The Five Minute DBA

MySQL User Conference 2010

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About Us...

- http://www.percona.com
- http://MysqlPerformanceBlog.com
- http://www.bigdbahead.com

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Principal Architect

Who is a five minute dba

- A five minute dba is someone who is not a database administrator by trade, but rather is drafted into the role out of necessity
- Typically they have development skills or General system administration skills
- These are the jacks of all trades

When do you become a DBA

- When it hits the fan of course!

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Disclaimer!

Its important to distinguish this up front:

- I am giving you the easy answers, which are not always the correct answers..
- If you only have 5 minutes to spend on one of these database topics, you lose a lot of flexibility
- I could spend lots of time talking about everything here, instead I am focusing on maximizing your benefit.

Common Mistakes

- Running old outdated buggy versions
- Default Configuration
- Inadequate resources (shared or dedicated)
- Not Enough Memory
- Over-allocation of Memory
- Treating the database like a black box
- Poorly written & optimized queries
- Too many queries
- Too many Connections

Performance Analysis

- Define what is slow (as low level as possible): single page, entire app, writing data, reading data etc.
  - Understand your workload
  - Response time
- You want to target your specific problem, however reviewing your entire stack is a good thing
- Don't tune via google (each problem is unique)
- Use Tools available to you

Tuning walk through

- Define what is slow? If its a single page, the process is drastically different then if its general slowness.
  - Assume General Slowness
- #1 What has changed? A new deployment? More users? Etc? Sometimes a roll-back of a buggy code release is the best fix.
  - DO NOT ASSUME ITS THE DATABASE!
- I do a quick review of the obvious:
  -

Versions?

- MySQL 4.0
- MySQL 5.0
- MySQL 5.1
- MySQL 5.4/5.5
- Percona Server
- MariaDB
- OurDelta

Storage Engine Selection

- Innodb
- Innodb Plugin
- XtraDB
- MyISAM
- Maria
- Many Many more....

Hardware & OS

- Old Kernel?
- Multi-core servers, scalability getting better (~16 cores +)
- Fit your hot data into memory!
  - Typically more memory is better
- IO is a Major bottleneck
  - RAID For your databases is a must
  - Battery Backed Controller
  - RAID 10 typically better then RAID 5
  - SSD's for optimal performance
- Network should not be forgotten

Tuning Walk through

- Next I start by looking at the server (Sar, vmstat, top, iostat -x)
  - Too much io, maybe not enough memory, missing indexes, or bad config
  - Cpu maxed out could be lots of users, lots of concurrent queries, or something else.
  - Is the problem even MySQL? Often times we see issues with non-database software
  - top process is something else (i.e. apache, php, cron job, etc)
  - Network is often overlooked

Operating System Tools

- Sysstat
  - Iostat
  - Sar
- Vmstat
- Top
-

SYSSTAT

- Sar is your friend, every unix/linux server should setup sar to collect stats in the background.
  - Sar Can give you historical reports on : CPU, Disk, Memory, Network, and a lot more.
  - Scheduled to collect data via cron
  -
- Iostat is valuable in gauging disk performance
  - avwait+svctim = response time (iostat -x)

Sar Network Stats

```
matt@matt-desktop:~$ sar -n DEV 1
Linux 2.6.31-15-generic (matt-desktop)  04/07/2010     _i686_    (2 CPU)

09:35:40 PM     IFACE   rxpck/s   txpck/s    rxkB/s    txkB/s   rxcmp/s   txcmp/s  rxmcst/s
09:35:41 PM        lo      0.00      0.00      0.00      0.00      0.00      0.00      0.00
09:35:41 PM      eth1  38472.00  38467.00   2960.72  27532.34      0.00      0.00      0.00
09:35:41 PM      eth0     11.00      3.00      2.35      0.41      0.00      0.00      0.00

09:35:41 PM     IFACE   rxpck/s   txpck/s    rxkB/s    txkB/s   rxcmp/s   txcmp/s  rxmcst/s
09:35:42 PM        lo      0.00      0.00      0.00      0.00      0.00      0.00      0.00
09:35:42 PM      eth1  38441.58  38443.56   2969.10  27494.13      0.00      0.00      0.00
09:35:42 PM      eth0      0.99      0.99      0.07      0.47      0.00      0.00      0.00

09:35:42 PM     IFACE   rxpck/s   txpck/s    rxkB/s    txkB/s   rxcmp/s   txcmp/s  rxmcst/s
09:35:43 PM        lo      0.00      0.00      0.00      0.00      0.00      0.00      0.00
09:35:43 PM      eth1  39780.00  39777.00   3070.57  28451.08      0.00      0.00      0.00
09:35:43 PM      eth0      2.00      1.00      0.13      0.47      0.00      0.00      0.00
```

