

MySQL 8.0 Architecture and Enhancements

Lalit Choudhary
Bug Analyst at Percona

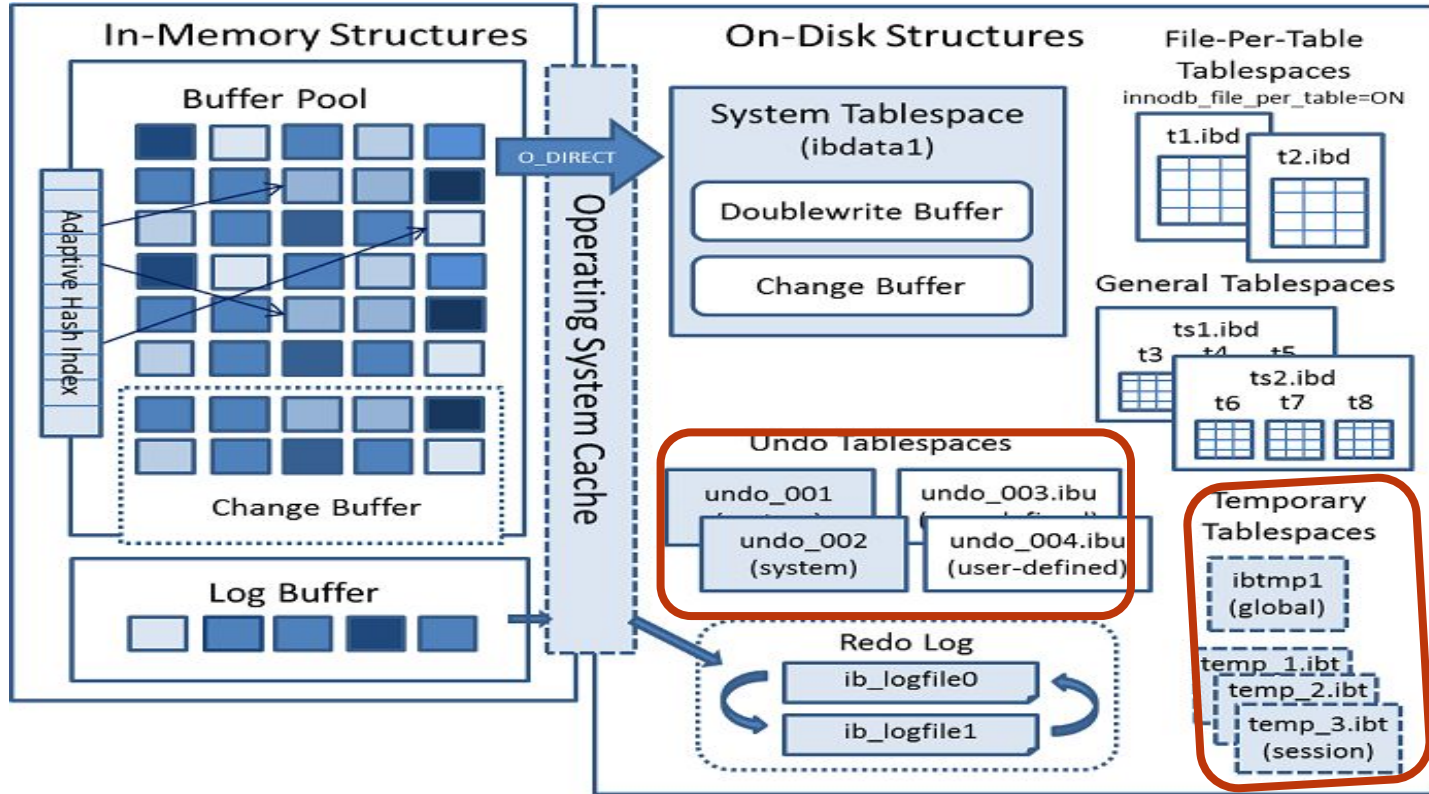


Agenda

- **MySQL 8.0 Architecture**
 - In-Memory Structure
 - On-Disk Structure
- **MySQL 8.0 Enhancement**
 - Data dictionary
 - InnoDB
 - Configuration and Logging
 - Replication
 - Security

