CONF42

Building a Scalable Multi-Tenant Frontend Architecture for a B2B E-Commerce Platform

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MERCLOUD

👋 Hello, I’m Guilherme

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📍 London, UK

👨‍💻 17 years in the industry

Let’s connect!

- linkedin.com/in/guidr
- x.com/gui_dr
- github.com/guidr

linktr.ee/guidr

MERCLOUD

CONNECTING BUSINESSES

B2B E-Commerce SaaS Platform

Designed to cater to the complex needs of enterprises selling to other enterprises by providing a direct online sales channel to customers.

Our customers:

- 🏭 **Manufacturers & Suppliers**
- 🚚 **Distributors**
- 🛒 **Wholesalers**
- 🚢 **Importers**

🔗 **Explore more at** https://mercloud.io

What is a B2B E-Commerce?

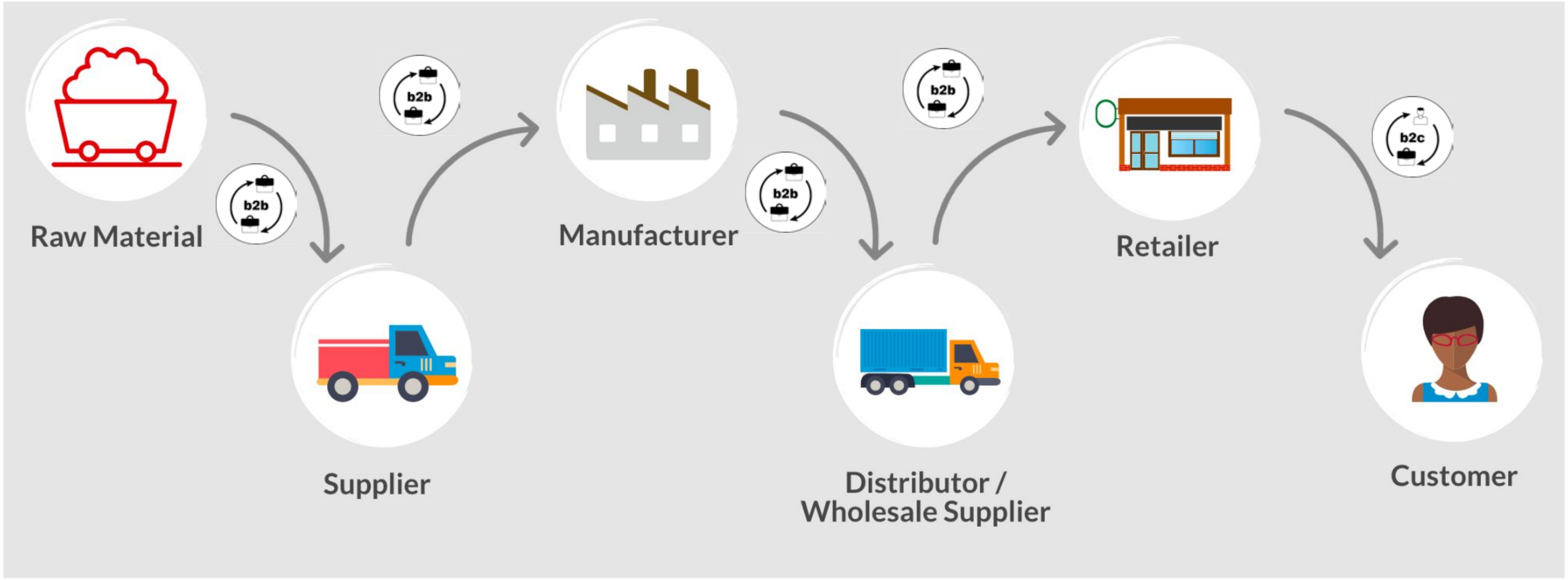
An electronic framework that facilitates business transactions between multiple enterprises in the supply chain.

- 💵 Customized pricing models
- 💸 Complex tax regimes
- 🏷️ Targeted discounts
- 📦 Bulk transactions
- 🏅 Exclusive products
- ✅ Multi-layered approval processes

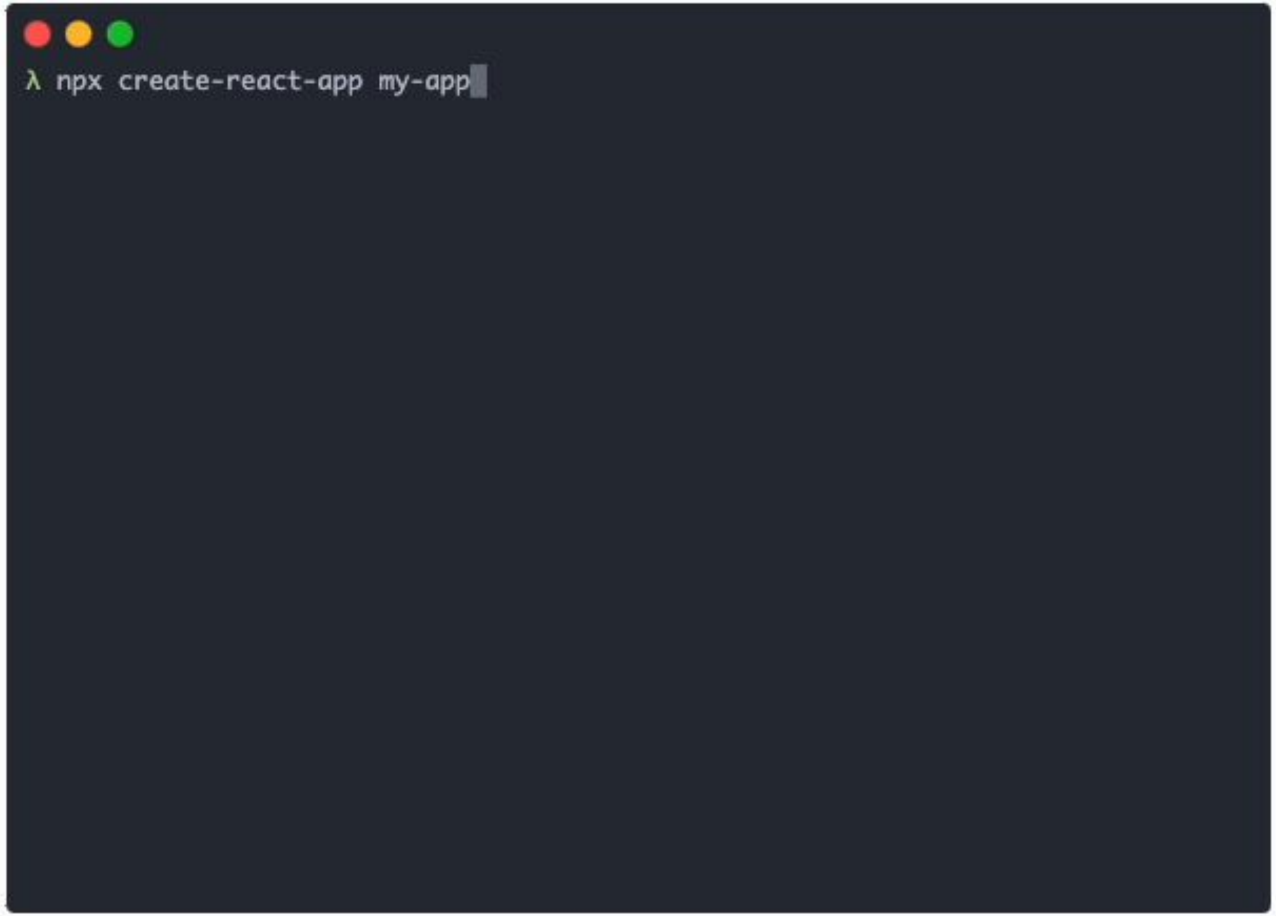
The goal is often to establish long-term relationships rather than one-time transactions.

Who are the Customers?