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Sar CPU

```
matt@matt-desktop:~$ sar 1
Linux 2.6.31-15-generic (matt-desktop)  04/07/2010     _i686_    (2 CPU)

09:37:20 PM     CPU     %user     %nice   %system   %iowait    %steal     %idle
09:37:21 PM     all      0.51      0.00      0.00      0.00      0.00     99.49
09:37:22 PM     all      0.00      0.00      0.50      0.00      0.00     99.50
09:37:23 PM     all      0.00      0.00      0.50      0.00      0.00     99.50
09:37:24 PM     all      0.00      0.00      0.00      0.00      0.00    100.00
09:37:25 PM     all      0.00      0.00      0.50      0.00      0.00     99.50
09:37:26 PM     all      0.00      0.00      0.00      0.00      0.00    100.00
09:37:27 PM     all      0.00      0.00      0.50      0.00      0.00     99.50
```

Sar Memory

```
matt@matt-desktop:~$ sar -r 1
Linux 2.6.31-15-generic (matt-desktop)  04/07/2010     _i686_    (2 CPU)

09:38:53 PM kbmemfree kbmemused  %memused kbbuffers  kbcached  kbcommit   %commit
09:38:54 PM    665232   1395448     67.72       864    193856   1523272     44.77
09:38:55 PM    665232   1395448     67.72       864    193856   1523272     44.77
09:38:56 PM    665232   1395448     67.72       864    193856   1523272     44.77
09:38:57 PM    665232   1395448     67.72       864    193856   1523272     44.77
09:38:58 PM    665232   1395448     67.72       864    193856   1523272     44.77
09:38:59 PM    665232   1395448     67.72       864    193856   1523272     44.77
09:39:00 PM    665232   1395448     67.72       864    193856   1523272     44.77
09:39:01 PM    664108   1396572     67.77       896    194588   1523360     44.78
09:39:02 PM    664108   1396572     67.77       896    194588   1523360     44.78
09:39:03 PM    664108   1396572     67.77       896    194588   1523360     44.78
```

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IOSTAT

```
matt@matt-desktop:~$ iostat -x 1
Linux 2.6.31-15-generic (matt-desktop)    04/07/2010  _i686_      (2 CPU)

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           0.38    0.04    0.48    0.02    0.00   99.08

Device:         rrqm/s   wrqm/s     r/s     w/s   rsec/s   wsec/s avgrq-sz avgqu-sz   await  svctm  %util
sda               0.10    30.82    0.17    0.44    11.77   250.03   428.22     0.02   28.10   2.17   0.13

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
          56.00    0.00   37.50    6.50    0.00    0.00

Device:         rrqm/s   wrqm/s     r/s     w/s   rsec/s   wsec/s avgrq-sz avgqu-sz   await  svctm  %util
sda              30.00 12497.00   11.00  102.00   424.00 86640.00   770.48     7.11   58.55   3.68  41.60

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
          38.31    0.00   29.35   19.90    0.00   12.44

Device:         rrqm/s   wrqm/s     r/s     w/s   rsec/s   wsec/s avgrq-sz avgqu-sz   await  svctm  %util
sda              19.00 12004.00   10.00  130.00   232.00 111208.00   796.00    10.98   81.94   3.94  55.20
```

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VMSTAT

- Can give you a realtime view of changes on the system to CPU/Memory
-

```
# vmstat 1
procs -----------memory---------- ---swap-- -----io---- -system-- ----cpu----
 r  b   swpd   free   buff  cache   si   so    bi    bo   in   cs us sy id wa
 0  0     96  10856  91496 625748    0    0     3     8    1    2  0  0 100  0
 0  0     96  10856  91496 625772    0    0     0     0  327   22  0  0 100  0
 0  0     96  10856  91496 625772    0    0     0     0  295   18  0  0 100  0
 0  0     96  10856  91496 625772    0    0     0     0  320   19  0  0 100  0
 0  0     96  10856  91496 625772    0    0     0     0  291   16  0  0 100  0
 0  0     96  10856  91496 625772    0    0     0     0  301   21  0  0 100  0
 0  0     96   9116  91496 625772    0    0     0     0  304   47  0  0 100  0
 0  0     96   9092  91496 625772    0    0     0     0  349   34  0  0 100  0
 0  0     96   9100  91496 625772    0    0     0     0  302   16  0  0 100  0
```