8.0

MySQL 8.0 Architecture

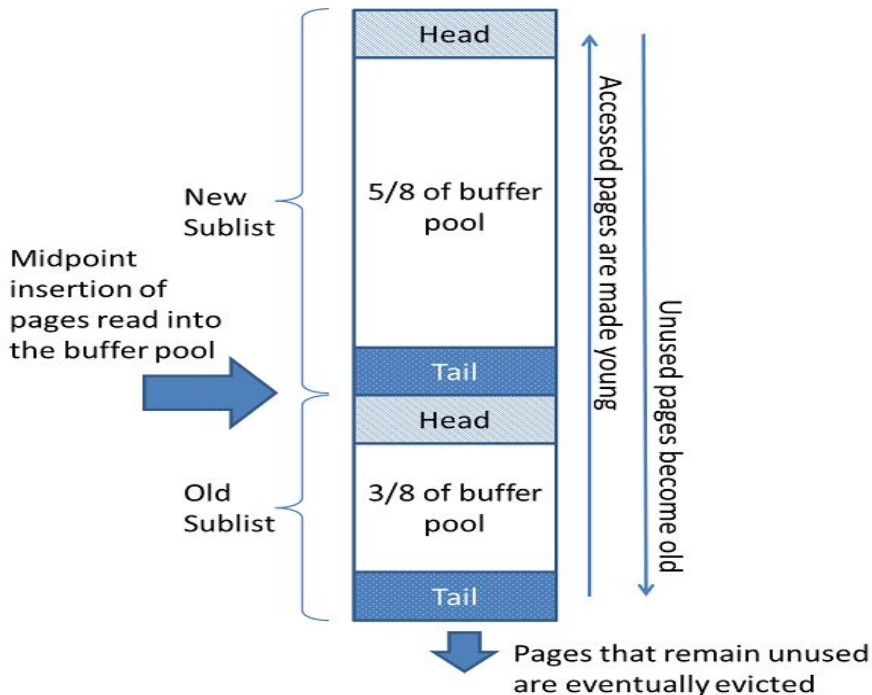


Source



Buffer Pool [In-Memory]

- Caches table and index data as it is accessed.
- Permits frequently used data to be processed directly from memory.
- **Configuration variable:**
Innodb buffer pool size



Buffer Pool [In-Memory]

- **Monitoring the Buffer Pool:**

- SHOW ENGINE INNODB STATUS;
- INFORMATION_SCHEMA.INNODB_BUFFER_POOL_STATS

- **Configuration to improve Performance:**

- InnoDB Buffer Pool Size
- Multiple Buffer Pool Instances
- InnoDB Buffer Pool Flushing

Change Buffer [In-Memory]

- Caches changes to secondary index pages.

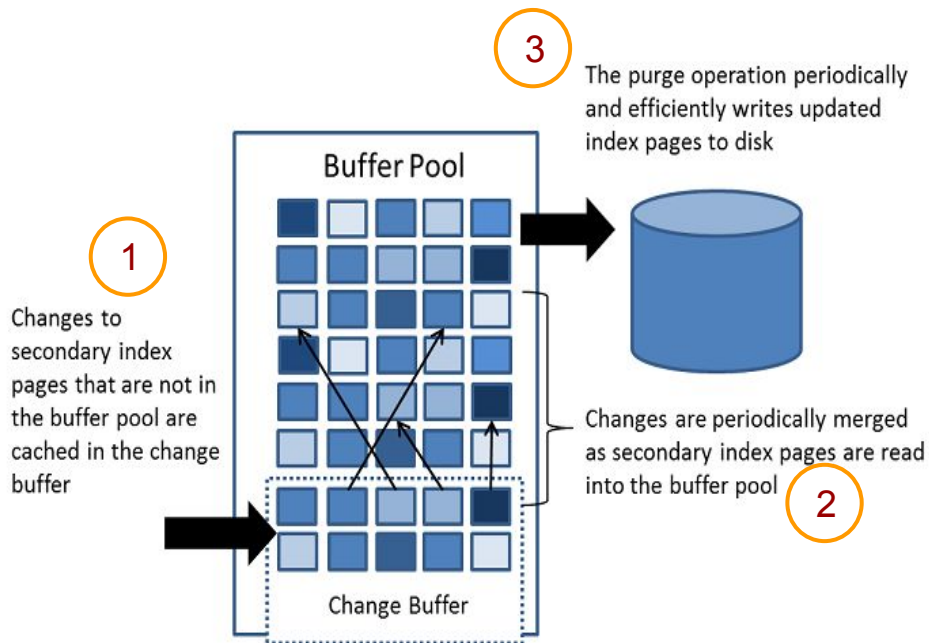
- **Configuration variable:**

innodb change buffering
innodb change buffer max size

- **Monitoring the Buffer Pool:**

SHOW ENGINE INNODB STATUS\G

INSERT BUFFER AND ADAPTIVE HASH INDEX



Adaptive Hash Index [In-Memory]

