САНКТ-ПЕТЕРБУРГСКИЙ НАЦИОНАЛЬНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ ИТМО

Отчет по лабораторной работе №3

по дисциплине: “Администрирование компьютерных сетей”

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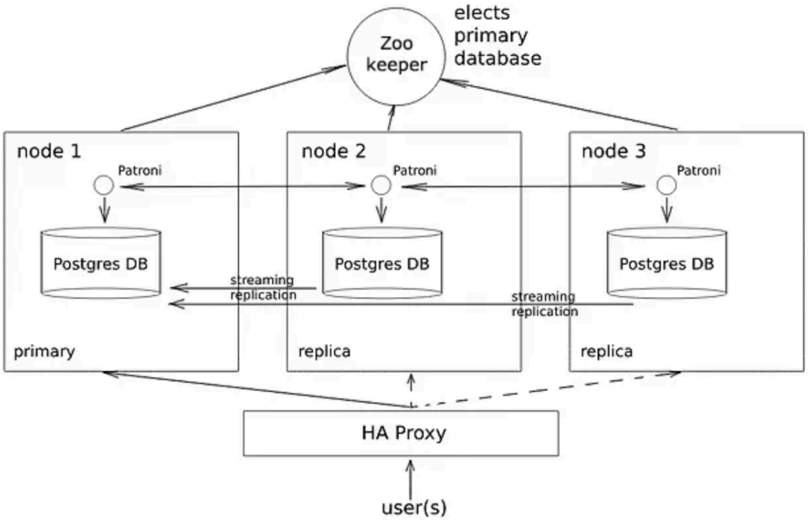
2024 г.

Задача

Развернуть и настроить высокодоступный кластер Postgres



Часть 1. Поднимаем Postgres

Подготавливаем Dockerfile для нашего постгреса. Подготавливаем compose файл, в котором описываем наш деплой постгреса. Так же добавляем в него Zookepeer, который нужен для непосредственного управления репликацией и определением “лидера” кластера. Создаем postgres0.yml и затем на основе него — postgres1.yml.

Деплоим с помощью команды docker-compose up -d:

```
 ⠿ zoo Pulled                                                                                  100.9s
   ⠿ 56f27190e824 Pull complete                                                                 16.2s
   ⠿ 8e70b9b9b078 Pull complete                                                                 95.6s
   ⠿ 732c9ebb730c Pull complete                                                                 95.7s
   ⠿ ed746366f1b8 Pull complete                                                                 95.8s
   ⠿ 10894799ccd9 Pull complete                                                                 95.9s
   ⠿ 8d377259558c Pull complete                                                                 96.3s
   ⠿ e7688095d1e6 Pull complete                                                                 96.3s
   ⠿ 8eab815b3593 Pull complete                                                                 96.4s
   ⠿ 00ded6dd259e Pull complete                                                                 96.4s
   ⠿ 296f622c8150 Pull complete                                                                 96.5s
   ⠿ 4ee3050cff6b Pull complete                                                                 96.6s
   ⠿ 98acab318002 Pull complete                                                                 98.1s
   ⠿ 878348106a95 Pull complete                                                                 98.1s
 ⠿ pg-slave Warning                                                                              0.5s
[+] Building 96.0s (10/10) FINISHED
 => [internal] load build definition from Dockerfile                                             0.0s
 => => transferring dockerfile: 888B                                                             0.0s
 => [internal] load .dockerignore                                                                0.0s
 => => transferring context: 2B                                                                  0.0s
 => [internal] load metadata for docker.io/library/postgres:15                                   0.0s
 => [1/5] FROM docker.io/library/postgres:15                                                     0.2s
 => [internal] load build context                                                                0.0s
 => => transferring context: 3.64kB                                                              0.0s
 => [2/5] RUN apt-get update -y &&     apt-get install -y netcat-openbsd python3-pip curl python3-psycopg2 python3-venv iputils-ping    67.0s
 => [3/5] RUN python3 -m venv /opt/patroni-venv &&     /opt/patroni-venv/bin/pip install --upgrade pip &&     /opt/patroni-venv/bin/pip install patroni[zookeeper] psycopg2-binary    25.8s
 => [4/5] COPY postgres0.yml /postgres0.yml                                                      0.0s
 => [5/5] COPY postgres1.yml /postgres1.yml                                                      0.0s
 => exporting to image                                                                           2.9s
 => => exporting layers                                                                          2.9s
 => => writing image sha256:93b83a1ed8970de0f4e67167ee07cd9ddee2d8928081cc711c0638af29fcb0c8     0.0s
 => => naming to localhost/postres:patroni                                                       0.0s

Use 'docker scan' to run Snyk tests against images to find vulnerabilities and learn how to fix them
[+] Running 6/6
 ⠿ Network lab-3_default     Created                                                             0.1s
 ⠿ Volume "lab-3_pg-slave"   Created                                                             0.0s
 ⠿ Volume "lab-3_pg-master"  Created                                                             0.0s
 ⠿ Container pg-slave        Started                                                             0.9s
 ⠿ Container zoo             Started                                                             0.9s
 ⠿ Container pg-master       Started                                                             0.9s
```

