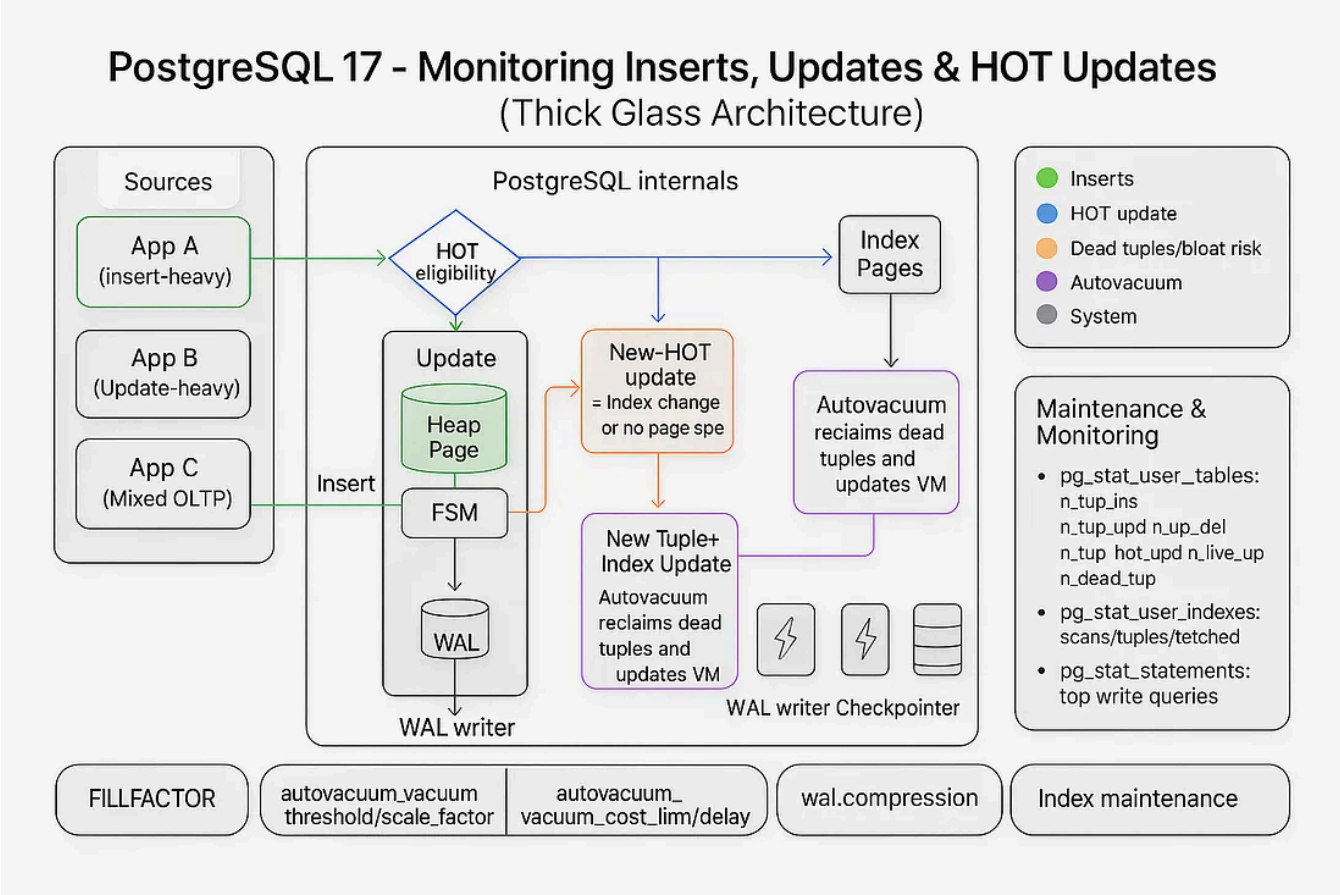
23 - PostgreSQL 17 Performance Tuning: Monitoring Inserts, Updates, and HOT Updates

4 min read · Sep 7, 2025

Jeyaram Ayyalusamy Following



When tuning PostgreSQL, it is very important to understand the **INSERT, UPDATE, and DELETE patterns** of your tables. Different workloads create different storage challenges — for example, some tables may only ever receive inserts, while others may be heavily updated.

