

pgBackRest

Frequently Asked Questions



data egret

Your remote PostgreSQL DBA team

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SECURING YOUR DATABASE AVAILABILITY, SO THAT YOUR TEAM CAN FOCUS ON NEW FEATURE DEVELOPMENT.

- Migrations
- DB audit
- Performance optimisation
- Backup & restore
- Architectural review
- Advising Data Science teams
- Developer training

on premise & cloud



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Felxible approach and
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Contributing Sponsor.
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Stefan Fercot

- Senior PostgreSQL Expert @Data Egret
- pgBackRest fan & contributor
- aka. pgstef
- <https://pgstef.github.io>

*Need a Disaster and Recovery Plan? ;-)
Contact **Data Egret** to talk to me about backups and
high-availability!*

pgBackRest

- aims to be a simple, reliable backup and **restore** system
- current release: 2.51 (March 25, 2024)
- local or remote operation (via SSH or TLS server)
- parallel and asynchronous operations
- S3, Azure, and GCS support
- client-side encryption (aes-256-cbc)
- ...

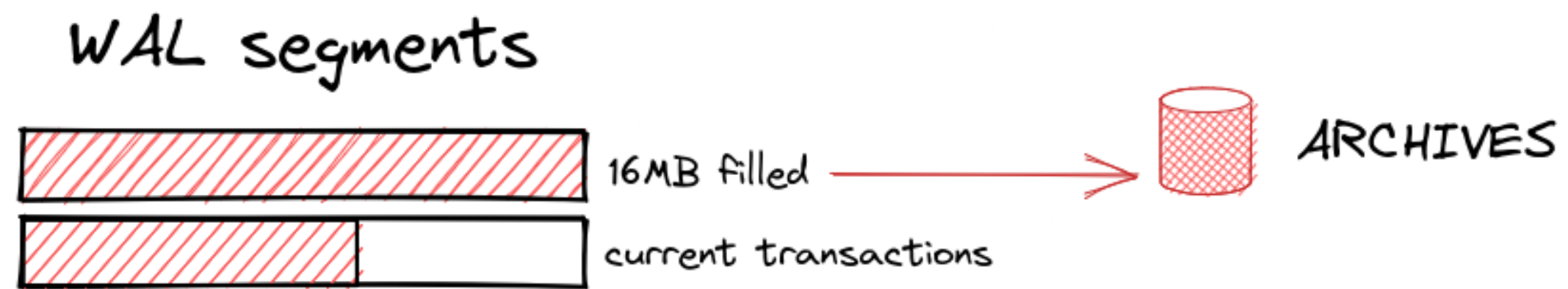
pgBackRest Frequently Asked Questions

- archiving system
- what to monitor and how?
- restore possibilities

Archiving system

- `archive_command` vs `pg_receivewal` (not supported)
- how to improve it?
- what can go wrong with archiving?

