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MySQL & Friends

LEFRED

MYSQL POINT-IN-TIME RECOVERY LIKE A ROCKSTAR

ORACLE®

MySQL Point-in-Time Recovery like a Rockstar

Accelerate MySQL point-in-time recovery for large workloads

FOSDEM, February 2018

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about.me/lefred

Who am I ?

Frédéric Descamps

- @lefred
- MySQL Evangelist
- Hacking MySQL since 3.23
- devops believer
- living in Belgium **B E**
- http://lefred.be

what is PITR ?

point-in-time recovery

PITR: Definition

from Wikipedia (thank you Jaime)

Point-in-time recovery (PITR) in the context of computers involves systems whereby an administrator can restore or recover a set of data or a particular setting from a time in the past.

Once PITR logging starts for a PITR-capable database, a database administrator can restore that database from backups to the state that it had at any time since.

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MySQL PITR

requirements

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To be able to perform point-in-time recovery with MySQL, you need to have:

- decent backups
- binary logs enabled
- keeping your binlogs at least since the last successful backup

MySQL PITR

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see the manual: https://dev.mysql.com/doc/refman/5.7/en/point-in-time-recovery.html

MySQL PITR

Example

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- We have one database with 16 tables

```
sysbench /usr/share/sysbench/oltp_insert.lua --db-driver=mysql
        --mysql-user=root --mysql-host=localhost --table-size=100000
        --tables=16 prepare
```

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- We have one physical backup

```
/opt/mysql/meb-4.1/bin/mysqlbackup --host=127.0.0.1
                     --backup-dir=mysqlbackup backup
/opt/mysql/meb-4.1/bin/mysqlbackup --host=127.0.0.1
                     --backup-dir=mysqlbackup apply-log
```

Example

- We have one database with 16 tables

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```

Any other backup solution can be used

Example (2)

- We write data using 8 threads for 1h:

```
sysbench /usr/share/sysbench/oltp_insert.lua --db-driver=mysql
         --mysql-user=root --mysql-host=localhost --table-size=100000
         --tables=16 --threads=8 --report-interval=10 --time=3600 run
```

Example (2)

- We write data using 8 threads for 1h:

```
sysbench /usr/share/sysbench/oltp_insert.lua --db-driver=mysql
         --mysql-user=root --mysql-host=localhost --table-size=100000
         --tables=16 --threads=8 --report-interval=10 --time=3600 run
```

- And let's modify a record with something we can track ;-)

```
mysql> update sbtest3 set pad='fred' where id = 126551;
Query OK, 1 row affected (0.02 sec)
Rows matched: 1  Changed: 1  Warnings: 0
```

Suddenly...

Suddenly...

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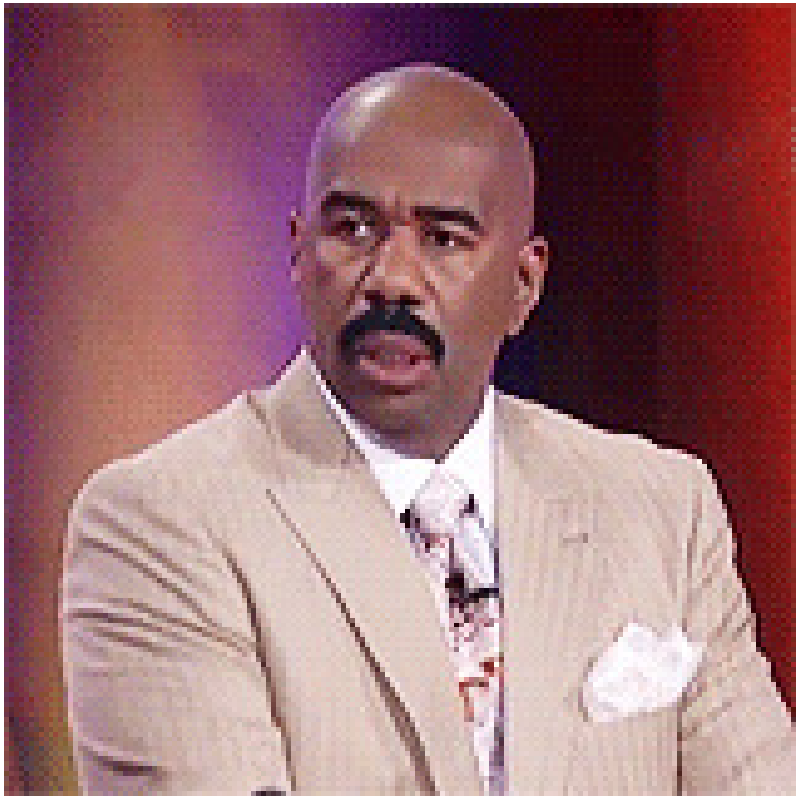
```
mysql> update sbtest4 set pad="oups";
Query OK, 1066269 rows affected (8.52 sec)
Rows matched: 1066269  Changed: 1066269  Warnings: 0
```