Product Supply Chain

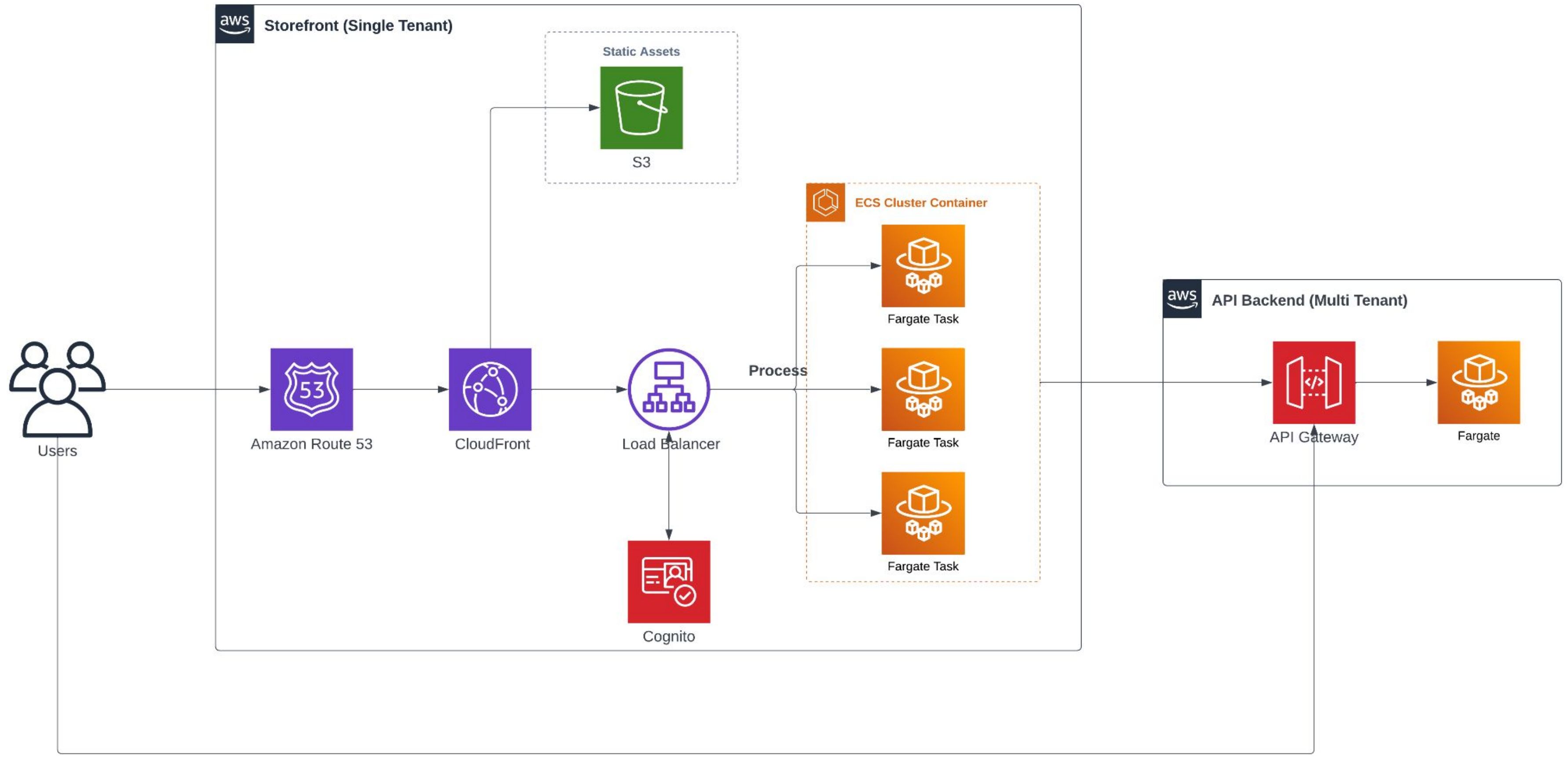


Where We Started



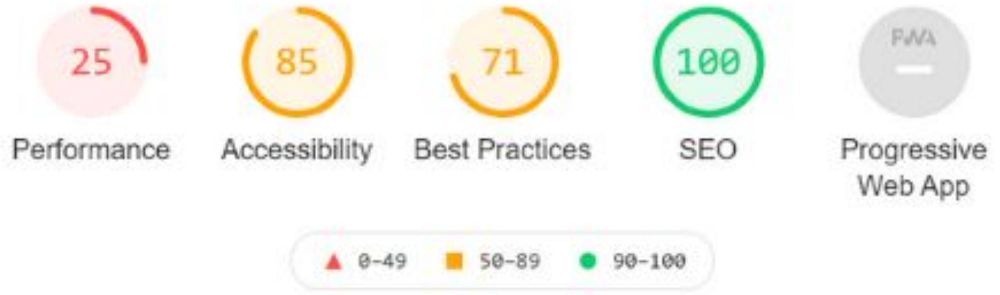
```
λ npx create-react-app my-app
```

Our MVP Architecture



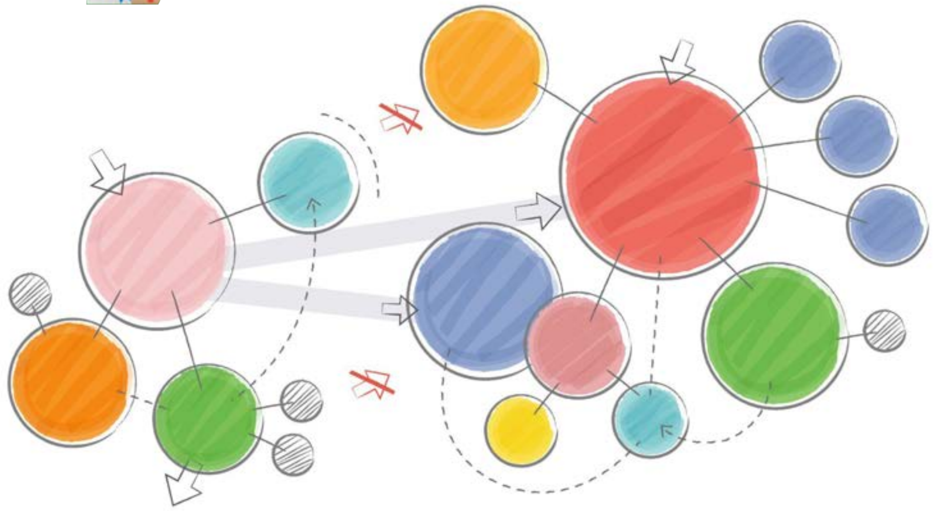
Constraints 😨

- Replicated stacks for each customer - High costs 💸
- Slow onboarding of tenants - Hard to fully automate
- Complicated infrastructure - Challenging to deliver new features
- Slow deployment - Too many stacks to update and invalidate cache
- Difficult to monitor
- Poor performance



Re-imagining our Architecture 👨‍🎨

Rebuild the storefront application to modernise it and support the increasing customer base.



- Increased scalability
- Reduced management overhead
- Faster onboarding experience
- Quicker deployments
- Better cache invalidation
- Lower latency - Our customers are spread around the globe
- Better observability

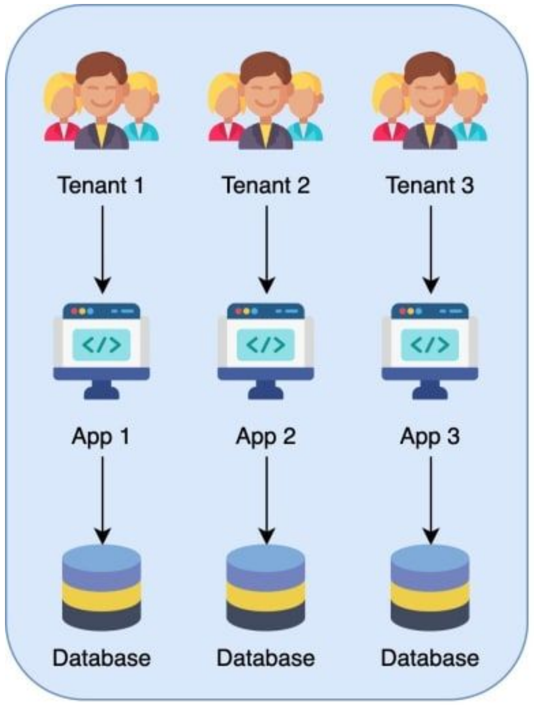
The Solution

Create a multi-tenant architecture!

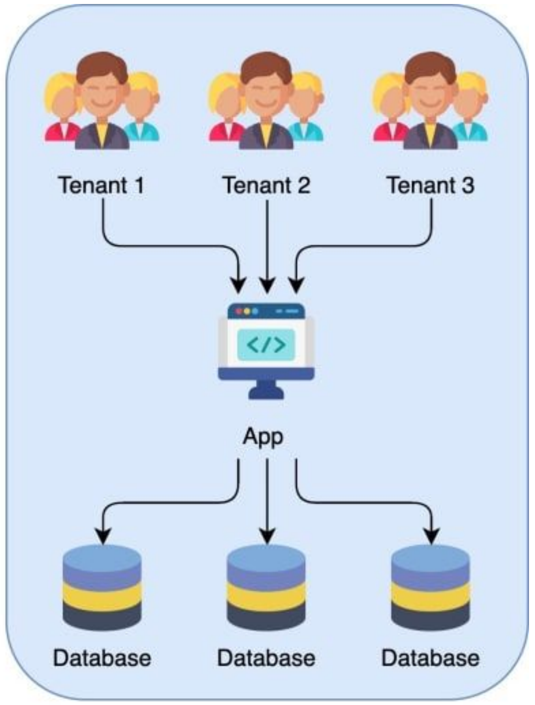
What is a Multi-Tenant Architecture?

❝ *It's a software architecture where a single instance of the software runs on a server and serves multiple customers, known as "tenants", allowing for data isolation, scalability, and resource optimization across various clients within the same infrastructure.*

Tenancy Models

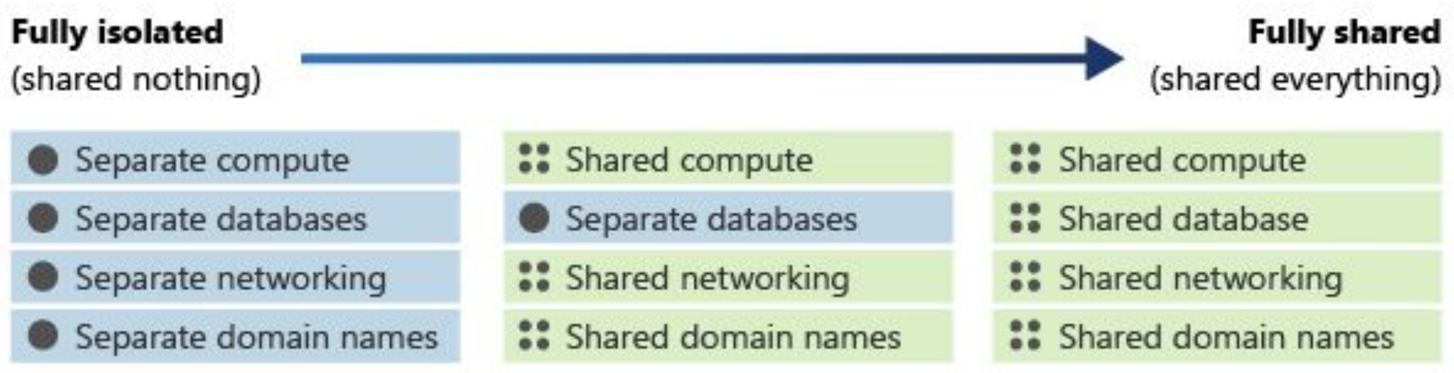


Single Tenant



Multi Tenant

Isolation Strategies



https://learn.microsoft.com/en-us/azure/architecture/guide/multitenant/considerations/tenancy-models#tenant-isolation

Benefits of a Multi-Tenant Architecture

💰 **Cost Efficiency:** Shared resources among tenants

📈 **Scalability:** Horizontal scaling to accommodate more tenants

🛠️ **Simplified Management:** One pipeline to rule ‘em all allowing quick onboarding

🔐 **Security and Compliance:** Centralized management ensures uniform policies

👨‍💻 **Developer Productivity:** Single codebase

🏃 **Business Agility:** Quickly adapt to new demands and rapid launching of features

Technology Choices

🧑‍💻Build on

NEXT.JS

🚀 Deploy to

▲Vercel

🧑‍💻 **Great DX:** Zero config, simplified routing, hot code reloading

🛠️ **Rich Built-in Features:** SSR, SSG and ISR

⚛️ **React Ecosystem:** Our team already had experience on React

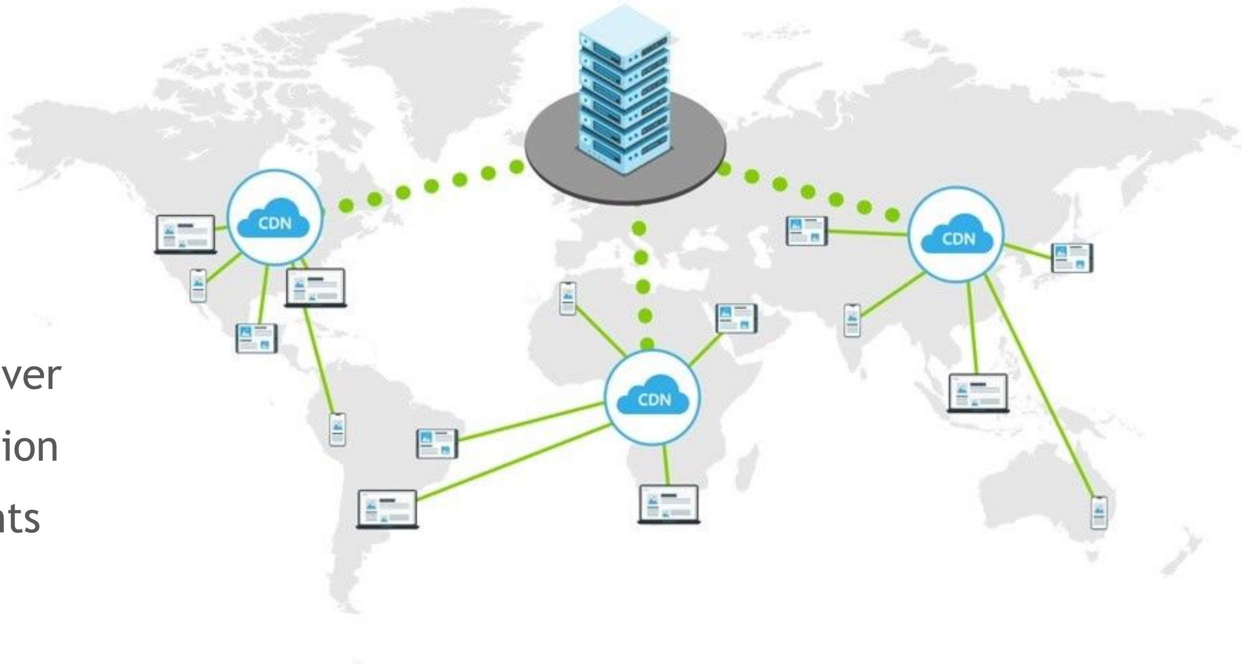
⚡ **Performance Optimization:** Automatic code splitting, image optimization, prefetching

