InnoDB Performance Optimisation

Mydbops Database Meetup

Presented by

Karthik P R

About Mydbops

Mydbops is into MySQL/MongoDB Support and Consulting. It is founded by experts who have scaled database at **Yahoo! ,Percona and Datavail.** We are providing an expert level support and 24*7 monitoring for MySQL databases and its related technologies like **MariaDB , Percona (also clustering)** . We support modern database technologies in MySQL which includes **Galera (Clustering), Group Replication** , SQL aware Load balancers like **Maxscale / ProxySQL**.

About Me

CEO / DB Architect

Mydbops

Agenda

- InnoDB History
- InnoDB Features
- InnoDB Architecture
- InnoDB Performance Tuning
- General Recommendations

InnoDB History

- Introduced in 1995 by Finland based company called Innobase
- In 2000, Innobase started collaboration with MySQL AB
- Oracle acquired Innobase in October 2005
- Become Default storage engine for Mysql 5.5 in 2010
- JSON Support introduced in MySQL 5.7
- Separated Undo Log in MySQL 8.0

InnoDB Features

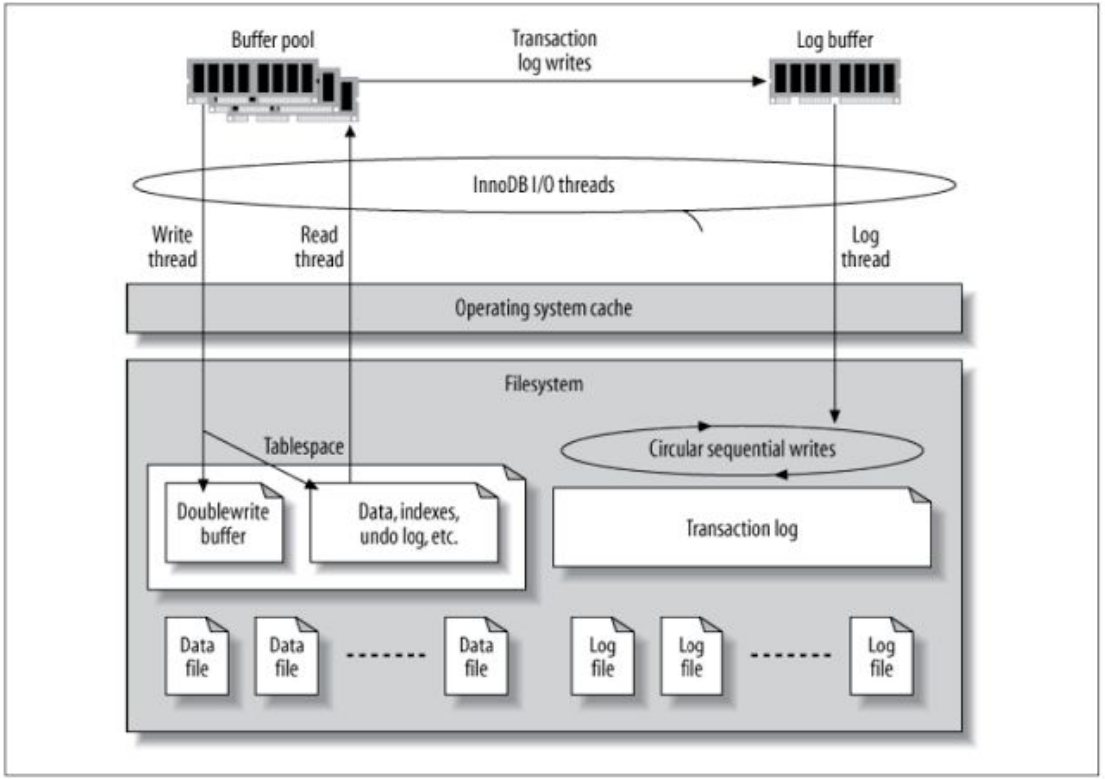
- ACID transaction Engine
- B+Tree Based Indexing
- Index Organised tables
- MVCC Support.
- Efficiently designed for OLTP workload.
- Foreign Key Support.
- Virtual column and Full text search support