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TOP

- Get a current Snapshot of running processes

```
Tasks: 159 total,   2 running, 157 sleeping,   0 stopped,   0 zombie
Cpu(s): 15.3%us, 15.5%sy,  0.0%ni, 54.6%id,  0.8%wa,  3.3%hi, 10.6%si,  0.0%st
Mem:   2060680k total,  1303952k used,   756728k free,      664k buffers
Swap:  1341388k total,       64k used,  1341324k free,   102512k cached

  PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
 9460 root      20   0 1028m 1.0g  524 R   90 51.0   2:10.80 redis-server
 9544 matt      20   0  2468 1184  884 R    0  0.1   0:00.03 top
    1 root      20   0  2528 1116  768 S    0  0.1   0:01.07 init
    2 root      15  -5     0    0    0 S    0  0.0   0:00.00 kthreadd
    3 root      RT  -5     0    0    0 S    0  0.0   0:00.01 migration/0
    4 root      15  -5     0    0    0 S    0  0.0   0:00.04 ksoftirqd/0
    5 root      RT  -5     0    0    0 S    0  0.0   0:00.00 watchdog/0
    6 root      RT  -5     0    0    0 S    0  0.0   0:00.01 migration/1
```

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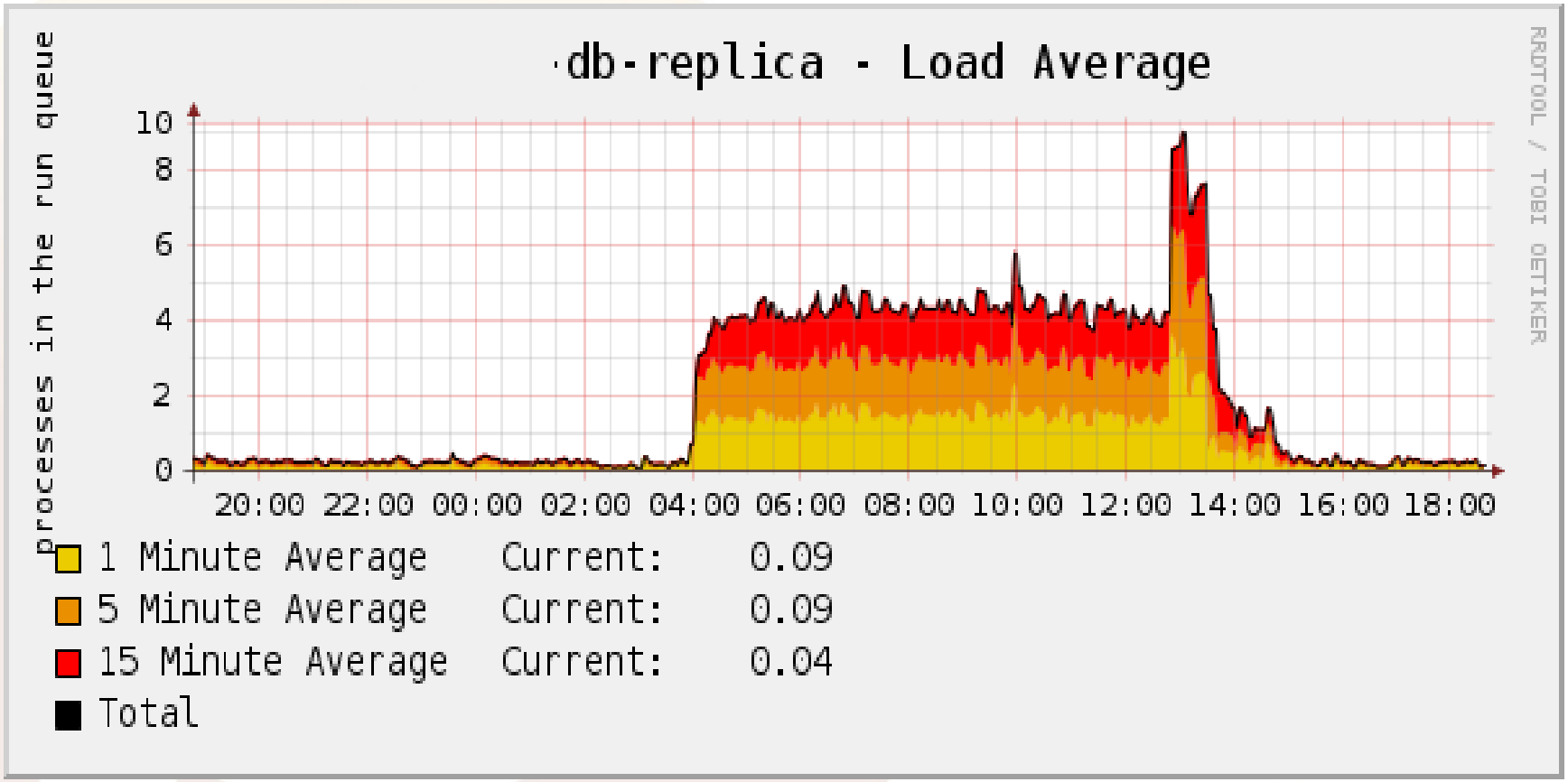
cacti

