

МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ
Федеральное государственное автономное образовательное учреждение высшего образования
«КРЫМСКИЙ ФЕДЕРАЛЬНЫЙ УНИВЕРСИТЕТ им. В. И. ВЕРНАДСКОГО»
ФИЗИКО-ТЕХНИЧЕСКИЙ ИНСТИТУТ
Кафедра компьютерной инженерии и моделирования

«Создание простого кластера СУБД»

Лабораторная работа
по дисциплине «Методы распределенных информационных систем»
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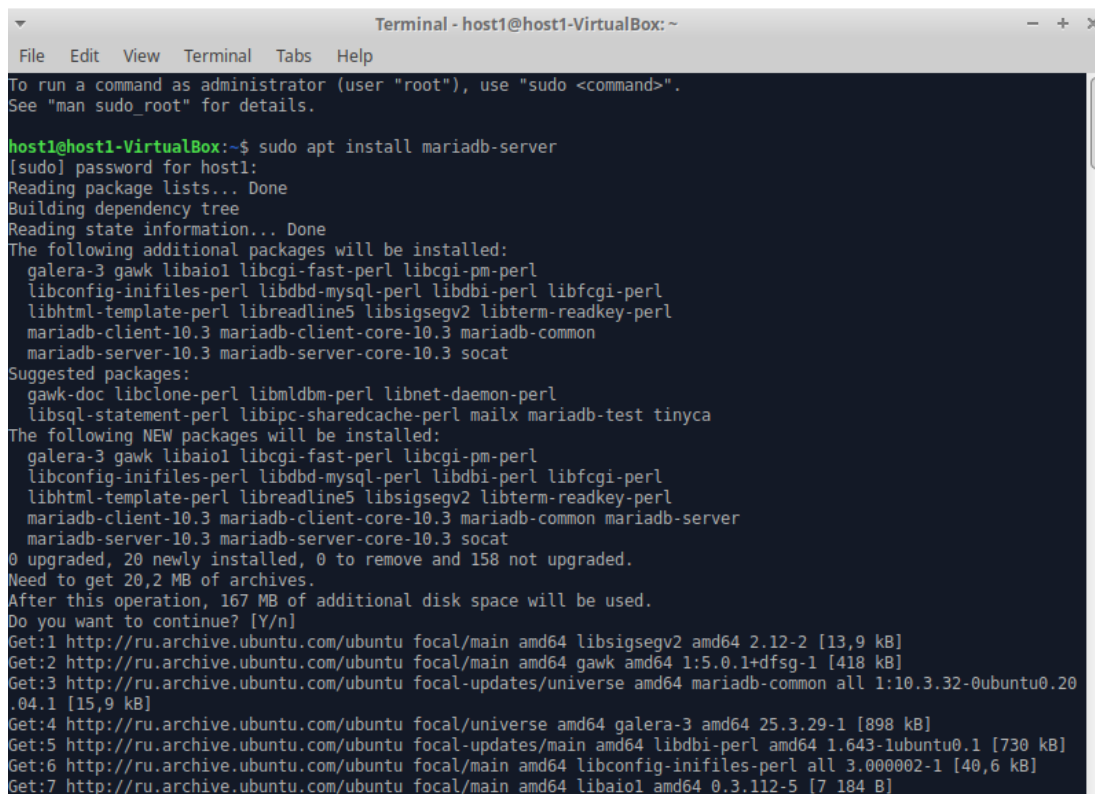
Лабораторная работа №3

Цели:

- Создание простого кластера СУБД

Ход работы

1. Установка MariaDB



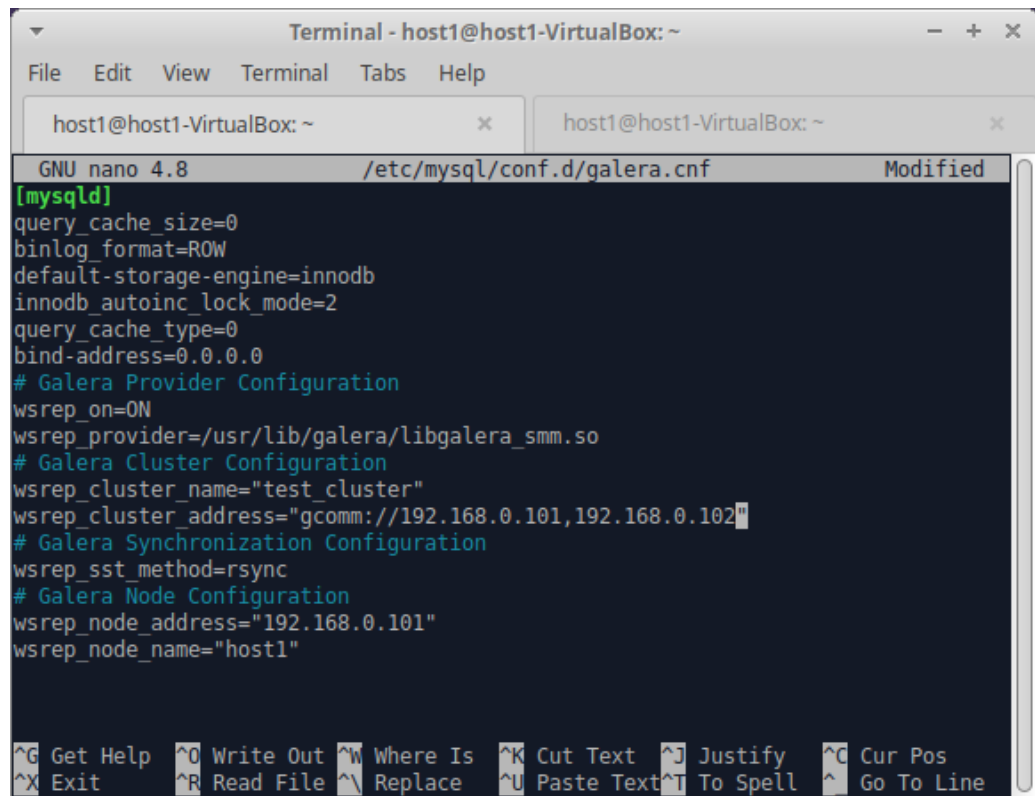
```
Terminal - host1@host1-VirtualBox: ~
File Edit View Terminal Tabs Help

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

host1@host1-VirtualBox:~$ sudo apt install mariadb-server
[sudo] password for host1:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  galera-3 gawk libaiol libcgi-fast-perl libcgi-pm-perl
  libconfig-inifiles-perl libdbd-mysql-perl libdbi-perl libfcgi-perl
  libhtml-template-perl libreadline5 libsigsegv2 libterm-readkey-perl
  mariadb-client-10.3 mariadb-client-core-10.3 mariadb-common
  mariadb-server-10.3 mariadb-server-core-10.3 socat
Suggested packages:
  gawk-doc libclone-perl libmldbm-perl libnet-daemon-perl
  libsql-statement-perl libipc-sharedcache-perl mailx mariadb-test tinyca
The following NEW packages will be installed:
  galera-3 gawk libaiol libcgi-fast-perl libcgi-pm-perl
  libconfig-inifiles-perl libdbd-mysql-perl libdbi-perl libfcgi-perl
  libhtml-template-perl libreadline5 libsigsegv2 libterm-readkey-perl
  mariadb-client-10.3 mariadb-client-core-10.3 mariadb-common mariadb-server
  mariadb-server-10.3 mariadb-server-core-10.3 socat
0 upgraded, 20 newly installed, 0 to remove and 158 not upgraded.
Need to get 20,2 MB of archives.
After this operation, 167 MB of additional disk space will be used.
Do you want to continue? [Y/n]
Get:1 http://ru.archive.ubuntu.com/ubuntu focal/main amd64 libsigsegv2 amd64 2.12-2 [13,9 kB]
Get:2 http://ru.archive.ubuntu.com/ubuntu focal/main amd64 gawk amd64 1:5.0.1+dfsg-1 [418 kB]
Get:3 http://ru.archive.ubuntu.com/ubuntu focal-updates/universe amd64 mariadb-common all 1:10.3.32-0ubuntu0.20
.04.1 [15,9 kB]
Get:4 http://ru.archive.ubuntu.com/ubuntu focal/universe amd64 galera-3 amd64 25.3.29-1 [898 kB]
Get:5 http://ru.archive.ubuntu.com/ubuntu focal-updates/main amd64 libdbi-perl amd64 1.643-1ubuntu0.1 [730 kB]
Get:6 http://ru.archive.ubuntu.com/ubuntu focal/main amd64 libconfig-inifiles-perl all 3.000002-1 [40,6 kB]
Get:7 http://ru.archive.ubuntu.com/ubuntu focal/main amd64 libaiol amd64 0.3.112-5 [7 184 B]
```