🌎 **Robust Community and Ecosystem**

Compute at the Edge

- Global Edge Network
- Serverless Functions
- Managed scalability
- Observability as priority
- Multi-AZ / Automatic failover
- Automatic cache invalidation and purging on deployments

- **Serverless-first approach**



Serverless, in a nutshell 🥜

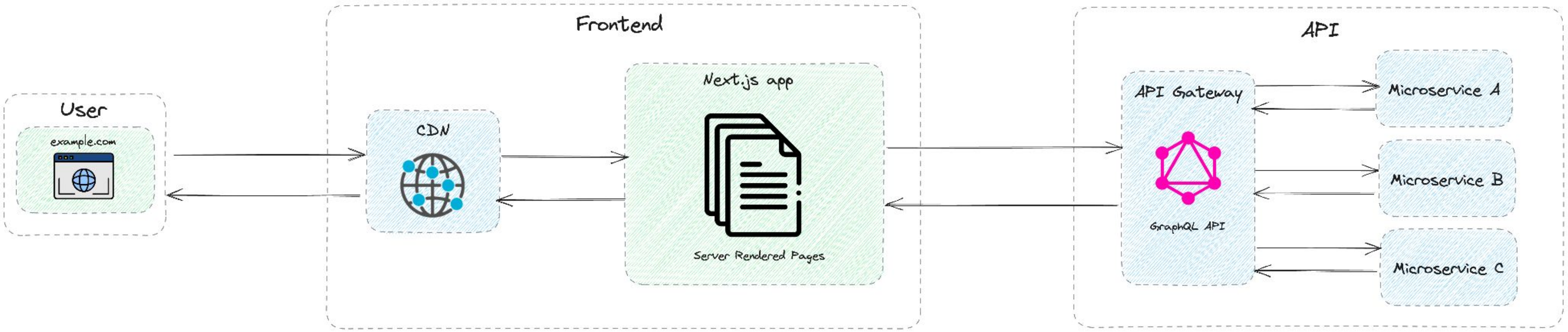
- A way of running applications in the cloud
- Of course, there are servers... we just don't have to manage them
- We pay (only) for what we use
- Small units of compute (functions), triggered by events

With benefits 🎁

- More focus on the business logic (generally)
- Increased team agility (mostly)
- Automatic scalability (sorta)
- Not a universal solution, but it can work well in many situations!

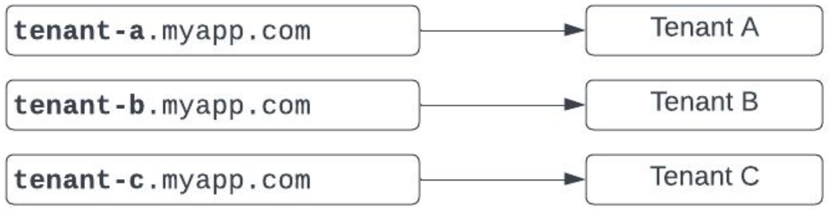
Credit: Luciano Mammino (https://loige.co)

The Idea

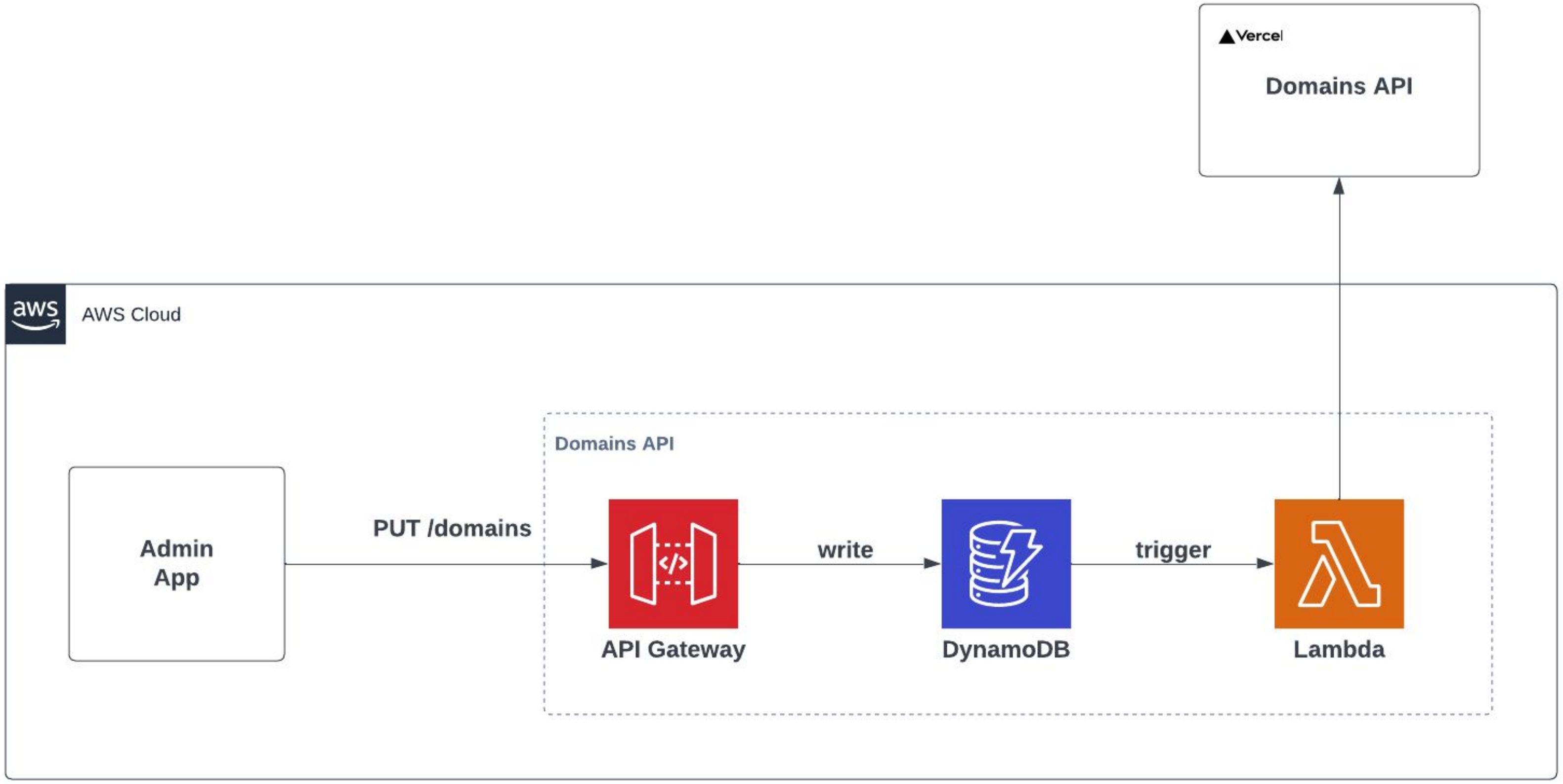

User
example.com
Frontend
CDN
Next.js app
Server Rendered Pages
API
API Gateway
GraphQL API
Microservice A
Microservice B
Microservice C

