Serverless Planet-Scale Geospatial with Protomaps & PMTiles

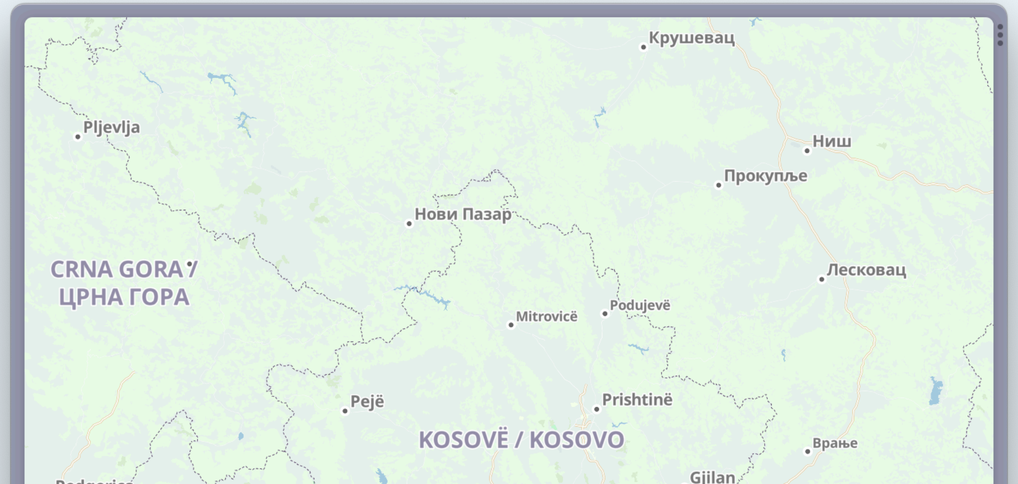
protomaps

protomaps

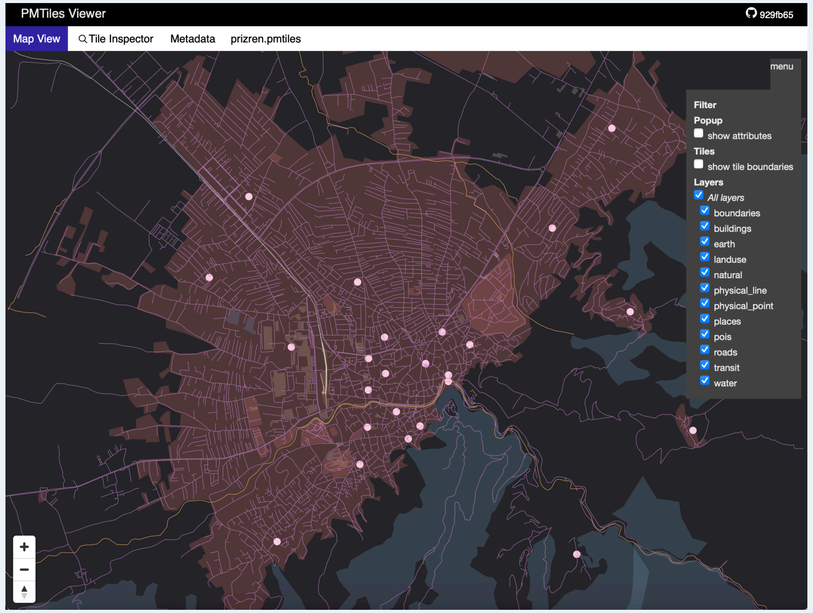
Protomaps is a **free and open source** map of the world.

It's a trivially self-hostable **vector tile** product based on OpenStreetMap.

