



Contents

FOREWORD	xv
ACKNOWLEDGMENTS	xvii
INTRODUCTION	xix

PART I

Features and Foundations

1 Oracle and Tightly Integrated Hardware and Software Platforms	3
A History of Appliance-like Computing Solutions	5
Oracle's Evolution Towards Integrated Hardware and Software	7
Oracle Exadata Database Machine Fundamental Concepts	10
Software Integration and the Oracle Exadata Database Machine	13
Impact of the Platform on Personnel	15
Future Directions	17
Summary	18
2 Oracle 11g Enterprise Edition Features	19
Data Integrity and Performance	20
Locks and Lock Management	22
MVRC	23
Flashback	26
Real Application Clusters	27
What Is RAC?	27
RAC and Availability	28
RAC and Scalability	29

Cache Fusion	30
Allocating Resources and RAC	33
RAC One	36
RAC and the Exadata Database Machine	36
Automatic Storage Management	37
What Is ASM?	37
ASM and Performance	39
ASM and Availability	39
ASM and Management	40
Partitioning	41
What Is Partitioning?	41
Partitioning Types	42
Other Benefits	46
Partitioning and the Exadata Database Machine	47
Parallel Execution	47
What Is Parallel Execution?	48
What Can Be Parallelized?	48
How Parallelism Works	49
Partition-wise Parallel Joins	52
How Do You Configure Parallel Execution?	54
Degree of Parallelism	55
Modifying DOP	57
Ensuring DOP	59
Parallelism and RAC	61
In-memory Parallel Execution	62
Parallelism and Exadata	62
Data Guard	63
What Is Data Guard?	63
How Can Data Guard Be Implemented?	63
Data Guard and Exadata	66
Compression	67
What Types of Compression	
Does Oracle Support?	67
SecureFiles	68
Benefits of Compression	68

Database Resource Manager	69
What Is Database Resource Manager?	69
How Does Database Resource Manager Work?	70
What Can Database Resource Manager Affect?	71
Other Factors	72
How Does Database Resource Manager Work with Exadata?	72
Analysis Capabilities	73
Analytic Functions	73
Data Mining	73
Enterprise Manager	74
Data Movement	77
Utilities	77
Features	78
Operating Systems	79
Solaris Support	79
Oracle Linux	80
Other Oracle Database 11g Features	80
Materialized Views	81
Oracle OLAP	82
Star Transformation	82
Encryption	84
Summary	84
3 Exadata Software Features	87
Smart Scan	89
How Standard Queries Work	89
How Smart Scan Queries Work	90
Individual Tables	90
Join Filtering	92
Monitoring Savings from Smart Scan	94
Other Offloaded Processing	96
Fast File Creation	96
Incremental Backup	97
Data Mining Scoring	98
Encryption	98

x Achieving Extreme Performance with Oracle Exadata

Exadata Hybrid Columnar Compression	99
What Is Exadata Hybrid Columnar Compression?	100
How It Works	100
Compression Options	102
Decompression	102
Advantages	103
ILM and Oracle Compression	104
Storage Indexes	104
How Storage Indexes Work	105
Storage Indexes at Work	106
Exadata Smart Flash Cache	107
What Is the Exadata Smart Flash Cache?	107
How Can You Use the Exadata Smart Flash Cache?	108
How Does Exadata Smart Flash Cache Determine What Is Cached?	109
Exadata Smart Flash Cache Statistics	111
Benefits from Exadata Smart Flash Cache	112
I/O Resource Manager	112
Benefits from I/O Resource Manager	113
Architecture of an IORM Plan	113
IORM at Work	115
Interacting with Exadata Storage Server Software	118
Management Software Components	118
Command Interfaces	119
CellCLI	119
dcli	120
ADRCI	120
CellCLI Command Overview	120
Summary	123
4 Oracle Exadata Database Machine Platform	
Hardware Components	125
Latency and Balance	126
Processor Speeds, Memory Capacity, and Storage	127
How Hardware Components Work Together	129