- Great Visual Presentation of Historical Stats
  - MySQL, Apache, Sphinx, Memcached, (Entire Stack)
- Baron Wrote and Maintains the MySQL Templates
- Can add a lot of value...

- Example:
  Mysterious Slowdown

Last night

- OMG The Server was sooo slow



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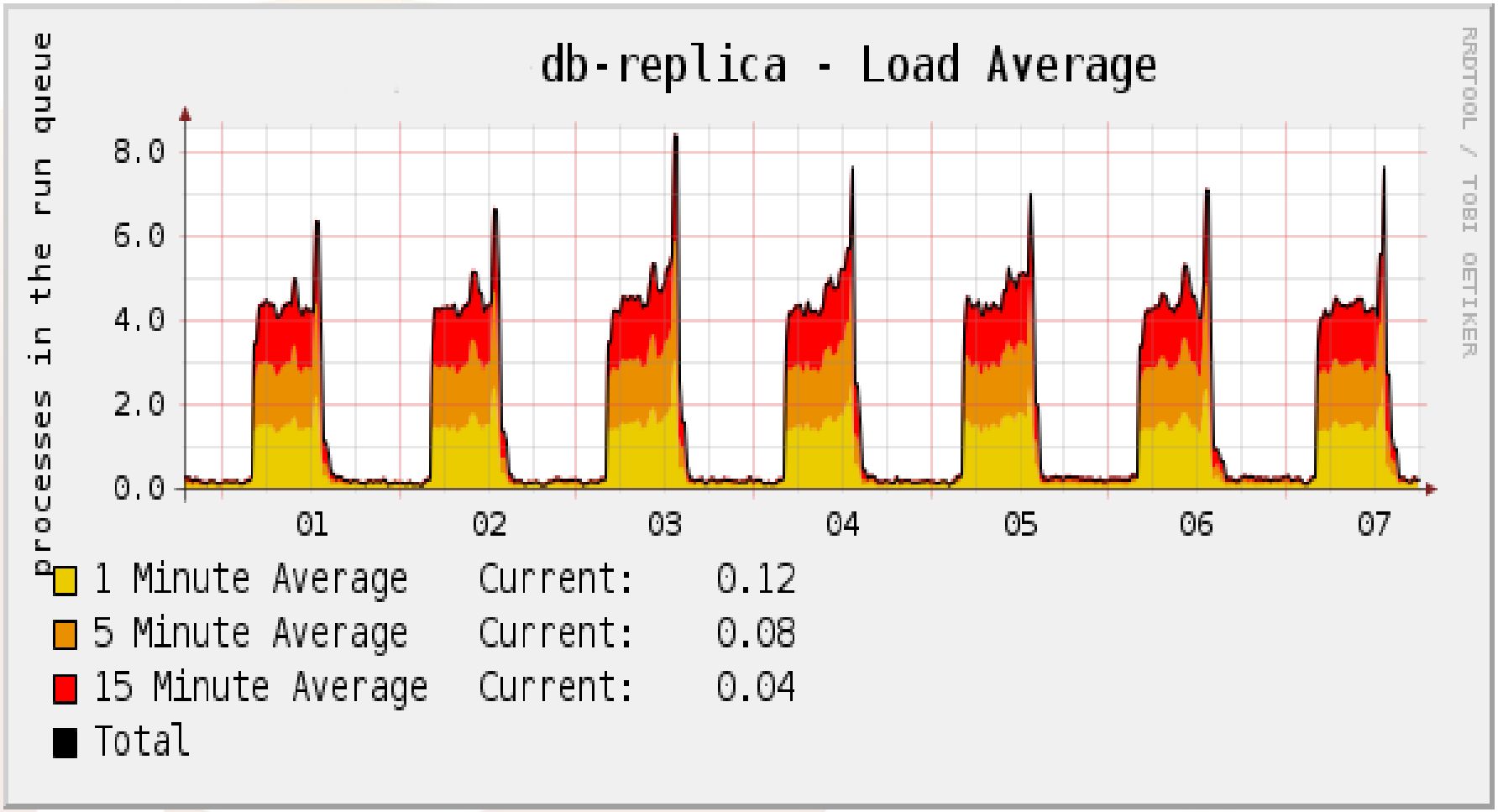
Last Night Dig Deeper



