注意事项

- 本文档适用于MySQL 8.0版本的单主模式
- 节点数量建议奇数个（如3、5、7、9），且最大支持的节点数为9个

生命周期

参数相关

参数模版

```
#### Group Replication
plugin-load-add='group_replication.so'
transaction_write_set_extraction=XXHASH64
loose-group_replication_group_name='aaaaaaaa-aaaa-aaaa-aaaa-aaaaaaaaaaaa'
loose-group_replication_start_on_boot=off
loose-group_replication_enforce_update_everywhere_checks=off
loose-group_replication_ip_whitelist='0.0.0.0/0'
loose-group_replication_local_address='mgr1:33061'
loose-group_replication_group_seeds ='mgr1:33061,mgr2:33061,mgr3:33061'
loose-group_replication_bootstrap_group=off
loose-group_replication_single_primary_mode=on
loose-group_replication_clone_threshold=50000
loose-group_replication_gtid_assignment_block_size=1

#### Clone Plugin
plugin-load-add=mysql_clone.so
loose-clone_autotune_concurrency=ON
loose-clone_max_concurrency=16
loose-clone_max_data_bandwidth=100
loose-clone_max_network_bandwidth=100
loose-clone_ddl_timeout=300
```

- group_replication_group_seeds参数为种子节点的service地址
- group_replication_local_address为当前节点service地址
- group_replication_start_on_boot在有PRIMARY节点时，建议重新设置为ON
- group_replication_clone_threshold为超过指定事务延迟数量后触发Clone Plugin重搭备库
- group_replication_gtid_assignment_block_size为为每个成员保留的连续GTID的数量，默认值为1000000

相关参数

- group_replication_force_members参数：
  - 以逗号分割的地址列表，例如"host1:port1,host2:port2"。此系统变量用于强制创建新的组成员资格，其中被排除的成员（未写进该系统变量中的成员）在该变量设置成功之后就不会收到新视图消息且会被阻塞（阻塞写入操作）。然后你需要手动移除/关闭被排除在该系统变量的参数列表之外的成员。另外，如果列表中的存在任何无效主机名，则可能导致后续执行START GROUP_REPLICATION语句失败，因为这些无法通讯的Server无法响应组成员间的通讯请求
  - 在系统变量group_replication_force_members指定的每个Server上需要使用系统变量group_replication_local_address设置一个有效的IP地址（或主机名）与端口，如果是IPV6地址，则需要在方括号中指定，例如："198.51.100.44:33061,[2001:db8:85a3:8d3:1319:8a2e:370:7348]:33061,example.org:33061"
  - 组复制的组通信引擎（XCom）将检查所提供的IP地址是否为有效格式，并检查是否包含了当前无法访问的Server。如果存在这两种情况，则所设置的新配置将无法验证通过，这个时候，组可能会发生阻塞，因此，必须小心地设置该系统变量的值为组中当前可用的（**ONLINE**）Server地址和端口信息，否则报错`ERROR 1231 (42000): Variable 'group_replication_force_members' can't be set to the value of 'mgr1:33061,mgr3:33061'`。

- 在强制执行新的成员资格配置之前，必须确保要被排除在外的组成员的Server已经关闭，这一点很重要。如果没有关闭，请在设置该系统变量之前将其关闭。因为，如果被排除的组成员仍然在线，那么，当使用该系统变量强制设置新的组成员资格时，被排除的组成员可能会自动形成新的组成员资格，即，该强制成员资格的配置操作导致组发生了人为的脑裂
- 当使用系统变量group_replication_force_members成功强制创建新的组成员资格并解除了组的阻塞状态之后，需要先将系统变量group_replication_force_members的值清空之后，才能够使用START GROUP_REPLICATION语句启动组复制。要详细了解相关的步骤，请参见"4.4 网络划分”
- 全局变量，动态变量，字符串类型，MySQL 5.7.17版本引入

手工操作Clone Plugin

- 前提：必须保证Clone Plugin插件已加载成功
- 在备库上执行，配置donor实例的相关信息：

```
SET GLOBAL clone_valid_donor_list = '[主库ip]:[主库数据库端口]';
```

- 在备库使用具有CLONE_ADMIN权限或者管理权限账号用户，执行如下命令（donor实例账号可使用管理权限账号或者有BACKUP_ADMIN权限用户）：

```
CLONE INSTANCE FROM '[主库管理权限账号]'@'[主库ip]':[主库数据库端口] IDENTIFIED BY '[用户密码]' ;
```

集群创建

- 创建用户（可以加入到docker-entrypoint.sh）

```
mysql> SET SQL_LOG_BIN=0;
mysql> CREATE USER rpl_user@'%' IDENTIFIED WITH mysql_native_password BY 'password';
mysql> GRANT REPLICATION SLAVE ON *.* TO rpl_user@'%';
mysql> GRANT BACKUP_ADMIN ON *.* TO rpl_user@'%';
```

- 配置复制通道

```
mysql> CHANGE MASTER TO MASTER_USER='rpl_user', MASTER_PASSWORD='password' FOR CHANNEL 'group_replication_recovery';
```

- 启动集群

```
### 引导节点启动
mysql> SET GLOBAL group_replication_bootstrap_group=ON;
mysql> START GROUP_REPLICATION;
mysql> SET GLOBAL group_replication_bootstrap_group=OFF;

### 非引导节点启动（返回OK才能代表集群加入成功）
mysql> START GROUP_REPLICATION;
```

高可用

找出主节点

- 在单主模式的拓扑中找出当前的主节点，可以使用performance_schema.replication_group_members表中的MEMBER_ROLE列值来判断，MEMBER_ROLE列值为**PRIMARY**的组成员即为当前组中的主节点。replication_group_members表的内容查询示例如下：

```
mysql> SELECT MEMBER_HOST, MEMBER_ROLE FROM
performance_schema.replication_group_members;
+-------------+-------------+
| MEMBER_HOST | MEMBER_ROLE |
+-------------+-------------+
| mgr2        | PRIMARY     |
| mgr3        | SECONDARY   |
| mgr1        | SECONDARY   |
+-------------+-------------+
3 rows in set (0.00 sec)
```

检查节点运行状态

```
mysql> select member_state from performance_schema.replication_group_members
where member_id=@@server_uuid;
+--------------+
| member_state |
+--------------+
| ONLINE       |
+--------------+
1 row in set (0.00 sec)
```

组成员状态

- ONLINE：表示该成员已经准备好作为一个功能齐全的组成员（活跃成员），这意味着该成员可以正常接受客户端的访问（单主模式下，主要节点可接受读写访问，辅助节点只可接受只读访问；多主模式下，所有成员都是主要节点，都可以接受读写访问）。
- RECOVERING：表示该成员正在成为该组的活跃成员，目前正在恢复过程中，正在接受来自donor节点的状态转移数据。
- OFFLINE：表示该Server已加载了MGR插件，但此时Server不属于任何组。
- ERROR：表示该成员处于错误状态，不能作为任何组的成员正常工作。如果该Server曾经成功加入过组一次，后续发生任何故障，则会根据系统变量group_replication_exit_state_action设置的在退出操作（默认值为READ_ONLY）时执行不同的调整，使得成员在执行退出之后所处的状态可能不同。如果设置为READ_ONLY，则该成员退出时处于只读模式(super_read_only= on)，成员状态可能可能为OFFLINE；如果设置为OFFLINE_MODE，则该成员退出时处于脱机模式(offline_mode= on, super_read_only= on)，此时成员状态为ERROR，而不是OFFLINE状态。如果设置为ABORT_SERVER，则该成员在意外脱离组并耗尽了重新加入组的尝试次数之后，数据库的实例进程将被自动关闭，并从组的视图中删除该成员。
- UNREACHABLE：当本地故障检测器怀疑某个给定的成员不可访问时(例如，由于非自愿与组断开了连接时)，将显示该成员的状态为UNREACHABLE。

