How to Keep your Database Happy

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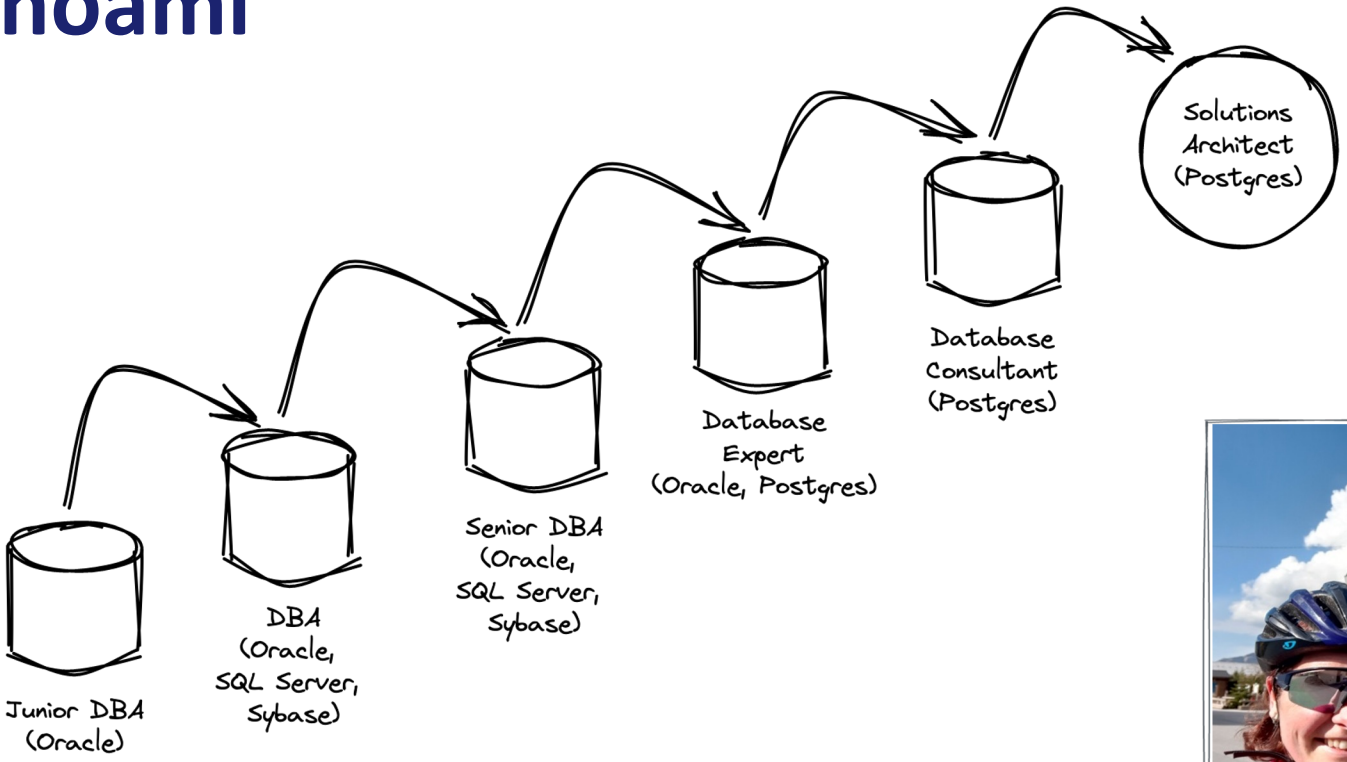
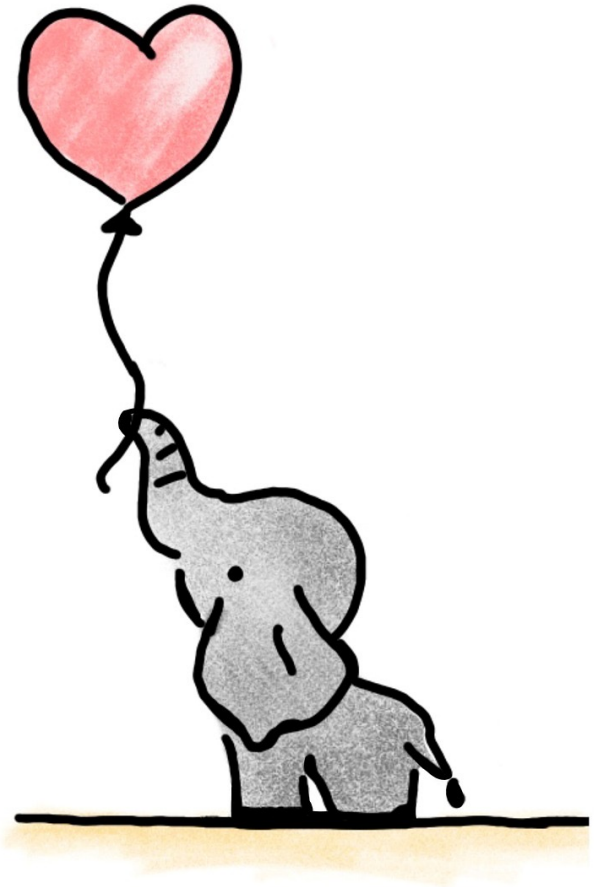
whoami


Junior DBA
(Oracle)
DBA
(Oracle,
SQL Server,
Sybase)
Senior DBA
(Oracle,
SQL Server,
Sybase)
Database
Expert
(Oracle, Postgres)
Database
Consultant
(Postgres)
Solutions
Architect
(Postgres)

Introduction



Agenda

1. Set **Memory & Performance Parameters**
2. Schedule (and test) **Backups**
3. Implement **High Availability**
4. Configure **Connections**
5. Put in place **Logging, Monitoring & Alerting**

