SQLskills Immersion Event

IEPTO1: Performance Tuning and Optimization

Module 0: Overview

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

- **Class runs for TEN half days**
  - Monday, March 15 through Friday, March 19, 2021
  - ***AND,*** Monday, March 22 through Friday, March 26, 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:
IEPTO1

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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)

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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

PLURALSIGHT

- **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!**

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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**
- **<u>Upon completion</u> 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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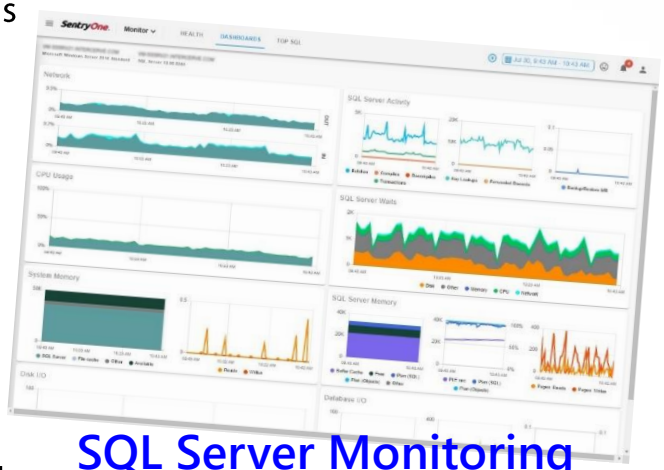
Recommendation:
Leverage Great Products!

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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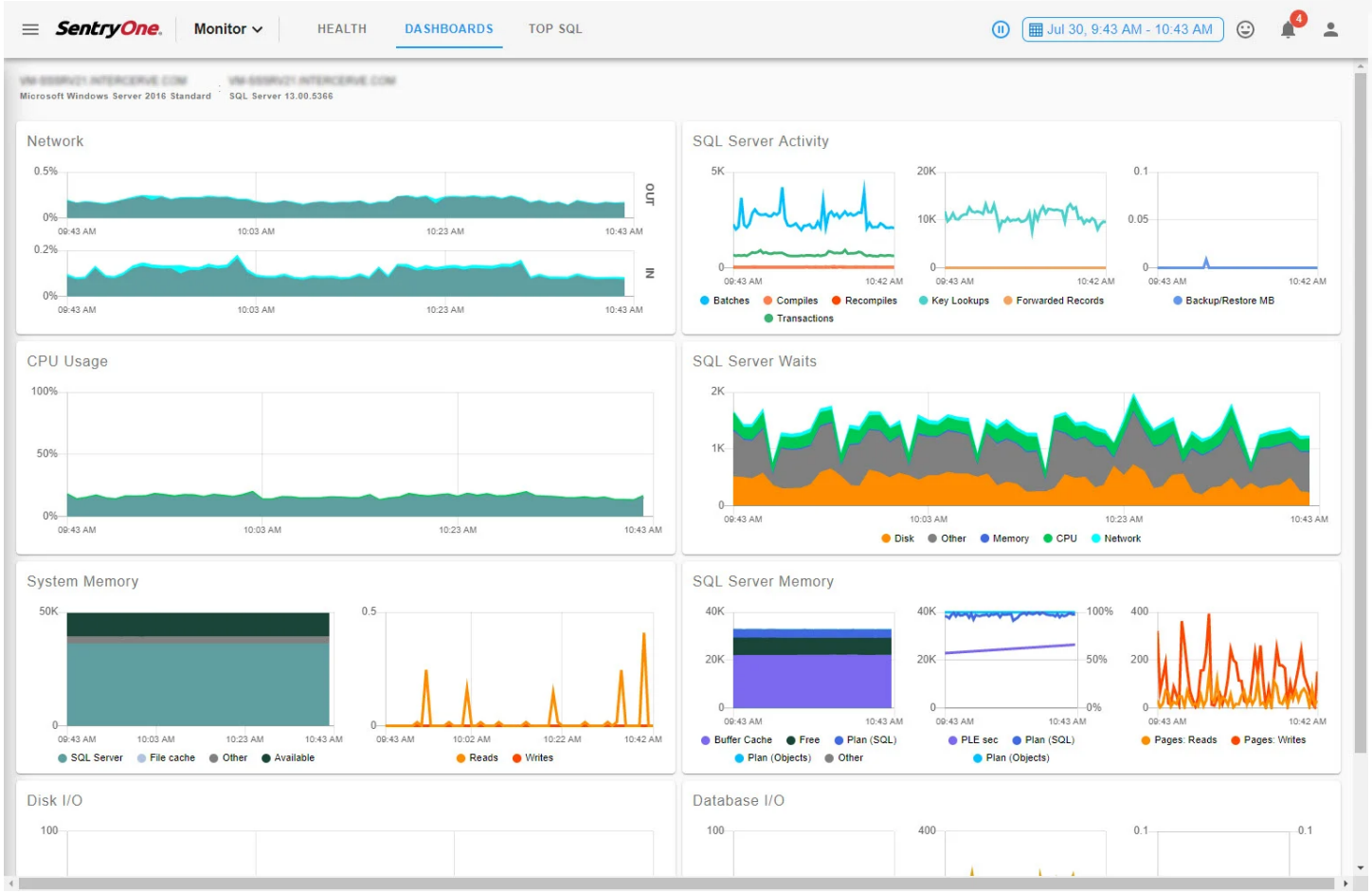
SentryOne™