测试集群规模

- 三节点集群

```
mysql> SELECT * FROM performance_schema.replication_group_members;
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| CHANNEL_NAME              | MEMBER_ID                            | MEMBER_HOST
| MEMBER_PORT | MEMBER_STATE | MEMBER_ROLE | MEMBER_VERSION |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| group_replication_applier | 24970b5a-abb8-11ea-a2de-fa81a7d31000 | mgr3
|        3306 | ONLINE       | PRIMARY     | 8.0.21         |
| group_replication_applier | 81c0a576-e73e-11ea-b222-fab1adf37901 | mgr1
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
| group_replication_applier | d296c823-f181-11ea-9215-faf458539601 | mgr2
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
3 rows in set (0.00 sec)
```

- 五节点集群

```
mysql> SELECT * FROM performance_schema.replication_group_members;
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| CHANNEL_NAME              | MEMBER_ID                            | MEMBER_HOST
| MEMBER_PORT | MEMBER_STATE | MEMBER_ROLE | MEMBER_VERSION |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| group_replication_applier | 24970b5a-abb8-11ea-a2de-fa81a7d31000 | mgr3
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
| group_replication_applier | 5f39c910-f0ef-11ea-9d06-fade95161d00 | mgr5
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
| group_replication_applier | 81c0a576-e73e-11ea-b222-fab1adf37901 | mgr1
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
| group_replication_applier | d296c823-f181-11ea-9215-faf458539601 | mgr2
|        3306 | ONLINE       | PRIMARY     | 8.0.21         |
| group_replication_applier | ed2e272a-f0ec-11ea-bb1b-fa2eff81cc00 | mgr4
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
5 rows in set (0.00 sec)
```

主节点挂掉

新主选择策略

- 各成员在选举新主要节点时考虑的因素，按照顺序依次如下（候选者必须保证实例状态为ONLINE）：
  - 第一个要考虑的因素：哪些组成员运行的MySQL Server版本是最低的。
  - 第二个要考虑的因素：如果组中有多个成员运行在最低版本的MySQL Server上，则要考虑的第二个因素是每个成员的成员权重设置值，该值由每个成员上的系统变量group_replication_member_weight指定（有效值为0~100的数字，默认值为50）。

    - 第三个要考虑的因素：如果不止一个成员运行在低版本的MySQL Server上，且其中不止一个成员的权重值无效（不支持系统变量group_replication_member_weight），则就需要考虑第三个因素，即按照每个成员的UUID号进行排序（按照每个组成员的server_uuid系统变量值排序），选择具有最小UUID值的成员作为主要节点。

- group_replication_consistency一致性参数：
    - EVENTUAL：RO和RW事务在执行之前都不会等待前面的事务应用完成（即，事务直接执行，不等待积压事务应用完成）。这是group_replication_consistency变量的默认值（也是引入该系统变量之前组复制的默认行为）。RW事务不等待其他成员应用事务。意味着设置该值的成员中的事务可以先于其他成员外部化。还意味着，在发生主要节点故障转移时，新的主要节点不需要等待积压的事务（来自旧的主要节点的事务）立即接受新的RO和RW事务，这可能造成新的RO事务读取到陈旧的数据（因为之前旧主要节点中的最新数据还未同步到新的主要节点）、新的RW事务可能由于冲突导致回滚（冲突认证检测会发现新的RW事务可能与来自旧主要节点的积压RW事务发生冲突）。**测试下来是：在relay log没有应用完成时，新主只允许读，不允许写**

```
### 新主
mysql> select Count_transactions_remote_in_applier_queue from
performance_schema.replication_group_member_stats where
member_id=@@server_uuid;
+--------------------------------------------+
| Count_transactions_remote_in_applier_queue |
+--------------------------------------------+
|                                      13211 |
+--------------------------------------------+
1 row in set (0.12 sec)

mysql> select id from sbtest1 limit 1;
+--------+
| id     |
+--------+
| 211518 |
+--------+
1 row in set (0.02 sec)

mysql> create database test111;
ERROR 1290 (HY000): The MySQL server is running with the --super-read-only
option so it cannot execute this statement

### error log
2020-09-16T15:35:46.233740+08:00 0 [System] [MY-011507] [Repl] Plugin
group_replication reported: 'A new primary with address mgr2:3306 was
elected. The new primary will execute all previous group transactions before
allowing writes.'
2020-09-16T15:35:46.234025+08:00 0 [System] [MY-011503] [Repl] Plugin
group_replication reported: 'Group membership changed to mgr1:3306,
mgr2:3306 on view 16002368682085552:24.'

2020-09-16T15:36:20.216065+08:00 636 [System] [MY-011566] [Repl] Plugin
group_replication reported: 'Setting super_read_only=OFF.'
2020-09-16T15:36:20.218126+08:00 636 [System] [MY-011510] [Repl] Plugin
group_replication reported: 'This server is working as primary member.'
2020-09-16T15:36:20.246364+08:00 12 [Note] [MY-011485] [Repl] Plugin
group_replication reported: 'Primary had applied all relay logs, disabled
conflict detection.'
```

- BEFORE_ON_PRIMARY_FAILOVER：新RO或RW事务在新当选的主要节点应用完成来自旧的主要节点的积压事务之前，会被保持（不应用，类似于处在等待状态，积压事务被应用完成之后，才会处理新的RO和RW事务）。这确保当主要节点故障转移发生时，客户端总是能查询到发生故障的主要节点上的最新值，从而保证了一致性。但这意味着新的主要节点在应用积压事务过程中的延迟（这里指的是客户端访问新主要节点的响应延迟）客户端需要自行处理。通常这种延迟很小，但是实际延迟时间的长短取决于积压事务的大小。

```
### 新主
mysql> select Count_transactions_remote_in_applier_queue from
performance_schema.replication_group_member_stats where
member_id=@@server_uuid;
+-------------------------------------------+
| Count_transactions_remote_in_applier_queue |
+-------------------------------------------+
|                                     56155 |
+-------------------------------------------+
1 row in set (0.00 sec)

mysql> select id from sbtest1 limit 1; //hang

mysql> create database test111; //hang

mysql> show processlist;
+------+-------------+-----------+------+---------+------+------------------
---------------------------------+------------------------------------------
+
| Id   | User        | Host      | db   | Command | Time | State
                                | Info                                      |
+------+-------------+-----------+------+---------+------+------------------
---------------------------------+------------------------------------------
+
...
| 1068 | root        | localhost | NULL | Query   |  105 | Executing hook on
transaction begin.              | create database test111                   |
                       |
| 1073 | root        | localhost | test | Query   |   72 | Executing hook on
transaction begin.              | select id from sbtest1 limit 1            |
| 1074 | root        | localhost | NULL | Query   |    0 | starting
                                | show processlist
|
+------+-------------+-----------+------+---------+------+------------------
---------------------------------+------------------------------------------
+-----------+---------------+
22 rows in set (0.11 sec)

### error log
2020-09-16T17:10:53.642207+08:00 0 [System] [MY-011507] [Repl] Plugin
group_replication reported: 'A new primary with address mgr2:3306 was
elected. The new primary will execute all previous group transactions before
allowing writes.'
2020-09-16T17:10:53.663487+08:00 0 [System] [MY-011503] [Repl] Plugin
group_replication reported: 'Group membership changed to mgr1:3306,
mgr2:3306 on view 16002368682085552:36.'

2020-09-16T17:13:27.424277+08:00 1071 [System] [MY-011566] [Repl] Plugin
group_replication reported: 'Setting super_read_only=OFF.'
```

```
2020-09-16T17:13:27.431966+08:00 12 [Note] [MY-011485] [Repl] Plugin
group_replication reported: 'Primary had applied all relay logs, disabled
conflict detection.'
2020-09-16T17:13:27.432016+08:00 1071 [System] [MY-011510] [Repl] Plugin
group_replication reported: 'This server is working as primary member.'
```

