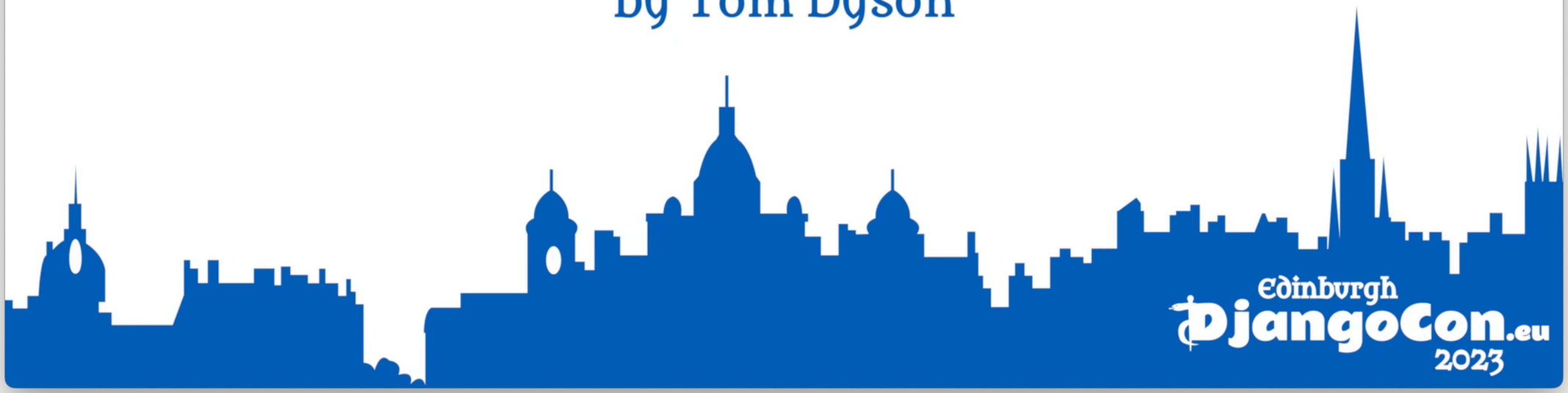
Django, SQLite, and Production

DjangoCon Europe

Anže Pečar, June 7 2024

Use SQLite in production

by Tom Dyson



SQLite in production?

It depends

What is SQLite?

fedidevs.com

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*Discover **10341** superb devs from across the Fediverse!*

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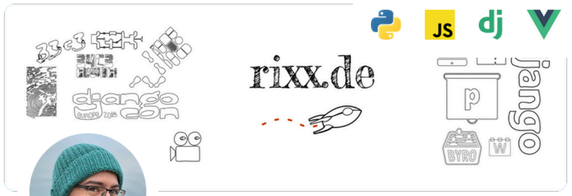


Following

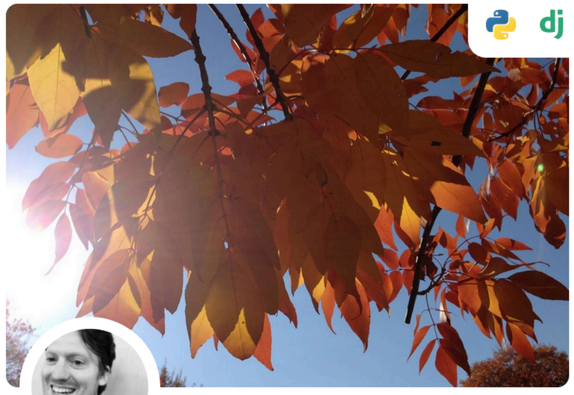
rixx

@rixx

pretalx▪Python/Django/vue.js▪Three Django projects in a trench coat▪he/him

Admin here. Please report instead of DMing.

Last seen	Posts	Followers
5 days, 15 ho...	17,670	5,807



Following

Jeff Triplett

@webology

⛺ @defnado cofounder, 🏝️ @djangocon organizer, 🏎️ @revsys consultant, 🐍 @Thepsf former director, vice-chair, and treasurer, 🦄 @djangoproject member, 🏀, ✨, 💪, ⛹️, 🤖, Oh Mai.

If you are into #django and #python...

