Differences between MariaDB and MySQL
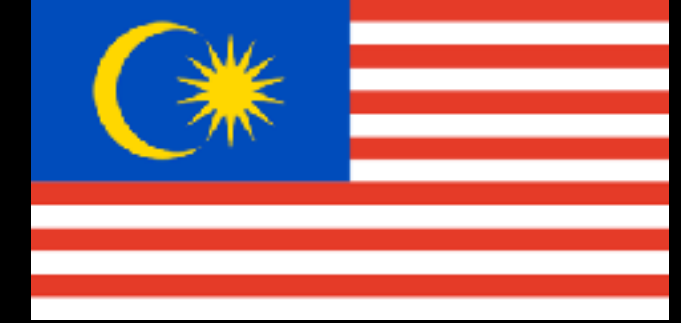
Colin Charles, Chief Evangelist, Percona Inc.
colin.charles@percona.com / byte@bytebot.net
http://bytebot.net/blog/ | @bytebot on Twitter

Percona Webminar
24 January 2018

whoami

- Chief Evangelist, Percona Inc

- Founding team of MariaDB Server (2009-2016), previously at Monty Program Ab, merged with SkySQL Ab, now MariaDB Corporation

- Formerly MySQL AB (exit: Sun Microsystems)

- Past: Fedora Project (FESCO), OpenOffice.org

- MySQL Community Contributor of the Year Award winner 2014

A good base blog post resource

- High level, *answer* to a whitepaper

- https://www.percona.com/blog/2017/11/02/mysql-vs-mariadb-reality-check/

Define: compatibility (OED)

- A state in which two things are able to exist or occur together without problems or conflict.

1.2 *Computing* The ability of one computer, piece of software, etc. to work with another.

'*software compatibility is another important factor to consider*'

Why this matters

- MariaDB Server is the "default" MySQL in pretty much every Linux distribution except Ubuntu (shipping MySQL 5.7)

- It isn't MySQL - there are also many cloud providers that have an option for MariaDB

  - Amazon Web Services (AWS) RDS MariaDB, Microsoft Azure, Rackspace Cloud

- There are incompatibilities with connectors

  - https://github.com/brianmario/mysql2/issues/878

  - MariaDB Connector/C for MySQL and MariaDB Server. It is libmysqlclient API compatible. LGPL. OpenSSL/GnuTLS/schannel (no more yaSSL/wolfSSL)

  - header change in MariaDB 10.2.6 and mysqlclient python binding - https://lists.launchpad.net/maria-developers/msg10726.html

Commitments

- Verbal commitments: **"MySQL 5.6, should be comparable to MariaDB Server 10.1. And for 10.2 it should be compatible with MySQL 5.7"** — Michael "Monty" Widenius, CTO of MariaDB Corporation and MariaDB Foundation, 7 October 2016, MariaDB Developer's Meeting, Amsterdam

- http://mariadb.org/about/

  - "It is an enhanced, drop-in replacement for MySQL."

Licensing

- MariaDB Server: GPLv2 only

- MariaDB MaxScale: Business Source License

- MariaDB ColumnStore: GPLv2 only

  - Backup & Restore, ColumnStore Kafka data adapter, MariaDB MaxScale CDC Data Adapter: Business Source License

- MySQL has Community (GPLv2) and Enterprise releases

Support

- What is the support ecosystem and landscape like?

- Training?

- MySQL Certification (MariaDB Corporation started certification at M17)

Community Contributions

- Oracle Contributor Agreement (OCA)

- MariaDB Contributor Agreement (MCA)

- BSD New

- Who maintains the code? What is the state of community contributed code?

Governance

- MariaDB Corporation

- MariaDB Foundation

- Is there vendor lock-in in open source?

- How many users are there, really?

