МИНИСТЕРСТВО НАУКИ
И ВЫСШЕГО ОБРАЗОВАНИЯ
РОССИЙСКОЙ ФЕДЕРАЦИИ

Федеральное государственное бюджетное
образовательное учреждение высшего образования
«НОВОСИБИРСКИЙ ГОСУДАРСТВЕННЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ»

НГТУ
НЭТИ | Факультет прикладной
математики и информатики

Кафедра теоретической и прикладной информатики

Лабораторная работа № 3

по дисциплине «Администрирование информационных систем»

ТРАНЗАКЦИИ, БЛОКИРОВКИ, ЖУРНАЛ

Бригада 2 ХАЙДАЕВ К.Е.

Группа ПМИ-82 ЗЯБЛИЦЕВА У.П.

Вариант 2

Преподаватели АВРУНЕВ О.Е.

Новосибирск, 2022

1 Получить значения параметров конфигурации, определяющих работу блокировок:

- Предельное время ожидания снятия блокировки

  deadlock_timeout - Время ожидания блокировки (в миллисекундах), по истечении которого будет выполняться проверка состояния взаимоблокировки.

  show deadlock_timeout;

```
[dba@centos-7 ~]$ psql demo
psql (14.1)
Type "help" for help.

demo=# Show deadlock_timeout;
 deadlock_timeout
------------------
 1s
(1 row)
```

- Запись об ожидании блокировки сверх установленного в журнал сервера

  cat /var/lib/pgpro/std-11/data/postgresql.conf

```
#log_lock_waits = off                  # log lock waits >= deadlock_timeout
#log_recovery_conflict_waits = off     # log standby recovery conflict waits
                                       # >= deadlock_timeout
#log_parameter_max_length = -1         # when logging statements, limit logged
                                       # bind-parameter values to N bytes;
```

Show log_lock_waits;

```
demo=# show log_lock_waits;
 log_lock_waits
----------------
 off
(1 row)
```

log_lock_waits - определяет, нужно ли фиксировать в журнале события, когда сеанс ожидает получения блокировки дольше, чем указано в deadlock_timeout. Так как этот параметр по умолчанию выключен, необходимо включить его.

ALTER SYSTEM SET log_lock_waits=on;

```
demo=# ALTER SYSTEM SET log_lock_waits=on;
ALTER SYSTEM
```

Выполним перезагрузку файла конфигурации.

select pg_reload_conf();

```
demo=# select pg_reload_conf();
 pg_reload_conf
----------------
 t
(1 row)

demo=# show log_lock_waits;
 log_lock_waits
----------------
 on
(1 row)
```

- Получить значения параметров конфигурации, отвечающих за работу WAL:
    - Уровень информации, помещаемой в WAL

      show wal_level;

      ```
      demo=# show wal_level;
       wal_level
      -----------
       replica
      (1 row)
      ```

    - Выполняется ли запись полного образа страницы в WAL при первом изменении, после контрольной точки

      show full_page_writes;

      ```
      demo=# show full_page_writes;
       full_page_writes
      ------------------
       on
      (1 row)
      ```

    - Выполняется ли сжатие образа страницы

      show wal_compression;

      ```
      demo=# show wal_compression;
       wal_compression
      -----------------
       off
      (1 row)
      ```

    - Пауза между записью буфера WAL

      show wal_writer_delay;

      ```
      demo=# show wal_writer_delay;
       wal_writer_delay
      ------------------
       200ms
      (1 row)
      ```

- Получить список сегментов WAL

  select * from pg_ls_waldir();

```
demo=# select * from pg_ls_waldir();
           name           |   size   |      modification
--------------------------+----------+------------------------
 000000010000000000000012 | 16777216 | 2022-03-14 10:00:29+07
 000000010000000000000013 | 16777216 | 2022-02-16 07:21:33+07
 000000010000000000000014 | 16777216 | 2022-02-16 07:21:34+07
 000000010000000000000015 | 16777216 | 2022-02-16 07:21:34+07
 000000010000000000000016 | 16777216 | 2022-02-16 07:21:35+07
 000000010000000000000017 | 16777216 | 2022-02-16 07:21:37+07
 000000010000000000000018 | 16777216 | 2022-02-16 07:21:43+07
 000000010000000000000019 | 16777216 | 2022-02-16 07:21:44+07
 00000001000000000000001A | 16777216 | 2022-02-16 07:21:56+07
 00000001000000000000001B | 16777216 | 2022-02-16 07:21:56+07
 00000001000000000000001C | 16777216 | 2022-03-13 10:32:14+07
 00000001000000000000001D | 16777216 | 2022-03-13 10:32:14+07
 00000001000000000000001E | 16777216 | 2022-03-13 10:51:34+07
 00000001000000000000001F | 16777216 | 2022-03-13 10:54:53+07
(14 rows)
```

- Получить текущий идентификатор транзакции, текущий LSN, идентификатор последней контрольной точки.
    - Текущий идентификатор транзакции: SELECT * from txid_current();

```
demo=# SELECT * from txid_current();
 txid_current
--------------
          897
(1 row)
```

    - Текущий LSN. Select pg_current_wal_lsn();

```
demo=#  select pg_current_wal_lsn();
 pg_current_wal_lsn
--------------------
 0/122EE840
(1 row)
```

    - Идентификатор последней контрольной точки.

