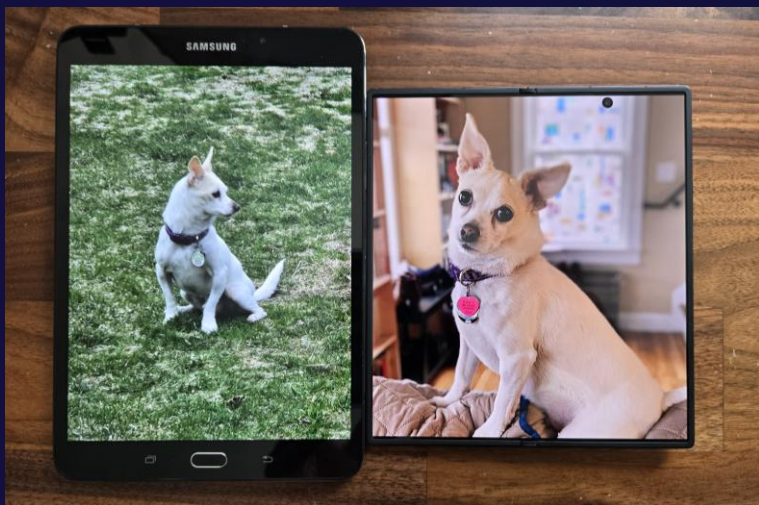




Change Tracking in SQL Server 2025: Exploring Change Event Streaming vs CDC

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About Me

- 25+ years as a DBA
- Data Platform Women in Tech (WIT) Virtual UG, Co-leader
- WITspiration, Co-founder
- Redgate Community Ambassador
- Microsoft MVP, Data Platform
- In my spare time, I can usually be found doing something musical or something geeky with my husband, Andy, and our dog, Sebastian.



Here's the Scenario:

- Breaking up a legacy monolith system into smaller parts
 - Microservices
 - Many databases
 - Teams choosing their database RDBMS & set ups
- Creation of analytical system
 - (Near) Real-time analytics
- No cross-database joins
- Need to share data across the systems
- Need before and after data changes

Options We're Ruling Out



Option 1: Add columns to the table

Pros:

- We can use these columns directly

Cons:

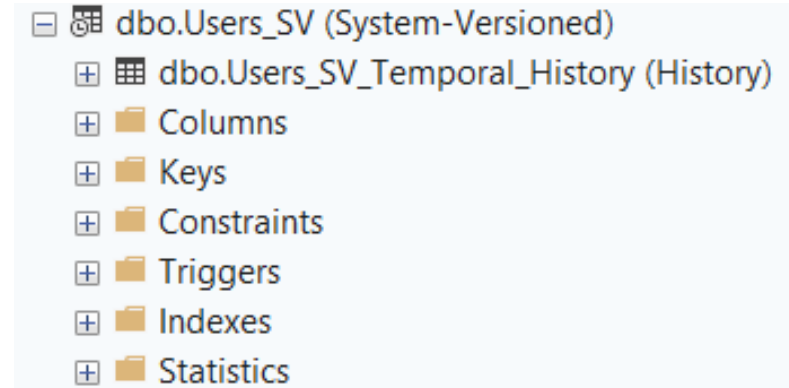
- Querying large tables can take time
- Not guaranteed to always be populated properly
- Only has the updated data

```
CREATE TABLE dbo.Users(  
    Id INT IDENTITY(1,1) NOT NULL,  
    DisplayName NVARCHAR(40) NOT NULL,  
    CreationDate DATETIME NOT NULL,  
    LastUpdateDate DATETIME NOT NULL,  
    CONSTRAINT PK_Users_Id PRIMARY KEY CLUSTERED (Id),  
    INDEX IDX_Users_DisplayName (DisplayName)  
)
```

Option 2: Temporal Tables\System Versioned Tables

Pros:

- Maintained by SQL Server
- Stores both previous and current versions of rows



Cons:

- Querying large tables can take time
- Potential overhead if not set up properly with additional indexing and retention periods.
- See documentation for limitations

Option 3: Change Tracking

Pros:

- Only identifies that row that has changed
- Managed by SQL Server

Cons:

- Does not capture the original or updated data
- Requires additional set up and overhead.

What are we left with?

