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Dogfooding Workers at Cloudflare

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Rita Kozlov

Product Manager, Workers

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Cloudflare Workers = Cloudflare's Serverless Platform

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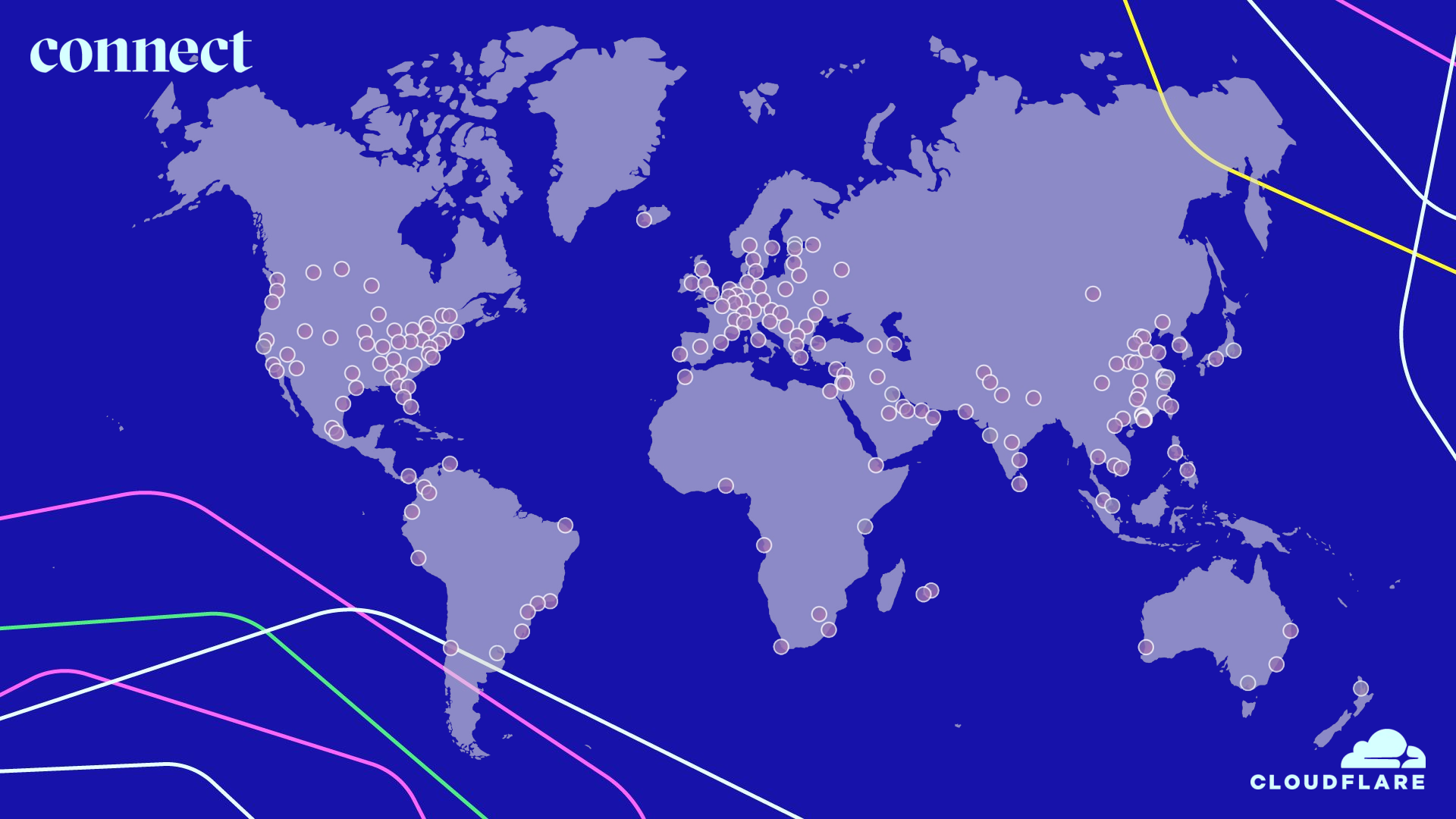
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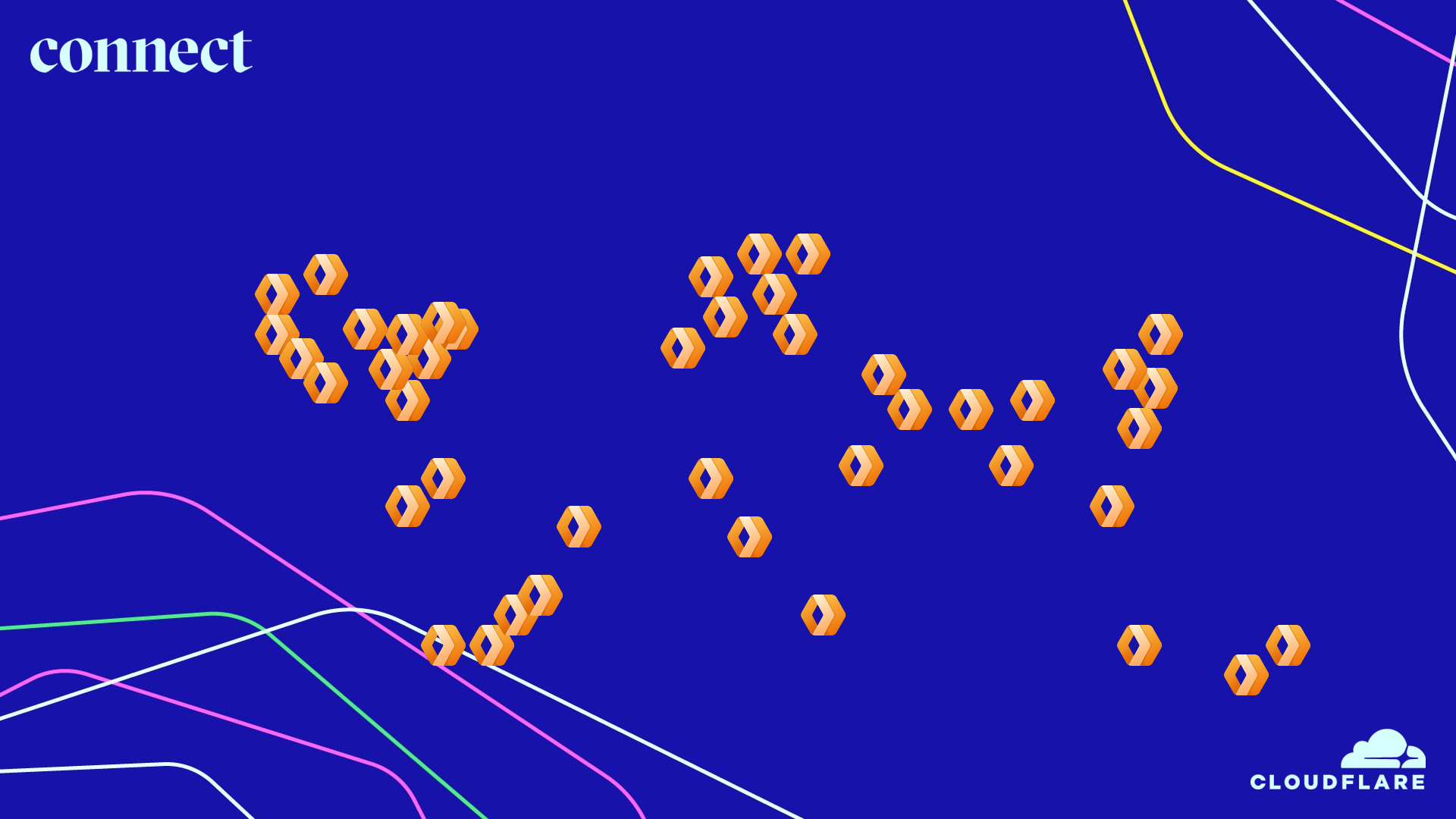

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Serverless

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Serverless at Global Scale

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How do I get started with Cloudflare Workers?

