MySQL主从架构

一、背景

随着公司业务的发展，对数据库的要求越来越高，以前的单机MySQL肯定是玩不转了，亟需升级成MySQL集群，这是一个公司在业务发展时不得不面临的问题。就单机MySQL而言，自己玩玩可以，运用到实际项目中，那肯定要挨批的。一方面数据不安全，万一数据库的电脑磁盘坏了，就坑了。另一方面数据库的并发能力是有限的，一般并发数200～500就差不多了，当然你要继续往上增，也是可以的，那就影响整体Mysql的响应时间。

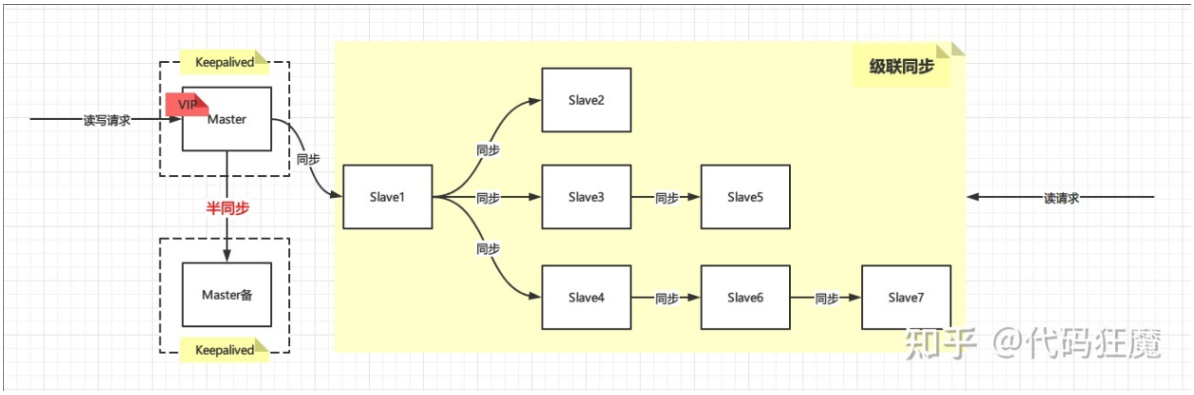
二、集群方案

2.1 主从数据同步（主写从读）

具体配置参照本文档下的《主从架构配置》文件

该配置只能用于主写从读，如果向从数据库写入数据，由于不能将数据同步到主数据库，从而导致主从数据库不一致的问题。

2.2 普通双机热备



优点：

- 读写分离，增加整体性能
- Master有故障转移（采用Keepalived实现），当Master宕机时，备用Master自动顶上去，且IP无变化（VIP）
- Master和备用Master之间采用半同步机制，最大程度上保证数据一致性

缺点：

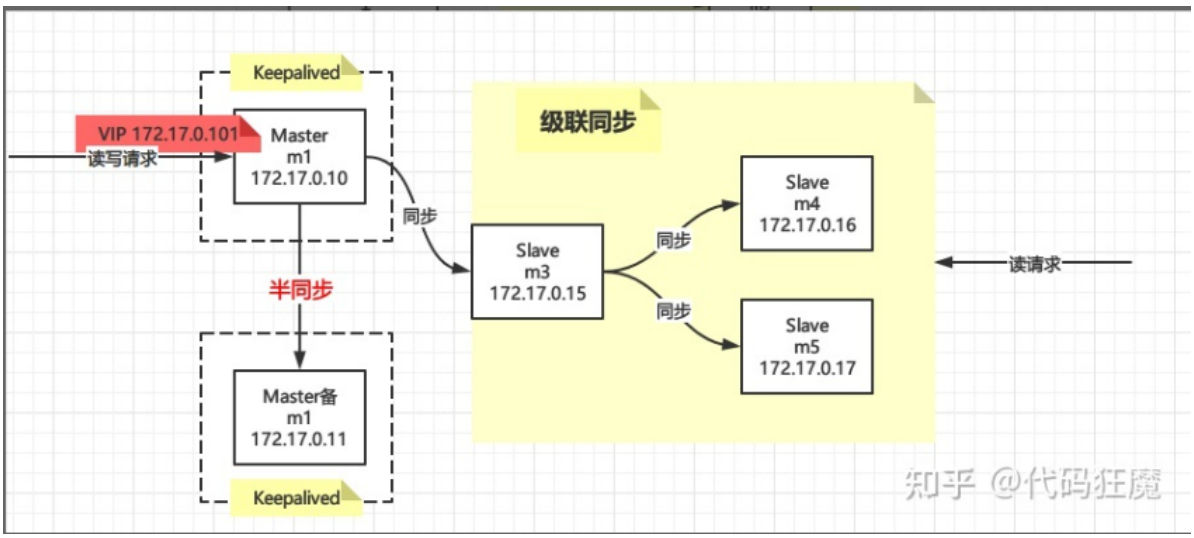
- Master故障转移时，Slave需要用脚本手动切换，增加复杂度
- 数据存在一致性问题，因为异步，所以Slave的数据一定不是最新的，需要等待一个时间窗后才能读取
- Slave过多时Slave对Master的负载以及网络带宽都会成为一个严重的问题

