Practical Performance Tuning *using Digested SQL Logs*

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Salesforce Marketing Cloud

Who?

- Database Architect
- Salesforce Marketing Cloud (Radian6 & Buddy Media stack)

Why?

- I can’t be the only one

Talking about today…

- Slow database: the problem & the solution
- What is the MySQL “Slow Log”?
- Making sense of log contents
- Interpreting the digested log
- Tuning examples

Slow Database: the problem & the solution

The Problem

- Slow database. Why?
- Long-running queries
- Small “fast” queries (numerous & not tuned)
- Small “fast” queries (tuned but extremely numerous)

The Solution

- Watch everything then analyze
- Catch all queries, even the “fast” queries
- Look at *total time spent* on each query
- Attack them from the top, down

Capture Everything

- “Slow” Log
- Detailed
- *Too* detailed?

What is the MySQL “Slow Log”?

Slow Log: Purpose

- Log all queries
- Time threshold
- Capture information about each query
  - Execution time
  - Row counts
  - User & Host
  - Others

Slow Log: Contents

```
# Time: 150329  9:52:13
# User@Host: root[root] @ localhost []  Id:     1
# Schema: sakila  Last_errno: 0  Killed: 0
# Query_time: 0.019128  Lock_time: 0.009394  Rows_sent: 1  Rows_examined: 200  Rows_affected: 0
# Bytes_sent: 267
SET timestamp=1427633533;
select * from actor where first_name='JOHN';
```

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Slow Log: Configuration

- `set global long_query_time = 0;`
- threshold execution time for inclusion in slow log

Slow Log: Configuration

- `set global slow_query_log_file = '/path/to/slow.log';`
- location of the slow log file

Slow Log: Configuration

- `set global log_slow_verbosity = 'microtime';`
- what to include in the slow log file
  - microtime
  - innodb
  - query_plan
  - profiling

Slow Log: Configuration

- `set global slow_query_log_use_global_control = 'long_query_time, log_slow_verbosity';`
- make slow log configuration changes apply to all sessions, including open sessions

Slow Log: Configuration

- `set global log_slow_slave_statements = 1;`
- include replicated SQL in the slow log

Slow Log: Configuration

- `set global slow_query_log = 1;`
- turn on the slow log!
- High activity / slow disk
- General overhead

Slow Log with different MySQL versions

Slow-Log in *Stock* 5.1 / 5.5 / 5.6

- ```
  set global slow_query_log_file = '/path/to/slow.log';
  set global long_query_time=0;
  set global slow_query_log=1;
  ```
- Logs only for sessions created after logging starts
  ```

Slow-Log in *Percona* 5.1 / 5.5 / 5.6

- ```
  set global slow_query_log_file = '/path/to/slow.log';
  set global long_query_time=0;
  set global slow_query_log=1;
  ```
- Logs only for sessions created after logging starts
  ```

Slow-Log in *Percona* 5.1

- ```
  set global slow_query_log_file = '/path/to/slow.log';
  set global long_query_time=0;
  set global log_slow_verbosity='microtime,innodb';
  set global use_global_log_slow_control=1;
  set global log_slow_slave_statements=1;
  set global slow_query_log=1;
  ```
- Logs all sessions (and include innodb info & slave SQL)
  ```

Slow-Log in *Percona* 5.5 / 5.6

- ```
  set global slow_query_log_file = '/path/to/slow.log';
  set global long_query_time=0;
  set global log_slow_verbosity='microtime,innodb';
  set global slow_query_log_use_global_control=1;
  set global log_slow_slave_statements=1;
  set global slow_query_log=1;
  ```
- Logs all sessions (and include innodb info & slave SQL)
  ```

	5.1 / 5.5 / 5.6 Stock	5.1 Percona	5.5 / 5.6 Percona
long_query_time	yes	yes	yes
slow_query_log_file	yes	yes	yes
log_slow_verbosity	no: "microtime" only	yes	yes
slow_query_log _use_global_control	no: session only	"use_global_log _slow_control"	yes
log_slow_slave _statements	no	yes	yes

	5.1 / 5.5 / 5.6 Stock	5.1 Percona	5.5 / 5.6 Percona
long_query_time	yes	yes	yes
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slow_query_log_file	yes	yes	yes
log_slow_verbosity	no: "microtime" only	yes	yes
slow_query_log _use_global_control	no: session only	"use_global_log _slow_control"	yes
log_slow_slave _statements	no	yes	yes

Making Sense of Log Contents

- Millions of pieces of data
- `grep | awk | sort | uniq -c`
- pt-query-digest
  - created by *Baron Schwartz*
  - primarily developed by him and *Daniel Nichter*

pt-query-digest

- Aggregates log entry data by query *fingerprint*
- Sorts output by whatever's important to you

pt-query-digest: *query fingerprint*

```
select * from actor where first_name='JOHN';
SELECT /* my query */ last_name From actor where   first_name  =  'Bob';
```

```
select * from actor where first_name=?
```

```
select 50, last_name from actor
   where first_name='JOHN' and last_name in ('SMITH', 'JONES');
```

```
select ?, last_name from actor where first_name=? and last_name in(?+)
```

pt-query-digest: Output

```
# 1825.5s user time, 19.6s system time, 526.79M rss, 677.20M vsz
# Current date: Tue Mar 10 12:16:58 2015
# Hostname: db1234
# Files: slow.log.db5678
# Overall: 6.36M total, 775 unique, 10.90k QPS, 5.54x concurrency
```

