Secrets of the Oracle Database

Norbert Debes

Apress®

Secrets of the Oracle Database

Copyright © 2009 by Norbert Debes

All rights reserved. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage or retrieval system, without the prior written permission of the copyright owner and the publisher.

ISBN-13 (pbk): 978-1-4302-1952-1

ISBN-13 (electronic): 978-1-4302-1953-8

Printed and bound in the United States of America 9 8 7 6 5 4 3 2 1

Trademarked names may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, we use the names only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

Lead Editor: Jonathan Gennick
Editorial Board: Clay Andres, Steve Anglin, Mark Beckner, Ewan Buckingham, Tony Campbell, Gary Cornell, Jonathan Gennick, Michelle Lowman, Matthew Moodie, Jeffrey Pepper, Frank Pohlmann, Ben Renow-Clarke, Dominic Shakeshaft, Matt Wade, Tom Welsh
Project Manager: Beth Christmas
Copy Editor: Lisa Hamilton
Associate Production Director: Kari Brooks-Copony
Production Editor: Kelly Winquist
Compositor: Susan Glinert
Proofreader: Greg Teague
Indexer: Norbert Debes
Artist: April Milne
Cover Designer: Kurt Krames
Manufacturing Director: Tom Debolski

Distributed to the book trade worldwide by Springer-Verlag New York, Inc., 233 Spring Street, 6th Floor, New York, NY 10013. Phone 1-800-SPRINGER, fax 201-348-4505, e-mail orders-ny@springer-sbm.com, or visit http://www.springeronline.com.

For information on translations, please contact Apress directly at 2855 Telegraph Avenue, Suite 600, Berkeley, CA 94705. Phone 510-549-5930, fax 510-549-5939, e-mail info@apress.com, or visit http://www.apress.com.

Apress and friends of ED books may be purchased in bulk for academic, corporate, or promotional use. eBook versions and licenses are also available for most titles. For more information, reference our Special Bulk Sales–eBook Licensing web page at http://www.apress.com/info/bulksales.

The information in this book is distributed on an “as is” basis, without warranty. Although every precaution has been taken in the preparation of this work, neither the author(s) nor Apress shall have any liability to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the information contained in this work.

The source code for this book is available to readers at http://www.apress.com. You will need to answer questions pertaining to this book in order to successfully download the code.

Contents

Foreword xix
About the Author xxi
About the Foreword Writer xxiii
Acknowledgments xxv
Introduction xxvii

PART 1 Initialization Parameters

CHAPTER 1 Partially Documented Parameters 3

AUDIT_SYSLOG_LEVEL 3
Syslog Facility 4
Introduction to Auditing 4
Using AUDIT_SYSLOG_LEVEL 6
Auditing Non-Privileged Users 6
Lessons Learned 8
PGA_AGGREGATE_TARGET 8
Introduction to Automatic PGA Memory Management 8
Misconceptions About PGA_AGGREGATE_TARGET 10
Researching PGA_AGGREGATE_TARGET 11
Creating a Large Table with a Pipelined Table Function 11
V$SQL_WORKAREA_ACTIVE 12
_PGA_MAX_SIZE 16
_SMM_MAX_SIZE 17
_SMM_PX_MAX_SIZE 18
Shared Server 18
Parallel Execution 18
Lessons Learned 20
EVENT 21
Syntax 21
Leveraging Events at the Instance-Level 22
Case Study 22

OS_AUTHENT_PREFIX 22
OPS$ Database Users and Password Authentication 23
Case Study. 23
Lessons Learned. 26
Source Code Depot 27

CHAPTER 2 **Hidden Initialization Parameters** 29

Trace File Permissions and _TRACE_FILES_PUBLIC 30
ASM Test Environment and _ASM_ALLOW_ONLY_RAW_DISKS 31
ASM Hidden Parameters 32
Setting Up Oracle Clusterware for ASM 33
ASM Instance Setup 34
Disk Failure Simulation 37
Source Code Depot 37

