# Multi-tenant database systems : the good, the bad, the ugly

# Who are you listening to?

- Pierre Ducroquet (French, sorry for your ears)
- Developer turned PostgreSQL DBA since about 10 years now
  - Working at Entr’ouvert, small french (mostly-)SaaS company

- Sometimes I wish I had not seen things

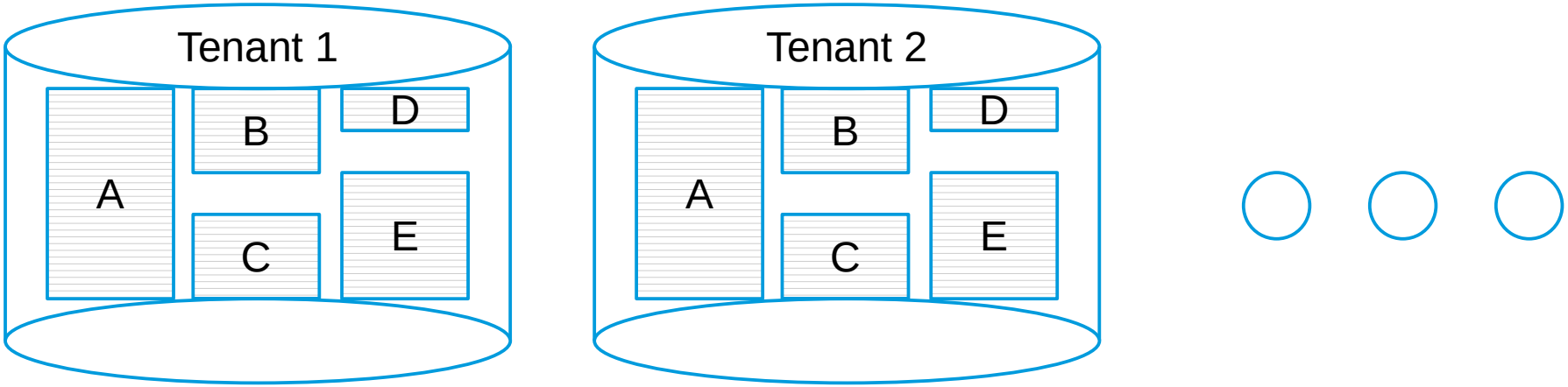
# What is a multi-tenant system

- Wikipedia says:

  Software multitenancy is a software architecture in which a single instance of software runs on a server and serves multiple tenants. A tenant is a group of users who share a common access with specific privileges to the software instance.

