Lab 8 - sprawozdanie

Wojciech Przybytek, Dariusz Piwowarski

Wprowadzenie

Stworzono serwer `test_db` w katalogu `/tmp`

```
postgres@b266e31efaed:/usr/lib/postgresql/14/bin$ ./initdb -D /tmp/test_db
The files belonging to this database system will be owned by user "postgres".
This user must also own the server process.

The database cluster will be initialized with locale "en_US.utf8".
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.

creating directory /tmp/test_db ... ok
creating subdirectories ... ok
selecting dynamic shared memory implementation ... posix
selecting default max_connections ... 100
selecting default shared_buffers ... 128MB
selecting default time zone ... Etc/UTC
creating configuration files ... ok
running bootstrap script ... ok
performing post-bootstrap initialization ... ok
syncing data to disk ... ok

initdb: warning: enabling "trust" authentication for local connections
You can change this by editing pg_hba.conf or using the option -A, or
--auth-local and --auth-host, the next time you run initdb.

Success. You can now start the database server using:

    ./pg_ctl -D /tmp/test_db -l logfile start
```

Zmieniono port serwera na `5440`

```
58  # - Connection Settings -
59
60  listen_addresses = '*'
61                     # comma-separated list of addresses;
62                     # defaults to 'localhost'; use '*' for all
63                     # (change requires restart)
64  port = 5440            # (change requires restart)
```

Uruchomiono serwer

```
postgres@b266e31efaed:/usr/lib/postgresql/14/bin$ ./pg_ctl -D /tmp/test_db -l /tmp
/test_db_logfile start
waiting for server to start.... done
server started
```

Połączono się do serwera do bazy `postgres` i utworzono tabelę `tbl`

```
postgres@b266e31efaed:/usr/lib/postgresql/14/bin$ psql -p 5440 -d postgres
psql (14.1 (Debian 14.1-1.pgdg110+1))
Type "help" for help.

postgres=# create table tbl(id int primary key, name varchar);
CREATE TABLE
postgres=# \d tbl
                    Table "public.tbl"
 Column |       Type        | Collation | Nullable | Default
--------+-------------------+-----------+----------+---------
 id     | integer           |           | not null |
 name   | character varying |           |          |
Indexes:
    "tbl_pkey" PRIMARY KEY, btree (id)
```

Do tabeli dodano 4 testowe rekordy

```
postgres=# insert into tbl values(1, 'roman');
INSERT 0 1
postgres=# insert into tbl values(2, 'toman');
INSERT 0 1
postgres=# insert into tbl values(3, 'koman');
INSERT 0 1
postgres=# insert into tbl values(4, 'loman');
INSERT 0 1
postgres=# select * from tbl;
 id | name
----+-------
  1 | roman
  2 | toman
  3 | koman
  4 | loman
(4 rows)
```

Usunięto rekordy o id mniejszym od 3, a następnie wszystkie rekordy

```
postgres=# delete from tbl where id < 3;
DELETE 2
postgres=# select * from tbl;
 id | name
----+-------
  3 | koman
  4 | loman
(2 rows)

postgres=# truncate tbl;
TRUNCATE TABLE
postgres=# select * from tbl;
 id | name
----+------
(0 rows)
```

Usunięto tabelę `tbl`

```
postgres=# drop table tbl;
DROP TABLE
postgres=# \d tbl;
Did not find any relation named "tbl".
```

Zatrzymano instancję serwera

```
postgres@b266e31efaed:/usr/lib/postgresql/14/bin$ ./pg_ctl -D /tmp/test_db -l /tmp
/test_db_logfile stop
waiting for server to shut down.... done
server stopped
```

