LSM Application Tuning

Procedures
v.1.0, 12/11/2009, Dan Graham

*This document describes the first round of performance tuning
enhancements to the Linux System Monitor.*

Introduction

The LSM application was installed in production, in the first week of
December. However, there were performance problems, immediately
evident with both the GUI and back-end processes. This document
describes a profiling tool (profiler.pl) that was developed for
MySQL. Also, described are the changes to the LSM application (mostly
database indexing design) that resulted in large performance gains
for the GUI and the server. These changes will be put into production
on 12/14/2009.

Overview

Good database design is the most important criteria for good
performance. The LSM application was using several single-column
indexes on each table. However, it was noted that MySQL can only use
one index at a time during queries. So, the indexing schema was
replaced with several multi-column indexes that improve lookup speed.
After reviewing the built-in profiling tools for MySQL, it was
decided to write a simple profiling tool that was more suited to the
purpose of tuning this application. This tool allowed monitoring of
many queries in a back-end process – tracking number of milliseconds
for each query pattern, which could then be taken individually into
MySQL command line and "explain"ed. The treeSelector GUI set-up time
was taken from **2.3 minutes down to 6.5 seconds**. A back-end
aggregation was taken from **26.7 minutes down to 14.4 minutes**. It is
hoped that these speedups will be more dramatic with larger data-sets
due to the indexing. (For example, reducing the 3-minute+ wait on the
GUI currently in production to seconds. And, also reducing the
multiple hour aggregations to minutes.)

The other problem with the LSM application is the large sizes of the
tables involved. Currently in production, there are millions of rows
in the hourly_agg table, for example. The vast majority of these rows
are due to the "Network Utilization" statistics. It is believed that
the large quantity of these statistics are due to the fact that the
interface may be running in "promiscuous" mode and picking up not
just the network traffic for cfg0, but for all of the devices and
servers on the St. Paul network. The "-p" option will be introduced,
next week, on the "trafshow" command that the probe is running, to

take it out of promiscuous mode.

GUI Speedup 1 (TreeSelector)

An improved indexing strategy was used in the database design. In addition, based on "explain", the "USE INDEX" hint was used in the code. Only the first and last profiles will be listed, here. The program "profiler.pl" in the Appendix was used.

Table 1: Profile of TreeSelector GUI prior to speedup

SQL Statement	Number of Milliseconds
	84575
select info from processlist	83147
select distinct Key11 from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and time_month=str_to_date('?', '?') order by Key11	47555
select distinct Key10 from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and time_month=str_to_date('?', '?') order by Key10	5623
select distinct TKey12 from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' and TKey7='?' and TKey8='?' and TKey9='?' and TKey10='?' and TKey11='?' order by TKey12	630
select distinct Key9 from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and time_month=str_to_date('?', '?') order by Key9	561
select TopId from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' and TKey7='?' and TKey8='?' and TKey9='?' and TKey10='?' and TKey11='?' and TKey12='?' and TKey13='?' and TKey14='?' and TKey15='?'	451

select distinct Key8 from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and time_month=str_to_date('?', '?') order by Key8	447
select distinct TKey11 from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' and TKey7='?' and TKey8='?' and TKey9='?' and TKey10='?' order by TKey11	298
select TKeyDesc11 from topo_desc where TopId='?'	216
select distinct Key7 from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and time_month=str_to_date('?', '?') order by Key7	124
select distinct TKey9 from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' and TKey7='?' and TKey8='?' order by TKey9	113
select distinct TKey10 from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' and TKey7='?' and TKey8='?' and TKey9='?' order by TKey10	110
select distinct Key6 from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and time_month=str_to_date('?', '?') order by Key6	107
select TKeyDesc10 from topo_desc where TopId='?'	62
select distinct TKey2 from topo_def where TKey1='?' order by TKey2	15
select distinct Key5 from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and time_month=str_to_date('?', '?') order by Key5	14
select distinct Key4 from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and time_month=str_to_date('?', '?') order by Key4	13
select distinct Key3 from monthly_agg	10

