

Get unlimited access to the best of Medium for less than \$1/week. [Become a member](#)



PostgreSQL 17: How to Backup and Restore Using pg_basebackup on the Same Host

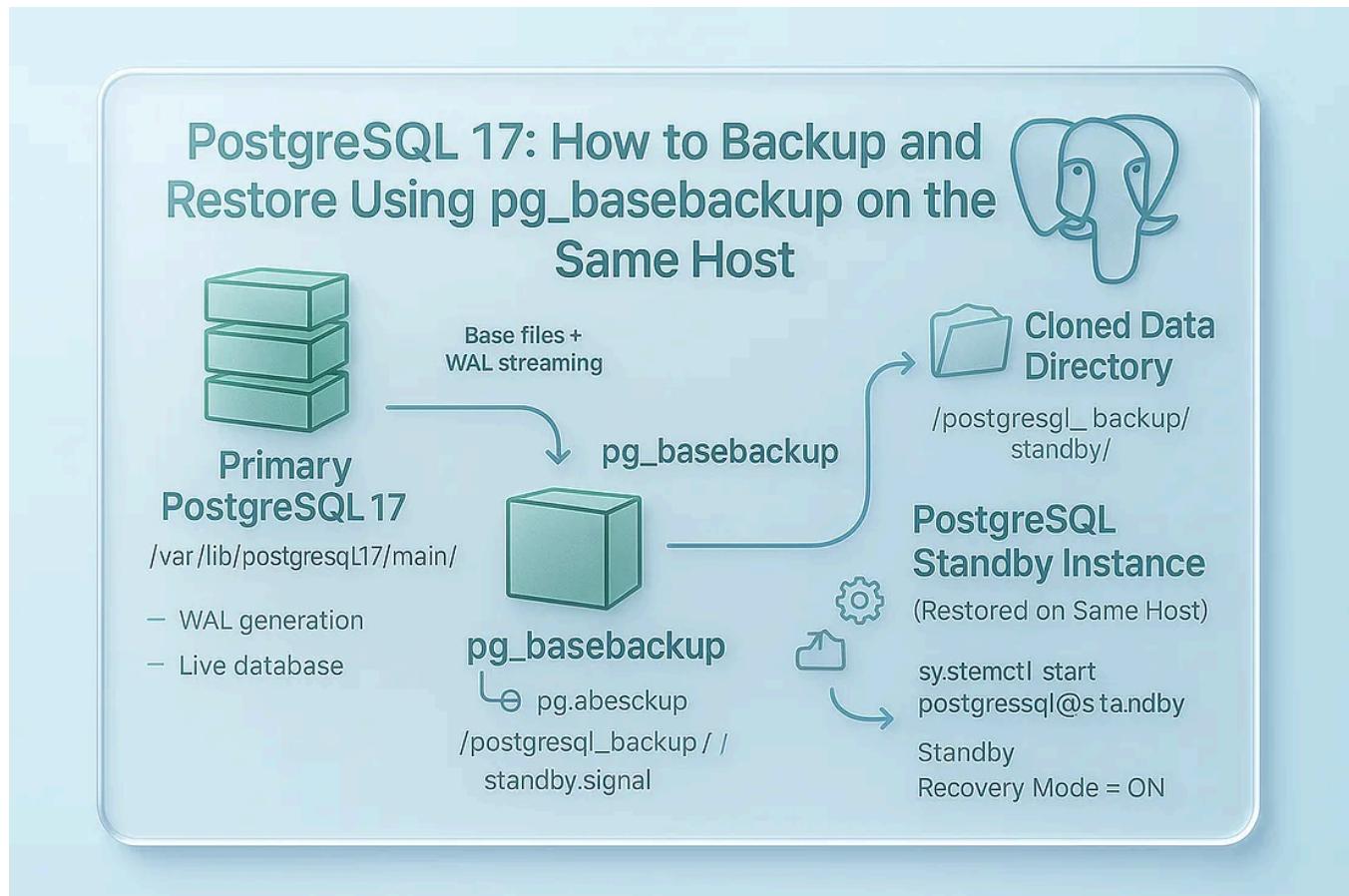
28 min read · 6 days ago

J Jeyaram Ayyalusamy Following

Listen

Share

More



PostgreSQL 17: How to Backup and Restore Using pg_basebackup on the Same Host

When managing PostgreSQL databases, ensuring a **reliable, consistent, and fast backup strategy** is essential for any production environment. One of the most

efficient tools available natively within PostgreSQL is `pg_basebackup`.

This guide walks you through everything you need to know about using `pg_basebackup` to perform a **full backup and restore operation on the same host**. Whether you're preparing for disaster recovery, building replication, or setting up Point-in-Time Recovery (PITR), `pg_basebackup` should be part of your toolkit.

Why Use `pg_basebackup`?

`pg_basebackup` is a PostgreSQL-native utility designed to take **binary-level, physical backups** of the database cluster. Here's why it's so widely recommended:

1. Zero Downtime Backups

You can run `pg_basebackup` while PostgreSQL is actively running. Thanks to PostgreSQL's Write-Ahead Logging (WAL) system, the tool can stream all changes happening during the backup to ensure consistency.

No need to stop your database. Your applications and users won't even notice.

2. PITR & Replication-Ready

When used with WAL streaming (-x flag) or WAL archiving, `pg_basebackup` enables:

- **Point-in-Time Recovery (PITR):** Rewind your database to any moment after the backup.
- **Standby Initialization:** The backup can be used to set up a streaming replica (standby node) for high availability.

It automatically generates the `standby.signal` file (if using -R flag), preparing the backup directory for replication mode.

3. Cluster-Wide Coverage

Unlike `pg_dump`, which backs up **individual databases** (logical backup), `pg_basebackup` backs up the **entire cluster** including:

- All user databases
- Global objects (roles, tablespaces)
- Configuration files
- WAL segments
- Replication metadata

This is a **complete snapshot** of everything inside your PostgreSQL instance.

4. Perfect for Cloud-Based PostgreSQL

Running PostgreSQL on AWS EC2, Azure VM, GCP Compute Engine, or on-premise Linux servers? `pg_basebackup` is ideal because:

- It can be automated with cron or shell scripts.
- It doesn't require third-party software.
- It can be used as part of an HA or DR setup with minimal configuration.

Whether you're backing up a 1GB test instance or a multi-terabyte production node, `pg_basebackup` scales gracefully.

Prerequisites Before Using pg_basebackup

Before jumping into backup/restore steps, make sure your system meets the following conditions:

PostgreSQL 17 Installed & Running

Check if PostgreSQL is installed and running:

```
psql --version  
sudo systemctl status postgresql-17
```

You should see something like:

```
[postgres@ip-172-31-20-155 ~]$ psql --version  
psql (PostgreSQL) 17.5  
[postgres@ip-172-31-20-155 ~]$
```

```
[postgres@ip-172-31-20-155 ~]$ sudo systemctl status postgresql-17  
● postgresql-17.service - PostgreSQL 17 database server  
    Loaded: loaded (/usr/lib/systemd/system/postgresql-17.service; enabled; pr  
      Active: active (running) since Fri 2025-06-27 17:00:27 UTC; 7h ago  
    Invocation: 0594acf74fad4411b78da3700cb1e647  
      Docs: https://www.postgresql.org/docs/17/static/  
    Process: 74444 ExecStartPre=/usr/pgsql-17/bin/postgresql-17-check-db-dir ${  
 Main PID: 74450 (postgres)  
     Tasks: 8 (limit: 5687)  
   Memory: 37.7M (peak: 41.3M)  
     CPU: 13.578s  
    CGroup: /system.slice/postgresql-17.service  
            ├─74450 /usr/pgsql-17/bin/postgres -D /var/lib/pgsql/17/data/  
            ├─74451 "postgres: logger "  
            ├─74452 "postgres: checkpointer "  
            ├─74453 "postgres: background writer "  
            ├─74455 "postgres: walwriter "  
            ├─74456 "postgres: autovacuum launcher "  
            ├─74457 "postgres: archiver failed on 000000010000000200000035"  
            └─74458 "postgres: logical replication launcher "  
  
Jun 27 17:00:27 ip-172-31-20-155.ec2.internal systemd[1]: Starting postgresql-1  
Jun 27 17:00:27 ip-172-31-20-155.ec2.internal postgres[74450]: 2025-06-27 17:00  
Jun 27 17:00:27 ip-172-31-20-155.ec2.internal postgres[74450]: 2025-06-27 17:00  
Jun 27 17:00:27 ip-172-31-20-155.ec2.internal systemd[1]: Started postgresql-17  
[postgres@ip-172-31-20-155 ~]$
```

Open in app ↗

Sample Database (Optional)

To verify the effectiveness of your backup, it's useful to load a sample database like `dvdrental`.