    - BEFORE：RW事务在应用（applied）之前会等待所有前面的事务（积压事务）完成，RO事务在执行（executed）之前会等待所有前面的事务（积压事务）完成。这样使得事务仅通过牺牲响应延迟就可以确保读取到最新的值。实际上，只是确保了RO事务上的同步，对于RW事务来说，只是等待了它之前积压的事务完成，并不会等待它在所有的其他组成员上完成应用（不过，由于RO事务要求同步，RO事务能够将一部分甚至大部分数据进行同步，所以能够一定程度上减少RW事务上的同步开销，也就是说，该一致性级别适合于写多读少的场景）。
    - AFTER：RW事务会等待它的更改被应用到所有其他成员。此一致性级别对RO事务没有影响（因为RO事务不会产生数据变更）。它只确保在本地成员上提交RW事务时，该RW事务的数据变更会在组中其他所有成员中应用，以便所有后续的事务在任何成员上都能够获取到最新的数据（通过确保只在RW事务上使用同步，RW事务会将所有写入的新数据都实时同步到组中其他的所有成员中，这就减少了RO事务上的同步开销。也就是说，该一致性级别比较适合读多写少的场景）。
    - BEFORE_AND_AFTER：一致性级别要求最高，RW和RO事务执行时都要求数据同步，RW事务在执行时需要等待之前的积压事务应用完成，且需要等待自己的数据变更在其他所有组成员上都应用。RO事务在执行时需要等待之前的积压事务应用完成。该一致性级别适合对数据的读写一致性都要求高的场景。
- 如何选择一致性级别：
    - 场景1：读多写少，且在不允许读取到陈旧的数据的情况下，还要求配置读负载均衡。在这种情况下，应该选择一致性级别为 AFTER。
    - 场景2：写多读少，且不允许读取到陈旧的数据。在这种情况下，你应该选择一致性级别为 BEFORE。
    - 场景3：工作负载中的特定事务（如：更新敏感数据）需要读取组的最新数据。在这种情况下，应该选择一致性级别为 BEFORE。
    - 场景4：读多写少，且希望RW事务一旦提交就会被同步到组中的其他任何成员，以便后续的RO事务都能够读取到最新数据，不会导致RO事务读取最新数据时产生同步开销。在这种情况下，应该选择一致性级别为 AFTER。
    - 场景5：读多写少，且希望RW事务一旦提交就会被同步到组中的其他任何成员，且希望后续的RW和RO事务总是能够读取到最新的数据，也不希望后续RO事务读取最新数据时产生同步开销。这种情况下，应该选择一致性级别为 BEFORE_AND_AFTER。

旧主加入集群

- 启动mysqld后，重新加入集群

```
mysql> START GROUP_REPLICATION;
```

特殊情况

```
### 两个从节点处于非ONLINE状态
mysql> SELECT * FROM performance_schema.replication_group_members;
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| CHANNEL_NAME              | MEMBER_ID                            | MEMBER_HOST
| MEMBER_PORT | MEMBER_STATE | MEMBER_ROLE | MEMBER_VERSION |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
```

```
| group_replication_applier | 24970b5a-abb8-11ea-a2de-fa81a7d31000 | mgr3
|        3306 | ONLINE       | PRIMARY     | 8.0.21         |
| group_replication_applier | 81c0a576-e73e-11ea-b222-fab1adf37901 | mgr1
|        3306 | RECOVERING   | SECONDARY   | 8.0.21         |
| group_replication_applier | d296c823-f181-11ea-9215-faf458539601 | mgr2
|        3306 | RECOVERING   | SECONDARY   | 8.0.21         |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
3 rows in set (0.05 sec)

### 把PRIMARY节点正常down掉（shutdown方式）
mysql> SELECT * FROM performance_schema.replication_group_members;
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| CHANNEL_NAME              | MEMBER_ID                            | MEMBER_HOST
| MEMBER_PORT | MEMBER_STATE | MEMBER_ROLE | MEMBER_VERSION |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| group_replication_applier | 81c0a576-e73e-11ea-b222-fab1adf37901 | mgr1
|        3306 | RECOVERING   | SECONDARY   | 8.0.21         |
| group_replication_applier | d296c823-f181-11ea-9215-faf458539601 | mgr2
|        3306 | RECOVERING   | SECONDARY   | 8.0.21         |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
2 rows in set (0.00 sec)
```

- 此时无法选出新主，而且旧主重新启动后无法加入集群

```
### slave节点选主失败
...
2020-09-08T16:01:22.005895+08:00 24 [Note] [MY-011578] [Repl] Plugin
group_replication reported: 'No valid donors exist in the group, retrying'
2020-09-08T16:01:22.006001+08:00 24 [Note] [MY-011577] [Repl] Plugin
group_replication reported: 'Retrying group recovery connection with another
donor. Attempt 8/10'
...

### 旧主加入集群报错（GTID不匹配）
...
2020-09-08T16:00:04.225073+08:00 0 [ERROR] [MY-011526] [Repl] Plugin
group_replication reported: 'This member has more executed transactions than
those present in the group. Local transactions: aaaaaaaa-aaaa-aaaa-aaaa-
aaaaaaaaaaaa:1-3935842 > Group transactions: aaaaaaaa-aaaa-aaaa-aaaa-
aaaaaaaaaaaa:1-3901055'
2020-09-08T16:00:04.225143+08:00 0 [ERROR] [MY-011522] [Repl] Plugin
group_replication reported: 'The member contains transactions not present in the
group. The member will now exit the group.'
2020-09-08T16:00:04.225242+08:00 0 [System] [MY-011503] [Repl] Plugin
group_replication reported: 'Group membership changed to mgr3:3306, mgr1:3306,
mgr2:3306 on view 15994906509078252:55.'
...
```

- 解决方式如下（由于没有状态为ONLINE的节点，所以需要重新引导集群）：

```
### 选择GTID最大的实例（旧主）重新拉起集群
mysql> set global group_replication_bootstrap_group=ON;
```

```
Query OK, 0 rows affected (0.00 sec)

mysql> start group_replication;
Query OK, 0 rows affected (2.27 sec)

mysql> set global group_replication_bootstrap_group=OFF;
Query OK, 0 rows affected (0.00 sec)

### slave重新加入集群
mysql> stop group_replication;
Query OK, 0 rows affected (1.01 sec)

mysql> start group_replication;
Query OK, 0 rows affected (3.20 sec)
```