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Gaul’s law

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Designing complex systems is hard

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Start simple!

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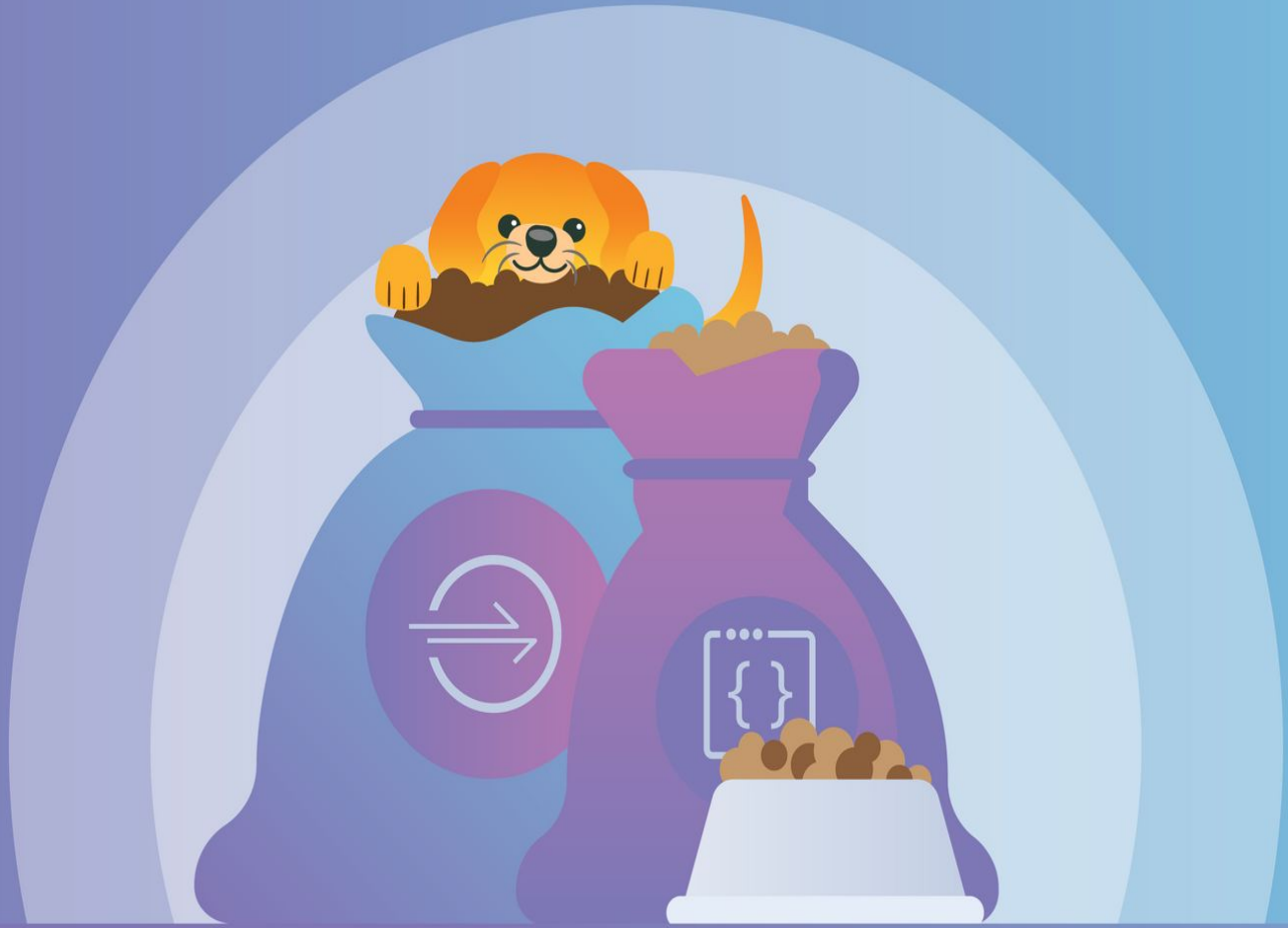
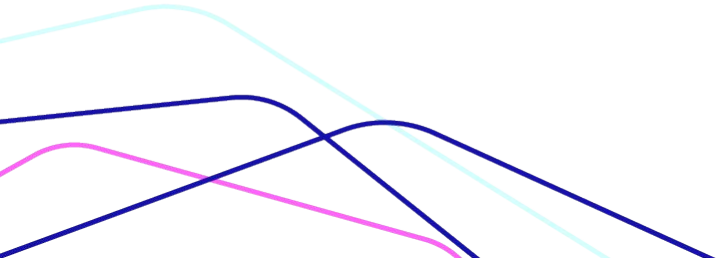


Cloudflare’s Journey into Workers

- **Augment:** Deprecating old TLS
- **Enhance:** Access on Workers
- **Greenfield:** Workers.dev reservation system



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Case study #1: Deprecating old TLS

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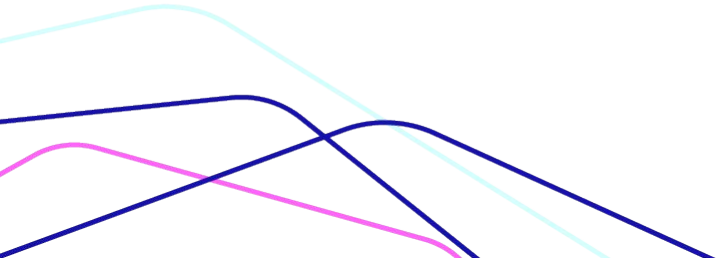
Deprecating old TLS

Requirement

- PCI: need to disable TLS < 1.2



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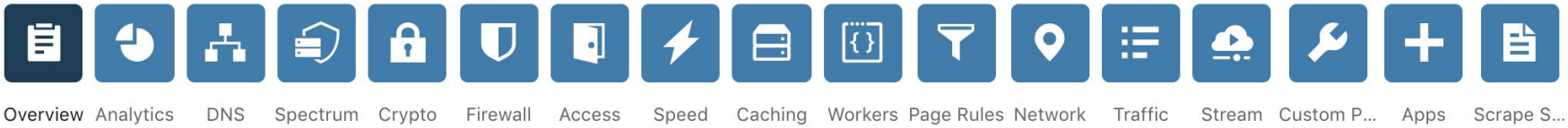
Deprecating old TLS

Requirement

- PCI: need to disable TLS < 1.2

Challenge

- Cloudflare has many different services



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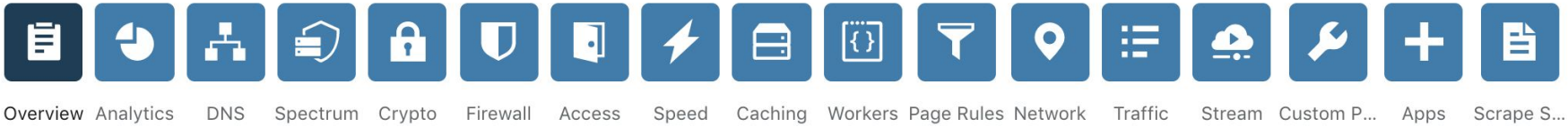
Deprecating old TLS

Requirement

- PCI: need to disable TLS < 1.2

Challenge

- Cloudflare has many different services
- Every service — owned by a different team, different stack



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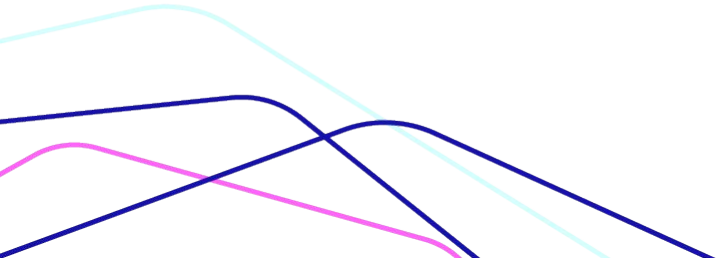
Deprecating old TLS

With Workers

- Cloudflare Workers sits between the eyeball, and the origin(s)
- Set up a proxy
- Disable old TLS at the Worker level