Change Data Capture (CDC)

- Introduced SQL Server 2008
- “Pull”

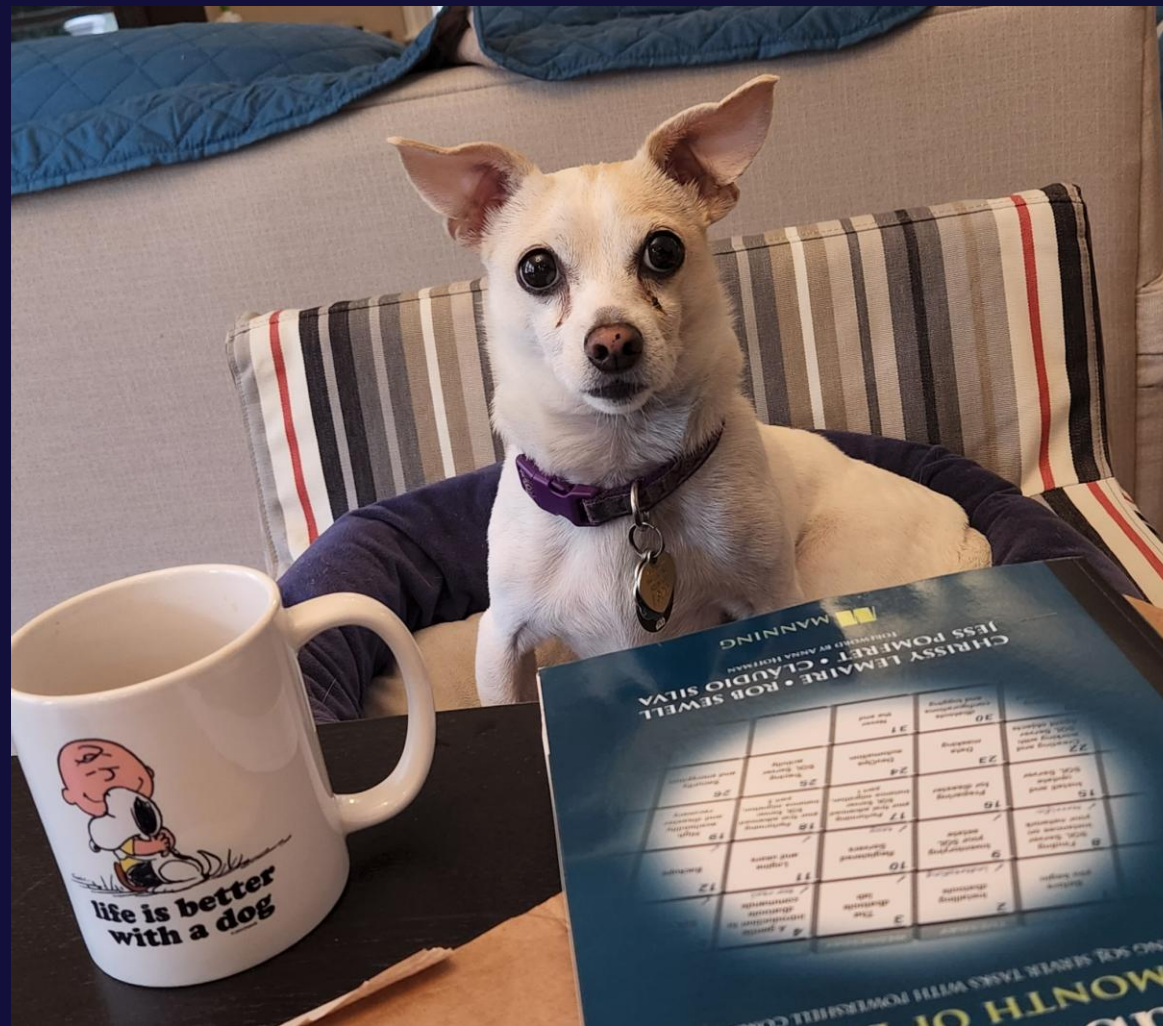
Change Event Streaming (CES)

- Introduced SQL Server 2025 (Preview)
- “Push”

