

ORACLE®

ORACLE PRESS™ — EXCLUSIVELY FROM MCGRAW-HILL/OSBORNE

ORACLE⁹ⁱ DBA Handbook

Manage a Robust, High-Performance Oracle Database

KEVIN LONEY

Senior Technical Management
Consultant at TUSC and Best-Selling
Author of *Oracle8i: The Complete
Reference*

MARLENE THERIAULT

Oracle DBA and Author of *Oracle
Security Handbook*

And the Experts at TUSC

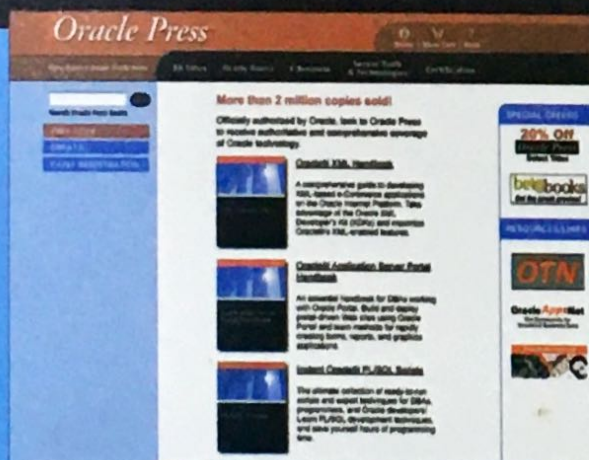


ORIGINAL • AUTHENTIC

Oracle Press™

AND ONLY FROM OSBORNE

Expert authors, cutting-edge coverage, the latest releases...find it all at OraclePressBooks.com



Online, you'll find:

- FREE code for selected books
- FREE sample chapters
- Complete online Oracle Press catalog
- Details on new and upcoming Oracle Press titles
- Special offers and discounts
- Enter-to-win contests
- News and press information
- Information about our expert authors
- Details on how to write for Oracle Press
- And much more!

From a full selection of titles focusing on Oracle's core database products to our in-depth coverage of emerging applications, Web development tools, and e-Business initiatives, Oracle Press continues to provide essential resources for every Oracle professional. For a complete list of Oracle Press titles—

from the exclusive publisher of Oracle Press books—and other valuable resources, go to OraclePressBooks.com.

Get the most complete information on Oracle's #1 line of e-Business and database technologies at OraclePressBooks.com

THE MCGRAW HILL COMPANIES
 FOR DONATION ONLY
 NOT FOR RESALE
 12ASA07
 FOR DONATION ONLY
 NOT FOR RESALE



ORACLE®

Oracle Press™

Oracle9i DBA Handbook

Kevin Loney
Marlene Theriault
and the experts at TUSC

McGraw-Hill/Osborne

New York Chicago San Francisco
Lisbon London Madrid Mexico City Milan
New Delhi San Juan Seoul Singapore Sydney Toronto

GIFT OF THE ASIA FOUNDATION
NOT FOR RE-SALE

QUÀ TẶNG CỦA QUỸ CHÂU Á
KHÔNG ĐƯỢC BÁN LẠI



McGraw-Hill/Osborne

2100 Powell Street, 10th Floor
Emeryville, California 94608
U.S.A.

To arrange bulk purchase discounts for sales promotions, premiums, or fund-raisers, please contact McGraw-Hill/Osborne at the above address. For information on translations or book distributors outside the U.S.A., please see the International Contact Information page immediately following the index of this book.

Oracle9i DBA Handbook

Copyright © 2002 by The McGraw-Hill Companies, Inc. (Publisher). All rights reserved. Printed in the United States of America. Except as permitted under the Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of Publisher.

Oracle is a registered trademark and Oracle9i is a trademark or registered trademark of Oracle Corporation.

7890 DOC DOC 0198765

ISBN 0-07-219374-3

Publisher

Brandon A. Nordin

Vice President & Associate Publisher

Scott Rogers

Acquisitions Editor

Lisa McClain

Project Editors

Judith Brown

Jody McKenzie

Acquisitions Coordinator

Athena Honore

Technical Editor

Scott Gossett

Copy Editor

Judith Brown

Proofreader

Marian Selig

Indexer

Claire Splan

Computer Designers

George Toma Charbak, Tara A. Davis,
Mickey Galicia, Lauren McCarthy

Illustrators

Michael Mueller, Lyssa Wald

Series Design

Jani Beckwith

Cover Series Design

Damore Johann Design, Inc.

This book was composed with Corel VENTURA™ Publisher.