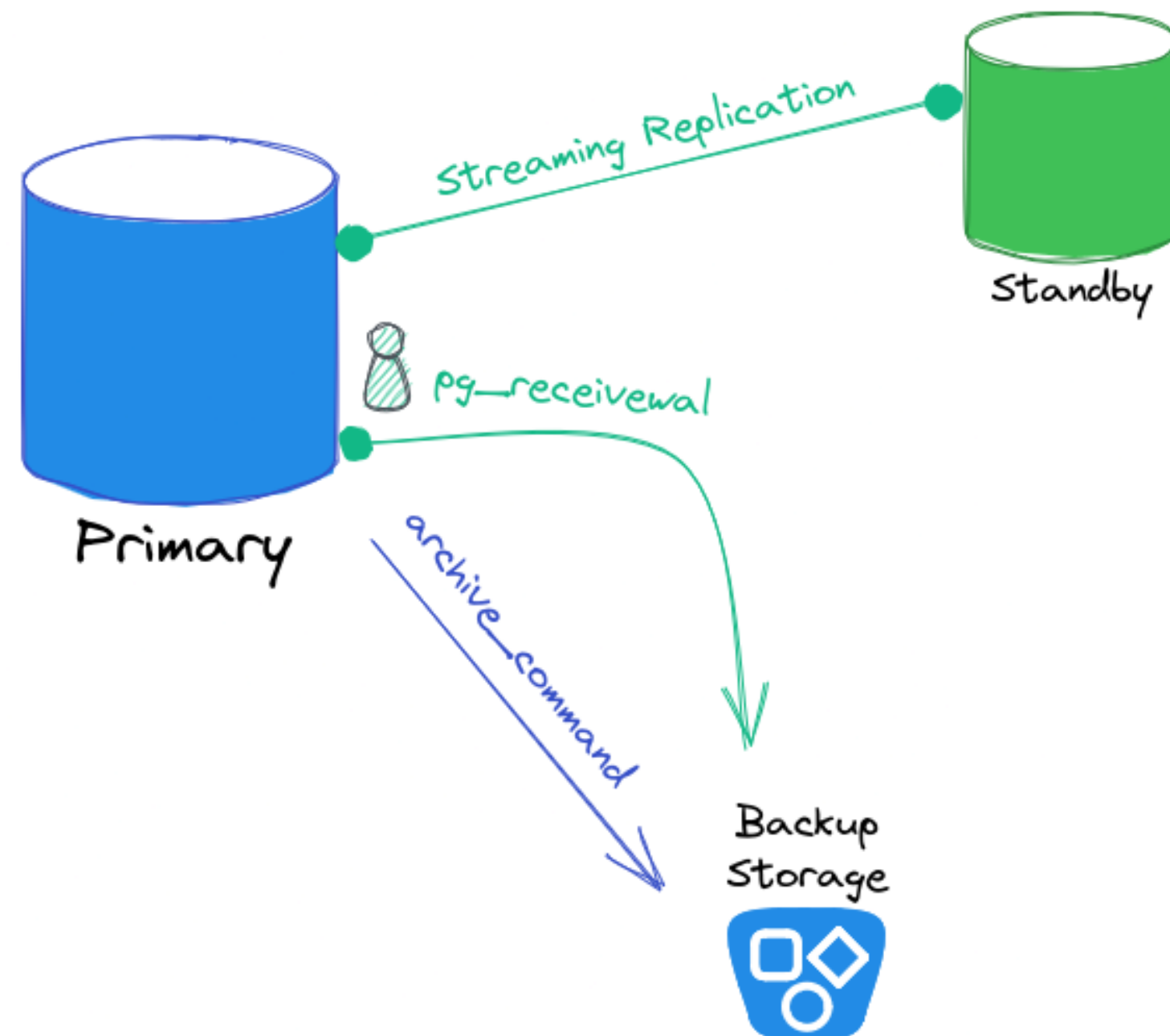
WAL archiving process



`.partial` WAL file

- usually < 16MB
- `pg_receivewal` = standby without data
- `.partial` is pushed by the standby server at promote time

Example (1)



Example (2)

```
archive_command = 'cp %p /shared/archives/%f'
```

```
pg_receivewal -D /shared/receivewal -v
```

```
/usr/pgsql-16/bin/pgbench -i -s 65
```

Example (3)

```
$ ps -o pid,cmd fx
  PID CMD
24712 /usr/pgsql-16/bin/postgres -D /var/lib/pgsql/16/data/
...
24853 \_ postgres: walsender ... streaming 0/34F2ED18
24929 \_ postgres: walsender ... streaming 0/34F2ED18
```

```
$ ls /shared/archives
...
00000001000000000000000033
```

```
$ ls /shared/receivewal
...
00000001000000000000000033
00000001000000000000000034.partial
```

Example (4)

```
$ psql -c "SELECT pg_promote();" 
```

```
$ ls /shared/archives/  
...  
0000000100000000000000034.partial  
00000002.history
```

`pg_receivewal` still points to the old primary!

Timelines

A correct restore from backup, PITR or not,...
...always involves a timeline switch!

- archive recovery complete -> new timeline
 - part of WAL segment file names
 - to identify the series of WAL records generated after that recover
 - `.history` files

Faster archiving?

- async archiving
- compression types
- compression level

Async archiving

- using `archive-async=y`
 - temporary data (acknowledgments) stored into the `spool-path`
 - early archiving using `process-max` processes

Compression types

- file compression types supported (`compress-type`):
 - `bz2` - bzip2
 - `gz` - gzip (default)
 - `lz4`
 - `zst` - Zstandard

Compression level

- when `compress-level` is not specified
 - defaults levels based on `compress-type`
 - bz2 - 9
 - gz - 6
 - lz4 - 1
 - zst - 3