Install wget in your linux machine

```
[postgres@ip-172-31-20-155 ~]$ sudo yum install wget -y
Updating Subscription Management repositories.
Unable to read consumer identity

This system is not registered with an entitlement server. You can use "rhc" or

Last metadata expiration check: 3:16:56 ago on Fri Jun 27 21:10:15 2025.
Dependencies resolved.
=====
          Package           Architecture
=====
Installing:
wget                         x86_64

Transaction Summary
=====
Install 1 Package

Total download size: 807 k
Installed size: 3.3 M
Downloading Packages:
wget-1.24.5-5.el10.x86_64.rpm

Total
Running transaction check
Transaction check succeeded.
Running transaction test
Transaction test succeeded.
Running transaction
  Preparing           :
  Installing         : wget-1.24.5-5.el10.x86_64
  Running scriptlet: wget-1.24.5-5.el10.x86_64
Installed products updated.

Installed:
  wget-1.24.5-5.el10.x86_64

Complete!
[postgres@ip-172-31-20-155 ~]$
```

You can download it from <https://neon.com/postgresql/postgresql-getting-started/postgresql-sample-database> and restore it using:

```
wget https://neon.com/postgresqltutorial/dvdrental.zip
```

Output:

```
[postgres@ip-172-31-20-155 ~]$ wget https://neon.com/postgresqltutorial/dvdrental.zip
--2025-06-28 00:28:58-- https://neon.com/postgresqltutorial/dvdrental.zip
Resolving neon.com (neon.com)... 76.76.21.21
Connecting to neon.com (neon.com)|76.76.21.21|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 550906 (538K) [application/zip]
Saving to: 'dvdrental.zip'

dvdrental.zip                                              100%[=====] 2025-06-28 00:28:58 (113 MB/s) - ‘dvdrental.zip’ saved [550906/550906]

[postgres@ip-172-31-20-155 ~]$ 

[postgres@ip-172-31-20-155 ~]$ ls -ltr
total 540
drwx----- 4 postgres postgres      51 Jun 21 16:18 17
-rw-r--r-- 1 postgres postgres 550906 Jun 27 19:08 dvdrental.zip
[postgres@ip-172-31-20-155 ~]$ 

[postgres@ip-172-31-20-155 ~]$ unzip dvdrental.zip
Archive:  dvdrental.zip
  inflating: dvdrental.tar

[postgres@ip-172-31-20-155 ~]$ ls -ltr
total 3312
-rw-r--r-- 1 postgres postgres 2835456 May 12 2019 dvdrental.tar
drwx----- 4 postgres postgres      51 Jun 21 16:18 17
-rw-r--r-- 1 postgres postgres 550906 Jun 27 19:08 dvdrental.zip
```

Create dvdrental database and restore

```
createdb dvdrental
```

```
postgres=# \l+
```

| Name | Owner | Encoding | Locale | Provider | Collate | Ctype | Loca |
|-------------|----------|----------|--------|----------|---------|---------|------|
| dvdrental | postgres | UTF8 | libc | | C.UTF-8 | C.UTF-8 | |
| metrics_lab | postgres | UTF8 | libc | | C.UTF-8 | C.UTF-8 | |
| postgres | postgres | UTF8 | libc | | C.UTF-8 | C.UTF-8 | |
| template0 | postgres | UTF8 | libc | | C.UTF-8 | C.UTF-8 | |
| | | | | | | | |
| template1 | postgres | UTF8 | libc | | C.UTF-8 | C.UTF-8 | |
| | | | | | | | |

(5 rows)

```
postgres=#
```

```
[postgres@ip-172-31-20-155 ~]$
```

```
[postgres@ip-172-31-20-155 ~]$ pg_restore -d dvdrental /var/lib/pgsql/dvdrental
```

```
[postgres@ip-172-31-20-155 ~]$
```

```
pg_restore -d dvdrental -v /var/lib/pgsql/dvdrental.tar
```

This will populate the server with realistic test data to validate backup integrity.

```
[postgres@ip-172-31-20-155 ~]$ pg_restore -d dvdrental -v /var/lib/pgsql/dvdrental
```

```
pg_restore: connecting to database for restore
```

```
pg_restore: creating TYPE "public.mpaa_rating"
```

```
pg_restore: creating DOMAIN "public.year"
```

```
pg_restore: creating FUNCTION "public._group_concat(text, text)"
```

```
pg_restore: creating FUNCTION "public.film_in_stock(integer, integer)"
```

```
pg_restore: creating FUNCTION "public.film_not_in_stock(integer, integer)"
```

```
pg_restore: creating FUNCTION "public.get_customer_balance(integer, timestamp without time zone)"
```

```
pg_restore: creating FUNCTION "public.inventory_held_by_customer(integer)"
```

```
pg_restore: creating FUNCTION "public.inventory_in_stock(integer)"
```

```
pg_restore: creating FUNCTION "public.last_day(timestamp without time zone)"
```

```
pg_restore: creating FUNCTION "public.last_updated()"
```

```
pg_restore: creating SEQUENCE "public.customer_customer_id_seq"
```

```
pg_restore: creating TABLE "public.customer"
```

```
pg_restore: creating FUNCTION "public.rewards_report(integer, numeric)"
pg_restore: creating AGGREGATE "public.group_concat(text)"
pg_restore: creating SEQUENCE "public.actor_actor_id_seq"
pg_restore: creating TABLE "public.actor"
pg_restore: creating SEQUENCE "public.category_category_id_seq"
pg_restore: creating TABLE "public.category"
pg_restore: creating SEQUENCE "public.film_film_id_seq"
pg_restore: creating TABLE "public.film"
pg_restore: creating TABLE "public.film_actor"
pg_restore: creating TABLE "public.film_category"
pg_restore: creating VIEW "public.actor_info"
pg_restore: creating SEQUENCE "public.address_address_id_seq"
pg_restore: creating TABLE "public.address"
pg_restore: creating SEQUENCE "public.city_city_id_seq"
pg_restore: creating TABLE "public.city"
pg_restore: creating SEQUENCE "public.country_country_id_seq"
pg_restore: creating TABLE "public.country"
pg_restore: creating VIEW "public.customer_list"
pg_restore: creating VIEW "public.film_list"
pg_restore: creating SEQUENCE "public.inventory_inventory_id_seq"
pg_restore: creating TABLE "public.inventory"
pg_restore: creating SEQUENCE "public.language_language_id_seq"
pg_restore: creating TABLE "public.language"
pg_restore: creating VIEW "public.nicer_but_slower_film_list"
pg_restore: creating SEQUENCE "public.payment_payment_id_seq"
pg_restore: creating TABLE "public.payment"
pg_restore: creating SEQUENCE "public.rental_rental_id_seq"
pg_restore: creating TABLE "public.rental"
pg_restore: creating VIEW "public.sales_by_film_category"
pg_restore: creating SEQUENCE "public.staff_staff_id_seq"
pg_restore: creating TABLE "public.staff"
pg_restore: creating SEQUENCE "public.store_store_id_seq"
pg_restore: creating TABLE "public.store"
pg_restore: creating VIEW "public.sales_by_store"
pg_restore: creating VIEW "public.staff_list"
pg_restore: processing data for table "public.actor"
pg_restore: processing data for table "public.address"
pg_restore: processing data for table "public.category"
pg_restore: processing data for table "public.city"
pg_restore: processing data for table "public.country"
pg_restore: processing data for table "public.customer"
pg_restore: processing data for table "public.film"
pg_restore: processing data for table "public.film_actor"
pg_restore: processing data for table "public.film_category"
pg_restore: processing data for table "public.inventory"
pg_restore: processing data for table "public.language"
pg_restore: processing data for table "public.payment"
pg_restore: processing data for table "public.rental"
pg_restore: processing data for table "public.staff"
pg_restore: processing data for table "public.store"
pg_restore: executing SEQUENCE SET actor_actor_id_seq
pg_restore: executing SEQUENCE SET address_address_id_seq
pg_restore: executing SEQUENCE SET category_category_id_seq
```

```
pg_restore: executing SEQUENCE SET city_city_id_seq
pg_restore: executing SEQUENCE SET country_country_id_seq
pg_restore: executing SEQUENCE SET customer_customer_id_seq
pg_restore: executing SEQUENCE SET film_film_id_seq
pg_restore: executing SEQUENCE SET inventory_inventory_id_seq
pg_restore: executing SEQUENCE SET language_language_id_seq
pg_restore: executing SEQUENCE SET payment_payment_id_seq
pg_restore: executing SEQUENCE SET rental_rental_id_seq
pg_restore: executing SEQUENCE SET staff_staff_id_seq
pg_restore: executing SEQUENCE SET store_store_id_seq
pg_restore: creating CONSTRAINT "public.actor actor_pkey"
pg_restore: creating CONSTRAINT "public.address address_pkey"
pg_restore: creating CONSTRAINT "public.category category_pkey"
pg_restore: creating CONSTRAINT "public.city city_pkey"
pg_restore: creating CONSTRAINT "public.country country_pkey"
pg_restore: creating CONSTRAINT "public.customer customer_pkey"
pg_restore: creating CONSTRAINT "public.film_actor film_actor_pkey"
pg_restore: creating CONSTRAINT "public.film_category film_category_pkey"
pg_restore: creating CONSTRAINT "public.film film_pkey"
pg_restore: creating CONSTRAINT "public.inventory inventory_pkey"
pg_restore: creating CONSTRAINT "public.language language_pkey"
pg_restore: creating CONSTRAINT "public.payment payment_pkey"
pg_restore: creating CONSTRAINT "public.rental rental_pkey"
pg_restore: creating CONSTRAINT "public.staff staff_pkey"
pg_restore: creating CONSTRAINT "public.store store_pkey"
pg_restore: creating INDEX "public.film_fulltext_idx"
pg_restore: creating INDEX "public.idx_actor_last_name"
pg_restore: creating INDEX "public.idx_fk_address_id"
pg_restore: creating INDEX "public.idx_fk_city_id"
pg_restore: creating INDEX "public.idx_fk_country_id"
pg_restore: creating INDEX "public.idx_fk_customer_id"
pg_restore: creating INDEX "public.idx_fk_film_id"
pg_restore: creating INDEX "public.idx_fk_inventory_id"
pg_restore: creating INDEX "public.idx_fk_language_id"
pg_restore: creating INDEX "public.idx_fk_rental_id"
pg_restore: creating INDEX "public.idx_fk_staff_id"
pg_restore: creating INDEX "public.idx_fk_store_id"
pg_restore: creating INDEX "public.idx_last_name"
pg_restore: creating INDEX "public.idx_store_id_film_id"
pg_restore: creating INDEX "public.idx_title"
pg_restore: creating INDEX "public.idx_unq_manager_staff_id"
pg_restore: creating INDEX "public.idx_unq_rental_rental_date_inventory_id_cust"
pg_restore: creating TRIGGER "public.film film_fulltext_trigger"
pg_restore: creating TRIGGER "public.actor last_updated"
pg_restore: creating TRIGGER "public.address last_updated"
pg_restore: creating TRIGGER "public.category last_updated"
pg_restore: creating TRIGGER "public.city last_updated"
pg_restore: creating TRIGGER "public.country last_updated"
pg_restore: creating TRIGGER "public.customer last_updated"
pg_restore: creating TRIGGER "public.film last_updated"
pg_restore: creating TRIGGER "public.film_actor last_updated"
pg_restore: creating TRIGGER "public.film_category last_updated"
pg_restore: creating TRIGGER "public.inventory last_updated"
```

```
pg_restore: creating TRIGGER "public.language_last_updated"
pg_restore: creating TRIGGER "public.rental_last_updated"
pg_restore: creating TRIGGER "public.staff_last_updated"
pg_restore: creating TRIGGER "public.store_last_updated"
pg_restore: creating FK CONSTRAINT "public.customer_customer_address_id_fkey"
pg_restore: creating FK CONSTRAINT "public.film_actor_film_actor_actor_id_fkey"
pg_restore: creating FK CONSTRAINT "public.film_actor_film_actor_film_id_fkey"
pg_restore: creating FK CONSTRAINT "public.film_category_film_category_category"
pg_restore: creating FK CONSTRAINT "public.film_category_film_category_film_id"
pg_restore: creating FK CONSTRAINT "public.film_film_language_id_fkey"
pg_restore: creating FK CONSTRAINT "public.address_fk_address_city"
pg_restore: creating FK CONSTRAINT "public.city_fk_city"
pg_restore: creating FK CONSTRAINT "public.inventory_inventory_film_id_fkey"
pg_restore: creating FK CONSTRAINT "public.payment_payment_customer_id_fkey"
pg_restore: creating FK CONSTRAINT "public.payment_payment_rental_id_fkey"
pg_restore: creating FK CONSTRAINT "public.payment_payment_staff_id_fkey"
pg_restore: creating FK CONSTRAINT "public.rental_rental_customer_id_fkey"
pg_restore: creating FK CONSTRAINT "public.rental_rental_inventory_id_fkey"
pg_restore: creating FK CONSTRAINT "public.rental_rental_staff_id_key"
pg_restore: creating FK CONSTRAINT "public.staff_staff_address_id_fkey"
pg_restore: creating FK CONSTRAINT "public.store_store_address_id_fkey"
pg_restore: creating FK CONSTRAINT "public.store_store_manager_staff_id_fkey"
[postgres@ip-172-31-20-155 ~]$
```