Information has been obtained by Publisher from sources believed to be reliable. However, because of the possibility of human or mechanical error by our sources, Publisher, or others, Publisher does not guarantee to the accuracy, adequacy, or completeness of any information included in this work and is not responsible for any errors or omissions or the results obtained from the use of such information.

Oracle Corporation does not make any representations or warranties as to the accuracy, adequacy or completeness of any information contained in this Work, and is not responsible for any errors or omissions.

About the Authors

Kevin Loney, a senior technical management consultant with TUSC, is an internationally recognized expert in the design, development, administration, and tuning of Oracle databases. An Oracle developer and DBA since 1987, he has implemented both transaction processing systems and data warehouses. He provides expert assistance to companies for the implementation and tuning of their business-critical Oracle applications.

The author of numerous technical articles, he is the lead author or coauthor for best-selling books including *Oracle8i: The Complete Reference*, *Instant Oracle PL/SQL Scripts*, and *Oracle8 Advanced Tuning and Administration*. He regularly presents at Oracle user conferences in North America and Europe.

Marlene Theriault has more than 19 years experience as an Oracle database administrator. She is lead author or coauthor of the *Oracle Security Handbook*, *Oracle8i Networking 101*, *Oracle DBA 101*, *Oracle8i DBA Handbook*, and *Oracle Security*. She has presented technical papers and tutorials at Oracle conferences all over the world. Marlene is noted for her ability to make difficult concepts easily understandable. She and her husband, Nelson, are avid recreational walkers. She can be reached at mtheriault@mindspring.com.



Contents at a Glance

PART I

Database Architecture

1 Getting Started with the Oracle Architecture	3
2 Hardware Configurations and Considerations	61
3 Planning and Managing Tablespaces	87
4 Physical Database Layouts	105

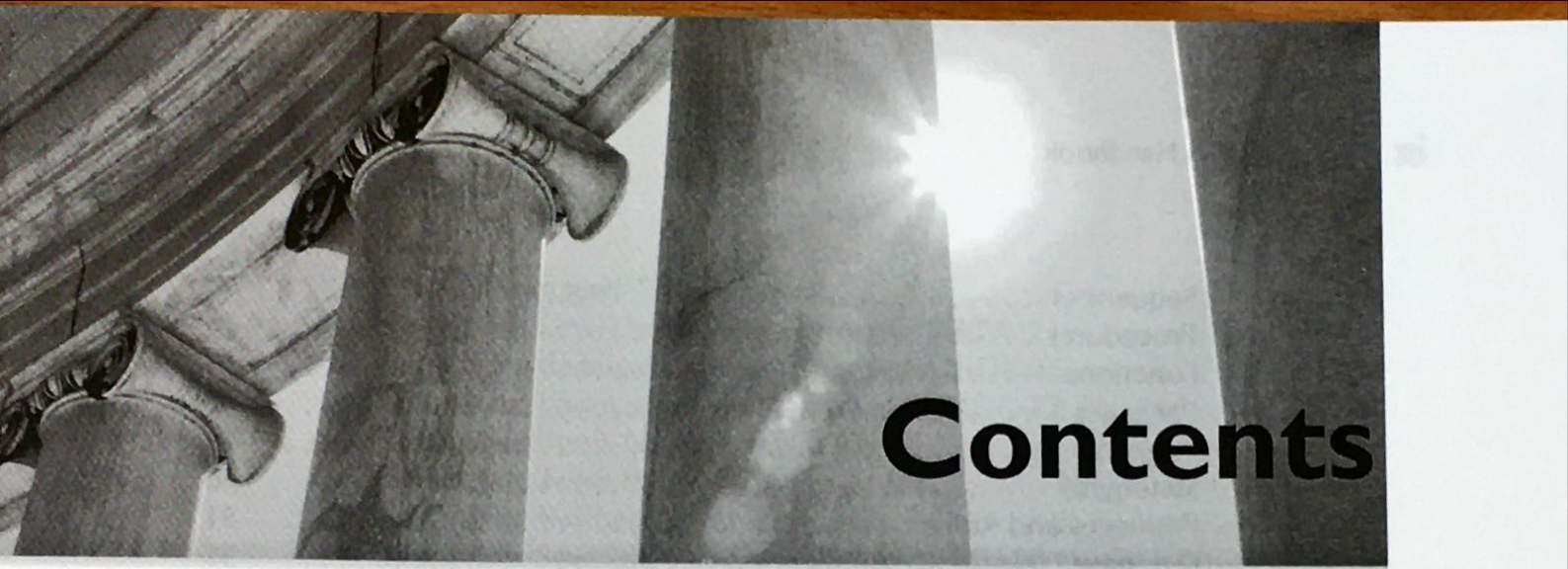
PART II

Database Management

5 Managing the Development Process	157
6 Monitoring Space Usage	209
7 Managing Transactions	247
8 Database Tuning	283
9 Using STATSPACK	345
10 Database Security and Auditing	357
11 Backup and Recovery Options	419
12 Using Recovery Manager (RMAN)	473