By analyzing these patterns, you can decide whether you need to run **reindexing**, **CLUSTER**, or whether you are benefiting from **HOT (Heap-Only Tuple) updates**, which significantly improve update performance.

Step 1: Create a Large Products Table

For this demo, let's work with a `products` table containing 10 million rows:

```
CREATE TABLE products (
    product_id   BIGSERIAL PRIMARY KEY,
    product_name TEXT,
    category     TEXT,
    price        NUMERIC(10,2),
    stock_qty    INT
);
```

```
postgres=# CREATE TABLE products (
    product_id   BIGSERIAL PRIMARY KEY,
    product_name TEXT,
    category     TEXT,
    price        NUMERIC(10,2),
    stock_qty    INT
);
CREATE TABLE
postgres=#
```

```
-- Insert 10 million rows
INSERT INTO products (product_name, category, price, stock_qty)
SELECT
```

```
    'Product_' || g,
    'Category_' || (g % 50),
    (random()*500)::NUMERIC(10,2),
    (random()*100)::INT
FROM generate_series(1, 10000000) g;
ANALYZE products;
```

```
postgres=# -- Insert 10 million rows
INSERT INTO products (product_name, category, price, stock_qty)
SELECT
    'Product_' || g,
    'Category_' || (g % 50),
    (random()*500)::NUMERIC(10,2),
    (random()*100)::INT
FROM generate_series(1, 10000000) g;
ANALYZE products;
INSERT 0 10000000
ANALYZE
postgres=#
```

Step 2: Run Inserts and Updates

We'll simulate different workloads:

```
-- Insert new products (append-only workload)
INSERT INTO products (product_name, category, price, stock_qty)
SELECT
    'New_Product_' || g,
    'Category_' || (g % 50),
    (random()*500)::NUMERIC(10,2),
    (random()*100)::INT
FROM generate_series(1, 100000) g;
```

```
postgres=# -- Insert new products (append-only workload)
INSERT INTO products (product_name, category, price, stock_qty)
SELECT
    'New_Product_' || g,
    'Category_' || (g % 50),
    (random()*500)::NUMERIC(10,2),
    (random()*100)::INT
FROM generate_series(1, 100000) g;
INSERT 0 100000
postgres=#
```

```
-- Update stock quantity (update-heavy workload)
UPDATE products
SET stock_qty = stock_qty + 5
WHERE category = 'Category_10';
```

```
postgres=# -- Update stock quantity (update-heavy workload)
UPDATE products
SET stock_qty = stock_qty + 5
WHERE category = 'Category_10';
UPDATE 202000
postgres=#
```

```
-- Delete some rows (sparse blocks may remain)
DELETE FROM products WHERE category = 'Category_20';
```

```
postgres=# DELETE FROM products WHERE category = 'Category_20';
DELETE 202000
postgres=#
```

Step 3: Inspect Table Modification Stats

Now, let's check how many inserts, updates, and deletes have been performed on `products`.

```
SELECT relname,
       n_tup_ins AS inserts,
       n_tup_upd AS updates,
       n_tup_del AS deletes,
       n_tup_hot_upd AS hot_updates
FROM pg_stat_user_tables
WHERE relname = 'products';
```

📊 Sample Output:

```
postgres=# SELECT relname,
       n_tup_ins AS inserts,
       n_tup_upd AS updates,
       n_tup_del AS deletes,
       n_tup_hot_upd AS hot_updates
FROM pg_stat_user_tables
WHERE relname = 'products';
 relname  | inserts  | updates | deletes | hot_updates
----------+----------+---------+---------+-------------
 products | 10100000 |  404000 |  202000 |           2
```

```
(1 row)

postgres=#
```

Step 4: Interpreting the Results

- **Inserts** → show how many rows were added. Tables that only grow (append-only) are generally simpler to maintain.
- **Updates** → indicate how often rows are modified. Heavy updates increase the chance of **dead tuples**, requiring VACUUM and possibly reindexing.
- **Deletes** → reveal potential for **sparse blocks**, where space is wasted. In such cases, you may consider running `CLUSTER` to fully reorganize the table.
- **HOT Updates** → these are the most interesting metric. HOT (Heap-Only Tuple) updates mean that PostgreSQL was able to update a row **without moving it to a new page**, keeping it in the same block.

