

Advanced MySQL 15.03. - 19.03.2021

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- <http://schulung.t3isp.de/documents/pdfs/mysql/mysql-performance.pdf>

- <https://mariadb.com/kb/en/incompatibilities-and-feature-differences-between-mariadb-105-and-mysql-80/>
- <https://mysqlserverteam.com/the-bind-address-option-now-supports-multiple-addresses/>

Installation

Installation with tar-bundle Centos 8/Redhat 8

Steps, if there is not outside connection Linux Machine to MySQL repo or internet

```
## Step 1: Download bundle to your local machine
https://dev.mysql.com/downloads/mysql/

## Step 2: Download winscp
## just google

## Step 3: Transfer bundle to server with winscp

## Step 4: mv tar and untar folder
sudo su -
mv /home/kurs/mysql-8.0.23-1.el8.x86_64.rpm-bundle.tar /usr/src
cd /usr/src
mkdir mysql-install
cd mysql-install
tar xvf ../mysql-8.0.23-1.el8.x86_64.rpm-bundle.tar

## Step 5: change into folder and install necessary files
## Install no debuginfo - packages
yum install mysql-community-{server,client,common,libs,client-plugins}-8*
```

Start and retrieve password

```
systemctl start mysqld
systemctl enable mysqld
systemctl status mysqld
grep 'temporary password' /var/log/mysqld.log
```

Change temporary password

```
mysql -uroot -p
## important must fit password criteria
## using P@ssw0rd for training purpose
alter user root@localhost identified by 'P@ssw0rd';
```

Ref:

<https://dev.mysql.com/doc/mysql-installation-excerpt/5.7/en/linux-installation-rpm.html>

Installation from centos8/centos7

```
yum install mysql-server mysql
```

Login ohne passwort - mysql-client

Simple version with cleartext pass

```
## cat /root/.my.cnf
[client]
password=P@ssw0rd
## now you can call as root

mysql
```

Login with --login-path

Walkthrough - Default (client)

```
## Step 1: Eventually Set/Change password
mysql>alter user root@localhost identified by 'MYSECRETPASS'
mysql>quit
## set pass in loginpath
## in this case if not set loginpath is 'client'

## Step 2: set password for client use
## Set the same pass as set above
[root@localhost ~]# mysql_config_editor set --user=root --password

## Step 3: use it
## Feel happy using / pass will be taken from:
[root@localhost ~]# ls -la /root/.mylogin.cnf
[root@localhost ~]# mysql
```

Walkthrough - loginpath=admin (client)

```
## Step 1: Eventually Set/Change password
mysql>alter user admin@localhost identified by 'MYSECRETPASS'
mysql>quit
## set pass in loginpath
## in this case if not set loginpath is 'client'

## Step 2: set password for client use
## Set the same pass as set above
[root@localhost ~]# mysql_config_editor set --loginpath=admin --user=root --password

## Step 3: use it
## Feel happy using / pass will be taken from:
[root@localhost ~]# ls -la /root/.mylogin.cnf
[root@localhost ~]# mysql --loginpath=admin
```

Side - Notes (file is not encrypted but obfuscated)

- <https://jira.mariadb.org/browse/MDEV-20665>
- https://mariadb.com/kb/en/mysql_config_editor-compatibility/

How to see set password in .mylogin.cnf (unsafe)

```
## https://www.percona.com/blog/2016/09/07/get-passwords-plain-text-mylogin-cnf/
my_print_defaults -s client
```

Ref:

- <https://dev.mysql.com/doc/refman/8.0/en/mysql-config-editor.html>

Using HashiCorp-Vault for Authentication

- <https://www.vaultproject.io/docs/secrets/databases>

Configuration

Port change on Centos/Redhat

```
## Walkthrough
/etc/my.cnf
port=13306

## Change port in selinux
## this will be persistent across reboots
semanage port -a -t mysqld_port_t -p tcp 13306

## Errors can be found in
## /var/log/audit/audit.log

systemctl restart mysqld
```

Binlog - Management

Binlog

Key Facts

```
show variables like '%log_bin%';  
## set in configuration  
log_bin  
## changed during session for not logging actions in session to binlog  
sql_log_bin
```

show master status

```
## at which position is the master currently  
show master status
```

when using slave potential master

```
## on by default on mysql 8  
## off by default on mysql 5.7  
log_slaves_updates = on  
  
## this must be on, if you want to use slave as master later  
## alle update from master are logged to binary of slave if log-bin=on
```

