(December 1st, 2021)

If you know someone who would benefit from being an Insider, feel free to forward this PDF to them so they can sign up here.

Note: As an Insider, you can read all prior Insider newsletters here.

Quick Tips for our Insider friends!

This newsletter is coming to you from Redmond, WA, where we've been deluged with rain from 'atmospheric rivers' for the last few weeks – the wettest November on record up here!

THE SALE IS HERE – UP TO 75% OFF! See below for details.

Registration is open for the remainder of our 2021 SQLskills Insider learning sessions every Wednesday – see here!

Take care and stay safe out there!

SQLskills News

END OF YEAR BLOWOUT SALE – We're feeling festive!

We said we'd offer "up to 70% OFF" and we decided we'd go up to 75% OFF!

These are the best prices we've ever offered. We hope that these deep discounts allow you to get the training you need so you can stay on top of your career and SQL Server technology!

These BETTER-THAN-BLACK-FRIDAY, ROCK-BOTTOM PRICES are AVAILABLE only from December 1 through 23:59:59.997 December 10, 2021 UTC.

- 68% OFF each of our individual courses
- 72% OFF all of our Bundles except...
- 75% OFF of our Blackbelt Bundle

These prices are available ONLINE and with CREDIT CARD purchases ONLY. Each person wanting to go through this deep, technical training sets up their own account during the purchase process; and access will be given immediately upon the completion of the purchase.

All the details are in our shop HERE.

SQLskills Insider Sessions!

Our first batch of SQLskills Insider Sessions are done and we had a great / interactive audience. It was really nice to reconnect with so many of you!

We wrote about the motivation behind our Insider Sessions and you can register for just one, or the entire series here: https://www.SQLskills.com/iSessions.

The main page with all the details is here, including the five sessions that Kimberly has already completed around execution, caching, and recompilation.

Coming up:

- **SQLskills Insider Session: Query Store Best Practices with Erin Stellato**
  - TODAY at 10am PST – details
- **SQLskills Insider Session: Understanding Statistics: The Histogram with Kimberly L. Tripp**
  - Wednesday, December 8, 2021 – details

Our thought: block around this time – EVERY Wednesday! **Dedicate 2 hours a week to Improving Your SQL skills with SQLskills**! Join us when it makes sense (hopefully always! ☺) or, read blog posts, review topics of interest, go spelunking in the documentation on a topic that's always interested you. Stay fresh, stay current – stay ahead of the competition!

Block the time NOW, register online, and each week we'll send you a meeting link with joining instructions. And, stay tuned, we'll announce the rest of the year's line-up of topics and speakers soon!

Book Review

The most recent book I've read is Robert M. Hazen's *Symphony In C: Carbon And The Evolution Of (Almost) Everything*. This is an excellent book about life's most essential element. Excerpt from Amazon précis: "Carbon is everywhere: in the paper of this book and the blood of our bodies. It's with us from beginning to end, present in our baby clothes and coffin alike. We live on a carbon planet, and we are carbon life. No other element is so central to our well-being; yet, when missing or misaligned, carbon atoms can also bring about disease and even death. At once ubiquitous and mysterious, carbon holds the answers to some of humanity's biggest questions. Where did Earth come from? What will ultimately become of it—and of us? With poetic storytelling, earth scientist Robert M. Hazen explores the universe to discover the past, present, and future of life's most essential element. We're not only "made of star stuff," as Carl Sagan famously observed, but "Big Bang stuff," too. Hazen reveals that carbon's grand symphony began with a frenzied prelude shortly after the dawn of creation, bringing new attention to the tiny number of Big Bang–created carbon atoms that often get overlooked. In minutes, violently colliding protons and neutrons improbably formed the first carbon atoms, which can still be found within our bodies. His book then unfolds in four movements, building momentum as he explores carbon as the element of Earth, Air, Fire, and Water."

Highly recommended!

The Curious Case of…

This section of the newsletter explains recent problems we've helped with on client systems or been asked about over email or #sqlhelp; they might be something you're experiencing too.

Jonathan's had a few instances recently where a database scope configuration has been erroneously set to 1 and caused performance issues, so he set out to track down the culprit. You can read all about his solution here…

Ponderings…

(From me this time – enjoy!)

One thing that sometimes confuses people is when the size of a backup does not agree with the expectations of the DBA, based on actions being performed.

Here's a scenario. A DBA runs a script that performs a large ETL operation involving tens of millions of rows of deleted data and new, inserted data within the same transaction (more on that later). The DBA knows that the ETL process shouldn't run for more than an hour, so after it had been running for more than 4 hours, the DBA kills the process – which then takes a further 3 hours to roll back. Someone had made a mistake in the script and it was deleting way more data than it should.