- Act like in-memory database on systems.

- **Configuration variable:**

Innodb_adaptive_hash_index
innodb_adaptive_hash_index_parts

- **Monitoring the Buffer Pool:**

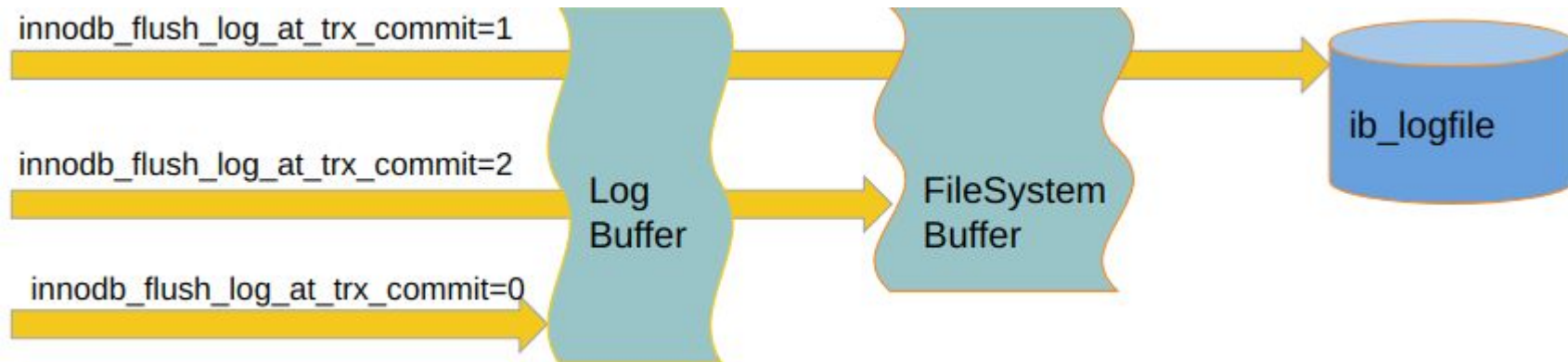
SHOW ENGINE INNODB STATUS\G ----> “*SEMAPHORES*”

Log Buffer [In-Memory]

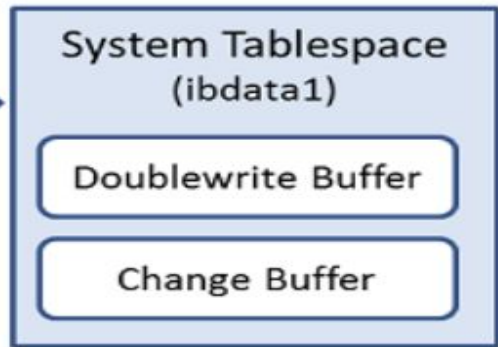
- Buffer for redo logs.
- **Configuration variable:**

innodb_log_buffer_size

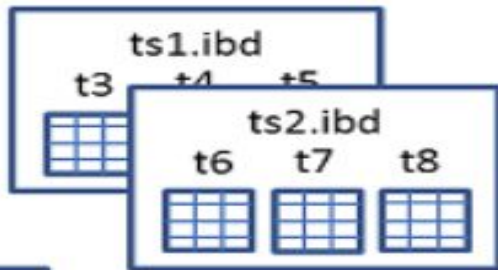
innodb_flush_log_at_trx_commit



Tablespace [On-Disk]



General Tablespaces



Example:

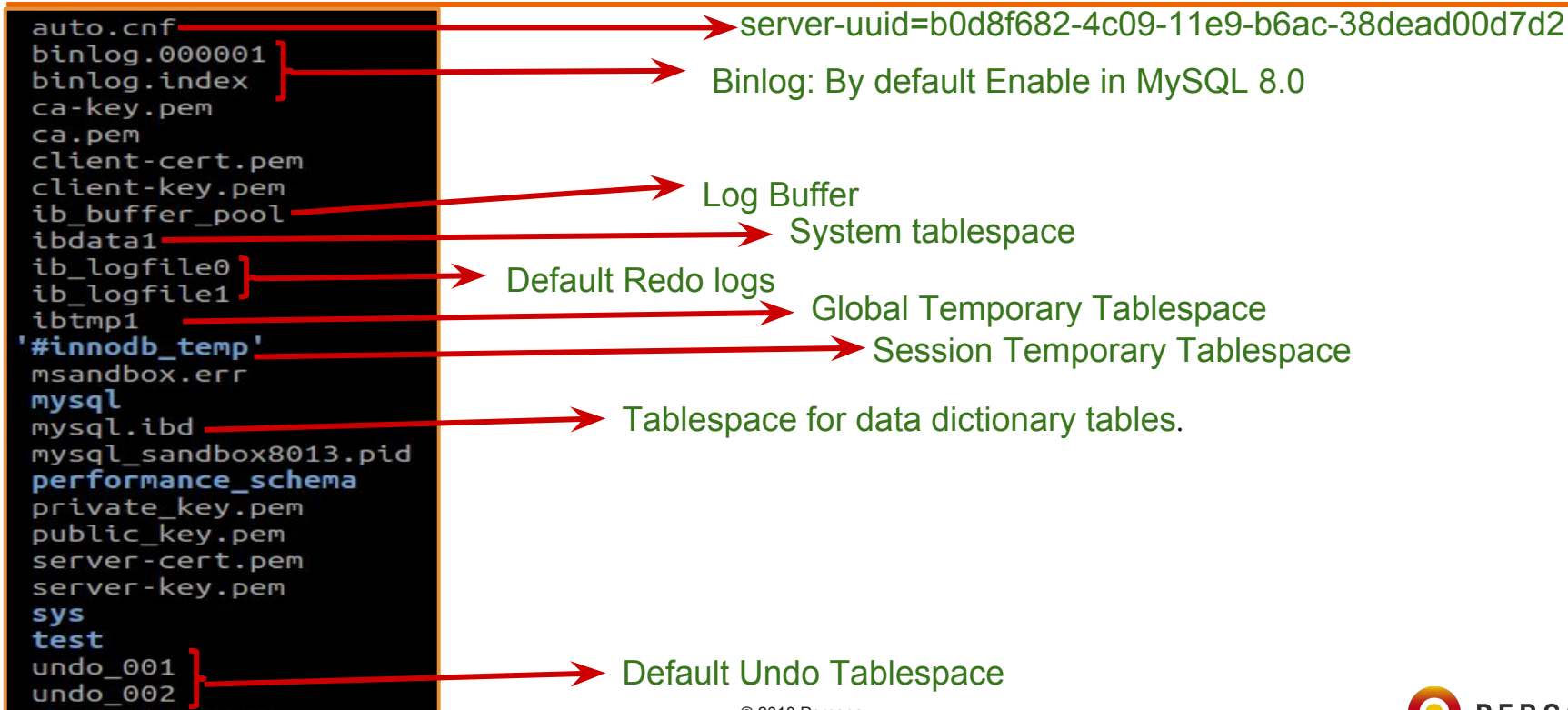
```
innodb_data_file_path =  
/data/ibdata1:1G;/data/ibdata2:500M:autoextend
```

Example:

```
CREATE TABLESPACE `ts1` ADD DATAFILE 'ts1.ibd'  
Engine=InnoDB;
```

```
CREATE TABLE t1 (c1 int PRIMARY KEY)  
TABLESPACE ts1 Engine=InnoDB;
```

On-Disk Structure [On-Disk]

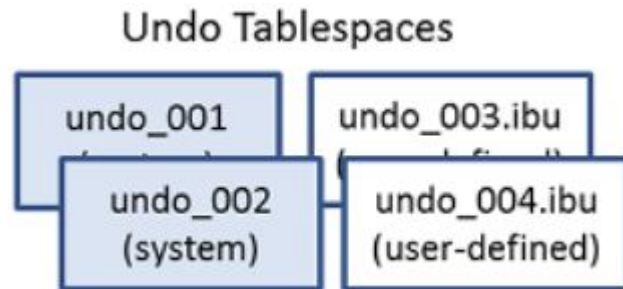


Undo Tablespace & Logs [On-Disk]