Przebieg ćwiczenia

Utworzono i uruchomiono serwer `primary_db` na porcie `5433` , który nasłuchuje na połączenia z dowolnego adresu

```
postgres@b266e31efaed:/usr/lib/postgresql/14/bin$ cat /tmp/primary_db_logfile
2024-04-29 17:30:02.204 UTC [296] LOG:  starting PostgreSQL 14.1 (Debian 14.1-1.pgdg110+1) on x86_64-pc-linux-gnu, compiled by gcc (Debian 10.2.1-6) 10.2.1 20210110, 64-bit
2024-04-29 17:30:02.204 UTC [296] LOG:  listening on IPv4 address "0.0.0.0", port 5433
2024-04-29 17:30:02.204 UTC [296] LOG:  listening on IPv6 address "::", port 5433
2024-04-29 17:30:02.206 UTC [296] LOG:  listening on Unix socket "/var/run/postgresql/.s.PGSQL.5433"
2024-04-29 17:30:02.211 UTC [297] LOG:  database system was shut down at 2024-04-29 17:26:46 UTC
2024-04-29 17:30:02.216 UTC [296] LOG:  database system is ready to accept connections
```

Stworzono użytkownika `repuser` z flagą `replication`

```
postgres=# create user repuser with replication
postgres-# ;
CREATE ROLE
```

Umożliwiono użytkownikowi `repuser` łączenie się z serwerem z maszyny localhost w pliku `pg_hba.conf`

```
# TYPE  DATABASE        USER            ADDRESS                 METHOD

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

Utworzono replikę serwera o nazwie `replica_db`

```
postgres@b266e31efaed:/usr/lib/postgresql/14/bin$ pg_basebackup -h localhost -U repuser -p 5433 -D /tmp/replica_db -R -C --slot slot_name --checkpoint fast
postgres@b266e31efaed:/usr/lib/postgresql/14/bin$ ls /tmp/replica_db/
backup_label     global        pg_hba.conf    pg_multixact  pg_serial     pg_stat_tmp  pg_twophase  pg_xact               standby.signal
backup_manifest  pg_commit_ts  pg_ident.conf  pg_notify     pg_snapshots  pg_subtrans  PG_VERSION   postgresql.auto.conf
base             pg_dynshmem   pg_logical     pg_replslot   pg_stat       pg_tblspc    pg_wal       postgresql.conf
```

```
postgres@b266e31efaed:/usr/lib/postgresql/14/bin$ cat /tmp/replica_db/postgresql.auto.conf
# Do not edit this file manually!
# It will be overwritten by the ALTER SYSTEM command.
primary_conninfo = 'user=repuser passfile=''/var/lib/postgresql/.pgpass'' channel_binding=prefer host=localhost port=5433 sslmode=prefer sslcompression=0 sslsni=1 ssl_min_pro
tocol_version=TLSv1.2 gssencmode=prefer krbsrvname=postgres target_session_attrs=any'
primary_slot_name = 'slot_name'
```

Uruchomiono replikę na porcie `5434`

```
postgres@b266e31efaed:/usr/lib/postgresql/14/bin$ cat /tmp/replica_db_logfile
2024-04-29 17:52:03.165 UTC [376] LOG:  starting PostgreSQL 14.1 (Debian 14.1-1.pgdg110+1) on x86_64-pc-linux-gnu, compiled by gcc (Debian 10.2.1-6) 10.2.1 20210110, 64-bit
2024-04-29 17:52:03.165 UTC [376] LOG:  listening on IPv4 address "0.0.0.0", port 5434
2024-04-29 17:52:03.165 UTC [376] LOG:  listening on IPv6 address "::", port 5434
2024-04-29 17:52:03.168 UTC [376] LOG:  listening on Unix socket "/var/run/postgresql/.s.PGSQL.5434"
2024-04-29 17:52:03.172 UTC [377] LOG:  database system was interrupted; last known up at 2024-04-29 17:48:03 UTC
2024-04-29 17:52:03.269 UTC [377] LOG:  entering standby mode
2024-04-29 17:52:03.272 UTC [377] LOG:  redo starts at 0/2000028
2024-04-29 17:52:03.273 UTC [377] LOG:  consistent recovery state reached at 0/2000100
2024-04-29 17:52:03.273 UTC [376] LOG:  database system is ready to accept read-only connections
2024-04-29 17:52:03.279 UTC [381] LOG:  started streaming WAL from primary at 0/3000000 on timeline 1
```

