

PostgreSQL

Дано:

Две VM на yandex cloud.

Задание:

Настроить репликацию в PostgreSQL.

Виртуальные машины

Фильтр по имени

Все статусы

Все зоны доступности

<input type="checkbox"/>	Имя	Статус	ОС	Платформа	vCPU	Доля vCPU	RAM	Прерываемая	Размер дисков	Зона доступности	Внутренний IPv4	Публичный IPv4	Дата создания	Идентификатор	
<input type="checkbox"/>	replica	Running		Intel Ice Lake	2	50 %	2 ГБ	нет	13 ГБ	ru-central1-a	10.128.0.18	84.201.175.153	2022-09-02, в 09:38	fhngh4gnbnn6fp09gn7	...
<input type="checkbox"/>	master	Running		Intel Ice Lake	2	50 %	2 ГБ	нет	13 ГБ	ru-central1-a	10.128.0.29	84.201.159.88	2022-09-02, в 09:30	fhnqfkkvth52e4h382ea	...

Устанавливаем PostgreSQL на сервере master и задаем пароль пользователю postgres.

```
root@master: ~  
The database cluster will be initialized with locale "en_US.UTF-8".  
The default database encoding has accordingly been set to "UTF8".  
The default text search configuration will be set to "english".  
  
Data page checksums are disabled.  
  
fixing permissions on existing directory /var/lib/postgresql/10/main ... ok  
creating subdirectories ... ok  
selecting default max_connections ... 100  
selecting default shared_buffers ... 128MB  
selecting default timezone ... Etc/UTC  
selecting dynamic shared memory implementation ... posix  
creating configuration files ... ok  
running bootstrap script ... ok  
performing post-bootstrap initialization ... ok  
syncing data to disk ... ok  
  
Success. You can now start the database server using:  
  
    /usr/lib/postgresql/10/bin/pg_ctl -D /var/lib/postgresql/10/main -l logfile start  
  
Ver Cluster Port Status Owner    Data directory          Log file  
10  main    5432 down   postgres /var/lib/postgresql/10/main /var/log/postgresql/postgresql-10-main.log  
update-alternatives: using /usr/share/postgresql/10/man/man1/postmaster.1.gz to provide /usr/share/man/man1/postmaster.1.gz (postmaster.1.gz)  
in auto mode  
Setting up postgresql (10+190ubuntu0.1) ...  
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...  
Processing triggers for ureadahead (0.100.0-21) ...  
Processing triggers for libc-bin (2.27-3ubuntu1.6) ...  
Processing triggers for systemd (237-3ubuntu10.53) ...  
root@master:~# su - postgres  
postgres@master:~$ psql -c "ALTER ROLE postgres PASSWORD 'qweasdzxc'"  
ALTER ROLE  
postgres@master:~$ |
```

В /etc/postgresql/10/main/pg_hba.conf прописываем строку разрешающую подключаться к этому серверу с сервера replica. Указываем внутренний ip адрес сервера replica.

```
root@master: ~
GNU nano 2.9.3 /etc/postgresql/10/main/pg_hba.conf

# Database and user names containing spaces, commas, quotes and other
# special characters must be quoted.  Quoting one of the keywords
# "all", "sameuser", "samerole" or "replication" makes the name lose
# its special character, and just match a database or username with
# that name.
#
# This file is read on server startup and when the server receives a
# SIGHUP signal.  If you edit the file on a running system, you have to
# SIGHUP the server for the changes to take effect, run "pg_ctl reload",
# or execute "SELECT pg_reload_conf()".
#
# Put your actual configuration here
# -----
#
# If you want to allow non-local connections, you need to add more
# "host" records.  In that case you will also need to make PostgreSQL
# listen on a non-local interface via the listen_addresses
# configuration parameter, or via the -i or -h command line switches.
host    replication    postgres    10.128.0.18/32    md5

# DO NOT DISABLE!
# If you change this first entry you will need to make sure that the
# database superuser can access the database using some other method.
# Noninteractive access to all databases is required during automatic
# maintenance (custom daily cronjobs, replication, and similar tasks).
#

^G Get Help      ^O Write Out    ^W Where Is     ^K Cut Text     ^J Justify      ^C Cur Pos      M-U Undo        M-A Mark Text   M-] To Bracket
^X Exit          ^R Read File    ^\ Replace      ^U Uncut Text   ^T To Spell     ^_ Go To Line    M-E Redo        M-6 Copy Text   M-W WhereIs Next

root@master: ~                                     root@replica: ~
```

