What is new in PostgreSQL 14

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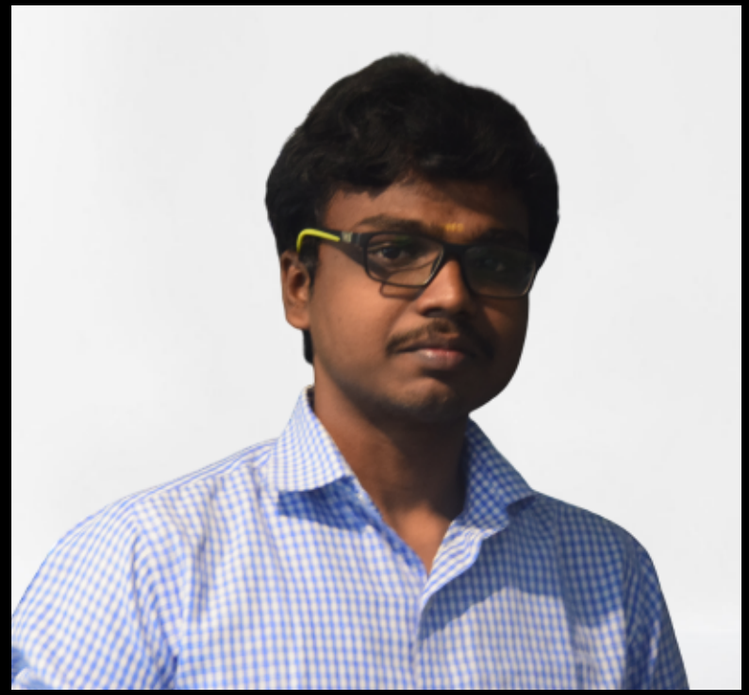
Mydbops 10th MyWebinar

About Me

- Database Reliability Engineer
- Focusing on MySQL and PostgreSQL
- Expertise on performance tuning and troubleshooting
- Active blogger



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About Mydbops

- Services on top open source databases
- Founded in 2016
- 70 Members team
- Assisted over 500+ Customers
- AWS Partner and a PCI Certified Organisation

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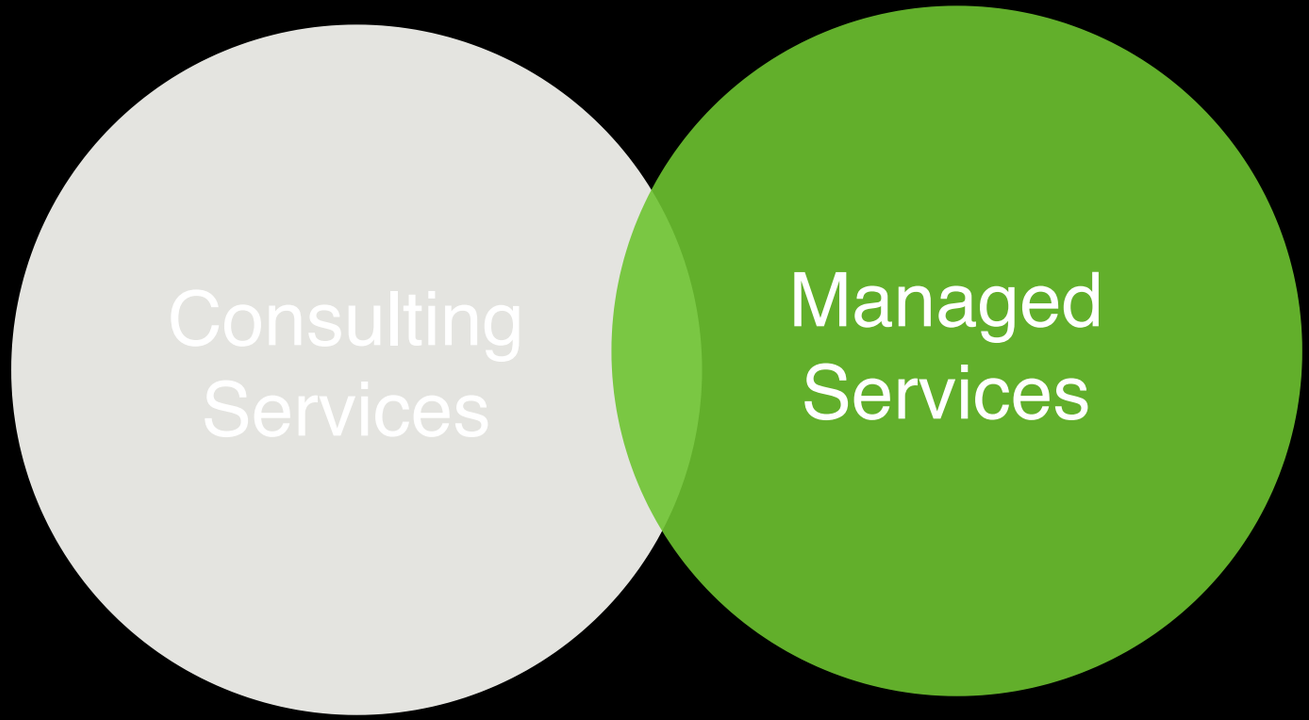
Mydbops Services



Focuses on Top Opensource database MySQL, MongoDB and PostgreSQL

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Our Clients

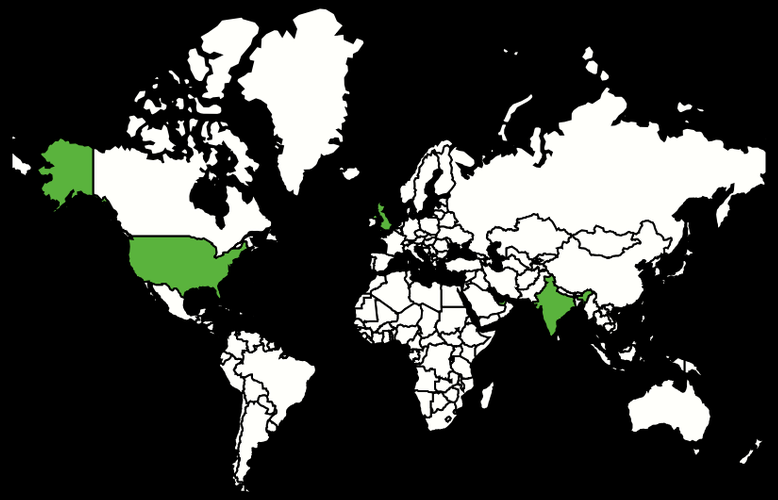
500 + Clients In 5 Yrs. of Operations

Flipkart

SWIGGY

yulu

NYKAA



DREAM11

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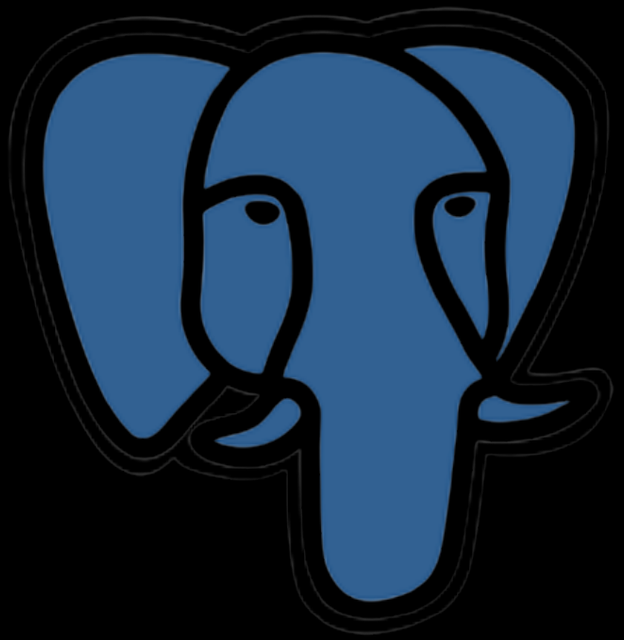
PostgreSQL 14



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Overview

- Released on September 30, 2021
- With a lot of new features and bug fixed
- Every Quarter - Minor Releases
- Every Third Quarter - Major Release

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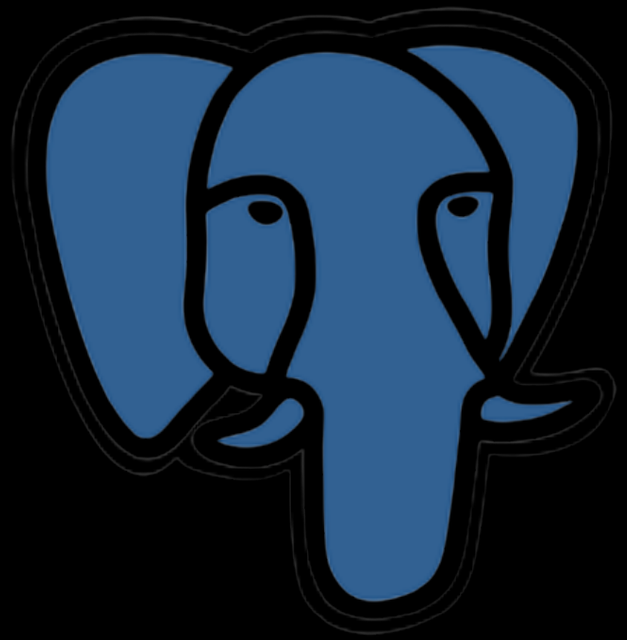
New Features