Проверяем в логах, что зукипер запустился:

```
mbp-alex:lab-3 alex$ docker ps
CONTAINER ID   IMAGE                          COMMAND                  CREATED         STATUS         PORTS                                        NAMES
daf59584fe5b   confluentinc/cp-zookeeper:7.7.1   "/etc/confluent/dock…"   3 minutes ago   Up 3 minutes   2888/tcp, 0.0.0.0:2181->2181/tcp, 3888/tcp   zoo
f201b58583c5   localhost/postres:patroni       "docker-entrypoint.s…"   3 minutes ago   Up 3 minutes   8008/tcp, 0.0.0.0:5433->5432/tcp             pg-master
ccb9022515fd   localhost/postres:patroni       "docker-entrypoint.s…"   3 minutes ago   Up 3 minutes   8008/tcp, 0.0.0.0:5434->5432/tcp             pg-slave
mbp-alex:lab-3 alex$
```

```
mbp-alex:lab-3 alex$ docker logs zoo
===> User
uid=1000(appuser) gid=1000(appuser) groups=1000(appuser)
===> Configuring ...
===> Running preflight checks ...
===> Check if /var/lib/zookeeper/data is writable ...
===> Check if /var/lib/zookeeper/log is writable ...
===> Launching ...
===> Launching zookeeper ...
[2024-12-16 21:16:54,530] INFO Reading configuration from: /etc/kafka/zookeeper.properties (org.apache.zookeeper.server.quorum.QuorumPeerConfig)
[2024-12-16 21:16:54,532] INFO clientPortAddress is 0.0.0.0:2181 (org.apache.zookeeper.server.quorum.QuorumPeerConfig)
[2024-12-16 21:16:54,533] INFO secureClientPort is not set (org.apache.zookeeper.server.quorum.QuorumPeerConfig)
[2024-12-16 21:16:54,533] INFO observerMasterPort is not set (org.apache.zookeeper.server.quorum.QuorumPeerConfig)
[2024-12-16 21:16:54,533] INFO metricsProvider.className is org.apache.zookeeper.metrics.impl.DefaultMetricsProvider (org.apache.zookeeper.server.quorum.QuorumPeerConfig)
[2024-12-16 21:16:54,534] INFO autopurge.snapRetainCount set to 3 (org.apache.zookeeper.server.DatadirCleanupManager)
[2024-12-16 21:16:54,534] INFO autopurge.purgeInterval set to 0 (org.apache.zookeeper.server.DatadirCleanupManager)
[2024-12-16 21:16:54,534] INFO Purge task is not scheduled. (org.apache.zookeeper.server.DatadirCleanupManager)
[2024-12-16 21:16:54,534] WARN Either no config or no quorum defined in config, running in standalone mode (org.apache.zookeeper.server.quorum.QuorumPeerMain)
[2024-12-16 21:16:54,536] INFO Log4j 1.2 jmx support not found; jmx disabled. (org.apache.zookeeper.jmx.ManagedUtil)
[2024-12-16 21:16:54,536] INFO Reading configuration from: /etc/kafka/zookeeper.properties (org.apache.zookeeper.server.quorum.QuorumPeerConfig)
[2024-12-16 21:16:54,537] INFO clientPortAddress is 0.0.0.0:2181 (org.apache.zookeeper.server.quorum.QuorumPeerConfig)
[2024-12-16 21:16:54,537] INFO secureClientPort is not set (org.apache.zookeeper.server.quorum.QuorumPeerConfig)
[2024-12-16 21:16:54,537] INFO observerMasterPort is not set (org.apache.zookeeper.server.quorum.QuorumPeerConfig)
[2024-12-16 21:16:54,537] INFO metricsProvider.className is org.apache.zookeeper.metrics.impl.DefaultMetricsProvider (org.apache.zookeeper.server.quorum.QuorumPeerConfig)