Disable binary logging

```
## /etc/my.cnf  
[mysqld]  
skip-log-bin  
## or  
## disable-log-bin  
  
### Restart  
## systemctl restart mysqld  
## now master is empty  
mysql>show master status
```

binlog_format

```
## STATEMENT  
## The direct statement will be used  
## e.g. INSERT INTO actors (first_name, last_name) values ('hans','mustermann')  
  
## MIXED  
## Server decides if to use STATEMENT or ROW for each sql - statement  
  
## ROW
```


Workaround for tail -f ;o) for binlog

```
mysqlbinlog -vvv -R -t --stop-never binlog.00000
```

mysqlbinlog with date

```
mysqlbinlog --stop-datetime="2021-03-15 15:23" binlog.000012
```

mysqlbinlog over multiple binlogs

```
mysqlbinlog -vvv --stop-position=465 binlog.000010 binlog.000011 binlog.000012 >  
/usr/recovery.sql
```

Ref:

<https://dev.mysql.com/doc/refman/8.0/en/replication-options-binary-log.html>

Backup and Restore

Best Practice mysqldump

best practice mysqldump

```
## important to dump --event and --routines starting from
## mysql 8, because they are not part of mysql-tables anymore

## flush-logs - create new binlog after dump -> good for pit (Point-In-Time -
Recovery)
## master-data = 2 (2 means comment)
##
mysqldump --all-databases --flush-logs --master-data=2 --routines --events >
/usr/src/all-databases.sql
```

Also delete old logs after mysqldump (not for master-slave)

```
mysqldump --delete-master-logs --all-databases --flush-logs --master-data=2 --routines
--events > /usr/src/all-databases.sql
```

use transaction -> for dumping

```
mysqldump --single-transactions --delete-master-logs --all-databases --flush-logs --
master-data=2 --routines --events > /usr/src/all-databases.sql
```

Point-In-Time-Recovery

mysqlbackup - MySQL Enterprise Backup

Walkthrough

```
## Download von mysqlbackup
### Step 1
## File auf ssh-server runterladen (MySQL 2) und installieren
sudo su -
cd /usr/src
unzip V1006234-01.zip
rpm -i mysql-commercial-backup-8.0.23-1.1.el8.x86_64.rpm

### Step 2
## Backup durchführen
mysqlbackup --user=root --password --host=127.0.0.1 --backup-image=/backups/my.mbi \
  --backup-dir=/backups/backup-tmp backup-to-image
echo $? # 0 is success

### Step 3
mysqlbackup --backup-image=/backups/my.mbi validate
echo $?

### Step 4
## systemctl stop mysqld
cd /var/lib/
mv mysql mysql.bkup
### backup-tmp-back needs to be empty
mysqlbackup --backup-image=/backups/my.mbi --backup-dir=/backups/backup-tmp-back copy-
back-and-apply-log
chown -R mysql:mysql /var/lib/mysql
systemctl start mysqld
```

xtrabackup 8 with Centos/Redhat

Walkthrough

```
xtrabackup --backup --target-dir=/backups/20210316
## Apply crash-recovery-log -> aka ib_logfile_1
xtrabackup --prepare --target-dir=/backups/20210316
## Restore
systemctl stop mysqld
cd /var/lib
mv mysql mysql.bkup
xtrabackup --copy-back --target-dir=/backups/20210316
chown -R mysql:mysql mysql
## special selinux
restorecon -r /var/lib/mysql
systemctl start mysqld
```

move-back with alternative datadir

```
xtrabackup --copy-back --datadir=/var/lib/coolio --target-dir=/backups/20210316
```

Variablen

Use-Cases Variables

Select into

```
select first_name,last_name from actor where actor_id = 1;
+-----+-----+
| first_name | last_name |
+-----+-----+
| PENELOPE   | GUINNESS  |
+-----+-----+
1 row in set (0.00 sec)

mysql> select first_name,last_name into @vorname,@nachname from actor where actor_id =
1;
Query OK, 1 row affected (0.00 sec)

mysql> select @vorname;
+-----+
| @vorname |
+-----+
| PENELOPE |
+-----+
1 row in set (0.00 sec)

mysql>
```