select pg_control_checkpoint();

```
demo=# select pg_control_checkpoint();
                                         pg_control_checkpoint
------------------------------------------------------------------------------------------------------
 (0/122EE730,0/122EE6F8,000000010000000000000012,1,1,t,0:897,24712,1,0,733,1,897,1,1,0,0,"2022-03-14 10:00:11+07")
(1 row)
```

(checkpoint_lsn | redo_lsn |redo_wal_file| timeline_id | prev_timeline_id | full_page_writes | next_xid | next_oid | next_multixact_id | next_multi_offset | oldest_xid | oldest_xid_dbid | oldest_active_xid | oldest_multi_xid | oldest_multi_dbid | oldest_commit_ts_xid | newest_commit_ts_xid | checkpoint_time)

sudo /usr/bin/pg_controldata /var/lib/pgpro/std-14/data

```
pg_control version number:            1300
pg_control edition:                   Postgres Pro Standard
Catalog version number:               202110041
Database system identifier:           7065075820039160463
Database cluster state:               in production
pg_control last modified:             Mon 14 Mar 2022 10:20:12 AM +07
Latest checkpoint location:           0/122EE878
Latest checkpoint's REDO location:    0/122EE840
Latest checkpoint's REDO WAL file:    000000010000000000000012
Latest checkpoint's TimeLineID:       1
Latest checkpoint's PrevTimeLineID:   1
Latest checkpoint's full_page_writes: on
Latest checkpoint's NextXID:          0:898
Latest checkpoint's NextOID:          24712
Latest checkpoint's NextMultiXactId:  1
Latest checkpoint's NextMultiOffset:  0
Latest checkpoint's oldestXID:        733
Latest checkpoint's oldestXID's DB:   1
Latest checkpoint's oldestActiveXID:  898
Latest checkpoint's oldestMultiXid:   1
Latest checkpoint's oldestMulti's DB: 1
Latest checkpoint's oldestCommitTsXid:0
Latest checkpoint's newestCommitTsXid:0
Time of latest checkpoint:            Mon 14 Mar 2022 10:20:12 AM +07
Fake LSN counter for unlogged rels:   0/3E8
Minimum recovery ending location:     0/0
Min recovery ending loc's timeline:   0
Backup start location:                0/0
Backup end location:                  0/0
End-of-backup record required:        no
wal_level setting:                    replica
wal_log_hints setting:                off
max_connections setting:              44
max_worker_processes setting:         8
max_wal_senders setting:              10
max_prepared_xacts setting:           0
max_locks_per_xact setting:           64
track_commit_timestamp setting:       off
Maximum data alignment:               8
Database block size:                  8192
Blocks per segment of large relation: 131072
WAL block size:                       8192
Bytes per WAL segment:                16777216
Maximum length of identifiers:        64
Maximum columns in an index:          32
Maximum size of a TOAST chunk:        1996
Size of a large-object chunk:         2048
Date/time type storage:               64-bit integers
Float8 argument passing:              by value
Data page checksum version:           1
Mock authentication nonce:            d1382020f022057058f711742a71ccf3c710c0558e07632db66e78f50dfb2e91
Uses ICU:                             yes
ICU library version:                  50.2.0.0
```

2 Установить драйвер postgres для python (sudo yum install python-psycopg2).

sudo yum install python-psycopg2

```
[dba@centos-7 ~]$ pip freeze | grep psycopg2
psycopg2-binary==2.9.3
```

3 Запустить определенное количество python-сценариев, выполняющих в цикле модификацию строк таблицы.

Бригада: 2

Таблица: bookings.tickets

Количество одновременно запущенных программ: 5

```
demo=# select a.* from bookings.tickets a order by a.ticket_no limit 10;
   ticket_no    | book_ref | passenger_id |   passenger_name    |                                  contact_data
----------------+----------+--------------+---------------------+--------------------------------------------------------------------------------
 0005432000987 | 06B046   | 8149 604011  | VALERIY TIKHONOV    | {"phone": "+70127117011"}
 0005432000988 | 06B046   | 8499 420203  | EVGENIYA ALEKSEEVA  | {"phone": "+70378089255"}
 0005432000989 | E170C3   | 1011 752484  | ARTUR GERASIMOV     | {"phone": "+70760429203"}
 0005432000990 | E170C3   | 4849 400049  | ALINA VOLKOVA       | {"email": "volkova.alina_03101973@postgrespro.ru", "phone": "+70582584031"}
 0005432000991 | F313DD   | 6615 976589  | MAKSIM ZHUKOV       | {"email": "m-zhukov061972@postgrespro.ru", "phone": "+70149562185"}
 0005432000992 | F313DD   | 2021 652719  | NIKOLAY EGOROV      | {"phone": "+70791452932"}
 0005432000993 | F313DD   | 0817 363231  | TATYANA KUZNECOVA   | {"email": "kuznecova-t-011961@postgrespro.ru", "phone": "+70400736223"}
 0005432000994 | CCC5CB   | 2883 989356  | IRINA ANTONOVA      | {"email": "antonova.irina04121972@postgrespro.ru", "phone": "+70844502960"}
 0005432000995 | CCC5CB   | 3097 995546  | VALENTINA KUZNECOVA | {"email": "kuznecova.valentina10101976@postgrespro.ru", "phone": "+70268080457"}
 0005432000996 | 1FB1E4   | 6866 920231  | POLINA ZHURAVLEVA   | {"phone": "+70639918455"}
(10 rows)
```

```
import psycopg2
from time import sleep
conn = psycopg2.connect("dbname='demo' user='dba' host='127.0.0.1' password='sladkiyKot'")
cur = conn.cursor()
cur.execute("""select a.*
            from bookings.tickets a
            order by a.ticket_no
            limit 10""")
rows = cur.fetchall()
for i in rows:
 cur.execute("""update bookings.tickets
             set passenger_name = 'PYTHON SCRIPT'
             where ticket_no = %s""", (i[0],))
 sleep(4)
 conn.commit()
```