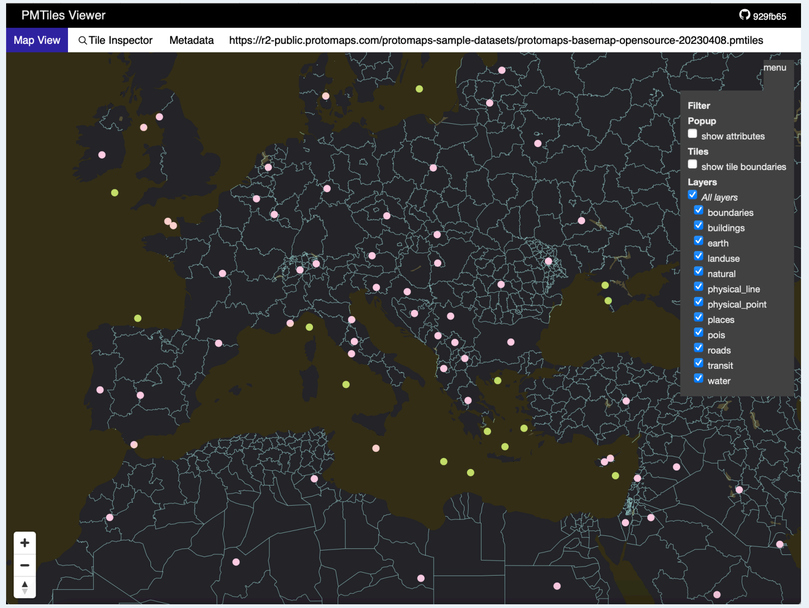
At its core is an **open and serverless** file format, **PMTiles.**



Prizren to Planet



prizren.pmtiles
103 tiles
1.3 MB
362 bytes of directories



planet.pmtiles
1.4 billion tiles
109 GB
305 MB of directories

“Cloud-Native data formats are structured to allow users to use **HTTP range requests** to efficiently access specific data needed for analysis.

These formats are well-suited to be hosted in cloud **object storage** services which are designed to serve large volumes of data using generic RESTful / HTTP data transfer protocols.”

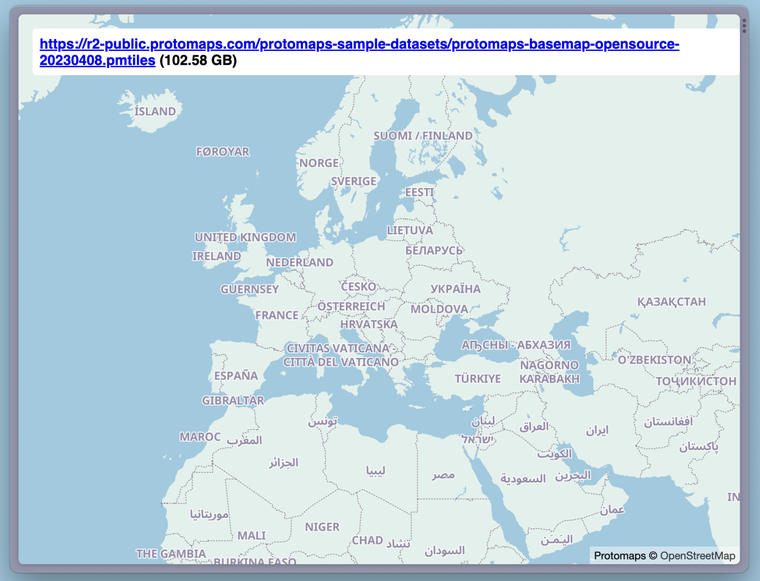
https://cloudnativegeo.org

s3://planet.pmtiles

HTTP 206 Partial Content (16 kB)
HTTP 206 Partial Content /0/0/0.mvt

Leaflet

OpenLayers



MapLibre

s3://planet.pmtiles

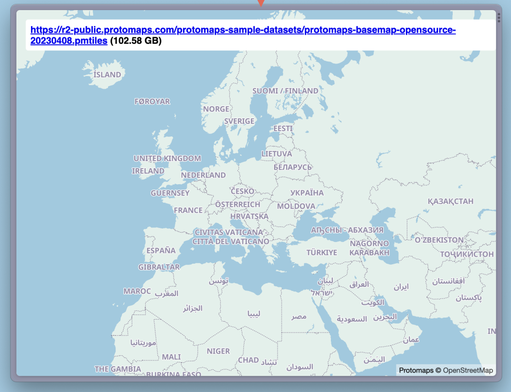
HTTP 206 Partial Content (16 kB)
HTTP 206 Partial Content /0/0/0.mvt