Variables can only be used for field-values

```
### This does not work

mysql> set @tabellenname='actor'
mysql> insert into @tabellenname (first_name,last_name) values ('a','b');
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that
corresponds to your MySQL server version for the right syntax to use near
'@tabellenname (first_name,last_name) values ('a','b')' at line 1
mysql> insert into concat(@tabellenname,'') (first_name,last_name) values ('a','b');
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that
corresponds to your MySQL server version for the right syntax to use near
'@tabellenname,') (first_name,last_name) values ('a','b')' at line 1
mysql> select concat(@tabellenname,'');
+-----+
| concat(@tabellenname,') |
+-----+
| actor                    |
+-----+
1 row in set (0.00 sec)
```

```
mysql> set @feld='last_name';  
Query OK, 0 rows affected (0.00 sec)
```

```
mysql> insert into tabellenname (@feld, first_name) values ('a','b');  
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that  
corresponds to your MySQL server version for the right syntax to use near '@feld,  
first_name) values ('a','b')' at line 1  
mysql> insert into tabellenname (last_name, first_name) values (@feld,'b');  
ERROR 1146 (42S02): Table 'sakila.tabellenname' doesn't exist
```

```
## THIS DOES WORK
```

```
mysql> insert into actor (last_name, first_name) values (@feld,'b');  
Query OK, 1 row affected (0.00 sec)
```

```
mysql> insert into @tabellenname (last_name, first_name) values (@feld,'b');  
ERROR 1064 (42000): You have an error in your SQL syntax; check the manual that  
corresponds to your MySQL server version for the right syntax to use near  
'@tabellenname (last_name, first_name) values (@feld,'b')' at line 1
```

MariaDB vs. MySQL

Comparing MySQL vs. MariaDB

Cluster

```
MariaDB (im Bauch) - im Repo:
=====

2007:
Galera Cluster (virtuell synchrone Cluster)
--> Auto-Provisioning -> Node konfigurieren -> dann holt sie sich die Daten selbst

MySQL - im Repo:
=====

viel, viel später:
Group Replication (=Cluster)

aber: es gibt auch eine binary von codership - mit galera cluster
```

Features

- Welche Features brauche ich .

Spezielle Features von MariaDB

- Flashback (auf älteren Datenstand gehen ohne komplettes neues Backup + PIT - Recovery).
- Encryption

Speziele von MySQL

- Persistent settings of variables
- Spezielle Tools (mysql_repl)

Unterschiede sind

- Implementierungen ändern sich (z.B. mariadb -> user -> views)

MariaDB

- MaxScale + MariaDB Galera Cluster

Performance (InnoDB)

Important Configuration Settings-Innodb

innodb_buffer_pool_size

```
## how big is it ?
show variables like 'innodb_buffer%';

## 70-80% of memory of system
## evaluate with
show engine innodb status
pager grep -i 'free buffers'
show engine innodb status
pager
```

innodb_log_buffer_size

```
## how big is it ?
show variables like 'innodb_log_buffer%'

### should be able to hold one commit
```

innodb_log_file_size

```
## Should hold work load of 120 minutes
```

- <https://www.percona.com/blog/2008/11/21/how-to-calculate-a-good-innodb-log-file-size/>

innodb_flush_trx_commit

```
## Defaults to 1
## flush from log_buffer to log
## after every commit
## ACID compliant

## Only set to 0 or 2 if you are willing to loose 1 second of data
## in case of Stand-Alone and Master-Slave

## On group-replication / galera cluster
## 0 <- is safe because of virtuell synchronisation
```

innodb_flush_method

```
##### Linux
O_DIRECT
## use only on linux,
## can increase performance

### Do not use or be critical about it
O_DIRECT_NOI_FSYNC
```



```
### Set persistent and restart server
## only persist do not change during runtime
mysql> set persist_only innodb_flush_method = 'O_DIRECT';
## only works when systemd is the start/stop - system
## or windows service
mysql> restart
## now it is changed
mysql> show variables like 'innodb_flush_method'

##### Windows

## no need to change, because O_DIRECT does not work
```

innodb_flush_neighbors

```
## for ssd - disks keep 0 which is default

## for hd - set to 1
## means dirty neighbor pages are flushed to disk as well from
## innodb_buffer_pool on flushing
set persist innodb_flush_neighbors=1;
```

skip-name-resolve

```
## do not do name resolving / no local or dns lookup
## from now on user@hostname entries do not work
mysql> set persist_only skip_name_resolve = ON;
mysql> restart
```

