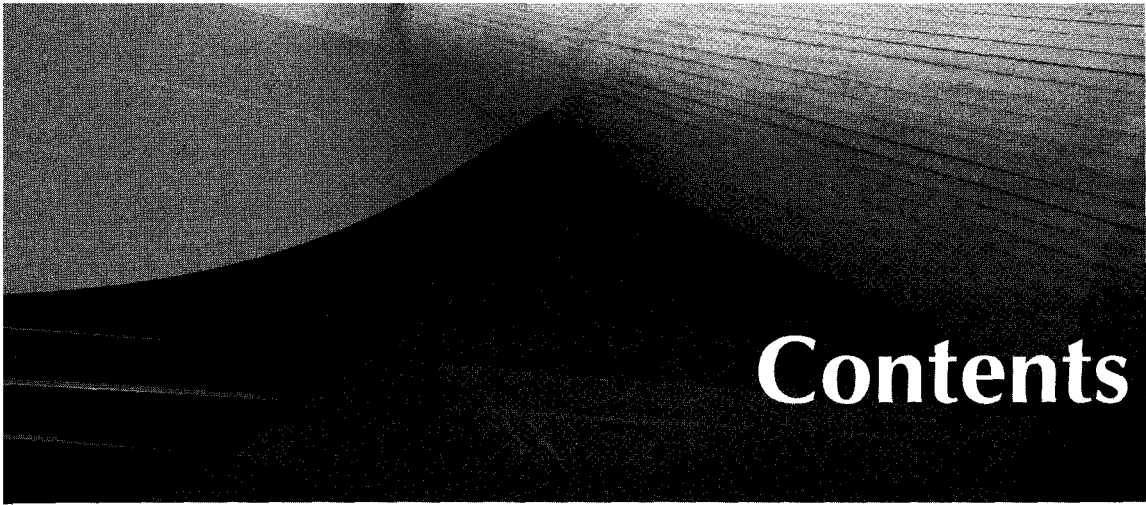




Contents

ACKNOWLEDGMENTS	xxiii
INTRODUCTION	xxvii

PART I

Oracle's Grid Infrastructure

1 Architecting the Oracle Database Grid	3
LunarTrax: To the Moon and Beyond!	4
Planning the Grid	5
The Grid and Planned Maintenance	6
Oracle Technologies: Reducing the Impact of Maintenance	7
Recovering Quickly from Failures	8
Oracle Technologies at Play	9
Protecting Against and Recovering from User Errors	10
Oracle Technology Checkpoint: Flashback Query and Flashback Table	11
Again with the Flashback Database	11
Planning for Expansion and Future Growth	11
Oracle Technology: Automatic Storage Management	12
Again with the Oracle Clusterware	12
Disaster Recovery	13
Oracle Technology: Oracle Data Guard	13
What Next?	14
Test, Test, and Test Some More	14
Go Forth and Conquer	17
2 Oracle VM	19
Virtualization Basics	20
Oracle VM	20
Oracle VM Server and Dom-0	21
Oracle VM Manager	25

Using Oracle VM Manager	29
Server Pools	29
Servers	29
Resources	29
Virtual Machines	29
Using Oracle VM Server	39
Multiple VM Servers Using iSCSI for Shared Discs	42
Supported Oracle VM Configurations for Grid Infrastructure and Oracle RAC	44
Using Prebuilt Oracle RAC Templates	44
Summary	45
3 Grid Infrastructure	47
Cluster Ready Services	48
CRS Concepts	49
Voting Disk/File	49
Oracle Cluster Registry (OCR)	53
Oracle Local Registry (OLR)	55
Grid Naming Service (GNS)	56
Single Client Access Name and Its Listener	58
Virtual IP Addresses	61
Cluster Time Synchronization Services	61
Server Pools and Policy-Based Cluster Management	62
Role-Separated Management	64
Node Number Pinning and Leases	64
Agents	65
Integrating Intelligent Platform Management Interface (IPMI)	66
CRS Architecture	66
Oracle HA Services Daemon	68
Cluster Ready Services Daemon (CRSD)	73
Clusterware Trace Files	74
Summary	76
4 Grid Infrastructure Installation and Configuration	77
GI Installation Choices and Requirements	78
Shared GI Home vs. Local GI Home	78
Separate Users for GI Home and DB Home	78
Shared Storage Choices for Clusterware Files	79
Networking Requirements for CRS and Oracle RAC	81
Network Interface Bonding	82
Hardware Requirements	82
Cluster Verification Utility	84
Grid Infrastructure Install	97
Troubleshooting a GI Installation	114
Recovering from Failure in root.sh	115