CLOUDFLARE Workers

AWS Lambda

Leaflet

OpenLayers



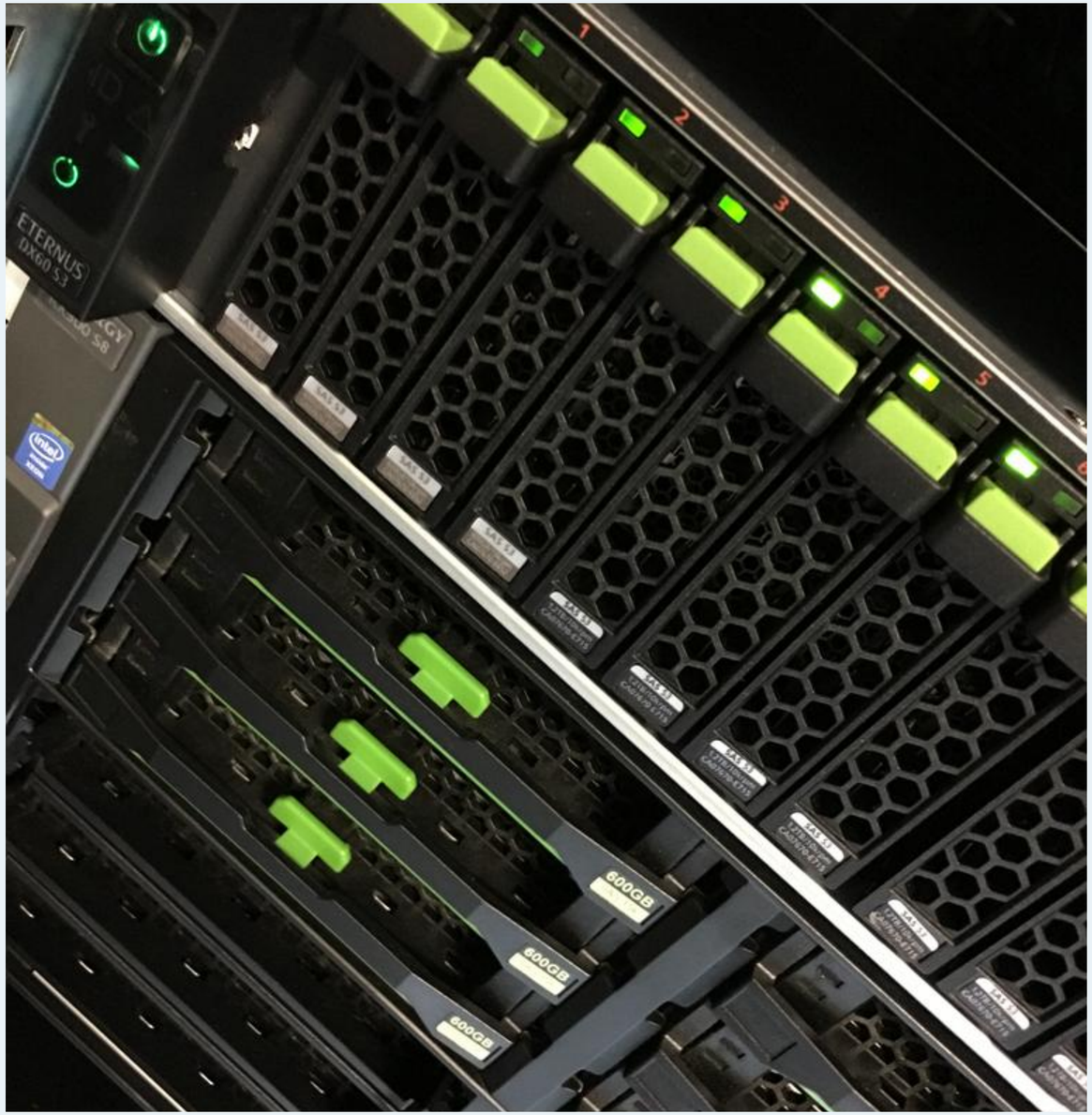
MapLibre

MYTH

Serverless is the **cheapest, fastest or easiest** way to host maps on the web.