Проверим скрипт

```
[dba@centos-7 ~]$ python3 lab3.py
[dba@centos-7 ~]$ psql demo
psql (14.1)
Type "help" for help.

demo=# select a.* from bookings.tickets a order by a.ticket_no limit 10;
   ticket_no    | book_ref | passenger_id | passenger_name |                                  contact_data
----------------+----------+--------------+----------------+--------------------------------------------------------------------------------
 0005432000987 | 06B046   | 8149 604011  | PYTHON SCRIPT  | {"phone": "+70127117011"}
 0005432000988 | 06B046   | 8499 420203  | PYTHON SCRIPT  | {"phone": "+70378089255"}
 0005432000989 | E170C3   | 1011 752484  | PYTHON SCRIPT  | {"phone": "+70760429203"}
 0005432000990 | E170C3   | 4849 400049  | PYTHON SCRIPT  | {"email": "volkova.alina_03101973@postgrespro.ru", "phone": "+70582584031"}
 0005432000991 | F313DD   | 6615 976589  | PYTHON SCRIPT  | {"email": "m-zhukov061972@postgrespro.ru", "phone": "+70149562185"}
 0005432000992 | F313DD   | 2021 652719  | PYTHON SCRIPT  | {"phone": "+70791452932"}
 0005432000993 | F313DD   | 0817 363231  | PYTHON SCRIPT  | {"email": "kuznecova-t-011961@postgrespro.ru", "phone": "+70400736223"}
 0005432000994 | CCC5CB   | 2883 989356  | PYTHON SCRIPT  | {"email": "antonova.irina04121972@postgrespro.ru", "phone": "+70844502960"}
 0005432000995 | CCC5CB   | 3097 995546  | PYTHON SCRIPT  | {"email": "kuznecova.valentina10101976@postgrespro.ru", "phone": "+70268080457"}
 0005432000996 | 1FB1E4   | 6866 920231  | PYTHON SCRIPT  | {"phone": "+70639918455"}
(10 rows)
```

Запустим 5 программ одновременно в фоновом режиме:

for i in {1..5}; do echo -n "Python program $i start";python3 lab3.py & done

```
[dba@centos-7 ~]$ for i in {1..5}; do echo -n "Python program $i start";python3 lab3.py & done
Python program 1 start[1] 5613
Python program 2 start[2] 5614
Python program 3 start[3] 5615
Python program 4 start[4] 5616
Python program 5 start[5] 5617
[dba@centos-7 ~]$ ps
  PID TTY          TIME CMD
 3942 pts/0    00:00:00 bash
 5613 pts/0    00:00:00 python3
 5614 pts/0    00:00:00 python3
 5615 pts/0    00:00:00 python3
 5616 pts/0    00:00:00 python3
 5617 pts/0    00:00:00 python3
 5625 pts/0    00:00:00 ps
```

4 Во время выполнения получить информацию о блокировках:

Select relation,page,tuple,mode,pid,virtualxid from pg_locks order by 5;

```
demo=# Select relation,page,tuple,mode,pid,virtualxid from pg_locks order by 5;
 relation | page | tuple |       mode       | pid  | virtualxid
----------+------+-------+------------------+------+------------
          |      |       | ExclusiveLock    | 7885 | 7/1241
    16433 |      |       | RowExclusiveLock | 7885 |
    16433 |      |       | AccessShareLock  | 7885 |
          |      |       | ExclusiveLock    | 7885 |
    16473 |      |       | RowExclusiveLock | 7885 |
    16473 |      |       | AccessShareLock  | 7885 |
          |      |       | ShareLock        | 7886 |
    16473 |      |       | AccessShareLock  | 7886 |
    16473 |      |       | RowExclusiveLock | 7886 |
    16433 |      |       | AccessShareLock  | 7886 |
    16433 |      |       | RowExclusiveLock | 7886 |
          |      |       | ExclusiveLock    | 7886 | 8/281
          |      |       | ExclusiveLock    | 7886 |
    16433 | 6143 |    38 | ExclusiveLock    | 7886 |
    16473 |      |       | AccessShareLock  | 7887 |
          |      |       | ExclusiveLock    | 7887 |
          |      |       | ExclusiveLock    | 7887 | 9/160
    16433 |      |       | RowExclusiveLock | 7887 |
    16433 |      |       | AccessShareLock  | 7887 |
    16473 |      |       | RowExclusiveLock | 7887 |
    16433 | 6143 |    38 | ExclusiveLock    | 7887 |
          |      |       | ExclusiveLock    | 7888 |
    16473 |      |       | AccessShareLock  | 7888 |
    16433 | 6143 |    38 | ExclusiveLock    | 7888 |
    16473 |      |       | RowExclusiveLock | 7888 |
    16433 |      |       | AccessShareLock  | 7888 |
    16433 |      |       | RowExclusiveLock | 7888 |
          |      |       | ExclusiveLock    | 7888 | 10/134
    16433 |      |       | RowExclusiveLock | 7889 |
    16473 |      |       | RowExclusiveLock | 7889 |
    16473 |      |       | AccessShareLock  | 7889 |
          |      |       | ExclusiveLock    | 7889 |
    16433 | 6143 |    38 | ExclusiveLock    | 7889 |
    16433 |      |       | AccessShareLock  | 7889 |
          |      |       | ExclusiveLock    | 7889 | 11/134
          |      |       | ExclusiveLock    | 7894 | 12/26
    12295 |      |       | AccessShareLock  | 7894 |
(37 rows)
```