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PostgreSQL 14 Features

01 Server Side Enhancements

02 Improvements to Query Parallelism

03 Security Enhancements

04 Features for Application Developers

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PostgreSQL 14 Features

05 Enhancements in Monitoring

06 Enhancements in pg_stat_statements

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Server Side Enhancements

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Reducing B Tree Index Bloat

BLOAT

- Dead tuples - Bloat
- Vacuum - Mark it as Reusable
- Index page scan becomes huge
- Unnecessary pages in RAM

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Heap Only Tuple

- Version 8.3
- No need to update index

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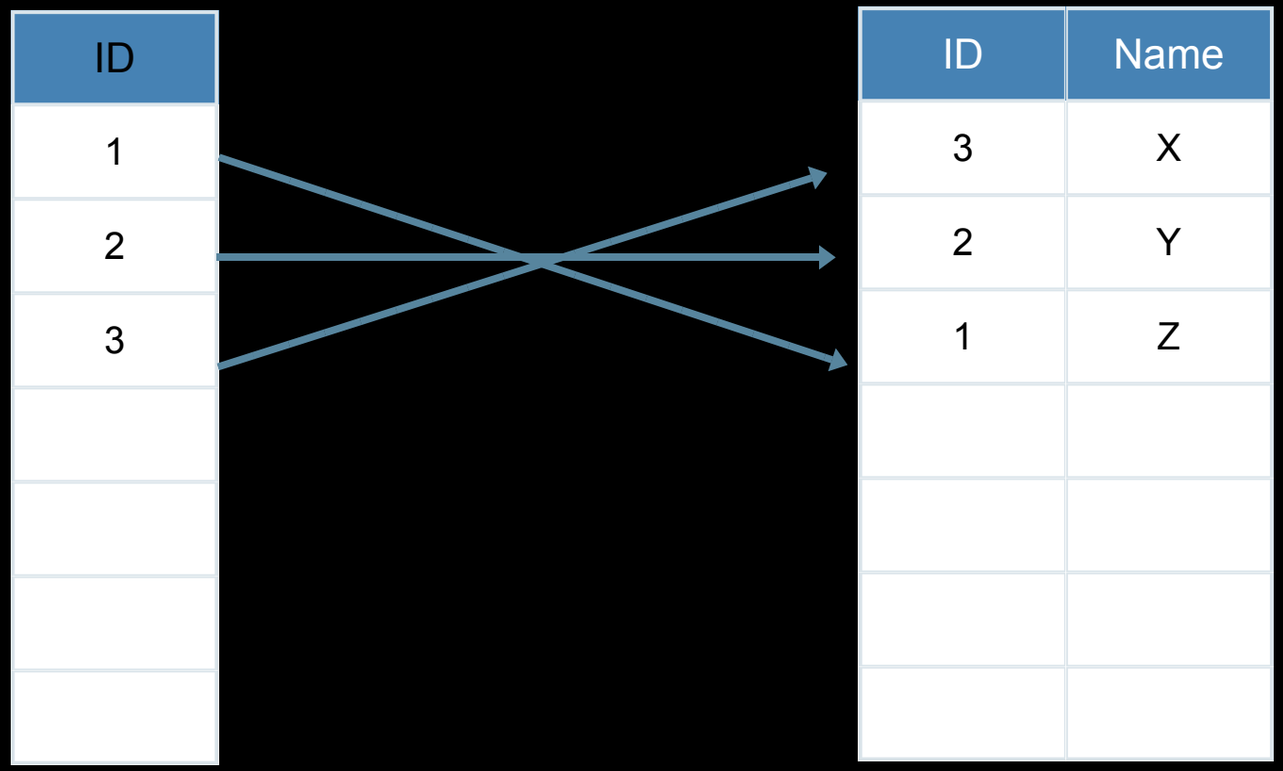
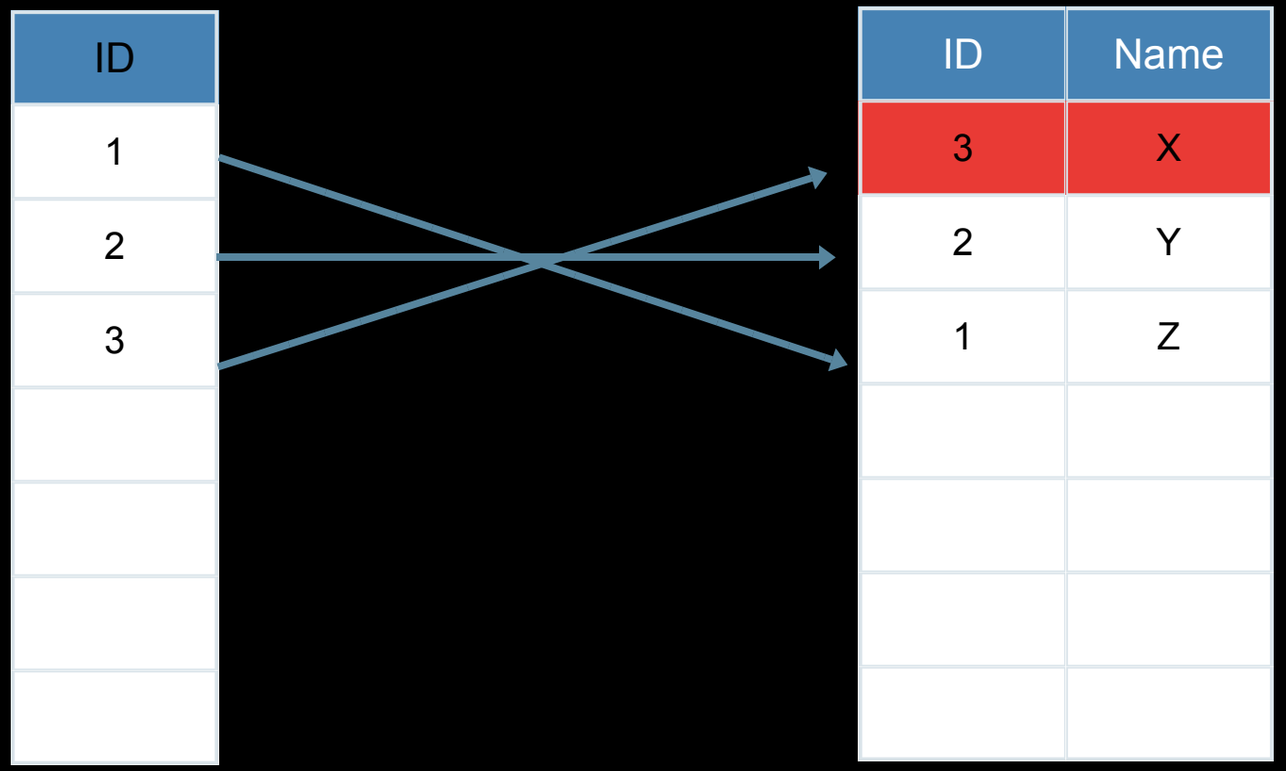
Heap Only Tuple