Example (1) - initial state

```
SELECT application_name, sent_lsn, write_lsn, flush_lsn FROM pg_stat_replication;
```

application_name	sent_lsn	write_lsn	flush_lsn
walreceiver	0/37000060	0/37000060	0/37000060
pg_receivewal	0/37000060	0/37000060	0/37000000

(2 rows)

```
SELECT last_archived_wal FROM pg_stat_archiver;
```

last_archived_wal
0000000100000000000000036

(1 row)

Example (2) - archiving too slow

```
/usr/pgsql-16/bin/pgbench -n -P 1 -T 60 -j 2 -c 50
```

```
SELECT application_name, sent_lsn, write_lsn, flush_lsn FROM pg_stat_replication;
 application_name | sent_lsn | write_lsn | flush_lsn
-----+-----+-----+-----
 walreceiver      | 0/E5130110 | 0/E5129E10 | 0/E5123BC0
 pg_receivewal    | 0/E5130110 | 0/E4B5A528 | 0/E4000000
(2 rows)
```

```
SELECT last_archived_wal FROM pg_stat_archiver;
 last_archived_wal
-----
 000000010000000000000000E0
(1 row)
```

Example (3) - final state

```
SELECT application_name, sent_lsn, write_lsn, flush_lsn FROM pg_stat_replication;
```

application_name	sent_lsn	write_lsn	flush_lsn
walreceiver	1/395F90E8	1/395F90E8	1/395F90E8
pg_receivewal	1/395F90E8	1/395F9038	1/39000000

(2 rows)

```
SELECT last_archived_wal FROM pg_stat_archiver;
```

last_archived_wal
000000010000000100000038

(1 row)

Example (4) - improvements

```
process-max=2
archive-async=y
compress-type=zst
```

```
/usr/pgsql-16/bin/pgbench -n -P 1 -T 60 -j 2 -c 50
```

```
SELECT application_name, sent_lsn, write_lsn, flush_lsn FROM pg_stat_replication;
 application_name | sent_lsn | write_lsn | flush_lsn
-----+-----+-----+-----
 walreceiver      | 1/C510CFA8 | 1/C5000000 | 1/C5000000
 pg_receivewal    | 1/C510CFA8 | 1/BF0F4B80 | 1/BF000000
(2 rows)
```

```
SELECT last_archived_wal FROM pg_stat_archiver;
 last_archived_wal
-----
 0000000100000001000000C3
(1 row)
```

What can go wrong with archiving?

Things can get worst... and it will! (Laetitia Avrot)

Archiving fails...

```
ERROR: [082]: WAL segment ... was not archived before the 60000ms timeout  
HINT: check the archive_command to ensure that all options are correct  
HINT: check the PostgreSQL server log for errors
```

`archive-push` console output goes into the PostgreSQL logs!

Error example (1)

```
ERROR: [103]: unable to find a valid repository:
repo1: [FileMissingError] unable to load info file '.../archive/demo/archive.info'
      or '.../archive/demo/archive.info.copy':
FileMissingError: unable to open missing file '.../archive/demo/archive.info' for read
FileMissingError: unable to open missing file '.../archive/demo/archive.info.copy' for read
HINT: archive.info cannot be opened but is required to push/get WAL segments.
HINT: is archive_command configured correctly in postgresql.conf?
HINT: has a stanza-create been performed?
```

Error example (2)

```
ERROR: [050]: unable to acquire lock on file '/tmp/pgbackrest/demo-archive.lock': Permission denied  
HINT: does 'postgres:postgres' running pgBackRest have permissions  
on the '/tmp/pgbackrest/demo-archive.lock' file?
```

asynchronous archiving uses an archive lock to prevent more than one
async process being launched

WAL segments piling up...