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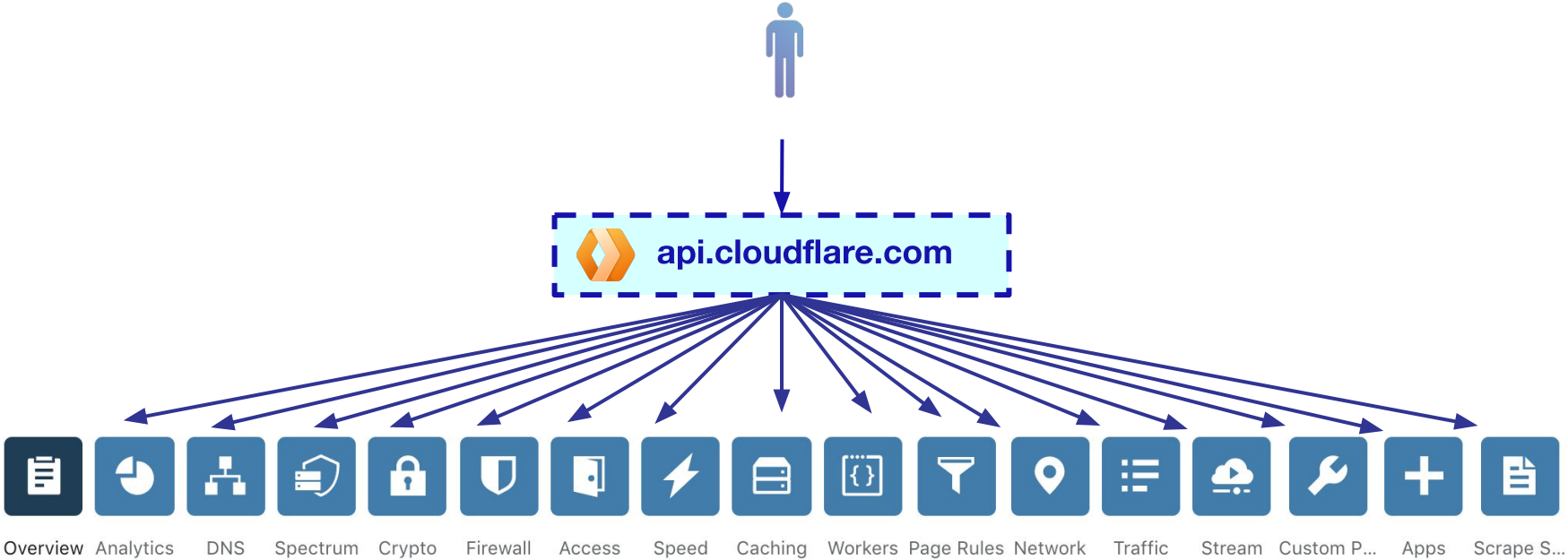
Deprecating old TLS

Solution



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Deprecating old TLS

Super simple!

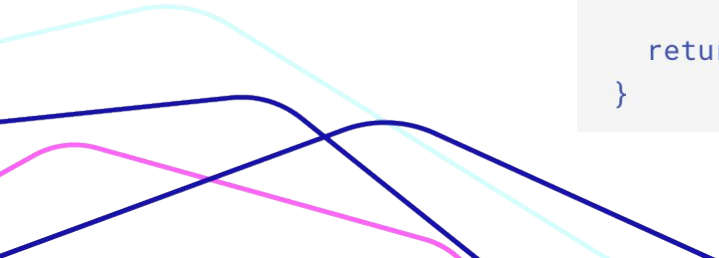
You can do this too!

```
addEventListener('fetch', event => {
  event.respondWith(sslBlock(event.request))
})

async function sslBlock(request) {
  // Find TLS version - This will appear as "undefined" in the Preview
  // For specific cipher blocking, you can inspect request.cf.tlsCipher
  let tlsVersion = (request.cf || {}).tlsVersion

  // Allow only TLS versions 1.2 and 1.3
  if ((tlsVersion != 'TLSv1.2') && (tlsVersion != 'TLSv1.3')){
    return new Response("Please use TLS version 1.2 or higher.",
    { status: 403, statusText: "Forbidden" })
  }

  return fetch(request)
}
```



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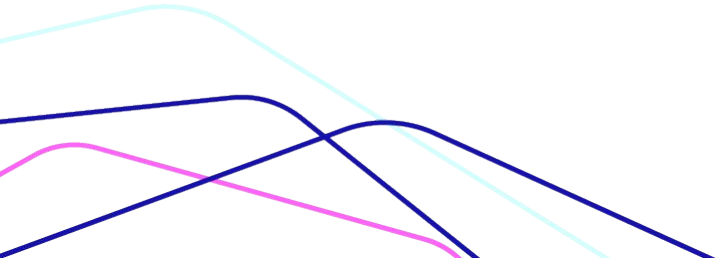
Deprecating old TLS

- Easy to unify many different services
- No performance hit



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Case study #2: Access on Workers

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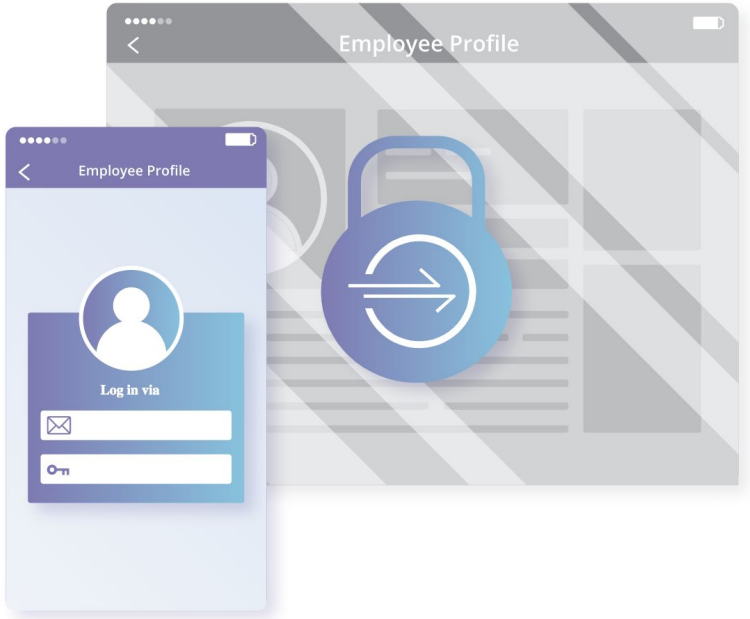
Access on Workers

What is Cloudflare Access?

A perimeter-less access control solution for cloud and on-premise applications.



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Access on Workers

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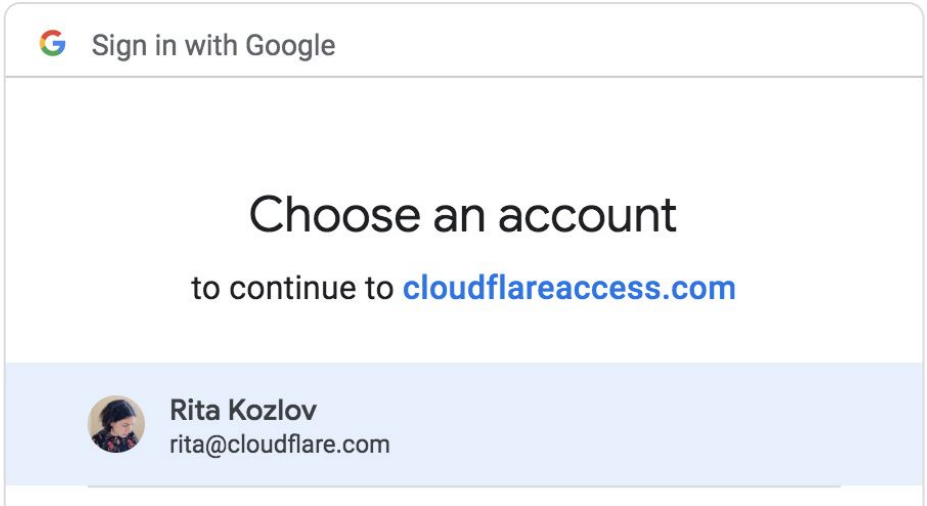
Access on Workers