Adding and Removing Nodes from a Cluster	116
Adding a Node	116
Deleting a Node	117
Upgrading to GI	119
Things to Note for ASM	120
Upgrade Paths	120
The Actual Upgrade	120
What's New for 11.2.0.2	122
Summary	124
5 Oracle Automatic Storage Management	125
ASM Concepts	126
ASM for Single-Instance Databases	126
ASM Instances	126
ASM Disks	127
ASM Disk Groups	130
ASM Files, Directories, and Aliases	142
ASM Metadata	143
ASM Dynamic Volumes	143
ASM Dynamic Volume Manager	144
ASM Cluster File System	148
ACFS for the Database Home	149
ACFS for a General Purpose File System	154
ACFS Read-Only Snapshots	159
ACFS Tagging	160
ACFS Replication	161
ACFS Security	165
ACFS Encryption	168
Summary	169

PART II

Oracle Real Application Clusters (Oracle RAC)

6 Oracle RAC Setup/Configuration	173
Oracle RAC/RDBMS Install Options	174
Shared Home vs. Private Drives for the RDBMS	174
Owner of the DB Home	175
File System Choice for DB Files	176
cluvfy	176
Installing Oracle RAC	180
Patching the Environment	183
ASM Disk Group Creation	183
Database Creation with DBCA	185
Workload Management Considerations	190

Enabling Archiving	190
Extending Oracle RAC Databases to New Nodes	191
Extending the Oracle RDBMS/Oracle RAC Home	192
Add an Instance to a Policy-Managed Database	192
Add an Instance to an Administrator-Managed Database	192
Deleting an Instance from the Oracle RAC Database	193
Delete an Instance from a Policy-Managed Database	193
Delete an Instance from an Administrator-Managed Database	193
Installing Earlier RDBMS Releases	194
Using Older Oracle Database Versions with GI	194
Installing a Version 10.2 RDBMS on 11.2 GI	195
Creating a 10.2 Database Using DBCA	197
Oracle RAC on Extended Distance Clusters	198
Stretching a Cluster	198
Stretching Network Connections	199
Shared Storage	199
Voting Disks	201
Summary	202
7 Oracle RAC Administration	203
Oracle RAC vs. Single-Instance: Additional Processes	204
LCK: Lock Process	204
LMD: Lock Manager Daemon Process	204
LMON: Lock Monitor Process	205
LMS: Lock Manager Server Process	205
ACFS: ASM Cluster File System CSS Process	205
ACMS: Atomic Control File to Memory Service Process	205
GTXn: Global Transaction Process	206
LMHB: Global Cache/Enqueue Service Heartbeat Monitor	206
PING: Interconnect Latency Measurement Process	206
RMSn: Oracle RAC Management Process	206
RSMN: Remote Slave Monitor Process	206
Oracle RAC vs. Single-Instance: The Basics	206
Cache Fusion: A Brief Intro	206
Dynamic Resource Mastering	207
Reconfiguration	207
Cache Coherency in an Oracle RAC Environment	208
Redo and Rollback with Oracle RAC	209
Redo Logs and Instance Recovery	209
Redo Logs and Media Recovery	210
Parallelism in an Oracle RAC Environment	211
Types of Parallelism	212

Monitoring the Environment	213
Database Control and Grid Control	214
OS Watcher (OSW)	215
Cluster Health Monitor (CHM)	217
ORION	218
Tuning with AWR and ADDM	218
Intelligent Infrastructure	218
MMON Background Process	218
Automatic Workload Repository	219
Automatic Database Diagnostic Monitor	220
What Drives ADDM?	221
Interconnect Performance	222
Sequence Caches	224
HugePages on Linux	225
Archiving and Backing Up	226
Archiving with NFS Mount Points for Your Archive Destination	226
Archiving in a Cluster File System Environment	227
Archiving in an ASM Environment	228
Additional Notes on Archiving in an Oracle RAC Environment	229
Patches and Patchsets	229
Rolling Patch Updates	229
Online Patching (Hot Patching)	231
The Out-of-Place Patchset Model	231
Proactive Maintenance Strategy	231
Recommended Patches	232
Patchset Updates	232
Managing the Oracle RAC Database with SRVCTL	233
The Server Control Utility (SRVCTL)	233
Management Through Policies	237
Managing Diagnostic Data	239
Automatic Diagnostic Repository	239
ADRCI Command-Line Utility	239
ADR Structure	239
ADR in Oracle RAC	240
Reporting and Resolving a Problem	241
Summary	241
8 Utility Computing: Applications as Services	243
Services Concepts	244
Services as a Workload	244
Services as the Application's Interface to the Database	245
Services from the Database Perspective	245

Distributing Work Among Oracle RAC Nodes for Performance	248
Client-Side Load Balancing	248
Server-Side Load Balancing	248
Load-Balancing Configuration	249
Event Notification	249
Notification Concepts	249
Oracle Notification Service	250
FAN Callouts	252
Creating Services and Callouts	253
Creating Services	253
Viewing Services from Within the Database	258
Using SRVCTL to Manage Services and Node Applications	259
Node Applications	259
Managing Services via SRVCTL	261
Cluster Listener Configuration	264
Grid Naming Service and Listeners	264
SCAN Listeners	264
Local Listeners	266
Listener Registration and PMON Discovery	266
Why a Virtual IP? TCP Timeouts	267
Why a SCAN Virtual IP?	268
Connect-Time Failover	269
Transparent Application Failover	270
Server-Side vs. Client-Side TAF	270
Implementing TAF	270
Easy Connect	275
Oracle RAC/Standby/Replication Environments	275
Integration with OEM	278
Summary	280

