MariaDB 10.2
New Features

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MariaDB 10.2 – New Features

➢ History
➢ New Features for Devs
➢ New Features for Ops
➢ Outlook to MariaDB 10.3
Now we are in the mess...

My mysql got replaced with MariaDB

Hello, my mysql got replaced with mariadb, trying to install mysql-server gives me that:

```
root@BananasOnFire:~# sudo apt-get install mysql-server
Reading package lists... Done
Building dependency tree
Reading state information... Done
Package mysql-server is not available, but is referred to by another package.
This may mean that the package is missing, has been obsoleted, or
is only available from another source
However the following packages replace it:
   mariadb-server-10.2:1386 mariadb-server-10.2

E: Package 'mysql-server' has no installation candidate
```

go to: bananasonfire.tk/phpmyadmin says:

```
Not Found
The requested URL /phpmyadmin was not found on this server.

Apache/2.4.18 (Ubuntu) Server at bananasonfire.tk Port 80

I lost all my databases :(
```
Branches and Forks

- MariaDB and MySQL are Open Source (GPL v2)
  - This means everybody is allowed to DiY
  - → Branches and Forks

- Who uses a MariaDB/MySQL in here?
  - Chaos will happen! :-(
  - Examples: Replication, Protocol X, SE: MariaDB CS, etc., Window Functions, Virtual Columns, JSON, CTE, ...
MariaDB and Linux Distros

- **Redhat/CentOS:**
  - 6 → MySQL 5.1,
  - 7 → MariaDB 5.5

- **Ubuntu:**
  - 14.04 → MySQL 5.5,
  - 16.04 → MySQL 5.7,
  - 18.04 → MySQL 5.7 (MariaDB 10.1)

- **Debian:**
  - 8 → MySQL 5.5,
  - 9 → MariaDB 10.1

- **SuSE SLE / OpenSuSE:**
  - 11 SP2/3 → MySQL 5.1,
  - 12 → MariaDB 10.0
  - Leap 42.3 → MariaDB 10.0, Leap 15.0, → MariaDB 10.2 Tumbleweed → MariaDB 10.2
MariaDB History

- 5.1 … 5.5
  - New Storage Engines: Aria, XtraDB, PBXT, Federated-X, OQGRAPH
  - Plug-ins (Authentication, Thread Pool)
  - Optimizer improvements
  - Virtual Columns

- 10.0
  - Parallel Replication, GTID, Multi Source Replication
  - Storage Engines: Cassandra, CONNECT, Spider, TokuDB, Sequence
  - Mroonga (CJK) FTS
  - Roles, Audit Plug-in

- 10.1
  - Galera ready by default
  - Table, Tablespace, Redo Log, Binary Log encryption
  - MariaDB Column Store
MariaDB 10.2 History

- MariaDB 10.2.14 Stable: Mar/Apr 2018
- MariaDB 10.2.13 Stable: 13 Feb 2018
- MariaDB 10.2.12 Stable: 4 Jan 2018
- MariaDB 10.2.11 Stable: 28 Nov 2017
- MariaDB 10.2.10 Stable: 31 Oct 2017
- MariaDB 10.2.9 Stable: 27 Sep 2017
- MariaDB 10.2.8 Stable: 18 Aug 2017
- MariaDB 10.2.7 Stable: 12 Jul 2017
- MariaDB 10.2.6 Stable: 23 May 2017
- MariaDB 10.2.5 RC: 5 Apr 2017
- MariaDB 10.2.4 RC: 17 Feb 2017
- MariaDB 10.2.3 Beta: 24 Dec 2016
- MariaDB 10.2.2 Beta: 27 Sep 2016
- MariaDB 10.2.1 Alpha: 4 Jul 2016
- MariaDB 10.2.0 Alpha: 18 Apr 2016

Rule of thumb: Wait for about ½ year...
Recent MariaDB 10.2?