InnoDB Architecture

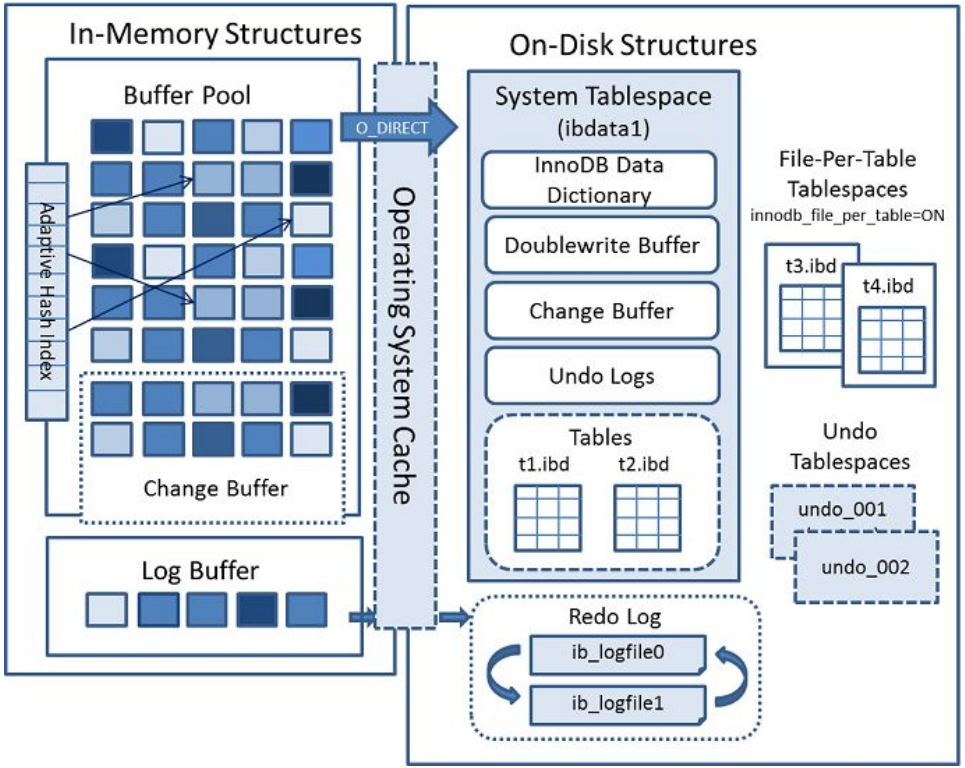
Why InnoDB Architecture ?

- Fine Tuning needs Architecture Knowledge
- Awareness about Internals
- Data Structures (on disk / In Memory)
- Transaction , locking . MVCC
- Checkpoint , Flushing , Purging