В файле /etc/postgresql/12/main/postgresql.conf указываем настройки репликации. Находим в нем параметры указанные в низу скриншота, раскомментируем их и подставляем свои значения.

```
root@master: ~
GNU nano 2.9.3 /etc/postgresql/10/main/postgresql.conf Modified

# CONFIG FILE INCLUDES
#-----

# These options allow settings to be loaded from files other than the
# default postgresql.conf. Note that these are directives, not variable
# assignments, so they can usefully be given more than once.

include_dir = 'conf.d'           # include files ending in '.conf' from
                                # a directory, e.g., 'conf.d'
#include_if_exists = '...'       # include file only if it exists
#include = '...'                 # include file

#-----
# CUSTOMIZED OPTIONS
#-----

# Add settings for extensions here

listen_addresses = 'localhost, 10.128.0.29'
wal_level = hot_standby
archive_mode = on
archive_command = 'cd .'
max_wal_senders = 8
hot_standby = on

^G Get Help    ^O Write Out   ^W Where Is    ^K Cut Text    ^J Justify     ^C Cur Pos     M-U Undo       M-A Mark Text   M-] To Bracket
^X Exit        ^R Read File   ^\ Replace     ^U Uncut Text  ^T To Spell    ^_ Go To Line   M-E Redo       M-6 Copy Text   M-W WhereIs Next

root@master: ~                                root@replica: ~
```

Создадим тестовую БД и таблицу на сервере master для имитации боевой среды.

```
root@master: ~
postgres@master:~$ psql
psql (10.22 (Ubuntu 10.22-0ubuntu0.18.04.1))
Type "help" for help.

postgres=# \l
                                List of databases
  Name      | Owner   | Encoding | Collate | Ctype   | Access privileges
-----+-----+-----+-----+-----+-----
 postgres   | postgres | UTF8      | en_US.UTF-8 | en_US.UTF-8 |
 template0  | postgres | UTF8      | en_US.UTF-8 | en_US.UTF-8 | =c/postgres      +
            |          |           |             |             | postgres=CTc/postgres
 template1  | postgres | UTF8      | en_US.UTF-8 | en_US.UTF-8 | =c/postgres      +
            |          |           |             |             | postgres=CTc/postgres
 testdb     | postgres | UTF8      | en_US.UTF-8 | en_US.UTF-8 |
(4 rows)

postgres=# \connect testdb;
You are now connected to database "testdb" as user "postgres".
testdb=# CREATE TABLE test_table (id INT, name TEXT);
CREATE TABLE
testdb=# INSERT INTO test_table (id, name) VALUES (1, 'test');
INSERT 0 1
testdb=# \dt
                List of relations
 Schema |   Name   | Type  | Owner
-----+-----+-----+-----
 public | test_table | table | postgres
(1 row)

testdb=# |
```