UPDATE without WHERE clause !?!

Find what we need to avoid after restore

```
mysql> show master status;
+------------------+-----------+...+---------------------------------------------+
| File             | Position  |   | Executed_Gtid_Set                           |
+------------------+-----------+...+---------------------------------------------+
| imac2-bin.000005 | 622915384 |   | 25d97ef9-005b-11e8-bf1b-685b359e77d5:1-1072032 |
+------------------+-----------+...+---------------------------------------------+
1 row in set (0.00 sec)
```

Let's verify...

```
mysql> pager grep -A 1 -B 2 'sbtest.sbtest4' | grep -B 4 Update

mysql> show binlog events in 'imac2-bin.000005';
--
| imac2-bin.000005 | 277145452 | Gtid        | ... |
           SET @@SESSION.GTID_NEXT= '25d97ef9-005b-11e8-bf1b-685b359e77d5:1072032' |
| imac2-bin.000005 | 277145513 | Query       | ... | BEGIN                          |
| imac2-bin.000005 | 277145583 | Table_map   | ... | table_id: 154 (sbtest.sbtest4)|
| imac2-bin.000005 | 277145638 | Update_rows | ... | table_id: 154                  |

mysql> pager sed -n -e '/25d97ef9-005b-11e8-bf1b-685b359e77d5:1072032/,/COMMIT/ p'
        | grep COMMIT

mysql> show binlog events in 'imac2-bin.000005';
| imac2-bin.000005 | 622915357 | Xid | ... | 622915384 | COMMIT /* xid=1072253 */
```

This is good, let's then keep the position **277145452**

Stop MySQL and save the binlogs

```
[root@imac2 ~]# systemctl stop mysqld
[root@imac2 ~]# mkdir /mnt/mysql/binlogs
[root@imac2 ~]# cd /var/lib/mysql

[root@imac2 mysql]# cp imac2-bin.* /mnt/mysql/binlogs/
```

Stop MySQL and save the binlogs

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[root@imac2 ~]# cd /var/lib/mysql

[root@imac2 mysql]# cp imac2-bin.* /mnt/mysql/binlogs/
```

Restore the backup

```
[root@imac2 mysql]# rm -rf *
[root@imac2 mysql]# /opt/mysql/meb-4.1/bin/mysqlbackup
                     --backup-dir=/tmp/mysqlbackup copy-back
...
mysqlbackup completed OK! with 3 warnings
[root@imac2 mysql]# chown -R mysql. *
```

Point-in-Time Recovery

Now we can start MySQL and replay the binlogs from the backup position, until the "EVENT" (*277145452*)

```
# grep binlog_position backup_variables.txt
binlog_position=imac2-bin.000004:888830919
```

```
[root@imac2 binlogs]# time mysqlbinlog -j 888830919
                        --stop-position 277145452 imac2-bin.00000[4-5] | mysql
real    305m18.867s
```

I only needed to replay events from imac2-bin.00000[4-5] in fact, but it could be way more than that

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```

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```
-rw-r----- 1 root root 1.1G Jan 23 21:27 imac2-bin.000004
-rw-r----- 1 root root 595M Jan 23 21:27 imac2-bin.000005
```

Was it really like a rockstar ?