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1. **Set Memory & Performance Parameters**
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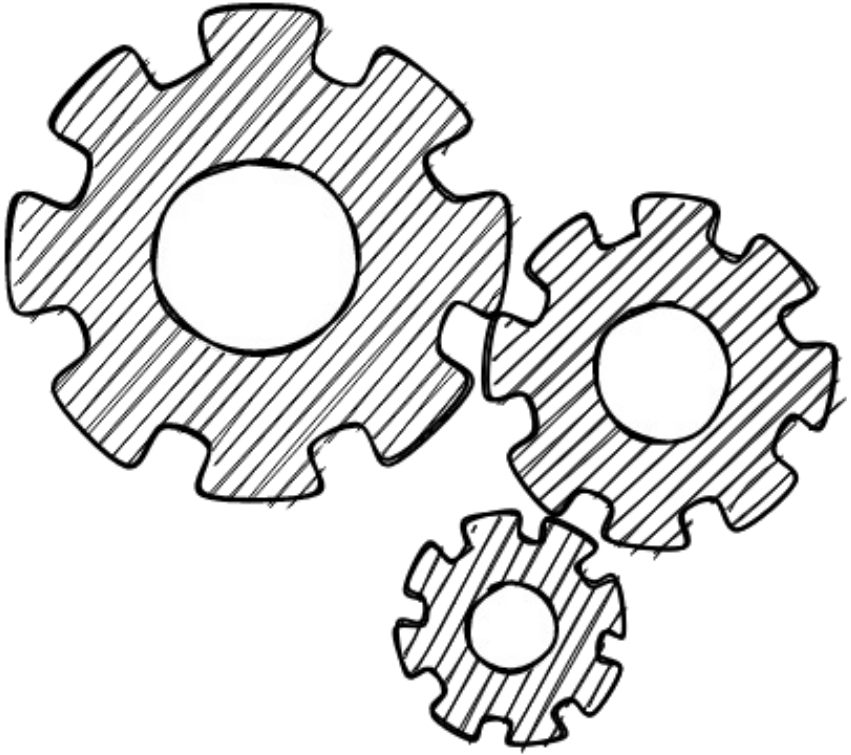
Memory & Performance Settings

- Small footprint by default
- May not be right for prod
- Over 350 parameters
  - Memory allocation
  - WAL and Checkpoints



Memory Allocation

https://www.postgresql.org/docs/current/runtime-config-resource.html

```
postgres=# alter system set shared_buffers =
```

~ 25-40% of RAM

Memory dedicated to Postgres to use for caching data

Memory Allocation

https://www.postgresql.org/docs/current/runtime-config-resource.html

```
postgres=# alter system set shared_buffers =
```

~ 25-40% of RAM

```
postgres=# alter system set work_mem =
```

~ 10MB
or increase for specific sessions

max memory used by a query operation before spilling to disk

use “log_temp_files” to see if temp files are created

Memory Allocation

https://www.postgresql.org/docs/current/runtime-config-resource.html

```
postgres=# alter system set shared_buffers =
```

~ 25-40% of RAM

```
postgres=# alter system set work_mem =
```

~ 10MB
or increase for specific sessions

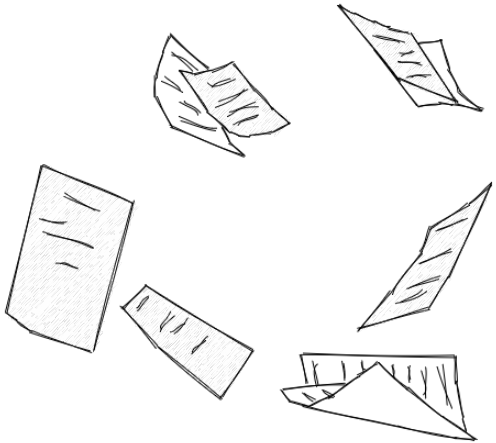
```
postgres=# alter system set maintenance_work_mem =
```

~ 5% of RAM

Memory that can be used by maintenance operations

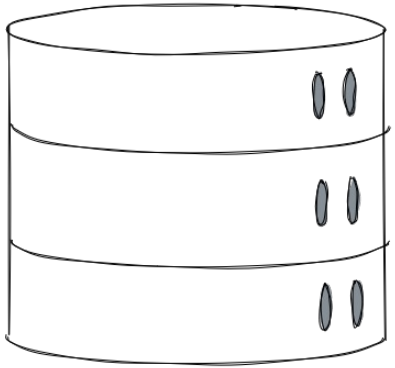
WAL/Checkpoint Tuning

https://www.postgresql.org/docs/current/runtime-config-wal.html



Checkpoint:

Dirty data pages flushed to disk



Checkpoints are expensive!

WAL/Checkpoint Tuning

https://www.postgresql.org/docs/current/runtime-config-wal.html

```
postgres=# alter system set wal_buffers = 32MB
```

~3% shared_buffers, up to 16MB

memory available for WAL before it's synced to disk

WAL/Checkpoint Tuning

https://www.postgresql.org/docs/current/runtime-config-wal.html

```
postgres=# alter system set wal_buffers = 32MB

postgres=# alter system set checkpoint_timeout = 10 - 30 mins
```

A checkpoint will be triggered if
one hasn't taken place within checkpoint_timeout

WAL/Checkpoint Tuning

https://www.postgresql.org/docs/current/runtime-config-wal.html

```
postgres=# alter system set wal_buffers = 32MB

postgres=# alter system set checkpoint_timeout = 10 - 30 mins

postgres=# alter system set max_wal_size = 1/2 to 2/3 available space for WAL
```