Устанавливаем PostgreSQL на сервере replica и задаем пароль пользователю postgres.

```
root@replica: ~  
  
Data page checksums are disabled.  
  
fixing permissions on existing directory /var/lib/postgresql/10/main ... ok  
creating subdirectories ... ok  
selecting default max_connections ... 100  
selecting default shared_buffers ... 128MB  
selecting default timezone ... Etc/UTC  
selecting dynamic shared memory implementation ... posix  
creating configuration files ... ok  
running bootstrap script ... ok  
performing post-bootstrap initialization ... ok  
syncing data to disk ... ok  
  
Success. You can now start the database server using:  
  
    /usr/lib/postgresql/10/bin/pg_ctl -D /var/lib/postgresql/10/main -l logfile start  
  
Ver Cluster Port Status Owner    Data directory          Log file  
10  main     5432  down   postgres /var/lib/postgresql/10/main /var/log/postgresql/postgresql-10-main.log  
update-alternatives: using /usr/share/postgresql/10/man/man1/postmaster.1.gz to provide /usr/share/man/man1/postmaster.1.gz (postmaster.1.gz)  
in auto mode  
Setting up postgresql (10+190ubuntu0.1) ...  
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...  
Processing triggers for ureadahead (0.100.0-21) ...  
Processing triggers for libc-bin (2.27-3ubuntu1.6) ...  
Processing triggers for systemd (237-3ubuntu10.53) ...  
root@replica:~# su - postgres  
postgres@replica:~$ psql -c "ALTER ROLE postgres PASSWORD 'qweasdzxc'"  
ALTER ROLE  
postgres@replica:~$ exit  
logout  
root@replica:~# |
```

root@master: ~

root@replica: ~

Останавливаем postgresQL.

В файл /etc/postgresql/10/main/pg_hba.conf добавляем строчку.

```
root@replica: ~
GNU nano 2.9.3 /etc/postgresql/10/main/pg_hba.conf Modified

local all postgres peer

# TYPE DATABASE USER ADDRESS METHOD

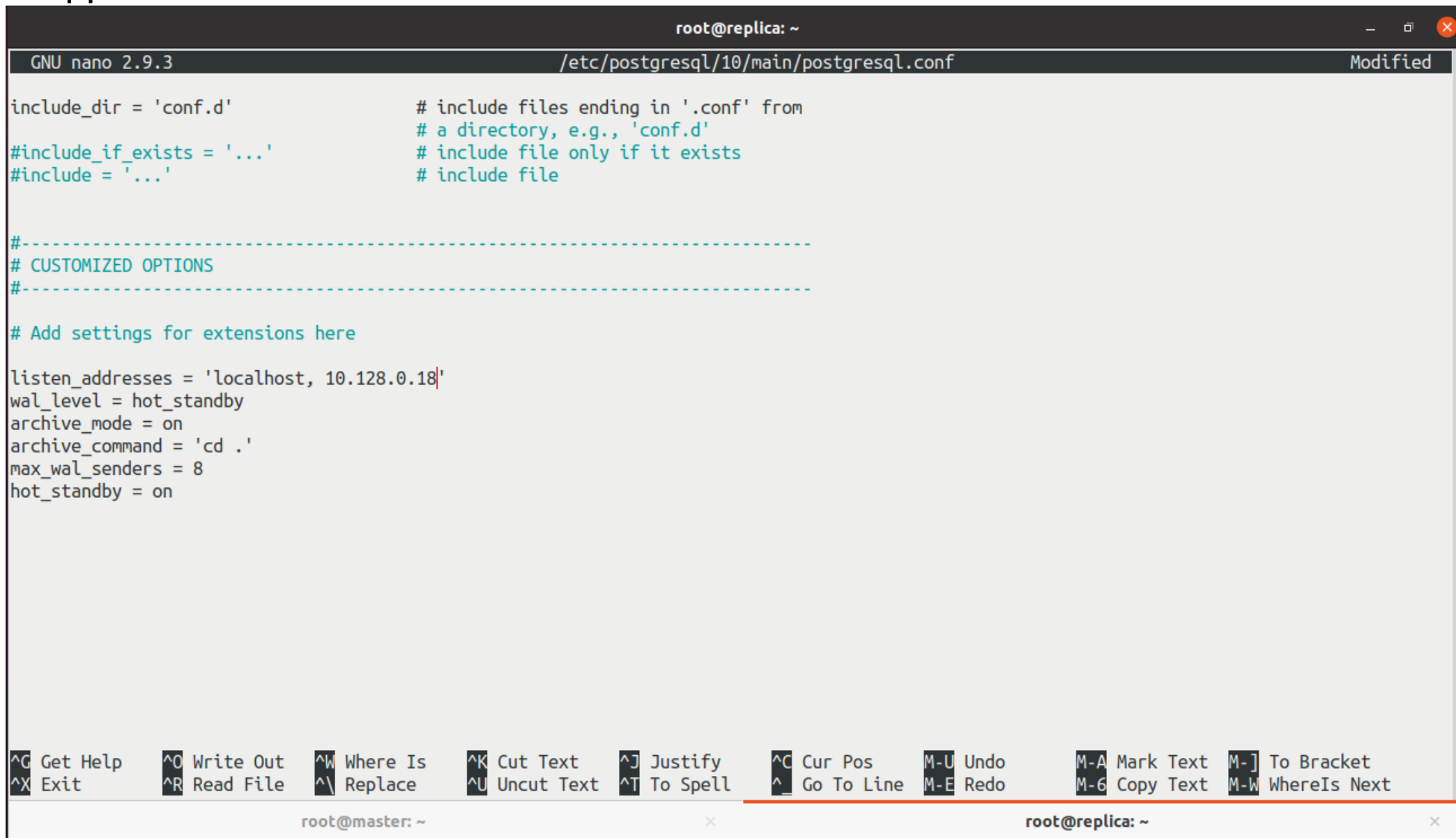
# "local" is for Unix domain socket connections only
local all all peer
# IPv4 local connections:
host all all 127.0.0.1/32 md5
# IPv6 local connections:
host all all ::1/128 md5
# Allow replication connections from localhost, by a user with the
# replication privilege.
local replication all peer
host replication all 127.0.0.1/32 md5
host replication all ::1/128 md5

#Master-replica
host replication postgres 10.128.0.29/32 md5

^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos M-U Undo M-A Mark Text M-] To Bracket
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell ^_ Go To Line M-E Redo M-6 Copy Text M-W WhereIs Next

root@master: ~ root@replica: ~
```