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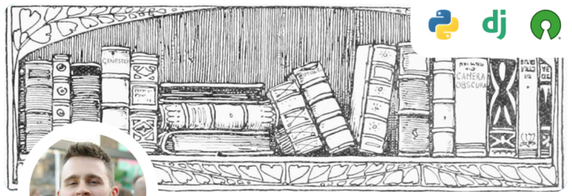

Following

Adam Johnson

@adamchainz

#Django technical board member

🍕 London Django Meetup Organizer with @cgl

✍️ Author of three books on Django and Git

🇬🇧 London / 🇵🇹 Lisbon

Last seen	Posts	Followers
1 day, 15 hour...	2,376	1,336

Following

Following

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Programming Language

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Frameworks, Libraries, and others

Open Source (6) Postgres (4)

Django (2) React (1) Linux (1)

🔴 Live Conferences

Happening right now! You can join the discussion even if you are not attending!

CONFERENCE	LOCATION	POSTS
DjangoCon EU Jun 5 - 9, 2024	Vigo, Spain	127

Upcoming Conferences

Join the discussion and get hyped for the upcoming conferences.

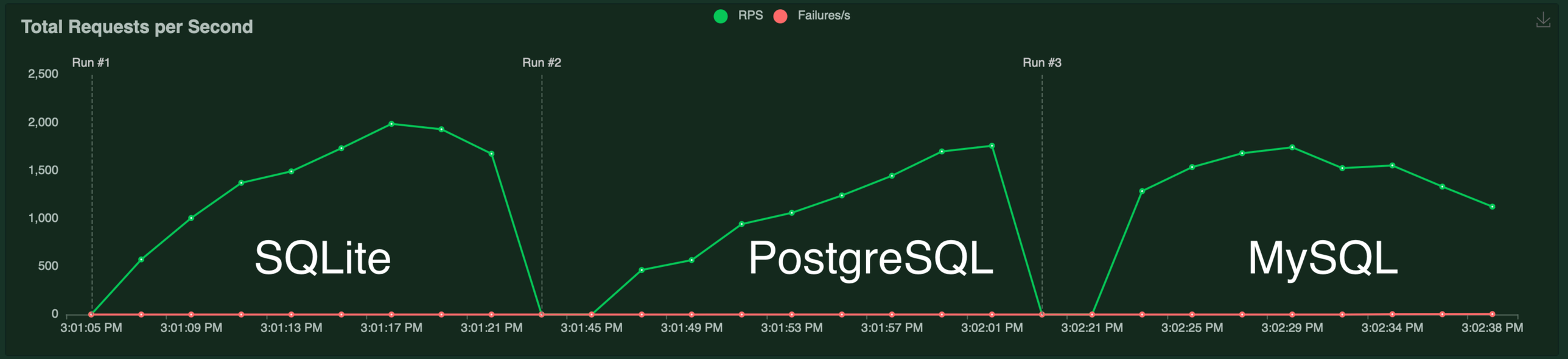
CONFERENCE	LOCATION	POSTS

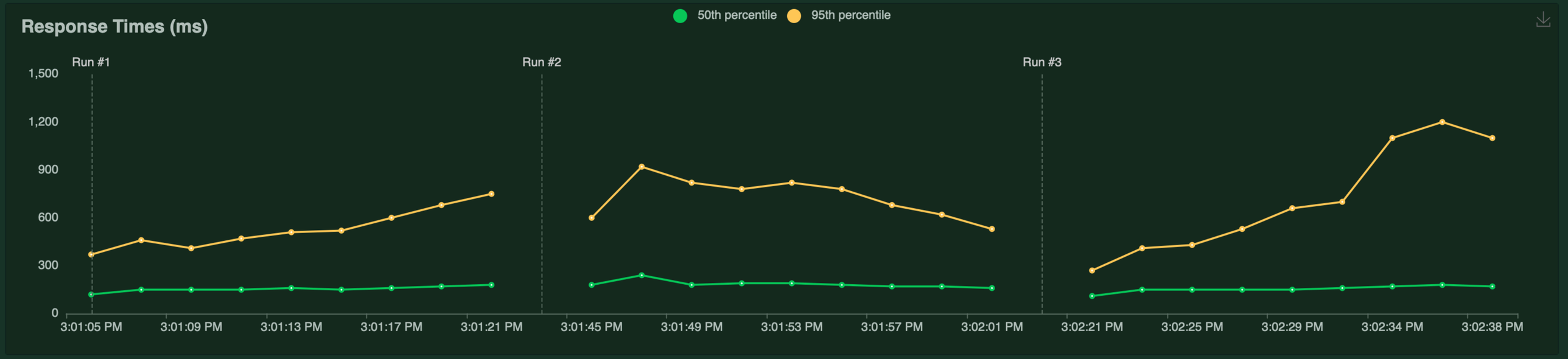
Read only app

db.sqlite3

```
COPY db.sqlite3 .
```

Readonly Benchmark





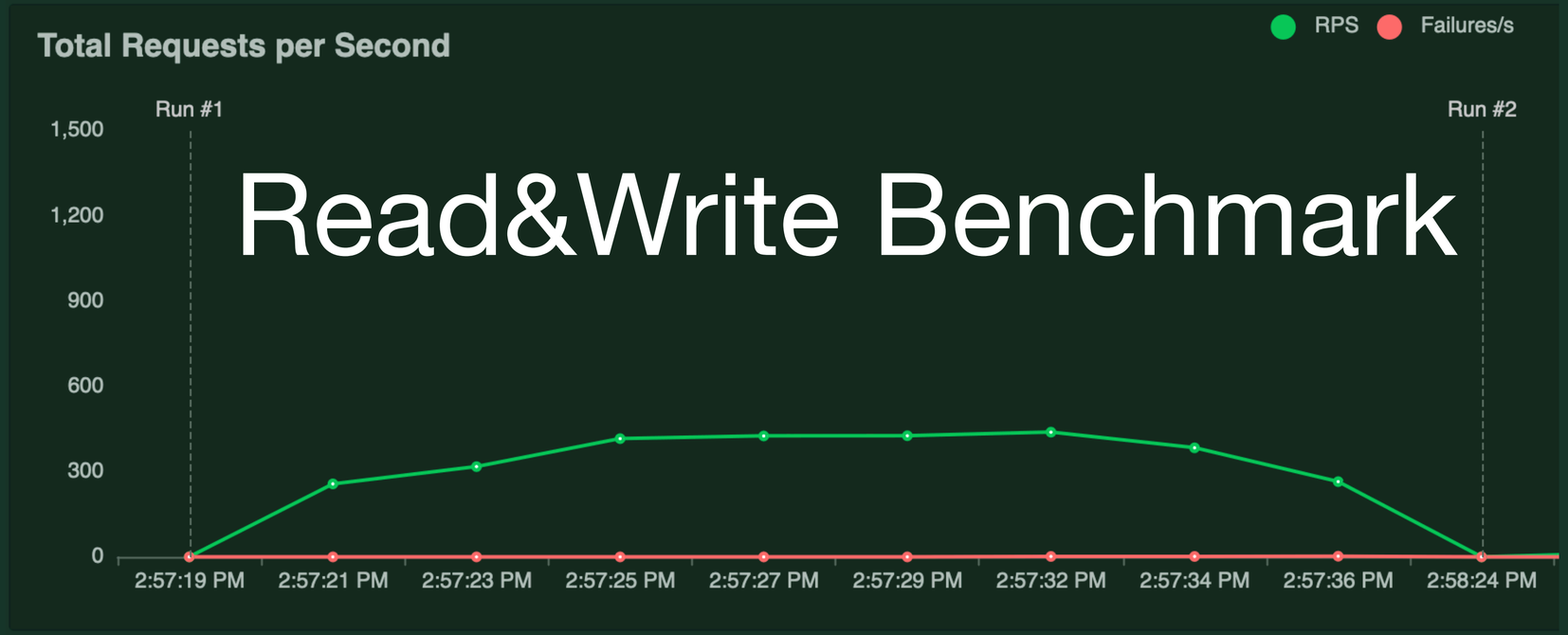
Honeymoon stage

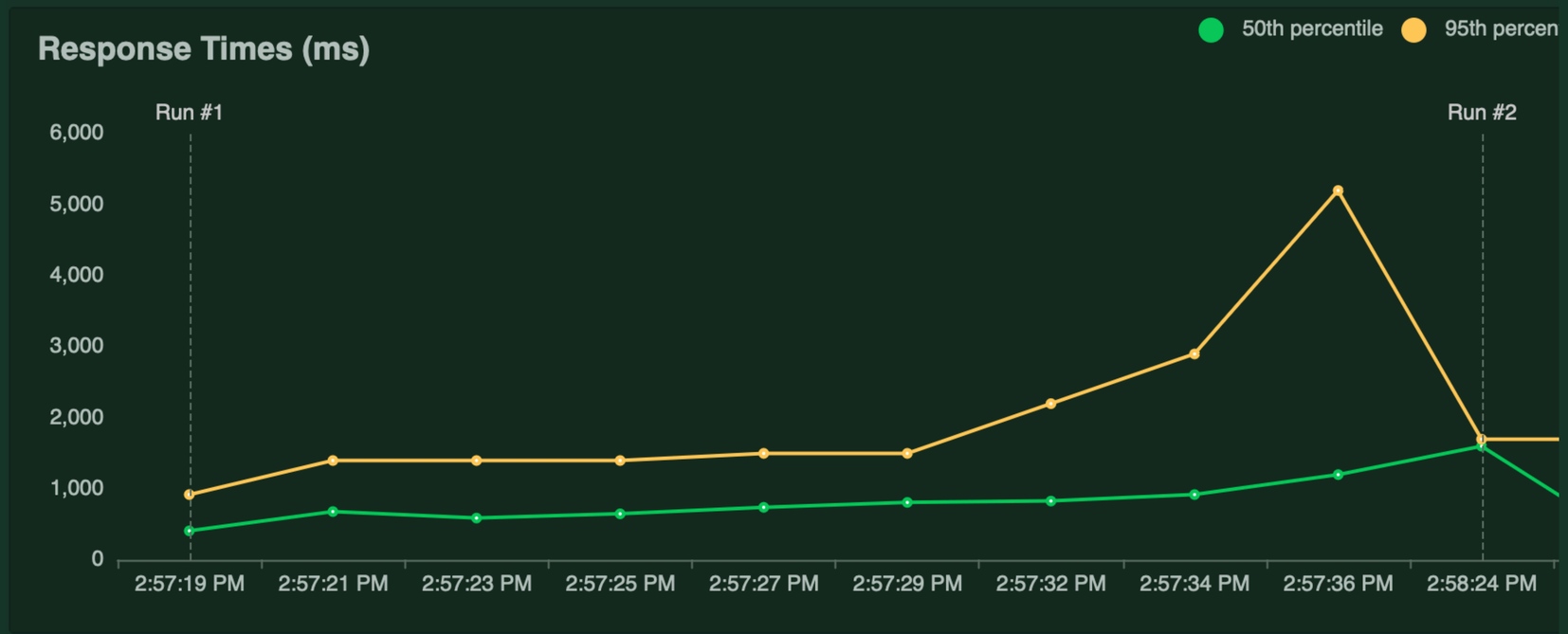
Writes

Docker 🛑

Writes block