pt-query-digest: Output

```
# Time range: 2015-03-10 11:34:01 to 11:43:44
# Attribute          total     min     max     avg     95%  stddev  median
# ===========     ======= ======= ======= ======= ======= ======= =======
# Exec time          3228s     1us      79s   507us   657us    52ms   131us
# Lock time           303s       0       2s    47us   125us     1ms    30us
# Rows sent        173.14M       0   7.27M   28.56   20.43   8.25k    0.99
# Rows examine     781.43M       0  11.46M  128.90   59.77  15.43k    0.99
# Rows affecte     128.30k       0      77    0.02       0    0.17       0
# Rows read        781.43M       0  11.46M  128.90   59.77  15.43k    0.99
# Bytes sent        11.60G       0 414.78M    1.91k   2.62k 358.51k  537.02
# Query size         1.48G       6 121.50k  250.43  719.66  363.95  166.51
```

pt-query-digest: Output

Query execution time

```
# Time rang                34:01 to 11:43:44
# Attribute          total     min     max     avg     95%  stddev  median
# ==========         ======= ======= ======= ======= ======= ======= =======
# Exec time             3228s      1us      79s    507us    657us     52ms    131us
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# Rows read           781.43M        0   11.46M  128.90   59.77  15.43k    0.99
# Bytes sent           11.60G        0  414.78M    1.91k    2.62k 358.51k  537.02
# Query size            1.48G        6  121.50k  250.43  719.66  363.95  166.51
```

pt-query-digest: Output

```
# Time range: 2                11:34:01 to 11:43:44
# Attribute          total     min     max     avg     95%  stddev  median
# ========== ========= ======= ======= ======= ======= ======= =======
# Exec time          3228s      1us      79s    507us    657us     52ms    131us
# Lock time           303s        0        2s     47us    125us      1ms     30us
# Rows sent        173.14M        0    7.27M    28.56    20.43    8.25k     0.99
# Rows examine     781.43M        0   11.46M   128.90    59.77   15.43k     0.99
# Rows affecte     128.30k        0       77     0.02        0     0.17        0
# Rows read        781.43M        0   11.46M   128.90    59.77   15.43k     0.99
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```

Time before query executes

pt-query-digest: Output

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# ========= ======= ======= ======= ======= ======= ======= =======
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# Query size        1.48G        6  121.50k   250.43   719.66   363.95   166.51
```

Rows returned to the client

pt-query-digest: Output

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```

Rows scanned for selects

pt-query-digest: Output

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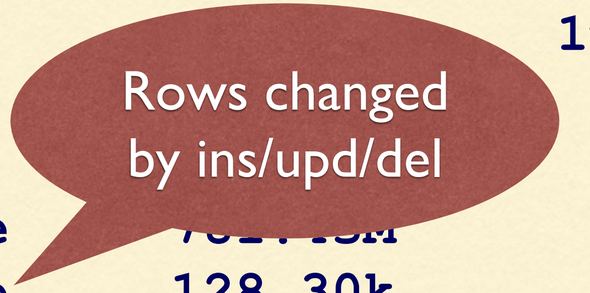

pt-query-digest: Output

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```

Rows read to process ins/upd/del

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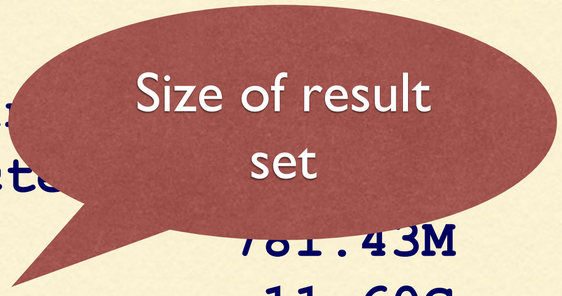

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# Query size         1.48G        6 121.50k   250.43   719.66   363.95   166.51
```

Size of incoming SQL

pt-query-digest: Output

```
# Profile
# Rank Query ID           Response time   Calls   R/Call V/M    Item
# ==== ================== =============== ======= ====== ====== ==================================================
#    1 0x2AEA6C2B72904C1E  431.5703 13.4%    1578 0.2735   0.30 SELECT UNION Roles RoleGrants DefaultRolePermissions
#    2 0x97C874BC88FDB2E3  226.4475  7.0%      48 4.7177  49.80 SELECT Event EventAttribute
#    3 0x4A106EF2450AEAC1  119.0458  3.7%  547909 0.0002   0.03 SELECT ApplicationUser Client
#    4 0x00694E9F0A0CD23D  113.0377  3.5%     313 0.3611   0.05 SELECT ExtendedMediaTypeAttribute TopicFilter
#    5 0x813031B8BBC3B329  110.2512  3.4%  206088 0.0005   1.80 COMMIT
# MISC 0xMISC             2218.8264 68.7% 5600850 0.0004    0.0 <769 ITEMS>
```

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# ==== ================== =============== ======= ====== ====== ==================================================
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pt-query-digest: Output

Hash of query fingerprint

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```

pt-query-digest: Output

How many times this SQL ran

```
# Profile
# Rank Query ID           Response time   Calls   R/Call V/M    Item
# ==== ================== =============== ======= ====== ====== ==================================================
#    1 0x2AEA6C2B72904C1E  431.5703 13.4%    1578 0.2735   0.30 SELECT UNION Roles RoleGrants DefaultRolePermissions
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```

pt-query-digest: Output

Mean response time per call

```
# Profile
# Rank Query ID           Response time   Calls   R/Call V/M    Item
# ==== ================== =============== ======= ====== ====== ==================================================
#    1 0x2AEA6C2B72904C1E  431.5703 13.4%    1578 0.2735   0.30 SELECT UNION Roles RoleGrants DefaultRolePermissions
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# MISC 0xMISC             2218.8264 68.7% 5600850 0.0004    0.0 <769 ITEMS>
```