relation - OID отношения, являющегося целью блокировки
page - номер страницы в отношении, являющейся целью блокировки
tuple - номер кортежа на странице, являющегося целью блокировки
mode - название режима блокировки, которая удерживается или запрашивается этим процессом
pid - идентификатор серверного процесса, удерживающего или ожидающего эту блокировку

PID ▲	Lock type	Target relation	Page	Tuple	vXID (target)	XID (target)	Class	Object ID	vXID (owner)	Mode	Granted?
3129	relation	pg_locks							3/14584	AccessShareLock	true
7885	relation	bookings.tickets							7/1243	RowExclusiveLock	true
7885	relation	bookings.tickets_pkey							7/1243	RowExclusiveLock	true
7886	relation	bookings.tickets							8/282	RowExclusiveLock	true
7886	relation	bookings.tickets_pkey							8/282	RowExclusiveLock	true
7887	relation	bookings.tickets_pkey							9/160	AccessShareLock	true
7887	relation	bookings.tickets_pkey							9/160	RowExclusiveLock	true
7887	relation	bookings.tickets							9/160	AccessShareLock	true
7887	relation	bookings.tickets							9/160	RowExclusiveLock	true
7888	relation	bookings.tickets_pkey							10/134	RowExclusiveLock	true
7888	relation	bookings.tickets							10/134	AccessShareLock	true
7888	relation	bookings.tickets							10/134	RowExclusiveLock	true
7888	relation	bookings.tickets_pkey							10/134	AccessShareLock	true
7889	relation	bookings.tickets_pkey							11/134	AccessShareLock	true
7889	relation	bookings.tickets							11/134	AccessShareLock	true
7889	relation	bookings.tickets_pkey							11/134	RowExclusiveLock	true
7889	relation	bookings.tickets							11/134	RowExclusiveLock	true

В pg_locks, в отличие от Dashboard, указываются блокировки с режимом ExclusiveLock. Каждая транзакция удерживает блокировку ExclusiveLock на своей виртуальной транзакции virtualxid.

5 После окончания выполнения:

- Получить список сегментов WAL

```
demo=# select * from pg_ls_waldir();
           name           |   size   |      modification
--------------------------+----------+------------------------
 000000010000000000000012 | 16777216 | 2022-03-14 11:55:33+07
 000000010000000000000013 | 16777216 | 2022-02-16 07:21:33+07
 000000010000000000000014 | 16777216 | 2022-02-16 07:21:34+07
 000000010000000000000015 | 16777216 | 2022-02-16 07:21:34+07
 000000010000000000000016 | 16777216 | 2022-02-16 07:21:35+07
 000000010000000000000017 | 16777216 | 2022-02-16 07:21:37+07
 000000010000000000000018 | 16777216 | 2022-02-16 07:21:43+07
 000000010000000000000019 | 16777216 | 2022-02-16 07:21:44+07
 00000001000000000000001A | 16777216 | 2022-02-16 07:21:56+07
 00000001000000000000001B | 16777216 | 2022-02-16 07:21:56+07
 00000001000000000000001C | 16777216 | 2022-03-13 10:32:14+07
 00000001000000000000001D | 16777216 | 2022-03-13 10:32:14+07
 00000001000000000000001E | 16777216 | 2022-03-13 10:51:34+07
 00000001000000000000001F | 16777216 | 2022-03-13 10:54:53+07
(14 rows)
```

- Текущий идентификатор транзакций.

```
demo=# SELECT * from txid_current();
 txid_current
--------------
         1568
(1 row)
```