SQLskills' strategic partners and class sponsor

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PLURALSIGHT

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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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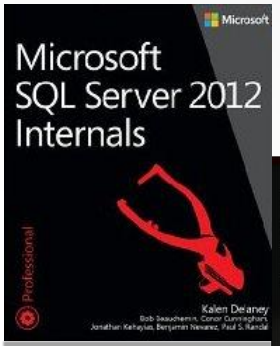
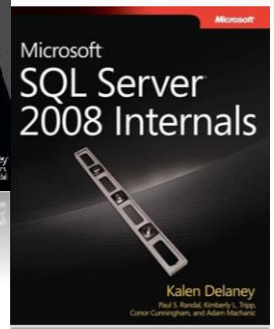
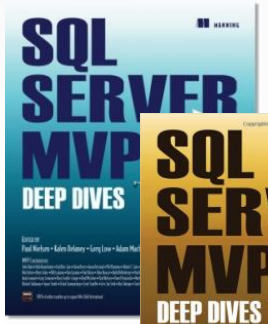
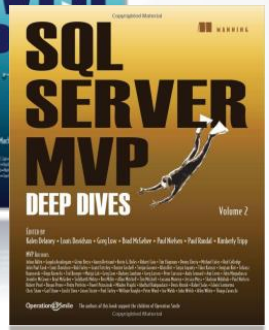
Author/Instructor: Paul S. Randal









- Consultant/Trainer/Speaker/Author
- CEO, SQLskills.com
  - Email: 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…)

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M1: Database Structures

- Records
- Pages
- Extents
- Allocation bitmaps
- IAM chains and allocation units

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M2: Data File Internals/Maintenance

- Physical layout considerations
- Allocation algorithms
- Instant initialization
- Auto-grow
- To shrink or not to shrink?
- Data compression
- Tempdb

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M3: Locking and Blocking

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

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M4: Versioning

- **Understanding isolation levels**
- **Isolation in SQL Server**
  - By default, uses locking
  - Optionally, can use versioning (and locking)
- **Controlling isolation levels**
- **Statement-level read consistency**
- **Transaction-level read consistency**
- **Overhead/Monitoring**
- **Isolation summary**

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M5: Logging, Recovery, and the Transaction Log

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

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M6: Index Internals

- **Index concepts**
- **Table structure**
- **Index internals**
  - Heaps
  - Why cluster
  - Table usage
  - Employee table case study
- **Clustering key columns in nonclustered indexes**
- **Indexing for Performance**
  - What do we know?
  - What should we do?
  - Suggestions for the clustering key!

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M7: Index Fragmentation

- Data access methods
- What is index fragmentation?
- How does index fragmentation happen?
- Detecting index fragmentation
- Avoiding index fragmentation
- Removing index fragmentation

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M8: Internals and Data Access

- **Data access patterns**
- **Covering**
  - Understanding selectivity
  - Understanding the "tipping point"
- **What methods exist for covering?**
  - Nonclustered indexes (all releases)
  - Using indexed views (SQL Server 2000+)
  - Using INCLUDE (SQL Server 2005+)
  - Using filtered indexes (SQL Server 2008+)
  - Using filtered statistics (SQL Server 2008+)
- **Too many cooks in the kitchen…**
- **Index consolidation**

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M9: Statistics – Internals and Updates

- **Cost-based optimization**
- **Data access patterns**
- **Statistics**
  - What do they look like?
  - What are they telling us?
  - How do you see them?
  - When / how do they get created?
  - When / how do they get updated?
- **Additional resources**

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M10: Indexing Strategies

- **Indexing for performance**
  - Design strategies
  - Overall strategies
- **Using the tools for tuning**
  - SET STATISTICS IO ON
  - Showplan
  - Missing indexes
- **Indexing for AND**
- **Indexing for OR**
- **Indexing for joins**
- **Indexing for aggregates**
- **Indexed views vs. columnstore indexes**
- **Rowstore indexes vs. columnstore indexes**

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M11: Cardinality Estimation Issues

- **Selectivity and estimates**
- **Query complexity**
- **Estimates from statistics**
  - Sampling
  - The histogram
  - Filtered statistics
  - Uneven distribution
- **Migrations / Upgrades / Regressions**
- **Appendix: Changes to Cardinality Estimation (CE) in SQL 2014**

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Appendix: Database Development & Design

- **Whose Job Is It?**
- **Resources**
  - Pluralsight: SQL Server: Why Physical Database Design Matters
    - Author/Presenter: Kimberly L. Tripp, SQLskills.com
    - http://pluralsight.com/training/Courses/Description/sqlserver-why-physical-db-design-matters
  - Pluralsight: Developing and Deploying SQL Server ISV Applications
    - Author/Presenter: Erin Stellato, SQLskills.com
    - http://pluralsight.com/training/Courses/Description/sqlserver-developing-deploying-supporting-isv-applications
- **Things to consider**
  - Data type best practices
  - Understanding row width (vertical partitioning)
  - Application inconsistencies in types
  - The cost of poor design

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