where TopId='?' and Key1='?' and Key2='?' and time_month=str_to_date('?', '?') order by Key3	
select distinct TKey8 from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' and TKey7='?' order by TKey8	9
select distinct Key2 from monthly_agg where TopId='?' and Key1='?' and time_month=str_to_date('?', '?') order by Key2	7
select TKeyDesc2 from topo_desc where TopId='?'	7
select TKeyDesc8 from topo_desc where TopId='?'	5
select TKeyDesc9 from topo_desc where TopId='?'	2
select TKeyDesc7 from topo_desc where TopId='?'	1
select TKeyDesc6 from topo_desc where TopId='?'	1
select distinct TKey7 from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' order by TKey7	1
select distinct TKey5 from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' order by TKey5	1
select distinct TKey3 from topo_def where TKey1='?' and TKey2='?' order by TKey3	1

Table 2: Profile of TreeSelector GUI after all speedups

SQL Statement	Number of Milliseconds
select info from processlist	39485
select distinct Key11 from monthly_agg use index (monthly_agg_ind11) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and time_month=str_to_date('?', '?') order	2476

by Key11	
	1238
select distinct Key10 from monthly_agg use index (monthly_agg_ind10) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and time_month=str_to_date('?', '?') order by Key10	820
select distinct TKey12 from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' and TKey7='?' and TKey8='?' and TKey9='?' and TKey10='?' and TKey11='?' order by TKey12	535
select TopId from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' and TKey7='?' and TKey8='?' and TKey9='?' and TKey10='?' and TKey11='?' and TKey12='?' and TKey13='?' and TKey14='?' and TKey15='?'	388
select distinct TKey11 from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' and TKey7='?' and TKey8='?' and TKey9='?' and TKey10='?' order by TKey11	255
select TKeyDesc11 from topo_desc where TopId='?'	145
select distinct Key9 from monthly_agg use index (monthly_agg_ind9) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and time_month=str_to_date('?', '?') order by Key9	127
select distinct TKey9 from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' and TKey7='?' and TKey8='?' order by TKey9	116
select distinct Key8 from monthly_agg use index (monthly_agg_ind8) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and time_month=str_to_date('?', '?') order by Key8	102
select distinct TKey10 from topo_def	96

where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' and TKey7='?' and TKey8='?' and TKey9='?' order by TKey10	
select TKeyDesc10 from topo_desc where TopId='?'	49
select distinct Key7 from monthly_agg use index (monthly_agg_ind7) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and time_month=str_to_date('?', '?') order by Key7	43
select distinct Key2 from monthly_agg use index (monthly_agg_ind2) where TopId='?' and Key1='?' and time_month=str_to_date('?', '?') order by Key2	35
select distinct TKey2 from topo_def where TKey1='?' order by TKey2	31
select distinct Key6 from monthly_agg use index (monthly_agg_ind6) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and time_month=str_to_date('?', '?') order by Key6	30
select distinct Key3 from monthly_agg use index (monthly_agg_ind3) where TopId='?' and Key1='?' and Key2='?' and time_month=str_to_date('?', '?') order by Key3	14
select distinct Key4 from monthly_agg use index (monthly_agg_ind4) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and time_month=str_to_date('?', '?') order by Key4	10
select TKeyDesc2 from topo_desc where TopId='?'	9
select TKeyDesc8 from topo_desc where TopId='?'	6
select distinct Key5 from monthly_agg use index (monthly_agg_ind5) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and time_month=str_to_date('?', '?') order by Key5	6
select TKeyDesc9 from topo_desc where TopId='?'	5
select distinct TKey8 from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?'	5

and TKey6='?' and TKey7='?' order by TKey8	
select distinct TKey7 from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' order by TKey7	2
set autocommit=1	1

GUI Speedup 2 (StatPresent)

The speedup for presenting statistics on the right pane, when a topology node was selected on the tree, is presented, here. The first two tables is the profile after the indexing change was already done. The second two profiles show the improvements after the "USE INDEX" hint was used.