2.3 Keepalived双主热备

2.3.1 架构

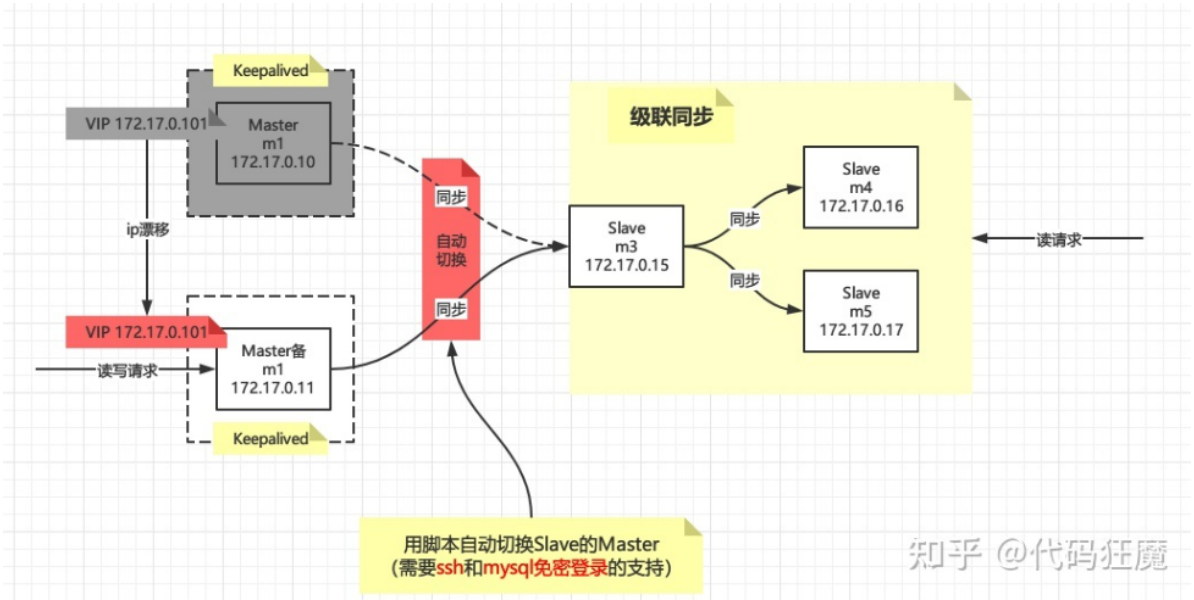
m1和m2作为双主，**互为主从**且同步方式为**半同步**，为什么呢？因为这样在Master主机宕机恢复，对Master备机写入的数据也能重新同步到Master主，此时的主备角色正好颠倒过来，所以要设置互为主从且半同步。

m3作为级联复制的中间节点，新增加m4和m5作为新的Slave，正常情况下架构如下：



当发生故障时，VIP自动漂移到Master备机上面，且通过Keepalived的状态脚本自动切换Slave，即m3到Master备机上，当Master主机（m1）恢复时，VIP又会自动漂移到m1上并且m3也会自动切换到m1上！

Keepalived状态切换脚本需要ssh和mysql免密登录的支持，其原理就是m1或者m2检测到自己成为Master角色时，通过ssh登录到m3上执行MySQL的切换命令