3节点中从节点少数挂掉

- 正常关闭（shutdown方式）和异常关闭（kill -9方式），主库均是可正常提供服务；对业务短暂影响：

```
...
[ 4228s ] thds: 64 tps: 89.99 qps: 1896.88 (r/w/o: 1300.92/415.97/179.99) lat
(ms,95%): 977.74 err/s: 0.00 reconn/s: 0.00
[ 4229s ] thds: 64 tps: 9.00 qps: 525.13 (r/w/o: 320.08/187.05/18.00) lat
(ms,95%): 1258.08 err/s: 0.00 reconn/s: 0.00
[ 4230s ] thds: 64 tps: 1.00 qps: 7.00 (r/w/o: 5.00/0.00/2.00) lat (ms,95%):
2585.31 err/s: 0.00 reconn/s: 0.00
[ 4231s ] thds: 64 tps: 180.02 qps: 3088.39 (r/w/o: 2211.28/517.07/360.05) lat
(ms,95%): 2632.28 err/s: 0.00 reconn/s: 0.00
...
```

- 从节点加入集群；启动mysqld后，重新加入集群

```
mysql> start group_replication;
Query OK, 0 rows affected (3.20 sec)
```

3节点中从节点多数挂掉

情况1：实例异常关闭（主库不可读写）

- 3节点挂掉2从节点（kill -9方式）

```
mysql> SELECT * FROM performance_schema.replication_group_members;
+---------------------------+--------------------------------------+-------------
+-------------+-------------+-------------+---------------+
| CHANNEL_NAME              | MEMBER_ID                            | MEMBER_HOST
| MEMBER_PORT | MEMBER_STATE | MEMBER_ROLE | MEMBER_VERSION |
+---------------------------+--------------------------------------+-------------
+-------------+-------------+-------------+---------------+
| group_replication_applier | 24970b5a-abb8-11ea-a2de-fa81a7d31000 | mgr3
|        3306 | UNREACHABLE  | SECONDARY   | 8.0.21        |
| group_replication_applier | 81c0a576-e73e-11ea-b222-fab1adf37901 | mgr1
|        3306 | UNREACHABLE  | SECONDARY   | 8.0.21        |
| group_replication_applier | d296c823-f181-11ea-9215-faf458539601 | mgr2
|        3306 | ONLINE       | PRIMARY     | 8.0.21        |
+---------------------------+--------------------------------------+-------------
+-------------+-------------+-------------+---------------+
3 rows in set (0.00 sec)
```

- 查看error log，发现主库是不可访问（block）

```
2020-09-10T14:30:29.699617+08:00 0 [Warning] [MY-011493] [Repl] Plugin
group_replication reported: 'Member with address mgr3:3306 has become
unreachable.'
2020-09-10T14:30:30.699095+08:00 0 [Warning] [MY-011493] [Repl] Plugin
group_replication reported: 'Member with address mgr1:3306 has become
unreachable.'
2020-09-10T14:30:30.699161+08:00 0 [ERROR] [MY-011495] [Repl] Plugin
group_replication reported: 'This server is not able to reach a majority of
members in the group. This server will now block all updates. The server will
remain blocked until contact with the majority is restored. It is possible to use
group_replication_force_members to force a new group membership.'
```

- 所有从节点重新加入集群；此时集群异常，服务不可用。解决方式如下：

```
### 强制把PRIMARY节点创建新的组成员资格（排除不可用成员）
mysql> set global group_replication_force_members='mgr2:33061';
Query OK, 0 rows affected (7.65 sec)

mysql> set global group_replication_force_members='';
Query OK, 0 rows affected (0.65 sec)

### 其他节点
mysql> start group_replication;
Query OK, 0 rows affected (7.68 sec)
```

情况2：实例正常关闭（主库可读写）

- 3节点挂掉2从节点（shutdown方式）

```
mysql> SELECT * FROM performance_schema.replication_group_members;
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| CHANNEL_NAME              | MEMBER_ID                            | MEMBER_HOST
| MEMBER_PORT | MEMBER_STATE | MEMBER_ROLE | MEMBER_VERSION |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| group_replication_applier | 24970b5a-abb8-11ea-a2de-fa81a7d31000 | mgr3
|        3306 | ONLINE       | PRIMARY     | 8.0.21         |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
1 row in set (0.00 sec)
```

- 所有从节点重新加入集群

```
mysql> start group_replication;
Query OK, 0 rows affected (3.20 sec)
```

3节点中主节点+从节点过半挂掉

情况1：实例异常关闭（不会选出新主，存活的slave节点不可读写）

- 3节点挂掉1主+1从（kill -9方式）

```
mysql> SELECT * FROM performance_schema.replication_group_members;
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| CHANNEL_NAME              | MEMBER_ID                            | MEMBER_HOST
| MEMBER_PORT | MEMBER_STATE | MEMBER_ROLE | MEMBER_VERSION |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| group_replication_applier | 24970b5a-abb8-11ea-a2de-fa81a7d31000 | mgr3
|        3306 | UNREACHABLE  | SECONDARY   | 8.0.21         |
| group_replication_applier | 81c0a576-e73e-11ea-b222-fab1adf37901 | mgr1
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
| group_replication_applier | d296c823-f181-11ea-9215-faf458539601 | mgr2
|        3306 | UNREACHABLE  | PRIMARY     | 8.0.21         |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
3 rows in set (0.00 sec)
```

- 存活的slave的error log，发现无法提供服务（block）

```
...
2020-09-10T14:48:16.376698+08:00 0 [Warning] [MY-011493] [Repl] Plugin
group_replication reported: 'Member with address mgr2:3306 has become
unreachable.'
2020-09-10T14:48:17.376047+08:00 0 [Warning] [MY-011493] [Repl] Plugin
group_replication reported: 'Member with address mgr3:3306 has become
unreachable.'
2020-09-10T14:48:17.376094+08:00 0 [ERROR] [MY-011495] [Repl] Plugin
group_replication reported: 'This server is not able to reach a majority of
members in the group. This server will now block all updates. The server will
remain blocked until contact with the majority is restored. It is possible to use
group_replication_force_members to force a new group membership.'
```

- 此时集群异常，服务不可用。解决方式如下：
  - 如果存在ONLINE节点

```
### 强制把ONLINE节点创建新的组成员资格（排除不可用成员）
mysql> set global group_replication_force_members='mgr1:33061';
Query OK, 0 rows affected (7.65 sec)

mysql> set global group_replication_force_members='';
Query OK, 0 rows affected (0.65 sec)

### 其他节点加入集群
mysql> start group_replication;
Query OK, 0 rows affected (7.68 sec)
```

```
* 如果没有状态为ONLINE的节点，需要重新引导集群

```mysql
### 选择GTID最大的实例（旧主）重新拉起集群
mysql> set global group_replication_bootstrap_group=ON;
Query OK, 0 rows affected (0.00 sec)

mysql> start group_replication;
Query OK, 0 rows affected (2.27 sec)

mysql> set global group_replication_bootstrap_group=OFF;
Query OK, 0 rows affected (0.00 sec)