- Undo tablespaces contain undo logs
- Automated and Manual truncation
- Add/Drop Undo Tablespaces at runtime [MySQL 8.0.14]

Example:

```
CREATE UNDO TABLESPACE undo03 ADD DATAFILE  
'undo03.ibu';
```



InnoDB undo directory

InnoDB undo log truncate

Tables:

INFORMATION_SCHEMA.INNODB_TABLESPACES

Temporary Tablespace [On-Disk]

- Global temporary tablespace

User-created temporary tables

- session temporary tablespaces

- User-created temporary tables.
- Internal temporary tables created by the optimizer.

Temporary
Tablespaces

ibtmp1
(global)

innodb_temp_data_file_path

temp_1.ibt
temp_2.ibt
temp_3.ibt
(session)

innodb_temp_tablespaces_dir

Enhancement [MySQL 8.0]

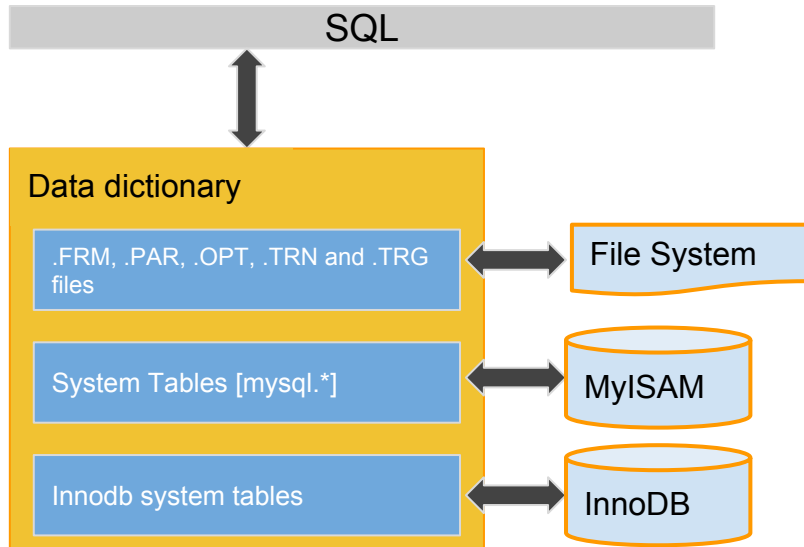
- Data dictionary
- INNODB Encryption
- Configuration Error Logging
- Replication
- Security

Data Dictionary [MySQL 8.0]

