PostgreSQL: The Full-Stack Database

A.K.A. "AI won't replace us, Postgres will!"

PostgreSQL is a Database.

And it's kinda cool.

It supports

- Relational data
- NoSQL capabilities (JSON, JSONB, hstore, etc.)
- *Weird* data types (arrays, IP addresses, etc.)
- Pub/Sub (LISTEN/NOTIFY)
- Advanced querying (CTEs, window functions, etc.)
- Row-level security
- ACID compliance

And you can extend it...

```
CREATE EXTENSION [extension_name];
```

In a lot of ways!

- In SQL
- In C
- In Python
- In Rust

Ok, what can you do with them?

Extension can do almost anything!

Add support for new data types

- PostGIS (geospatial)
- pgvector (vector embeddings)
- Hstore (key-value store)
- UUID-OSSP (UUID generation)

Integrate with other databases

- postgres_fdw (PostgreSQL)
- mysql_fdw (MySQL)
- mongo_fdw (MongoDB)
- redis_fdw (Redis)
- pgmemcache

Full-Text Search

- pg_trgm
- pg_search
- pg_bm25
- NoraSearch

Extend with new languages

- PL/Python
- PL/Rust
- PL/V8 (JavaScript)
- PL/Perl
- PL/Haskell
- PL/pgSQL (built-in)

Change paradigms

- Citus (distributed SQL)
- TimescaleDB (time-series)
- pgduckdb / pgquack (analytical)

Or performance tuning

- pg_stat_statements
- pg_partman

Add AI capabilities

- pgai
- postgresml

But we want to get replaced!

Ok... but we want a full-stack database!

How can we do that?

We need:

- Backend logic
- REST / GraphQL API
- Authentication
- Job scheduling
- Static file serving
- Caching (optional)

Backend logic

- Stored procedures
- Triggers
- PL/Python
- pgai (AI-powered functions)
- pg_fsm (finite state machines)

GraphQL API

- pg_graphql
- omnigres/omni_httpd

Authentication

- pgjwt
- pgcrypto
- (or eventually omnigres)

Job scheduling

- pg_cron

Static file serving

- omnigres/omni_httpd

Caching (optional)

- pgmemcache
- redis_fdw

Or...

...just use Postgres as a cache!

```
CREATE UNLOGGED TABLE cache (
    id serial PRIMARY KEY,
    key text UNIQUE NOT NULL,
    value jsonb,
    inserted_at timestamp
);

CREATE INDEX idx_cache_key ON cache (key);
```

See: https://medium.com/redis-with-raphael-de-lio/can-postgres-replace-redis-as-a-cache-f6cba13386dc

Extras

Frontend components?

https://react-postgres-components.vercel.app

```
export default function helloWorld () => {
  const [{version}] = sql`SELECT version()`; // no `await` needed!
  return <h1>Hello from <em>inside</em> Postgres: {version}</h1>;
}
```

And what about Testing? pgTAP!

pgTAP

```
CREATE EXTENSION pgtap;

SELECT plan(2);

SELECT is(1, 1, 'One is one');
SELECT is(2, 1, 'Two is one');

SELECT * FROM finish();
```

Let's try it out!