MariaDB Komplettkurs

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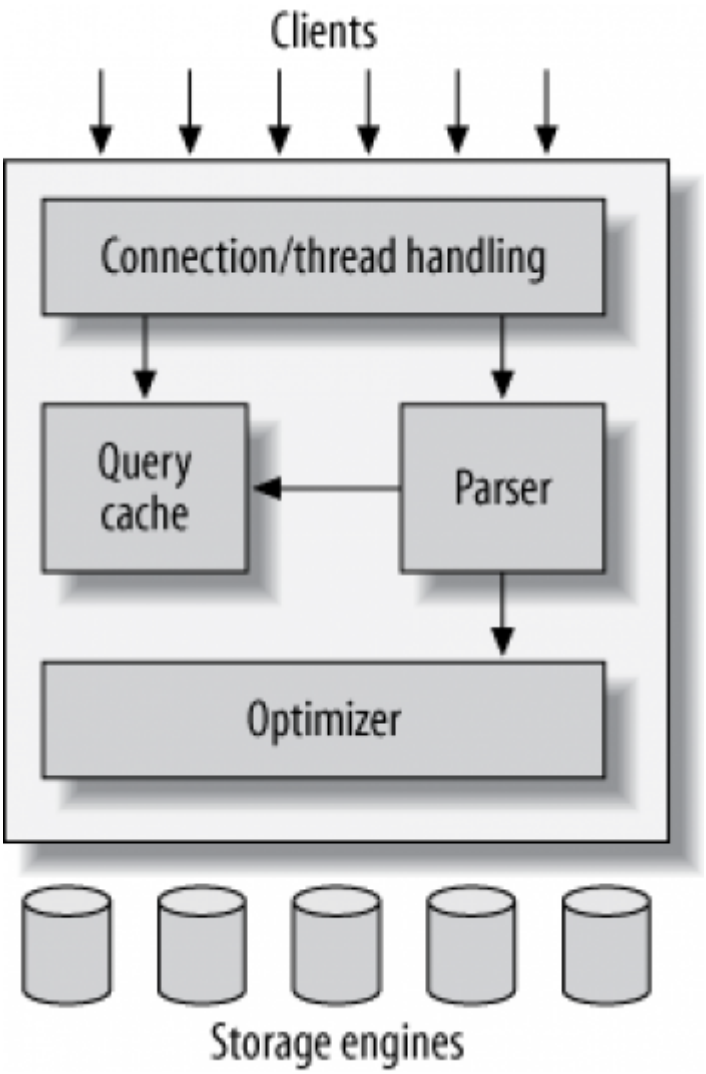
Architecture of MariaDB

Architecture Server (Steps)



Query Cache Usage and Performance

Performance query cache

- Always try to optimize innodb with disabled query cache first (innodb_buffer_pool)
- If you use query_cache system can only use on CPU-Core. !!

How to enable query cache

```
## have_query_cache means compiled in mysql
## query_cache_type off means not enable by config
-- query cache is diabled
mysql> show variables like '%query_cache%';
+------------------------------+---------+
| Variable_name                | Value   |
+------------------------------+---------+
| have_query_cache             | YES     |
| query_cache_limit            | 1048576 |
| query_cache_min_res_unit     | 4096    |
| query_cache_size             | 1048576 |
| query_cache_type             | OFF     |
| query_cache_wlock_invalidate | OFF     |
+------------------------------+---------+
6 rows in set (0.01 sec)

root@trn01:/etc/mysql/mysql.conf.d# tail mysqld.cnf
[mysqld]
pid-file        = /var/run/mysqld/mysqld.pid
socket          = /var/run/mysqld/mysqld.sock
datadir         = /var/lib/mysql
log-error       = /var/log/mysql/error.log
## By default we only accept connections from localhost
bind-address    = 0.0.0.0
## Disabling symbolic-links is recommended to prevent assorted security risks
symbolic-links=0
query-cache-type=1

systemctl restart mysql

mysql> show variables like '%query_cache%';
+------------------------------+---------+
| Variable_name                | Value   |
+------------------------------+---------+
| have_query_cache             | YES     |
| query_cache_limit            | 1048576 |
| query_cache_min_res_unit     | 4096    |
| query_cache_size             | 1048576 |
| query_cache_type             | ON      |
| query_cache_wlock_invalidate | OFF     |
+------------------------------+---------+
6 rows in set (0.01 sec)
```

```
mysql> show status like '%Qcache%';
+-------------------------+---------+
| Variable_name           | Value   |
+-------------------------+---------+
| Qcache_free_blocks      | 1       |
| Qcache_free_memory      | 1031832 |
| Qcache_hits             | 0       |
| Qcache_inserts          | 0       |
| Qcache_lowmem_prunes    | 0       |
| Qcache_not_cached       | 0       |
| Qcache_queries_in_cache | 0       |
| Qcache_total_blocks     | 1       |
+-------------------------+---------+
8 rows in set (0.00 sec)

## status in session zurücksetzen.
mysql> flush status;
Query OK, 0 rows affected (0.00 sec)
```

Performance bottleneck - mutex

https://mariadb.com/de/resources/blog/flexible-mariadb-server-query-cache/

Something planned ?

- Nope ;o(Demand is new
- You might be able to use Demand together with maxscale
- Refer to: https://mariadb.com/de/resources/blog/flexible-mariadb-server-query-cache/

```
A mutual exclusion object (mutex) is a programming object that allows multiple program threads to share a resource (such as a folder) but not simultaneously. Mutex is set to unlock when the data is no longer needed or when a routine is finished. Mutex creates a bottleneck effect. The blocking means only one query can look at the Query Cache at a time and other queries must wait. A query that must wait to look in the cache only to find it isn’t in the cache will be slowed instead of being accelerated.
```

Optimizer-Basics

General

- All optimizer today are cost-based

Cost-Based

```
## How much costs are needed to get the information
```

Storage Engines

Why ?

```
Let's you choose:
How your data is stored
```

What ?

- Performance, features and other characteristics you want

What do they do ?

- In charge for: Responsible for storing and retrieving all data stored in MySQL
- Each storage engine has its:
  - Drawbacks and benefits
- Server communicates with them through the storage engine API
  - this interface hides differences
  - makes them largely transparent at query layer
  - api contains a couple of dozen low-level functions e.g. “begin a transaction”, “fetch the row that has this primary key”

Storage Engine do not ....

- Storage Engines do not parse SQL
- Storage Engines do not communicate with each other

They simply .....

- They simply respond to requests from the server

Which are the most important one ?