MariaDB Repository:

```bash
apt-get install software-properties-common
apt-key adv --recv-keys --keyserver \
   hkp://keyserver.ubuntu.com:80 0xF1656F24C74CD1D8
add-apt-repository 'deb [arch=amd64,i386,ppc64el] \
   http://mirrors.n-ix.net/mariadb/repo/10.2/ubuntu \
   xenial main'
apt update
apt install mariadb-server
```

- MariaDB DEB/RPM Packages
- MariaDB binary tar-ball
- Supported architectures
  - 32 and 64-bit Linux, 32- and 64-bit Windows, POWER8: ppc64 and ppc64le, (ARM not by MariaDB!)
- MariaDB 10.2 is the current major stable version. It will be supported until May 2022.
InnoDB Storage Engine

- InnoDB from MySQL 5.7 ported
  - Before XtraDB 5.6 from Percona
  - On disk format is identical to XtraDB, so no upgrade problem is expected? → test carefully! (possibly dump/restore)
  - Most InnoDB 5.7 features should be available

- Variables changes
  - new, deprecated, removed, ignored, changed defaults
  - XtraDB specific variables are ignored
  - Check before upgrade, test upgrade!

- InnoDB Spatial Index support (GIS)
- Persistent AUTO_INCREMENT fix
- Crash recovery reporting, startup/shutdown more robust.
Other Storage Engines I

- **Aria**
  - `aria_recover → aria_recover_options = BACKUP, QUICK`

- **TokuDB**
  - Percona TokuDB, ACID, Fractal Trees, heavy write load
  - Own package, updated to newer release

- **CONNECT**
  - Updated to newer release
  - Zip Files Tables support added
  - JDBC Table Type support added
  - MongoDB support added MONGO table type
Other Storage Engines II

- **MongoDB**
  - Beta support added
  - Bases on CONNECT SE
  - 4 Drivers: MongoDB C, MongoDB Java, MongoDB JDBC, JSON table
- **MyRocks / RocksDB / MariaRocks**
  - From Facebook, LSM-tree database, for Flash, I/O and space efficient
  - Alpha SE added
- **Galera**
  - Updated to (25.)3.23
  - SST method mariabackup
- **Mroonga CJK FTS**
  - Updated to newer release
  - Split into separate package
Window Functions

• What is it?
  • Buzzwords: Reporting, DWH, OLAP, Cube, Business Intelligence, Analytics, Big Data
  • SQL:2003 – SQL:2011
  • MariaDB 10.2 does not support full standard yet

• Seems to be compatible with MySQL

• `window_function(expression) OVER ( PARTITION BY ... ORDER BY ... )`

• Window Functions are computed after all WHERE, GROUP BY and HAVING clauses, right before ORDER BY
Available Window Functions

- Ranking, Bucketing
  - DENSE_RANK, NTILE, NTH_VALUE, PERCENTILE_CONT, PERCENTILE_DISC, PERCENT_RANK, RANK, ROW_NUMBER
- References other rows/data
  - LAG, LAST_VALUE, LEAD
- Statistics
  - CUME_DIST, MEDIAN
- Aggregate Functions to be used as Window Functions:
  - AVG, BIT_AND, BIT_OR, BIT_XOR, COUNT, SUM
- MariaDB 10.2 also supports Window Frames
  - \{ RANGE | ROWS \} BETWEEN frame_start AND frame_end
  - frame = \{value PRECEDING | CURRENT ROW | value FOLLOWING\}
- MariaDB Column Store seems to support more functions!
Window Functions Example

- Top 3 earners of each department and compare salaries with the average salary

```
SELECT *
FROM (  
    SELECT RANK() OVER (PARTITION BY dept ORDER BY salary DESC) AS ranking  
    , dept, name, salary  
    , ROUND(AVG(salary) OVER (PARTITION BY dept), 2) AS avg_salary  
    FROM employee_salaries
) AS salary_ranks
WHERE ranking <= 3;
```

<table>
<thead>
<tr>
<th>ranking</th>
<th>dept</th>
<th>name</th>
<th>salary</th>
<th>avg_salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engineering</td>
<td>Dharma</td>
<td>3500</td>
<td>2633.33</td>
</tr>
<tr>
<td>2</td>
<td>Engineering</td>
<td>Bình</td>
<td>3000</td>
<td>2633.33</td>
</tr>
<tr>
<td>3</td>
<td>Engineering</td>
<td>Adalynn</td>
<td>2800</td>
<td>2633.33</td>
</tr>
<tr>
<td>1</td>
<td>Sales</td>
<td>Carbry</td>
<td>500</td>
<td>325.00</td>
</tr>
<tr>
<td>2</td>
<td>Sales</td>
<td>Clytemnestra</td>
<td>400</td>
<td>325.00</td>
</tr>
<tr>
<td>3</td>
<td>Sales</td>
<td>Juraj</td>
<td>300</td>
<td>325.00</td>
</tr>
<tr>
<td>3</td>
<td>Sales</td>
<td>Kalpana</td>
<td>300</td>
<td>325.00</td>
</tr>
</tbody>
</table>
Window Functions Example

```
SELECT SUBSTR(event_name, 11) AS event,
      ROUND(timer_wait/1000/1000, 3) AS time_us
FROM performance_schema.events_stages_history_long
WHERE nesting_event_id = 212
ORDER BY event_id ASC
;
```

