.2.1.2 Software Requirements

Software Item	Requirement
Operating System	AIX Version 4.1.4 or later

Table 2. Software Requirements for Oracle Product Installation on a Single Server

3.2.2 Requirements for Concurrent or Parallel Server Installation

Table 3 shows the requirements for concurrent or parallel server installation.

3.2.2.1 Hardware/Software Requirements

Item	Requirement
Hardware CPU	IBM HACMP Cluster (1-8 node)
Operating System	AIX/6000 Version 4.1.4 and HACMP Version 4.1.1
Distributed Lock Manager	HACMP Version 4.1.1

Table 3. Hardware and Software Requirements for Oracle Parallel Server Installation

Also required are shared disk drives using raw partitions to hold database control and log files. These shared disk drives should be accessible by all nodes in the cluster. The raw devices used should be the character raw devices (/dev/rdisk/virtual_file_name) and not block raw devices.

3.2.3 Requirements for Oracle Optional Products

For the prerequisite requirements of Oracle optional products, please refer to the Oracle manual. The Oracle products are usually grouped into the following categories:

- Tools
- Precompilers
- CASE Products
- SQL*Net V2

Note that when you install an individual product, the dependent products are installed automatically by the Installer.

You can find more information about prerequisites or requirements for Oracle products that are included in one of the four categories mentioned above in *Chapter 2, "Requirements,"* in the *Oracle7 for AIX-Based Systems Installation and Configuration Guide*.

Below, we only show you some examples of the tables that we installed in this book, such as the Oracle Tools, PL/SQL Release 2.1 and SQL*Plus Release 3.1, and the SQL*Net with TCP/IP Protocol Adapter requirements or prerequisites for installation.

PL/SQL Release 2.1

Software Requirement	Version	State During Installation
Oracle Server	7.1	Installed
Hardware Requirement		
None		

Table 4. Prerequisites for PL/SQL Release 2.1

SQL*Plus Release 3.1

Software Requirement	Version	State During Installation
Oracle Server	7.1	Running
Hardware Requirement		
None		

Table 5. Prerequisites for SQL*Plus Release 3.1

SQL Net*Release 2.1

Software Requirement	Version	State During Installation
Oracle Server	7.1	Installed
Oracle TCP/IP Adapter	2.1	Installed
TCP/IP for AIX 4.1.4	Included in O/S	Installed
Hardware Requirement		
Token-Ring Adapter or Ethernet Adapter supported for IBM RS/6000		

Table 6. Prerequisite for SQL*Net Release 2.1

Oracle TCP/IP Adapter Release 2.1

Software Requirement	Version	State During Installation
Oracle Server	7.1	Installed
SQL*Net	2.1	Installed
Hardware Requirement		
Token-Ring Adapter or Ethernet Adapter supported for IBM RS/6000		

Table 7. Prerequisites for Oracle TCP/IP Adapter Release 2.1

3.3 Disk Space and Memory Sizing for Oracle

This section is designed as a planning tool. It provides the information required to calculate the distribution space, database space, and memory requirements for each Oracle product available for installation on your system. Also we will discuss the memory requirement based on users. Follow the step-by-step procedure to calculate the disk storage and memory requirements for your specific installation. Note that these instructions provide only generalized estimates of your disk and memory needs, not a precise calculation.

3.3.1 Required Calculations

The calculations result in two values for total disk storage and two values for system memory. These values are:

Distribution Space	Space required in megabytes to store the products on disk.
Database Space	Megabytes of space the product requires in the database space. Assess the number of Oracle blocks required by dividing this amount by the default Oracle block size for your machine.
First User Memory	An estimate of virtual memory space, in kilobytes, used when the first user runs the product.

Memory/Additional (User) An estimate of the virtual memory space, in kilobytes, used when each additional user runs the product.

3.3.2 Disk Space Requirements

In this section, we will explain the disk space sizing sheet for use as a tool for sizing and estimating the space required for an Oracle installation. There are six kinds of sheets, one for each category of Oracle product.

3.3.2.1 Oracle Server and Networking Products

To arrive at a basic estimate of your space needs for Oracle and the networking products, perform these calculations:

1. Select the product you want to install by placing a check mark in the first column of each product.

Note: For server installation, several products, such as Oracle Server and its components, Oracle Common Libraries and Utilities, Oracle Toolkit, and SQL*Net, are mandatory.

2. Calculate the Distribution (**Dist**) Space by subtotaling the values for the selected products in "A" at the bottom of the column.
3. Calculate the Database Space (**DB Sp**) by subtotaling the values for the selected products in "B" at the bottom of the column.
4. Transfer the First User Memory Space (**#1 User**) value for the Oracle Server to the Subtotal "C" at the bottom of the column.
5. Calculate the **Additional Users** memory space under the **Memory Space Requirements** heading.

Enter the number of additional users you estimate for the Oracle Server in the **Users** column.

Multiply **Users** by **KB per** and place the result in **Total**. For example:

$$9 \text{ users} \times 186 \text{ KB per} = 1674 \text{ KB}$$

Transfer this value into Subtotal **D** at the bottom of the column.

6. In the table's **Summary** section, enter **A**, **B**, **C**, and **D** subtotals.

Add the #1 User Memory (**C**) and Additional User Memory (**D**) and enter the result in the Virtual Memory Total (**E**).

Below are the tables showing the disk space sizing sheets for the Oracle server products and Oracle networking products.

Space Requirements for Oracle Server Products							
Disk Storage Requirements				Memory Space Requirements			
v		Dist.	DB Sp	#1 User	Additional Users		
Use	Product	(MB)	(MB)	(KB)	Users	KB per	Total
v	Oracle Server	36.60	12.5	6458		x 489	
	SQL*DBA			2589		x 283	
	SQL*Loader			1778		x 204	
	Export			1654		x 223	
	Import			1590		x 207	
	Server Manager (Line Mode only)	20.19	N/A	1752		x 221	
	Server Manager (Motif bitmapped & Line Mode)	42.88	N/A	3515		x 364	
	+ Distributed Opt	0.10	N/A				
	+ Parallel Server Opt.	0.08	N/A				
v	+ Parallel Query Opt	0.08	N/A				
v	Toolkit II	43.06	N/A				
v	Oracle Common Lib & Utilities	22.10	N/A				
	Migration Utility	1.85	N/A				
	Oracle Parallel Backup/Restore Util.	30.00	10.0	1024			
		Σ A	Σ B	Σ C			Σ D
	Subtotals =						
Summary							
A	Tot. Distribution Space (A)			(MB)			
B	Tot. Database Space (B)			(MB)			
C	#1 User Memory (C)			(KB)			
D	Additional User Memory (D)			(KB)			
E	Virtual Memory Total (C+D)			(KB)			

Table 8. Disk Sizing Sheet for Oracle Server Products

Space Requirements for Oracle Networking Products							
Disk Storage Requirements				Memory Space Requirements			
v		Dist.	DB Sp	#1 User	Additional Users		
Use	Product	(MB)	(MB)	(KB)	Users	KB per	Total
SQL*Net V1:							
	SQL*Net Async	0.27	N/A				
	SQL*Net DECnet	0.12	N/A				
	SQL*Net LU6.2	0.13	N/A				
	SQL*Net SPX/IPX	2.55	N/A				
	SQL*Net Named Pipes		N/A				
	SQL*Net TCP/IP	0.32	N/A				
SQL*Net V2:							
v	SQL*Net V2	35.59	0.2				
	TNS Listener			1183		x 176	
	DECnet	0.12	N/A				
	LU6.2	0.14	N/A	7		x 2	
	OSI	0.16	N/A				
	SPX/IPX	4.51	N/A	695		x 152	
	Names Server	3.93	N/A	1806		x 215	
v	TCP/IP	0.12	N/A				
	Interchange	5.81	N/A				
	Network Manager	22.51	N/A	3266		x 323	
	Interchange Control Utility			1260		x 169	
	Interchange Listener			1224		x 168	
	Navigator			1187		x 168	
	Configuration Tool	N/A	0.2				
		Σ A	Σ B	Σ C			Σ D
	Subtotals =						
Summary							
A	Tot. Distribution Space (A)			(MB)			
B	Tot. Database Space (B)			(MB)			
C	#1 User Memory (C)			(KB)			
D	Additional User Memory (D)			(KB)			
E	Virtual Memory Total (C+D)			(KB)			

Table 9. Disk Sizing Sheet for Oracle Networking Products

3.3.2.2 Oracle Tools

The calculation procedures for sizing the space requirements of Oracle Tools products is the same as above. You must keep in mind that First User Memory (**#1 User**) is extremely difficult to predict because it depends heavily on the application. Furthermore, the number of cursors opened by applications can significantly affect the size of associated shadow processes. The numbers given in this sheet are to be understood as the bare minimum.

1. Select the product you want to install by placing a check mark in the first column of each product.
2. Calculate the Distribution (**Dist**) Space by subtotalling the values for the selected products in **A** at the bottom of the column.
3. Calculate the Database Space (**DB Sp**) by subtotalling the values for the selected products in **B** at the bottom of the column.

4. Transfer the First User Memory Space (**#1 User**) value for the Oracle Tools to the Subtotal **C** at the bottom of the column.

5. Calculate the Additional Users Memory Space.

Enter the number of additional users you estimate for the Oracle Tools in the **Users** column.

Multiply **Users** by **KB per** and place the result in **Total**. For example:

9 additional users of SQL*Plus x 778 KB per = 7002 KB

Transfer this value into Subtotal **D** at the bottom of the column.

6. In the table's **Summary** section, enter **A**, **B**, **C**, and **D** subtotals.

Add the #1 User Memory (**C**) and Additional Users Memory (**D**) and enter the result in the Virtual Memory Total (**E**).

Below are the tables showing the disk space sizing sheets for the Oracle Tools products.

Space Requirements for Oracle Tools							
Disk Storage Requirements				Memory Space Requirements			
v		Dist.	DB Sp	#1 User	Additional Users		
Use	Product	(MB)	(MB)	(KB)	Users	KB per	Total
	Easy*SQL						
	Oracle Data Query	17.81	0.4	3424		x 756	
	Oracle*Mail	48.50	N/A	2628		x 362	
	Oracle*Terminal	5.77	N/A	667		x 194	
	PL/SQL 1.0		N/A				
	PL/SQL 2.0	0.28	N/A				
	SQL*Calc	2.99	N/A				
	Oracle Toolkit I	1.29	N/A				
	Oracle XA Library	0.15	N/A				
	SQL*Forms V3.0	24.99	1.2				
	Design (Char Mode)			4614		x 1034	
	Runtime (Char Mode)			3511		x 710	
	SQL*Menu V5.0	21.84	0.8				
	Design (Char Mode)			4388		x 998	
	Runtime (Char Mode)			3565		x 760	
	SQL*Plus	5.65	0.6	3472		x 778	
	SQL*QMX	2.97					
	SQL*Report	2.37	N/A				
	rpt			1748		x 230	
	rpf			46		x 9	
	SQL*ReportWriter	2.37	N/A				
	Design			2642		x 230	
	Runtime			2424		x 302	
		Σ A	Σ B	Σ C			Σ D
	Subtotals =						
Summary							
A	Tot. Distribution Space (A)			(Mb)			
B	Tot. Database Space (B)			(Mb)			
C	#1 User Memory (C)			(Kb)			
D	Additional User Memory (D)			(Kb)			
E	Virtual Memory Total (C+D)			(Kb)			

Table 10. Disk Sizing Sheet for Oracle Tools Products

3.3.2.3 Oracle CASE Products

Although in this redbook we did not install any CASE products, it is necessary for you to know about disk size spacing for these products.

The categories of space requirements given for CASE*Designer are as follows:

- casefront** The executable run by all users at all times. It is the startup window from which users invoke the different CASE*Designer diagrammers, depending on the stage of development.
- caseerd** The diagrammer invoked by all users at the entity relationship definition stage of development.

casefhd The diagrammer invoked by all users at the function hierarchy definition stage of development.

casedfd The diagrammer invoked by all users at the dataflow definition stage of development.

casemd The diagrammer invoked by all users who are checking completeness and validity links between pairs of element types.

The calculation procedures for sizing space requirements of Oracle CASE products are the same as above. The numbers given in this sheet are to be understood as the bare minimum.

1. Select the product you want to install by placing a check mark in the first column of each product.
2. Calculate the Distribution (**Dist**) Space by subtotaling the values for the selected products in **A** at the bottom of the column.
3. Calculate the Database space (**DB Sp**) by subtotaling the values for the selected products in **B** at the bottom of the column.
4. Transfer the First User Memory Space (**#1 User**) value for the Oracle Tools to the Subtotal **C** at the bottom of the column.
5. Calculate the Additional Users Memory Space.

Enter the number of additional users you estimate for the Oracle Tools in the **Users** column.

Multiply **Users** by **KB per** and place the result in **Total**. For example:

3 addtl. users of CASE*Designer casemd x 930 KB per = 2790 KB

Transfer this value into Subtotal **D** at the bottom of the column.

1. In the table's **Summary** section, enter **A**, **B**, **C**, and **D** subtotals.

Add the #1 User Memory (**C**) and Additional Users Memory (**D**) and enter the result in the Virtual Memory Total (**E**).

Below are the tables showing the disk space sizing sheets for the Oracle CASE products.

Space Requirements for CASE Products							
Disk Storage Requirements				Memory Space Requirements			
v		Dist.	DB Sp	#1 User	Additional Users		
Use	Product	(MB)	(MB)	(KB)	Users	KB per	Total
	CASE*Dictionary	53.18	7.5				
	Runtime			1730		x 237	
	CASE*Generator	33.65	4.5				
	Runtime			1895		x 281	
	CASE*Designer	15.11	3.5				
	casefront Runtime			2107		x 330	
	caseerd Runtime			2575		x 426	
	casefhd Runtime			2504		x 430	
	casedfd Runtime			2689		x 496	
	casemd Runtime			2904		x 930	
		ΣA	ΣB	ΣC			ΣD
	Subtotals =						
Summary							
A	Tot. Distribution Space (A)			(MB)			
B	Tot. Database Space (B)			(MB)			
C	#1 User Memory (C)			(KB)			
D	Additional User Memory (D)			(KB)			
E	Virtual Memory Total (C+D)			(KB)			

Table 11. Disk Sizing Sheet for Oracle CASE Products

3.3.2.4 Oracle Precompiler Products

Although in this redbook we did not install any precompiler products, it is necessary for you to know about disk size spacing for these products.

Calculating memory usage of these products also requires differentiation of application development and production cycles.

During application development, a few programmers will be using the prox (procob for COBOL, proc for C, proada for Ada, propas for Pascal, and profor for FORTRAN) executable extensively. During the production cycles, many more users may be executing the finished programs, which have been linked with the SQLLIB run-time library. Remember that each precompiler application may spawn an Oracle shadow process; so the same rule for including the per-additional-user memory consumption of the Oracle Kernel applies to precompilers.

Disk space for the precompilers is somewhat redundant. It is calculated assuming only one language is installed on your system. When a second language is installed, the additional free space required is not as great as listed because different languages share common libraries.

The calculation procedures for sizing space requirements of Oracle precompiler products have two phases. First, you have to calculate the development cycle calculations, which are the same as for other products above.

1. Select the product you want to install by placing a check mark in the first column of each product.
2. Calculate the Distribution (Dist) Space by subtotalling the values for the selected products in **A** at the bottom of the column.

3. Calculate the Database space (**DB Sp**) by subtotalling the values for the selected products in **B** at the bottom of the column.
4. Transfer the First User Memory Space (**#1 User**) value for the Oracle Tools to the Subtotal **C** at the bottom of the column.
5. Calculate the Additional Users Memory Space.

Enter the number of additional users you estimate for the Oracle Tools in the **Users** column.

Multiply **Users** by **KB per** and place the result in **Total**. For example:

2 addtl. users of Pro*C V2 x 329 KB per = 658 KB

Transfer this value into Subtotal **D** at the bottom of the column.

6. In the table's **Summary** section, enter **A**, **B**, **C**, and **D** subtotals.

Add the #1 User Memory (**C**) and Additional Users Memory (**D**) and enter the result in the Virtual Memory Total (**E**).

Below are the tables showing the first-phase disk space sizing sheets for the Oracle precompiler products.

Space Requirements for CASE Products							
Disk Storage Requirements				Memory Space Requirements			
v		Dist.	DB Sp	#1 User	Additional Users		
Use	Product	(MB)	(MB)	(KB)	Users	KB per	Total
	Pro*Ada	1.10	N/A	3251		x 307	
	Pro*C v1.6	1.10	N/A	3261		x 396	
	Pro*C v2	1.10	N/A	3534		x 329	
	Pro*COBOL 1.6	1.10	N/A	3271		x 308	
	Pro*FORTRAN 1.6	1.10	N/A	3254		x 306	
	SQL*Module for Ada	8.83	N/A	3286		x 306	
	SQL*Module for C	8.83	N/A	3286		x 306	
		Σ A	Σ B	Σ C			Σ D
	Subtotals =						
Summary							
A	Tot. Distribution Space (A)			(MB)			
B	Tot. Database Space (B)			(MB)			
C	#1 User Memory (C)			(KB)			
D	Additional User Memory (D)			(KB)			
E	Virtual Memory Total (C+D)			(KB)			

Table 12. First-Phase Disk Sizing Sheet for Oracle Precompiler Products

After you have finished the first-phase calculation above, you must continue to calculate the second phase, which is the use cycle calculation. To calculate the minimum memory requirement for a finished user program, perform the following steps:

- a. Determine the text and data size of each executable by using the size command.
- b. Add the text and data total to determine the first user memory requirement for the program (F).

$$text + data = 1st_User_Total$$

3.3.2.6 Oracle Product Documentation Library

The Product Documentation Library contains online documentation for each Oracle product.

If you want to install this online product installation documentation library, you must add from about 1.5 MB to a maximum of 40 MB of additional space, depending on how many of the documents you want to install to your Distribution Space (A), in the final calculation sheet of disk space sizing before you prepare your installation tasks.

For more information about this documentation library and how to use it, please refer to the *Getting Started with Oracle Online Documentation for AIX* manual from the Oracle Corporation.

3.3.3 Final Calculation of Disk Requirement

Enter the **A**, **B**, and **E** totals from the individual tables into the table below. Total the three columns (including the additional Disk Space requirement) to determine the total distribution space, database space, and virtual memory space you will need.

Total Space Requirements (MB)			
Transfer Table	Disk Space (A)	Database Space (B)	Virtual Memory (E)
Oracle Server Products			
Precompiler Products: Development Cycle			
Precompiler Products: User Cycle	n/a	n/a	
Oracle Networking Products			
Oracle CASE Products			
Oracle Tools Products			
Oracle Online Documentation		n/a	n/a
Additional installation space for files generated during installation	+ 21 MB (Minimum)	n/a	n/a
Temporary space for relinking	+ 40 MB (minimum)		
TOTALS			

Table 14. Total Disk Sizing Summary Sheet

Chapter 4. Sample Configurations for Highly Available Databases

This chapter describes the sample HACMP for AIX configurations used for installing and testing the highly available databases.

In each case, the cluster consisted of two nodes. The sample clusters tested were in the following configurations:

- Rotating resources
- Cascading resources (mutual takeover)
- Concurrent access (mode 3)

4.1 Preinstallation Activities and Considerations for HACMP

We will not give a detailed description of the cluster preinstallation activities. These can be found either in the HACMP installation guide or in the redbook *An HACMP Cookbook*, SG24-4553.

The steps to be taken are:

1. Configuring the `/etc/hosts` and the `/.rhosts` files on all nodes
2. Configuring the network adapters (boot addresses for IP address takeover)
3. Connecting the shared disks (change adapter IDs for SCSI)
4. Configuring the non-IP connections, RS232 or TMSCSI
5. Creating the volume groups:
 - `varyon automatic = NO`
 - `quorum = NO` (for concurrent access `quorum = YES`)
 - `create volume group concurrent capable = Yes` for concurrent access
6. Creating the logical volumes
 - If using raw logical volumes, make sure that the logical volume is at least 1 MB bigger than the size needed for a database application.
7. Creating any filesystems (This depends upon your database and is definitely NOT done for concurrent access.)
 - `mount = false`
8. Importing the volume group definitions on the backup node(s). Reset the `varyon automatic` to `NO`, because `importvg` sets it to its default of `YES`.

4.2 Rotating Configuration for Highly Available Databases

This cluster, consisting of two nodes, was set up in a rotating configuration. The cluster was configured as shown in Figure 4.

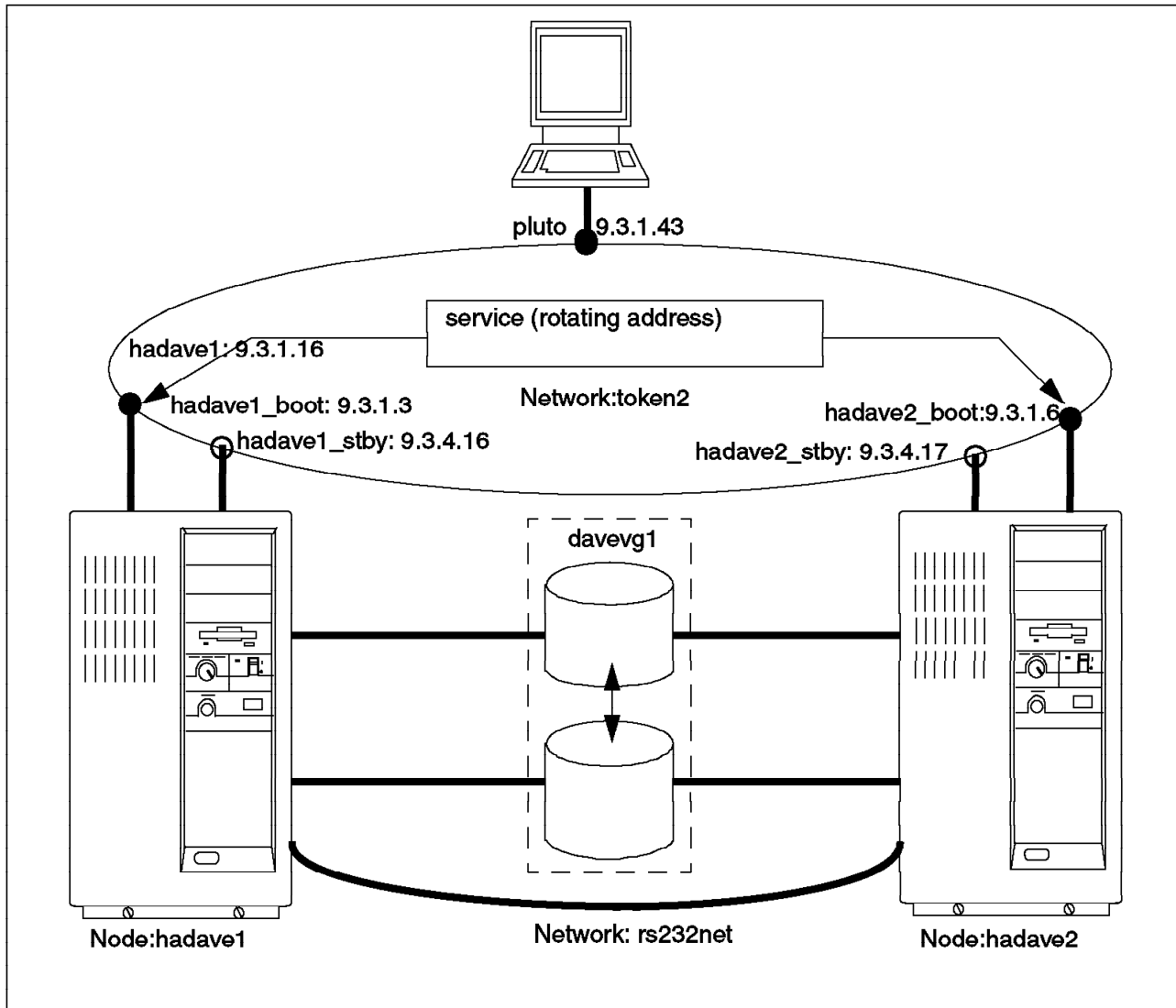


Figure 4. Cluster Configuration for Rotating Resources

4.2.1 Rotating Cluster Description

This cluster has two nodes with the configuration described below:

4.2.1.1 Cluster

To configure the cluster, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Topology**
3. Select: **Configure Cluster**

4. Select: **Add a Cluster Definition**

Then enter the **Cluster ID** and **Cluster Name** on the Add a Cluster panel.

```

                                Add a Cluster Definition
Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Cluster ID                    [2]                #
* Cluster Name                  [ha_clu]
F1=Help      F2=Refresh      F3=Cancel      F4=List
F5=Reset     F6=Command     F7=Edit       F8=Image
F9=Shell     F10=Exit        Enter=Do

```

After this SMIT screen, we will no longer show the function keys. Other than that, each screen is still shown in its entirety, just as you will see it in SMIT.

4.2.1.2 Nodes

Add the node definitions for all of the cluster nodes:

Enter: smit hacmp

1. Select: **Cluster Configuration**
2. Select: **Cluster Topology**
3. Select: **Configure Nodes**
4. Select: **Add Cluster Nodes**

```

                                Add Cluster Nodes
Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Node Names                    [hadave1 hadave2]

```

4.2.1.3 Adapter Configuration for Rotating Resources

Add the definitions of all of the network adapters, including the non-IP networks.

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Topology**
3. Select: **Configure Adapters**
4. Select: **Add an Adapter**

Add the appropriate data to the entry fields in the Add an Adapter panel.

```

                                Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Adapter IP Label                [hadave1_boot]
* Network Type                    [token]                +
* Network Name                   [token2]               +
* Network Attribute              public                    +
* Adapter Function               boot                    +
* Adapter Function []
Adapter Hardware Address         []
Node Name                       [hadave1]                +

```

```

                                Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Adapter IP Label                [hadave1_stby]
* Network Type                    [token]                +
* Network Name                   [token2]               +
* Network Attribute              public                    +
* Adapter Function               standby                 +
Adapter Identifier              []
Adapter Hardware Address         []
Node Name                       [hadave1]                +

```

```

                                Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Adapter IP Label                [hadave1]
* Network Type                    [token]                +
* Network Name                   [token2]               +
* Network Attribute              public                    +
* Adapter Function               service                 +
Adapter Identifier              []
Adapter Hardware Address         [42005a4f1111]
Node Name                       []                        +

```

Note there is no longer a shared adapter function for rotating resources. It is now added as a service adapter, leaving the Node Name field blank. This creates an adapter definition that is not tied to any one node, but rather rotates between nodes as they enter and leave the cluster.

Now, the boot and standby adapters for the second node are added.

```

Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Adapter IP Label                [hadave2_boot]
* Network Type                    [token]                +
* Network Name                    [token2]               +
* Network Attribute               public                    +
* Adapter Function                boot                    +
Adapter Identifier                []
Adapter Hardware Address          []
Node Name                        [hadave2]                +

```

```

Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Adapter IP Label                [hadave2_stby]
* Network Type                    [token]                +
* Network Name                    [token2]               +
* Network Attribute               public                    +
* Adapter Function                standby                 +
Adapter Identifier                []
Adapter Hardware Address          []
Node Name                        [hadave2]                +

```

Now, we add the RS232 network (non-IP) adapters.