The daily differential backup then happens that night and the DBA expects it to be very small as nothing had changed in the database. Instead it was around 130GB and the DBA is left wondering why? If the operation rolled back so that there were no changes in the database then the differential backup should not have backed anything up, right?

Wrong. Although the logical contents of the database were unchanged by the rolled-back ETL process, the physical contents of the database *did* change.

Every time a data file page is changed for any reason, the extent that the page is part of is marked as changed in one of the Differential Bitmaps (sometimes known as DIFF_MAP pages, Differential Change Maps, or DCM pages). This 'mark as changed' operation is irrevocable.

In fact, it's more than irrevocable (if that's grammatically possible!) in that if the change that caused the extent to be marked as changed rolls back, the act of rolling back the change generates MORE changes – i.e. doing the reverse of the original change. The roll-back changes ALSO cause the extents to be marked as changed, as they're changing them too.

The next differential backup happens and all the extents that were touched by the ETL process are marked as changed – physically changed – and so must be backed up.

You might ask why the roll back of a change doesn't unmark the extent as being changed in some way. It's not feasible to do so. Consider the case where there are multiple concurrent transactions that all change pages in the same extent, and then one of the transactions rolls back. It can't unmark the extent as being changed because the extent still contains the changes from the other transactions. Trying to keep track of when it would be possible to unmark each extent as changed would be excessively problematic (essentially involving a very complicated referencing-counting mechanism for each extent).

Furthermore, any time a data file page is changed, the Log Sequence Number in the page header is updated to reflect the LSN of the log record describing the most recent change to the page. This newer version of the page MUST be backed up so that crash recovery works correctly. Even if the change is rolled back, the roll back involves generating another log record with the reverse change in it (called a COMPENSATION log record), that updates the page's LSN once more. And so this must be backed up as well.

Call to action: The next time you're wondering about perceived disparities in backup sizes, work through what's happened at the physical level to the data pages and the log and make sure you understand the algorithms involved. Remember that the more you understand how SQL Server works under the covers, the easier it is to make sense of the behaviors you observe day-to-day.

#TBT

(Turn Back Time…) Blog posts we've published since the previous newsletter plus some older resources we've referred to recently that you may find useful.

The theme for the TBT this time is on-disk structures:

- Kimberly's Pluralsight course: *SQL Server: Why Physical Database Design Matters*
- Kimberly's Pluralsight course: *SQL Server: Indexing for Performance* (which goes into lots of detail on index structures)
- Paul's blog posts on the basics:
  - *Inside the Storage Engine: Anatomy of a record*
  - *Inside the Storage Engine: Anatomy of a page*
  - *Inside the Storage Engine: Anatomy of an extent*
  - *Inside the Storage Engine: IAM pages, IAM chains, and allocation units*
  - *Inside The Storage Engine: GAM, SGAM, PFS and other allocation maps*
- Paul's blog post categories:
  - *Inside the Storage Engine*
  - *On-disk Structures*

Posts since the last newsletter:

- Paul: *Why the Optimizer Doesn't Use Buffer Pool Knowledge* (on SQLPerformance.com)
- Tim: *How to Restore Databases From Native SQL Server Backups* (on the SentryOne blog)
- Jonathan: *Logging Database Scoped Configuration Changes*

I hope you find these useful and interesting!

Video Demo

In this week's demo video, Jon takes a look at the importance of permissions for the NT AUTHORITY\SYSTEM account in Availability Groups and how to troubleshoot failed failovers for an availability replica caused by incorrect permissions for the SYSTEM account in SQL Server.

The video is about 7.5 minutes long and you can get it in MP4 format here.

The demo code is here.

Enjoy!

Upcoming SQLskills Events

We've moved all our classes to early 2022 – schedule details will be published shortly.

With our new streaming system, you can now choose to attend a live, online event or purchase a recording to watch at your leisure, either individually or as part of a bundle. And all attendees of live events get lifetime access to the class recordings too!

To help your boss understand the importance of focused, technical training, we've also added a few items to help you justify spending your training dollars with us:

- Letter to your boss explaining why SQLskills training is worthwhile
- Community blog posts about our classes
- Immersion Event FAQ

LIVE, Online Immersion Events:

Spring 2022

- Details coming soon.

You can get all the details on our training options page or just go directly to our new shop.

Summary

We hope you've enjoyed this issue - we really enjoy putting these together.

If there is anything else you're interested in, we'd love to hear from you - drop us a line.

Thanks,
Paul and Kimberly

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