Tools

Install percona toolkit - Centos/Redhat 8

Walkthrough

```
yum install https://repo.percona.com/yum/percona-release-latest.noarch.rpm
yum search percona
yum install percona-toolkit
## now tools are available starting with pt-
pt- # TAB - TAB
```

Percona Monitoring and Slow Queries GUI

Demo

- <https://pmmdemo.percona.com/>

Documentation

- <https://www.percona.com/doc/percona-monitoring-and-management/2.x/index.html>

Indexes und slow query log

slow query log

Activation

```
mysql> set global slow_query_log = on
-- in seconds
mysql> set global long_query_time = 0.01
-- log sql - staments that have no index
mysql> set global log_queries_not_using_indexes = ON
```

Function Index

Replication

show slave hosts/show replicas

```
## from 5.7. -> 8.0.21  
show slave hosts  
## from 8.0.22  
show replicas
```

clone-plugin

Walkthrough

```
## On Joiner -> Server that shall get the clone
## Plugin needs to be loaded
mysql> show plugins
## if not present install
mysql> install plugin clone soname 'mysql_clone.so'

## On Donor - server that provides clone
## needs a user with 'BACKUP_ADMIN'
## Joiner: needs a 'CLONE_ADMIN'
## on Donor -> master
create user cloneuser@'192.168.56.105' identified by 'your_Secret_pass';
grant backup_admin,clone_admin on *.* to cloneuser@'192.168.56.105';

## On Joiner - test connection
mysql -ucloneuser -p -h 192.168.56.105
mysql> show grants
```

Prerequisites for cloning

```
## on both systems these values must be identical
## collation / character - the server stuff
mysql> show variables like 'innodb_page_size';
+-----+-----+
| Variable_name | Value |
+-----+-----+
| innodb_page_size | 16384 |
+-----+-----+
1 row in set (0.00 sec)

mysql> show variables like 'innodb_data_file_path';
+-----+-----+
| Variable_name | Value |
+-----+-----+
| innodb_data_file_path | ibdata1:12M:autoextend |
+-----+-----+
1 row in set (0.00 sec)

mysql> show variables like 'max_allowed_packet';
+-----+-----+
| Variable_name | Value |
+-----+-----+
| max_allowed_packet | 67108864 |
+-----+-----+
1 row in set (0.01 sec)

mysql> show global variables like '%character%';
+-----+-----+
| Variable_name | Value |
+-----+-----+
```

```

+-----+-----+
| character_set_client      | utf8mb4      |
| character_set_connection  | utf8mb4      |
| character_set_database    | utf8mb4      |
| character_set_filesystem  | binary       |
| character_set_results     | utf8mb4      |
| character_set_server      | utf8mb4      |
| character_set_system      | utf8         |
| character_sets_dir        | /usr/share/mysql/charsets/ |
+-----+-----+

8 rows in set (0.01 sec)

mysql> show global variables like '%collation%';
+-----+-----+
| Variable_name            | Value        |
+-----+-----+
| collation_connection     | utf8mb4_0900_ai_ci |
| collation_database       | utf8mb4_0900_ai_ci |
| collation_server         | utf8mb4_0900_ai_ci |
| default_collation_for_utf8mb4 | utf8mb4_0900_ai_ci |
+-----+-----+

4 rows in set (0.01 sec)

mysql> select tablespace_name, file_name from information_schema.files where file_type
like 'UNDO LOG';
+-----+-----+
| TABLESPACE_NAME | FILE_NAME |
+-----+-----+
| innodb_undo_001 | ./undo_001 |
| innodb_undo_002 | ./undo_002 |
+-----+-----+

2 rows in set (0.00 sec)

```

Increase Verbosity

```

## on master - really important
## because you can see the progress and return-code: success -> 0
mysql> set global log_error_verbosity=3

## eventually on joiner - not tested output verbosity yet
mysql> set global log_error_verbosity.de

```

Overview clone variables

```

show variables like '%clone%'
-> ;
+-----+-----+
| Variable_name            | Value        |
+-----+-----+
| clone_autotune_concurrency | ON           |