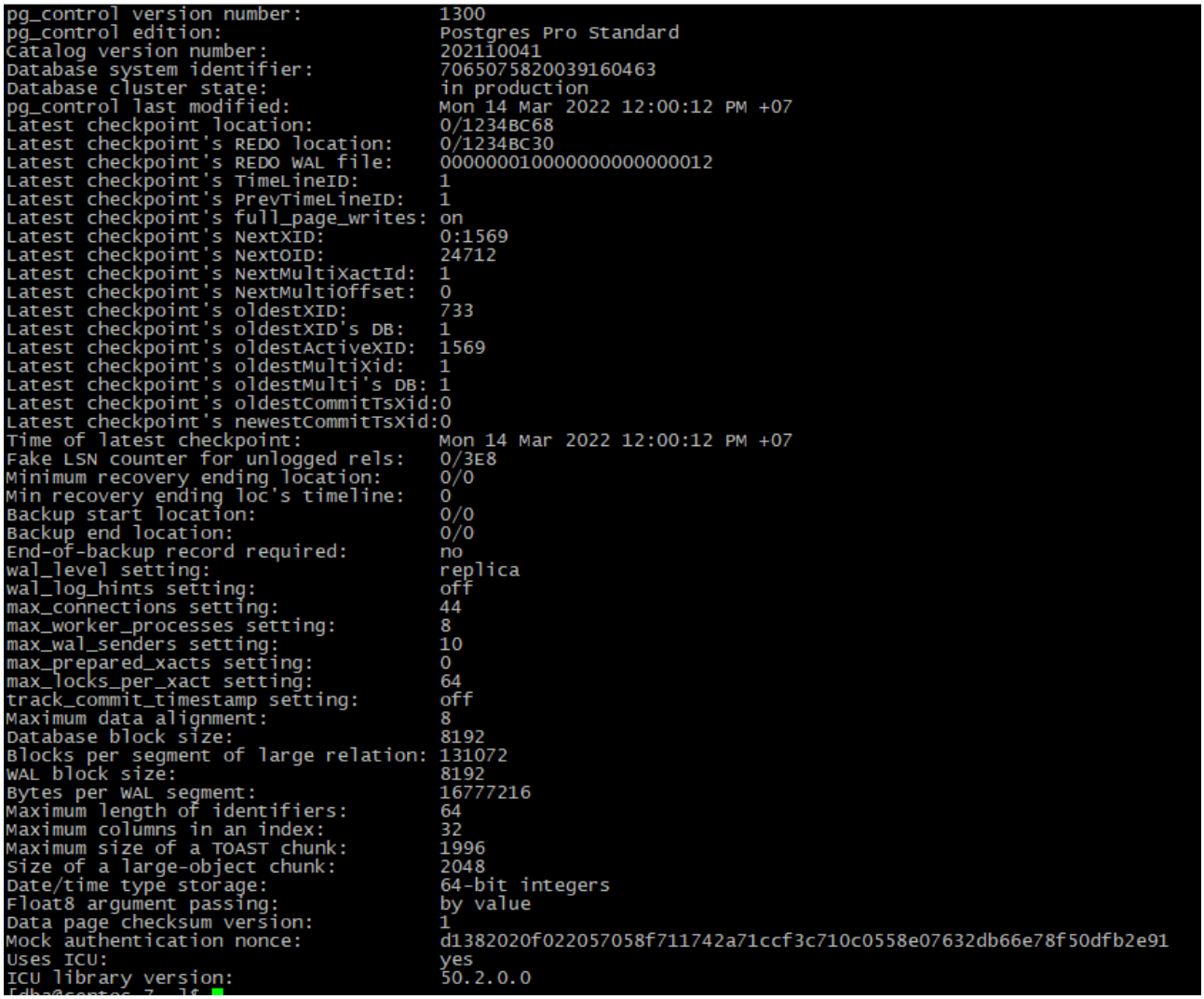
- Текущий LSN.

```
demo=#  select pg_current_wal_lsn();
 pg_current_wal_lsn
--------------------
 0/1234BD18
(1 row)
```

- Идентификатор последней контрольной точки.

checkpoint_lsn | redo_lsn | redo_wal_file | timeline_id | prev_timeline_id | full_page_writes | next_xid | next_oid | next_multixact_id | next_multi_offset | oldest_xid | oldest_xid_dbid | oldest_active_xid | oldest_multi_xid | oldest_multi_dbid | oldest_commit_ts_xid | newest_commit_ts_xid | checkpoint_time

```
demo=# select  pg_control_checkpoint();
                                    pg_control_checkpoint
---------------------------------------------------------------------------------------------------------
 (0/1234BC68,0/1234BC30,000000010000000000000012,1,1,t,0:1569,24712,1,0,733,1,1569,1,1,0,0,"2022-03-14 12:00:12+07")
(1 row)
```



Список сегментов WAL: 2022-03-14 10:00:29+07 -> 2022-03-14 11:55:33+07
Идентификатор транзакции: 897 -> 1568
LSN: 0/122EE840 --> 0/1234BD18
Идентификатор последней контрольной точки: 0/122EE878 -> 0/1234BC68

Каждая программа выполняет 10 операций update. Всего запускается 5 программ. Значит, проходит 50 транзакций. 1 – транзакция для вывода таблицы блокировок.

Изменить значения конфигурационных параметров, при необходимости перезапустить службу postgres, убедиться, что значения параметров изменились.

Изменяемые значения параметров:
Уровень wal – логический. Сжимать образ полной страницы, записываемой в WAL.
ALTER SYSTEM SET wal_level = logical;
ALTER SYSTEM SET wal_compression = on;

```
demo=# ALTER SYSTEM SET wal_level = logical;
ALTER SYSTEM
demo=# ALTER SYSTEM SET wal_compression = on;
ALTER SYSTEM
```

sudo systemctl restart postgrespro-std-14

```
[dba@centos-7 ~]$ sudo systemctl restart postgrespro-std-14
[dba@centos-7 ~]$ psql demo
psql (14.1)
Type "help" for help.

demo=# Show wal_level;
 wal_level
-----------
 logical
(1 row)

demo=# Show wal_compression;
 wal_compression
-----------------
 on
(1 row)
```