pt-query-digest: Output

Variance to Mean ratio
(indicates spread of values)

```
# Profile
# Rank Query ID           Response time   Calls   R/Call V/M    Item
# ==== ================== =============== ======= ====== ====== ==================================================
#    1 0x2AEA6C2B72904C1E  431.5703 13.4%    1578 0.2735   0.30 SELECT UNION Roles RoleGrants DefaultRolePermissions
#    2 0x97C874BC88FDB2E3  226.4475  7.0%      48 4.7177  49.80 SELECT Event EventAttribute
#    3 0x4A106EF2450AEAC1  119.0458  3.7%  547909 0.0002   0.03 SELECT ApplicationUser Client
#    4 0x00694E9F0A0CD23D  113.0377  3.5%     313 0.3611   0.05 SELECT ExtendedMediaTypeAttribute TopicFilter
#    5 0x813031B8BBC3B329  110.2512  3.4%  206088 0.0005   1.80 COMMIT
# MISC 0xMISC             2218.8264 68.7% 5600850 0.0004    0.0 <769 ITEMS>
```

pt-query-digest: Output

```
# Profile
# Rank Query ID           Response time   Calls   R/Call V/M    Item
# ==== ================== =============== ======= ====== ====== ==================================================
#    1 0x2AEA6C2B72904C1E  431.5703 13.4%    1578 0.2735   0.30 SELECT UNION Roles RoleGrants DefaultRolePermissions
#    2 0x97C874BC88FDB2E3  226.4475  7.0%      48 4.7177  49.80 SELECT Event EventAttribute
#    3 0x4A106EF2450AEAC1  119.0458  3.7%  547909 0.0002   0.03 SELECT ApplicationUser Client
#    4 0x00694E9F0A0CD23D  113.0377  3.5%     313 0.3611   0.05 SELECT ExtendedMediaTypeAttribute TopicFilter
#    5 0x813031B8BBC3B329  110.2512  3.4%  206088 0.0005   1.80 COMMIT
# MISC 0xMISC             2218.8264 68.7% 5600850 0.0004    0.0 <769 ITEMS>
```

pt-query-digest: Output per Query

```
# Query 3: 939.81 QPS, 0.20x concurrency, ID 0x4A106EF2450AEAC1 at byte 2946778373

# Scores: V/M = 0.03
# Time range: 2015-03-10 11:34:01 to 11:43:44
# Attribute    pct   total     min     max     avg     95%  stddev  median
# ============ === ======= ======= ======= ======= ======= ======= =======
# Count          8  547909
# Exec time      3    119s   100us   922ms   217us   424us      2ms   159us
# Lock time     10      31s    18us    10ms    56us   131us     97us    36us
# Rows sent      0 535.07k       1       1       1       1       0       1
# Rows examine   0 535.07k       1       1       1       1       0       1
# Rows affecte   0       0       0       0       0       0       0       0
# Rows read      0 535.07k       1       1       1       1       0       1
# Bytes sent    12   1.41G   2.62k   2.89k   2.71k   2.62k    6.83   2.62k
# Query size     5  78.87M     148     176  150.94  151.03    2.37  143.84
```

Rank in sort order

t-query-digest: Output per Query

```
# Query 3: 939.81 QPS, 0.20x concurrency, ID 0x4A106EF2450AEAC1 at byte 2946778373

# Scores: V/M = 0.03
# Time range: 2015-03-10 11:34:01 to 11:43:44
# Attribute    pct   total     min     max     avg     95%  stddev  median
# ============ === ======= ======= ======= ======= ======= ======= =======
# Count          8  547909
# Exec time      3    119s   100us   922ms   217us   424us      2ms   159us
# Lock time     10      31s    18us    10ms    56us   131us     97us    36us
# Rows sent      0 535.07k       1       1       1       1       0       1
# Rows examine   0 535.07k       1       1       1       1       0       1
# Rows affecte   0       0       0       0       0       0       0       0
# Rows read      0 535.07k       1       1       1       1       0       1
# Bytes sent    12   1.41G   2.62k   2.89k   2.71k   2.62k    6.83   2.62k
# Query size     5  78.87M     148     176  150.94  151.03    2.37  143.84
```

How many per second

query-digest: Output per Query

```
# Query 3: 939.81 QPS, 0.20x concurrency, ID 0x4A106EF2450AEAC1 at byte 2946778373

# Scores: V/M = 0.03
# Time range: 2015-03-10 11:34:01 to 11:43:44
# Attribute    pct   total     min     max     avg     95%  stddev  median
# ============ === ======= ======= ======= ======= ======= ======= =======
# Count          8  547909
# Exec time      3     119s   100us   922ms   217us   424us      2ms   159us
# Lock time     10      31s    18us    10ms    56us   131us     97us    36us
# Rows sent      0 535.07k       1       1       1       1       0       1
# Rows examine   0 535.07k       1       1       1       1       0       1
# Rows affecte   0       0       0       0       0       0       0       0
# Rows read      0 535.07k       1       1       1       1       0       1
# Bytes sent    12   1.41G   2.62k   2.89k   2.71k   2.62k    6.83   2.62k
# Query size     5  78.87M     148     176  150.94  151.03    2.37  143.84
```

pt-query-digest: per Query

Query ID

```
# Query 3: 939.81 QPS, 0.20x concurrency, ID 0x4A106EF2450AEAC1 at byte 2946778373

# Scores: V/M = 0.03
# Time range: 2015-03-10 11:34:01 to 11:43:44
# Attribute    pct   total     min     max     avg     95%  stddev  median
# ============ === ======= ======= ======= ======= ======= ======= =======
# Count          8  547909
# Exec time      3     119s   100us   922ms   217us   424us      2ms   159us
# Lock time     10      31s    18us    10ms    56us   131us     97us    36us
# Rows sent      0 535.07k       1       1       1       1       0       1
# Rows examine   0 535.07k       1       1       1       1       0       1
# Rows affecte   0       0       0       0       0       0       0       0
# Rows read      0 535.07k       1       1       1       1       0       1
# Bytes sent    12   1.41G   2.62k   2.89k   2.71k   2.62k    6.83   2.62k
# Query size     5  78.87M     148     176  150.94  151.03    2.37  143.84
```