Read&Write Benchmark

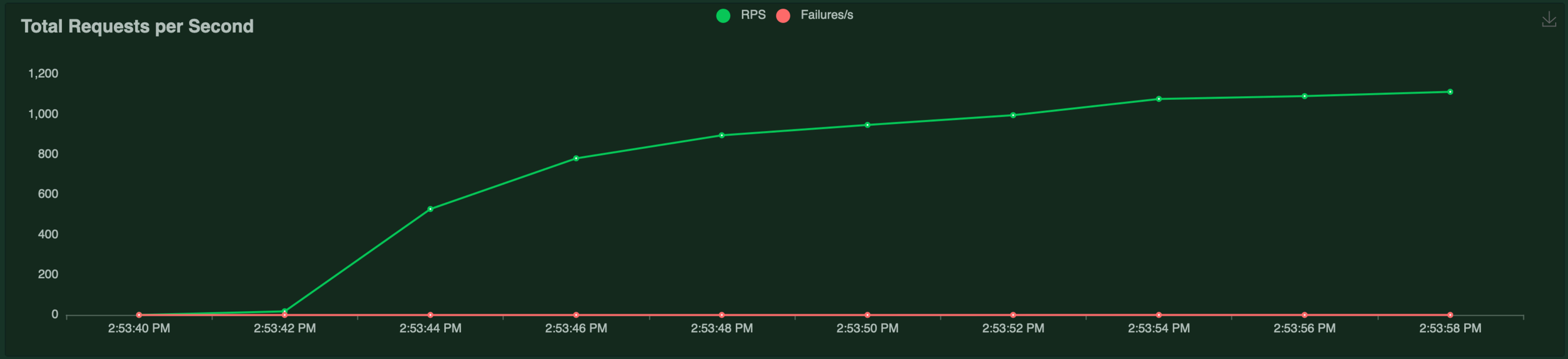


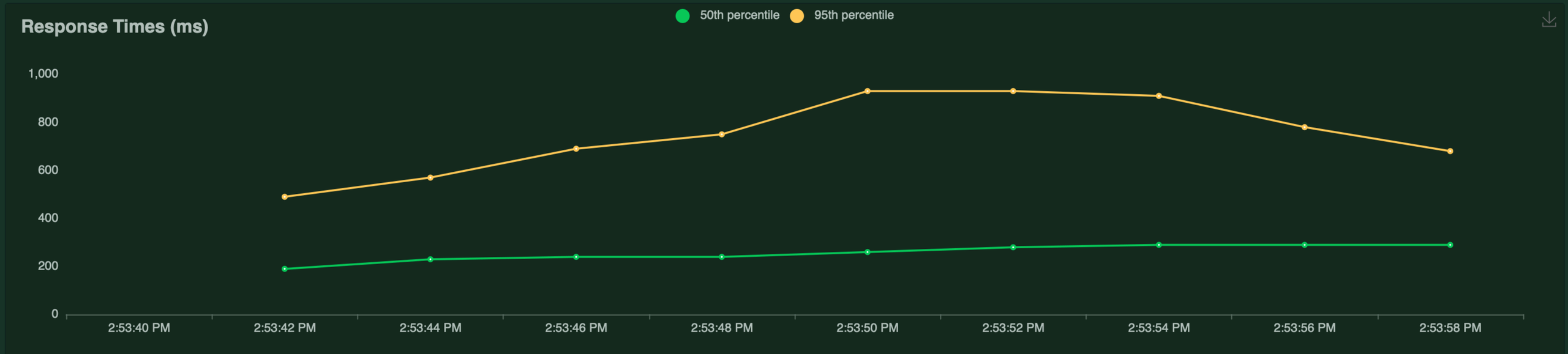


Unblock reads

```
PRAGMA journal_mode='WAL'
```

Read & Write Benchmark (WAL)





Database is locked

```
timeout=999999
```

New issue

We notified recently active members in the fedidevs project of this issue

ISSUE

OperationalError /

database is locked

Aug. 28, 2023, 6:38:35 a.m. UTC ID: 5d7b215636954b5488547295551d8d21

project	fedidevs
environment	production
level	error

Suspect Commits

Strip whitespace

c5a1103 — **Anže Pečar**

Exception

```
OperationalError: database is locked
  File "django/db/backends/utils.py", line 89, in _execute
    return self.cursor.execute(sql, params)
  File "django/db/backends/sqlite3/base.py", line 328, in execute
    return super().execute(query, params)

OperationalError: database is locked
(15 additional frame(s) were not displayed)
...
  File "accounts/views.py", line 41, in index
    page_obj = paginator.get_page(page_number)
```

Crisis stage

Transactions

Deferred transactions

```
BEGIN;
SELECT * FROM auth_user;
UPDATE auth_user SET last_login_date = NOW();
COMMIT;
```

