R S I

ORACLE

INSTALLATION GUIDE

Oracle Programmer's Guide - Version 2.3

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O R A C L E

INSTALLATION GUIDE

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1.0 INTRODUCTION

This document is a guide to the installation of the PDP-11 or VAX version of the ORACLE Relational Data Base Management System running under the RSX-11M, IAS or VMS operating systems. It is organized in the following manner:

Section 1 is the introduction;

Section 2 presents an architectural overview of ORACLE;

Section 3 presents the computer hardware required to install and use ORACLE;

Section 4 presents the procedure for installing ORACLE on an RSX-11M system;

Section 5 presents the procedure for installing ORACLE on an IAS system.

Section 6 presents the procedure for installing ORACLE on a VAX/VMS system.

Appendix A contains tuning information for ORACLE.

Appendices B-F are germane to the VAX/VMS installation.

Appendices G-J are germane to the PDP-11 RSX11M installation.

Appendices K-M are germane to the PDP-11 IAS installation.

Familiarity with the RSX-11M,IAS or VMS operating system is assumed in this document. For the purpose of review however, several terms are given brief definitions.

1. Task or Image -- a linked file which may be installed and loaded from disk by the operating system and subsequently executed.

2. Region or Partition -- a named area in memory which may be accessed by any task with appropriate privileges.

3. Library -- a collection of macros or routines in one file.

    a) A Macro library is maintained in ASCII format for use by the assembler.

b) An Object library contains assembled and/or compiled routines or subroutines. This is accessed by the task builder at link time. If all code in the library is reentrant, the library may be memory resident.

2.0 ARCHITECTURAL OVERVIEW

This section of the manual relates ORACLE's functional attributes to ORACLE's internal structure. This information is necessary to configure or tune ORACLE for an installation's particular application environment.

The ORACLE DBMS is composed of five functional areas. (See Figure 2.1) These are briefly described below:

1) ORACLE Code -- The ORACLE program itself contains three functional areas:

    a) The SQL Data Language - parses and compiles SQL statements.
    b) The Integrated Data Dictionary - decodes data records.
    c) The Kernel - manages space and provides database access routines.

2) Memory Resident Work Areas

    a) Database Buffer Pool Cache.
    b) ORACLE Interface Communication Region.
    c) Kernel Data Area.

3) User Interface Modules

    a) User Friendly Interface (UFI) - terminal interface.
    b) The Host Language Interface - user program interface.

4) The Oracle Cleanup Task

    a) Detects user task aborts and frees the database resources in use by abnormally terminating user programs and terminal processes.

5) The Journal Task

    a) Writes modified buffers to the journal files and to the database files.

    b) Synchronizes journal and database activities so that database integrity is insured.

ORACLE Components

```
   /                                          /|
  /                                          / |
 /                                          /  |
+-----------------------------------------+   |
|        |                                |   |
|   U    |          U  S  E  R            |   |
|        |        P R O G R A M           |   |
|   F    |                                |  /|
|        |- - - - - - - - - - - - - - - -  |  / |
|   I    | USER INTERFACE MODULES         | /  |
|=========================================|  C |
|                S  Q  L                  |  O |
|- - - - - - - - - - - - - - - - - - - - - |  D |
|         D I C T I O N A R Y             |  E/|
|- - - - - - - - - - - - - - - - - - - - - |  / |
|             K E R N E L                 | /  |
|-----------------------------------------|  W |
|                K  D  A                  |  O |
|- - - - - - - - - - - - - - - - - - - - - |  R |
|     S Q L  W O R K  A R E A S           |  K/|
|- - - - - - - - - - - - - - - - - - - - - |  / |
|        B U F F E R   P O O L            | / /|
|-----------------------------------------|  / |
|        J O U R N A L  T A S K           | / /|
|-----------------------------------------|  / |
|         ORACLE CLEANUP TASK             | /  |
|=========================================|    |
|                                         |    |
|          O P E R A T I N G              |   /
|                                         |  /
|             S Y S T E M                 | /
|                                         |/
+-----------------------------------------+
```

FIGURE 2.1

2.1 **ORACLE Task**

The ORACLE task is composed of a header and a stack area containing code which passes control to a shared code. The shared code consists of the resident root and eight memory resident overlays which logically contain the following: (1) the kernel; (2) the parser; (3) the SQL execute code; and (4) the space management segment (see the figure below).

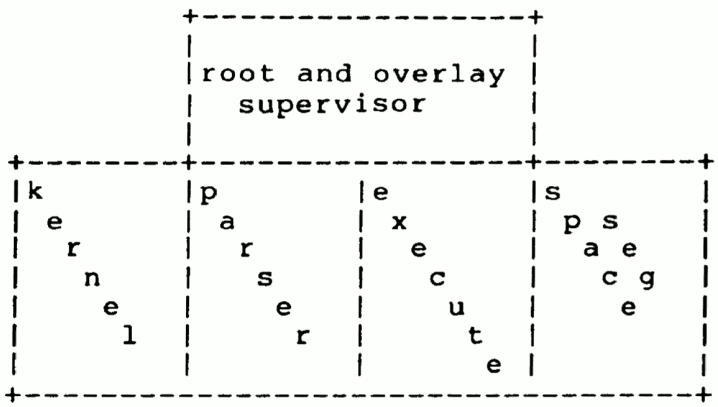

FIGURE 2.2

The Kernel provides the Database Management primitives, such as, insert or delete a record, scan an index, etc. It also contains the Data Dictionary manipulation routines.