<table>
<thead>
<tr>
<th>event</th>
<th>time_us</th>
</tr>
</thead>
<tbody>
<tr>
<td>init</td>
<td>37.567</td>
</tr>
<tr>
<td>checking permissions</td>
<td>3.614</td>
</tr>
<tr>
<td>Opening tables</td>
<td>36.098</td>
</tr>
<tr>
<td>After opening tables</td>
<td>0.446</td>
</tr>
<tr>
<td>System lock</td>
<td>0.181</td>
</tr>
<tr>
<td>Table lock</td>
<td>0.747</td>
</tr>
<tr>
<td>Sending data</td>
<td>15.270</td>
</tr>
<tr>
<td>end</td>
<td>2.125</td>
</tr>
<tr>
<td>query end</td>
<td>1.458</td>
</tr>
<tr>
<td>closing tables</td>
<td>0.431</td>
</tr>
<tr>
<td>removing tmp table</td>
<td>15.401</td>
</tr>
<tr>
<td>Unlocking tables</td>
<td>0.968</td>
</tr>
<tr>
<td>freeing items</td>
<td>3.087</td>
</tr>
<tr>
<td>cleaning up</td>
<td>1.228</td>
</tr>
</tbody>
</table>
### Window Functions Example

```sql
SELECT RANK() OVER (ORDER BY event_id) AS rank,
       SUBSTR(event_name, 11) AS event,
       CAST(ROUND(timer_wait/1000/1000, 3) AS DOUBLE) AS time_us,
       CAST(ROUND((timer_wait / SUM(timer_wait) OVER ()) * 100, 1) AS DOUBLE) AS time_pct,
       CAST(ROUND((SUM(timer_wait) OVER (ORDER BY event_id))/1000/1000, 3) AS DOUBLE) AS time_cum,
       CAST(ROUND((SUM(timer_wait) OVER (ORDER BY event_id) / SUM(timer_wait) OVER ())) * 100, 1) AS DOUBLE) AS cum_pct
FROM performance_schema.events_stages_history_long
WHERE nesting_event_id = 212
ORDER BY event_id ASC;
```

<table>
<thead>
<tr>
<th>rank</th>
<th>event</th>
<th>time_us</th>
<th>time_pct</th>
<th>time_cum</th>
<th>cum_pct</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>init</td>
<td>37.567</td>
<td>16.1</td>
<td>37.567</td>
<td>16.1</td>
</tr>
<tr>
<td>2</td>
<td>checking permissions</td>
<td>3.614</td>
<td>1.5</td>
<td>41.181</td>
<td>17.6</td>
</tr>
<tr>
<td>3</td>
<td>Opening tables</td>
<td>36.098</td>
<td>15.5</td>
<td>77.279</td>
<td>33.1</td>
</tr>
<tr>
<td>4</td>
<td>After opening tables</td>
<td>0.446</td>
<td>0.2</td>
<td>77.725</td>
<td>33.3</td>
</tr>
<tr>
<td>5</td>
<td>System lock</td>
<td>0.181</td>
<td>0.1</td>
<td>77.906</td>
<td>33.4</td>
</tr>
<tr>
<td>6</td>
<td>Table lock</td>
<td>0.747</td>
<td>0.3</td>
<td>78.653</td>
<td>33.7</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Sending data</td>
<td>15.27</td>
<td>6.5</td>
<td>208.794</td>
<td>89.4</td>
</tr>
<tr>
<td>16</td>
<td>end</td>
<td>2.125</td>
<td>0.9</td>
<td>210.919</td>
<td>90.3</td>
</tr>
<tr>
<td>17</td>
<td>query end</td>
<td>1.458</td>
<td>0.6</td>
<td>212.377</td>
<td>91.0</td>
</tr>
<tr>
<td>18</td>
<td>closing tables</td>
<td>0.431</td>
<td>0.2</td>
<td>212.808</td>
<td>91.1</td>
</tr>
<tr>
<td>19</td>
<td>removing tmp table</td>
<td>15.401</td>
<td>6.6</td>
<td>228.209</td>
<td>97.7</td>
</tr>
<tr>
<td>20</td>
<td>Unlocking tables</td>
<td>0.968</td>
<td>0.4</td>
<td>229.177</td>
<td>98.2</td>
</tr>
<tr>
<td>21</td>
<td>freeing items</td>
<td>3.087</td>
<td>1.3</td>
<td>232.264</td>
<td>99.5</td>
</tr>
<tr>
<td>22</td>
<td>cleaning up</td>
<td>1.228</td>
<td>0.5</td>
<td>233.492</td>
<td>100.0</td>
</tr>
</tbody>
</table>
```

![Profile Chart](chart.png)

*Profile Chart depicting the time distribution across different events.*
Common Table Expressions

- **WITH** → Common Table Expression (CTE)
  - Refer to a subquery expression many times
  - Like a temporary table per query
  - Temporary named result set / View
  - Seems to be compatible with MySQL (not with MS SQL Server)
  - Makes SQL more readable
  - Since SQL:1999

- Non-recursive CTE
- Recursive CTE