- MyISAM/Aria
- InnoDB
- Memory
- CSV
- Blackhole (/dev/null)
- Archive
- Partition
- Federated/FederatedX

Installation

Installation (Ubuntu)

Setup repo and install

- https://downloads.mariadb.org/mariadb/repositories/

```
### repo
sudo apt-get install software-properties-common
sudo apt-key adv --fetch-keys 'https://mariadb.org/mariadb_release_signing_key.asc'
## does an apt update after setting repo - automatically
sudo add-apt-repository 'deb [arch=amd64,arm64,ppc64el]
https://mirror.dogado.de/mariadb/repo/10.5/ubuntu focal main'
sudo apt install mariadb-server
```

Secure installation

```
mariadb-secure-installation
## OR: if not present before 10.4
mysql_secure_installation
```

Start/Status/Stop von MariaDB

start/stop/status

```
## als root - user
systemctl status mariadb
systemctl stop mariadb
systemctl start mariadb
```

Does mariadb listen to the outside world

How to check ?

```
lsof -i | grep mariadb
## localhost means it does NOT listen to the outside now
## mariadbd  5208           mysql   19u  IPv4  56942      0t0  TCP localhost:mysql
(LISTEN)
```

Configuration

Adjust configuration and restart

```
## change config in /etc/mysql/50-server.cnf
## After that restart server - so that it takes your new config
systemctl restart mariadb
echo $? # Was call restart succesful -> 0
```

Set global server system variable

Find out current value

```
## show global variable
show global variables like '%automatic_sp%'
## or // variable_name needs to be in captitals
use information_schema
select * from global_variables where variable_name like '%AUTOMATIC_SP%';

## If you know the exact name
select @@global.automatic_sp_privileges;
select @@GLOBAL.automatic_sp_privileges;
```

Set global Variable

```
## will be set like so till next restart of mysql server
set global automatic_sp_privileges = 0
```

automatic_sp_privileges can only be set globally

```
## Refer to: server system variable doku

## Has same value in global an session scope
MariaDB [information_schema]> select @@automatic_sp_privileges; select
@@global.automatic_sp_privileges;
+----------------------------+
| @@automatic_sp_privileges |
+----------------------------+
|                          0 |
+----------------------------+
1 row in set (0.000 sec)

+-----------------------------------+
| @@global.automatic_sp_privileges |
+-----------------------------------+
|                                 0 |
+-----------------------------------+
1 row in set (0.000 sec)
```

Reference:

- https://mariadb.com/kb/en/server-system-variables/#automatic_sp_privileges

Information Schema / Status / Processes

Show server status

Through mysql

```
## in mysql interface (client)
mysql
status;
```

With mysqladmin

```
mysqladmin status
## or if you want to know more
mysqladmin extended status
```

Kill long running process

```
## Session 1
## sleep for 120 seconds
select sleep(120)

## Session 2
show processlist
## kill process you have identified for sleep(120)
MariaDB [(none)]> show processlist;
+----+------+-----------+----------+---------+------+------------+------------------
+----------+
| Id | User | Host      | db       | Command | Time | State      | Info             |
Progress |
+----+------+-----------+----------+---------+------+------------+------------------
+----------+
| 36 | root | localhost | NULL     | Query   |    0 | starting   | show processlist  |
0.000 |
| 37 | root | localhost | training | Query   |    4 | User sleep | select sleep(120) |
0.000 |
+----+------+-----------+----------+---------+------+------------+------------------
+----------+
2 rows in set (0.000 sec)
## take 37
kill 37

## Session 1: query terminates
ERROR 2013 (HY000): Lost connection to MySQL server during query
```

Kill (kickout user) and stop server

```
MariaDB [mysql]> show processlist;
+----+----------+-----------+----------+---------+------+----------+------------------
+----------+
| Id | User     | Host      | db       | Command | Time | State    | Info
| Progress |
+----+----------+-----------+----------+---------+------+----------+------------------
+----------+
| 30 | root     | localhost | mysql    | Sleep   |   10 |          | NULL
|    0.000 |
| 34 | root     | localhost | mysql    | Query   |    0 | starting | show processlist
|    0.000 |
| 43 | training | localhost | training | Sleep   |    5 |          | NULL
|    0.000 |
+----+----------+-----------+----------+---------+------+----------+------------------
+----------+
3 rows in set (0.000 sec)

MariaDB [mysql]> quit
Bye
root@its-lu20s04:~# mysql -e 'kill 43' && systemctl stop mariadb
root@its-lu20s04:~#
```

Security and User Rights

Get Rights of user

Secure with SSL server/client

Create CA and Server-Key

```
## On Server - create ca and certificates
sudo mkdir -p /etc/mysql/ssl
sudo cd /etc/mysql/ssl

## create ca.
sudo openssl genrsa 4096 > ca-key.pem

## create ca-certificate
## Common Name: MariaDB Admin
sudo openssl req -new -x509 -nodes -days 365000 -key ca-key.pem -out ca-cert.pem

## create server-cert
## Common Name: MariaDB Server
## Password: --- leave empty ----
sudo openssl req -newkey rsa:2048 -days 365000 -nodes -keyout server-key.pem -out
server-req.pem

## Next process the rsa - key
sudo openssl rsa -in server-key.pem -out server-key.pem

## Now sign the key
sudo openssl x509 -req -in server-req.pem -days 365000 -CA ca-cert.pem -CAkey ca-
key.pem -set_serial 01 -out server-cert.pem
```

Verify certificates

```
openssl verify -CAfile ca-cert.pem server-cert.pem
```

Configure Server

```
## create file
## /etc/my.cnf.d/z_ssl.cnf
[mysqld]
ssl-ca=/etc/mysql/ssl/ca-cert.pem
ssl-cert=/etc/mysql/ssl/server-cert.pem
ssl-key=/etc/mysql/ssl/server-key.pem
### Set up TLS version here. For example TLS version 1.2 and 1.3 ##
tls_version = TLSv1.2,TLSv1.3

## Set ownership
chown -vR mysql:mysql /etc/mysql/ssl/
```

Restart and check for errors

```
systemctl restart mariadb
journalctl -u mariadb
```

Setup on clients

```
## from
## copy /etc/mysql/ssl/ca-cert.pem
## to client
cd /etc/mysql
tar cvfz ssl.tar.gz ssl
scp ssl.tar.gz 11trainingdo@ip:/tmp
```

```
sudo vi /etc/mysql/mariadb.conf.d/50-mysql-clients.cnf

Append/edit in [mysql] section:

### MySQL Client Configuration ##
ssl-ca=/etc/mysql/ssl/ca-cert.pem

###  Force TLS version for client too
##tls_version = TLSv1.2,TLSv1.3
#### This option is disabled by default ###
#### ssl-verify-server-cert ###

## only works if you have no self-signed certificate
ssl-verify-server-cert
```

Test connection on client

```
mysql --ssl -uxyz -p -h <ip-of-server>
mysql>status
SSL:                    Cipher in use is TLS_AES_256_GCM_SHA384
```

Force to use ssl

```
## on server
## now client can only connect, when using ssl
mysql> grant USAGE on *.* to remote@10.10.9.144 require ssl;
```

On client to enable ssl by default for root

```
vi /root/.my.cnf
[mysql]
ssl

## now mysql will always use ssl
mysql -uxyz -p -h10.10.9.110
```

Ref

- https://www.cyberciti.biz/faq/how-to-setup-mariadb-ssl-and-secure-connections-from-clients/

Create User/Grant/Revoke - Management of users

Create user

```
create user training@localhost identified by 'deinpasswort';
```

Drop user (=delete user)

```
drop user training@localhost
```

Change User (e.g. change authentication)

```
## change pass
alter user training@localhost identified by 'newpassword';
```