[2024-12-16 21:16:54,537] INFO Starting server (org.apache.zookeeper.server.ZooKeeperServerMain)
[2024-12-16 21:16:54,548] INFO ServerMetrics initialized with provider org.apache.zookeeper.metrics.impl.DefaultMetricsProvider@40e6dfe1 (org.apache.zookeeper.server.ServerMetrics)
[2024-12-16 21:16:54,550] INFO ACL digest algorithm is: SHA1 (org.apache.zookeeper.server.auth.DigestAuthenticationProvider)
[2024-12-16 21:16:54,551] INFO zookeeper.DigestAuthenticationProvider.enabled = true (org.apache.zookeeper.server.auth.DigestAuthenticationProvider)
[2024-12-16 21:16:54,553] INFO zookeeper.snapshot.trust.empty : false (org.apache.zookeeper.server.persistence.FileTxnSnapLog)
[2024-12-16 21:16:54,560] INFO  (org.apache.zookeeper.server.ZooKeeperServer)
[2024-12-16 21:16:54,561] INFO   ______                   _                                        (org.apache.zookeeper.server.ZooKeeperServer)
[2024-12-16 21:16:54,561] INFO  |___  /                  | |                                       (org.apache.zookeeper.server.ZooKeeperServer)
[2024-12-16 21:16:54,561] INFO     / /    ___     ___    | |__    ___     ___    _ __     ___    _ __    (org.apache.zookeeper.server.ZooKeeperServer)
[2024-12-16 21:16:54,561] INFO    / /    / _ \   / _ \   | |/ /   / _ \   / _ \  | '_ \   / _ \  | '__|  (org.apache.zookeeper.server.ZooKeeperServer)
[2024-12-16 21:16:54,561] INFO   / /__  | (_) | | (_) |  |   <   |  __/ |  __/  | |_) | |  __/  | |     (org.apache.zookeeper.server.ZooKeeperServer)
[2024-12-16 21:16:54,561] INFO  /_____|  \___/   \___/   |_|\_\   \___|  \___|  | .__/   \___|  |_|  (org.apache.zookeeper.server.ZooKeeperServer)
[2024-12-16 21:16:54,561] INFO                                                  | |                    (org.apache.zookeeper.server.ZooKeeperServer)
[2024-12-16 21:16:54,561] INFO                                                  |_|                    (org.apache.zookeeper.server.ZooKeeperServer)
[2024-12-16 21:16:54,561] INFO  (org.apache.zookeeper.server.ZooKeeperServer)
[2024-12-16 21:16:54,564] INFO Server environment:zookeeper.version=3.8.4-9316c2a7a97e1666d8f4593f34dd6fc36ecc436c, built on 2024-02-12 22:16 UTC (org.apache.zookeeper.server.ZooKeeperServer)
[2024-12-16 21:16:54,564] INFO Server environment:host.name=zoo (org.apache.zookeeper.server.ZooKeeperServer)
```

```
[2024-12-16 21:16:54,795] INFO Configuring NIO connection handler with 10s sessionless connection timeout, 2 selector thread(s), 16 worker threads, and 64 k
erver.NIOServerCnxnFactory)
[2024-12-16 21:16:54,796] INFO binding to port 0.0.0.0/0.0.0.0:2181 (org.apache.zookeeper.server.NIOServerCnxnFactory)
[2024-12-16 21:16:54,810] INFO Using org.apache.zookeeper.server.watch.WatchManager as watch manager (org.apache.zookeeper.server.watch.WatchManagerFactory)
[2024-12-16 21:16:54,810] INFO Using org.apache.zookeeper.server.watch.WatchManager as watch manager (org.apache.zookeeper.server.watch.WatchManagerFactory)
```