pt-query-digest: Output per Query

Percent of Total

```
# Que                 , 0.20x concurrency, ID 0x4A106EF2450AEAC1 at byte 2946778373
# Scores: V/M =  0.03
# Time range: 2015-03-10 11:34:01 to 11:43:44
# Attribute    pct   total     min     max     avg     95%  stddev  median
# ============ === ======= ======= ======= ======= ======= ======= =======
# Count          8  547909
# Exec time      3     119s   100us   922ms   217us   424us      2ms   159us
# Lock time     10      31s    18us    10ms    56us   131us     97us    36us
# Rows sent      0 535.07k       1       1       1       1       0       1
# Rows examine   0 535.07k       1       1       1       1       0       1
# Rows affecte   0       0       0       0       0       0       0       0
# Rows read      0 535.07k       1       1       1       1       0       1
# Bytes sent    12   1.41G   2.62k   2.89k   2.71k   2.62k    6.83   2.62k
# Query size     5  78.87M     148     176  150.94  151.03    2.37  143.84
```

pt-query-digest: Output per Query

Total this query

```
# Query 3: 93[illegible]  0x concurrency, ID 0x4A106EF2450AEAC1 at byte 2946778373

# Scores: V/M = 0.0[illegible]
# Time range: 2015-03-10 11:34:01 to 11:43:44
# Attribute    pct   total     min     max     avg     95%  stddev  median
# ============ === ======= ======= ======= ======= ======= ======= =======
# Count          8  547909
# Exec time      3     119s   100us   922ms   217us   424us      2ms   159us
# Lock time     10      31s    18us    10ms    56us   131us     97us    36us
# Rows sent      0 535.07k       1       1       1       1       0       1
# Rows examine   0 535.07k       1       1       1       1       0       1
# Rows affecte   0       0       0       0       0       0       0       0
# Rows read      0 535.07k       1       1       1       1       0       1
# Bytes sent    12   1.41G   2.62k   2.89k   2.71k   2.62k    6.83   2.62k
# Query size     5  78.87M     148     176  150.94  151.03    2.37  143.84
```

pt-query-digest: Output per Query

```
# Query 3: 939.81 QPS, 0.20x concurrency, ID 0x4A106EF2450AEAC1 at byte 2946778373

# Scores: V/M = 0.03
# Time range: 2015-03-10 11:
# Attribute    pct   total     min     max     avg     95%  stddev  median
# ===========  ===  =======  ======= ======= ======= ======= ======= =======
# Count          8   547909
# Exec time      3     119s   100us   922ms   217us   424us      2ms   159us
# Lock time     10       31s    18us    10ms    56us   131us     97us    36us
# Rows sent      0  535.07k       1       1       1       1       0       1
# Rows examine   0  535.07k       1       1       1       1       0       1
# Rows affecte   0        0       0       0       0       0       0       0
# Rows read      0  535.07k       1       1       1       1       0       1
# Bytes sent    12    1.41G   2.62k   2.89k   2.71k   2.62k    6.83   2.62k
# Query size     5   78.87M     148     176  150.94  151.03    2.37  143.84
```

Stats

pt-query-digest: Output per Query

```
# String:
# Databases    sphere
# Hosts        dm1234 (90486/36%), dm2345 (79213/24%), ap3456 (77959/23%)
# Last errno   0
# Users        appuser01 (478323/87%), appuser02 (64465/11%), appuser03(5049/0%)
```

pt-query-digest: Output per Query

```
# Query_time distribution
#   1us
#  10us  ##
# 100us  ##################################################
#   1ms  ####
#  10ms  #
# 100ms  #
#    1s
#  10s+
```

pt-query-digest: Output per Query

```
# Tables
#    SHOW TABLE STATUS FROM `sphere` LIKE 'ApplicationUser'\G
#    SHOW CREATE TABLE `sphere`.`ApplicationUser`\G
#    SHOW TABLE STATUS FROM `sphere` LIKE 'Client'\G
#    SHOW CREATE TABLE `sphere`.`Client`\G
# EXPLAIN /*!50100 PARTITIONS*/
SELECT au.*, c.active, c.clientEndDate FROM ApplicationUser au JOIN Client c ON
au.clientId = c.clientId WHERE userId = 48954\G
```

pt-query-digest: Useful Switches

- **`--limit`**
- “Top-n” limit
- Percent and/or number of results
- `--limit 95%:20`
- `--limit 5`
- `--limit 10%`

pt-query-digest: Useful Switches

- **--show-all**
- Show all values in lists, not just what fits on one line

pt-query-digest: Useful Switches

- **`--order-by`**
- Specify how to sort the output
- Parameter is {*metric*}:{*function*}
- `--order-by Query_time:sum` *(default)*
- `--order-by Bytes_sent:sum` *(interface saturation?)*
- `--order-by Rows_examined:sum` *(Find table scans)*
- `--order-by Query-time:cnt` *(find high QPS)*

pt-query-digest: Useful Switches

- **`--explain`**
- Explain each query
- Specify where to connect for the Explain Plan queries
- `--explain h=myServer,P=3306,u=myUser,p=secret`

Generating Log Digests

First: Get *pt-query-digest*

```
wget percona.com/get/pt-query-digest
chmod +x pt-query-digest
```