Table 3: Profile of StatPresent GUI prior to speedup

SQL Statement	Number of Milliseconds
select info from processlist	15347
select DATE_FORMAT(DATE_ADD(time_week, INTERVAL '?' SECOND),'?') as dt, val from weekly_agg where TopId='?' and Key1='?' and Key2='?' and time_week between str_to_date('?', '?') and str_to_date('?', '?') and counter='?' and countTopId='?' and agg_type='?' order by time_week	273
select DATE_FORMAT(DATE_ADD(time_week, INTERVAL '?' SECOND), '?') as dt, val from weekly_agg where TopId='?' and Key1='?' and Key2='?' and time_week between str_to_date('?', '?') and str_to_date('?', '?') and counter='?' and countTopId='?' and agg_type='?' order by time_week	258
	232
select distinct countTopId, counter from monthly_agg where TopId='?' and Key1='?' and Key2='?' and time_month=str_to_date('?', '?')	123
select Key3, Key4, Key5, Key6, Key7, Key8, Key9, DATE_FORMAT(DATE_ADD(meas_time, INTERVAL '?' SECOND), '?') as mt, agg_type, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and	82

time_month=str_to_date('?', '?') and counter='?' and countTopId='?'	
select Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, DATE_FORMAT(DATE_ADD(meas_time, INTERVAL '?' SECOND), '?') as mt, agg_type, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and time_month=str_to_date('?', '?') and counter='?' and countTopId='?'	67
select Key3, Key4, Key5, DATE_FORMAT(DATE_ADD(meas_time, INTERVAL '?' SECOND), '?') as mt, agg_type, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and time_month=str_to_date('?', '?') and counter='?' and countTopId='?'	40
select Key3, Key4, Key5, Key6, Key7, Key8, DATE_FORMAT(DATE_ADD(meas_time, INTERVAL '?' SECOND), '?') as mt, agg_type, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and time_month=str_to_date('?', '?') and counter='?' and countTopId='?'	28
select countDesc from count_desc where TopId='?' and counter='?'	16
select TKeyDesc1, TKeyDesc2, TKeyDesc3, TKeyDesc4, TKeyDesc5, TKeyDesc6, TKeyDesc7, TKeyDesc8, TKeyDesc9, TKeyDesc10, TKeyDesc11, TKeyDesc12, TKeyDesc13, TKeyDesc14, TKeyDesc15 from topo_desc where TopId='?'	6
select TKey1, TKey2, TKey3, TKey4, TKey5, TKey6, TKey7, TKey8, TKey9, TKey10, TKey11, TKey12, TKey13, TKey14, TKey15 from topo_def where TopId='?'	4

Table 4: Profile of StatPresent GUI prior to speedup

SQL Statement	Number of Milliseconds
select info from processlist	22458
select DATE_FORMAT(DATE_ADD(time_week, INTERVAL '?' SECOND), '?') as dt, val from weekly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and time_week between str_to_date('?', '?') and str_to_date('?', '?') and counter='?'	243

SQL Statement	Number of Milliseconds
and countTopId='?' and agg_type='?' order by time_week	
	211
select DATE_FORMAT(DATE_ADD(time_week, INTERVAL '?' SECOND),'?') as dt, val from weekly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and time_week between str_to_date('?', '?') and str_to_date('?', '?') and counter='?' and countTopId='?' and agg_type='?' order by time_week	139
select distinct countTopId, counter from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and time_month=str_to_date('?', '?')	122
select Key9, Key10, Key11, DATE_FORMAT(DATE_ADD(meas_time, INTERVAL '?' SECOND), '?') as mt, agg_type, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and time_month=str_to_date('?', '?') and counter='?' and countTopId='?'	79
select TKeyDesc1, TKeyDesc2, TKeyDesc3, TKeyDesc4, TKeyDesc5, TKeyDesc6, TKeyDesc7, TKeyDesc8, TKeyDesc9, TKeyDesc10, TKeyDesc11, TKeyDesc12, TKeyDesc13, TKeyDesc14, TKeyDesc15 from topo_desc where TopId='?'	1