Agenda

- How CDC & CES Work
- Setup
- Demos
- “Cautionary Tales”
- When To Use Each

How They Work

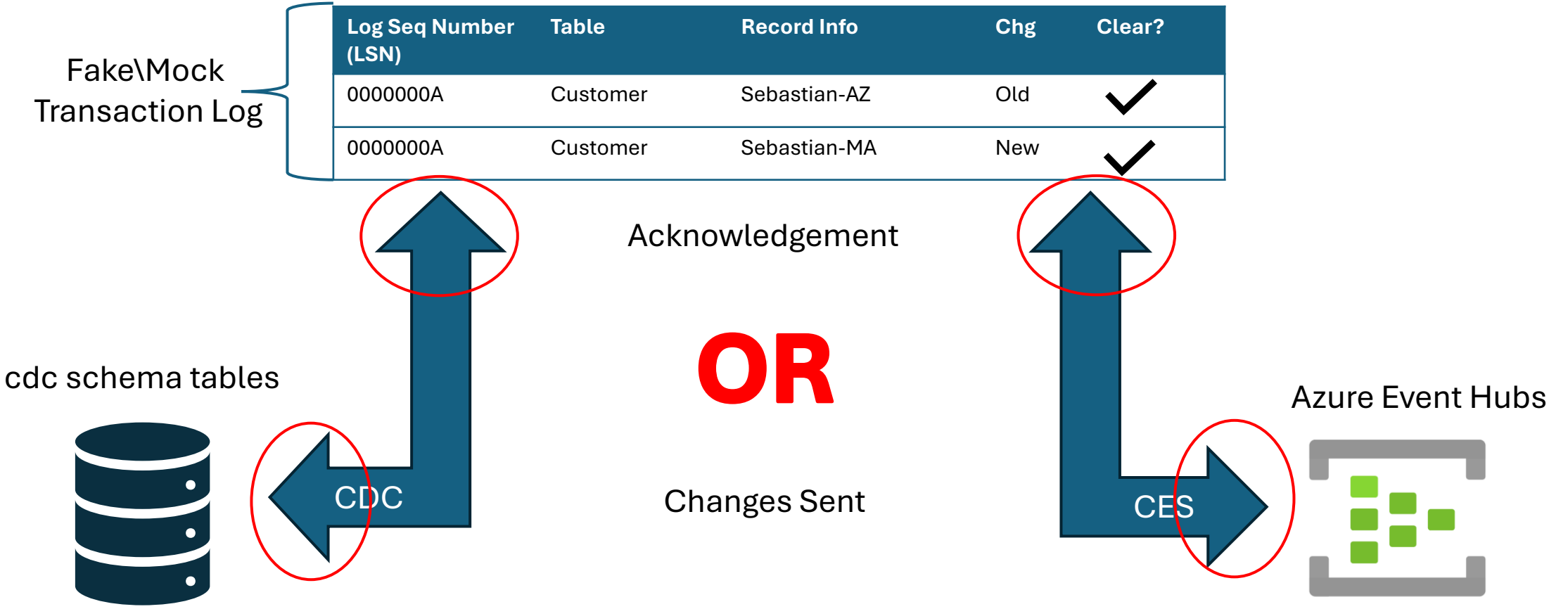


Overview of Capture Process for CDC & CES

- Specify tables to track
- Transaction Logs are scanned for changes which are sent to the appropriate system
 - CDC – cdc schema tables inside the database
 - CES – Azure Event Hubs
 - Managed, high-throughput message service
- Logs receive acknowledgement of changes
- After retention period, change data is removed

How this works:

```
UPDATE Customer
SET State = 'MA'
WHERE FirstName = 'Sebastian'
```



Transaction Logs – Word of Warning

- Can't clear logs if changes can't be written or messages haven't been acknowledged.
- Monitor Log Growth to make sure that these are not blockers:

```
SELECT db.name,  
       db.is_cdc_enabled,  
       db.is_change_feed_enabled,  
       db.log_reuse_wait_desc,  
       usage.total_log_size_in_bytes/1024 AS TotalSizeInKB,  
       usage.used_log_space_in_bytes/1024 AS TotalSpaceInKB,  
       usage.used_log_space_in_percent,  
       usage.log_space_in_bytes_since_last_backup/1024 AS SpaceUsedSinceLastBackupInKB  
FROM sys.databases AS db  
JOIN sys.dm_db_log_space_usage AS usage ON usage.database_id = db.database_id
```