A checkpoint will be triggered if this amount of WAL is generated

Increase if checkpoints frequently triggered by max_wal_size

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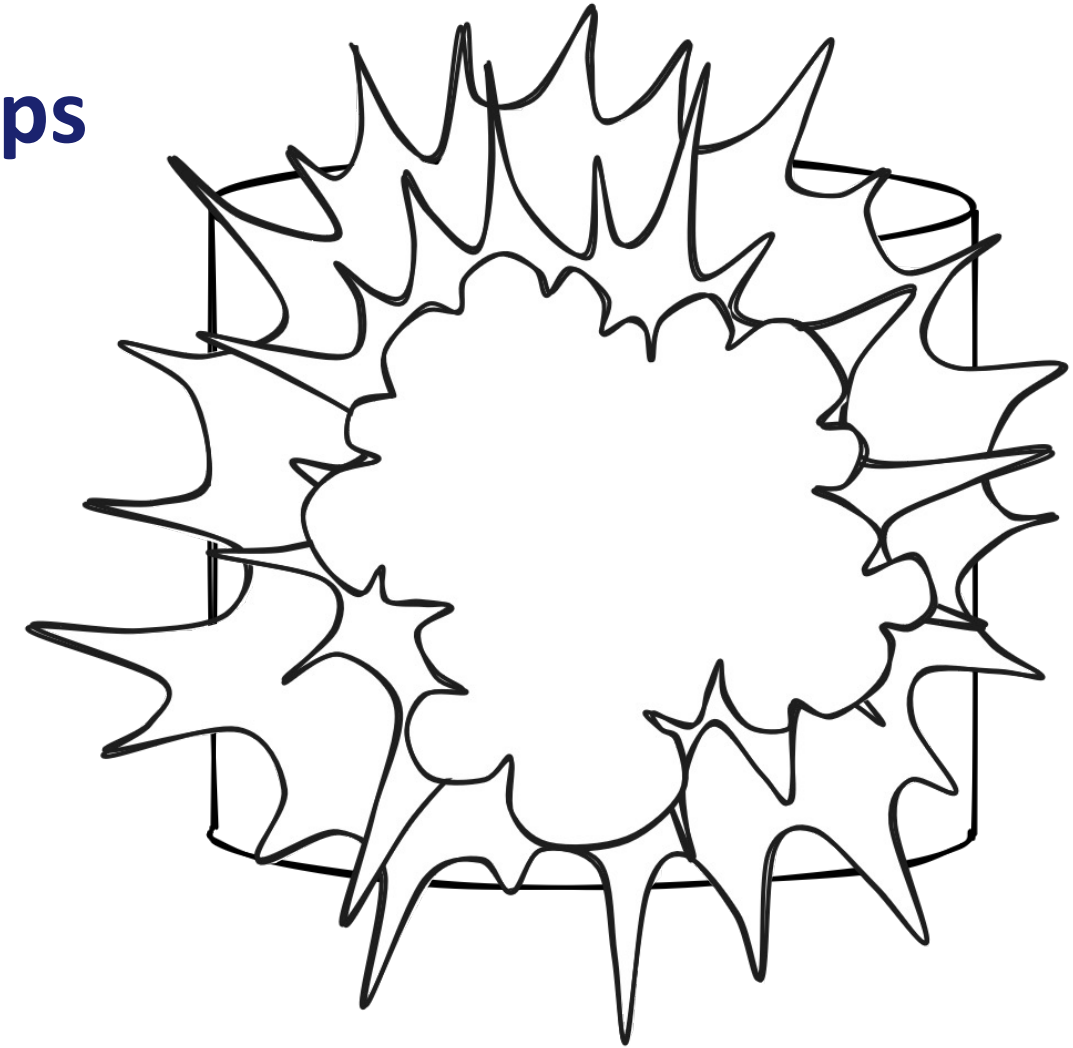
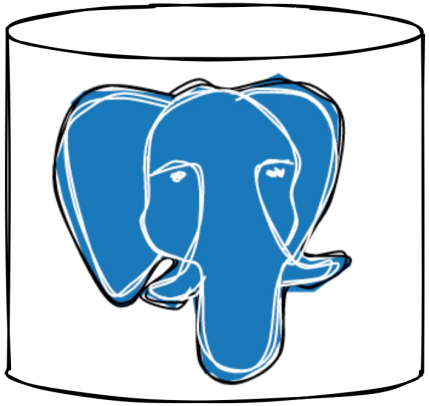
Backups

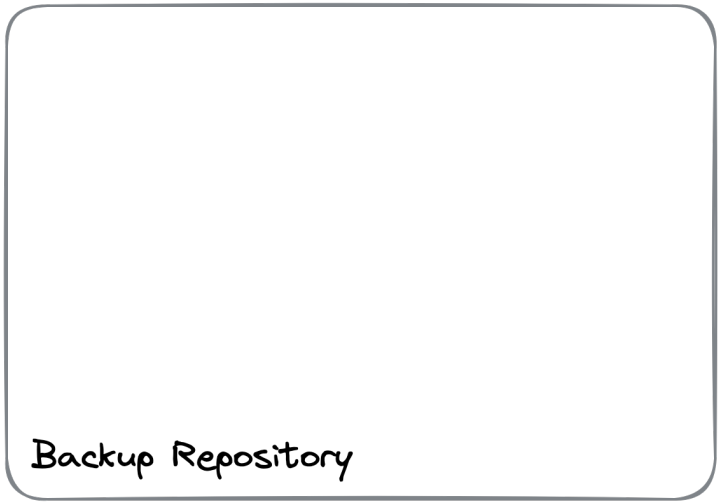


Backups

Area of disk:

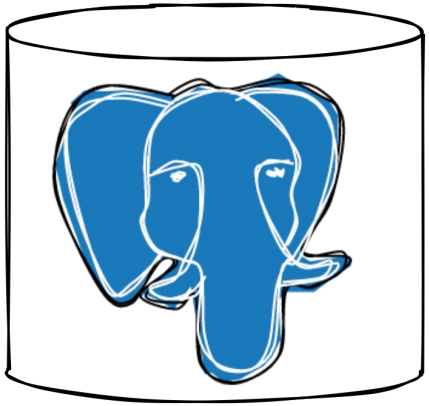
- on DB server
- on another server
- Network storage
- Cloud storage

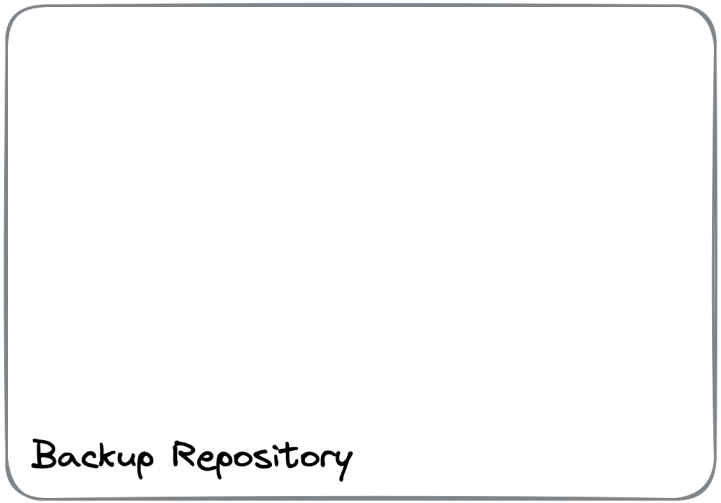




Backups

- pgBackRest
- Barman





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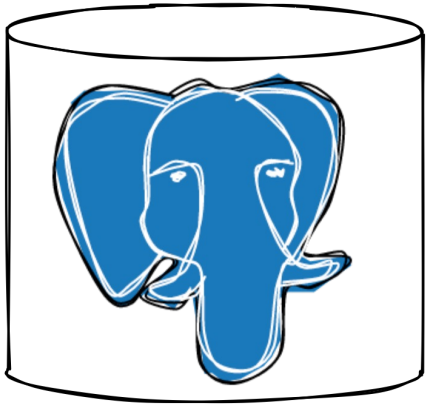
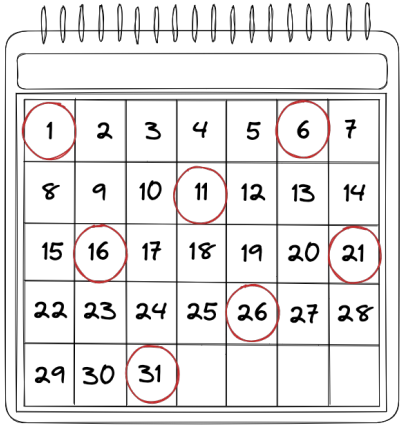