Generating Log Digests

Then: Enable the slow log for a limited time

```
mysql -e'set global {all the settings from earlier}'
mysql -e'set global slow_query_log=1'
sleep 60
mysql -e'set global slow_query_log=0'
```

Generating Log Digests

Digest the resulting log…

```
./pt-query-digest /path/to/slow.log >digest.txt
```

Generating Log Digests (Periodic)

For 10 minutes:

- Enable the slow log
- Wait 30 seconds
- Disable the slow log
- Wait 30 seconds

Then…

```
pt-query-digest --limit 5 --explain h=…,P=…
    /path/to/slow.log   >digest.txt
```

Generating Log Digests (Emergency)

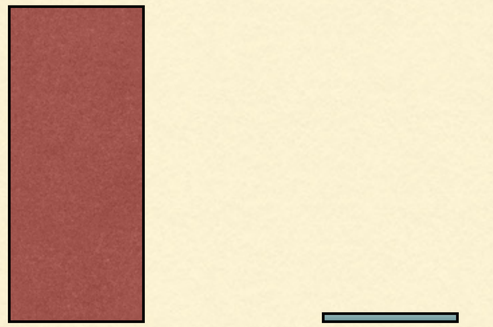
- Enable the slow log
- Wait 30 seconds
- Disable the slow log

Then…

```
pt-query-digest --show-all /path/to/slow.log >digest.txt
```

Interpreting Digested Logs

- Most important metric: **total** execution time

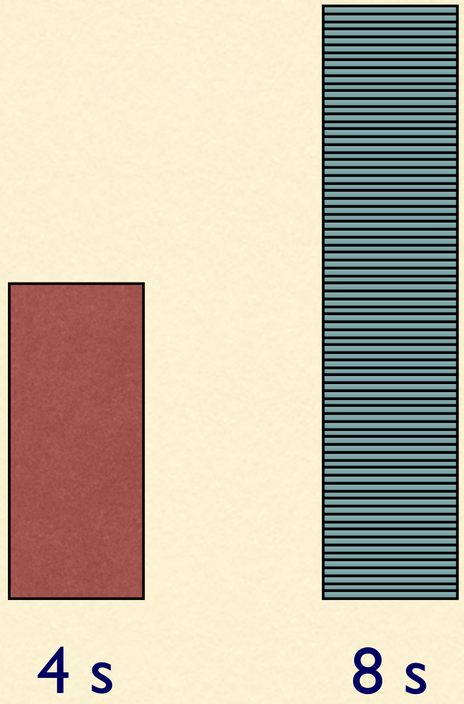


4 s

100 ms

Interpreting Digested Logs

- Most important metric: **total** execution time



pt-query-digest: Output

```
# Profile
# Rank Query ID           Response time   Calls   R/Call V/M    Item
# ==== ================== =============== ======= ====== ====== ==================================================
#    1 0x2AEA6C2B72904C1E  431.5703 13.4%    1578 0.2735   0.30 SELECT UNION Roles RoleGrants DefaultRolePermissions
#    2 0x97C874BC88FDB2E3  226.4475  7.0%      48 4.7177  49.80 SELECT Event EventAttribute
#    3 0x4A106EF2450AEAC1  119.0458  3.7%  547909 0.0002   0.03 SELECT ApplicationUser Client
#    4 0x00694E9F0A0CD23D  113.0377  3.5%     313 0.3611   0.05 SELECT ExtendedMediaTypeAttribute TopicFilter
#    5 0x813031B8BBC3B329  110.2512  3.4%  206088 0.0005   1.80 COMMIT
# MISC 0xMISC             2218.8264 68.7% 5600850 0.0004    0.0 <769 ITEMS>
```

pt-query-digest: Output

Single Most Important Metric

```
# Profile
# Rank Query ID           Response time  Calls   R/Call V/M    Item
# ==== ================== ============== ======= ====== ====== ==========================================================
#    1 0x2AEA6C2B72904C1E   431.5703 13.4%    1578 0.2735   0.30 SELECT UNION Roles RoleGrants DefaultRolePermissions
#    2 0x97C874BC88FDB2E3   226.4475  7.0%      48 4.7177  49.80 SELECT Event EventAttribute
#    3 0x4A106EF2450AEAC1   119.0458  3.7%  547909 0.0002   0.03 SELECT ApplicationUser Client
#    4 0x00694E9F0A0CD23D   113.0377  3.5%     313 0.3611   0.05 SELECT ExtendedMediaTypeAttribute TopicFilter
#    5 0x813031B8BBC3B329   110.2512  3.4%  206088 0.0005   1.80 COMMIT
# MISC 0xMISC              2218.8264 68.7% 5600850 0.0004    0.0 <769 ITEMS>
```

THEN look at each query, starting from the top

Interpreting Digested Logs (Steps)

- Generate Digest, sorted by total execution time per query
- Start with Query #1; work your way down
- Don't get distracted by other queries in the list, or not in the list
- Ignore the actual SQL until you start tuning

Interpreting Digested Logs (Steps)

Two main reasons for appearing on the list:

- High queries-per-second *(high enough that fast queries are making the list)*
- Expensive query *(not running often, but when they do…)*

And also…

- "Sort of expensive" — *fast enough, except when we run a lot of them*

Interpreting Digested Logs (examples)

```
# Rank Query ID           Response time  Calls   R/Call  V/M    Item
# ==== ================== ============== ======= ======= ====== ================================
#    1 0xA4129148F8ED32B2 607.1264 25.3%     255  2.3809   2.40 SELECT UserAttributes
#    2 0x2AEA6C2B72904C1E 389.5737 16.2%    1346  0.2894   0.24 SELECT UNION Roles RoleGrants
#    3 0xFB33D80D68CDD066 146.5731  6.1%   15175  0.0097   9.27 SELECT PostStatusException
#    4 0xC1EDA7581D372A3F 139.4136  5.8%       4 34.8534   1.35 SELECT TopicFilter FilterGroup
FilterQuery
```