Linux Host Access (e.g., EC2, Localhost)

This tutorial assumes:

- You're using a **Linux-based server**
- You're logged in as or have sudo access to the `postgres` system user
- You have access to the `pg_basebackup` binary

Confirm it's installed:

```
which pg_basebackup
```

Output example:

```
[postgres@ip-172-31-20-155 ~]$ which pg_basebackup
/usr/bin/pg_basebackup
[postgres@ip-172-31-20-155 ~]$
```

PostgreSQL Superuser or Replication Role

The user running `pg_basebackup` must:

- Have `REPLICATION` privilege in PostgreSQL
- Be able to connect to the local server via TCP/IP or socket

You can check user roles:

```
\du
```

And the role should include:

| Role name | Attributes |
|------------|--------------------|
| replicator | Replication, Login |

Make sure the role can connect by setting the appropriate entries in `pg_hba.conf`:

```
# Allow local replication connections
local    replication   all              trust
```

Reload PostgreSQL after changes:

```
sudo systemctl reload postgresql
```

With all prerequisites checked, you're now ready to **perform a full backup and restore** using `pg_basebackup`, which we'll cover in the next step.

 Tip: Use this setup not just for disaster recovery, but also to clone databases for development, testing, or analytics workloads — all without impacting the production instance.

Step-by-Step Backup & Restore Using `pg_basebackup` in PostgreSQL 17

When it comes to ensuring PostgreSQL is both **resilient and recoverable**, `pg_basebackup` is the default tool DBAs trust for full, binary-level backups. To use it effectively, especially for **point-in-time recovery (PITR)** or setting up a **replica**, it's essential to configure **WAL archiving** properly.

Let's walk through the first two steps to prepare PostgreSQL 17 for safe and restorable backups.

Step 1: Verify Your PostgreSQL 17 Environment

Before taking any backup, it's good practice to confirm your database configuration and understand your **WAL** (Write-Ahead Logging) settings.

Connect to the PostgreSQL Instance

First, switch to the PostgreSQL system user and open a `psql` session:

```
sudo su - postgres  
psql
```

Once you're inside the `psql` shell, run the following diagnostics:

◆ View the Current Data Directory

```
SHOW data_directory;
```

This displays the full path where PostgreSQL stores all its data files. For version 17, it typically looks like:

```
/var/lib/pgsql/17/data
```

This directory will later be your **source** for backup, and understanding its location is critical before using `pg_basebackup`.

◆ List Databases

```
\l
```

This shows a list of databases present in the cluster. Make sure your production or sample databases (like `dvdrental`) are active and online.

◆ Check Tablespaces

```
\db+
```

Tablespaces can point to additional physical locations outside the default `data_directory`. If you use tablespaces, `pg_basebackup` will back them up too — but you must ensure those paths are accessible and writable.

◆ Review Archive-Related Settings

```
SELECT name, setting, unit
FROM pg_settings
WHERE name LIKE 'archive%';
```

This outputs values like:

| | | |
|-----------------|---------|--|
| archive_mode | off | |
| archive_command | (empty) | |
| archive_timeout | 0 | |

If `archive_mode` is `off`, and `archive_command` is empty — your database isn't ready for **WAL archiving**, and backups won't support PITR or replica creation.

Let's fix that next.



Step 2: Enable WAL Archiving in PostgreSQL 17

WAL (Write-Ahead Logging) is the heart of PostgreSQL's durability and crash recovery. To back up the database **in a way that allows replaying changes**, WAL segments must be archived externally using an archive command.

Edit the PostgreSQL Configuration File

Exit `psql`, and edit the `postgresql.conf` file located inside your PostgreSQL 17 data directory:

```
sudo vi /var/lib/pgsql/17/data/postgresql.conf
```

Locate or add the following lines:

```
archive_mode = on
archive_timeout = 300
archive_command = 'test ! -f /var/lib/pgsql/17/data/pg_wal/%f && cp %p /var/lib/pgsql/17/data/pg_wal/'
```

Let's break it down:

- **archive_mode = on**

Activates the archiving process, instructing PostgreSQL to allow `archive_command` execution.

- **archive_timeout = 300**

This forces PostgreSQL to switch and archive WAL files every 5 minutes, even if they're not full. It's useful for ensuring WAL availability in low-traffic systems.

- **archive_command = '...'**

Defines the shell command used to copy completed WAL segments.

- **%p** = path to the WAL file to be archived

- **%f** = file name only

The `test ! -f` part prevents overwriting if the WAL file already exists in the target directory.

📁 Create the Archive Directory

You must ensure the archive destination exists and has proper permissions:

```
sudo mkdir -p /var/lib/pgsql/17/backups/pg_wal  
sudo chown postgres:postgres /var/lib/pgsql/17/backups/pg_wal
```

```
[root@ip-172-31-92-215 ~]# sudo mkdir -p /var/lib/pgsql/17/backups/pg_wal  
[root@ip-172-31-92-215 ~]#  
[root@ip-172-31-92-215 ~]# sudo chown postgres:postgres /var/lib/pgsql/17/backups/pg_wal  
[root@ip-172-31-92-215 ~]#
```

Without this step, `archive_command` will silently fail or raise permission errors in the logs.

🔄 Restart PostgreSQL 17

Once the configuration is updated and the archive directory is ready, apply the changes:

```
sudo systemctl restart postgresql-17
```

Verify the status:

```
sudo systemctl status postgresql-17
```

And tail the PostgreSQL logs to confirm WAL archiving is working:

```
sudo journalctl -u postgresql-17 -f
```

You should see log lines such as:

```
archiver: archived WAL file "00000001000000000000000A1"
```

✓ At This Point

Your PostgreSQL 17 setup is now ready for:

- Hot backups using `pg_basebackup`
- PITR (Point-In-Time Recovery)
- Initializing standby replicas

💼 Step 3: Take a Full Cluster Backup with `pg_basebackup` in PostgreSQL 17

Now that WAL archiving is enabled and PostgreSQL 17 is correctly configured, you're ready to take a **consistent, binary-level backup** using `pg_basebackup`.

Unlike logical backups (`pg_dump`), `pg_basebackup` gives you a complete snapshot of the **entire PostgreSQL data directory**, making it ideal for disaster recovery, cloning, or setting up standby replicas.

🎯 What pg_basebackup Does

- Captures the full data directory, including user data, system catalogs, configuration files, and WAL files.
- Supports **streaming WAL** so your backup is consistent even while the server is running.
- Works with both **compressed and uncompressed** formats.

Let's explore both options:

◆ Option 1: Compressed Backup (Tar + Gzip)

This option is useful when:

- You have limited disk space.
- You want to archive backups offsite (e.g., S3, GCS).
- You prefer smaller files for faster transfer.

🏗 Step 1: Create Backup Directory

```
sudo mkdir -p /var/lib/pgsql/pg_backup
sudo chown postgres:postgres /var/lib/pgsql/pg_backup
```

```
[root@ip-172-31-92-215 ~]# sudo mkdir -p /var/lib/pgsql/pg_backup
[root@ip-172-31-92-215 ~]#
```

```
[root@ip-172-31-92-215 ~]# sudo chown postgres:postgres /var/lib/pgsql/pg_backup  
[root@ip-172-31-92-215 ~]#
```

This ensures the directory is writable by the `postgres` user.



🚀 Step 2: Run the Compressed Backup Command

```
pg_basebackup \  
-h localhost \  
-p 5432 \  
-U postgres \  
-D /var/lib/pgsql/pg_backup \  
-Ft \  
-z \  
-Xs \  
-P
```

```
[postgres@ip-172-31-92-215 ~]$ pg_basebackup \  
-h localhost \  
-p 5432 \  
-U postgres \  
-D /var/lib/pgsql/pg_backup \  
-Ft \  
-z \  
-Xs \  
-P  
Password:  
38520/38520 kB (100%), 1/1 tablespace  
[postgres@ip-172-31-92-215 ~]$  
[postgres@ip-172-31-92-215 ~]$
```

Let's break down what each flag means:

Flag Description -h Host to connect to (localhost since we're backing up the local DB) -p Port where PostgreSQL is running (default: 5432) -u PostgreSQL user with replication privileges (postgres) -D Destination directory for the backup files -Ft Format as tar archive -z Gzip compress the archive -xs Stream the WAL files during the backup -P Show progress (interactive view of backup process)

 If you haven't configured .pgpass or trust in pg_hba.conf, this command may prompt for a password.