Проверяем в логах, что одна нода постгреса из двух стала лидером:

```
2024-12-16 21:17:07,638 INFO: Reaped pid=33, exit status=0
2024-12-16 21:17:07,639 INFO: Lock owner: postgresql1; I am postgresql0
2024-12-16 21:17:07,639 INFO: establishing a new patroni heartbeat connection to postgres
2024-12-16 21:17:07,667 INFO: no action. I am (postgresql0), a secondary, and following a leader (postgresql1)
2024-12-16 21:17:17,645 INFO: no action. I am (postgresql0), a secondary, and following a leader (postgresql1)
```

Часть 2. Проверяем репликацию

Подключились к pg-master:

```
mbp-alex:lab-3 alex$ psql -h localhost -p 5433 -U postgres -d postgres
Password for user postgres:
psql (14.15 (Homebrew), server 15.6 (Debian 15.6-1.pgdg120+2))
WARNING: psql major version 14, server major version 15.
         Some psql features might not work.
Type "help" for help.

postgres=# _
```

Создали таблицу и записали туда данные:

```
postgres=# CREATE TABLE test_table (
    id SERIAL PRIMARY KEY,
    data TEXT
);

INSERT INTO test_table (data) VALUES ('First row'), ('Second row');
CREATE TABLE
INSERT 0 2
postgres=#
```

Подключились ко второй ноде (реплике) и увидели, что создалась такая же таблица:

```
mbp-alex:lab-3 alex$ psql -h localhost -p 5433 -U postgres -d postgres
Password for user postgres:
psql (14.15 (Homebrew), server 15.6 (Debian 15.6-1.pgdg120+2))
WARNING: psql major version 14, server major version 15.
         Some psql features might not work.
Type "help" for help.

postgres=# SELECT * FROM test_table;
 id |    data
----+------------
  1 | First row
  2 | Second row
(2 rows)

postgres=#
```

Проверили режим read-only на реплике. Попробовали выполнить операции на реплике и получили ошибку:

```
postgres=# INSERT INTO test_table (data) VALUES ('New row');
ERROR:  cannot execute INSERT in a read-only transaction
postgres=#
```

Часть 3. Делаем высокую доступность

Добавили HAProxy в docker-compose.yml, создали файл haproxy.cfg, поменяли порт на 7001, так как 7000 уже использовался на компьютере. Затем перезапустили проект и проверили логи:

```
MacBook-Pro-Alex:lab-3 alex$ docker-compose up -d
[+] Running 4/4
 ⠿ Container pg-master           Started
 ⠿ Container zoo                 Started
 ⠿ Container pg-slave            Started
 ⠿ Container postgres_entrypoint  Started
MacBook-Pro-Alex:lab-3 alex$ docker ps
CONTAINER ID   IMAGE                            COMMAND                  CREATED         STATUS         PORTS                                                NAMES
6ef69d5d436e   haproxy:3.0                      "docker-entrypoint.s…"   7 minutes ago   Up 5 seconds   0.0.0.0:5432->5432/tcp, 0.0.0.0:7001->7000/tcp       postgres_entrypoint
f24a6657f457   confluentinc/cp-zookeeper:7.7.1  "/etc/confluent/dock…"   14 minutes ago  Up 6 seconds   2888/tcp, 0.0.0.0:2181->2181/tcp, 3888/tcp           zoo
135443a4cb55   localhost/postres:patroni         "docker-entrypoint.s…"   14 minutes ago  Up 6 seconds   8008/tcp, 0.0.0.0:5434->5432/tcp                     pg-slave
55e11efb4d8f   localhost/postres:patroni         "docker-entrypoint.s…"   14 minutes ago  Up 6 seconds   8008/tcp, 0.0.0.0:5433->5432/tcp                     pg-master
MacBook-Pro-Alex:lab-3 alex$
```

