Copy your databases

Percona Live 2021
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Topics

When and why?
Where from?
MySQL-side methods
Storage-side methods
Comparisons and Recommendations
MySQL at Booking.com

- In use 15+ years
- Thousands of instances
- Hundreds of replication chains
- Data storage across our business
Database copies – Why?

- New instances
- Replacements
- Upgrades
- Backups
Database copies – Where From?
Primary master
Intermediate/standby replica
Shared replica serving users
Dedicated replica
## Comparison

<table>
<thead>
<tr>
<th></th>
<th>Efficiency (cost saving)</th>
<th>Speed</th>
<th>User Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Master</td>
<td>High</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Intermediate / standby</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>Existing replica</td>
<td>High</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Dedicated replica</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>
Recommendation

- First choice: Dedicated replica
- Second choice: Intermediate/standby
- For creating new chains: Primary master
MySQL-side methods

Online
- mysqldump style
- xtrabackup style
- Native Cloning

Offline
- file rsync
- ZFS send/receive

Backup & restore
mysqldump / mariadump

- SQL: DDL + DML + GTID
- Very flexible
  - Including version downgrade and load to other vendors
- Very slow
- The last resort; don't even bother automating
xtrabackup / mariabackup

- Tablespaces + log
- "prepare" after copy
- No downgrade in MySQL 8, MariaDB 10.5
- Fast enough for many uses
Native Cloning

- Oracle MySQL 8 only
- Exact version match only
- Simple command via SQL interface
- 2-3 times faster than xtrabackup
File copy

- Create consistent copy of database files
  - Shutdown for snapshot or copy
- Copy using rsync (daemon), pigz, …
  - or filesystem tools – ZFS send/receive
- Transport efficiency is a factor here
Storage-side methods

- Command storage to make snapshot of data
- Copy/clone/restore snapshot
- Start new instance
- Profit!
Inconsistent snapshot

Replica

Data Volume

Scan 1 to N

Data Volume Copy

txn 1

txn 2

N
Consistent snapshot

![Diagram showing a consistent snapshot with replica, log structure FS, and transactions]

- Replica
- Log structure FS
- Transaction 1 (txn 1)
- Transaction 2 (txn 2)
- Snapshot pointer
- Transaction 1 (txn 1)
Shutdown for copy?

- Have you analysed the storage system in great detail?
- Do you feel lucky?
- No?
- Then shutdown MySQL for snapshot.
Advantages of storage copy

- Fast (usually)
- Features are already available (with most modern storage)
- Can be simpler than host copy
Limitations?

- Available immediately?
- Performance while copying?
- Ancestor volume must continue to exist?
- Limited number of descendents?
- Concurrency limits?
- Copy between storage clusters?
- Management complexity?
Backup and restore

● You have backup, and also restore.

● Restore is…
  ● Not scalable (restore a backup to one target only)
  ● Often not very fast
  ● Often not made for intensive use 24/7

● Useful secondary copying method
Concurrency

- Hardware limits
  - 6Gb/s SATA, 10Gb/s Ethernet
- Mutually incompatible methods
  - Online vs offline
- Snapshot freshness
- Replicating during snap copying works fine
After copying data

- Attach the volume to server instance, if needed
- Change server_id and server_uuid
- Set up replication as needed
  - Use GTID and AUTO_POSITION
  - Or join to a group or cluster
- System automation setup
- Register with monitoring & metrics
## Comparisons

<table>
<thead>
<tr>
<th></th>
<th>Flexible (version)</th>
<th>Speed</th>
<th>Online (source)?</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MySQLdump</td>
<td>Very</td>
<td>Very slow</td>
<td>Yes</td>
<td>Last resort</td>
</tr>
<tr>
<td>xtrabackup</td>
<td>Yes *</td>
<td>Medium</td>
<td>Yes</td>
<td>First choice</td>
</tr>
<tr>
<td>Native</td>
<td>No *</td>
<td>Fast</td>
<td>Yes</td>
<td>Handy extra</td>
</tr>
<tr>
<td>File copy</td>
<td>Yes *</td>
<td>Fast</td>
<td>No</td>
<td>First choice</td>
</tr>
<tr>
<td>Storage copy</td>
<td>Yes *</td>
<td>Very fast (or maybe slow)</td>
<td>No</td>
<td>If available, first choice</td>
</tr>
<tr>
<td>Restore</td>
<td>Yes</td>
<td>Slow</td>
<td>Varies</td>
<td>Second choice</td>
</tr>
</tbody>
</table>

* Remember no downgrades on Oracle MySQL 8, Percona 8, and MariaDB 10.5
Recommendation

- Online copy will sometimes be necessary
- Implement automation for several options:
  - First choices: `xtrabackup`, File copy, Storage copy (if available)
  - Second choices: Native, Restore
- Do not:
  - Assume storage cloning is always possible
  - Rely on Native alone (makes upgrades painful)