### slave重新加入集群
mysql> stop group_replication;
Query OK, 0 rows affected (1.01 sec)

mysql> start group_replication;
Query OK, 0 rows affected (3.20 sec)
```
```

情况2：实例正常关闭（会选出新主，新主可读写）

- 正常（shutdown方式）down掉master和其中一个slave，此时会正常选新主

```
mysql> SELECT * FROM performance_schema.replication_group_members;
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| CHANNEL_NAME              | MEMBER_ID                            | MEMBER_HOST
| MEMBER_PORT | MEMBER_STATE | MEMBER_ROLE | MEMBER_VERSION |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| group_replication_applier | 81c0a576-e73e-11ea-b222-fab1adf37901 | mgr1
|        3306 | ONLINE       | PRIMARY     | 8.0.21         |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
1 row in set (0.00 sec)
```

- 查看error log，发现新主可对外提供服务

```
...
2020-09-10T14:54:53.246877+08:00 0 [Warning] [MY-011499] [Repl] Plugin
group_replication reported: 'Members removed from the group: mgr3:3306'
2020-09-10T14:54:53.246895+08:00 0 [System] [MY-011500] [Repl] Plugin
group_replication reported: 'Primary server with address mgr3:3306 left the
group. Electing new Primary.'
2020-09-10T14:54:53.247677+08:00 0 [Note] [MY-013519] [Repl] Plugin
group_replication reported: 'Elected primary member gtid_executed: aaaaaaaa-
aaaa-aaaa-aaaa-aaaaaaaaaaaa:1-97450'
2020-09-10T14:54:53.247727+08:00 0 [Note] [MY-013519] [Repl] Plugin
group_replication reported: 'Elected primary member applier channel
received_transaction_set: aaaaaaaa-aaaa-aaaa-aaaa-aaaaaaaaaaaa:1-97450'
2020-09-10T14:54:54.247903+08:00 0 [System] [MY-011507] [Repl] Plugin
group_replication reported: 'A new primary with address mgr2:3306 was elected.
The new primary will execute all previous group transactions before allowing
writes.'
2020-09-10T14:54:54.248454+08:00 0 [System] [MY-011503] [Repl] Plugin
group_replication reported: 'Group membership changed to mgr2:3306 on view
15997208178291927:5.'
2020-09-10T14:54:54.249112+08:00 58 [System] [MY-011566] [Repl] Plugin
group_replication reported: 'Setting super_read_only=OFF.'
2020-09-10T14:54:54.249503+08:00 58 [System] [MY-011510] [Repl] Plugin
group_replication reported: 'This server is working as primary member.'
2020-09-10T14:54:54.249553+08:00 9 [Note] [MY-011485] [Repl] Plugin
group_replication reported: 'Primary had applied all relay logs, disabled
conflict detection.'
```

- 其余节点重新加入集群

```
mysql> start group_replication;
Query OK, 0 rows affected (3.20 sec)
```

5节点中从节点少数挂掉

- 正常关闭（shutdown方式）和异常关闭（kill -9方式），主库均是可正常提供服务；对业务短暂影响：

```
...
[ 31s ] thds: 64 tps: 194.01 qps: 4176.17 (r/w/o: 2913.12/875.04/388.02) lat
(ms,95%): 475.79 err/s: 0.00 reconn/s: 0.00
[ 32s ] thds: 64 tps: 289.97 qps: 5462.42 (r/w/o: 3807.59/1074.89/579.94) lat
(ms,95%): 434.83 err/s: 0.00 reconn/s: 0.00
[ 33s ] thds: 64 tps: 67.00 qps: 1811.02 (r/w/o: 1258.01/419.00/134.00) lat
(ms,95%): 694.45 err/s: 0.00 reconn/s: 0.00
[ 34s ] thds: 64 tps: 55.98 qps: 1119.68 (r/w/o: 783.78/223.94/111.97) lat
(ms,95%): 1032.01 err/s: 0.00 reconn/s: 0.00
...
[ 54s ] thds: 64 tps: 58.00 qps: 1159.93 (r/w/o: 811.95/231.99/115.99) lat
(ms,95%): 1376.60 err/s: 0.00 reconn/s: 0.00
[ 55s ] thds: 64 tps: 74.02 qps: 1480.40 (r/w/o: 1036.28/296.08/148.04) lat
(ms,95%): 1401.61 err/s: 0.00 reconn/s: 0.00
[ 56s ] thds: 64 tps: 63.99 qps: 537.94 (r/w/o: 409.95/0.00/127.99) lat
(ms,95%): 1376.60 err/s: 0.00 reconn/s: 0.00
[ 57s ] thds: 64 tps: 508.98 qps: 10408.52 (r/w/o: 7303.66/2086.90/1017.95) lat
(ms,95%): 158.63 err/s: 0.00 reconn/s: 0.00
[ 58s ] thds: 64 tps: 306.99 qps: 6479.89 (r/w/o: 4507.92/1357.98/613.99) lat
(ms,95%): 331.91 err/s: 0.00 reconn/s: 0.00
[ 59s ] thds: 64 tps: 344.96 qps: 6754.29 (r/w/o: 4685.50/1378.85/689.93) lat
(ms,95%): 262.64 err/s: 0.00 reconn/s: 0.00
...
```

- 查看error log，发现把down掉的节点自动踢出集群

```
2020-09-11T09:42:10.252098+08:00 0 [Warning] [MY-011493] [Repl] Plugin
group_replication reported: 'Member with address mgr3:3306 has become
unreachable.'
2020-09-11T09:42:11.247812+08:00 0 [Warning] [MY-011493] [Repl] Plugin
group_replication reported: 'Member with address mgr1:3306 has become
unreachable.'
2020-09-11T09:42:28.364829+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 0 host mgr2'
2020-09-11T09:42:28.416326+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 1 host mgr4'
2020-09-11T09:42:28.416357+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 2 host mgr5'
2020-09-11T09:42:28.416381+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] pid 4095 Installed site start={4317e324
229288 0} boot_key={4317e324 229277 0} event_horizon=10 node 0
chksum_node_list(&site->nodes) 1576502695'
2020-09-11T09:42:29.978238+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Group is able to support up to communication
protocol version 8.0.16'
2020-09-11T09:42:29.978973+08:00 0 [Warning] [MY-011499] [Repl] Plugin
group_replication reported: 'Members removed from the group: mgr3:3306,
mgr1:3306'
2020-09-11T09:42:29.991819+08:00 0 [System] [MY-011503] [Repl] Plugin
group_replication reported: 'Group membership changed to mgr5:3306, mgr2:3306,
mgr4:3306 on view 15997208178291927:27.'
```

- 启动mysqld后，从节点重新加入集群

```
mysql> start group_replication;
Query OK, 0 rows affected (3.20 sec)
```

