Migration Workshop
PXC 5.5 to MariaDB 10.4
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About FromDual GmbH

Support

MySQL

Galera Cluster

Consulting

remote-DBA

Percona Server

MariaDB

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OSB Open Source Business Alliance

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History

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MariaDB Architecture

- mysqld (SQL-Layer)
- InnoDB
- MyISAM
- Aria
- Memory
- wsrep hooks
- Galera Replication Plugin

Database

Storage Engine

Galera Cluster
Database History

- MariaDB/MySQL are Open Source (GPLv2)
  - → Branches and forks

Chaos will happen! :-(
- See Sybase ASE vs. MS SQL Server (1995(v6.0)-2005)
- Examples: Protocol X, User management, Window Functions, Virtual Columns, JSON, CTE, PL/SQL, Group Replication, ...
Storage Engine History

• Storage Engine manages physically data.
• InnoDB is required for Galera!!!
• InnoDB Storage Engine by InnoBase OY
  • In MySQL since 2003?
  • Acquired by Oracle in 2005!
  • MySQL acquired by Oracle in 2009 → InnoDB and MySQL together again
• Forked by Percona in 2008/09 → XtraDB
• And MariaDB?
InnoDB@MariaDB

- MariaDB 5.1 – InnoDB Plug-in, Percona XtraDB 5.1
- MariaDB 5.2/5.3 – Percona XtraDB 5.1
- MariaDB 5.5 – Percona XtraDB 5.5
- MariaDB 10.0 – Percona XtraDB 5.6
- MariaDB 10.1 – Percona XtraDB 5.6
- MariaDB 10.2 – InnoDB 5.7 from MySQL 5.7
- MariaDB 10.3.7 ff. – MariaDB Branch of InnoDB 5.7

Galera Plug-in History

- Galera was developed by Codership OY
- 2009 – Galera Demo release with MySQL 5.1
- 2010 – works with MariaDB 5.1 and Percona Server 5.1 (later called Percona XtraDB Cluster)
- 2011 – MySQL 5.5/Galera v1
- 2012 – Galera v2: Incremental State Transfer (IST)
- 2012 – Percona XtraDB Cluster 5.5/Galera v2
- 2013 – MySQL 5.6/Galera v3
- 2013 – MariaDB Galera Cluster 5.5/Galera v2
- 2013 – Percona XtraDB Cluster 5.6/Galera v3
- 2014 – MariaDB 5.5/Galera v3
- 2014 – MariaDB 10.0/Galera v3
- 2014 – MariaDB 10.1: Galera ready by default
- 2017 – MySQL 5.7 support/Galera v3
- 2018 – Percona Branch of Galera (Codership: Drop-release)
- 2019 – MariaDB 10.4/Galera v4
- 2020 – Q2 MySQL 8.0 support (Galera v4)
Protocol and Connectors

Application

Connector/

MySQL Protocol

Protocol -X

Binlog Format

mysqld SQL-Layer

Handler Interface

InnoDB MyISAM Aria Memory

File Format

DB files

Galera Replication Plugin

wsrep hooks

Galera API
Protocol and Connectors

- MariaDB Connectors:
  - /J, /C, /ODBC, /Node.js, /Python
  - Perl DBD-MariaDB
  - other Connectors from MySQL Eco-system
- MySQL 5.7:
  - Protocol changes
  - MySQL Authentication protocol
  - old de-supported, new different
- MySQL 5.7: Protocol-X (JSON, CRUD)
- Galera 24.x – 26.x (v2 - v4)
- InnoDB File Format: Antelope, Barracuda
  - InnoDB Row Format: COMPACT, REDUNDANT, DYNAMIC, COMPRESSED
- Binlog Format Versions
  - GTID Format is different in MariaDB
  - See Replication Compatibility further down
MariaDB Editions

- Community vs. Enterprise
  - DB Server + Features + Services
- MaxScale
  - v1 GPL vs. v2+ BSL
- MariaDB Column Store
  - Was in community and should be again in CE
- MariaDB Enterprise Server
  - Enhanced
  - Hardened
  - Secured
Why the Migration?

- Political reasons (Oracle is bad?)?
- Software vendor support (Open-Xchange's opinion/decision)?
- Fanboy?
- Company policy (Whitelist, why?)?
- Features?
- Strategical thoughts?
- Distro-Repositories?
Upgrade Migration Path

• This is NOT an Upgrade any more this is a Migration!!!
• Is Application ready for the new MariaDB version?
• Contains:
  • Migration from PXC to MariaDB (5.5?)
  • Upgrade from MariaDB 5.5 → 10.0 → (10.1 → 10.2 → 10.3) → 10.4 (shortcuts?)
  • Upgrade from Galera v2 → v3 → v4
• Not officially supported in one step!
• Possibilities:
  • Dump/Restore (1 step)
  • Follow the Migration Path (3 to 6 steps)
• Reduce impact on service
  • Master (old) → Slave (new)
• Testing Cluster and Application carefully
Migration Path

Rolling Upgrade from MariaDB 5.5 to next higher release seems to be possible.