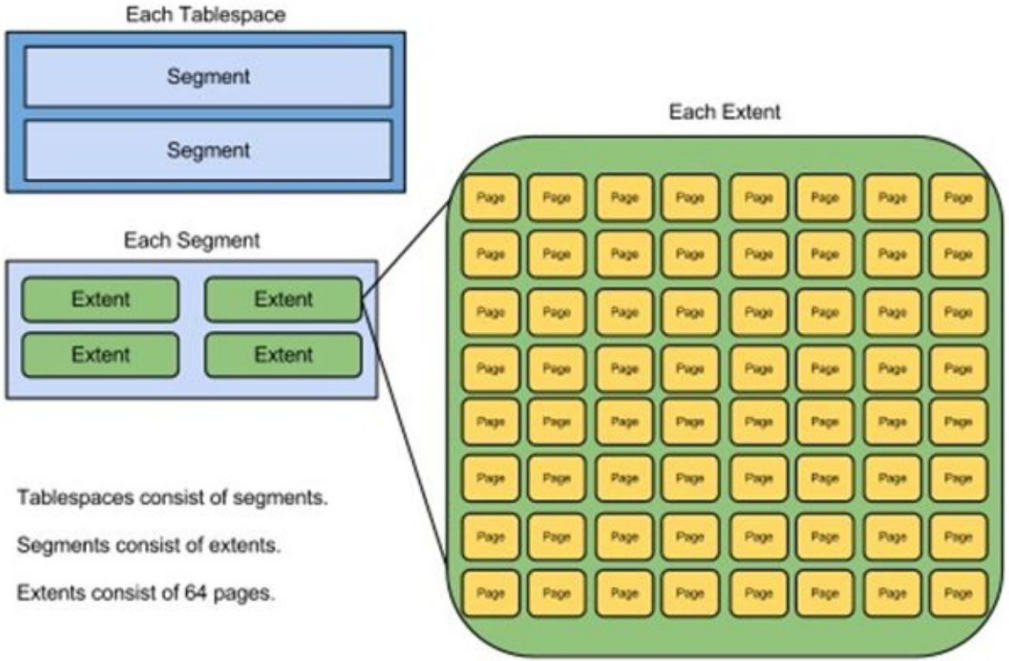
InnoDB Architecture



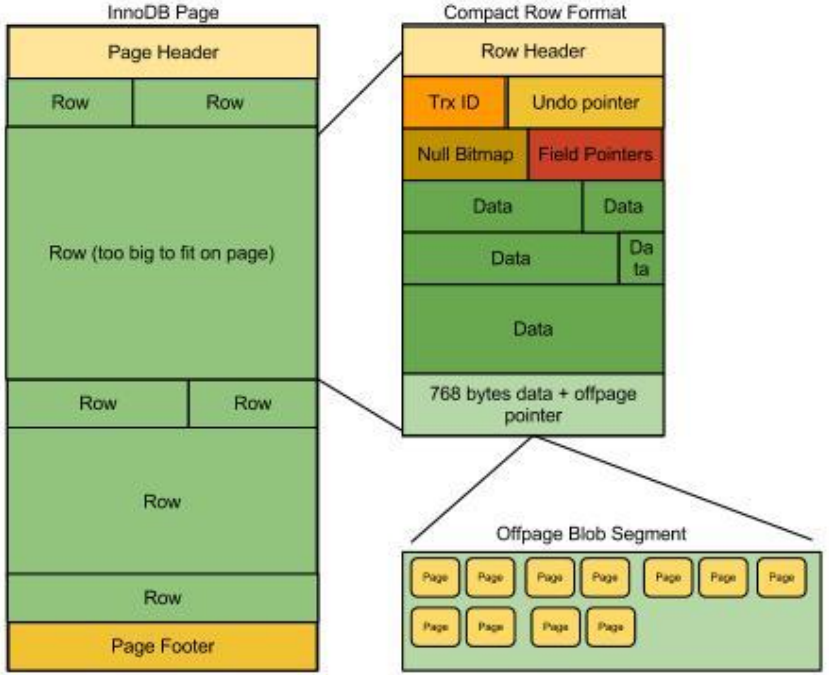
InnoDB Architecture



InnoDB Architecture



InnoDB Architecture



InnoDB Performance Tuning

InnoDB Buffer Pool

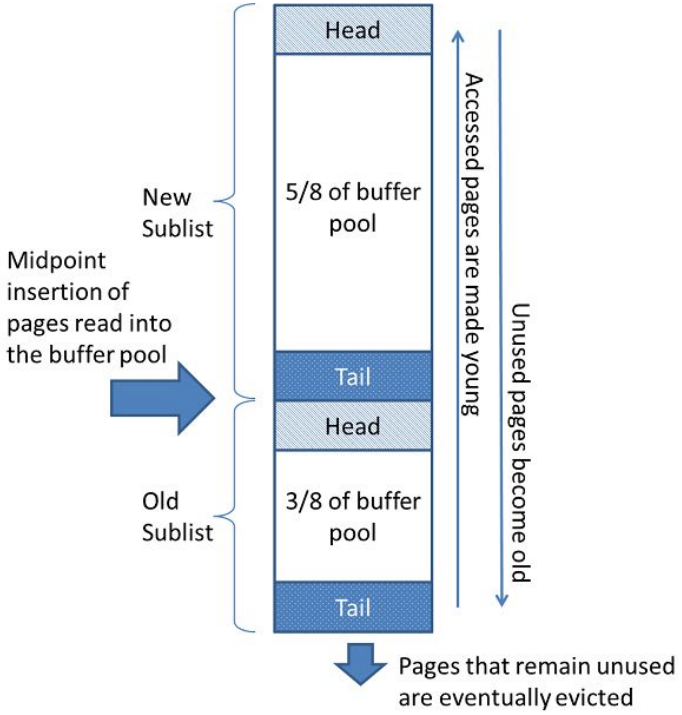
- Global memory for InnoDB
- Caches the Index and data pages
- Locks and Dictionary cache
- Adaptive hash index
- Change buffering

InnoDB buffer pool can be resized online in MySQL 5.7

InnoDB Performance Tuning

InnoDB Buffer Pool

- LRU based Flushing
- Young and Old (LRU)
- O_Direct is best flushing
- Compressed and Uncompressed pages in memory