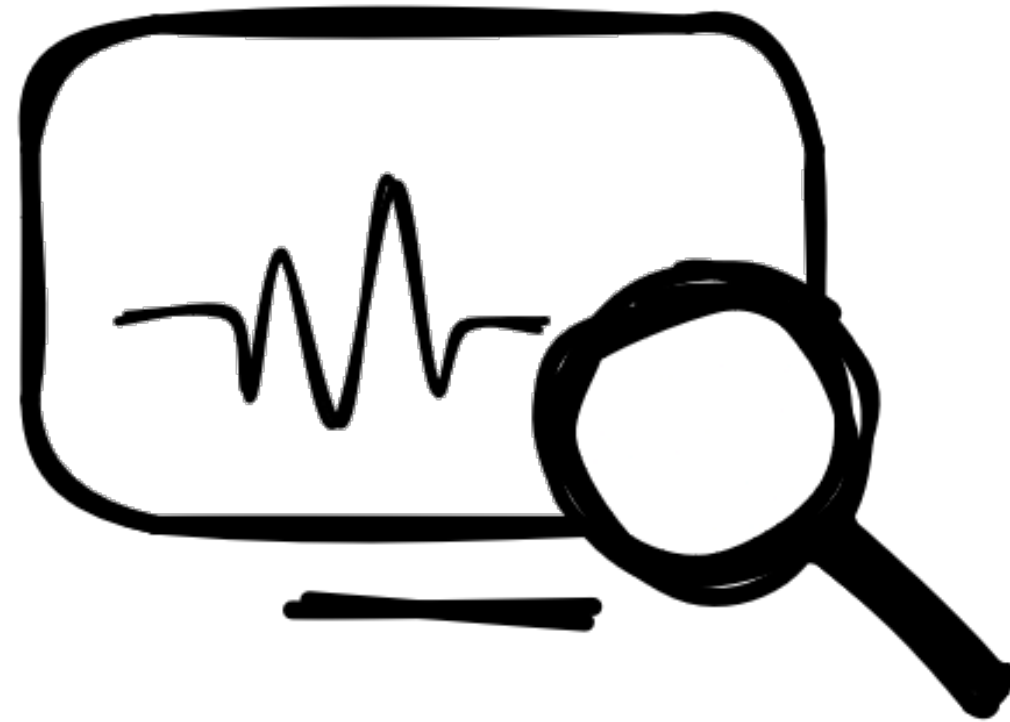
an error prevent PostgreSQL to remove/recycle the WAL file!

```
$ ls data/pg_wal/archive_status |grep .ready
...
000000010000000020000001B.ready
000000010000000020000001C.ready
000000010000000020000001D.ready
000000010000000020000001E.ready
```

Archiving queue

- `archive-push-queue-max`
 - maximum size of the PostgreSQL archive queue
 - prevent the WAL space from filling up until PostgreSQL stops completely...
 - ...but generate **missing archives!**
- very important to monitor archiving to ensure it continues working

Monitoring



What & How?

Logs

- `log-level-console` (stdout): **warn** by default
- `log-level-file` : **info** by default
- usually interesting to set `log-level-console` to **info** and `log-level-file` to **debug**

Archive-push

```
[demo:archive-push]  
log-level-console=debug
```

info command - json output

```
$ pgbackrest info --stanza=demo --output=json
{"archive":[{"database":{"id":1,"repo-key":1},
{"id":"16-1",
"max":"0000000100000002000000082",
"min":"0000000100000001000000039"}],
"backup":[{"archive":{"start":"0000000100000002000000072","stop":"0000000100000002000000082"}},
...
}
```

Backups

- retention
 - how old is your latest backup?
 - how old is your latest **full** backup?
 - how old is your **oldest** full backup?
 - how many full, diff or incr backups are in the repository?
 - does it meet the retention settings?

Backups - example

```
Long message      : full=1
Long message      : diff=0
Long message      : incr=3
Long message      : latest_bck=20240514-140212F_20240515-083055I
Long message      : latest_bck_type=incr
Long message      : latest_bck_age=3h28m33s
Long message      : latest_full=20240514-140212F
Long message      : latest_full_age=21h57m10s
Long message      : oldest_bck=20240514-140212F
Long message      : oldest_bck_age=21h57m10s
```

example generated with `check_pgbackrest`

Archives

- backup command checks archives needed for the consistency

```
$ pgbackrest --stanza=demo backup --type=full
...
INFO: check archive for segment(s) 000000010000000000000000DC:000000010000000000000000DC
...
```

- info command shows oldest and latest WAL archive in the repository

```
$ pgbackrest --stanza=demo info
...
wal archive min/max (16): 00000001000000000000000099/000000010000000000000000DC
```

Archives - questions

- what if archives needed for the backups consistency get removed after the backup?
- are all the archives between oldest and latest (from info) present in the repository?

```
Long message      : latest_archive_age=2m51s
Long message      : latest_archive=0000000100000000000000E7
Long message      : latest_bck_archive_start=0000000100000000000000DC
Long message      : latest_bck=20240515-122650F
Long message      : oldest_archive=000000010000000000000099
Long message      : oldest_bck_archive_start=000000010000000000000099
```