Cheapest: Rent Servers

- **Egress bandwidth** is a major cost of hosting map data
- Bandwidth on cloud providers up to **$0.02 USD per gigabyte**
- Unmetered bandwidth servers available from OVH, Hetzner

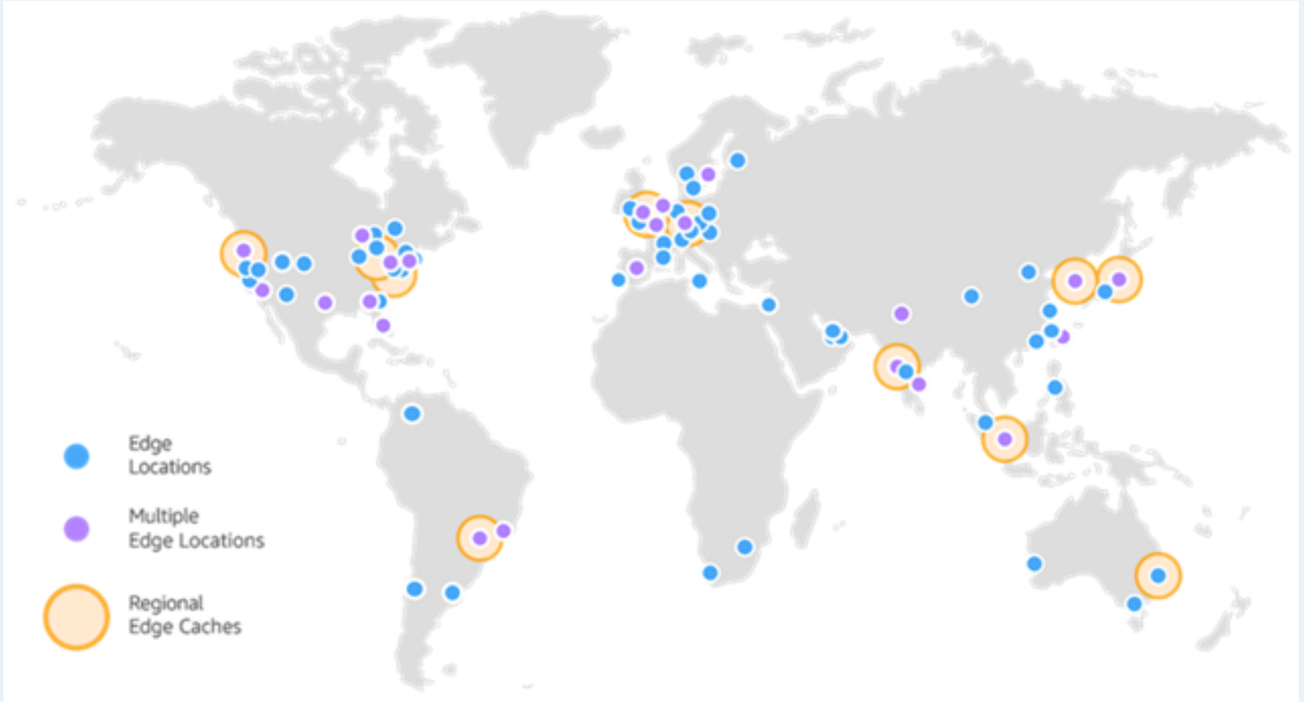


Fastest: Don’t use Object Stores

- Latency for a **single request** to S3, R2, Azure Blobs is 50+ ms
- Requests for a single map tile might require **multiple round-trips**
- Typical databases and filesystems can accomplish the same thing in **single-digit milliseconds**

Easiest: Buy a SaaS

- No setup, predictable costs
- Subscription fee + **pay for what you use**
- Major providers use a Content Delivery Network (CDN) to **cache tiles close to users**



AWS CloudFront Network

So **why bother** with serverless geospatial?

