PostgresPro

PGCONF RUSSIA 2024

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Отдел образовательных программ Postgres Professional

- все в свободном доступе
  https://postgrespro.ru/education
- Хабр
  https://habr.com/ru/company/postgrespro/blog/
- пишите
  edu@postgrespro.ru

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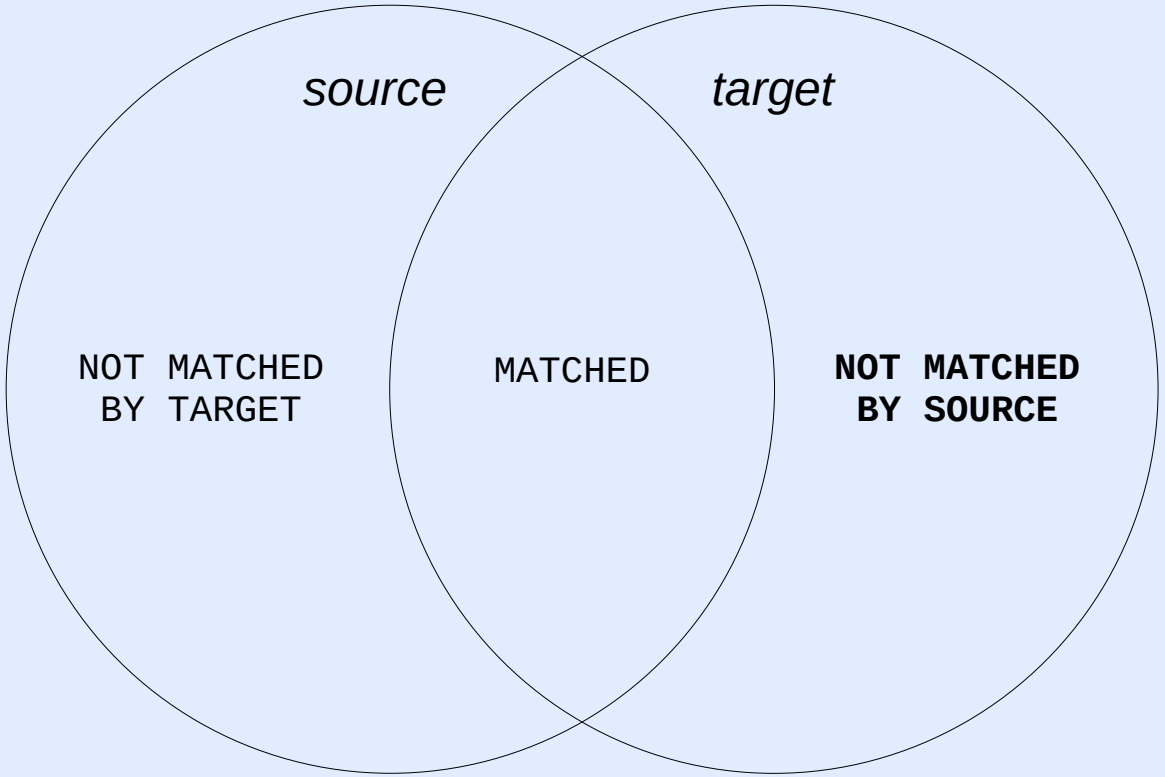
Команды SQL

MERGE: строки целевой таблицы/представления, которых нет в источнике

```
MERGE
    INTO target
    USING source ON condition
WHEN MATCHED
THEN
    UPDATE|DELETE|NOTHING
WHEN NOT MATCHED [BY TARGET]
THEN
    INSERT|NOTHING
WHEN NOT MATCHED BY SOURCE
THEN
    UPDATE|DELETE|NOTHING
```



Команды SQL

MERGE: получение результата

```
MERGE INTO target AS t
     USING source AS s
…
RETURNING merge_action(), s.*, t.*;
 merge_action | id | descr | id | descr
--------------+----+-------+----+-------
 UPDATE       |  1 | Один  |  1 | Один
 UPDATE       |  2 | Два   |  2 | Два
 DELETE       |    |       |  3 | Три
 INSERT       |  0 | Ноль  |  0 | Ноль
(4 rows)
```