👉 A **high percentage of HOT updates** is a very good sign because:

- Updates stay local to the page.
- Fewer index changes are needed.
- Performance is better, especially for update-heavy workloads.

Why HOT Updates Matter

Normally, PostgreSQL creates a new row version for each update, even if only one column changes. This means more dead tuples, more index churn, and more VACUUM overhead.

With HOT updates:

- The row version stays **inside the same page**.

- Index entries don't need to be updated.
- VACUUM has less work to do.

The general rule is:

- **If your workload is update-heavy, aim for a high HOT update ratio.**
- This shows PostgreSQL is efficiently handling updates without bloating indexes.

✅ By monitoring **inserts, updates, deletes, and HOT updates** in `pg_stat_user_tables`, you can clearly see how your workload behaves and adjust your **maintenance strategy** (VACUUM, REINDEX, CLUSTER) accordingly.

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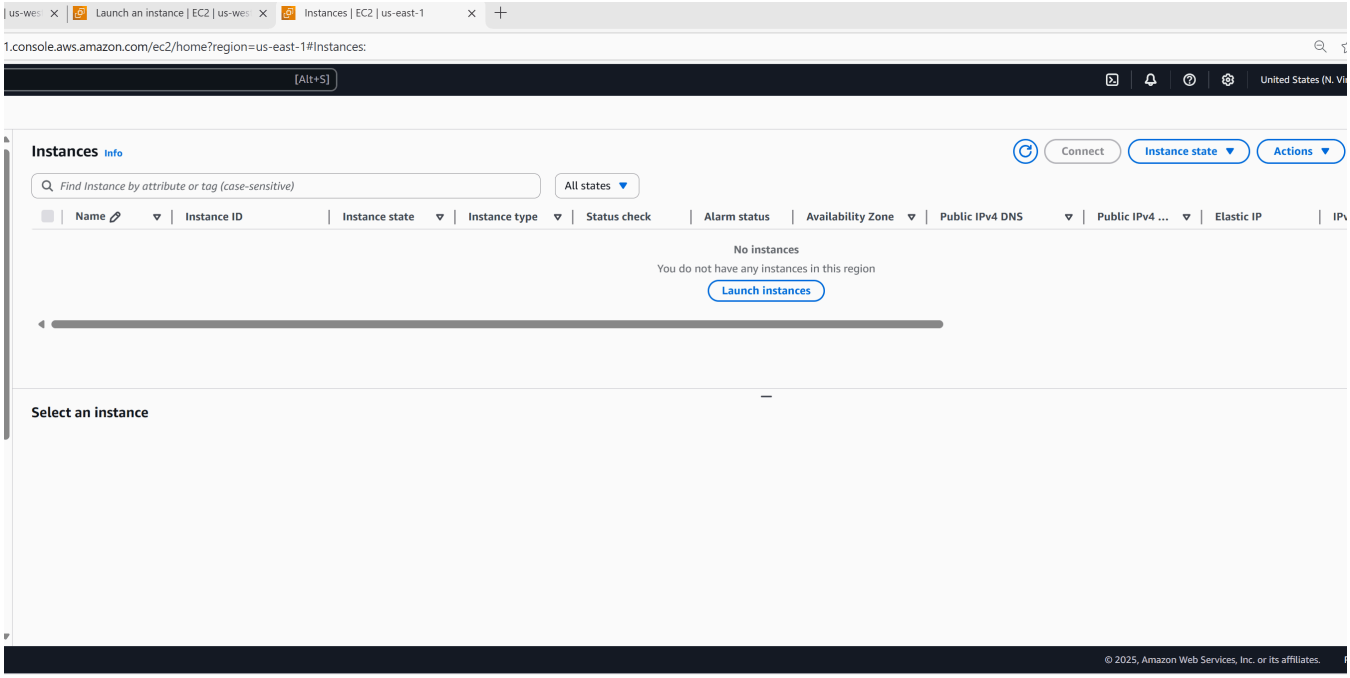