5节点中从节点多数挂掉

情况1：实例异常关闭（主库不可读写）

- 5节点挂掉3从节点（kill -9方式）

```
mysql> select * from performance_schema.replication_group_members;
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| CHANNEL_NAME              | MEMBER_ID                            | MEMBER_HOST
| MEMBER_PORT | MEMBER_STATE | MEMBER_ROLE | MEMBER_VERSION |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| group_replication_applier | 24970b5a-abb8-11ea-a2de-fa81a7d31000 | mgr3
|        3306 | UNREACHABLE  | SECONDARY   | 8.0.21         |
| group_replication_applier | 5f39c910-f0ef-11ea-9d06-fade95161d00 | mgr5
|        3306 | UNREACHABLE  | SECONDARY   | 8.0.21         |
| group_replication_applier | 81c0a576-e73e-11ea-b222-fab1adf37901 | mgr1
|        3306 | UNREACHABLE  | SECONDARY   | 8.0.21         |
| group_replication_applier | d296c823-f181-11ea-9215-faf458539601 | mgr2
|        3306 | ONLINE       | PRIMARY     | 8.0.21         |
| group_replication_applier | ed2e272a-f0ec-11ea-bb1b-fa2eff81cc00 | mgr4
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
5 rows in set (0.00 sec)
```

- 查看error log，发现主库是不可访问（block）

```
2020-09-11T09:47:09.423934+08:00 0 [Warning] [MY-011493] [Repl] Plugin
group_replication reported: 'Member with address mgr5:3306 has become
unreachable.'
2020-09-11T09:47:09.424063+08:00 0 [Warning] [MY-011493] [Repl] Plugin
group_replication reported: 'Member with address mgr3:3306 has become
unreachable.'
2020-09-11T09:47:10.422034+08:00 0 [Warning] [MY-011493] [Repl] Plugin
group_replication reported: 'Member with address mgr1:3306 has become
unreachable.'
2020-09-11T09:47:10.422083+08:00 0 [ERROR] [MY-011495] [Repl] Plugin
group_replication reported: 'This server is not able to reach a majority of
members in the group. This server will now block all updates. The server will
remain blocked until contact with the majority is restored. It is possible to use
group_replication_force_members to force a new group membership.'
```

- 此时集群异常，服务不可用。解决方式如下：
  - 如果存在ONLINE节点

```
### 强制把ONLINE节点创建新的组成员资格（排除不可用成员）
mysql> set global group_replication_force_members='mgr2:33061,mgr4:33061';
Query OK, 0 rows affected (7.65 sec)

mysql> set global group_replication_force_members='';
Query OK, 0 rows affected (0.65 sec)

### 其他节点加入集群
mysql> start group_replication;
Query OK, 0 rows affected (7.68 sec)
```

```
* 如果没有状态为ONLINE的节点，需要重新引导集群

```mysql
### 选择GTID最大的实例（旧主）重新拉起集群
mysql> set global group_replication_bootstrap_group=ON;
Query OK, 0 rows affected (0.00 sec)

mysql> start group_replication;
Query OK, 0 rows affected (2.27 sec)

mysql> set global group_replication_bootstrap_group=OFF;
Query OK, 0 rows affected (0.00 sec)

### slave重新加入集群
mysql> stop group_replication;
Query OK, 0 rows affected (1.01 sec)

mysql> start group_replication;
Query OK, 0 rows affected (3.20 sec)
```

情况2：实例正常关闭（主库可读写）

- 5节点挂掉3从节点（shutdown方式）

```
mysql> select * from performance_schema.replication_group_members;
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| CHANNEL_NAME              | MEMBER_ID                            | MEMBER_HOST
| MEMBER_PORT | MEMBER_STATE | MEMBER_ROLE | MEMBER_VERSION |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| group_replication_applier | d296c823-f181-11ea-9215-faf458539601 | mgr2
|        3306 | ONLINE       | PRIMARY     | 8.0.21         |
| group_replication_applier | ed2e272a-f0ec-11ea-bb1b-fa2eff81cc00 | mgr4
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
2 rows in set (0.00 sec)
```

- 查看error log，是正常退出
```

```
2020-09-11T10:16:36.441014+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 0 host mgr2'
2020-09-11T10:16:36.441096+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 1 host mgr3'
2020-09-11T10:16:36.441224+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 2 host mgr1'
2020-09-11T10:16:36.441289+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 3 host mgr4'
2020-09-11T10:16:36.441331+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] pid 4095 Installed site start={4317e324 938
3} boot_key={4317e324 927 3} event_horizon=10 node 0 chksum_node_list(&site-
>nodes) 3501394841'
2020-09-11T10:16:37.450066+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Group is able to support up to communication
protocol version 8.0.16'
2020-09-11T10:16:37.450214+08:00 0 [Warning] [MY-011499] [Repl] Plugin
group_replication reported: 'Members removed from the group: mgr5:3306'
2020-09-11T10:16:37.450442+08:00 0 [System] [MY-011503] [Repl] Plugin
group_replication reported: 'Group membership changed to mgr3:3306, mgr1:3306,
mgr2:3306, mgr4:3306 on view 15997902952405166:7.'
2020-09-11T10:16:39.448533+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Failure reading from fd=44 n=0'

2020-09-11T10:16:46.024182+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 0 host mgr2'
2020-09-11T10:16:46.024261+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 1 host mgr1'
2020-09-11T10:16:46.024280+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 2 host mgr4'
2020-09-11T10:16:46.024326+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] pid 4095 Installed site start={4317e324 980
1} boot_key={4317e324 969 1} event_horizon=10 node 0 chksum_node_list(&site-
>nodes) 3096956483'
2020-09-11T10:16:47.034267+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Group is able to support up to communication
protocol version 8.0.16'
2020-09-11T10:16:47.034455+08:00 0 [Warning] [MY-011499] [Repl] Plugin
group_replication reported: 'Members removed from the group: mgr3:3306'
2020-09-11T10:16:47.034629+08:00 0 [System] [MY-011503] [Repl] Plugin
group_replication reported: 'Group membership changed to mgr1:3306, mgr2:3306,
mgr4:3306 on view 15997902952405166:8.'
2020-09-11T10:16:49.028454+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Failure reading from fd=38 n=0'

2020-09-11T10:17:01.957816+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 0 host mgr2'
2020-09-11T10:17:02.080559+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 1 host mgr4'
2020-09-11T10:17:02.080643+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] pid 4095 Installed site start={4317e324 1502
1} boot_key={4317e324 1491 1} event_horizon=10 node 0 chksum_node_list(&site-
>nodes) 340536863'
2020-09-11T10:17:03.248207+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Group is able to support up to communication
protocol version 8.0.16'
2020-09-11T10:17:03.248376+08:00 0 [Warning] [MY-011499] [Repl] Plugin
group_replication reported: 'Members removed from the group: mgr1:3306'
```

```
2020-09-11T10:17:03.267198+08:00 0 [System] [MY-011503] [Repl] Plugin
group_replication reported: 'Group membership changed to mgr2:3306, mgr4:3306 on
view 15997902952405166:9.'
2020-09-11T10:17:05.083430+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Failure reading from fd=40 n=0'
```

- 所有从节点重新加入集群

```
mysql> start group_replication;
Query OK, 0 rows affected (3.20 sec)
```