```
postgres=# select * from pg_stat_replication;
 pid | usesysid | usename | application_name | client_addr | client_hostname | client_port |         backend_start         | backend_xmin |   state   | sent_lsn  | write_lsn
| flush_lsn | replay_lsn | write_lag | flush_lag | replay_lag | sync_priority | sync_state |          reply_time
-----+----------+---------+------------------+-------------+-----------------+-------------+-------------------------------+--------------+-----------+-----------+-----------
+-----------+------------+-----------+-----------+------------+---------------+------------+-------------------------------
 382 |    16384 | repuser | walreceiver      | 127.0.0.1   |                 |       37626 | 2024-04-29 17:52:03.277078+00 |              | streaming | 0/3000148 | 0/3000148
| 0/3000148 | 0/3000148  |           |           |            |             0 | async      | 2024-04-29 17:55:09.342455+00
(1 row)
```

```
postgres=# select * from pg_stat_wal_receiver;
 pid |  status   | receive_start_lsn | receive_start_tli | written_lsn | flushed_lsn | received_tli |      last_msg_send_time       |     last_msg_receipt_time     | latest_e
nd_lsn |       latest_end_time       | slot_name | sender_host | sender_port |
                                              conninfo

-----+-----------+-------------------+-------------------+-------------+-------------+--------------+-------------------------------+-------------------------------+---------
-------+-----------------------------+-----------+-------------+-------------+-------------------------------------------------------------------------------------------
----------------------------------------------------------------------------------------------------------------------------------------------------------------------------
----------------------
 381 | streaming | 0/3000000         |                 1 | 0/3000148   | 0/3000148   |            1 | 2024-04-29 17:56:09.539512+00 | 2024-04-29 17:56:09.539635+00 | 0/300014
8      | 2024-04-29 17:53:09.0098+00 | slot_name | localhost   |        5433 | user=repuser passfile=/var/lib/postgresql/.pgpass channel_binding=prefer dbname=replication hos
t=localhost port=5433 fallback_application_name=walreceiver sslmode=prefer sslcompression=0 sslsni=1 ssl_min_protocol_version=TLSv1.2 gssencmode=prefer krbsrvname=postgres ta
rget_session_attrs=any
(1 row)
```

Na serwerze primary utworzono tabelę `tbl` i dodano do niej przykładowe rekordy

```
postgres=# create table tbl(id int primary key, name varchar);
CREATE TABLE
postgres=# insert into tbl values(1, 'woman');
INSERT 0 1
postgres=# insert into tbl values(2, 'poman');
INSERT 0 1
postgres=# insert into tbl values(3, 'joman');
INSERT 0 1
postgres=# select * from tbl;
 id | name
----+-------
  1 | woman
  2 | poman
  3 | joman
(3 rows)
```

Na serwerze backup pojawiła się jej replika

```
postgres=# \d
        List of relations
 Schema | Name | Type  |  Owner
--------+------+-------+----------
 public | tbl  | table | postgres
(1 row)

postgres=# select * from tbl;
 id | name
----+-------
  1 | woman
  2 | poman
  3 | joman
(3 rows)
```

Przetestowano działanie operacji `DELETE` na tabeli na serwerze primary i sprawdzono ponownie tabelę na replice

```
postgres=# delete from tbl where id < 2;
DELETE 1
postgres=# select * from tbl;
 id | name
----+-------
  2 | poman
  3 | joman
(2 rows)
```

```
postgres=# select * from tbl;
 id | name
----+-------
  2 | poman
  3 | joman
(2 rows)
```

To samo przetestowano dla operacji `TRUNCATE`

```
postgres=# truncate table tbl;
TRUNCATE TABLE
postgres=# select * from tbl;
 id | name
----+------
(0 rows)
```

```
postgres=# select * from tbl;
 id | name
----+------
(0 rows)
```

Zatrzymano instancję primary

```
postgres@b266e31efaed:/usr/lib/postgresql/14/bin$ pg_ctl -D /tmp/primary_db -l /tmp/primary
_db_logfile stop
waiting for server to shut down.... done
server stopped
```

Wykonano ręcznego failovera i wypromowano serwer repliki na nowego mastera, a następnie przetestowano jej działanie

```
postgres@b266e31efaed:/$ pg_ctl -D /tmp/replica_db -l /tmp/replica_db_logfile promote
waiting for server to promote.... done
server promoted
postgres@b266e31efaed:/$ psql -p 5434 -d postgres
psql (14.1 (Debian 14.1-1.pgdg110+1))
Type "help" for help.