6 **Повторить запуск сценариев, и получение информации о сегментах журналов.**

```
demo=# select * from pg_ls_waldir();
           name            |   size   |      modification
---------------------------+----------+------------------------
 000000010000000000000012 | 16777216 | 2022-03-14 12:28:31+07
 000000010000000000000013 | 16777216 | 2022-02-16 07:21:33+07
 000000010000000000000014 | 16777216 | 2022-02-16 07:21:34+07
 000000010000000000000015 | 16777216 | 2022-02-16 07:21:34+07
 000000010000000000000016 | 16777216 | 2022-02-16 07:21:35+07
 000000010000000000000017 | 16777216 | 2022-02-16 07:21:37+07
 000000010000000000000018 | 16777216 | 2022-02-16 07:21:43+07
 000000010000000000000019 | 16777216 | 2022-02-16 07:21:44+07
 00000001000000000000001A | 16777216 | 2022-02-16 07:21:56+07
 00000001000000000000001B | 16777216 | 2022-02-16 07:21:56+07
 00000001000000000000001C | 16777216 | 2022-03-13 10:32:14+07
 00000001000000000000001D | 16777216 | 2022-03-13 10:32:14+07
 00000001000000000000001E | 16777216 | 2022-03-13 10:51:34+07
 00000001000000000000001F | 16777216 | 2022-03-13 10:54:53+07
(14 rows)

demo=# \q
[dba@centos-7 ~]$
[dba@centos-7 ~]$ for i in {1..5}; do echo -n "Python program $i start";python3 lab3.py & done
Python program 1 start[1] 9573
Python program 2 start[2] 9574
Python program 3 start[3] 9575
Python program 4 start[4] 9576
Python program 5 start[5] 9577
[dba@centos-7 ~]$ psql demo
psql (14.1)
Type "help" for help.

demo=# select * from pg_ls_waldir();
           name            |   size   |      modification
---------------------------+----------+------------------------
 000000010000000000000012 | 16777216 | 2022-03-14 12:32:32+07
 000000010000000000000013 | 16777216 | 2022-02-16 07:21:33+07
 000000010000000000000014 | 16777216 | 2022-02-16 07:21:34+07
 000000010000000000000015 | 16777216 | 2022-02-16 07:21:34+07
 000000010000000000000016 | 16777216 | 2022-02-16 07:21:35+07
 000000010000000000000017 | 16777216 | 2022-02-16 07:21:37+07
 000000010000000000000018 | 16777216 | 2022-02-16 07:21:43+07
 000000010000000000000019 | 16777216 | 2022-02-16 07:21:44+07
 00000001000000000000001A | 16777216 | 2022-02-16 07:21:56+07
 00000001000000000000001B | 16777216 | 2022-02-16 07:21:56+07
 00000001000000000000001C | 16777216 | 2022-03-13 10:32:14+07
 00000001000000000000001D | 16777216 | 2022-03-13 10:32:14+07
 00000001000000000000001E | 16777216 | 2022-03-13 10:51:34+07
 00000001000000000000001F | 16777216 | 2022-03-13 10:54:53+07
(14 rows)
```

```
[dba@centos-7 ~]$ ps
  PID TTY          TIME CMD
 8920 pts/1    00:00:00 bash
 9600 pts/1    00:00:00 ps
[dba@centos-7 ~]$ psql demo
psql (14.1)
Type "help" for help.

demo=# select * from pg_ls_waldir();
           name            |   size   |      modification
---------------------------+----------+------------------------
 000000010000000000000012 | 16777216 | 2022-03-14 12:33:31+07
 000000010000000000000013 | 16777216 | 2022-02-16 07:21:33+07
 000000010000000000000014 | 16777216 | 2022-02-16 07:21:34+07
 000000010000000000000015 | 16777216 | 2022-02-16 07:21:34+07
 000000010000000000000016 | 16777216 | 2022-02-16 07:21:35+07
 000000010000000000000017 | 16777216 | 2022-02-16 07:21:37+07
 000000010000000000000018 | 16777216 | 2022-02-16 07:21:43+07
 000000010000000000000019 | 16777216 | 2022-02-16 07:21:44+07
 00000001000000000000001A | 16777216 | 2022-02-16 07:21:56+07
 00000001000000000000001B | 16777216 | 2022-02-16 07:21:56+07
 00000001000000000000001C | 16777216 | 2022-03-13 10:32:14+07
 00000001000000000000001D | 16777216 | 2022-03-13 10:32:14+07
 00000001000000000000001E | 16777216 | 2022-03-13 10:51:34+07
 00000001000000000000001F | 16777216 | 2022-03-13 10:54:53+07
(14 rows)
```

Проверить наличие в журнале сервера записей об ожидании снятия блокировки.

sudo ls /var/lib/pgpro/std-14/data/log

```
[dba@centos-7 ~]$ sudo ls /var/lib/pgpro/std-14/data/log
postgresql-2022-02-16_060232.log  postgresql-2022-02-24_000000.log  postgresql-2022-03-04_000000.log  postgresql-2022-03-12_000000.log
postgresql-2022-02-17_000000.log  postgresql-2022-02-25_000000.log  postgresql-2022-03-05_000000.log  postgresql-2022-03-12_025429.log
postgresql-2022-02-18_000000.log  postgresql-2022-02-26_000000.log  postgresql-2022-03-06_000000.log  postgresql-2022-03-13_000000.log
postgresql-2022-02-19_000000.log  postgresql-2022-02-27_000000.log  postgresql-2022-03-07_000000.log  postgresql-2022-03-14_000000.log
postgresql-2022-02-20_000000.log  postgresql-2022-02-28_000000.log  postgresql-2022-03-08_000000.log  postgresql-2022-03-14_122816.log
postgresql-2022-02-21_000000.log  postgresql-2022-03-01_000000.log  postgresql-2022-03-09_000000.log
postgresql-2022-02-22_000000.log  postgresql-2022-03-02_000000.log  postgresql-2022-03-10_000000.log
postgresql-2022-02-23_000000.log  postgresql-2022-03-03_000000.log  postgresql-2022-03-11_000000.log
```