Possible shortcut?

Galera ready by default

Rolling Upgrade questionable

v2 → v3

v4 ← v3
Migration Path

- Within the same base version (for example MySQL 5.5 → MariaDB 5.5) you can in most cases just uninstall MySQL and install MariaDB and you are good to go. There is no need to dump and restore databases.

- If you are running an older MariaDB Galera Cluster 5.5 release that still uses Galera 2, then it is recommended to first upgrade to the latest MariaDB Galera Cluster 5.5 release that uses Galera 3.

Rolling Cluster Upgrade

- Check system variable changes (my.cnf).
- Check replication or feature changes
- Ideally increase Galera Cache size (e.g. 2G)
- Backup Cluster/Node
- for each Node
  - `SET GLOBAL innodb_fast_shutdown=0;`
  - Stop MariaDB
  - Uninstall/Install Binaries
  - Adapt my.cnf
  - Start MariaDB
  - Run `mysql_upgrade`
Migration Possibilities

• Dump/Restore (1 step)
  • Downtime for Restore Time + PiTR
  • simple
• Follow the Migration Path (3 to 6 steps)
  • Complicated and error-prone and a lot of work
  • Theoretically no down time
• Reduce impact on service
  • Master (old) → Slave (new), then switch
  • Downtime only a few seconds
  • Infrastructure intensive
• KISS
  • Choose a simple solution → less error-prone
  • Relax your (downtime) constraints!
# Replication Compatibility

![Replication Compatibility Table](https://mariadb.com/kb/en/mariadb-vs-mysql-compatibility/)

- **☑** This combination is supported.
- **☒** This combination is not supported.
- **☆** MariaDB can't make any claims about MySQL-only combinations. Refer to the documentation for the specific MySQL version to determine supported combinations.

## Table of Replication Compatibility

<table>
<thead>
<tr>
<th>Master →</th>
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<th>MariaDB-10.1</th>
<th>MariaDB-10.2</th>
<th>MariaDB-10.3</th>
<th>MariaDB-10.4</th>
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Changes between PXC 5.5 and MariaDB 10.4

• Overview of differences between PXC 5.5 and MariaDB 10.4
  • PXC 5.5: You are running on about 6 to 8 year old technology
  • Product
    • https://mariadb.com/kb/en/release-notes/
    • https://mariadb.com/kb/en/changes-improvements-in-mariadb-100/

• Operations: Where do you stand now?
  • IST, Bootstrap, SST method, WAN Segmentation, Streaming Replication, System Tables

• InnoDB vs XtraDB vs ...?
  • See discussions before

• Is MariaDB 10.4 mature enough yet?
  • Why do you ask? It is GA since June 2019...
Backup/Restore in MariaDB 10.4

- Logical backup: mariadb-dump
- Physical backup: mariabackup
  - Analog to xtrabackup
  - In fact mariabackup is fork of xtrabackup 2.3
- Point-in-Time-Recovery based on Binary Logs
Logical Backup/Restore

```bash
mariadb-dump --user=root \
--all-databases --flush-privileges \
--flush-logs --single-transaction \
--master-data=2 --hex-blob \
--quick --triggers --routines --events \
> full_dump.sql

mariadb --user=root < full_dump.sql
```
Physical Backup/Restore

```
mariabackup --user=root --galera-info \ 
 --backup --target-dir=/bck/full_backup
mariabackup --user=root --prepare \ 
 --target-dir=/bck/full_backup
```

```
rmdir -rf /var/lib/mysql/*
mariabackup --user=root --copy-back \ 
 --datadir=/var/lib/mysql \ 
 --target-dir=/bck/full_backup
chown -R mysql: /var/lib/mysql
```
Load-Balancer

- HAproxy
  - “stupid” TCP/IP Load-Balancer
  - simple and fast, lot of know-how around
- MaxScale (v2 commercial)
  - Proxy
  - “clever” but more complicated
- ProxySQL
  - Proxy
  - “clever” but more complicated
Tuning MariaDB - Essentials

- Hardware
- O/S
- Database configuration
- Design
  - Data Model: OLTP vs OLAP
  - InnoDB PK
  - Data Types
  - Indexing
- SQL Query tuning