Команды SQL

COPY... FROM: игнорирование ошибок преобразования форматов

```
CREATE TABLE t (id int PRIMARY KEY);

COPY t FROM STDIN (on_error 'ignore', log_verbosity verbose);
Enter data to be copied followed by a newline.
End with a backslash and a period on a line by itself, or an EOF signal.
>> 1
>> два
>> три
>> 4
>> \.
NOTICE:  skipping row due to data type incompatibility at line 2 for column id: "два"
NOTICE:  skipping row due to data type incompatibility at line 3 for column id: "три"
NOTICE:  2 rows were skipped due to data type incompatibility
COPY 2

SELECT * FROM t;
 id
----
  1
  4
(2 rows)
```

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Команды SQL

Темпоральные первичные и уникальные ключи

```
CREATE EXTENSION btree_gist;

CREATE TABLE events(
    event text,
    during tstzrange,
    PRIMARY KEY (event, during WITHOUT OVERLAPS)
);

INSERT INTO events VALUES
    ('PGConf.Russia', '[2024-04-08 09:00, 2024-04-09 20:00)');

INSERT INTO events VALUES
    ('PGConf.Russia', '[2024-04-09 18:00, 2024-04-10 20:00)');
ERROR:  conflicting key value violates exclusion constraint "events_pkey"
```

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Команды SQL

Темпоральные внешние ключи

```
CREATE TABLE timetable(
    title text,
    event text,
    during tstzrange,
    FOREIGN KEY (event, PERIOD during)
        REFERENCES events (event, PERIOD during)
);

INSERT INTO timetable VALUES
    ('PostgreSQL 17', 'PGConf.Russia', '[2024-04-08 10:30, 2024-04-08 11:25)');

INSERT INTO timetable VALUES
    ('PostgreSQL 17', 'PGConf.Russia', '[2024-04-10 10:30, 2024-04-10 11:25)');
ERROR:  insert or update on table "timetable" violates foreign key constraint
"timetable_event_during_fkey"
```

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Команды SQL

Секционирование: слияние секций

```
ALTER TABLE partitioned_table
    MERGE PARTITIONS (
        p2024_01,
        p2024_02,
        p2024_03
    )
    INTO p2024_q1;
```

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Команды SQL

Секционирование: разделение секции

```
ALTER TABLE partitioned_table
    SPLIT PARTITION p2024_q1
    INTO (
        PARTITION p2024_01 FOR VALUES FROM ('2024-01-01') TO ('2024-02-01'),
        PARTITION p2024_02 FOR VALUES FROM ('2024-02-01') TO ('2024-03-01'),
        PARTITION p2024_03 FOR VALUES FROM ('2024-03-01') TO ('2024-04-01')
    );
```

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Команды SQL

Триггер ON LOGIN и параметр *event_triggers*

```
CREATE FUNCTION check_login() RETURNS event_trigger
AS $$
BEGIN
    -- Проверки
    -- Настройка контекста сеанса
END;
$$ LANGUAGE plpgsql;

CREATE EVENT TRIGGER check_login
    ON LOGIN
    EXECUTE FUNCTION check_login();
```

Встроенные функции

random: случайное число в заданном диапазоне

```
SELECT random(2,5), random(0,3.14) FROM generate_series(1,5);
 random | random
--------+--------
      2 |   0.43
      5 |   0.98
      3 |   0.12
      5 |   2.18
      2 |   2.43
(5 rows)
```

~~Безопасность~~ сервера

Запрет на использование ALTER SYSTEM

```
=# SHOW allow_alter_system;
 allow_alter_system
--------------------
 off
(1 row)

=# ALTER SYSTEM SET wal_level = minimal;
ERROR:  ALTER SYSTEM is not allowed in this environment
```

Администрирование сервера

Привилегия MAINTAIN и роль pg_maintain (вторая попытка)

```
GRANT MAINTAIN
   ON pg_class
   TO alice
```

VACUUM, ANALYZE,
VACUUM FULL, CLUSTER,
REINDEX,
REFREFH MATERIALYZED VIEW,
LOCK TABLE

```
GRANT pg_maintain
   TO alice
```