В файле /etc/postgresql/10/main/postgresql.conf находим в нем параметры указанные в низу скриншота, раскомментируем их и подставляем свои значения.



```
root@replica: ~
GNU nano 2.9.3 /etc/postgresql/10/main/postgresql.conf Modified

include_dir = 'conf.d'           # include files ending in '.conf' from
                                # a directory, e.g., 'conf.d'
#include_if_exists = '...'       # include file only if it exists
#include = '...'                 # include file

#-----
# CUSTOMIZED OPTIONS
#-----

# Add settings for extensions here

listen_addresses = 'localhost, 10.128.0.18'
wal_level = hot_standby
archive_mode = on
archive_command = 'cd .'
max_wal_senders = 8
hot_standby = on

^G Get Help  ^O Write Out  ^W Where Is   ^K Cut Text   ^J Justify    ^C Cur Pos    M-U Undo      M-A Mark Text  M-] To Bracket
^X Exit      ^R Read File  ^\ Replace    ^U Uncut Text ^T To Spell   ^_ Go To Line  M-E Redo      M-6 Copy Text  M-W WhereIs Next

root@master: ~ x root@replica: ~ x
```

На сервере replica удаляем каталог с дефолтной БД и создаем его пустым. Потом с помощью утилиты pg_basebackup создаем бэкап с сервера master и скачиваем его на сервер replica.

```
root@replica: ~
root@replica:~# su - postgres
postgres@replica:~$ cd /var/lib/postgresql/10/
postgres@replica:~/10$ rm -rf main
postgres@replica:~/10$ ls -al
total 8
drwxr-xr-x 2 postgres postgres 4096 Sep  2 07:48 .
drwxr-xr-x 3 postgres postgres 4096 Sep  2 06:48 ..
postgres@replica:~/10$ mkdir main
postgres@replica:~/10$ chmod go-rwx main
postgres@replica:~/10$ ls -al
total 12
drwxr-xr-x 3 postgres postgres 4096 Sep  2 07:50 .
drwxr-xr-x 3 postgres postgres 4096 Sep  2 06:48 ..
drwx----- 2 postgres postgres 4096 Sep  2 07:50 main
postgres@replica:~/10$ pg_basebackup -P -R -X stream -c fast -h 10.128.0.29 -U postgres -D ./main
Password:
31572/31572 kB (100%), 1/1 tablespace
postgres@replica:~/10$ ls -al main/ | grep recovery.conf
-rw-rw-r-- 1 postgres postgres 178 Sep  2 07:50 recovery.conf
postgres@replica:~/10$ exit
logout
root@replica:~# service postgresql start
root@replica:~#
```