PART 2 **Data Dictionary Base Tables**

CHAPTER 3 **Introduction to Data Dictionary Base Tables** 41

Large Objects and PCTVERSION vs. RETENTION 42

CHAPTER 4 **IND$, V$OBJECT_USAGE, and Index Monitoring** 45

Schema Restriction 45
Index Usage Monitoring Case Study 47
Function MONITOR_SCHEMA_INDEXES. 47
Enabling Index Monitoring on Schema HR. 48
Lessons Learned. 52
Source Code Depot. 53

PART 3 **Events**

CHAPTER 5 **Event 10027 and Deadlock Diagnosis** 57

Deadlocks 57
Event 10027 58

CHAPTER 6 **Event 10046 and Extended SQL Trace** 61

CHAPTER 7 Event 10053 and the Cost Based Optimizer 63

Trace File Contents 66
Case Study 67
Query Blocks and Object Identifiers 68
Query Transformations Considered 68
Legend 70
Results of Bind Variable Peeking 71
Optimizer Parameters. 71
System Statistics 76
Object Statistics for Tables and Indexes 77
Single Table Access Path and Cost 79
Join Orders 81
Execution Plan. 84
Predicate Information 85
Hints and Query Block Names. 85
Source Code Depot 86

CHAPTER 8 Event 10079 and Oracle Net Packet Contents 87

Case Study 87

PART 4 **X$ Fixed Tables**

CHAPTER 9 Introduction to X$ Fixed Tables 93

X$ Fixed Tables and C Programming 93
Layered Architecture 94
Granting Access to X$ Tables and V$ Views 96
Drilling Down from V$ Views to X$ Fixed Tables 97
Drilling Down from V$PARAMETER to the Underlying X$ Tables 97
Relationships Between X$ Tables and V$ Views 102
Source Code Depot 104

CHAPTER 10 X$BH and Latch Contention 105

Source Code Depot 111

CHAPTER 11 X$KSLED and Enhanced Session Wait Data 113

Drilling Down from V$SESSION_WAIT 113
An Improved View 114
Source Code Depot 118

CHAPTER 12 X$KFFXP and ASM Metadata 119

X$KFFXP 119
Salvaging an SPFILE 120
Mapping Segments to ASM Storage 122

PART 5 SQL Statements

CHAPTER 13 ALTER SESSION/SYSTEM SET EVENTS 129

Tracing Your Own Session 129
ALTER SESSION SET EVENTS 130
ALTER SYSTEM SET EVENTS 131
ALTER SESSION/SYSTEM SET EVENTS and Diagnostic Dumps 132
Immediate Dumps 133

CHAPTER 14 ALTER SESSION SET CURRENT_SCHEMA 135

Privilege User vs. Schema User 135
Creating Database Objects in a Foreign Schema 137
Restrictions of ALTER SESSION SET CURRENT_SCHEMA 138
Advanced Queuing 138
RENAME 139
Private Database Links 139
Stored Outlines 140

CHAPTER 15 ALTER USER IDENTIFIED BY VALUES 143

The Password Game 143
Locking Accounts with ALTER USER IDENTIFIED BY VALUES 145
ALTER USER and Unencrypted Passwords 146

CHAPTER 16 SELECT FOR UPDATE SKIP LOCKED 149

Advanced Queuing 149
Contention and SELECT FOR UPDATE SKIP LOCKED 151
DBMS_LOCK—A Digression 159
Source Code Depot 162

PART 6 Supplied PL/SQL Packages

CHAPTER 17 DBMS_BACKUP_RESTORE 165

Recovery Manager 165
Disaster Recovery Case Study with Tivoli Data Protection for Oracle 170
Source Code Depot 172

CHAPTER 18 DBMS_IJOB 173

Introduction to DBMS_JOB 173
BROKEN Procedure 173
FULL_EXPORT Procedure 175
REMOVE Procedure 176
RUN Procedure 177
Source Code Depot 179

CHAPTER 19 DBMS_SCHEDULER 181

Running External Jobs with the Database Scheduler 181
Exit Code Handling 182
Standard Error Output 183
External Jobs on UNIX 185
Removal of Environment Variables 186
Command Line Processing 188
External Jobs and Non-Privileged Users 190