Table 5: Profile of StatPresent GUI after speedup

SQL Statement	Number of Milliseconds
select info from processlist	9410
	571
select DATE_FORMAT(DATE_ADD(time_week, INTERVAL '?' SECOND),'?') as dt, val from weekly_agg use index (weekly_agg_ind3) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and time_week between str_to_date('?', '?') and str_to_date('?', '?') and counter='?' and countTopId='?' and	7

agg_type='?' order by time_week	
select distinct countTopId, counter from monthly_agg use index (monthly_agg_ind3) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and time_month=str_to_date('?', '?')	2
select Key4, Key5, Key6, Key7, DATE_FORMAT(DATE_ADD(meas_time, INTERVAL '?' SECOND), '?') as mt, agg_type, val from monthly_agg use index (monthly_agg_ind3) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and time_month=str_to_date('?', '?') and counter='?' and countTopId='?'	2
select Key4, Key5, Key6, Key7, Key8, Key9, DATE_FORMAT(DATE_ADD(meas_time, INTERVAL '?' SECOND), '?') as mt, agg_type, val from monthly_agg use index (monthly_agg_ind3) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and time_month=str_to_date('?', '?') and counter='?' and countTopId='?'	1
select DATE_FORMAT(DATE_ADD(time_week, INTERVAL '?' SECOND), '?') as dt, val from weekly_agg use index (weekly_agg_ind3) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and time_week between str_to_date('?', '?') and str_to_date('?', '?') and counter='?' and countTopId='?' and agg_type='?' order by time_week	1

Table 6: Profile of StatPresent GUI after speedup

SQL Statement	Number of Milliseconds
select info from processlist	12342
	308
select distinct countTopId, counter from monthly_agg use index (monthly_agg_ind8) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and time_month=str_to_date('?', '?')	20
select DATE_FORMAT(DATE_ADD(time_week, INTERVAL '?' SECOND),'?') as dt, val from weekly_agg use index (weekly_agg_ind8) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and	15

SQL Statement	
Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and time_week between str_to_date('?', '?') and str_to_date('?', '?') and counter='?' and countTopId='?' and agg_type='?' order by time_week	
select DATE_FORMAT(DATE_ADD(time_week, INTERVAL '?' SECOND), '?') as dt, val from weekly_agg use index (weekly_agg_ind8) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and time_week between str_to_date('?', '?') and str_to_date('?', '?') and counter='?' and countTopId='?' and agg_type='?' order by time_week	7
select Key9, Key10, Key11, DATE_FORMAT(DATE_ADD(meas_time, INTERVAL '?' SECOND), '?') as mt, agg_type, val from monthly_agg use index (monthly_agg_ind8) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and time_month=str_to_date('?', '?') and counter='?' and countTopId='?'	2

SERVER Speedup (Aggregations)

The server tuning involved two index design changes, utilization of "USE INDEX", and also a code improvement: It was noticed from the profile that a query to select the maximum date was taking up half of the time. This query ensured that the Measurement Time displayed for Maximum and Minimum sequences was always the latest time observed (for identical data). A query involving a second order-by criteria of "meas_time desc" was used, instead.