```sql
WITH [ RECURSIVE ] cte AS
  ( SELECT * FROM test WHERE id = 42 )
SELECT * FROM cte;
```
WITH SalesCTE (SalesPersonID, SalesOrderID, SalesYear) AS
(
    SELECT SalesPersonID, SalesOrderID,
    , YEAR(OrderDate) AS SalesYear
    FROM SalesOrderHeader
    WHERE SalesPersonID IS NOT NULL
)
SELECT SalesPersonID, COUNT(SalesOrderID) AS TotalSales,
    SalesYear
FROM SalesCTE
GROUP BY SalesYear, SalesPersonID
ORDER BY SalesPersonID, SalesYear;

+---------------+------------+-----------+
<table>
<thead>
<tr>
<th>SalesPersonID</th>
<th>TotalSales</th>
<th>SalesYear</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>2018</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>2018</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>2018</td>
</tr>
</tbody>
</table>
+---------------+------------+-----------+
WITH RECURSIVE DirectReports(Name, Title, EmployeeID, EmployeeLevel, Sort) AS
(
    SELECT CONCAT(e.FirstName, ' ', e.LastName),
           e.Title, e.EmployeeID, 1,
           CONCAT(e.FirstName, ' ', e.LastName)
    FROM MyEmployees AS e
    WHERE e.ManagerID IS NULL
    UNION ALL
    SELECT CONCAT(REPEAT('|    ', EmployeeLevel), e.FirstName, ' ', e.LastName),
           e.Title, e.EmployeeID, EmployeeLevel + 1,
           CONCAT(RTRIM(Sort), '|    ', FirstName, ' ', LastName)
    FROM MyEmployees AS e
    JOIN DirectReports AS d ON e.ManagerID = d.EmployeeID
)
SELECT EmployeeID, Name, Title, EmployeeLevel
FROM DirectReports
ORDER BY Sort;

<table>
<thead>
<tr>
<th>EmployeeID</th>
<th>Name</th>
<th>Title</th>
<th>EmployeeLevel</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ken Sánchez</td>
<td>Chief Executive Officer</td>
<td>1</td>
</tr>
<tr>
<td>273</td>
<td>Brian Welcker</td>
<td>Vice President of Sales</td>
<td>2</td>
</tr>
<tr>
<td>16</td>
<td>David Bradley</td>
<td>Marketing Manager</td>
<td>3</td>
</tr>
<tr>
<td>23</td>
<td>Mary Gibson</td>
<td>Marketing Specialist</td>
<td>4</td>
</tr>
<tr>
<td>274</td>
<td>Stephen Jiang</td>
<td>North American Sales Manager</td>
<td>3</td>
</tr>
<tr>
<td>276</td>
<td>Linda Mitchell</td>
<td>Sales Representative</td>
<td>4</td>
</tr>
<tr>
<td>275</td>
<td>Michael Blythe</td>
<td>Sales Representative</td>
<td>4</td>
</tr>
<tr>
<td>285</td>
<td>Syed Abbas</td>
<td>Pacific Sales Manager</td>
<td>3</td>
</tr>
<tr>
<td>286</td>
<td>Lynn Tsoflias</td>
<td>Sales Representative</td>
<td>4</td>
</tr>
</tbody>
</table>
Check Constraints

• Restricts data to add to a table → Error
• Before Columns defaults/constraints:
  • `CURRENT_TIMESTAMP`
  • `AUTO_INCREMENT`
  • `PRIMARY KEY`
  • `DEFAULT something`
  • `UNIQUE`
  • `FOREIGN KEY`
• Most deterministic functions and UDF
• I did not say this makes sense or is IMHO the correct way doing it...
Check Constraint Example

CREATE TABLE Employees (  
    EmployeeID SMALLINT UNSIGNED AUTO_INCREMENT PRIMARY KEY  
    , FirstName VARCHAR(30) NOT NULL CHECK (CHAR_LENGTH(FirstName) > 2)  
    , LastName VARCHAR(40) NOT NULL  
    , Title VARCHAR(50) NOT NULL CHECK (Title != 'God')  
    , DeptID SMALLINT UNSIGNED NOT NULL  
    , ManagerID INT UNSIGNED NULL  
    , Salary DECIMAL(7,2) DEFAULT 0.0 CHECK (Salary < 10000.0)  
    , CONSTRAINT c_deptid CHECK (DeptID > 0)  
);  

ALTER TABLE Employees  
    ADD CONSTRAINT c_mgr CHECK (ManagerId > 0);  

ALTER TABLE Employees  
    ADD CONSTRAINT c_dpt CHECK (DeptID BETWEEN 1 AND 100);  

ALTER TABLE Employees  
    ADD CONSTRAINT c_last CHECK (LastName = UPPER(LastName));
DEFAULTs with expressions

- Support for DEFAULT for columns with expressions