Interpreting Digested Logs (example 1)

Reality-*based*…

Interpreting Digested Logs (example 1)

```
# Rank Query ID           Response time  Calls   R/Call  V/M    Item
# ==== ================== ============== ======= ======= ====== ==================================
#    1 0xA4129148F8ED32B2 607.1264 25.3%     255  2.3809   2.40 SELECT UserAttributes
#    2 0x2AEA6C2B72904C1E 389.5737 16.2%    1346  0.2894   0.24 SELECT UNION Roles RoleGrants
#    3 0xFB33D80D68CDD066 146.5731  6.1%   15175  0.0097   9.27 SELECT PostStatusException
#    4 0xC1EDA7581D372A3F 139.4136  5.8%       4 34.8534   1.35 SELECT TopicFilter FilterGroup
FilterQuery
```

Interpreting Digested Logs (example 1)

```
# Query 1: 0.45 QPS, 1.08x concurrency, ID 0xA4129148F8ED32B2 at byte 1012395036

# Scores: V/M = 2.40
# Time range: 2015-03-29 09:55:10 to 10:04:31
# Attribute    pct   total     min     max     avg     95%  stddev  median
# ============ === ======= ======= ======= ======= ======= ======= =======
# Count          0     255
# Exec time     25     607s     8ms      6s      2s      5s      2s      2s
# Lock time      0    135ms    21us     4ms    529us     2ms    793us     64us
# Rows sent      0   49.95k       0     372  200.58  346.17  160.67  346.17
# Rows examine   0    2.67M  10.73k  10.73k  10.73k  10.73k       0  10.73k
# Rows affecte   0        0       0       0       0       0       0       0
# Rows read      0    2.67M  10.73k  10.73k  10.73k  10.73k       0  10.73k
# Bytes sent     0    1.11M     339   7.96k   4.44k   7.31k   3.24k   7.31k
# Query size     0   30.37k     118     122  121.97  118.34    0.35  118.34
```

Interpreting Digested Logs (example 1)

```
# Query 1: 0.45 QPS, 1.08x concurrency, ID 0xA4129148F8ED32B2 at byte 1012395036

# Scores: V/M = 2.40
# Time range: 2015-03-29 09:55:10 to 10:04:31
# Attribute    pct   total     min     max     avg     95%  stddev  median
# ============ === ======= ======= ======= ======= ======= ======= =======
# Count          0     255
# Exec time     25     607s     8ms      6s      2s      5s      2s      2s
# Lock time      0    135ms    21us     4ms    529us     2ms    793us     64us
# Rows sent      0   49.95k       0     372  200.58  346.17  160.67  346.17
# Rows examine   0    2.67M  10.73k  10.73k  10.73k  10.73k       0  10.73k
# Rows affecte   0        0       0       0       0       0       0       0
# Rows read      0    2.67M  10.73k  10.73k  10.73k  10.73k       0  10.73k
# Bytes sent     0    1.11M     339   7.96k   4.44k   7.31k   3.24k   7.31k
# Query size     0   30.37k     118     122  121.97  118.34    0.35  118.34
```

Interpreting Digested Logs (example 1)

```
# Query 1: 0.45 QPS, 1.08x concurrency, ID 0xA4129148F8ED32B2 at byte 1012395036

# Scores: V/M = 2.40
# Time range: 2015-03-29 09:55:10 to 10:04:31
# Attribute    pct   total     min     max     avg     95%  stddev  median
# ============ === ======= ======= ======= ======= ======= ======= =======
# Count          0     255
# Exec time     25    607s     8ms      6s      2s      5s      2s      2s
# Lock time      0    135ms    21us     4ms    529us     2ms    793us     64us
# Rows sent      0  49.95k       0     372  200.58  346.17  160.67  346.17
# Rows examine   0   2.67M  10.73k  10.73k  10.73k  10.73k       0  10.73k
# Rows affecte   0       0       0       0       0       0       0       0
# Rows read      0   2.67M  10.73k  10.73k  10.73k  10.73k       0  10.73k
# Bytes sent     0   1.11M     339   7.96k   4.44k   7.31k   3.24k   7.31k
# Query size     0  30.37k     118     122  121.97  118.34    0.35  118.34
```

Interpreting Digested Logs (example 1)

```
# Query 1: 0.45 QPS, 1.08x concurrency, ID 0xA4129148F8ED32B2 at byte 1012395036

# Scores: V/M = 2.40
# Time range: 2015-03-29 09:55:10 to 10:04:31
# Attribute    pct   total     min     max     avg     95%  stddev  median
# ============ === ======= ======= ======= ======= ======= ======= =======
# Count          0     255
# Exec time     25     607s     8ms      6s      2s      5s      2s      2s
# Lock time      0    135ms    21us     4ms    529us     2ms    793us     64us
# Rows sent      0   49.95k       0     372  200.58  346.17  160.67  346.17
# Rows examine   0    2.67M  10.73k  10.73k  10.73k  10.73k       0  10.73k
# Rows affecte   0        0       0       0       0       0       0       0
# Rows read      0    2.67M  10.73k  10.73k  10.73k  10.73k       0  10.73k
# Bytes sent     0    1.11M     339   7.96k   4.44k   7.31k   3.24k   7.31k
# Query size     0   30.37k     118     122  121.97  118.34    0.35  118.34
```