sudo cat /var/lib/pgpro/std-14/data/log/postgresql-2022-03-14_122816.log

```
                          where ticket_no = '0005432000987'
2022-03-14 12:32:38.082 +07 [9581] LOG:  process 9581 acquired ShareLock on transaction 1570 after 4007.583 ms
2022-03-14 12:32:38.082 +07 [9581] CONTEXT:  while rechecking updated tuple (6143,28) in relation "tickets"
2022-03-14 12:32:38.082 +07 [9581] STATEMENT:  update bookings.tickets
                          set passenger_name = 'PYTHON SCRIPT'
                          where ticket_no = '0005432000987'
2022-03-14 12:32:38.082 +07 [9582] LOG:  process 9582 acquired ShareLock on transaction 1570 after 4007.719 ms
2022-03-14 12:32:38.082 +07 [9582] CONTEXT:  while rechecking updated tuple (6143,28) in relation "tickets"
2022-03-14 12:32:38.082 +07 [9582] STATEMENT:  update bookings.tickets
                          set passenger_name = 'PYTHON SCRIPT'
                          where ticket_no = '0005432000987'
2022-03-14 12:32:38.082 +07 [9580] LOG:  process 9580 acquired ShareLock on transaction 1570 after 4008.444 ms
2022-03-14 12:32:38.082 +07 [9580] CONTEXT:  while rechecking updated tuple (6143,28) in relation "tickets"
2022-03-14 12:32:38.082 +07 [9580] STATEMENT:  update bookings.tickets
                          set passenger_name = 'PYTHON SCRIPT'
                          where ticket_no = '0005432000987'
2022-03-14 12:32:39.082 +07 [9582] LOG:  process 9582 still waiting for ShareLock on transaction 1572 after 1000.159 ms
2022-03-14 12:32:39.082 +07 [9582] DETAIL:  Process holding the lock: 9581. Wait queue: 9582, 9580.
2022-03-14 12:32:39.082 +07 [9582] CONTEXT:  while rechecking updated tuple (6143,31) in relation "tickets"
2022-03-14 12:32:39.082 +07 [9582] STATEMENT:  update bookings.tickets
                          set passenger_name = 'PYTHON SCRIPT'
                          where ticket_no = '0005432000987'
2022-03-14 12:32:39.083 +07 [9580] LOG:  process 9580 still waiting for ShareLock on transaction 1572 after 1000.077 ms
2022-03-14 12:32:39.083 +07 [9580] DETAIL:  Process holding the lock: 9581. Wait queue: 9582, 9580.
2022-03-14 12:32:39.083 +07 [9580] CONTEXT:  while rechecking updated tuple (6143,31) in relation "tickets"
2022-03-14 12:32:39.083 +07 [9580] STATEMENT:  update bookings.tickets
                          set passenger_name = 'PYTHON SCRIPT'
                          where ticket_no = '0005432000987'
2022-03-14 12:32:42.089 +07 [9582] LOG:  process 9582 acquired ShareLock on transaction 1572 after 4006.267 ms
2022-03-14 12:32:42.089 +07 [9582] CONTEXT:  while rechecking updated tuple (6143,31) in relation "tickets"
2022-03-14 12:32:42.089 +07 [9582] STATEMENT:  update bookings.tickets
                          set passenger_name = 'PYTHON SCRIPT'
                          where ticket_no = '0005432000987'
2022-03-14 12:32:42.089 +07 [9580] LOG:  process 9580 acquired ShareLock on transaction 1572 after 4006.340 ms
2022-03-14 12:32:42.089 +07 [9580] CONTEXT:  while rechecking updated tuple (6143,31) in relation "tickets"
2022-03-14 12:32:42.089 +07 [9580] STATEMENT:  update bookings.tickets
                          set passenger_name = 'PYTHON SCRIPT'
                          where ticket_no = '0005432000987'
2022-03-14 12:32:43.089 +07 [9580] LOG:  process 9580 still waiting for ShareLock on transaction 1573 after 1000.118 ms
2022-03-14 12:32:43.089 +07 [9580] DETAIL:  Process holding the lock: 9582. Wait queue: 9580.
2022-03-14 12:32:43.089 +07 [9580] CONTEXT:  while rechecking updated tuple (6143,34) in relation "tickets"
2022-03-14 12:32:43.089 +07 [9580] STATEMENT:  update bookings.tickets
                          set passenger_name = 'PYTHON SCRIPT'
                          where ticket_no = '0005432000987'
2022-03-14 12:32:46.095 +07 [9580] LOG:  process 9580 acquired ShareLock on transaction 1573 after 4006.168 ms
2022-03-14 12:32:46.095 +07 [9580] CONTEXT:  while rechecking updated tuple (6143,34) in relation "tickets"
2022-03-14 12:32:46.095 +07 [9580] STATEMENT:  update bookings.tickets
                          set passenger_name = 'PYTHON SCRIPT'
                          where ticket_no = '0005432000987'
```

7 Модифицировать сценарий так, чтобы подтверждение транзакции производилось не после каждого update, а после завершения цикла. Выполнить одновременно два сценария. Сравнить значения идентификатора транзакции и LSN, до и после выполнения. Проверить наличие в журнале сервера записей о превышении deadlock_timeout.

