MySQL Backup and Restore at Facebook Scale

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...and how it’s not rocket science

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When do we need backups?

How do we perform backups?

How do we restore backups?
When do we need backups?

How do we perform backups?

How do we restore backups?
When do we need backups?

How do we perform backups?

How do we restore backups?
When do we need backups?
MALICIOUS ATTACKER
HARDWARE FAILURE
HUMAN ERROR
FULL DUMPS

DIFFS
How do we perform backups?
Every database, every day
<table>
<thead>
<tr>
<th>Feature</th>
<th>Logical Backups</th>
<th>Physical Backups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer Logic</td>
<td>Easy</td>
<td>Complex</td>
</tr>
<tr>
<td>Debugging</td>
<td>Easy</td>
<td>Complex</td>
</tr>
<tr>
<td>Single Table Restore</td>
<td>Easy</td>
<td>Complex</td>
</tr>
<tr>
<td>Portability</td>
<td>Consistent</td>
<td>Inconsistent</td>
</tr>
<tr>
<td>Backup and Restore Duration</td>
<td>Long</td>
<td>Short</td>
</tr>
</tbody>
</table>
Technical setup

**mysqlldump**

**number of rows** for each table

**zstd** compression

**trailing index**
mysqldump --single-transaction --skip-lock-tables (...)

mysqldump --single-transaction --skip-lock-tables (...) | compress and add index
mysqldump --single-transaction --skip-lock-tables (...) | compress and add index | upload
Trailing index

```
{
   "size": 7331,
   "offset": 1337,
   "table_name": "foo"
},
{
   "size": 223,
   "offset": 8668,
   "table_name": "bar"
}
```
Open-source

mysql:\
https://github.com/facebook/mysql-5.6

zstd:
https://github.com/facebook/zstd
Open source tooling will get the job done
Open source tooling will get the job done

- automysqlbackup
  - scheduling
  - email notifications
  - custom backup rotation
Open source tooling will get the job done

automysqlbackup
- scheduling
- email notifications
- custom backup rotation

monitoring tools
- alerting
Technical setup

- **full dump format**
- **2 files** for a single diff backup
- **rows removed**
- **rows inserted and updated**
most recent dump backup, “base dump”

new dump

---

**DiffDatabase**

---

diff1

CREATE TABLE foo
INSERT INTO foo
-- rows for foo: 1337
CREATE TABLE bar
INSERT INTO bar

---

diff2

CREATE TABLE foo
INSERT INTO foo
-- rows for foo: 7331
CREATE TABLE bar
INSERT INTO bar
CREATE TABLE foo
INSERT INTO foo
-- rows for foo: 1337
CREATE TABLE bar
INSERT INTO bar

CREATE TABLE foo
INSERT INTO foo
-- rows for foo: 1337
CREATE TABLE bar
INSERT INTO bar
F D D D D F D D D D D F
2-3x+ less space used
Explore the open source tooling
Explore the open source tooling

automysqlbackup

- scheduling
- email notifications
- custom backup rotation
- differential backups
Due diligence checklist
Due diligence checklist

- verify the size
Due diligence checklist

- verify the size
- set up alerting
Due diligence checklist

- verify the size
- set up alerting
- store checksums and metadata
Technical setup

all transactions for all databases from master compressed using zstd metadata stored
Due diligence checklist

- verify the size
- set up alerting
- store checksums and metadata
Due diligence checklist

- verify the size
- set up alerting
- store checksums and metadata
- detect gaps in transactions backed up
Due diligence checklist

- verify the size
- set up alerting
- store checksums and metadata
- detect gaps in transactions backed up
- monitor the "backup lag"
How do we restore backups?
Continuous restore pipeline
Continuous restore pipeline
Continuous restore pipeline

Loadbalancer — Scheduler
Continuous restore pipeline

Loadbalancer

DB

Scheduler
Continuous restore pipeline

Loadbalancer -> DB -> Worker

MySQL

Scheduler
SELECT  CHECKSUM  DOWNLOAD  LOAD  VERIFY  REPLAY  CHECKSUM
SELECT  CHECKSUM  DOWNLOAD  LOAD  VERIFY  REPLAY  CHECKSUM
Start small and build up
Today’s agenda

Why do we need backups?

Backups and restores made easy

How to make sure our backups don’t go to ”/dev/null”? 
Today’s agenda

Why do we need backups?

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How to make sure our backups don’t go to ”/dev/null”?
Today’s agenda

Why do we need backups?

Backups and restores made easy

How to make sure our backups don’t go to ”/dev/null”?
“The best outages are the ones that don’t happen.”

PRETTY MUCH EVERY PRODUCTION ENGINEER I KNOW
Thank you
Ola Berjak

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