5.7

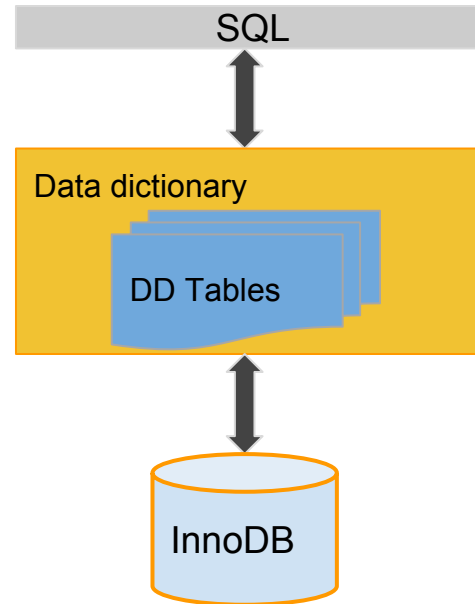
Metadata files

.FRM, .PAR, .OPT, .TRN and .TRG files



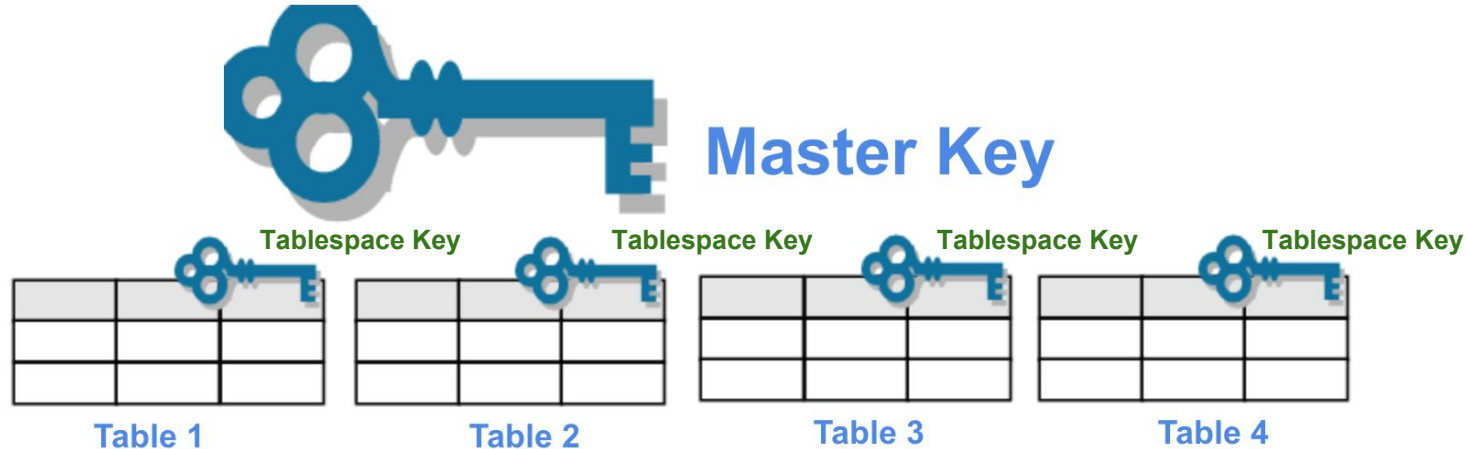
8.0

Native data dictionary based on InnoDB.
Transactional data dictionary.



MySQL 8.0 Data-at-rest encryption

- Each individual tablespace has its own encryption key
- Each tablespace key is encrypted by the Global Master Key
- Each time a tablespace is moved a new key is generated. This is called a transfer key.



InnoDB Encryption [MySQL 8.0]

- File-Per-Table Tablespace [Introduced in 5.7]
- System Tablespaces (ibdata)

ALTER TABLESPACE mysql ENCRYPTION = 'Y/N';

- General Tablespaces

CREATE/ALTER ENCRYPTION = 'Y/N';

InnoDB Encryption [MySQL 8.0]

- UNDO Tablespaces [innodb_undo_log_encrypt
- REDO Log [innodb_redo_log_encrypt conf]
- Binary Log Files and Relay Log Files [binlog_encryption]

Configuration and Logging [MySQL 8.0]

- Persisted System Variables

set persist innodb_redo_log_encrypt=ON

set persist innodb_undo_log_encrypt=ON;

set persist binlog_encryption=ON;

```
lalit@lalit-ThinkPad-T480:~/sandboxes/msb_8_0_15/data$ cat mysqld-auto.cnf
{ "Version" : 1 , "mysql_server" : { "innodb_redo_log_encrypt" : { "Value" : "ON"
, "Metadata" : { "Timestamp" : 1553683485546793 , "User" : "msandbox" , "Host" : "
localhost" } } , "innodb_undo_log_encrypt" : { "Value" : "ON" , "Metadata" : { "Ti
mestamp" : 1553683501343984 , "User" : "msandbox" , "Host" : "localhost" } } , "my
sql_server_static_options" : { "binlog_encryption" : { "Value" : "ON" , "Metadata"
: { "Timestamp" : 1553683512464656 , "User" : "msandbox" , "Host" : "localhost" }
```

Logging in MySQL 8.0

- Defaults change: `log_error_verbosity=2`
- Suppress error logs of type warning or note

Configuration:

```
[mysqld]
```

```
log_error_verbosity=2    # error and warning messages only
```

```
log_error_suppression_list='ER_PARSER_TRACE,MY-010001,10002'
```