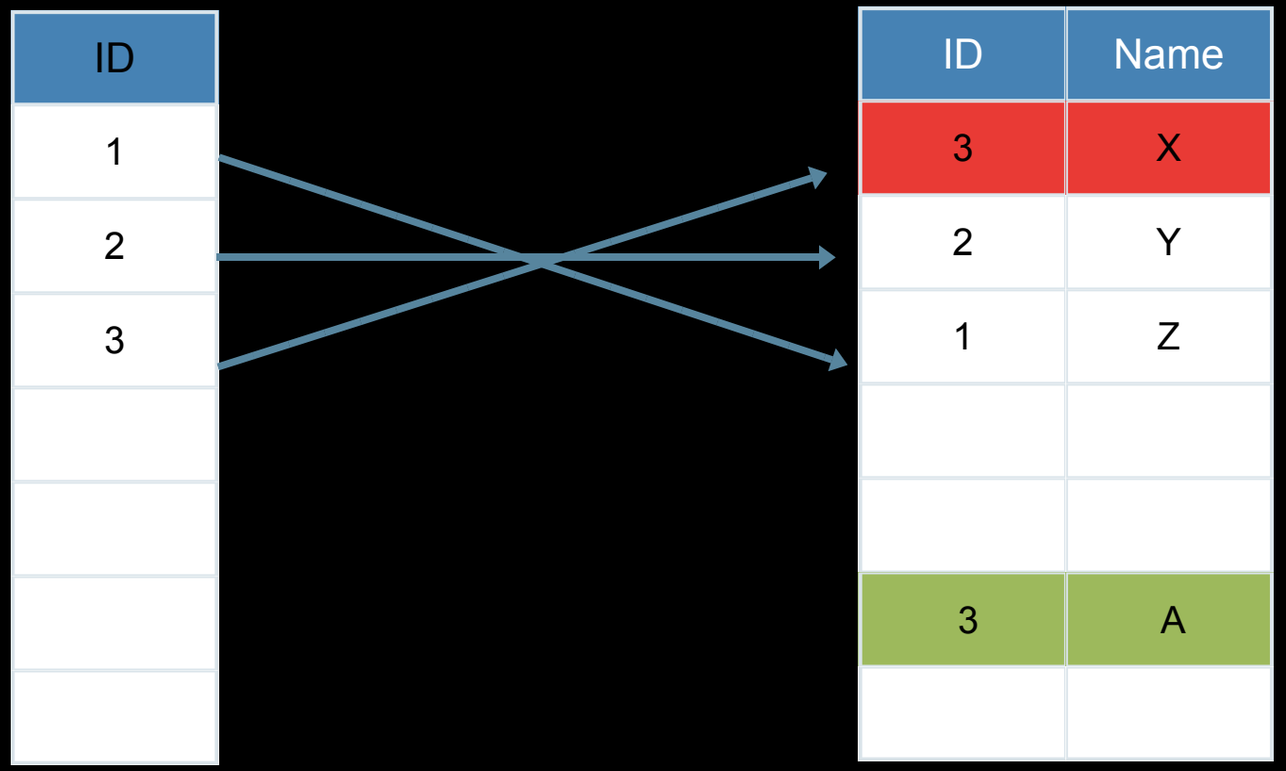
Mydbops

Heap Only Tuple



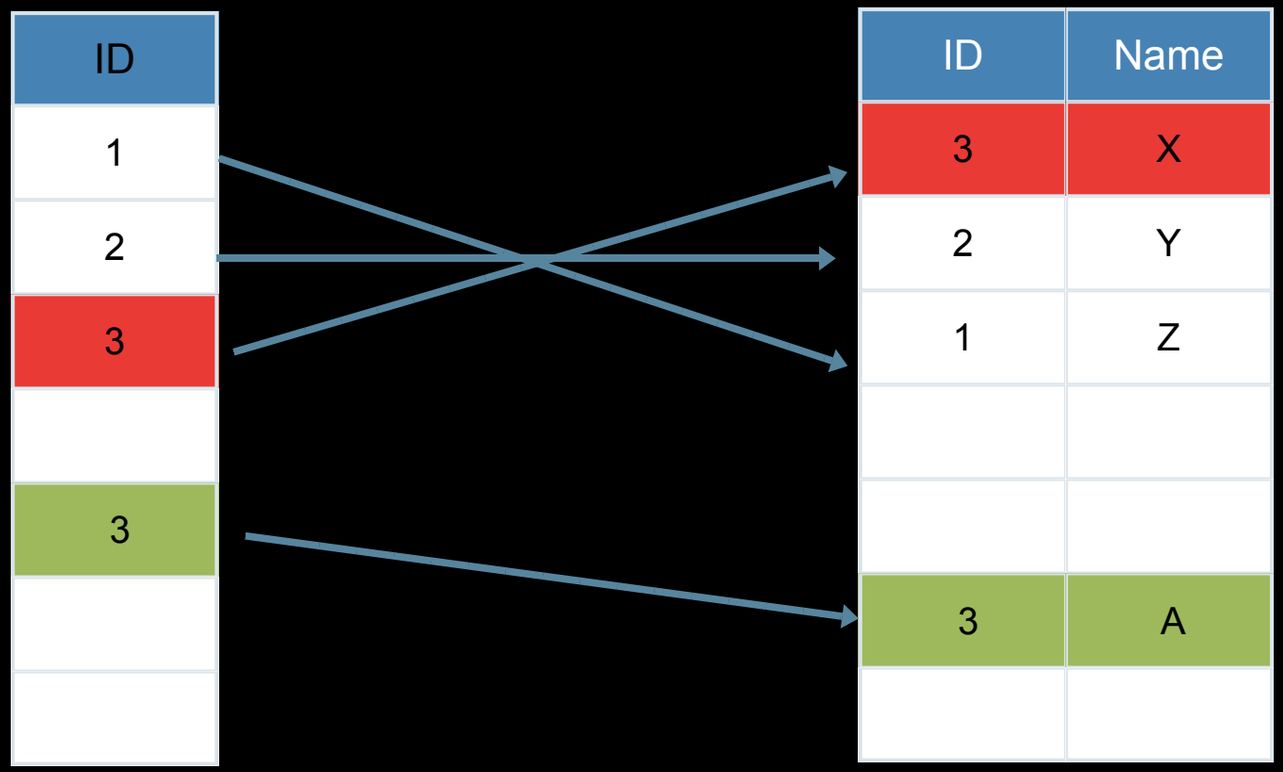
Mydbops

Heap Only Tuple



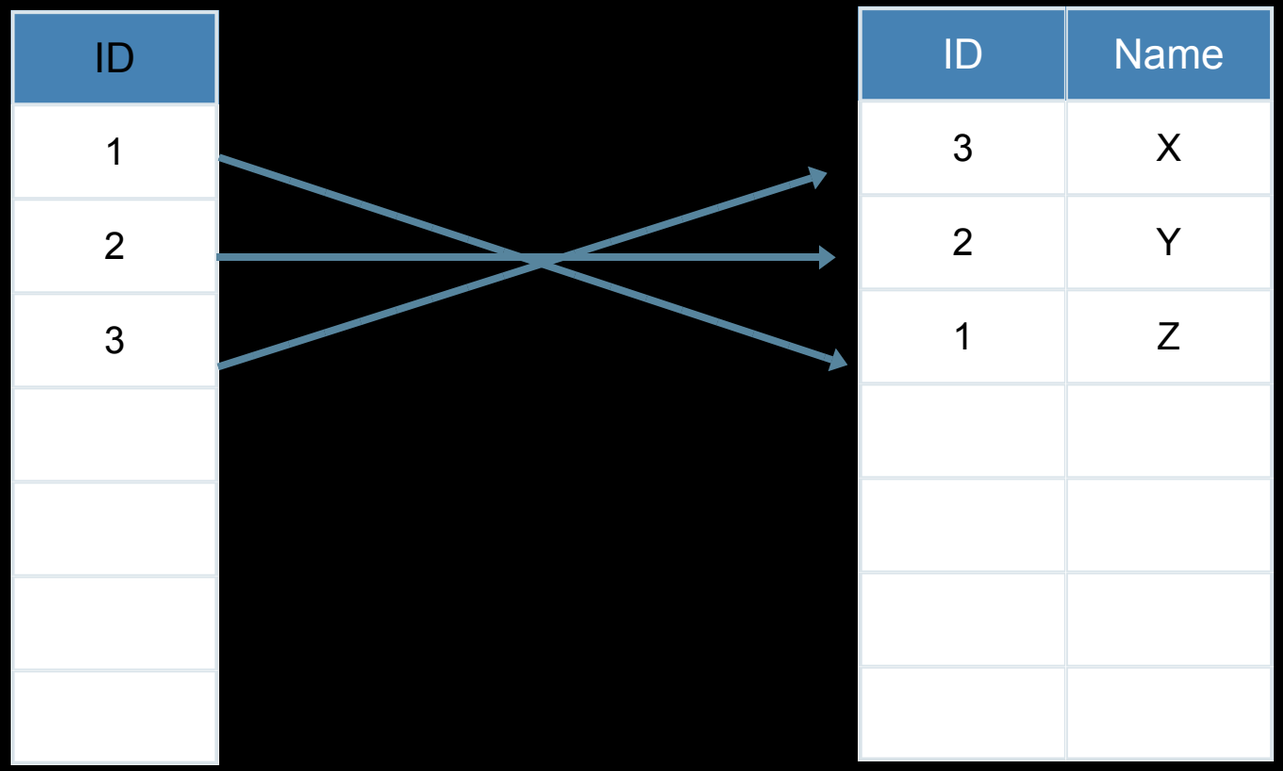
Mydbops

Heap Only Tuple



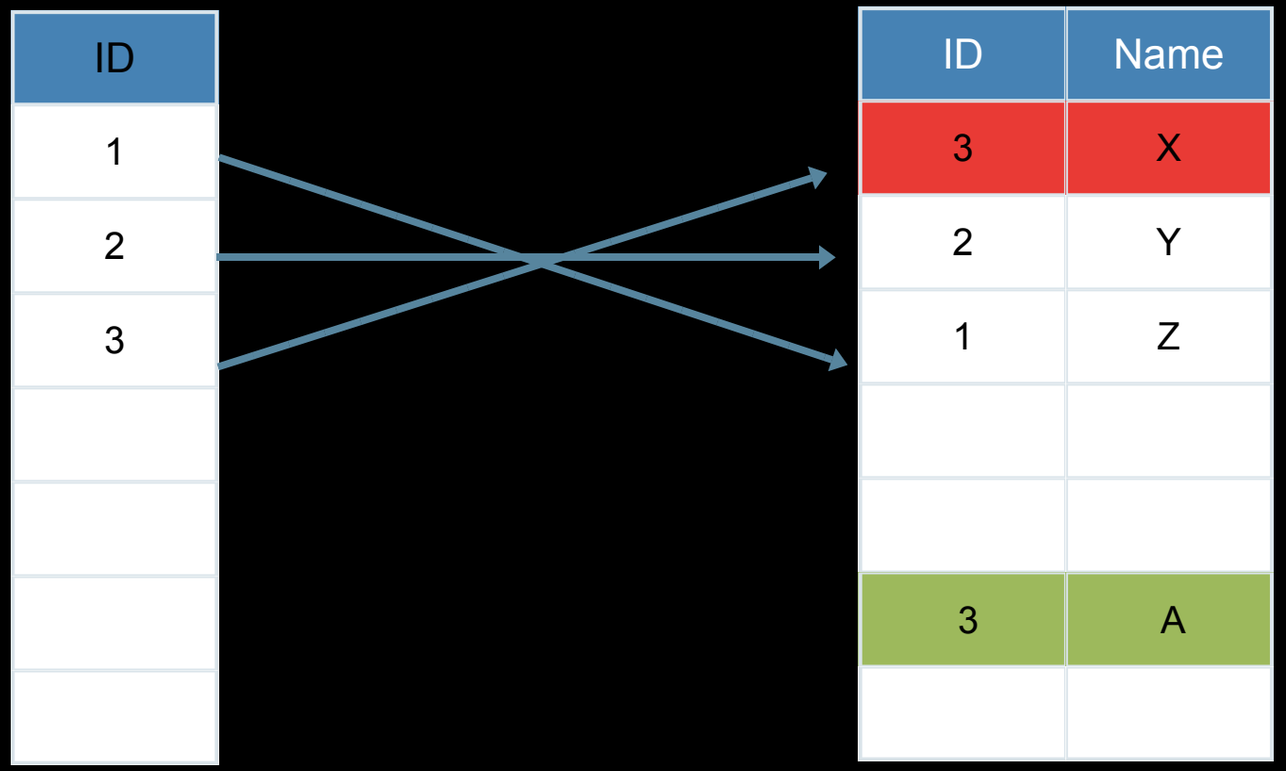
Mydbops

Heap Only Tuple



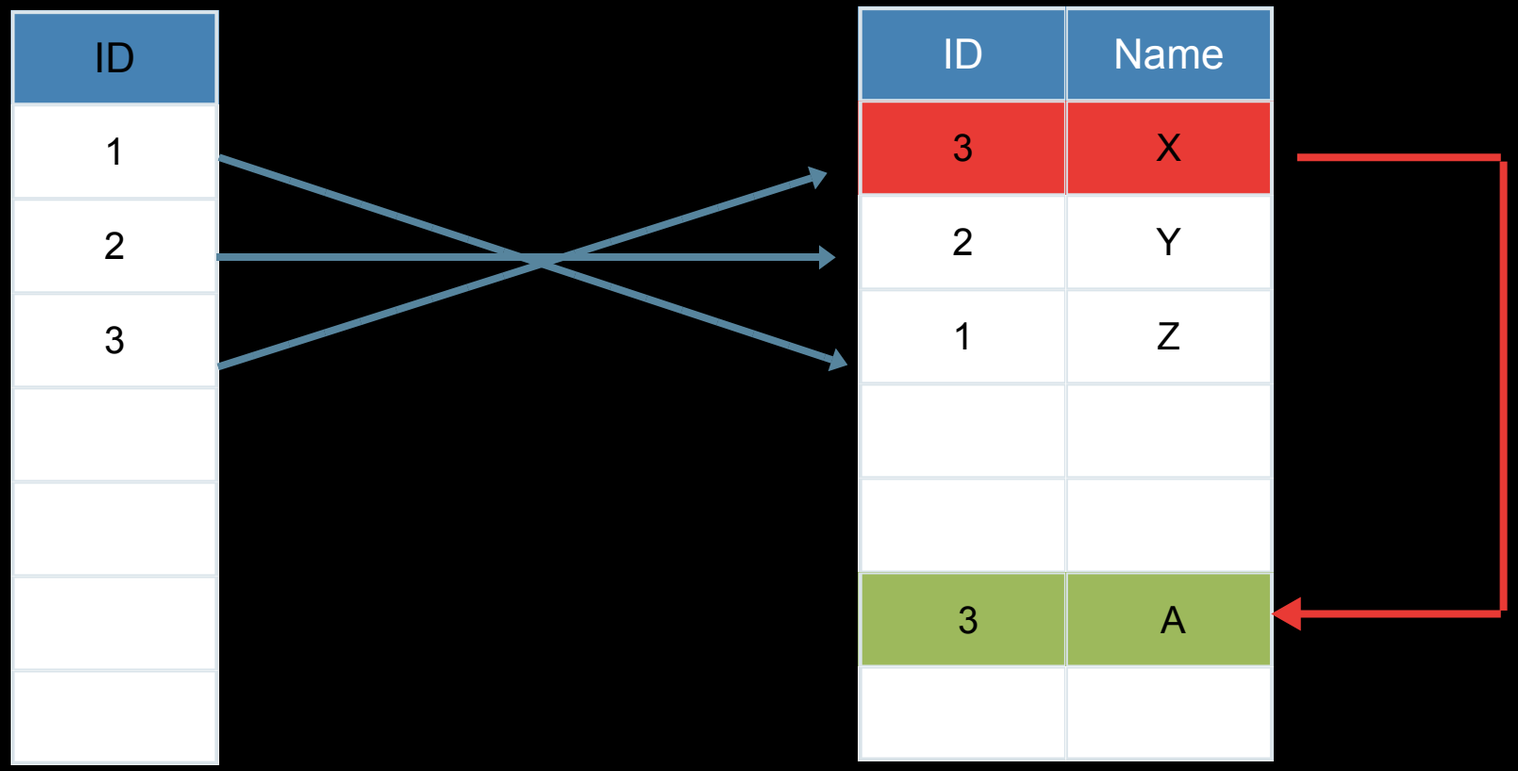
Mydbops

Heap Only Tuple



Mydbops

Heap Only Tuple



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Killed Index Tuples

```
CREATE UNLOGGED TABLE test (
    id integer PRIMARY KEY,
    val text NOT NULL
) WITH (autovacuum_enabled = off);

INSERT INTO test SELECT i, 'text number ' || i FROM
generate_series(1, 1000000) AS i;


DELETE FROM test WHERE id BETWEEN 501 AND 799500;

Analyze test;
```

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Killed Index Tuples

```
test=# EXPLAIN (ANALYZE, BUFFERS, COSTS OFF, TIMING OFF)
SELECT * FROM test WHERE id BETWEEN 1 AND 800000;
                          QUERY PLAN
-----------------------------------------------------------
-----
 Index Scan using test_pkey on test (actual rows=1000
loops=1)
   Index Cond: ((id >= 1) AND (id <= 800000))
   Buffers: shared hit=7284
 Planning:
   Buffers: shared hit=25
 Planning Time: 0.204 ms
 Execution Time: 95.223 ms
(7 rows)
```

Killed Index Tuples

```
test=# EXPLAIN (ANALYZE, BUFFERS, COSTS OFF, TIMING OFF)
SELECT * FROM test WHERE id BETWEEN 1 AND 800000;
                          QUERY PLAN
-----------------------------------------------------------
-----
 Index Scan using test_pkey on test (actual rows=1000
loops=1)
   Index Cond: ((id >= 1) AND (id <= 800000))
   Buffers: shared hit=2196
 Planning:
   Buffers: shared hit=8
 Planning Time: 0.196 ms
 Execution Time: 3.815 ms
(7 rows)
```

Bottom-Up Index Tuple Deletion

- Introduced in Version 14
- Delete Index Entries pointed to dead tuples
- Performing the operation of the VACUUM