Number of Funding Rounds	**9**	Total Funding Amount	**$98.2M**

Announced Date	Transaction Name	Number of Investors	Money Raised	Lead Investors
Sep 29, 2017	Series C - MariaDB	6	$27M	Alibaba
May 8, 2017	Venture Round - Mar...	1	€25M	European Investment Bank...
Apr 5, 2016	Series B - MariaDB	1	$3M	—
Jan 21, 2016	Series B - MariaDB	2	$9M	—
Feb 26, 2015	Series B - MariaDB	1	€3M	—
Oct 23, 2013	Series B - MariaDB	5	$20M	Intel Capital
May 30, 2012	Series A - MariaDB	1	$2.5M	—
Apr 4, 2012	Series A - MariaDB	3	$4M	OnCorps, Inc.
Sep 1, 2010	Venture Round - Mar...	1	$2M	—

Releases

MariaDB	MySQL
5.1: 1 Feb 2010	5.1: 14 Nov 2008
5.2: 10 Nov 2010	
5.3: 29 Feb 2012	
5.5: 11 Apr 2012	5.5: 3 Dec 2010
	5.6: 5 Feb 2013
10.0: 31 Mar 2014	
10.1: 17 Oct 2015	
	5.7: 21 Oct 2015
10.2: 23 May 2017	

What's documented?

- https://mariadb.com/kb/en/the-mariadb-library/mariadb-vs-mysql-compatibility/

- Tracker bug: https://jira.mariadb.org/browse/MDEV-10392

- https://mariadb.com/kb/en/library/system-variable-differences-between-mariadb-and-mysql/

Replication

Replication Compatibility

Slave↓ Master→	MariaDB-5.5	MariaDB-10.0	MariaDB-10.1	MariaDB-10.2	MySQL-5.6	MySQL-5.7	MySQL-8.0
MariaDB-5.5	Ok	No	No	No	No	No	No
MariaDB-10.0	Ok	Ok			Ok		
MariaDB-10.1	Ok	Ok	Ok		Ok		
MariaDB-10.2	Ok	Ok	Ok	Ok	Ok	Ok	
MySQL-5.6					X	X	X
MySQL-5.7					X	X	X
MySQL-8.0					X	X	X

Note X: Refer to MySQL documentation

Note: When replication from MySQL in GTID mode, MariaDB will remove the MySQL GTID events and replace them with MariaDB GTID events.

GTID variances

```
[MariaDB [(none)]> show global variables like '%gtid%';
+----------------------+-------+
| Variable_name        | Value |
+----------------------+-------+
| gtid_binlog_pos      | 0-1-9 |
| gtid_binlog_state    | 0-1-9 |
| gtid_current_pos     | 0-1-9 |
| gtid_domain_id       | 0     |
| gtid_ignore_duplicates | OFF |
| gtid_slave_pos       |       |
| gtid_strict_mode     | OFF   |
| wsrep_gtid_domain_id | 0     |
| wsrep_gtid_mode      | OFF   |
+----------------------+-------+
9 rows in set (0.00 sec)
```

```
[mysql> show global variables like '%gtid%';
+-----------------------------------+-------+
| Variable_name                     | Value |
+-----------------------------------+-------+
| binlog_gtid_simple_recovery       | ON    |
| enforce_gtid_consistency          | OFF   |
| gtid_executed                     |       |
| gtid_executed_compression_period  | 1000  |
| gtid_mode                         | OFF   |
| gtid_owned                        |       |
| gtid_purged                       |       |
| session_track_gtids               | OFF   |
+-----------------------------------+-------+
8 rows in set (0.01 sec)
```

- https://mariadb.com/kb/en/library/gtid/#the-domain-id

Replication

- Default binlog format is now `MIXED`

- Default `replicate_annotate_row_events` is ON

- Binlog event compression

- Time delayed replication arrives

- `read_binlog_speed_limit` - restricting the speed at which the slave reads the binlog from the master

- DML only Flashback - rollback instances/databases/tables to an older snapshot (via Alibaba!)