Although it is no longer mandatory to have the label of the tty device terminated by ttyn, where n is the AIX assigned device number (for example, we could have entered hadave1_nonip), we recommend that, for clarity, you use the ttyn method as used in previous versions of HACMP.

```

Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Adapter IP Label                [hadave1_tty0]
* Network Type                    [rs232]                +
* Network Name                    [rs232net]             +
* Network Attribute               serial                 +
* Adapter Function                service                 +
Adapter Identifier                [/dev/tty0]
Adapter Hardware Address          []
Node Name                        [hadave1]                +

```

```

                                Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Adapter IP Label                [hadave2_tty0]
* Network Type                    [rs232]           +
* Network Name                    [rs232net]        +
* Network Attribute                serial            +
* Adapter Function                 service          +
Adapter Identifier                 [/dev/tty0]
Adapter Hardware Address           []
Node Name                          [hadave2]       +

```

Make sure that your RS232 network is functioning before starting up the cluster manager; you do this by typing:

```

stty < /dev/ttyn on one node and then,
stty < /dev/ttyn on the other node

```

When you type the command on the first node, the command should hang with no response. When you type the same command on the other node, both nodes should display their tty settings. In our example, we would use /dev/tty0 in the command, since this is the tty device that we are using on each node.

4.2.1.4 Synchronize the Cluster

To synchronize the cluster, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Topology**
3. Select: **Synchronize Cluster Topology**

Press **Enter** to synchronize the cluster.

4.2.1.5 Rotating Resources Definition

To define the rotating resources, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Resources**
3. Select: **Define Resource Groups**
4. Select: **Add a Resource Group**

Enter the appropriate data in the entry fields on the Add a Resource Group panel.

```

                                Add a Resource Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

* Resource Group Name          [Entry Fields]
                                [dbD1]
* Node Relationship            rotating          +
* Participating Node Names    [hadave1 hadave2]  +

```

4.2.1.6 Rotating Application Servers

To add a rotating application server, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
 - Select: **Cluster Resources**
 - Select: **Define Application Servers**
 - Select: **Add an Application Server**

```

                                Add Application Server

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

* Server Name                  [Entry Fields]
                                [applidb_D1]
* Start Script                 [/usr/HACMP_ANSS/script/start_D1]
* Stop Script                  [/usr/HACMP_ANSS/script/stop_D1]

```

4.2.1.7 Configuring Rotating Resource Groups

To configure rotating resource groups, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Resources**
3. Select: **Change/Show Resources for a Resource Group**
4. Select: **dbD1**

```

                                Configure a Resource Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
Resource Group Name                dbD1
Node Relationship                   rotating
Participating Node Names           hadave1 hadave2

Service IP Label                   [hadave1]                +
Filesystems                       [/oradatafs1]          +
Filesystems to Export              []                       +
Filesystems to NFS Mount           []                       +
Volume Groups                     []                       +
Concurrent Volume Groups           []                       +
Raw Disk PVIDs                    []                       +
Application Servers                [applidb_D1]           +
Miscellaneous Data                 []

Inactive Takeover Activated        false                    +
9333 Disk Fencing Activated        false                    +
SSA Disk Fencing Activated         false

```

4.2.1.8 Synchronize Cluster Resources

To synchronize cluster resources, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Resources**
3. Select: **Synchronize Cluster Resources**

Press **Enter** to synchronize the cluster.

4.3 Cascading Configuration for Highly Available Databases

This cluster, consisting of two nodes, was set up in what is traditionally called a Mutual Takeover configuration. The cluster was configured as shown in Figure 5.

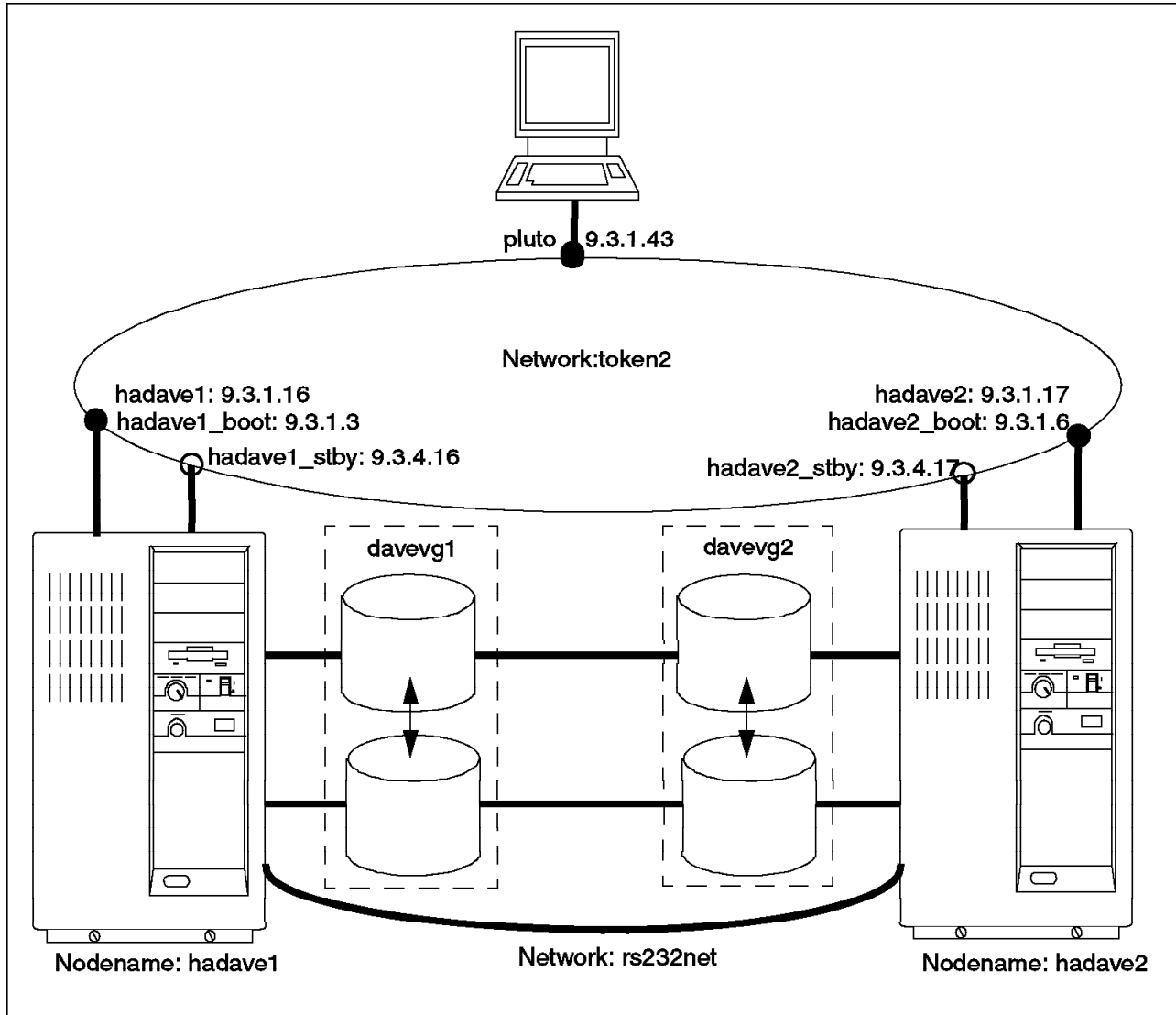


Figure 5. Cluster Configuration for Cascading Resources

Each node is installed with its own database. For example, hadave1 has a database, d1, residing on the external disks that make up the volume group davevg1. Node hadave2 has a database, d2, residing on the external disks that make up the volume group davevg2. In the event of a failure, each node will provide backup for the other one.

4.3.1 Cascading Cluster Description

The following sections describe the setup for a cascading cluster.

4.3.1.1 Cluster and Node Setup

The cluster and nodes were defined exactly as in the rotating configuration. See Section 4.2.1.1, “Cluster” on page 32, for the cluster definition and Section 4.2.1.2, “Nodes” on page 33, for the node definition.

4.3.1.2 Adapter Configuration for Cascading Resources

Add the definitions of all of the network adapters, including the non-IP networks. We will only show the network adapters being added for one node. You will need to add adapters for all nodes in your cluster.

For cascading resources, we need the service, boot, and standby adapters.

To add the adapters, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Topology**
3. Select: **Configure Adapters**
4. Select: **Add an Adapter**

Enter the appropriate data in the entry fields in the Add an Adapter panels.

```

                                Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Adapter IP Label                [hadave1]
* Network Type                    [token]                +
* Network Name                    [token2]                +
* Network Attribute                public                    +
* Adapter Function                 service                    +
Adapter Identifier                 []
Adapter Hardware Address           [42005a4f1111]
Node Name                          [hadave1]                +

```

```

                                Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Adapter IP Label                [hadave1_boot]
* Network Type                    [token]                +
* Network Name                    [token2]                +
* Network Attribute                public                    +
* Adapter Function                 boot                    +
Adapter Identifier                 []
Adapter Hardware Address           []
Node Name                          [hadave1]                +

```

```

                                Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Adapter IP Label                [hadave1_stby]
* Network Type                    [token]                +
* Network Name                    [token2]                +
* Network Attribute                public                    +
* Adapter Function                 standby                 +
Adapter Identifier                 []
Adapter Hardware Address           []
Node Name                         [hadave1]                +

```

Now add the service, boot and standby adapters for the other nodes.

The RS232 network is set up as before in Section 4.2.1.3, “Adapter Configuration for Rotating Resources” on page 34.

We also used the target mode SCSI connection as a serial network.

```

                                Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Adapter IP Label                [hadave1_tm SCSI0]
* Network Type                    [tm SCSI]                +
* Network Name                    [tm1_network]          +
* Network Attribute                serial                    +
* Adapter Function                 service                 +
Adapter Identifier                 [/dev/tm SCSI0]
Adapter Hardware Address           []
Node Name                         [hadave1]                +

```

Make sure that your TMSCSI network is functioning before starting up the cluster manager; you do this by typing:

```

cat < /dev/tm SCSI0.tm on one node and then,
cat > /etc/motd (or any file) > /dev/tm SCSI0.im on the other node

```

This network was dropped when we were doing the concurrent access setup.

4.3.1.3 Synchronize the Cluster

To synchronize the cluster, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Topology**
3. Select: **Synchronize Cluster Topology**

Press **Enter** to synchronize the cluster.

4.3.1.4 Cascading Resources Definition

To define the cascading resources, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Resources**
3. Select: **Define Resource Groups**
4. Select: **Add a Resource Group**

Enter the appropriate data in the entry fields on the Add a Resource Group panels.

```

                                Add a Resource Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Resource Group Name           [dbD1]
* Node Relationship              cascading      +
* Participating Node Names     [hadave1 hadave2]  +

```

```

                                Add a Resource Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Resource Group Name           [dbD2]
* Node Relationship              cascading      +
* Participating Node Names     [hadave1 hadave2]  +

```

4.3.1.5 Cascading Application Servers

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Resources**
3. Select: **Define Application Servers**
4. Select: **Add an Application Server**

Enter the appropriate data in the entry fields on the Add Application Server panels.

```

                                Add Application Server

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Server Name                   [applidb_D1]
* Start Script                   [/usr/HACMP_ANSS/script/start_D1]
* Stop Script                    [/usr/HACMP_ANSS/script/stop_D1]

```

```

Add Application Server

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

* Server Name                [Entry Fields]
                             [appldb_D2]
* Start Script                [/usr/HACMP_ANSS/script/start_D2]
* Stop Script                 [/usr/HACMP_ANSS/script/stop_D2]

```

4.3.1.6 Configuring Cascading Resource Groups

To configure the cascading resource groups, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Resources**
3. Select: **Change/Show Resources for a Resource Group**
4. Select: **either dbD1 or dbD2**

Enter the appropriate data in the entry fields of the Configure a Resource Group panels.

```

Configure a Resource Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

Resource Group Name          [Entry Fields]
                             dbD1
Node Relationship             cascading
Participating Node Names     hadave1 hadave2

Service IP Label              [hadave1]                +
Filesystems                   [/oradatafs1]           +
Filesystems to Export         []                       +
Filesystems to NFS Mount      []                       +
Volume Groups                 []                       +
Concurrent Volume Groups      []                       +
Raw Disk PVIDs                []                       +
Application Servers           [appldb_D1]             +
Miscellaneous Data            []

Inactive Takeover Activated   false                    +
9333 Disk Fencing Activated   false                    +
SSA Disk Fencing Activated    false                    +

```

```

                                Configure a Resource Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
Resource Group Name              dbD2
Node Relationship                 cascading
Participating Node Names        hadave1 hadave2

Service IP Label                 [hadave2]                +
Filesystems                     [/oradataafs2]          +
Filesystems to Export           []                       +
Filesystems to NFS Mount        []                       +
Volume Groups                   []                       +
Concurrent Volume Groups        []                       +
Raw Disk PVIDs                  []                       +
Application Servers              [applidb_D2]           +
Miscellaneous Data              []

Inactive Takeover Activated      false                    +
9333 Disk Fencing Activated      false                    +
SSA Disk Fencing Activated       false                    +

```

4.3.1.7 Synchronize Cluster Resources

To synchronize the cluster resources, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Resources**
3. Select: **Synchronize Cluster Resources**

Press **Enter** to synchronize the cluster.

4.4 Concurrent Configuration for Highly Available Databases

This cluster, consisting of two nodes, was set up in what is called a Concurrent Mode cluster configuration. The cluster was configured as shown in Figure 6.

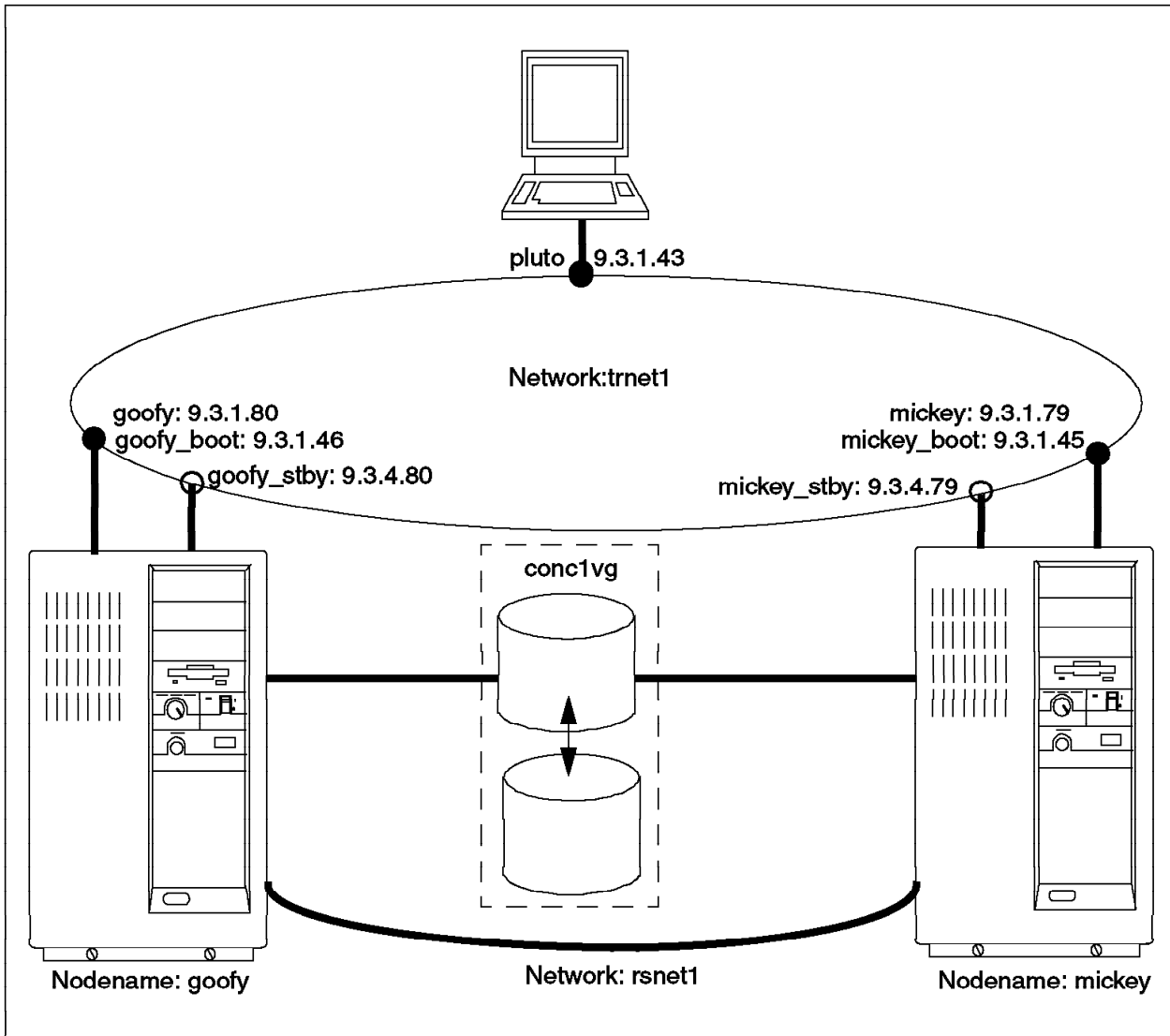


Figure 6. Cluster Configuration for Concurrent Resources

4.4.1 Creating the Concurrent Volume Group

You need to create a shared volume group that can be accessed by all of the nodes in the cluster (in our case, two nodes, mickey and goofy) at the same time.

After having physically connected the disks to all of the nodes, you need to create a volume group that is “concurrent capable”.

You can do this by either using SMIT or the command line.

Enter: `smit mkvg`

Enter the appropriate data in the entry fields on the Add a Volume Group panel.

```

                                Add a Volume Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
VOLUME GROUP name                [conclvg]
Physical partition SIZE in megabytes 4                +
PHYSICAL VOLUME names            [hdisk5 hdisk6]    +
Activate volume group AUTOMATICALLY no                +
    at system restart?
Volume group MAJOR NUMBER        []                +#
Create VG Concurrent Capable?    yes                +
Auto-varyon in Concurrent Mode?  no                +
  
```

You must have your LANG variable set to C POSIX for this SMIT panel to display correctly.

The other alternative is to enter the following on the command line:

```
mkvg -f -y'conclvg' `~n` `~c' hdisk5 hdisk6
```

Next, execute a varyon in nonconcurrent mode in order to create the logical volumes:

```
varyonvg conclvg
```

Create the raw logical volumes that will store your database. An example for the minimum number of raw logical volumes needed to create an Oracle parallel database accessible from two nodes is shown in Figure 7.

ORACLE Object	LV name	ORACLE File Name	Minimum LV size
System tablespace	dblv	/dev/rdblv	32 MB
Rollback tablespace	rollv	/dev/rrollv	4 MB
Temp tablespace	templv	/dev/rtemplv	4 MB
User tablespace	uservlv	/dev/ruservlv	4 MB
Tools tablespace	toollv	/dev/rtoollv	20 MB
Logfile 1 (instance 1)	log1lv	/dev/rlog1lv	4 MB
Logfile 2 (instance 1)	log2lv	/dev/rlog2lv	4 MB
Logfile 3 (instance 1)	log3lv	/dev/rlog3lv	4 MB
Logfile 1 (instance 2)	t2log1	/dev/rt2log1	4 MB
Logfile 2 (instance 2)	t2log2	/dev/rt2log2	4 MB
Logfile 3 (instance 2)	t2log3	/dev/rt2log3	4 MB
Control file 1	c1lv	/dev/rc1lv	4 MB
Control file 2	c2lv	/dev/rc2lv	4 MB
Control file 3	c3lv	/dev/rc3lv	4 MB

Figure 7. Logical Volumes for Concurrent Oracle Access

Instance 2 is the Oracle instance running on the second node. It needs its own log files. The sizes given for the logical volumes are the minimum required to load Oracle and the sample database that comes with it. For more detailed information, please see the Oracle Parallel Server documentation.

Create these logical volumes by using SMIT or the command line.

Enter: smit mklv

```

                                Add a Logical Volume

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
Logical volume NAME                [dblv]
* VOLUME GROUP name                conclvg
* Number of LOGICAL PARTITIONS     [4] #
PHYSICAL VOLUME names              [hdisk5] +
Logical volume TYPE                [raw_lv]
POSITION on physical volume        outer_middle +
RANGE of physical volumes          minimum +
MAXIMUM NUMBER of PHYSICAL VOLUMES
to use for allocation              [] #
Number of COPIES of each logical
partition                          1 +
Mirror Write Consistency?          no +
Allocate each logical partition copy
on a SEPARATE physical volume?     yes +
RELOCATE the logical volume during reorganization? yes +
Logical volume LABEL               []
MAXIMUM NUMBER of LOGICAL PARTITIONS [128]
Enable BAD BLOCK relocation?       no +
SCHEDULING POLICY for writing logical
partition copies                   parallel +
Enable WRITE VERIFY?               no +
File containing ALLOCATION MAP       []
Stripe Size?                       [Not Striped] +

```

NOTE: You must answer no to mirror write consistency and no to bad block relocation.

We entered raw_lv for the logical volume type. If you leave it blank, AIX will set it to the default value, JFS.

or on the command line enter:

```

mklv -y'dblv' -t'raw_lv' -c'2' -w'n' -b'n'
conclvg 1 hdisk5 hdisk6

```

Then create all of the above logical volumes.

When you are finished creating all the logical volumes, you will want to varyoff the volume group to allow it and its definitions to be imported to the other node.

```

varyoffvg conclvg

```

On the OTHER node (goofy in our case), enter:

```
importvg -y conclvg hdisk6  
varyonvg conclvg  
chvg -a n conclvg (make sure that it does not varyon at boot)
```

4.4.2 Concurrent Cluster Description

This cluster has two nodes with the configuration described below:

4.4.2.1 Cluster

To define the cluster, do the following:

Enter: smit hacmp

1. Select: **Cluster Configuration**
2. Select: **Cluster Topology**
3. Select: **Configure Cluster**
4. Select: **Add a Cluster Definition**

Enter the appropriate data in the entry fields on the Add a Cluster Definition panel.

```
                                Add a Cluster Definition  
  
Type or select values in entry fields.  
Press Enter AFTER making all desired changes.  
  
                                [Entry Fields]  
* Cluster ID                    [1]                               #  
* Cluster Name                   [disney]
```

4.4.2.2 Nodes

Add the node definitions for all of the cluster nodes by doing the following:

Enter: smit hacmp

1. Select: **Cluster Configuration**
2. Select: **Cluster Topology**
3. Select: **Configure Nodes**
4. Select: **Add Cluster Nodes**

Enter the appropriate data in the entry fields on the Add Cluster Nodes panels.

```

                                Add Cluster Nodes

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

* Node Names                                [Entry Fields]
                                              [mickey]

```

```

                                Add Cluster Nodes

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

* Node Names                                [Entry Fields]
                                              [goofy]

```

4.4.2.3 Adapter Configuration for Concurrent Resources

Add the definitions of all of the network adapters, including the non-IP networks. We will only show the network adapters being added for one node; you will need to add adapters for all nodes in your cluster.

For concurrent resources, we will define the service, boot, and standby adapters.

To add the adapters, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Topology**
3. Select: **Configure Adapters**
4. Select: **Add an Adapter**

Enter the appropriate data in the entry fields on the Add an Adapter panels.

```

                                Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

* Adapter IP Label                            [Entry Fields]
* Network Type                               [goofy]
* Network Name                               [token] +
* Network Attribute                          [token2] +
* Adapter Function                           public +
Adapter Identifier                           service +
Adapter Hardware Address                     [9.3.1.80]
Node Name                                    [0x42005a4f1111]
                                              [goofy] +

```

```

                                Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Adapter IP Label                [goofy_boot]
* Network Type                    [token]           +
* Network Name                   [token2]          +
* Network Attribute              public                +
* Adapter Function               boot +
Adapter Identifier                [9.3.1.46]
Adapter Hardware Address         []
Node Name                       [goofy]           +

```

```

                                Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Adapter IP Label                [goofy_stby]
* Network Type                    [token]           +
* Network Name                   [token2]          +
* Network Attribute              public                +
* Adapter Function               standby +
Adapter Identifier                [9.3.4.80]
Adapter Hardware Address         []
Node Name                       [goofy]           +

```

We will also add the RS232 network (non-IP).

Make sure that your RS232 network is functioning before starting up the cluster:

```

stty < /dev/tty0 on one node and then,
stty < /dev/tty0 on the other node

```

```

                                Add an Adapter

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Adapter IP Label                [goofy_tty0]
* Network Type                    [rs232]           +
* Network Name                   [rsnet1]          +
* Network Attribute              serial +
* Adapter Function               service +
Adapter Identifier                [/dev/tty0]
Adapter Hardware Address         []
Node Name                       [goofy]           +

```

4.4.2.4 Synchronize the Cluster

To synchronize the cluster, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Topology**
3. Select: **Synchronize Cluster Topology**

Press **Enter** to synchronize the cluster.

4.4.2.5 Concurrent Resource Definition

To define the concurrent resources, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Resources**
3. Select: **Define Resource Groups**
4. Select: **Add a Resource Group**

Enter the appropriate data in the entry fields on the Add a Resource Group panels.

```

                                     Add a Resource Group
Type or select values in entry fields.
Press Enter AFTER making all desired changes.

* Resource Group Name                [Entry Fields]
* Node Relationship                   [db_conc]
* Participating Node Names           concurrent +
                                     [goofy mickey] +

```

Priority is ignored for concurrent resource groups.

We need to add the following two resource groups in the order that the service IP labels are acquired and used as service addresses by participating nodes. They are also used to start and stop the database applications.

```

                                     Add a Resource Group
Type or select values in entry fields.
Press Enter AFTER making all desired changes.

* Resource Group Name                [Entry Fields]
* Node Relationship                   [agoofy_IP]
* Participating Node Names           cascading +
                                     [goofy mickey] +

```

```

                                Add a Resource Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Resource Group Name           [amickey_IP]
* Node Relationship              cascading      +
* Participating Node Names      [mickey goofy]  +

```

4.4.2.6 Concurrent Application Servers

To add concurrent application servers, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Resources**
3. Select: **Define Application Servers**
4. Select: **Add an Application Server**

Enter the appropriate data in the entry fields on the Add Application Server panels.

```

                                Add Application Server

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Server Name                   [applidb1_conc]
* Start Script                  [/usr/HACMP_ANSS/script/start_concDB1]
* Stop Script                   [/usr/HACMP_ANSS/script/stop_concDB1]

```

```

                                Add Application Server

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
* Server Name                   [applidb2_conc]
* Start Script                  [/usr/HACMP_ANSS/script/start_concDB2]
* Stop Script                   [/usr/HACMP_ANSS/script/stop_concDB2]

```

4.4.2.7 Configuring Concurrent Resource Groups

We add three resource groups, one for the concurrent volume group and one each for the IP addresses (which also start and stop the databases).

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Resources**
3. Select: **Change/Show Resources for a Resource Group**

Enter the appropriate data in the entry fields on the Configure a Resource Group panels.

```

                                Configure a Resource Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
Resource Group Name              db_conc
Node Relationship                 concurrent
Participating Node Names        mickey goofy

Service IP Label                 []                +
Filesystems                     []                +
Filesystems to Export           []                +
Filesystems to NFS Mount       []                +
Volume Groups                   []                +
Concurrent Volume Groups       [conclvg]      +
Raw Disk PVIDs                 []                +
Application Servers             []                +
Miscellaneous Data              []

Inactive Takeover Activated     false          +
9333 Disk Fencing Activated     false          +
SSA Disk Fencing Activated     false          +

```

Select: **agoofy_IP**

```

                                Configure a Resource Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
Resource Group Name              agoofy_IP
Node Relationship                 cascading
Participating Node Names        goofy mickey

Service IP Label                 [goofy]      +
Filesystems                     []                +
Filesystems to Export           []                +
Filesystems to NFS Mount       []                +
Volume Groups                   []                +
Concurrent Volume Groups       []                +
Raw Disk PVIDs                 []                +
Application Servers             [applidb2_conc] +
Miscellaneous Data              []

Inactive Takeover Activated     false          +
9333 Disk Fencing Activated     false          +
SSA Disk Fencing Activated     false          +

```

Select: **amickey_IP**

```

                                Configure a Resource Group

Type or select values in entry fields.
Press Enter AFTER making all desired changes.

                                [Entry Fields]
Resource Group Name             amickey_IP
Node Relationship                cascading
Participating Node Names       mickey goofy

Service IP Label                [mickey]           +
Filesystems                    []              +
Filesystems to Export          []              +
Filesystems to NFS Mount      []              +
Volume Groups                  []              +
Concurrent Volume Groups      []              +
Raw Disk PVIDs                []              +
Application Servers            [applldb1_conc] +
Miscellaneous Data             []

Inactive Takeover Activated    false          +
9333 Disk Fencing Activated   false          +
SSA Disk Fencing Activated    false          +

```

4.4.2.8 Synchronize Cluster Resources

To synchronize the cluster resources, do the following:

Enter: `smit hacmp`

1. Select: **Cluster Configuration**
2. Select: **Cluster Resources**
3. Select: **Synchronize Cluster Resources**

Press **Enter** to synchronize the cluster.

