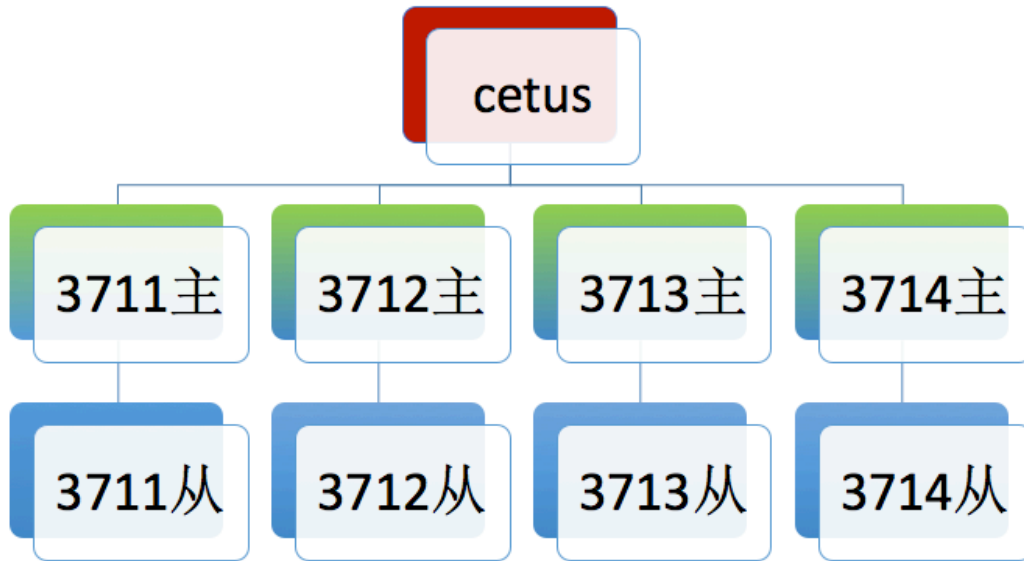# MySQL 5.7.21 XA bug 的外部现象

发现的 XA bug 现象是数据库的 xa 状态跟 binlog 记录的状态不一致。测试 MySQL 版本为 5.7.21。连接分片中间件，运行模拟银行转账的脚本，测试过程随机 kill -9 杀掉后端数据库，过 10 分钟后，查看各个后端数据库的 xa 悬挂事务，并且比对分片 cetus 的 xa log 和 MySQL binlog，判断悬挂事务的是否正常。一个 cetus 后面接四个写节点 3711/3712/3713/3714，每个写节点带一个从库：



分两种情况分析已发现的 xa bug

## 主库存在 xa 事务：

3713 主库发现 xa 事务，其他主库和所有从库未发现与之对应的 xa 事务

```
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 21
Server version: 5.7.21-log MySQL Community Server (GPL)

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> xa recover;
+----------+--------------+--------------+----------------------------------+
| formatID | gtrid_length | bqual_length | data                             |
+----------+--------------+--------------+----------------------------------+
|        1 |           32 |            0 | clt-0.0.0.0:7001-5496_23_1229736 |
|        1 |           32 |            0 | clt-0.0.0.0:7001-5496_23_1230780 |
+----------+--------------+--------------+----------------------------------+
2 rows in set (0.00 sec)

mysql>
```

检查 clt-0.0.0.0:7001-5496_23_1229736 在 cetus 中的执行情况，可以看到 cetus 已经向四个写节点发送 xa commit，这个事务在 cetus 看来，已经成功了。

```
[mysql-cetus@hz-10-         logs6001]$ cat xa.log_23|grep clt-0.0.0.0:7001-5496_23_1229736
2018/04/10 23:30:03 +588 [info] XA COMMIT 'clt-0.0.0.0:7001-5496_23_1229736' 10.      3711@43,10.      :3712@25,10      :3713@65,10.      :3714@3
```

提示：xa recover 看到的 data，在 binlog 中记录的是十六进制的小写形式，可以在 python 中做一下转换
python
import base64
print base64.b16encode(b'clt-0.0.0.0:7001-5496_23_1229736').lower()

```
[mysql-cetus@hz-10-         logs6001]$ python
import base64
Python 2.7.5 (default, Oct 11 2015, 17:47:16)
[GCC 4.8.3 20140911 (Red Hat 4.8.3-9)] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> import base64
>>> print base64.b16encode(b'clt-0.0.0.0:7001-5496_23_1229736').lower()
636c742d302e302e302e303a373030312d353439365f32335f31323239373336
```