Interpreting Digested Logs (example 1)

```
# Query_time distribution
#   1us
#  10us
# 100us
#   1ms  #
#  10ms  ##################################################
# 100ms  #######
#    1s  ##################################################
#  10s+
```

Interpreting Digested Logs (example 1)

```
select userId, clientId, userAttributeTypeId, value from UserAttributes
 where clientId = 23495 and userAttributeTypeId = 1\G

# *************************** 1. row ***************************
#            id: 1
#   select_type: SIMPLE
#         table: UserAttributes
#    partitions: NULL
#          type: ALL
# possible_keys: NULL
#           key: NULL
#       key_len: NULL
#           ref: NULL
#          rows: 11270
#         Extra: Using where
```

Interpreting Digested Logs (example 1)

```
select userId, clientId, userAttributeTypeId, value from UserAttributes
 where clientId = 23495 and userAttributeTypeId = 1\G

# *************************** 1. row ***************************
#            id: 1
#   select_type: SIMPLE
#         table: UserAttributes
#    partitions: NULL
#          type: ALL
# possible_keys: NULL
#           key: NULL
#       key_len: NULL
#           ref: NULL
#          rows: 11270
#         Extra: Using where
```

Interpreting Digested Logs (example 1)

```
select userId, clientId, userAttributeTypeId, value from UserAttributes
 where clientId = 23495 and userAttributeTypeId = 1\G

# *************************** 1. row ***************************
#            id: 1
#   select_type: SIMPLE
#         table: UserAttributes
#    partitions: NULL
#          type: ALL
# possible_keys: NULL
#           key: NULL
#       key_len: NULL
#           ref: NULL
#          rows: 11270
#         Extra: Using where
```

New index required.

Interpreting Digested Logs (example 2)

Reality-*based*…

Interpreting Digested Logs (example 2)

```
# Rank Query ID           Response time  Calls   R/Call  V/M    Item
# ==== ================== ============== ======= ======= ====== ================================
#    1 0xA4129148F8ED32B2 607.1264 25.3%     255  2.3809   2.40 SELECT UserAttributes
#    2 0x2AEA6C2B72904C1E 389.5737 16.2%    1346  0.2894   0.24 SELECT UNION Roles RoleGrants
#    3 0xFB33D80D68CDD066 146.5731  6.1%   15175  0.0097   9.27 SELECT PostStatusException
#    4 0xC1EDA7581D372A3F 139.4136  5.8%       4 34.8534   1.35 SELECT TopicFilter FilterGroup
FilterQuery
```

Interpreting Digested Logs (example 2)

```
# Query 2: 2.38 QPS, 0.69x concurrency, ID 0x2AEA6C2B72904C1E at byte 367386570

# Scores: V/M = 0.24
# Time range: 2015-03-29 09:55:08 to 10:04:34
# Attribute    pct   total     min     max     avg     95%  stddev  median
# ============ === ======= ======= ======= ======= ======= ======= =======
# Count          0    1346
# Exec time     16     390s     60ms       2s   289ms   740ms   265ms   141ms
# Lock time      0   762ms   228us    16ms   566us      1ms      1ms   348us
# Rows sent      0 379.60k       0  14.55k  288.79  346.17    1.71k     9.83
# Rows examine  42 192.12M     508   3.65M 146.16k 174.27k 563.30k    9.33k
# Rows affecte   0       0       0       0       0       0       0       0
# Rows read     42 192.12M     508   3.65M 146.16k 174.27k 563.30k    9.33k
# Bytes sent     0   4.17M      69 160.12k   3.17k   3.69k  18.78k  174.84
# Query size     0   3.45M   2.58k   2.63k   2.62k   2.62k      25   2.62k
```

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# Query size     0    3.45M   2.58k   2.63k   2.62k   2.62k      25   2.62k
```

Interpreting Digested Logs (example 2)

```
# Query_time distribution
#   1us
#  10us
# 100us
#   1ms
#  10ms  ################################
# 100ms  ##############################################################################
#    1s  #
#  10s+
```

Interpreting Digested Logs (example 2)

Index problem.

Interpreting Digested Logs (example 3)

Reality-*based*…

Interpreting Digested Logs (example 3)

```
# Rank Query ID           Response time  Calls   R/Call  V/M    Item
# ==== ================== ============== ======= ======= ====== ================================
#    1 0xA4129148F8ED32B2 607.1264 25.3%     255  2.3809   2.40 SELECT UserAttributes
#    2 0x2AEA6C2B72904C1E 389.5737 16.2%    1346  0.2894   0.24 SELECT UNION Roles RoleGrants
#    3 0xFB33D80D68CDD066 146.5731  6.1%   15175  0.0097   9.27 SELECT PostStatusException
#    4 0xC1EDA7581D372A3F 139.4136  5.8%       4 34.8534   1.35 SELECT TopicFilter FilterGroup
FilterQuery
```

Interpreting Digested Logs (example 3)

```
# Query 3:  26.48 QPS, 0.26x concurrency, ID 0xFB33D80D68CDD066 at byte 1736951949

# Scores: V/M = 9.27
# Time range: 2015-03-29 09:55:01 to 10:04:34
# Attribute    pct   total     min     max     avg     95%  stddev  median
# ============ === ======= ======= ======= ======= ======= ======= =======
# Count          0   15175
# Exec time      6     147s   105us     18s     10ms      1ms    299ms    152us
# Lock time      0    704ms     19us     11ms     46us     57us    232us     26us
# Rows sent     29  46.15M       0    4.64M    3.11k    30.19  93.65k        0
# Rows examine  11  52.57M       0    5.21M    3.55k    40.45 107.60k        0
# Rows affecte   0       0       0        0        0        0       0        0
# Rows read     11  52.57M       0    5.21M    3.55k    40.45 107.60k        0
# Bytes sent    12 879.86M     207   88.14M   59.37k   793.42   1.76M   202.40
# Query size     0   2.87M     185      530   198.43   212.52   49.09   183.58
```

Interpreting Digested Logs (example 3)