◆ Option 2: Uncompressed Backup (Tar Format Only)

This is ideal for:

- Local development.
- When speed matters more than space.
- Testing backup/restore pipelines.

Step 1: Create the Destination Directory

```
sudo mkdir -p /var/lib/pgsql/pg_backup_uncompressed  
sudo chown postgres:postgres /var/lib/pgsql/pg_backup_uncompressed
```

```
[root@ip-172-31-92-215 ~]# sudo mkdir -p /var/lib/pgsql/pg_backup_uncompressed  
[root@ip-172-31-92-215 ~]#  
[root@ip-172-31-92-215 ~]# sudo chown postgres:postgres /var/lib/pgsql/pg_backup_uncompressed  
[root@ip-172-31-92-215 ~]#
```

Step 2: Run the Uncompressed Backup

```
pg_basebackup \
-h localhost \
-p 5432 \
-U postgres \
-D /var/lib/pgsql/pg_backup_uncompressed \
-Ft \
-Xs \
-P
```

```
[root@ip-172-31-92-215 ~]# pg_basebackup \
-h localhost \
-p 5432 \
-U postgres \
-D /var/lib/pgsql/pg_backup_uncompressed \
-Ft \
-Xs \
-P
Password:
38523/38523 kB (100%), 1/1 tablespace
[root@ip-172-31-92-215 ~]#
```

This command will create .tar files but will **not compress them** with gzip. This results in:

- Faster backup times.
- Larger file sizes.
- Easier extraction when restoring.

Step 4: Verify Backup Completion

Whether you created a compressed or uncompressed backup, it's important to verify that all expected files were written.

📁 For Uncompressed Backup:

```
ls -lrt /var/lib/pgsql/pg_backup_uncompressed
```

You should see files like:

```
[root@ip-172-31-92-215 ~]# ls -lrt /var/lib/pgsql/pg_backup_uncompressed
total 55104
-rw-----. 1 root root 39448064 Jun 30 19:52 base.tar
-rw-----. 1 root root 194152 Jun 30 19:52 backup_manifest
-rw-----. 1 root root 16778752 Jun 30 19:52 pg_wal.tar
[root@ip-172-31-92-215 ~]#
```

These are:

- `base.tar` : Contains your cluster data (tables, indexes, catalogs).
- `pg_wal.tar` : Contains the necessary WAL files to restore the database to a consistent state.

📦 For Compressed Backup:

If you used the `-z` flag, your output may look like:

```
[root@ip-172-31-92-215 ~]# ls -ltr /var/lib/pgsql/pg_backup
total 5924
-rw-----. 1 postgres postgres 194152 Jun 30 19:51 backup_manifest
-rw-----. 1 postgres postgres 5848048 Jun 30 19:51 base.tar.gz
-rw-----. 1 postgres postgres 17685 Jun 30 19:51 pg_wal.tar.gz
[root@ip-172-31-92-215 ~]#
```

You can extract them later using:

```
tar -xzf base.tar.gz
```

or:

```
gzip -d base.tar.gz  
tar -xf base.tar
```

🛡️ Tips for Ensuring a Healthy Backup

- ⌚ Schedule this backup process regularly via `cron`.
- 🧪 Periodically test restoring your backups to avoid surprises during a real incident.
- 📦 If backing up to remote storage, validate file integrity using checksums.
- 📈 Monitor WAL size during the backup to avoid filling disk space (especially for large clusters).

🌟 Step 5: Simulate a Failure (Disaster Recovery Test)

Once you've completed a successful backup using `pg_basebackup`, it's essential to test the recovery process.

Backups are **only useful if they can be restored** — so this step validates your strategy.

We'll simulate a failure by shutting down PostgreSQL and **deleting the entire data directory**, as if the server had been corrupted or suffered disk loss.

▼ Stop PostgreSQL 17 Service

To simulate failure, start by stopping the active PostgreSQL instance. This avoids file corruption during deletion.

```
sudo systemctl stop postgresql-17
```

```
[root@ip-172-31-92-215 ~]#  
[root@ip-172-31-92-215 ~]# sudo systemctl stop postgresql-17  
[root@ip-172-31-92-215 ~]#
```

You can verify the status using:

```
sudo systemctl status postgresql-17
```

```
[root@ip-172-31-92-215 ~]# sudo systemctl status postgresql-17  
○ postgresql-17.service - PostgreSQL 17 database server  
    Loaded: loaded (/usr/lib/systemd/system/postgresql-17.service; enabled; pr  
      Active: inactive (dead) since Mon 2025-06-30 19:56:27 UTC; 2min 34s ago  
        Duration: 8min 37.580s  
      Invocation: ea4788d10d604eb382f91449d80e545d  
        Docs: https://www.postgresql.org/docs/17/static/  
      Process: 20056 ExecStartPre=/usr/pgsql-17/bin/postgresql-17-check-db-dir ${  
      Process: 20062 ExecStart=/usr/pgsql-17/bin/postgres -D ${PGDATA} (code=exit  
    Main PID: 20062 (code=exited, status=0/SUCCESS)  
    Mem peak: 83M  
      CPU: 370ms  
  
Jun 30 19:47:46 ip-172-31-92-215.ec2.internal systemd[1]: Starting postgresql-1  
Jun 30 19:47:46 ip-172-31-92-215.ec2.internal postgres[20062]: 2025-06-30 19:47  
Jun 30 19:47:46 ip-172-31-92-215.ec2.internal postgres[20062]: 2025-06-30 19:47  
Jun 30 19:47:46 ip-172-31-92-215.ec2.internal systemd[1]: Started postgresql-17  
Jun 30 19:56:24 ip-172-31-92-215.ec2.internal systemd[1]: Stopping postgresql-1  
Jun 30 19:56:27 ip-172-31-92-215.ec2.internal systemd[1]: postgresql-17.service  
Jun 30 19:56:27 ip-172-31-92-215.ec2.internal systemd[1]: Stopped postgresql-1  
Jun 30 19:56:27 ip-172-31-92-215.ec2.internal systemd[1]: postgresql-17.service  
[root@ip-172-31-92-215 ~]#
```

The service should now be inactive (dead state).

Delete the Existing Data Directory

Now, delete PostgreSQL's `data_directory`. This mimics a catastrophic event like disk failure or accidental deletion.

⚠️ Caution: Only do this in a test or staging environment — not production!

```
sudo rm -rf /var/lib/pgsql/17/data
```

```
[root@ip-172-31-92-215 ~]#
[root@ip-172-31-92-215 ~]# sudo rm -rf /var/lib/pgsql/17/data
[root@ip-172-31-92-215 ~]#
```

💡 PostgreSQL stores all critical data in this directory: system catalogs, databases, config files, WAL segments, etc.

At this point, PostgreSQL has **no idea how to start** — it's as if the cluster never existed. Next, let's restore it.

Step 6: Restore the Backup (Base Files + WAL Files)

With the original cluster erased, we now rebuild the PostgreSQL 17 environment using the files generated by `pg_basebackup`.

You'll restore:

- `base.tar.gz` : Full physical snapshot of your database
- `pg_wal.tar.gz` : Write-Ahead Logs required to bring the cluster to a consistent state

📁 Step 6.1: Restore the Base Backup

Let's restore the snapshot that holds all database data.

📌 Step 1: Go to the Backup Location

Navigate to the location where you saved your backup:

```
cd /var/lib/pgsql/pg_backup
```

```
[root@ip-172-31-92-215 ~]# cd /var/lib/pgsql/pg_backup
[root@ip-172-31-92-215 pg_backup]#
[root@ip-172-31-92-215 pg_backup]#
```

Your backup directory should contain `base.tar.gz` and `pg_wal.tar.gz`.

📌 Step 2: Recreate the Data Directory

Now we recreate the PostgreSQL 17 data directory from scratch:

```
sudo mkdir -p /var/lib/pgsql/17/data
sudo chown postgres:postgres /var/lib/pgsql/17/data
```

```
[root@ip-172-31-92-215 pg_backup]#
[root@ip-172-31-92-215 pg_backup]# sudo mkdir -p /var/lib/pgsql/17/data
[root@ip-172-31-92-215 pg_backup]#
[root@ip-172-31-92-215 pg_backup]# sudo chown postgres:postgres /var/lib/pgsql/
[root@ip-172-31-92-215 pg_backup]#
```

This prepares the environment for extraction.

📌 Step 3: Extract the Base Backup

If your backup is compressed (`base.tar.gz`), first unzip it:

```
gunzip base.tar.gz
```

```
[root@ip-172-31-92-215 pg_backup]#
[root@ip-172-31-92-215 pg_backup]# gunzip base.tar.gz
[root@ip-172-31-92-215 pg_backup]#
```

Now extract its contents into the new data directory:

```
tar -xvf base.tar -C /var/lib/pgsql/17/data
```

```
[root@ip-172-31-92-215 pg_backup]# tar -xvf base.tar -C /var/lib/pgsql/17/data
backup_label
tablespace_map
pg_wal/
./pg_wal/archive_status/
./pg_wal/summaries/
global/
global/1262
global/2964
global/1213
global/1260
global/1261
global/1214
global/2396
global/6000
global/3592
global/6243
global/6100
global/4177
global/4178
global/2966
global/2967
global/4185
global/4186
global/4175
global/4176
global/2846
global/2847
global/4181
global/4182
global/4060
global/4061
global/6244
global/6245
global/4183
global/4184
global/2671
global/2672
global/2965
```

This command restores the **entire PostgreSQL system**, including:

- `base/` → database files
- `global/` → system-wide metadata
- `pg_xact/`, `pg_multixact/`, `pg_stat/` → transaction status
- Config files like `postgresql.auto.conf`, `standby.signal`, etc.

At this point, your database structure is rebuilt.

Step 6.2: Restore WAL Segment Files

WAL files are essential to make the database consistent — they allow recovery up to the moment the backup finished.

