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How to Optimize MySQL Performance Using MySQLTuner

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Running MySQL at optimal settings for specific resources helps handle larger server loads and
prevents server slowdown. Generally, after tuning Apache (/docs/websites/apache-tips-and-
tricks/tuning-your-apache-server) to handle larger loads, it is beneficial to tune MySQL to
additional connections.

Database tuning is an expansive topic, and this guide covers only the basics of editing your
MySQL configuration. Large MySQL databases can require a considerable amount of memory.
For this reason, we recommend using a high memory Linode (/pricing#high-memory) for such
setups.

> **Note**
> The steps in this guide require root privileges. Be sure to run the steps below as **root** or with the `sudo` prefix. For
> more information on privileges see our Users and Groups (/docs/tools-reference/linux-users-and-groups) guide.

Tools That Can Help Optimize MySQL

In order to determine if your MySQL database needs to be reconfigured, it is best to look at how
your resources are performing now. This can be done with the top command
(/docs/uptime/monitoring/top-htop-iotop) or with the Linode Longview
(/docs/platform/longview/longview) service. At the very least, you should familiarize yourself with
the RAM and CPU usage of your server, which can be discovered with these commands:

```
echo [PID]  [MEM]  [PATH] &&  ps aux | awk '{print $2, $4, $11}' | sort -k2rn | head -n 20
ps -eo pcpu,pid,user,args | sort -k 1 -r | head -20
```

MySQLTuner

The MySQLTuner (http://mysqltuner.com/) script assesses your MySQL installation, and then
outputs suggestions for increasing your server's performance and stability.

1. Download and run MySQLTuner:

   ```
   curl -L http://mysqltuner.pl/ | perl
   ```

2. It outputs your results:
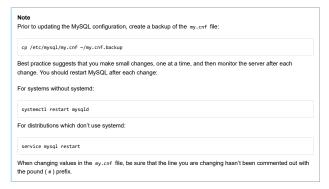
```
 >>  MySQLTuner 1.4.0 - Major Hayden <major@mhtx.net>
 >>  Bug reports, feature requests, and downloads at http://mysqltuner.com/
 >>  Run with '--help' for additional options and output filtering
Please enter your MySQL administrative login: root
Please enter your MySQL administrative password:
[OK] Currently running supported MySQL version 5.5.41-0+wheezy1
[OK] Operating on 64-bit architecture

-------- Storage Engine Statistics -------------------------------------------
[--] Status: +ARCHIVE +BLACKHOLE +CSV -FEDERATED +InnoDB +MRG_MYISAM
[--] Data in InnoDB tables: 1M (Tables: 11)
[--] Data in PERFORMANCE_SCHEMA tables: 0B (Tables: 17)
[!!] Total fragmented tables: 11

-------- Security Recommendations  -------------------------------------------
[OK] All database users have passwords assigned

-------- Performance Metrics -------------------------------------------------
[--] Up for: 47s (113 q [2.404 qps], 42 conn, TX: 19K, RX: 7K)
[--] Reads / Writes: 100% / 0%
[--] Total buffers: 192.0M global + 2.7M per thread (151 max threads)
[OK] Maximum possible memory usage: 597.8M (60% of installed RAM)
[OK] Slow queries: 0% (0/113)
[OK] Highest usage of available connections: 0% (1/151)
[OK] Key buffer size / total MyISAM indexes: 16.0M/99.0K
[!!] Query cache efficiency: 0.0% (0 cached / 71 selects)
[OK] Query cache prunes per day: 0
[OK] Temporary tables created on disk: 25% (54 on disk / 213 total)
[OK] Thread cache hit rate: 97% (1 created / 42 connections)
[OK] Table cache hit rate: 24% (52 open / 215 opened)
[OK] Open file limit used: 4% (48/1K)
[OK] Table locks acquired immediately: 100% (62 immediate / 62 locks)
[OK] InnoDB buffer pool / data size: 128.0M/1.2M
[OK] InnoDB log waits: 0
-------- Recommendations -----------------------------------------------------
General recommendations:
    Run OPTIMIZE TABLE to defragment tables for better performance
    Enable the slow query log to troubleshoot bad queries
Variables to adjust:
    query_cache_limit (> 1M, or use smaller result sets)
```

MySQLTuner offers suggestions regarding how to better the database's performance. If you are wary about updating your database on your own, following MySQLTuner's suggestions is one of the safer ways to improve your database performance.

