

# SQL Server Transaction Log

An introduction to transaction log internals

Time : Approximately 1 hour  
Level : 300 (Approximately)

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# Who Am I?

- Passionate about understanding how databases work, performance and scalability
- Credit
  - SQL Skills
  - Thomas Kejser
  - PluralSight
  - Books and blogs
- 2.5 years as a DBA

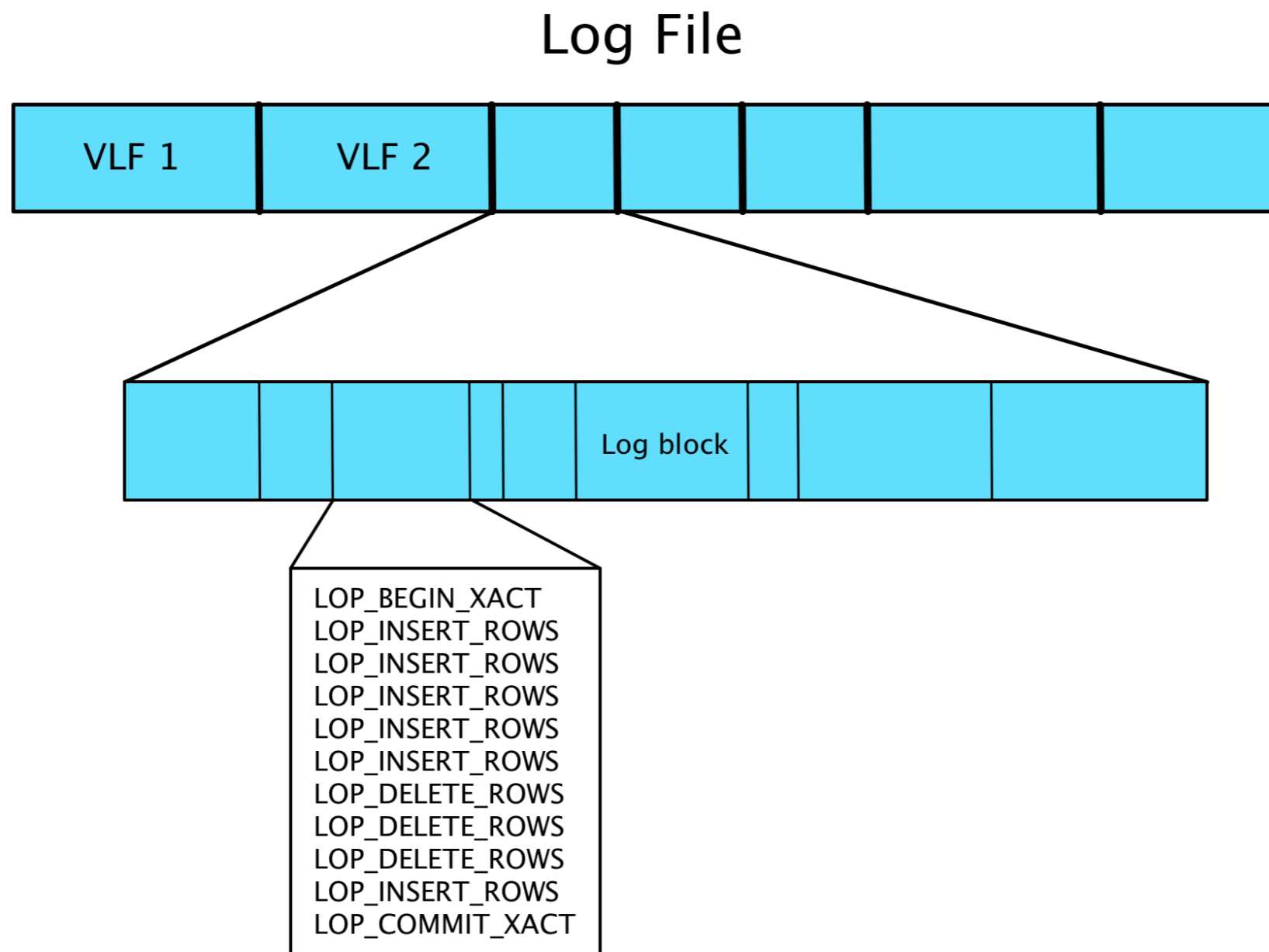
# Assumptions

- Know what a log file (LDF) is
- Understand the log from a high level
- Know what Write Ahead Logging (WAL) is
- Understand recovery models

# Introduction

- Transaction log structure
- The circular and not so circular nature of the log
- Sizing the log - including changes in 2014
- How much log a page split generates
- Myths and misconceptions
- Hidden slides and resources