Deferred transactions

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BEGIN;
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COMMIT;
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UPDATE auth_user SET last_login_date = NOW();
COMMIT;
```

Deferred transactions

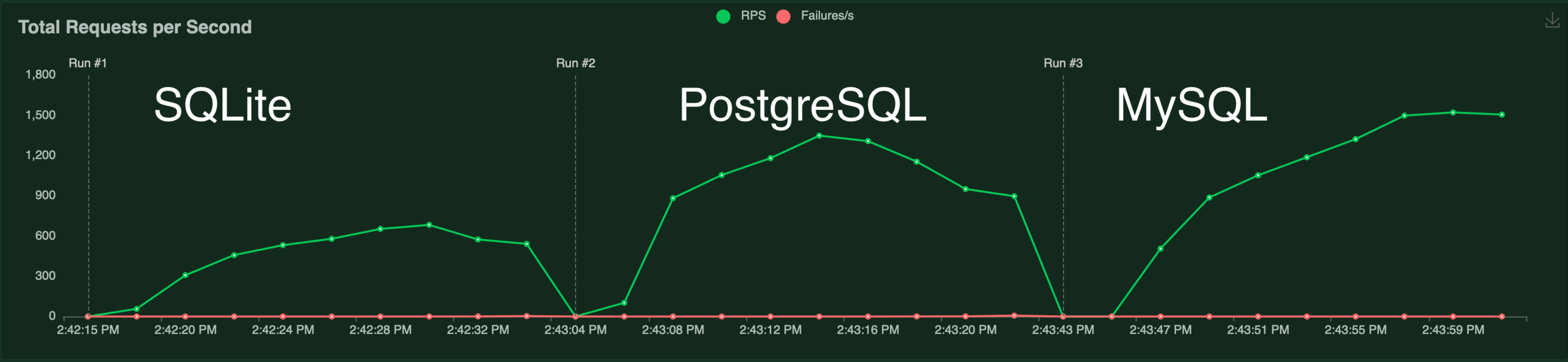
```
BEGIN;
SELECT * FROM auth_user;
UPDATE auth_user SET last_login_date = NOW();
COMMIT;
```

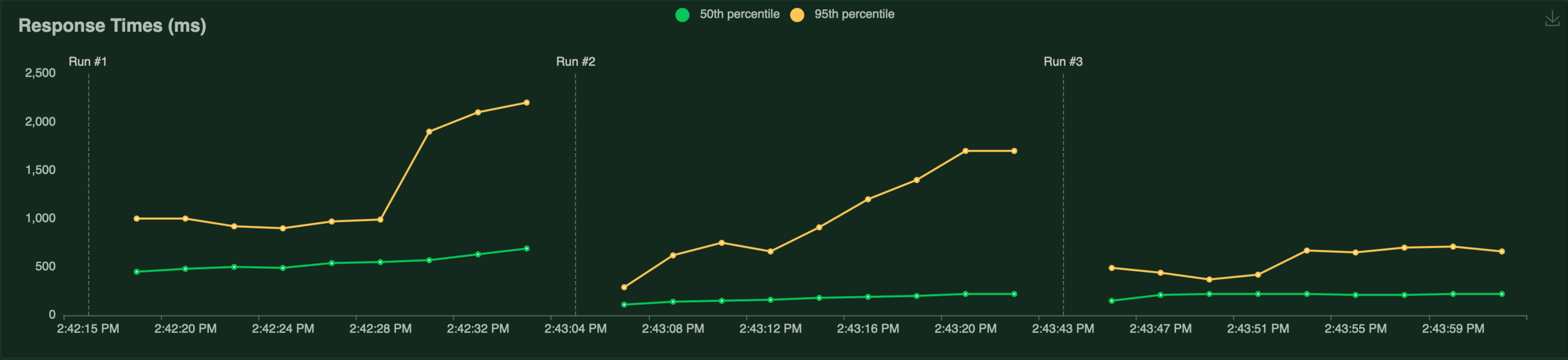
```
BEGIN IMMEDIATE;
SELECT * FROM auth_user;
UPDATE auth_user SET last_login_date = NOW();
COMMIT;
```

Write heavy

One concurrent write per database

Writeonly Benchmark





Multiple db.sqlite3 files

Beyond a single server

LiteFS

Backups

copy/paste is not safe

```
sqlite3 my.db ".backup 'my.db.bck'"
```

Litestream

Partnership stage

New in Django 5.1