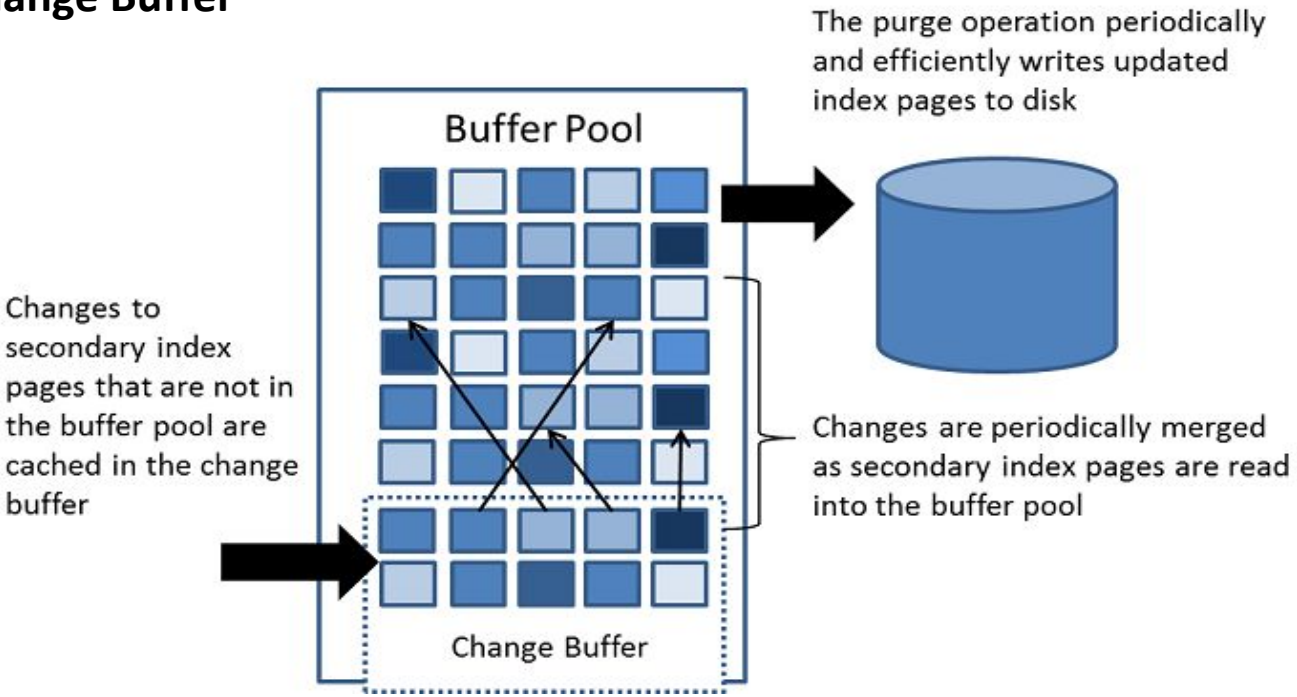
InnoDB Performance Tuning

InnoDB Buffer Pool Config

- InnoDB_buffer_pool_size (70%-80% of Memory)
- innodb_buffer_pool_instances (No of CPU core)
- innodb_buffer_pool_dump_pct (> 70 % is good)
- innodb_buffer_pool_chunk_size

InnoDB Performance Tuning

InnODB Change Buffer



InnoDB Performance Tuning

InnoDB Change Buffer

- Present on both Disk and in memory
- Buffer pool hold Change buffer
- B+tree writes are buffered
- Restrict the size of change buffer

  Innodb_change_buffering=all
  Innodb_change_buffer_max_size (20-30)

InnoDB Performance Tuning

InnoDB Adaptive Hash Index

- Hash table lookup to B+tree
- Fasten the access inside buffer pool
- Works for Primary and Secondary keys (OLTP)
- Do not work well with text or queries with multiple join

innodb_adaptive_hash_index
innodb_adaptive_hash_index_parts

InnoDB Performance Tuning

InnoDB Log Buffer

- Holds the data in memory before flushing to disk
- Larger log file reduce contention
- Can Flush on every commit (for Durability)
- Defaults work pretty well for most workloads.