Логи pg-master:

```
2024-12-16 22:25:20.164 UTC [22] LOG:  received SIGHUP, reloading configuration files
server signaled
2024-12-16 22:25:20.164 UTC [22] LOG:  parameter "synchronous_standby_names" changed to "postgresql1"
2024-12-16 22:25:20.281 UTC [47] LOG:  standby "postgresql1" is now a synchronous standby with priority 1
2024-12-16 22:25:20.281 UTC [47] STATEMENT:  START_REPLICATION SLOT "postgresql1" 0/8000000 TIMELINE 5
2024-12-16 22:25:22,275 INFO: Synchronous standby status assigned to ['postgresql1']
2024-12-16 22:25:22,279 INFO: no action. I am (postgresql0), the leader with the lock
2024-12-16 22:25:30,164 INFO: no action. I am (postgresql0), the leader with the lock
2024-12-16 22:25:40,165 INFO: no action. I am (postgresql0), the leader with the lock
2024-12-16 22:25:50,160 INFO: no action. I am (postgresql0), the leader with the lock
2024-12-16 22:26:00,155 INFO: no action. I am (postgresql0), the leader with the lock
2024-12-16 22:26:10,164 INFO: no action. I am (postgresql0), the leader with the lock
2024-12-16 22:26:20,159 INFO: no action. I am (postgresql0), the leader with the lock
2024-12-16 22:26:30,155 INFO: no action. I am (postgresql0), the leader with the lock
2024-12-16 22:26:40,160 INFO: no action. I am (postgresql0), the leader with the lock
```

Логи zoo:

```
[2024-12-16 22:25:08,167] INFO Started AdminServer on address 0.0.0.0, port 8080 and command URL /command
[2024-12-16 22:25:08,171] INFO Using org.apache.zookeeper.server.NIOServerCnxnFactory as server connectio
[2024-12-16 22:25:08,171] WARN maxCnxns is not configured, using default value 0. (org.apache.zookeeper.s
[2024-12-16 22:25:08,173] INFO Configuring NIO connection handler with 10s sessionless connection timeout
erver.NIOServerCnxnFactory)
[2024-12-16 22:25:08,173] INFO binding to port 0.0.0.0/0.0.0.0:2181 (org.apache.zookeeper.server.NIOServe
[2024-12-16 22:25:08,184] INFO Using org.apache.zookeeper.server.watch.WatchManager as watch manager (org
[2024-12-16 22:25:08,184] INFO Using org.apache.zookeeper.server.watch.WatchManager as watch manager (org
[2024-12-16 22:25:08,184] INFO zookeeper.snapshotSizeFactor = 0.33 (org.apache.zookeeper.server.ZKDatabas
[2024-12-16 22:25:08,184] INFO zookeeper.commitLogCount=500 (org.apache.zookeeper.server.ZKDatabase)
[2024-12-16 22:25:08,186] INFO zookeeper.snapshot.compression.method = CHECKED (org.apache.zookeeper.serv
[2024-12-16 22:25:08,187] INFO Reading snapshot /var/lib/zookeeper/data/version-2/snapshot.35 (org.apache
[2024-12-16 22:25:08,190] INFO The digest in the snapshot has digest version of 2, with zxid as 0x35, and
[2024-12-16 22:25:08,202] INFO 32 txns loaded in 8 ms (org.apache.zookeeper.server.persistence.FileTxnSna
[2024-12-16 22:25:08,202] INFO Snapshot loaded in 17 ms, highest zxid is 0x55, digest is 29968604713 (org
```