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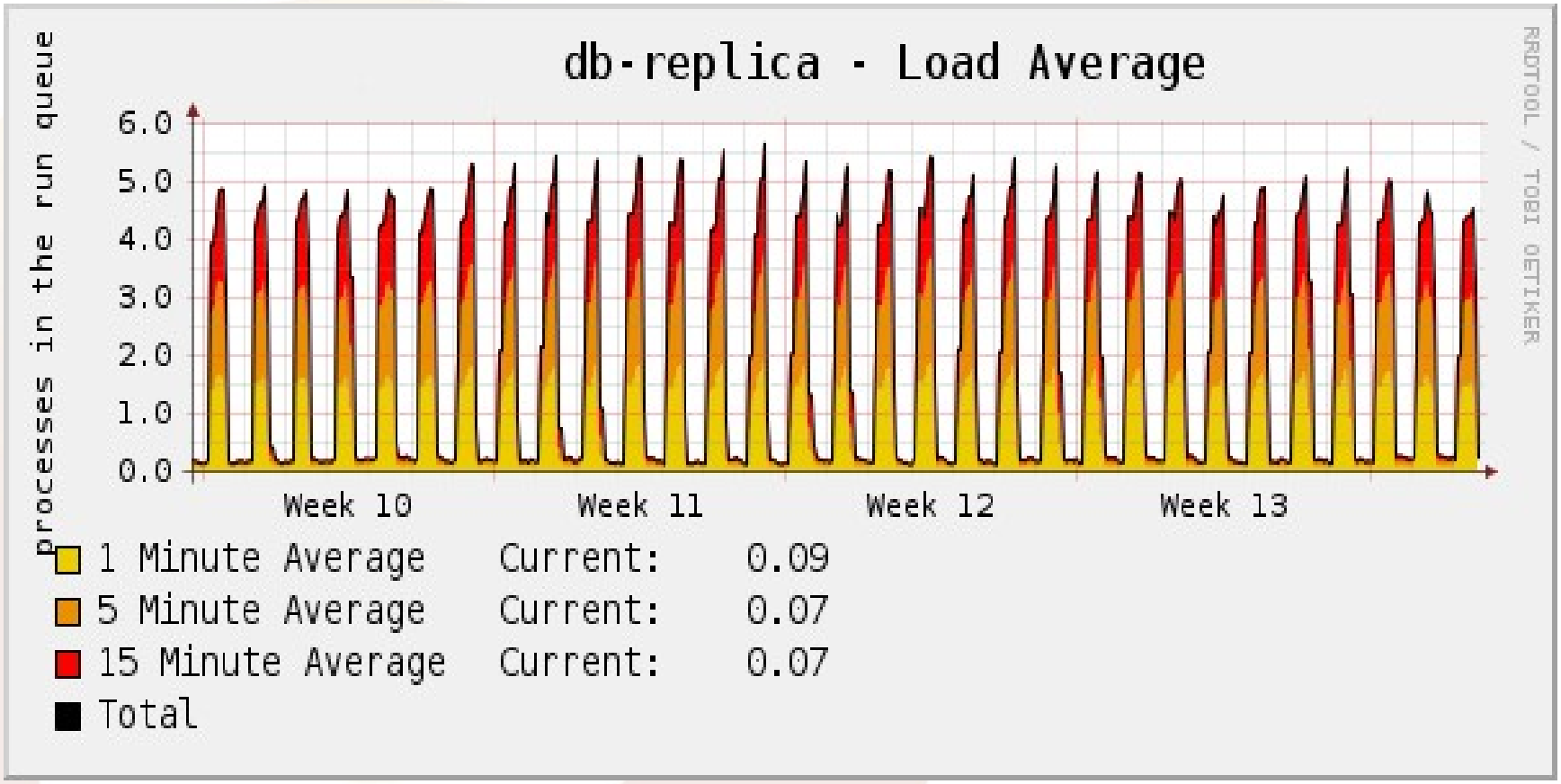
And Even Deeper



Oops slow down was the nightly backup....