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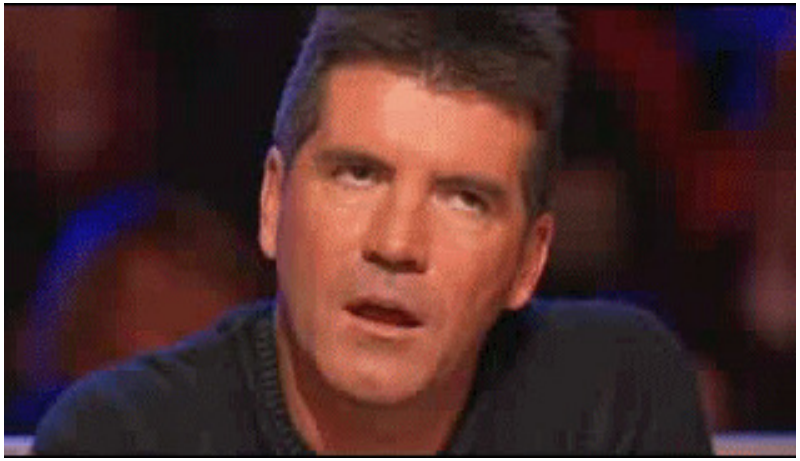
NO !

Why not ?

If you have a large amount of large binary logs and your workload is not single threaded like **mysqlbinlog**... this process can take for eveeeeeeeeer !



Let's do it like a rockstar !

Find and Set the last executed GTID during backup

```
[root@imac2 mysql]# cat backup_variables.txt | grep gtid
gtid_executed=25d97ef9-005b-11e8-bf1b-685b359e77d5:1-6001
```

The name of the file depends of your backup tool

After restoring the backup, restart MySQL with this change in `my.cnf`:

```
skip-slave-start
```

Finally set the GTID **AND ALSO** the GTID of the transaction we want to avoid:

```
mysql> reset master;

mysql> SET @@GLOBAL.GTID_PURGED='25d97ef9-005b-11e8-bf1b-685b359e77d5:1-6001,
                                 25d97ef9-005b-11e8-bf1b-685b359e77d5:1072032';
```

MySQL PITR

Now the cool stuff!

We will copy all the saved binlogs and rename them as **relaylogs** !

```
[root@imac2 mysql]# for i in $(ls /mnt/mysql/binlogs/*.0*)
 do
   ext=$(echo $i | cut -d'.' -f2)
   cp $i imac2-relay-bin.$ext
 done
```

We will copy all the saved binlogs and rename them as **relaylogs** !

```
[root@imac2 mysql]# for i in $(ls /mnt/mysql/binlogs/*.0*)
 do
   ext=$(echo $i | cut -d'.' -f2)
   cp $i imac2-relay-bin.$ext
 done
```

Don't forget to create the index file too:

```
[root@imac2 mysql]# ls ./imac2-relay-bin.0* >imac2-relay-bin.index
[root@imac2 mysql]# chown mysql. *relay*
[root@imac2 mysql]# cat imac2-relay-bin.index
./imac2-relay-bin.000001
./imac2-relay-bin.000002
./imac2-relay-bin.000003
./imac2-relay-bin.000004
./imac2-relay-bin.000005
```

Get ready to do PITR like a rockstar !

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```
mysql> SET GLOBAL server_id = 99;
        #replicate-same-server-id=1 won't work because of #89375

mysql> SET GLOBAL SLAVE_PARALLEL_TYPE='LOGICAL_CLOCK';

mysql> SET GLOBAL SLAVE_PARALLEL_WORKERS=8;

mysql> CHANGE MASTER TO RELAY_LOG_FILE='imac2-relay-bin.000001',
       RELAY_LOG_POS=4, MASTER_HOST='dummy';

mysql> START SLAVE SQL_THREAD;
```

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```

And you can even monitor it:

```
mysql> select * from
        performance_schema.replication_applier_status_by_worker\G

mysql> show global variables like 'gtid_executed';
```

it took less than 22 mins !

if you are brave and want to go at light speed

Try https://github.com/lefred/MyUndelete

Thank you !

Any Questions ?

http://lefred.be