

SQLskills Immersion Event

IEPTO2: Performance Tuning and Optimization

Module 0: Overview



Daily Course Format: Mon, Tue, Wed, Th, and Fri

- **Class runs for TEN half days**
 - Monday, April 12 through Friday, April 16, 2021
 - **AND**, Monday, April 19 through Friday, April 23, 2021
- **Each day**
 - Lecture: 90 minutes from 9am until 10:30am PT
 - Please use "CHAT" for questions **during** the lecture
 - Open Q&A: 30 minutes from 10:30am until 11:00am PT
 - Will address unanswered questions from chat
 - Mandatory break: 30 minutes from 11:00am until 11:30am PT
 - Everyone needs a bit of a break!
 - Lecture: 90 minutes from 11:30am until 1:00pm PT
 - Please use "CHAT" for questions **during** the lecture
 - Open Q&A: up to 60 minutes from 1:00pm until 2:00pm PT
 - Will address unanswered questions from chat
 - Can open up for "open mic" questions

**Time
Conversions**
9:00am PT
= Noon ET
= 4:00pm UTC
Use this to see the
exact time in YOUR
time zone:
[IEPTO2 &
Upcoming Time
Changes](#)



Class Format: No LABS???

- **Class time – lecture / demo / questions! And, please **ASK questions!****
 - There are no stupid questions... everyone started with ZERO knowledge about SQL Server!
 - If you're thinking it – you're probably not alone... speak up!
- **Why not lab time?**
 - Historically folks defer on labs to respond to email, etc.
⇒ losing valuable class time
 - We can spend more time on content
⇒ covering both MORE content and in more depth!
 - You receive all of the demo code and samples; you can reproduce everything we show you and pick where to really focus your attention!
 - You can take time to really study the content that's most appropriate to you
 - You can skip content that's not appropriate
 - You can take the RIGHT time for each/every exercise (rather than some being done quickly and others needing more time... potentially getting frustrated without enough time)

Course Resources, Pluralsight Access, and Alumni

- **Paul (paul@sqlskills.com) will send you an email for a FREE 30-day access to ALL SQLskills online training classes on Pluralsight**
 - No strings attached, no credit-card required
 - If you don't receive it, send mail to Paul
- **Course resources will be sent upon course completion**
- **We may want to update a slide or two, add some notes/resources based on questions and discussions, and process the recordings**
 - Please do not distribute; this is for course attendees only
 - Full details / access information will be sent upon course completion
- **Email us: Training@SQLskills.com if you have any problems finding or accessing any of your course materials**
- **And, now that you've attended one of our courses; you can ALWAYS register using the 'alumnus' discount (without quotes); we hope to see you again!**



Course Resources

- **Course content (this slide deck)**
 - One “two-slides per side” PDF for optimal printing (save some trees!)
 - One “full slide” PDF for optimal viewing and/or online note-taking
- **Demos**
 - All instructor-led demo scripts
 - All reference scripts
- **Reference links and additional resources**
- **Online recordings for these sessions**
- **Upon completion look for a “BadgeMe” email**



Please do not redistribute: These resources are for attendees only.
Please respect our IP and time in creating these resources
and do not share/forward.



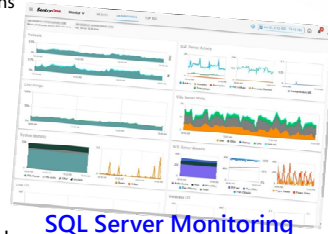
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Recommendation: Leverage Great Products!

SentryOne™

- Even with as much training as we will provide, you can't know everything
- SQL Server is powerful, complex, and has lots of different potential issues let third party software help!
- SQLskills partners with SentryOne because we really feel they've made the best suite of SQL Server products available
- **LEARN MORE:**
 - SQL Server Monitoring: <https://www.sentryone.com/sql-server/sql-server-monitoring>
 - Plus, get your questions answered!
 - Email Andy / Devon your specific monitoring questions
 - -- MailTo: ayun@sentryone.com
 - -- MailTo: dwilson@sentryone.com
- **Plan Explorer**
 - <https://www.sentryone.com/plan-explorer>
 - [Advanced Plan Explorer Usage for Tuning Execution Plans](#)
- **Special SQLskills-Only Presentations Coming in May!**
 - Details will be posted on your course contents page!



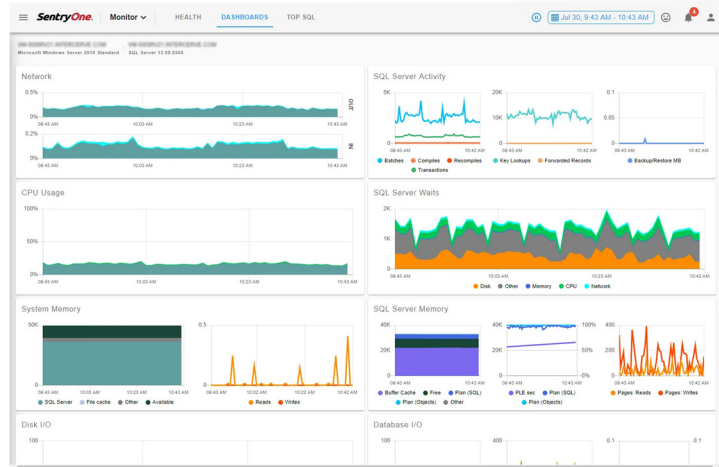
[SQL Server Monitoring](#)



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Immersion Events IEPTO Parts 1 & 2

- **IEPTO1 – Internals and Performance**
 - About solving problems through design, indexing and maintenance
 - Heavily tied to internals
 - Generally requires three things:
 - Know your data
 - Know your workload
 - Know how SQL Server works
- **IEPTO2 – Performance Tuning**
 - About finding problems and understanding the MANY different angles from which you need look
 - No single topic will solve all of your problems
 - Some topics will be more immediately valuable
 - Over time, you'll probably tackle all of them...