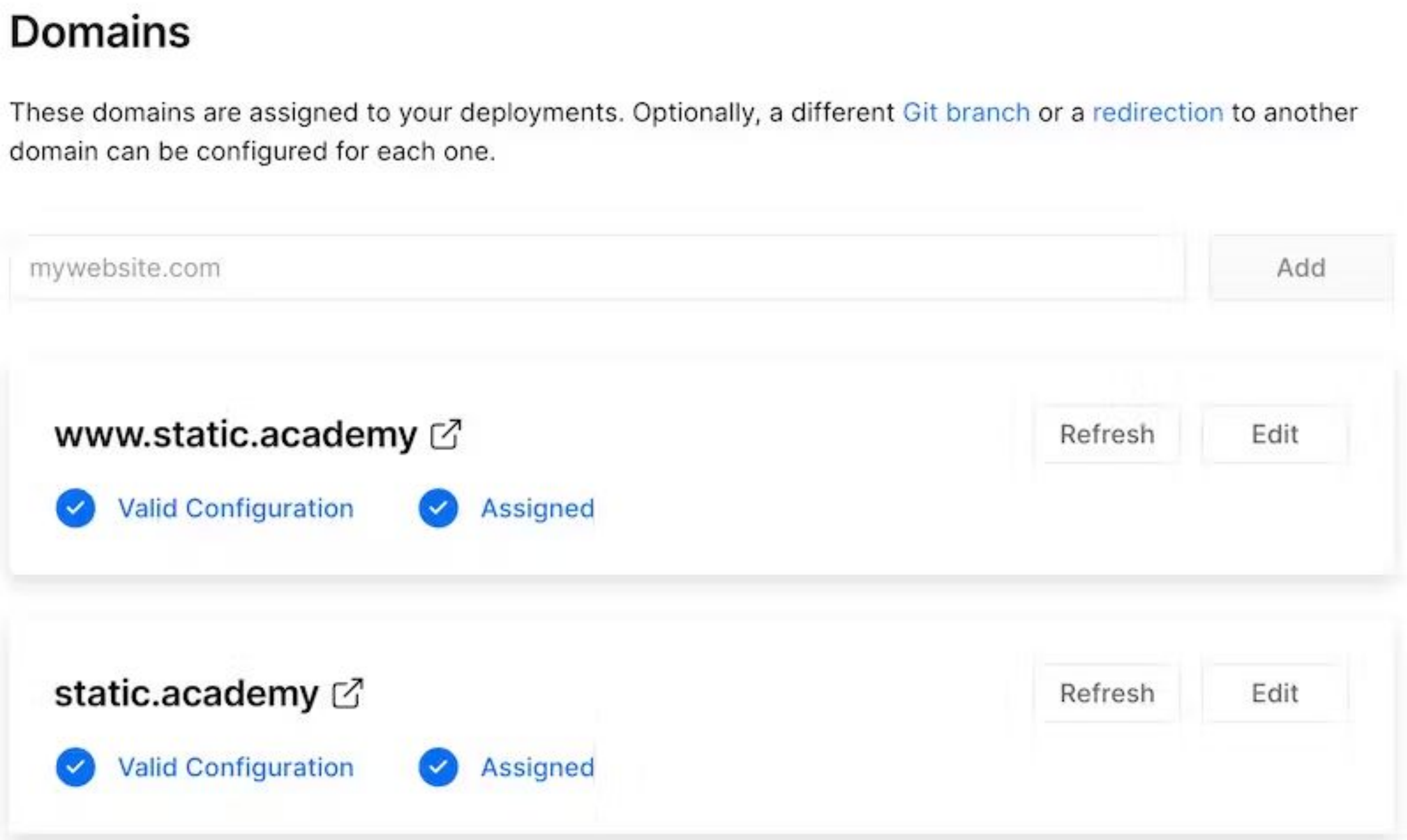
The Challenges

Mapping Domains to Tenants



Mapping Domains to Tenants





Domains

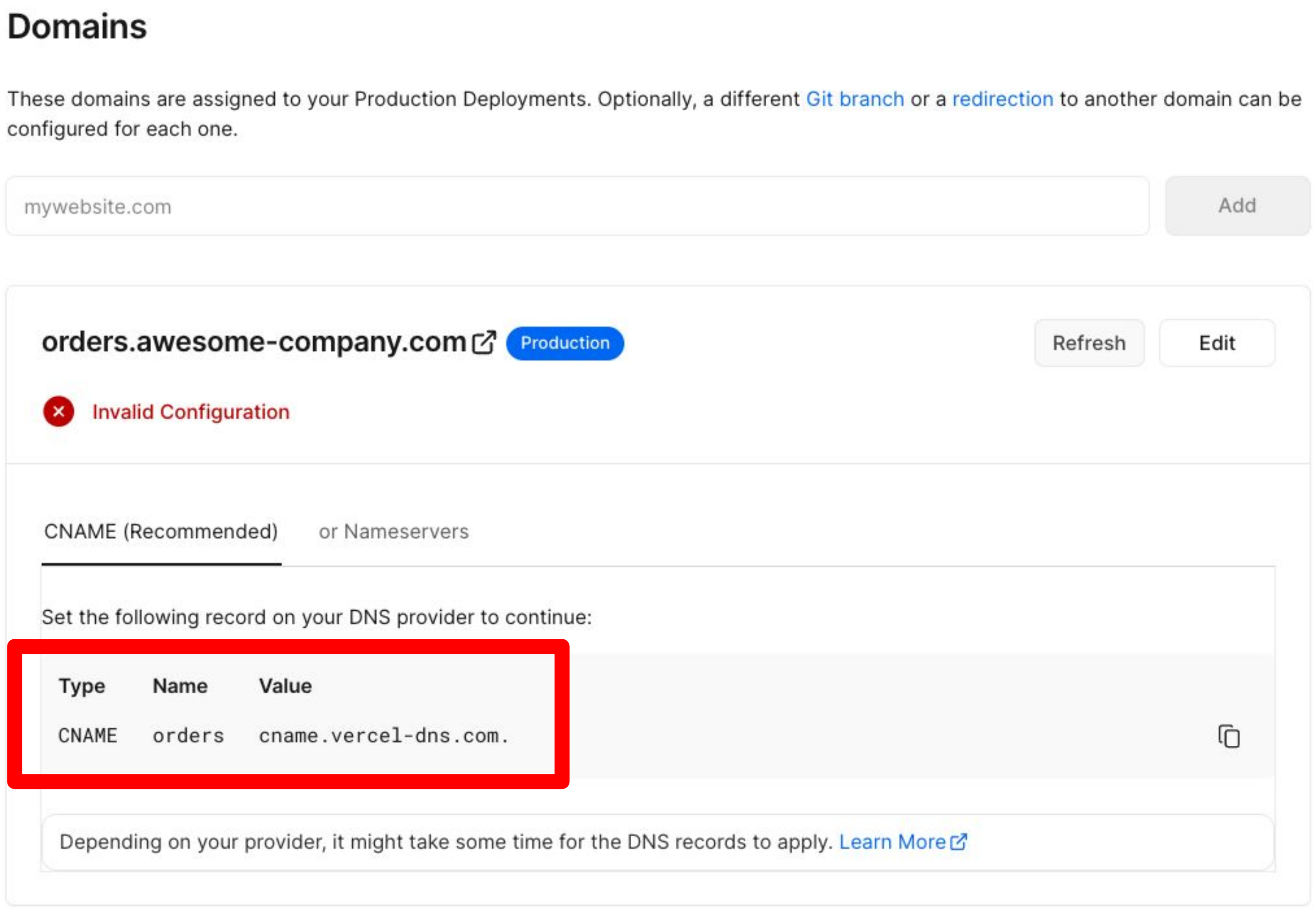
These domains are assigned to your deployments. Optionally, a different Git branch or a redirection to another domain can be configured for each one.

www.static.academy

✓ Valid Configuration ✓ Assigned

static.academy

✓ Valid Configuration ✓ Assigned



Domains

These domains are assigned to your Production Deployments. Optionally, a different Git branch or a redirection to another domain can be configured for each one.

mywebsite.com

Add

orders.awesome-company.com Production

Refresh

Edit

Invalid Configuration

CNAME (Recommended)

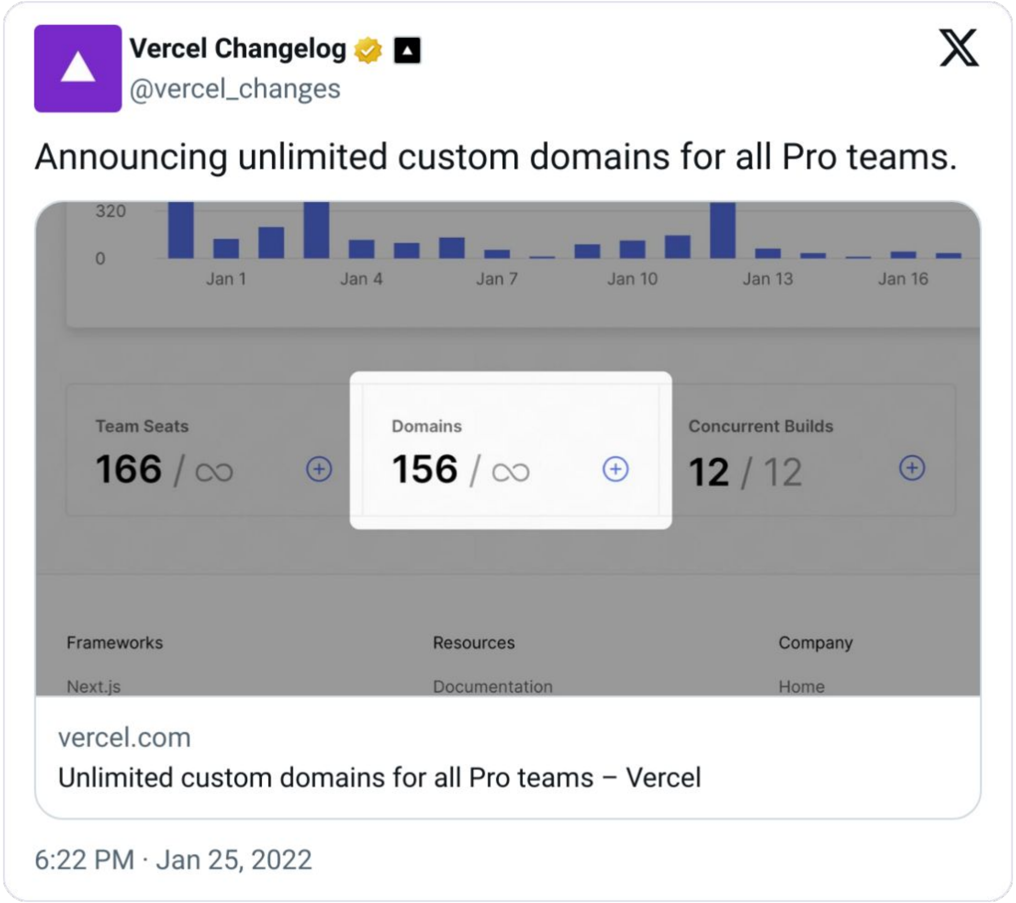
or Nameservers

Set the following record on your DNS provider to continue:

Type	Name	Value
CNAME	orders	cname.vercel-dns.com.

Depending on your provider, it might take some time for the DNS records to apply. Learn More

API Limits?



Vercel Changelog
@vercel_changes

Announcing unlimited custom domains for all Pro teams.