Рис. 1 - Установка MariaDB

2. Настройка первой ноды



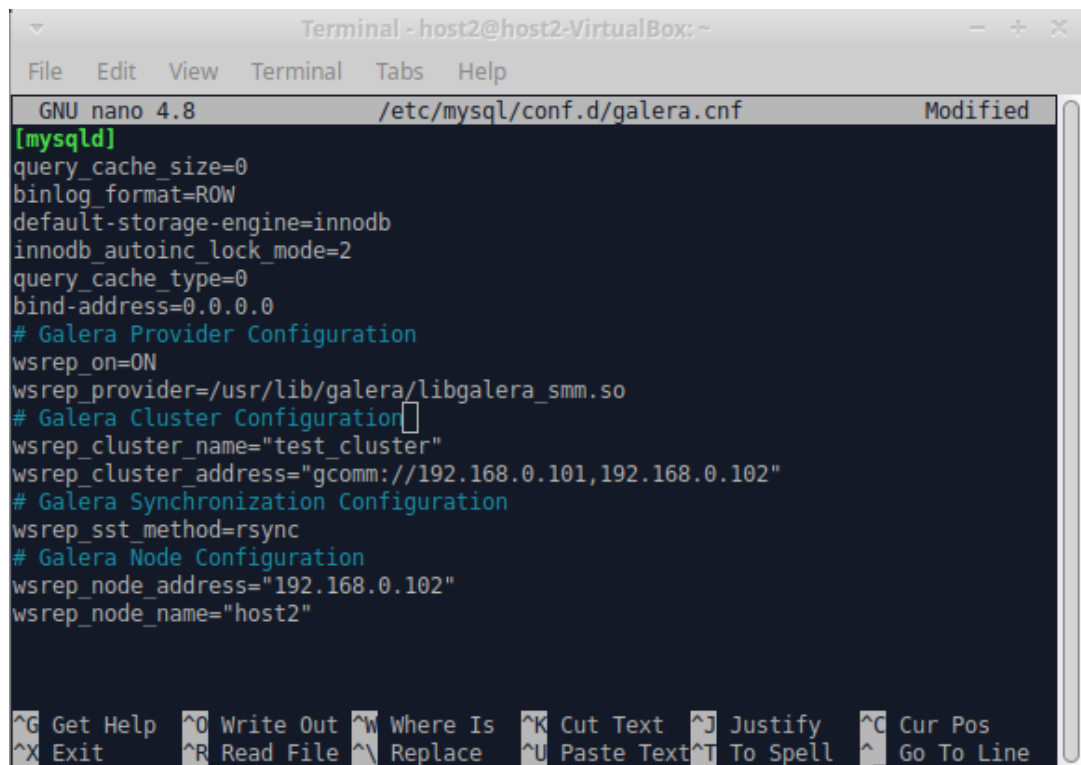
```

Terminal - host1@host1-VirtualBox: ~
File Edit View Terminal Tabs Help
host1@host1-VirtualBox: ~
GNU nano 4.8 /etc/mysql/conf.d/galera.cnf Modified
[mysqld]
query_cache_size=0
binlog_format=ROW
default-storage-engine=innodb
innodb_autoinc_lock_mode=2
query_cache_type=0
bind-address=0.0.0.0
# Galera Provider Configuration
wsrep_on=ON
wsrep_provider=/usr/lib/galera/libgalera_smm.so
# Galera Cluster Configuration
wsrep_cluster_name="test_cluster"
wsrep_cluster_address="gcomm://192.168.0.101,192.168.0.102"
# Galera Synchronization Configuration
wsrep_sst_method=rsync
# Galera Node Configuration
wsrep_node_address="192.168.0.101"
wsrep_node_name="host1"
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos
^X Exit ^R Read File ^\ Replace ^U Paste Text ^T To Spell ^_ Go To Line

```

Рис. 2 - Настройка файла конфигурации

3. Настройка остальных нод



```

Terminal - host2@host2-VirtualBox: ~
File Edit View Terminal Tabs Help
host2@host2-VirtualBox: ~
GNU nano 4.8 /etc/mysql/conf.d/galera.cnf Modified
[mysqld]
query_cache_size=0
binlog_format=ROW
default-storage-engine=innodb
innodb_autoinc_lock_mode=2
query_cache_type=0
bind-address=0.0.0.0
# Galera Provider Configuration
wsrep_on=ON
wsrep_provider=/usr/lib/galera/libgalera_smm.so
# Galera Cluster Configuration
wsrep_cluster_name="test_cluster"
wsrep_cluster_address="gcomm://192.168.0.101,192.168.0.102"
# Galera Synchronization Configuration
wsrep_sst_method=rsync
# Galera Node Configuration
wsrep_node_address="192.168.0.102"
wsrep_node_name="host2"
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos
^X Exit ^R Read File ^\ Replace ^U Paste Text ^T To Spell ^_ Go To Line