Step 1: Decompress the WAL Archive

```
gunzip pg_wal.tar.gz
```

```
[root@ip-172-31-92-215 pg_backup]#  
[root@ip-172-31-92-215 pg_backup]# gunzip pg_wal.tar.gz  
[root@ip-172-31-92-215 pg_backup]#
```

This creates `pg_wal.tar`.

📌 Step 2: Create the pg_wal Directory

If it doesn't already exist, create the WAL segment directory inside the restored cluster:

```
mkdir -p /var/lib/pgsql/17/data/pg_wal
```

```
[root@ip-172-31-92-215 pg_backup]#  
[root@ip-172-31-92-215 pg_backup]# mkdir -p /var/lib/pgsql/17/data/pg_wal  
[root@ip-172-31-92-215 pg_backup]#
```

You may need to remove a partially extracted pg_wal/ folder before restoring, to avoid conflicts.

📌 Step 3: Extract the WAL Files

```
tar -xvf pg_wal.tar -C /var/lib/pgsql/17/data/pg_wal
```

```
[root@ip-172-31-92-215 pg_backup]#  
[root@ip-172-31-92-215 pg_backup]# tar -xvf pg_wal.tar -C /var/lib/pgsql/17/dat  
00000001000000000000000000000002
```

```
archive_status/00000001000000000000000000000000.done  
[root@ip-172-31-92-215 pg_backup]#
```

This places all archived WAL files into the correct location, enabling PostgreSQL to **replay transactions and finalize recovery** when started.

🔍 Step 6.3: Verify the Restored Structure

Before proceeding, quickly check the directory structure:

```
ls -lh /var/lib/pgsql/17/data  
ls -lh /var/lib/pgsql/17/data/pg_wal
```

```
[root@ip-172-31-92-215 pg_backup]#  
[root@ip-172-31-92-215 pg_backup]# ls -lh /var/lib/pgsql/17/data  
total 64K  
-rw----- 1 postgres postgres 3 Jun 30 19:36 PG_VERSION  
-rw----- 1 postgres postgres 225 Jun 30 19:51 backup_label  
drwx----- 6 postgres postgres 46 Jun 30 19:51 base  
-rw----- 1 postgres postgres 30 Jun 30 19:47 current_logfiles  
drwx----- 2 postgres postgres 4.0K Jun 30 20:03 global  
drwx----- 2 postgres postgres 32 Jun 30 19:36 log  
drwx----- 2 postgres postgres 6 Jun 30 19:36 pg_commit_ts  
drwx----- 2 postgres postgres 6 Jun 30 19:36 pg_dynshmem  
-rw----- 1 postgres postgres 5.4K Jun 30 19:36 pg_hba.conf  
-rw----- 1 postgres postgres 2.6K Jun 30 19:36 pg_ident.conf  
drwx----- 4 postgres postgres 68 Jun 30 19:51 pg_logical  
drwx----- 4 postgres postgres 36 Jun 30 19:36 pg_multixact  
drwx----- 2 postgres postgres 6 Jun 30 19:36 pg_notify  
drwx----- 2 postgres postgres 6 Jun 30 19:51 pg_replslot  
drwx----- 2 postgres postgres 6 Jun 30 19:36 pg_serial  
drwx----- 2 postgres postgres 6 Jun 30 19:36 pg_snapshots  
drwx----- 2 postgres postgres 6 Jun 30 19:47 pg_stat  
drwx----- 2 postgres postgres 6 Jun 30 19:36 pg_stat_tmp  
drwx----- 2 postgres postgres 6 Jun 30 19:36 pg_subtrans
```

```
drwx----- . 2 postgres postgres      6 Jun 30 19:36 pg_tblspc
drwx----- . 2 postgres postgres      6 Jun 30 19:36 pg_twophase
drwx----- . 4 postgres postgres     77 Jun 30 20:06 pg_wal
drwx----- . 2 postgres postgres     18 Jun 30 19:36 pg_xact
-rw----- . 1 postgres postgres     88 Jun 30 19:36 postgresql.auto.conf
-rw----- . 1 postgres postgres    31K Jun 30 19:47 postgresql.conf
-rw----- . 1 postgres postgres      0 Jun 30 19:51 tablespace_map
[root@ip-172-31-92-215 pg_backup]#
```

```
[root@ip-172-31-92-215 pg_backup]# ls -lh /var/lib/pgsql/17/data/pg_wal
total 16M
-rw----- . 1 postgres postgres 16M Jun 30 19:51 000000010000000000000002
drwx----- . 2 postgres postgres 43 Jun 30 20:06 archive_status
drwx----- . 2 postgres postgres   6 Jun 30 19:47 summaries
[root@ip-172-31-92-215 pg_backup]#
```

You should see PostgreSQL folders like:

- base/, pg_wal/, pg_xact/, global/, pg_stat/
- Files like PG_VERSION, postgresql.auto.conf, pg_control

This confirms that your cluster has been physically restored.



Step 7: Update PostgreSQL 17 Restore Configuration

After restoring the base data and WAL (Write-Ahead Log) files, we must ensure that PostgreSQL knows **how to locate and restore the archived WAL files** during startup. This is done via the `restore_command` setting in the `postgresql.conf` file.



What is `restore_command`?

The `restore_command` tells PostgreSQL how to **retrieve archived WAL segments** when starting up after a crash or when performing recovery. It is essential for:

- Crash recovery
- Replication
- Point-in-Time Recovery (PITR)

During recovery, PostgreSQL will:

1. Detect it needs to replay WAL.
2. Request each missing WAL segment by name.
3. Use `restore_command` to fetch the segment.

If the file is not found, recovery will **pause or fail**, which is why this step is critical.

Editing the Configuration File

Open the `postgresql.conf` file in your restored cluster's data directory:

```
sudo vi /var/lib/pgsql/17/data/postgresql.conf
```

Scroll down to the **archiving and recovery** section and set the following:

```
restore_command = 'cp /var/lib/pgsql/17/backups/pg_wal/%f /var/lib/pgsql/17/dat
```

Explanation of this line:

- `%f` : The filename of the requested WAL segment (e.g., `00000001000000010000005A`)
- `%p` : The absolute path where PostgreSQL expects the WAL segment

- `cp` : The command that physically copies the file from the archive to the required location

 This command ensures PostgreSQL can retrieve and apply archived WALs during recovery.

Ensure Permissions Are Correct

Make sure the `postgres` user has ownership and permissions over the `pg_wal` directory and the restored files:

```
sudo chown -R postgres:postgres /var/lib/pgsql/17/data
sudo chown -R postgres:postgres /var/lib/pgsql/17/backups
```

```
[root@ip-172-31-92-215 pg_backup]#
[root@ip-172-31-92-215 pg_backup]# sudo chown -R postgres:postgres /var/lib/pgsql/17/data
[root@ip-172-31-92-215 pg_backup]#
[root@ip-172-31-92-215 pg_backup]# sudo chown -R postgres:postgres /var/lib/pgsql/17/backups
[root@ip-172-31-92-215 pg_backup]#
```

Step 8: Restart PostgreSQL 17 and Verify Restoration

With everything in place — restored files and `restore_command` configured — it's time to bring the PostgreSQL service back online and confirm that everything works.

Restart PostgreSQL 17

Start the PostgreSQL service:

```
sudo systemctl start postgresql-17
```

If you are getting an error like the one below, then you need to troubleshoot it as follows

I have just reproduced the error for your reference

```
[root@ip-172-31-92-215 pg_backup]# sudo systemctl start postgresql-17
Job for postgresql-17.service failed because the control process exited with error code 1.
See "systemctl status postgresql-17.service" and "journalctl -xeu postgresql-17".
[root@ip-172-31-92-215 pg_backup]#
```

You need to run the following command to check the error details

```
journalctl -xeu postgresql-17.service
```

You will see error details like the following:

data directory “/var/lib/pgsql/17/data” has invalid permissions

DETAIL: Permissions should be u=rwx (0700) or u=rwx,g=rx (0750).

Run the following journalctl command:

```
[root@ip-172-31-92-215 pg_backup]# journalctl -xeu postgresql-17.service
● A stop job for unit postgresql-17.service has finished.
●
● The job identifier is 83856 and the job result is done.
Jun 30 19:56:27 ip-172-31-92-215.ec2.internal systemd[1]: postgresql-17.service
● Subject: Resources consumed by unit runtime
● Defined-By: systemd
● Support: https://access.redhat.com/support
●
● The unit postgresql-17.service completed and consumed the indicated resource
Jun 30 20:09:34 ip-172-31-92-215.ec2.internal systemd[1]: Starting postgresql-1
● Subject: A start job for unit postgresql-17.service has begun execution
● Defined-By: systemd
● Support: https://access.redhat.com/support
●
● A start job for unit postgresql-17.service has begun execution.
●
● The job identifier is 84142.
Jun 30 20:09:34 ip-172-31-92-215.ec2.internal postgres[20483]: 2025-06-30 20:09
Jun 30 20:09:34 ip-172-31-92-215.ec2.internal postgres[20483]: 2025-06-30 20:09
Jun 30 20:09:34 ip-172-31-92-215.ec2.internal systemd[1]: postgresql-17.service
● Subject: Unit process exited
● Defined-By: systemd
● Support: https://access.redhat.com/support
●
● An ExecStart= process belonging to unit postgresql-17.service has exited.
●
● The process' exit code is 'exited' and its exit status is 1.
Jun 30 20:09:34 ip-172-31-92-215.ec2.internal systemd[1]: postgresql-17.service
● Subject: Unit failed
● Defined-By: systemd
● Support: https://access.redhat.com/support
●
● The unit postgresql-17.service has entered the 'failed' state with result 'e
Jun 30 20:09:34 ip-172-31-92-215.ec2.internal systemd[1]: Failed to start postg
● Subject: A start job for unit postgresql-17.service has failed
● Defined-By: systemd
● Support: https://access.redhat.com/support
●
● A start job for unit postgresql-17.service has finished with a failure.
●
● The job identifier is 84142 and the job result is failed.
[root@ip-172-31-92-215 pg_backup]#
```

```
[root@ip-172-31-92-215 pg_backup]#  
[root@ip-172-31-92-215 pg_backup]# sudo chmod 750 /var/lib/pgsql/17/data  
[root@ip-172-31-92-215 pg_backup]#
```

```
[root@ip-172-31-92-215 pg_backup]#  
[root@ip-172-31-92-215 pg_backup]# sudo systemctl start postgresql-17  
[root@ip-172-31-92-215 pg_backup]#
```