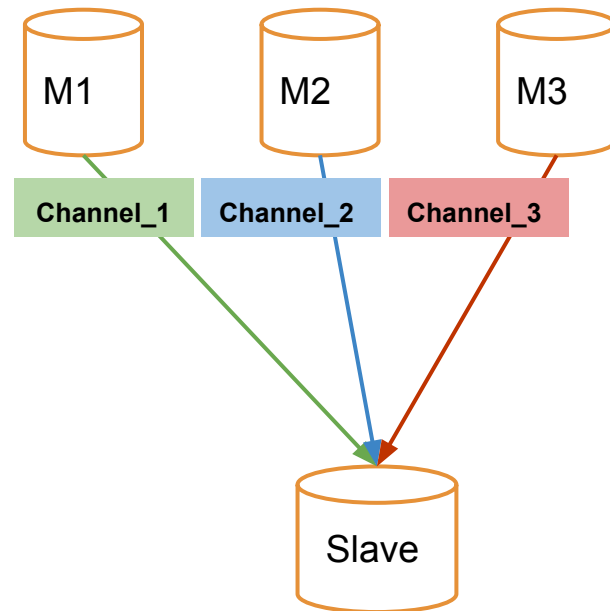
Replication [MySQL 8.0]

- Multi-source Replication Per Channel
Filters

Example:

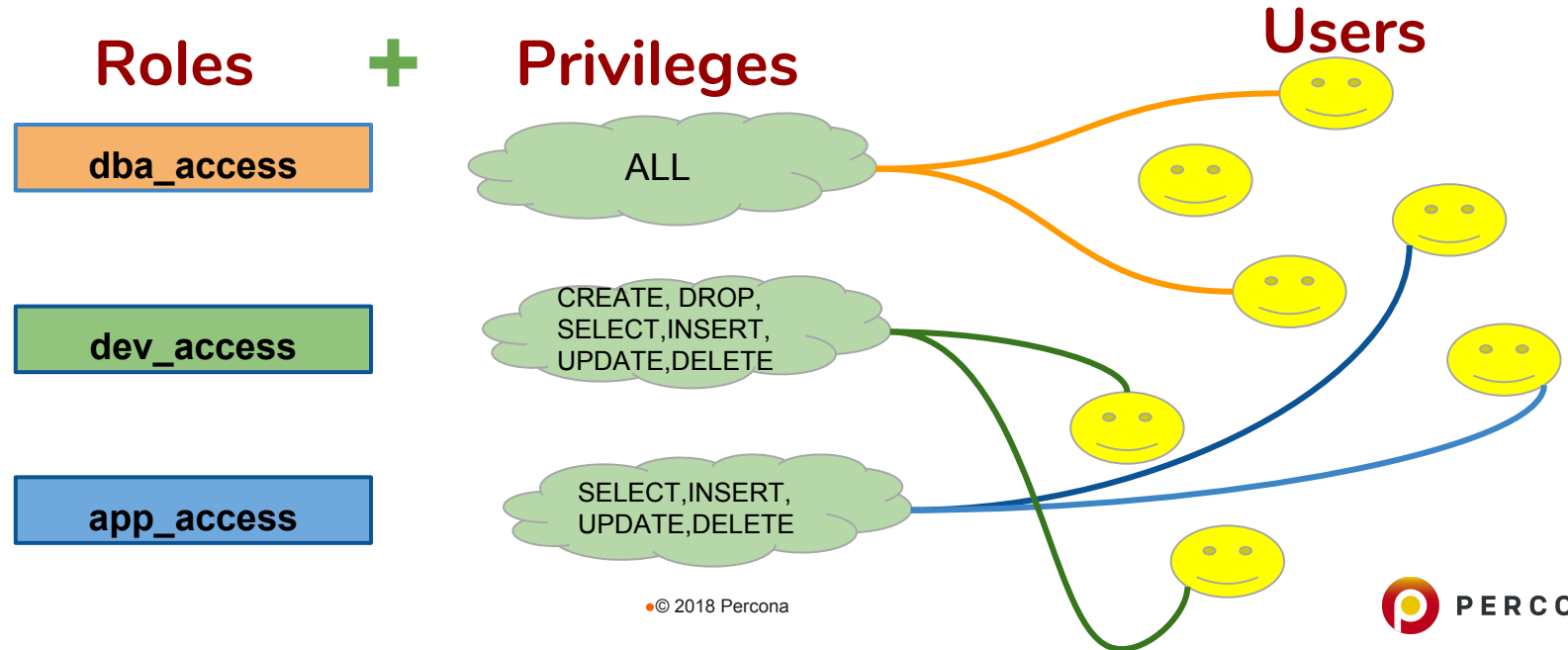
```
CHANGE REPLICATION FILTER  
REPLICATE_DO_DB=(db1) FOR CHANNEL  
channel_1;
```