postgres=# insert into tbl values(4, 'moman');
INSERT 0 1
```

Zadanie domowe

Dla `primary_db` stworzono multi standby setup z 3 innymi serwerami

```
postgres=# select * from pg_stat_replication;
-[ RECORD 1 ]----+------------------------------
pid              | 793
usesysid         | 16384
usename          | repuser
application_name | walreceiver
client_addr      | 127.0.0.1
client_hostname  |
client_port      | 34638
backend_start    | 2024-05-06 17:42:41.592295+00
backend_xmin     |
state            | streaming
sent_lsn         | 0/6000060
write_lsn        | 0/6000060
flush_lsn        | 0/6000060
replay_lsn       | 0/6000060
write_lag        |
flush_lag        |
replay_lag       |
sync_priority    | 0
sync_state       | async
reply_time       | 2024-05-06 17:43:31.813636+00
-[ RECORD 2 ]----+------------------------------
pid              | 803
usesysid         | 16384
usename          | repuser
application_name | walreceiver
client_addr      | 127.0.0.1
client_hostname  |
client_port      | 36550
backend_start    | 2024-05-06 17:42:51.485143+00
backend_xmin     |
state            | streaming
sent_lsn         | 0/6000060
write_lsn        | 0/6000060
flush_lsn        | 0/6000060
replay_lsn       | 0/6000060
write_lag        |
flush_lag        |
replay_lag       |
sync_priority    | 0
sync_state       | async
reply_time       | 2024-05-06 17:43:31.638602+00
```

```
-[ RECORD 3 ]----+-----------------------------
pid              | 814
usesysid         | 16384
usename          | repuser
application_name | walreceiver
client_addr      | 127.0.0.1
client_hostname  |
client_port      | 32780
backend_start    | 2024-05-06 17:42:59.437685+00
backend_xmin     |
state            | streaming
sent_lsn         | 0/6000060
write_lsn        | 0/6000060
flush_lsn        | 0/6000060
replay_lsn       | 0/6000060
write_lag        |
flush_lag        |
replay_lag       |
sync_priority    | 0
sync_state       | async
reply_time       | 2024-05-06 17:43:29.458639+00
```

Oraz kaskadową replikację dla z 3 serwerami

```
-[ RECORD 4 ]----+-----------------------------
pid              | 870
usesysid         | 16384
usename          | repuser
application_name | walreceiver
client_addr      | 127.0.0.1
client_hostname  |
client_port      | 53786
backend_start    | 2024-05-06 17:48:27.774289+00
backend_xmin     |
state            | streaming
sent_lsn         | 0/8000060
write_lsn        | 0/8000060
flush_lsn        | 0/8000060
replay_lsn       | 0/8000060
write_lag        |
flush_lag        |
replay_lag       |
sync_priority    | 0
sync_state       | async
reply_time       | 2024-05-06 17:50:18.087109+00
```

```
postgres@b266e31efaed:/$ psql -p 5437 -d postgres
psql (14.1 (Debian 14.1-1.pgdg110+1))
Type "help" for help.

postgres=# \x
Expanded display is on.
postgres=# select * from pg_stat_replication;
-[ RECORD 1 ]----+------------------------------
pid              | 903
usesysid         | 16384
usename          | repuser
application_name | walreceiver
client_addr      | 127.0.0.1
client_hostname  |
client_port      | 47752
backend_start    | 2024-05-06 17:49:03.293558+00
backend_xmin     |
state            | streaming
sent_lsn         | 0/8000060
write_lsn        | 0/8000060
flush_lsn        | 0/8000060
replay_lsn       | 0/8000060
write_lag        |
flush_lag        |
replay_lag       |
sync_priority    | 0
sync_state       | async
reply_time       | 2024-05-06 17:51:33.693469+00
```