4.4.2.9 Starting the Cluster

Before you start the cluster, make sure that the nodes are on their boot IP addresses and that the shared concurrent volume group is varied off. You might have left it varied on after you created your logical volumes. If you do not varyoff the volume group, the startup will fail because the cluster manager will not be able to varyon the volume group in concurrent mode.

Chapter 5. Oracle Nonparallel Database Installation

This chapter outlines the steps involved in installing an Oracle nonparallel database. The database, along with other Oracle selected products, was installed on each node in the sample cluster discussed in the previous chapter.

We begin with planning the installation, which involves selecting the Oracle products for installation and sizing the disk space requirement for those products. We then explain the tasks involved in the installation, which are divided into:

- Preinstallation Tasks
- Installation Tasks
- Postinstallation Tasks

This database installation is a nonparallel database installation. Each of the above tasks was carried out on each node in the cluster. We will show you the work done in node hadave1 and alert you if there were any differences in another node.

5.1 Planning for Oracle Installation

This section describes the planning stages for the Oracle database installation on the sample cluster described in the previous chapter. We show exactly what database products should be installed and how to determine your disk sizing requirement for those selected database products.

5.1.1 Oracle Products Installed

The Oracle products selected for installation on the rotating and cascading cluster configurations are listed below.

1. Oracle Server Products:
 - Oracle7 Server with the Parallel Query option and its dependent products, such as the Oracle Common Libraries and Utilities and Toolkit II.
2. Oracle Tools Products:
 - PL/SQL Release 2.1
 - SQL*Plus Release 3.1
3. Oracle Networking Products:
 - SQL*Net V2.1 with TCP/IP Protocol Adapter

We did not install any CASE products, precompiler products, or Oracle online documentation.

5.1.2 Disk Space Sizing for Selected Oracle Products

After selecting the products listed above, we now must calculate the disk space requirement based on disk space sizing sheets that we described in Chapter 5, "Oracle Nonparallel Database Installation" on page 55 .

Below are the disk space sizing sheets we must fill in including all the products that will be installed on this cluster.

Space Requirements for Oracle Server Products							
Disk Storage Requirements				Memory Space Requirements			
v		Dist.	DB Sp	#1 User	Additional Users		
Use	Product	(MB)	(MB)	(KB)	Users	KB per	Total
v	Oracle Server	36.60	12.5	6458	1	x 489	489
	SQL*DBA			2589	1	x 283	283
	SQL*Loader			1778	1	x 204	204
	Export			1654	1	x 223	223
	Import			1590	1	x 207	207
	Server Manager (Line Mode only)	20.19	N/A	1752		x 221	
	Server Manager (Motif bitmapped & Line Mode)	42.88	N/A	3515		x 364	
	+ Distributed Opt	0.10	N/A				
	+ Parallel Server Opt.	0.08	N/A				
v	+ Parallel Query Opt	0.08	N/A				
v	Toolkit II	43.06	N/A				
v	Oracle Common Lib & Utilities	22.10	N/A				
	Migration Utility	1.85	N/A				
	Oracle Parallel Backup/Restore Util.	30.00	10.0	1024			
		Σ A	Σ B	Σ C			Σ D
	Subtotals =	101.84	12.5	14069			1612
Summary							
A	Tot. Distribution Space (A)	101.84		(MB)			
B	Tot. Database Space (B)	12.50		(MB)			
C	#1 User Memory (C)	14069		(KB)			
D	Additional User Memory (D)	1612		(KB)			
E	Virtual Memory Total (C+D)	15681		(KB)			

Table 15. Disk Sizing Result Sheet for Oracle Server Products

Note: Each product selected for installation is indicated by (v). The total disk space required for each product is written in **bold** type.

Space Requirements for Oracle Tools							
Disk Storage Requirements				Memory Space Requirements			
v		Dist.	DB Sp	#1 User	Additional Users		
Use	Product	(MB)	(MB)	(KB)	Users	KB per	Total
	Easy*SQL						
	Oracle Data Query	17.81	0.4	3424		x 756	
	Oracle*Mail	48.50	N/A	2628		x 362	
	Oracle*Terminal	5.77	N/A	667		x 194	
	PL/SQL 1.0		N/A				
v	PL/SQL 2.0	0.28	N/A				
	SQL*Calc	2.99	N/A				
v	Oracle Toolkit I	1.29	N/A				
	Oracle XA Library	0.15	N/A				
	SQL*Forms V3.0	24.99	1.2				
	Design (Char Mode)			4614		x 1034	
	Runtime (Char Mode)			3511		x 710	
	SQL*Menu V5.0	21.84	0.8				
	Design (Char Mode)			4388		x 998	
	Runtime (Char Mode)			3565		x 760	
v	SQL*Plus	5.65	0.6	3472	1	x 778	778
	SQL*QMX	2.97					
	SQL*Report	2.37	N/A				
	rpt			1748		x 230	
	rpf			46		x 9	
	SQL*ReportWriter	2.37	N/A				
	Design			2642		x 230	
	Runtime			2424		x 302	
		Σ A	Σ B	Σ C			Σ D
	Subtotals =	7.22	0.6	3472			778
Summary							
A	Tot. Distribution Space (A)		7.22	(MB)			
B	Tot. Database Space (B)		0.60	(MB)			
C	#1 User Memory (C)		3472	(KB)			
D	Additional User Memory (D)		778	(KB)			
E	Virtual Memory Total (C+D)		4250	(KB)			

Table 16. Disk Sizing Result Sheet for Oracle Tools Products

Note: Each product selected for installation is indicated by (v). The total disk space required for each product is written in **bold** type.

Space Requirements for Oracle Networking Products							
Disk Storage Requirements				Memory Space Requirements			
v		Dist.	DB Sp	#1 User	Additional Users		
Use	Product	(MB)	(MB)	(KB)	Users	KB per	Total
SQL*Net V1:							
	SQL*Net Async	0.27	N/A				
	SQL*Net DECnet	0.12	N/A				
	SQL*Net LU6.2	0.13	N/A				
	SQL*Net SPX/IPX	2.55	N/A				
	SQL*Net Named Pipes		N/A				
	SQL*Net TCP/IP	0.32	N/A				
SQL*Net V2:							
v	SQL*Net V2	35.59	0.2				
	TNS Listener			1183	1	x 176	176
	DECnet	0.12	N/A				
	LU6.2	0.14	N/A	7		x 2	
	OSI	0.16	N/A				
	SPX/IPX	4.51	N/A	695		x 152	
	Names Server	3.93	N/A	1806		x 215	
v	TCP/IP	0.12	N/A				
	Interchange	5.81	N/A				
	Network Manager	22.51	N/A	3266		x 323	
	Interchange Control Utility			1260		x 169	
	Interchange Listener			1224		x 168	
	Navigator			1187		x 168	
	Configuration Tool	N/A	0.2				
		ΣA	ΣB	ΣC			ΣD
	Subtotals =	35.71	0.20	1183			176
Summary							
A	Tot. Distribution Space (A)		35.71				(MB)
B	Tot. Database Space (B)		0.20				(MB)
C	#1 User Memory (C)			1183			(KB)
D	Additional User Memory (D)			176			(KB)
E	Virtual Memory Total (C+D)			1359			(KB)

Table 17. Disk Sizing Result Sheet for Oracle Networking Products

Note: Each product selected for installation is indicated by **(v)**. The total disk space required for each product is written in **bold** type.

After completing the calculations on these sizing sheets, we must fill in the **A**, **B**, and **E** totals from the individual sheets above into the final calculation sheet shown below.

Total Space Requirements (MB)			
Transfer Table	Disk Space (A)	Database Space (B)	Virtual Memory (E)
Oracle Server Products	101.84	12.5	15.68
Precompiler Products: Development Cycle			
Precompiler Products: User Cycle	n/a	n/a	
Oracle Networking Products	35.71	0.2	1.36
Oracle Tools Products	7.22	0.6	4.25
Oracle Online Documentation		n/a	n/a
Additional installation space for files generated during installation	+ 21.00	n/a	n/a
Temporary space for relinking	40.00	n/a	n/a
TOTALS	205.77	13.3	21.29

Table 18. Total Disk Sizing Result Sheet

Note: From the above Total Disk Space Sizing Summary sheet, we can estimate that the minimum space for those selected products for nonparallel database installation on the first sample cluster is about 250 MB.

5.2 Preinstallation Tasks

The preinstallation tasks involve deciding where to put the database failure and recovery files, creating the Oracle group and user, and defining a number of Oracle environmental variables.

The work is carried out either by root or by the newly created Oracle user.

5.2.1 Preinstallation Considerations

You will need to decide a number of things before beginning the installation process.

ORACLE_HOME—This is an Oracle environmental variable that contains the full path name of the Oracle Server system home directory.

ORACLE_SID—This is the Oracle Server system identifier. The ORACLE_SID (or sid as it is commonly known) appears in the names of certain control files (for example, initsid.ora).

The two variables above uniquely identify each Oracle database. Two instances running on one machine may have the same ORACLE_HOME, but must have different ORACLE_SID's.

You must also put the following files on the external (shared) disks:

- Database files
These files will contain your database and will have the extension .dbf.
- Log files
There will be a minimum of two log files, `logsid.dbf` and `log2sid.dbf`.
- Control files
There will be three control files: `cntrl1sid.ctl`, `cntrl2sid.ctl` and `cntrl3sid.ctl`.
- Configuration files as well as the temporary and rollback segments
These segments should be placed in their own tablespaces in order to avoid fragmenting other tablespaces.

Below are the procedures for preinstallation tasks that must be performed by root and by the Oracle software owner.

5.2.2 Preinstallation Tasks Performed by root

This section provides instructions for preinstallation tasks performed as root on both nodes in the cluster.

Tasks Performed as root
1. Check for free disk space
2. Check for hardware and software requirements
3. Prepare for relinking
4. Set kernel parameters
5. Create dba group
6. Create Oracle software owner login
7. Create <code>ORACLE_HOME</code> directory
8. Create a local bin directory

Figure 8. Preinstallation Tasks Performed as root for Nonparallel Databases

5.2.2.1 Check for Free Disk Space

We reviewed the disk space requirement for this cluster and made sure there was enough space for installation as described in the previous section.

5.2.2.2 Check for Hardware and Software Requirements

Review the hardware and software requirements for the Oracle7 server as well as for other Oracle products for your installation in Chapter 3 of this book.

For example: Make sure that the installed network is already working properly and tested to ensure it is functioning in the cluster environment.

5.2.2.3 Prepare for Relinking

Relinking relies on operating system facilities. The following required facilities must be installed and usable before you can perform relinking successfully:

- A `/tmp` directory with sufficient space on your system. Relinking creates temporary files in `/tmp`.
- The loader, `ld`
- The following utilities:

- make
- ar, the library manipulation utilities
- The following system libraries:
 - Networking libraries
 - X libraries (if you will install X-based products, including CASE)
 - Motif libraries (if you will install Motif-based products)

5.2.2.4 Create the dba Group

As root, at the command prompt, type:

```
smitty group
```

Select **Add a group** from the menu; then type in the group name and group ID, and then press **Enter**.

Below are the parameters we put in for both nodes in this sample cluster configuration:

```
group name = dba
```

```
group id   = 201
```

5.2.2.5 Create the Oracle Software Owner Login

Create an Oracle software owner login on both nodes, hadave1 and hadave2, with the following properties:

```
login name oracle
```

```
UID number A number between 3 and 32767 (in our case we set the UID=
          210)
```

```
default GID number A number between 3 and 32767 (in our case we set the
          UID= 201), corresponding to the dba group
```

```
home directory /home/oracle
```

```
login shell /bin/ksh
```

Oracle Software Owner Privileges: The Oracle software owner has two special privileges that other members of the dba group do not have:

- Ability to change the ownership or mode of an Oracle Server file
- Ability to write to mode 755 database files and directories

Master DBA: Because the properly installed Oracle system database files never need ownership or mode adjustment, there is no need to log in as oracle except at installation, patch, or upgrade time. So, it is important that only the site's master DBA have access to the oracle account.

5.2.2.6 Create the ORACLE_HOME Directory

As root, create ORACLE_HOME in this sample configuration as /home/oracle by entering the following command:

```
# mkdir /home/oracle
# chown oracle.dba /home/oracle
# chmod 755 /home/oracle
```

Note: For this sample configuration, we installed the Oracle code on each machine in the cluster. In order to avoid having a large /home/oracle, we created a filesystem, /dev/orastuff, and mounted it over /home/oracle.

5.2.2.7 Create a Local bin Directory

Check if this local bin directory already exists. If not, you must create this directory in order to allow every user to execute from it. At the prompt, type:

```
# mkdir /usr/lbin  
# chmod 777 /usr/lbin
```

5.2.3 Preinstallation Tasks Performed as the Oracle Software Owner

This section provides instructions for tasks performed as the Oracle software owner for all preinstallations on both nodes in the cluster.

Tasks Performed as Oracle Software Owner
1. Set environment variables

Figure 9. Preinstallation Tasks Performed as oracle for Nonparallel Databases

5.2.3.1 Set the Environment Variables

The following environment variables must be set in the Oracle software owner's environment. Below is the basic Oracle user environment.

To set the variables, log in as *oracle*, and then issue the following commands:

- `umask 022`
- `vi .profile`

Enter the following variables with your site-specific values (we show ours for the sample cluster configuration here):

```
ORACLE_HOME=/home/oracle; export $ORACLE_HOME  
ORACLE_SID=D1; export $ORACLE_SID  
ORACLE_TERM=1ft; export $ORACLE_TERM  
PATH=$ORACLE_HOME/bin:/usr/lbin:/usr/local/bin; export $PATH
```

Note: For node hadave2, we set the `ORACLE_SID=D2`.

5.2.4 Preinstallation Tasks for the Selected Products

As described in the previous chapter, we need to install the Oracle Tools, such as PL/SQL V2.0, SQL*Plus V3.1, and the Oracle Networking product called SQL*Net V2, for this cluster. For most Oracle Tools, there are no preinstallation tasks to be done, except for the SQL*Net V2 with TCP/IP Protocol Adapter.

Complete the following tasks before installing SQL*Net with TCP/IP Protocol Adapter:

1. Verify that the network is functioning properly by doing a file transfer with FTP or by using telnet to log into a remote system.
2. Verify that you have a listener entry in the `/etc/services` file. This service must be reserved for your SQL*Net V2 listener, and usually, the port is 1521. If your system is not preconfigured with this entry, go to the `etc/services` file and add the following line:

```
listener 1521/tcp oracle
```

where `listener` is the name of this particular listener, as set in the `listener.ora` and `sqlnet.ora` files. See Appendix C, “Oracle Configuration Files for Cascading Resources” on page 127, for the `listener.ora` and `sqlnet.ora` files for this sample configuration.

5.3 Installation Tasks

This section guides you through the installation of the Oracle database. There are two kinds of media upon which the Oracle software resides, tape and CD-ROM. We received our Oracle release on a CD-ROM. You might have it on a tape, in which case, you should refer to the “*Installation*” chapter in the *Oracle7 for AIX-Based Systems, Installation and Configuration Guide*.

5.3.1 Loading the Installer from the Distribution Media

1. Log into the `oracle` account and then `su` to `root`

```
login: oracle
passwd: <passwd>
$ su root
passwd: <passwd>
#
```

2. Create a directory for mounting the CD-ROM, and set the permissions to make it accessible by all users by entering the following command:

```
# mkdir /cdrom
```

Note: `/cdrom` is an example for this sample cluster CD-ROM mount point.

```
# chmod 777 /cdrom
```

3. Create the Oracle link directory, and set permissions to make it accessible by all users by entering the following commands:

```
# cd /home/oracle
# mkdir stage
```

Note: `stage` is an example for this sample configuration Oracle link directory, from which we link the CD-ROM and the staging area for this installation.

```
# chmod 777 stage
```

Attention: You must make sure you have already calculated your space requirement and have enough space in /home/oracle for your ORACLE_HOME directory.

4. Mount the CD-ROM, and exit the superuser account by entering the following commands:

```
# mount -rv cdrfs /dev/cd0 /cdrom
# exit
$
```

Your CD-ROM is now mounted on /cdrom.

Note: You must have superuser privileges to mount or umount the CD-ROM. Be sure to umount the CD-ROM before removing the CD-ROM from the drive.

5. Change directory to the CD-ROM directory:

```
$ cd /cdrom/orainst
```

6. Run the start-up script:

```
$ ./start.sh
```

When prompted, enter the name of the directory you wish to link to: /home/oracle/stage. The start.sh script provides links from UNIX filenames in the /stage to the ISO 9660 format filenames on the CD-ROM.

5.3.2 Running the rootpre.sh Script

Log in as root, and change to the /home/oracle/stage/orainst directory:

```
$ su root
```

```
passwd: <password>
```

```
#cd /home/oracle/stage/orainst
```

Run rootpre.sh, and exit the root account:

```
# ./rootpre.sh
# exit
$
```

Attention: You may need to export your environment variables as root by using the export command to make sure your ORACLE_HOME, ORACLE_SID, and ORACLE_TERM are already set.

Note: For Oracle Parallel Server, you must run rootpre.sh on all nodes. During the installation, you will be prompted for the names of additional nodes. If rootpre.sh has not been run on those nodes, the Installer copies the script into the remote \$ORACLE-HOME/orainst directory and prompts you to continue with the installation after running this script on the remote nodes.

When you run the rootpre.sh script, it will automatically add three lines in your /etc/inittab file:

```
orapw:2:wait:/etc/loadext /etc/pw-syscall4.1
orakx:2:wait:/etc/loadext /etc/adspc4.1
orakx2:2:wait:/etc/adspcinit
```

That's why after you run the rootpre.sh, you may need to reboot your system, or you can run the three initial scripts as root by typing:

```
# /etc/loadext /etc/pw-syscall4.1
# /etc/loadext /etc/adspc4.1
# /etc/adspcinit
```

5.3.3 Running the Installer

Perform the following steps to start the Installer.

You should still be logged into the *oracle* account and be in the */home/oracle/stage/orainst* directory.

Invoke the Installer by entering the following command:

```
$ ./orainst
```

This performs the necessary setup operations for the Installer, and then invokes the Installer for you.

Note: After you have started the Installer, you are asked if you have run *rootpre.sh*. If you have already run the script, answer Yes to the prompt, and proceed with the installation. If you did not run this script, you must exit the Installer and run *rootpre.sh* before proceeding with the installation.

Note: You can see your installation's log by typing the following command in another window or terminal:

```
# tail -f /home/oracle/orainst/install.log
```

5.3.4 Entering the ORACLE_HOME Pathname

You must define the *ORACLE_HOME* environment variable prior to starting the Installer. The value you specify in your environment will be displayed as the default in the following Installer prompt:

Enter the pathname of your *ORACLE_HOME* directory:

The *ORACLE_HOME* pathname defines where the Oracle software will be installed. For this sample configuration, the pathname is */home/oracle*.

5.3.5 Entering the Oracle Software Owner's Name

In the "Preinstallation" section, you created a user account to own the Oracle software you are installing. This user must be a member of the *dba* group, and is referred to as the Oracle software owner in this document. The Installer will prompt you with the following:

Enter the name of the Oracle owner:

You will enter the name of the Oracle owner: *oracle*

The default value presented at the prompt is based on the environment setup that was determined by you when you performed the preinstallation tasks.

If the default value is already true according to your setup, then just press **Enter**, and continue to the next step.

5.3.6 Choosing the Installer Action

After you have provided the information to the initial Installer prompts, the Install Action screen will be displayed.

For a standard, first-time installation, select the **COMPLETE SOFTWARE/DATABASE FRESH INSTALL**. This option will install the product software and create database objects for the selected products that you want to install. By now, you see that the Installer will prompt you for several parameters that you have to specify.

In this sample configuration, we only chose Oracle Server and SQL*Plus. After the Oracle Server was running well, we installed the SQL*Net for Servers and Clients.

5.3.7 Specifying Parameters to the Installer

After you have chosen the products you want for installation, the Installer will prompt for several parameters:

5.3.7.1 Specify the Database Instance Name

You must pay attention to the default value that the Installer prompts. The default value must match your ORACLE_SID setup in the Oracle user environment or profile. If it does not, you must enter the value according to your setup.

For this sample configuration, the value is D1 on node hadave1 and D2 on node hadave2.

5.3.7.2 Specify National Language Support (NLS)

The Installer allows you to specify a language in which to receive screen messages for those utilities that support NLS.

If you are licensed to use the multilingual option, just select **ALL LANGUAGES**.

For this sample configuration, the value is ALL LANGUAGES.

5.3.7.3 Relink Option

The Installer offers you the option to relink the executables with the following prompt:

Would you like to relink Oracle Product executables? By default, the Installer will not relink any product executables, with the exception of the Oracle Server, which is relinked automatically if necessary.

For Patch installations, relinking executables is required.

The default is No.

You might want to chose Yes so all your selected products' executables will be relinked automatically.

In this sample configuration, we chose Yes for the relink option.

Refer to the "Overview of Installation" chapter in the *Oracle Server for AIX-Based Installation and Configuration Guide*.

5.3.7.4 Install Port-Specific Online Documentation

For installing Oracle documentation, please refer to the Oracle manual for the specific option.

5.3.8 Selecting Products for Installation

By now, you see that the Installer prompts you with the list of Oracle products that reside on your distribution media (tape or CD).

Use the arrow keys to scroll to, and the space bar to select, one or more Oracle products that you want to install.

After you have chosen the products, use the Tab key to navigate to the (Install) button and press **Enter** or **Return** to activate the installation phase.

Note: For the cluster DAVE sample configuration, we only chose Oracle Server and SQL*Plus with the Parallel Query Option, and the SQL*Net V2 with TCP/IP Protocol Adapter.

Watch the installation proceed and answer:

- Database-creation prompts
- Product-installation prompts

5.3.9 Database Creation Prompts

The following information shows you how to answer the prompt for database creation made by the Installer.

5.3.9.1 Name the Database

You are prompted for a database name as follows:

Enter the database name for the ORACLE_SID database:

The default value is the same value you previously entered for the ORACLE_SID instance name prompt.

5.3.9.2 Select the Character Set

You can choose a character set as listed from the Installer's prompt:

The default value is US7ASCII.

5.3.9.3 Enter the Password for the SYSTEM User

You will see this prompt from the Installer:

Please enter the password for the 'SYSTEM' Oracle userid:

By default, the password is manager, but you can enter the password for this administration user for security purposes.

5.3.9.4 Enter the Password for the SYS User

You will see this prompt from the Installer:

Please enter the password for the 'SYS' Oracle userid:

Just as for the SYSTEM user, you can also enter the password for this user for security purposes.

Note: The SYSTEM and SYS users are automatically created for you when you install Oracle Server. These users have dba privileges.

5.3.9.5 Enable Connect Internal

If you choose to create your database using the Installer, you are prompted to enable Connect Internal for the dba and operator users as follows:

```
Would you like to (1) set the passwords for the internal users (viz.,
'dba' and 'operator') and (2) enable/disable remote connect internal? No
```

The default is No, but if you want to set passwords for these two internal users, allowing them to Connect Internal without passwords, then you must choose Yes.

5.3.9.6 Name Control Files

You will be prompted with the message below:

```
Do you want to use the following files as control files?:
```

```
$ORACLE_HOME/dbs/ctr11.sid.ctl
$ORACLE_HOME/dbs/ctr12.sid.ctl
$ORACLE_HOME/dbs/ctr13.sid.ctl
```

By default, all three control files are located in one place. The \$ORACLE_HOME in the prompted menu is the Oracle home directory that you created during the preinstallation tasks. In this sample configuration, the home directory is /home/oracle. The **sid** is the variable that you set for your database name or your ORACLE_SID, and in our example, it was D1 for hadave1 and D2 for hadave2.

Note: We suggest that in HACMP environment, you put these three control files in the external shared disk. This will protect from a node failure so that Oracle can be started with its own control files. In this sample configuration, we put the control files in the /oradatads1/ora_ctl directory for node hadave1 and in the /oradatafs2/ora_ctl directory for node hadave2.

If you decide to put these files in the external shared disk, then you must choose NO; the Installer will prompt you to enter the place where you want to put these three files.

5.3.9.7 Name and Size Redo Log Files

After the name of control files, you are prompted for the names and sizes of your redo log files as follows:

The following are the default file names and sizes which will be used to create the new database. Select (OK) to continue to the next screen of default files:

```
LOG1 (500k): ORACLE_HOME/dbs/log1.sid.dbf
LOG2 (500k): ORACLE_HOME/dbs/log2.sid.dbf
LOG3 (500k): ORACLE_HOME/dbs/log3.sid.dbf
```

By default, all three redo log files are located in one place. The \$ORACLE_HOME in the prompted menu is the Oracle home directory that you created during the preinstallation tasks. In this sample configuration, the home directory is /home/oracle. The **sid** is the variable that you set for your database name or your ORACLE_SID, and in our example, it was D1 for hadave1 and D2 for hadave2.

Note: We suggest that in an HACMP environment, you put these three redo log files in the external shared disk. This will protect from a node failure so that Oracle can be started with its own redo log files. In this sample configuration, we put the control files in the /oradatads1/ora_ctl directory for node hadave1 and in the /oradatafs2/ora_ctl directory for node hadave2.

If you decide to put these files in the external shared disk, then you must not choose OK; the Installer will prompt you to enter the place where you want to put these three files.

5.3.9.8 Name and Size Data Files

Next you are prompted for the names and sizes of your data files as follows:

The following are the default file names and sizes which will be used to create the new database. Select (OK) to continue to the next screen of default files:

```
SYSTEM (25M) : ORACLE_HOME/dbs/systdb_name.dbf
ROLLBACK (4M) : ORACLE_HOME/dbs/rbsdb_name.dbf
TEMP (550k) : ORACLE_HOME/dbs/tempdb_name.dbf
USERS (1M) : ORACLE_HOME/dbs/usrd_name.dbf
TOOLS (15M) : ORACLE_HOME/dbs/toold_name.dbf
```

By default, all these data files are located in one place. The \$ORACLE_HOME in the prompted menu is the Oracle home directory that you have created during the preinstallation tasks. In this sample configuration, it is /home/oracle. The *db_name* is the variable you set for your database name or your ORACLE_SID, and in our example, it was D1 for hadave1 and D2 for hadave2.

Note: We suggest that in an HACMP environment, you put these data files in the external shared disk. This will protect from a node failure so that Oracle can be started with its own data files. In this sample configuration, we put the data files in the /oradatads1/ora_ctl directory for node hadave1 and in the /oradatafs2/ora_ctl directory for node hadave2.

If you decide to put these files in the external shared disk, then you must not choose OK; the Installer will prompt you to enter the place where you want to put these data files.

Note: If you want to change the sizes of these data files, please refer to the table below for the recommended sizes of data files.