  Innodb_log_buffer_size

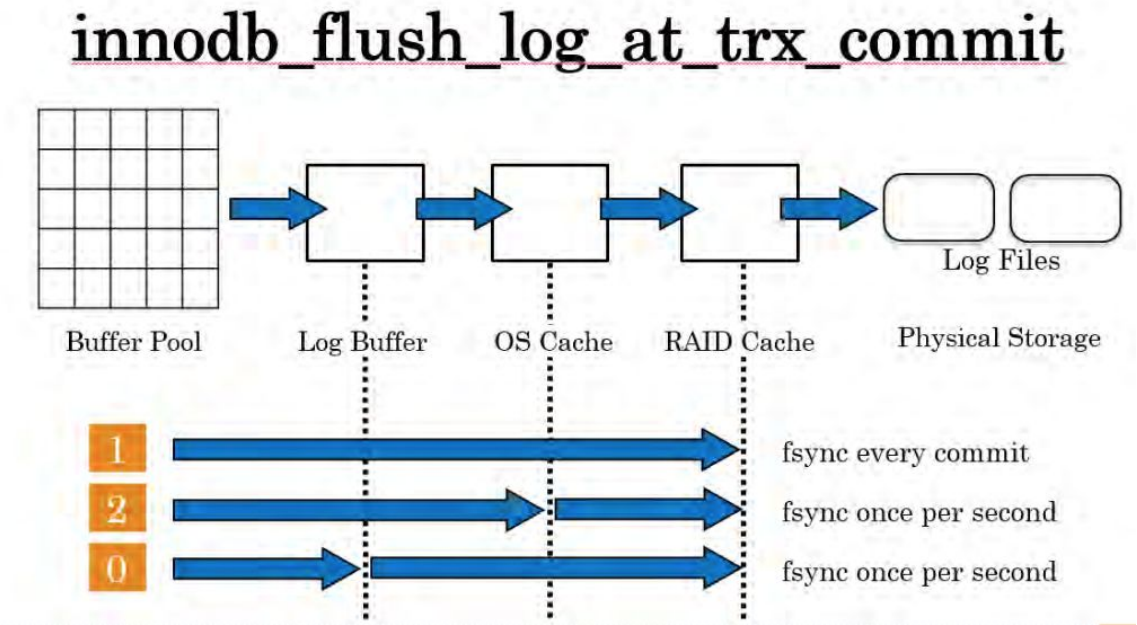
InnoDB Performance Tuning

InnoDB flush log at trx commit

- Controls the flushing of data from log buffer to log file.
- Supports 3 different flush behaviour
- More durability set is as default value 1
- innodb_flush_log_at_timeout controls the flush frequency

InnoDB Performance Tuning

InnoDB Flush log at trx commit



InnoDB Performance Tuning

InnoDB log File Size

- Two physical log files of equal size.
- Records all changes to tablespace
- Helps in crash recovery
- Overwritten when the page is flushed from buffer pool (Checkpoint)
- **innodb_log_files_in_group** controls the number of files

InnoDB Performance Tuning

InnoDB log File Size

- Two physical log files of equal size.
- Records all changes to tablespace
- Helps in crash recovery
- Overwritten when the page is flushed from buffer pool (Checkpoint)
- ***innodb_log_files_in_group*** controls the number of redo log files

InnoDB Performance Tuning

InnoDB log File Size

- Larger log file better write performance
- Tradeoff longer recovery time
- Defaults is 48 MB is low for any production workload

innodb_log_file_size=(>512M) (Size can be calculated by *innodb_os_log_written*)
innodb_log_files_in_group=2

Note : PMM calculates very efficiently co-relate with checkpoint

InnoDB Performance Tuning

Innodb Flush method

- How data to InnoDB data files and log files is flushed ?
- default is FSYNC
- It can be numeral in MySQL 8.0 (0,1,2,3,4,5)

innodb_flush_method=O_DIRECT(4)

InnoDB Performance Tuning

Isolation Level

- How transaction isolated from each other ?
- A major role in locking along with work load
- Default Repeatable read.

transaction_isolation=read_committed/repeatable_read

InnoDB Performance Tuning

innodb_dedicated_server (8.0)

- Manages major tuning parameter based on your system memory
    - innodb_buffer_pool_size
    - innodb_log_file_size
    - innodb_log_file_in_group
    - innodb_flush_method
- Enable it only on dedicated MySQL server.

InnoDB Performance Tuning

- innodb_io_capacity
- innodb_io_capacity_max
- innodb_doublewrite
- innodb_checksum_algorithm
- innodb_autoinc_lock_mode
- innodb_purge_threads

InnoDB Performance Tuning

- innodb_flush_neighbors
- innodb_stats_on_metadata
- innodb_stats_persistent_sample_pages
- innodb_max_dirty_pages_pct
- innodb_max_purge_lag
- innodb_max_purge_lag_delay

InnoDB Performance Tuning

- innodb_thread_concurrency
- innodb_concurrency_tickets
- innodb_file_format
- innodb_page_size
- innodb_write_io_threads
- innodb_read_io_threads

General Recommendations

- Ensure there is primary key or Unique key in all tables.
- Smaller the primary key better they will be.
- Avoid shared tablespace for innodb tables.
- Consider partition for huge tables (query might need changes).
- Do not make config changes without knowing its production impact.
- 80-90% of performance gain can be achieved by tweaking 4-6 variables.

Contact us

info@mydbops.com
www.mydbops.com
080-48505683

Thank You