Сейчас настройки серверов master и replica одинаковые и при необходимости реплика может становиться мастером. Наличие пустого файла recovery.conf ,который создается при выполнении команды pg_basebackup с параметром -R, будет означать что этот сервер replica.

```
root@master: ~
root@replica: ~
```

Для проверки репликации создаем таблицу на сервере master.



```
root@master: ~
root@master:~# su - postgres
postgres@master:~$ psql -c "CREATE TABLE test_replica (id INT, name TEXT);"
CREATE TABLE
postgres@master:~$ psql -c "INSERT INTO test_replica (id, name) VALUES (1, 'test');"
INSERT 0 1
postgres@master:~$ |
```

The image shows a terminal window titled 'root@master: ~'. The user switches to the 'postgres' user using 'su - postgres'. Then, they execute 'psql -c "CREATE TABLE test_replica (id INT, name TEXT);"', which returns 'CREATE TABLE'. Next, they execute 'psql -c "INSERT INTO test_replica (id, name) VALUES (1, 'test');"', which returns 'INSERT 0 1'. The prompt is now 'postgres@master:~\$ |'. At the bottom of the terminal, there are two tabs: 'root@master: ~' and 'root@replica: ~'.

Проверяем наличие таблицы на сервере replica.
Попытаемся создать таблицу на сервере replica.
Это не получается так как сервер настроен только на репликацию.

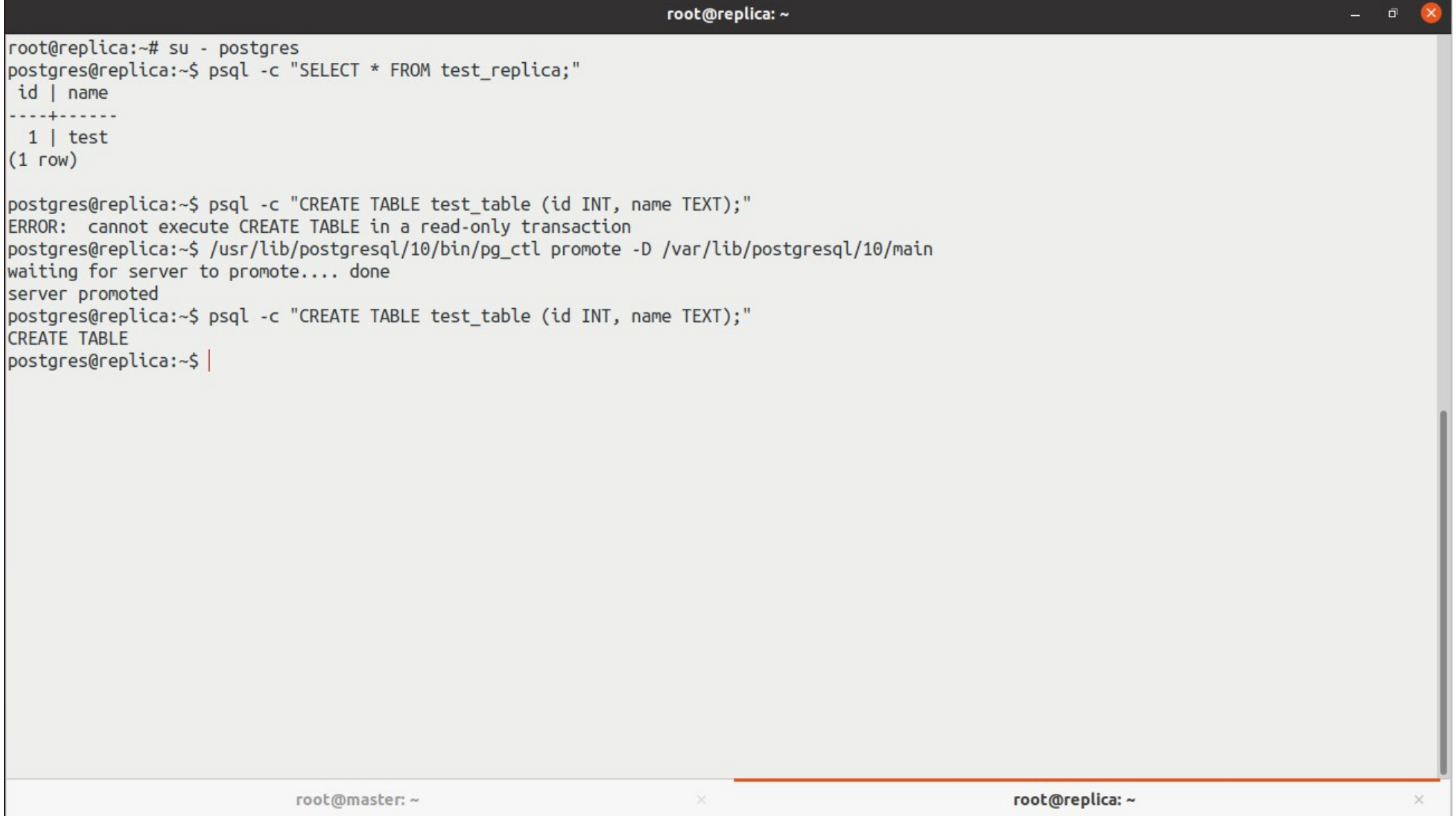


```
root@replica: ~  
root@replica:~# su - postgres  
postgres@replica:~$ psql -c "SELECT * FROM test_replica;"  
 id | name  
----+-----  
  1 | test  
(1 row)  
  
postgres@replica:~$ psql -c "CREATE TABLE test_table (id INT, name TEXT);"  
ERROR:  cannot execute CREATE TABLE in a read-only transaction  
postgres@replica:~$ |
```