```

Рис. 3 - Конфигурация вторичной ноды

4. Запуск кластера

```
File Edit View Terminal Tabs Help
host1@host1-VirtualBox:~$ sudo mysql -u root -p -e "show status like 'wsrep_'"
Enter password:
+-----+-----+
| Variable_name | Value |
+-----+-----+
| wsrep_applier_thread_count | 1 |
| wsrep_apply_oooe | 0.000000 |
| wsrep_apply_ool | 0.000000 |
| wsrep_apply_window | 0.000000 |
| wsrep_causal_reads | 0 |
| wsrep_cert_deps_distance | 0.000000 |
| wsrep_cert_index_size | 0 |
| wsrep_cert_interval | 0.000000 |
| wsrep_cluster_conf_id | 4 |
| wsrep_cluster_size | 2 |
| wsrep_cluster_state_uuid | 5c5b9c48-6d36-11ec-9cfd-523809148a4c |
| wsrep_cluster_status | Primary |
| wsrep_cluster_weight | 2 |
| wsrep_commit_oooe | 0.000000 |
| wsrep_commit_ool | 0.000000 |
| wsrep_commit_window | 0.000000 |
| wsrep_connected | ON |
| wsrep_desync_count | 0 |
| wsrep_evs_delayed | |
| wsrep_evs_evict_list | |
| wsrep_evs_repl_latency | 0/0/0/0/0 |
| wsrep_evs_state | OPERATIONAL |
| wsrep_flow_control_paused | 0.000000 |
| wsrep_flow_control_paused_ns | 0 |
| wsrep_flow_control_recv | 0 |
| wsrep_flow_control_sent | 0 |
| wsrep_gcomm_uuid | 1418bbe0-6d38-11ec-9710-bf7673c88487 |
| wsrep_incoming_addresses | , |
+-----+-----+
```

Рис. 4 - Проверка статуса Galera (host1)

```
host2@host2-VirtualBox: ~ x host2@host2-VirtualBox: ~ x
host2@host2-VirtualBox:~$ sudo mysql -u root -p -e "show status like 'wsrep_'"
Enter password:
+-----+-----+
| Variable_name | Value |
+-----+-----+
| wsrep_applier_thread_count | 1 |
| wsrep_apply_oooe | 0.000000 |
| wsrep_apply_ool | 0.000000 |
| wsrep_apply_window | 0.000000 |
| wsrep_causal_reads | 0 |
| wsrep_cert_deps_distance | 0.000000 |
| wsrep_cert_index_size | 0 |
| wsrep_cert_interval | 0.000000 |
| wsrep_cluster_conf_id | 4 |
| wsrep_cluster_size | 2 |
| wsrep_cluster_state_uuid | 5c5b9c48-6d36-11ec-9cfd-523809148a4c |
| wsrep_cluster_status | Primary |
| wsrep_cluster_weight | 2 |
| wsrep_commit_oooe | 0.000000 |
| wsrep_commit_ool | 0.000000 |
| wsrep_commit_window | 0.000000 |
| wsrep_connected | ON |
| wsrep_desync_count | 0 |
| wsrep_evs_delayed | |
| wsrep_evs_evict_list | |
| wsrep_evs_repl_latency | 0/0/0/0/0 |
| wsrep_evs_state | OPERATIONAL |
| wsrep_flow_control_paused | 0.000000 |
| wsrep_flow_control_paused_ns | 0 |
| wsrep_flow_control_recv | 0 |
| wsrep_flow_control_sent | 0 |
| wsrep_gcomm_uuid | 5c5b1ecf-6d36-11ec-a2ce-1742093a526f |
+-----+-----+
```

