

Contents

Introduction	xxix
Chapter 1: SQL Server 2008 Architecture	1
The Expanding Role of a DBA	1
Production DBA	1
Development DBA	2
Business Intelligence DBA	3
Hybrid DBA	3
New Things You Need to Learn	4
SQL Server Architecture	5
Transaction Log and Database Files	5
SQL Native Client	6
System Databases	7
Schemas	9
Synonyms	9
Dynamic Management Views	10
SQL Server 2008 Data Types	10
Editions of SQL Server	16
Compact (32-bit only)	17
SQL Express (32-bit only)	17
Workgroup Edition (32-bit and 64-bit)	17
Web Edition (32-bit and 64-bit)	17
Standard Edition (32-bit and 64-bit)	17
Enterprise, Evaluation, and Developer Editions (32-bit and 64-bit)	17
Operating System	18
Maximum Capacity of SQL Server	18
Database Features By Edition	19
Licensing	31
Summary	34
Chapter 2: SQL Server 2008 Installation Best Practices	35
Planning the System	35
Hardware Options	36
Software and Install Options	40

Contents

Installing SQL Server	45
Side-By-Side, Upgrade, and New Installs	45
Scripted Installation	46
Remote Installation	47
Local Installation	47
Where Are the Sample Databases?	50
Installing Analysis Services	51
Burning in the System	52
Post-Install Configuration	52
SQL Server Configuration Manager	53
SQL Server Management Studio	53
tempdb	54
Back It Up	56
Uninstalling SQL Server	57
Uninstalling Reporting Services	57
Uninstalling Analysis Services	58
Uninstalling the SQL Server Database Engine	58
Common Installation Issues	59
Installing Client Tools from a Network Share	59
Admin Tools Not Installed by Default on Remote Cluster Nodes	60
Minimum Configuration Warning	60
Troubleshooting a Failed Install	60
Summary	61
Chapter 3: Upgrading SQL Server 2008 Best Practices	63
Why Upgrade to SQL Server 2008?	63
Risk Mitigation — The Microsoft Contribution	64
Independent Software Vendors and SQL Community Contributions	65
Upgrading to SQL Server 2008	65
In-Place Upgrading	66
Side-by-Side Upgrade	67
In-Place Upgrade versus Side-By-Side Upgrade Considerations	67
Pre-Upgrade Checks	69
SQL Server Upgrade Advisor	69
Installing the SQL Server 2008 Upgrade Advisor	69
Using the Upgrade Advisor	70
Scripting the Upgrade Advisor	72
Resolving Upgrade Issues	73
SQL Server 2008 Upgrade Assistant	75
Backward Compatibility	77
Unsupported and Discontinued Features	77
SQL Server 2008 Deprecated Database Features	78
Other SQL Server 2008 Changes Affecting Behavior	78

Contents

SQL Server Component Considerations	79
Upgrading Full-Text Catalog to SQL Server 2008	79
Upgrading Reporting Services	80
Upgrading Analysis Services	80
Upgrading DTS to SQL Server 2008 Integration Services (SSIS)	81
Log Shipping	88
Failover Clustering and Data Mirroring	88
Upgrading to 64-bit	88
Post-Upgrade Checks	89
Poor Query Performance After Upgrade	89
Updating Usage Counters	90
SQL Server Configuration Manager	91
Policy-Based Management	91
Summary	96
Chapter 4: Managing and Troubleshooting the Database Engine	97
Configuration Tools	97
SQL Server Configuration Manager	97
Dedicated Administrator Connection	99
Configuration Servers and Server Groups	100
Startup Parameters	101
Startup Stored Procedures	104
Rebuilding the System Databases	105
Management Studio	106
Reports	106
Configuring SQL Server	108
Filtering Objects	112
Error Logs	113
Activity Monitor	114
Monitoring Processes in T-SQL	118
Trace Flags	120
Getting Help from Support	124
SQLDumper.exe	124
SQLDiag.exe	125
Summary	127
Chapter 5: Automating SQL Server	129
Maintenance Plans	129
Maintenance Plan Wizard	130
Maintenance Plan Designer	132
SQL Server Agent	136
Automation Components	137
SQL Server Agent Security	151
	xv