```
# Query 3: 26.48 QPS, 0.26x concurrency, ID 0xFB33D80D68CDD066 at byte 1736951949

# Scores: V/M = 9.27
# Time range: 2015-03-29 09:55:01 to 10:04:34
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# Rows affecte   0       0       0       0        0        0        0        0
# Rows read     11  52.57M       0    5.21M    3.55k    40.45  107.60k        0
# Bytes sent    12 879.86M     207   88.14M   59.37k   793.42    1.76M   202.40
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# Query size     0   2.87M     185      530   198.43  212.52   49.09   183.58
```

Interpreting Digested Logs (example 3)

```
# Query_time distribution
#   1us
#  10us
# 100us  ##############################################################
#   1ms  ###
#  10ms  #
# 100ms  #
#    1s  #
#  10s+  #
```

Interpreting Digested Logs (example 3)

```
select blogPostId, postStatusId from PostStatusException where topicFilterId in (560938,549993)
and publishedDate between '2014-05-02 22:34:22' and '2015-03-29 10:02:12'\G

# *************************** 1. row ***************************
#            id: 1
#   select_type: SIMPLE
#         table: PostStatusException
#    partitions: NULL
#          type: range
# possible_keys: PRIMARY,topicFilterPublishedDate
#           key: PRIMARY
#       key_len: 4
#           ref: NULL
#          rows: 13285286
#         Extra: Using where
```

Interpreting Digested Logs (example 3)

- **Acceptable index in this case.**
- **For this query, some predicates naturally return large result sets.**

Interpreting Digested Logs (example 4)

Not reality-based…
But sometimes happens!

Interpreting Digested Logs (example 4)

```
# Query 2: 826.48 QPS, 8.26x concurrency, ID 0x4B33D80D68CDD066 at byte 176951949

# Scores: V/M = 1.27
# Time range: 2015-03-29 09:55:01 to 10:04:34
# Attribute    pct   total     min     max     avg     95%  stddev  median
# ============ === ======= ======= ======= ======= ======= ======= =======
# Count          0  915175
# Exec time     26    205s   105us   802us   224us   118us    99us   198us
# Lock time      0   704ms    19us    91us    46us    57us   232us    26us
# Rows sent     29  46.15M       0    4.64    3.11    3.19    2.05       0
# Rows examine  11  52.57M       0    5.21    3.55    4.45    2.60       0
# Rows affecte   0       0       0       0       0       0       0       0
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Interpreting Digested Logs (example 4)

```
# Query 2: 826.48 QPS, 8.26x concurrency, ID 0x4B33D80D68CDD066 at byte 176951949

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# Rows read     11  52.57M       0   5.21M    3.55   40.45  107.60       0
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# Query size     0  22.87M     185     530  198.43  212.52   49.09  183.58
```

Interpreting Digested Logs (other cases)

```
# Databases    schema1 (813422/89%), schema2 (101753/11%)
# Hosts        ap1234 (813323/89%), ap2345 (89429/10%), ap3456 (12324/1%)
# Last errno   0
# Users        user1 (813422/89%), user2 (101753/11%)
```

Interpreting Digested Logs (other cases)

```
# Databases    schema1 (813422/89%), schema2 (101753/11%)
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```
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# Last errno    0
# Users         user1 (813422/89%), user2 (101753/11%)
```

Talk to developers, verify logic

Talk to Operations, verify traffic pattern

Trending

- Spreadsheet
- Set up database to accept pt-query-digest output (see `--review` and `--history` switches)

Other Slow Log Analyses

Finding Outliers

- Reports of a slow query that doesn't make it in the log digest

```
# Query_time: 0.019128  Lock_time: 0.009394  Rows_sent: 1  Rows_examined: 200  Rows_affected: 0
# Bytes_sent: 267
SET timestamp=1427633533;
select * from actor where first_name='JOHN';
```

- Dump out all access times from the slow log for this query:

```
grep -B 3 'select \* from actor where first_name' slow.log | \
  grep Query | cut -f3 -d' ' | tr -d . >file
```

Other Slow Log Analyses

Finding Outliers

- Reports of a slow query that doesn't make it in the log digest

```
# Query_time: 0.019128  Lock_time: 0.009394  Rows_sent: 1  Rows_examined: 200  Rows_affected: 0
# Bytes_sent: 267
SET timestamp=1427633533;
select * from actor where first_name='JOHN';
```

- *Go right nuts:* Dump out all access times from the slow log for this query, including timestamps:

```
grep -B 3 'select \* from actor where first_name' slow.log | \
  grep -E 'Query|timestamp' | cut -f2,3 -d' ' | tr '=' ' ' | \
  (while read Q T; do read TS; echo $TS $T; done) | \
  cut -f2,3 -d' ' | tr -d ';' >file
```

Extra Reading / Resources

- Percona Docs
  - http://www.percona.com/doc/percona-server/5.5/diagnostics/slow_extended_55.html
  - http://www.percona.com/doc/percona-server/5.1/diagnostics/slow_extended.html?id=percona-server:features:slow_extended_51
  - http://www.percona.com/doc/percona-toolkit/2.2/pt-query-digest.html
- MySQL Docs
  - http://dev.mysql.com/doc/refman/5.5/en/slow-query-log.html
- Slides, and script to safely do periodic slow log digests
  - bit.ly/BobBurgessPercona2015

Thank You!

Bob Burgess

rburgess@salesforce.com

bit.ly/BobBurgessPercona2015

Please fill out the session evaluation!