The Parse and Execute segments comprise SQL. The SQL parser accesses the data dictionary to validate and translate to internal form all SQL statements. The Execute overlay then executes the SQL statement by making Kernel calls.

The Space Management segment is responsible for all disk space and buffer cache management in the database.

2.2 RegionsS

Three regions are required by ORACLE as work areas: a Buffer Pool Cache, a SQL work area Region, and the Kernel Data Area.

Buffer Pool
The Buffer Pool is used to store disk blocks that have been read into main storage. ORACLE disk blocks are 512 bytes long for the PDP-11. ORACLE maintains recently accessed data in the buffer pool. ORACLE uses a "least recently used" algorithm to control reuse of buffers from the pool. The buffer pool is shared by all concurrent copies of ORACLE.

SQL Work Area Region
The ORACLE SQL Work Area Region is used for passing data between the user task and ORACLE. The mapping context returned to the user by ORACLE during initialization is a window into this region.

When the user program issues an OPEN call, ORACLE allocates a SQL Work Area (SWA) from the SQL Work Area Region. The address of the calling program's cursor is placed into the SWA. The size of the SWA is 3K bytes unless otherwise specified in the OPEN call. SWA's may be from 1K to 16K bytes.

When the user program issues a SQL call ORACLE parses and then compiles the SQL statement. The compiled SQL statement is stored in the SWA.

The location of buffers and data type conversion information passed in the DEFINE call is stored in the SWA. BIND calls modify compiled SQL statements that are stored in the SWA.

When the user program issues an EXECUTE call for a SQL query statement and subsequently issues a FETCH call, the results of the query are temporarily stored in the SWA.

Kernel Data Area
The Kernel Data Area (KDA) is used to control allocation of serially reuseable resources within ORACLE. The KDA contains buffer and work area headers, ENQ lists, database control vectors and the dictionary cache.

The Buffer Headers control allocation and identify the contents of buffers in the buffer pool.

The Work Area Headers control the allocation of Logon Work Areas (LWA's) and SQL Work Areas (SWA's) from the SQL Work Area Region.

ENQ entries are used for locking out access to rows of tables as those rows are being updated.

Database and Extent Vectors are used to control an open database.

The Dictionary Cache maintains the definition of the active tables and the columns within those tables that are being accessed.

Each of these areas may be altered or tuned to reflect a specific environment. (See Appendix A)

2.3 USER INTERFACE MODULES

The primary interactive user interface to the ORACLE database system is the User Friendly Interface (UFI). UFI provides the user with the ability to enter all SQL commands at a terminal. Additionally, UFI can spool output to a file and optionally queue the file for printing, write SQL commands to a file, edit current SQL commands, and execute SQL commands from a saved file. UFI is installed with the task name SQL.

The Database File utility (DBF) is a task which provides the user with the ability to manipulate database files in an on-line environment.

When a user wishes to create his or her own database task, the distributed user interface modules must be included in the task image. The user code interface is provided in full in the HOST LANGUAGE INTERFACE Manual.

The Interactive Application Facilities (IAG and IAF) and the Report Writer (RPT and RPF) allow database application to be developed without the need for conventional programming.

2.4 ORACLE Cleanup Task

ORACLE maintains the status of each user/ORACLE task pair in the Global Task Table (GTT), which resides in the KDA. If a task terminates execution while ORACLE cursors are still open, certain cleanup of the ORACLE environment must be done. Hence, abnormal task termination must be sensed by the ORACLE data base system.

The ORACLE cleanup task (OCLNUP) is installed at system startup. It is run every 10 seconds to determine if any user task has aborted. OCLNUP serializes access to the GTT and scans it for entries belonging to the exiting task. For each entry found, the following functions are performed:

* Kill the appropriate ORACLE task
* Dequeue all owned resources
* Close open databases
* Free the Kernel context areas
* Free the SQL context area (in OCLCTX)
* Free any allocated I/O buffer
* Free the GTT entry

2.5 Journal Task

ORACLE uses a single task to control the updating of the databases and the creation of the database journal files. The journal task (JTS) synchronizes the writing of updated memory buffers to the database files on disk to insure that database integrity is maintained. The journal files are written prior to updating the databases so that the journal may always be used to restore the database to the most current state.