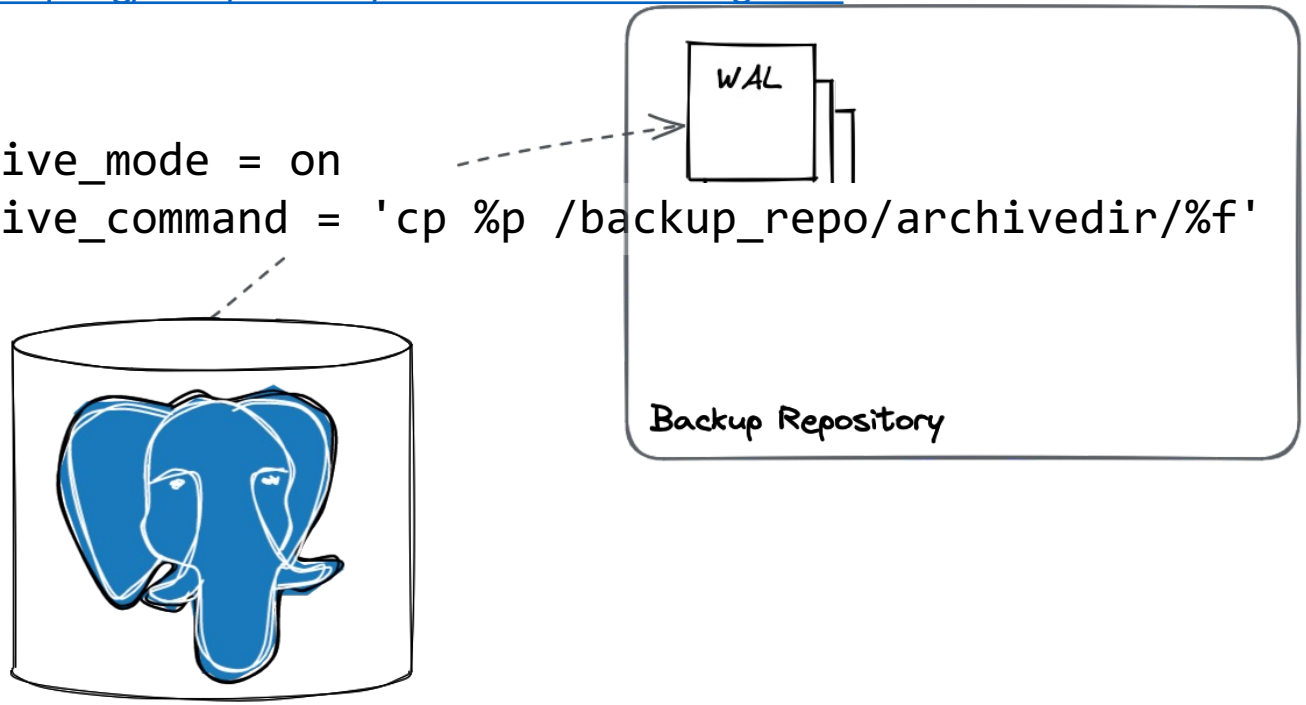


Backup Repository

Backups

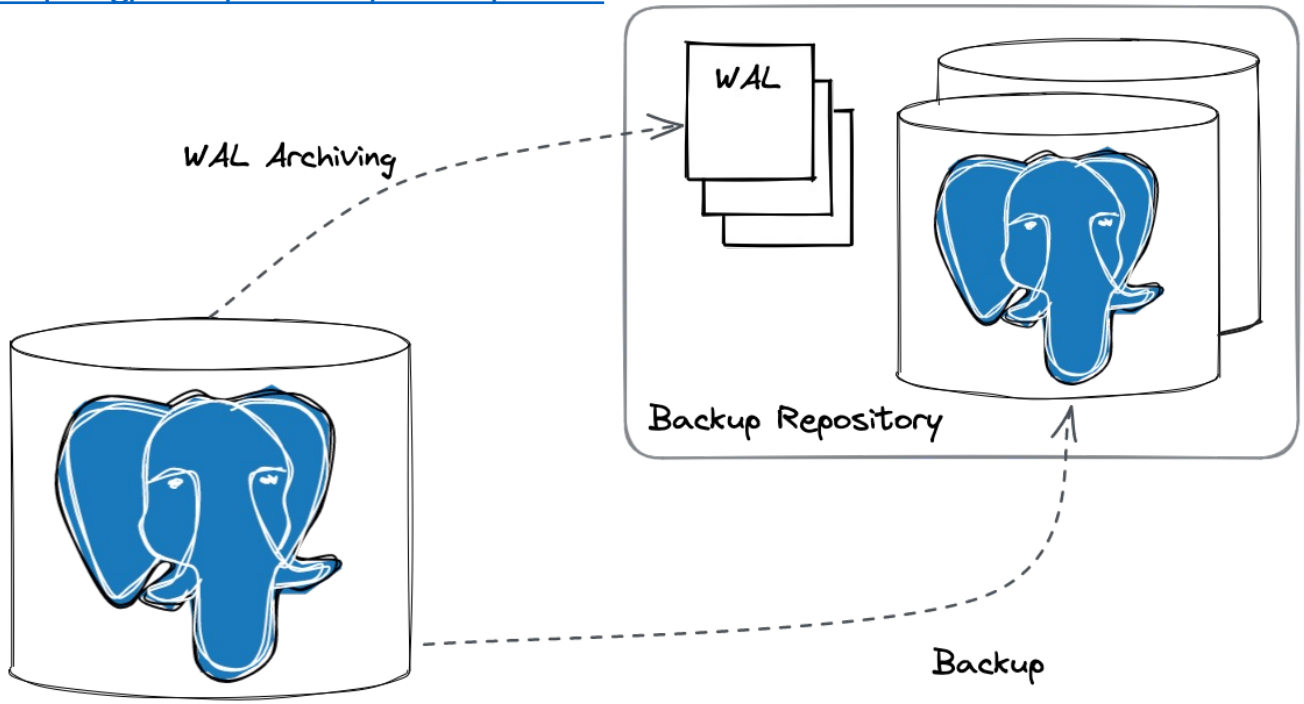
https://www.postgresql.org/docs/current/continuous-archiving.html

```
archive_mode = on
archive_command = 'cp %p /backup_repo/archivedir/%f'
```



Backups

https://www.postgresql.org/docs/current/backup.html



Configuring Backups with pgBackRest

https://pgbackrest.org/user-guide.html#quickstart

```
karen$ sudo apt install -y pgbackrest

postgres$ vi /etc/pgbackrest.conf

[global]
repo1-path=/backup_repo/pgbackrest
repo1-retention-full=2

[main]
pg1-path=/var/lib/postgresql/16/main
```

Configuring Backups with pgBackRest

https://pgbackrest.org/user-guide.html#quickstart

```
postgres$ vi /etc/postgresql/16/main/postgresql.conf

        archive_command = 'pgbackrest --stanza=main archive-push %p'

karen$ sudo systemctl restart postgresql

postgres$ pgbackrest --stanza=main --log_level_console=info stanza-create

postgres$ pgbackrest --stanza=main --log_level_console=info check
```

Configuring Backups with pgBackRest

https://pgbackrest.org/user-guide.html#quickstart

```
postgres$ pgbackrest --stanza=main --type=full backup

postgres$ crontab -e

        #m h  dom mon dow    command

        30 06  *   *   0     pgbackrest --type=full --stanza=main backup
        30 06  *   *   1-6   pgbackrest --type=diff --stanza=main backup

postgres$ pgbackrest --stanza=main info
```

Schrödinger's Backup

"The condition of any backup is unknown until a restore is attempted."