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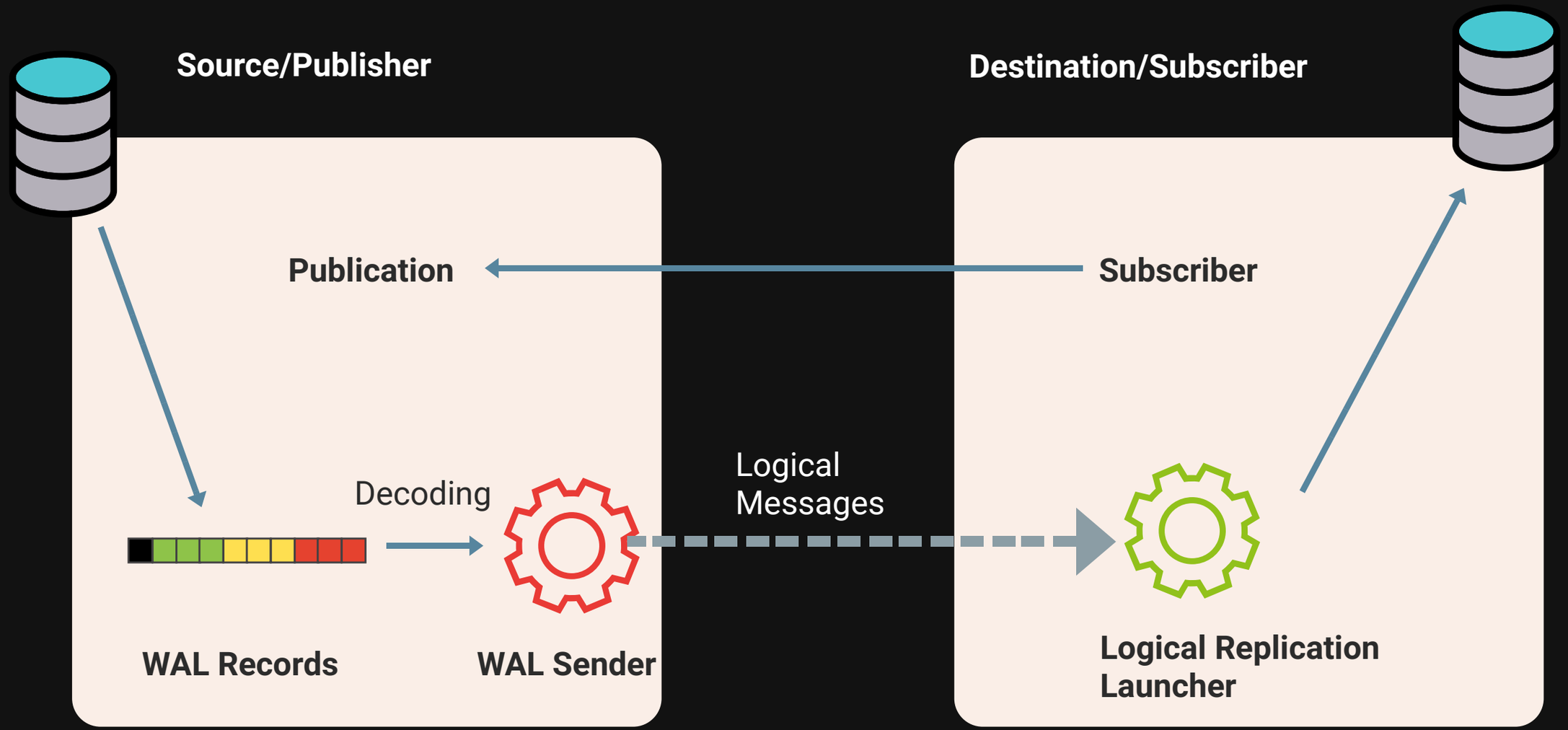
Replicating in-progress Transactions

Logical Replication - Publisher/Subscriber Model



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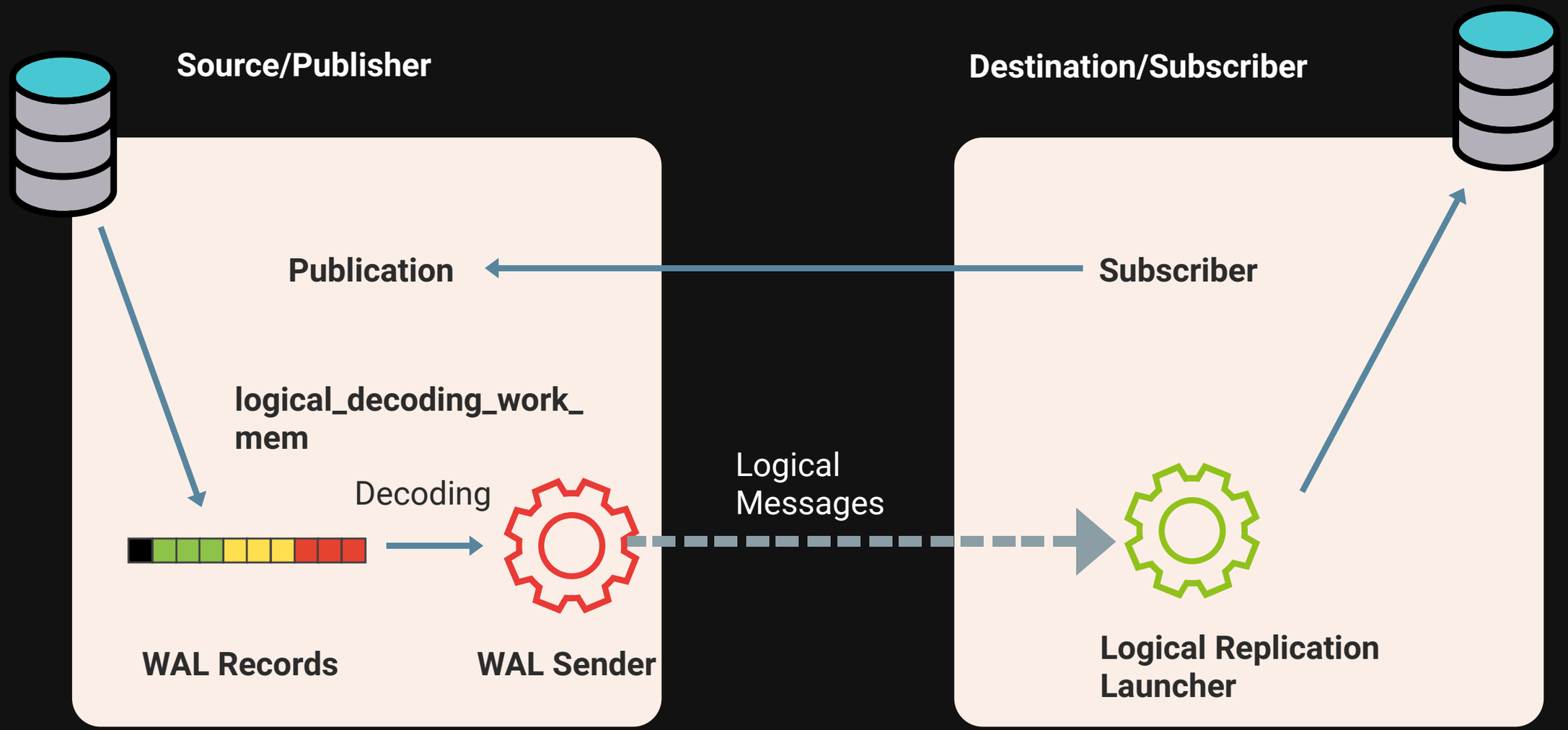
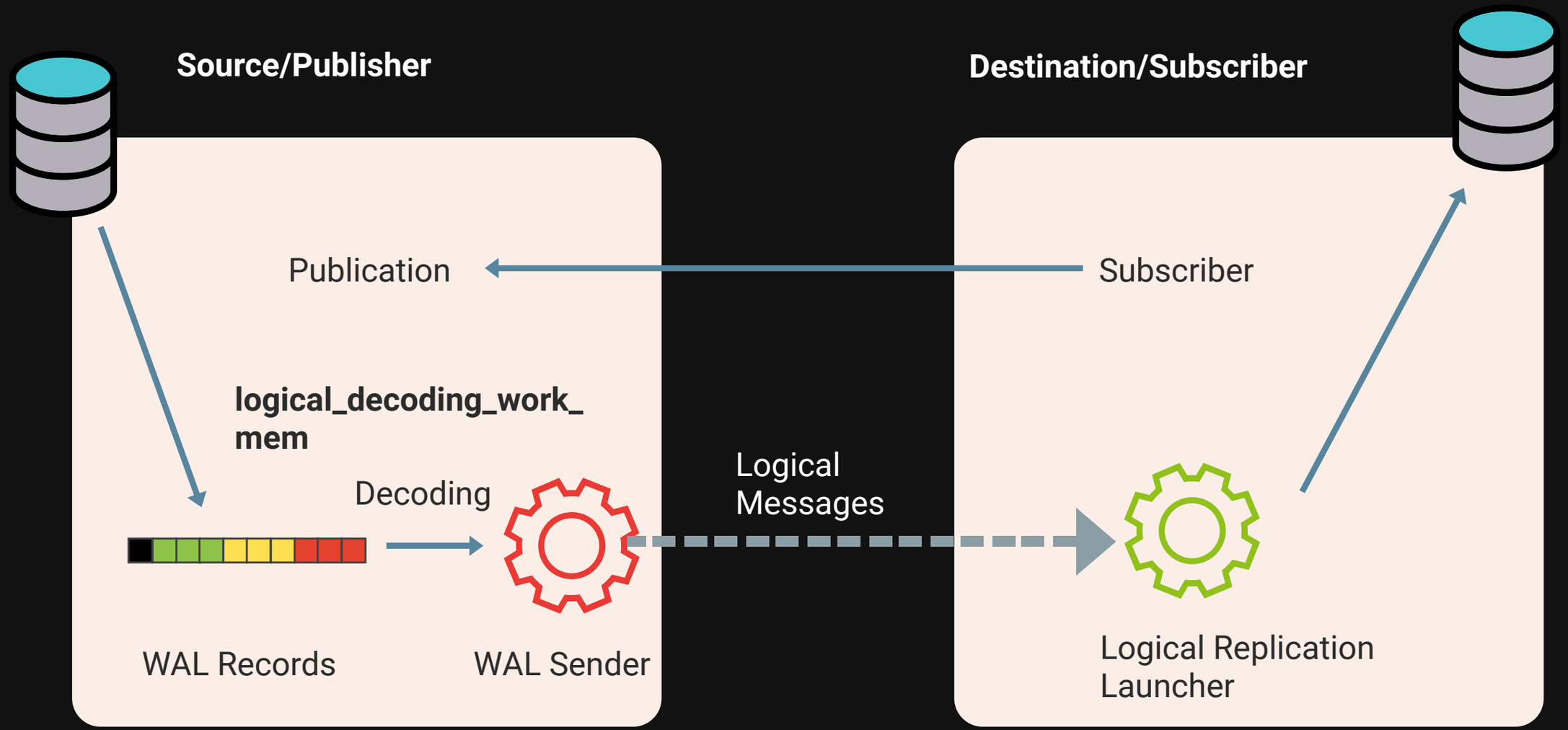
logical_decoding_work_mem - PostgreSQL 13