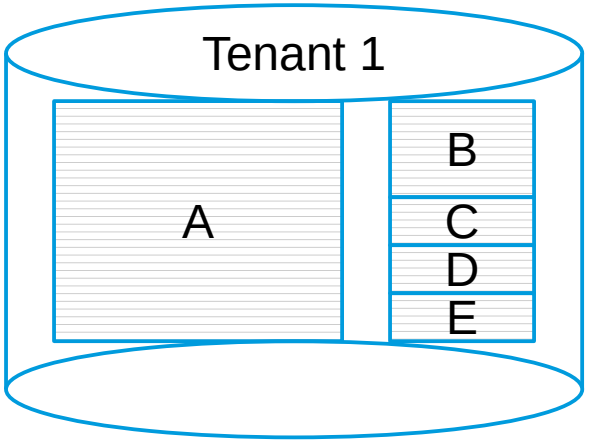
# What is a multi-tenant system

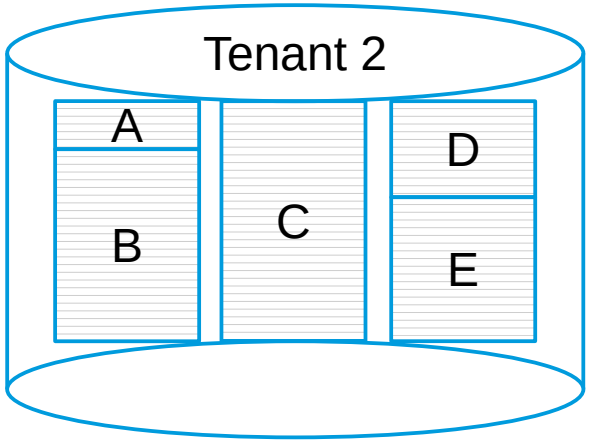
- Theory

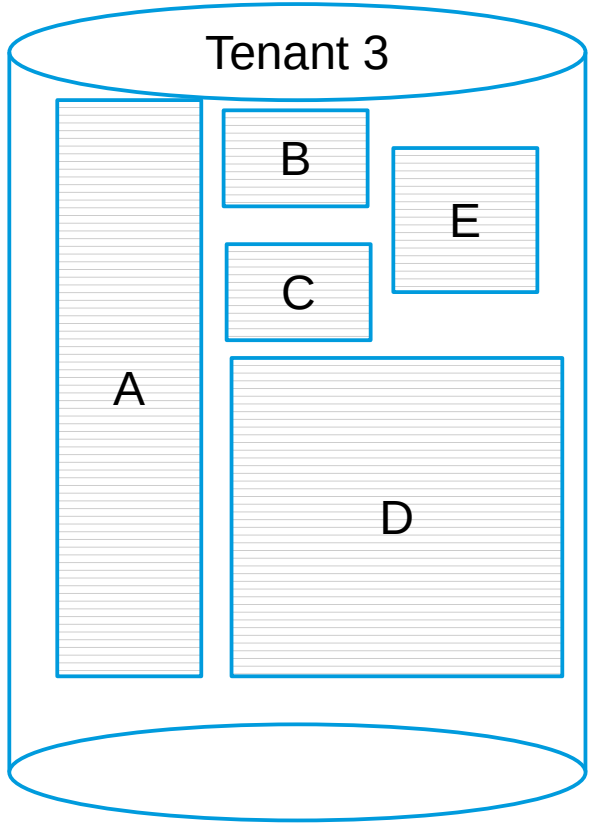


# What is a multi-tenant system

- Theory vs reality…



# How to implement it in the database?

- PostgreSQL extensions like Citus
- One deployment per tenant
- Spread a tenant_id column everywhere
- One database per tenant
- One schema per tenant

# PostgreSQL extensions

- I only saw the Citus extension
- Never used it myself, so I can’t say much here that would be relevant
- I quote them, « Must design application for Citus »
- Most systems I saw evolved into multi-tenant later, sorry Citus…

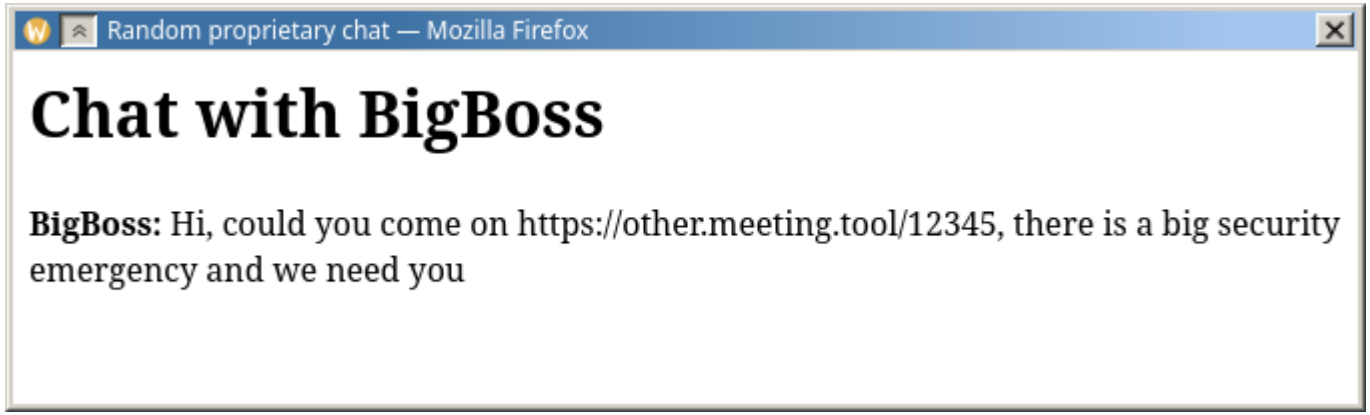
# One deployment per tenant

- So you’ve got this big furnace and throw sysadmin/devops/$ into it
- This is not a DBA job, this is an automation job
- There is a cloud infra devroom on FOSDEM tomorrow for this kind of talk