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Instructors

- **Why do we need multiple?**
 - Different perspectives
 - Different areas of expertise
 - Different problem solving skillsets
 - No one knows everything...
- **This class is about knowing:**
 - Where to look
 - What tools are available
 - All sorts of tips/tricks/best practices along the way!



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Consultant / Trainer / Speaker / Writer

- Author / instructor for SQL Server Immersion Events: IEPTO1, IEPTO2, and IEHADR
- Author / presenter for Pluralsight
- Instructor and exam author for SQL Server and Sharepoint MCMs
- Author / manager of SQL Server 2005 and 2008 Launch Content
- Author / speaker at Microsoft TechEd, SQLPASS, ITForum, TechDays, and SQLIntersection
- Author of SQL Server Whitepapers on MSDN/TechNet: Partitioning, Snapshot Isolation, Manageability, SQLCLR for DBAs
- Author / presenter for MSDN and TechNet (25+)
- Instructor / SME for Microsoft University

Data Platform MVP

- 17 years: 2002-2019



When I'm not working with SQL

- Traveler/adventurer and avid diver / photographer: www.BlueWaterImages.com
- @KimberlyLTripp on Insta

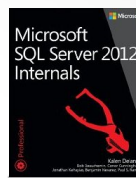


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 - Blog: <https://www.sqlskills.com/blogs/Paul>
 - Twitter: @PaulRandal
- Contributing Editor of TechNet Magazine, author of the SQL Q&A column, articles on DBA topics, multiple whitepapers for Microsoft
- 5 years at DEC responsible for the VMS file-system and chkdsk equivalent
- Almost 9 years as developer/manager in the SQL Storage Engine team through August 2007, ultimately responsible for Core Storage Engine
 - Wrote DBCC component, other Storage Engine code, DBCC CHECKDB/repair for SQL 2005
- SQL Server/Data Platform MVP since 2008
- Regular presenter at worldwide conferences on HA/DR, administration, performance, and internals (#1 rated sessions at multiple PASS Summits)
- Course author/instructor for Microsoft Certified Master qualifications
- (I also like diving, electronics, robotics, Arduino, books, sheep...)

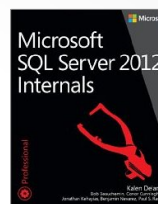


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- Contributing Author: *SQL Server 2008 Internals and Troubleshooting*, *Microsoft SQL Server 2012 Internals*
- Microsoft Certified Master: SQL Server 2008
- SQL Server MVP since October 2008
- Author of Using Extended Events whitepaper on MSDN
- Developed Extended Events Manager SSMS Addin for SQL Server 2008 Open Source project on Codeplex
- Member of the Tampa SQL Server User Group and PASS



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 - Twitter: @ErinStellato
- Data Platform MVP since January 2012
- PASS volunteer since 2010
- 12 years working for software vendors, helping to support customer implementations in a variety of ways
- 13 years as a SQL Server professional



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M1: Creating a Foundation for Tuning/Optimizing

- How we approach tuning and optimization
- Server, instance, and database settings
- Checking system health
- Methods for analyzing performance



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M2: Extended Events

- Transitioning from Trace/Profiler to Extended Events
- Extended Events core concepts and architecture
- Target practice
- Event session basics
- Actions, predicates, and system health
- Extended Events UI
- Appendix

M3: Wait Statistics

- How thread scheduling works in SQL Server
- Fundamentals of waits, latches, and spinlocks
- Investigating waits, latches, and spinlocks using DMVs
- Common scenarios, including:
 - Data and log file I/O
 - Latch contention in tempdb and user tables
 - Parallelism
 - Quantum exhaustion

M4: I/O Concepts and I/O Subsystems for DBAs

- Defining storage terminology
 - IOPS, MB/sec, Latency
- Magnetic vs. Solid State Drives (SSDs)
- RAID configurations
- Storage Area Networks
- Configuring drives in Windows
- Testing with Diskspd and Iometer

M5: 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

M6: Analyzing Query Performance

- Capturing changes in query performance
- Capturing and analyzing plans
- Common operators
- Essential information in a plan

M7: Putting New Features Into Practice

- Columnstore
- In-Memory OLTP
- Cardinality Estimator
- Query Store plan forcing / automatic plan correction
- Distributed Replay

M8: Plan Cache

- **Understanding plan cache**
 - Statement execution
 - sp_executesql
 - Dynamic string execution
 - Query fingerprints ⇒ the cumulative effect
 - Reducing plan cache pollution
- **Understanding/optimizing stored procedures**
 - Stored procedure creation
 - Stored procedure coding best practices for performance
 - Stored procedure execution
 - Stored procedure recompilation/optimization

M9: Index Analysis

(short review for those of you who took IEPTO1 long ago)

- **Nonclustered indexes: key to better performance**
- **Indexing for performance:**
 - During design
 - During QA
 - In production
- **Key production strategy – an ordered approach:**
 1. Index cleanup
 2. Index health
 3. Missing indexes

M10: SQLOS Memory Management and Memory Performance Tuning

- SQLOS Memory Manager
 - SQL Server 2008 R2 and earlier
 - SQL Server 2012 and higher
- 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

M11: Deadlock Analysis *(if time permits)*

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

M12: Performance Issue Patterns

- 11 common performance issue patterns
- Interactive investigation into each pattern
 - Pulling together much of what we've discussed this week

Appendix: Data Collection and Baselining

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