External Jobs on Windows 191
Command Line Argument Handling 192
Windows Environment Variables 193
External Jobs and Non-Privileged Users 193
Services Created by the ORADIM Utility 194
OracleJobScheduler Service 194
Source Code Depot 195

CHAPTER 20 DBMS_SYSTEM 197

GET_ENV Procedure 197
KCFRMS Procedure 198
KSDDDT Procedure 200
KSDFLS Procedure 201
KSDIND Procedure 201
KSDWRT Procedure 202
READ_EV Procedure 204
SET_INT_PARAM_IN_SESSION Procedure 205
SET_BOOL_PARAM_IN_SESSION Procedure 207
SET_EV Procedure 207
SET_SQL_TRACE_IN_SESSION Procedure 210
WAIT_FOR_EVENT Procedure 210

CHAPTER 21 DBMS_UTILITY 213

NAME_RESOLVE Procedure 213
Name Resolution and Extraction of Object Statistics 218
Source Code Depot 220

PART 7 **Application Development**

CHAPTER 22 Perl DBI and DBD::Oracle 223

Circumnavigating Perl DBI Pitfalls 223
A Brief History of Perl and the DBI 224
Setting Up the Environment for Perl and the DBI 224
UNIX Environment 225
Windows Environment 229

Transparently Running Perl Programs on UNIX Systems 232
Transparently Running Perl Programs on Windows 233
Connecting to an ORACLE DBMS Instance 235
DBI connect Syntax 236
Connecting Through the Bequeath Adapter 237
Connecting Through the IPC Adapter 237
Connecting Through the TCP/IP Adapter 239
Easy Connect 240
Connecting with SYSDBA or SYSOPER Privileges 240
Connecting with Operating System Authentication 241
Connect Attributes 243
Comprehensive Perl DBI Example Program 244
Exception Handling 248
Source Code Depot 249

CHAPTER 23 Application Instrumentation and End-to-End Tracing 251

Introduction to Instrumentation 251
Case Study 253
JDBC End-to-End Metrics Sample Code 254
Compiling the Program 256
Instrumentation at Work 256
Setting Up Tracing, Statistics Collection, and the Resource Manager 256
Using TRCSESS 261
TRCSESS and Shared Server 263
Instrumentation and the Program Call Stack 266
Source Code Depot 267

PART 8 Performance

CHAPTER 24 Extended SQL Trace File Format Reference 271

Introduction to Extended SQL Trace Files 271
SQL and PL/SQL Statements 272
Recursive Call Depth 272

Database Calls 273
Parsing 274
PARSING IN CURSOR Entry Format 275
PARSE Entry Format 276
PARSE ERROR Entry Format 278
EXEC Entry Format 278
FETCH Entry Format 278
Execution Plan Hash Value 279
Plan Hash Value Case Study 279
CLOSE Entry Format 283
COMMIT and ROLLBACK 284
UNMAP 285
Execution Plans, Statistics, and the STAT Entry Format 285
STAT Entry Format in Oracle9i 286
STAT Entry Format in Oracle10g and Oracle11g 286
Wait Events 288
WAIT Entry Format 288
WAIT in Oracle9i 289
WAIT in Oracle10g and Oracle11g 290
Bind Variables 290
BINDS Entry Format 291
Statement Tuning, Execution Plans, and Bind Variables 295
Miscellaneous Trace File Entries 301
Session Identification 302
Service Name Identification 302
Application Instrumentation 303
ERROR Entry Format 306
Application Instrumentation and Parallel Execution Processes 308

CHAPTER 25 Statspack 311

Introduction to Statspack 311
Retrieving the Text of Captured SQL Statements 313
Accessing STATS$SQLTEXT 317
Capturing SQL Statements with Formatting Preserved 323
Undocumented Statspack Report Parameters 324
Statspack Tables 325
Finding Expensive Statements in a Statspack Repository 330

Identifying Used Indexes 331
Execution Plans for Statements Captured with SQL Trace 331
Finding Snapshots with High Resource Utilization 334
High CPU Usage 335
High DB Time 337
Importing Statspack Data from Another Database 340
Source Code Depot 343