Default Data File	Default Size	Minimum Size
\$ORACLE_HOME/dbs/systdb_name.dbf	25 MB	5 MB
\$ORACLE_HOME/dbs/rbsdb_name.dbf	4 MB	1400 KB
\$ORACLE_HOME/dbs/tempdb_name.dbf	550 KB	260 KB
\$ORACLE_HOME/dbs/toold_name.dbf	15 MB	1 MB
\$ORACLE_HOME/dbs/usrd_name.dbf	1 MB	200 KB

Table 19. Recommended Sizes Database File Sizes

5.3.10 Product Installation Prompts

If you choose optional products you want to install (for example, in this configuration, we chose SQL*Plus V2), you are prompted for these by the Installer. For complete information about the product installation prompts, see the *Oracle Server7 for AIX-Based Installation and Configuration Guide*.

Below is the product-installation prompt for this sample cluster installation.

SQL*Plus v3.1:

Would you like to load the SQL*Plus Help Facility? Yes

Answer Yes if you need the Help Facility and can spare the disk space.

Also, you will be asked to respond to the prompt below:

Would you like to load the SQL*Plus Demo tables? Yes

Answer Yes if you want the demo database tables and can spare the disk space.

SQL*Net v2:

The SQL*Net V2 listener (tnslsnr) must be setuid root if it is to support SQL*Net v1 database links through a SQL*Net v2 connection.

Would you like to setuid tnslnsr to root? No

The SQL*Net v2 listener must be shut down before upgrading. Select YES if you have shut down the listener from another terminal/window. Select NO to abort installation in order to stop the listener. Yes

Would you like to install the SQL*Net Network Manager tables in your database? No

5.4 Postinstallation Tasks

This section will guide you through the postinstallation procedures of the Oracle Nonparallel Database for this sample cluster. For the complete information, please refer to the “*Post-Installation*” chapter from the *Oracle7 for AIX-Based Systems, Installation and Configuration Guide*.

The tasks covered in this section are:

1. Tasks performed as root
2. Tasks performed as Oracle owner
3. Tasks performed for other selected Oracle products, such as SQL*Net

At the end of successful installation, you should receive a prompt confirming that all requested actions have been performed. You can check your log file for any possible errors that might have occurred during the installation. For information about error messages and codes, please refer to the *Oracle7 Server Messages and Codes Manual*.

5.4.1 Tasks Performed as root

The following figure lists the tasks performed as root at postinstallation time on both nodes in the cluster.

Tasks Performed as root
1. Run the root.sh script
2. Verify database security and integrity
3. Create Oracle Server user logins

Figure 10. Postinstallation Tasks Performed as root for Nonparallel Databases

5.4.1.1 Run the root.sh Script

The Installer creates a root.sh file, and for each component of the software you install, there is a corresponding piece in the root.sh script. The root.sh must be run by the root user when you have completed a successful installation. This shell script sets the necessary permissions for certain Oracle products.

- Log in as root.

```
$ su root
```

```
passwd: <password>
```

- If you are not already there, change directories to your \$ORACLE_HOME/orainst.

The Installer creates the root.sh script in the \$ORACLE_HOME/orainst directory.

- Run the root.sh script.

To run root.sh, enter the following:

```
# sh ./root.sh
```

The output of the root.sh script will be something like the following example:

```
Running ORACLE7 root.sh script...
The following environment variables are set as :
ORACLE_OWNER= oracle
ORACLE_HOME= ORACLE_HOME
ORACLE_SID= sid
Are these settings correct (Y/N)? [Y]:
Enter the full pathname of the local bin directory [/usr/bin]:
Checking for "oracle" user id...
Replacing existing entry for sid in /etc/oratab
The previous entry is now a comment.
ORACLE7 root.sh execution completed.
Setting orasrv file protections
....
```

Depending on which products you have selected to install, messages are displayed to alert you to the progress of the root.sh actions.

Attention: Because you login as root, you may have to set your ORACLE_HOME, ORACLE_SID, and ORACLE_OWNER variables by issuing the following commands on the command line according to your environment. Below are the commands we issued for the sample configuration:

```
# ORACLE_OWNER= oracle ; export ORACLE_OWNER
# ORACLE_HOME= /home/oracle ; export ORACLE_OWNER
# ORACLE_SID= D1 ; export
```

Note: D1 is the ORACLE_SID for node hadave1 and D2 is the ORACLE_SID for hadave2.

5.4.1.2 Verify Database Security and Integrity

To maintain integrity of the Oracle code, all executables in the \$ORACLE_HOME/bin directory must be writable by the Oracle owner only.

You must verify that these files have file modes 751 or 755. Also, to maintain discretionary access to data, all databases, redo log and control files that may be put in the external disks must be readable by the Oracle owner and group only, including the root user for highly available purposes.

5.4.1.3 Create Oracle Server User Logins

For each Oracle user, create a login with the following properties:

Login name the user's username

UID number number between 3 and 32767

Default GID number between 3 and 32767 not the dba group

Home directory /home/oracle

Login shell /bin/ksh

5.4.2 Tasks Performed as the Oracle Software Owner

The following figure lists the tasks performed as the Oracle software owner for postinstallations on both nodes in the cluster.

Tasks Performed as oracle
1. Verify your <i>oratab</i> file

Figure 11. Postinstallation Tasks Performed as oracle for Nonparallel Databases

5.4.2.1 Verify Your oratab File

- Log in as oracle
- See the /etc/oratab file that was created by the Installer after you ran root.sh file as root.

The format of the /etc/oratab file is:

```
ORACLE_SID:ORACLE_HOME:[Y/N]
```

Make sure the ORACLE_SID and ORACLE_HOME match with your setup created during the preinstallation tasks.

The [Y/N] field indicates whether you want to activate the dbstart and dbshut commands for your configuration.

Note: In this sample configuration, we edited the third field to Y, so the cluster manager will activate the database startup and shutdown in the cluster configuration.

5.4.3 Tasks Performed for Other Selected Oracle Products

Below, we show you the postinstallation tasks for SQL*Net V2 with TCP/IP Protocol Adapter. For complete information about postinstallation tasks for other Oracle products, such as Oracle CASE, and the precompiler, refer to the *“Post-Installation Tasks for Oracle Products”* chapter in the *Oracle7 for AIX-Based Systems, Installation and Configuration Guide*.

As Oracle software owner, you must make several configuration files for the listener of SQL*Net to work properly.

There are two configuration files for this sample cluster; those files are listener.ora and tnsnames.ora. For complete information about the configuration files for SQL*Net in Server and Client, please refer to the *SQL*Net Administrator’s Guide*. These two files must be placed in the right directory, depending on whether you have set up your TNS_ADMIN directory in your user environment or not. If you have set your TNS_ADMIN directory to a specific directory, for example /home/oracle/tns_admin, after you edit those two files, you must put them into the /home/oracle/tns_admin directory. If you did not set up the TNS_ADMIN directory to a specific directory, then you must put those files into the /etc directory after you have make them.

Login as oracle, and then edit listener.ora:

```
$ cd TNS_NAMES  
$ vi listener.ora
```

After you have finished with the listener.ora file, then you have to make the tnsnames.ora file:

```
$ vi tnsnames.ora
```

You can see the listener.ora and tnsnames.ora files for this sample cluster configuration in C.1.4, “File: /home/oracle/tns_admin/listener.ora” on page 130 and C.1.5, “File: /home/oracle/tns_admin/tnsnames.ora” on page 131.

Chapter 6. Client Installation and Setup

In Figure 4 on page 32, we see that there is a client called pluto that connects to the cluster. This client needs to access the database that resides in nodes or servers in the cluster. Also, the client must be able to access the highly available database so that whenever something happens that results in a node failure between the two nodes in the cluster, this client will still be able to access the database.

This chapter describes how to prepare the client in the two sample clusters that we discussed in the previous chapters. The topics here include:

- Client/server configuration
- Client software
- Client installation tasks and setup

6.1 Client/Server Configuration

There are three types of client/server configurations in the relational database environment, and the differences between these three configurations are based on three main issues:

- The location of the database server software
- The location of the tools software
- The location of the database objects

We will discuss the three types of client/server configurations, and then describe the specific client used in this redbook.

6.1.1 Configuration A

In this configuration, all the software (server and tools) is on the server. The database objects for the server and tools are also created on the server.

The client only has a copy of the tools software; it accesses the server through database networking software, such as SQL*Net.

The database objects have already been installed by the server installation.

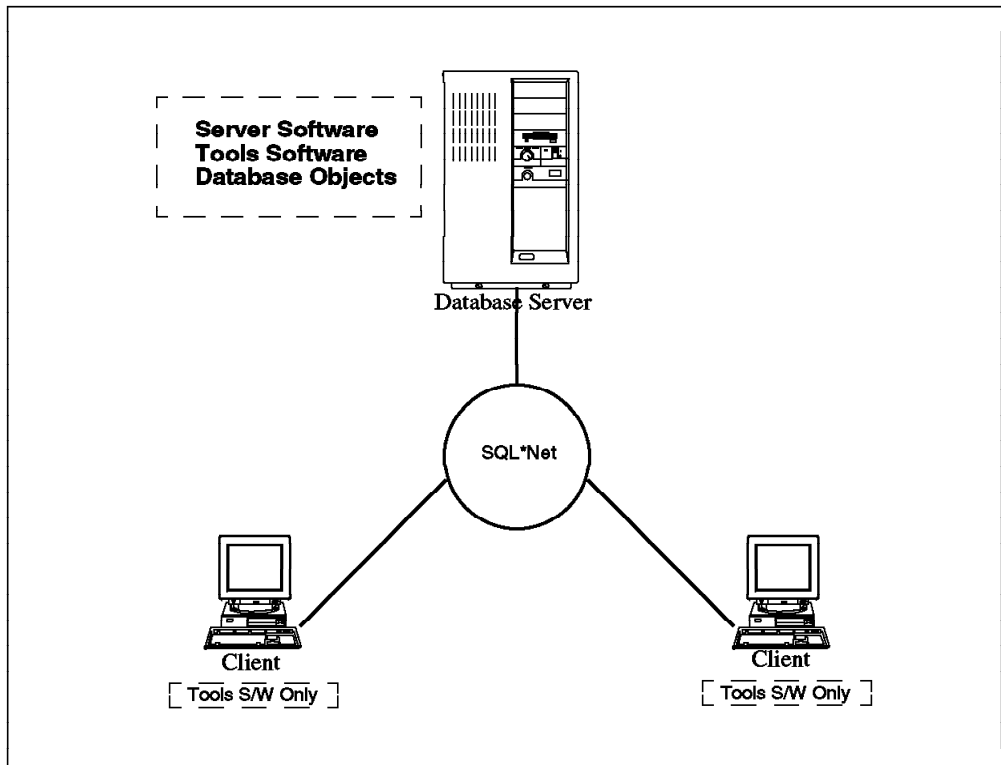


Figure 12. Configuration A

For this kind of configuration, the client only needs the tools and the database networking software installed.

6.1.2 Configuration B

In the second configuration, all the software (server and tools) is on the server. The database objects for the server and tools are also created on the server.

The client is NFS-mounted to the server's \$ORACLE_HOME directory, and therefore, there is no software installed on the client.

In this kind of client/server configuration, the workload of the server is very high, and a configuration such as this can work only if the server and the client have the same operating system.

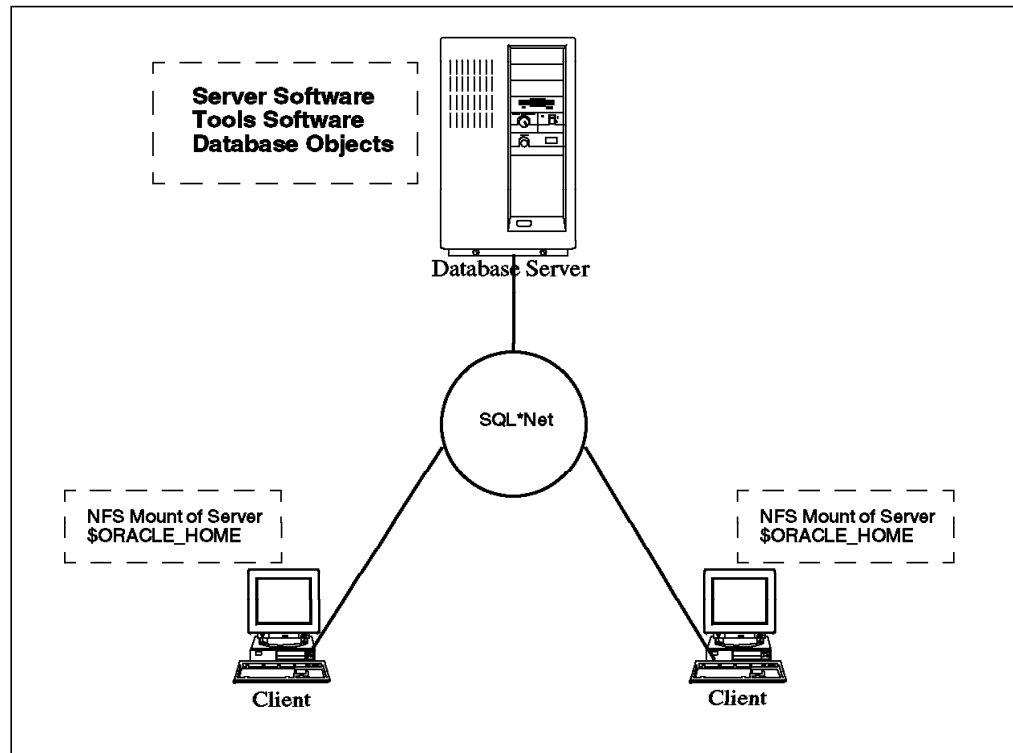


Figure 13. Configuration B

For this kind of configuration, we only need to set up NFS for the client so it can mount the server \$ORACLE_HOME directory.

6.1.3 Configuration C

In the third configuration, the database server software is on the server, and the database objects for the server are created on the server.

The client has all the tools software, and the database objects for these tools are created on the server by using SQL*Net.

The basic steps for this kind of client/server configuration are listed below:

1. Install the database server software and create database objects on the server using the **Complete SW/DB Fresh Install** option from the Installer menu.
2. Start the database server and then:
 - Configure listener.ora and tnsnames.ora files on the server
 - Copy the tnsnames.ora file to the client
3. Install the database tools software on the client using the **Install/Upgrade/Patch Software Only** option from the Installer menu.
4. Create database objects for these tools on the server using the **Create New DB Object** option from the Installer menu. And remember that you must create these objects for the tools by using SQL*Net.

Note: For more information about configuring SQL*Net files, please refer to the SQL*Net documentation.

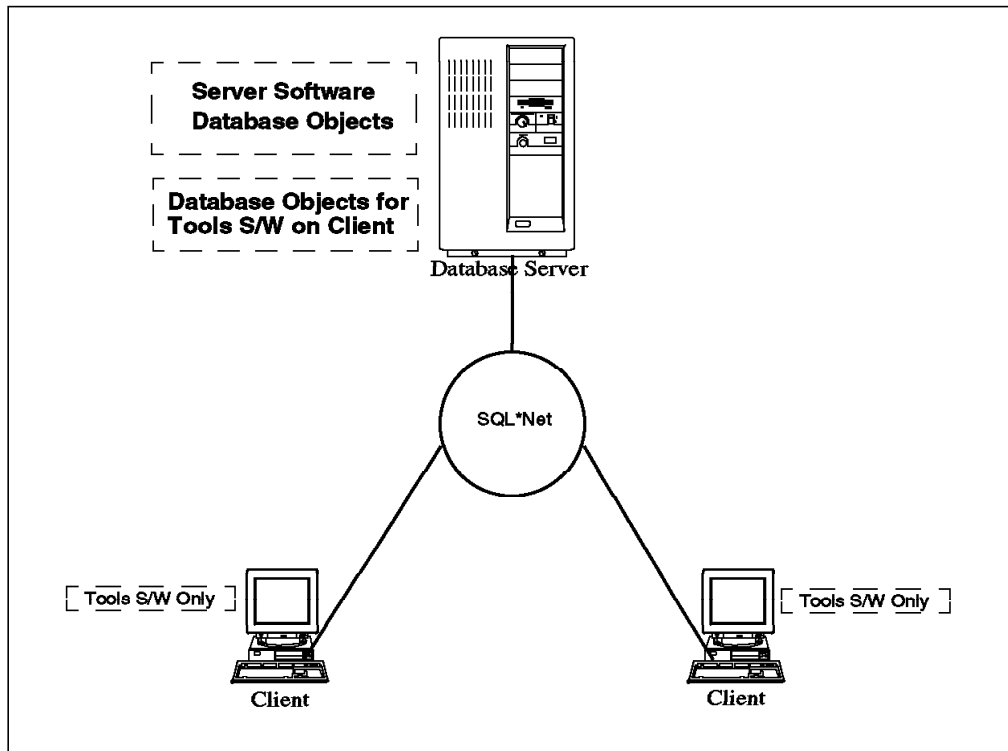


Figure 14. Configuration C

We only used configuration A for testing our highly available database.

The client used for this sample is a RISC System/6000 workstation with the AIX Version 4.1.4 operating system. It has a token-ring adapter that has been set up for TCP/IP connection to the network where both clusters reside.

The important things involved in preparation of this client, which we don't discuss here, are listed below:

1. Installing the AIX Version 4.1.4 operating system
2. Setting up TCP/IP for the token-ring adapter, including setting the hostname= pluto and IP address= 9.3.1.43 for this client

After preparing the client as stated above, the following software for this client should be installed:

- SQL*Plus
- SQL*Net V2.1 with TCP/IP Protocol Adapter

The last thing before doing the installation is determining the disk space requirement for those selected products.

6.2 Installation and Setup

This section describes the tasks for installing the software required by the client and setting up access to the Oracle databases from the server in the cluster.

The tasks are almost the same as for the server installation; they only differ in several instances, which we describe later. The work for this client installation is divided into:

- Preinstallation tasks
- Installation tasks
- Postinstallation tasks

6.2.1 Preinstallation Tasks

The work is carried out either by root or by the newly created Oracle user.

6.2.1.1 Preinstallation Tasks Performed as root

This section provides instructions for tasks performed as root for all preinstallations on the client.

Tasks Performed as root
1. Check for free disk space
2. Prepare for relinking
3. Create dba group
4. Create Oracle software owner login
5. Create <i>ORACLE_HOME</i> directory
6. Create a local bin directory

Figure 15. Preinstallation Tasks Performed as root for Client Installation

Check for Free Disk Space

We reviewed the disk space requirement for this client and made sure there was enough space for installation.

Create the dba Group

As root, at the command prompt, type:

```
smitty group
```

Select **Add a group** from the menu; then type in the group name and group ID, and press **Enter**.

Below are the parameters we put in for the client in this sample cluster configuration:

```
group name = dba
```

```
group id   = 201
```

Create the Oracle Software Owner Login

Create an Oracle software owner login on the client with the following properties:

```
Login name oracle
```

```
UID number A number between 3 and 32767 (in our case, we set the UID=
210)
```

```
Default GID number A number between 3 and 32767 (in our case, we set the
UID= 201), corresponding to the dba
```

```
Home directory /home/oracle
```

```
Login shell /bin/ksh
```

Create the ORACLE_HOME Directory

As root, create ORACLE_HOME at the client, */home/oracle*, by entering the following commands:

```
# mkdir /home/oracle
# chown oracle.dba /home/oracle
# chmod 755 /home/oracle
```

Create a Local bin Directory

Check if this local bin directory already exists. If not, you must create this directory in order to allow every user to execute from it. At the prompt, type:

```
# mkdir /usr/lbin
# chmod 777 /usr/lbin
```

6.2.1.2 Preinstallation Tasks by Oracle

This section provides instructions for tasks performed as the Oracle software owner for preinstallations on the client.

Tasks Performed as Oracle Software Owner
1. Set environment variables

Figure 16. Preinstallation Tasks Performed as the oracle for Client Installations

Set Environment Variables

The following environment variables must be set in the Oracle software owner's environment.

To set the variables, log in as oracle, and issue the following commands:

- umask 022
- vi .profile

Enter the following variables to your site-specific values (we show ours for this client):

```
ORACLE_HOME=/home/oracle; export $ORACLE_HOME
ORACLE_SID=D1; export $ORACLE_SID
ORACLE_TERM=1ft; export $ORACLE_TERM
PATH=$ORACLE_HOME/bin:/usr/lbin:/usr/local/bin; export $PATH
```

6.2.2 Installation Tasks

This section guides you through the installation of several Oracle Tools, SQL*Plus and SQL*Net (the Oracle networking product) on the client.

6.2.2.1 Load the Installer from the Distribution Media

1. Log into the *oracle* account and then su to root

```
login: oracle
passwd: <password>
$ su root
passwd: <password>
#
```

2. Create a directory for mounting the CD-ROM, and set the permissions to make it accessible by all users by entering the following command:

```
# mkdir /cdrom
```

Note: /cdrom is an example for this sample cluster CD-ROM mount point.

```
# chmod 777 /cdrom
```

3. Create the Oracle link directory, and set permissions to make it accessible by all users by entering the following command:

```
# cd /home/oracle
# mkdir stage
```

Note: stage is an example for this sample configuration Oracle link directory from which we link the CD-ROM and the staging area for this installation.

```
# chmod 777 stage
```

Attention: You must make sure you have already calculated your space requirement and have enough space in /home/oracle for your ORACLE_HOME directory.

4. Mount the CD-ROM and exit the superuser account by entering the following command:

```
# mount -rv cdrfs /dev/cd0 /cdrom
# exit
$
```

Your CD-ROM is now mounted on /cdrom.

Note: You must have superuser privileges to mount or unmount the CD-ROM. Be sure to unmount the CD-ROM before removing the CD from the drive.

5. Change directory to the CD-ROM directory.

```
$ cd /cdrom/orainst
```

6. Run the start-up script.

```
$ ./start.sh
```

When prompted, enter the name of the directory you want to link to: /home/oracle/stage. The start.sh script provides links from UNIX filenames in the /stage to the ISO 9660 format filenames on the CD.

6.2.2.2 Run rootpre.sh

Log in as root, and change to the /home/oracle/stage/orainst directory:

```
$ su root
```

```
passwd: <password>
```

```
#cd /home/oracle/stage/orainst
```

Run rootpre.sh, and exit the root account:

```
# ./rootpre.sh
# exit
$
```

Attention: You may need to export your environment variables as root by using the export command to make sure your ORACLE_HOME, ORACLE_SID, and ORACLE_TERM are already set.

When you run the rootpre.sh, Oracle will automatically add three lines into your /etc/inittab, for example:

```
orapw:2:wait:/etc/loadext /etc/pw-syscall4.1
orakx:2:wait:/etc/loadext /etc/adspc4.1
orakx2:2:wait:/etc/adspcinit
```

That's why, after you run the `rootpre.sh`, you may need to reboot your system, or you can run the three initial scripts as root by typing:

```
# /etc/loadext /etc/pw-syscall4.1
# /etc/loadext /etc/adspc4.1
# /etc/adspcinit
```

6.2.2.3 Run the Installer

Perform the following steps to start the Installer.

You should still be logged into the `oracle` account and be in the `/home/oracle/stage/orainst` directory.

Invoke the Installer by entering the following:

```
$ ./orainst
```

This performs the necessary setup operations for the Installer, then invokes the Installer for you.

Note: After you have started the Installer, you are asked if you have run `rootpre.sh`. If you have already run the script, answer Yes to the prompt, and proceed with the installation. If you did not run this script, you must exit the Installer and run `rootpre.sh` before proceeding with the installation.

Note: you can see your installation's log by typing the following command in another window or terminal:

```
# tail -f /home/oracle/orainst/install.log
```

6.2.2.4 Enter the ORACLE_HOME Pathname

You must define the `ORACLE_HOME` environment variable prior to starting the Installer. The value you specify in your environment will be displayed as the default in the following Installer prompt:

Enter the pathname of your `ORACLE_HOME` directory:

The `ORACLE_HOME` pathname defines where the Oracle software will be installed. For this sample configuration, it is `/home/oracle`.

6.2.2.5 Enter the Oracle Software Owner Name

In the "Preinstallation Tasks" section, you have created a user account to own the Oracle software you are installing. This user must be a member of the `dba` group and is referred to as the Oracle software owner in this document. The Installer will prompt you to:

Enter the name of the Oracle owner:

You will enter the name of the Oracle software owner: `oracle`

The default value presented at the prompt is based on the environment set up by you when you performed the preinstallation tasks.

If the default value is already true according to your setup, then just press **Enter**, and continue to next step.

6.2.2.6 Choose the Installer Action

After you have provided the information at the initial Installer prompts, the Install Action screen will be displayed.

For installing the SQL*Plus and SQL*Net Software for the client, select **INSTALL/UPGRADE/PATCH SOFTWARE ONLY**. This option will install product software only and will not create database objects for the installation process. By now, you see that the Installer will prompt you for several parameters that you have to specify.

6.2.2.7 Specify Parameters to the Installer

After you have chosen the products you want for installation, the Installer will prompt you for several parameters:

Specify National Language Support (NLS)

The Installer allows you to specify a language in which to receive screen messages for those utilities that support NLS.

If you are licensed to use the multilingual option, then just select **ALL LANGUAGES**.

For this sample configuration, the value is ALL LANGUAGES.

Relink Option

With the following prompt, the Installer offers you the option to relink the executables:

Would you like to relink Oracle Product executables? By default, the Installer will not relink any product executables, with the exception of the Oracle Server which is relinked automatically if necessary. For Patch installations relinking executables is required.

The default is No.

You might want to chose Yes so that all the executables for your selected products will be relinked automatically.

For this client installation, we chose Yes for the relink option.

Refer to the "Overview of Installation" chapter in the *Oracle Server for AIX-Based Installation and Configuration Guide*.

Install Port-Specific Online Documentation

For installing Oracle documentation, refer to Oracle manual for the specific option.

6.2.2.8 Select Products to be Installed

Now you will see the Installer prompt you with the list of Oracle products that reside on your distribution media.

Use the arrow keys to scroll to, and the space bar to select, one or more Oracle products that you want to install.

After you have chosen the products, use the Tab key to navigate to the (Install) button and press **Enter** or **Return** to activate the installation phase.

Watch the installation proceed, and answer the product installation prompts.

6.2.2.9 Product-Installation Prompts

Below is the product installation prompt for the client installation:

SQL*Plus V3.1:

Would you like to load the SQL*Plus Help Facility? Yes

Answer Yes if you need the Help Facility and can spare the disk space.

Also, you will be asked to respond to the following prompt:

Would you like to load the SQL*Plus Demo tables? Yes

Answer Yes if you need the Demo Facility and can spare the disk space.

SQL*Net V2:

The SQL*Net V2 listener (tnslsnr) must be setuid root if it is to support SQL*Net v1 database links through a SQL*Net v2 connection.

Would you like to setuid tnslnr to root? No

The SQL*Net v2 listener must be shutdown before upgrading. Select YES if you have shutdown the listener from another terminal/window. Select NO to abort installation in order to stop the listener. Yes

Would you like to install the SQL*Net Network Manager tables in your database? No

6.2.3 Postinstallation Tasks

This section guides you through the postinstallation procedures for the client.

The tasks covered in this section are:

1. Tasks performed as root
2. Tasks performed as Oracle owner
3. Tasks performed for other selected Oracle Products, such as SQL*Net

At the end of a successful installation, you should receive a prompt confirming that all requested actions have been performed. You can check your log file for any possible errors that might have occurred during the installation. For information about error messages and codes, please refer to the *Oracle7 Server Messages and Codes Manual*.

6.2.3.1 Tasks Performed as root

The figure below shows the tasks performed as root for post installation on the client.