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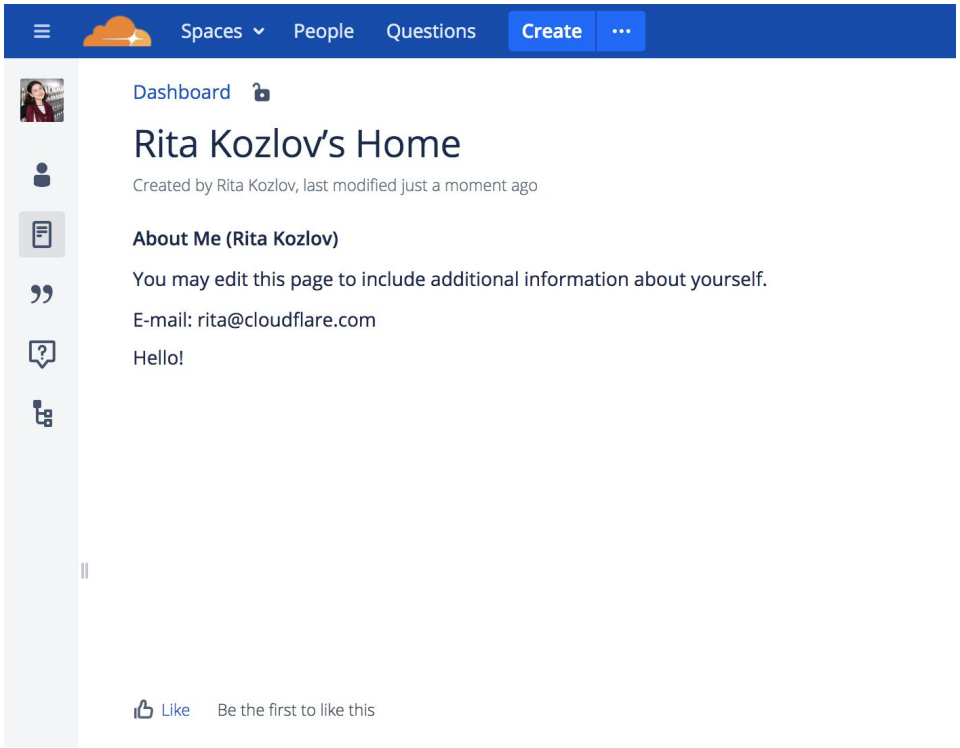
Access on Workers



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Access on Workers

How does it work?

Access on Workers

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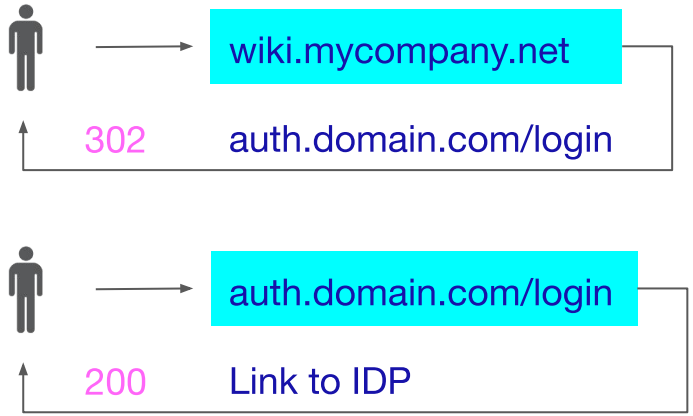

Access on Workers

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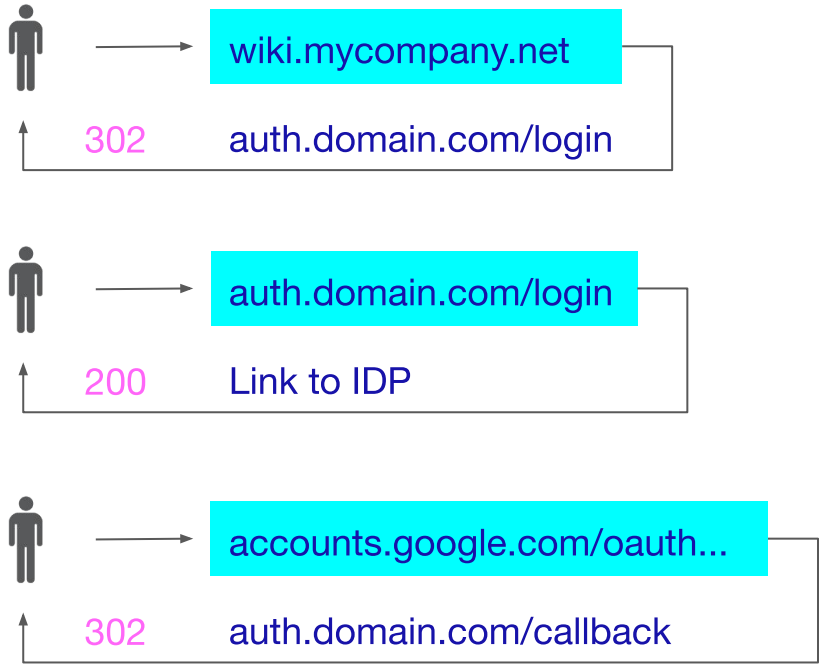

Access on Workers

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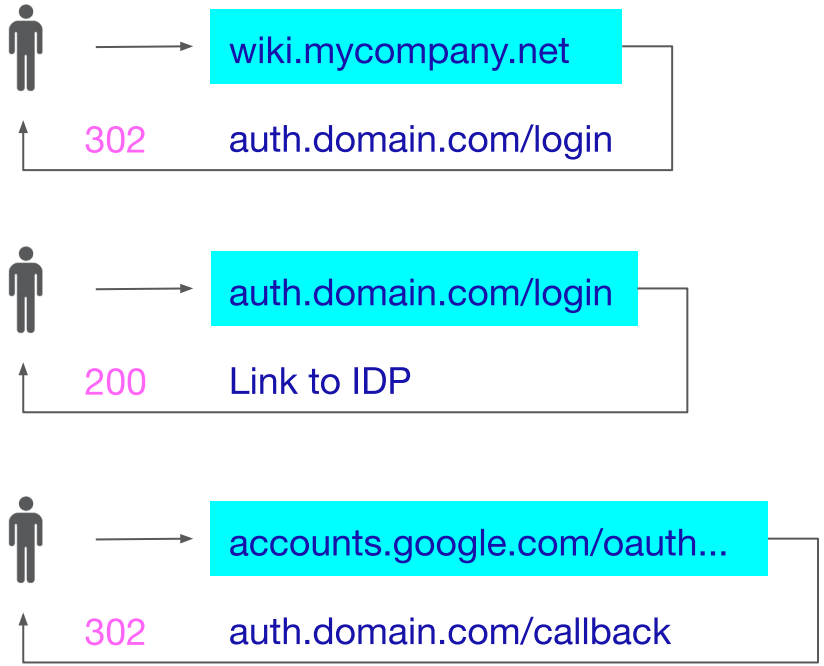