PART III

Disaster Planning

9 Oracle Data Guard	283
Making the Right Choice	284
Physical Standby Databases	285
Snapshot Standby Databases	286
Logical Standby Databases	286
Creating a Physical Standby	288
Creating a Snapshot Standby	298
Creating a Logical Standby	300
Logical Standby Unsupported Objects	300

Log Transport Services	305
Defining Log Transport Services Destinations	305
Log Transport Services Security	309
Standby Redo Logs	309
Protection Modes	310
Maximum Protection	310
Maximum Availability	311
Maximum Performance	312
Handling Network Disconnects	313
Gap Detection and Resolution	314
Automatic Gap Resolution	315
FAL Gap Resolution	315
Managing a Physical Standby Database	316
Starting a Physical Standby	316
Starting and Stopping Managed Recovery	317
Accommodating Physical Changes on the Primary	318
Monitoring a Physical Standby	320
Read-Only Physical Standby Including Oracle	
Active Data Guard	322
Managing a Logical Standby Database	326
Starting and Stopping SQL Apply	327
Monitoring SQL Apply Progress	327
Deletion of Standby Archived Logs	328
Protecting the Logical Standby from User Modifications	329
Recovering from Errors	330
Changing the Default Behavior of the SQL Apply Engine	331
Performing a Role Transition Using Switchover	332
Performing a Role Transition Using Failover	335
Failover First Steps	336
Reinstating a Database After a Failover	339
Summary	340
10 Backup and Recovery for MAA Environments	341
The Importance of Media Backups	342
RMAN: A Primer	344
RMAN and the Controlfile	345
RMAN and the Data Block	346
RMAN Command-Line Usage	347
Preparing an RMAN Backup Strategy	348
The Flash Recovery Area	348
RMAN Configuration Parameters	351
Caring for Your Controlfile	354
The Snapshot Controlfile	355
The Recovery Catalog	356

Backups for the MAA Database	358
The High Availability Backup Strategy	358
Backing Up the Flash Recovery Area	366
Backup Housekeeping	367
Performing Recovery	371
Database Recovery: Restore and Recover	372
Block Media Recovery	375
Database Recovery: Data Recovery Advisor	376
Media Management Considerations	382
The SBT Interface	382
Backing Up Directly to Tape	384
Oracle Secure Backup and the OSB Cloud Module	385
RMAN and Oracle Data Guard	385
Using RMAN to Build the Standby Database	385
Using the Physical Standby Database to Create Backups	387
RMAN and Oracle RAC	391
RMAN Configuration for the Cluster	391
Summary	396

11 Flashback Recovery	397
Being Prepared for the Inevitable: Flashback Technology	398
Laying the Groundwork	399
Flashback Query and Flashback Table	400
Configuring for Flashback Query and Flashback Table	401
Flashback Query	402
Flashback Versions Query	403
Flashback Transaction Query	404
Flashback Table	405
Flashback Drop	406
The Recycle Bin	406
Flashback Transaction	408
Flashback Database	413
Flashback Logs	414
Flashback Retention Target	415
Flashback Database: Tuning and Tweaking	416
Different Uses of Flashback Database	418
Summary	420

PART IV

Enhancing Availability with Additional Features

12 Oracle Data Guard Broker	423
Oracle Data Guard Broker Architecture Overview	424
Oracle Data Guard Broker Configuration	425

Monitoring an Oracle Data Guard Broker Configuration	427
Modifying a Broker-Managed Oracle Data Guard Configuration	429
Role Transitions with Oracle Data Guard Broker	431
Increasing Database Availability with Fast-Start Failover	436
Enhancing Application Availability with Fast Application Notification and Role-Based Services	440
Summary	442
13 Oracle Grid Control	443
What Is Oracle Grid Control?	444
Grid Control Architecture	446
Preparing to Install Oracle Grid Control 11g Release 1	447
OS Prerequisites	447
Creating and Configuring the Repository Database	451
Oracle Management Agents	471
Administration of Grid Control	473
Common OMS Administration Tasks	474
Common Agent Administration Tasks	475
Managing Targets	476
Monitoring	478
How Does Grid Control Do It?	479
Modifying Default Metric Settings	479
Notifications	480
Configuring Notification Methods	480
MAA Environment Administration Using Grid Control	482
Managing Oracle VM	483
Managing Grid Infrastructure	483
Managing Oracle RAC Databases	485
Managing Oracle Data Guard Configurations	486
Managing Database Backups	488
My Oracle Support and Grid Control	488
Summary	489
Index	491