再看四个主库和四个从库的 binlog
3711 主库：
主库 binlog 已经记录 xa commit，并且实例中没有悬挂事务

```
[mysql3711@                data]$ mysqlbinlog -vvv mysql-bin.000012>a.txt
[mysql3711@                data]$ cat a.txt |grep 636c742d302e302e302e303a373030312d353439365f32335f31323239373336
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
#180410 23:30:03 server id 1013711  end_log_pos 1441946 CRC32 0x0858e931       XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA COMMIT X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
```

3711 从库：
现象同 3711 主库，已 xa commit，无悬挂事务

```
[mysql3711@                data]$ mysqlbinlog -vvv mysql-bin.000003> a.txt
[mysql3711@                data]$ cat a.txt |grep 636c742d302e302e302e303a373030312d353439365f32335f31323239373336
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
#180410 23:30:03 server id 1013711  end_log_pos 11838132 CRC32 0x01ae9fb1       XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA COMMIT X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
```

## 3712 主库：

现象同 3711 主库，已 xa commit，无悬挂事务

```
[mysql3712@              data]$  cat a.txt |grep 636c742d302e302e302e303a373030312d353439365f32335f31323239373336
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
#180410 23:30:03 server id 1013712  end_log_pos 1464924 CRC32 0x857c2ae1      XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA COMMIT X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
```

## 3712 从库：

现象同 3711 主库，已 xa commit，无悬挂事务

```
[mysql3712@              data]$ cat a.txt |grep 636c742d302e302e302e303a373030312d353439365f32335f31323239373336
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
#180410 23:30:03 server id 1013712  end_log_pos 11880723 CRC32 0xe984df44      XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA COMMIT X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
```

## 3713 主库：

主库 binlog 已经记录 xa commit，但是出现了悬挂事务！下面在看看 3713 从库

```
[mysql3713@hz-           data]$  cat a.txt |grep 636c742d302e302e302e303a373030312d353439365f32335f31323239373336
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
#180410 23:30:03 server id 1013713  end_log_pos 1458043 CRC32 0xc17e25e4      XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA COMMIT X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
```

## 3713 从库：

现象同 3711 主库，已 xa commit，无悬挂事务，证明 3713 主库的 binlog 已同步
到 3713 从库，并且从库 slave_sql_thread 已经成功应用传过来的 binlog

```
[mysql3713@              data]$  cat a.txt |grep 636c742d302e302e302e303a373030312d353439365f32335f31323239373336
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
#180410 23:30:03 server id 1013713  end_log_pos 11946257 CRC32 0x855d4ca6      XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA COMMIT X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
```

## 3714 主库：

现象同 3711 主库，已 xa commit，无悬挂事务

```
[mysql3714@              data]$ cat a.txt |grep 636c742d302e302e302e303a373030312d353439365f32335f31323239373336
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
#180410 23:30:03 server id 1013714  end_log_pos 1446776 CRC32 0x2438eab0      XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA COMMIT X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
```

## 3714 从库：

现象同 3711 主库，已 xa commit，无悬挂事务

```
[mysql3714@              data]$ cat a.txt |grep 636c742d302e302e302e303a373030312d353439365f32335f31323239373336
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
#180410 23:30:03 server id 1013714  end_log_pos 1446776 CRC32 0x2438eab0      XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
XA COMMIT X'636c742d302e302e302e303a373030312d353439365f32335f31323239373336',X'',1
```

结论：cetus 向所有后端写节点发送 xa commit，3713 主库接收到 xa commit 命
令，将 xa commit 命令写入本实例 binlog，binlog 被拉到从库，主库执行 xa commit
前被用 kill -9 杀掉。主库重新启动后不能识别 xa 事务的正确状态，导致了悬挂事
务。