(In case I convinced you it is a fad or waste of time)

Like a SaaS, scaling, uptime* and maintenance **are someone else's job**

* Cloud storage does go down sometimes

Like a SaaS, you **pay only for what you use**

(And it’s 30x-100x cheaper)

Cost Example

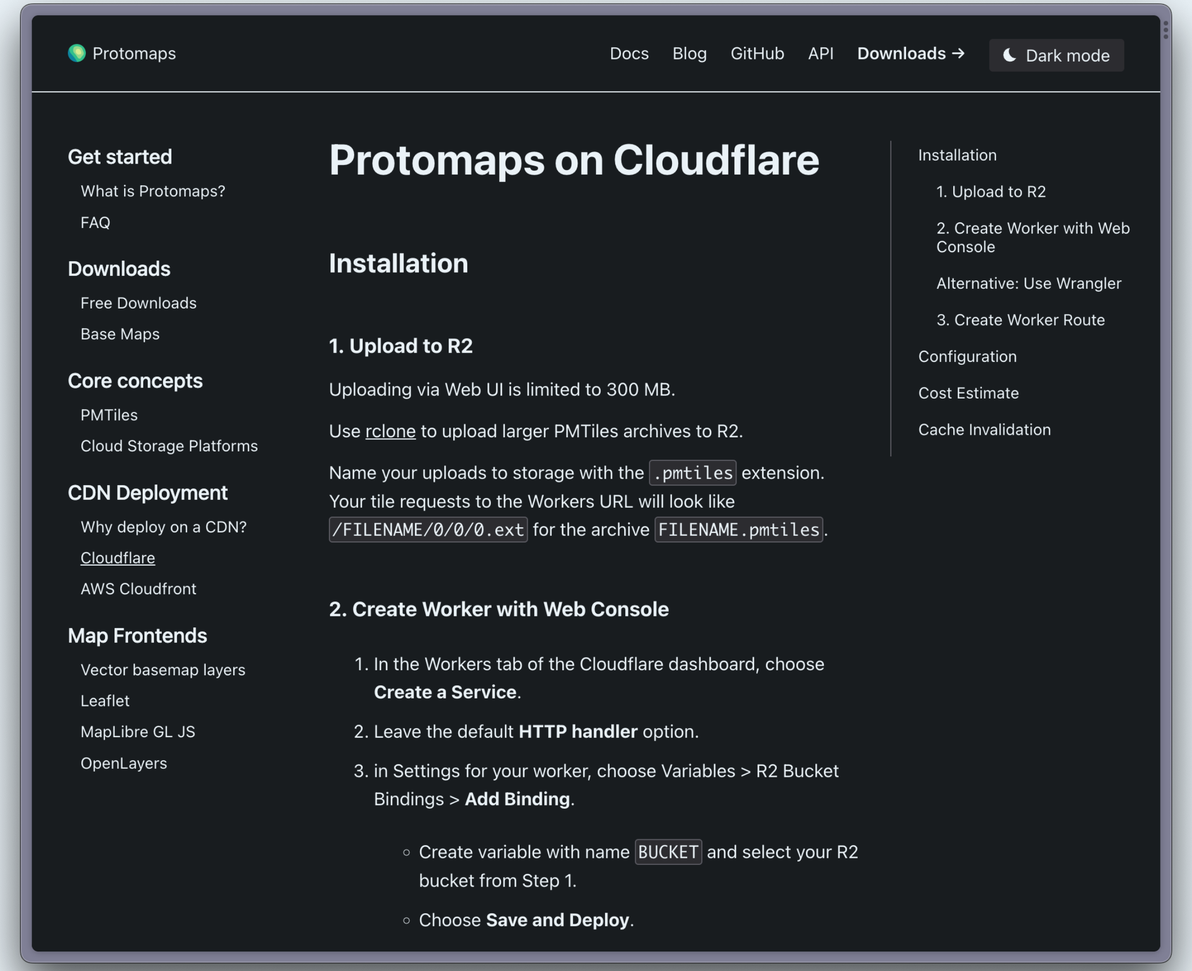
- An application with 5 million tile requests per month
- **~300,000 sessions** (~15-20 tile requests per session)
- Google Maps: $2000 / month
- Protomaps on AWS: **$60 / month**
- Protomaps on Cloudflare: **$10 / month**