@nixcraft

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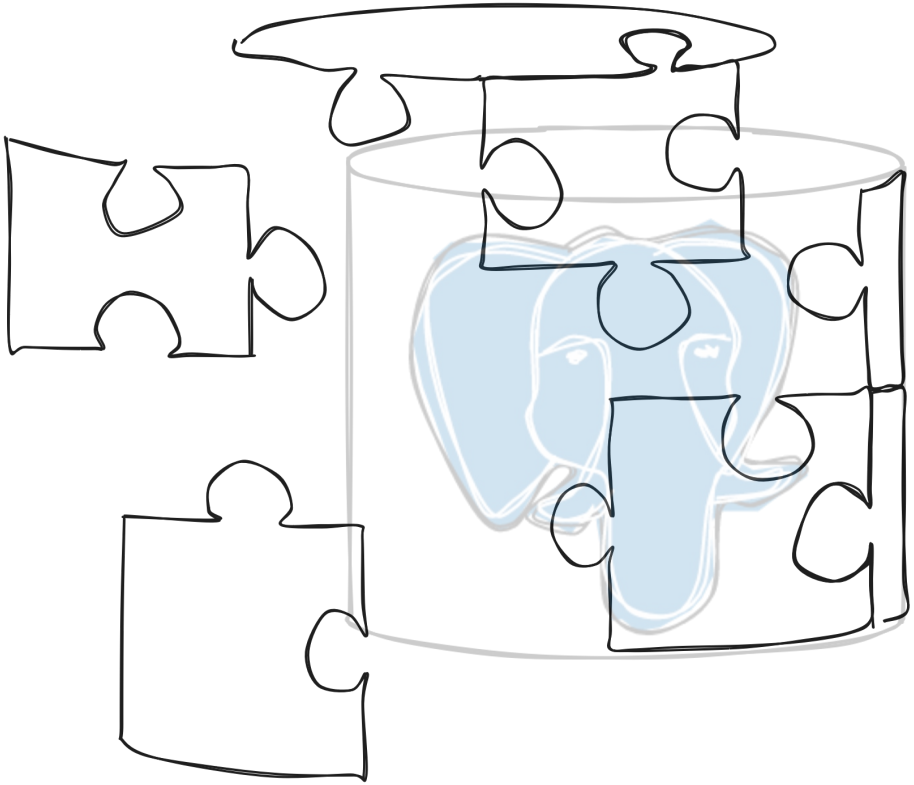
High Availability

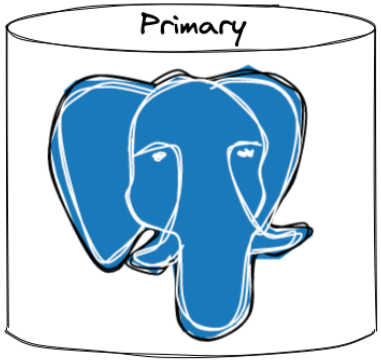
- If unable to wait for a restore
- Implement high availability

  or

- Consider a managed service



High Availability
Step-by-step



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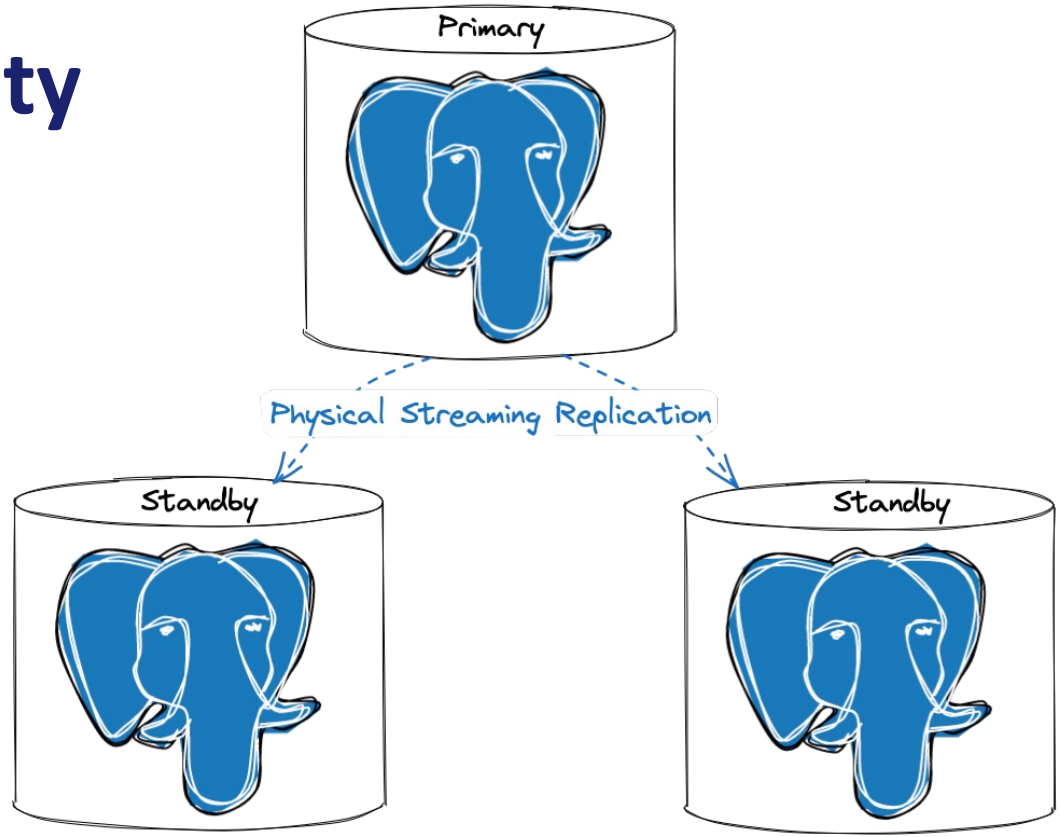