3.0 HARDWARE REQUIREMENTS

3.1 PDP-11

* CPU	PDP-11 with EIS
* Memory	128K bytes above the operating system requirements for ORACLE common partitions 64K bytes in a system controlled partition for UFI; 78K bytes in a system controlled partition for IAP or RPT
* Terminal	Any supported terminal
* Tape	9 track, 800 or 1600 BPI -- for tape distribution of ORACLE
* Disk Space	4000 blocks for ORACLE Distribution and task images
* Database Space	4096 blocks for the ORACLE system database, at least 4096 blocks for the ORAWRK database (optional), and at least 1024 blocks per user database. All databases require contiguous space for each extent (see the DBF users guide for a description of extents).

3.2 VAX

* CPU	VAX-11/780 or VAX-11/750
* Memory	300KB required above the operating system requirements
* Terminal	Any supported terminal
* Tape	9 track, 1600 BPI -- for tape distribution of ORACLE
* Disk Space	4000 blocks for ORACLE Distribution and task images
* Database Space	4096 blocks for the ORACLE system database, at least 4096 blocks for the ORAWRK database (optional), and at least 1024 blocks per user database. All databases require contiguous space for each extent (see the DBF users guide for a description of extents).

4.0 ORACLE/RSX-11M INSTALLATION PROCEDURE

In order to provide the appropriate RSX-11M environment for ORACLE, a number of options must be selected at system generation, and several new partitions must be added to the system. These issues are discussed below.

System Software:

RSX-11M Version 3.1 or later

The following sysgen options must be included:

* Mapped System
* SEND/RECEIVE Directives
* PLAS Directives
* STOP Directive

Partitions required in the system are as follows:

*	ORACLE	302000 (8)	
*	OCLCTX	12000 (8)	or larger
*	OCLBUF	24000 (8)	or larger
*	OCLKDA	20000 (8)	

Four partitions must be added to your system. This is most easily accomplished by the following procedure:

1. Make a new copy of all privileged tasks;
2. Make a new copy of RSX-11M.SYS from RSX-11M.TSK (assuming it was saved) and RSX-11M.STB;
3. Edit your VMR install command file to reflect partition changes;
4. INS [1,54]VMR;-1 INS [1,54]BOO;-1
5. Run VMR using the install command file and the new copy of RSX-11M.SYS;
6. Software boot the new system and save.

The following is a summary of the ORACLE installation procedure:

1. Log in under a privileged account.
2. Place distribution on appropriate device, allocate (and mount, if disk) the device.
3. Copy the distribution medium.
4. Execute the command file ORBLD.11M.
5. Log off the system.

4.1 Log on and Copy the Distribution Files

Log into your system under a privileged account in the form [g,m] where the group number must be in the range of 1 to 7.

1. For magtape distribution use the command

```
ALL dev:
```

where "dev" is the device specification of the drive containing the distribution medium.

2. The following command will copy the ORACLE TAPE distribution files into the target UIC:

```
FLX SY:/RS=dev:[*,*]*.*/DO
```

4.2 Building ORACLE

The distribution kit contains the file ORBLD.11M. This command file builds and installs ORACLE. Upon successful completion the validation test may be run and the results verified. In order to use the Interactive Application Facility, video terminal description files must be compiled. The descriptions for VT100, VT52, and OWL terminals may be built as part of the ORACLE installation.

Type the following command to build and install ORACLE:

```
@ORBLD.11M
```

The command file will place the task images on the SY: device and current UIC for the account to which you are logged on.

4.3 Log Off

Upon successful termination of the validation test the ORACLE Installation is complete. Log off the system by typing the command

```
BYE
```

The user may wish to add the invocation of the ORACLE install file ORINS.11M to the system startup command file, LB0:[1,2]STARTUP.CMD. ORINS.11M installs four copies of ORATSK named ORAAAA, ORAAAB, ORAAAC, and ORAAAD to support up to four users. If additional users are desired, ORINS.11M may be modified to install as many copies of ORATSK as are required. The task names must continue the sequence given above.

4.7 ORACLE Files

The following files are reguired to be on the same device and UIC as the ORINS.11M command file for ORACLE initialization to succeed:

OCLCTX.TSK	Context Region task image
OCLBUF.TSK	Buffer Region task image
OCLKDA.TSK	Kernel Data Region
OCLKDA.STB	KDA Symbol Table
ORACLE.TSK	ORACLE Library
ORACLE.STB	Library symbol table
ORATSK.TSK	The ORACLE Task
OCHECK.TSK	The ORACLE Task initiator
JTS.TSK	The journal creation task
UFI.TSK	User Friendly Interface (SQL)
DBF.TSK	Create Database Utility
IAP.TSK	Interactive Application Procesor
IAG.TSK	Interactive Application Generator
IMP.TSK	Import Utility
EXP.TSK	Export Utility
OIM.TSK	Old Import Utility
RPT.TSK	Report Writer Utility
RPF.TSK	Report Formatter Utility
JNL.TSK	Journal Utility
CRT.TSK	CRT Definition Utility
IAGUPGRD.TSK	IAF Upgrade Utility
ORINS.11M	ORACLE Installation Command File
SDLLIB.MLB	System Development Library