```
postgres=# select * from pg_stat_wal_receiver;
-[ RECORD 1 ]---------+-----------------------------------------------------------------
--------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------
------------------------------------------
pid                   | 869
status                | streaming
receive_start_lsn     | 0/8000000
receive_start_tli     | 1
written_lsn           | 0/8000148
flushed_lsn           | 0/8000148
received_tli          | 1
last_msg_send_time    | 2024-05-06 17:53:45.675142+00
last_msg_receipt_time | 2024-05-06 17:53:45.6753+00
latest_end_lsn        | 0/8000148
latest_end_time       | 2024-05-06 17:52:15.474789+00
slot_name             | c_slot_name_1
sender_host           | localhost
sender_port           | 5433
conninfo              | user=repuser passfile=/var/lib/postgresql/.pgpass channel_binding=p
refer dbname=replication host=localhost port=5433 fallback_application_name=walreceiver ssl
mode=prefer sslcompression=0 sslsni=1 ssl_min_protocol_version=TLSv1.2 gssencmode=prefer kr
bsrvname=postgres target_session_attrs=any
```

```
postgres@b266e31efaed:/$ psql -p 5438 -d postgres
psql (14.1 (Debian 14.1-1.pgdg110+1))
Type "help" for help.

postgres=# \x
Expanded display is on.
postgres=# select * from pg_stat_replication;
-[ RECORD 1 ]----+------------------------------
pid              | 936
usesysid         | 16384
usename          | repuser
application_name | walreceiver
client_addr      | 127.0.0.1
client_hostname  |
client_port      | 38084
backend_start    | 2024-05-06 17:49:47.897534+00
backend_xmin     |
state            | streaming
sent_lsn         | 0/8000060
write_lsn        | 0/8000060
flush_lsn        | 0/8000060
replay_lsn       | 0/8000060
write_lag        |
flush_lag        |
replay_lag       |
sync_priority    | 0
sync_state       | async
reply_time       | 2024-05-06 17:51:58.394698+00
```

```
postgres=# select * from pg_stat_wal_receiver;
-[ RECORD 1 ]---------+--------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
-----------------------------------------
pid                   | 902
status                | streaming
receive_start_lsn     | 0/8000000
receive_start_tli     | 1
written_lsn           | 0/8000148
flushed_lsn           | 0/8000148
received_tli          | 1
last_msg_send_time    | 2024-05-06 17:53:15.676156+00
last_msg_receipt_time | 2024-05-06 17:53:15.676339+00
latest_end_lsn        | 0/8000148
latest_end_time       | 2024-05-06 17:52:15.476395+00
slot_name             | c_slot_name_2
sender_host           | localhost
sender_port           | 5437
conninfo              | user=repuser passfile=/var/lib/postgresql/.pgpass channel_binding=p
refer dbname=replication host=localhost port=5437 fallback_application_name=walreceiver ssl
mode=prefer sslcompression=0 sslsni=1 ssl_min_protocol_version=TLSv1.2 gssencmode=prefer kr
bsrvname=postgres target_session_attrs=any
```

```
postgres@b266e31efaed:/$ psql -p 5439 -d postgres
psql (14.1 (Debian 14.1-1.pgdg110+1))
Type "help" for help.

postgres=# \x
Expanded display is on.
postgres=# select * from pg_stat_replication;
(0 rows)

postgres=# select * from pg_stat_wal_receiver;
-[ RECORD 1 ]---------+-------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------
----------------------------------------
pid                   | 935
status                | streaming
receive_start_lsn     | 0/8000000
receive_start_tli     | 1
written_lsn           | 0/8000148
flushed_lsn           | 0/8000148
received_tli          | 1
last_msg_send_time    | 2024-05-06 17:52:45.577583+00
last_msg_receipt_time | 2024-05-06 17:52:45.577712+00
latest_end_lsn        | 0/8000148
latest_end_time       | 2024-05-06 17:52:15.477405+00
slot_name             | c_slot_name_3
sender_host           | localhost
sender_port           | 5438
conninfo              | user=repuser passfile=/var/lib/postgresql/.pgpass channel_binding=p
refer dbname=replication host=localhost port=5438 fallback_application_name=walreceiver ssl
mode=prefer sslcompression=0 sslsni=1 ssl_min_protocol_version=TLSv1.2 gssencmode=prefer kr
bsrvname=postgres target_session_attrs=any
```