PART III **Networked Oracle**

13	Oracle Net	515
14	Tuning 9iAS	563
15	Managing Large Databases	593
16	Managing Distributed Databases	635
A	SQL Reference for DBA Commands	683



Contents

ACKNOWLEDGMENTS	xxi
INTRODUCTION	xxiii

PART I

Database Architecture

I Getting Started with the Oracle Architecture	3
Overview of Databases and Instances	4
Databases	4
Other Files	6
Oracle Managed Files	8
Instances	9
About Software Installation	10
Oracle Installation Options and Components	11
Creating a Database	13
Using the Oracle Database Configuration Assistant	13
Initialization Parameter Configuration: Memory	21
Manually Creating a Database	31
Background Processes	33
Internal Database Structures	37
Tables, Columns, and Datatypes	37
Constraints	40
Abstract Datatypes	42
Partitions and Subpartitions	43
Users	44
Schemas	44
Indexes	45
Clusters	46
Hash Clusters	47
Views	47

Sequences	48
Procedures	48
Functions	49
Packages	49
Triggers	50
Synonyms	51
Privileges and Roles	51
Database Links	53
Segments, Extents, and Blocks	54
Undo Segments and Rollback Segments	54
Materialized Views	55
Context Areas	55
Program Global Area (PGA)	56
Backup/Recovery Capabilities	58
Security Capabilities	59
Using OEM	61
2 Hardware Configurations and Considerations	61
Architecture Overview	62
Stand-Alone Hosts	63
Stand-Alone Hosts with Disk Arrays	64
Stand-Alone Hosts with Disk Shadowing	68
Stand-Alone Hosts with Multiple Databases	69
Networked Hosts	71
Networks of Databases	72
Remote Updates: The Advanced Replication Option	74
Real Application Clusters	76
Multiple Processors: The Parallel Query and Parallel Load Options	78
Client/Server Database Applications	79
Three-Tier Architectures	80
Oracle Enterprise Gateway Access	82
Standby Databases	82
Replicated Databases	84
External File Access	85
External Table Access	86
3 Planning and Managing Tablespaces	87
The End Product	88
The Optimal Flexible Architecture (OFA)	88
The Starting Point: The SYSTEM Tablespace	88
Separating Application Data Segments: DATA	90

Locally Managed Tablespaces	90
Separating Low-Usage Data Segments: DATA_2	91
Separating Application Index Segments: INDEXES	92
Separating Low-Usage Index Segments: INDEXES_2	93
Separating Tools Segments: TOOLS	94
Separating Tools Indexes: TOOLS_I	94
Separating Rollback Segments: RBS	95
Separating Specialty Rollback Segments: RBS_2	95
Using an Undo Tablespace	96
Separating Temporary Segments: TEMP	96
Separating User-Specific Temporary Segments: TEMP_USER	97
Separating Users: USERS	98
Additional Tablespace Types	99
Advanced Tablespace Types	99
Commonsense Logical Layouts	101
Solutions	103
4 Physical Database Layouts	105
Database File Layout	106
I/O Contention among Datafiles	107
I/O Bottlenecks among All Database Files	109
Concurrent I/O among Background Processes	112
Defining the Recoverability and Performance Goals for the System	113
Defining the System Hardware and Mirroring Architecture	113
Identifying Disks That Can Be Dedicated to the Database	114
Choosing the Right Layout	115
Verification of I/O Estimates	118
Solutions	120
Small Development Database Layout	120
Production OLTP Database Layout	121
Production OLTP Database with Historical Data Layout	121
Data Warehouse Layout	122
File Location	124
Database Space Usage Overview	125
Implications of the storage Clause	126
Locally Managed Tablespaces	127
Table Segments	129
Index Segments	129
Rollback Segments	130
Temporary Segments	130
Free Space	132

Resizing Datafiles	134
Automating Datafile Extensions	134
How to Move Database Files	135
Moving Datafiles	138
Moving a Datafile with Oracle Enterprise Manager	143
Moving Online Redo Log Files	145
Moving Control Files	146
How to Deallocate Space from Segments	146
Shrinking Datafiles	147
Shrinking Tables, Clusters, and Indexes	149
How to Rebuild Indexes	150
Online Index Rebuilds	150
Using Oracle Managed Files (OMFs)	150
Configuring the Environment	151
Creating Oracle Managed Files	152
Maintenance of Oracle Managed Files	153
Physically Fit	