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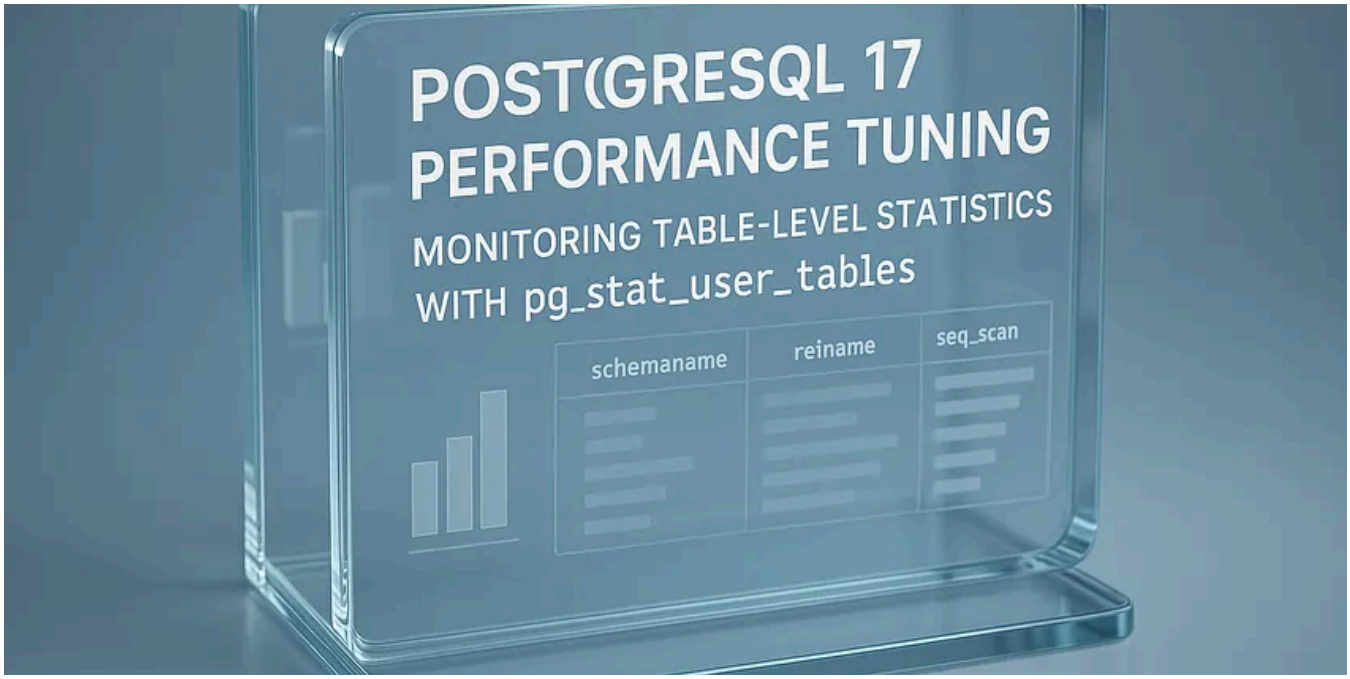

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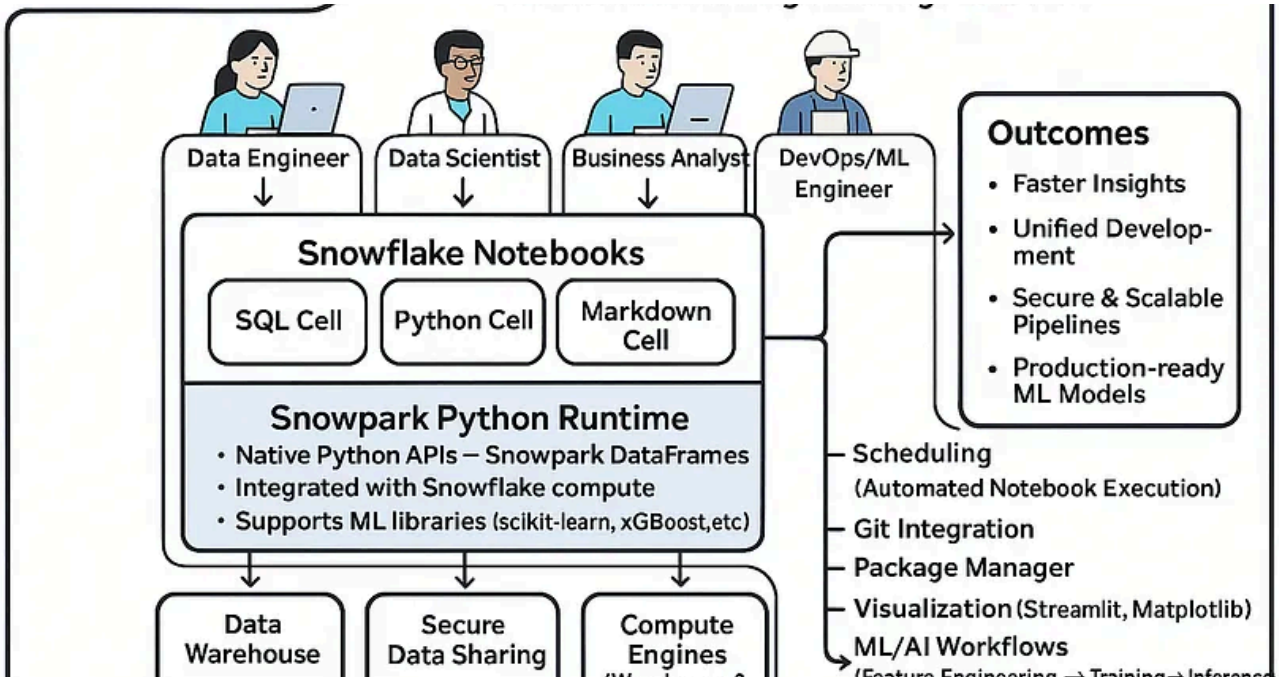

