



Migration Workshop PXC 5.5 to MariaDB 10.4

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About FromDual GmbH

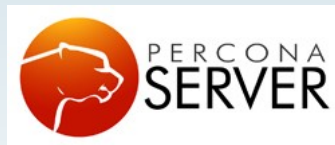
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Support



Consulting

remote-DBA



Training





Contents

Migration Workshop

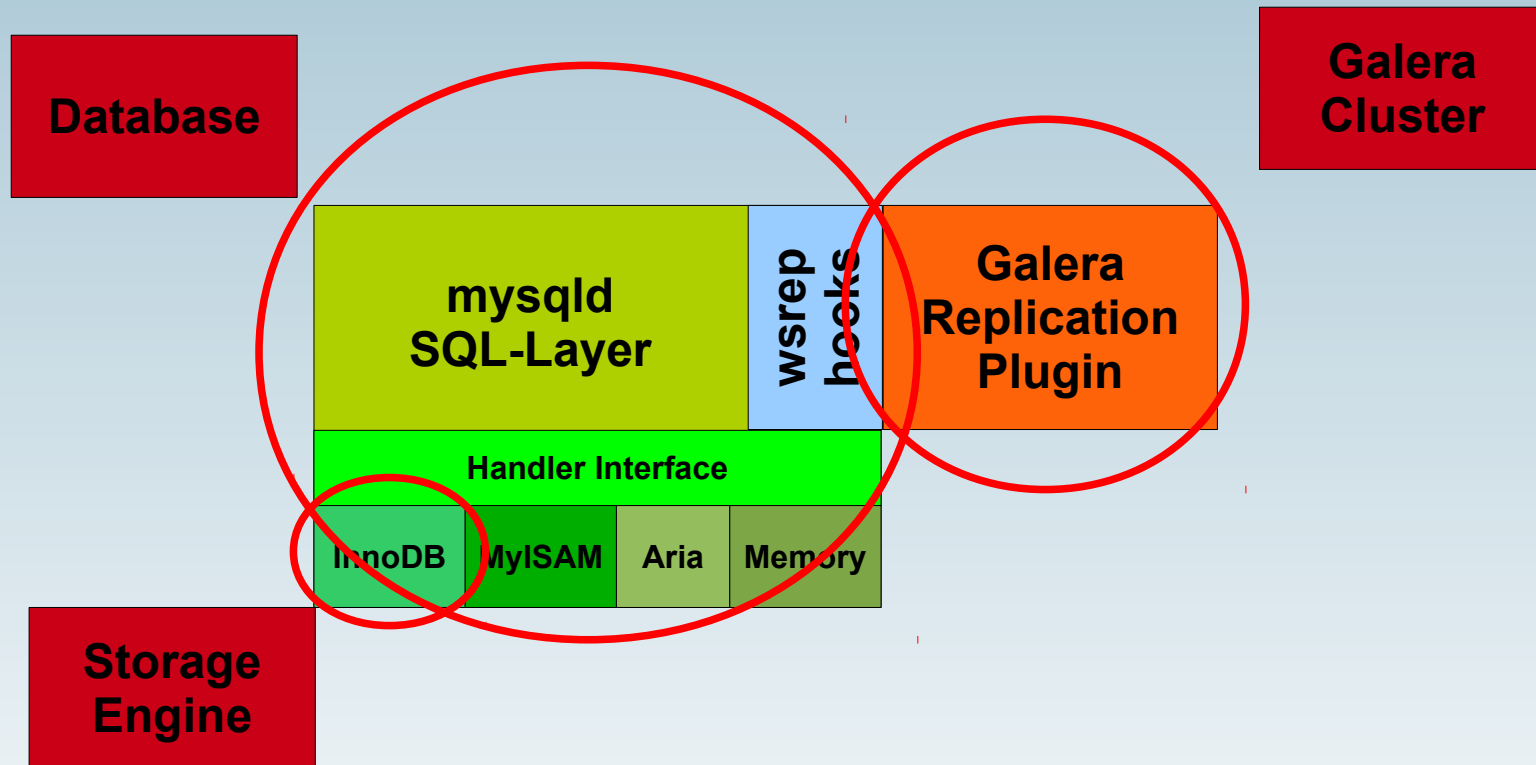
- History
- Why the Migration?
- Upgrade Path
- Changes between PXC 5.5 and MariaDB 10.4
- Backup/Restore in MariaDB 10.4
- Load-Balancer
- Tuning MariaDB – The Essentials