Set global or db rights for a user

```
grant all on *.* to training@localhost
## only a specific db
grant all on mydb.* to training@localhost
```

Revoke global or dg right from a suer

```
revoke select on *.* from training@localhost
## only from a specific db
revoke select on training.* from training@localhost
```

Refs:

- https://mariadb.com/kb/en/grant/#the-grant-option-privilege
- https://mariadb.com/kb/en/revoke/

User- and Permission-concepts (best-practice)

Database - Objects

Create Database

Show all tables within db

show all tables in database

```
## connect with db training
mysql training
mysql> show tables;
|training|
```

describe

```
MariaDB [training]> describe mitarbeiter;
+---------+---------------------+------+-----+---------+-------+
| Field   | Type                | Null | Key | Default | Extra |
+---------+---------------------+------+-----+---------+-------+
| id      | tinyint(3) unsigned | NO   | PRI | NULL    |       |
| name    | varchar(50)         | YES  |     | NULL    |       |
| vorname | varchar(30)         | YES  |     | NULL    |       |
+---------+---------------------+------+-----+---------+-------+
3 rows in set (0.001 sec)
```

show create

```
MariaDB [training]> show create table mitarbeiter;
+-------------+-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
-----------------------------------------+
| Table       | Create Table
|
+-------------+-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
-----------------------------------------+
| mitarbeiter | CREATE TABLE `mitarbeiter` (
  `id` tinyint(3) unsigned NOT NULL,
  `name` varchar(50) DEFAULT NULL,
  `vorname` varchar(30) DEFAULT NULL,
  PRIMARY KEY (`id`)
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 |
+-------------+-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
-----------------------------------------+
1 row in set (0.000 sec)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```

```
### Triggers



### Ref with walkthrough

  * https://mariadb.com/kb/en/trigger-overview/

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## Locking

### Identify Deadlocks in innodb


### Example
```

SELECT l.*, t.* FROM information_schema.INNODB_LOCKS l JOIN information_schema.INNODB_TRX t ON l.lock_trx_id = t.trx_id WHERE trx_state = 'LOCK WAIT' \G

```
### Refs

  * https://mariadb.com/kb/en/information-schema-innodb_locks-table/

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## InnoDB - Storage Engine

### InnoDB - Storage Engine - Structure


![InnoDB Structure](/images/InnoDB-Structure.jpg)

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### Important InnoDB - configuration - options to optimized performance


### Innodb buffer pool

  * How much data fits into memory
  * Free buffers = pages of 16 Kbytes
  * Free buffer * 16Kbytes = free innodb buffer pool in KByte
```

does not in windows -> pager grep

pager grep -i 'free buffers'

does not work with workbench or heidisql because of formatting + \G only works in client

show engine innodb status \G Free buffers 7905 1 row in set (0.00 sec)

```
### Innodb buffer pool stats with status
```

Also works in heidisql or workbench

show status like '%buffer%';

```
### Overview innodb server variables / settings

  * https://dev.mysql.com/doc/refman/5.7/en/innodb-parameters.html

### Change innodb_buffer_pool
```

/etc/mysql/mysql.conf.d/mysqld.cnf

70-80% of memory on dedicated mysql

[mysqld] innodb-buffer-pool-size=6G

systemctl restart mysql

mysql mysql>show variables like 'innodb%buffer%';

```
### innodb_flush_method
```

Ideally O_DIRECT on Linux, but please test it, if it really works well.

```
###     innodb_flush_log_at_trx_commit
```

When is fliushing done from innodb_log_buffer to log. Default: 1 : After every commit -> best performance 2. -> once per second

Good to use 2, if you are willing to loose 1 second of data on powerfail

```
### innodb_flush_neighbors
```

on ssd disks set this to off, because there is no performance improvement

innodb_flush_neighbors=0

Default = 1

```
### innodb_log_file_size
```

Should holw 60-120 min of data flow

Calculate like so:

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

```
### skip-name-resolv.conf
```

work only with ip's - better for performance

/etc/my.cnf skip-name-resolve

```
  * https://nixcp.com/skip-name-resolve/


### Ref:

  * https://dev.mysql.com/doc/refman/5.7/en/innodb-buffer-pool-resize.html


### Privilegs for show engine innodb status
```

show engine innodb status \G ERROR 1227 (42000): Access denied; you need (at least one of) the PROCESS privilege(s) for this operation

```
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## Training Data

### Setup training data "contributions"


### Walkthrough

  * Complete process takes about 10 minutes

```bash
cd /usr/src
apt update; apt install -y git
git clone https://github.com/jmetzger/dedupe-examples.git
cd dedupe-examples
cd mysql_example
```
```

```
## Eventually you need to enter (in mysql_example/mysql.cnf)
## Only necessary if you cannot connect to db by entering "mysql"
## password=<your_root_pw>
./setup.sh
```

Backup and Restore (Point-In-Time aka PIT)

Backup with mysqldump - best practices

Dumping (best option) without active binary log

```
mysqldump --all-databases --single-transaction > /usr/src/all-databases
## if you want to include procedures use --routines
## with event - scheduled tasks
mysqldump --all-databases --single-transaction --routines --events > /usr/src/all-
databases
```

Useful options for PIT

```
## —quick not needed, because included in —opt which is enabled by default

## on local systems using socket, there are no huge benefits concerning --compress
## when you dump over the network use it for sure
mysqldump --all-databases --single-transaction --gtid --master-data=2 --routines --
events --flush-logs --compress > /usr/src/all-databases.sql;
```

With PIT_Recovery you can use --delete-master-logs

- All logs before flushing will be deleted

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

Version with zipping

```
mysqldump —-all-databases —-single-transaction —-gtid —-master-data=2 —-routines
--events —-flush-logs --compress | gzip > /usr/src/all-databases.sql.gz
```

Performance Test mysqldump (1.7 Million rows in contributions)

```
date; mysqldump --all-databases --single-transaction --gtid --master-data=2 --routines
--events --flush-logs --compress > /usr/src/all-databases.sql; date
Mi 20. Jan 09:40:44 CET 2021
Mi 20. Jan 09:41:55 CET 2021
```

Seperated sql-structure files and data-txt files including master-data for a specific database

```
# backups needs to be writeable for mysql
mkdir /backups
chmod 777 /backups
chown mysql:mysql /backups
mysqldump --tab=/backups contributions
mysqldump --tab=/backups --master-data=2 contributions
mysqldump --tab=/backups --master-data=2 contributions > /backups/master-data.tx
```

Flashback

- Redoes insert/update/delete entries from binlog (binlog_format = 'ROW')

Referenz:

- https://mariadb.com/kb/en/flashback/

mariabackup

Walkthrough

```
## user eintrag in /root/.my.cnf
[mariabackup]
user=root
## pass is not needed here, because we have the user root with unix_socket - auth

mkdir /backups
## target-dir needs to be empty or not present
mariabackup --target-dir=/backups/20210120 --backup
## apply ib_logfile0 to tablespaces
## after that ib_logfile0 ->  0 bytes
mariabackup --target-dir=/backups/20210120 --prepare