# tenant_id column

- Security (do you trust your developers?)
- Statistics and optimizer (correlations, correlations everywhere)
- Indexing is trickier (Should I add tenant_id in each index? Should I add tenant-specific indexes?)
- You ~~need~~ want PoWA
- Why is that query slow occasionnaly only ?
- Most tools work fine

# And now for something completely different



# Row Level Security for tenants ?

- Perfect exemple of a false good idea
- It works, but it’s not designed for this
- RLS aims for high, strict security standards, not your usual environment
  - You’ll have to tag everything as leakproof...

# One database per tenant

- Security breachs must happen in the application before the DB starts being used, much harder
- No indexing drama (kind of)
- Tools will work fine (sort of)
- Session pooling will suffer (a lot)
- Forget about pg_stat_statements (really)
- Open question : can you use logical replication ?
  - Once I have PostgreSQL 16, I'll tell you what happens...

# One schema per tenant

- Security breachs are possible, but quite hard to do without a full SQL injection
- No indexing drama (kind of)
- Session pooling will kind of work (sort of)
- Tools will endure pain (a lot)
- Forget about pg_stat_statements (don’t even bother installing it)

# Tools, tools, what tools?

- pg_dump/pg_restore
  - -j : « Run the most time consuming steps concurrently »
    - Well… no
  - Toc.dat is going to be huge and its parsing is not optimal
    - Patchs pending, sorry for my lack of time

# Tools, tools, what tools?

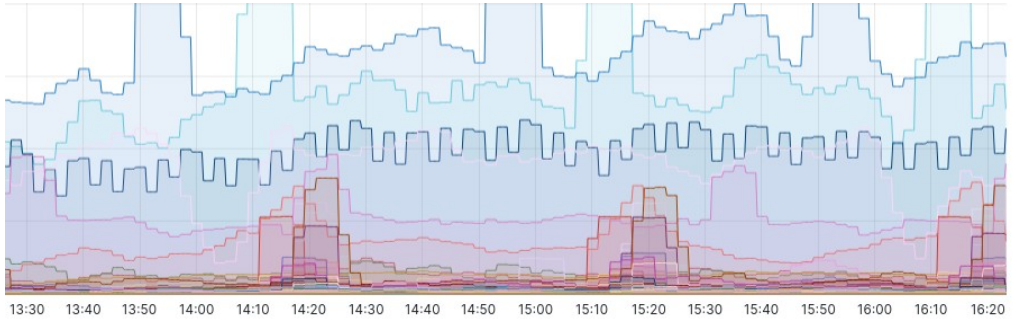
- Backups
  - You use pgbackrest, right ?
  - Enable repo bundle, the best new feature it had in the past years !
  - Being able to restore a single schema would be great

# Tools, tools, what tools?

- pg_stat_statements
  - One database per tenant ?
    - You will need a huge value for pg_stat_statements.max
  - One schema per tenant ?
    - You will not see what happens per tenant
    - Normalization is broken here.

# Tools, tools, what tools?

- Monitoring tools…
  - Forget about graphs
  - No tool (to my knowledge) will split your database schemas



# Rabbit holes, rabbit holes everywhere !

- There is no perfect solution.
- I think a mix of schema per tenant and database per tenant works quite well.
- If you can, measure and think it through before committing to any solution.
- And put on a happy face, our job would be boring without these.
  - Or worse, you could be working with Some Cloud SQL solutions…

# Thanks !

Questions ?

# Extra…

- Going too far, demonstration
  - Writing a PostgreSQL extension to work around impossible statistics
  - You know about optimizer « hints » ?
  - OFFSET 0 is one of them…