- Continuous streaming binary log backup added to mysqlbinlog

5.1/5.2

- `mysqld` reads `[mariadb]` part of `my.cnf` for MariaDB Server only options

- Binary-only storage engines won't work without recompilation due do different THD structure (e.g. commercial engines like ScaleDB)

- Extended slow query log statistics (microslow patch from Percona)

- More memory utilised: Aria used to handle internal temporary tables, needs configuration

- MariaDB only: table elimination

5.3

- Error numbers for MariaDB are at 1900+; MySQL has to deal: https://bugs.mysql.com/bug.php?id=72062

- Microseconds arrived; but got *fixed* in MariaDB 10.1 to follow the MySQL 5.6 format

- `SHOW PROCESSLIST` with progress reporting

- New features: dynamic columns, virtual columns (5.7), HandlerSocket plugin, Cassandra storage engine (now deprecated)

- Huge changes in optimiser + replication

  - https://mariadb.com/kb/en/library/optimizer-feature-comparison-matrix/

```
MariaDB [(none)]> select * from INFORMATION_SCHEMA.processlist\G
*********************** 1. row ***********************
           ID: 13
         USER: root
         HOST: localhost
           DB: NULL
      COMMAND: Query
         TIME: 0
        STATE: Filling schema table
         INFO: select * from INFORMATION_SCHEMA.processlist
      TIME_MS: 0.468
        STAGE: 0
    MAX_STAGE: 0
     PROGRESS: 0.000
  MEMORY_USED: 85096
EXAMINED_ROWS: 0
     QUERY_ID: 28
  INFO_BINARY: select * from INFORMATION_SCHEMA.processlist
          TID: 19574
```

```
mysql> select * from INFORMATION_SCHEMA.processlist\G
*********************** 1. row ***********************
           ID: 39296
         USER: root
         HOST: localhost
           DB: NULL
      COMMAND: Query
         TIME: 0
        STATE: executing
         INFO: select * from INFORMATION_SCHEMA.processlist
      TIME_MS: 0
    ROWS_SENT: 0
ROWS_EXAMINED: 0
1 row in set (0.00 sec)
```

```
      Info: NULL
  Progress: 0.000
*********************** 6. row ***********************
        Id: 13
      User: root
      Host: localhost
        db: NULL
   Command: Query
      Time: 0
     State: init
      Info: show processlist
  Progress: 0.000
6 rows in set (0.00 sec)
```

```
mysql> show processlist\G
*********************** 1. row ***********************
        Id: 39296
      User: root
      Host: localhost
        db: NULL
   Command: Query
      Time: 0
     State: starting
      Info: show processlist
  Rows_sent: 0
Rows_examined: 0
1 row in set (0.00 sec)
```

10.0

Incompatibilities between MariaDB 10.0 and MySQL 5.6

- MySQL does not support MariaDB's Spider Storage Engine.
- All MySQL binaries (`mysqld`, `myisamchk` etc.) give a warning if one uses a prefix of an option (such as `--big-table` instead of `--big-tables`). MariaDB binaries work in the same way as most other Unix commands and don't give warnings when using unique prefixes.
- MariaDB GTID is not compatible with MySQL 5.6. This means that one can't have MySQL 5.6 as a slave for MariaDB 10.0. However MariaDB 10.0 can be a slave of MySQL 5.6 or any earlier MySQL/MariaDB version. Note that MariaDB and MySQL also have different GTID system variables, so these need to be adjusted when migrating.
- MariaDB 10.0 multi-source replication is not supported in MySQL 5.6.
- To make CREATE TABLE ... SELECT work the same way in statement based and row based replication it's by default executed as CREATE OR REPLACE TABLE on the slave. One benefit of this is that if the slave dies in the middle of CREATE ... SELECT it will be able to continue.
  - One can use the slave-ddl-exec-mode variable to specify how `CREATE TABLE` and `DROP TABLE` is replicated.
- See also a detailed breakdown of System variable differences between MariaDB 10.0 and MySQL 5.6.
- MySQL 5.6 has performance schema enabled by default. For performance reasons MariaDB 10.0 has it disabled by default. You can enable it by starting `mysqld` with the option `--performance-schema`.
- MariaDB 10.0 does not support the MySQL Memcached plugin. However, data stored using memcached can be retrieved because the data is stored as InnoDB tables. MariaDB is able to start successfully with an error message of not being able to find libmemcached.so library.
- Users created with MySQL's SHA256 password algorithm cannot be used in MariaDB 10.0.
- MariaDB 10.0 does not support delayed replication - MDEV-7145.
- Also see a detailed breakdown of System variable differences between MariaDB 10.0 and MySQL 5.6.
- The low-level temporal format used by TIME, DATETIME and TIMESTAMP is different in MySQL 5.6 and MariaDB 10.0. (In MariaDB 10.1, the MySQL implementation is used by default - see mysql56_temporal_format.)