### Recover
systemctl stop mariadb
mv /var/lib/mysql /var/lib/mysql.bkup
mariabackup --target-dir=/backups/20200120 --copy-back
chmod -R mysql:mysql /var/lib/mysql
systemctl start mariadb
```

Ref.

https://mariadb.com/kb/en/full-backup-and-restore-with-mariabackup/

Use xtrabackup for MariaDB 5.5

For mariadb 5.5 you can use xtrabackup instead of mariabackup

- https://www.percona.com/doc/percona-xtrabackup/2.4/index.html

Ready-made-back-scripts

- https://gist.github.com/skarllot/2576266

Performance

io-Last/CPU-Last

IO-gebundene - Last (Input/Output)

```
Gegeben wenn:
- Hoher waiting wert in top (wa-wert in CPU-Liste)
- + Hohelast   1,5, 15 min     1,2   1.5  2 (Load) -> top
```

CPU-Gebundene - Last

```
Gegeben wenn:
- NUR: Hohe Last -> Wert in top -> 2 1.5 0.5 (Load)
- Waiting-wert: 0
```

-

Views and performance

General

- SHOW CREATE VIEW
- Views can use 3 algorithms:
  - merge
  - simple rewrites (translates the query)
- temptable
  - Creates a temptable to retrieve information
  - In this case no indexes can be used
  - Shows up explain with : ```

+----+-------------+------------+------+---------------+------+---------+------+------+-------+ | id | select_type | table | type | possible_keys | key | key_len | ref | rows | Extra | +----+-------------+------------+------+---------------+------+---------+------+------+-------+ | 1 | PRIMARY | | ALL | NULL | NULL | NULL | NULL | 33 | NULL | | 2 | DERIVED | task | ALL | NULL | NULL | NULL | NULL | 33 | NULL | +----+-------------+------------+------+---------------+------+---------+------+------+-------+

```
   * undefined
     * MySQL chooses, if to use merge or temptable
     * prefers merge over temptable if possible



### Handling (best practice)

   * You can define the algorithm when creating the view
   * If you define merge and mysql cannot handle it
     * you will get a warning
```

mysql> CREATE ALGORITHM=MERGE VIEW priority_counts AS SELECT priority_id, COUNT(1) AS quanity FROM task GROUP BY priority_id; Query OK, 0 rows affected, 1 warning (0.12 sec)

mysql> SHOW WARNINGS; +---------+------+--+ | Level | Code | Message | +---------+------+--+ | Warning | 1354 | View merge algorithm can't be used here for now (assumed undefined algorithm) | +---------+------+--+ 1 row in set (0.08 sec)

```
   * Ref: https://dba.stackexchange.com/questions/54481/determining-what-algorithm-mysql-view-is-using


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### Partitions and Explain


### Walkthrough
```

EXPLAIN PARTITIONS

DROP TABLE IF EXISTS audit_log; CREATE TABLE audit_log (yr YEAR NOT NULL, msg VARCHAR(100) NOT NULL) ENGINE=InnoDB PARTITION BY RANGE (yr) (PARTITION p0 VALUES LESS THAN (2010), PARTITION p1 VALUES LESS THAN (2011), PARTITION p2 VALUES LESS THAN (2012), PARTITION p3 VALUES LESS THAN MAXVALUE); INSERT INTO audit_log(yr,msg) VALUES (2005,'2005'),(2006,'2006'),(2011,'2011'),(2020,'2020'); EXPLAIN PARTITIONS SELECT * from audit_log WHERE yr in (2011,2012)\G

```
### Partitions sliced by hash of field
```

CREATE TABLE employees (id INT NOT NULL, fname VARCHAR(30), lname VARCHAR(30), hired DATE NOT NULL DEFAULT '1970-01-01', separated DATE NOT NULL DEFAULT '9999-12-31', job_code INT, store_id INT) PARTITION BY HASH(store_id) PARTITIONS 4;

```
<div class="page-break"></div>

### 3 Phases of DataSize


### Phase 1: Table content is small (only some rows)
```

table scan is quicker than index search

e.g. 10 entries

so eventually index is not needed

```
### Phase 2: Index is good !!
```

performance gain by using index

Step 1: Obtaining id's from index (primary key id)

Step 2: Retrieving data

```
### Phase 3: Index is not improve performance / or would makes performance worse
```

Step 1: lookup in index: 1 70 1040 2100 35000 -> there is a lot of space (other rows) in between.

Step 2: Lookup data, but a lot lookups needed

-> random reads -> So mysql might be better off to do a table scan.

```


<div class="page-break"></div>
```

```
## Optimal use of indexes

### Index and Functions (Cool new feature in MySQL 5.7)


### No index can be used on an index:
```

explain select * from actor where upper(last_name) like 'A%'; +----+-------------+-------+------------+------+---------------+------+---------+------+------+----------+-------------+ | id | select_type | table | partitions | type | possible_keys | key | key_len | ref | rows | filtered | Extra | +----+-------------+-------+------------+------+---------------+------+---------+------+------+----------+-------------+ | 1 | SIMPLE | actor | NULL | ALL | NULL | NULL | NULL | NULL | 200 | 100.00 | Using where | +----+-------------+-------+------------+------+---------------+------+---------+------+------+----------+-------------+

```
### Workaround with virtual columns (possible since mysql 5.7)
```

1. Create Virtual Column with upper

alter table sakila add idx_last_name_upper varchar(45) GENERATED ALWAYS AS upper(last_name);

2. Create an index on that column

create index idx_last_name_upper on actor (last_name_upper);

```
### Now we try to search the very same
```

explain select * from actor where last_name_upper like 'A%'; +----+-------------+-------+------------+-------+----------------------+----------------------+---------+------+------+----------+-------------+ | id | select_type | table | partitions | type | possible_keys | key | key_len | ref | rows | filtered | Extra | +----+-------------+-------+------------+-------+----------------------+----------------------+---------+------+------+----------+-------------+ | 1 | SIMPLE | actor | NULL | range | idx_last_name_upper | idx_last_name_upper | 183 | NULL | 7 | 100.00 | Using where | +----+-------------+-------+------------+-------+----------------------+----------------------+---------+------+------+----------+-------------+ 1 row in set, 1 warning (0.00 sec)

```
### Preview MySQL 8

  * MySQL 8 support functional indexes

<div class="page-break"></div>

### Index and Likes


### 1. like 'Will%' - Index works
```

```
explain select last_name from donors where last_name like 'Will%';

### 2. like '%iams' - Index does not work
```

-- because like starts with a wildcard explain select last_name from donors where last_name like '%iams';

```

### 3. How to fix 3, if you are using this often ?
```

Walkthrough

Step 1: modify table

alter table donors add last_name_reversed varchar(70) GENERATED ALWAYS AS (reverse(last_name));
create index idx_last_name_reversed on donors (last_name_reversed);

besser - Variante 2 - untested

alter table donors add last_name_reversed varchar(70) GENERATED ALWAYS AS (reverse(last_name)), add index idx_last_name_reversed on donors (last_name_reversed);

Step 2: update table - this take a while

update donors set last_name_reversed = reversed(last_name)

Step 3: work with it

select last_name,last_name_reversed from donor where last_name_reversed like reverse('%iams');

