

# **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, October 5 through Friday, October 9, 2020
  - **AND**, Monday, October 12 through Friday, October 16, 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:

[IEPTO1](#)

# 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**



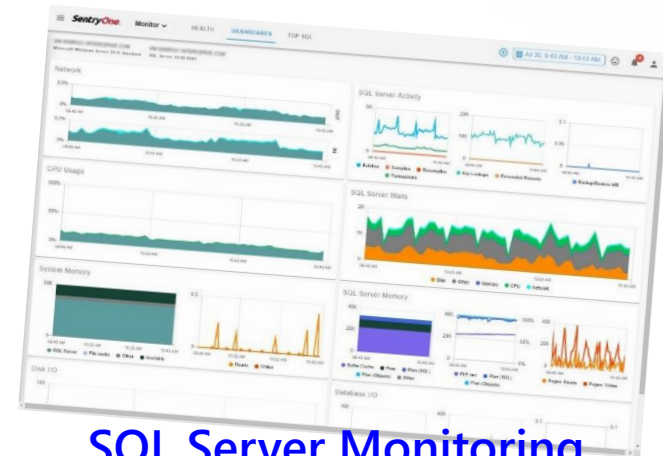
**Please do not redistribute: These resources are for attendees only.  
Please respect our IP and time in creating these resources  
and do not share/forward.**



# 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 Monday, October 19, at 10:00am PT
  - **Going Beyond Just Monitoring With SentryOne**
  - <https://global.gotomeeting.com/join/232239365>
  - 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
    - **MailTo: [ayun@sentryone.com](mailto:ayun@sentryone.com)**






[SQL Server Monitoring](#)



## Kimberly L. Tripp

Founder / President, SQLskills

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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](http://www.BlueWaterImages.com)
- @KimberlyLTripp on Insta 

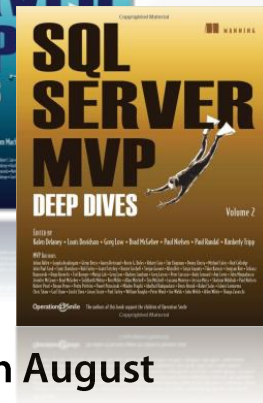
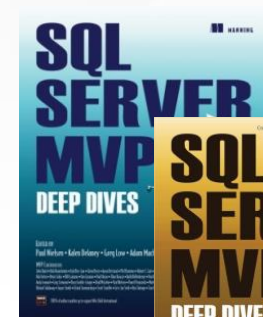
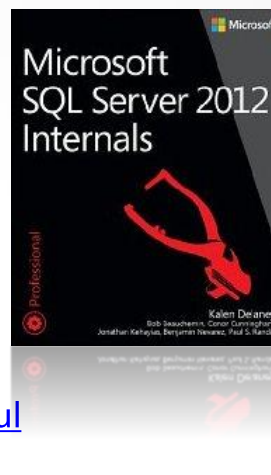




# Author/Instructor: Paul S. Randal



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  - 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...)





# M1: Database Structures

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

## M2: Data File Internals/Maintenance

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

# 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

# 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**

# 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

# 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!

# M7: Index Fragmentation

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



# 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**

# 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**

# 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**

# 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**

# 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