> 此文档只实现了Keepalive主备切换功能（即m1与m2的切换），如需切实现slave由m1切换到m2，请参照其他文档，添加相应脚本。

2.3.2 环境准备

Mysql 版本： 8.0.27

```
docker run -d --name m1 -p 3306:3306 -e MYSQL_ROOT_PASSWORD=123456 -e
TZ="Asia/Shanghai" -v /home/rebei/m1/config:/etc/mysql/conf.d mysql --
authentication_policy=mysql_native_password

docker restart m1
docker exec -it m1 mysql -uroot -p123456
----------------------------------------------------------------------
docker run -d --name m2 -p 3306:3306 -e MYSQL_ROOT_PASSWORD=123456 -e
TZ="Asia/Shanghai" -v /home/rebei/m2/config:/etc/mysql/conf.d mysql --
authentication_policy=mysql_native_password

docker restart m2
docker exec -it m2 mysql -uroot -p123456
----------------------------------------------------------------------

#----------------------------------------------------------------------
#docker run -d --name s1 -p 4306:3306 -e MYSQL_ROOT_PASSWORD=123456 -e
TZ="Asia/Shanghai" -v #/home/rebei/s1/config:/etc/mysql/conf.d mysql --
authentication_policy=mysql_native_password

#docker restart s1
#docker exec -it s1 mysql -uroot -p123456
----------------------------------------------------------------------
```

注意：需要确认一下每台设备上的server_uuid是否相同，如果相同，则需重置，否则后面的主从复制会出错。

```
docker exec -it m1 /bin/sh
cat /var/lib/mysql/auto.cnf
#如果一致，则删除重新启动服务
rm -f /var/lib/mysql/auto.cnf
docker restart m1
```

2.3.3 双主配置

> Master主机：192.168.200.104
>
> Master备机：192.168.200.105

- Master主机（m1）

```
vim /home/rebei/m1/config/my.cnf
# 修改配置
[mysqld]
user=mysql
character-set-server=utf8mb4
collation-server=utf8mb4_general_ci
```

```
log-bin=mysql-bin-master
server_id=1
log_replica_updates=1
plugin-
load="rpl_semi_sync_source=semisync_source.so;rpl_semi_sync_replica=sem
isync_replica.so"
rpl_semi_sync_source_enabled=1
rpl_semi_sync_replica_enabled=1

[client]
default-character-set=utf8mb4
```

- Master备机（m2）

  说明：server_id必须与m1不同

```
vim /home/rebei/m2/config/my.cnf
# 修改配置
[mysqld]
user=mysql
character-set-server=utf8mb4
collation-server=utf8mb4_general_ci
log-bin=mysql-bin-master
server_id=2
log_replica_updates=1
plugin-
load="rpl_semi_sync_source=semisync_source.so;rpl_semi_sync_replica=sem
isync_replica.so"
rpl_semi_sync_source_enabled=1
rpl_semi_sync_replica_enabled=1

[client]
default-character-set=utf8mb4
```

  可使用show plugins查看主从插件是否安装成功

```
show plugins
```

show plugins 输入一个 SQL 表达式来过滤结果 (使用 Ctrl+Space)

	Name	Status	Type	Library	License
36	MyISAM	ACTIVE	STORAGE ENGINE	[NULL]	GPL
37	MRG_MYISAM	ACTIVE	STORAGE ENGINE	[NULL]	GPL
38	PERFORMANCE_SCHEMA	ACTIVE	STORAGE ENGINE	[NULL]	GPL
39	TempTable	ACTIVE	STORAGE ENGINE	[NULL]	GPL
40	ARCHIVE	ACTIVE	STORAGE ENGINE	[NULL]	GPL
41	BLACKHOLE	ACTIVE	STORAGE ENGINE	[NULL]	GPL
42	FEDERATED	DISABLED	STORAGE ENGINE	[NULL]	GPL
43	ngram	ACTIVE	FTPARSER	[NULL]	GPL
44	mysqlx_cache_cleaner	ACTIVE	AUDIT	[NULL]	GPL
45	mysqlx	ACTIVE	DAEMON	[NULL]	GPL
46	rpl_semi_sync_source	ACTIVE	REPLICATION	semisync_sourc	GPL
47	rpl_semi_sync_replica	ACTIVE	REPLICATION	semisync_replic	GPL

- 创建同步用户

  在m1与m2机器的MySQl上执行一下脚本

```
DROP USER 'repl'@'%' ;
CREATE USER 'repl'@'%' IDENTIFIED BY 'repl';
GRANT REPLICATION SLAVE ON *.* TO 'repl'@'%';
flush privileges;
```

  查看Matser状态

```
SHOW MASTER STATUS;
```

SHOW MASTER STATUS 输入一个 SQL 表达式来过滤结果 (使用 Ctrl+Space)