Contents

Configuring SQL Server Agent	156
Database Mail	160
Multiserver Administration	166
Summary	172
Chapter 6: Integration Services Administration and Performance Tuning	175
A Tour of Integration Services	175
Integration Services Uses	176
The Four Main Parts of Integration Services	177
Project Management and Change Control	179
Administration of the Integration Services Service	179
An Overview of the Integration Services Service	179
Configuration	180
Event Logs	185
Monitoring Activity	187
Administration of Integration Services Packages	187
An Overview of Integration Services Packages	187
Creating Packages	188
Management	191
Deployment	194
Execution and Scheduling	199
Applying Security to Integration Services	203
An Overview of Integration Services Security	203
Securing Packages	203
Saving Packages	205
Running Packages	205
Package Resources	205
Digital Signatures	206
Summary	206
Chapter 7: Analysis Services Administration and Performance Tuning	207
Tour of Analysis Services	207
Unified Dimensional Model Components	208
Analysis Services Architectural Components	209
Administering Analysis Services Server	210
Required Services	212
Analysis Services Scripting Language	212
Administering Analysis Services Databases	214
Deploying Analysis Services Databases	214
Processing Analysis Services Objects	217
Backing Up and Restoring Analysis Services Databases	219
Synchronizing Analysis Services Databases	222

Contents

Analysis Services Performance Monitoring and Tuning	223
Monitoring Analysis Services Events Using SQL Profiler	223
Creating Traces for Replay	224
Using Flight Recorder for After-the-Fact Analysis	226
Management of Analysis Services Storage	227
Storage Modes	227
Partition Configuration	227
Designing Aggregations	228
Applying Security to Analysis Services	233
Server Role	233
Database Role	233
Database Role Permissions	234
Summary	236
Chapter 8: Administering the Development Features	237
Service Broker	237
Service Broker Architecture	238
Service Broker Examples	246
Activation	260
Conversation Groups	265
Security Considerations for Service Broker	267
Transport Security	267
Routing	271
Dialog Security	275
Conversation Priorities	279
Setting Conversation Priorities	279
Reviewing Conversation Priorities	288
Administering Service Broker	288
Installing Service Broker Application	289
Setting Permission on Service Broker Objects	290
Managing Service Broker Queues	292
Poison Message Handling	293
Moving Service Broker Applications	295
Copying Service Broker Applications	296
Replacing Expired Certificates	297
Troubleshooting Service Broker Applications	297
Performance Tuning Service Broker	307
Introduction to CLR Integration	308
SQL Server As .NET Runtime Host	308
Application Domains	309
T-SQL versus CLR	310
Extended Stored Procedures versus CLR	310
	xvii

Contents

Enabling CLR Integration	311
Creating the CLR Assembly	312
Deploying the Assembly	315
Cataloging Objects	321
Application Domains	324
Performance Monitoring	325
Summary	327
Chapter 9: Securing the Database Engine	329
Security Principles	329
The Principle of Least Privilege	329
The CIA Triad	330
Defense in Depth	331
Creating a Secure Configuration	332
New Security Features in SQL Server 2008	332
Operating System Security	333
Operating System Security and SQL Server	337
Surface Area Configuration	341
Endpoints	342
Typical Endpoint Configuration	342
Other Endpoints	344
Windows Authentication Changes in SQL Server 2008	344
Identity and Access Control	344
Server Principals/Logins	345
Credentials	354
Users	355
Schemas	358
Schema Example	359
Changing Schemas	362
User/Schema Separation	362
Changing the Schema Owner	363
INFORMATION_SCHEMA and sys Schemas	364
Securables and Object Permissions	364
Ownership Chaining	364
Cross-Database Ownership Chaining	365
Permission Context	366
EXECUTE AS Command	367
Troubleshooting Permissions Issues	369
Encryption	370
Setting Up an Encryption Methodology	370
Encrypting the Data	372

