

# OpenWorld 2017

# MySQL Performance

A Cheatsheet

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ORACLE  
OPEN  
WORLD

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SAN FRANCISCO, CA

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Graphical Only  
Section Header

# NEXT 15-MINUTE BRIEFING

Subtitle

## MySQL Performance

# Safe Harbor Statement

The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

# Objectives



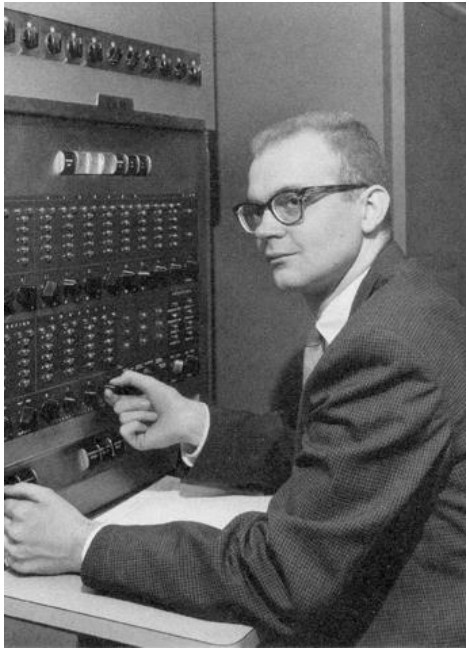
Address database design from scratch



Find out what optimization techniques may improve performance of consolidated deployments

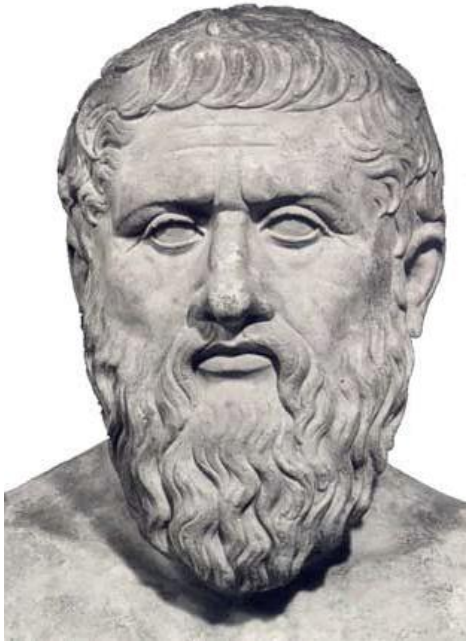


Take the most out of existing hardware



“Premature optimization is the root of all evil”

– Donald Knuth



“The beginning is the most important part of the work”

– Plato

# Mini-Briefing Agenda

- 1 Strategy
- 2 Engine
- 3 Design
- 4 Tuning
- 5 Analysis
- 6 Benchmarking

A man with a beard and mustache, wearing a dark suit, light blue shirt, and dark tie, is looking intently at a tablet computer. The background is a blurred bokeh of lights, suggesting an indoor setting at night. The overall color palette is dominated by teal and blue tones.

# Strategy

**From a real world problem to a database solution**



# Strategy

- Estimate workload
- Get the most out of hardware
- Estimate dataset growth in time
- Maximize uptime (upgrades, redundancy)
- Establish a redundancy and backup policy
- And finally **strive for best performance!**

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# Engine

What storage engine do I need?

# Engine

## InnoDB

- ACID
- Locks
- FKs

## MyISAM

- Simpler
- Read-intensive
- Footprint

## NDB

- In memory
- Distributed
- Key lookups

**MEMORY**  
**FEDERATED**  
**CSV**  
**MERGE**  
[...]

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# Design

**Model entities and relationships and do database design**

# Design

- Minimize disk usage, reduce read/write volume
- Smallest data type
- Row format compact/dynamic/compressed
- Short primary key
- Prefer composite indexes
- Indexing prefixes of strings
- Split tables and use joins

# Design II

- Prefer numeric columns
- Use binary collation
- Same data type comparisons
- Prefer VARCHAR to blob if <8KB
- Consecutive primary keys
- Blob types: compress, normalize, store, hash comparison
- Find the right size for table cache

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# Tuning

Speed up queries with indexes, optimize IO and increase concurrency

# Tuning

## Indexing

- Primary key and auto increment
- Foreign keys
- Index prefixes
- Multiple columns index
- Generated column index
- Covering index
- EXPLAIN index usage
- ANALYZE TABLE



# Tuning

## InnoDB IO

- Right size for buffer pool size ([innodb buffer pool size](#))
- Buffer pool instances ([innodb buffer pool instances](#))
- What the right size for REDO log?
- Try different flush methods ([innodb flush method](#))
- Control read-ahead requests
- Are you deploying on VMs?
- Additional storage devices for data/log files
- Non-rotational vs rotational storage
- RAID recommendations

# Tuning

## InnoDB concurrency

- Big transactions vs auto commit
- Beware of huge rollbacks
- Read only transactions?
- Isolation levels
- Thread model/thread pooling/connection pooling