10.1/10.2

Incompatibilities between MariaDB 10.1 and MySQL 5.7

- MariaDB 10.1 does not support MySQL 5.7's JSON.
- MariaDB 10.1's InnoDB encryption is implemented differently than MySQL 5.7's InnoDB encryption.
- MariaDB 10.1 does not support the ngram and MeCab full-text parser plugins - MDEV-10267, MDEV-10268.
- MariaDB 10.1 does not support multiple triggers for a table - MDEV-6112.
- MariaDB 10.1 does not support CREATE TABLESPACE for InnoDB.
- Also see Incompatibilities between MariaDB 10.0 and MySQL 5.6.
- Also see a detailed breakdown of System variable differences between MariaDB 10.1and MySQL 5.7.
- MariaDB does not support MySQL 5.7's X protocol.

Incompatibilities between MariaDB 10.2 and MySQL 5.7

- System variable differences between MariaDB 10.2 and MySQL 5.7.
- Function differences between MariaDB 10.2 and MySQL 5.7.
- Note : Multiple triggers per table was added in 10.2
- The ROWS and RECURSIVE keywords are reserved words in MariaDB 10.2, but not in MySQL 5.7.
- MariaDB InnoDB encryption is implemented differently than MySQL 5.7's InnoDB encryption.
- MariaDB stores JSON as true text, not in binary format as MySQL. The reason is that our JSON functions are much faster than MySQL's so we didn't need to see a need for storing things in binary format as it adds a lot of complexity when manipulating JSON objects.
- For the same reason, MariaDB's JSON data type is an alias for LONGTEXT.
- MariaDB 10.2 does not support MySQL's JSON operators (-> and ->>).
- MariaDB 10.2 does not support the ngram and MeCab full-text parser plugins - MDEV-10267, MDEV-10268.
- MariaDB 10.2 does not support the MySQL X plugin.
- MariaDB 10.2 does not support the MySQL general table spaces.
- Also see Incompatibilities between MariaDB 10.1 and MySQL 5.7.

JSON

- 5.7 has a binary data type, MariaDB chooses not to implement it this way, choosing to not "violate the SQL standard" - https://jira.mariadb.org/browse/MDEV-9144

  - claims it is as fast, but there are no benchmarks - https://jira.mariadb.org/browse/MDEV-13777

X Protocol

- MariaDB Server has **no** support for the MySQL X Protocol

- This means you cannot use `mysqlsh` to access MariaDB Server either

Encryption

- MySQL 5.7 and MariaDB Server 10.1+ implement encryption differently (one is fully tablespace encryption, the other is based on the Google patch for tablespace encryption in addition to having table encryption)

- One does not encrypt logs, the other does

- MySQL requires `innodb_file_per_table`

- MySQL implementation works fully with Percona XtraDB Cluster

  - MariaDB Galera Cluster `gcache` is unencrypted - https://jira.mariadb.org/browse/MDEV-9639

- `mysqlbinlog` cannot read encrypted binary logs - https://jira.mariadb.org/browse/MDEV-8813

CJK language support

- Add "ngram" support to MariaDB Server: https://jira.mariadb.org/browse/MDEV-10267

- Add "MeCab" support to MariaDB Server: https://jira.mariadb.org/browse/MDEV-10268