	File	Position	Binlog_Do_DB	Binlog_Ignore_DB	Executed_Gtid_Set
1	mysql-bin-master.000001	156			

binglog文件　偏移量

2.3.4 互为主从

（1）将Master主挂载成为Master备机的从机

```
STOP SLAVE;
RESET SLAVE;

CHANGE MASTER TO
MASTER_HOST='192.168.200.105',
MASTER_USER='repl',
MASTER_PASSWORD='repl',
MASTER_LOG_FILE='mysql-bin-master.000001',
MASTER_LOG_POS=156;

START SLAVE;
```

说明：

MASTER_HOST：主机IP（该sql脚本是在从机上执行）

MASTER_LOG_FILE：主机对应的偏移文件

MASTER_LOG_POS：主机对应的偏移量

（2）将Master备机挂载成为Master主机的从机，需修改对应的IP及偏移量

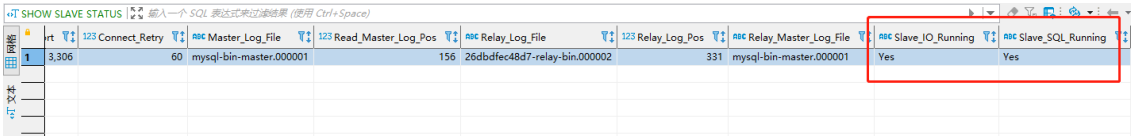
```
STOP SLAVE;
RESET SLAVE;

CHANGE MASTER TO
MASTER_HOST='192.168.200.104',
MASTER_USER='repl',
MASTER_PASSWORD='repl',
MASTER_LOG_FILE='mysql-bin-master.000001',
MASTER_LOG_POS=156;

START SLAVE;
```

- 查看下是否挂载成功

```
SHOW SLAVE STATUS;
```



- 查看半同步是否开启

```
show variables like 'rpl_semi_sync_source_enabled';
show variables like 'rpl_semi_sync_replica_enabled';
```

最后在自行测试下载Master主机上面写数据Master备机能否同步，反过来再测试下。

2.3.5 配置keepalived

（1）安装keepalived

```
yum install -y keepalived
```

> 注意：Keepalived就安装在Docker运行的宿主机上面，安装在docker里面IP无法绑定(亲测)

（2）Master主机配置

```
vi /etc/keepalived/keepalived.conf
```

```
! Configuration File for keepalived

global_defs {
    router_id HA-M1
    script_user root
    enable_script_security
}
```

```
vrrp_script chk_mysql {
    script /etc/keepalived/chk_mysql.sh
    interval 60
    fall 3
    rise 2
}

vrrp_instance VI_MYSQL {
    state MASTER
    interface ens33
    virtual_router_id 100
    priority 100
    advert_int 1

    authentication {
        auth_type PASS
        auth_pass 1111
    }

    virtual_ipaddress {
        192.168.200.200 dev ens33 label ens33:vip
    }

    track_script {
        chk_mysql
    }
}
```

- router_id：标识，两台需不一样
- state MASTER：表明这台是Master角色
- priority：优先级，MASTER角色比BACKUP高!
- virtual_router_id：虚拟路由编号，两台需要一致
- 192.168.200.200 dev ens33 label ens33:vip：这就是我们配置的VIP：192.168.200.200
- script /etc/keepalived/chk_mysql.sh：MySQL的检测脚本，定时去检测MySQL进程是否挂掉，如果挂掉，在脚本里面重启之，定时通过interval配置，上面配置的是2s检测一次

> 注意：interval如果过小可能会导致如下错误：/etc/keepalived/chk_nginx.sh exited due to signal 15

(3) Master备机配置

```
vi /etc/keepalived/keepalived.conf
```

```
! Configuration File for keepalived

global_defs {
    router_id HA-M2  #router id配置,与主机不一致
```

```
    script_user root
    enable_script_security
}

vrrp_script chk_mysql { #定义MYSQL状态检测脚本
    script /etc/keepalived/chk_mysql.sh
    interval 30
    fall 3
    rise 2
}

vrrp_instance VI_MYSQL {
    state BACKUP    #角色配置
    interface ens33 #网卡配置
    virtual_router_id 100 #必须与主机一致
    nopreempt
    priority 50     #优先级配置，必须小于MASTER
    advert_int 1
    # mcast_src_ip 192.168.200.104

    authentication {
        auth_type PASS
        auth_pass 1111
    }

    virtual_ipaddress {
        192.168.200.200 dev ens33 label ens33:vip #虚拟IP
    }

    track_script {
        chk_mysql
    }
}
```