Mydbops

Logical Decode Work Mem - PostgreSQL 13



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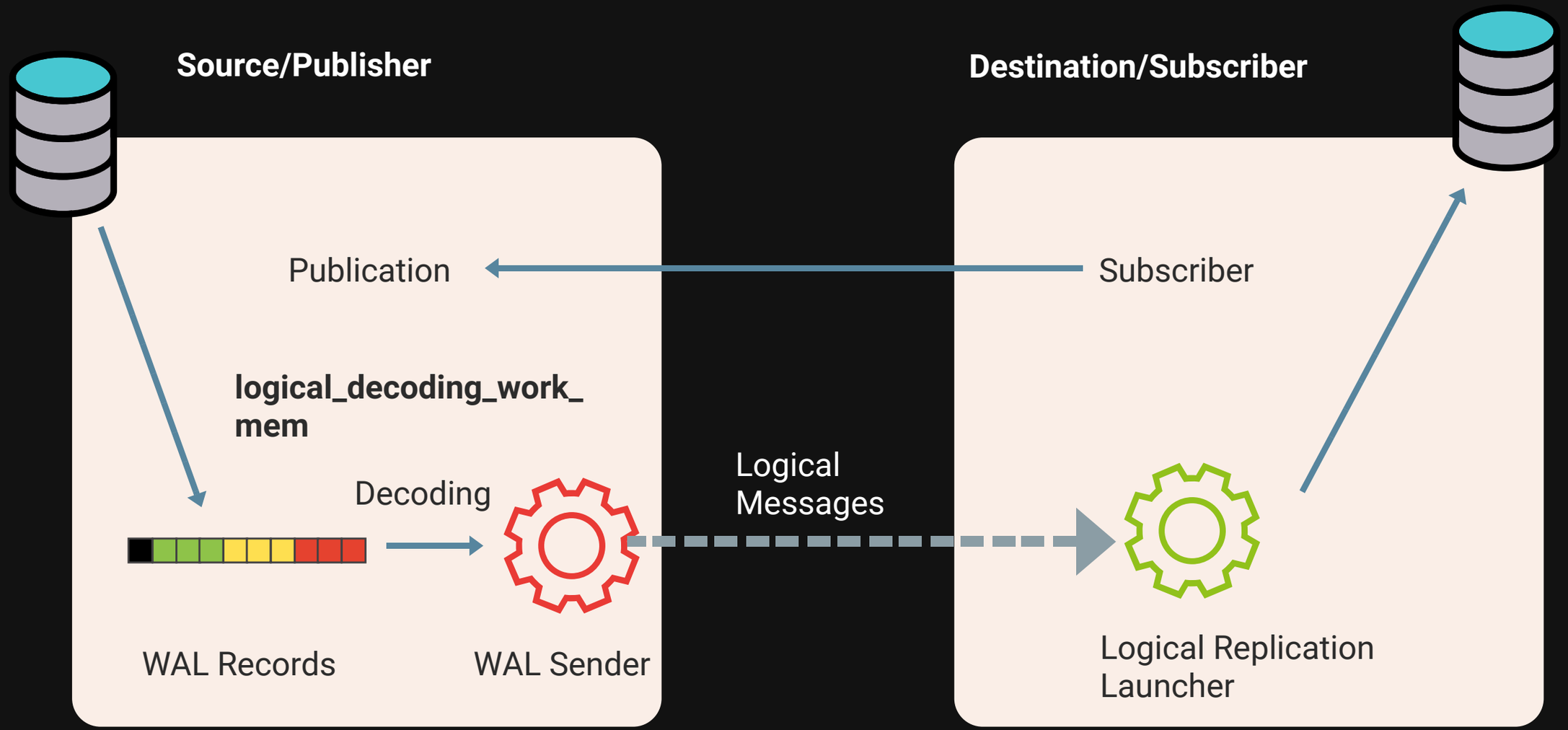
Streaming in-progress Transactions - PostgreSQL 14



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Streaming in-progress Transactions - PostgreSQL 14

```
[publisher configurations]:

wal_level = logical
synchronous_standby_names = '*'
logical_decoding_work_mem=1MB
```

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Streaming in-progress Transactions - PostgreSQL 14

```
[publisher setup]


CREATE TABLE test(id int ,name text);
CREATE PUBLICATION test_pub FOR TABLE test;

[subscription setup]


CREATE TABLE test(id int ,name text);
CREATE SUBSCRIPTION test_sub CONNECTION 'host=127.0.0.1
port=5432 dbname=postgres' PUBLICATION test_pub;
```

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Streaming in-progress Transactions - PostgreSQL 14

```
[publisher setup]


CREATE TABLE test(id int ,name text);
CREATE PUBLICATION test_pub FOR TABLE test;

[subscription setup]


CREATE TABLE test(id int ,name text);
CREATE SUBSCRIPTION test_sub CONNECTION 'host=127.0.0.1
port=5432 dbname=postgres' PUBLICATION test_pub;
```

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Streaming in-progress Transactions - PostgreSQL 14

```
INSERT INTO test SELECT i, REPEAT('x', 10) FROM
generate_series(1,5000000) AS i;

Time Taken for Commit : 6.7 Secs
```

Streaming in-progress Transactions - PostgreSQL 14

```
ALTER SUBSCRIPTION test_sub SET(STREAMING = ON)

INSERT INTO test SELECT i, REPEAT('x', 10) FROM
generate_series(1,5000000) AS i;

Time taken for COMMIT: 3.5 secs
```

LZ4 Toast Compression

TOAST

- Mechanism used to avoid exceeding the size of data block
- Try Compress
- Wider field values into a smaller pieces
- Default, this is 2KB
- Every table will have its own toast table

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New Compression Configuration

- pglz - in built compression
- lz4 - New compression method added
- New Configuration Variable - default_toast_compression
- --with-lz4

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Idle Session Timeout

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Idle_session_timeout

- New variable
- Almost the same purpose of idle_in_transaction_session_timeout

```
postgres=#  select name,setting,unit,user,pending_restart from
pg_settings where name = 'idle_session_timeout' \gx
-[ RECORD 1 ]---+---------------------
name            | idle_session_timeout
setting         | 0
unit            | ms
context         | user
pending_restart | f
```

Mydbops

idle_in_transaction_session_timeout

- Available since PostgreSQL 9.6
- Maximum allowed idle time between queries, when **in transaction**

```
postgres=#  select name,setting,unit,context,pending_restart from
pg_settings where name = 'idle_in_transaction_session_timeout' \gx
-[ RECORD 1 ]---+-----------------------------------
name            | idle_in_transaction_session_timeout
setting         | 0
unit            | ms
context         | user
pending_restart | f
```

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idle_in_transaction_session_timeout

- Opened a new session

```
postgres=# set idle_in_transaction_session_timeout=2000;
SET
postgres=#
```

- Started a new transaction

```
postgres=# start transaction;
START TRANSACTION
postgres=*#  select name,setting from pg_settings where name =
'idle_in_transaction_session_timeout' \gx
-[ RECORD 1 ]-----------------------------
name    | idle_in_transaction_session_timeout
setting | 2000
```

Mydbops

idle_in_transaction_session_timeout

```
postgres=# start transaction;
START TRANSACTION
postgres=*#  select name,setting from pg_settings where name =
'idle_in_transaction_session_timeout' \gx
-[ RECORD 1 ]-------------------------------
name    | idle_in_transaction_session_timeout
setting | 2000

postgres=*#  select name,setting from pg_settings where name =
'idle_in_transaction_session_timeout' \gx
FATAL:  terminating connection due to idle-in-transaction timeout
server closed the connection unexpectedly
        This probably means the server terminated abnormally
        before or while processing the request.
The connection to the server was lost. Attempting reset:
Succeeded.
postgres=#
```