Setup

CDC

Azure Event Hubs

CES



CDC Set up

- Enable CDC in the database
- Enable CDC for the tables
- SQL Server Agent must be running
 - 2 jobs are created per database: Capture & Cleanup
 - Scheduler for Azure SQL DB

Agent Job Activity:

Name ^	Enabled	Status	Last Run Outcome	Last Run
 cdc.StackOverflow_CDC_capture	yes	Executing...	Unknown	never
 cdc.StackOverflow_CDC_cleanup	yes	Idle	Succeeded	3/4/2026 3:07:43 AM

CDC SQL Agent Jobs – Capture

- Settings for job procs
 - MaxTrans = # of transactions in each scan cycle (Default 10000)
 - Maxscans = # of scan cycles to execute to get all the rows (Default 10)
 - Continuous = Is this running continuously? (Default 1)
 - PollingInterval = # of seconds between scans (Default 5)
- Must be running for CDC to be working
- Starts when SQL Agent Job starts by default
 - Consider adding an additional job schedule to start if it is stopped
 - Add check to monitoring\alerting system to see if it's not running

CDC SQL Agent Jobs – Cleanup

- Settings for job procs
 - Retention Period Default 4320 minutes (3 days)
 - Threshold Default 5000
- Deletes in batches:

```
delete top( @p1 ) from [cdc].[dbo_Users_CT]
where __$start_lsn < @p2
```

 - Performance Consequence if not run in a while
 - Azure SQL DB - Runs every hour while database is running

CES Set up - Azure Event Hubs

- Must be set up before CES is enabled
- Choose protocol for the messages
 - AMQP
 - Kafka
- Security currently differs depending on your SQL engine
 - EntraID (Azure SQL DB)
 - Security Access Key (SQL Server)
- Can have multiple partitions for messages in Event Hub

1. Create the Namespace

Pricing Tiers:

- Basic
- Standard
- Premium
- Dedicated

The screenshot shows the 'Create Namespace' page in the Azure portal for Event Hubs. The page is divided into sections: 'Project Details' and 'Instance Details'. In the 'Project Details' section, the 'Subscription' is selected (redacted) and the 'Resource group' is 'SQLCON26_CDC_CES'. In the 'Instance Details' section, the 'Pricing tier' is set to 'Standard', which is highlighted with a red rectangular box. Below the 'Pricing tier' dropdown, there is a link 'Browse the available plans and their features'. The 'Throughput Units' are set to 1, and 'Enable Auto-Inflate' is unchecked. At the bottom, there are buttons for 'Review + create', '< Previous', and 'Next: Advanced >'.

2. Create the Event Hub

Create Event Hub ...
Event Hubs

Basics Capture Review + create

Event Hub Details

Partition count ⓘ

Partition count ⓘ

Retention

Configure retention settings for this Event Hub. [Learn more](#)