Like running your own infrastructure, you can rely on an **all-FOSS geo stack**

Instead of hosted SaaS API secret sauce

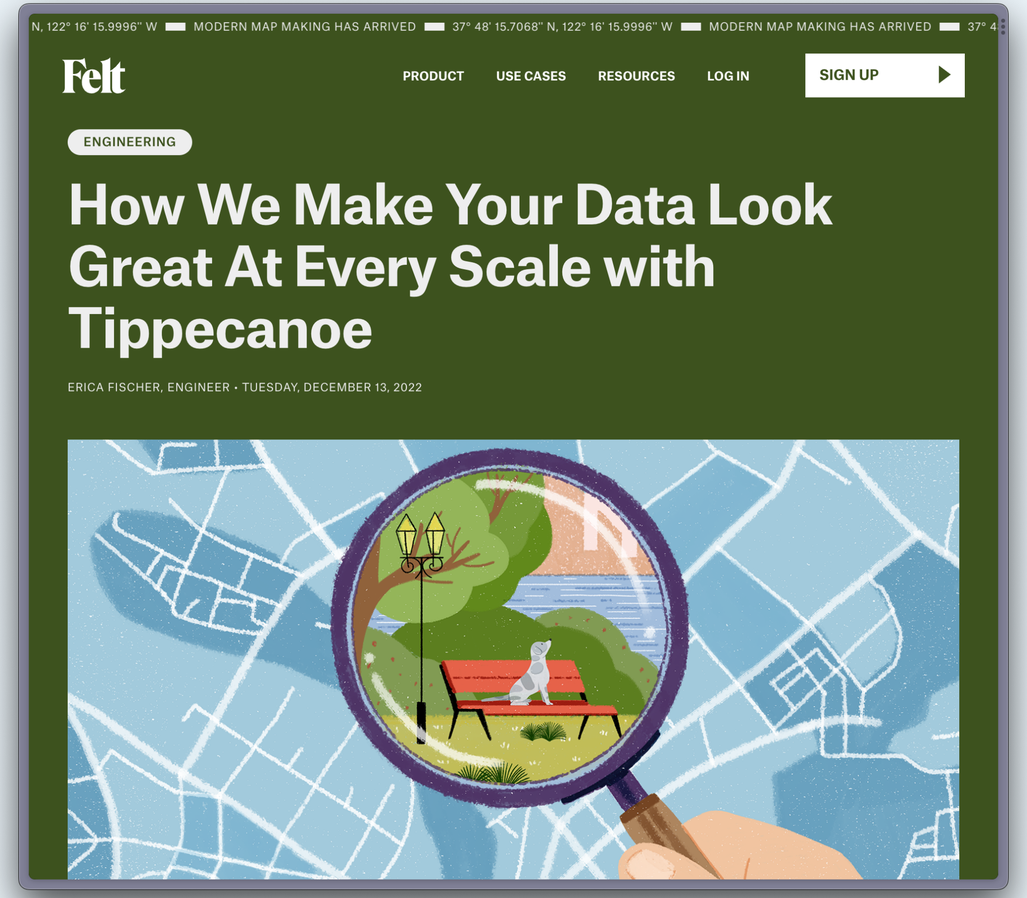
Combating Vendor Lock-in

- Object storage + functions + CDN
- Integrations **work the same way** on Cloudflare and AWS Cloudfront
- **Azure** and Google Cloud support in progress



A true FOSS ecosystem

- github.com/felt/tippecanoe creates PMTiles natively from your own geodata
- github.com/onthegomap/planetiler creates PMTiles basemaps natively from OpenStreetMap
- github.com/protomaps/go-pmtiles inspects, uploads and converts from other formats