lab3_mod.py – новый файл с модификацией.

```
demo=# select pg_current_wal_lsn();
 pg_current_wal_lsn
--------------------
 0/12358230
(1 row)

demo=# select txid_current();
 txid_current
--------------
         1635
(1 row)
```

python3 lab3.py & python3 lab3_mod.py &
После

```
demo=# select txid_current();
 txid_current
--------------
         1647
(1 row)

demo=# select pg_current_wal_lsn();
 pg_current_wal_lsn
--------------------
 0/1235AE80
(1 row)
```

Ошибки deadlock_timeout за время работы не произошло.

```
2022-03-14 12:32:39.083 +07 [9580] LOG:  process 9580 still waiting for ShareLock on transaction 1572 after 1000.077 ms
2022-03-14 12:32:39.083 +07 [9580] DETAIL:  Process holding the lock: 9581. Wait queue: 9582, 9580.
2022-03-14 12:32:39.083 +07 [9580] CONTEXT:  while rechecking updated tuple (6143,31) in relation "tickets"
2022-03-14 12:32:39.083 +07 [9580] STATEMENT:  update bookings.tickets
                        set passenger_name = 'PYTHON SCRIPT'
                        where ticket_no = '0005432000987'
2022-03-14 12:32:42.089 +07 [9582] LOG:  process 9582 acquired ShareLock on transaction 1572 after 4006.267 ms
2022-03-14 12:32:42.089 +07 [9582] CONTEXT:  while rechecking updated tuple (6143,31) in relation "tickets"
2022-03-14 12:32:42.089 +07 [9582] STATEMENT:  update bookings.tickets
                        set passenger_name = 'PYTHON SCRIPT'
                        where ticket_no = '0005432000987'
2022-03-14 12:32:42.089 +07 [9580] LOG:  process 9580 acquired ShareLock on transaction 1572 after 4006.340 ms
2022-03-14 12:32:42.089 +07 [9580] CONTEXT:  while rechecking updated tuple (6143,31) in relation "tickets"
2022-03-14 12:32:42.089 +07 [9580] STATEMENT:  update bookings.tickets
                        set passenger_name = 'PYTHON SCRIPT'
                        where ticket_no = '0005432000987'
2022-03-14 12:32:43.089 +07 [9580] LOG:  process 9580 still waiting for ShareLock on transaction 1573 after 1000.118 ms
2022-03-14 12:32:43.089 +07 [9580] DETAIL:  Process holding the lock: 9582. Wait queue: 9580.
2022-03-14 12:32:43.089 +07 [9580] CONTEXT:  while rechecking updated tuple (6143,34) in relation "tickets"
2022-03-14 12:32:43.089 +07 [9580] STATEMENT:  update bookings.tickets
                        set passenger_name = 'PYTHON SCRIPT'
                        where ticket_no = '0005432000987'
2022-03-14 12:32:46.095 +07 [9580] LOG:  process 9580 acquired ShareLock on transaction 1573 after 4006.168 ms
2022-03-14 12:32:46.095 +07 [9580] CONTEXT:  while rechecking updated tuple (6143,34) in relation "tickets"
2022-03-14 12:32:46.095 +07 [9580] STATEMENT:  update bookings.tickets
                        set passenger_name = 'PYTHON SCRIPT'
                        where ticket_no = '0005432000987'
2022-03-14 12:56:29.679 +07 [10001] LOG:  process 10001 still waiting for ShareLock on transaction 1620 after 1000.244 ms
2022-03-14 12:56:29.679 +07 [10001] DETAIL:  Process holding the lock: 10000. Wait queue: 10001.
2022-03-14 12:56:29.679 +07 [10001] CONTEXT:  while updating tuple (6143,43) in relation "tickets"
2022-03-14 12:56:29.679 +07 [10001] STATEMENT:  update bookings.tickets
                        set passenger_name = 'PYTHON SCRIPT'
                        where ticket_no = '0005432000987'
2022-03-14 12:57:08.727 +07 [10001] LOG:  process 10001 acquired ShareLock on transaction 1620 after 40047.955 ms
2022-03-14 12:57:08.727 +07 [10001] CONTEXT:  while updating tuple (6143,43) in relation "tickets"
2022-03-14 12:57:08.727 +07 [10001] STATEMENT:  update bookings.tickets
                        set passenger_name = 'PYTHON SCRIPT'
                        where ticket_no = '0005432000987'
2022-03-14 12:59:06.435 +07 [10199] LOG:  process 10199 still waiting for ShareLock on transaction 1636 after 1000.284 ms
2022-03-14 12:59:06.435 +07 [10199] DETAIL:  Process holding the lock: 10198. Wait queue: 10199.
2022-03-14 12:59:06.435 +07 [10199] CONTEXT:  while updating tuple (6143,51) in relation "tickets"
2022-03-14 12:59:06.435 +07 [10199] STATEMENT:  update bookings.tickets
                        set passenger_name = 'PYTHON SCRIPT'
                        where ticket_no = '0005432000987'
2022-03-14 12:59:45.478 +07 [10199] LOG:  process 10199 acquired ShareLock on transaction 1636 after 40042.684 ms
2022-03-14 12:59:45.478 +07 [10199] CONTEXT:  while updating tuple (6143,51) in relation "tickets"
2022-03-14 12:59:45.478 +07 [10199] STATEMENT:  update bookings.tickets
                        set passenger_name = 'PYTHON SCRIPT'
                        where ticket_no = '0005432000987'
```