- Most MariaDB functions are possible
- Referring to earlier columns in the DEFAULT expression is possible.
- The DEFAULT clause CANNOT contain any stored functions or subqueries.
- BLOB and TEXT fields can now have a DEFAULT value
CREATE TABLE employee (  
id INT UNSIGNED NOT NULL AUTO_INCREMENT PRIMARY KEY  ,  
short_uuid BIGINT UNSIGNED DEFAULT UUID_SHORT()  ,  
first_name VARCHAR(30) NOT NULL  ,  
last_name VARCHAR(40) NOT NULL  ,  
salary DECIMAL(7,2) DEFAULT 1000.0  ,  
bonus DECIMAL(7,2) DEFAULT (salary * 0.1) );

INSERT INTO employee  
VALUES (DEFAULT, DEFAULT, 'Oli', 'Sennhauser', 900.0, DEFAULT);

SELECT * FROM employee;

ALTER TABLE employee  
MODIFY bonus DECIMAL(7,2) DEFAULT (salary * 0.12);
GeoJSON / JSON / GIS

- The **JSON** data type was introduced (alias for **LONGTEXT**)
- **JSON** functions added
- InnoDB support for spatial indices (GIS)
- GeoJSON support
  - [http://geojson.org/](http://geojson.org/)
  - `ST_AsGeoJSON` and `ST_GeomFromGeoJSON` functions
  - For imported/exported using GeoJSON format
CREATE TABLE geojson (  
id INT UNSIGNED NOT NULL AUTO_INCREMENT  
, j JSON  
, g GEOMETRY NOT NULL  
, PRIMARY KEY (id)  
, SPATIAL INDEX(g)  
, CONSTRAINT c_json CHECK (JSON_VALID(j))
) ENGINE = InnoDB;

INSERT INTO geojson VALUES  
(NULL, ST_AsGeoJSON(ST_GeomFromText('POINT(5.3 7.2)'))  
, PointFromText('POINT(5.3 7.2)'));

SET @poly1 = ST_GeomFromText('Polygon((0 0,0 3,3 3,3 0,0 0))');
SET @poly2 = ST_GeomFromText('Polygon((5 5,5 8,8 8,5 5,5 5))');
SELECT id, j, ST_AsText(g)  
, MBRContains(@poly1, g) AS 1  
, MBRContains(@poly2, g) AS 2
FROM geojson;

<table>
<thead>
<tr>
<th>id</th>
<th>j</th>
<th>ST_AsText(g)</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>{&quot;type&quot;: &quot;Point&quot;, &quot;coordinates&quot;: [5.3, 7.2]}</td>
<td>POINT(5.3 7.2)</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Virtual Columns / VIEWS

- VC exists since MariaDB 5.2
  - Generated and Persistent Columns
- Lots of restrictions lifted for Virtual computed columns
  - Expression > 252 Characters long
  - VC can base on other VC
  - Client depending functions, UDF
  - Deterministic functions for VC
  - Indexing VC
  - VIEWS support subquery in FROM clause
- Optimizer Condition push down to VIEWS
Other features added

- **PREPARE** Statement/Dynamic SQL now understand most expressions
- Catchall for **LIST** partitions: **DEFAULT**
- Multiple **TRIGGERS** per table allowed
- **EXPLAIN** **FORMAT=JSON** various new information
- Optimizer fixes (Push down condition to non-mergeable **VIEWS*/derived tables)
- **ANALYZE TABLE** re-implemented lock free
- New reserved keywords:
  - **RECURSIVE**, **ROWS**, **WINDOW** (table alias only), **JSON**
Oracle compatibility

- **Oracle-style EXECUTE IMMEDIATE**
  
  ```sql
  SET @debug = 1;
  EXECUTE IMMEDIATE CONCAT(IF(@debug,
    'EXPLAIN ', ''), 'SELECT * FROM dual');
  ```

- Number of supported decimals in DECIMAL from 30 to 38 (Oracle style)
  
  ```sql
  DECIMAL(65, 38)
  ```

- Adding NOPAD collations ('a' != 'a   ')

- See also MariaDB 10.3
  
  ```sql
  sql_mode = ORACLE
  ```
MariaDB Connectors

- C and C++ Connector
  - Old libmysqlclient was GPL
  - Connector/C 3.0.3 (LGPL)
- Java Connector
  - Connector/J 2.2.2 (LGPL), supports Java 8 and higher
  - Type 4 JDBC driver, JDBC 1.4.2 compliant
- ODBC Connector
  - Connector/ODBC 3.0.3 (LGPL)
  - Supports ODBC Standard 3.5
- Perl DBI
  - DBD::MariaDB
- Other Connectors
  - User MySQL Connectors
Binary Logging

- `server_id` default changed from 0 to 1