Рис. 5 - Проверка статуса Galera (host2)

```

Terminal - host1@host1-VirtualBox: ~
File Edit View Terminal Tabs Help

ze
Enter password:
wsrep_cluster_size 2
host1@host1-VirtualBox:~$ mysql -u root -p
Enter password:
ERROR 1698 (28000): Access denied for user 'root'@'localhost'
host1@host1-VirtualBox:~$ sudo mysql -u root -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 44
Server version: 10.3.32-MariaDB-0ubuntu0.20.04.1 Ubuntu 20.04

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

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

MariaDB [(none)]> create database galera_test
-> Ctrl-C -- exit!
Aborted
host1@host1-VirtualBox:~$ sudo mysql -u root -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 45
Server version: 10.3.32-MariaDB-0ubuntu0.20.04.1 Ubuntu 20.04

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

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

MariaDB [(none)]> create database galera_test;
Query OK, 1 row affected (0.005 sec)

MariaDB [(none)]> S

```

Рис. 6 - Создание таблицы в активной нодe

```

Terminal - host2@host2-VirtualBox: ~
File Edit View Terminal Tabs Help

host2@host2-VirtualBox: ~
wsrep_repl_keys_bytes | 0
wsrep_repl_other_bytes | 0
wsrep_replicated | 0
wsrep_replicated_bytes | 0
wsrep_rollbacker_thread_count | 1
wsrep_thread_count | 2
+-----+
host2@host2-VirtualBox:~$ mysql -u root -p
Enter password:
ERROR 1698 (28000): Access denied for user 'root'@'localhost'
host2@host2-VirtualBox:~$ sudo mysql -u root -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 41
Server version: 10.3.32-MariaDB-0ubuntu0.20.04.1 Ubuntu 20.04

Copyright (c) 2000, 2018, Oracle, MariaDB Corporation Ab and others.

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

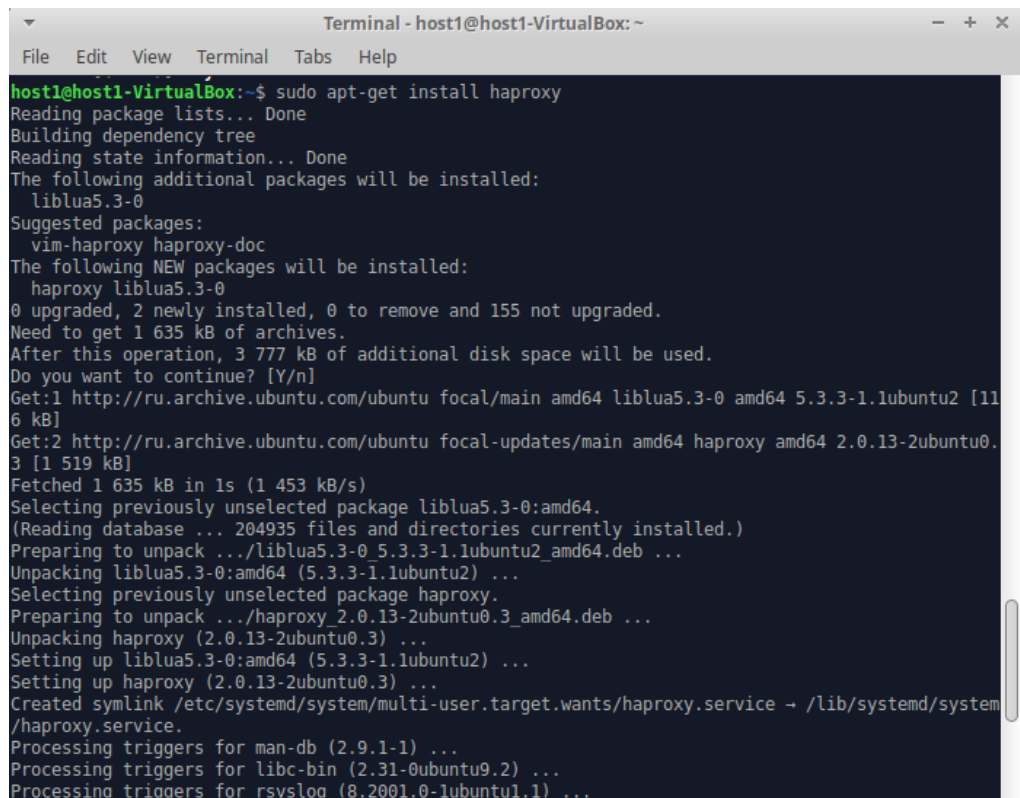
MariaDB [(none)]> show databases;
+-----+
| Database |
+-----+
| galera_test |
| information_schema |
| mysql |
| performance_schema |
+-----+
4 rows in set (0.000 sec)

MariaDB [(none)]> S