The following files must remain in LB:[1,1] for ORACLE to operate correctly (they are moved to LB:[1,1] during ORACLE installation):

DBFOST.	DBF initialization statements
ORAERR.MSG	ORACLE error message text

The following files must remain on a disk for use in task building programs which use the ORACLE Host Language Interface:

OFOLIB.OLB	FORTRAN, COBOL, and PASCAL interface routines
OCELIB.OLB	C interface routines
ORALIB.OLB	ORACLE interface routines
CLIB.OLB	C library routines - this library is different from any you may have received from a C compiler vendor

4.8 ORACLE Installation for RSX11M 3.1

There is a deficiency in RSX11M version 3.1 which does not allow the same task file to be installed with more than one task name. The task file ORATSK is intalled once for each potential concurrent ORACLE user with the task names 'ORAAAA', 'ORAAAB', etc. To install ORACLE on RSX11M version 3.1, the ORATSK.TSK file must be duplicated for each ORACLE task, then installed with the correct names. The MCR commands used to accomplish this feat are listed below. The INS commands should be inserted into the ORINS.11M command file.

```
>PIP ORAAAA.TSK=ORATSK.TSK ! MAKES DUPLICATES OF ORATSK
>PIP ORAAAB.TSK=ORATSK.TSK
>PIP ORAAAC.TSK=ORATSK.TSK
>PIP ORAAAD.TSK=ORATSK.TSK
>PIP OCLNUP.TSK=ORATSK.TSK ! MAKES A COPY OF ORATSK FOR
>                          ! ...THE CLEAN UP TASK
>!
>INS ORAAAA/TASK=ORAAAA    ! INSTALL THE ORACLE TASKS
>INS ORAAAB/TASK=ORAAAB    ! ...THESE INSTALLS SHOULD
>INS ORAAAC/TASK=ORAAAC    ! ...IN BE ORINS.11M
>INS ORAAAD/TASK=ORAAAD
>INS OCLNUP/TASK=OCLNUP
```

5.0 ORACLE/IAS INSTALLATION PROCEDURE

System Software:

IAS Version 3.0 or later

Create a privileged account for ORACLE; include privilege for logical block I/O to a disk. Choose the disk on which the database will be built. If this is the system disk timesharing must be shut down and the disk must be mounted DCF from MCR.

Ex: MOU DB0:IASSYS/CHA=[DCF]

If the disk is other than the system disk it should be mounted (preferably at system start up) from a privileged account with the following command:

Ex: MOU/NOOP/GLO/CON dkx:name

The following is a summary of the IAS installation procedure:

1. Log in on the ORACLE account
2. Place distribution media on appropriate device and mount
3. Copy distribution media
4. replace the IAS task builder with the one from the distribution
5. Edit the following .SRC files to reflect site requirements: OCLKDA,OCLBUF,OCLCTX,ORBLD
6. Execute the command file ORBLD.IAS
7. Log off

5.1 LOG ON

Log into the privileged ORACLE Account with the command

LOGIN ORACLE A

5.2 Place Distribution Media on System

1. For magtape distribution

MOU/NOOP/FOR mtx: X

where "mtx" is the device and unit specification of the drive containing the distribution medium.

2. For disk cartridge distribution use the command

```
MOU/NOOP dkx: ORACLE
```

where "dkx" is the device specification of the disk drive containing the ORACLE distribution.

5.3 Copy the Distribution Files

1. The following command will copy the ORACLE distribution files into the target UIC:

```
MC FLX SY:/RS=mtx:[*,*]*.*/DO
```

2. For disk cartridge distribution use the command

```
COPY dkx:[1,50]*.*  *.*
```

5.4 Replace IAS Task Builder

The task builder distributed with IAS does not handle memory resident overlays properly. If you have not obtained the corrected task builder from DEC remove the one currently installed in the system and install the corrected version.

```
REM ...TKB
INS TKB
```

5.5 Edit Source Files

Edit the ORACLE build command file, ORBLD.IAS to set the creation of the system database to the proper disk. (It must be mounted Control Functions Enabled).

Edit the files OCLCTX.SRC and OCLBUF.SRC to reflect the number of users which must be concurrently supported by this installation.

The system may be further tuned by changing OPARAM (ref. APPENDIX A)

5.6 Build ORACLE

The distribution kit contains the file ORBLD.IAS. This command file builds and installs ORACLE.