（3）创建Mysql状态检测脚本

```
touch /etc/keepalived/chk_mysql.sh
chmod +x /etc/keepalived/chk_mysql.sh
```

chk_mysql.sh

```
cat > /etc/keepalived/chk_mysql.sh <<EOF
#!/bin/bash
MYSQL=/usr/bin/mysql
MYSQL_HOST=192.168.3.254
MYSQL_USER=root
MYSQL_PASSWORD=123456
CHECK_TIME=3

#mysql  is working MYSQL_OK is 1 , mysql down MYSQL_OK is 0
```

```
MYSQL_OK=1

function check_mysql_helth (){
    $MYSQL -h $MYSQL_HOST -u$MYSQL_USER -p${MYSQL_PASSWORD} -e "show
status;" >/dev/null 2>&1
    if [ $? = 0 ] ;then
    MYSQL_OK=1
    else
    MYSQL_OK=0
    fi
    return $MYSQL_OK
}
while [ $CHECK_TIME -ne 0 ]
do
    let "CHECK_TIME -= 1"
    check_mysql_helth
if [ $MYSQL_OK = 1 ] ; then
    CHECK_TIME=0
    exit 0
fi
if [ $MYSQL_OK -eq 0 ] &&  [ $CHECK_TIME -eq 0 ]
then
    systemctl stop keepalived
    exit 1
fi
sleep 1
done
EOF
```