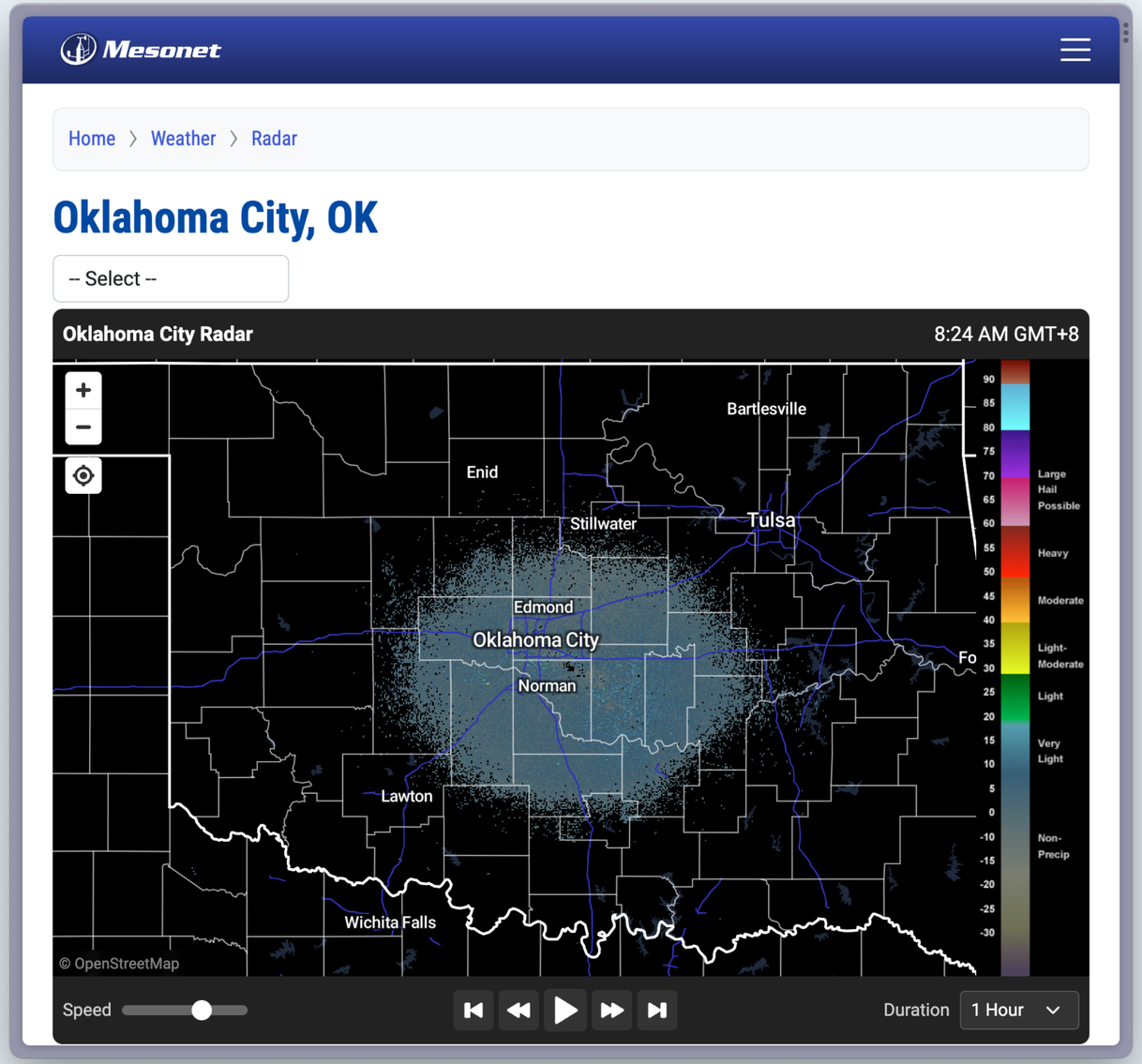


Thanks to Felt for funding this feature!