Tuning MySQL

When altering the MySQL configuration, be alert to the changes and how they affect your database. Even when following the instructions of programs such as MySQLTuner, it is best to have some understanding of the process.

The file you are changing is located at `/etc/mysql/my.cnf`.

> **Note**
>
> Prior to updating the MySQL configuration, create a backup of the `my.cnf` file:
>
> ```
> cp /etc/mysql/my.cnf ~/my.cnf.backup
> ```
>
> Best practice suggests that you make small changes, one at a time, and then monitor the server after each change. You should restart MySQL after each change:
>
> For systems without systemd:
>
> ```
> systemctl restart mysqld
> ```
>
> For distributions which don't use systemd:
>
> ```
> service mysql restart
> ```
>
> When changing values in the `my.cnf` file, be sure that the line you are changing hasn't been commented out with the pound (`#`) prefix.

key_buffer

Changing the `key_buffer` allocates more memory to MySQL, which can substantially speed up your databases, assuming you have the memory free. The `key_buffer` size should generally take up no more than 25 percent of the system memory when using the MyISAM table engine, and up to 70 percent for InnoDB. If the value is set too high, resources are wasted.

According to MySQL's documentation, for servers with 256MB (or more) of RAM with many tables, a setting of 64M is recommended. Servers with 128MB of RAM and fewer tables can be set to 16M, the default value. Websites with even fewer resources and tables can have this value set lower.

max_allowed_packet

This parameter lets you set the maximum size of a sendable packet. A packet is a single SQL state, a single row being sent to a client, or a log being sent from a master to a slave. If you know that your MySQL server is going to be processing large packets, it is best to increase this to the size of your largest packet. Should this value be set too small, you would receive an error in your error log.

thread_stack

This value contains the stack size for each thread. MySQL considers the default value of the `thread_stack` variable sufficient for normal use; however, should an error relating to the `thread_stack` be logged, this can be increased.

thread_cache_size

If `thread_cache_size` is "turned off" (set to 0), then any new connection being made needs a new thread created for it. When the connections disengage the thread is destroyed. Otherwise, this value sets the number of unused threads to store in a cache until they need to be used for a connection. Generally this setting has little affect on performance, unless you are receiving hundreds of connections per minute, at which time this value should be increased so the majority of connections can be made on cached threads.

max_connections

This parameter sets the maximum amount of *concurrent* connections. It is best to consider the maximum amount of connections you have had in the past before setting this number, so you'll have a buffer between that upper number and the `max_connections` value. Note, this does not indicate the maximum amount of *users* on your website at one time; rather it shows the maximum amount of users making *requests* concurrently.

table_cache

This value should be kept higher than your `open_tables` value. To determine this value use:
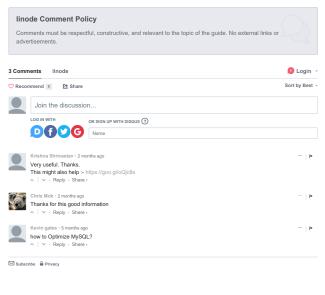
```
SHOW STATUS LIKE 'open%';
```

More Information

You may wish to consult the following resources for additional information on this topic. While these are provided in the hope that they will be useful, please note that we cannot vouch for the accuracy or timeliness of externally hosted materials.

- MySQL Documentation Library (http://dev.mysql.com/doc/index.html)
- MySQL Tuning Server Parameters (http://dev.mysql.com/doc/refman/5.7/en/server-parameters.html)
- MySQLTuner (http://mysqltuner.com/)

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