CHAPTER 26 Integrating Extended SQL Trace and AWR 345

Retrieving Execution Plans 345
Lessons Learned 348
Source Code Depot 349

CHAPTER 27 ESQLTRCPROF Extended SQL Trace Profiler 351

Categorizing Wait Events 352
Calculating Response Time and Statistics 353
Case Study. 354
Running the Perl Program 354
Calculating Statistics 357
Calculating Response Time 357
ESQLTRCPROF Reference 358
Command Line Options 359
ESQLTRCPROF Report Sections 360
Lessons Learned 369
Source Code Depot 370

CHAPTER 28 The MERITS Performance Optimization Method 371

Introduction to the MERITS Method 371
Measurement 372
Measurement Tools 372
Assessment 377
Resource Profiles and Performance Assessment Tools 378
Reproduction 379
Improvement 380
Extrapolation 380
Installation 381

MERITS Method Case Study 381
Phase 1—Measurement 382
Phase 2—Assessment. 382
Phase 3—Reproduction. 389
Phase 4—Improvement. 392
Phase 5—Extrapolation 397
Phase 6—Installation. 397
Lessons Learned. 398
Source Code Depot 398

PART 9 Oracle Net

CHAPTER 29 TNS Listener IP Address Binding and IP=FIRST 401

Introduction to IP Address Binding 401
Multihomed Systems 403
IP=FIRST Disabled 405
Host Name. 405
Loopback Adapter. 407
Boot IP Address. 407
Service IP Address 408
IP=FIRST Enabled 409
Lessons Learned 410

CHAPTER 30 TNS Listener TCP/IP Valid Node Checking 413

Introduction to Valid Node Checking 413
Enabling and Modifying Valid Node Checking at Runtime 415

CHAPTER 31 Local Naming Parameter ENABLE=BROKEN 419

Node Failure and the TCP/IP Protocol 419

CHAPTER 32 Default Host Name in Oracle Net Configurations 423

Default Host Name 423
Disabling the Default Listener 425

PART 10 Real Application Clusters

CHAPTER 33 Session Disconnection, Load Rebalancing, and TAF ... 429

Introduction to Transparent Application Failover ... 429
ALTER SYSTEM DISCONNECT SESSION ... 430
SELECT Failover ... 431
Failover at the End of a Transaction ... 435
Session Disconnection and DBMS_SERVICE ... 437
Setting Up Services with DBMS_SERVICE ... 437
Session Disconnection with DBMS_SERVICE and TAF ... 439
Lessons Learned ... 442
Source Code Depot ... 443

CHAPTER 34 Removing the RAC Option Without Reinstalling ... 445

Linking ORACLE Software ... 445
Case Study ... 447
Simulating Voting Disk Failure ... 447
Removing the RAC Option with the Make Utility ... 449
Conversion of a CRS Installation to Local-Only ... 451
Re-enabling CRS for RAC ... 454
Lessons Learned ... 455

PART 11 Utilities

CHAPTER 35 OERR ... 459

Introduction to the OERR Script ... 459
Retrieving Undocumented Events ... 461
Source Code Depot ... 463

CHAPTER 36 Recovery Manager Pipe Interface ... 465

Introduction to Recovery Manager ... 465
Introduction to DBMS_PIPE ... 466

RMAN_PIPE_IF Package 467
RMAN_PIPE_IF Package Specification 468
Using the Package RMAN_PIPE_IF 468
Validating Backup Pieces 475
Internode Parallel Backup and Restore 476
Source Code Depot 477

CHAPTER 37 ORADEBUG SQL*Plus Command 479

Introduction to ORADEBUG 479
ORADEBUG Workflow 480
ORADEBUG Command Reference 480
Attaching to a Process 481
ORADEBUG IPC 483
ORADEBUG SHORT_STACK 485
Diagnostic Dumps 486
Lessons Learned 491

PART 12 **Appendixes**

APPENDIX A Enabling and Disabling DBMS Options 495

APPENDIX B Bibliography 497

APPENDIX C Glossary 499

INDEX 507