（4）启动keepalived，并查看虚拟IP是否绑定成功

```
#实时查看keepalived启动日志，看是否有错误
tail -f /var/log/messages
#启动keepalived
systemctl start keepalived
#查看虚拟IP是否绑定成功
ifconfig
```

```
[root@localhost ~]# ifconfig
br-3869e3e8a3ac: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        inet 172.18.0.1  netmask 255.255.0.0  broadcast 172.18.255.255
        ether 02:42:3b:19:40:84  txqueuelen 0  (Ethernet)
        RX packets 246  bytes 81514 (79.6 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 301  bytes 38148 (37.2 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

docker0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.17.0.1  netmask 255.255.0.0  broadcast 172.17.255.255
        inet6 fe80::42:f1ff:fe01:9973  prefixlen 64  scopeid 0x20<link>
        ether 02:42:f1:01:99:73  txqueuelen 0  (Ethernet)
        RX packets 246  bytes 81514 (79.6 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 301  bytes 38148 (37.2 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.200.105  netmask 255.255.255.0  broadcast 192.168.200.255
        inet6 fe80::b0f4:3b81:4994:3b64  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:84:36:2c  txqueuelen 1000  (Ethernet)
        RX packets 4383  bytes 320223 (312.7 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 7046  bytes 870802 (850.3 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

ens33:vip: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.200.200  netmask 255.255.255.255  broadcast 0.0.0.0
        ether 00:0c:29:84:36:2c  txqueuelen 1000  (Ethernet)

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 388  bytes 25120 (24.5 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 388  bytes 25120 (24.5 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

veth54817f6: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet6 fe80::44be:30ff:fe18:1910  prefixlen 64  scopeid 0x20<link>
        ether 46:be:30:18:19:10  txqueuelen 0  (Ethernet)
        RX packets 246  bytes 84958 (82.9 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 309  bytes 38804 (37.8 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

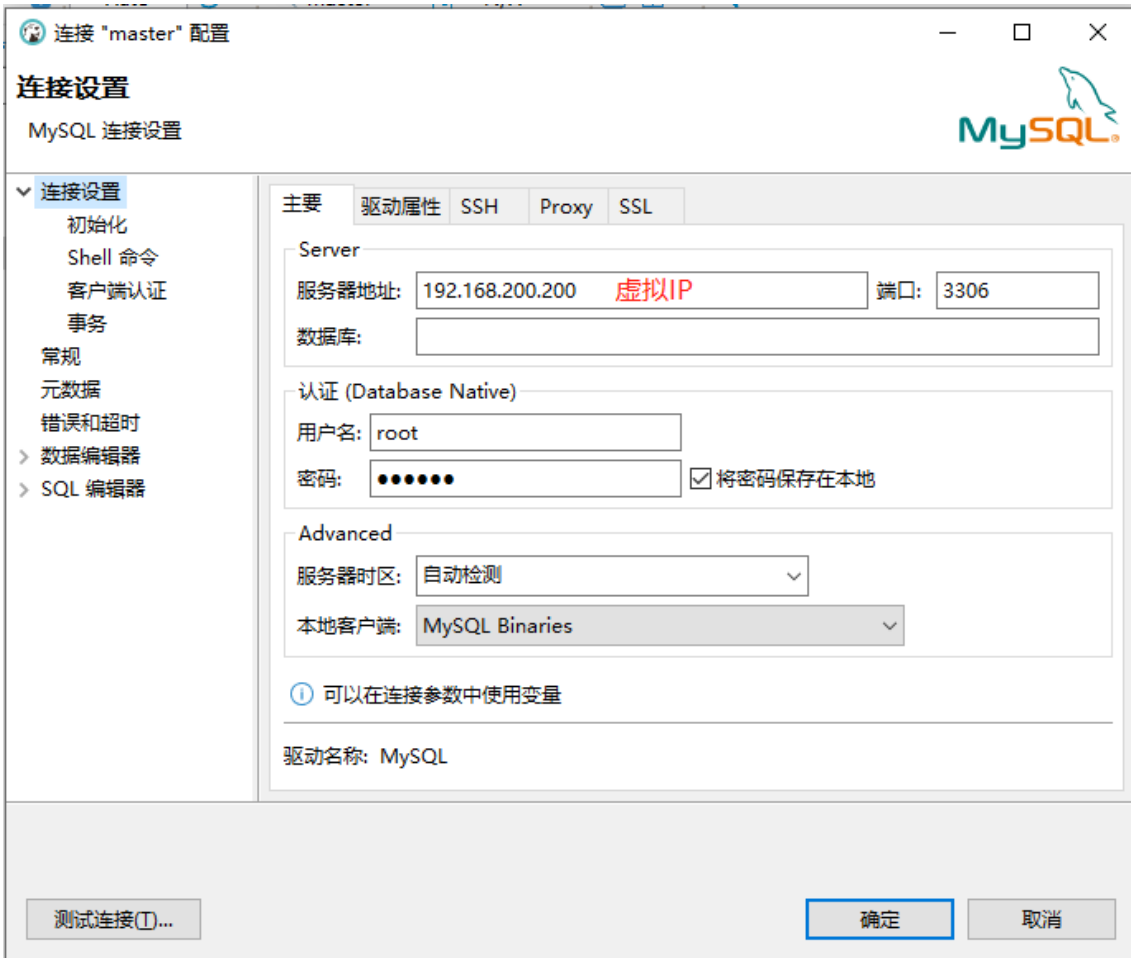
（5）安装Mysql客户端（也可直接通过Windows连接）