Idle_session_timeout

- Maximum idle time between the queries, when not in a transaction

```
postgres=# set Idle_session_timeout = 5000;
SET
postgres=#  select name,setting from pg_settings where name =
'idle_in_transaction_session_timeout' \gx
-[ RECORD 1 ]-----------------------------
name    | idle_in_transaction_session_timeout
setting | 0

postgres=#  select name,setting from pg_settings where name =
'idle_in_transaction_session_timeout' \gx
FATAL:  terminating connection due to idle-session timeout
server closed the connection unexpectedly
        This probably means the server terminated abnormally
        before or while processing the request.
The connection to the server was lost. Attempting reset:
Succeeded.
```

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Idle_session_timeout

- Helps to handle idle connections
- Apply only for the upcoming connections
- Should have higher value than application timeout

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Improvement to Query Parallelism

Refresh Materialized View

Mydbops

Materialized View

- Database Object
- Stores only the result of the query
- Refresh needs to be done

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Materialized View

- Loaded data in PostgreSQL 13

```
(postgres13)=> CREATE TABLE table_test (grp int, data numeric);
CREATE TABLE
Time: 3.282 ms
(postgres13)=>
(postgres13)=> INSERT INTO table_test SELECT 100, random() FROM
generate_series(1, 5000000);
INSERT 0 5000000
Time: 8064.350 ms (00:08.064)
(postgres13)=>
(postgres13)=> INSERT INTO table_test SELECT 200, random() FROM
generate_series(1, 5000000);
INSERT 0 5000000
Time: 9250.536 ms (00:09.251)
(postgres13)=>
```

Materialized View

- Loaded data in PostgreSQL 14

```
(postgres14)=> CREATE TABLE table_test (grp int, data numeric);
CREATE TABLE
Time: 13.577 ms
(postgres14)=>
(postgres14)=> INSERT INTO table_test SELECT 100, random() FROM
generate_series(1, 5000000);
INSERT 0 5000000
Time: 7204.919 ms (00:07.205)
(postgres14)=>
(postgres14)=> INSERT INTO table_test SELECT 200, random() FROM
generate_series(1, 5000000);
INSERT 0 5000000
Time: 8618.068 ms (00:08.618)
```

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Materialized View

- Executing a query on both version

```
(postgres13)=> SELECT grp, avg(data), count(*) FROM table_test
GROUP BY 1;
 grp |            avg             |  count
-----+----------------------------+---------
 100 | 0.49997968954960787679 3 | 5000000
 200 | 0.50012354616793038739 3 | 5000000
(2 rows)
Time: 960.802 ms

(postgres14)=> SELECT grp, avg(data), count(*) FROM table_test
GROUP BY 1;
 grp |            avg             |  count
-----+----------------------------+---------
 100 | 0.50017301919687580407 2 | 5000000
 200 | 0.50006568233528992873 9 | 5000000
(2 rows)
Time: 965.867 ms
```

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Materialized View

- Creating materialized view for the static table

```
(postgres13)=> CREATE MATERIALIZED VIEW test_view AS SELECT grp,
avg(data), count(*) FROM table_test GROUP BY 1;
SELECT 2
Time: 983.138 ms

(postgres14)=> CREATE MATERIALIZED VIEW test_view AS SELECT grp,
avg(data), count(*) FROM table_test GROUP BY 1;
SELECT 2
Time: 978.225 ms
(postgres14)=>
```

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Materialized View

- Querying the materialized view instead of table

```
(postgres13)=> select * from test_view;
 grp |          avg           |  count
-----+------------------------+---------
 100 | 0.49997968954960787679 | 5000000
 200 | 0.50012354616793038739 | 5000000
(2 rows)
Time: 0.561 ms

(postgres14)=> select * from test_view;
 grp |          avg           |  count
-----+------------------------+---------
 100 | 0.50017301919687580407 | 5000000
 200 | 0.50006568233528992873 | 5000000
(2 rows)
Time: 0.540 ms
```

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Refresh Materialized View

- Refreshing the materialized view to get the updated result

```
(postgres13)=> refresh materialized view test_view;
REFRESH MATERIALIZED VIEW
Time: 2027.911 ms (00:02.028)
(postgres13)=>

(postgres14)=> refresh materialized view test_view;
REFRESH MATERIALIZED VIEW
Time: 961.503 ms
```

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Refresh Materialized View

- Explain plan with parallel workers

```
(postgres14)=> explain  SELECT grp, avg(data), count(*) FROM
table_test GROUP BY 1;
                                                  QUERY PLAN
-------------------------------------------------------------------------------
-----------------------------------
 Finalize GroupAggregate  (cost=127997.34..127997.87 rows=2
width=44)
   Group Key: grp
   ->  Gather Merge  (cost=127997.34..127997.81 rows=4 width=44)
         Workers Planned: 2
         ->  Sort  (cost=126997.32..126997.32 rows=2 width=44)
               Sort Key: grp
               ...... on table_test  (cost=0.00..95747.02
rows=4166702 width=15)
(9 rows)

Time: 0.438 ms
```

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Refresh Materialized View

- Other than refresh, remaining use parallelism
- For version < 14, it is better to recreate it than refresh
- During refresh, it will lock the content
- Concurrent option, but PK is mandatory

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Return Query

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Security Improvements

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Default Authentication Method

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Default Authentication Method - scram-sha-256

- Previously MD5 hashing method
- Easy to reconstruct
- Expensive Hash Function
- Introduced in V10, now made it as default
- Client needs to support it

```
authentication method 10 not supported
```

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Predefined Roles

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Predefined Roles - pg_read_all_data or pg_write_all_data

- Be a superuser
- Provide access to the complete database

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Predefined Roles - pg_read_all_data

- Read all data(Tables, views and sequences)
- Select access on objects and usage access on schemas

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Predefined Roles - pg_write_all_data

- Write all data(Tables, views and sequences)
- Insert, Update, Delete access on objects and usage access on schemas

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Predefined Roles - pg_read_all_data or pg_write_all_data

```
(postgres14)=> create user testing;
CREATE ROLE
Time: 5.468 ms
(postgres14)=> set role to 'testing';
SET
Time: 0.392 ms
(postgres14)=> SELECT grp, avg(data), count(*) FROM table_test
GROUP BY 1;
ERROR:  permission denied for table table_test
Time: 2.010 ms
(postgres14)=>
```

Predefined Roles - pg_read_all_data or pg_write_all_data

```
(postgres14)=> reset role;
RESET
Time: 0.189 ms

(postgres14)=> grant pg_read_all_data to testing;
GRANT ROLE
Time: 4.202 ms
(postgres14)=>
(postgres14)=> set role to 'testing';
SET
Time: 0.148 ms
(postgres14)=> SELECT grp, avg(data), count(*) FROM table_test
GROUP BY 1;
 grp |          avg             |  count
-----+--------------------------+---------
 100 | 0.50017301919687580 4072 | 5000000
 200 | 0.50006568233528992 8739 | 5000000
(2 rows)
```

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Features for Application Developers

New JSON Syntax

New JSON Syntax

- Since PostgreSQL 9.2
- Had unique syntax

Old Syntax:

```
where (jsonb_column->>'name')::varchar = 'Aakash:
DBRE(2021)';
```

New Syntax:

```
where jsonb_column['name'] = '"Aakash: DBRE(2021)"';
```

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Multirange Datatypes

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Range

- Beginning and End value
- Datetime or Integer
- This train is running between X and Y

Range - Classic SQL

```
create table track_activity (
id serial primary key,
appname varchar(100),
start_ts timestamp,
end_ts timestamp
);

insert into track_activity (appname,start_ts,end_ts) values
('Whatapp', '2021-10-01 4:00', '2021-10-01 7:00');
insert into track_activity (appname,start_ts,end_ts) values
('Facebook', '2021-10-01 7:00', '2021-10-01 11:00');
insert into track_activity (appname,start_ts,end_ts) values
('Whatsapp', '2021-10-01 11:00', '2021-10-01 21:00');
insert into track_activity (appname,start_ts,end_ts) values
('Instagram', '2021-10-01 22:00', '2021-10-01 23:00');
```

Mydbops

Range - Classic SQL

```
(postgres14)=> select * from track_activity;
 id |  appname  |       start_ts      |        end_ts
----+-----------+---------------------+---------------------
  1 | Whatapp   | 2021-10-20 04:00:00 | 2021-10-20 07:00:00
  2 | Facebook  | 2021-10-20 07:00:00 | 2021-10-20 11:00:00
  3 | Whatsapp  | 2021-10-20 11:00:00 | 2021-10-20 21:00:00
  4 | Instagram | 2021-10-20 22:00:00 | 2021-10-20 23:00:00
(4 rows)
```

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Range - Classic SQL

```
(postgres14)=> select id, appname from track_activity where
start_ts <= '2021-10-20 11:00'::timestamp and end_ts >= '2021-10-
20 12:00'::timestamp;
 id | appname
----+-----------
  3 | Whatsapp
(1 row)
```

Mydbops

Range - Classic SQL

```
(postgres14)=> select id, appname from track_activity where
(start_ts <= '2021-10-20 11:00'::timestamp and end_ts >= '2021-10-
20 12:00'::timestamp) or (start_ts <= '2021-10-20
17:00'::timestamp and end_ts >= '2021-10-20 18:00'::timestamp);
 id | appname
----+-----------
  3 | Whatsapp
(1 row)
```