Type the following command to build and install ORACLE:

```
@ORBLD.IAS
```

5.7 Log Off

Upon successful termination of the validation test, the ORACLE Installation is complete. Log off the system by typing the command

```
LOGO
```

5.8 ORACLE FILES

[1,x]	OCLCTX.TSK	Context Region task image
[1,x]	OCLBUF.TSK	Buffer Region task image
[1,x]	OCLKDA.TSK	Kernel Data Region
[1,x]	OCLKDA.STB	KDA Symbol Table
[1,x]	ORACLE.TSK	ORACLE Library
[1,x]	ORACLE.STB	Library symbol table
[1,x]	ORATSK.TSK	The ORACLE Task
[1,x]	UFI.TSK	User Friendly Interface
[1,x]	DBF.TSK	Database File Utility
[1,x]	CRT.TSK	CRT Definition Utility
[1,x]	IAG.TSK	Create Form Task
[1,x]	IAP.TSK	Forms Transaction Processor
[1,x]	IMP.TSK	Import Utility
[1,x]	EXP.TSK	Export Utility
[1,x]	OIM.TSK	Old Import Utility
[1,x]	RPT.TSK	Report Writer Utility
[1,x]	RPF.TSK	Report Formatter Utility
[1,x]	ORBLD.IAS	ORACLE Build Command File
[1,x]	ORINS.IAS	ORACLE Install Command File
[1,x]	ORREM.IAS	ORACLE Remove Command File
[1,x]	SQLBLD.IAS	Personnel Database Build
[1,x]	SQLDEMO.IAS	Demo using Personnel DB

6.0 ORACLE/VMS INSTALLATION PROCEDURE

This chapter outlines the procedures for installing the ORACLE system on a DEC 11/780 VAX computer running under version 2.0 of the VMS operating system. These procedures correspond with ORACLE version 2.3.

6.1 VAX Installation Tape

The VAX installation tape contains a container file of the files necessary to run the ORACLE Relational Database Management system. The files are restored into a single directory using the RMS RESTORE utility (RST).

The tape contains files necessary to install, operate, and maintain the ORACLE system. They fall into the following categories:

- Command files to load and install ORACLE;
- Image files of the ORACLE system and related utilities;
- Library files containing the native mode user interface;
- Source files for those modules containing database tuning parameters;

Appendix 'B' is a listing of the files contained on tape.

6.2 Pre-Installation Activities

Prior to installing the ORACLE system and restoring the installation tape the following activities must be completed:

1. A new account must be defined on VMS, for example 'ORACLE', which has the privileges and quotas defined in appendix 'C'. Note that all ORACLE accounts must have UIC's with the same group code as ORACLE (ex: [100,x], where x can have any value). The required privileges and quotas for a user account are listed in Appendix 'C'. The user log in command file should invoke SYS$ORACLE:ORACLE.COM

6.3 Installation Process

1. Log onto the ORACLE system account and use the following two commands to invoke the ORACLE bootstrapping loader on the installation tape:

   MOUNT MTA0: ORACLE

   @MTA0:ORBOOT

2. The loader will announce itself and ask for the name of the device to load from. Answer with the same device name used above (i.e., MTA0:).

3. You will be prompted for any additional information necessary as the procedure continues.

Note: The following is a summary of the operation of the loader.

After purging and renaming all files existing in the directory, the loader will proceed to load the new versions in from the tape. When done, the loader passes control to the newly loaded procedure INSTALL.COM. The INSTALL procedure first insures that there is a LOGIN.COM files which calls ORACLE.COM. Second, INSTALL configures GRPSYM.COM and ORACLE.COM so that they define SYS$ORACLE as the current directory. Next, it calls ORACLE.COM to define ORACLE symbols. If you are using a different VAX/VMS version than the one on which the ORACLE system was built, INSTALL will call LINKORA.COM to relink. The LINKORA procedure reads the required object libraries off the tape and relinks all ORACLE components.

6.4 ORACLE Installation and Validation

The following procedures will install and activate the ORACLE system and validate the installation.

1. Log on using the 'ORACLE' account.

2. Type @ORINIT to activate the ORACLE system.

3. Create a system database using the command below:

   ```
   $ DBF C ORACLE ORACLE.DBS 4096
   ```

   The name of the system database (oracle.dbs) and the size (4096) are installation dependent. Refer to the ORACLE Utilities guide for a description of these parameters.

4. Create and define the 'personnel' user database using the following command:

   ```
   $ DBF C PERSONNEL PERSONNEL.DBS 2K SCOTT/TIGER
   ```

5. Build the PERSONNEL database tables.

   ```
   $ SQL @SQLBLD.SQL
   ```

6. Execute ORACLE validation demonstration.

   ```
   $ SQL @SQLDOC.SQL
   ```

   At the completion of this step ORACLE is functionally installed and validated. The system is now available for general use by other users.

6.5 Daily ORACLE Initialization

To initialize ORACLE on a daily basis perform the following steps:

1. Log on to ORACLE
2. Enter @ORINIT to load the ORACLE system.
3. Define the system database:

```
$ DBF SD ORACLE.DBS
```

To bring down ORACLE at the end of the day perform the following steps:

1. Log on to ORACLE
2. Type @ORSTOP
3. Log off.

6.6 Site Specific Changes to ORACLE

RUNORA is the executable image which creates the detached ORACLE processes. It determines both the base priority at which an ORACLE process runs and how many concurrently active ORACLE processes can be created. As delivered, RUNORA activates an ORACLE process at priority 4 and supports six concurrent users. To change either of these parameters, edit the RUNORA options file, RUNORA.OPT. Relink RUNORA by typing the command:

```
@BLDRUNORA
```

Then reinitialize ORACLE.