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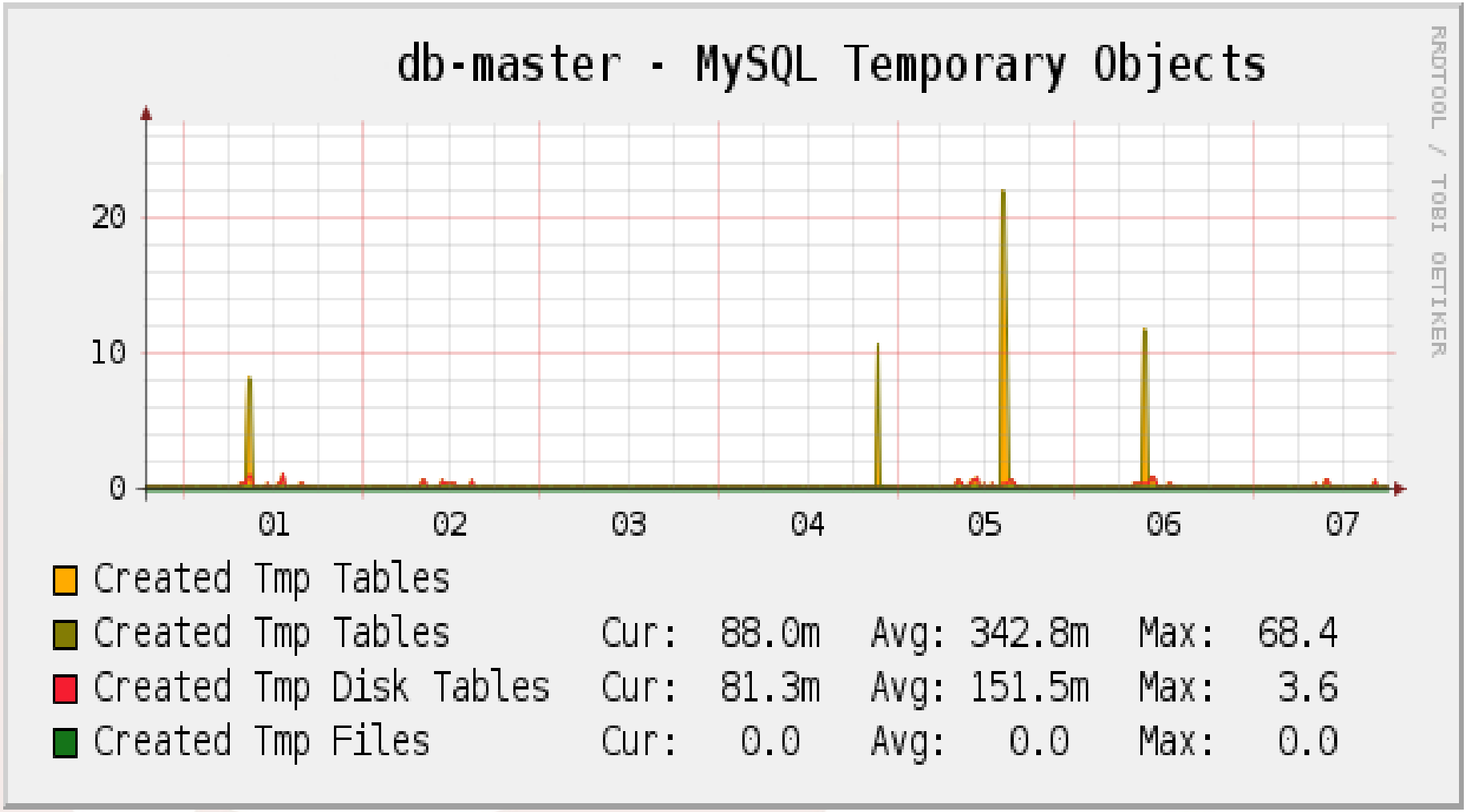
#2 Slowdown



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Tuning Walk Through

- Do a quick review of the configuration parameters, making sure that the values are set to something reasonable.

