

# SQL Server Performance Tuning

by Daniel AG

## Course Description

Our SQL Server Performance Tuning and Optimization course will give you a practical optimization technique to put into production. We ensure you understand WHY and HOW a technique works rather than just what the technique is all about.

As well as optimization techniques, this course will also help with design and architecture so you can prevent performance and scalability problems from happening. All the modules will be addressed on multiple fronts: how SQL Server works, implementation considerations and techniques, common problems, troubleshooting, and resolutions.

This course is essential for all SQL Server Developers, DBAs, Data Engineers, and Architects.

## Course Information

**Comprehensive SQL Server Performance Tuning Training Covering Following Topics:**

- Database Structures
- Data File Internals and Maintenance
- Transactions and Locking
- Row Versioning and Isolation
- Optimizing Logging and Recovery
- Statistics: Internals and Updates
- Cardinality Estimation Issues
- SQL Server I/O
- SQLOS Scheduling
- Index Internals, Analysis, Fragmentation and Strategies

+1 267 718 1533 ag.daniel@empiredatasystems.com www.empiredatasystems.com

- CPU Performance Tuning
- Extended Events
- Wait and Latch Statistics
- Query Plan Analysis
- Statement Execution, Stored Procedures, and the Plan Cache
- Changes in Query Performance
- Deadlock Analysis
- Performance Issue Patterns and Baseline Analysis
- SQLOS Memory Management and Memory Performance Tuning

**With the Course Students Get:**

- Comprehensive Course Materials
- Recorded Video of Each Class
- Reading Materials
- Lab Exercises
- Research Papers
- Microsoft Certification Materials
- Interview Questions
- Resume Preparation
- Placement Assistance
- On the Job Support Assistance

## Course Contents

https://empiredatasystems.com/sql-server-performance-tuning-training.html

### Module 1: Database Structures

- Records, record structure, and optimizations
- Pages and page structure
- Allocation bitmaps
- IAM chains and allocation units

### Module 2: Data File Internals and Maintenance

- Physical layout considerations
- Allocation algorithms and optimizations
- Instant initialization
- Growth, shrink, and their problems
- Data compression
- Tempdb configuration and performance

### Module 3: Transactions and Locking

- The anatomy of a data modification
- Locking and blocking
- Granularity
- Escalation
- Duration
- Troubleshooting locking behavior
- Blocking situations
- Deadlock situations

## Module 4: Row Versioning and Isolation

- Understanding isolation levels
- Isolation in SQL Server
- Controlling isolation levels
- Statement-level read consistency
- Transaction-level read consistency
- Overhead/monitoring

## Module 5: Optimizing Logging and Recovery

- Transaction log architecture
- Log records
- Checkpoints and recovery
- Transaction log operations
- Recovery models
- Log file provisioning and maintenance

## Module 6: Index Internals and Data Access

- Index concepts
- Table structure
- Index internals
- Heaps vs. clustered indexes
- Table usage
- Clustering key choice and performance implications
- Data access patterns
- Understanding selectivity
- Understanding the ‘tipping point’

## Module 7: Index Fragmentation

- Data access methods
- Fragmentation and its effect on performance
- How does fragmentation happen?
- Optimizing indexes to remove and prevent fragmentation

## Module 8: Internals and Covering

- What methods exist for covering?
- Nonclustered indexes
- Using indexed views
- Using INCLUDE
- Using filtered indexes
- Using filtered statistics
- Practical index consolidation

## Module 9: Statistics: Internals and Updates

- How the Optimizer uses statistics
- Statistics from A-to-Z
- What they look like
- What they are telling us
- How to see them
- When/how they get created
- When/how they get updated

## Module 10: Cardinality Estimation Issues

- Problems/solutions with statistics
- Steps in histogram
- Filtered statistics
- Uneven distribution
- SQL Server 2014 cardinality estimation changes

## Module 11: Indexing Strategies

- Indexing for performance
- Indexing for AND (highly-selective queries, index intersection, covering
- Indexing for OR (tuning, re-writing)
- Indexing for joins (join types, which strategies use what types of indexes, 3 phases of tuning)
- Indexing for aggregates (hash aggregates, stream aggregates, indexed views)

## Module 12: SQL Server I/O

- Data and log reading and writing
- Tempdb contention and space usage
- Basic monitoring

## Module 13: I/O Concepts for DBAs

- Defining storage terminology
- IOPS, MB/sec, Latency
- Magnetic vs. Solid-State Drives (SSDs)
- RAID configurations
- Mount points
- Partition alignment problems
- Testing with SQLIO and IOMeter
- Direct-attached storage
- Traditional vs. PCI-Express drives