APPENDIX A: SYSTEM TUNING

A.1 Kernal Data Area

There are several parameters in the KDA which may be altered by the user to reflect his environment. The KDA parameters are contained in a macro in SDLLIB.MLB which is supplied with ORACLE. The macro OPARAM must be extracted from the library, edited to change the desired parameters, the replaced in the library. The KDA must then be reassembled and the object program replaced in KDALIB.OLB using the librarian utility. ORACLE tasks rebuilt by the command file ORBLD distributed with your system. The maximum allowable size of the KDA is 8K bytes. The parameters of note are as follows:

BUF$N	Number of 512 byte buffers in OCLBUF; This is adjusted at run time to reflect the actual size of OCLBUF. ORACLE will not execute properly with fewer than 20 buffers (24000 bytes octal dedicated to the buffer region.
ENQ$N	Number of entries on Resource Wait lists.
DXV$N	Number of Database Context Vectors; Controls the number of databases which may be concurrently open.
EXV$N	The total number of extens which may comprise the concurrently open databases.
GTT$N	Number of User/ORACLE task pairs; Controls the number of users and user tasks which are concurrently logged onto ORACLE.
CST$N	Number of active cursors: Controls the number of cursors which may be concurrently open.
RLC$N	Number of Relations on Cache; This controls the size of the table definition cache. This parameter should approach or exceed the number of tables concurrently accessed to reduce dictionary access.

DOC$N — Number of Domains on Cache; This parameter controls the number of data item definitions which are cached in memory. Occurrence of dictionary access on disk will diminish as this parameter approaches the number of Domains concurrently used.

SQL$N — Maximum number of 1K SQL Work Areas; This is set at run time to reflect the size in 1K areas of OCLCTX if it is smaller than SQL$N.

SWP$N — Number of context swap areas in the ORACLE system database.

FLS$N — A threshold number to control the writing of modified buffers which should be equal to the number of buffers divided by 8. If there are fewer than 32 buffers (20 is the minumum number), FLS$N should be set to 2. Use of to small a value for FLS$N will result in degraded system performance, especially when database journaling is active.

A.2 **SQL Work Area**

The SQL Work Area (OCLCTX) must be large enough to accommodate the largest number of concurrent users you wish to support with your system. It is the area from which individual SWA's are allocated. A user may allocate a maximum of 16K bytes of work space. The default allocation is 3K bytes; thus, the distributed copy of OCLCTX will support a maximum of four users if each uses the default size. An interactive user may control the allocation of buffer space in 1K increments through UFI with the "#WORKSIZE" n command, where 1 <= n <= 16. A user program may control allocation at LOGON and when OPENing databases.

To change the size of OCLCTX edit the file OCLCTX.SRC to reflect the new size, reassemble the module and task build. (If you are using RSX11M, then the size of the context area may be altered by changing the size of the OCLCTX partition to the desired size. When OCLCTX is installed into the OCLCTX partition, its size will increase to fill the partition. There is no need to edit OCLCTX.SRC, or to rebuild OCLCTX.) After relinking OCLCTX, reinitialize the ORACLE system to incorporate the new region.

A.3 ORACLE Buffer Area

The ORACLE Buffer Region (OCLBUF) contains buffers for I/O operations between the user database, the system database, and the ORACLE Kernal. Since these buffers are used as a data cache, disk I/O may be reduced significantly by increasing the size of OCLBUF. The effect of size increase is application dependent, specifically on the number of concurrent users, concurrent active databases and the randomness of database use. The minimum size of the OCLBUF is 20 buffers (10240. bytes). The maximum (and recommended) size is 64 buffers (32768. bytes).

To change the size of OCLBUF, edit the file OCLBUF.SRC to reflect the new size, reassemble the module and task build. (If you are using RSX11M, then the size of the buffer area may be altered by changing the size of the OCLBUF partition to the desired the size. When OCLBUF is installed into the OCLBUF partition, its size will increase to fill the partition. There is no need to edit OCLBUF.SRC, or to rebuild OCLBUF.) After relinking OCLBUF reinitialize the ORACLE system to incorporate the new region.

A.4 Database Structure

An ORACLE installation consists of at least two databases: the system database and one or more user databases.

System Database

The system database contains control information used in locating user databases. The system database also provides work areas for sorting and other operations on user databases. The system database name is always 'ORACLE' and must be at least 4096 blocks in size. DBF commands are used to create, initialize, or re-initialize the system database. After it is created, ORACLE must be informed of its file name every time ORACLE is initialized by using the 'DBF SD' command.