Team Seats
166 / ∞

Domains
156 / ∞

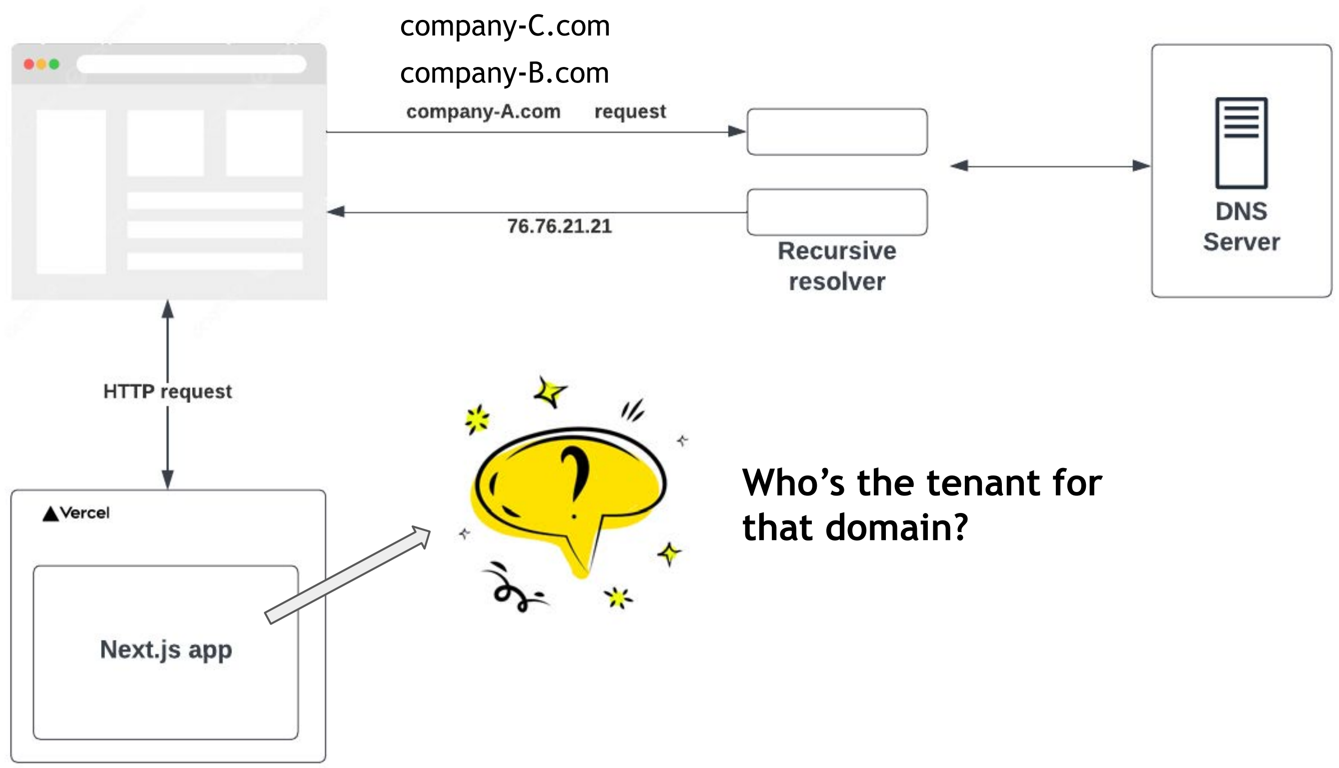
Concurrent Builds
12 / 12

vercel.com
Unlimited custom domains for all Pro teams – Vercel

6:22 PM · Jan 25, 2022

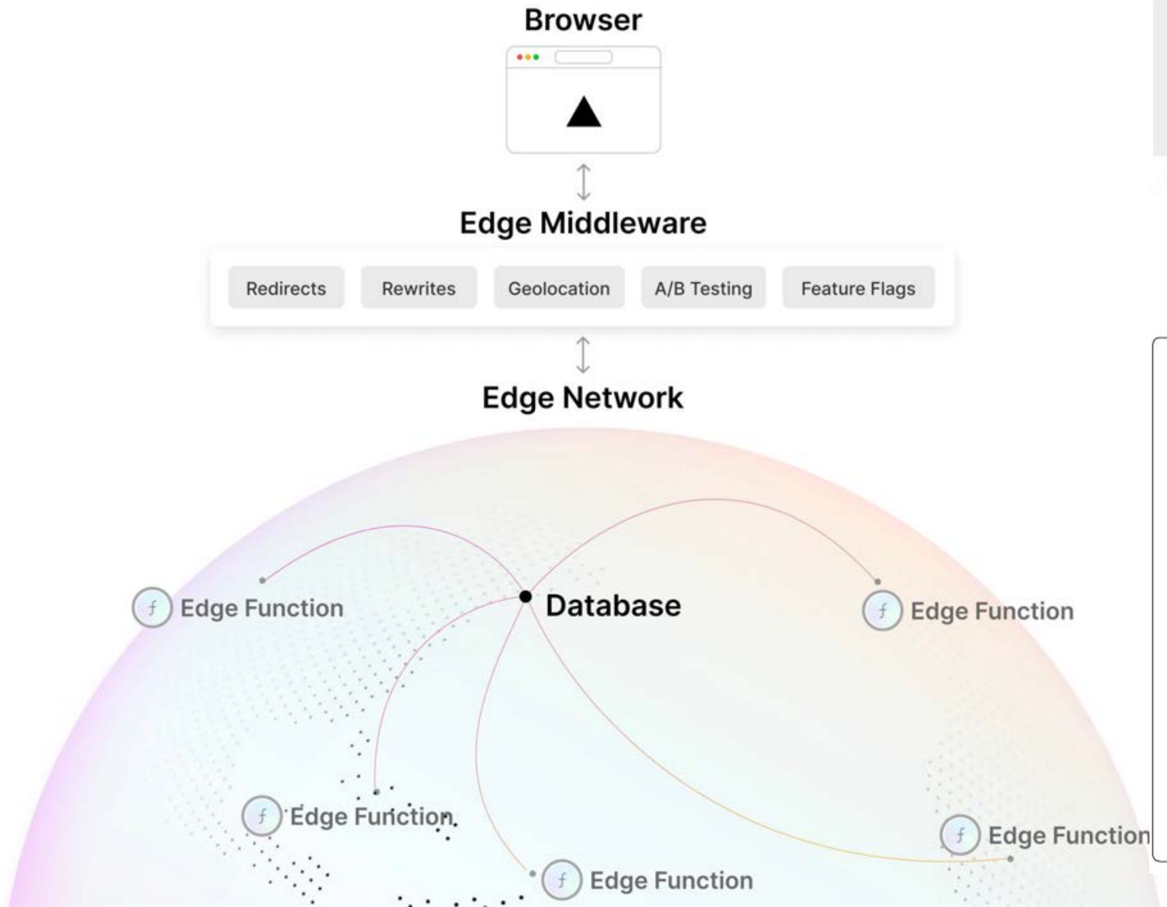
https://twitter.com/vercel_changes/status/1486041800129323013

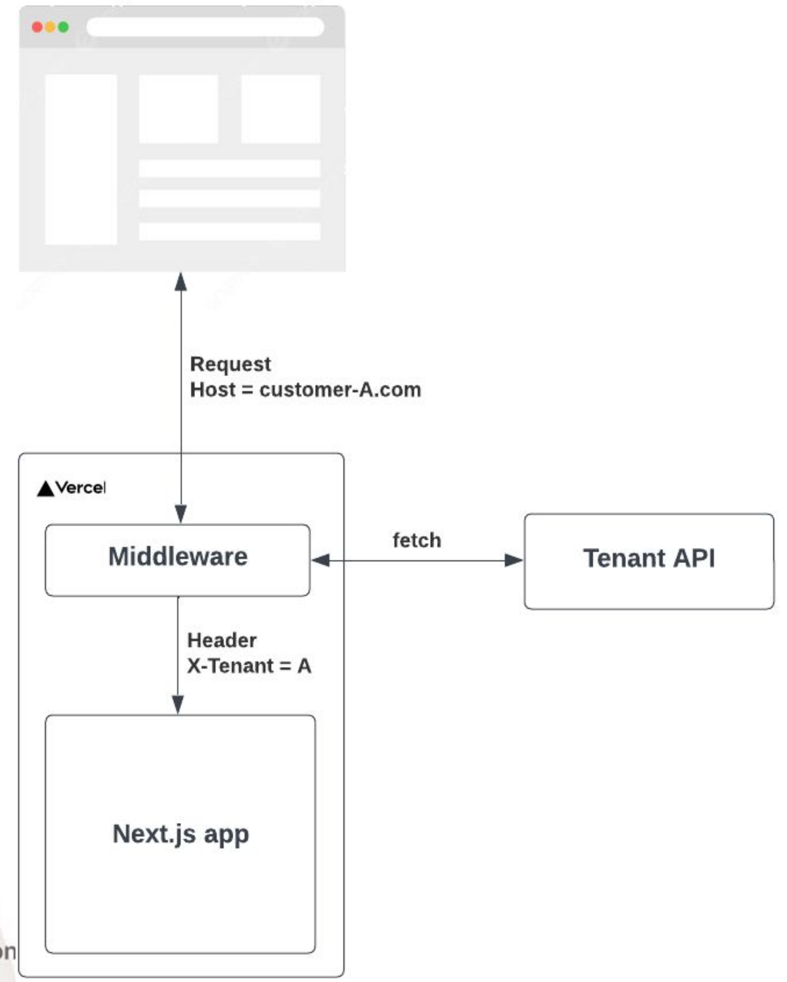
Identifying the Tenant



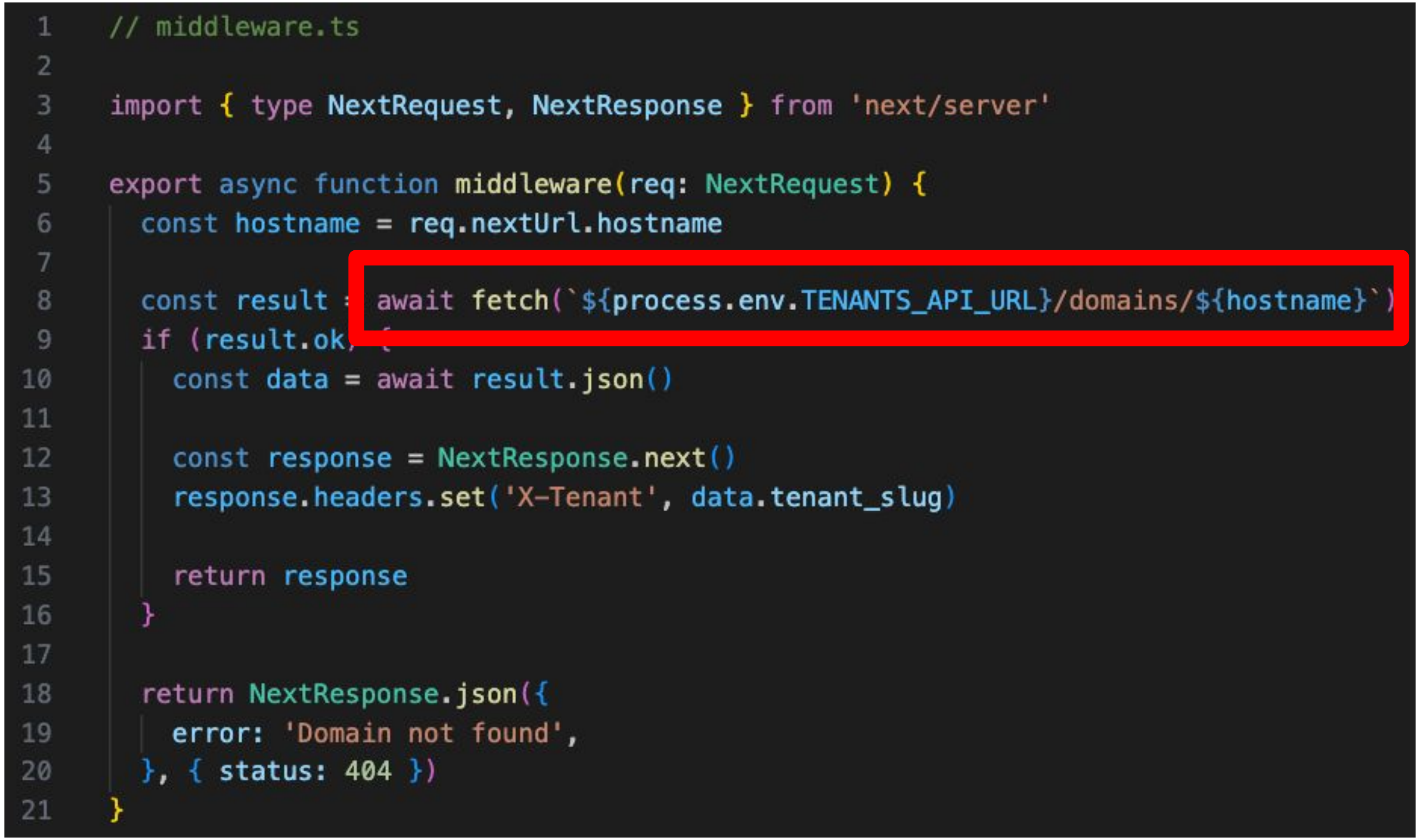
Who's the tenant for that domain?