Access on Workers

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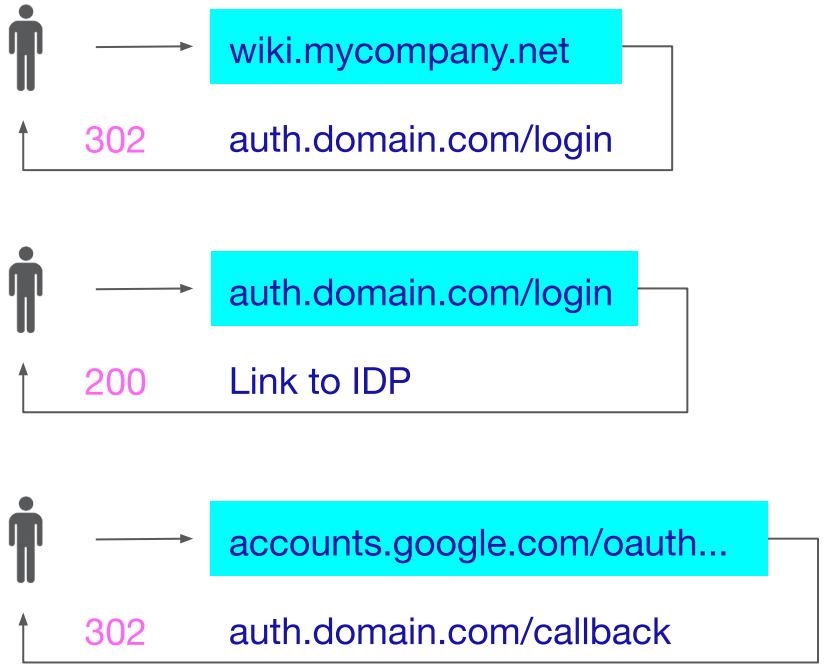
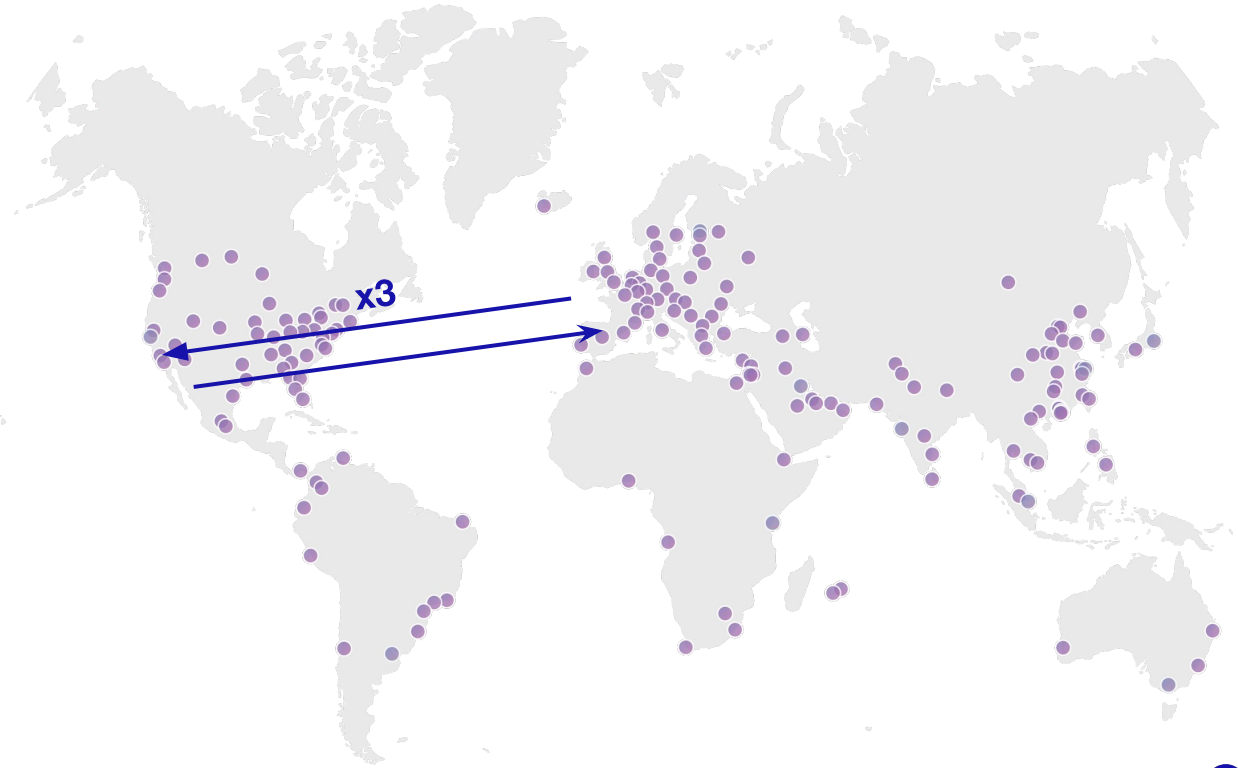


Access on Workers

Challenge

For every action you take, you have to go all the way back to one of our core data centers

- At least 3 times for login path



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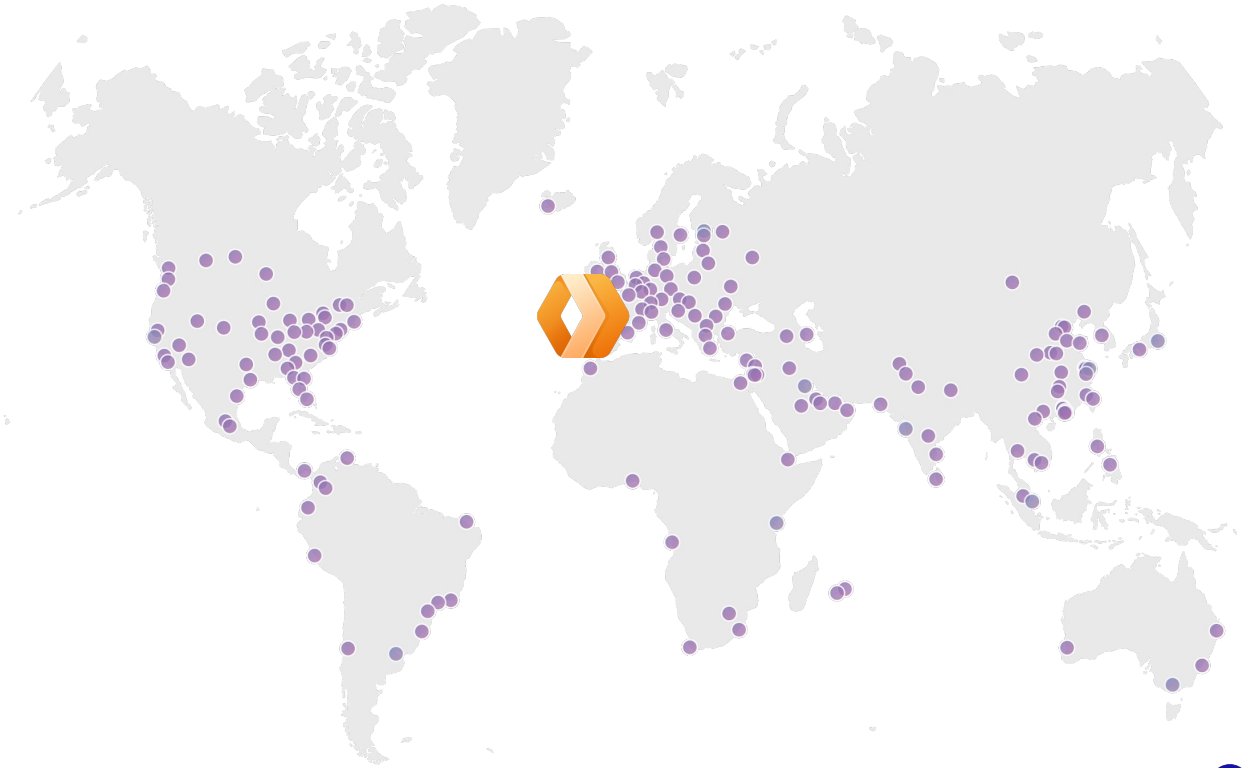
Access on Workers

With Workers:

Do authentication at the edge — all the needed information is in the JWT

- Now only bottleneck is identity provider



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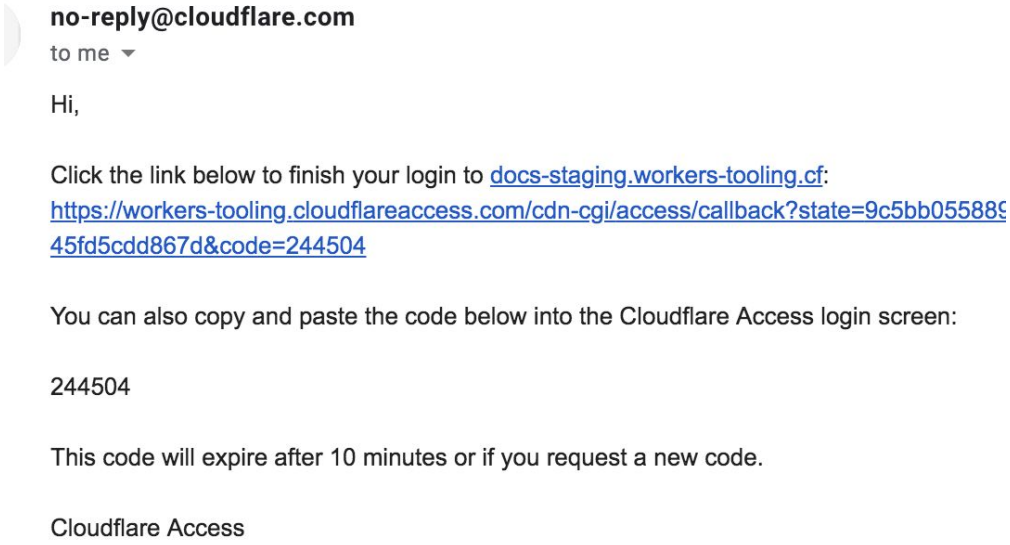
Access on Workers

Single-time nonce



no-reply@cloudflare.com
to me

Hi,

Click the link below to finish your login to docs-staging.workers-tooling.cf:
https://workers-tooling.cloudflareaccess.com/cdn-cgi/access/callback?state=9c5bb055889
45fd5cdd867d&code=244504

You can also copy and paste the code below into the Cloudflare Access login screen:

244504

This code will expire after 10 minutes or if you request a new code.

Cloudflare Access

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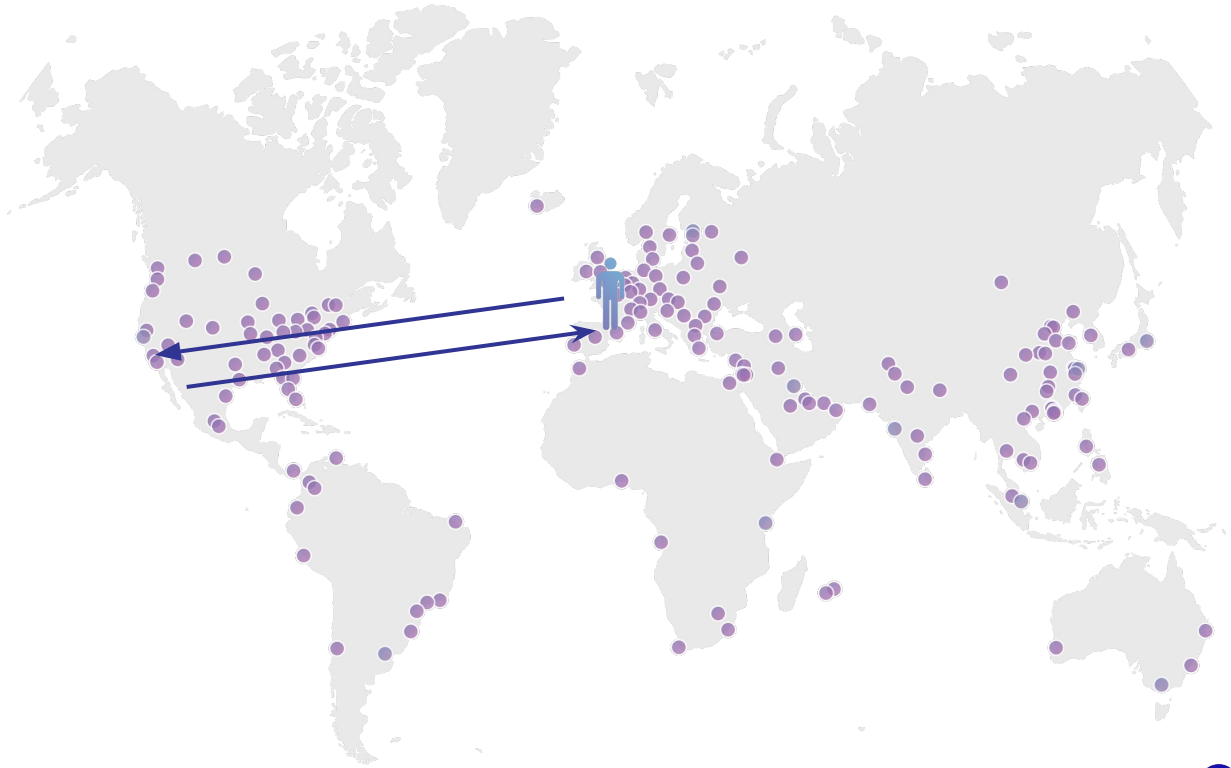
Access on Workers

Challenge

If you use the single time nonce, the nonce would be generated in a single location



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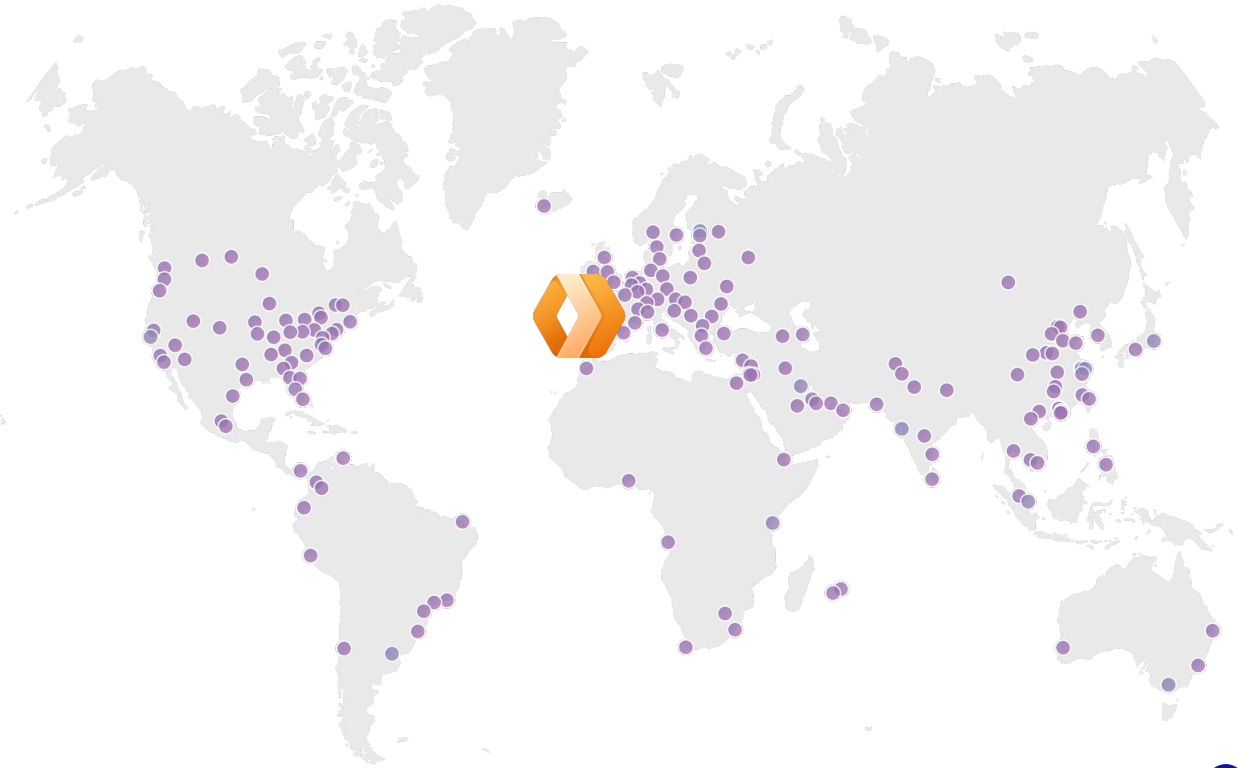
Access on Workers