ORACLE Work Database

An ORACLE work database may be created which will be used by ORACLE for performing ORDER BY, UNIQUE, and GROUP BY operations. It may be of any size greater than 4096 blocks and it my be composed of more than one extent. The name of the work database is always ORAWRK. It may be entered and removed using DBF at will.

User Databases

Each user database is composed of one or more operating system files. A user database is composed of a dictionary, indexes and user data clusters.

The following information may prove useful in approximating the size of a database:

A 500 block area is reserved in the database for user views.

Each record which is stored in the database has a 24 byte header and a 2 byte header for each non-null item in the row. Additionally, the database space allocation has a 64 byte granu arity which must be considered when sizing the database.

ORACLE allows any data item within a table to have an index associated with it. These compressed key indices allow rapid access to data when querying or updating the database. A key or image is (7 + key) bytes in length. The format is shown below:

```
+-------------------------+
|   |    |    |   |       |
| L | FB | FC |RBA| KEY... |
|   |    |    |   |       |
+-------------------------+
```

L length byte
FB flag byte
FC Forward compression
RBA Relative Byte Address (4 bytes)
KEY Compressed key (1.1 bytes, average)

A balanced tree-structure is used to build the database keys. Thus, the use of forward and backward data compression on the lowest key level provides optimum space utilization and minimum access overhead. Index blocks split when they become full. Thus, on the average an index block will be approximately three-fourths full.

The following formulae approximate the size of a database in bytes:

TS = RS + IS + 262144

IS = 1.33 * 8.1 * NK

RS = SUM (NR(i) * CEIL { ARS(i) / 64 } * 64), i = 1 to NT

ARS(i) = 24 + (SUM (AS(i,j) + 2), j = 1 to NC(i))

where

TS is the total size of the database in bytes

IS is the size of the image (index) area in bytes

RS is the size of the row area in bytes

NK is the total number of non-null occurrences of imaged columns

NR(i) is the total number of rows in table i

ARS(i) is the average size of each row in table i

AS(i,j) is the average size of data in column j of table i

NC(i) is the number of columns in each row of table i

NT is the number of tables in the database

CEIL is a function which takes the minimum integer larger then the number, e.g., CEIL [2.1] = 3.

SUM (AS + 2) for each item is the sum of the average sizes of the column values

NR is the number of rows in a table

NK is the number of keyed (imaged) items in a table

NI is the number of nonull items in a row

APPENDIX B: VAX DISTRIBUTION DIRECTORY

Directory _DRA0:[ORACLE]

BLDRUNORA.COM	RUNORA link command file
BSE.EXE	RSI Full Screen Editor
CLIB.OLB	"C" Object library
CRT.EXE	CRT Definition Utility
DBF.EXE	DBF Utility
DBFOST.	System Database structure
DEMO.INP	IAF demo source file
DEMO.RPT	RPT demo source file
EXP.EXE	Export Utility
GRPSYM.COM	ORACLE group symbol definition command file
IAG.EXE	Interactive Application Generator Utility
IAFDEMO.SQL	IAF DEMO database initialization command file
IAP.EXE	Interactive Application Processor Utility
IMP.EXE	Import Utility
JNU.EXE	Journal Utililty
JTS.EXE	Journal File Creation/Buffer Flush Task
KDA.SRC	Kernal Data Area (OCLKDA) source
LINKORA.COM	ORACLE Component relink command file
LOCK.EXE	LOCK image -- Locks part of ORACLE in memory
LOCK1.EXE	LOCK1 image -- Locks part of ORACLE in memory
OCLBUF.EXE	OCLBUF global section
OCLBUF.SRC	OCLBUF Source
OCLCTX.EXE	OCLCTX global section
OCLCTX.SRC	OCLCTX source
OCLKDA.EXE	OCLKDA global section
OCLKDA.TSK	OCLKDA backup image
OCLNUP.EXE	ORACLE Cleanup image
OIM.EXE	Old Import Utility (Imports an ORACLE 2.2 file)
ORAAAx.EXE	ORACLE images (where x = A-X)
ORACLE.COM	ORACLE User Symbol definition (reference in LOGIN.COM)
ORACLE.EXE	ORACLE Global section
ORACLE.TSK	ORACLE Global section backup
ORAERR.MSG	ORACLE Error message file
ORAFOR.MAR	FORTRAN HLI Interface source
ORALIB.OLB	General User/ORACLE Interface Library
ORAPAD.OPT	User image link option file
ORDIR.COM	ORACLE account subdirectory creation
ORINIT.COM	ORACLE initialization command file
ORINS.COM	ORACLE "install" command file