History

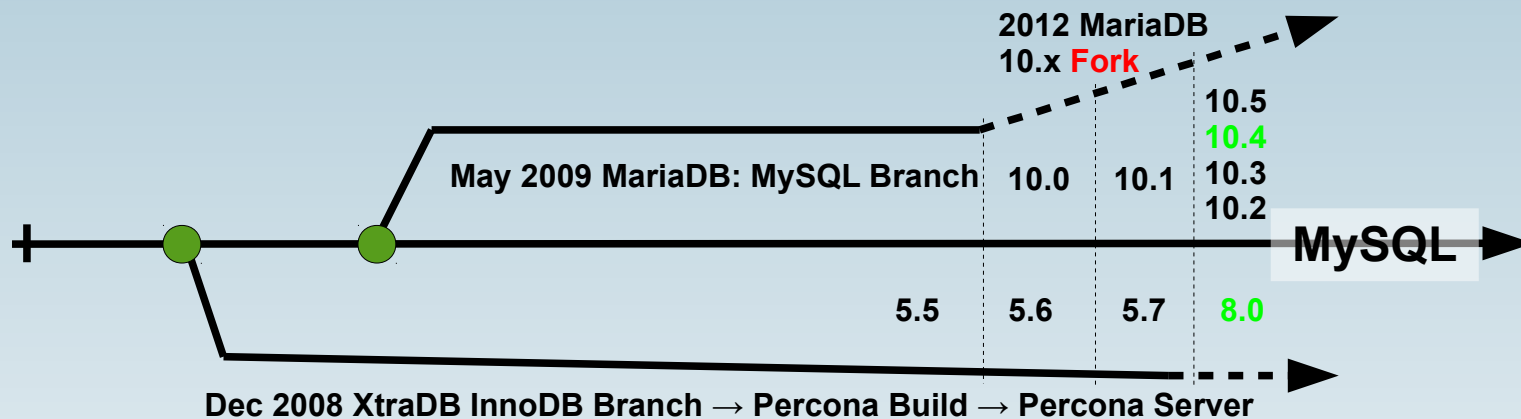
- **Database**
- **Storage Engines**
- **Galera Plug-in**
- **Protocol and Connectors**
- **MariaDB Community vs. Enterprise Edition**

MariaDB Architecture



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 InnoDB 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**