With Workers

Generate the nonce and store in KV

- Originally used cache API, but when users travel, they might connect to a different PoP



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Access on Workers

Approach: Worker per endpoint

- Split out logic
  - /login
  - /callback
  - etc
- Lower risk deployments
- Easier to work individually

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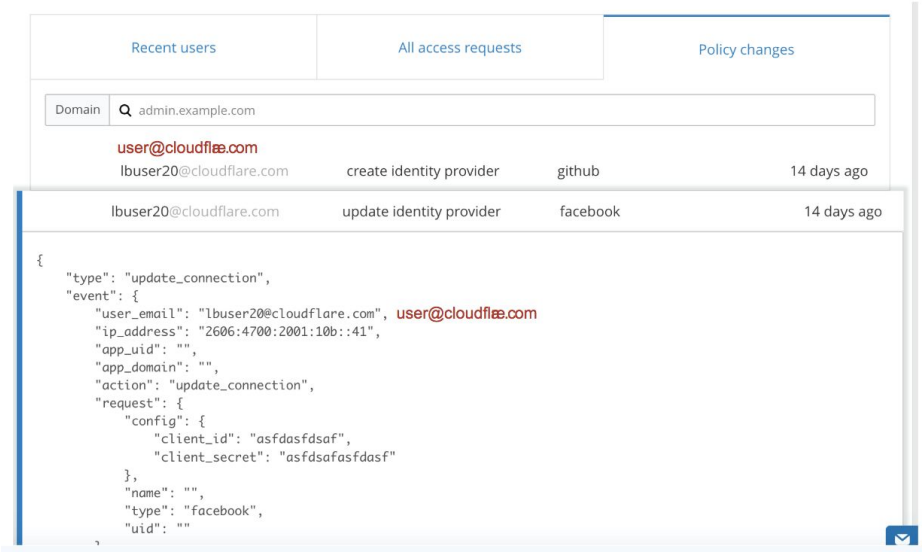
Access on Workers

Approach: logging

Asynchronous logging with

`WaitUntil()`

- Audit logs
- Sentry logs



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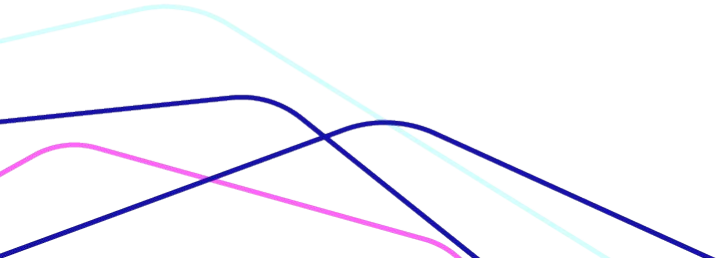
Access on Workers

- Improved performance
- Improved reliability (reduced points of failure)
- Try different approaches



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Case study #3: Reservations for workers.dev

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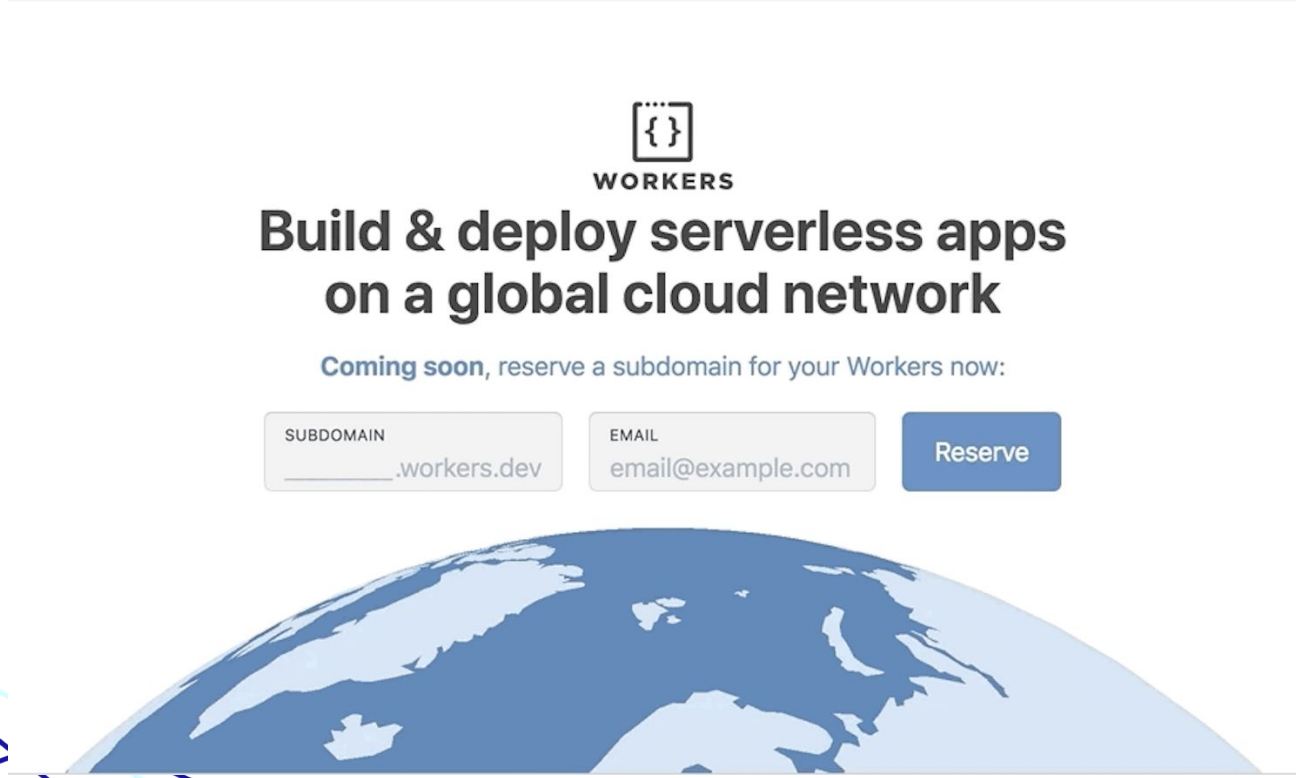
Reservations for workers.dev



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Reservations for workers.dev

Requirements

- Limit reservations to one per email address.
- We only want to allow a single reservation per subdomain— need a reliable uniqueness constraint within the datastore on write.
- Blacklist a few key subdomains

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Reservations for workers.dev

Requirements

- Limit reservations to one per email address.
- We only want to allow a single reservation per subdomain— need a reliable uniqueness constraint within the datastore on write.
- Blacklist a few key subdomains

Challenges

- Didn’t know how many sign-ups we were going to get
- Didn’t want something cumbersome to maintain long term
- Needed something *quickly*

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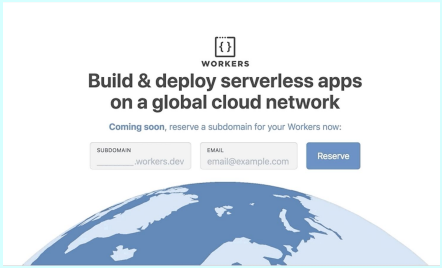
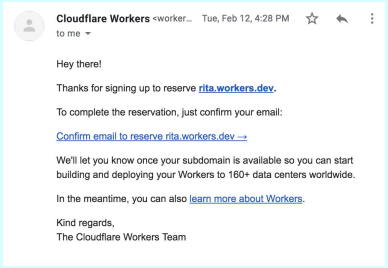
Reservations for workers.dev

Flow

1 Reserve subdomain



2 Send email



3 Confirmed!

rita.workers.dev reserved by rita@cloudflare.com

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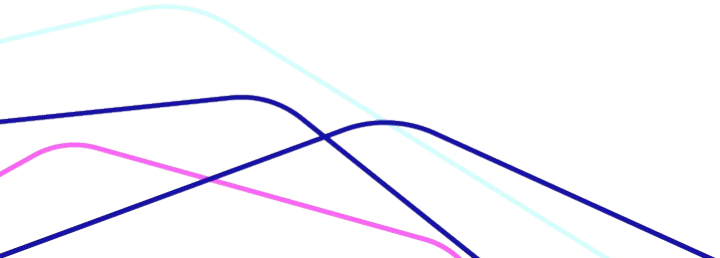
Reservations for workers.dev