# 从库存在 xa 事务：

3714 从库发现 xa 事务，其他主库和所有从库未发现与之对应的 xa 事务

```
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 243
Server version: 5.7.21-log MySQL Community Server (GPL)

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> xa recover;
+----------+-------------+-------------+----------------------------------------+
| formatID | gtrid_length | bqual_length | data                                  |
+----------+-------------+-------------+----------------------------------------+
|        1 |          32 |           0 | clt-0.0.0.0:7001-5496_23_1227527       |
+----------+-------------+-------------+----------------------------------------+
1 row in set (0.00 sec)
```

检查 clt-0.0.0.0:7001-5496_23_1227527 在 cetus 中的执行情况，可以看到 cetus 发到 3714 主库的 xa prepare 失败，然后回滚另外三个写节点的 xa prepare。

```
2018/04/10 23:29:04 +145 [warn] XA PREPARE 'clt-0.0.0.0:7001-5496_23_1227527' 10.120.12.84:3714@9 failed
2018/04/10 23:29:04 +145 [info] XA ROLLBACK 'clt-0.0.0.0:7001-5496_23_1227527' 10.120.12.84:3711@22,10.120.12.84:3712@4,10.120.12.84:3713@62
```

转换 clt-0.0.0.0:7001-5496_23_1227527 为十六进制

```
import base64
Python 2.7.5 (default, Oct 11 2015, 17:47:16)
[GCC 4.8.3 20140911 (Red Hat 4.8.3-9)] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> import base64
>>> print base64.b16encode(b'clt-0.0.0.0:7001-5496_23_1227527').lower()
636c742d302e302e302e303a373030312d353439365f32335f31323237353237
```

3711 主库：
主库 binlog 已经记录 xa prepare 和 xa rollback，并且实例中没有悬挂事务

```
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
#180410 23:29:04 server id 1013711  end_log_pos 195894 CRC32 0x423b5a00      XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA ROLLBACK X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
```

3711 从库：
同 3711 主库，已经记录 xa prepare 和 xa rollback，并且实例中没有悬挂事务

```
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
#180410 23:29:04 server id 1013711  end_log_pos 9170603 CRC32 0x0263cccf      XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA ROLLBACK X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
```

3712 主库：
同 3711 主库，已经记录 xa prepare 和 xa rollback，并且实例中没有悬挂事务

```
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
#180410 23:29:04 server id 1013712  end_log_pos 229610 CRC32 0x8bd1f06d      XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA ROLLBACK X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
```

3712 从库：
同 3711 从库，已经记录 xa prepare 和 xa rollback，并且实例中没有悬挂事务

```
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
#180410 23:29:04 server id 1013712  end_log_pos 9184720 CRC32 0xb7fd4eb4      XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA ROLLBACK X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
```

### 3713 主库：

同 3711 主库，已经记录 xa prepare 和 xa rollback，并且实例中没有悬挂事务

```
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
#180410 23:29:04 server id 1013713  end_log_pos 9497483 CRC32 0xd10204e0      XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA ROLLBACK X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
```

### 3713 从库：

同 3711 从库，已经记录 xa prepare 和 xa rollback，并且实例中没有悬挂事务

```
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
#180410 23:29:04 server id 1013713  end_log_pos 9275612 CRC32 0xdd377bae      XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA ROLLBACK X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
```

### 3714 主库：

主库只记录了 xa prepare，没有 xa rollback，但是实例中没有悬挂事务

```
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
#180410 23:29:04 server id 1013714  end_log_pos 253269 CRC32 0xa1ca706c      XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
```

### 3714 从库：

从库同样只记录了 xa prepare，没有 xa rollback，但是实例中有悬挂事务

```
XA START X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA END X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
#180410 23:29:04 server id 1013714  end_log_pos 9182496 CRC32 0x2bd24386      XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
XA PREPARE X'636c742d302e302e302e303a373030312d353439365f32335f31323237353237',X'',1
```

结论：cetus 向写节点发送 xa prepare，mysql3714 接收到 xa prepare 命令，将 xa prepare 命令写入本实例 binlog，binlog 被拉到从库，主库执行 xa prepare 前被 kill -9 杀掉，主库重新启动不能正确识别 xa 事务的正确状态，导致主库没有悬挂事务，而从库有悬挂事务，这种情况需要把从库 xa 事务进行 rollback。