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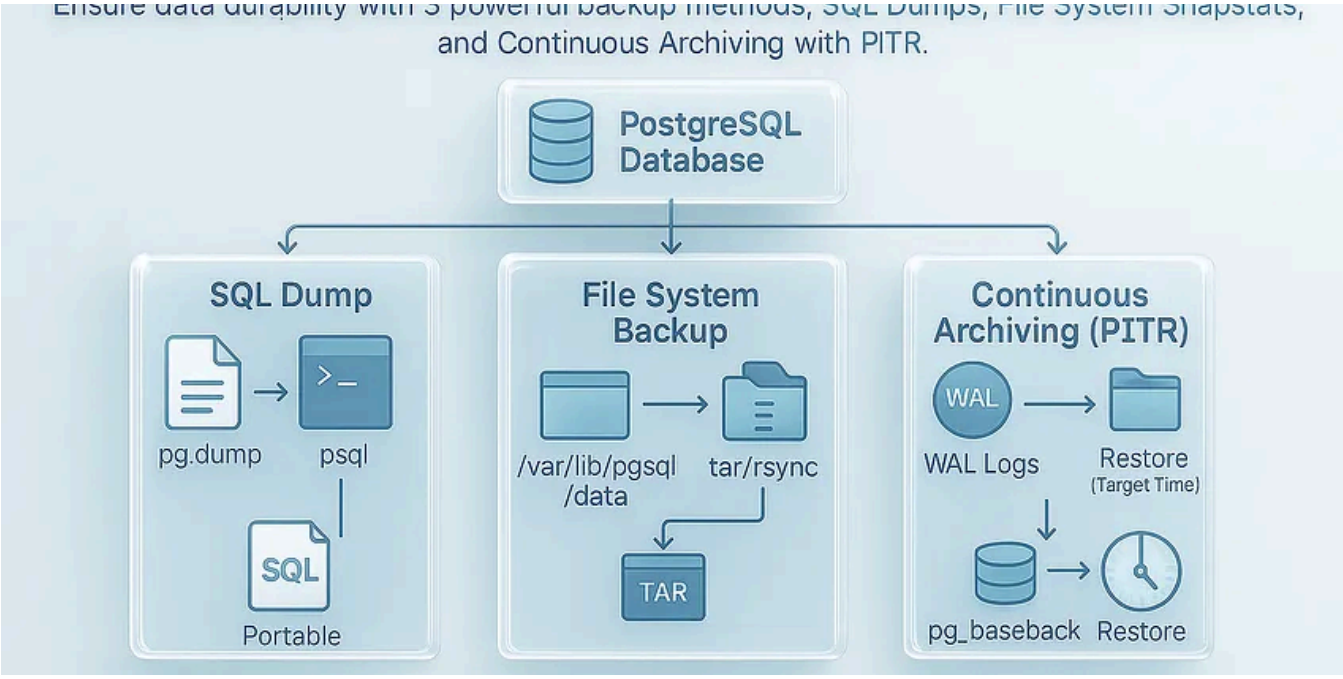