- `--replicate-do-db=channel_1:db1`
- `--replicate-ignore-db=channel_1:db2`



Security [MySQL 8.0]

- SQL Roles : It is a collection of privileges



Security [MySQL 8.0]

- Automatic assignment and granting of default roles when new users are created [mandatory_roles]
- Password rotation policy enforcement [default_password_lifetime]
- Old password required for SET PASSWORD for some users

Security [MySQL 8.0]

- Password rotation policy enforcement [default_password_lifetime]
- Old password required for SET PASSWORD for some users

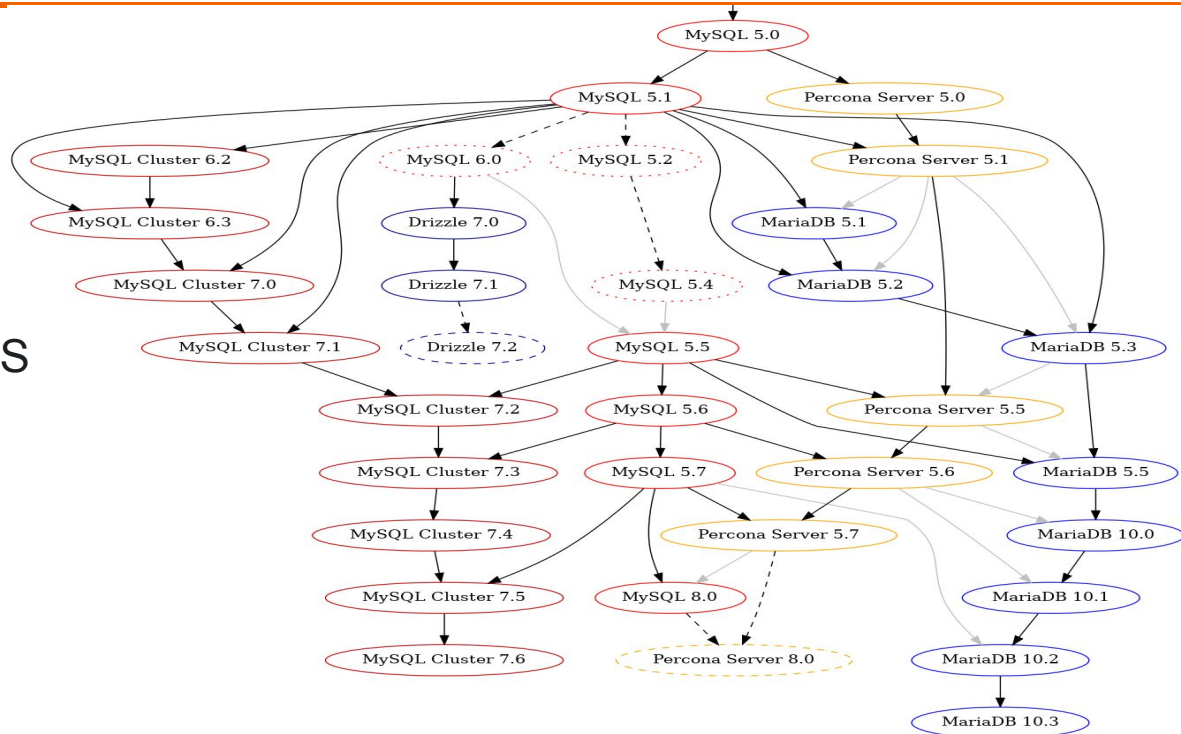
Percona Server: MySQL improved

- **Patch (not fork) MySQL to add:**

- Enterprise features for free (threadpool, PAM auth)
- Instrumentation
- Performance/scalability
- Selected new features



What's the deal with all those forks?



- <http://bit.ly/2Qq9czS>

References

<https://dev.mysql.com/doc/refman/8.0/en/innodb-tablespace-encryption.html>

<https://dev.mysql.com/doc/refman/8.0/en/roles.html>

Thank you!

- Join Us