- gb18030 support: https://jira.mariadb.org/browse/MDEV-7495

PERFORMANCE_SCHEMA

- No `sys` schema - https://jira.mariadb.org/browse/MDEV-9077

- No new PERFORMANCE_SCHEMA instrumentation from 5.7 - https://jira.mariadb.org/browse/MDEV-6114

- e.g. 52 rows in set (0.00 sec) vs. 87 rows in set (0.00 sec)

Security

- MySQL: `sha256_password`

- MariaDB: `ed25519` password plugin

- Needless to say the above are **incompatible** with each other

- `validate_password` is on by default in MySQL 5.7 (not in MariaDB)

Other bits

- MariaDB: `SHOW EXPLAIN FOR <thread_id>`

- MySQL: `EXPLAIN FOR CONNECTION <thread_id>`

  - https://jira.mariadb.org/browse/MDEV-10000

- MySQL has `SUPER READONLY`, missing in MariaDB - https://jira.mariadb.org/browse/MDEV-9458

- Optimiser trace: https://jira.mariadb.org/browse/MDEV-6111

- Replication crash-safety for non-GTID slaves - https://jira.mariadb.org/browse/MDEV-8946

- Minimal/NOBLOB Binlog Row Image replication fails when tables from master have different PK in slave - https://jira.mariadb.org/browse/MDEV-8398

Installation…

- MySQL: https://dev.mysql.com/downloads/repo/yum/ - grab a package — e.g. mysql57-community-release-el7-9.noarch.rpm

- MariaDB Server: https://downloads.mariadb.org/mariadb/repositories/ - copy/paste, edit a file, then install

- Percona Server: https://www.percona.com/doc/percona-server/5.7/installation/yum_repo.html - yum install Percona-Server-server-57

Starting up

- MySQL / Percona Server

  - `service mysqld start`

  - `grep 'temporary password' /var/log/mysqld.log`

  - `ALTER USER 'root'@'localhost' IDENTIFIED BY 'rootmeOK!';`

- MariaDB Server? `mysql -uroot` "just works"

mysql.user table changes

- MariaDB Server and MySQL differ here (not just by addition of roles) - `mysql.user.password` is just `mysql.user.authentication_string`

- Password expiry is coming? https://jira.mariadb.org/browse/MDEV-7597

- Password last changed? Lifetime?

- `ACCOUNT LOCK/UNLOCK`

- `VALIDATE_PASSWORD_STRENGTH()` SQL function doesn't work in MariaDB Server

```
        max_questions: 10                    max_questions: 10
         max_updates: 20                      max_updates: 20
      max_connections: 30                  max_connections: 30
  max_user_connections: 1              max_user_connections: 1
               plugin:                              plugin: mysql_native_password
  authentication_string:              authentication_string:
      password_expired: N                  password_expired: N
               is_role: N           password_last_changed: 2017-06-05 04:58:04
          default_role:                  password_lifetime: NULL
     max_statement_time: 0.000000           account_locked: N
```

More 5.7

- Optimizer hints (and the cost based optimizer itself?) - https://jira.mariadb.org/browse/MDEV-9078

- RENAME INDEX - https://jira.mariadb.org/browse/MDEV-7318

- Query rewriting? - https://jira.mariadb.org/browse/MDEV-5561

- GIS: GeoJSON functions? Geohash functions?

  - SELECT ST_AsGeoJSON(ST_GeomFromText('POINT(11.11111 12.22222)'),2);

  - SELECT ST_GeoHash(180,0,10), ST_GeoHash(-180,-90,15);

Tools

- including new tools like `mysql_ssl_rsa_setup`? `mysqlpump`?

- why will `xtrabackup` not work with MariaDB Server encryption or compression? https://jira.mariadb.org/browse/MDEV-10367

  - answer: fork `xtrabackup` to call it MariaDB Backup

- When merging XtraDB, why isn't it complete, with backup locks? https://jira.mariadb.org/browse/MDEV-5336

- tools that require MySQL GTID don't work with MariaDB Server (e.g. `mysqlfailover, mysqlrpladmin`, MHA, MySQL Router, etc.)