```

## Version 2 with pt-online-schema-change

```

profiling-get-time-for-execution-of.query

   * Get better values, how long queries take

Example
```

set profiling = 1

## Step 2 - Execute query

select last_name as gross from donors where last_name like lower('WILLI%')

## Step 3 - Show profiles
```

show profiles; +----------+------------+---+ | Query_ID | Duration | Query | +----------+------------+---+ | 1 | 0.01993525 | select last_name as gross from donors where last_name like lower('WILLI%') | 4 rows in set, 1 warning (0.00 sec)

Step 4 - Show profile for a specific query

mysql> show profile for query 1; +----------------------+----------+ | Status | Duration | +----------------------+----------+ | starting | 0.000062 | | checking permissions | 0.000006 | | Opening tables | 0.000021 | | init | 0.000017 | | System lock | 0.000007 | | optimizing | 0.000007 | | statistics | 0.000083 | | preparing | 0.000012 | | executing | 0.000004 | | Sending data | 0.022251 | | end | 0.000005 | | query end | 0.000008 | | closing tables | 0.000007 | | freeing items | 0.001792 | | cleaning up | 0.000016 | +----------------------+----------+ 15 rows in set, 1 warning (0.00 sec)

```
<div class="page-break"></div>

### Find out cardinality without index


### Find out cardinality without creating index
```

select count(distinct donor_id) from contributions;

select count(distinct(vendor_city)) from contributions; +------------------------------+ | count(distinct(vendor_city)) | +------------------------------+ | 1772 | +------------------------------+ 1 row in set (4.97 sec)

```
<div class="page-break"></div>

## Monitoring

### What to monitor?


### What to monitor

#### System

  * Last auf dem System (top)
  * Festplatte (z.B. 85% voll ?) df /var/lib/mysql
  * Swap (Wenn geswappt wird ist Hopfen und Malz verloren)

#### Erreichbarkeit

  * Server per ping erreichen (mysqladmin ping -h ziel-ip)
  * Einlogbar ? (myadmin ping -h ziel-ip -u control_user

#### Platte aka IO-Subsystem (iostats)

  * http://schulung.t3isp.de/documents/pdfs/mysql/mysql-performance.pdf
```

```
| --       | --          | -- |
| ------------- |:-------------:| -----:|
| Read/Write requests          | IOPS (Input/Output operations per second) | -- |
| Average IO wait    | Time that queue operations have to wait for disk access |   --
|
| Average Read/Write time | Time it takes to finish disk access operations (latency) |
-- |
| Read/Write bandwidth | Data transfer from and towards your disk | -- |

#### Gneral mysql metrics
```

mysql -E -e "select variable_value from information_schema.session_status where variable_name = 'uptime'";

max connections

MariaDB [(none)]> show status like 'max_used_connections'; +----------------------+-------+ | Variable_name | Value | +----------------------+-------+ | Max_used_connections | 1 | +----------------------+-------+ 1 row in set (0.001 sec)

MariaDB [(none)]> show variables like 'max_connections'; +-----------------+-------+ | Variable_name | Value | +-----------------+-------+ | max_connections | 151 | +-----------------+-------+ 1 row in set (0.001 sec)

mysqladmin status

you will find uptime here in seconds

```
| Metric    | Comments    | Suggested Alert |
| ------------- |:-------------:| -----:|
| Uptime    | Seconds since the server was started. We can use this to detect
respawns.     | When uptime is < 180. (seconds)  |
| Threads_connected    | Number of clients currently connected. If none or too high,
something is wrong.    | None |
| Max_used_connections |    Max number of connections at a time since server started.
(max_used_connections / max_connections) indicates if you could run out soon of
connection slots.|    When connections usage is > 85%. |
| Aborted_connects |    Number of failed connection attempts. When growing over a
period of time either some credentials are wrong or we are being attacked.    | When
aborted connects/min > 3. |

#### InnoDB

| Metric | Coments | Suggested Alert |
| ------------- |:-------------:| -----:|
| Innodb_row_lock_waits    | Number of times InnoDB had to wait before locking a row.
| None |
| Innodb_buffer_pool_wait_free    | Number of times InnoDB had to wait for memory
pages to be flushed. If too high, innodb_buffer_pool_size is too small for current
write load.    | None |
```

```
#### Query tracking

| Metric    | Comments    | Suggested Alert |
| ------------- |:-------------:| -----:|
| Slow_queries    | Number of queries that took more than long_query_time seconds to execute. Slow queries generate excessive disk reads, memory and CPU usage. Check slow_query_log to find them.    | None |
| Select_full_join    | Number of full joins needed to answer queries. If too high, improve your indexing or database schema.    | None |
| Created_tmp_disk_tables    | Number of temporary tables (typically for joins) stored on slow spinning disks, instead of faster RAM.    | None |
| (Full table scans) Handler_read%    Number of times the system reads the first row of a table index. (if 0 a table scan is done - because no key was read). Sequential reads might indicate a faulty index.    None

#### Track Errors
```

journalctl -u mariadb | grep -i Error

```


#### Ref

  * https://blog.serverdensity.com/how-to-monitor-mysql/

#### Monitoring with pmm (Percona Management Monitoring)

https://pmmdemo.percona.com

[Documentation](https://www.percona.com/doc/percona-monitoring-and-management/2.x/details/commands/pmm-admin.html)

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## Replication

### Slave einrichten - gtid (mit mariabackup)


### Step 0.5a: Installation on ubuntu/debian
```

apt update apt install mariadb-backup

check if available

mariabackup --version

prepare for mariabackup if you use it with root and with unix_socket

/root/.my.cnf [mariabackup] user=root

```
### Step 1: mariabackup on master
```

mkdir /backups

target-dir needs to be empty or not present

mariabackup --target-dir=/backups/20210121 --backup

apply ib_logfile0 to tablespaces

after that ib_logfile0 -> 0 bytes

mariabackup --target-dir=/backups/20210121 --prepare

```
### Step 2: Transfer to new slave (from master)
```

root@master:

rsync -e ssh -avP /backups/20210121 student@10.10.9.144:/home/student/

```
### Step 3: Setup replication user on master
```

as root@master

##mysql> CREATE USER repl@'10.10.9.%' IDENTIFIED BY 'password'; GRANT REPLICATION SLAVE ON . TO 'repl'@'10.10.9.%';

```
### Step 3a (Optional): Test repl user (connect) from slave
```

as root@slave

you be able to connect to

mysql -urepl -p -h10.10.9.110

test if grants are o.k.

show grants

```
### Step 4a: Set server-id on master -> 1
```

[mysqld] server-id=1

systemctl restart mariadb

```
### Step 4b: Set server-id on slave -> 3 + same config as server 1 + log_slave_update
```

[mysqld] server-id = 3

activate master bin log, if this slave might be a master later

log_bin = /var/log/mysql/mysql-bin.log binlog_format = ROW log_slave_update = 1

systemctl restart mariadb

auf dem master config mit rsync rüberschrieben

root@master

rsync -e ssh -avP /etc/mysql/mariadb.conf.d/z_uniruhr.cnf kurs@10.10.9.144:/home/kurs/