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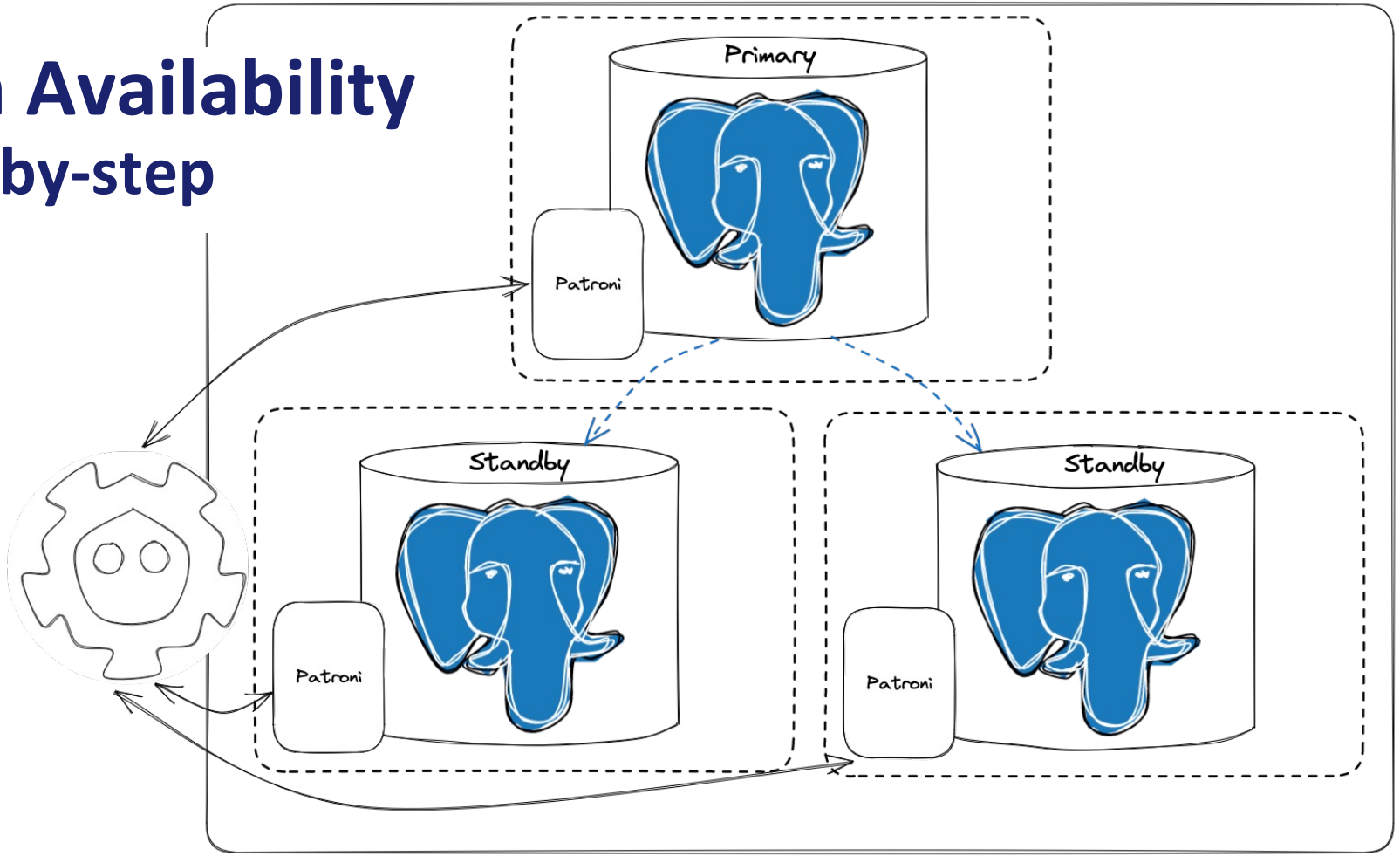

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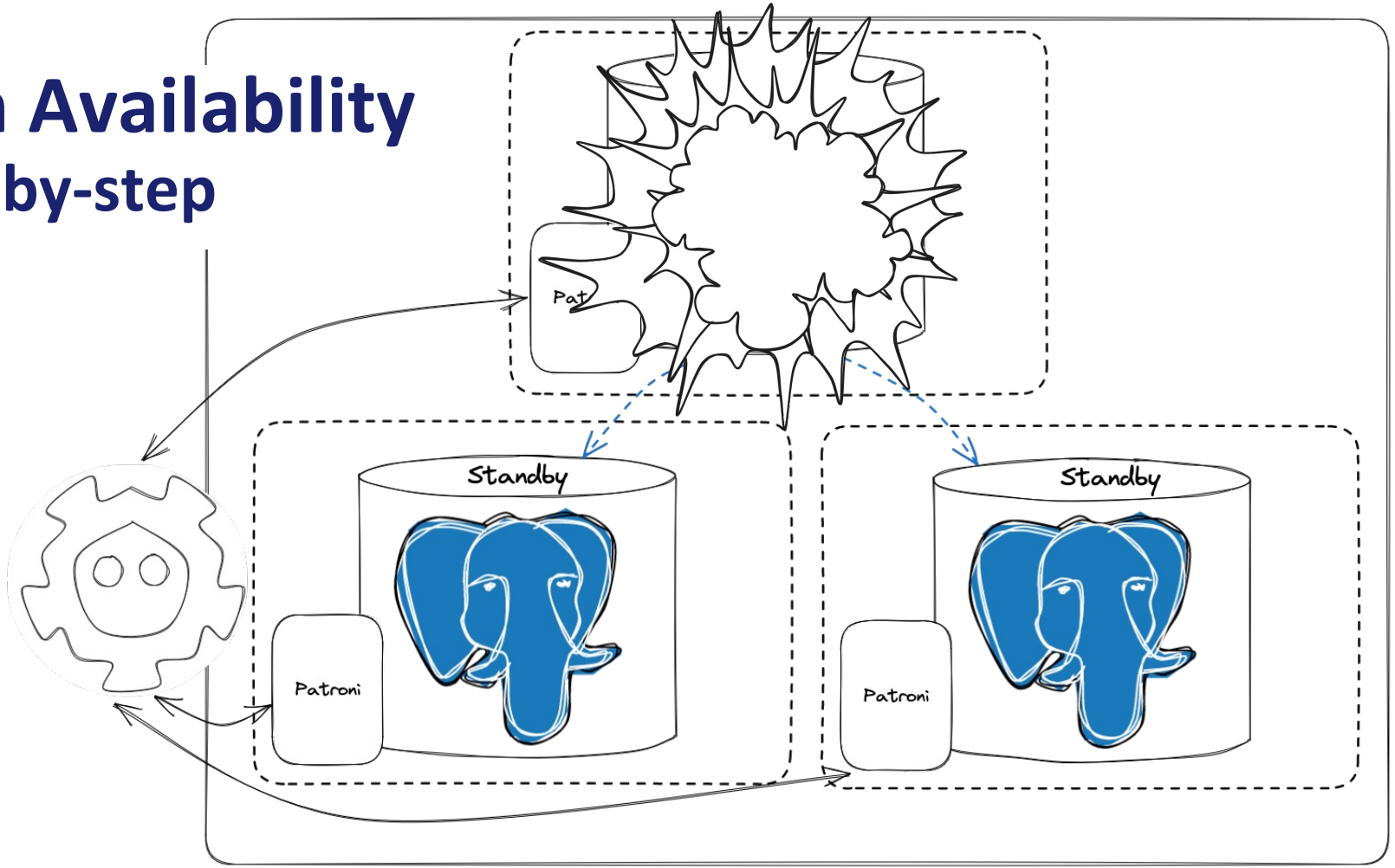