5节点中主节点+从节点过半挂掉

情况1：实例异常关闭（不会选出新主，存活的slave节点不可读写）

- 5节点挂掉1主+2从（kill -9方式）

```
mysql> SELECT * FROM performance_schema.replication_group_members;
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| CHANNEL_NAME              | MEMBER_ID                            | MEMBER_HOST
| MEMBER_PORT | MEMBER_STATE | MEMBER_ROLE | MEMBER_VERSION |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| group_replication_applier | 24970b5a-abb8-11ea-a2de-fa81a7d31000 | mgr3
|        3306 | UNREACHABLE  | SECONDARY   | 8.0.21         |
| group_replication_applier | 5f39c910-f0ef-11ea-9d06-fade95161d00 | mgr5
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
| group_replication_applier | 81c0a576-e73e-11ea-b222-fab1adf37901 | mgr1
|        3306 | UNREACHABLE  | SECONDARY   | 8.0.21         |
| group_replication_applier | d296c823-f181-11ea-9215-faf458539601 | mgr2
|        3306 | UNREACHABLE  | PRIMARY     | 8.0.21         |
| group_replication_applier | ed2e272a-f0ec-11ea-bb1b-fa2eff81cc00 | mgr4
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
5 rows in set (0.00 sec)
```

- 存活的slave的error log，发现无法提供服务（block）

```
...
2020-09-11T10:22:35.802230+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Failure reading from fd=97
n=18446744073709551615'
2020-09-11T10:22:37.280950+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Failure reading from fd=92
n=18446744073709551615'
2020-09-11T10:22:39.631006+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Failure reading from fd=96
n=18446744073709551615'
2020-09-11T10:22:41.391466+08:00 0 [Warning] [MY-011493] [Repl] Plugin
group_replication reported: 'Member with address mgr1:3306 has become
unreachable.'
2020-09-11T10:22:42.391497+08:00 0 [Warning] [MY-011493] [Repl] Plugin
group_replication reported: 'Member with address mgr3:3306 has become
unreachable.'
2020-09-11T10:22:45.389921+08:00 0 [Warning] [MY-011493] [Repl] Plugin
group_replication reported: 'Member with address mgr2:3306 has become
unreachable.'
2020-09-11T10:22:45.390091+08:00 0 [ERROR] [MY-011495] [Repl] Plugin
group_replication reported: 'This server is not able to reach a majority of
members in the group. This server will now block all updates. The server will
remain blocked until contact with the majority is restored. It is possible to use
group_replication_force_members to force a new group membership.'
```

- 此时集群异常，服务不可用。解决方式如下：
  - 如果存在ONLINE节点

```
### 强制把ONLINE节点的实例创建新的组成员资格（排除不可用成员）
mysql> set global group_replication_force_members='mgr5:33061,mgr4:33061';
Query OK, 0 rows affected (7.65 sec)

mysql> set global group_replication_force_members='';
Query OK, 0 rows affected (0.65 sec)

### 其他节点加入集群
mysql> start group_replication;
Query OK, 0 rows affected (7.68 sec)
```

```
* 如果没有状态为ONLINE的节点，需要重新引导集群

```mysql
### 选择GTID最大的实例（旧主）重新拉起集群
mysql> set global group_replication_bootstrap_group=ON;
Query OK, 0 rows affected (0.00 sec)

mysql> start group_replication;
Query OK, 0 rows affected (2.27 sec)

mysql> set global group_replication_bootstrap_group=OFF;
Query OK, 0 rows affected (0.00 sec)

### slave重新加入集群
mysql> stop group_replication;
```
```

```
Query OK, 0 rows affected (1.01 sec)

mysql> start group_replication;
Query OK, 0 rows affected (3.20 sec)
```

情况2：实例正常关闭（会选出新主，新主可读写）

- 正常（shutdown方式）down掉master和其中2个slave，此时会正常选新主

```
mysql> SELECT * FROM performance_schema.replication_group_members;
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| CHANNEL_NAME              | MEMBER_ID                            | MEMBER_HOST
| MEMBER_PORT | MEMBER_STATE | MEMBER_ROLE | MEMBER_VERSION |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| group_replication_applier | 5f39c910-f0ef-11ea-9d06-fade95161d00 | mgr5
|        3306 | ONLINE       | PRIMARY     | 8.0.21         |
| group_replication_applier | ed2e272a-f0ec-11ea-bb1b-fa2eff81cc00 | mgr4
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
2 rows in set (0.00 sec)
```

- 查看error log，发现新主可对外提供服务

```
...
2020-09-11T10:27:58.302953+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 0 host mgr2'
2020-09-11T10:27:58.303077+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 1 host mgr3'
2020-09-11T10:27:58.303100+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 2 host mgr4'
2020-09-11T10:27:58.303116+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 3 host mgr5'
2020-09-11T10:27:58.303148+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] pid 31898 Installed site start={4317e324
32757 2} boot_key={4317e324 32746 2} event_horizon=10 node 3
chksum_node_list(&site->nodes) 2224465125'
2020-09-11T10:27:59.449692+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 0 host mgr2'
2020-09-11T10:27:59.449820+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 1 host mgr4'
2020-09-11T10:27:59.449860+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 2 host mgr5'
2020-09-11T10:27:59.449881+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] pid 31898 Installed site start={4317e324
32830 1} boot_key={4317e324 32819 1} event_horizon=10 node 2
chksum_node_list(&site->nodes) 1576502695'
2020-09-11T10:28:00.575229+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Group is able to support up to communication
protocol version 8.0.16'
2020-09-11T10:28:00.575329+08:00 0 [Warning] [MY-011499] [Repl] Plugin
group_replication reported: 'Members removed from the group: mgr1:3306,
mgr3:3306'
```

```
2020-09-11T10:28:00.575469+08:00 0 [System] [MY-011503] [Repl] Plugin
group_replication reported: 'Group membership changed to mgr5:3306, mgr2:3306,
mgr4:3306 on view 15997910941470696:6.'
2020-09-11T10:28:01.446516+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Failure reading from fd=100 n=0'
2020-09-11T10:28:02.457072+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Failure reading from fd=68 n=0'
2020-09-11T10:28:02.807305+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 0 host mgr4'
2020-09-11T10:28:02.807364+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Re-using server node 1 host mgr5'
2020-09-11T10:28:02.807388+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] pid 31898 Installed site start={4317e324
33010 0} boot_key={4317e324 32999 0} event_horizon=10 node 1
chksum_node_list(&site->nodes) 1595143356'
2020-09-11T10:28:04.095484+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Group is able to support up to communication
protocol version 8.0.16'
2020-09-11T10:28:04.095572+08:00 0 [Warning] [MY-011499] [Repl] Plugin
group_replication reported: 'Members removed from the group: mgr2:3306'
2020-09-11T10:28:04.095598+08:00 0 [System] [MY-011500] [Repl] Plugin
group_replication reported: 'Primary server with address mgr2:3306 left the
group. Electing new Primary.'
2020-09-11T10:28:04.096206+08:00 0 [Note] [MY-013519] [Repl] Plugin
group_replication reported: 'Elected primary member gtid_executed: aaaaaaaa-
aaaa-aaaa-aaaa-aaaaaaaaaaaa:1-373057'
2020-09-11T10:28:04.096272+08:00 0 [Note] [MY-013519] [Repl] Plugin
group_replication reported: 'Elected primary member applier channel
received_transaction_set: aaaaaaaa-aaaa-aaaa-aaaa-aaaaaaaaaaaa:1-365722:365727-
379341'
2020-09-11T10:28:05.096436+08:00 0 [System] [MY-011507] [Repl] Plugin
group_replication reported: 'A new primary with address mgr5:3306 was elected.
The new primary will execute all previous group transactions before allowing
writes.'
2020-09-11T10:28:05.096827+08:00 0 [System] [MY-011503] [Repl] Plugin
group_replication reported: 'Group membership changed to mgr5:3306, mgr4:3306 on
view 15997910941470696:7.'
2020-09-11T10:28:06.093366+08:00 0 [Note] [MY-011735] [Repl] Plugin
group_replication reported: '[GCS] Failure reading from fd=67 n=0'
2020-09-11T10:28:32.116452+08:00 115 [System] [MY-011566] [Repl] Plugin
group_replication reported: 'Setting super_read_only=OFF.'
2020-09-11T10:28:32.117366+08:00 115 [System] [MY-011510] [Repl] Plugin
group_replication reported: 'This server is working as primary member.'
2020-09-11T10:28:32.117371+08:00 67 [Note] [MY-011485] [Repl] Plugin
group_replication reported: 'Primary had applied all relay logs, disabled
conflict detection.'
```