Identifying the Tenant



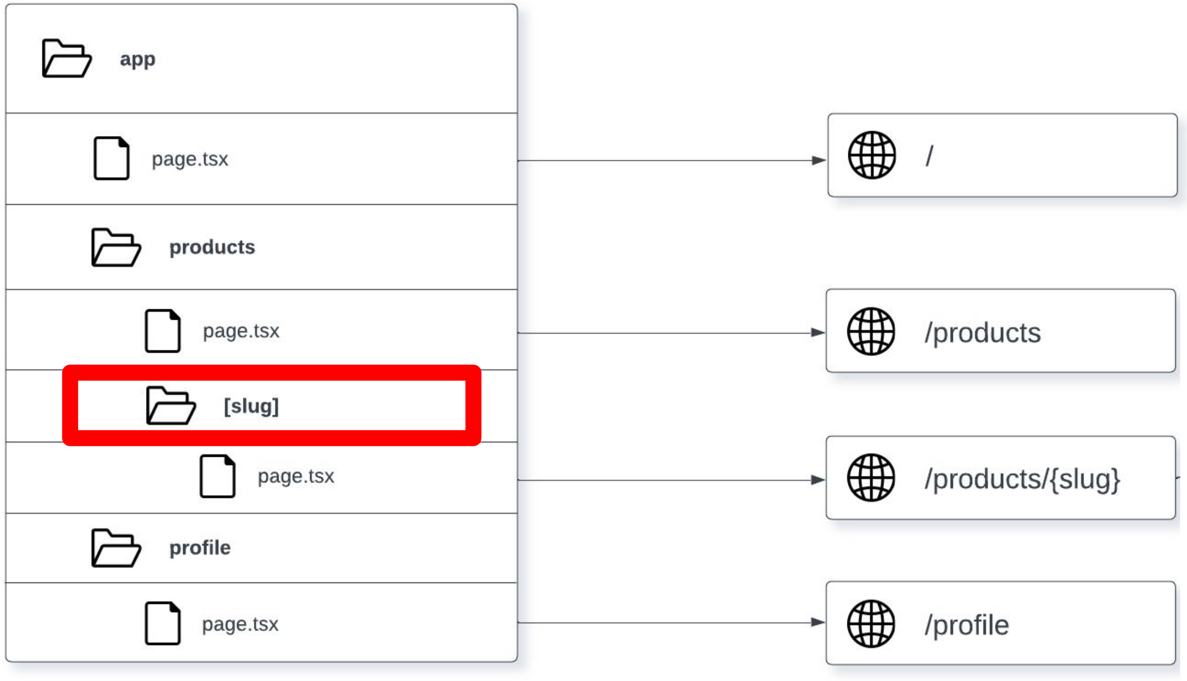


Identifying the Tenant

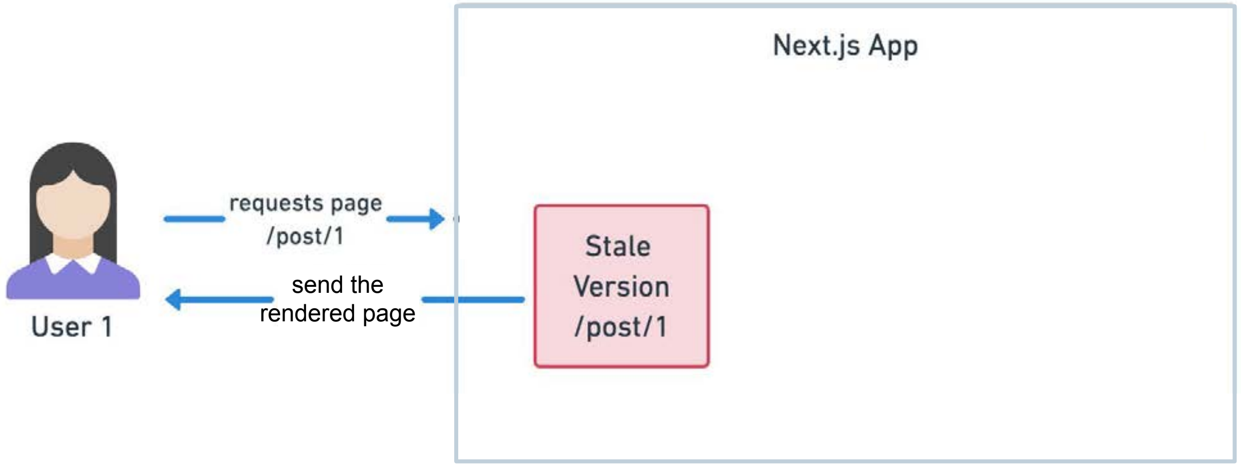


```ts
// middleware.ts

import { type NextRequest, NextResponse } from 'next/server'

export async function middleware(req: NextRequest) {
  const hostname = req.nextUrl.hostname

  const result = await fetch(`${process.env.TENANTS_API_URL}/domains/${hostname}`)
  if (result.ok) {
    const data = await result.json()

    const response = NextResponse.next()
    response.headers.set('X-Tenant', data.tenant_slug)

    return response
  }

  return NextResponse.json({
    error: 'Domain not found',
  }, { status: 404 })
}
```

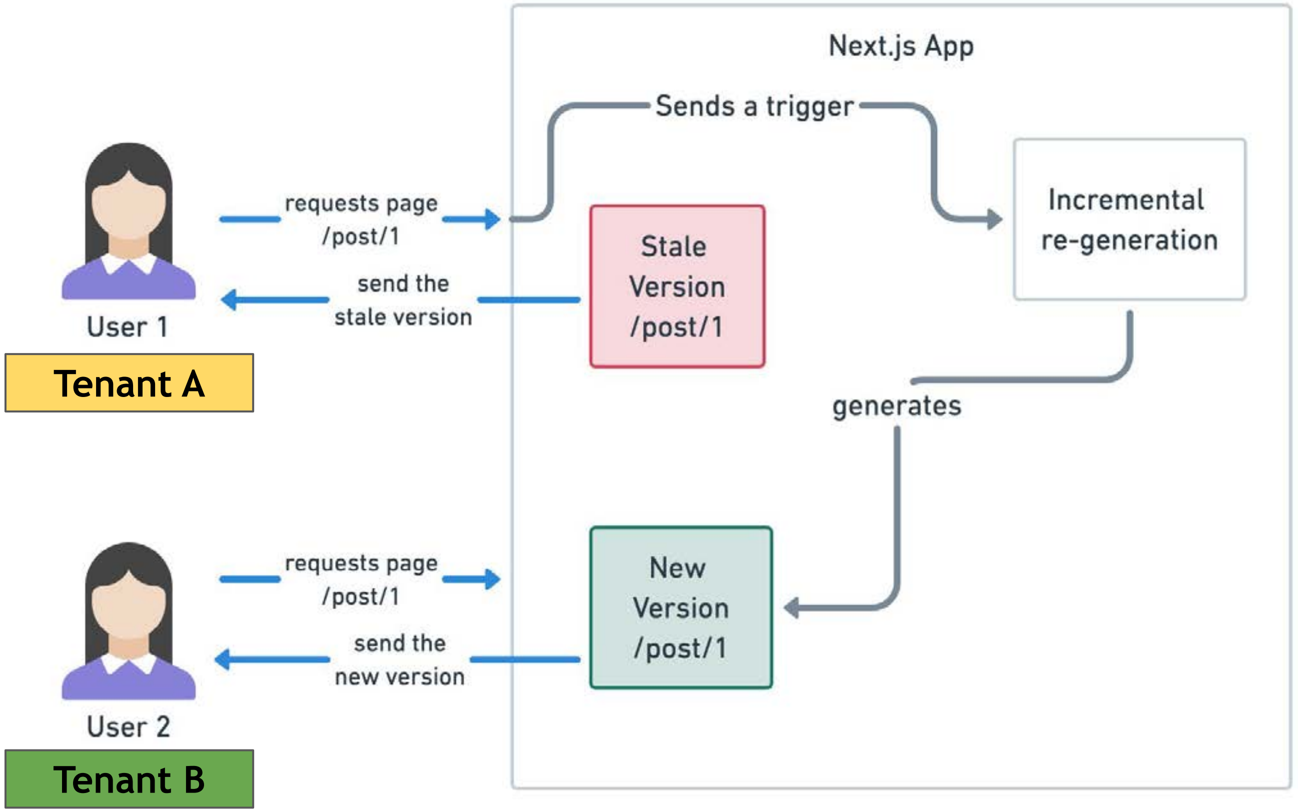
Routing


app
page.tsx
products
page.tsx
[slug]
page.tsx
profile
page.tsx
/
/products
/products/{slug}
/profile

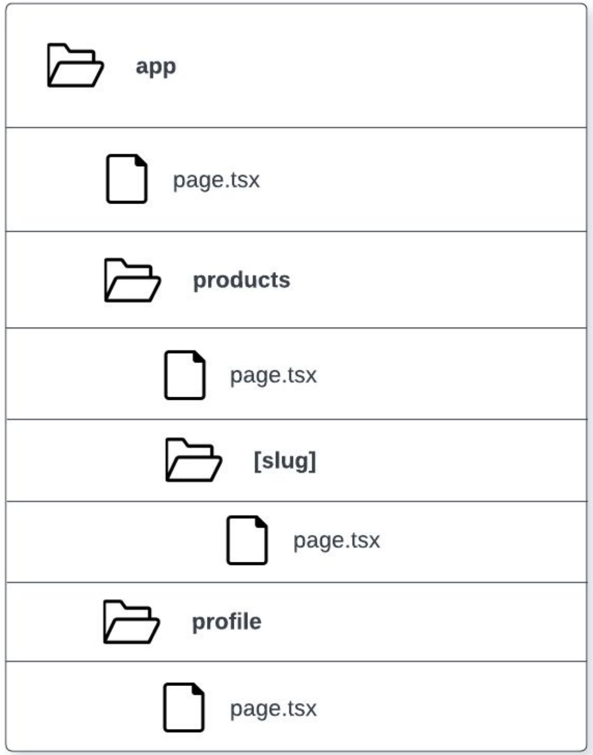
Caching Page Outputs



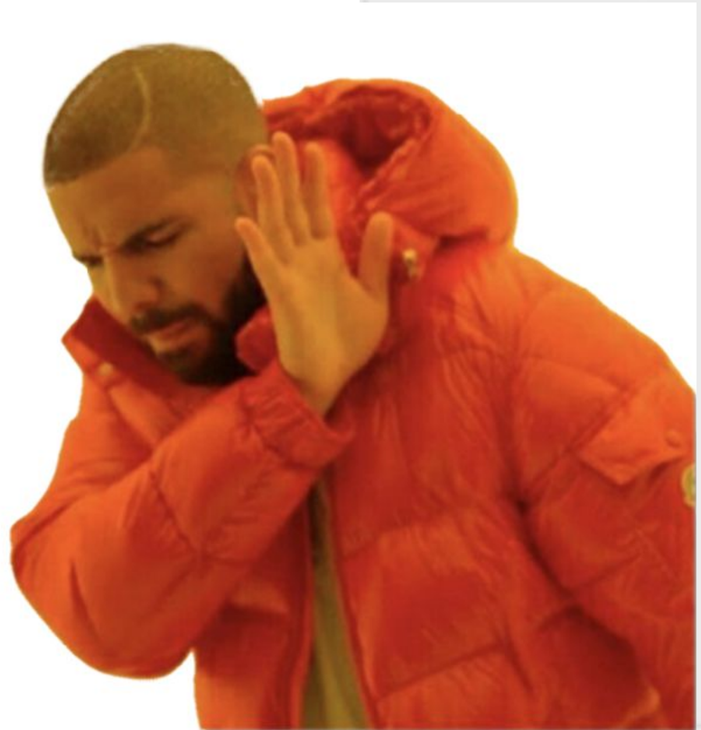
Incremental Static Regeneration (ISR)