Tasks Performed as root
1. Run the root.sh script

Figure 17. Postinstallation Tasks Performed as root for Client Installations

Run the root.sh script

The Installer creates a root.sh file, and for each component of the software you install, there is a corresponding piece in the root.sh script. The root.sh must be run by the root user when you have completed a successful installation. This shell script sets the necessary permissions for certain Oracle products.

- Log in as root.
\$ su root
passwd: <password>
- If you are not already there, change directories to your \$ORACLE_HOME/orainst directory.
The Installer creates the root.sh script in the \$ORACLE_HOME/orainst directory.
- Run the **root.sh** script.

To run root.sh, enter the following command:

```
# sh ./root.sh
```

The output of the root.sh script will be something like the following example:

```
Running ORACLE7 root.sh script...
The following environment variables are set as :
ORACLE_OWNER= oracle
ORACLE_HOME= ORACLE_HOME
ORACLE_SID= sid
Are these settings correct (Y/N)? [Y]:
Enter the full pathname of the local bin directory [/usr/sbin]:
Checking for "oracle" user id...
Replacing existing entry for sid in /etc/oratab
The previous entry is now a comment.
ORACLE7 root.sh execution completed.
Setting orasrv file protections
....
```

Attention: Because you log in as a root, you may have to set your ORACLE_HOME, ORACLE_SID, and ORACLE_OWNER variables by issuing the following commands on the command line according to your environment. Below are the commands we issued for the sample configuration:

```
# ORACLE_OWNER= oracle ; export ORACLE_OWNER
# ORACLE_HOME= /home/oracle ; export ORACLE_OWNER
# ORACLE_SID= D1 ; export
```

6.2.3.2 Tasks Performed for Other Selected Oracle Products

Below, we show you the postinstallation tasks for SQL*Net V2 with TCP/IP Protocol Adapter. For complete information about postinstallation tasks for other Oracle products, such as Oracle CASE and the precompiler, please refer to the *"Post-Installation Tasks for Oracle Products"* chapter in the *Oracle7 for AIX-Based Systems, Installation and Configuration Guide*.

As Oracle software owner, you must make a configuration file for the listener of SQL*Net to work properly.

There is one configuration file for this client, called tnsnames.ora. For complete information about the configuration files for SQL*Net in the server and the client, please refer to the *SQL*Net Administrator's Guide*. This file must be placed in the correct directory, depending on whether you have set up your TNS_ADMIN directory in your user environment or not. If you have set your TNS_ADMIN directory to a specific directory, for example, /home/oracle/tns_admin, then after you edit the file, you must put it into the /home/oracle/tns_admin directory. If

you did not set up the TNS_ADMIN directory to a specific directory, then you must put the file into the /etc directory after you have made it.

```
$ vi tnsnames.ora
```

You can see the tnsnames.ora files for this client configuration in E.1.3, “Client /etc/tnsnames.ora File” on page 142.

Chapter 7. Testing the Oracle Server Database

This chapter shows how we tested our databases. The start and stop scripts defined in the various HACMP configurations are shell scripts in which we make calls to the start and stop scripts of the database under test.

We have tried to make the database start and stop scripts reusable. The actual name of the database and the commands to stop and start it along with other database-specific information were put into a file called *databaseName.vars*. This file is sourced into the stop and start scripts.

The file is called *oracle.vars*.

All of the files are kept in the */usr/HACMP_ANSS/script* directory. This was done to allow use of the tools developed in *An HACMP Cookbook*, SG24-4553.

7.1 Stopping and Starting the Oracle Database

The application server, defined in the node resources, is used to stop and start the Oracle database(s).

7.1.1 The *oracle.vars* File

This file contains the name(s) of the database, its users, the home directory of each database, and the host on which the database normally resides. You will have to change this file so that it contains your site-specific values. Some of the changes you make in this file will also entail changes in the *ora_start* script. The *oracle.vars* file we used is shown in Appendix F, "Scripts Used in Our Examples" on page 145.

7.1.2 Starting Oracle

There are a certain number of Oracle configuration files that need to be set up before the database will start up. These files are:

- */etc/oratab*
- *listener.ora*
- *tnsnames.ora*
- *sqlnet.ora*

A complete listing of these files may be found in Appendix D.

The startup script for rotating resources is */usr/HACMP_ANSS/script/start_D1*.

Cascading resources have two (in our case) or more startup scripts:

- On *hadave1*: */usr/HACMP_ANSS/script/start_D1*
- On *hadave2*: */usr/HACMP_ANSS/script/start_D2*

Concurrent resources have two (in our case) or more start scripts:

- On *mickey*: */usr/HACMP_ANSS/script/start_concDB1*
- On *goofy*: */usr/HACMP_ANSS/script/start_concDB2*

All of the above scripts are simply shell scripts that call the database startup program called ora_start and send it the relevant parameters.

```
/usr/HACMP_ANSS/script/ora_start oracle D1 /home/oracle
```

An example for start_D1 is shown below in Figure 19, but the behavior is identical for all of the startup scripts.

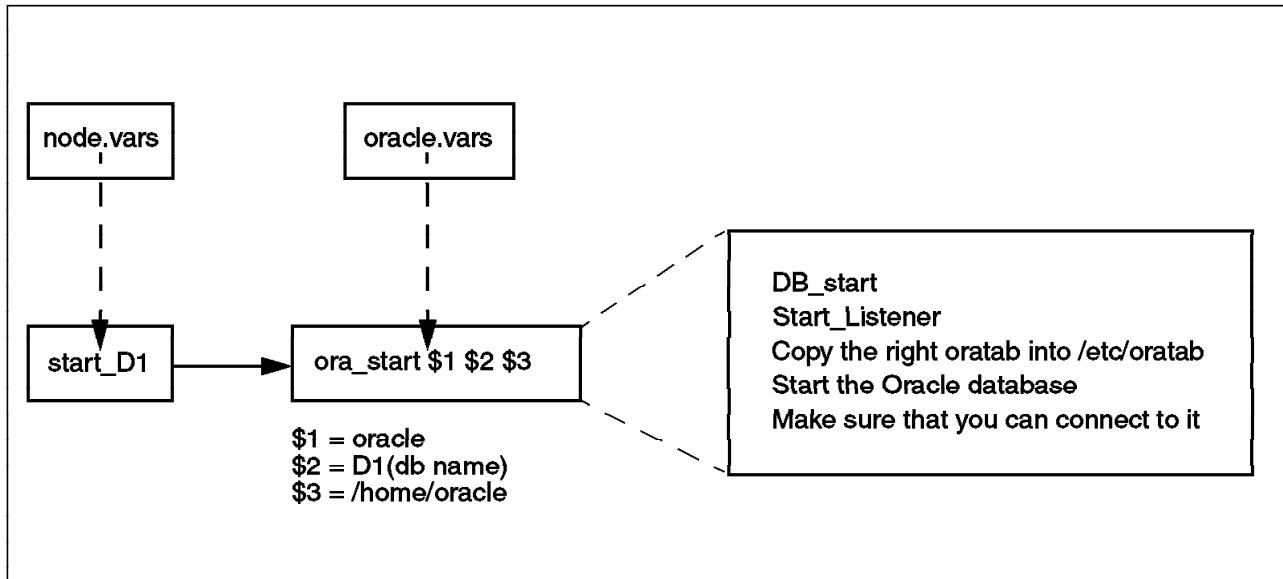


Figure 18. Oracle Start Script Schema

Once Oracle has successfully started, you should see the LGWR (log writer), DBWR (database writer), SMON (system monitor), and the PMON (process monitor) processes running. If you are using SQL*Net, then you should also see the listener process running.

In our case, using the *ps* command, we saw the following:

```
# ps -fu oracle
  UID  PID  PPID  C   STIME   TTY  TIME  CMD
oracle 8556   1    0 14:24:42   -   0:02 ora_lgwr_D1
oracle 9222   1    0 14:24:19   -   0:00 /home/oracle/bin/tnslsnr lisD12
oracle 10838  1    0 16:18:17   -   0:01 oracleD1 (LOCAL=NO)
oracle 18282  1    0 14:24:40   -   0:05 ora_dbwr_D1
oracle 22118 25188  3 16:23:15   -   0:00 oracleD1 (DESCRIPTION=(LOCAL=YES
oracle 22894  1    0 14:24:44   -   0:01 ora_smon_D1
oracle 24168  1    0 14:24:38   -   0:02 ora_pmon_D1
```

We see that there is a connection from a remote client (PID 10838) and a local connection to the D1 database (PID 22118). The listener process is /home/oracle/bin/tnslsnr lisD12 (PID 92222).

7.1.3 Modifying the Oracle dbstart Script for Concurrent Access

VERY IMPORTANT: There is one modification you must make to the dbstart script provided by Oracle. This script is found in your \$ORACLE_HOME/bin directory.

As it is provided, the script will not start up the database in parallel mode. You need to make the following change. For all occurrences of the first stanza (there are two of them in the current dbstart script), **you need to change *startup* to *startup parallel***.

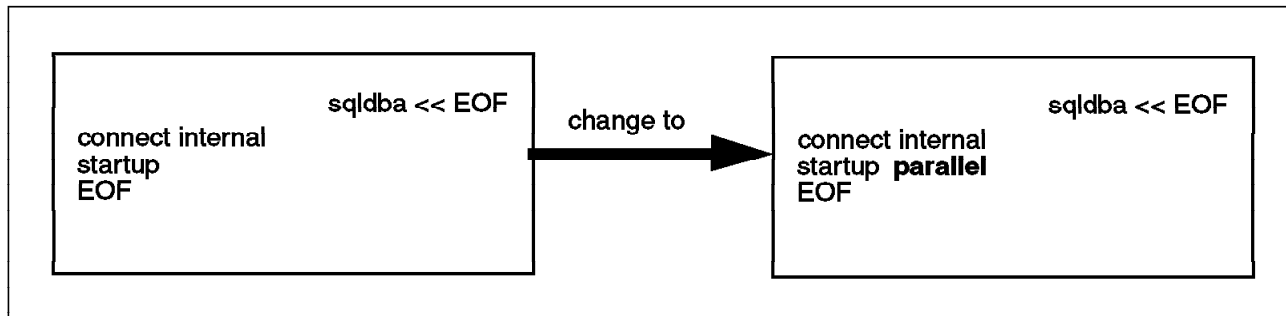


Figure 19. Modification to be Made to Oracle dbstart Script

7.1.4 Stopping Oracle

The stop script for rotating resources is /usr/HACMP_ANSS/script/stop_D1.

Cascading resources have two (in our case) or more stop scripts:

- On hadave1: /usr/HACMP_ANSS/script/stop_D1
- On hadave2: /usr/HACMP_ANSS/script/stop_D2

Concurrent resources have two (in our case) or more stop scripts:

- On mickey: /usr/HACMP_ANSS/script/stop_concDB1
- On goofy: /usr/HACMP_ANSS/script/stop_concDB2

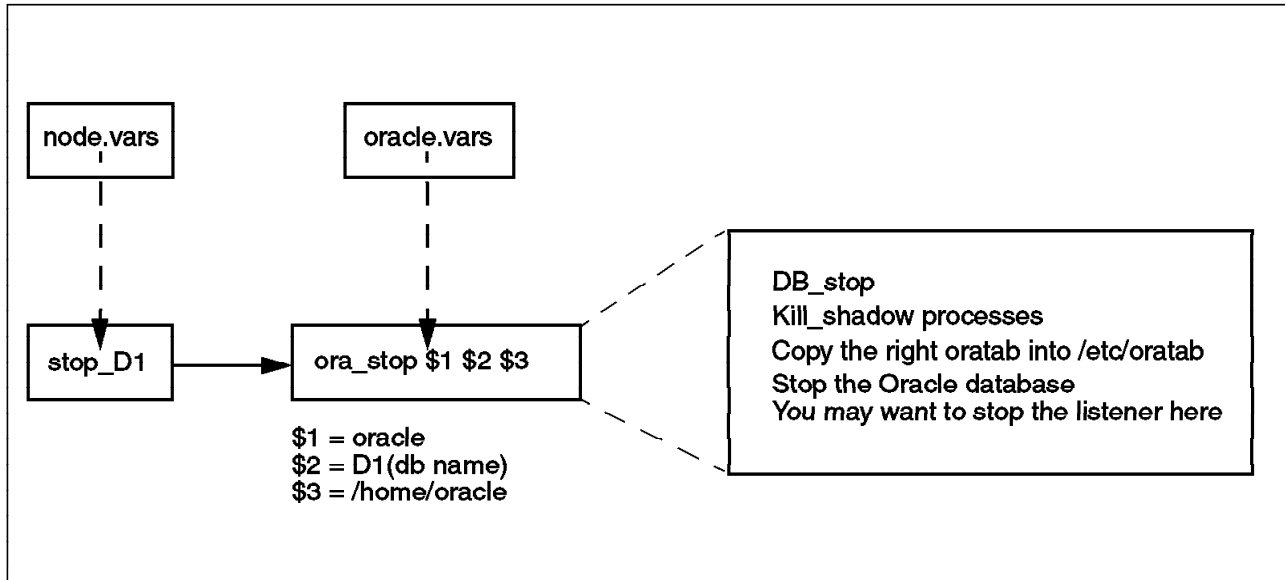


Figure 20. Oracle Stop Script Schema

All of the above scripts are simply shell scripts that call the database shutdown program called `ora_stop` and send it the relevant parameters.

```
/usr/HACMP_ANSS/script/ora_stop oracle D1 /home/oracle
```

An example for `stop_D1` is shown above in Figure 20, but the behavior is identical for all of the stop scripts.

Chapter 8. Oracle Parallel Server Database Installation

This chapter outlines the steps involved in installing Oracle Parallel Server Database on the cluster sample configuration for two nodes described in Section 4.4, “Concurrent Configuration for Highly Available Databases” on page 45. We begin with planning the installation and then discuss selecting Oracle products for installation and determining their disk space requirements. Then, we explain the tasks involved in the installation. These tasks are divided into the following categories:

- Preinstallation tasks
- Installation tasks
- Postinstallation tasks

This database installation is a parallel database installation. The preinstallation and postinstallation tasks were done twice, once for each node, but the installation tasks were done simultaneously for both nodes. We will describe the steps to complete from preinstallation through postinstallation.

8.1 Planning for Oracle Installation

This section describes the planning considerations for Oracle Parallel Server Database installation on the sample cluster mentioned above. We show exactly what database products should be installed and how to determine your disk space requirement for those selected database products.

8.1.1 Selecting the Oracle Products to be Installed

The concurrent sample cluster that was described in Section 4.4, “Concurrent Configuration for Highly Available Databases” on page 45, needs concurrent access capability for its database, so it needs the Oracle Parallel Server Database and its prerequisites.

Below are the Oracle products we selected for installation on this sample configuration:

1. Oracle Server Products:
 - Oracle7 Server with Parallel Query option and its dependent products, such as the Oracle Common Libraries and Utilities and Toolkit II.
 - Parallel Server Option
 - Distributed Option
 - Oracle Parallel Backup/Restore Utility
2. Oracle Tools Products:
 - PL/SQL Release 2.1
 - SQL*Plus Release 3.1
3. Oracle Networking Products:
 - SQL*Net V2.1 with TCP/IP Protocol Adapter

We did not install any CASE products, precompiler products, or Oracle online documentation.

8.1.2 Disk Space Sizing for Selected Oracle Products

Having selected the products listed above, we now show you how to calculate the disk space requirement based on the disk space sizing sheets that we described in Chapter 3, “Database Planning, System Requirements, and Sizing” on page 15 .

The following tables show the disk space sizing sheets you must fill in according to all the selected products that will be installed on this cluster.

Space Requirements for Oracle Server Products							
Disk Storage Requirements				Memory Space Requirements			
v		Dist.	DB Sp	#1 User	Additional Users		
Use	Product	(MB)	(MB)	(KB)	Users	KB per	Total
v	Oracle Server	36.60	12.5	6458	1	x 489	489
	SQL*DBA			2589	1	x 283	283
	SQL*Loader			1778	1	x 204	204
	Export			1654	1	x 223	223
	Import			1590	1	x 207	207
	Server Manager (Line Mode only)	20.19	N/A	1752		x 221	
	Server Manager (Motif bitmapped \$ Line Mode)	42.88	N/A	3515		x 364	
v	+ Distributed Opt	0.10	N/A				
v	+ Parallel Server Opt.	0.08	N/A				
v	+ Parallel Query Opt	0.08	N/A				
v	Toolkit II	43.06	N/A				
v	Oracle Common Lib & Utilities	22.10	N/A				
	Migration Utility	1.85	N/A				
v	Oracle Parallel Backup/Restore Util.	30.00	10.0	1024			
		Σ A	Σ B	Σ C			Σ D
	Subtotals =	132.02	22.5	14069			1612
Summary							
A	Tot. Distribution Space (A)		132.02	(MB)			
B	Tot. Database Space (B)		22.5	(MB)			
C	#1 User Memory (C)		14069	(KB)			
D	Additional User Memory (D)		1612	(KB)			
E	Virtual Memory Total (C+D)		15681	(KB)			

Table 20. Disk Requirement Summary Sheet for Oracle Server Products

Note: Each product selected for installation is indicated by **(v)**. The total disk space required for each product is written in **bold** type.

Space Requirements for Oracle Tools							
Disk Storage Requirements				Memory Space Requirements			
v		Dist.	DB Sp	#1 User	Additional Users		
Use	Product	(MB)	(MB)	(KB)	Users	KB per	Total
	Easy*SQL						
	Oracle Data Query	17.81	0.4	3424		x 756	
	Oracle*Mail	48.50	N/A	2628		x 362	
	Oracle*Terminal	5.77	N/A	667		x 194	
	PL/SQL 1.0		N/A				
v	PL/SQL 2.0	0.28	N/A				
	SQL*Calc	2.99	N/A				
v	Oracle Toolkit I	1.29	N/A				
	Oracle XA Library	0.15	N/A				
	SQL*Forms V3.0	24.99	1.2				
	Design (Char Mode)			4614		x 1034	
	Runtime (Char Mode)			3511		x 710	
	SQL*Menu V5.0	21.84	0.8				
	Design (Char Mode)			4388		x 998	
	Runtime (Char Mode)			3565		x 760	
v	SQL*Plus	5.65	0.6	3472	1	x 778	778
	SQL*QMX	2.97					
	SQL*Report	2.37	N/A				
	rpt			1748		x 230	
	rpf			46		x 9	
	SQL*ReportWriter	2.37	N/A				
	Design			2642		x 230	
	Runtime			2424		x 302	
		Σ A	Σ B	Σ C			Σ D
	Subtotals =	7.22	0.6	3472			778
Summary							
A	Tot. Distribution Space (A)	7.22		(MB)			
B	Tot. Database Space (B)	0.60		(MB)			
C	#1 User Memory (C)	3472		(KB)			
D	Additional User Memory (D)	778		(KB)			
E	Virtual Memory Total (C+D)	4250		(KB)			

Table 21. Disk Requirement Summary Sheet for Oracle Tools Products

Note: Each product selected for installation is indicated by (v). The total disk space required for each product is written in **bold** type.

Space Requirements for Oracle Networking Products							
Disk Storage Requirements				Memory Space Requirements			
v		Dist.	DB Sp	#1 User	Additional Users		
Use	Product	(MB)	(MB)	(KB)	Users	KB per	Total
SQL*Net V1:							
	SQL*Net Async	0.27	N/A				
	SQL*Net DECnet	0.12	N/A				
	SQL*Net LU6.2	0.13	N/A				
	SQL*Net SPX/IPX	2.55	N/A				
	SQL*Net Named Pipes		N/A				
	SQL*Net TCP/IP	0.32	N/A				
SQL*Net V2:							
v	SQL*Net V2	35.59	0.2				
	TNS Listener			1183	1	x 176	176
	DECnet	0.12	N/A				
	LU6.2	0.14	N/A	7		x 2	
	OSI	0.16	N/A				
	SPX/IPX	4.51	N/A	695		x 152	
	Names Server	3.93	N/A	1806		x 215	
v	TCP/IP	0.12	N/A				
	Interchange	5.81	N/A				
	Network Manager	22.51	N/A	3266		x 323	
	Interchange Control Utility			1260		x 169	
	Interchange Listener			1224		x 168	
	Navigator			1187		x 168	
	Configuration Tool	N/A	0.2				
		Σ A	Σ B	Σ C			Σ D
	Subtotals =	35.71	0.20	1183			176
Summary							
A	Tot. Distribution Space (A)	35.71					(MB)
B	Tot. Database Space (B)	0.20					(MB)
C	#1 User Memory (C)			1183			(KB)
D	Additional User Memory (D)			176			(KB)
E	Virtual Memory Total (C+D)			1359			(KB)

Table 22. Disk Requirement Summary Sheet for Oracle Networking Products

Note: Each product selected for installation is indicated by **(v)**. The total disk space required for each product is written in **bold** type.

After completing the calculations on the sizing sheets above, we must fill in the **A**, **B**, and **E** totals from the individual sheets into the final calculation sheet shown in the following table.

Total Space Requirements (MB)			
Transfer Table	Disk Space (A)	Database Space (B)	Virtual Memory (E)
Oracle Server Products	132.02	22.5	15.68
Precompiler Products: Development Cycle			
Precompiler Products: User Cycle	n/a	n/a	
Oracle Networking Products	35.71	0.2	1.36
Oracle Tools Products	7.22	0.6	4.25
Oracle Online Documentation		n/a	n/a
Additional installation space for files generated during installation	+ 21.00	n/a	n/a
Temporary space for relinking	40.00	n/a	n/a
TOTALS	235.95	13.3	21.29

Table 23. Total Disk Requirement Summary Sheet

Note: From the Total Disk Space Sizing Summary sheet above, we can estimate that the minimum space for those selected products for Oracle Parallel Server Database installation on the second sample cluster is about 300 MB. With this estimated space requirement, we can prepare all the tasks for installing the database. The installation is discussed in 8.3, “Installation Tasks for Oracle Parallel Server Database” on page 98.

8.2 Preinstallation Tasks for Oracle Parallel Server Databases

If you want to use the concurrent capability, you need to install the Oracle Parallel Server Database with the Oracle Server. This section provides instructions for preinstallation tasks for Oracle Parallel Server Database.

Figure 21 shows the tasks you must perform on each node, mickey and goofy, in order to install your Oracle Parallel Server Database.

Tasks for Installing Oracle Parallel Server Database
1. Create dba group on all nodes
2. Create Oracle software owner on all nodes
3. Set up user equivalence
4. Create ORACLE_HOME directory on all nodes
5. Determine number of raw disk sections
6. Check that distributed lock manager is running
7. Preinstallation tasks for optional Oracle products

Figure 21. Preinstallation Tasks for Installing Oracle Parallel Server Database

8.2.1 Creating the dba Group

As root, at the command prompt, type:

```
# smitty group
```

Select **Add a group** from the menu; type in the group name and group ID, and press **Enter**.

Below are the entries for the sample configuration we made:

```
Group name      dba
GID number      201
```

8.2.2 Creating the Oracle Software Owner Login

Create an Oracle software owner login with the following properties:

```
Llogin name      oracle
UID number       A number between 3 and 32767 (for example, 210)
Default GID number A number between 3 and 32767 (for example, 201)
                  corresponding with the dba group name you just
                  created
Home directory   /home/oracle
Login shell      /bin/ksh
```

8.2.3 Setting Up User Equivalence

The Oracle software owner must have user equivalence set up so the Installer can remote copy Oracle products.

1. Perform this step as the Oracle software owner. To check for user equivalence, perform an rlogin to each of the other nodes in the cluster. If you are prompted for a password, user equivalence is not set up, and the Installer will not be able to rcp to the remote directories.
2. Perform this step as *oracle*. To set up user equivalence, as *oracle*, edit your */etc/hosts.equiv* file or *.rhosts* file to include entries for the other nodes on the cluster.

8.2.4 Creating the ORACLE_HOME Directory

As root, create the ORACLE_HOME directory, */home/oracle* in this sample configuration, by entering the following command:

```
# mkdir /home/oracle
# chown oracle.dbc /home/oracle
# chmod 755 /home/oracle
```

As part of the installation, the Installer, which is the name of tool for installing Oracle, will install Oracle products on one node and copy the required set of files for each installed product to all the nodes in the cluster. After a complete installation, all nodes appear to be identical.

Oracle tools and any applications may reside on a file system that is shared by all the nodes in the cluster.

8.2.5 Creating Raw Logical Volumes

To create the raw logical volumes, please refer to Section 4.1, “Preinstallation Activities and Considerations for HACMP” on page 31. Perform this task as root. You must create a minimum of 14 raw disk sections according to the following guidelines:

- Create three for your control files.
- Create three for each instance’s log files. If you want to have two instances, for example C1 and C2, you have to make three log raw logical volumes for each instance, for a total of six raw logical volumes for the two instances.
- Create one for each of the following data files: system, rollback, temp, users, and tools.

The logical volume names and minimum sizes for our example are shown in Figure 7 on page 46. These logical volumes are all created on a shared volume group. The sizing of your logical volumes will depend on the size of your database.

Attention: Do not use filesystems for Oracle Parallel Server Database data. All files associated with an Oracle Parallel Server Database must reside on *raw logical volumes* (for example /dev/rlog1) so that they can be accessed by all nodes in the cluster. Although each instance has its own log files, all instances must have access to all log files at instance recovery time. Control and data files are shared by all instances.

8.2.6 Checking That Distributed Lock Manager is Running

The instances of a parallel server use the HACMP cluster lock manager to communicate with each other and to coordinate modifications of data blocks.

Use the following command to test whether the distributed lock manager is running:

```
# ps -ef |grep cllockd
```

To make sure the cluster lock manager works properly, you can do a test with a sample C program which is listed in Figure 56 on page 138. You can compile this sample program by typing the following command:

```
# cc testlm.c -o testlm -lcl -lclm -lclstr
```

After compiling the sample program, you just run the program by typing:

```
# ./testlm
```

Make sure that the result is like that shown below:

```
immediate return status of lock request: CLM_NORMAL in astfunc
completion function status: CLM_NORMAL
immediate return status of lock request: CLM_NORMAL in astfunc
completion function status: CLM_NORMAL
immediate return status of unlock request: CLM_NORMAL
```

8.2.7 Preinstallation Tasks for Optional Oracle Products

As stated in the previous chapter, we need to install the Oracle Tools products, PL/SQL V2.0, SQL*Plus V3.1, and the Oracle networking product called SQL*Net V2, for this cluster. For Oracle Tools products, there are no preinstallation tasks to do, but for the SQL*Net V2 with TCP/IP Protocol Adapter, there are preinstallation tasks that have to be done *on each node* before we start to install.

Complete the following tasks on each node before installing the SQL*Net V2 with TCP/IP Protocol Adapter:

1. Verify that the network is functioning properly by doing a file transfer with FTP or by using telnet to log into a remote system.
2. Verify that you have a listener entry in the `/etc/services` file. This service must be reserved for your SQL*Net V2 listener, and usually the port is 1521. If your system is not preconfigured with this entry, go to the `/etc/services` file and add the following line:

```
listener 1521/tcp oracle
```

where `listener` is the name of this particular listener, as set in the `listener.ora` and `sqlnet.ora` files. See D.1, "Customized Files" on page 133 for the `listener.ora` and `sqlnet.ora` files for this sample configuration.

8.3 Installation Tasks for Oracle Parallel Server Database

This section guides you through the installation of the Oracle Parallel Server Database. We will use CD-ROM media for this installation, so if you use cartridge tape as your Oracle distribution media, please refer to the "Installation" chapter of the *Oracle7 for AIX-Based Systems, Installation and Configuration Guide*.

At the beginning of this chapter, we told you that the installation could be done in one session. So you just need to do the installation from one machine. Don't forget to make sure that your HACMP cluster lock manager is already running.