Top General Config Parms

- query_cache_size (Disable in many versions)
- log_slow_queries
  - long_query_time
- max_connections
- expire_logs_days

MyISAM

- key_buffer_size

Top Innodb Config Parms

- innodb_buffer_pool_size
- innodb_flush_log_at_trx_commit
- innodb_log_file_size

Plugin/Mysql 5.5+/XtraDB Specific

- innodb_io_capacity
- innodb_read_ahead
-

Memory and Swapping

- Disk IO is bad, Avoiding swapping things that should be in memory to disk (do not disable swap however)
- read_buffer, read_rnd_buffer, sort_buffer, join_buffer are all allocated per thread so be careful!
- You want temp tables to be built in memory not on disk (TMPFS?):

```
| Created_tmp_disk_tables  |  48  |
| Created_tmp_files        |   5  |
| Created_tmp_tables       | 229  |
```

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Tuning walk through

- Next I typically see whats running in the data, with show processlist and show innodb status.
  - What is happening right now? Is there long running queries? Are there excessive locks?
  - If the slowdown was in the past, and not now I will analyze the slow query logs

Database Specific Tools

- Mysql
  - “show full processlist”
  - “show global status”
  - “Show innodb status”
- Mysqladmin
- Slow Query Log
  - Mk-query-digest
  - Mysqldumpslow
- Innotop
- Mytop
- mext

Show Processlist

```
mysql> show processlist\G
*************************** 1. row ***************************
     Id: 52
   User: bench
   Host: domU-12-31-39-0C-41-81.compute-1.internal:42315
     db: simple_benchmark
Command: Sleep
   Time: 0
  State:
   Info: NULL
*************************** 14. row ***************************
     Id: 65
   User: bench
   Host: domU-12-31-39-0C-41-81.compute-1.internal:42328
     db: simple_benchmark
Command: Query
   Time: 0
  State: init
   Info: insert into simple_benchmark.simple_comments (lookup_id, comment, mydate) values ( '8519163', 'Comme
*************************** 15. row ***************************
     Id: 66
   User: bench
   Host: domU-12-31-39-0C-41-81.compute-1.internal:42329
     db: simple_benchmark
Command: Sleep
   Time: 0
  State:
   Info: NULL
```

MYSQLADMIN

- Mysqladmin extended -r -i1 will give you mysql stats at 1 second intervals, change the -i to increase decrease...
- A few stats of note:
  -
    - Created_tmp_disk_tables
    - Created_tmp_tables
    - Innodb_rows_deleted
    - Innodb_rows_inserted
    - Innodb_rows_read
    - Innodb_rows_updated
    - Qcache_hits
    - Qcache_inserts
    - Questions

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mext

- Mext can take the output from mysqladmin and put the status variables side by side, this makes it very convenient to look for differences

```
 ./mext -- mysqladmin ext -uroot -p -ri10 -c5
Enter password:
Aborted_clients                          414        0        0        0        0
Aborted_connects                        5567        0        0        1        0
Binlog_cache_disk_use                    143        0        0        0        0
Binlog_cache_use                     1684365      137      103      121      103
Bytes_received                    6573889322  1019405   976357  1004167  1049549
[cut]
Com_alter_table                         38510        0        3        2        0
Com_delete                            8565850      211      181      170      170
[cut]
Com_drop_table                          25934        0        2        1        0
[cut]
Com_insert                           18209688      431      332      400      382
Com_insert_select                     2746057        0        0        0        0
[cut]
Com_select                           20053974     2304     2175     2257     2363
```

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Slow Query Log

- The Slow Query log is your friend! As mentioned earlier queries that take over a certain amount of time are logged here. (Percona Patches for complete picture)
- Summarize the slow query log with Maatkit, mk-query-digest or mysqldumpslow if maatkit is not available
- Look for not only the longest running query, but also the one with lots of executions and cumulated time

Mk-Query-Digest Sample output

```
# Rank Query ID           Response time    Calls   R/Call     Item
# ==== ================== ================ ======= ========== ====
#    1 0x8C7EB27BB63FF462 151160.7560 20.7%   71573   2.1120 SELECT inventory?_? items
#    2 0x63492E9334BB2FC6 138992.1057 19.0%   48642   2.8575 SELECT inventory?_? items
#    3 0x5944495FF54B5660 92821.6612 12.7%   21195   4.3794 SELECT inventory?_? items
#    4 0x91C4D337AA26ACC3 70416.1841  9.6%   11453   6.1483 SELECT friends
#    5 0x3D9076526CC5050F 51275.8723  7.0%    9777   5.2445 SELECT inventory?_? items
#    6 0x31BCEC4EC58F55DA 29466.2476  4.0%    9719   3.0318 SELECT inventory?_? outfit_items items
#    7 0x2FF2EA7DB37919C1 25728.2731  3.5%   11822   2.1763 SELECT markings
#    8 0xB8E818280406E88F 22495.9115  3.1%    9440   2.3830 SELECT quests quest_status
```

