

# 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, October 19 through Friday, October 23, 2020
  - **AND**, Monday, October 26 through Friday, October 30, 2020
- **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](mailto: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](mailto: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!**



PLURALSIGHT

# 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**



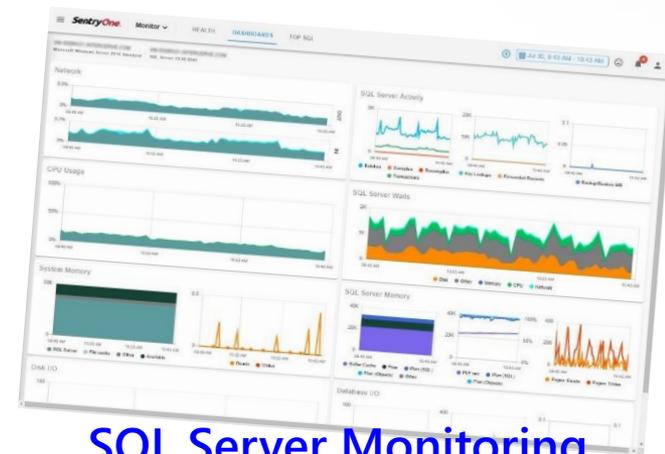
**Please do not redistribute: These resources are for attendees only.  
Please respect our IP and time in creating these resources  
and do not share/forward.**



# Recommendation: Leverage Great Products!



- 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:** Join Andy Yun, Principal Solutions Engineer from SentryOne on Tuesday, November 3, at 10:00am PT
  - **Going Beyond Just Monitoring With SentryOne**
  - <https://global.gotomeeting.com/join/710727485>
  - Attendees of the GoToMeeting will EACH receive:
    - SQL Sentry Premium subscription license (6 months)
    - Raffle for additional SentryOne gift pack
  - Plus, get *your* questions answered!
    - Email Andy your specific monitoring questions (*no later than October 14 at 3pm PT*)
    - **MailTo: [ayun@sentryone.com](mailto:ayun@sentryone.com)**



[SQL Server Monitoring](#)

# 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...

# 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!



## 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



## Kimberly L. Tripp

Founder / President, SQLskills

- ✉ [Kimberly@SQLskills.com](mailto:Kimberly@SQLskills.com)
- 🐦 [@KimberlyLTripp](https://twitter.com/KimberlyLTripp)
- 🌐 [www.sqlskills.com/blogs/Kimberly](http://www.sqlskills.com/blogs/Kimberly)



## Data Platform MVP

- 17 years: 2002-2019

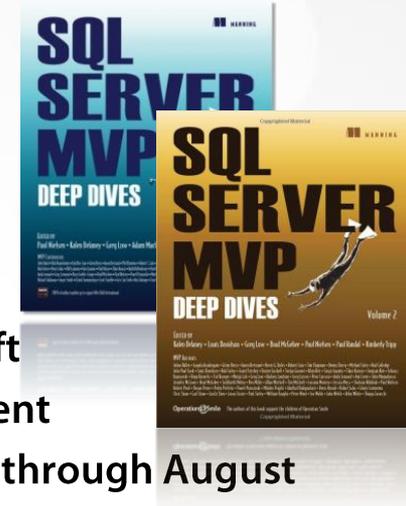
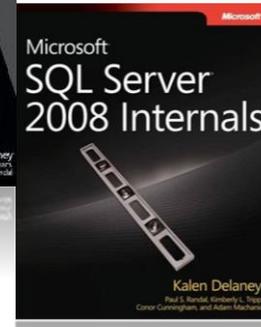
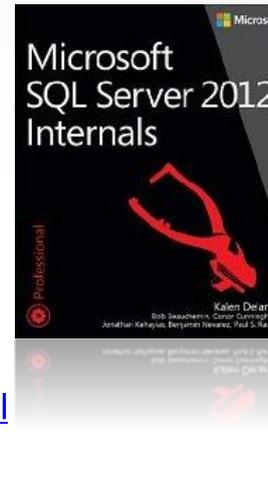
## When I'm not working with SQL

- Traveler/adventurer and avid diver / photographer: [www.BlueWaterImages.com](http://www.BlueWaterImages.com)
- @KimberlyLTripp on Insta



# Author/Instructor: Paul S. Randal

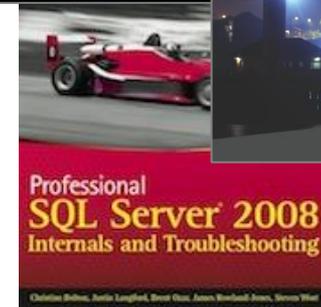
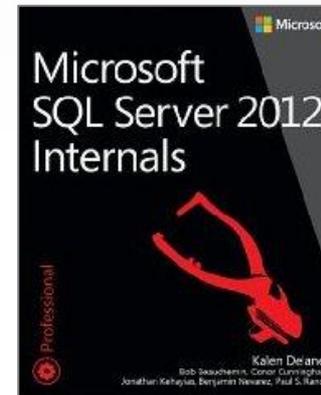
- Consultant/Trainer/Speaker/Author
- CEO, [SQLskills.com](http://SQLskills.com)
  - Email: [Paul@SQLskills.com](mailto:Paul@SQLskills.com)
  - Blog: <https://www.sqlskills.com/blogs/Paul>
  - Twitter: @PaulRandal
- Contributing Editor of TechNet Magazine, author of the SQL Q&A column, articles on DBA 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
- 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
- Owner and Manager of the SQLintersection conference
- (I also like diving, electronics, robotics, Arduino, books, sheep...)



# Author/Instructor: Jonathan Kehayias



- Consultant/Trainer/Speaker/Author
- Principal Consultant, [SQLskills.com](http://SQLskills.com)
  - Email: [Jonathan@SQLskills.com](mailto:Jonathan@SQLskills.com)
  - Blog: <https://www.SQLskills.com/blogs/Jonathan>
  - Twitter: @SQLPoolBoy
- 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



# Author/Instructor: Erin Stellato

- Consultant/Trainer/Speaker
- Principal Consultant, [SQLskills.com](https://www.sqlskills.com)
  - Email: [Erin@SQLskills.com](mailto:Erin@SQLskills.com)
  - Blog: <https://www.sqlskills.com/blogs/Erin>
  - 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



# 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

# 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 Baselineing

- **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

# Introductions

- **Name**
- **Company name**
- **Where you're based geographically**
- **The job role that describes you best:**
  - Database Administrator
  - Database Developer
  - Database Architect
  - Jack of all trades?
- **What version you focus on most**
- **What versions you support**
  - Don't be shy, you're not the only one that has SQL Server 2000 😊