MesoNet.org

Case Study

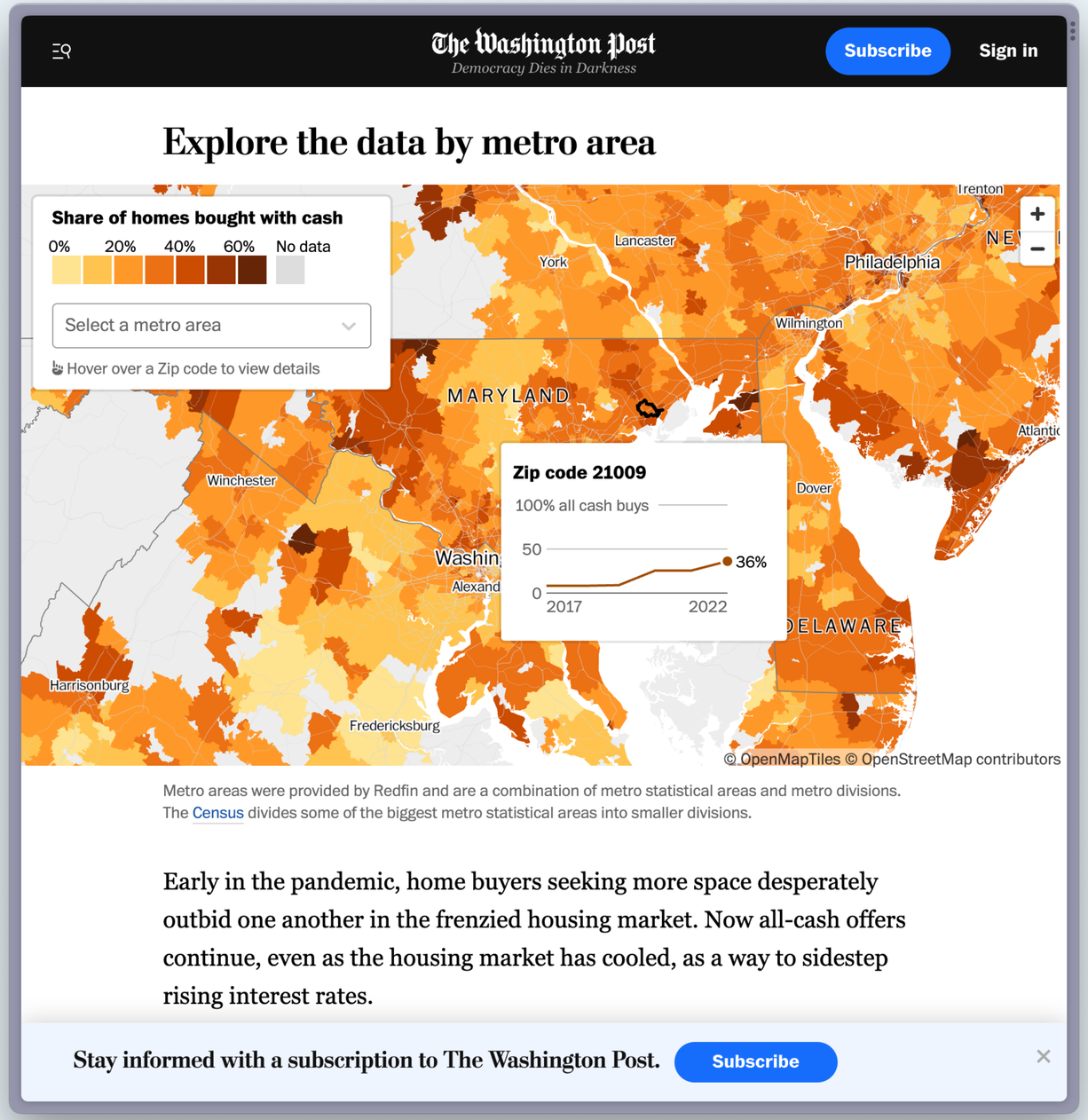
- Public sector + weather web app
- “thanks to the ease of deployment we’ve been able to focus on the rebuild instead of worrying about API Pricing.”



Washington Post

Data Journalism

- High traffic news site
- “PMTiles are an impressive and elegant solution to tile hosting. Deploying a new tileset to a service like Amazon S3 requires uploading just **one big file rather than millions — saving a ton of time.** And we don’t need to run a tileserver to fetch tiles. It’s so smart.” - www.kschaul.com



Good reasons to use Protomaps

- A frontend with static deployment is miles easier to **maintain and budget**
- You want to deploy an open geo stack on **infrastructure you already have**
- Client project handoff needs to be **free of third-party dependencies**
- **Privacy** and GDPR
- Air-gapped offline usage

Reasons not to use Protomaps

- You need the fastest or cheapest map tiling system possible
- Provisioning servers or containers is the fun part of your job
- Managing a regional or planet file on storage is too involved for your project
- **Use the hosted API** at protomaps.com supported by GitHub Sponsors

Thank you Sponsors!

GitHub.com/protomaps/sponsors

- Sponsors support the free hosted API - and you can use it commercially, too
- Free on-demand portal for OSM and basemap tilesets
- Continued development of FOSS ecosystem and basemap product
- Contact: brandon@protomaps.com

protomaps