```

Рис. 7 - Демонстрация работы кластера

5. Создание единой точки подключения с помощью HAProxy



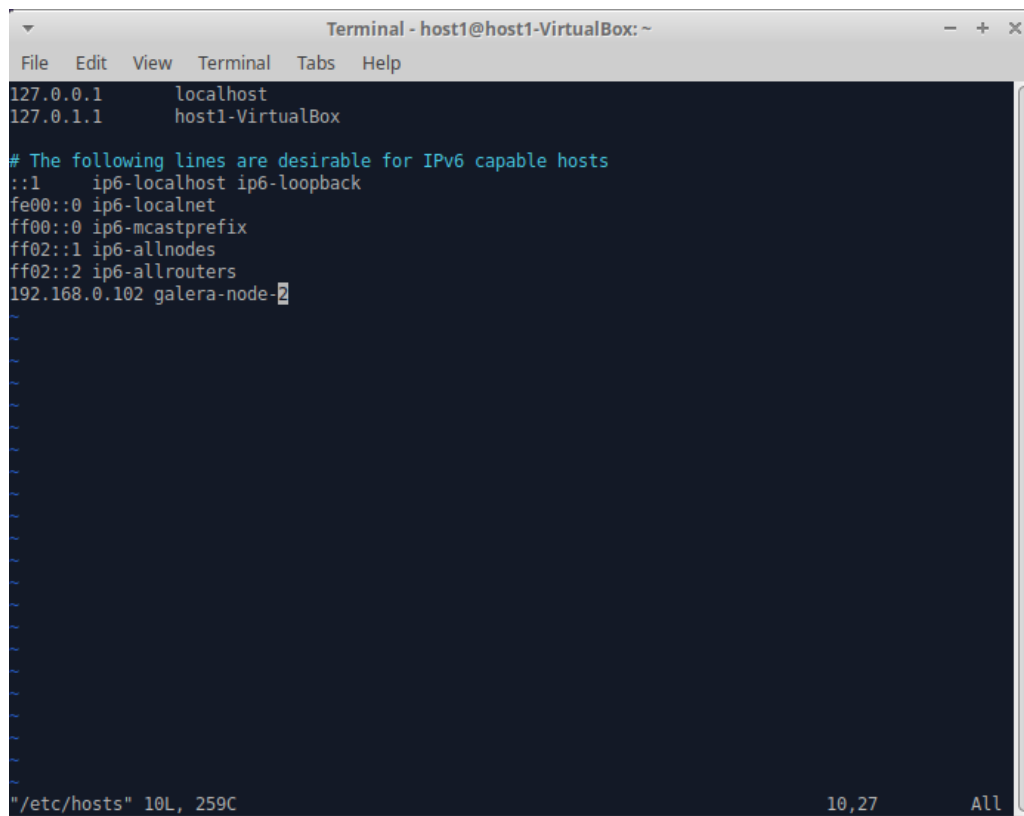
```

Terminal - host1@host1-VirtualBox: ~
File Edit View Terminal Tabs Help

host1@host1-VirtualBox:~$ sudo apt-get install haproxy
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  liblua5.3-0
Suggested packages:
  vim-haproxy haproxy-doc
The following NEW packages will be installed:
  haproxy liblua5.3-0
0 upgraded, 2 newly installed, 0 to remove and 155 not upgraded.
Need to get 1 635 kB of archives.
After this operation, 3 777 kB of additional disk space will be used.
Do you want to continue? [Y/n]
Get:1 http://ru.archive.ubuntu.com/ubuntu focal/main amd64 liblua5.3-0 amd64 5.3.3-1.1ubuntu2 [116 kB]
Get:2 http://ru.archive.ubuntu.com/ubuntu focal-updates/main amd64 haproxy amd64 2.0.13-2ubuntu0.3 [1 519 kB]
Fetched 1 635 kB in 1s (1 453 kB/s)
Selecting previously unselected package liblua5.3-0:amd64.
(Reading database ... 204935 files and directories currently installed.)
Preparing to unpack .../liblua5.3-0_5.3.3-1.1ubuntu2_amd64.deb ...
Unpacking liblua5.3-0:amd64 (5.3.3-1.1ubuntu2) ...
Selecting previously unselected package haproxy.
Preparing to unpack .../haproxy_2.0.13-2ubuntu0.3_amd64.deb ...
Unpacking haproxy (2.0.13-2ubuntu0.3) ...
Setting up liblua5.3-0:amd64 (5.3.3-1.1ubuntu2) ...
Setting up haproxy (2.0.13-2ubuntu0.3) ...
Created symlink /etc/systemd/system/multi-user.target.wants/haproxy.service → /lib/systemd/system/haproxy.service.
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for libc-bin (2.31-0ubuntu9.2) ...
Processing triggers for rsyslogd (8.2001.0-1ubuntu1.1) ...