Oracle Exadata Database Machine Packaging Basics	130
Installation and Initial Deployment Considerations	137
Upgrade Choices for Existing Systems	140
Connecting to the Database Machine	141
Highly Available Hardware Considerations	143
Summary	144

PART II

Best Practices

5 Managing the Exadata Database Machine	149
Exadata Storage Server Architecture	151
Database Server Software Components	151
Exadata Storage Server Software Components	153
Exadata Storage Server Administration	162
Using CellCLI	163
Exadata Storage Server OS	
Users and Privileges	165
Using dcli	166
Exadata Storage Server Setup	168
Exadata Storage Server Security Configuration	175
Exadata Storage Server Monitoring	179
Monitoring with Metrics and Alerts	179
Monitoring Active Requests	191
Monitor Using the Oracle Database	192
Monitoring with Oracle Enterprise Manager	196
Oracle Integrated Lights Out Manager	205
Summary	207
6 High Availability and Backup Strategies	209
Exadata Maximum Availability Architecture (MAA)	210
High Availability with Oracle Data Guard	212
Using Oracle GoldenGate	
with Database Machine	218
Database Machine Patches and Upgrades	224
Exadata Storage Server High Availability	230
Preventing Data Corruption	232

Exadata Database Machine Backup and Recovery Best Practices	238
Backup Tools Best Practices	240
Oracle Database Backup Strategy	246
Database Recovery Best Practices	257
Summary	259
7 Deploying Data Warehouses on the Oracle Exadata Database Machine	261
Data Warehousing Basics	263
Generic Oracle Query Optimization	268
Embedded Analytics in Oracle	271
SQL Aggregation and Analytics Extensions	271
OLAP	271
Data Mining	274
Unique Exadata Features for Optimal Query Response	275
Data Warehousing Compression Techniques	278
The Typical Life of a Query	279
Best Practices for Data Loading	280
Partitioning, Backups, and High Availability in Data Warehouses	282
Data Models, Business Intelligence Tools, and Security	283
Data Models	284
Business Intelligence Tools	285
Security Considerations	287
Sizing the Platform for Data Warehousing and Justifying Purchase	287
Summary	290
8 Exadata and OLTP	293
OLTP Workloads and Exadata Features	294
Exadata Hardware and OLTP	296
General Hardware and Infrastructure Considerations	296
Exadata Smart Flash Cache	297
Oracle 11g and OLTP	301
Classic Oracle Features	301
Oracle and Linux	305
Quality of Service Management	306

Exadata Software and OLTP	310
Exadata Nodes and OLTP	311
Exadata as a Complete System	312
Summary	313
9 Consolidating Databases with the Oracle Exadata	
Database Machine	315
Why Consolidate?	316
How the Oracle Exadata Database Machine	
Helps Consolidation	317
Database Server Consolidation	318
CPU Sizing Considerations	318
Memory Sizing	320
I/O Sizing	321
System Sizing	323
Storage Consolidation	324
Network Consolidation	324
Workload Consolidation and Isolation	325
Services	326
Database Server Pools	326
Workload Management	328
Meeting and Exceeding SLAs	329
Instance Caging	329
I/O Resource Manager (IORM)	333
Quality of Service Management	338
Consolidation Design	338
RAC Considerations	338
Workload-Based Consolidation	339
Time Zone-Based Consolidation	340
Overprovisioning Consolidation	340
Tight SLA Provisioning	341
Testing	341
Summary	342

10 Migrating to the Exadata Database Machine	343
Premigration Steps	345
Discovering the Current Environment	346
Database Machine Capacity Planning and Sizing	355
Choosing a Migration Strategy	360
Migration Steps for Non-Oracle Databases	364
Database Schema Migration	364
Server-side Scripts Migration	365
Data Migration and Synchronization	365
Using Automated Tools for Migration	369
Migration Steps for Oracle Databases	374
Migrating Using Physical Methods	375
Migrating Using Logical Methods	381
Summary	384
A Exadata Capacity and Performance Specifications	385
Exadata Database Machine Storage Capacity	386
Exadata Storage Server Performance	387
Index	389