Two Workers

- Reserve subdomains
- Validate email



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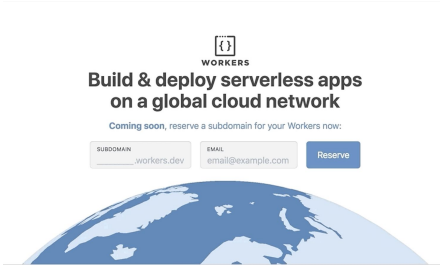
Reservations for workers.dev

Reserve subdomain Worker



Firestore

reservations	
subdomain: rita	email: rita@cloudflare.com

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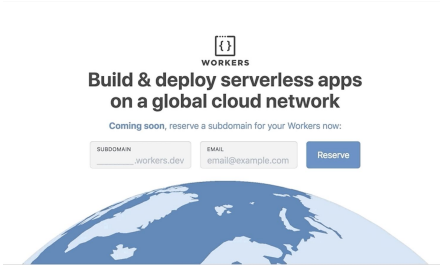
Reservations for workers.dev

Reserve subdomain Worker



Firestore

reservations	
subdomain: rita	email: rita@cloudflare.com

- Auth to GCP
- Check subdomain not taken
- Check subdomain not blacklisted
- Write to Firestore

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Reservations for workers.dev

Assemble data into JSON

```
const fs = require('fs')
const path = require('path')
const YAML = require('yaml-js')

// Service Definition for Cloud Firestore can be found here:
// https://github.com/googleapis/googleapis/blob/master/google/firestore/firestore_v1.yaml
// Service Account Config should be the JSON file you saved in the last step
let [serviceDefinitionPath, serviceAccountConfigPath] = process.argv.slice(2)

let serviceDefinition = YAML.load(fs.readFileSync(serviceDefinitionPath))
let serviceAccountConfig = require(path.resolve(serviceAccountConfigPath))

// JWT spec at https://developers.google.com/identity/protocols/OAuth2ServiceAccount#jwt-auth
let payload = {
  aud: `https://${serviceDefinition.name}/${serviceDefinition.apis[0].name}`,
  iss: serviceAccountConfig.client_email,
  sub: serviceAccountConfig.client_email,
}

let privateKey = serviceAccountConfig.private_key
let privateKeyID = serviceAccountConfig.private_key_id
let algorithm = 'RS256'
let url = `https://firestore.googleapis.com/v1beta1/projects/${serviceAccountConfig.project_id}/databases/(default)/documents`

// The object we want to send to KV
let FIREBASE_JWT_CONFIG = {
  payload,
  privateKey,
  privateKeyID,
  algorithm,
  url,
}

// Write out to JSON file to send to KV
fs.writeFileSync('./config/metadata.json', JSON.stringify(FIREBASE_JWT_CONFIG))

console.log('Worker metadata file created at', metadataFilename)
```

Auth to GCP using JWT

```
import jose from 'node-jose';

/**
 * Generate a Google Cloud API JWT
 *
 * @param config - the JWT configuration
 */
export default async function generateJWT(config) {
  const iat = new Date().getTime() / 1000;
  let payload = {
    ...config.payload,
    iat: iat,
    exp: iat + 3600
  };

  const signingKey = await jose.JWK.asKey(
    config.privateKey.replace(/\\n/g, '\n'),
    'pem'
  );

  const sign = await jose.JWS.createSign(
    { fields: { alg: config.algorithm, kid: config.privateKeyID } },
    signingKey
  )
    .update(JSON.stringify(payload), 'utf8')
    .final();

  const signature = sign.signatures[0];
  return [signature.protected, sign.payload, signature.signature].join('.');
}
```

https://blog.cloudflare.com/api-at-the-edge-workers-and-firestore/

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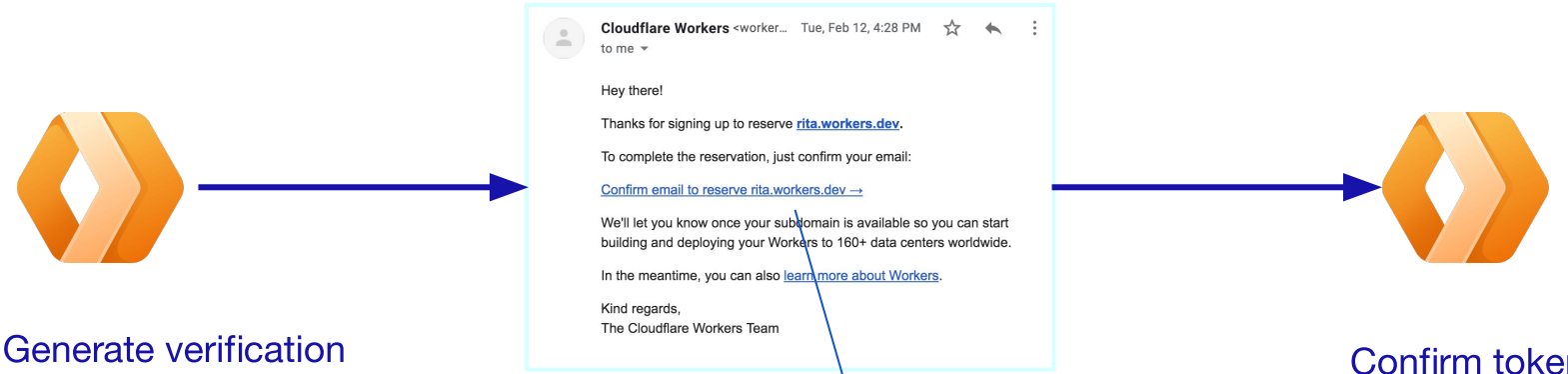
Reservations for workers.dev

Verify email Worker



- Generate verification token & store in Firestore
- Use Mandrill API to send email

https://workers.dev/?**email**=rita%40cloudflare.com&**token**=ClO6kdDKSc8dDlVVnqJK&subdomain=rita

Confirm token

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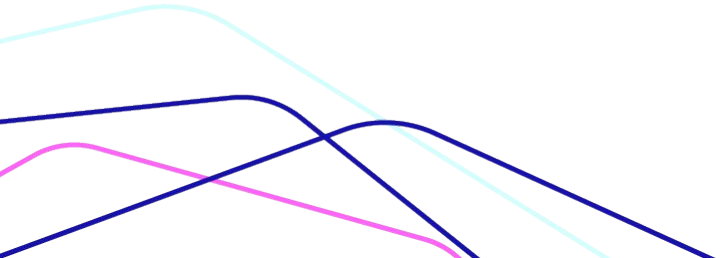
Reservations for workers.dev

- Successful launch
- Seamlessly scalable
- No double-bookings!
- No need to maintain
- Can be used with any APIs / cloud providers



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What did we learn?

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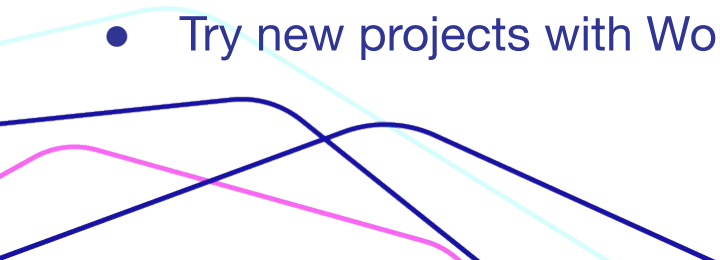
What did we learn?

- Start small!
  - Move functionality to the edge deliberately
- Break up endpoints into multiple Workers
  - Deploy frequently!
  - Work in small, independent teams
- Workers allow us to move quickly
  - Constantly iterate — higher engineering velocity
- Try new projects with Workers



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Thank you!
Questions?
rita@cloudflare.com

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