Table 7: Back end aggregation prior to speedup

SQL Statement	Number of Milliseconds
select info from processlist	1710099
select max(DATE_FORMAT(meas_time, '?')) as mt from meas_vals where val='?' and TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and counter='?' and meas_time	151786

between str_to_date('?', '?') and str_to_date('?', '?')	
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	144344
select max(DATE_FORMAT(meas_time, '?')) as mt from meas_vals where val='?' and TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	90198
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc	75340
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	74338
select avg(val) as avgA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	70777
select max(DATE_FORMAT(meas_time, '?')) as mt from meas_vals where val='?' and TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and	59692

Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	51514
select max(DATE_FORMAT(meas_time, '?')) as mt from meas_vals where val='?' and TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	45814
select distinct counter from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	45045
select max(DATE_FORMAT(meas_time, '?')) as mt from meas_vals where val='?' and TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	43495
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val	41209
select max(DATE_FORMAT(meas_time, '?')) as mt from meas_vals where val='?' and TopId='?' and Key1='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	31404

select avg(val) as avgA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	29188
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc	29149
select sum(val) as sumA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	28129
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	26123
select max(DATE_FORMAT(meas_time, '?')) as mt from meas_vals where val='?' and TopId='?' and Key1='?' and Key2='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	22549
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by	22092

val	
select avg(val) as avgA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	21497
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc	21363
select max(DATE_FORMAT(meas_time, '?')) as mt from meas_vals where val='?' and TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	20326
select sum(val) as sumA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	20243
select distinct counter from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	19754
select max(DATE_FORMAT(meas_time, '?')) as mt from meas_vals where val='?' and TopId='?' and Key1='?' and Key2='?' and Key3='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	19425
select max(DATE_FORMAT(meas_time, '?')) as mt from meas_vals where val='?' and TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and counter='?' and meas_time between str_to_date('?',	19174

'?') and str_to_date('?', '?')	
select max(DATE_FORMAT(meas_time, '?')) as mt from meas_vals where val='?' and TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	18828
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc	18374
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val	15714
select distinct counter from meas_vals where TopId='?' and Key1='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	14669
select avg(val) as avgA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	14651
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc	13404
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and	12741

Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc	
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc	12631
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc	12448
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc	11554
select avg(val) as avgA from meas_vals where TopId='?' and Key1='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	11418
select distinct counter from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	10746
select sum(val) as sumA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	10585
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and counter='?' and meas_time between str_to_date('?', '?') and	9999

str_to_date('?', '?') order by val	
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val	9864
select avg(val) as avgA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	9647
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc	9519
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc	9461
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val	8973
select sumA, avgA, minA, maxA from meas_types where TopId='?' and counter='?'	8845
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and	7979

Key4='?' and Key5='?' and Key6='?' and Key7='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val	
select distinct Key9 from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	7454
select distinct counter from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	7048
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val	6957
select avg(val) as avgA from meas_vals where TopId='?' and Key1='?' and Key2='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	6292
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val	6116
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val	5784
select distinct counter from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and	5662

Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, val from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val	5016
select avg(val) as avgA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	4651
select distinct Key8 from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	4600
select distinct Key11 from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	4566
select distinct Key7 from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	4388
select distinct Key2 from meas_vals where TopId='?' and Key1='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	4312
select avg(val) as avgA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	3943
select avg(val) as avgA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	3935

select avg(val) as avgA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	3685
update meas_vals set agg_month=1 where meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2791
select sum(val) as sumA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2788
select distinct Key10 from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2679
select distinct counter from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2629
select distinct counter from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2531
select distinct counter from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2482
select distinct Key4 from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2434
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and	2395

Key7='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	
select distinct counter from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2368
select distinct Key6 from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2317
select distinct counter from meas_vals where TopId='?' and Key1='?' and Key2='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2287
select distinct Key5 from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2219
select distinct Key3 from meas_vals where TopId='?' and Key1='?' and Key2='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2039
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg where TopId='?' and Key1='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	1617
select sum(val) as sumA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	1386
select sum(val) as sumA from meas_vals where TopId='?' and Key1='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	1314
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11,	1150

Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	834
select sum(val) as sumA from meas_vals where TopId='?' and Key1='?' and Key2='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	830
select sum(val) as sumA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	712
select sum(val) as sumA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	680
select sum(val) as sumA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	665
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	647
select sum(val) as sumA from meas_vals where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and counter='?' and meas_time between str_to_date('?', '?') and	621

str_to_date('?', '?')	
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	606
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	570
show tables	220
show databases	127
select @@version_comment limit 1	95
update monthly_agg set Key10='?',Key15='?',Key2='?',Key1='?',Key5='?',Key12='?',Key8='?',Key13='?',Key14='?',Key4='?',Key11='?',Key6='?',Key3='?',Key7='?',Key9='?', meas_time='?', val='?' where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	90
select distinct TopId from meas_vals where meas_time between str_to_date('?', '?') and str_to_date('?', '?') and ((agg_month is null) or (agg_month=0))	87
select TKey1, TKey2, TKey3, TKey4, TKey5, TKey6, TKey7, TKey8, TKey9, TKey10, TKey11, TKey12, TKey13, TKey14, TKey15 from topo_def where TopId='?'	71
update monthly_agg set Key10='?',Key15='?',Key2='?',Key1='?',Key5='?',Key12='?',Key8='?',Key13='?',Key14='?',Key4='?',Key11='?',Key6='?',Key3='?',Key7='?',Key9='?', meas_time='?', val='?' where TopId='?' and Key1='?'	35

and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	
select TopId from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' and TKey7='?' and TKey8='?' and TKey9='?' and TKey10='?' and TKey11='?' and TKey12='?' and TKey13='?' and TKey14='?' and TKey15='?'	33
update monthly_agg set Key10='?',Key15='?',Key2='?',Key1='?',Key5='?',Key12='?',Key8='?',Key13='?',Key14='?',Key4='?',Key11='?',Key6='?',Key3='?',Key7='?',Key9='?', meas_time='?', val='?' where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	23
select distinct(DATE_FORMAT(meas_time, '?')) as dt from meas_vals where (agg_month is null) or (agg_month=0)	13
commit	8
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	6
explain	

Table 8: Back-end aggregation after speedup

SQL Statement	Number of Milliseconds
select info from processlist	1112403
select Key10, Key15, Key2, Key1, Key5,	107700

Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg use index (monthly_agg_ind9) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg use index (monthly_agg_ind11) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	78555
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg use index (monthly_agg_ind10) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	52210
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc, meas_time desc	37490
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and counter='?' and meas_time between str_to_date('?', '?') and	36635

str_to_date('?', '?') order by val desc, meas_time desc	
select avg(val) as avgA from meas_vals use index (meas_vals_ind14) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	29002
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc, meas_time desc	26688
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc, meas_time desc	25699
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc, meas_time desc	24543
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc, meas_time desc	23580
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index	21752

(meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc, meas_time desc	
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc, meas_time desc	21521
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val asc, meas_time desc	19913
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg use index (monthly_agg_ind8) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	18762
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val asc, meas_time desc	18394
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15,	15421

meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val asc, meas_time desc	
select avg(val) as avgA from meas_vals use index (meas_vals_ind16) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	13721
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val asc, meas_time desc	13645
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc, meas_time desc	13520
select distinct counter from meas_vals use index (meas_vals_ind14) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	13474
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and counter='?' and meas_time between str_to_date('?', '?') and	13467

str_to_date('?', '?') order by val asc, meas_time desc	
select sum(val) as sumA from meas_vals use index (meas_vals_ind16) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	13404
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val asc, meas_time desc	12619
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val asc, meas_time desc	11902
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc, meas_time desc	11585
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val asc,	10978

meas_time desc	
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val asc, meas_time desc	10379
select avg(val) as avgA from meas_vals use index (meas_vals_ind15) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	8923
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val desc, meas_time desc	8670
select sum(val) as sumA from meas_vals use index (meas_vals_ind15) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	8580
select avg(val) as avgA from meas_vals use index (meas_vals_ind13) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	6780
select avg(val) as avgA from meas_vals use index (meas_vals_ind6) where TopId='?' and Key1='?' and counter='?' and meas_time between str_to_date('?',	6754