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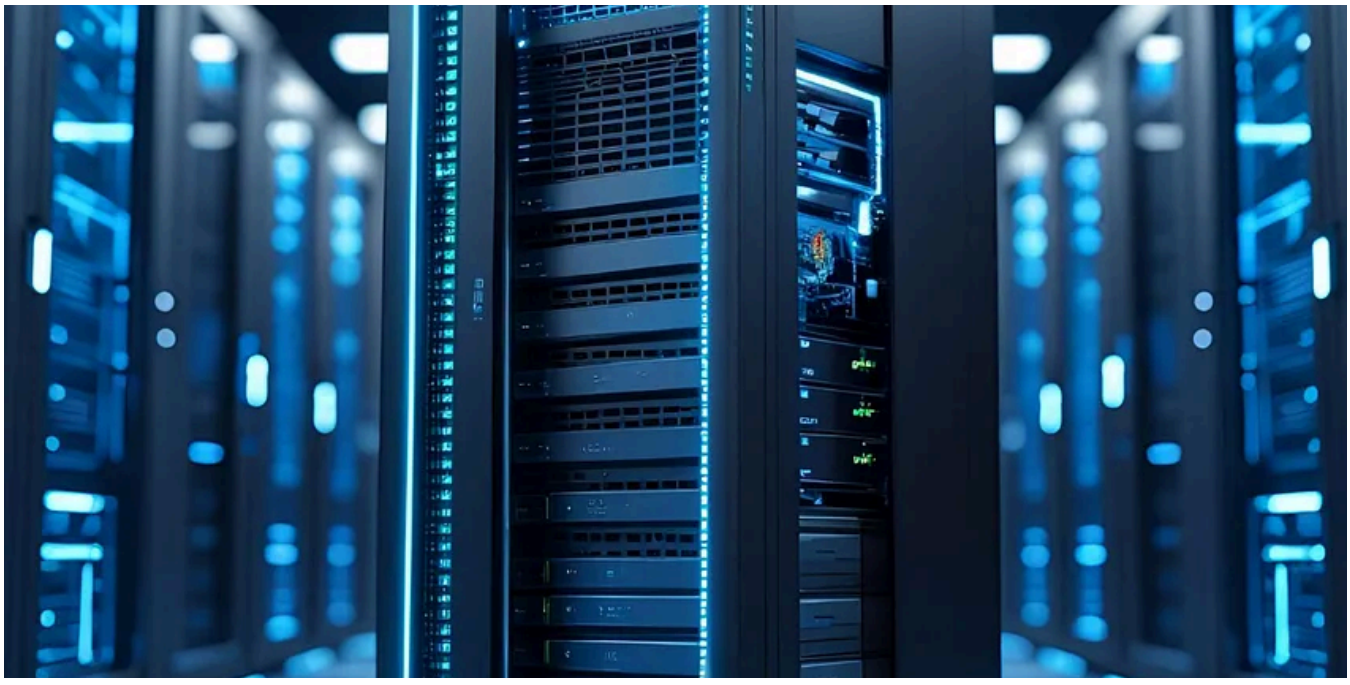

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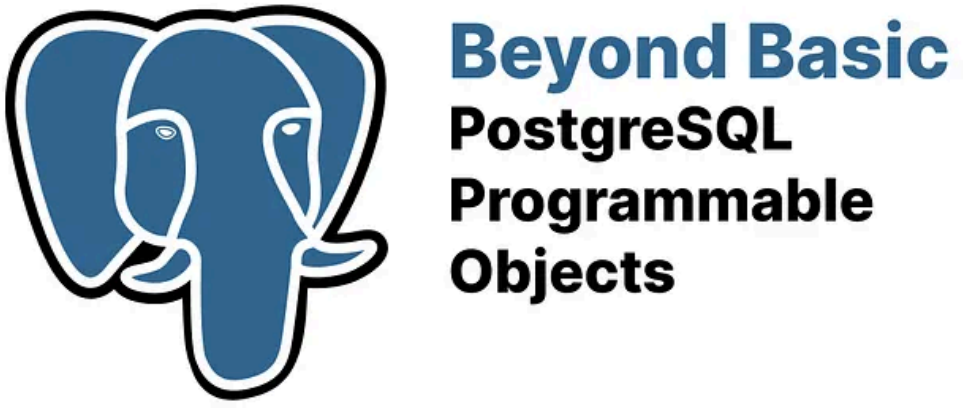