- `binlog_format` default changed to MIXED (before STATEMENT) why not ROW??? :-(
- `binlog_annotate_row_events (Master)` default changed to ON
  - → Original Statement in Binary Log (increases size)
    - Example next page
- `binlog_checksum = CRC32`
  - before was NONE (0)
# at 830
#180306 12:32:07 server id 1 end_log_pos 872 CRC32 0xb900f6c2
# GTID 0-1-22 trans
/*!100001 SET @@session.gtid_seq_no=22*/!*!/;
BEGIN /*!/;
# at 872
# at 944
#180306 12:32:07 server id 1 end_log_pos 944 CRC32 0xe03cbb03
# Annotate_rows:
#Q> insert into test values (NULL, 'Some data', NULL)
#180306 12:32:07 server id 1 end_log_pos 996 CRC32 0xa93c6f0b
# Table_map: `test`.`test` mapped to number 24
# at 996
#180306 12:32:07 server id 1 end_log_pos 1048 CRC32 0x3e58a57d
# Write_rows: table id 24 flags: STMT_END_F
BINLOG 'N3yeWhMBAAAAANAAAAAQDAAAAABgAAAAAAAABHR1c3QABHR1c3QAAwMPEQOAAAAC288qQ==
N3yeWhcBAAAANAAAAABgEAAAABgAAAAAEC288qQ==
1Tb21lIGRhdGFannw3faVYPg==
'*!/;
### INSERT INTO `test`.`test`
### SET
### @1=1
### @2='Some data'
### @3=1520335927
# at 1048
#180306 12:32:07 server id 1 end_log_pos 1079 CRC32 0xbf8ef8cd Xid = 28
COMMIT/*!/;
Replication I

- `slave_parallel_workers` alias for `slave_parallel_threads`
- Default of `slave_net_timeout` reduced to 60 seconds from 3600
- `read_binlog_speed_limit` restricts speed the Slave reads the binary log from master
- `replicate_annotate_row_events` (Slave) default changed to ON
  - `log_slave_updates = 1`
- Compression of events in the binary log is supported
  - `log_bin_compress` and `log_bin_compress_min_len` 10 ... 1024 (256)
- Replicate MariaDB GTIDs to other nodes in the Galera Cluster
Replication II

- Delayed replication
  - `CHANGE MASTER TO master_delay = 3600;`
    - Slave must be stopped
  - `START SLAVE UNTIL master_gtid_pos = ...;`
- `SHOW PROCESSLIST` for Slave Threads
  - Time is now counted from start of wait
  - New Slave thread Commands:
    - `Slave_IO` for Slave thread reading relay log
    - `Slave_SQL` for slave executing SQL commands or distribution queries to Slave workers
    - `Slave_worker` for slave threads executing SQL commands in parallel replication
I_S, P_S and Status

- INFORMATION_SCHEMA / I_S
  - Generated Columns information added to I_S.columns
  - I_S.user_variables added

- PERFORMANCE_SCHEMA / P_S
  - Updated to 5.6.31, but still off :-(

- Status
  - Com_show_create_user, Com_alter_user, Com_multi, Com_reset_connection, Executed_triggers
  - Innodb_have_punch_hole, Innodb_pages0_read, Innodb_scrub_log, Innodb_encryption_num_key_requests
Variables

- Changed defaults
  - `binlog_checksum`, `server_id`, `binlog_format`, `replicate_annotate_row_events`, `binlog_annotate_row_events`, `slave_net_timeout`
  - `innodb_strict_mode`, `innodb_compression_algorithm`, `innodb_log_compressed_pages`, `innodb_use_atomic_writes`, `innodb_use_trim`
  - `group_concat_max_len`, `aria_recover`, `myisam_recover_options`
- New
  - `max_recursive_iterations`, `standards_compliant_cte`
  - `thread_pool_prio_kickup_timer`, `thread_pool_priority`, `read_binlog_speed_limit`, `slave_parallel_workers`, `log_bin_compress`, `log_bin_compress_min_len`
  - `innodb_deadlock_detect`, `innodb_stats_include_delete_marked`, `innodb_tmpdir`
  - `tmp_disk_table_size`, `tmp_memory_table_size`, `aria_recover_options`, `compression_default`
- Deprecated
  - `innodb_mtflush_threads`, `innodb_use_mtflush`
  - XtraDB specific variables are ignored
- Removed
  - `innodb_api_*`, `innodb_purge_stop_now`, `innodb_purge_run_now`
MariaDB Server version