```

Рис. 8- Установка HAProxy



```

Terminal - host1@host1-VirtualBox: ~
File Edit View Terminal Tabs Help

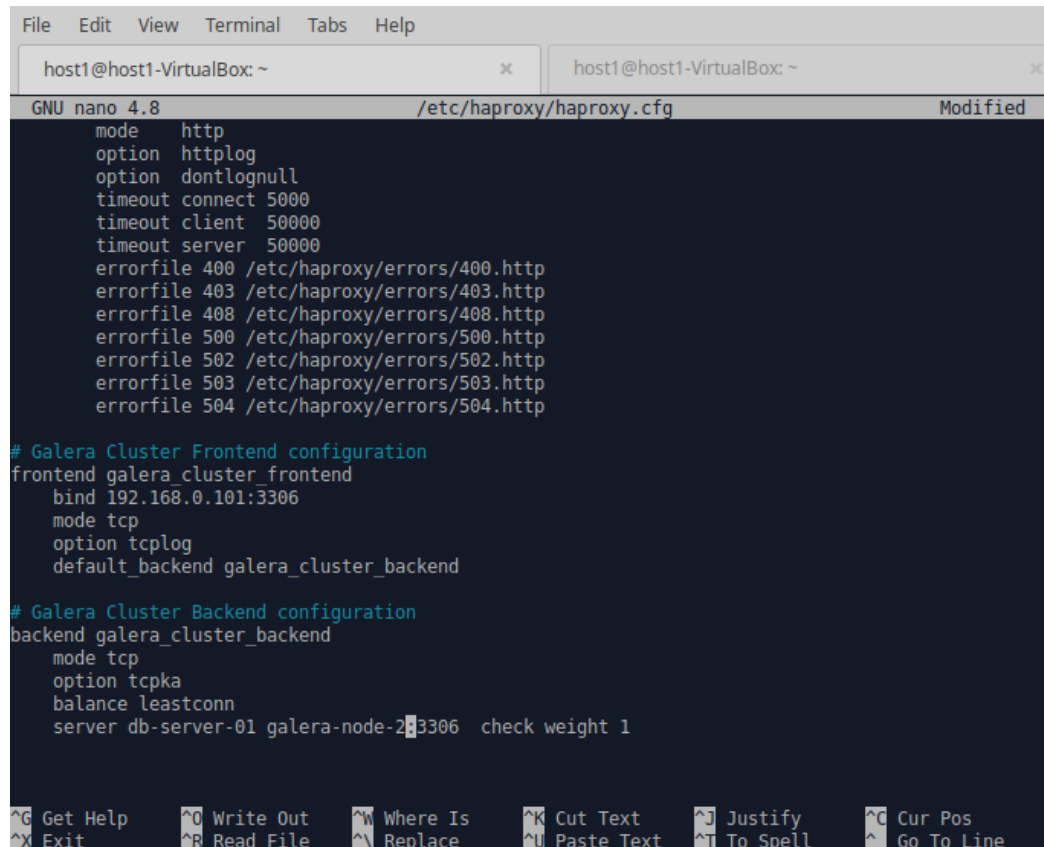
127.0.0.1    localhost
127.0.1.1    host1-VirtualBox

# The following lines are desirable for IPv6 capable hosts
::1        ip6-localhost ip6-loopback
fe00::0    ip6-localnet
ff00::0    ip6-mcastprefix
ff02::1    ip6-allnodes
ff02::2    ip6-allrouters
192.168.0.102 galera-node-2

"/etc/hosts" 10L, 259C
10,27 All