8.3.1 Loading the Installer from the Distribution Media

1. Log into the `oracle` account and then `su` to root

```
login: oracle
passwd: <password>
$ su root
passwd: <password>
#
```

2. Create a directory for mounting the CD-ROM, and set the permissions to make it accessible by all users by entering the following command:

```
# mkdir /cdrom
```

Note: `/cdrom` is an example for this sample cluster CD-ROM mount point.

```
# chmod 777 /cdrom
```

3. Create the Oracle link directory, and set permissions to make it accessible by all users by entering the following:

```
# cd /home/oracle
# mkdir stage
```

Note: stage is an example for this sample configuration Oracle link directory from which we link the CD-ROM and the staging area for this installation.

```
# chmod 777 stage
```

Attention: You must make sure you have already calculated your space requirement and have enough space in /home/oracle for your ORACLE_HOME Directory.

4. Mount the CD-ROM and exit the superuser account by entering the following:

```
# mount -rv cdrfs /dev/cd0 /cdrom
# exit
$
```

Your CD-ROM is now mounted on /cdrom.

Note: You must have superuser privileges to mount or unmount the CD-ROM. Be sure to unmount the CD-ROM before removing the CD from the drive.

5. Change directory to the CD-ROM directory.

```
$ cd /cdrom/orainst
```

6. Run the start-up script.

```
$ ./start.sh
```

When prompted, enter the name of the directory you want to link to: /home/oracle/stage. The start.sh script provides links from UNIX filenames in the /stage directory to the ISO 9660 format filenames on the CD.

8.3.2 Running rootpre.sh

Log in as root, and change to the /home/oracle/stage/orainst directory:

```
$ su root
```

```
passwd: <password>
```

```
#cd /home/oracle/stage/orainst
```

Run rootpre.sh, and exit the root account:

```
# ./rootpre.sh
# exit
$
```

Attention: You may need to export your environment variables as root by using the export command to make sure your ORACLE_HOME, ORACLE_SID, and ORACLE_TERM are already set.

Note: For this parallel server installation, remember that you must run rootpre.sh on all nodes. During the installation, you will be prompted for the names of additional nodes. If rootpre.sh has not been run on those nodes, the Installer copies the script into the remote \$ORACLE-HOME/orainst directory and prompts you to continue with the installation after running this script on the remote nodes.

When you run the rootpre.sh script, Oracle will automatically add three lines into your /etc/inittab file:

```
orapw:2:wait:/etc/loadext /etc/pw-syscall4.1
orakx:2:wait:/etc/loadext /etc/adspc4.1
orakx2:2:wait:/etc/adspcinit
```

That's why, after you run the `rootpre.sh` script, you may need to reboot your system. Alternatively, you can run the three initial scripts as root by typing:

```
# /etc/loadext /etc/pw-syscall4.1
# /etc/loadext /etc/adspc4.1
# /etc/adspcinit
```

8.3.3 Running the Installer

Perform the following steps to start the Installer.

You should still be logged into the *oracle* account and be in the `/home/oracle/stage/orainst` directory.

Invoke the Installer by entering the following:

```
$ ./orainst
```

This performs the necessary setup operations for the Installer. It then invokes the Installer for you.

Note: After you have started the Installer, you are asked if you have run `rootpre.sh`. If you have already run the script, answer Yes to the prompt, and proceed with the installation. If you did not run this script, you must exit the Installer and run `rootpre.sh` before proceeding with the installation.

Note: You can see your installation's log by typing the following command in another window or terminal:

```
# tail -f /home/oracle/orainst/install.log
```

8.3.4 Entering the ORACLE_HOME Pathname

You must define the `ORACLE_HOME` environment variable prior to starting the Installer. The value you specify in your environment will be displayed as the default in the following Installer prompt:

Enter the pathname of your `ORACLE_HOME` directory:

The `ORACLE_HOME` pathname defines where the Oracle software will be installed. For this sample configuration, it is `/home/oracle`.

8.3.5 Entering the Oracle Software Owner's Name

In Section 8.2.2, "Creating the Oracle Software Owner Login" on page 96, you created a user account to own the Oracle software you are installing. This user must be a member of the `dba` group, and is referred to as the Oracle software owner in this document. The Installer will prompt you to:

Enter the name of the Oracle owner:

You will enter the name of the Oracle software owner: `oracle`

The default value presented at the prompt is based on the environment set up by you when you performed the preinstallation tasks.

If the default value is already true according to your setup, then just press **Enter** and continue to the next step.

8.3.6 Choosing the Installer Action

After you have provided the information at the initial Installer prompts, the Install Action screen will be displayed.

For a standard first-time installation, select **Complete Software/Database Fresh Install**. This option will install the product software and create database objects for the selected products you want to install. The Installer will prompt you for several parameters to specify.

In this parallel server installation, we have to choose the Parallel Server option in addition to Oracle Server, SQL*Plus, PL/SQL, and SQL*Net.

8.3.7 Oracle Parallel Server Installation Prompts

The Installer will prompt you concerning the installation of Parallel Server on a remote server or node.

Select (Yes) to have the products installed on all nodes that comprise the cluster for Oracle7 Parallel Server.

You must then specify the names and Oracle homes of the remote nodes when prompted to do so by the Installer. You only specify the remote nodes, not the node where you are running the Installer.

For example: You can enter your remote hostname and the Oracle home_directory for the remote node by typing the following when the Installer prompts you:

```
goofy:/home/oracle
```

Note: If rootpre.sh hasn't been run on each of the nodes, you must run it now before continuing the action. After you have finished running rootpre.sh on all nodes, you might be prompted by the Installer to enter again your remote node hostname and its Oracle home directory. Skip this question by making it blank and pressing **Enter**, so the Installer continues to the next screen. Otherwise, the Installer will keep asking about your remote hostname.

Note: Remember to use raw logical volumes for all the database files. When asked to provide filenames, use the name starting with an "r" (for example: use /dev/rlv1, instead of /dev/lv1). When asked for the file sizes, specify a size that is at least 8 KB less than the raw device size. When specifying sizes in megabytes, a good general rule is to specify one megabyte less than the device size.

8.3.8 Specifying Parameters to the Installer

After you have chosen the products you want to install, the Installer will prompt for several parameters:

8.3.8.1 Specifying the Database Instance Name

You must pay attention to the default value that the Installer prompts with. The default value must match your ORACLE_SID setup in the *oracle* user environment or profile. If it does not, you must enter the value according to your setup.

For this parallel database server sample configuration, the instance name is C1 on both nodes, mickey and goofy.

8.3.8.2 Specifying National Language Support (NLS)

The Installer allows you to specify a language in which to receive screen messages for those utilities that support NLS.

If you are licensed to use the multilingual option, then just select **ALL LANGUAGES**.

For this sample configuration, the value is ALL LANGUAGES.

8.3.8.3 Relink Option

The Installer offers you the option to relink the executables with the following prompt:

Would you like to relink Oracle Product executables? By default, the Installer will not relink any product executables, with the exception of the Oracle Server which is relinked automatically if necessary. For Patch installations relinking executables is required.

The default is No.

You might want to choose Yes, so all the executables for your selected products will be relinked automatically.

In this sample configuration, we chose Yes for the relink option.

Refer to the "Overview of Installation" chapter in the *Oracle Server for AIX-Based Installation and Configuration Guide*.

8.3.8.4 Installing Port-Specific Online Documentation

For installing Oracle Documentation, refer to the Oracle manual for the specific option.

8.3.9 Selecting Products for Installation

By now, you will see that the Installer prompts you with the list of Oracle products that reside on your distribution media (tape or CD).

Use the arrow keys to scroll to, and the space bar to select, one or more Oracle products that you want to install.

After you have chosen the products, use the Tab key to navigate to the (Install) button, and press **Enter** or **Return** to activate the installation phase.

Note: For the cluster disney sample configuration, we chose Oracle Server and SQL*Plus, with the Parallel Query Option, the SQL*Net V2 with TCP/IP Protocol Adapter and the Parallel Database capability, which includes the Parallel Server option, the Distributed option, and the Oracle Parallel Backup/Restore Utility.

Watch the installation proceed and answer:

- Database-creation prompts
- Product-installation prompts

8.3.10 Database Creation Prompts

The following information shows you how to answer the prompts for databases created by the Installer.

8.3.10.1 Naming the Database

You are prompted for a database name as follows:

Enter the database name for the ORACLE_SID database:

The default value is the same value you previously entered for the ORACLE_SID instance name prompt.

8.3.10.2 Selecting the Character Set

You can choose a character set as listed from the Installer's prompt:

The default value is US7ASCII.

8.3.10.3 Entering the Password for the SYSTEM User

You will see this prompt from the Installer:

Please enter the password for the 'SYSTEM' Oracle userid:

By default, the password is manager, but for security purposes, you can enter the password for this administration user.

8.3.10.4 Entering the Password for the SYS User

You will see this prompt from the Installer:

Please enter the password for the 'SYS' Oracle userid:

Just as for the SYSTEM user, for security purposes, you can enter the password for this user.

Note: Both SYSTEM and SYS users are automatically created for you when you install Oracle Server. These users have dba privileges.

8.3.10.5 Enabling Connect Internal

If you choose to create your database using the Installer, you are prompted to enable Connect Internal for the dba and operator users as follows:

Would you like to (1) set the passwords for the internal users (viz., 'dba' and 'operator') and (2) enable/disable remote connect internal? No

The default is No, but if you want to set passwords for these two internal users, allowing them to Connect Internal without passwords, then you must choose Yes.

8.3.10.6 Naming the Control Files

You will be prompted with the message below:

Do you want to use the following files as control files?:

`$ORACLE_HOME/dbs/ctr11.sid.ctl`

`$ORACLE_HOME/dbs/ctr12.sid.ctl`

`$ORACLE_HOME/dbs/ctr13.sid.ctl`

By default, all three control files are located in one place. The `$ORACLE_HOME` in the prompted menu is the Oracle home directory that you created during the preinstallation tasks. In this sample configuration, it is `/home/oracle`. The **sid** is the variable you set for your database name or your `ORACLE_SID`. In our example, it is `C1`.

Note: We suggest that in an HACMP environment, you put these three control files in the external shared disk. It will protect from a node failure so Oracle still can be started with its own control files. Remember that because this is a parallel database, you must put all your control files in raw logical volumes. In this sample configuration, we put the control files in `/dev/rctl1lv`, `/dev/rctl2lv`, and `/dev/rctl3lv`.

If you decide to put these files in the external shared disk, then you must choose `NO`. The Installer will then prompt you to enter the place where you want to put these three files.

8.3.10.7 Naming and Sizing Redo Log Files

After giving the name of the control files, you are prompted for the names and sizes of your redo log files as follows:

The following are the default file names and sizes which will be used to create the new database. Select `(OK)` to continue to the next screen of default files:

`LOG1 (500k): ORACLE_HOME/dbs/log1.sid.dbf`

`LOG2 (500k): ORACLE_HOME/dbs/log2.sid.dbf`

`LOG3 (500k): ORACLE_HOME/dbs/log3.sid.dbf`

By default, all three redo log files for an instance are located in one place. The `$ORACLE_HOME` in the prompted menu is the Oracle home directory you created during the preinstallation tasks. In this sample configuration, it is `/home/oracle`. The **sid** is the variable you set for your database name or your `ORACLE_SID`.

Note: We suggest that in an HACMP environment, you put these three redo log files in the external shared disk. This will protect from a node failure so Oracle still can be started with its own redo log files. And remember that because this is a parallel database, you must put all your redo log files in raw logical volumes. In this sample configuration, we put the redo log files in `/dev/rlog1lv`, `/dev/rlog2lv`, and `/dev/rlog3lv` for the first instance, `C1`, and in `/dev/rt2log1lv`, `/dev/rt2log2lv`, and `/dev/rt2log3lv` for the second instance, `C2`. All logical volumes are created before you do the installation tasks.

If you decide to put these files in the external shared disk, then you must not choose `OK`. The Installer will then prompt you to enter where you want to put these files.

8.3.10.8 Naming and Sizing Data Files

Next, you are prompted for the names and sizes of your data files as follows:

The following are the default file names and sizes which will be used to create the new database. Select (OK) to continue to the next screen of default files:

SYSTEM (25M) : ORACLE_HOME/dbs/syst`db_name`.dbf
ROLLBACK (4M) : ORACLE_HOME/dbs/rbs`db_name`.dbf
TEMP (550k) : ORACLE_HOME/dbs/temp`db_name`.dbf
USERS (1M) : ORACLE_HOME/dbs/usr`db_name`.dbf
TOOLS (15M) : ORACLE_HOME/dbs/tool`db_name`.dbf

By default, all these data files are located in one place. The \$ORACLE_HOME in the prompted menu is the Oracle home directory you created during the preinstallation tasks. In this sample configuration, it is /home/oracle. The `db_name` is the variable you set for your database name or your ORACLE_SID. In this sample cluster, it is C1.

Note: We suggest that in an HACMP environment, you put these data files in the external shared disk. This will protect from a node failure so Oracle can still be started with its own data files. In this sample cluster configuration, we put the data files in raw logical volumes as shown below because this is parallel server database:

`/dev/rdb1v` for the system tablespace
`/dev/rroll1v` for the rollback tablespace
`/dev/rtemp1v` for the temp tablespace
`/dev/ruser1v` for the user tablespace
`/dev/rtool1v` for the tools tablespace

If you decide to put these files in the external shared disk, then you must not choose OK. The Installer will then prompt you to enter the place where you want to put these data files.

8.3.11 Product Installation Prompts

If you choose optional products you want to install (for example, in this configuration we chose SQL*Plus V2), you are prompted by the Installer accordingly. For complete information about the product installation prompts, please see the *Oracle Server7 for AIX-Based Installation and Configuration Guide*.

Below are the product installation prompts for this sample cluster installation.

SQL*Plus V3.1:

Would you like to load the SQL*Plus Help Facility? Yes

Answer Yes if you need the Help Facility and can spare the disk space.

Also you will be asked to respond to the prompt below:

Would you like to load the SQL*Plus Demo tables? Yes

Answer Yes if you need the demo tables and can spare the disk space.

SQL*Net V2:

The SQL*Net V2 listener (tnslsnr) must be setuid root if it is to support SQL*Net v1 database links through a SQL*Net v2 connection.
 Would you like to setuid tnslnr to root? No
 The SQL*Net v2 listener must be shutdown before upgrading. Select YES if you have shutdown the listener from another terminal/window. Select NO to abort installation in order to stop the listener. Yes
 Would you like to install the SQL*Net Network Manager tables in your database? No

8.4 Postinstallation Tasks for Oracle Parallel Server Database

This section guides you through the postinstallation procedures of the Oracle Parallel Server Database for this sample cluster. For complete information, please refer to the “Post-Installation” chapter from the *Oracle7 for AIX-Based Systems, Installation and Configuration Guide*.

The tasks covered in this section are:

1. Tasks performed as root
2. Tasks performed as Oracle owner
3. Tasks performed for other selected Oracle products, such as SQL*Net

At the end of a successful installation, you should receive a prompt confirming that all requested actions have been performed. You can check your log file for any possible errors that might have occurred during the installation. For information about error messages and codes, please refer to the *Oracle7 Server Messages and Codes Manual*.

8.4.1 Tasks Performed as root

The figure below shows the tasks performed as root for postinstallations on both nodes in the cluster.

Tasks Performed as root
1. Run the root.sh script
2. Verify database security and integrity
3. Create Oracle Server user logins

Figure 22. Postinstallation Tasks Performed as root for a Parallel Server Database

8.4.1.1 Running the root.sh script

The Installer creates a root.sh file, and for each component of the software you install, there is a corresponding piece in the root.sh script. The root.sh script must be run by the root user when you have completed a successful installation. This shell script sets the necessary permissions for certain Oracle products.

- Log in as root.

```
$ su root
passwd: <password>
```

1. If you are not already there, change directories to your \$ORACLE_HOME/orainst directory.

The Installer creates the root.sh script in the \$ORACLE_HOME/orainst directory.

2. Run the root.sh script.

To run root.sh, enter the following:

```
# sh ./root.sh
```

The output of the root.sh script will be something like the following example:

```
Running ORACLE7 root.sh script...
The following environment variables are set as:
ORACLE_OWNER= oracle
ORACLE_HOME= ORACLE_HOME
ORACLE_SID= sid
Are these settings correct (Y/N)? [Y]:
Enter the full pathname of the local bin directory [/usr/bin]:
Checking for "oracle" user id...
Replacing existing entry for sid in /etc/oratab
The previous entry is now a comment.
ORACLE7 root.sh execution completed.
Setting orasrv file protections
....
```

Depending on which products you have selected to install, messages are displayed to alert you to the progress of the root.sh actions.

Attention: Because you logged in as root, you may have to set your ORACLE_HOME, ORACLE_SID, and ORACLE_OWNER variables according to your environment by issuing the following commands from the command line. Below are the commands we issued for the sample configuration:

```
# ORACLE_OWNER= oracle ; export ORACLE_OWNER
# ORACLE_HOME= /home/oracle ; export ORACLE_OWNER
# ORACLE_SID= C1 ; export
```

Note: C1 is the ORACLE_SID for node mickey, and C2 is for node goofy.

8.4.1.2 Verifying Database Security and Integrity

To maintain the integrity of the Oracle code, all executables in the \$ORACLE_HOME/bin directory must be writable by the Oracle owner only.

You must verify that these files have file modes 751 or 755. Also to maintain discretionary access to data, all databases, redo logs, and control files that may be put in the external disks must be readable by the Oracle owner and group only, including the root user.

8.4.1.3 Creating Oracle Server User Logins

For each Oracle user, create a login with the following properties:

Login name	the user's username
UID number	A number between 3 and 32767
Default GID	A number between 3 and 32767, not the dba group
Home directory	/home/oracle
Login shell	/bin/ksh

8.4.2 Tasks Performed as Oracle Software Owner

The figure below lists the tasks performed as Oracle software owner for postinstallations on both nodes in the cluster.

Tasks Performed as Oracle Software Owner
1. Verify your <i>oratab</i> file
2. Edit your <code>\$ORACLE_HOME/dbs/initsid.ora</code> file

Figure 23. Postinstallation Tasks Performed as oracle for a Parallel Server Database

8.4.2.1 Verifying Your oratab File

- Log in as *oracle*.
- See your `/etc/oratab` file, which was created by the Installer after you ran `root.sh` file as root.

This format of `/etc/oratab` file is shown below:

```
ORACLE_SID:ORACLE_HOME:[Y/N]
```

Make sure the `ORACLE_SID` and `ORACLE_HOME` match with your previous setup in the preinstallation tasks you have done.

The `[Y/N]` indicates whether you want to activate the `dbstart` and `dbshut` commands for your configuration.

Note: In this sample configuration, we edit the third field to `Y` so the cluster manager will activate the database startup and shutdown in the cluster configuration.

8.4.2.2 Editing the \$ORACLE_HOME/dbs/initsid.ora File

In the Oracle Parallel Server, there is a file called `initsid.ora` in the `$ORACLE_HOME/dbs` directory in each node which you have to edit. This file will be used as a configuration file when starting the remote database instance on other nodes.

For example, when the cluster is started on both nodes, `mickey` and `goofy` each run their own instance, `C1` at `mickey` and `C2` at `goofy`. If node `mickey` is down or crashes for some reason, then node `goofy` must start `C1`. In such a case, the client that only knows about instance `C1` can still connect to the database. The `$ORACLE_HOME/dbs/initsid.ora` file must have a full path name for pointing to the `configREM.ora` file which was located in the same directory. You have to make sure that your `initC1.ora` and `initC2.ora` at both nodes `mickey` and `goofy` have a full path name pointing to its `configREM.ora` file. Below, we show you the line in the example `initC1.ora` file which you must edit:

```
ifile = /home/oracle/dbs/configRem.ora
```

Usually the default will show :

```
ifile = ./configRem.ora
```

Also you have to make sure that the files listed below exist in the `$ORACLE_HOME/dbs` directory in all nodes in the cluster:

- `configC1.ora`
- `configRem.ora`
- all your `initsid.ora` files, such as `initC1.ora` and `initC2.ora`

8.4.3 Tasks Performed for Other Selected Oracle Products

Below, we show you the postinstallation tasks for SQL*Net V2 with TCP/IP Protocol Adapter. For complete information about postinstallation tasks for other Oracle products, such as Oracle CASE, precompiler, please refer to the *“Post-Installation Tasks for Oracle Products”* chapter in the *Oracle7 for AIX-Based Systems, Installation and Configuration Guide*.

As Oracle software owner, you must make several configuration files for the listener of SQL*Net to work properly.

There are two configuration files for this sample cluster. These files are listener.ora and tnsnames.ora. For complete information about the configuration files for SQL*Net in the server and client, please refer to the *SQL*Net Administrator’s Guide*. These two files must be placed in the correct directory depending on whether you have set up a TNS_ADMIN variable in your user environment or not. If you have set your TNS_ADMIN variable to a specific directory, for example, /home/oracle/TNS_ADMIN, then after you edit the two files, you must put them in that directory. If you did not set up the TNS_ADMIN variable to a specific directory, then you must put the files into the /etc directory after you have created them.

Log in as *oracle* and edit the listener.ora file.

```
$ cd TNS_NAMES  
$ vi listener.ora
```

After you have finished with the listener.ora file, then you have to make the tnsnames.ora file:

```
$ vi tnsnames.ora
```

You can see the listener.ora files for this sample cluster configuration in D.1.4, “File: /home/oracle/tns_admin/listener.ora” on page 136 and the tnsnames.ora file in D.1.5, “File: /home/oracle/tns_admin/tnsnames.ora” on page 137.

Chapter 9. Testing the Parallel Server Database

This chapter shows how we tested our databases. The start and stop scripts defined in the various HACMP configurations are shell scripts in which we make calls to the start and stop scripts of the database under test.

We have tried to make the database start and stop scripts reusable. The actual name of the database and the commands to stop and start it along with other database-specific information was put into a file *database.name.vars*, and this file is sourced into the stop and start scripts.

For Oracle, the file is called *oracle.vars*

All of the files are kept in the */usr/HACMP_ANSS/script* directory. This was done to allow use of the tools developed in *An HACMP Cookbook*, SG24-4553.

9.1 Stopping and Starting the Oracle Database

The application server, defined in the node resources, is used to stop and start the Oracle database(s).

9.1.1 Oracle.vars File

This file contains the name(s) of the database, its users, the home directory of each database, and the host on which the database normally resides. You will have to change this file so that it contains your site-specific values. Some of the changes you make in this file will also entail changes in the *ora_start* script. The *oracle.vars* file we used is shown in Appendix F.

9.1.2 Starting Oracle

The startup script is */usr/HACMP_ANSS/script/start_D1*.

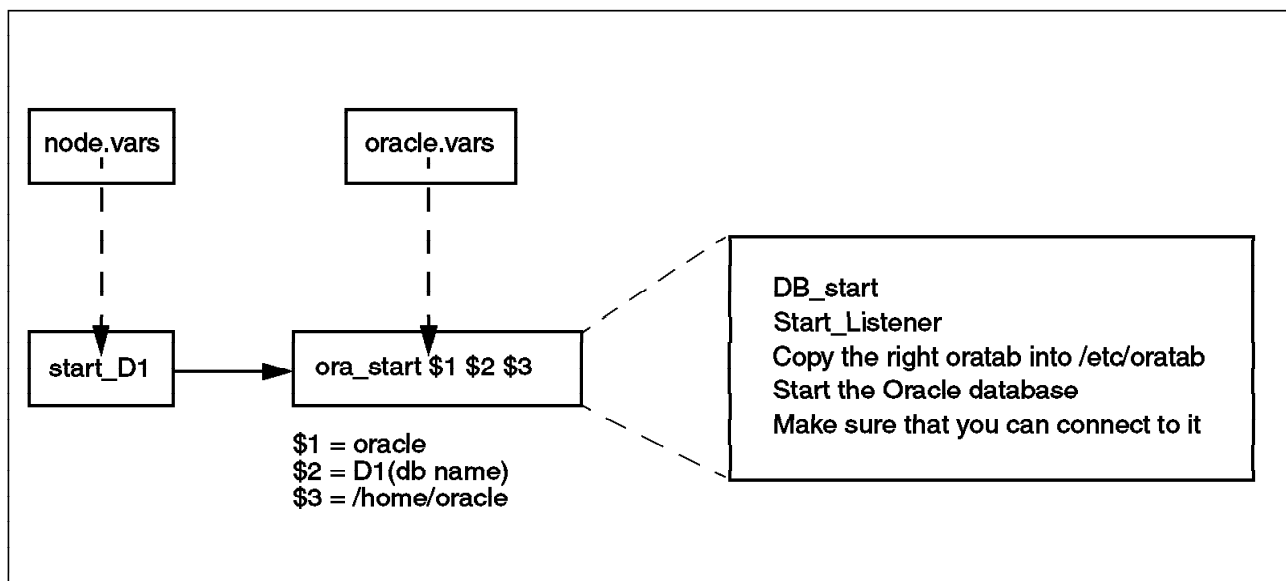


Figure 24. Oracle Start Script Schema

There are a certain number of Oracle configuration files that need to be set up before the database will start up. These files are:

- /etc/oratab
- listener.ora
- tnsnames.ora
- sqlnet.ora

A complete listing of these files may be found in Appendix D, “Oracle Configuration Files for Concurrent Resources” on page 133.

The start_D1 script calls the ora_start script with the relevant parameters, as shown below, to start the database:

```
/usr/HACMP_ANSS/script/ora_start oracle D1 /home/oracle
```

Once Oracle has successfully started, you should see the LGWR (log writer), DBWR (database writer), SMON (system monitor), and the PMON (process monitor) processes running. If you are using SQL*Net, you should also see the listener process running.

In our case, using the ps command, we saw:

```
# ps -fu oracle
  UID  PID  PPID  C   STIME   TTY  TIME CMD
oracle 8556   1    0 14:24:42   -   0:02 ora_lgwr_D1
oracle 9222   1    0 14:24:19   -   0:00 /home/oracle/bin/tnslnsr lisD12
oracle 10838  1    0 16:18:17   -   0:01 oracleD1 (LOCAL=NO)
oracle 18282  1    0 14:24:40   -   0:05 ora_dbwr_D1
oracle 22118 25188  3 16:23:15   -   0:00 oracleD1 (DESCRIPTION=(LOCAL=YE
oracle 22894  1    0 14:24:44   -   0:01 ora_smon_D1
oracle 24168  1    0 14:24:38   -   0:02 ora_pmon_D1
```

We see that there is a connection from a remote client (PID 10838), and a local connection to the D1 database (PID 22118). The listener process is /home/oracle/bin/tnslnsr lisD12 (PID 92222).

9.1.3 Stopping Oracle

The shutdown script is /usr/HACMP_ANSS/script/stop_D1.