```sql
SQL> SELECT @@version_comment, @@version;
+---------------------------------------------+
| @@version_comment | @@version     |
+---------------------------------------------+
| MariaDB Server | 8.0.4-rc-blog |
+---------------------------------------------+

SQL> status;
--------------
mysql  Ver 15.1 Distrib 10.2.13-MariaDB,
for Linux (x86_64) using readline 5.1
```

- Possibly you get MySQL Workbench working again with it...? ;-)
- Caution:
  
  ERROR: Could not find server version: Master reported unrecognized MySQL version '8.0.4-rc-blog'.
Security / Encryption

- Amazon AWS Key Management plug-in for Windows/Linux
  - AWS Key Management Service (KMS) for encryption at rest (on disk)
  - Customer Master Key (CMK) kept in AWS KMS
- Added support for OpenSSL 1.1 and LibreSSL
- Support CRC32 SSE2 implementation (hardware) under Windows
- Temporary InnoDB files are always encrypted if `innodb_encrypt_log` is set to 1
- 25 Security Vulnerability fixes:
User and Connection

- **New SHOW CREATE USER**
  - Similar to SHOW GRANTS but without Privileges
- **New ALTER USER / extended CREATE USER**
  - `ALTER USER 'fromdual'@'%' IDENTIFIED BY 'secret' REQUIRE SSL;`
  - `MAX_{QUERIES|UPDATE|CONNECTIONS}_PER_HOUR, MAX_USER_CONNECTIONS, TLS/SSL options`
- **Thread pool**
  - Higher priority to connections that have an active transaction
  - Controlled with `thread_pool_prio_kickup_timer` and `thread_pool_priority`
- **COM_RESET_CONNECTION** command added for pooled connections
- **More "secure" ed25519 Authentication Plug-in**
  - Replacement of old sha1, probably NOT compatible with MySQL sha256
Optimizations / Performance

- Optimizations for faster connection creation time.
  - Connection set-up faster by moving creation of THD to new thread.
- Allow online table rebuild when encryption or compression parameters change (InnoDB)
- Table open cache can automatically partition itself
  - Better throughput in some cases?
- Debugging:
  - Core dumps can now be enabled dynamically

- Not so much Marketing BS on Performance for 10.2!
Backup / Binlog / Flashback

- `mysqldump --add-drop-trigger`
- `mysqlbinlog`
  - Add continuous binary log backup to `mysqlbinlog`
  - `mysqlbinlog --user=replication --host=127.0.0.1 --raw \ --read-from-remote-server --stop-never --to-last-log binlog.000001`

- Flashback with `mysqlbinlog`
  - DML only (no DDL yet!) → `mysqldump --no-data from time to time`
  - `binlog_format = ROW`
  - `binlog_row_image = FULL`
  - `mysqlbinlog --flashback --start-position=1206 \ --stop-position=2008 binlog.000013`

Fixed in 10.2.7
Flashback Example