Cleanup policy ⓘ Delete

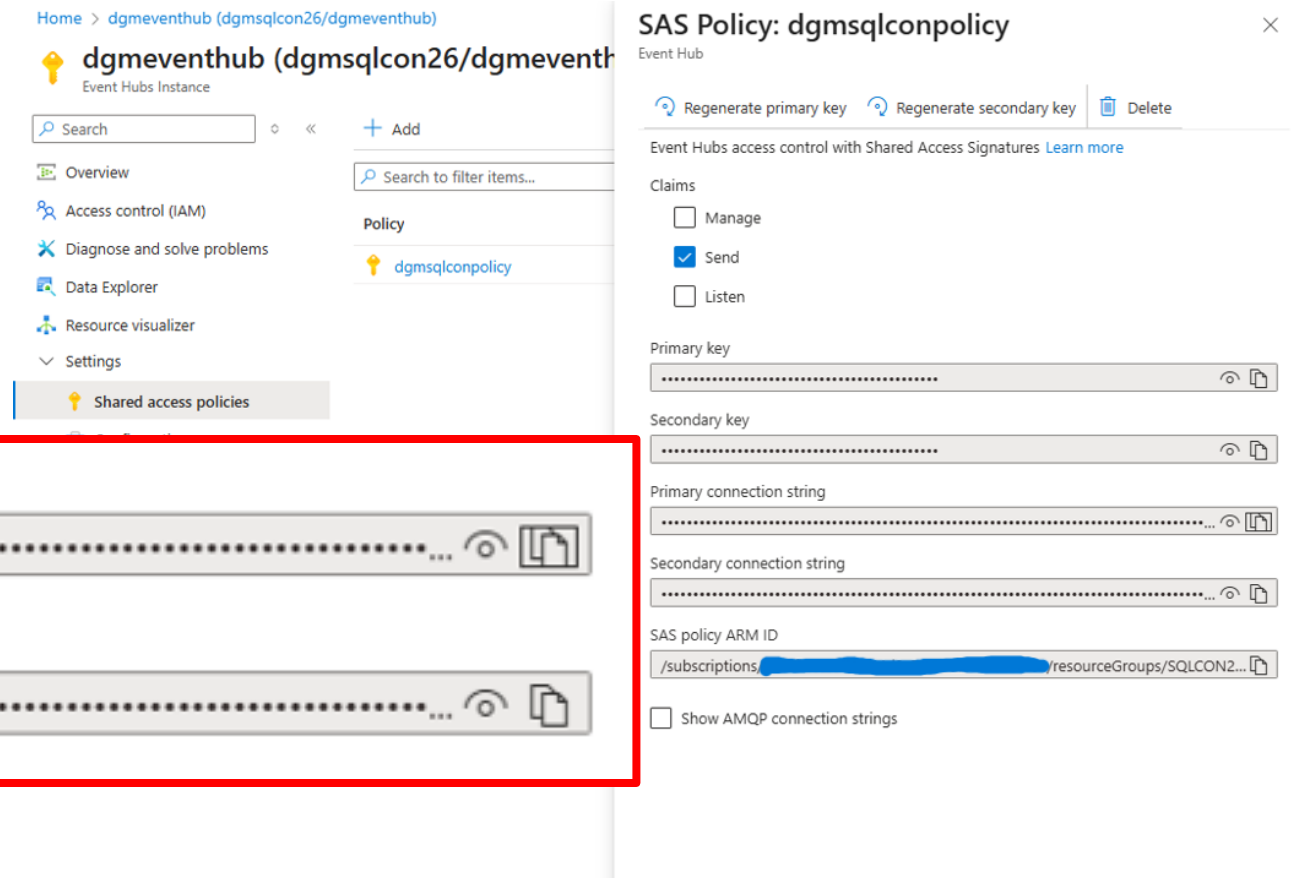
Retention time (hrs) * ⓘ 1 min. 1 hour, max. 168 hours (7days)

Retention time (hrs) * ⓘ 1 min. 1 hour, max. 168 hours (7days)

Review + create < Previous Next: Capture >

3. Create the Shared Access Policy – Kafka Protocol

*Skip if using EntraID
(Azure SQL DB)*



CES Set up - Database

- Enable Preview Features as this is technically still in Preview
 - Not needed for Azure SQL DB
- Enable Event Stream for the database
- Create an Event Stream Group for sending the messages
- Add the table to the stream group
 - Tables can only be in one stream group

NOTE: CES is incompatible with:

- CDC, DB Mirroring in Fabric, Replication

Demos

- Set up database
- Make changes



Cautionary Tales

aka Problems to Look For



High Availability – Availability Groups

- Neither are AG aware
- Consider making modifications to the jobs:
 - Add a job step to make sure that the database is the primary replica.
 - If it is, continue as normal. Otherwise, end job.
 - Add the jobs to the replicas in advance so they are ready to kick off if/when a failover occurs.
- If you are using read replicas to get LSNs for processing, the LSNs could be out of sync if the AGs are out of sync.

Disaster Recovery

- Restores
 - CDC requires an additional command for cdc to be retained: WITH KEEP_CDC
 - CES restores do not keep CES settings
- Disabling CDC erases everything!

Data Initialization

- CDC and CES are about capturing and streaming changes
- May require full resets at some point for some reason
 - New Setup
 - Disaster Recovery
- Have a plan for reseeding the data for the target systems

Processing Messages (CES)

- Ordering of events isn't necessarily maintained
 - May need additional help to identify the order of the updates
 - Within a partition, the logicalid value may be able to help
- Duplicate Messages are possible
 - If an acknowledgment isn't received for some reason, SQL Server will keep retrying the send
 - Consumer should be aware and know how to handle these cases
- Learning Curve: JSON, .NET, Kafka, Stream Analytics Jobs, etc.