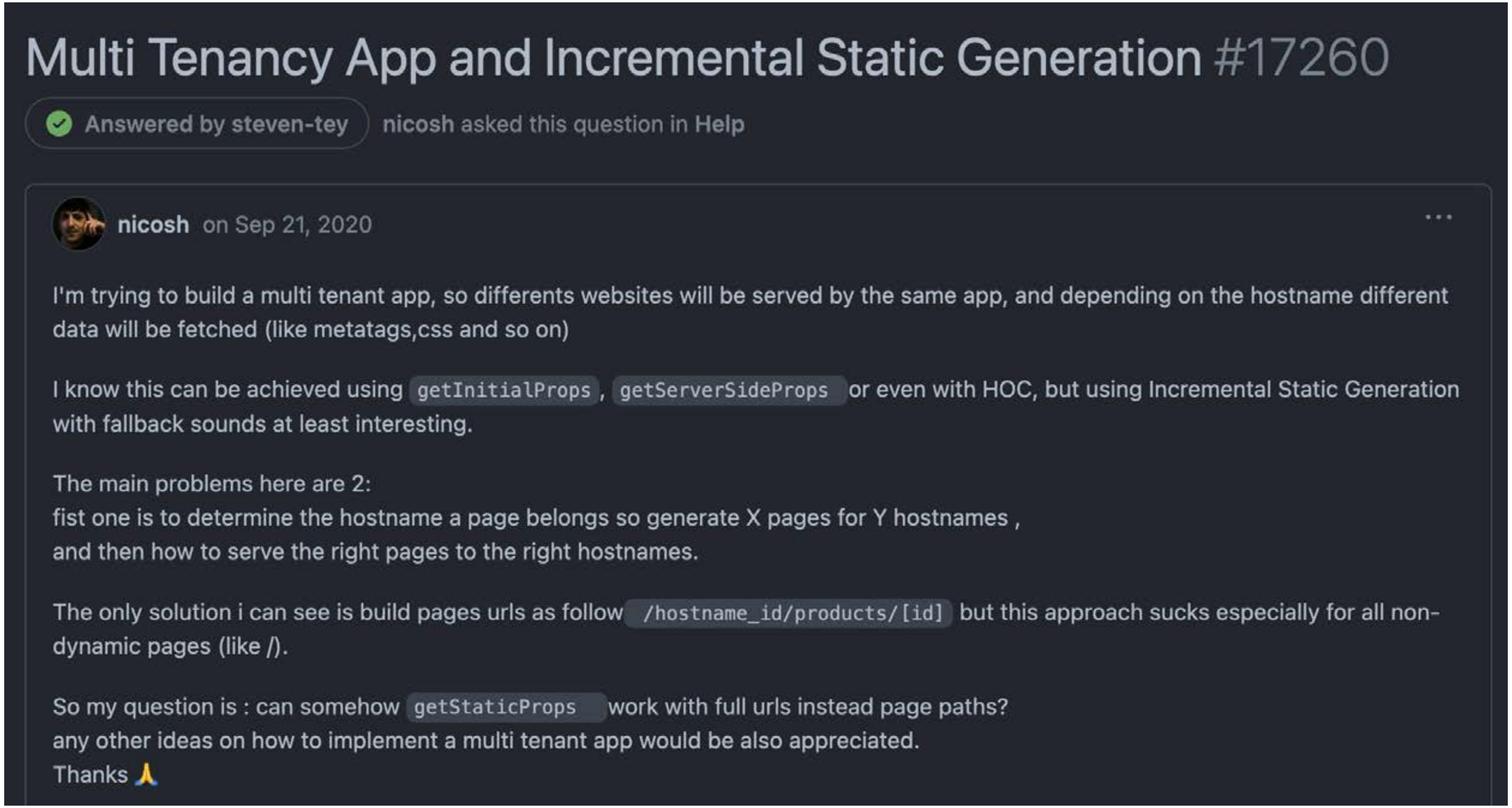


Tenant-based Routing



example.com/**tenant-A**/product/something





Multi Tenancy App and Incremental Static Generation #17260

Answered by steven-tey nicosh asked this question in Help

nicosh on Sep 21, 2020

I'm trying to build a multi tenant app, so differents websites will be served by the same app, and depending on the hostname different data will be fetched (like metatags,css and so on)

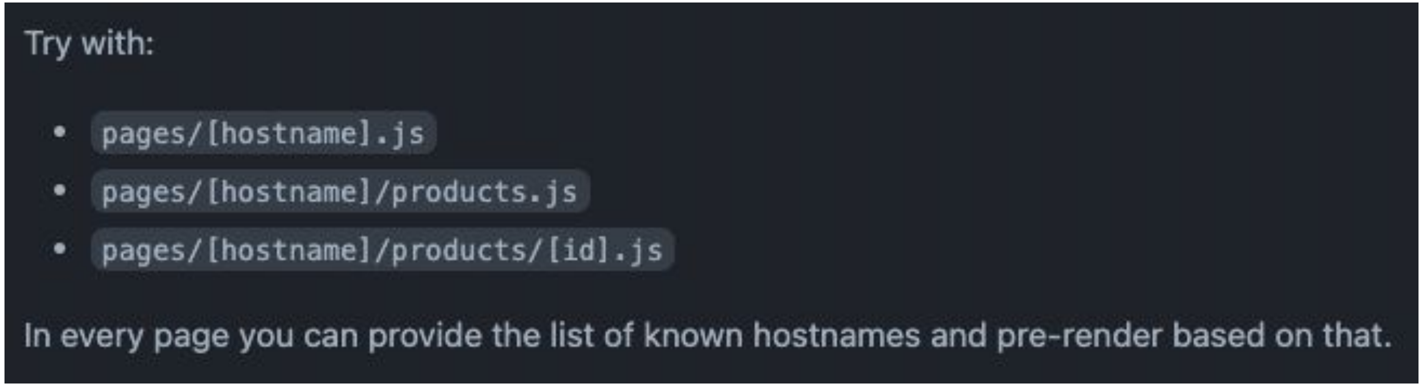
I know this can be achieved using `getInitialProps`, `getServerSideProps` or even with HOC, but using Incremental Static Generation with fallback sounds at least interesting.

The main problems here are 2:
fist one is to determine the hostname a page belongs so generate X pages for Y hostnames ,
and then how to serve the right pages to the right hostnames.

The only solution i can see is build pages urls as follow `/hostname_id/products/[id]` but this approach sucks especially for all non-dynamic pages (like /).

So my question is : can somehow `getStaticProps` work with full urls instead page paths?
any other ideas on how to implement a multi tenant app would be also appreciated.
Thanks 🙏

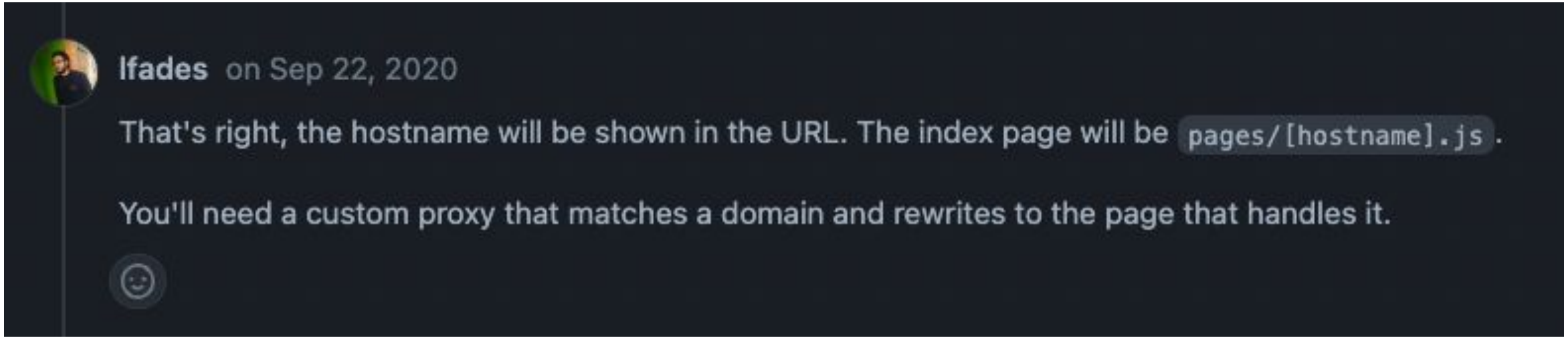
https://github.com/vercel/next.js/discussions/17260



Try with:

- `pages/[hostname].js`
- `pages/[hostname]/products.js`
- `pages/[hostname]/products/[id].js`

In every page you can provide the list of known hostnames and pre-render based on that.

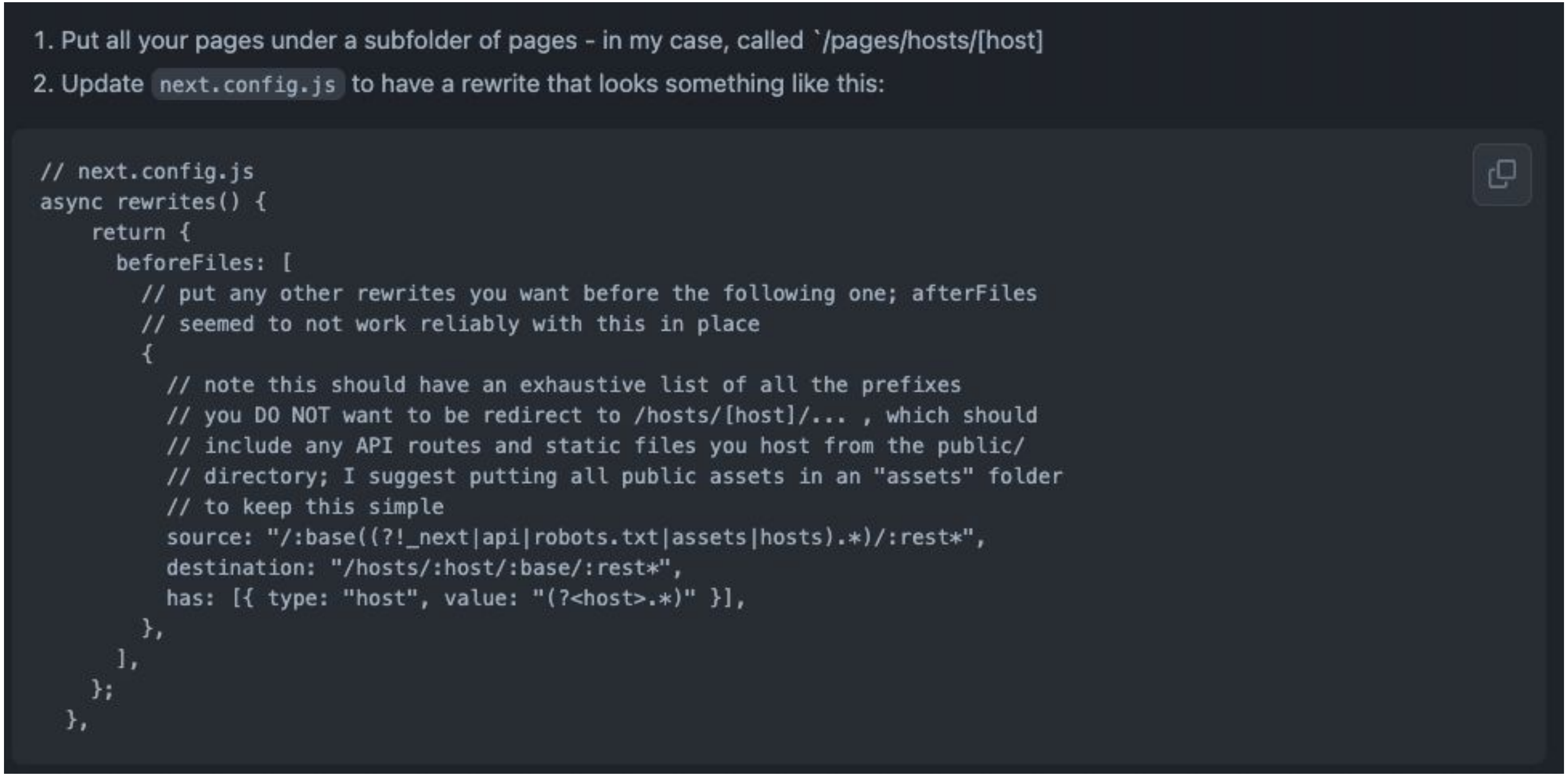


lfades on Sep 22, 2020

That's right, the hostname will be shown in the URL. The index page will be `pages/[hostname].js`.