MAINTAIN
на все отношения
в базе данных

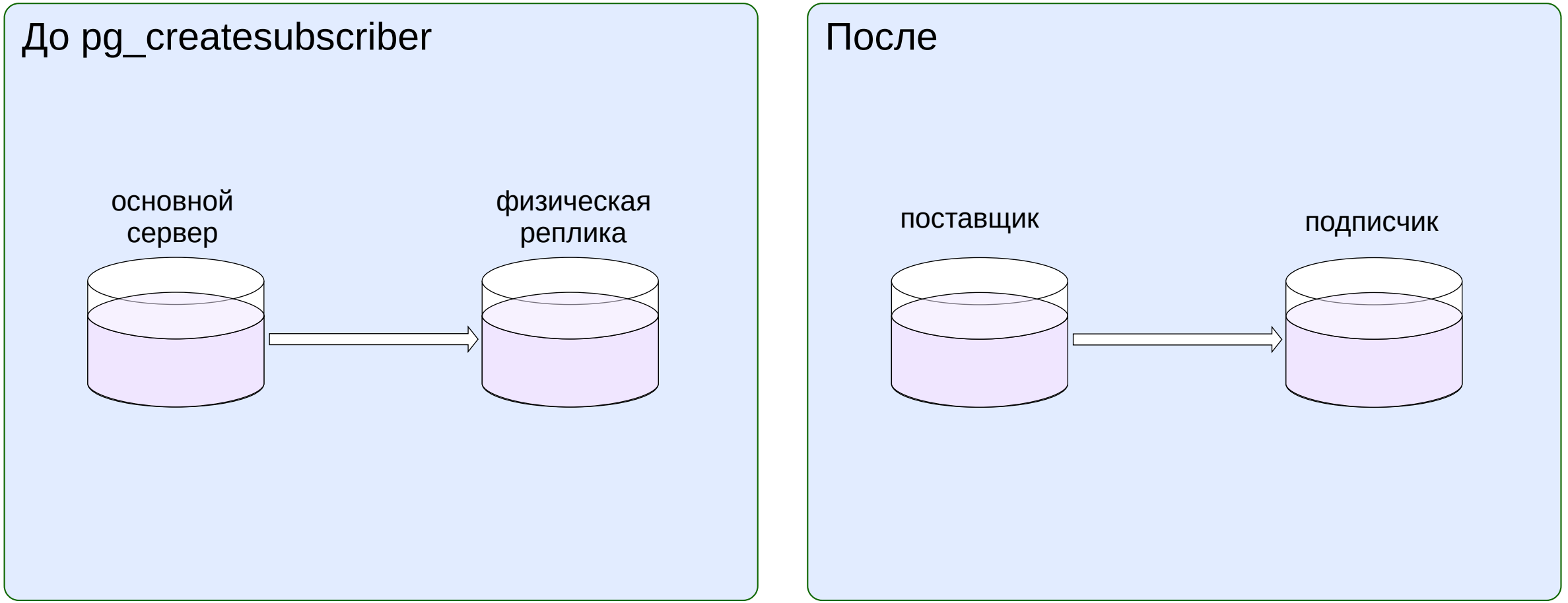
Администрирование сервера

transaction_timeout: завершение сеанса по достижении таймаута транзакции

```
=# \dconfig+ (idle|statement|transaction)*timeout
                          List of configuration parameters
              Parameter               | Value |  Type   | Context | Access privileges
--------------------------------------+-------+---------+---------+-------------------
 idle_in_transaction_session_timeout | 0     | integer | user    |
 idle_session_timeout                | 0     | integer | user    |
 statement_timeout                   | 0     | integer | user    |
 transaction_timeout                 | 0     | integer | user    |
(4 rows)
```

Логическая репликация

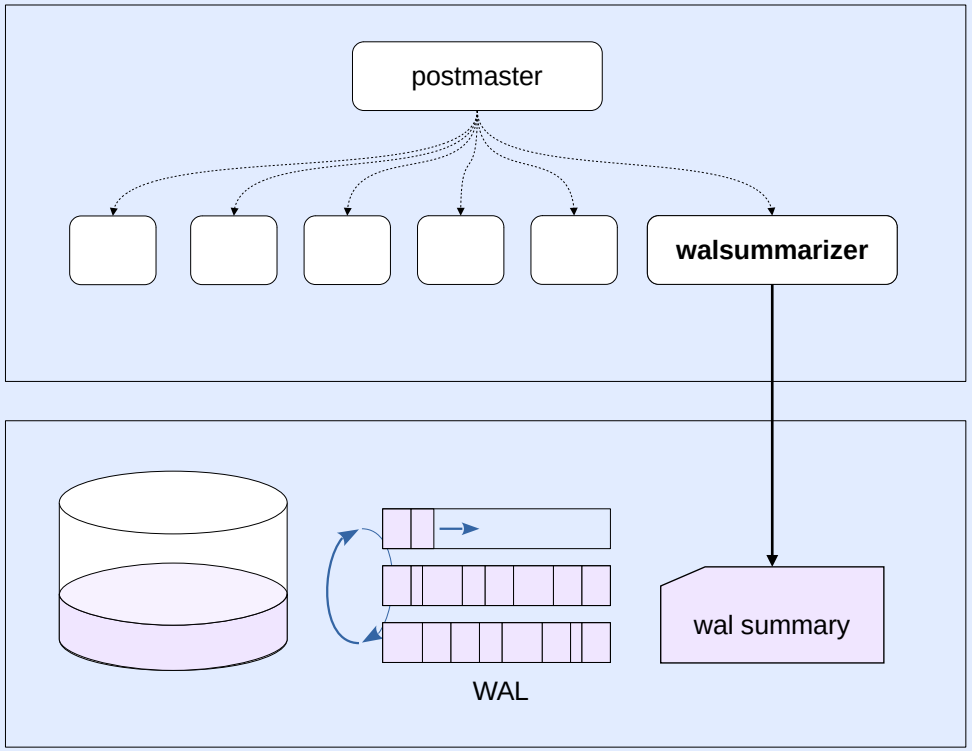
pg_createsubscriber: перевод физической реплики в логическую