```
### Step 5: Restore Data on slave
```

systemctl stop mariadb mv /var/lib/mysql /var/lib/mysql.bkup mariabackup --target-dir=/home/student/20210121 --copy-back chown -R mysql:mysql /var/lib/mysql systemctl start mariadb

```
### Step 6: master.txt for change command
```

root@slave

$ cat xtrabackup_binlog_info mariadb-bin.000096 568 0-1-2

SET GLOBAL gtid_slave_pos = "0-1-2";

/root/master.txt

get information from master-databases.sql dump

CHANGE MASTER TO MASTER_HOST="10.10.9.110", MASTER_PORT=3306, MASTER_USER="repl", MASTER_PASSWORD="password", MASTER_USE_GTID=slave_pos;

mysql < master.txt

or: copy paste into mysql>

mysql>

start slave

in mysql -> show slave status

mysql>show slave status

Looking for

Slave_IO_Running: Yes Slave_SQL_Running: Yes

```
### Walkthrough

https://mariadb.com/kb/en/setting-up-a-replication-slave-with-mariabackup/

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### Slave einrichten - master_pos


### Step 1: mysqldump on master
```

mkdir -p /backups/mysqldumpdir

in version 5.5. there is not --git so use it without --gtid

mysqldump --all-databases --single-transaction --master-data=2 --routines --events --compress > /backups/mysqldumpdir/master-databases.sql;

```
### Step 2: Transfer to new slave (from master)
```

root@master:

rsync -e ssh -avP /backups/mysqldumpdir/master-databases.sql kurs@10.10.9.144:/home/kurs/

```
### Step 3 (Optional): Be sure that slave is really fresh (no data yet)
```

if old not wanted data is present, e.g. other databases, start with fresh-installation by so:

as root

cd /var/lib mv mysql mysql.bkup mariadb-install-db --user=mysql

```
### Step 4: Setup replication user on master
```

as root@master

##mysql> CREATE USER repl@'10.10.9.%' IDENTIFIED BY 'password'; GRANT REPLICATION SLAVE ON . TO 'repl'@'10

```
### Step 4a (Optional): Test repl user (connect) from slave
```

as root@slave

you be able to connect to

mysql -urepl -p -h10.10.9.110

test if grants are o.k.

show grants

```
### Step 5a: Set server-id on master -> 1
```

[mysqld] server-id=1

systemctl restart mariadb

```
### Step 5b: Set server-id on slave -> 2 + same config as server 1
```

[mysqld] server-id = 2

activate master bin log, if this slave might be a master later

log_bin = /var/log/mysql/mysql-bin.log

systemctl restart mariadb

auf dem master config mit rsync rüberschrieben

root@master

rsync -e ssh -avP /etc/mysql/mariadb.conf.d/z_uniruhr.cnf kurs@10.10.9.144:/home/kurs/

root@slave

mv /home/kurs/z_uniruhr.cnf /etc/mysql/mariadb.conf.d/ chown root:root /etc/mysql/mariadb.conf.d
systemctl restart mariadb

```
### Step 6: Restore Data on slave
```

root@slave

cd /home/kurs mysql < master-databases.sql

```
### Step 7: master.txt for change command
```

root@slave

/root/master.txt

get information from master-databases.sql dump

CHANGE MASTER TO MASTER_HOST="10.10.9.110", MASTER_PORT=3310, MASTER_USER="repl", MASTER_PASSWORD="password", MASTER_LOG_FILE='mysqld-bin.000001', MASTER_LOG_POS=568;

Version 1

mysql < master.txt

or: copy paste into mysql>

in mysql -> show slave status

mysql>show slave status

Looking for

Slave_IO_Running: Yes Slave_SQL_Running: Yes

```
### Step 8: not working on 5.5.
```

Switch to using gtid later on:

show slave status; # look for using_gtid stop slave; CHANGE MASTER TO MASTER_USE_GTID = slave_pos; show slave status; # look for using_gtid start slave;

```
### Walkthrough

https://mariadb.com/kb/en/setting-up-a-replication-slave-with-mariabackup/

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### MaxScale installieren


###  Why do Loadbalancing with MaxScale ?


*  Cluster node transparent to application
    * Application does not see single nodes

*  If one node fails you will have no downtime
    * In opposite: To talking to this node directly

### License Implications since 2.x

*  MariaDB MaxScale >= 2.0 is licensed under MariaDB BSL.
```

```
*  maximum of three servers in a commercial context.
    * Any more, and you'll need to buy their commercial license.

*  MariaDB MaxScale 2.1.0 will be released under BSL 1.1 from the start

*  Each release transitions in about max 4 years to GPL


### The MaxScale load-balancer and its components

*  Routers
*  Listeners
*  Filters
*  Servers (backend database server)

####  Filters

*  Logging Filters
*  Statement rewriting filters
*  Result set manipulation filters
*  Firewill filter
*  Pipeline control filters
    * e.g. tee and send to a second server

*  Ref: https://mariadb.com/kb/en/mariadb-maxscale-25-regex-filter/

### Documentation - maxctrl

  * https://mariadb.com/kb/en/mariadb-maxscale-25-maxctrl/


### Installation and Setup

#### Installation
```

apt update apt install apt-transport-https curl

Setting up the repos

curl -sS https://downloads.mariadb.com/MariaDB/mariadb_repo_setup | sudo bash

Installing maxscale

apt install maxscale

```
#### Setup (Part 1: MaxScale db-user)

  * Do this on one of the galera nodes
  * Adjust IP !!

```bash
```
```

```
## IP FROM MAXSCALE
## Setup privileges on cluster nodes
## It is sufficient to set it on one node, because
## it will be synced to all the other nodes
## on node 1
CREATE USER 'maxscale'@'10.10.11.139' IDENTIFIED BY 'P@ssw0rd';
##
GRANT SELECT ON mysql.db TO 'maxscale'@'10.10.11.139';
GRANT SELECT ON mysql.user TO 'maxscale'@'10.10.11.139';
GRANT SELECT ON mysql.tables_priv TO 'maxscale'@'10.10.11.139';
##
GRANT SELECT ON mysql.columns_priv TO 'maxscale'@'10.10.11.139';
GRANT SELECT ON mysql.proxies_priv TO 'maxscale'@'10.10.11.139';
##
GRANT SHOW DATABASES ON *.* TO 'maxscale'@'10.10.11.139';
## Needed for maxscale
GRANT SELECT ON mysql.procs_priv TO 'maxscale'@'10.10.11.139';
GRANT SELECT ON mysql.roles_mapping TO 'maxscale'@'10.10.11.139';

## Additionally for cluster operations (rejoin,switchover,failover for master/slave
replications
## these permissions are needed
GRANT super, reload, process, show databases, event on *.* to
'maxscale'@'10.10.11.139';
## GRANT select on mysql.user to 'maxscale'@'10.10.11.139';
```