# Structure of the log - part 1



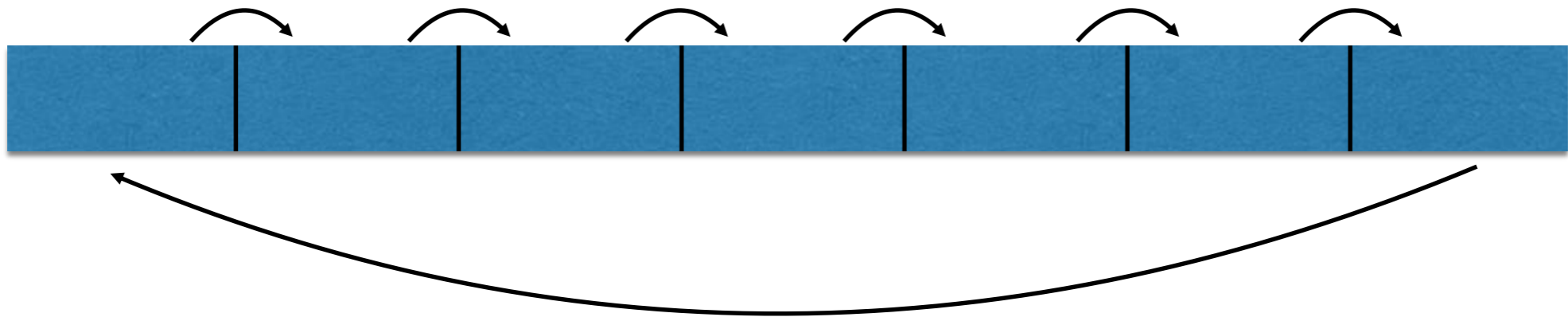
# Structure of the log - part 2

- One or more log files (Usually one)
- Conceptually split into Virtual Log Files (VLFs)
- Log blocks written to VLFs
  - Comprise log records (Rows)
  - 512b - 60KB (Grow in 512b increments)
  - Written on commit, abort or 60KB limit

# Structure of the log - part 2

- Demo - a look at the structure of the log with DBCC LOGININFO

# The circular nature of the log



- VLFs are made active as transactions roll into them
- Made inactive by checkpoint or log backup if possible
- Log rolls round if possible, grows if not

# The circular nature of the log

## - part 2

- What can hold a VLF active
  - An active transaction in the VLF
  - An undistributed transaction (Replication, AG or mirroring) in the VLF
  - An active full, differential or log backup that still needs to read that section of the log
  - In full or bulk logged recovery a change not yet reflected in a log backup
  - In simple recovery a change not yet reflected on disk (Checkpoint)

# The circular nature of the log

## - part 3

- Making a VLF inactive
  - No process holding the VLF active
  - Full or bulk logged - log backup
  - Simple or pseudo simple - checkpoint
  - Internal process now tries to mark VLFs inactive
- Log clearing / log truncation
  - Misnomer for the process by which VLFs are marked inactive, no data is removed from the log in this process

# The (Not so) circular nature of the log

- Demo - The circular nature of the log
- Demo - The not so circular nature of the log

# Sizing the log

- Why does this matter?
  - The not so circular nature of the log - minimise jumps in log use
  - Log growth stops all write activity for duration of growth
- Decide on the likely size of the log you need, err on the side of caution
- Decide on how many VLFs
- Should you shrink the log?

# Sizing the log VLFs

- Creating the log or adding space
- 2014 - if  $< 1/8$ th of log add single VLF otherwise same as below
  - Always must have at least 2 VLFs
  - $\leq 1\text{MB}$  2 VLFs
  - $> 1\text{MB} \leq 64\text{MB}$  4 VLFs
  - $> 64\text{MB} \leq 1\text{GB}$  8 VLFs
  - $> 1\text{GB}$  16 VLFs

# Demo

- Log sizing script - all VLFs should be the same size
- Limitations
  - Doesn't work in SQL Server 2014+
  - Check the results
  - Won't be exact size
    - Up to you to decide whether log should be bigger or smaller than desired

# Page splits and the log

- Demo - Log bytes generated by
  - Insert
  - Page split
  - Does record size affect the log

# Myths

- Unlogged user transactions
- Multiple log files increase performance
- Fully logged means every record change is logged
- Log clearing/truncation zero's the log
- Minimally logged Vs efficiently logged - next demo
  - Can a transaction be fully reconstituted from the log
- Truncate table is not logged - Demo

# Summary

- Structure of the log
- The circular nature of the log
- Growing and sizing the log
- Page splits
- Some myths around the log

# Resources

- Free

- <http://www.sqlskills.com/blogs/paul/category/transaction-log/>
- <https://msdn.microsoft.com/en-us/library/ms190925.aspx>

- Paid

- <http://www.pluralsight.com/courses/sqlserver-logging>
- <http://www.amazon.co.uk/Microsoft-SQL-Server-2012-Internals/dp/0735658560>

# Question and feedback?

## Thank you