Резервное копирование

Инкрементальные резервные копии

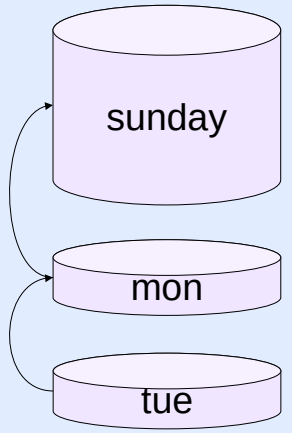
summarize_wal = on



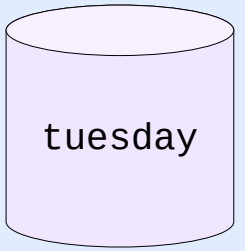

```
pg_basebackup -D sunday
```

```
pg_basebackup -D mon
    -i sunday/backup_manifest
```

```
pg_basebackup -D tue
    -i mon/backup_manifest
```




```
pg_combinebackup sunday mon tue
    -o tuesday
```



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Мониторинг

Прогресс очистки индексов

pg_stat_progress_vacuum

```
pid
datid
datname
relid
phase
heap_blks_total
heap_blks_scanned
heap_blks_vacuumed
index_vacuum_count
max_dead_tuple_bytes
dead_tuple_bytes
indexes_total
indexes_processed
```

Мониторинг

pg_stat_checkpointer: статистика процесса контрольной точки

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pg_stat_bgwriter

```
checkpoints_timed
checkpoints_req
checkpoint_write_time
checkpoint_sync_time
buffers_checkpoint
buffers_clean
maxwritten_clean
buffers_backend
buffers_backend_fsync
buffers_alloc
stats_reset
```

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pg_stat_bgwriter

```
buffers_clean
maxwritten_clean
buffers_alloc
stats_reset
```

pg_stat_checkpointer

```
num_timed
num_requested
restartpoints_timed
restartpoints_req
restartpoints_done
write_time
sync_time
buffers_written
stats_reset
```

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Мониторинг

EXPLAIN (memory) — объем памяти для построения плана

```
EXPLAIN (costs off, memory) SELECT * FROM t;
                    QUERY PLAN
-------------------------------------------------
 Seq Scan on t
 Planning:
   Memory: used=5640 bytes  allocated=8192 bytes
```

```
EXPLAIN (costs off, memory) SELECT * FROM t_partitioned;
                       QUERY PLAN
--------------------------------------------------------
 Append
   ->  Seq Scan on t_p1 t_partitioned_1
…
   ->  Seq Scan on t_p1000 t_partitioned_1000
 Planning:
   Memory: used=3422176 bytes  allocated=4210688 bytes
```

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Мониторинг

EXPLAIN (analyze, serialize) — затраты на сериализацию выходных данных

```
EXPLAIN (costs off, analyze) SELECT * FROM tickets;
                              QUERY PLAN
-----------------------------------------------------------------------
 Seq Scan on tickets (actual time=0.065..265.958 rows=2949857 loops=1)
 Planning Time: 0.070 ms
 Execution Time: 333.116 ms
```

```
EXPLAIN (costs off, analyze, serialize) SELECT * FROM tickets;
                              QUERY PLAN
-----------------------------------------------------------------------
 Seq Scan on tickets (actual time=0.087..258.809 rows=2949857 loops=1)
 Planning Time: 0.053 ms
 Serialization: time=1275.857 ms  output=338792kB  format=text
 Execution Time: 1647.735 ms
```

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