Contents

Creating a Helper Function Example	374
Column-Level Permissions	374
Transparent Data Encryption (TDE)	375
Extensible Key Management (EKM)	377
SQL Server Audit	377
Creating an Audit	377
Creating and Enabling a Server Audit Specification	378
Creating and Enabling a Database Audit Specification	380
Summary	381
Chapter 10: Change Management	383
Creating Projects	383
Creating a Connection	384
Creating a Project Query	385
Policy-Based Management	386
Policy-Based Management Overview	386
Policy-Based Management Step By Step	387
Scripting Policy-Based Management	392
Policy-Based Management Implementation	394
DDL Trigger Syntax	397
Database Triggers	397
Server Triggers	401
Trigger Views	402
sqlcmd	403
Scripting Overview	403
Executing sqlcmd from the Command Prompt	403
Executing sqlcmd from Management Studio	405
Creating Change Scripts	407
Data Dude	408
PowerShell	408
Version Tables	410
Summary	412
Chapter 11: Configuring the Server for Optimal Performance	413
What Every DBA Needs to Know about Performance	414
The Performance Tuning Cycle	414
Defining Good Performance	415
Focus on What's Most Important	415
What the Developer DBA Needs to Know about Performance	416
Users	417
SQL Statements	417

Contents

Data	417
Robust Schema	417
What the Production DBA Needs to Know about Performance	418
Optimizing the Server	419
Configuring Server Hardware	420
Windows Server System Reference Architecture	421
Windows Server Catalog	421
CPU	421
32-bit x86 Processors	421
x64	422
IA64	422
Choosing between x64 or IA64	422
Hyperthreading	423
Cache	424
Multi-Core	425
System Architecture	427
Memory	429
Physical Memory	429
Physical Address Space	429
Virtual Memory Manager	429
The Page File	430
Page Faults	430
Virtual Address Space	431
32-Bit System Memory Configuration	432
64-bit Systems	433
Memory Configuration Scenarios	434
I/O	436
Network	437
Disks	437
Storage Design	439
Designing a Storage System	441
Large Storage System Considerations: SAN Systems	445
Server Configuration	447
Fragmentation	452
Summary	453
Chapter 12: Optimizing SQL Server 2008	455
Application Optimization	455
Defining a Workload	455
System Harmony Is the Goal	456

Contents

The Silent Killer: I/O Problems	456
SQL Server I/O Process Model	457
Database File Placement	457
tempdb Considerations	458
Table and Index Partitioning	461
Why Consider Partitioning?	461
Implementing Partitioning	462
Creating a Partition Function	463
Creating Filegroups	464
Creating a Partition Scheme	464
Creating Tables and Indexes	465
Data Compression	470
Row Compression	470
Page Compression	471
Estimating Space Savings	473
Monitoring Data Compression	475
Data Compression Considerations	475
Memory Considerations and Enhancements	476
Tuning SQL Server Memory	476
Windows 2008 Hot-Add CPU	479
Configuring SQL Server 2008 for Dynamic Memory on an X86 Platform	479
64-bit Versions of SQL Server 2008	482
Resource Governor	482
CPU Considerations	488
Data Locality	488
Cache Coherency	489
Affinity Mask	489
Max Degree of Parallelism (MAXDOP)	492
Affinity I/O Mask	492
Max Server Memory	493
Index Creation Memory Option	494
Minimum Memory per Query	494
Summary	495
Chapter 13: Monitoring Your SQL Server	497
The Goal of Monitoring	498
Determining Your Monitoring Objectives	498
Establishing a Baseline	498
Comparing Current Metrics to the Baseline	499