Check the status immediately:

```
sudo systemctl status postgresql-17
```

```
[root@ip-172-31-92-215 pg_backup]#  
[root@ip-172-31-92-215 pg_backup]# sudo systemctl status postgresql-17  
● postgresql-17.service - PostgreSQL 17 database server  
    Loaded: loaded (/usr/lib/systemd/system/postgresql-17.service; enabled; pr  
      Active: active (running) since Mon 2025-06-30 20:16:34 UTC; 27s ago  
    Invocation: c4cd0309e4c84fe8933f472fbb3a3510  
      Docs: https://www.postgresql.org/docs/17/static/  
    Process: 20523 ExecStartPre=/usr/pgsql-17/bin/postgresql-17-check-db-dir ${  
 Main PID: 20529 (postgres)  
    Tasks: 8 (limit: 5687)  
   Memory: 34.2M (peak: 34.4M)  
     CPU: 65ms  
    CGroup: /system.slice/postgresql-17.service  
            ├─20529 /usr/pgsql-17/bin/postgres -D /var/lib/pgsql/17/data/  
            ├─20531 "postgres: logger "  
            ├─20532 "postgres: checkpointer "
```

```
|─ 20533 "postgres: background writer "
|─ 20535 "postgres: walwriter "
|─ 20536 "postgres: autovacuum launcher "
|─ 20537 "postgres: archiver "
└─ 20538 "postgres: logical replication launcher "
```

```
Jun 30 20:16:34 ip-172-31-92-215.ec2.internal systemd[1]: Starting postgresql-17
Jun 30 20:16:34 ip-172-31-92-215.ec2.internal postgres[20529]: 2025-06-30 20:16:34: LOG: starting PostgreSQL 17.0 (Ubuntu 17.0-1) on x86_64-pc-linux-gnu, compiled by gcc (Ubuntu 10.2.1-16ubuntu1) 10.2.1, 64-bit
Jun 30 20:16:34 ip-172-31-92-215.ec2.internal postgres[20529]: 2025-06-30 20:16:34: LOG: listening on IPv4 address "0.0.0.0", port 5432
Jun 30 20:16:34 ip-172-31-92-215.ec2.internal systemd[1]: Started postgresql-17
[root@ip-172-31-92-215 pg_backup]#
```

Expected output:

- Status should be active (running)
- No critical errors or failure messages

 If anything goes wrong (e.g., WAL not found, permissions denied), check logs with:

```
sudo journalctl -u postgresql-17 -n 50
```

💡 What Happens Behind the Scenes?

Once PostgreSQL starts:

1. It detects that a recovery is needed (based on the presence of `backup_label` or `standby.signal`).
2. It begins **replaying the WAL logs** from the `pg_wal` directory.
3. If additional segments are needed, it uses `restore_command` to fetch them.
4. After reaching consistency, it transitions to the normal operational state and accepts connections.

🔑 Connect to PostgreSQL and Validate the Restore

Switch to the `postgres` system user:

```
sudo su - postgres
```

```
[root@ip-172-31-92-215 pg_backup]# sudo su - postgres
Last login: Mon Jun 30 19:51:00 UTC 2025 on pts/2
[postgres@ip-172-31-92-215 ~]$  
[postgres@ip-172-31-92-215 ~]$
```

Then connect to PostgreSQL:

```
psql
```

```
[postgres@ip-172-31-92-215 ~]$  
[postgres@ip-172-31-92-215 ~]$ psql  
psql (17.5)  
Type "help" for help.  
  
postgres=#
```

Inside the PostgreSQL shell, check the list of databases:

\l+

You should see:

```
postgres=#  
postgres=# \l+
```

| Name | Owner | Encoding | Locale | Provider | Collate | Ctype | Locale |
|-----------|----------|----------|--------|----------|---------|---------|--------|
| dvdrental | postgres | UTF8 | libc | | C.UTF-8 | C.UTF-8 | |
| postgres | postgres | UTF8 | libc | | C.UTF-8 | C.UTF-8 | |
| template0 | postgres | UTF8 | libc | | C.UTF-8 | C.UTF-8 | |
| | | | | | | | |
| template1 | postgres | UTF8 | libc | | C.UTF-8 | C.UTF-8 | |
| | | | | | | | |

(4 rows)

```
postgres=#
```

 These are the exact databases that existed at the time of your backup.

You can explore tables and data:

```
\c dvdrental  
\dt  
SELECT COUNT(*) FROM some_table;
```

```
postgres=#  
postgres=# \c dvdrental  
You are now connected to database "dvdrental" as user "postgres".  
dvdrental=#  
dvdrental=# \dt  
List of relations
```

| Schema | Name | Type | Owner |
|--------|---------------|-------|----------|
| public | actor | table | postgres |
| public | address | table | postgres |
| public | category | table | postgres |
| public | city | table | postgres |
| public | country | table | postgres |
| public | customer | table | postgres |
| public | film | table | postgres |
| public | film_actor | table | postgres |
| public | film_category | table | postgres |
| public | inventory | table | postgres |
| public | language | table | postgres |
| public | payment | table | postgres |
| public | rental | table | postgres |
| public | staff | table | postgres |
| public | store | table | postgres |

(15 rows)

```
dvdrental=#  
dvdrental=# SELECT COUNT(*) FROM actor;  
count  
-----  
200  
(1 row)
```

```
dvdrental=#
```

This confirms that your data, structure, and transactions were fully restored.

✓ Summary of Steps Completed

| Step | Description |
|------|---|
| 1–4 | Took a full backup using <code>pg_basebackup</code> |
| 5 | Simulated a disaster by deleting the data directory |
| 6 | Restored base and WAL backup files |
| 7 | Configured <code>restore_command</code> in <code>postgresql.conf</code> |
| 8 | Restarted PostgreSQL and verified the recovery |

 Congratulations! You've just walked through a **realistic PostgreSQL 17 disaster recovery scenario** using native tools and no third-party plugins.

This setup prepares you for:

- Hardware crashes
- Accidental data deletion
- Cloud VM failures
- Compliance audits (via PITR)

Would you like to continue with:

-  Automating this backup/restore process via cron or shell scripts?
-  Sending WAL backups to AWS S3 or GCS for offsite recovery?
-  Performing Point-in-Time Recovery (PITR) to a specific timestamp?

Important Considerations When Using pg_basebackup in PostgreSQL 17

Creating a backup is easy. Creating a **useful** and **reliable** backup that you can confidently restore in a crisis is what truly matters. Let's take a closer look at some critical considerations to make your PostgreSQL backup strategy production-grade.

Compression Saves Disk Space — But May Increase CPU Load

When taking a backup using `pg_basebackup`, you can enable compression by adding the `-z` flag (e.g., `pg_basebackup -z ...`). This compresses the backup archive using

gzip, reducing file size significantly.

Benefits:

- Reduces disk space usage, especially for large databases
- Minimizes transfer size if you're uploading the backup to cloud storage
- Speeds up backups over the network

Tradeoffs:

- Compression consumes CPU. On busy or resource-constrained PostgreSQL servers, it may temporarily impact database performance during the backup window.
- Compression may slow down backup speed slightly depending on the server's I/O and CPU.

 **Best Practice:** Use compression on staging environments or schedule compressed backups during off-peak hours. Alternatively, perform the backup from a replica server to avoid impacting the primary database.



WAL Logs Are Not Optional — They Are Critical

One of the biggest mistakes novice DBAs make is backing up only the base data directory without including WAL (Write-Ahead Log) segments.

In PostgreSQL, WAL files are essential because:

- They contain all changes made to the database.
- PostgreSQL uses them to replay committed transactions that occurred after the base backup was taken.
- WALs are required for Point-in-Time Recovery (PITR) and replication.

If you lose the WAL logs, you may still have the base backup — but you'll lose any data created, updated, or deleted after that snapshot.

What to Do:

- Set `archive_mode = on` in `postgresql.conf`

- Configure a reliable `archive_command`, such as:

```
archive_command = 'cp %p /var/lib/pgsql/17/backups/pg_wal/%f'
```

- Store WAL files in durable storage (NFS, S3, GCS, etc.)
- Periodically clean up old WALs with tools like `pg_archivecleanup` to avoid disk overflows

 Without WAL backups, you cannot achieve PITR, and you risk partial or corrupted restores.

Test Your Backups Regularly

Taking a backup is only half the job — you need to know with certainty that your backups actually work.

Risks of Not Testing:

- Backups that look complete but are corrupted
- Archived WAL files missing or not properly copied
- `restore_command` not working, breaking recovery
- Inconsistent configurations that silently fail

How to Test:

- Set up a separate PostgreSQL 17 test server or container
- Simulate real disaster scenarios (delete the data directory)
- Restore the base backup and replay WALs
- Validate the data integrity (e.g., row counts, indexes, schema)



A backup you haven't tested is just a false sense of security.

Final Summary: PostgreSQL 17 Backup & Restore Workflow

Let's summarize everything we've covered — from the tools used to the critical best practices:

|  Task |  Tool / Step |  Notes |
|--|---|---|
| Backup Full Cluster | <code>pg_basebackup</code> | Use <code>-z</code> for compression, <code>-Xs</code> for streaming WAL |
| Restore Base + WAL | <code>tar + gunzip + cp</code> | Manual directory recreation required |
| Replay WAL for Recovery | <code>restore_command</code> | Crucial for transactional consistency |
| Enable PITR | Archive WAL files | Required for restoring to a specific time |
| Verify Restoration | <code>psql, \l, \dt, data checks</code> | Always confirm post-recovery state |

You're Now Ready for Real-World PostgreSQL Recovery Scenarios

By following this workflow, you've:

- Used PostgreSQL-native tools (no third-party dependencies)
- Taken a **hot backup** without downtime
- Recovered from a **simulated disaster** on the same host
- Ensured support for **WAL-based recovery and PITR**

Whether you're running PostgreSQL 17 on-prem, on EC2, or inside a Kubernetes cluster, this strategy scales.