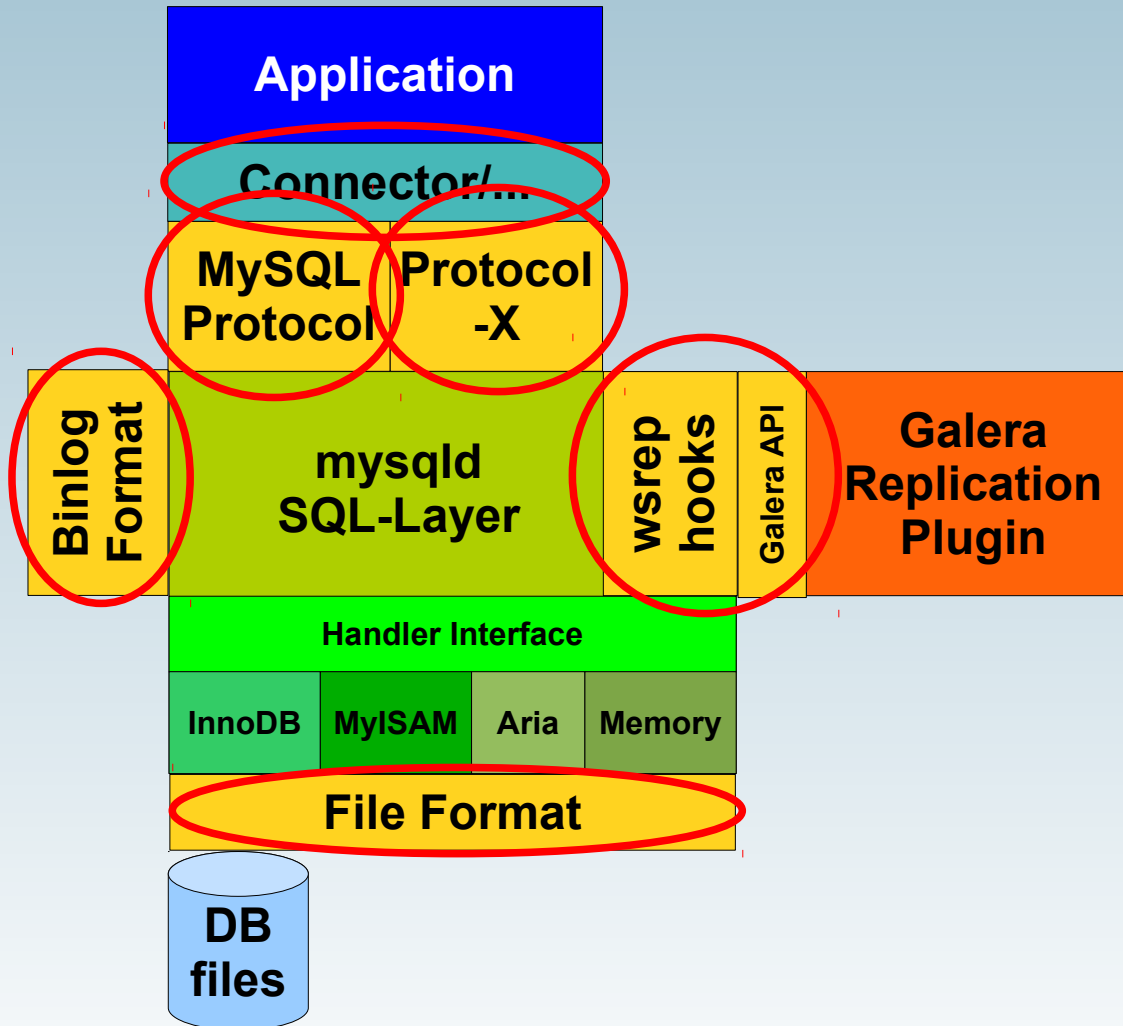
- **<https://mariadb.com/kb/en/innodb/>**
- **<https://mariadb.com/kb/en/about-xtradb/>**



Galera Plug-in History

- Galera was developed by Codership OY
- 1999 – PhD thesis: “The Database State Machine and Group Communication issues”, Uni Lausanne, Fernando Pedone (BRA)
- 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



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?