Mydbops

Range - Using Range Data Type

```
create table track_activity_range (
id serial primary key,
appname varchar(100),
time_ts tsrange
);

insert into track_activity_range (appname,time_ts) values
('Whatapp', '[2021-10-20 4:00, 2021-10-20 7:00]');
insert into track_activity_range (appname,time_ts) values
('Facebook', '[2021-10-20 7:00, 2021-10-20 11:00]');
insert into track_activity_range (appname,time_ts) values
('Whatsapp', '[2021-10-20 11:00, 2021-10-20 21:00]');
insert into track_activity_range (appname,time_ts) values
('Instagram', '[2021-10-20 22:00, 2021-10-20 23:00]');
```

Mydbops

Range - Using Range Data Type

```
(postgres14)=> select id, appname from track_activity_range where
time_ts @> '2021-10-20 12:00'::timestamp;
 id ┆ appname
----+----------
  3 | Whatsapp
(1 row)
```

Mydbops

Range - Using Range Data Type

```
(postgres14)=> select * from track_activity_range where id=3;
 id | appname  |                    time_ts
----+----------+---------------------------------------------
  3 | Whatsapp | ["2021-10-20 11:00:00","2021-10-20 21:00:00"]
(1 row)


(postgres14)=> update track_activity_range set time_ts = time_ts -
'[2021-10-20 11:00,2021-10-20 11:30]'::tsrange where id = 3;
UPDATE 1


(postgres14)=> select * from track_activity_range where id=3;
 id | appname  |                    time_ts
----+----------+---------------------------------------------
  3 | Whatsapp | ("2021-10-20 11:30:00","2021-10-20 21:00:00"]
(1 row)
```

Range - Using Range Data Type

```
(postgres14)=> select * from track_activity_range where id=3;
 id | appname  |                      time_ts
----+----------+-------------------------------------------------
  3 | Whatsapp | ("2021-10-20 11:30:00","2021-10-20 21:00:00"]
(1 row)
```

```
(postgres14)=> update track_activity_range set time_ts = time_ts -
'[2021-10-20 12:00,2021-10-20 12:30]' where id = 3;
ERROR:  result of range difference would not be contiguous
Time: 0.594 ms
(postgres14)=>
```

Mydbops

Range - Using Multi Range Data Type

```
create table track_activity_multirange (
id serial primary key,
appname varchar(100),
time_ts tsmultirange
);

insert into track_activity_multirange (appname,time_ts) values
('Whatapp', '{[2021-10-20 4:00, 2021-10-20 7:00]}');
insert into track_activity_multirange (appname,time_ts) values
('Facebook', '{[2021-10-20 7:00, 2021-10-20 11:00]}');
insert into track_activity_multirange (appname,time_ts) values
('Whatsapp', '{[2021-10-20 11:00, 2021-10-20 21:00]}');
insert into track_activity_multirange (appname,time_ts) values
('Instagram', '{[2021-10-20 22:00, 2021-10-20 23:00]}');
```

Mydbops

Range - Using Multi Range Data Type

```
(postgres14)=> select * from track_activity_multirange;
 id |   appname   |                          time_ts
----+-------------+-----------------------------------------------------
  1 | Whatapp     | {["2021-10-20 04:00:00","2021-10-20 07:00:00"]}
  2 | Facebook    | {["2021-10-20 07:00:00","2021-10-20 11:00:00"]}
  3 | Whatsapp    | {["2021-10-20 11:00:00","2021-10-20 21:00:00"]}
  4 | Instagram | {["2021-10-20 22:00:00","2021-10-20 23:00:00"]}
(4 rows)
```

Mydbops

Range - Using Multi Range Data Type

```
(postgres14)=> update track_activity_multirange set time_ts =
time_ts - '{[2021-10-20 12:00,2021-10-20 12:30]}' where id = 3;
UPDATE 1


(postgres14)=> select * from track_activity_multirange where id=3;
 id | appname  |
time_ts
----+----------+-----------------------------------------------
-----------------------------------------
  3 | Whatsapp | {["2021-10-20 11:00:00","2021-10-20 12:00:00"),
("2021-10-20 12:30:00","2021-10-20 21:00:00"]}
(1 row)
```

Mydbops

OUT Parameter for Stored Procedure

Mydbops

Out Parameter for Stored Procedure

- Only function has been supported
- Stored Procedure since V11
- Only supports IN , INOUT parameters
- More compatible with Oracle's Implementation of procedures

Mydbops

Enhancements in Monitoring

pg_stat_progress_copy

Mydbops

pg_stat_progress_copy

- Reporting progress of COPY commands

```
ppostgres=# select * from pg_stat_progress_copy \watch 1
                                                Tue Oct 19 13:25:45
2021 (every 1s)

 pid | datid | datname | relid | command | type |
bytes_processed | bytes_total | tuples_processed |
tuples_excluded
-----+-------+---------+-------+---------+------+-----------------
----+-------------+-------------------+-----------------
(0 rows)
```

Mydbops

pg_stat_progress_copy

- Session 1 - Load CSV with 10M records

```
postgres=# \copy (    select i, now() - random() * '2
years'::interval, random()
    from generate_series(1,10000000) i) to /dev/null;
```

Mydbops

pg_stat_progress_copy

- Session 2 - Monitoring pg_stat_progress_copy table continuously

```
                                                Tue Oct 19 13:31:31
2021 (every 1s)

  pid  | datid | datname  | relid | command | type |
bytes_processed | bytes_total | tuples_processed |
tuples_excluded
-------+-------+----------+-------+---------+------+----------
-------+-------------+--------------------+-----------------
 28382 | 14486 | postgres |     0 | COPY TO | PIPE |
2267809 |           0 |              41232 |               0
(1 row)
```

Mydbops

pg_stat_progress_copy

```
datname  | command | tuples_processed
----------+---------+------------------
 postgres | COPY TO |                0
(1 row)

  Tue Oct 19 13:37:24 2021 (every 1s)

 datname  | command | tuples_processed
----------+---------+------------------
 postgres | COPY TO |           704370
(1 row)

  Tue Oct 19 13:37:25 2021 (every 1s)

 datname  | command | tuples_processed
----------+---------+------------------
 postgres | COPY TO |          1612781
(1 row)
```

pg_stat_progress_copy

```
postgres=# \copy (    select i, now() - random() * '2
years'::interval, random()
    from generate_series(1,10000000) i) to /dev/null;
COPY 10000000
postgres=#
```

```
 datname | command | tuples_processed
---------+---------+------------------
(0 rows)

 Tue Oct 19 13:40:26 2021 (every 1s)

 datname | command | tuples_processed
---------+---------+------------------
(0 rows)
```

Mydbops

Enhancements in pg_stat_statements

Mydbops

pg_stat_statements

- Very useful extension
- Tracking execution statistics of all SQL statements
- Inexpensive
- Supports in all infra
- Load this data in grafana
- Stores the hash value

Mydbops

pg_stat_statements

```
postgres=# select query,calls from pg_stat_statements where userid=10;
                            query                                | calls
-----------------------------------------------------------------+-------
 select * from pg_stat_statements_info                           |     1
 select query,calls from pg_stat_statements where userid=$1      |     1
 select * from pg_stat_statements where userid=$1                |     3
 select version()                                                |     1
 select * from pg_stat_statements                                |     2
 create extension pg_stat_statements                             |     1
 show shared_preload_libraries                                   |     1
(7 rows)
```

Mydbops

pg_stat_statements

- When the given queries happened
- Queries with exact values

Mydbops

Enhancements in pg_stat_statements

- System View - pg_stat_statements_info
- Shows since the query stats are available

```
postgres=# select * from pg_stat_statements_info;
 dealloc |          stats_reset
---------+-------------------------------
       0 | 2021-10-18 14:28:12.693117+00
(1 row)
```

Mydbops

Enhancements in pg_stat_statements

- New log prefix added - %Q
- Also store the query id in the log file as well

```
postgres=# select queryid,query from pg_stat_statements limit 1;
       queryid       |                    query
---------------------+-----------------------------------------
 2403671352246453279 | select queryid,query from pg_stat_statements
(1 row)
```

In Error log:

```
2021-10-18 14:55:15 UTC [10840]: [2-1]
user=postgres,db=postgres,app=psql,client=
[local],query_id=2403671352246453279 LOG:  duration: 3.580 ms
```

Mydbops

Enhancements in pg_stat_statements

- New column added - rows
- No of rows processed

```
postgres=# select query,rows from pg_stat_statements limit 1;
                  query                       | rows
----------------------------------------------+------
 select queryid,query from pg_stat_statements |    7
(1 row)
```

Mydbops

Planning for Upgrade

- Logical / Physical Upgrade
- Perform dry-run if possible
- Version < 12 requires reindexing.
- Analyze needs to be performed
- Perform functional testing of application

Mydbops

References

- https://sql-info.de/postgresql/postgresql-14/articles-about-new-features-in-postgresql-14.html
- https://www.cybertec-postgresql.com/en/index-bloat-reduced-in-postgresql-v14/
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Thank You

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