```sql
#Q> insert into test values (null, 'Data where ups happens', null)
#Q> update test set data = 'Ups happens' where id = 5635999
#Q> delete from test where id = 5635999

#180308 19:23:51 server id 3336  end_log_pos 2008 CRC32 0xcb7ae7d2   Xid = 83
### INSERT INTO `test`.`test` ###
###   SET @1=5635999
###   @2='Ups happens'
###   @3=1520533412

#180308 19:23:32 server id 3336  end_log_pos 1771 CRC32 0x6e9eded3  Xid = 81
### UPDATE `test`.`test` ###
###   WHERE @1=5635999
###   @2='Ups happens'
###   @3=1520533412
###   SET @1=5635999
###   @2='Data where ups happens'
###   @3=1520533340

#180308 19:22:20 server id 3336  end_log_pos 1481 CRC32 0x8ae5fd7a   Xid = 79
### DELETE FROM `test`.`test` ###
###   WHERE @1=5635999
###   @2='Data where ups happens'
###   @3=1520533340
```
MariaBackup

- Alternative to XtraBackup and MySQL Enterprise Backup!
- Bases on XtraBackup 2.3.8
- Stable in 10.2.10 also for MariaDB 10.1, supported platforms: Linux and also on Windows!
- For InnoDB, Aria, MyISAM
- Hot online physical backup
  - full backup (all databases)
  - incremental backup (delta: complicated!)
  - partial backup (schema or table: complicated!)
- Supports Compressed and Encrypted Files
- Galera sst_method = mariabackup
MariaBackup Example

mariabackup --user=root --backup --target-dir=/backup/tape

mariabackup --user=root --prepare --target-dir=/backup/tape

mariabackup --user=root --copy-back --target-dir=/backup/tape
   --datadir=/var/lib/mysql
chown -R mysql:mysql /var/lib/mysql/

chown -R mysql:mysql /var/lib/mysql/
Other MariaDB tools

• MariaDB Column Store
  • Nov 2017: v1.1.2 GA, bases on MariaDB 10.2
  • Columnar Storage, designed for **analytic queries** on big data
  • Windows Functions!

• MaxScale
  • Used for: "in front of a database" (Proxy, Firewall, Router, ...)
  • Features: SQL Firewall, DoS protection, Read/write-splitting, Data masking, Query Caching, Schema-based sharding
  • 1.x is GPL (last release 2017-02, not supported any more)
  • 2.x is BSL, 2.2 is GA
  • Opponents: MySQL Router, ProxySQL (NOT a proxy!)
  • MySQL Router and MaxScale are note easy any more (but clever! and not so fast?), HAproxy is easy (but fast! and not so clever)
MariaDB Outlook 10.3

- System-Versioned Tables (SQL:2011)
- Storage Engine independent Column Compression
- Window functions improvements
- Invisible Columns
- Instant ADD COLUMN
- Optimizer and Performance improvements
- Spider SE and OQGRAPH SE upgrades
- Partition engine improvements

**AND:**

- `sql_mode = ORACLE` supports PL/SQL language subset
- PL/SQL `CREATE PACKAGE` support
- `INTERSECT` and `EXCEPT` (vs. `UNION`)
- Oracle style Sequences
MariaDB vs. Oracle

MariaDB ups the stakes in database war with Oracle

More than two years into the job, MariaDB CEO Michael Howard has ambitious plans for the open source database company. Many of which hinge on convincing Oracle customers to switch sides.

The open source database company MariaDB is aggressively courting Oracle customers, offering more portability and ease of migration to help enterprises make the switch.

MariaDB was developed by some of the original developers of the MySQL relational database, including Michael "Monty" Widensius, who jumped ship after MySQL was acquired by Oracle. It has always been developed as an open source 'drop in' replacement for MySQL.

MariaDB CEO Michael Howard

Michael Howard, who worked at Oracle for four years between 1996-2000, has been CEO of MariaDB since December 2015.
Q & A

Questions ?

Discussion?

We have time for some face-to-face talks...

- FromDual provides neutral and independent:
  - Consulting
  - Remote-DBA
  - Support for MySQL, Galera, Percona Server and MariaDB
  - Training