```
wget https://dev.mysql.com/get/mysql80-community-release-el7-5.noarch.rpm
rpm -ivh mysql80-community-release-el7-5.noarch.rpm
yum install mysql-community-client
```

2.3.6 测试

- 确认是否可以通过虚拟IP连接MYSQL

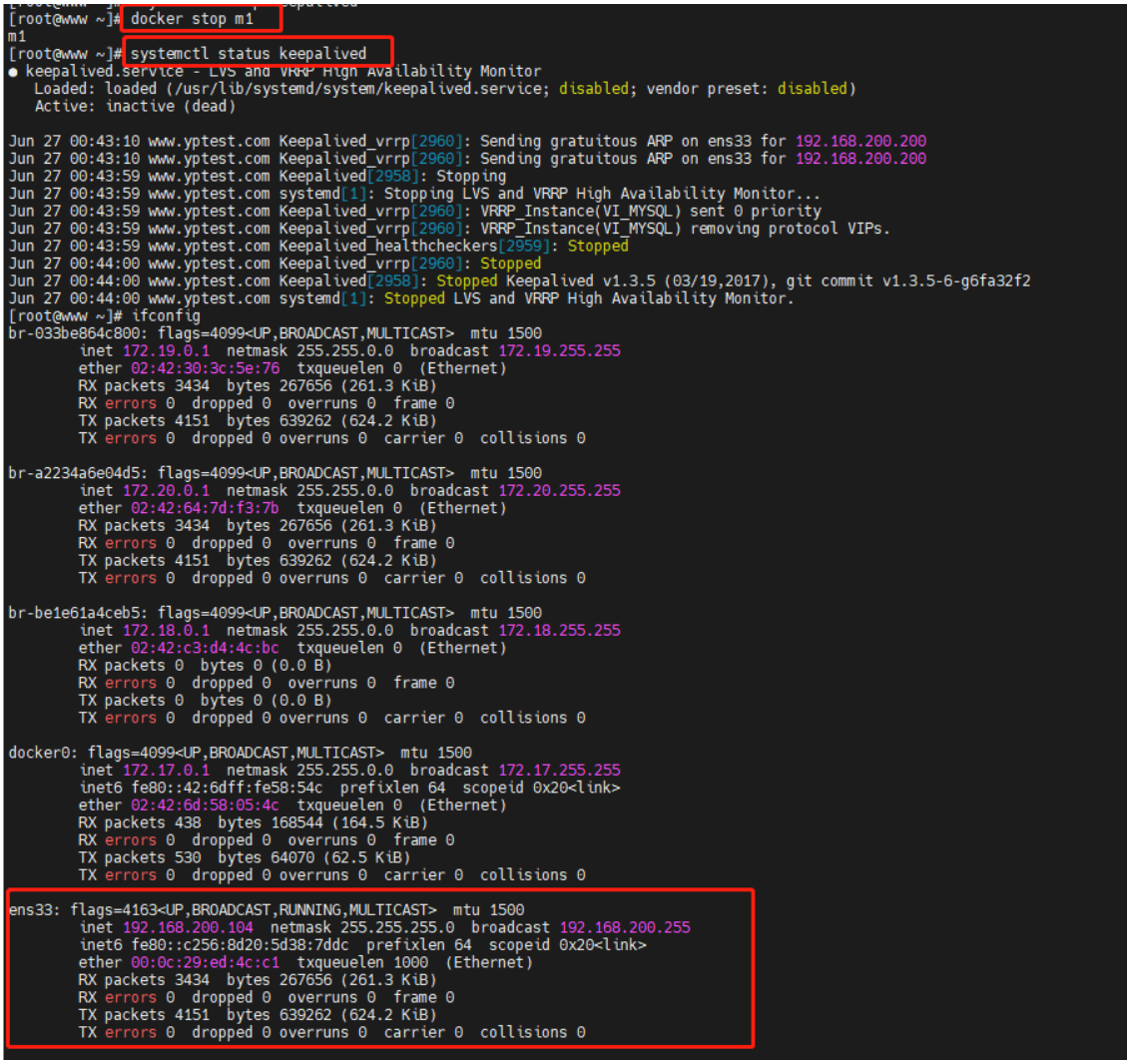
  先分别确认m1与m2容器中的MYSQL是否可以正常访问，再是否可以确认虚拟IP访问MYSQL



- 查看keepalived是否实现主备切换功能

  Master主机

```
#关闭Master主机的MySQL服务
docker stop m1
查看keepalived状态
systemctl status keepalived
#查看虚拟IP是否绑定情况（V此时IP已经漂移到备机）
ifconfig
```



Master备机

```
ifconfig
```

```
[root@localhost ~]# ifconfig
br-3869e3e8a3ac: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
        inet 172.18.0.1  netmask 255.255.0.0  broadcast 172.18.255.255
        ether 02:42:3b:19:40:84  txqueuelen 0  (Ethernet)
        RX packets 341  bytes 89534 (87.4 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 390  bytes 48064 (46.9 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

docker0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.17.0.1  netmask 255.255.0.0  broadcast 172.17.255.255
        inet6 fe80::42:f1ff:fe01:9973  prefixlen 64  scopeid 0x20<link>
        ether 02:42:f1:01:99:73  txqueuelen 0  (Ethernet)
        RX packets 341  bytes 89534 (87.4 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 390  bytes 48064 (46.9 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.200.105  netmask 255.255.255.0  broadcast 192.168.200.255
        inet6 fe80::b0f4:3b81:4994:3b64  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:84:36:2c  txqueuelen 1000  (Ethernet)
        RX packets 6396  bytes 457614 (446.8 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 10630  bytes 1257398 (1.1 MiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

ens33:vip: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.200.200  netmask 255.255.255.255  broadcast 0.0.0.0
        ether 00:0c:29:84:36:2c  txqueuelen 1000  (Ethernet)

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 524  bytes 33280 (32.5 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 524  bytes 33280 (32.5 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```