Логи haproxy:

```
[NOTICE]   (1) : New worker (8) forked
[NOTICE]   (1) : Loading success.
[WARNING]  (8) : Server postgres/postgresql_pg_master_5432 is DOWN, reason: Layer4 connection p
s active, 0 requeued, 0 remaining in queue.
[WARNING]  (8) : Server postgres/postgresql_pg_slave_5432 is DOWN, reason: Layer4 connection pr
 active, 0 requeued, 0 remaining in queue.
[ALERT]    (8) : proxy 'postgres' has no server available!
[WARNING]  (8) : Server postgres/postgresql_pg_master_5432 is UP, reason: Layer7 check passed,
queue.
MacBook-Pro-Alex:lab-3 alex$
```

Подключаемся к новой базе данных и проверяем, что подключение успешное. Вернулось значение f, значит сервер не находится в режиме восстановления и является мастером.

```
MacBook-Pro-Alex:lab-3 alex$ psql -h localhost -p 5432 -U postgres -d postgres
psql (14.15 (Homebrew), server 15.4)
WARNING: psql major version 14, server major version 15.
         Some psql features might not work.
Type "help" for help.

postgres=# SELECT pg_is_in_recovery();
 pg_is_in_recovery
-------------------
 f
(1 row)

postgres=#
```

Задание:

Отключили доступ до ноды, которая сейчас является мастером и проанализировали логи:

```
MacBook-Pro-Alex:lab-3 alex$ docker stop pg-master
pg-master
MacBook-Pro-Alex:lab-3 alex$ docker logs pg-slave
```

По выделенным логам видно, что был получен отказ в соединении с pg-master и что новый мастер - pg-slave готов взаимодействовать.

```
2024-12-16 23:01:20,339 INFO: no action. I am (postgresql1), a secondary, and following a leader (postgresql0)
2024-12-16 23:01:30,337 INFO: no action. I am (postgresql1), a secondary, and following a leader (postgresql0)
2024-12-16 23:01:40,338 INFO: no action. I am (postgresql1), a secondary, and following a leader (postgresql0)
2024-12-16 23:01:50,340 INFO: no action. I am (postgresql1), a secondary, and following a leader (postgresql0)
2024-12-16 23:02:00,336 INFO: no action. I am (postgresql1), a secondary, and following a leader (postgresql0)
2024-12-16 23:02:10,390 INFO: no action. I am (postgresql1), a secondary, and following a leader (postgresql0)
2024-12-16 23:02:13.054 UTC [653] FATAL:  could not receive data from WAL stream: server closed the connection unexpectedly
        This probably means the server terminated abnormally
        before or while processing the request.
2024-12-16 23:02:13.060 UTC [734] FATAL:  could not connect to the primary server: connection to server at "pg-master" (172.21.0.4), port 5432 failed: Connection refused
        Is the server running on that host and accepting TCP/IP connections?
2024-12-16 23:02:13.060 UTC [29] LOG:  waiting for WAL to become available at 0/9000018
2024-12-16 23:02:18.235 UTC [736] FATAL:  could not connect to the primary server: could not translate host name "pg-master" to address: Name or service not known
2024-12-16 23:02:18.235 UTC [29] LOG:  waiting for WAL to become available at 0/9000018
2024-12-16 23:02:20,340 INFO: no action. I am (postgresql1), a secondary, and following a leader (postgresql0)
2024-12-16 23:02:23.073 UTC [739] FATAL:  could not connect to the primary server: could not translate host name "pg-master" to address: Name or service not known
2024-12-16 23:02:23.073 UTC [29] LOG:  waiting for WAL to become available at 0/9000018
```

```
2024-12-16 22:12:52.839 UTC [29] LOG:  waiting for WAL to become available at 0/60000B8
2024-12-16 22:12:52,978 WARNING: Request failed to postgresql1: GET http://pg-slave:8008/patroni (HTTPConnectionPool(host='p
NewConnectionError('<urllib3.connection.HTTPConnection object at 0x7ffa40d25ed0>: Failed to establish a new connection: [Err
2024-12-16 22:12:52,997 INFO: promoted self to leader by acquiring session lock
server promoting
2024-12-16 22:12:52.998 UTC [29] LOG:  received promote request
2024-12-16 22:12:52.998 UTC [29] LOG:  redo done at 0/6000028 system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 30.1
```

```
2024-12-16 22:12:53.001 UTC [29] LOG:  selected new timeline ID: 3
2024-12-16 22:12:53.039 UTC [29] LOG:  archive recovery complete
2024-12-16 22:12:53.042 UTC [27] LOG:  checkpoint starting: force
2024-12-16 22:12:53.045 UTC [25] LOG:  database system is ready to accept connections
2024-12-16 22:12:53.054 UTC [27] LOG:  checkpoint complete: wrote 3 buffers (0.0%); 0 WAL file(s) added, 0 removed, 0 recycl
01 s, average=0.001 s; distance=32581 kB, estimate=32581 kB
2024-12-16 22:12:54,019 INFO: Lock owner: postgresql0; I am postgresql0
```