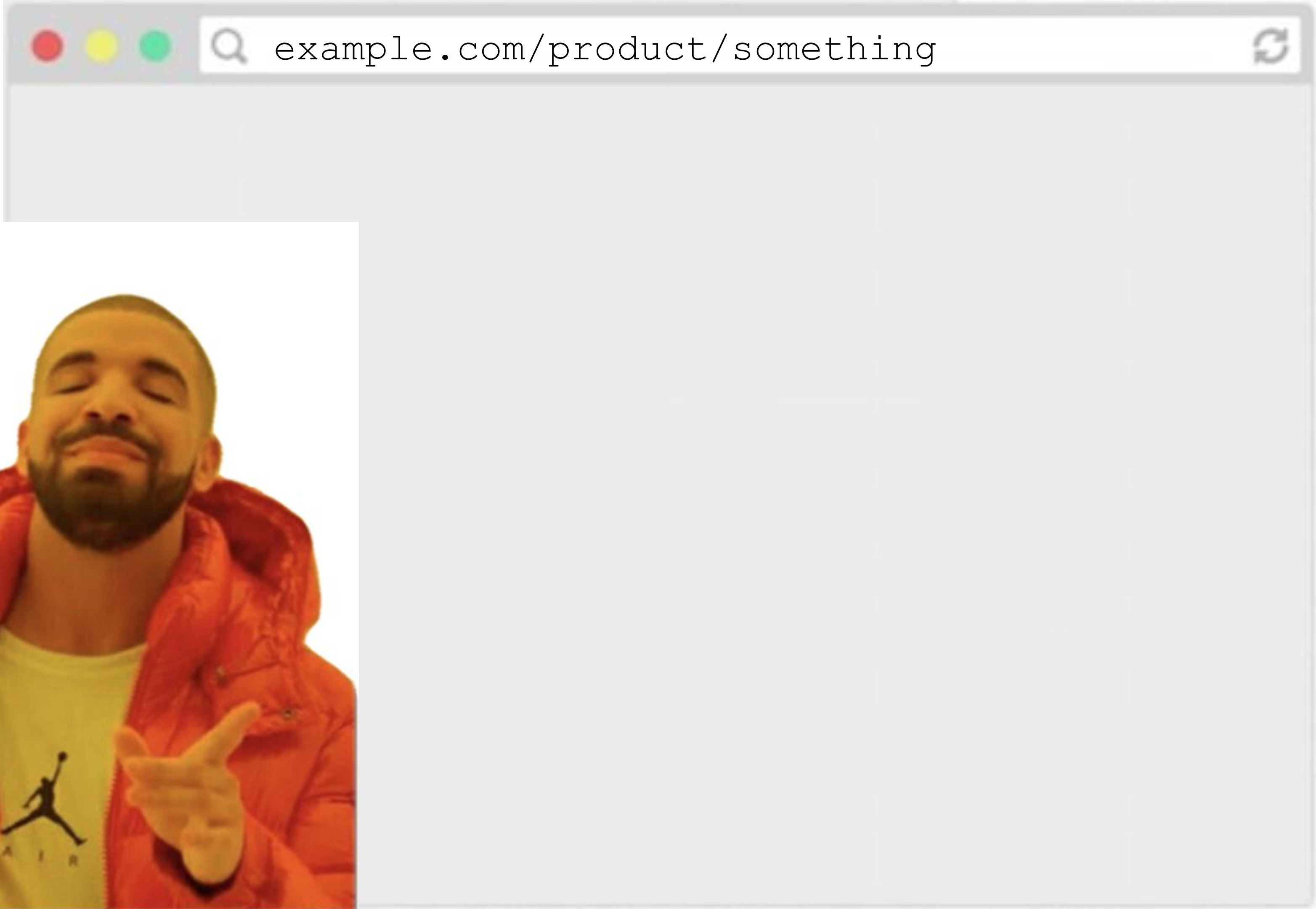
You'll need a custom proxy that matches a domain and rewrites to the page that handles it.

Solution: URL Rewrites



1. Put all your pages under a subfolder of pages - in my case, called `/pages/hosts/[host]
2. Update `next.config.js` to have a rewrite that looks something like this:

```
// next.config.js
async rewrites() {
    return {
      beforeFiles: [
        // put any other rewrites you want before the following one; afterFiles
        // seemed to not work reliably with this in place
        {
          // note this should have an exhaustive list of all the prefixes
          // you DO NOT want to be redirect to /hosts/[host]/... , which should
          // include any API routes and static files you host from the public/
          // directory; I suggest putting all public assets in an "assets" folder
          // to keep this simple
          source: "/:base((?!_next|api|robots.txt|assets|hosts).*)/:rest*",
          destination: "/hosts/:host/:base/:rest*",
          has: [{ type: "host", value: "(?<host>.*)" }],
        },
      ],
    };
  },
```


example.com/product/something

DEMO TIME!!
...WHAT COULD GO WRONG?

Source Code

github.com/guidr/nextjs-multi-tenant

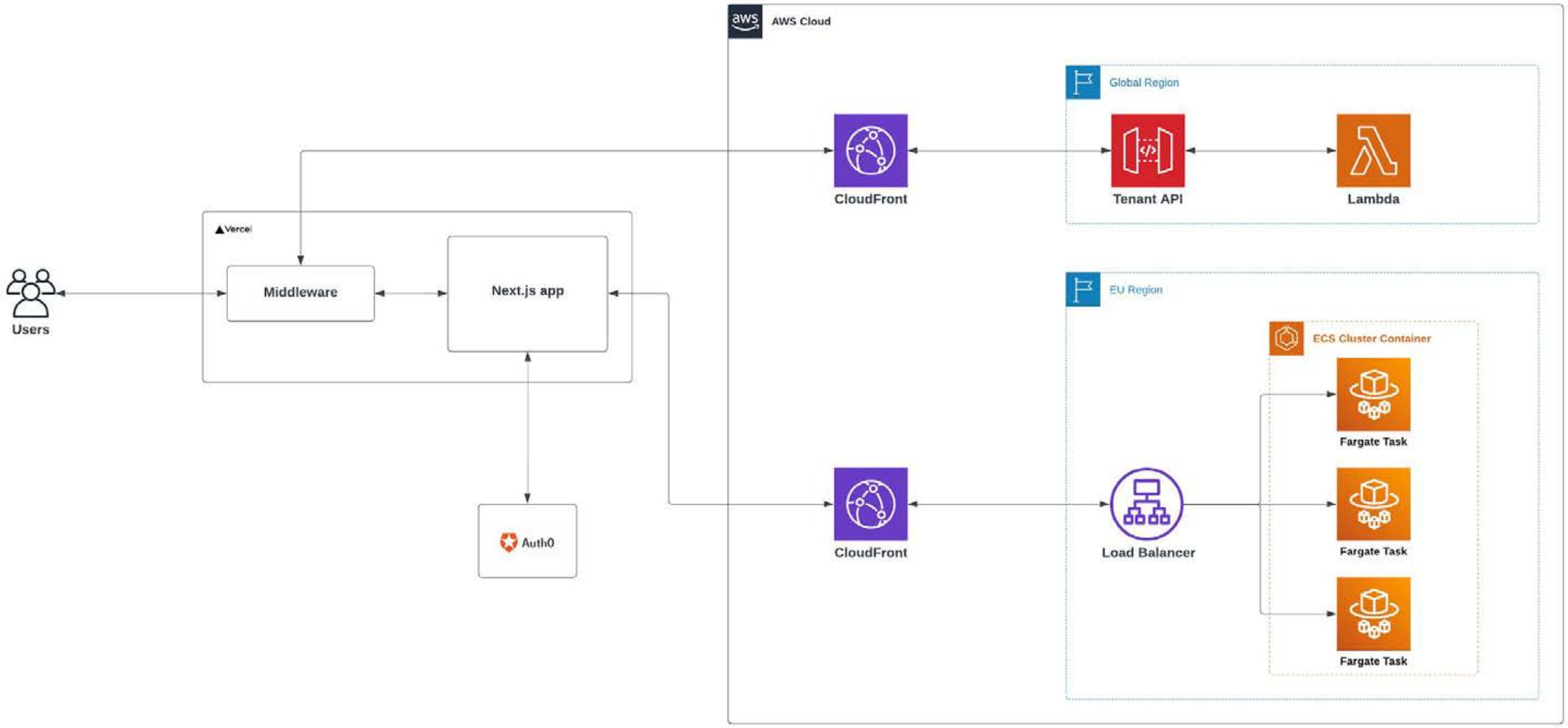
Vercel Platforms Starter Kit

https://github.com/vercel/platforms

> The Platforms Starter Kit is a full-stack Next.js app with multi-tenancy and custom domain support. Built with **Next.js App Router**, Vercel Postgres and the **Vercel Domains API**.

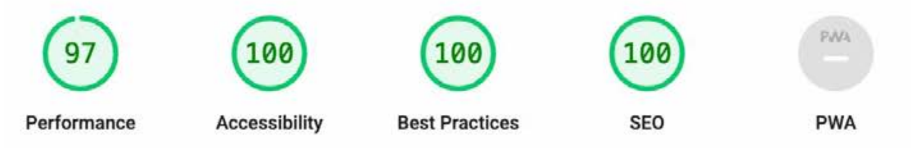
- ✅ Domain based routing
- ✅ URL rewrites using middleware
- ✅ Vercel Domains API

Where we Landed - MerCloud’s Architecture Overview



Outcomes

🚀 Massive improvements in performance



🌐 Lower latency: Servers are closer to the users

🏃 Increased dev team agility

☁️ No infrastructure management overhead

🤖 Easier to onboard new tenants (and fully automated!)

Lessons Learned

- Focus on business value, adopt tools and technologies that help you do that!
- Take advantage of strategies like Jamstack and ISR
- Be careful with Server Side Rendering (it slows down page load)
- Observability is a MUST
  - Tenant-aware
  - Consumption metrics: Who’s using what and how much?
- Do not do early optimization
  - Use metrics to drive it

linkedin.com/in/guidr

x.com/gui_dr

github.com/guidr

Thanks!

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https://mercloud.io