- vitess, started life on just MariaDB Server, but note they support 5.6/5.7 and only 10.0

Contributions?

- SPIDER

  - SPIDER works better if its recompiled (doesn't matter if its included, it isn't "feature complete")

  - Open since March 2015. Priority provided since May 2016. Finally resolved 27 November 2017 (merged into 10.3)

  - https://jira.mariadb.org/browse/MDEV-7698

- Are people still using HandlerSocket?

Storage Engines

- InnoDB 5.7 is now included in MariaDB Server 10.2 (there is no longer Percona XtraDB for the first time)

  - you need to remove XtraDB related options in my.cnf or the server won't start

  - https://lists.launchpad.net/maria-discuss/msg04708.html

- Is InnoDB fully tested?

  - Test cases still need merging - https://jira.mariadb.org/browse/MDEV-13626

  - Slow starts - https://jira.mariadb.org/browse/MDEV-13869 / https://lists.launchpad.net/maria-discuss/msg04922.html

  - Hangs on startup - https://jira.mariadb.org/browse/MDEV-9843

  - Persistent statistics - https://lists.launchpad.net/maria-discuss/msg04937.html

- BLACKHOLE, FEDERATED (now FederatedX) require you to actually load the plugins

  - was a "surprise" - https://jira.mariadb.org/browse/MDEV-11942 (now fixed)

- Status of other engines: OQGRAPH, SphinxSE? Cassandra deprecated

Open ended…

- How often are the 5.6/5.7 mysqltest's run on MariaDB Server?

- How often are upgrades from 5.6/5.7 tested?

Testing and QA matters

Kenny added a comment - 2015-11-25 10:19

If MariaDB intended to implement this and set metadatalocks, I wonder what the real use case is here and maybe that should be updated in the documentation

- It is doing an 'offline' OPTIMIZE TABLE in a very very very slow manner, which does not interfere with workload to other tables, but the practical use is none IMO.
- The only real benefit here is that you can reduce/remove fragmentation on a table without having to create a new tablespace and need a lot of free disk space, but as it's so slow, it's not practical at all.

Sergei Golubchik added a comment - 2016-05-02 20:35

This is a complex issue. OPTIMIZE always used to take rather strong locks because of MyISAM —MyISAM cannot allow any other connection accessing the table that is being optimized. InnoDB does not have this limitation. But we need to open the table to know whether it's MyISAM or InnoDB table. And we need to take metadata locks before the table is opened (because the table's engine is also part of metadata, we cannot read it without the metadata lock).

We'll fix it nevertheless. But may be this fix won't make it into 10.1.14

- https://jira.mariadb.org/browse/MDEV-9155

- https://lists.launchpad.net/maria-developers/msg10832.html

Today we already see this...

When to use MariaDB Server?

- MyRocks storage engine

- TokuDB storage engine

- MyISAM user? Segmented key caches will help

- CONNECT storage engine

- Threadpool

- PAM authentication

- GSSAPI authentication (Kerberos, Active Directory)

- Window functions

- PCRE Regular Expressions

- Optimistic parallel replication

- ANALYZE <statement>

- cracklib_password_check

- SQL Roles

The future

- MySQL 8 brings roles, CTEs, window functions, transactional data dictionary, histograms, SDIs (instead of FRMs), etc.

  - http://mysqlserverteam.com/the-mysql-8-0-0-milestone-release-is-available/

- MySQL 5.7 features are amazing: http://www.thecompletelistoffeatures.com/

- Will MariaDB Server 10.3 aim to be compatible with MySQL 8? Or just Oracle?

  - https://jira.mariadb.org/browse/MDEV-10137

  - https://jira.mariadb.org/browse/MDEV-11070

  - https://mariadb.com/kb/en/library/changes-improvements-in-mariadb-103/

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