Archives and timeline switch

- WAL archives on different timelines found...

```
$ pgbackrest --stanza=demo info
...
wal archive min/max (16): 00000001000000000000000099/000000020000000000000000E8
```

- parse `.history` file, find switch point and define boundary WAL

```
$ pgbackrest repo-get --stanza=demo archive/demo/16-1/00000002.history
1 0/E856A0E8 no recovery target specified
```

```
SELECT pg_walfile_name('0/E856A0E8');
       pg_walfile_name
-----
000000010000000000000000E8
```


Locks

- check `lock-path` content

```
$ ls /tmp/pgbackrest  
demo-archive.lock  
demo-backup.lock
```

Restore

pgBackRest handles the restore,
PostgreSQL handles the recovery !

Let's talk about `restore` command and recovery targets...

Restore type?

- `--type` (and `--target` to reach)
 - default - to the end of the archive stream
 - immediate - to backup consistency point
 - lsn - to LSN (Log Sequence Number), `recovery_target_lsn`
 - name - to restore point, `recovery_target_name`
 - xid - to transaction id, `recovery_target_xid`
 - time - to a specific timestamp, `recovery_target_time`
 - ...

Backup set

- `--set`
 - default: latest
 - auto-select for **time** and **lsn** target

Timeline

- `--target-timeline`
 - `recovery_target_timeline`
 - default: `latest` (v12+) or `current` (< v12)

Selective restore

- `--db-include`
 - databases not specifically included will be restored as sparse, zeroed files
 - built-in databases (template0, template1, and postgres) are always restored unless specifically excluded
- `--db-exclude`
 - databases excluded will be restored as sparse, zeroed files
 - with the `--db-include` option, only apply to built-in databases

Summary

- tweak your archiving system (async, compression type,...)
- monitor your backups and archives
- regularly try to restore your backups

Schrödinger's Law of Backups

*The condition/state of any backup is unknown until
a restore is attempted.*

About PostgreSQL recovery...

WEBINAR

THE PATH TO A SUCCESSFUL POSTGRESQL RECOVERY

20 JUNE, 13:00-14:00CEST

- Step-by-step restore procedure
- Various settings influencing the PostgreSQL recovery
- Practical scenarios using a quick demo setup

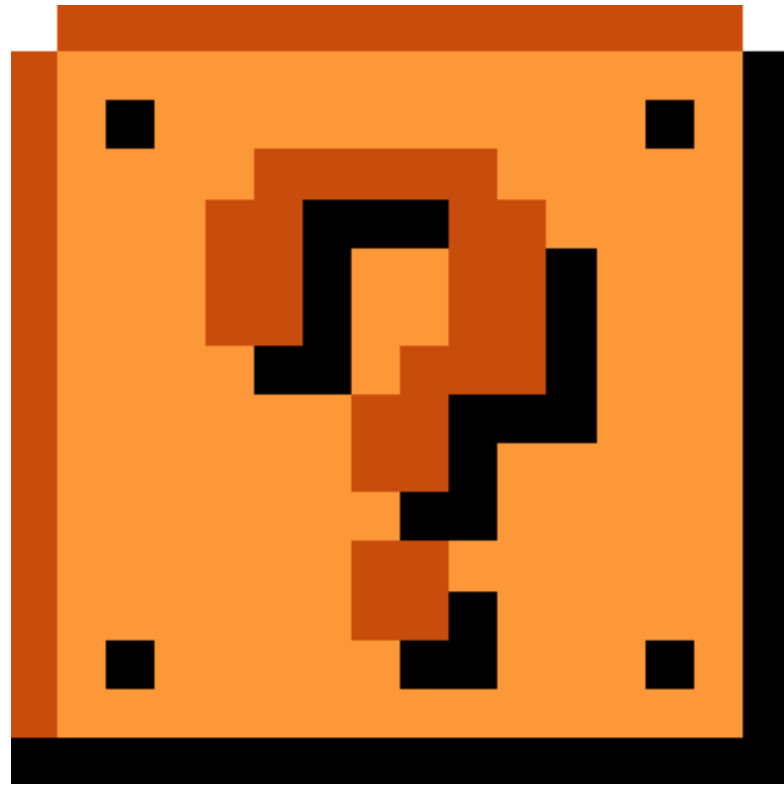


Register!

To boost your confidence in facing PostgreSQL recovery challenges!



Questions?



Thank you for your attention!