PART II

Database Management

5 Managing the Development Process	157
Three Critical Elements of Success	158
Cultural Processes	159
Management Processes	160
Defining the Environment	160
Role Definitions	161
Deliverables	163
Resource Management and Stored Outlines	166
Sizing Database Objects	174
Iterative Development	198
Iterative Column Definitions	198
Moving Tables Online	200
Forcing Cursor Sharing	202
Technology	202
CASE Tools	202
Shared Directories	203
Project Management Databases	203
Discussion Databases	203
Managing Package Development	203
Generating Diagrams	204

Space Requirements	204
Tuning Goals	204
Security Requirements	204
Data Requirements	205
Version Requirements	205
Execution Plans	205
Acceptance Test Procedures	206
The Testing Environment	206
The Managed Environment	207
6 Monitoring Space Usage	209
Common Problem Areas	210
Running Out of Free Space in a Tablespace	211
Insufficient Space for Temporary Segments	211
Rollback Segments That Have Reached Their Maximum Extension	212
Fragmentation of Data Segments	212
Fragmented Free Space	213
Improperly Sized SGA Areas	214
Target Selection	214
The End Product	214
Creating the Command Center Database	218
Getting the Data	223
Generating Alert Reports	229
The Space Summary Report	233
Purging Data	237
Monitoring Memory Objects	237
Additional Alerts and Warnings	238
Monitoring File I/O Distribution	238
Rate of Space Allocation Within an Object	243
The Well-Managed Database	246
7 Managing Transactions	247
Rollback Segments Overview	248
How the Database Uses Rollback Segments	249
Activating Rollback Segments	253
Specifying a Rollback Segment for a Transaction	254
Space Usage Within Rollback Segments	254
The optimal storage Clause	258
Monitoring Rollback Segment Usage	260
Shrinking Rollback Segments	260
Monitoring Current Status	261

Monitoring Dynamic Extensions	262
Transactions per Rollback Segment	265
Data Volumes in Rollback Segments	266
Using Oracle Enterprise Manager	
to Manage Rollback Segments	267
Creating a Rollback Segment from OEM	270
Creating a Rollback Segment Like an Existing Rollback Segment ..	271
Placing a Rollback Segment Online	271
Placing a Rollback Segment Offline	272
Removing a Rollback Segment	272
Choosing the Number and Size	272
Transaction Entry Volume	273
Number of Transactions	274
Determining the optimal Size	275
Creating the Rollback Segments	275
Production Versus Data Load Rollback Segments	277
Solutions	277
OLTP Applications	278
Data Warehouses/Batch Applications	279
Using Undo Tablespaces	280
Setting Undo Retention	280
Creating an Undo Tablespace	281
Monitoring an Undo Tablespace	281
System-Managed Undo Solutions	281
8 Database Tuning	283
Tuning Application Design	284
Effective Table Design	285
Distribution of CPU Requirements	286
Effective Application Design	288
Tuning SQL	289
Impact of Order on Load Rates	291
Additional Indexing Options	292
Generating Explain Plans	294
Tuning Memory Usage	297
Specifying the Size of the SGA	302
Using the Cost-Based Optimizer	303
Tuning Data Storage	305
Defragmentation of Segments	305
Evaluating Index Usage	308
Locally Managed Tablespaces	309
Defragmentation of Free Extents	310

Identifying Chained Rows	314
Increasing the Oracle Block Size	315
Using Index-Organized Tables	316
Tuning Data Manipulation	317
Bulk Inserts: Using the SQL*Loader Direct Path Option	318
Bulk Inserts: Common Traps and Successful Tricks	320
Bulk Deletes: The truncate Command	322
Partitions	323
Tuning Physical Storage	324
Using Raw Devices	324
Using RAID and Mirroring	324
Tuning Logical Storage	325
Reducing Network Traffic	325
Replication of Data	325
Using Remote Procedure Calls	332
Using OEM and the Performance Tuning Packs	334
The Oracle Expert Pack	335
The Oracle Performance Manager Option	337
Tuning Solutions	341
9 Using STATSPACK	345
Installing STATSPACK	346
Security of the PERFSTAT Account	347
Postinstallation	347
Gathering Statistics	348
Running the Statistics Report	351
Managing the STATSPACK Data	355
Deinstalling STATSPACK	356
10 Database Security and Auditing	357
Security Capabilities	358
Account Security	358
Object Privileges	359
System-Level Roles and Privileges	359
Implementing Security	359
The Starting Point: Operating System Security	359
Creating Users	360
Dropping Users	364
System-Level Privileges	364
User Profiles	370
Password Management	372
Preventing Password Reuse	375
Setting Password Complexity	376