```

clone_buffer_size	4194304
clone_ddl_timeout	300
clone_enable_compression	OFF
clone_max_concurrency	16
clone_max_data_bandwidth	0
clone_max_network_bandwidth	0
clone_ssl_ca	
clone_ssl_cert	
clone_ssl_key	
clone_valid_donor_list	

11 rows in set (0.01 sec)

Set compression on master (but takes cpu-load)

```
## before cloning or in general
set global clone_enable_compression = ON
```

Setup donor list and start clone

```
## on joiner
mysql> set global clone_valid_donor_list = '192.168.56.103:3306';
mysql> show variables like 'clone_valid_donor_list';

mysql> CLONE INSTANCE FROM 'cloneuser'@'192.168.56.103':3306 identified by 'P@ssw0rd';

mysql> show variables like 'clone_valid_donor%';
+-----+
| Variable_name | Value |
+-----+
| clone_valid_donor_list |      |
+-----+
```


Setup Replication with GTID

On master setup settings

```
mysql>set persist server_id=1;
mysql>set persist_only gtid_mode=ON
mysql>set persist_only enforce_gtid_consistency=true;
mysql>restart;
```

Setup replication user

```
create user 'repl'@'%' identified by 'mysecretpass' require ssl;
grant replication slave on *.* to 'repl'@'%'
```

On Slave use clone plugin

- See entry in this documentation

On Slave

```
mysql>set persist server_id=2;
mysql>set persist_only gtid_mode=ON
mysql>set persist_only enforce_gtid_consistency=true;
mysql>restart

set persist server_id=2;
set persist_only gtid_mode=ON;
set persist_only enforce_gtid_consistency=true;
restart;
```

Now setup master-connection-config

```
change master to master_host='192.168.56.103',
master_user='repl',master_password='mysecretpass',
master_auto_position=1, master_ssl = 1;
start slave;
show slave status \G
```

Installation Master-Slave with mysqlsh - mysql-shell

Remarks

```
## Warning: Do not try to use mysql-shell from epel-repo -> Centos/Redaht
## javascript is not supported
```

Installation on both servers

```
yum install https://dev.mysql.com/get/mysql80-community-release-el8-1.noarch.rpm
yum install mysql-shell
```

Configuration Basis Configuration on both servers

```
mysqlsh --uri root@localhost
dba.configureReplicaSetInstance()
## use 2
## setup user: repl
## and agree to do the changes -> Y
## Restart : Y
```

Now login in as replication user on master

```
mysql --uri repl@master
rs=dba.createReplicaSet('MasterSlaveGroup')
rs.status()
```

Probably if not reachable (test with telnet) setup firewall

```
## test if ports 3306 and 33061 are reachable from outside
## if not
firewall-cmd --add-service=mysql --permanent
firewall-cmd --add-port=33060/tcp --permanent
firewall-cmd --reload
```

Setup mysqlrouter

```
## on mysqlrouter server / same as app-server
## set same /etc/hosts file

192.168.56.103 master.training.local master
192.168.56.105 slave.training.local slave
192.168.56.106 router.training.local router

yum install https://dev.mysql.com/get/mysql80-community-release-el8-1.noarch.rpm
yum install mysql-router mysql

mysqlrouter --bootstrap repl@slave --conf-use-sockets --user mysqlrouter
systemctl start mysqlrouter
```

Setup on master

```
## mysql
mysql>create user training@'192.168.56.%' identified by 'P@ssw0rd';
mysql>grant all on *.* to training@'192.168.56.%;
```

ReplicaSet - Troubleshoot

Node crashes and data was changed

```
## node cannot join automatically
## you need to set the recoveryMethod
rs=dba.getReplicatSet()
rs.status()
rs.rejoinInstance('repl@slave',{recoveryMethod: 'clone'})
```

Documentaton

MySQL Performance pdf

- <http://schulung.t3isp.de/documents/pdfs/mysql/mysql-performance.pdf>

Incompabilities from MySQL 8 to MariaDB 10.5

- <https://mariadb.com/kb/en/incompatibilities-and-feature-differences-between-mariadb-105-and-mysql-80/>

multiple Bind-address starting from 8.0.13

- <https://mysqlserverteam.com/the-bind-address-option-now-supports-multiple-addresses/>