'?') and str_to_date('?', '?')	
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val asc, meas_time desc	6711
select distinct Key1, Key2, Key3, Key4, Key5, Key6, Key7, Key8, Key9, Key10, Key11, Key12, Key13, Key14, Key15, meas_time, val from meas_vals use index (meas_vals_ind20) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?') order by val asc, meas_time desc	6596
select sumA, avgA, minA, maxA from meas_types where TopId='?' and counter='?'	6369
select avg(val) as avgA from meas_vals use index (meas_vals_ind12) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	5279
select avg(val) as avgA from meas_vals use index (meas_vals_ind11) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	4834
select distinct counter from meas_vals use index (meas_vals_ind12) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	4750
select avg(val) as avgA from meas_vals use index (meas_vals_ind10) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and	4730

counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	
select avg(val) as avgA from meas_vals use index (meas_vals_ind9) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	4583
select distinct counter from meas_vals use index (meas_vals_ind6) where TopId='?' and Key1='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	4559
select distinct Key9 from meas_vals use index (meas_vals_ind14) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	4290
select avg(val) as avgA from meas_vals use index (meas_vals_ind8) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	4190
select avg(val) as avgA from meas_vals use index (meas_vals_ind7) where TopId='?' and Key1='?' and Key2='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	3964
select distinct counter from meas_vals use index (meas_vals_ind13) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	3435
select sum(val) as sumA from meas_vals use index (meas_vals_ind14) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	3412
select distinct counter from meas_vals use index (meas_vals_ind16) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and	3410

Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	
update meas_vals set agg_month=1 where meas_time between str_to_date('?', '?') and str_to_date('?', '?')	3261
select distinct Key11 from meas_vals use index (meas_vals_ind16) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	3137
select distinct counter from meas_vals use index (meas_vals_ind11) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2730
select distinct counter from meas_vals use index (meas_vals_ind10) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2645
select distinct counter from meas_vals use index (meas_vals_ind9) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2549
select distinct Key7 from meas_vals use index (meas_vals_ind12) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2443
select distinct counter from meas_vals use index (meas_vals_ind8) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2333
select distinct counter from meas_vals use index (meas_vals_ind15) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and meas_time	2232

between str_to_date('?', '?') and str_to_date('?', '?')	
select distinct counter from meas_vals use index (meas_vals_ind7) where TopId='?' and Key1='?' and Key2='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2182
select distinct Key6 from meas_vals use index (meas_vals_ind11) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2129
select distinct Key5 from meas_vals use index (meas_vals_ind10) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	2057
select distinct Key8 from meas_vals use index (meas_vals_ind13) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	1835
select sum(val) as sumA from meas_vals use index (meas_vals_ind13) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	1729
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg use index (monthly_agg_ind7) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	1668
select sum(val) as sumA from meas_vals use index (meas_vals_ind12) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	1484

select distinct Key10 from meas_vals use index (meas_vals_ind15) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	1473
select distinct Key3 from meas_vals use index (meas_vals_ind8) where TopId='?' and Key1='?' and Key2='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	1461
update monthly_agg set Key10='?',Key15='?',Key2='?',Key1='?',Key5='?',Key12='?',Key8='?',Key13='?',Key14='?',Key4='?',Key11='?',Key6='?',Key3='?',Key7='?',Key9='?', meas_time='?', val='?' where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	1435
select sum(val) as sumA from meas_vals use index (meas_vals_ind11) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	1398
select sum(val) as sumA from meas_vals use index (meas_vals_ind10) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	1348
select sum(val) as sumA from meas_vals use index (meas_vals_ind9) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	1262
select distinct Key2 from meas_vals use index (meas_vals_ind7) where TopId='?' and Key1='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	1219
select distinct Key4 from meas_vals use index (meas_vals_ind9) where TopId='?' and Key1='?' and Key2='?' and Key3='?'	1167