Переключили haproxy на нового мастера, проверили, что создание таблицы и запись данных в неё поддерживаются. В итоге после принудительного отключения patroni обеспечил переключение на репликацию.

```
MacBook-Pro-Alex:lab-3 alex$ psql -h localhost -p 5432 -U postgres -d postgres
psql (14.15 (Homebrew), server 15.4)
WARNING: psql major version 14, server major version 15.
         Some psql features might not work.
Type "help" for help.

postgres=# SELECT pg_is_in_recovery();
 pg_is_in_recovery
-------------------
 f
(1 row)
```

```
postgres=# CREATE TABLE test_table (
    id SERIAL PRIMARY KEY,
    data TEXT
);

INSERT INTO test_table (data) VALUES ('First row'), ('Second row');
CREATE TABLE
INSERT 0 2
postgres=# SELECT * FROM test_table;
 id |    data
----+------------
  1 | First row
  2 | Second row
(2 rows)

postgres=#
```

Ответы на вопросы:

1. *Порты 8008 и 5432 вынесены в разные директивы, expose и ports. По сути, если записать 8008 в ports, то он тоже станет exposed. В чем разница?*

Expose: просто указывает, что контейнер использует порт, но не делает его доступным для внешнего мира.

Ports: пробрасывает порт контейнера на хост, делая его доступным для внешних expose.

Expose — это только документация, а ports — это настройка доступности порта для внешнего мира.

2. *При обычном перезапуске композ-проекта, будет ли сбилден заново образ? А если предварительно отредактировать файлы postgresX.yml? А если содержимое самого Dockerfile? Почему?*

При выполнении команды `docker-compose up` используются уже существующие образы. Пересборка образов происходит только при указании флага `--build` или если необходимого образа нет в локальном хранилище. Docker проверяет наличие образов, указанных в `docker-compose.yml`, и, если они существуют, запускает контейнеры на их основе.

При изменении файлов конфигурации образы не пересобираются. Файлы конфигураций описывают конфигурацию запуска контейнеров, но не содержат инструкций для сборки образов. Если образы уже существуют, Docker использует их без изменений. Перезапуск проекта с помощью `docker-compose up` просто переопределяет параметры запуска контейнеров на основе обновленной конфигурации.

Если внесены изменения в `Dockerfile`, образы пересобираются только при явном указании: флага `--build` при запуске или при ручной пересборке образа командой `docker-compose up build.`

`Dockerfile` содержит инструкции для создания образов, но Docker не отслеживает изменения в файле автоматически. Чтобы применить изменения, необходимо вручную запустить процесс пересборки образа.