Stay Updated with Daily PostgreSQL & Cloud Tips!

If you've been finding my blog posts helpful and want to stay ahead with daily insights on PostgreSQL, Cloud Infrastructure, Performance Tuning, and DBA Best

Practices — I invite you to subscribe to my Medium account.

🔔 [Subscribe here](https://medium.com/@jramcloud1/subscribe) 👉 <https://medium.com/@jramcloud1/subscribe>

Your support means a lot — and you'll never miss a practical guide again!

🔗 Let's Connect!

If you enjoyed this post or would like to connect professionally, feel free to reach out to me on LinkedIn:

👉 [Jeyaram Ayyalusamy](#)

I regularly share content on **PostgreSQL, database administration, cloud technologies, and data engineering**. Always happy to connect, collaborate, and discuss ideas!

Postgresql

AWS

Sql

Oracle

Open Source



Following ▾

Written by Jeyaram Ayyalusamy

62 followers · 2 following

Oracle DBA | AWS Certified | 18+ yrs in DB Admin, RAC, GoldenGate, RDS, MySQL, PostgreSQL | Author of MySQL & RDS books | Cloud & Performance Expert

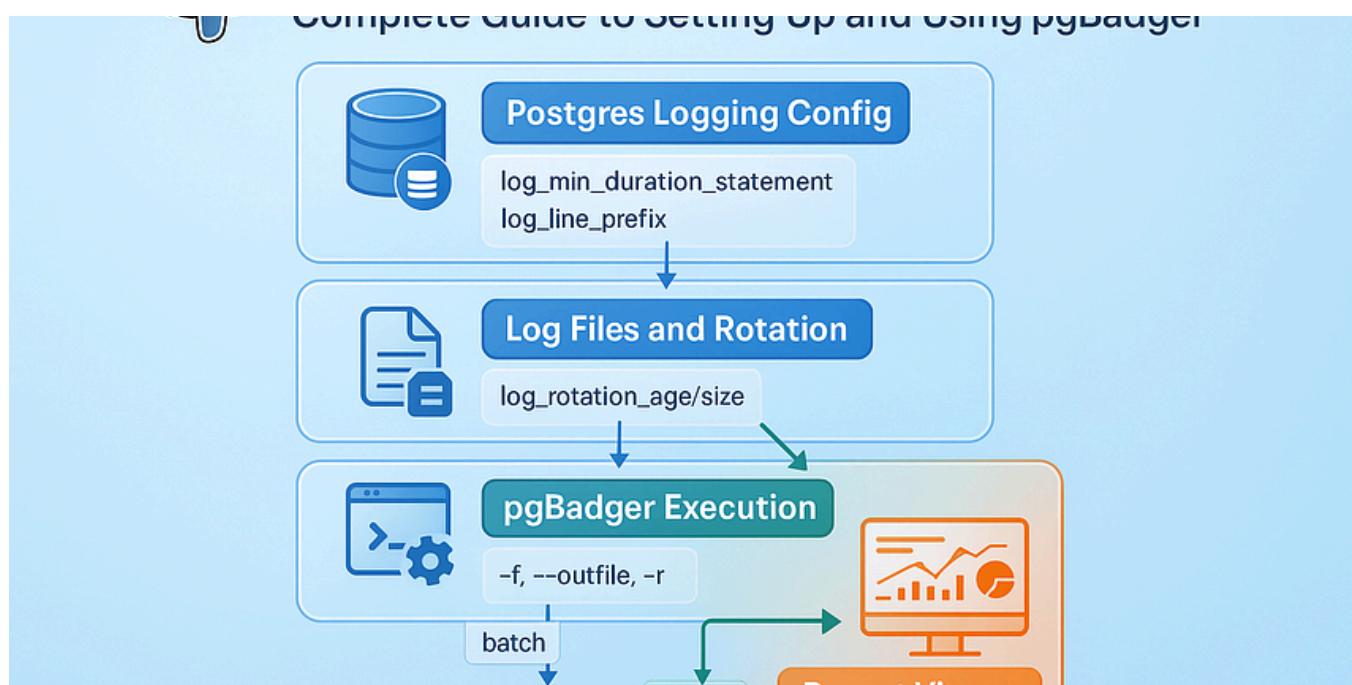
No responses yet



Gvadakte

What are your thoughts?

More from Jeyaram Ayyalusamy



J Jeyaram Ayyalusamy

PostgreSQL 17 Log Analysis Made Easy: Complete Guide to Setting Up and Using pgBadger

Managing a production-grade PostgreSQL instance isn't just about keeping data safe—it's about monitoring performance, identifying...

Jun 23 52



...



J Jeyaram Ayyalusamy

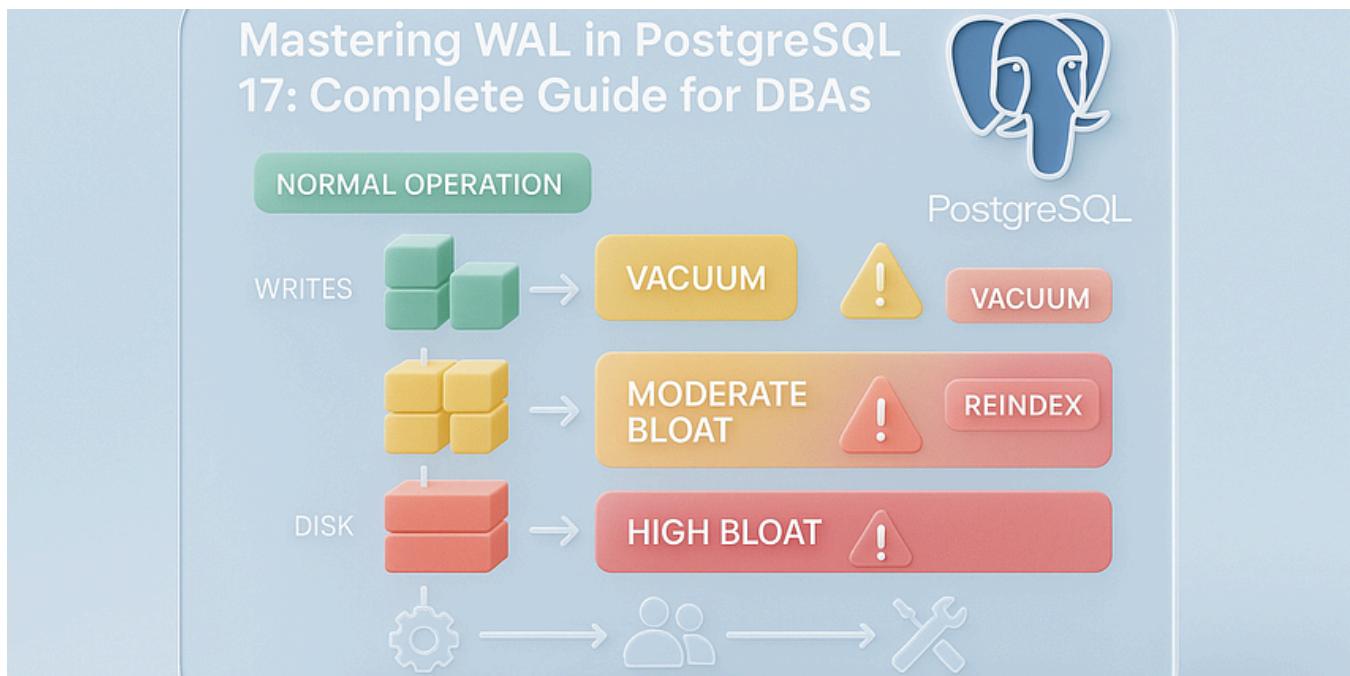
PostgreSQL 17 Administration: Mastering Schemas, Databases, and Roles

PostgreSQL has evolved into one of the most feature-rich relational databases available today. With version 17, its administrative...

Jun 9 3



...



J Jeyaram Ayyalusamy

Understanding and Managing Bloating in PostgreSQL: A Complete Guide for DBAs

PostgreSQL is a powerful, reliable, and feature-rich open-source relational database system. It's praised for its extensibility, ACID...

Jun 25  2



...



The image features five logos arranged horizontally: a blue stylized 'W' logo, a red fedora hat, a green mountain-like logo, a colorful group of people logo, and the Tux Linux penguin logo.

HOW TO INSTALL PostgreSQL 17 ON RED HAT, ROCKY, ALMALINUX,

 Jeyaram Ayyalusamy 

How to Install PostgreSQL 17 on Red Hat, Rocky, AlmaLinux, and Oracle Linux (Step-by-Step Guide)

PostgreSQL 17 is the latest release of one of the world's most advanced open-source relational databases. If you're using a Red Hat-based...

Jun 3



...

See all from Jeyaram Ayyalusamy

Recommended from Medium

PostgreSQL

Pivot Rows to Columns:

Common Mistakes and Fixes

The diagram illustrates the process of pivoting rows into columns. On the left, a table has three rows: 'A' in 'Jan', 'A' in 'Mar', and 'A' in '140'. An arrow points to the right, where the same data is shown as three columns: 'emp', 'jan_hors', and 'mar'. The 'jan_hors' column contains '160' for both 'A' in 'Jan' and 'A' in 'Mar', while the 'mar' column contains '0' for 'A' in 'Jan' and '140' for 'A' in 'Mar'.

| emp | month | emp | jan_hors | mar |
|-----|-------|-----|----------|-----|
| A | Jan | A | 160 | 0 |
| A | Mar | A | 160 | 140 |
| A | 140 | A | 0 | 140 |



Ajaymaurya

PostgreSQL Pivot Rows to Columns: Common Mistakes and Fixes

When working with data in PostgreSQL, pivoting rows into columns can feel like a superpower —until something breaks. Whether you're...