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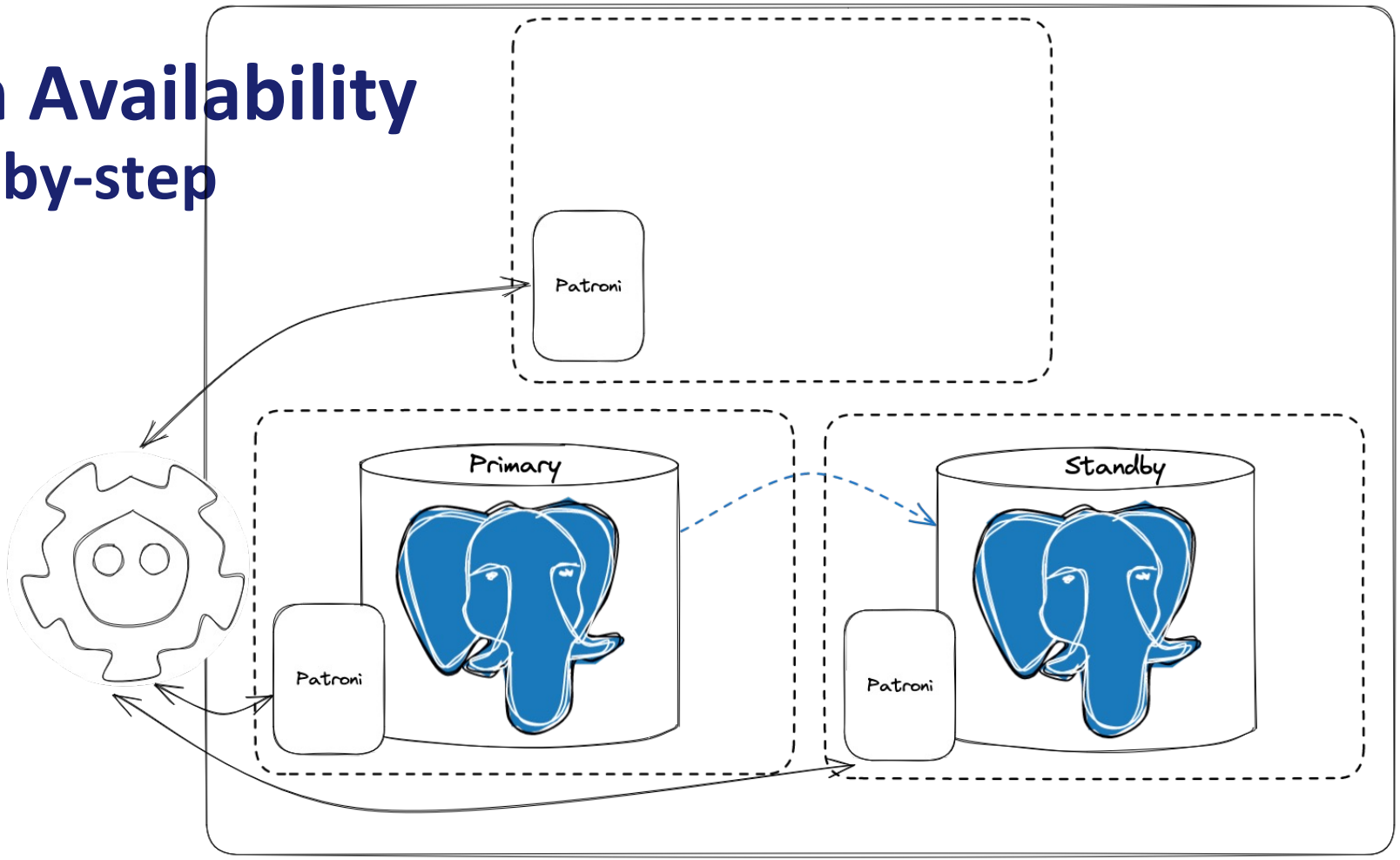
Step-by-step



High Availability: Documentation

- https://www.postgresql.org/docs/current/high-availability.html
- https://www.postgresql.org/docs/current/runtime-config-replication.html
- https://etcd.io/docs/v3.5/
- https://patroni.readthedocs.io/en/latest/README.html

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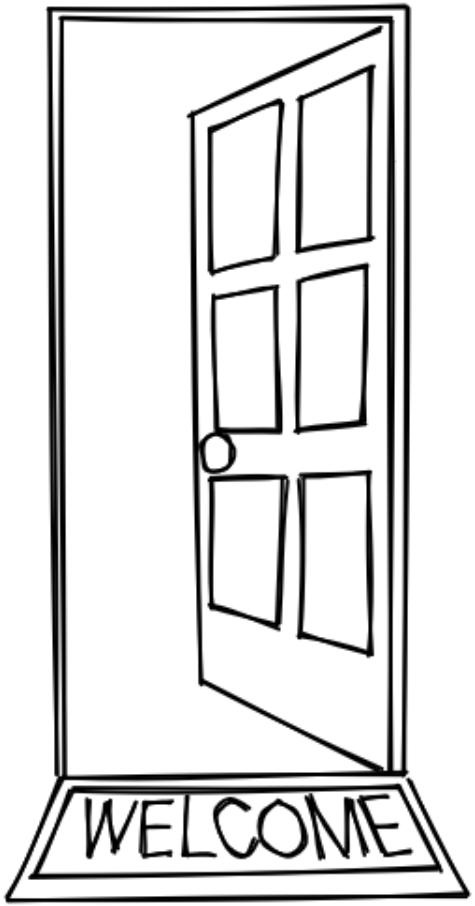
Configure Connections

- Define where/who to allow connections from
- Determine how users can authenticate
- Limit number of concurrent connections
- Prevent inactive sessions blocking other users
- Create appropriate application users



Configure Connections

https://www.postgresql.org/docs/current/runtime-config-connection.htm

```
listen_addresses = '*'
```

Allow connections from all available IP interfaces

Sets the host name or IP address(es) to listen to

Configure Connections

https://www.postgresql.org/docs/current/runtime-config-connection.htm

```
listen_addresses = '*'

max_connections = no more than 500
```