```
DATABASES = {
    "default": {
        "ENGINE": "django.db.backends.sqlite3",
        "NAME": BASE_DIR / "db.sqlite3",
        "OPTIONS": {
            "transaction_mode": "IMMEDIATE",
            "init_command": "PRAGMA journal_mode='WAL'", # <-- Enable WAL
        },
    }
}
```

Fixed #29280 -- Made the transactions behavior configurable on SQLite. #17760

Edit | Code

Merged **felixxm** merged 1 commit into `django:main` from `anze3db:sqlite_transaction_mode` on Jan 30

Conversation 34 | Commits 1 | Checks 18 | Files changed 5 | +112 −3

anze3db commented on Jan 19 • edited — Contributor

Opening this as a draft pull request until I figure out the following:

- [x] Where to add validation for the transaction_mode values?

Right now it's in `get_connection_params`, but it doesn't feel like the right place. We do validation for `NAME` there though, so maybe it's ok?

- [x] Is `OPTIONS` the right place for this `transaction_mode`?

Just double checking, since it doesn't feel clean that I have to pop it from the `OPTIONS` dict to avoid `TypeError: 'transaction_mode' is an invalid keyword argument for Connection()`

- [x] Figure out which documentation files to update

🎉 3

Reviewers

- charettes
- felixxm
- github-actions[bot]

Assignees

- felixxm

Labels

None yet

Projects

None yet

```
DATABASES = {
    "default": {
        "ENGINE": "django.db.backends.sqlite3",
        "NAME": BASE_DIR / "db.sqlite3",
        "OPTIONS": {
            "transaction_mode": "IMMEDIATE",
            "init_command": "PRAGMA journal_mode='WAL'; ...",
        },
    }
}
```

```
PRAGMA journal_mode = WAL;
PRAGMA synchronous = NORMAL;
PRAGMA mmap_size = 134217728; -- 128 megabytes
PRAGMA journal_size_limit = 27103364; -- 64 megabytes
PRAGMA cache_size = 2000;
```

https://fractaledmind.github.io/2024/04/15/sqlite-on-rails-the-how-and-why-of-optimal-performance/

Future improvements?

Don't change defaults

startproject

Documentation

More SQLite topics!

- Litestream/LiteFS
- Full text search
- Cache
- Pub Sub
- Job Processor Backend (django-task?)

Questions?

https://pecar.me

@anze3db@fosstodon.org

Questions?

https://pecar.me

@anze3db@fosstodon.org

Follow for more relationship advice

ACID Isolation

READ UNCOMMITED

READ COMMITED

REPEATABLE READ

SERIALIZABLE

READ UNCOMMITED*

READ COMMITED

REPEATABLE READ

SERIALIZABLE

READ UNCOMMITED

READ COMMITED

REPEATABLE READ

SERIALIZABLE

Litestack

```
# database connection
gem “pg”

# cache, cable & queue
gem “redis”
gem “hiredis”

# job processing
gem “sidekiq”

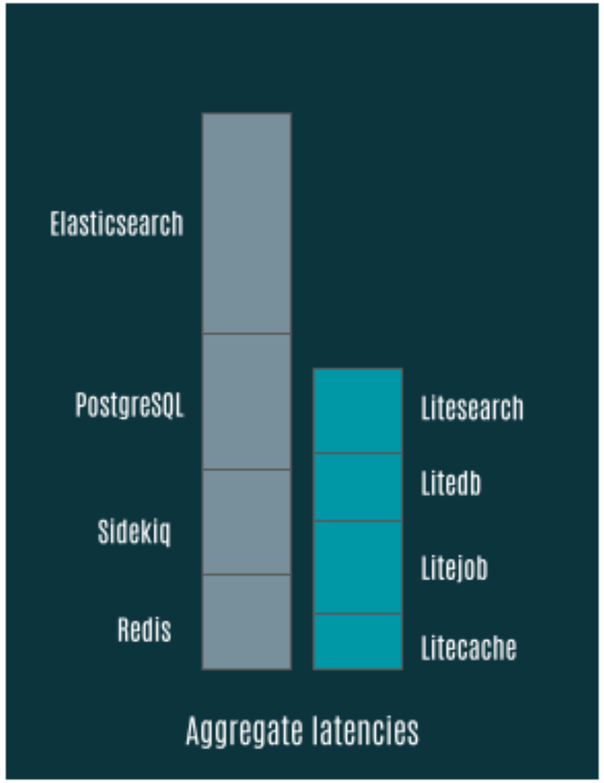
# full text search
gem “elasticsearch-rails”

# performance monitoring
gem “rails_performance”
```

Turn this ..

```
# almost everything
gem “litestack”
```

.. into this ..



.. and get this!