Contents

What's New in Monitoring for SQL Server 2008	499
Data Collection	500
SQL Server Extended Events	500
Choosing the Appropriate Monitoring Tools	500
Performance Monitor	501
CPU Resource Counters	502
Isolating Processor Bottlenecks	503
Disk Activity	503
Memory Usage	510
Performance Monitoring Tools	513
Monitoring Events	514
The Default Trace	516
SQL Trace	516
Event Notifications	528
SQL Server Extended Event Notifications	531
Monitoring with Dynamic Management Views and Functions	539
What's Going on Inside SQL Server	540
Viewing the Locking Information	543
Viewing Blocking Information	543
Index Usage in a Database	544
View Queries Waiting for Memory Grants	545
Connected User Information	546
Filegroup Free Space	546
Query Plan and Query Text for Currently Running Queries	547
Memory Usage	547
Monitoring Logs	548
Monitoring the SQL Server Error Log	548
Monitoring the Windows Event Logs	548
Management Data Warehouse	548
System Data Collection Sets	549
Viewing Data Collected By the System Data Collection Sets	549
Creating Your Own Data Collection Set	551
Examining the Data You Collected	553
Summary	554
Chapter 14: Performance Tuning T-SQL	555
Physical Query Processing	555
Compilation	559
Tools and Commands for Recompile Scenarios	563
Parser and Algebrizer	564
Optimization	565

Contents

Tuning Process	570
Database I/O Information	570
Working with the Query Plan	571
Join Algorithms	579
Index Access Methods	582
Data Modification Query Plan	595
Query Processing Enhancements on Partitioned Tables and Indexes	600
Gathering Query Plans for Analysis with SQL Trace	602
Summary	603
<hr/>	
Chapter 15: Indexing Your Database	605
<hr/>	
Noteworthy Index-Related Features in SQL Server	605
What's New for Indexes in SQL Server 2008	605
Index Features from SQL Server 2005	606
Sample Database	608
Partitioned Tables and Indexes	610
Why Use Partitioned Tables and Indexes?	610
Prerequisites for Partitioning	611
Creating Partitioned Tables	611
Filtered Indexes and Filtered Statistics	624
Index Maintenance	626
Monitoring Index Fragmentation	626
Cleaning Up Indexes	628
Database Tuning Advisor	630
Using the DTA to Tune Individual Queries	630
Too Many Indexes?	649
Tuning a Workload	651
Summary	652
<hr/>	
Chapter 16: Replication	653
<hr/>	
Replication Overview	653
Replication Types	654
Replication Components	655
Replication Enhancements in SQL Server 2008	656
Replication Models	657
Single Publisher, One or More Subscribers	657
Multiple Publishers, Single Subscriber	658
Multiple Publishers Also Subscribing	658
Updating Subscriber	660
Peer-to-peer	660

Contents

Implementing Replication	661
The Setup	662
Setting Up Distribution	663
Implementing Snapshot Replication	666
Implementing Transactional and Merge Replication	674
Peer-to-Peer Replication	675
Scripting Replication	679
Monitoring Replication	679
Replication Monitor	679
Performance Monitor	679
Replication DMVs	681
sp_replcounters	682
Summary	682
Chapter 17: Database Mirroring	683
Overview of Database Mirroring	683
Operating Modes of Database Mirroring	685
Database Mirroring Example	687
Database Mirroring and SQL Server 2008 Editions	697
Database Mirroring Catalog Views	698
Database Mirroring Role Change	700
Database Availability Scenarios	706
Monitoring Database Mirroring	709
Monitoring Using System Monitor	709
Monitoring Using Database Mirroring Monitor	711
Setting Thresholds on Counters and Sending Alerts	714
Monitoring Using SQL Profiler	716
Troubleshooting Database Mirroring	716
Troubleshooting Setup Errors	716
Troubleshooting Runtime Errors	717
Automatic Page Repair	718
Preparing the Mirror Server for Failover	719
Hardware, Software, and Server Configuration	719
Database Availability During Planned Downtime	720
SQL Job Configuration on the Mirror	722
Database TRUSTWORTHY Bit on the Mirror	722
Client Redirection to the Mirror	722
Mirroring Multiple Databases	723
Database Mirroring and Other High-Availability Solutions	724
Database Mirroring and Clustering	724
Database Mirroring and Transactional Replication	725
Database Mirroring and Log Shipping	725