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Mk-Query-digest

```
# Query 2: 1.24 QPS, 3.54x concurrency, ID 0x63492E9334BB2FC6 at byte 868762
# This item is included in the report because it matches --limit.
#              pct   total     min     max     avg     95%  stddev  median
# Count         18   48642
# Exec time     18 138992s      1s     25s      3s      7s      2s      2s
# Lock time     29     40s    24us   219ms   815us   568us     8ms   103us
# Rows sent     16   1.18M       0     109   25.49   62.76   16.46   20.43
# Rows exam      0   2.36M       0     218   50.97  124.25   32.93   40.45
# Users                 1 user1
# Hosts                10 db1... (7420), db1... (6991)... 8 more
# Databases             2 userdata2 (26716), userdata4 (21926)
# Time range 2009-11-20 23:59:04 to 2009-11-21 10:52:38
# bytes         13   7.37M     156     160  158.98  158.58       2  158.58
# Query_time distribution
#   1us
#  10us
# 100us
#   1ms
#  10ms
# 100ms
#    1s  ################################################################
#  10s+  #
# Tables
#    /* read */ SHOW TABLE STATUS FROM `user` LIKE 'inentory'\G
#    /* read */ SHOW CREATE TABLE `user`.`inventory`\G
#    /* read */ SHOW TABLE STATUS FROM `user` LIKE 'items'\G
#    /* read */ SHOW CREATE TABLE `user`.`items`\G
# EXPLAIN
SELECT name, url, item_id, items.type, stype, level FROM inventory
 INNER JOIN items USING (item_id) WHERE (owner_id = 323 AND status = 'p')\G
```

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Other Tools

- Innotop and mytop: These give a nice top like interface to show you whats happening in the database at the current moment (i.e. running queries, current stats, etc)
- New Relic is awesome for Rails...
-

Memcached?

- Review: More memory the better
- Caching frequently used data is an excellent way to boost performance
- This typically requires changes to your app
- Performance improvement can be dramatic

Tuning walk through

- Review the slow query log, parse the log with mk-query-digest.
- If I see something here, I will analyze it
- If your still at a loss, try using tcpdump to dump SQL statements into mk-query-digest and look for repeated queries. (Easier then the general query log if you need sub second slow queries).

Query Tuning

- Use Explain Plan
- Add Indexes where needed, do not over index
  - mk-duplicate-key-checker
- Lots of small queries can sometimes be more impactful than 1 big one.

Query Tuning

```
mysql> explain SELECT `userid` AS `userid` FROM `user` WHERE `b_id`='301965'  ;

+----+-------------+-----------+------+---------------+------+---------+------+------+-------------+
| id | select_type | table     | type | possible_keys | key  | key_len | ref  | rows | Extra       |
+----+-------------+-----------+------+---------------+------+---------+------+------+-------------+
|  1 | SIMPLE      | user      | ALL  | NULL          | NULL | NULL    | NULL | 9774 | Using where |
+----+-------------+-----------+------+---------------+------+---------+------+------+-------------+
1 row in set (0.00 sec)
```

- Notice Full scan
- 9K+ rows each run

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Add Index

```
mysql> explain SELECT `userid` AS `userid` FROM `user` WHERE `b_id`='301965'  ;

+----+-------------+------------+------+---------------+------+---------+------+------+-------------+
| id | select_type | table      | type | possible_keys | key  | key_len | ref  | rows | Extra       |
+----+-------------+------------+------+---------------+------+---------+------+------+-------------+
|  1 | SIMPLE      | user       | ALL  | NULL          | NULL | NULL    | NULL | 9774 | Using where |
+----+-------------+------------+------+---------------+------+---------+------+------+-------------+
1 row in set (0.00 sec)

mysql> alter table user add key (b_id);


Query OK, 10062 rows affected (0.31 sec)
Records: 10062  Duplicates: 0  Warnings: 0

mysql> explain SELECT `blocked` AS `userid` FROM `user` WHERE `b_id`='301965'  ;
+----+-------------+------------+------+---------------+---------+---------+-------+------+-------+
| id | select_type | table      | type | possible_keys | key     | key_len | ref   | rows | Extra |
+----+-------------+------------+------+---------------+---------+---------+-------+------+-------+
|  1 | SIMPLE      | user       | ref  | b_id          | b_id    | 4       | const |    1 |       |
+----+-------------+------------+------+---------------+---------+---------+-------+------+-------+
1 row in set (0.00 sec)
```

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Questions?

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