- 其余节点重新加入集群

```
mysql> start group_replication;
Query OK, 0 rows affected (3.20 sec)
```

整个集群Crash

- 解决方式：

```
### 选择GTID最大的实例重新拉起集群
mysql> set global group_replication_bootstrap_group=ON;
Query OK, 0 rows affected (0.00 sec)

mysql> start group_replication;
Query OK, 0 rows affected (2.27 sec)

mysql> set global group_replication_bootstrap_group=OFF;
Query OK, 0 rows affected (0.00 sec)

### slave重新加入集群
mysql> stop group_replication;
Query OK, 0 rows affected (1.01 sec)

mysql> start group_replication;
Query OK, 0 rows affected (3.20 sec)
```

增/删节点

增加节点（3节点->5节点）

- 新增节点配置文件（group_replication_group_seeds参数可动态变更）

```
### mgr4
...
loose-group_replication_local_address = 'mgr4:33061'
loose-group_replication_group_seeds
='mgr1:33061,mgr2:33061,mgr3:33061,mgr4:33061,mgr5:33061'
...

### mgr5
...
loose-group_replication_local_address = 'mgr5:33061'
loose-group_replication_group_seeds
='mgr1:33061,mgr2:33061,mgr3:33061,mgr4:33061,mgr5:33061'
...
```

- 新增节点加入集群

```
### 创建复制用户
mysql> SET SQL_LOG_BIN=0;
mysql> CREATE USER rpl_user@'%' IDENTIFIED WITH mysql_native_password BY
'password';
mysql> GRANT REPLICATION SLAVE ON *.* TO rpl_user@'%';
mysql> GRANT BACKUP_ADMIN ON *.* TO rpl_user@'%';

### 创建复制通道
mysql> CHANGE MASTER TO MASTER_USER='rpl_user', MASTER_PASSWORD='password' FOR
CHANNEL 'group_replication_recovery';

### 启动group replication（Clone Plugin或者追binlog方式）
mysql> START GROUP_REPLICATION;
```

- 新增节点效果

```
mysql> SELECT * FROM performance_schema.replication_group_members;
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| CHANNEL_NAME              | MEMBER_ID                            | MEMBER_HOST
| MEMBER_PORT | MEMBER_STATE | MEMBER_ROLE | MEMBER_VERSION |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| group_replication_applier | 24970b5a-abb8-11ea-a2de-fa81a7d31000 | mgr3
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
| group_replication_applier | 5f39c910-f0ef-11ea-9d06-fade95161d00 | mgr5
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
| group_replication_applier | 81c0a576-e73e-11ea-b222-fab1adf37901 | mgr1
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
| group_replication_applier | d296c823-f181-11ea-9215-faf458539601 | mgr2
|        3306 | ONLINE       | PRIMARY     | 8.0.21         |
| group_replication_applier | ed2e272a-f0ec-11ea-bb1b-fa2eff81cc00 | mgr4
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
5 rows in set (0.00 sec)
```

删除节点（5节点->3节点）

- 删除节点方式
  - mysqld执行stop group_replication;退出集群
  - pod直接剔除退出集群（使用shutdown方式，非kill -9方式）
- 删除节点配置文件（group_replication_group_seeds参数可动态变更）

```
### mgr1
...
loose-group_replication_group_seeds ='mgr1:33061,mgr2:33061,mgr3:33061'
...

### mgr2
...
loose-group_replication_group_seeds ='mgr1:33061,mgr2:33061,mgr3:33061'
...
```

```
### mgr3
...
loose-group_replication_group_seeds ='mgr1:33061,mgr2:33061,mgr3:33061'
...
```

- 删除节点效果

```
mysql> SELECT * FROM performance_schema.replication_group_members;
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| CHANNEL_NAME              | MEMBER_ID                            | MEMBER_HOST
| MEMBER_PORT | MEMBER_STATE | MEMBER_ROLE | MEMBER_VERSION |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
| group_replication_applier | 24970b5a-abb8-11ea-a2de-fa81a7d31000 | mgr3
|        3306 | ONLINE       | PRIMARY     | 8.0.21         |
| group_replication_applier | 81c0a576-e73e-11ea-b222-fab1adf37901 | mgr1
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
| group_replication_applier | d296c823-f181-11ea-9215-faf458539601 | mgr2
|        3306 | ONLINE       | SECONDARY   | 8.0.21         |
+---------------------------+--------------------------------------+-------------
+-------------+--------------+-------------+----------------+
3 rows in set (0.00 sec)
```

备份恢复

备份

- 可复用MySQL 8.0的xtrabackup备份逻辑（优先选备库）

恢复

- 可复用MySQL 8.0的xtrabackup恢复逻辑
- 启动新集群

```
### 引导节点启动
mysql> SET GLOBAL group_replication_bootstrap_group=ON;
mysql> START GROUP_REPLICATION;
mysql> SET GLOBAL group_replication_bootstrap_group=OFF;

### 非引导节点启动（返回OK才能代表集群加入成功）
mysql> START GROUP_REPLICATION;
```

监控

- 本节点是不是online:

```
select member_state from performance_schema.replication_group_members where
member_id=@@server_uuid;
```

- 当前节点是不是可以写：

```
select * from performance_schema.global_variables where variable_name in
('read_only', 'super_read_only');
```

- 复制是不是存在延迟，对比获得到的GTID和本节点执行的GTID是不是一致（远程获取的GTID-本节点执行的GTID=延迟的GTID数），获取的GTID：

```
### recovery通道接收的GTID
SELECT Received_transaction_set FROM
performance_schema.replication_connection_status WHERE Channel_name =
'group_replication_recovery';

### applier通道接收的GTID
SELECT Received_transaction_set FROM
performance_schema.replication_connection_status WHERE Channel_name =
'group_replication_applier';

### 本节点执行的GTID
select @@gtid_executed;
```

- 查看复制落后的事务数

```
select Count_transactions_remote_in_applier_queue from
performance_schema.replication_group_member_stats where member_id=@@server_uuid;
```

- 查看复制落后延时（MTS ON）：

```
select if(PROCESSING_TRANSACTION <>'',
timestampdiff(second,LAST_PROCESSED_TRANSACTION_ORIGINAL_COMMIT_TIMESTAMP,curren
t_timestamp()),0) lag_time from
performance_schema.replication_applier_status_by_coordinator where
SERVICE_STATE='ON' and  CHANNEL_NAME='group_replication_applier';
```

读写分离

> maxscale monitor模块编译加入grmon模块

手动切换

> select group_replication_set_as_primary('24970b5a-abb8-11ea-a2de-fa81a7d31000');