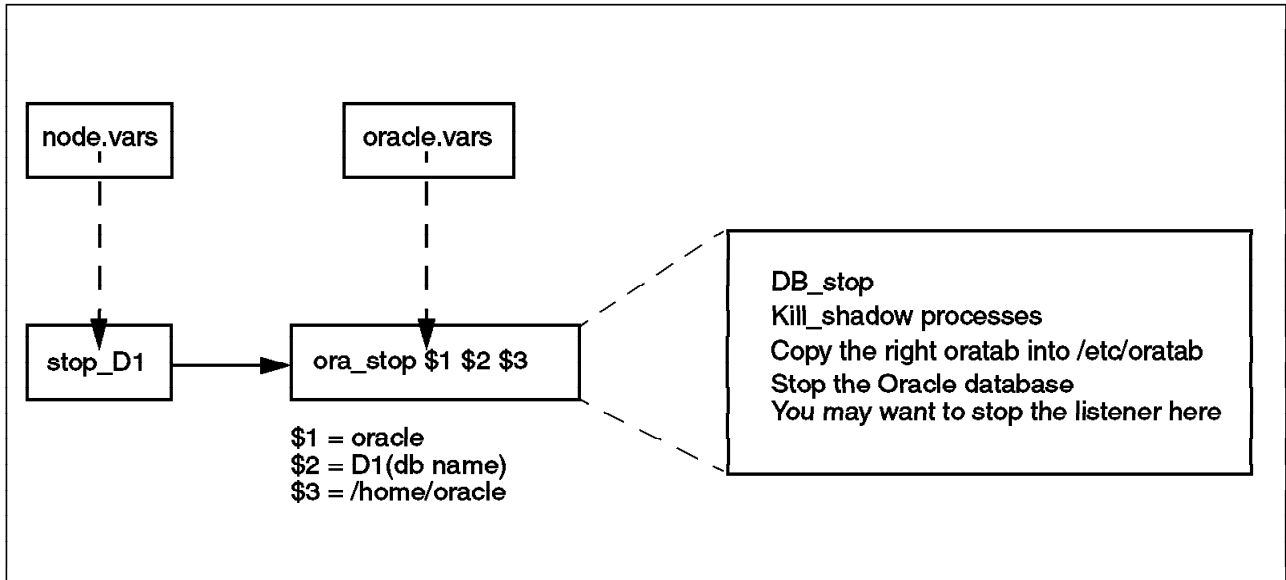


Figure 25. Oracle Stop Script Schema

Chapter 10. Common Errors, Problems, and Recommendations

This chapter discusses common Oracle error messages that you might encounter and problems you might have when you do the installation and setup. Also we will give some recommendations concerning the highly available database.

All of the discussions here are based on our experiences while preparing and doing all the tasks described in previous chapters. Therefore, this chapter is not intended to explain all errors and problems in Oracle. You might find errors or problems that differ from this chapter when you do your installation. However, if you run into some of the same problems that we did, perhaps this chapter will be helpful to you.

10.1 Common Errors and Problems

This section will describe several common errors that occur during the installation and during testing of database access from the client to the server.

For complete information about error messages, please refer to the *Oracle7 Server Messages and Codes Manual* and to the *SQL*Net Administration Guide*. Another good reference is the Appendix B discussion about “*Troubleshooting Your Installer Session*” in the *Oracle7 for AIX-Based Installation and Configuration Guide* for handling problems with the Installer.

10.1.1 Errors and Problems During the Installation Process

When you want to install the Oracle products, always remember the three stages of the process: preinstallation, installation, and postinstallation.

Failure to complete one of these three tasks will end in error, and you will not be able to run your database server and other Oracle products.

10.1.1.1 Installation-Stage Common Errors and Problems

This table shows the common errors that might happen while installing, and helps you to identify the possible reasons for the problem.

Table 24. Common Errors During the Installation Stage

Stage of Installation	Common Error
Installing the Installer	System requirement does not meet environment setup
Initial Installer prompts	Environment setup
Loading the product file	Not enough space in staging area File permissions problem
Installing the product files	Not enough space in \$ORACLE_HOME System requirement not met File permissions problem
Relinking product executables	Not enough space System requirement not met
Creating database objects	System configuration (such as shared memory) Database access problems

For example, you may see the following error message in your Installer menu while creating the database objects:

```
ORA-00210: cannot open control file /oradatafs2/ora_ct1/ct11.ora
```

From this, you know there is something wrong with your control file. Maybe the full pathname you specified is not correct, or your directory is inaccessible. You need to look at your directory permissions.

For complete information about error messages (cause and action), please refer to the *Oracle7 Server Messages and Codes Manual*.

10.1.1.2 Postinstallation-Stage Common Errors and Problems

Remember that every time you finish an installation, you must do the postinstallation tasks. If you forget to complete these tasks, an error situation will result, and you won't be able to run your installed products.

You need to run root.sh after you finish the installation.

```
# ./root.sh
```

You might find that the program always says: Unmatched variables for ORACLE_SID or ORACLE_HOME. If this occurs, you have to do the following:

```
# ORACLE_SID= <your oracle_sid> ; export ORACLE_SID
# ORACLE_HOME= <your oracle_home> ; export ORACLE_HOME
```

and as root, run the root.sh again.

10.1.2 SQL*Net Errors and Problems

When you try to run the listener on the server by typing:

```
$ lsnrctl start
```

you might receive this message:

```
TNS-01151: Missing listener name, LISTENER, in LISTENER.ORA
```

The message above means that you do not have a listener name in your listener.ora file, or that you have a listener name, but did not name it *LISTENER* or the default name. You have to check your listener.ora file and see if you have specified your listener name (see the example in the appropriate Appendix to your configuration). If you have, you should run the listener by typing the listener name after the lsnrctl start command.

The other common error message received when you run the listener is shown below:

```
TNS-12154: TNS: could not resolve service name
```

This error points to a problem related to the tnsnames.ora file. The service name specified cannot be located in the tnsnames.ora file. If you get this error message, do the following:

- Verify that your tnsnames.ora exists and is in the proper directory. Please refer to the previous chapter sections that discuss postinstallation tasks on the server and postinstallation tasks on the client.
- Check to see that the service name is mapped to a connect descriptor in the tnsnames.ora file and add or correct it if necessary.
- Make sure there are no syntax errors in the tnsnames.ora file; check to see if it has unmatched parentheses or stray characters.

```
TNS-12203: TNS: unable to connect to destination
```

This error indicates that the client is not able to find the desired database. If you get this error message, do the following:

- Be sure you have correctly entered the service name you want to reach.
- Look at the tnsnames.ora file to see that the ADDRESS parameters in the connect descriptor for the service name are correct.
- Check and verify if the listener on the remote node is up and listening. You can verify this by typing:

```
lsnrctl status <listener_name>
```

```
TNS-12545: TNS: name lookup failure
```

This error occurs when the listener on the remote node cannot be contacted. The ADDRESS in the tnsnames.ora file or the listener.ora file may be incorrect. This message also appears if the listener on the remote node has not been started.

Note: The error messages in SQL*Net or client-to-server connection errors are usually caused by errors in the tnsnames.ora or listener.ora files. Therefore, these files must be rechecked when you receive any of these errors.

For more information about all SQL*Net error messages, please refer to the *Oracle Network Products Message Manual*.

10.2 Recommendations

- We recommend strongly that you put the control files, redo log files, and all the database object files, such as system tablespace, rollback tablespace, temporary tablespace, and user tablespace, in the shared external disk in the HACMP environment, whether it is an Oracle Parallel or a Nonparallel Server Database.

The reason is that the location of these files is one of the critical points that determines whether or not your database is highly available.

- We also recommend that before you do all the installation tasks, carefully plan your database and prepare your system. For example, make sure your cluster functions properly without the database application. Carefully planning your database means planning all the names and variables for your database, the size of your database, and make sure you have the prerequisite hardware and software. For parallel databases, you also have to create all raw logical volumes needed for all of the database object files prior to the installation process.

Appendix A. System Configuration Files

This appendix contains output from the sample cluster that was installed with the Oracle Nonparallel Server Database.

A.1 System Files

The system files used in our setup are provided for you below.

A.1.1 File: /etc/hosts

We had the following /etc/hosts file on all of our nodes.

```
# Internet Address Hostname # Comments
# 192.9.200.1 net0sample # ethernet name/address
# 128.100.0.1 token0sample # token ring name/address
# 10.2.0.2 x25sample # x.25 name/address
127.0.0.1 loopback localhost # loopback (lo0) name/address
9.3.1.16 hadave1
9.3.4.16 hadave1_stby
9.3.1.3 hadave1_boot
9.3.1.17 hadave2
9.3.4.17 hadave2_stby
9.3.1.6 hadave2_boot
9.3.1.79 mickey
9.3.4.79 mickey_stby
9.3.1.45 mickey_boot
9.3.1.80 goofy
9.3.4.80 goofy_stby
9.3.1.46 goofy_boot
9.3.1.74 itsorusi
9.3.1.43 pluto
```

Figure 26. /etc/hosts File

A.1.2 File: /etc/hosts

We had the following /etc/hosts file on all of our nodes.

```
hadave1
hadave1_stby
hadave1_boot
hadave2
hadave2_stby
hadave2_boot
goofy
goofy_boot
goofy_stby
mickey
mickey_stby
mickey_boot
```

Figure 27. /etc/hosts File

A.1.3 File: /etc/filesystems

The following stanzas were common in the /etc/filesystems file on nodes hadave1 and hadave2.

```
/oradatafs1:
  dev           = /dev/davelv1
  vfs           = jfs
  log           = /dev/daveloglv1
  mount         = false
  check         = false
  type          = vgl_t
  options       = rw
  account       = false

/oradatafs2:
  dev           = /dev/davelv2
  vfs           = jfs
  log           = /dev/daveloglv2
  mount         = false
  check         = false
  type          = vg2_t
  options       = rw
  account       = false

/cdrom:
  dev           = /dev/cd0
  vfs           = cdrfs
  mount         = false
  options       = ro
  account       = false

/home/oracle:
  dev           = /dev/ora_lv
  vfs           = jfs
  log           = /dev/hd8
  mount         = true
  options       = rw
  account       = false
```

Figure 28. Part of Our /etc/filesystems File

A.1.4 File: /etc/inittab

The /etc/inittab file in our configuration is shown below.

```
init:2:initdefault:
brc::sysinit:/sbin/rc.boot 3 >/dev/console 2>&1 # Phase 3 of system boot
powerfail::powerfail:/etc/rc.powerfail 2>&1 | alog -tboot > /dev/console # Power Failure Detection
rc:2:wait:/etc/rc 2>&1 | alog -tboot > /dev/console # Multi-User checks
fbcheck:2:wait:/usr/sbin/fbcheck 2>&1 | alog -tboot > /dev/console # run /etc/firstboot
srcmstr:2:respawn:/usr/sbin/srcmstr # System Resource Controller
harc:2:wait:/usr/sbin/cluster/etc/harc.net # HACMP for AIX network startup
rctcpip:a:wait:/etc/rc.tcpip > /dev/console 2>&1 # Start TCP/IP daemons
rcnfs:a:wait:/etc/rc.nfs > /dev/console 2>&1 # Start NFS Daemons
cron:2:respawn:/usr/sbin/cron
qdaemon:a:wait:/usr/bin/startsrc -sqdaemon
writesrv:a:wait:/usr/bin/startsrc -swritesrv
uprintfd:2:respawn:/usr/sbin/uprintfd
logsymp:2:once:/usr/lib/ras/logsymptom # for system dumps
diagd:2:once:/usr/lpp/diagnostics/bin/diagd >/dev/console 2>&1
dt:2:wait:/etc/rc.dt
cons:0123456789:respawn:/usr/sbin/getty /dev/console
rc_clvmv:2:wait:/usr/sbin/clvm_cfg 2>&1
infod:2:once:startsrc -s infod
tty0:2:off:/usr/sbin/getty /dev/tty0
orapw:2:wait:/etc/loadext /etc/pw-syscall4.1
orakx:2:wait:/etc/loadext /etc/adspc4.1
orakx2:2:wait:/etc/adspcinit
clinit:a:wait:touch /usr/sbin/cluster/.telinit # HACMP for AIX This must be last entry in inittab!
```

Figure 29. /etc/inittab File

Appendix B. Oracle Configuration Files for Rotating Resources

This appendix contains output from the sample cluster that was installed for an Oracle Nonparallel Server Database in a rotating configuration.

B.1 Customized Files

The files are identical on all nodes unless otherwise stated. Where they are different, we show both sets of files. Generally, we only show one set of files.

B.1.1 File: /etc/services

An entry for the Oracle listener process with port 1521 needs to be added to the /etc/services file. The name in the first column has to be the same as the name used for the listener in the listener.ora file..

```
lisD1 1521/tcp # oracle listener - rotating
```

Figure 30. Entry Needed in /etc/services for the Listener

You will probably need to change it to match the listener name for your installation. In our case, the listener is named lisD1.

Note: Make sure that you carry out this change on all of the nodes participating in the rotating resources configuration.

B.1.2 File: /home/oracle/.profile

For both nodes, this file is the same, so we only show you the Oracle user's .profile for one of the nodes.

```
ORACLE_HOME=/home/oracle; export ORACLE_HOME
ORACLE_SID=D1 ; export ORACLE_SID
ORACLE_TERM=lfm ; export ORACLE_TERM
ORACLE_DOC=/home/oracle/ora_doc; export ORACLE_DOC
TNS_ADMIN=/home/oracle/tns_admin; export TNS_ADMIN

PATH=$ORACLE_HOME/bin:/usr/lbin:/usr/bin:/etc:/usr/sbin:/usr/ucb:
$HOME/bin:/usr/bin/X11:/sbin:.

export PATH
alias ocd='cd $ORACLE_HOME'
alias ocdo='cd $ORACLE_HOME/orainst'
alias ops='ps -fu oracle'

set -o vi

if [ -s "$MAIL" ]          # This is at Shell startup.  In normal
then echo "$MAILMSG"     # operation, the Shell checks
fi                        # periodically.
```

Figure 31. /home/oracle/.profile File

You will probably need to change the following variables in the .profile above for your own installation:

- ORACLE_HOME

- ORACLE_SID
- ORACLE_TERM
- ORACLE_DOC
- TNS_ADMIN

B.1.3 File: /etc/oratab

Below is the /etc/oratab file for nodes in a rotating configuration.

```
#
# This file is used by ORACLE utilities.  It is created by root.sh
# and updated by the ORACLE7 and SQL*Net install procedures.
#
# A colon, ':', is used as the field terminator.  A new line terminates
# the entry.  Lines beginning with a pound sign, '#', are comments.
#
# Entries are of the form:
#   $ORACLE_SID:$ORACLE_HOME:<N|Y>:
#
# The first and second fields are the system identifier and home
# directory of the database respectively.  The third field indicates
# to the dbstart utility that the database should, "Y", or should not,
# "N", be brought up at system boot time.
#
# Multiple entries with the same $ORACLE_SID are not allowed.
#
#
D1:/home/oracle:Y
```

Figure 32. /etc/oratab File for Rotating Resources

To match the name of your ORACLE_SID, you will probably need to change the D1 to whatever yours is called.

B.1.4 File: /home/oracle/tns_admin/listener.ora

The figure below shows a listener.ora file for a system running a single database.

```
lisD1=
  (ADDRESS_LIST=
    (ADDRESS=
      (PROTOCOL=TCP)
      (HOST =hadave1)
      (PORT =1521)
    )
  )
sid_list_lisD1=
  (SID_LIST=
    (SID_DESC=
      (SID_NAME=D1)
      (ORACLE_HOME=/home/oracle)
    )
  )
)
```

Figure 33. listener.ora File for Rotating Resources

You will probably need to change the following parameters to match your configuration:

- lisD1 and sid_list_lisD1 to your own values
- HOST to your hostname
- SID_NAME
- ORACLE_HOME

B.1.5 File: /home/oracle/tns_admin/tnsnames.ora

This is the /home/oracle/tns_admin/tnsnames.ora file for rotating resources.

```
D1=
(DESCRIPTION=
(AADDRESS_LIST=
(AADDRESS=
(PROTOCOL=TCP)
(HOST =hadave1)
(PORT =1521)
)
)
)
(CONNECT_DATA=
(SID=D1)
)
```

Figure 34. tnsnames.ora File for Rotating Resources

You will probably need to change:

- D1 to your own value
- HOST to your hostname
- SID

B.1.6 File: /home/oracle/tns_admin/sqlnet.ora

This is the /home/oracle/tns_admin/sqlnet.ora file for rotating resources.

```
# SET_AUTOMATIC_IPC=NO
TRACE_LEVEL_CLIENT=off
```

Figure 35. sqlnet.ora File for Rotating Resources

Appendix C. Oracle Configuration Files for Cascading Resources

This appendix contains output from the sample cluster that was installed for an Oracle Nonparallel Server Database in a cascading configuration.

C.1 Customized Files

The files are identical on all nodes unless otherwise stated. Where they are different, we show both sets of files. Generally, we only show one set of files.

C.1.1 File: /etc/services

An entry for the Oracle *listener* process with port 1521 needs to be added to the /etc/services file. The name in the first column has to be the same as the name used for the listener in the listener.ora file.

We only had one listener for all of the databases we were running. You may decide to use more than one listener, in which case, you will need a line for each listener with a different port number for each one.

```
lisD12 1521/tcp # oracle listener - cascading
```

Figure 36. Entry Needed in /etc/services File for the Listener

You will probably need to change lisD12 to match the listener name for your installation.

Note: Make sure that you carry out this change on all of the nodes participating in the rotating resources configuration.

C.1.2 File: /home/oracle/.profile

This is the /home/oracle/.profile file for hadave1.

```
ORACLE_HOME=/home/oracle; export ORACLE_HOME
ORACLE_SID=D1 ; export ORACLE_SID
ORACLE_TERM=lft ; export ORACLE_TERM
ORACLE_DOC=/home/oracle/ora_doc; export ORACLE_DOC
TNS_ADMIN=/home/oracle/tns_admin; export TNS_ADMIN

PATH=$ORACLE_HOME/bin:/usr/lbin:/usr/bin:/etc:/usr/sbin:/usr/ucb:$HOME/bin:/usr/bin/X11:/sbin:.

export PATH
alias ocd='cd $ORACLE_HOME'
alias ocd0='cd $ORACLE_HOME/orainst'
alias ops='ps -fu oracle'

set -o vi

if [ -s "$MAIL" ]          # This is at Shell startup. In normal
then echo "$MAILMSG"     # operation, the Shell checks
fi                       # periodically.
```

Figure 37. /home/oracle/.profile File on First Node

This is the /home/oracle/.profile file for hadave2.

```

ORACLE_HOME=/home/oracle; export ORACLE_HOME
ORACLE_SID=D2 ; export ORACLE_SID
ORACLE_TERM=1ft ; export ORACLE_TERM
ORACLE_DOC=/home/oracle/ora_doc; export ORACLE_DOC
TNS_ADMIN=/home/oracle/tns_admin; export TNS_ADMIN

PATH=$ORACLE_HOME/bin:/usr/lbin:/usr/bin:/etc:/usr/sbin:/usr/ucb:$HOME/bin:/usr/bin/X11:/sbin:.

export PATH
alias ocd='cd $ORACLE_HOME'
alias ocd0='cd $ORACLE_HOME/orainst'
alias ops='ps -fu oracle'

set -o vi

if [ -s "$MAIL" ]      # This is at Shell startup. In normal
then echo "$MAILMSG"  # operation, the Shell checks
fi                    # periodically.

```

Figure 38. /home/oracle/.profile File on Second Node

The only difference we had between the Oracle user .profiles was the different ORACLE_SID for each database.

You will probably need to change the following variables in the .profile files above:

- ORACLE_HOME
- ORACLE_SID
- ORACLE_TERM
- ORACLE_DOC
- TNS_ADMIN

C.1.3 File: /etc/oratab

Below is the /etc/oratab file for nodes in a cascading configuration.

A copy of the relevant oratab file is kept in our scripts directory. At cluster startup, we issue:

```
cp -p /usr/HACMP_ANSS/script/oratabD1 /etc/oratab
```

This is the oratab entry for hadave1.

```
# This file is used by ORACLE utilities.
It is created by root.sh
# and updated by the ORACLE7 and SQL*Net install procedures.
#
# A colon, ':', is used as the field terminator.
A new line terminates
# the entry.
Lines beginning with a pound sign, '#', are comments.
#
# Entries are of the form:
# $ORACLE_SID:$ORACLE_HOME:<N|Y>:
#
# The first and second fields are the system identifier and home
# directory of the database respectively.
The third field indicates
# to the dbstart utility that the database should, "Y", or should not,
# "N", be brought up at system boot time.
#
# Multiple entries with the same $ORACLE_SID are not allowed.
#
D1:/home/oracle:Y
```

Figure 39. Node 1 oratab Entry for the Database

This is the oratab entry for hadave2. We no longer show the comments contained in the file.

```
D2:/home/oracle:Y
```

Figure 40. Node 2 oratab Entry for the Database

When there has a been a failover, we use a file called oratabD12. This contains both database entries, as shown below.

```
D1:/home/oracle:Y
D2:/home/oracle:Y
```

Figure 41. oratab Entries for Both Databases Running on One Node

We copied this file into /etc/oratab. Make sure the file is copied with the oracle userid as its owner.

You will probably need to change:

- D1 to be that of your first database ORACLE_SID
- D2 to be that of your ORACLE_SID

C.1.4 File: /home/oracle/tns_admin/listener.ora

The figure below shows a listener.ora file for a system running more than one database. We had two databases and thus created a listener capable of working with each database separately or with both databases simultaneously.

This is the a listener.ora file for hadave1.

```
lisD12=
  (ADDRESS_LIST=
    (ADDRESS=
      (PROTOCOL=TCP)
      (HOST =hadave1)
      (PORT =1521)
    )
  )
sid_list_lisD12=
  (SID_LIST=
    (SID_DESC=
      (SID_NAME=D1)
      (ORACLE_HOME=/home/oracle)
    )
    (SID_DESC=
      (SID_NAME=D2)
      (ORACLE_HOME=/home/oracle)
    )
  )
)
```

Figure 42. listener.ora File for Cascading Resources, Node 1

This is the a listener.ora file for hadave2.

```
lisD12=
  (ADDRESS_LIST=
    (ADDRESS=
      (PROTOCOL=TCP)
      (HOST =hadave2)
      (PORT =1521)
    )
  )
sid_list_lisD12=
  (SID_LIST=
    (SID_DESC=
      (SID_NAME=D1)
      (ORACLE_HOME=/home/oracle)
    )
    (SID_DESC=
      (SID_NAME=D2)
      (ORACLE_HOME=/home/oracle)
    )
  )
)
```

Figure 43. listener.ora File for Cascading Resources, Node 2

For both of the above files, you will probably need to change:

- lisD12 and sid_list_lisD12 to your own values
- HOST to your hostname
- SID_NAME
- ORACLE_HOME

C.1.5 File: /home/oracle/tns_admin/tnsnames.ora

The tnsnames.ora file is the same on both nodes.

```

D1=
    (DESCRIPTION=
      (ADDRESS_LIST=
        (ADDRESS=
          (PROTOCOL=TCP)
          (HOST =hadave1)
          (PORT =1521)
        )
      )
    )
(CONNECT_DATA=
(SID=D1)
)
D2=
    (DESCRIPTION=
      (ADDRESS_LIST=
        (ADDRESS=
          (PROTOCOL=TCP)
          (HOST =hadave2)
          (PORT =1521)
        )
      )
    )
(CONNECT_DATA=
(SID=D2)
)
```

Figure 44. tnsnames.ora File for Cascading Resources

.You will probably need to change :

- D1 and D2 to your own values
- HOST to your hostnames
- SID

C.1.6 File: /home/oracle/tns_admin/sqlnet.ora

For both nodes, this file is the same, so we only show you the file for one of the two nodes.

```
# SET_AUTOMATIC_IPC=NO
TRACE_LEVEL_CLIENT=off
```

Figure 45. sqlnet.ora File for Cascading Resources

Appendix D. Oracle Configuration Files for Concurrent Resources

This appendix contains output from the sample cluster that was installed for an Oracle Parallel Server Database in a concurrent configuration.

D.1 Customized Files

The files are identical on all nodes unless otherwise stated. Where they are different, we show both sets of files. Generally, we only show one set of files.

D.1.1 File: /etc/services

An entry for the Oracle *listener* process with port 1521 needs to be added to the /etc/services file. The name in the first column has to be the same as the name used for the listener in the listener.ora file.

We only had one listener for all of the databases we were running. You may decide to use more than one listener, in which case you will need a line for each listener, with a different port number for each one.

```
lisC12          1521/tcp          # oracle listener - concurrent
```

Figure 46. Entry Needed in /etc/services for the Listener

You will probably need to change lisC12 to match the listener name for your installation.

Note: Make sure that you carry out this change on all of the nodes participating in the concurrent resources configuration.

D.1.2 File: /home/oracle/.profile

This is the /home/oracle/.profile file for node mickey.

```
ORACLE_HOME=/home/oracle; export ORACLE_HOME
ORACLE_SID=C1 ; export ORACLE_SID
ORACLE_TERM=1ft ; export ORACLE_TERM
ORACLE_DOC=/home/oracle/ora_doc; export ORACLE_DOC
TNS_ADMIN=/home/oracle/tns_admin; export TNS_ADMIN

PATH=$ORACLE_HOME/bin:/usr/lbin:/usr/bin:/etc:/usr/sbin:/usr/ucb:$HOME/bin:/usr
/
bin/X11:/sbin:.

export PATH
alias ocd='cd $ORACLE_HOME'
alias ocdo='cd $ORACLE_HOME/orainst'
alias ops='ps -fu oracle'

set -o vi

if [ -s "$MAIL" ]          # This is at Shell startup.  In normal
then echo "$MAILMSG"     # operation, the Shell checks
fi                        # periodically.
```

Figure 47. /home/oracle/.profile File on Node mickey

This is the /home/oracle/.profile file for node goofy.

```
ORACLE_HOME=/home/oracle; export ORACLE_HOME
ORACLE_SID=C2 ; export ORACLE_SID
ORACLE_TERM=lfm ; export ORACLE_TERM
ORACLE_DOC=/home/oracle/ora_doc; export ORACLE_DOC
TNS_ADMIN=/home/oracle/tns_admin; export TNS_ADMIN

PATH=$ORACLE_HOME/bin:/usr/lbin:/usr/bin:/etc:/usr/sbin:/usr/ucb:$HOME/bin:/usr
/
bin/X11:/sbin:.

export PATH
alias ocd='cd $ORACLE_HOME'
alias ocd0='cd $ORACLE_HOME/orainst'
alias ops='ps -fu oracle'

set -o vi

if [ -s "$MAIL" ]          # This is at Shell startup. In normal
then echo "$MAILMSG"      # operation, the Shell checks
fi                          # periodically.
```

Figure 48. /home/oracle/.profile File on Node goofy

The only difference we had between the Oracle user .profiles was the different ORACLE_SID for each database.

You will probably need to change the following variables in the .profile files above to match your own values:

- ORACLE_HOME
- ORACLE_SID
- ORACLE_TERM
- ORACLE_DOC
- TNS_ADMIN

D.1.3 File: /etc/oratab

Below is the /etc/oratab file for nodes in a concurrent configuration.

A copy of the relevant oratab is kept in our scripts directory. At cluster startup, we issue:

```
cp -p /usr/HACMP_ANSS/script/oratabD1 /etc/oratab
```

This is the oratab entry for node mickey.


```
# This file is used by ORACLE utilities.
It is created by root.sh
# and updated by the ORACLE7 and SQL*Net install procedures.
#
# A colon, ':', is used as the field terminator.
A new line terminates
# the entry.
Lines beginning with a pound sign, '#', are comments.
#
# Entries are of the form:
# $ORACLE_SID:$ORACLE_HOME:<N|Y>:
#
# The first and second fields are the system identifier and home
# directory of the database respectively.
The third field indicates
# to the dbstart utility that the database should, "Y", or should not,
# "N", be brought up at system boot time.
#
# Multiple entries with the same $ORACLE_SID are not allowed.
#
C1:/home/oracle:Y
```

Figure 49. *oratab* Entry for Concurrent Database on Node mickey

For node goofy, we had a file called *oratabD2*. We no longer show the comments contained in the file.

```
C2:/home/oracle:Y
```

Figure 50. *oratab* Entry for Concurrent Database on Node goofy

When there has been a failover, we have a file called *oratabD12* containing both entries as shown below.

```
C1:/home/oracle:Y
C2:/home/oracle:Y
```

Figure 51. *oratab* Entries for Both Databases Running on One Node

We copied this file into */etc/oratab*. Make sure that the file is copied with the oracle userid as its owner.