```
## On maxscale - server
apt update
apt install mariadb-client
## Test the connection
## Verbindung sollte aufgebaut werden
mysql -u maxscale -p -h <ip-eines-der-nodes>
mysql>show databases
```

SETUP (PART 2: CONFIGURATION)

```
## /etc/maxscale.cnf

[maxscale]

threads=auto
syslog=0
maxlog=1
log_warning=1
log_notice=1
log_info=0
log_debug=0

[TheMonitor]
type=monitor
module=mariadbmon
```

```
servers=server1,server2,server3
user=maxscale
password=P@ssw0rd
auto_rejoin=true
auto_failover=true

[RW-Split-Router]
type=service
router=readwritesplit
servers=server1,server2,server3
user=maxscale
password=P@ssw0rd
max_slave_connections=100%


[RW-Split-Listener]
type=listener
service=RW-Split-Router
protocol=MariaDBClient
port=3306

[server1]
type=server
address=142.93.98.60
port=3306
protocol=MariaDBBackend

[server2]
type=server
address=142.93.103.153
port=3306
protocol=MariaDBBackend

[server3]
type=server
address=142.93.103.246
port=3306
protocol=MariaDBBackend
```

```
## Start

systemctl start maxscale
```

```
## What does the log say ?

## /var/log/maxscale/maxscale.log
```

maxctrl

```
maxctrl list servers
maxctrl show server server1
```

```
maxctrl list services
maxctrl show service ReadWrite-Split-Router
```

Reference: MaxScale-Proxy mit Monitoring

MaxScale MariaDB-Monitor

Walkthrough:Automatic Failover Master Slave

https://mariadb.com/kb/en/mariadb-maxscale-25-automatic-failover-with-mariadb-monitor/

Tools

Percona-toolkit-Installation

Walkthrough

```
## Howto
## https://www.percona.com/doc/percona-toolkit/LATEST/installation.html

## Step 1: repo installieren mit deb -paket
wget https://repo.percona.com/apt/percona-release_latest.focal_all.deb;
apt update;
apt install -y curl;
dpkg -i percona-release_latest.focal_all.deb;
apt update;
apt install -y percona-toolkit;
```

pt-query-digist - analyze slow logs

Requires

- Install percona-toolkit

Usage

```
## first enable slow_query_log
set global slow_query_log = on
set global long_query_time = 0.2
## to avoid, that i have to reconnect with new session
set session long_query_time = 0.2

## produce slow query - for testing
select * from contributions where vendor_last_name like 'W%';
mysql > quit

##
cd /var/lib/mysql
## look for awhile wih -slow.log - suffix
pt-query-digest mysql-slow.log > /usr/src/report-slow.txt
less report-slow.txt
```

pt-online-schema-change howto

Requirements

- Install percona-toolkit

What does it do ?

```
## Altering table without blocking them
## Do a dry-run beforehand
pt-online-schema-change --alter "ADD INDEX idx_city (city)" --dry-run
D=contributions,t=donors
##
pt-online-schema-change --alter "ADD INDEX idx_city (city)" --execute
D=contributions,t=donors
```

Problems -> high cpu load

```
## fine - tune params
## e.g. --max-load
## refer to docs
https://www.percona.com/doc/percona-toolkit/3.0/pt-online-schema-
change.html#:~:text=pt%2Donline%2Dschema%2Dchange%20works%20by%20creating%20an%20empty,i
```

Ubuntu-with-Vagrant

Walkthrough

```
## Step 1: Download git for windows
https://git-scm.com/downloads
## Step 2: Install Virtualbox
https://download.virtualbox.org/virtualbox/6.1.18/VirtualBox-6.1.18-142142-Win.exe
## Step 3: Auf dem Desktop, rechte Maustaste -> git bash here
## in the bash
mkdir myvirtualmachine
vagrant init ubuntu/focal64
vagrant up
## and the you are in the machine (shell)
vagrant ssh
## within machine switch from vagrant user to root without password
sudo su -
## there you go - install whatever
```

Include provisioning in Vagrantfile

```
  config.vm.provision "shell", inline: <<-SHELL
    apt-get update
    apt-get install -y mysql-server-5.7 wget
    cd /usr/src
    touch foo
    wget https://downloads.mysql.com/docs/sakila-db.tar.gz
    tar xzvf sakila-db.tar.gz
    cd sakila-db
    mysql < sakila-schema.sql
    mysql < sakila-data.sql
  SHELL
end
```

Destroy machine

```
vagrant destroy -f

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## Extras

### User Variables

```

only valid within one session

set @host='localhost';

You can use it in select

select @host;

You can use it in the where clause

select mysql.user where host=@host;

not possible to use it within create user

DOES NOT WORK !

set @mypass='password'; create user someuser@somehost identified by @mypass;

```
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### Installation sakila-db
```

cd /usr/src wget https://downloads.mysql.com/docs/sakila-db.tar.gz tar xzvf sakila-db.tar.gz

cd sakila-db mysql < sakila-schema.sql mysql < sakila-data.sql

```
<div class="page-break"></div>

## Documentation

### Server System Variables

  * https://mariadb.com/kb/en/server-system-variables/#bind_address

### MySQL - Performance - PDF

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

### Source-Code MariaDB

  * https://github.com/MariaDB/server

## Diagnosis and measurement of performance

### Best practices to narrow down performance problems


### Pre-Requisites

  * System is slow

### Analyze - Checklist  - Step 1
```

Are there slow queries ?

look for time

show full processlist

or time - in seconds

select * from information_schema.processlist where time > 10;

```
### Re-Execute SELECT or where from UPDATE / DELETE
```

Is it still slow ?

Eventually kill

mysql>show processlist mysql>--kill mysql>-- example mysql>kill 44

```


### Explain what is going on
```

Explain Select....

```

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## Performance and optimization of SQL statements

### Do not use '*' whenever possible


### Why ?

  * You are adding .. to he server:
    * I/O
    * memory
    * CPU
  * You are preventing covering indexes

### Walkthrough. (Look at the time)

#### Using '*'
```

using '* '

pager grep "rows in set"; select * from donors where last_name like 'Willia%'; select * from donors where last_name like 'Willia%'; -- time between 0.02 and 0.04 secs -- 2424 rows in set (0.02 sec) -- reset pager pager

corresponding Explain (QEP)

explain select * from donors where last_name like 'Willia%'; +----+-------------+--------+------------+-------+------------------+------------------+---------+------+------+----------+-----------------------+ | id | select_type | table | partitions | type | possible_keys | key | key_len | ref | rows | filtered | Extra | +----+-------------+--------+------------+-------+------------------+------------------+---------+------+------+----------+-----------------------+ | 1 | SIMPLE | donors | NULL | range | donors_donor_info | donors_donor_info | 213 | NULL | 4748 | 100.00 | Using index condition | +----+-------------+--------+------------+-------+------------------+------------------+---------+------+------+----------+-----------------------+ 1 row in set, 1 warning (0.00 sec)