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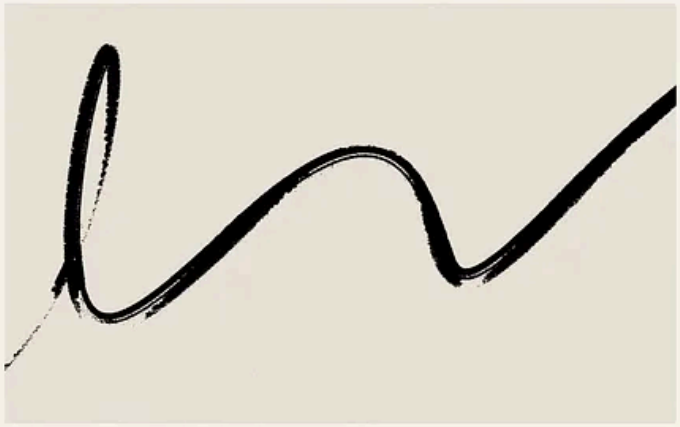

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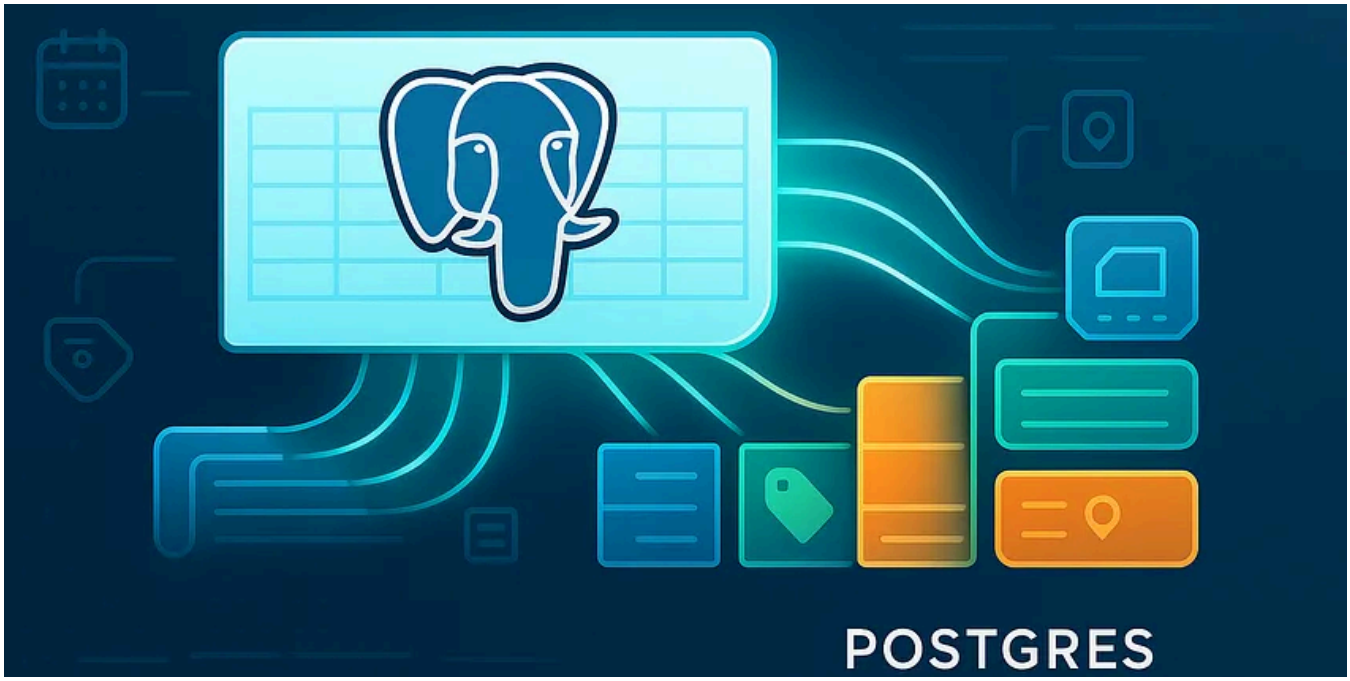

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