You will probably need to change:

- C1 to be that of your first database ORACLE_SID
- C2 to be that of your second database ORACLE_SID

D.1.4 File: /home/oracle/tns_admin/listener.ora

The figure below shows a listener.ora file for a system running more than one database. We had two databases and thus created a listener capable of working with each database separately, or with both databases simultaneously.

This is the listener.ora file for node mickey.

```
lisC12=
  (ADDRESS_LIST=
    (ADDRESS=
      (PROTOCOL=TCP)
      (HOST =mickey)
      (PORT =1521)
    )
  )
sid_list_lisC12=
  (SID_LIST=
    (SID_DESC=
      (SID_NAME=C1)
      (ORACLE_HOME=/home/oracle)
    )
    (SID_DESC=
      (SID_NAME=C2)
      (ORACLE_HOME=/home/oracle)
    )
  )
)
```

Figure 52. listener.ora File for Concurrent Resources on Node mickey

This is the listener.ora file for node goofy.

```
lisC12=
  (ADDRESS_LIST=
    (ADDRESS=
      (PROTOCOL=TCP)
      (HOST =goofy)
      (PORT =1521)
    )
  )
sid_list_lisC12=
  (SID_LIST=
    (SID_DESC=
      (SID_NAME=C1)
      (ORACLE_HOME=/home/oracle)
    )
    (SID_DESC=
      (SID_NAME=C2)
      (ORACLE_HOME=/home/oracle)
    )
  )
)
```

Figure 53. listener.ora File for Concurrent Resources on Node goofy

For both of the above files, you will probably need to change:

- lisC12 and sid_list_lisC12 to your own values
- HOST to your hostname
- SID_NAME
- ORACLE_HOME

D.1.5 File: /home/oracle/tns_admin/tnsnames.ora

The tnsnames.ora file is the same on both nodes.

```
C1=
    (DESCRIPTION=
      (ADDRESS_LIST=
        (ADDRESS=
          (PROTOCOL=TCP)
          (HOST =mickey)
          (PORT =1521)
        )
      )
    )
(CONNECT DATA=
  (SID=C2)
)
C2=
    (DESCRIPTION=
      (ADDRESS_LIST=
        (ADDRESS=
          (PROTOCOL=TCP)
          (HOST =goofy)
          (PORT =1521)
        )
      )
    )
(CONNECT DATA=
  (SID=C2)
)
```

Figure 54. tnsnames.ora File for Concurrent Resources

You will probably need to change :

- C1 and C2 to your own values
- HOST to your hostnames
- SID

D.1.6 File: /home/oracle/tns_admin/sqlnet.ora

For both nodes, this file is the same; so we only show you the file for one of the two nodes.

```
# SET_AUTOMATIC_IPC=NO
TRACE_LEVEL_CLIENT=off
```

Figure 55. sqlnet.ora File for Concurrent Resources

D.2 Sample C Program for Testing the Lock Manager

Below is the C program that can be compiled and used for testing the lock manager function.

The program is compiled using the following command:

```
cc testlm.c -o testlm -lcl -cllm -lclstr
```

D.2.1 Lock Manager Test File: /home/oracle/testlm.c

```
#include <cluster/clm.h>
#include <cluster/ast.h>
#include <sys/types.h>
#include <netinet/in.h>
#include <cluster/clinfo.h>
#include <signal.h>
void astfunc();
void bastfunc();
struct lockstatus lk_sb;
main()
{
    clm_stats_t ret;
    int options;
    /* Initialize lock manager */
    if ((ret = cl_initialize()) != CLE_OK) {
        clm_perror("couldn't connect to LM");
        exit(1);
    }
    /* Set up for polling rather than being signalled */
    /* Use SIGIO (or whatever) if you want a signal for ASTs/BASTs */
    clm_setnotify(SIG_DFL,0);
    options = LKM_SINGLDLCK;
    ret =
    clmlock(LKM_EXMODE,&lk_sb,options,"res1",4,astfunc,&lk_sb,bastfunc);
    clm_perror("Immediate return status of lock request");
    if (ret==CLM_BADARGS)
        exit(1);
    while (!ASTpoll(getpid(),0));
    options = LKM_SINGLDLCK | LKM_CONVERT;
    ret = clmlock(LKM_PWMODE,&lk_sb,options,0,0,astfunc,&lk_sb,bastfunc);
    clm_perror("Immediate return status of lock request");
    while (!ASTpoll(getpid(),0));
    ret = clmunlock(lk_sb.lockid,lk_sb.value,0);
    clm_perror("Immediate return status of unlock request");
    exit(0);
}
void astfunc(astargs)
void *astargs;
{
    struct lockstatus *lk_sb;
    char *msg;
    lk_sb = (struct lockstatus *) astargs;
    printf("in astfuncn");
    msg = clm_errmsg(lk_sb->status);
    printf("completion function status: %sn",msg);
}
}
```

Figure 56. Lock Manager Test Program - page 1 of 2

```
void bastfunc(astargs,mode)
void *astargs;
int mode;
{
int ret;
printf("in bastfunc, mode = %dn",mode);
ret = clmlock(LKM_NLMODE,&lksb,LKM_CONVERT,0,0,astfunc,0,bastfunc);
printf("ret = %dn", ret);
}
```

Figure 57. Lock Manager Test Program - page 2 of 2

Appendix E. Oracle Configuration Files for the Client

This appendix contains sample output from the client system.

E.1 Customized Files

The files will have identical entries on each of your client systems, unless otherwise stated.

E.1.1 File: /etc/services

The following entry is added into the clients /etc/services file by the Oracle Installer.

```
tcptlsv 1521/tcp
```

Figure 58. Client /etc/services Entry

E.1.2 File: /home/oracle/.profile

This is the client's /home/oracle/.profile file.

```
ORACLE_HOME=/home/oracle; export ORACLE_HOME
ORACLE_TERM=lft ; export ORACLE_TERM
ORACLE_DOC=/home/oracle/ora_doc; export ORACLE_DOC

PATH=$ORACLE_HOME/bin:/usr/sbin:/usr/bin:/etc:/usr/sbin:/usr/ucb:$HOME/bin:/usr
/
bin/X11:/sbin:

export PATH
alias ocd='cd $ORACLE_HOME'
alias ocdo='cd $ORACLE_HOME/orainst'
alias ops='ps -fu oracle'

set -o vi

if [ -s "$MAIL" ]          # This is at Shell startup. In normal
then echo "$MAILMSG"     # operation, the Shell checks
fi                        # periodically.

if [ -s "$MAIL" ]          # This is at Shell startup. In normal
then echo "$MAILMSG"     # operation, the Shell checks
fi                        # periodically.
```

Figure 59. Client .profile File

You will probably need to change the following variables in the .profile file above:

- ORACLE_HOME
- ORACLE_TERM
- ORACLE_DOC

E.1.3 Client /etc/tnsnames.ora File

The /etc/tnsnames.ora file is the same on all client systems..

```
C2=
  (DESCRIPTION=
    (ADDRESS_LIST=
      (ADDRESS=
        (COMMUNITY=)
        (PROTOCOL=tcp)
        (PORT=1521)
        (HOST=goofy)
      )
    )
  (CONNECT_DATA=
    (SID=C2)
  )
)
C1=
  (DESCRIPTION=
    (ADDRESS_LIST=
      (ADDRESS=
        (COMMUNITY=)
        (PROTOCOL=tcp)
        (PORT=1521)
        (HOST=mickey)
      )
    )
  (CONNECT_DATA=
    (SID=C1)
  )
)
D1=
  (DESCRIPTION=
    (ADDRESS_LIST=
      (ADDRESS=
        (COMMUNITY=)
        (PROTOCOL=tcp)
        (PORT=1521)
        (HOST=hadave1)
      )
    )
  (CONNECT_DATA=
    (SID=D1)
  )
)
```

Figure 60. Client /etc/tnsnames.ora File - page 1 of 2


```
D2=  
(DESCRIPTION=  
(ADDRESS_LIST=  
(ADDRESS=  
(COMMUNITY=)  
(PROTOCOL=tcp)  
(PORT=1521)  
(HOST=hadave2)  
)  
)  
(CONNECT_DATA=  
(SID=D2)  
)  
)
```

Figure 61. Client /etc/tnsnames.ora File - page 2 of 2

You will probably need to change :

- C1, C2, D1 and D2 to your own values
- HOST to your hostnames
- SID

E.1.4 Client /etc/sqlnet.ora File

The /etc/sqlnet.ora file will be the same on all client systems.

```
# SET_AUTOMATIC_IPC=NO  
TRACE_LEVEL_CLIENT=off
```

Figure 62. Client /etc/sqlnet.ora File

Appendix F. Scripts Used in Our Examples

The following Oracle-related shell scripts were created for use in our examples.

F.1 Oracle Startup Script: /usr/HACMP_ANSS/script/ora_start

```
#!/bin/ksh

#source the oracle variables file

. /usr/HACMP_ANSS/script/oracle.vars

#-----
# check the number of input parameters
# if not the right number then print usage:
#-----
if [ $# != 3 ]
then
    tput smso
    echo "usage: $0 Db_user Db_name Db_home_directory"
    tput sgr0
    exit
fi
#-----

[ $VERBOSE = "TRUE" ] && set -x

#-----
# $2 contains the name of the database you want to startup
# here it is assumed that there are not more than 2 databases
# if you have more then you must add a variable in oracle.vars
# and replace D12_BASE by the name of that variable and also
# change the WHICH_DB="$D1_BASE $D2_BASE" line to reflect the
# number of databases you are starting up
#
DB_USER="$1"
if [ $2 = ${D12_BASE:-none} ]
then
    WHICH_DB="$D1_BASE $D2_BASE"
else
    WHICH_DB="$2"
fi
DB_HOME="$3"
#-----

LSNR_active ()
{
    [ "$VERBOSE" = "TRUE" ] && set -x
    LSNR_STATE=`ps -fu $1 | grep -c "$2"`
    if [ $LSNR_STATE -eq 1 ]
    then
        LSNR_ACTIVE=true
    else
        LSNR_ACTIVE=false
    fi
}
```

Figure 63. Common ora_start Script - page 1 of 4

```

#-----
DB_active ()
{
[ "$VERBOSE" = "TRUE" ] && set -x
if [ $# != 2 ]
then
    DB_ACTIVE=false
else
    DB_STATE=`ps -fu $1 | grep -c "ora_.*$2"`
    if [ $DB_STATE -ge 4 ]
    then
        DB_ACTIVE=true
    else
        DB_ACTIVE=false
    fi
fi
}
#-----
connect_to_DB ()
{
[ "$VERBOSE" = "TRUE" ] && set -x

DB_CONNECT=""
    tput smso
    echo "TESTING base $1"
    tput sgr0
    export ORACLE_HOME=$2
    export ORACLE_SID=$1

$ORACLE_HOME/bin/sqlplus<<FIN
scott/tiger
WHENEVER SQLERROR CONTINUE;
DROP TABLE ntab$$;
CREATE TABLE ntab$$ ( nbr Number);
WHENEVER SQLERROR EXIT SQL.SQLCODE;
INSERT INTO ntab$$ VALUES(42);
COMMIT;
SELECT SYSDATE,nbr FROM ntab$$;
DROP TABLE ntab$$;
FIN
LRES=$?
if [ "$LRES" = "0" ]
then
    DB_CONNECT=ok
else
    DB_CONNECT=nok
fi
sleep 3
}
#-----
connection_OK ()
{
if [ $DB_CONNECT = ok ]
then
    echo everything is ok
else
    restart_DB
fi
}

```

Figure 64. Common ora_start Script - page 2 of 4

```

#-----
#if you have more than one listener then
#you will have to make more than one call to the LSNR_active function
#to take into account the other listeners.
#you will also need to update the oracle.vars file at
#the place marked add more oracle listeners here

DB_start ()
{
[ "$VERBOSE" = "TRUE" ] && set -x

#check to see that the listener is active if not start it

LSNR_active $DB_USER $LSNR_NAME
if [ $LSNR_ACTIVE = false ]
then
    echo "listener $LSNR_NAME is not active, it will be started"
    su - $DB_USER -c "$START_LISTNR"
else
    echo "listener $LSNR_NAME is already active"
fi

if [ "$1" = "${D1_BASE:-none}" ]
then
    cp -p /usr/HACMP_ANSS/script/oratabD1 /etc/oratab
    su - $DB_USER -c "$START_DB"

    DB_active $DB_USER $1
    if [ $DB_ACTIVE = true ]
    then
        DB_active $DB_USER $D2_BASE
        if [ $DB_ACTIVE = true ]
        then
            cp -p /usr/HACMP_ANSS/script/oratabD12 /etc/oratab
        fi
    fi
elif [ "$1" = "${D2_BASE:-none}" ]
then
    cp -p /usr/HACMP_ANSS/script/oratabD2 /etc/oratab
    su - $DB_USER -c "$START_DB"
    DB_active $DB_USER $1
    if [ $DB_ACTIVE = true ]
    then
        DB_active $DB_USER $D1_BASE
        if [ $DB_ACTIVE = true ]
        then
            cp -p /usr/HACMP_ANSS/script/oratabD12 /etc/oratab
        fi
    fi
elif [ "$1" = "${D12_BASE:-none}" ]
then
    cp -p /usr/HACMP_ANSS/script/oratabD12 /etc/oratab
    su - $DB_USER -c "$START_DB"

fi
}

```

Figure 65. Common ora_start Script - page 3 of 4

```
#-----  
##### main #####  
#-----  
for db in $WHICH_DB  
do  
    DB_active $DB_USER $db  
  
    if [ $DB_ACTIVE = true ]  
    then  
        echo "DB $db is already active"  
        connect_to_DB $db $DB_HOME  
        connection_OK  
    else  
        echo "DB $db is not active"  
        echo "it will be started up now"  
        DB_start $db  
    fi  
done
```

Figure 66. Common ora_start Script - page 4 of 4

F.2 Oracle Shutdown Script: /usr/HACMP_ANSS/script/ora_stop

```
#!/bin/ksh

#
# ora_stop
# script used to stop the oracle database
#

. /usr/HACMP_ANSS/script/oracle.vars

#-----
if [ $# != 3 ]
then
    tput smso
    echo "usage: $0 Db_user Db_name Db_home_directory"
    tput sgr0
    exit
fi
#-----
[ $VERBOSE = "TRUE" ] && set -x
#-----
DB_USER="$1"
if [ $2 = ${D12_BASE:-none} ]
then
    WHICH_DB="$D1_BASE $D2_BASE"
else
    WHICH_DB="$2"
fi
DB_HOME="$3"
#-----
DB_active ()
{
    [ "$VERBOSE" = "TRUE" ] && set -x
    if [ $# != 2 ]
    then
        DB_ACTIVE=false
    else
        DB_STATE=`ps -fu $1 | grep -c "ora_.*$2"`
        if [ $DB_STATE -ge 4 ]
        then
            DB_ACTIVE=true
        else
            DB_ACTIVE=false
        fi
    fi
}
#-----
# it is probably a good idea to do a shutdown abort of your
# database everytime. This is just in case you have lost one
# of your control files, after a disk failure
# maybe. If you have you will not be able to
# shutdown your database properly, the steps to take are:
# 1) shutdown abort
# 2) restart the database in RESTRICT mode
# 3) shut it down cleanly
# Look at the oracle information on control files for more info.
#
```

Figure 67. Common ora_stop Script - page 1 of 3

```

DB_stop_abort ()
{
[ "$VERBOSE" = "TRUE" ] && set -x
su - $DB_USER -c sqlclba <<FIN
connect internal
shutdown abort
FIN
}
#-----
DB_stop_immediate ()
{
[ "$VERBOSE" = "TRUE" ] && set -x
su - $DB_USER -c sqlclba <<FIN
connect internal
shutdown immediate
FIN
}
#-----
kill_shadow()
{
[ "$SHELL_DEBUG" = "TRUE" ] && set -x

PID_shadow=`ps -F "pid,args" -u oracle|egrep "sql.*|oracle$1"|awk '{print $1}'`
\
${PID_shadow:+kill -9 $PID_shadow}
}
#-----
DB_stop ()
{
[ "$VERBOSE" = "TRUE" ] && set -x
if [ "$1" = "${D1_BASE:-none}" ]
then
kill_shadow $D1_BASE
cp -p /usr/HACMP_ANSS/script/oratabD1 /etc/oratab
su - $DB_USER -c "$STOP_DB"
elif [ "$1" = "${D2_BASE:-none}" ]
then
kill_shadow $D2_BASE
cp -p /usr/HACMP_ANSS/script/oratabD2 /etc/oratab
su - $DB_USER -c "$STOP_DB"
elif [ "$1" = "${D12_BASE:-none}" ]
then
kill_shadow $D1_BASE
kill_shadow $D2_BASE
cp -p /usr/HACMP_ANSS/script/oratabD12 /etc/oratab
su - $DB_USER -c "$STOP_DB"
fi
}

```

Figure 68. Common ora_stop Script - page 2 of 3


```
#-----  
##### main #####  
#-----  
for db in $WHICH_DB  
do  
    DB_active $DB_USER $db  
    if [ $DB_ACTIVE = true ]  
    then  
        echo "DB $db is active"  
        echo "it will be stoped up now"  
        DB_stop $db  
    else  
        echo "DB $db is already stopped"  
    fi  
done
```

Figure 69. Common ora_stop Script - page 3 of 3

F.3 Rotating Resources: /usr/HACMP_ANSS/script/oracle.vars

The following scripts are particular to the rotating resources environment.

F.3.1 File: /usr/HACMP_ANSS/script/oracle.vars

This script sets the correct environment variables for rotating resources.

```
START_DB="dbstart"
STOP_DB="dbshut"

#add more oracle listeners here
#do not forget to export them below
LSNR_NAME="lisD1"
START_LSNR="lsnrctl start $LSNR_NAME"
STOP_LSNR="lsnrctl stop $LSNR_NAME"

D1_HOST="hadave1"

D1_USER="oracle"

D1_HOME="/home/oracle"

#if you have more databases then add them here
#one line for each database
D1_BASE="D1"
#if you want to start up several databases in one go
#then change the following line OR add another variable
#also look at the ora_start program
# eg D12_BASE="D12"

VERBOSE="TRUE"

export START_DB STOP_DB
export LSNR_NAME START_LSNR STOP_LSNR
export D1_HOST
export D1_USER
export D1_HOME
export D1_BASE
export VERBOSE
```

Figure 70. Oracle.vars for a Rotating Configuration.

Note: You could also use this file in a one-sided takeover scenario.

You will probably need to change:

- LSNR_NAME
- D1_HOST
- D1_USER
- D1_HOME
- D1_BASE

F.4 Cascading Resources: `usr/HACMP_ANSS/script/oracle.vars`

The following scripts are particular to the cascading resources environment.

F.4.1 File: `/usr/HACMP_ANSS/script/oracle.vars`

This script sets the correct environment variables for cascading resources.

```
START_DB="dbstart"
STOP_DB="dbshut"

#add more oracle listeners here
#do not forget to export them below
LSNR_NAME="lisD12"
START_LSNR="lsnrctl start $LSNR_NAME"
STOP_LSNR="lsnrctl stop $LSNR_NAME"

START_SQLNET="tcpctl start"
STOP_SQLNET="tcpctl stop"

ORACLE_SQLNET="orasrv"

D1_HOST="hadave1"
D2_HOST="hadave2"

D1_USER="oracle"
D2_USER="oracle"

D1_HOME="/home/oracle"
D2_HOME="/home/oracle"

#if you have more databases then add them here
#one line for each database
D1_BASE="D1"
D2_BASE="D2"

#if you want to start up several databases in one go
#then change the following line OR add another variable
#also look at the ora_start program
D12_BASE="D12"

VERBOSE="TRUE"

export START_DB STOP_DB
export LSNR_NAME START_LSNR STOP_LSNR
export START_SQLNET STOP_SQLNET ORACLE_SQLNET
export D1_HOST D2_HOST
export D1_USER D2_USER
export D1_HOME D2_HOME
export D1_BASE D2_BASE D12_BASE
export VERBOSE
```

Figure 71. Oracle.vars for a Cascading Configuration

You will probably need to change:

- LSNR_NAME
- D1_HOST and D2_HOST
- D1_USER and D2_USER
- D1_HOME and D2_HOME
- D1_BASE and D2_BASE and D12_BASE

F.5 Concurrent Resources: /usr/HACMP_ANSS/script/oracle.vars

The following scripts are particular to the concurrent resources environment.

F.5.1 File: /usr/HACMP_ANSS/script/oracle.vars

This script sets the correct environment variables for concurrent resources.

```
START_DB="dbstart"
STOP_DB="dbshut"

#add more oracle listeners here
#do not forget to export them below
LSNR_NAME="lisC12"
START_LSNR="lsnrctl start $LSNR_NAME"
STOP_LSNR="lsnrctl stop $LSNR_NAME"

START_SQLNET="tcpctl start"
STOP_SQLNET="tcpctl stop"

ORACLE_SQLNET="orasrv"

D1_HOST="mickey"
D2_HOST="goofy"

D1_USER="oracle"
D2_USER="oracle"

D1_HOME="/home/oracle"
D2_HOME="/home/oracle"

#if you have more databases then add them here
#one line for each database
D1_BASE="C1"
D2_BASE="C2"

#if you want to start up several databases in one go
#then change the following line OR add another variable
#also look at the ora_start program
D12_BASE="C12"

VERBOSE="TRUE"

export START_DB STOP_DB
export LSNR_NAME START_LSNR STOP_LSNR
export START_SQLNET STOP_SQLNET ORACLE_SQLNET
export D1_HOST D2_HOST
export D1_USER D2_USER
export D1_HOME D2_HOME
export D1_BASE D2_BASE D12_BASE
export VERBOSE
```

Figure 72. Oracle.vars for a Concurrent Configuration

You will probably need to change:

- LSNR_NAME
- D1_HOST and D2_HOST
- D1_USER and D2_USER
- D1_HOME and D2_HOME
- D1_BASE and D2_BASE and D12_BASE

Appendix G. Special Notices

This publication is intended to help HACMP specialists install and set up highly available Oracle databases. The information in this publication is not intended as the specification of any programming interfaces that are provided by HACMP for AIX or for the Oracle database products. See the PUBLICATIONS section of the IBM Programming Announcement for HACMP for AIX for more information about what publications are considered to be product documentation. Also, please refer to the official product documentation for the Oracle products you have purchased and plan to install.

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Appendix H. Related Publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

H.1 International Technical Support Organization Publications

For information on ordering these ITSO publications see "How To Get ITSO Redbooks" on page 159.

- *High Availability on the RISC System/6000 Family, SG24-4551*
- *An HACMP Cookbook, SG24-4553*

H.2 Redbooks on CD-ROMs

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Application Development Redbooks Collection	SBOF-7290	SK2T-8037
Personal Systems Redbooks Collection	SBOF-7250	SK2T-8042

H.3 Other Publications

These publications are also relevant as further information sources:

- *HACMP for AIX, Version 4.1.1: Concepts and Facilities, SC23-2767*
- *HACMP for AIX, Version 4.1.1: Planning Guide, SC23-2768*
- *HACMP for AIX, Version 4.1.1: Installation Guide, SC23-2769*
- *HACMP for AIX, Version 4.1.1: Administration Guide, SC23-2770*
- *HACMP for AIX, Version 4.1.1: Troubleshooting Guide, SC23-2771*
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- *HACMP for AIX, Version 4.1.1: Programming Client Applications, SC23-2773*
- *HACMP for AIX, Version 4.1.1: Master Index and Glossary, SC23-2774*
- *Official Oracle product documentation, shipped with the database product.*

How To Get ITSO Redbooks

This section explains how both customers and IBM employees can find out about ITSO redbooks, CD-ROMs, workshops, and residencies. A form for ordering books and CD-ROMs is also provided.

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```

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- **IBM Direct Publications Catalog on the World Wide Web**

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List of Abbreviations

ANSI	American National Standards Institute	ITSO	International Technical Support Organization
APA	all points addressable	LGWR	Log Writer
ARCH	Archiver Process	LOCK	Parallel Server Lock Processor
ASCII	American Standard Code for Information Interchange	ODM	Object Data Manager
AS/400	Application System/400	OLTP	On Line Transaction Processing
CASE	computer assisted software engineering	PGA	Program Global Area
CKPT	checkpoint	PMON	Process Monitor
DBWR	Database Writer	PROFS	Professional Office System
DNS	Domain Name Server	RECO	Recover Process
DSMIT	Distributed System Management Interface Tool	SGA	System Global Area or Shared Global Area
GODM	Global Object Data Manager	SMIT	System Management Interface Tool
HACMP	High Availability Cluster Multi-Processing	SMON	System Monitor
HANFS	High Availability Network File System	VGDA	Volume Group Descriptor Area
IBM	International Business Machines Corporation	VGSA	Volume Group Status Area

Index

Special Characters

/.rhosts 120
/etc/filesystems 120
/etc/hosts 119
/etc/inittab 121
/etc/oratab 124, 128, 134
/etc/oratab file 72
/etc/services 127, 133, 141
/etc/sqlnet.ora 143
/etc/tnsnames.ora 142
/home/oracle/.profile 123, 127, 133, 141
/home/oracle/tns_admin/listener.ora 124, 130, 136
/home/oracle/tns_admin/sqlnet.ora 125, 131, 137
/home/oracle/tns_admin/tnsnames.ora 125, 131, 137
/usr/HACMP_ANSS/script directory 87
/usr/HACMP_ANSS/script/ora_start 145
/usr/HACMP_ANSS/script/ora_stop 149
/usr/HACMP_ANSS/script/oracle.vars 152, 153, 154

A

abbreviations 163
application server 111
archived redo log 9
archiver (ARCH) process 13

B

bad block relocation 47
bibliography 157
boot adapter 35

C

cascading cluster 39
checkpoint (CKPT) 13
client installation and setup 75
client/server architecture 4
client/server configuration 75
concurrent cluster 45
concurrent volume group 45
connect internal 68
context area 3
control file 9, 68
cursor 3

D

data buffer cache 10
data dictionary 7
data file 69
data files 7
data segment 8

database writer (DBWR) 12
dbstart script for concurrent access 89
DBWR (database writer) 88
decision support database 16
dedicated serve 10
development database 16
disk space requirements 20

E

environment variables 62
errors 115
extent 8

I

in doubt transaction 13
index segment 8
init.ora file 9
instance 10

L

LGWR (log writer) 88
listener process 88
listener.ora 73, 77, 98
log writer (LGWR) 12
logical volumes for Oracle database 46

M

mirror write consistency 47
mixed database 16
multithreaded server 10
mutual takeover 39

N

nonparallel database installation 55

O

OLTP database 16
online redo log 9
ora_start 88
ora_start script 87
ora_stop 90
Oracle configuration files for cascading resources 127
Oracle configuration files for concurrent resources 133
Oracle configuration files for rotating resources 123
Oracle configuration files for the client 141
ORACLE_HOME 65
oracle.vars 87, 111

P

Parallel Server database installation 91
parallel server lock processes (LCKn) 13
parsing 3
PGA 10
PMON (process monitor) 88
process monitor (PMON) 12
Program Global Area 10

R

recover (RECO) process 13
redo log buffer 10
redo log file 68
redo log files 8
rollback segment 8
rootpre.sh script 64
rotating Ccluster 32
RS232 network 35

S

segment 8
service adapter 35
SGA 10
shared adapter 35
shared pool 10
SMON (system monitor) 88
SQL 2
SQL language 2
SQL*Net 88
sqlnet.ora 98
standby adapter 35
starting Oracle 87
stopping Oracle 89
system configuration files 119
system monitor (SMON) 12
system tablespace 8

T

tablespaces 8
temporary segment 8
testing the Oracle server database 87
TNS_ADMIN directory 73
tnsnames.ora 73, 77

U

user equivalence 96
user tablespace 8



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