## Module 14: I/O – Storage Area Networks for DBAs

- SAN components
- Multipathing

- iSCSI vs. fiber channel (FC)
- Shared vs. dedicated arrays
- Cache (on the drives, SAN controller, RAID controller, and Windows)
- Clustering
- Appendix: snapshot backups (SAN, not SQL)

### Module 15: SQLOS Scheduling and CPU Performance Tuning

- Understanding Windows scheduling
- Server hardware and NUMA
- CPU scheduling under SQLOS
- DMV monitoring
- Troubleshooting CPU performance issues
- Using Resource Governor to limit CPU usage

### Module 16: Extended Events

- Profiler vs. Extended Events
- Extended Events core concepts
- Event session basics
- Event execution lifecycle
- Event targets
- Extended Events UI

### Module 17: Wait and Latch Statistics

- Thread lifecycle
- Waits, latches, spinlocks
- DMVs
- Common wait types

### Module 18: Query Plan Analysis

- Why look at query plans?
- Capturing and analyzing plans
- Essential information in a query plan
- Understanding common operators
- Identifying typical plan patterns and steps for further investigation

### Module 19: Changes in Query Performance

- Using Distributed Replay to examine hardware, software, and workload changes
- Using the Query Store to examine workload and query plan changes
- Using plan guides and Query Store to force specific query plans
- Using In-Memory OLTP to change query performance

## Module 20: Statement Execution, Stored Procedures, and the Plan Cache

- Understanding/analyzing plan cache
- What's in the plan cache?
- Understanding/optimizing stored procedures
- A cautionary tale about scalar functions

## Module 21: Index Analysis

- Index cleanup
- Index health
- Missing indexes

## Module 22: SQLOS Memory Management and Memory Performance Tuning

- SQLOS Memory Manager
- SQLOS memory components
- Configuration options for SQL Server
- How to identify memory issues
- Internal memory pressure
- External memory pressure
- Virtual address space issues
- Resource semaphores
- DBCC commands

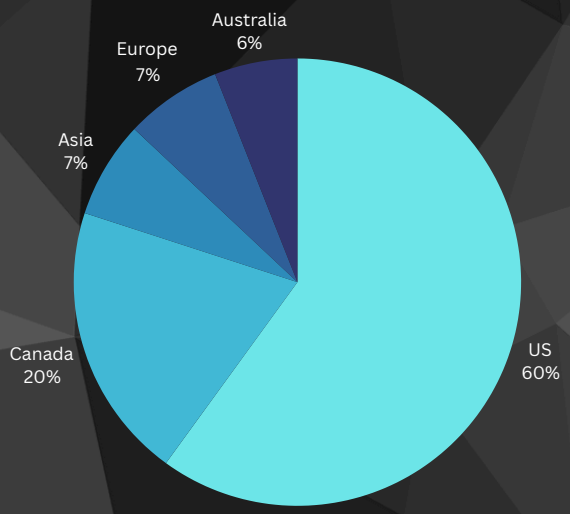
## Module 23: Deadlock Analysis

- Review of locking in SQL Server
- What is a deadlock
- Collecting deadlock graphs
- Anatomy of a deadlock
- Reading deadlock graphs
- Resolving deadlocks

## Module 24: Performance Issue Patterns

- Benchmark vs. baseline
- Data collection methods and tools
- Performance Monitor and Collector Sets
- PAL tool (Performance Analysis of Logs)
- SQL Trace, SQLDiag, and SQLNexus
- Analyzing Trace data

## Our Student Demographic




## Other Courses We Offer

- SQL Server Database Administration
- SQL Server Performance Tuning
- SQL Server Business Intelligence
- SQL Programming
- Microsoft Azure Administration
- Microsoft Azure Data Engineering
- DevOps Engineering
- AWS Solutions Architect
- Microsoft Azure AI Engineer

## Our Students Feedback




Please check the below link to see our student's feedback. These feedbacks are an excellent motivator for our trainers to improve in course delivery and engage more in students' training needs and career goals.

www.empiredatasystems.com/students-feedback.html

## Our Training Statistics

**16 Years of Experience**

**3671 Gratified Students**

**112 Training Batches**

**9634 Training Hours**

+1 267 718 1533

ag.daniel@empiredatasystems.com

www.empiredatasystems.com

# Program Partners

Microsoft

## About Microsoft

Microsoft is a leading innovator and the biggest player in creating innovative SQL tools. In this certification course, top subject matter experts will share knowledge in the domain of SQL.

**Benefits of this collaboration for learners:**

- Industry recognized certification from Microsoft
- Industry-specific case studies and project work

## Contact Us

**Daniel AG**
Empire Data Systems LLC,
256 Eagleview Blvd #387
Exton, PA 19341, USA

**+1 267 718 1533**

**ag.daniel@empiredatasystems.com**