May need to be much lower (<100) on a small system

maximum number of concurrent client connections allowed

Consider connection pooling above a few hundred connections

Configure Connections

https://www.postgresql.org/docs/current/runtime-config-connection.htm

```
listen_addresses = '*'

max_connections = no more than 500

idle_in_transaction_session_timeout = 30 mins
```

Maximum allowed idle time between queries, when in a transaction

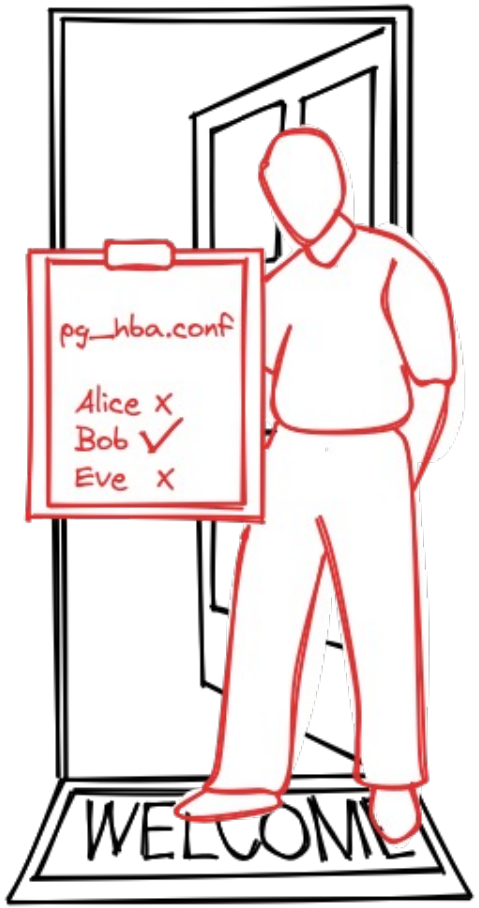
Configure Connections: pg_hba.conf

https://www.postgresql.org/docs/current/auth-pg-hba-conf.html

pg_hba.conf controls client authentication

- Users who are (or aren't) allowed to connect
- Where they can connect from
- Authentication method to use

Default pg_hba.conf allows local connections only



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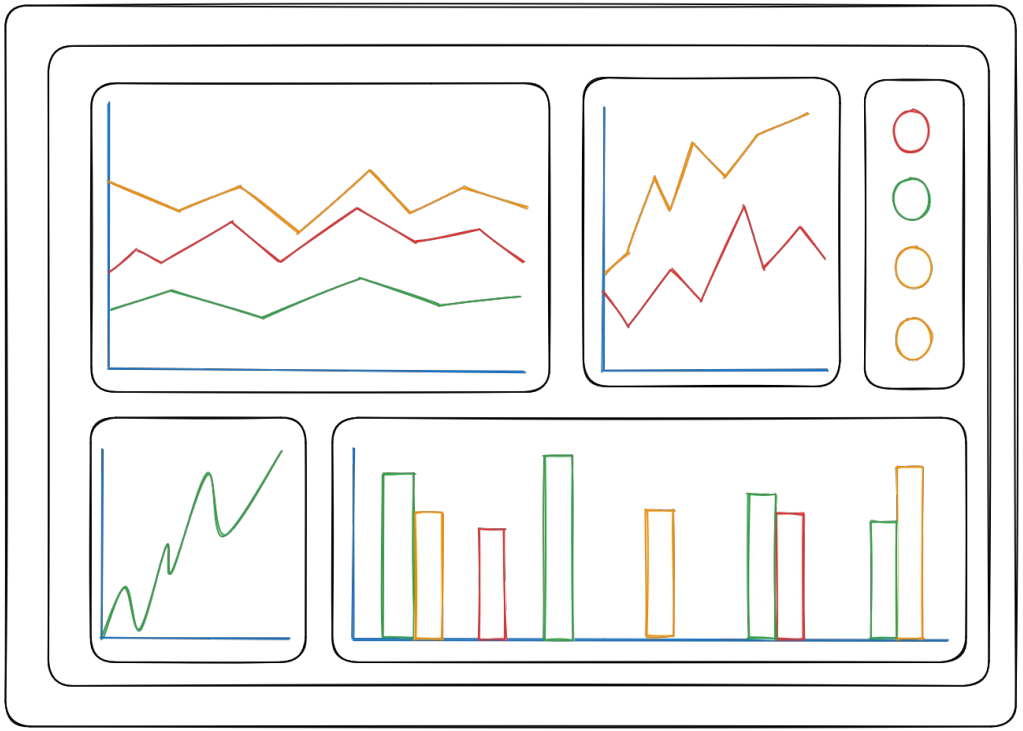
Logging, Monitoring & Alerting



Logging, Monitoring & Alerting

```
postgres=# show logging_collector;
 logging_collector
-------------------
 on
```

Logging, Monitoring & Alerting

```
postgres=# show log_directory;
 log_directory
---------------
 log

postgres=# show data_directory;
 data_directory
-----------------------------
 /var/lib/postgresql/16/main

postgres=# show log_filename;
 log_filename
--------------------------------
 postgresql-%Y-%m-%d_%H%M%S.log
```

Logging, Monitoring & Alerting: Parameters

https://www.postgresql.org/docs/current/runtime-config-logging.html

```
postgres=# alter system set log_min_duration_statement='1s';
```

or whatever counts as
"too long" in your system

Logging, Monitoring & Alerting: Parameters

https://www.postgresql.org/docs/current/runtime-config-logging.html

```
postgres=# alter system set log_min_duration_statement='1s';

postgres=# alter system set log_line_prefix= '%t:%r:%u@%d:[%p]: ';
```

timestamp

host connecting from

db user name

database connecting to

PID

Logging, Monitoring & Alerting: pg_stat_statements

https://www.postgresql.org/docs/current/pgstatstatements.html

```
shared_preload_libraries = 'pg_stat_statements'

postgres=# create extension pg_stat_statements;
CREATE EXTENSION

postgres=# select userid, queryid, mean_exec_time, calls from pg_stat_statements;

 userid |       queryid        | mean_exec_time | calls
--------+----------------------+----------------+-------
     10 |  3798936806175822236 |      0.1441105 |     2
     10 |  7986609124923425898 |      0.2023515 |     2
     10 | -7568047705441758065 |      0.1758495 |     2
     10 |  7338886451230691489 |       0.136604 |     2
     10 | -3691512427099624923 |         0.0287 |     2
```

Conclusions

Conclusions

- PostgreSQL really does Just Work™
- Check a few key **configuration parameters**
- Take (and test) regular **backups** of your database
- Put a **high availability** architecture in place
- Make sure the right **users/applications can connect**
- **Log activity** so you know and can react if something goes wrong
- Leave your database to look after itself

crunchydata

Thank You!

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Image acknowledgements

- Elephant with balloon: Jan-Mikael Stjernberg at Pixabay
- Welcome: based on image by... at Pixabay