★ Jun 27

15



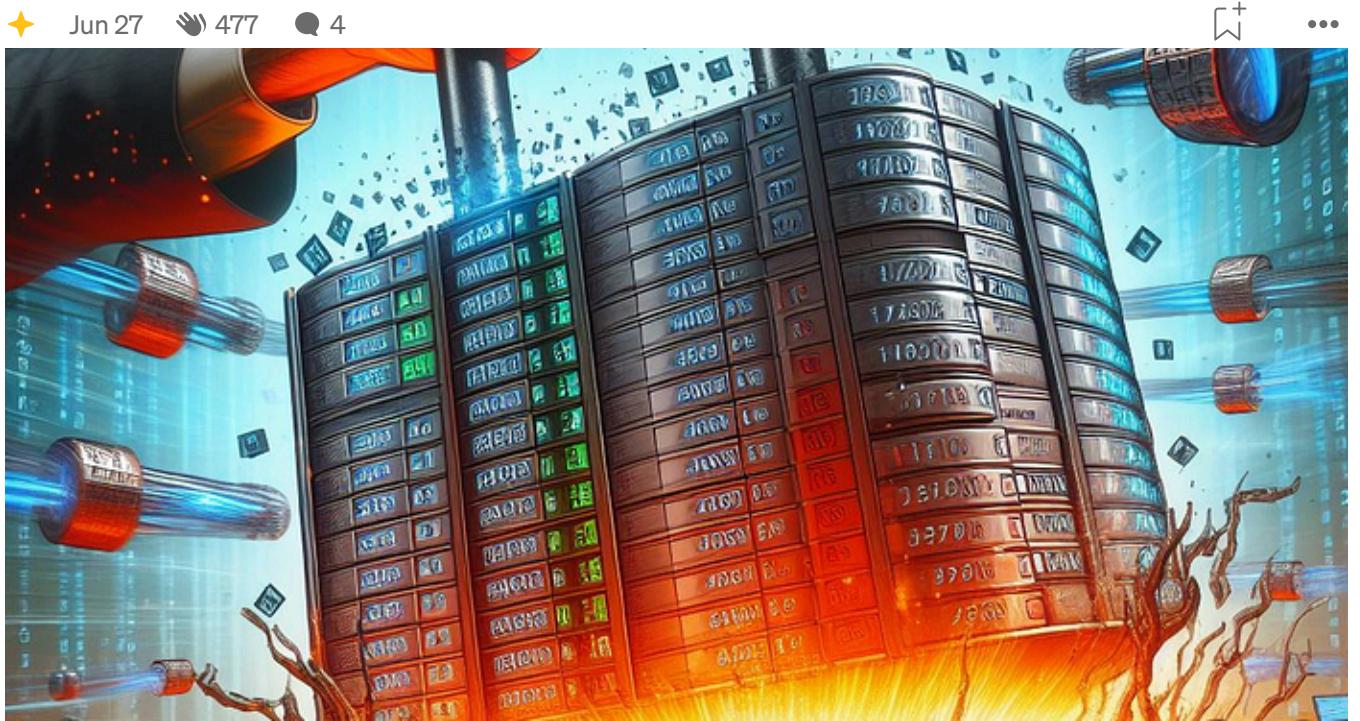
...



ThreadSafe Diaries

PostgreSQL 18 Just Rewrote the Rulebook, Groundbreaking Features You Can't Ignore

From parallel ingestion to native JSON table mapping, this release doesn't just evolve Postgres, it future-proofs it.

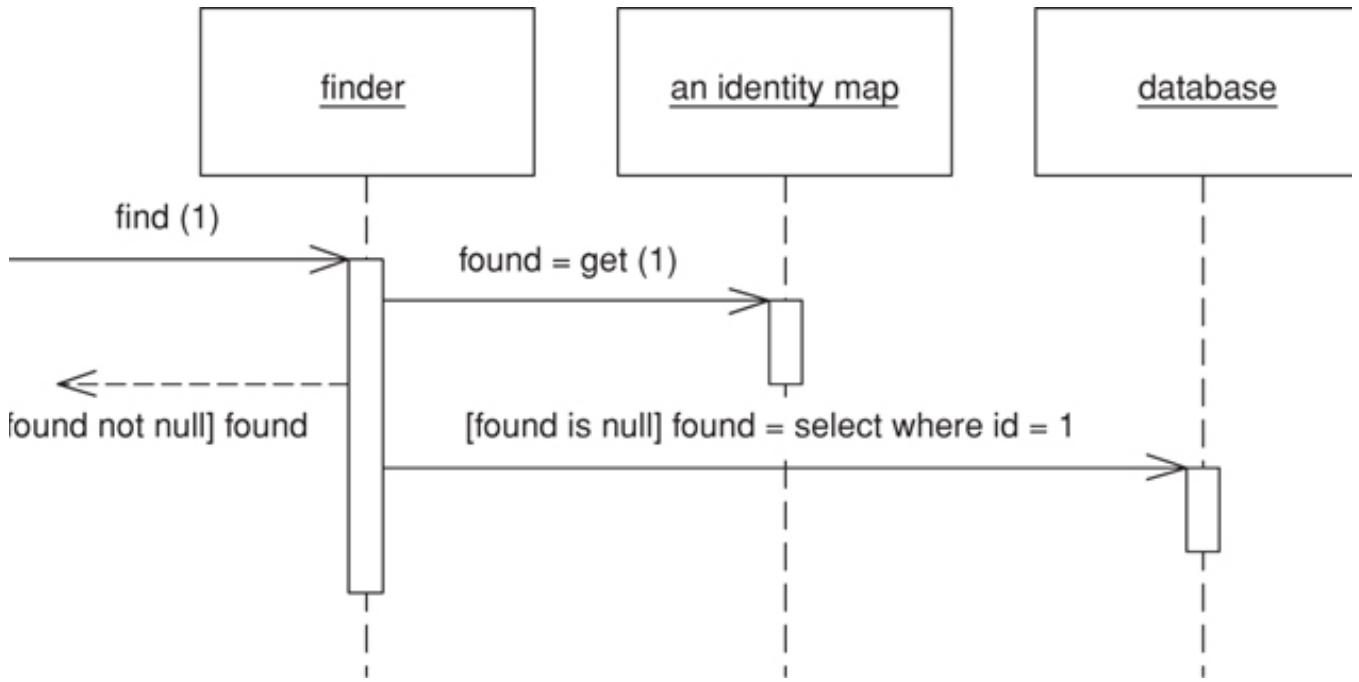


In Level Up Coding by Daniel Craciun

Stop Using UUIDs in Your Database

How UUIDs Can Destroy SQL Database Performance

Jun 25 793 50



Harishsingh

The Forgotten SQL Pattern That Reduced Our Query Time by 90%

Like many teams, we assumed our SQL queries were “good enough” because they returned the correct results. But when a simple dashboard...

6d ago 4



...

100M ROW
POSTGRESQL
TABLE WITH
ZERO DOWNTIME
(AND SURVIVED)

Mojtaba Azad

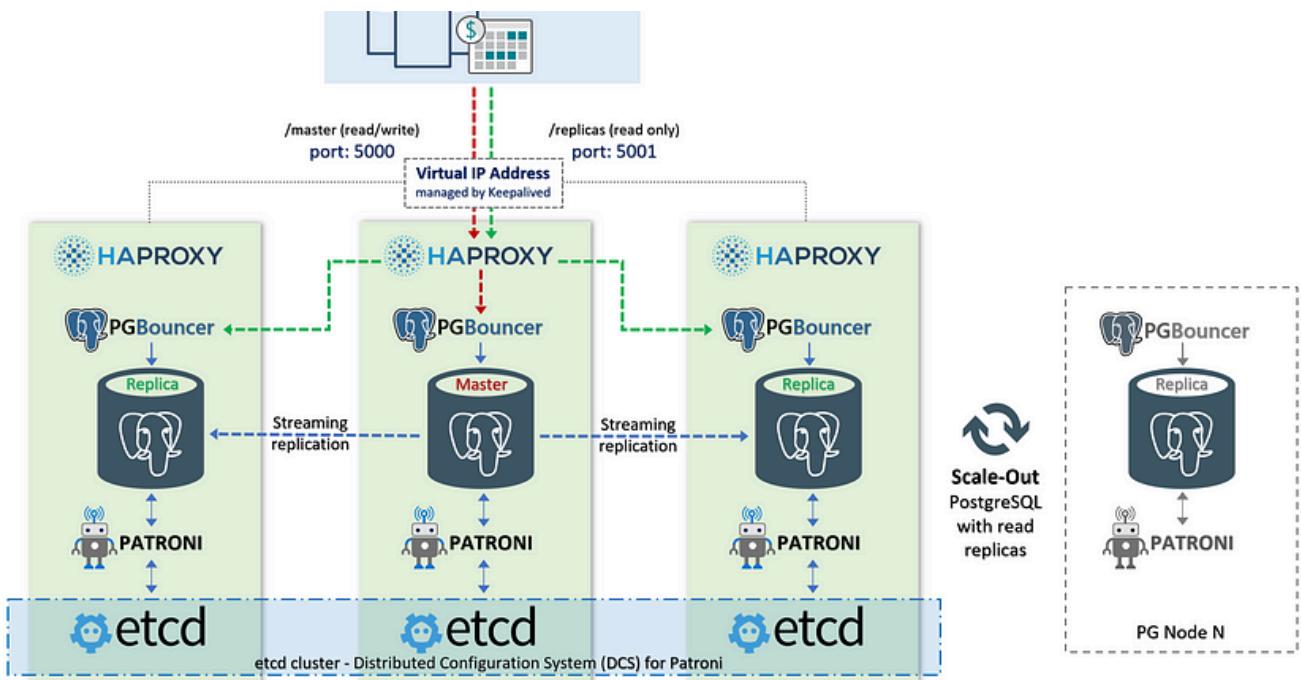
How We Migrated a 100M Row PostgreSQL Table With Zero Downtime (and Survived)

Here's how we pulled off a 100-million-row table migration in PostgreSQL without a single second of downtime, using only native tools.

Jun 7 56 2



...



Kanat Akylson

How to Deploy a High-Availability PostgreSQL Cluster in 5 Minutes Using Ansible and Patroni

This tutorial shows how to spin up a production-grade HA PostgreSQL cluster in just 5 minutes using m2y ready-made GitHub repository with...

Jun 9 · 64 · 1



See more recommendations