and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	
select sum(val) as sumA from meas_vals use index (meas_vals_ind8) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	1142
select sum(val) as sumA from meas_vals use index (meas_vals_ind7) where TopId='?' and Key1='?' and Key2='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	1083
select sum(val) as sumA from meas_vals use index (meas_vals_ind6) where TopId='?' and Key1='?' and counter='?' and meas_time between str_to_date('?', '?') and str_to_date('?', '?')	1011
update monthly_agg set Key10='?',Key15='?',Key2='?',Key1='?',Key5='?',Key12='?',Key8='?',Key13='?',Key14='?',Key4='?',Key11='?',Key6='?',Key3='?',Key7='?',Key9='?', meas_time='?', val='?' where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and Key11='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	918
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg use index (monthly_agg_ind1) where TopId='?' and Key1='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	695
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg use index (monthly_agg_ind2) where TopId='?' and Key1='?' and Key2='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	650
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9,	622

DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg use index (monthly_agg_ind4) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	
update monthly_agg set Key10='?',Key15='?',Key2='?',Key1='?',Key5='?',Key12='?',Key8='?',Key13='?',Key14='?',Key4='?',Key11='?',Key6='?',Key3='?',Key7='?',Key9='?', meas_time='?', val='?' where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and Key7='?' and Key8='?' and Key9='?' and Key10='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	613
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg use index (monthly_agg_ind5) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	582
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg use index (monthly_agg_ind3) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	538
select Key10, Key15, Key2, Key1, Key5, Key12, Key8, Key13, Key14, Key4, Key11, Key6, Key3, Key7, Key9, DATE_FORMAT(meas_time, '?') as dt, val from monthly_agg use index (monthly_agg_ind6) where TopId='?' and Key1='?' and Key2='?' and Key3='?' and Key4='?' and Key5='?' and Key6='?' and counter='?' and time_month=str_to_date('?', '?') and agg_type='?' and countTopId='?'	463
show tables	104
select distinct TopId from meas_vals	43

where meas_time between str_to_date('?', '?') and str_to_date('?', '?') and ((agg_month is null) or (agg_month=0))	
select TKey1, TKey2, TKey3, TKey4, TKey5, TKey6, TKey7, TKey8, TKey9, TKey10, TKey11, TKey12, TKey13, TKey14, TKey15 from topo_def where TopId='?'	19
select TopId from topo_def where TKey1='?' and TKey2='?' and TKey3='?' and TKey4='?' and TKey5='?' and TKey6='?' and TKey7='?' and TKey8='?' and TKey9='?' and TKey10='?' and TKey11='?' and TKey12='?' and TKey13='?' and TKey14='?' and TKey15='?'	15
show databases	10
select distinct(DATE_FORMAT(meas_time, '?')) as dt from meas_vals where (agg_month is null) or (agg_month=0)	7
set autocommit=1	1

APPENDIX A: profiler.pl

```perl
#!/usr/bin/perl

use Time::HiRes qw(usleep);

use DBI;

use POSIX qw(setsid);

use strict;

my $pid = fork;


die "could not fork" if (!defined($pid));

exit if ($pid > 0);



setsid();



my $dbh = DBI-
>connect("DBI:mysql:information_schema;host=localhost",'mysql','mysql');

my %prof;
```

```perl
my $sth = $dbh->prepare("select info from processlist");

open (OUTFILE, ">profiler.out");

local $SIG{'TERM'} = sub {

    foreach (sort {$prof{"$b"} <=> $prof{"$a"}} (keys %prof)) {

        print OUTFILE "$_ ==> ".$prof{"$_"}."\n";

    }

    close(OUTFILE);

    $sth->finish();

    $dbh->disconnect();

    exit(0);

};


my ($arr, $x, $query);

while (1) {

    die "query error: $dbh->errstr" if (!defined($sth->execute()));

    $arr = $sth->fetchall_arrayref({ });

    die "sth error" if (!defined($arr) && $sth->err);

    foreach $x (@$arr) {

        $query = $x->{"info"};

        $query =~ s/\'(.*?)\'/\'\?\'/g;

        $prof{"$query"} += 1;

    }

    usleep(1000);

}
```