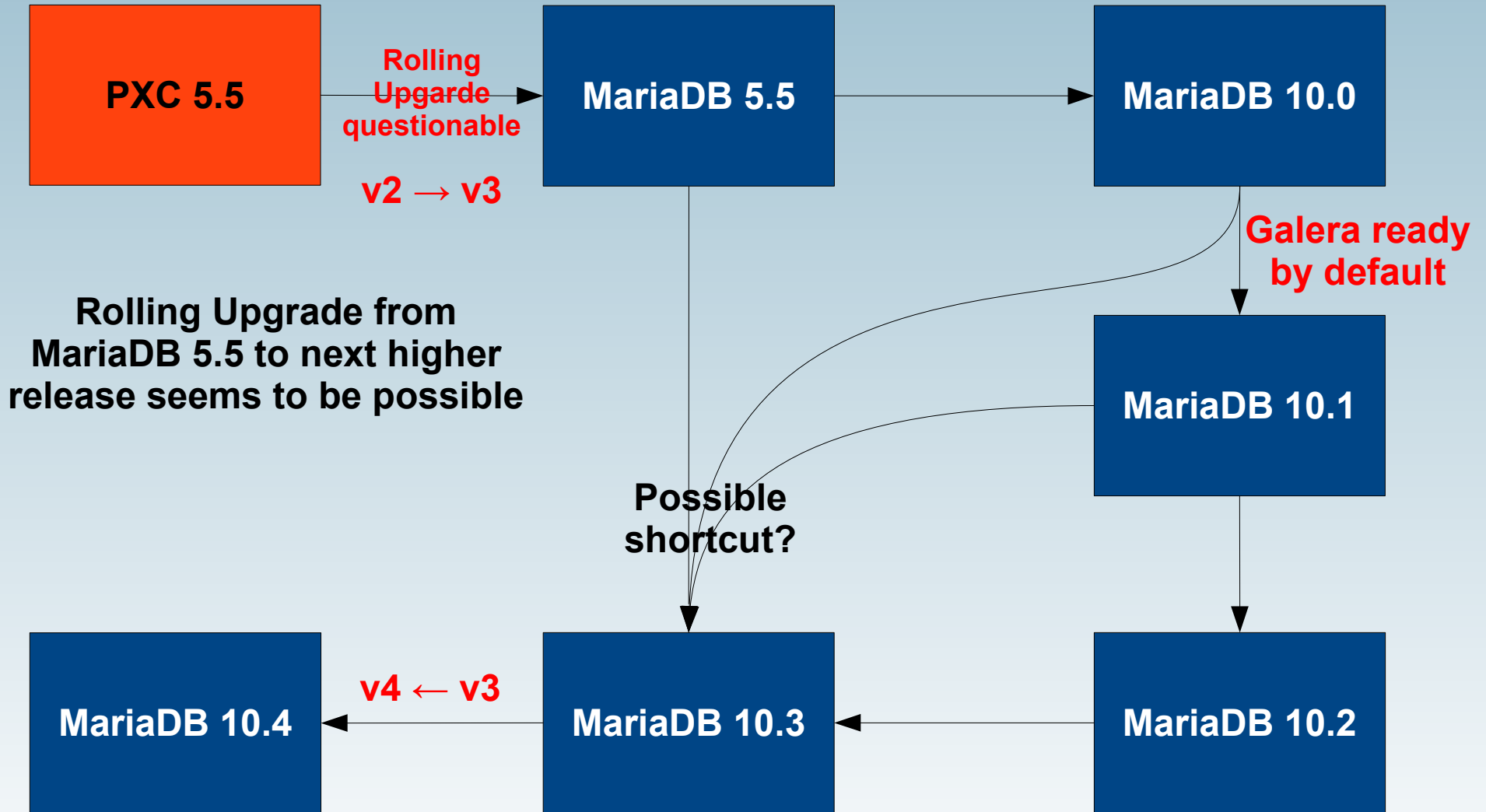
- **Political reasons (Oracle is bad!)?**
- **Software vendor support (Open-Xchange's opinion/decision)?**
- **Fanboy?**
- **Company policy (Whitelist, why?)?**
- **Features?**
- **Strategical thoughts?**
- **Distro-Repositories?**



~~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



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.**

<https://mariadb.com/kb/en/upgrading-from-mariadb-galera-cluster-55-to-mariadb-galera-cluster-100/>

<https://mariadb.com/kb/en/upgrading-from-mysql-to-mariadb/>

<https://mariadb.com/kb/en/upgrading-galera-cluster/>

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

Master →	MariaDB-5.5	MariaDB-10.1	MariaDB-10.2	MariaDB-10.3	MariaDB-10.4	MySQL-5.6	MySQL-5.7	MySQL-8.0
Slave ↓								
MariaDB-5.5	✓	✗	✗	✗	✗	✗	✗	✗
MariaDB-10.1	✓	✓				✓		
MariaDB-10.2	✓	✓	✓			✓	✓	
MariaDB-10.3	✓	✓	✓	✓		✓	✓	
MariaDB-10.4	✓	✓	✓	✓	✓	✓	✓	
MySQL-5.6						*	*	*
MySQL-5.7						*	*	*
MySQL-8.0						*	*	*

- ✓: 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.

- <https://mariadb.com/kb/en/mariadb-vs-mysql-compatibility/>



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-104/>
 - <https://mariadb.com/kb/en/changes-improvements-in-mariadb-103/>
 - <https://mariadb.com/kb/en/changes-improvements-in-mariadb-102/>
 - <https://mariadb.com/kb/en/changes-improvements-in-mariadb-101/>
 - <https://mariadb.com/kb/en/changes-improvements-in-mariadb-100/>
 - <https://mariadb.com/kb/en/changes-improvements-in-mariadb-55/>
 - **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

```
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
```

```
rm -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**