OROBJRST.COM	ORACLE objects restore command file
ORSTOP.COM	ORACLE Shutdown command file
ORSTOP.EXE	ORACLE Shutdown executable image
ORVAX.OLB	Library containing RUNORA objects
REGDESC.EXE	ORACLE Region Descriptor Global Common
RJTS.COM	Command file to create detached process running JTS
RLOCK.COM	Command file to create detached process running LOCK
RLOCK1.COM	Command file to create detached process running LOCK1
RORA.COM	Command file to create detached process running RUNORA
RPF.EXE	Report Formatter Utility
RPT.EXE	Report Writer Utility
RPTDEMO.SQL	RPT demo database initialization command file
RSI.EXE	ORACLE AME
RUNORA.EXE	Executable image to create detached ORACLE processes
RUNORA.OPT	Link option file for RUNORA
SAMPL3.FOR	Sample FORTRAN program
SQLBLD.SQL	Validation Database build file
SQLDOC.CMD	Validation Command file with comments
SQLDOC.SQL	Validation Command file
UFI.EXE	USER FRIENDLY INTERFACE Utility

APPENDIX C: VAX PRIVILEGES AND QUOTAS

Main ORACLE
Process privileges :

ALTPRI	may set priority to any level
CMKRNL	may change mode to kernel
GRPNAM	may insert in group logical name table
DETACH	may create detached processes
EXQUOTA	may exceed quotas
LOG_IO	may do logical I/O
GROUP	may affect other processes in same group
PSWAPM	may change process swap mode
TMPMBX	may create temporary mailbox
SYSGBL	may create system wide global sections
MOUNT	may execute mount ACP functions

ORACLE User
Process priveleges :

GRPNAM	may insert in group logical name table
GROUP	may affect other processes in same group
TMPMBX	may create temporary mailbox

Process Quotas:	ORACLE	USER
CPU limit :	INFINITE	INFINITE
Buffered I/O byte count quota :	20480	4096
Timer queue entry quota :	10	10
Paging file quota :	10000	10000
Direct I/ O limit :	12	6
Buffered I/O limit:	12	6
Open file quota :	30	20
Subprocess quota :	8	2
AST limit :	10	10

APPENDIX D: VAX COMMAND FILES

Listing of ORACLE.COM

```
$ASS _DRA0: SYS$ORACLE
DBF:==$SYS$ORACLE:DBF
DTM:==$SYS$ORACLE:DTM
EXP:==$SYS$ORACLE:EXP
IAG:==$SYS$ORACLE:IAG
IAP:==$SYS$ORACLE:IAP
IMP:==$SYS$ORACLE:IMP
OIM:==$SYS$ORACLE:OIM
RSI:==RUN SYS$ORACLE:RSI
SQL:==$SYS$ORACLE:UFI
```

Listing of GRPSYM.COM

```
$ASS/GR DRA0: SYS$ORACLE
$ASS/GR SYS$ORACLE:OCLNUP OCLNUP
$ASS/GR SYS$ORACLE:ORAAAA ORAAAA
$ASS/GR SYS$ORACLE:ORAAAB ORAAAB
$ASS/GR SYS$ORACLE:ORAAAC ORAAAC
$ASS/GR SYS$ORACLE:ORAAAD ORAAAD
$ASS/GR SYS$ORACLE:ORAAAE ORAAAE
$ASS/GR SYS$ORACLE:ORAAAF ORAAAF
$ASS/GR SYS$ORACLE:ORAAAG ORAAAG
$ASS/GR SYS$ORACLE:ORAAAH ORAAAH
$ASS/GR SYS$ORACLE:ORAAAI ORAAAI
$ASS/GR SYS$ORACLE:ORAAAJ ORAAAJ
$ASS/GR SYS$ORACLE:ORAAAK ORAAAK
$ASS/GR SYS$ORACLE:ORAAAL ORAAAL
$ASS/GR SYS$ORACLE:ORAAAM ORAAAM
$ASS/GR SYS$ORACLE:ORAAAN ORAAAN
$ASS/GR SYS$ORACLE:ORAAAO ORAAAO
$ASS/GR SYS$ORACLE:ORAAAP ORAAAP
$ASS/GR SYS$ORACLE:ORAAAQ ORAAAQ
$ASS/GR SYS$ORACLE:ORAAAR ORAAAR
$ASS/GR SYS$ORACLE:ORAAAS ORAAAS
$ASS/GR SYS$ORACLE:ORAAAT ORAAAT
$ASS/GR SYS$ORACLE:ORAAAU ORAAAU
$ASS/GR SYS$ORACLE:ORAAAV ORAAAV
$ASS/GR SYS$ORACLE:ORAAAW ORAAAW
$ASS/GR SYS$ORACLE:ORAAAX ORAAAX
$ASS/GR SYS$ORACLE:ORAAAY ORAAAY
$ASS/GR SYS$ORACLE:ORAAAZ ORAAAZ
```

APPENDIX E -- Sample VAX Installation (VMS 2.1)

APPENDIX F -- Sample VAX Installation (VMS 2.0)

APPENDIX G -- RSX11M Distribution Directory

APPENDIX H -- RSX11M Command Files

APPENDIX I -- Sample RSX11M Installation

APPENDIX J -- ORACLE Installation in Small RSX11M Configurations

APPENDIX K -- IAS Distribution Directory

APPENDIX L -- IAS Command Files

APPENDIX M -- Sample IAS Installation