



Edited by **Ken Henderson**

SQL Server 2005

Practical Troubleshooting

The Database Engine

Never-Before-Published Insiders' Information for Troubleshooting SQL Server 2005.

Microsoft
SQL Server 2005

Contents

About the Authors.....	ix
Preface.....	xii
Acknowledgments	xiv
1 Waiting and Blocking Issues	1
Wait Types	1
Troubleshooting Blocking	3
Identifying Blocking.....	3
Identifying Blocking Using sys.dm_os_waiting_tasks	3
Statistically Identifying Blocking.....	6
Identifying the Cause of Blocking	9
Current Statements and Plans	10
Blocking Patterns	10
Blocking Chains	11
Resource Type Specifics	13
Latches.....	13
Locks.....	22
External Wait Types	36
Timer and Queue Wait Types	36
IO Wait Types.....	38
Other Wait Types	39
Deadlocks.....	40
Monitoring Blocking	41
Wait Statistics	41
Current Wait Information	42
Conclusion	44
Other Resources	45
2 Data Corruption and Recovery Issues	47
Fundamentals	49
SQL Server 2005 Storage Internals	49
Database and File States.....	49
Resource Database	51
Catalog Views and Base System Tables.....	52
Allocation Structures	62
Database Checksum	66
Fast Recovery.....	66
Deferred Transactions	67
Read-Only Compressed Databases.....	67

SQL Server 2005 Enhancements	68
BACKUP Enhancements	68
RESTORE Enhancements.....	69
DBCC CHECKDB Enhancements	70
Data Recovery Best Practices	72
BACKUP/RESTORE Best Practices	72
Database and Transaction Log Best Practices	74
DBCC CHECKDB Best Practices.....	75
Data Recovery Troubleshooting Scenarios.....	76
System Database Recovery.....	76
Recovering the Resource Database.....	84
Failure to Create tempdb	86
Reinstalling the Operating System	86
User Database Inaccessible	87
Database Marked RECOVERY_PENDING	87
Handling Deferred Transactions	96
Database Marked SUSPECT	97
Attach Database Failures	99
BACKUP/RESTORE Failures	100
BACKUP Failures	100
RESTORE Failures	105
Database Consistency Errors	107
Handling Database Consistency Runtime Errors	107
Handling DBCC CHECKDB Errors.....	112
Repair Versus Restore	124
What Does Each Error Mean?.....	125
Explanation	125
User Action.....	125
What Does REPAIR_ALLOW_DATA_LOSS Really Mean?	126
Root Cause Analysis Before Recovering.....	127
What if Repair Doesn't Work?	127
Copying Data Versus Repair	128
Find the Root Cause of Corruption: The Checklist	128
3 Memory Issues	137
Introduction to Windows Memory Management	137
Internal Virtual Memory—Virtual Address Space	138
External Virtual Memory	141
Internal Physical Memory.....	141
External Physical Memory	143
Memory Pressure.....	144
NUMA Support.....	146

SQLOS and SQL Server Memory Management.....	147
Memory Node	148
Memory Clerks.....	149
Memory Objects.....	149
Memory Caches	150
Buffer Pool.....	153
Troubleshooting	159
4 Procedure Cache Issues	183
Procedure Cache Architecture.....	184
Types of Cached Objects.....	184
Structure of the Procedure Cache	189
Procedure Cache and Memory	190
Non-Cached Plans and Zero Cost Plans	193
Plan Sharing	193
Recompilation	194
Parameterization	195
How Cache Lookups Work	199
Cached Plan Reuse	201
Flushing the Procedure Cache.....	202
Common Cache-Related Problems and Solutions.....	202
Using the Procedure Cache to Identify Expensive Queries	202
Parameter Sniffing.....	205
High Compile Time Due to Poor Plan Reuse	216
High CPU Due to Excessive Cache Lookup Time	221
Memory Pressure Caused by Procedure Cache.....	222
Conclusion	224
5 Query Processor Issues	225
Query Processor Basics	225
Compilation-Execution Sequence	226
Execution Plans.....	227
Query Compilation and Plan Selection.....	231
Special Optimizations and Scenarios.....	233
Common Issues	237
Compilation Time and Parameterization.....	238
Indexing	242
Cardinality and Cost Estimation	245
Troubleshooting	247
Diagnostics	247
Control	254

Best Practices	268
Use Set-Oriented Programming	268
Provide Constraints and Statistics Information	268
Watch Complex Constructs.....	269
Avoid Dynamic Language Features When Possible.....	269
Further Reading	270
6 Server Crashes and Other Critical Failures	273
Fundamentals	274
SQL Server 2005 Server Recovery Internals	274
SQL Server 2005 Enhancements	280
Critical Errors and Server Recovery Troubleshooting.....	285
Troubleshooting Server Startup Failures	285
Troubleshooting Server-Critical Errors.....	291
Troubleshooting a Server Hang.....	326
7 Service Broker Issues	331
Broker Overview	332
Why Service Broker?	332
Service Broker Objects and Terms.....	333
Internal Architecture.....	333
Primary Diagnostic Tools and Methods.....	334
The Transmission Queue View	334
The SQL Profiler—Service Broker Trace Events	335
Error Log and NT Event Log	339
Broker Troubleshooting Walkthrough	339
Walkthrough of a Simple/Secure Broker Application.....	339
Other Service Broker Diagnostic Tools.....	348
Views	348
Perfmon.....	364
DBCC CHECKDB.....	367
Further Reading	368
8 SQLOS and Scheduling Issues	369
SQLOS Architecture	370
Memory and CPU Nodes	371
Schedulers.....	374
Tasks and Workers.....	374
SQL Server and SQLOS.....	375

Configuration and Troubleshooting	375
Node Configuration	375
Network Connection Affinity	376
Scheduler	379
Tasks and Workers	382
Load-Balancing Tasks Between Schedulers	383
Max Worker Threads Configuration	383
Lightweight Pooling Configuration	385
Affinity Mask Configuration	386
Disk I/O Completion Processing	388
Preemptive I/O Completion Processing	389
Scheduler Monitor	390
Hardware Configuration	404
Dedicated Admin Connection	406
Further Reading	409
 9 Tempdb Issues	 411
What Has Improved in SQL Server 2005?	413
How Is Tempdb Space Consumed?	416
What Is a User Object?	416
What Is an Internal Object?	417
What Is a Version Store Object?	418
Practical Troubleshooting	419
What to Do If You Run Out of Space in Tempdb	419
What Is Tempdb Page Latch Contention?	421
Conclusion	423
 10 Clustering Issues	 425
Example	426
Tools	429
Get Performance to an Acceptable Level	430
Add a Node	432
Why Did My Clustered SQL Server Instance Fail Over?	436
Why Does It Take So Long to Fail Over?	437
After Failover No One Can Connect	438
Add Disks	438
Replace a Disk	439
Move a Database	439
Conclusion	439
 The Aging Champion	 441
Index	445