Money! Money! Money!

- CES & Azure Event Hubs
 - Pricing Guide: [Azure Event Hubs Pricing](#)
 - Make sure you have the right tier set up
 - Know what happens when you hit limits
 - Emulator (unsupported) for development purposes:
 - [MS Learn - Azure Event Hubs Emulator Overview](#)
- CDC on Azure SQL DB
 - I/O of writing to and deleting from cdc schema tables
 - Transaction logs

When to use each



When to use CDC

- Changes do not need to be changed outside the environment
 - Same database
 - Different database, same SQL Server instance
 - Different SQL Server instance, same network
- No Azure or other cloud service
- Also using Replication, DB Mirroring in Fabric
- Batch processing
- SQL Server 2022 or earlier (Can still use with SQL 2025)

When to use CES

- Distributed systems
 - Azure DBs only
 - Hybrid Cloud & On Prem
 - Different RDBMS
- Real-time/near real-time processing
 - “Streaming data”

Resources



Transaction Log Resources

- [MS Learn - SQL Server Transaction Log Architecture and Management Guide](#)
- Paul Randal Blog Series:
 - <https://www.sqlskills.com/blogs/paul/category/transaction-log/>
 - <https://www.sqlskills.com/blogs/paul/the-sql-server-transaction-log-part-1-logging-basics/>

CDC Resources

- [MS Learn - About Change Data Capture SQL Server](#)
- [MS Learn - Change Data Capture Overview \(Azure SQL DB\)](#)
- [MS Learn - Enable and Disable Change Data Capture - SQL Server](#)
- [MS Learn - Administer and Monitor Change Data Capture](#)
- [MS Learn - System Tables for Change Data Capture](#)
- [MS Learn - System Stored Procs - Change Data Capture](#)

CES & Azure Event Hubs Resources

- [MS Learn - Change Event Streaming Overview](#)
- [MS Learn - Change Event Streaming – Configure](#)
- [MS Learn - Azure Event Hubs - Create](#)
- [MS Learn - Azure Event Hubs Emulator Overview](#)
- [Azure Event Hubs Pricing](#)

Any Questions?

Thank You For Coming!

Github:

https://github.com/DebtheDBA/CES_vs_CDC

Blog: [DebtheDBA.wordpress.com](https://debthedba.wordpress.com)

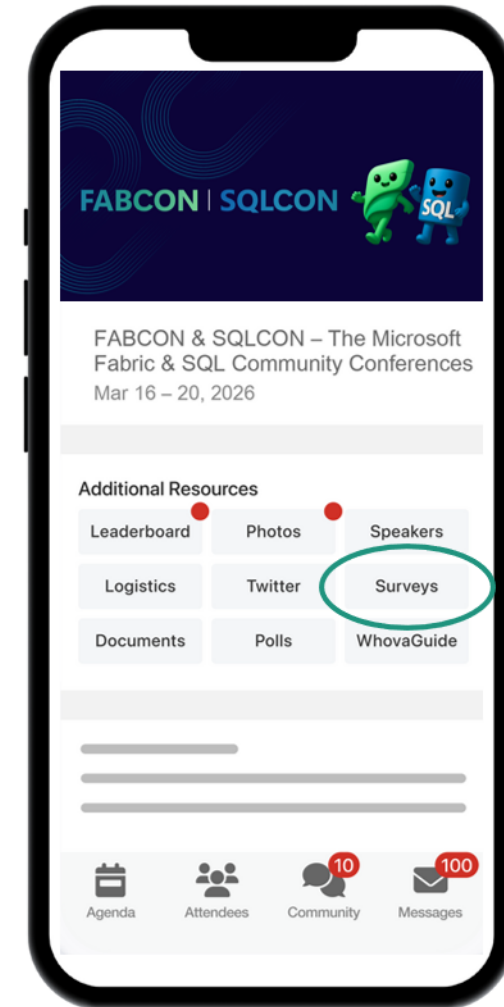
BlueSky: [@dgmelkin.bsky.social](https://bsky.app/profile/@dgmelkin.bsky.social)



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