The image shows a terminal window titled 'root@replica: ~'. The user switches to the 'postgres' user and runs a SQL query to select all data from a table named 'test_replica'. The output shows a single row with id 1 and name 'test'. Then, the user attempts to create a new table 'test_table' with columns 'id' (INT) and 'name' (TEXT). This results in an error: 'ERROR: cannot execute CREATE TABLE in a read-only transaction'. The terminal window is part of a larger desktop environment, with another window titled 'root@master: ~' visible at the bottom.

Имитируем останов сервера master и переводим сервер replica в режим записи.

Пытаемся создать таблицу и все удастся.



```
root@replica: ~
root@replica:~# su - postgres
postgres@replica:~$ psql -c "SELECT * FROM test_replica;"
 id | name
----+-----
  1 | test
(1 row)

postgres@replica:~$ psql -c "CREATE TABLE test_table (id INT, name TEXT);"
ERROR:  cannot execute CREATE TABLE in a read-only transaction
postgres@replica:~$ /usr/lib/postgresql/10/bin/pg_ctl promote -D /var/lib/postgresql/10/main
waiting for server to promote.... done
server promoted
postgres@replica:~$ psql -c "CREATE TABLE test_table (id INT, name TEXT);"
CREATE TABLE
postgres@replica:~$ |
```

The image shows a terminal window titled 'root@replica: ~'. The user switches to the 'postgres' user and runs a SQL query to select all data from 'test_replica', which returns one row with id 1 and name 'test'. Then, the user attempts to create a new table 'test_table', but receives an error: 'cannot execute CREATE TABLE in a read-only transaction'. To resolve this, the user runs 'pg_ctl promote' to switch the server to write mode. After the server is promoted, the 'CREATE TABLE' command succeeds without any errors. At the bottom of the terminal, there are two tabs: 'root@master: ~' and 'root@replica: ~', with the latter being the active window.