Contents

Mirroring Event Listener Setup	725
Database Snapshots	729
Summary	730
<hr/>	
Chapter 18: Backup and Recovery	731
<hr/>	
Types of Failure	731
Hardware Failure	732
User Error	732
Application Failure	732
Software Failure	732
Too Much Privilege	733
Local Disasters	733
Making Plans	733
Backup/Recovery Plan	734
Maintaining the Plan	738
Overview of Backup and Restore	739
How Backup Works	739
Backup Compression	742
How Restore Works	743
Comparing Recovery Models	744
Choosing a Model	745
Switching Recovery Models	746
Verifying the Backup Images	747
Backing Up History Tables	749
Permissions Required for Backup and Restore	750
Backing Up System Databases	750
Full-text Backup	751
Planning for Recovery	752
Recoverability Requirements	752
Data Usage Patterns	753
Maintenance Time Window	753
Other High-Availability Solutions	755
Developing and Executing a Backup Plan	755
Using SQL Server 2008 Management Studio	755
Database Maintenance Plans	760
Using Transact-SQL Backup Commands	762
Managing Backups	764
Backup and Restore Performance	764
Performing Recovery	765
Restore Process	765
SQL Server Management Studio Restore	769

Contents

T-SQL Restore Command	772
Restoring System Databases	773
Archiving Data	775
SQL Server 2008 Table Partitioning	775
Partitioned View	776
Disaster Recovery Planning	776
Summary	778
Chapter 19: SQL Server 2008 Log Shipping	779
Log Shipping Deployment Scenarios	779
Log Shipping to Create a Warm Standby Server	780
Log Shipping As a Disaster Recovery Solution	780
Log Shipping As a Report Database Solution	781
Log-Shipping Architecture	782
Primary Server	782
Secondary Server	783
Monitor Server	783
Log Shipping Process	783
System Requirements	784
Network	784
Identical Capacity Servers	784
Storage	784
Monitor Server	785
Software	785
Deploying Log Shipping	785
Initial Configuration	785
Deploying with Management Studio	786
Deploying with T-SQL Commands	790
Monitoring and Troubleshooting	791
Monitoring with Management Studio	792
Monitoring with Stored Procedures	793
Troubleshooting Approach	793
Managing Changing Roles	794
Synchronizing Dependencies	794
Switching Roles from the Primary to Secondary Servers	796
Switching Between Primary and Secondary Roles	798
Redirecting Clients to Connect to the Secondary Server	799

Contents

Database Backup Plan	800
Integrating Log Shipping with Other High-Availability Solutions	800
SQL Server 2008 Data Mirroring	801
Windows Failover Clustering	801
SQL Server 2008 Replication	801
Removing Log Shipping	802
Removing Log Shipping with Management Studio	802
Removing Log Shipping with T-SQL Commands	802
Log-Shipping Performance	803
Upgrading to SQL Server 2008 Log Shipping	803
Minimum Downtime Approach	803
With Downtime Approach	804
Deploy Log Shipping Approach	804
Summary	804
Chapter 20: Clustering SQL Server 2008	807
Clustering and Your Organization	808
What Clustering Can Do	808
What Clustering Cannot Do	809
Choosing SQL Server 2008 Clustering for the Right Reasons	810
Alternatives to Clustering	810
Clustering: The Big Picture	812
How Clustering Works	812
Clustering Options	814
Upgrading SQL Server Clustering	817
Don't Upgrade	817
Upgrading Your SQL Server 2008 Cluster In-Place	817
Rebuilding Your Cluster from Scratch	817
Backout Plan	819
Which Upgrade Option Is Best?	819
Getting Prepared for Clustering	819
Preparing the Infrastructure	820
Preparing the Hardware	821
Clustering Windows Server 2008	823
Before Installing Windows 2008 Clustering	823
Installing Windows Server 2008 Clustering	824
Configuring Windows Server 2008 for Clustering	827

Contents

Clustering SQL Server 2008	828
Clustering SQL Server	828
Installing the Service Pack and Hot Fixes	831
Test, Test, and Test Again	831
Maintaining the Cluster	833
Troubleshooting Cluster Problems	834
How to Approach Clustering Troubleshooting	834
Doing It Right the First Time	835
Gathering Information	835
Resolving Problems	836
Working with Microsoft	836
Summary	837
Index	839