```
#### using specific fields
```

pager grep 'rows in set'; select last_name,first_name from donors where last_name like 'Willia%'; pager; PAGER set to 'grep 'rows in set'' 2424 rows in set (0.01 sec)

explain select last_name,first_name from donors where last_name like 'Willia%'; +----+-------------+--------+------------+-------+------------------+------------------+---------+------+------+----------+--------------------------+ | id | select_type | table | partitions | type | possible_keys | key | key_len | ref | rows | filtered | Extra | +----+-------------+--------+------------+-------+------------------+------------------+---------+------+------+----------+--------------------------+ | 1 | SIMPLE | donors | NULL | range | donors_donor_info | donors_donor_info | 213 | NULL | 4748 | 100.00 | Using where; Using index | +----+-------------+--------+------------+-------+------------------+------------------+---------+------+------+----------+--------------------------+ 1 row in set, 1 warning (0.00 sec)

```
  * Uses cover index (indicator in Extra: using index)

### Ref:

  * https://www.oreilly.com/library/view/high-performance-
mysql/9780596101718/ch04.html

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### Be aware of subselects - Example 1

### Optimizer-hints (and why you should not use them)


### Tell the optimizer what to do and what not to do

  * https://dev.mysql.com/doc/refman/5.7/en/optimizer-hints.html#optimizer-hints-
syntax

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## Replication

### Replikation Read/Write

  * https://proxysql.com/blog/configure-read-write-split/

## Performance
```

```
### Best Practices


### Indexes

#### 2 Indexes vs. Combined Index

  * In most cases a combined index is better than 2 indexes.

### Joins

#### Field-Type

  * Do not use varchar() or char() aka string types of join field
  * better: integer (unsigned) && same size
    * e.g. actor_id id int unsigned

### Views

#### General

  * Only use views with merge
  * NO temptable please, these CANNOT be indexed.

### Where

#### No functions in where please

  * Why ? Index cannot be used.
  * example:
    * select first_name from actor where upper(first_name) like 'A%'

##### Alternative solution

  * use a virtual field and index virtual field (possible from mysql > 5.7)
  * Massive improvements in mysqL 8

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### Example sys-schema and Reference


### Examples
```

mysql> select * from sys.host_summary\G *** 1. row *** host: localhost statements: 1347 statement_latency: 7.55 m statement_avg_latency: 336.50 ms table_scans: 15 file_ios: 612857 file_io_latency: 1.66 m current_connections: 1 total_connections: 7 unique_users: 1 current_memory: 0 bytes total_memory_allocated: 0 bytes 1 row in set (0.01 sec)

```
### Ref:
```

```
  * https://github.com/mysql/mysql-sys/blob/master/README.md



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### Change schema online (pt-online-schema-change)

  * https://www.percona.com/doc/percona-toolkit/3.0/pt-online-schema-change.html

### Optimizer-Hints


### Tell the optimizer what to do and what not to do

  * https://dev.mysql.com/doc/refman/5.7/en/optimizer-hints.html#optimizer-hints-
syntax

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## Documentation / Literature

### Effective MySQL

  * https://www.amazon.com/Effective-MySQL-Optimizing-Statements-Oracle/dp/0071782796

### Last Training

  * https://github.com/jmetzger/training-mysql-developers-basics

### MySQL - Performance - PDF

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

### MariaDB Galera Cluster

  * http://schulung.t3isp.de/documents/pdfs/mariadb/mariadb-galera-cluster.pdf

### MySQL Galera Cluster

  * https://galeracluster.com/downloads/

## Questions and Answers

### Questions and Answers


### 1. Do you recommend Aurora
```

In my current humble opinion Aurora is a double edged sword. Aurora looks promising for scalablity, but a lot of stuff is modified mysql-stuff and in my opinion has a lot of restrictions.

You should be aware, that moving to Aurora might be a tasks and reverting back even more.

```
   * Refer to: https://ahmedahamid.com/aurora-mysql/

I would like to point you to a performance measurement report here:

   * https://galeracluster.com/2019/09/everdata-reports-galera-cluster-outshines-amazon-aurora-and-rds/

### 2. Get rid of unattended - upgrades problem (dirty hack)
```

ps aux | grep unatt kill

```
### 3. Archive Data
```

https://www.percona.com/doc/percona-toolkit/LATEST/pt-archiver.html

```
### 4. Does innodb do defragmentation by itself ?
```

Some background while doing research.

Nil performance benefits of defragmentation in index.

https://stackoverflow.com/questions/48569979/mariadb-table-defragmentation-using-optimize

```
### 5. Defragmentation
```

Optimize table

ALTER TABLE contributions engine = InnoDB

mariadb has a patch for defragmentation

https://mariadb.org/defragmenting-unused-space-on-innodb-tablespace/

alter table xyz engine=InnoDB - defragements

but is also invasive.

with ibdata1 innodb_file_per_table it lets the size grow

```
### 6. Is it possible to do select, update, deletes without using innodb_buffer in specific
```

No, this is not possible

```
### 7. Unit test framework in MySQL
```

No, there is no testing framework with MySQL

```
### 8. MariaDB - Advantages

  * flashback
  * Verschlüsselung von Tabellen // mariabackup
  * Einige Storage Engine (Aria -> MyISAM - crash-recovery)
  * JSON anders implementiert
  * galera
  * feature: defragementation
```

MysqL 8 does not: decode set profiling (still available but deprecated)

```
### 9. Select without locking
```

SET TRANSACTION ISOLATION LEVEL READ UNCOMMITTED ; BEGIN ; SELECT * FROM TABLE_NAME ; COMMIT ;

```
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### migration-mysql-update-5.6->5.7
```

==========

1. Sicherung. xtrabackup Mysqldump 16 GB ————
2.

Neue Location -> 5.6 <- Xtrbackup
Server runterfahren Update 5.7 Fahrt den Server wieder hoch

2. Source-Host (Old Host) -> mysqldump Neuen -> Installation von MySQL 5.7 Test-einspielen. < mysqldump

4-5 Stunden.

—> Konfiguration von mysql -> was wollt ihr übernehmen.

3. Replications - Slave auf neuem System -> 5.7 Hängt in den Master. Sicheren Transport —> ssh -tunnel .

-> Firewall-Regeln. —> ssl -absicherung

```
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## MySQL Do-Nots
```

```
### mysql-do-nots


### 1. No function in where (column_name)
```

Never use a function for the column name in where

e.g.

select * from donors where upper(last_name) like 'Willia%'

```
#### Why ?

  * Not index can be used
```

Not filtering possible by indx -> possible_keys -> NULL

explain select last_name from donors where upper(last_name) like 'WILLI%'; +----+-------------+--------+------------+-------+---------------+------------------+---------+------+--------+----------+-----------------------+ | id | select_type | table | partitions | type | possible_keys | key | key_len | ref | rows | filtered | Extra | +----+-------------+--------+------------+-------+---------------+------------------+---------+------+--------+----------+-----------------------+ | 1 | SIMPLE | donors | NULL | index | NULL | donors_donor_info | 687 | NULL | 701948 | 100.00 | Using where; Using index | +----+-------------+--------+------------+-------+---------------+------------------+---------+------+--------+----------+-----------------------+ 1 row in set, 1 warning (0.00 sec)

```
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```