```

Рис. 9 - Редактирование файла /etc/hosts



```

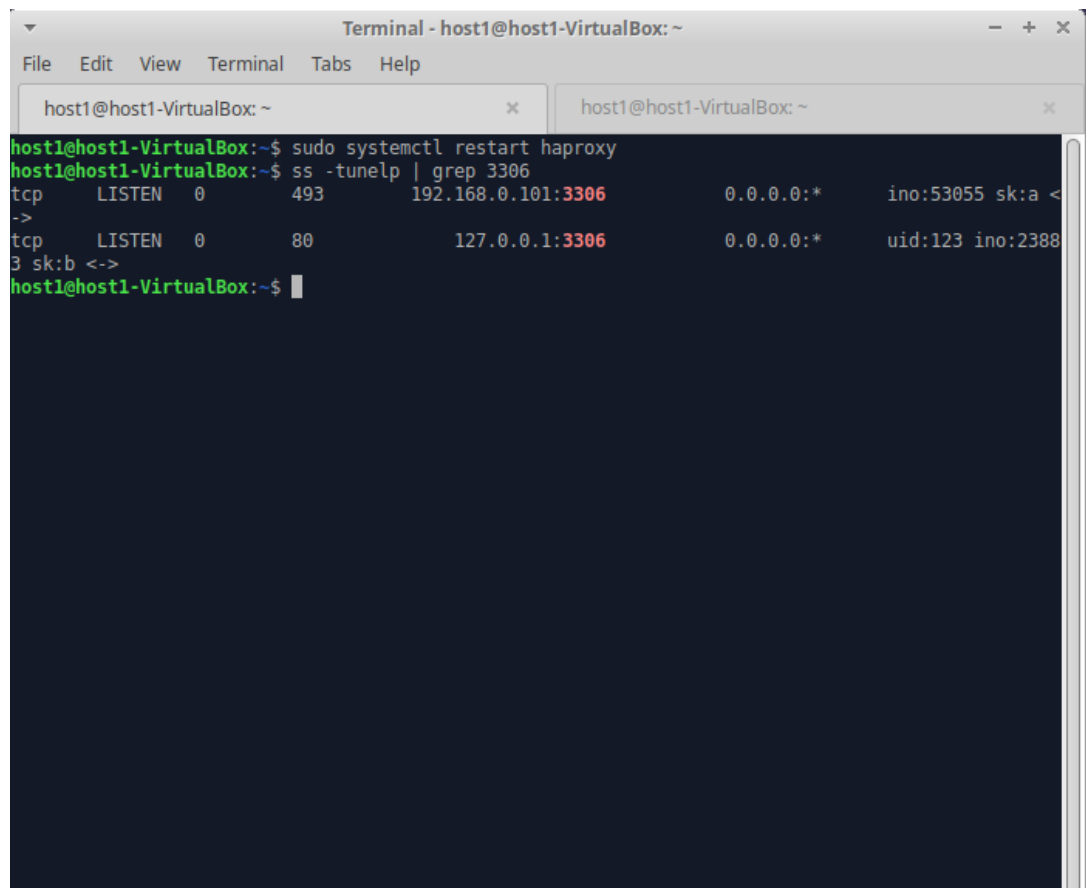
GNU nano 4.8 /etc/haproxy/haproxy.cfg Modified
mode http
option httplog
option dontlognull
timeout connect 5000
timeout client 50000
timeout server 50000
errorfile 400 /etc/haproxy/errors/400.http
errorfile 403 /etc/haproxy/errors/403.http
errorfile 408 /etc/haproxy/errors/408.http
errorfile 500 /etc/haproxy/errors/500.http
errorfile 502 /etc/haproxy/errors/502.http
errorfile 503 /etc/haproxy/errors/503.http
errorfile 504 /etc/haproxy/errors/504.http

# Galera Cluster Frontend configuration
frontend galera_cluster_frontend
  bind 192.168.0.101:3306
  mode tcp
  option tcplog
  default_backend galera_cluster_backend

# Galera Cluster Backend configuration
backend galera_cluster_backend
  mode tcp
  option tcpka
  balance leastconn
  server db-server-01 galera-node-2:3306 check weight 1

```

Рис. 10 - Конфигурация HAProxy



```

Terminal - host1@host1-VirtualBox: ~
host1@host1-VirtualBox: ~
host1@host1-VirtualBox:~$ sudo systemctl restart haproxy
host1@host1-VirtualBox:~$ ss -tunelp | grep 3306
tcp    LISTEN  0      493      192.168.0.101:3306      0.0.0.0:*    ino:53055 sk:a <
->
tcp    LISTEN  0      80       127.0.0.1:3306        0.0.0.0:*    uid:123 ino:2388
3 sk:b <->
host1@host1-VirtualBox:~$

```

Рис. 11 - Проверка HAProxy

Вывод

Создали простой кластер СУБД.