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# Analysis

**Tools to audit database performance**

# Analysis

## EXPLAIN

```
mysql> explain select from_date from dept_emp where from_date > "1985-01-01" and from_date < "1985-06-01" \G;
***** 1. row *****
      id: 1
  select_type: SIMPLE
        table: dept_emp
  partitions: NULL
         type: range
possible_keys: from_date_idx
          key: from_date_idx
       key_len: 3
          ref: NULL
         rows: 6536
   filtered: 100.00
      Extra: Using where; Using index
1 row in set, 1 warning (0.00 sec)
```

# Analysis

## PROFILE

- SET profiling=1;
- Execute query
- SHOW profiles;

```
show profile for query 1;
+-----+-----+
| Status                | Duration |
+-----+-----+
| starting              | 0.002574 |
| checking permissions  | 0.000099 |
| Opening tables        | 0.000027 |
| init                  | 0.000052 |
| System lock           | 0.000017 |
| optimizing             | 0.000018 |
| statistics            | 0.000116 |
| preparing             | 0.000028 |
| executing             | 0.000006 |
| Sending data          | 0.062824 |
| end                   | 0.000011 |
| query end             | 0.000009 |
| closing tables        | 0.000006 |
| freeing items         | 0.000012 |
| cleaning up           | 0.000024 |
+-----+-----+
```

# Analysis

## SHOW PROCESSLIST

```
mysql> show processlist;
+-----+-----+-----+-----+-----+-----+-----+-----+
| Id      | User | Host      | db      | Command | Time | State                | Info                |
+-----+-----+-----+-----+-----+-----+-----+-----+
| 659     | root | localhost | employees | Query   | 0    | starting            | show processlist   |
| 16359   | root | localhost | mysqlslap | Sleep   | 0    |                     | NULL               |
| 17261   | root | localhost | mysqlslap | Sleep   | 0    |                     | NULL               |
| 17263   | root | localhost | mysqlslap | Query   | 0    | Sending to client   | SELECT intcoll,charcoll FROM t1 |
| 17264   | root | localhost | mysqlslap | Query   | 0    | Sending data        | SELECT intcoll,charcoll FROM t1 |
| 17265   | root | localhost | mysqlslap | Query   | 0    | Sending to client   | SELECT intcoll,charcoll FROM t1 |
| 17269   | root | localhost | mysqlslap | Query   | 0    | Sending to client   | SELECT intcoll,charcoll FROM t1 |
| 17270   | root | localhost | mysqlslap | Query   | 0    | query end           | INSERT INTO t1 VALUES |
(73673339, 'BN3152Gza4GW7atxJKACYwJqDbFynLxqc0kh30YTwgz3FktQ43XTrqJ4PQ25frn7kXh |
| 17271   | root | localhost | mysqlslap | Query   | 0    | Sending data        | SELECT intcoll,charcoll FROM t1 |
```

# Analysis

## Performance Schema/Sys Schema

- Tables without PKs
- Queries that don't use indexes
- Buffer pool statistics
- Latency per file and thread
- Full scans
- Locks
- Slow queries
- [...]

# Analysis

## INNODB ENGINE STATUS and INNODB MONITORS

- Semaphores
- Transactions and lock wait
- Deadlocks
- REDO log usage
- IO operations and statistics
- Buffer pool statistics
- [...]



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# Benchmarking

Get ready for production

# Benchmarking

- Benchmarking strategies: single operation vs workload
- Open test databases: [world](#), [employees](#)
- [BENCHMARK](#) function
- [mysqlslap](#)
- [SysBench](#), [DBT2](#)

# Recommended Conference Sessions

## HOL7299: **MySQL Performance Tuning 101**

Tuesday, Oct 03, 11:30 a.m. - 12:30 p.m.

Hilton San Francisco Union Square (Ballroom Level) - Continental Ballroom 7

## CON7309: **MySQL 8.0: What's New in the Optimizer**

Wednesday, Oct 04, 12:00 p.m. - 12:45 p.m.

Marriott Marquis (Yerba Buena Level) - Salon 14

## CON7313: **MySQL 8.0: Performance, Scalability, and Benchmarks**

Wednesday, Oct 04, 5:30 p.m. - 6:15 p.m.

Marriott Marquis (Yerba Buena Level) - Salon 14





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# Monday Mix

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- CONNECT with Oracle Support executives, engineers, and developers
- ENGAGE on ideas, share experiences, and discover new opportunities
- RE-ENERGIZE with hors d'oeuvres, drinks, and inspiring conversations

Admission is open\* to Oracle Premier Support customers with an Oracle OpenWorld event badge and photo ID

\*subject to capacity

[oracle.com/goto/mondaymix](http://oracle.com/goto/mondaymix)

Monday,  
October 2, 2017

6:15–8:30 p.m.

Fang Restaurant  
660 Howard St., SF



(Just a 3-minute walk  
from Moscone)

See you there!

## Get in the Mix...



# Thank You

- MySQL Documentation  
[dev.mysql.com](http://dev.mysql.com)
- Support Blog  
[dev.mysql.com/support/blogs/](http://dev.mysql.com/support/blogs/)
- Stars Bar  
[oracle.com/goto/starsbar](http://oracle.com/goto/starsbar)

Q&A

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