Deploying Fast and Large Scale Web Applications

Thierry Sans

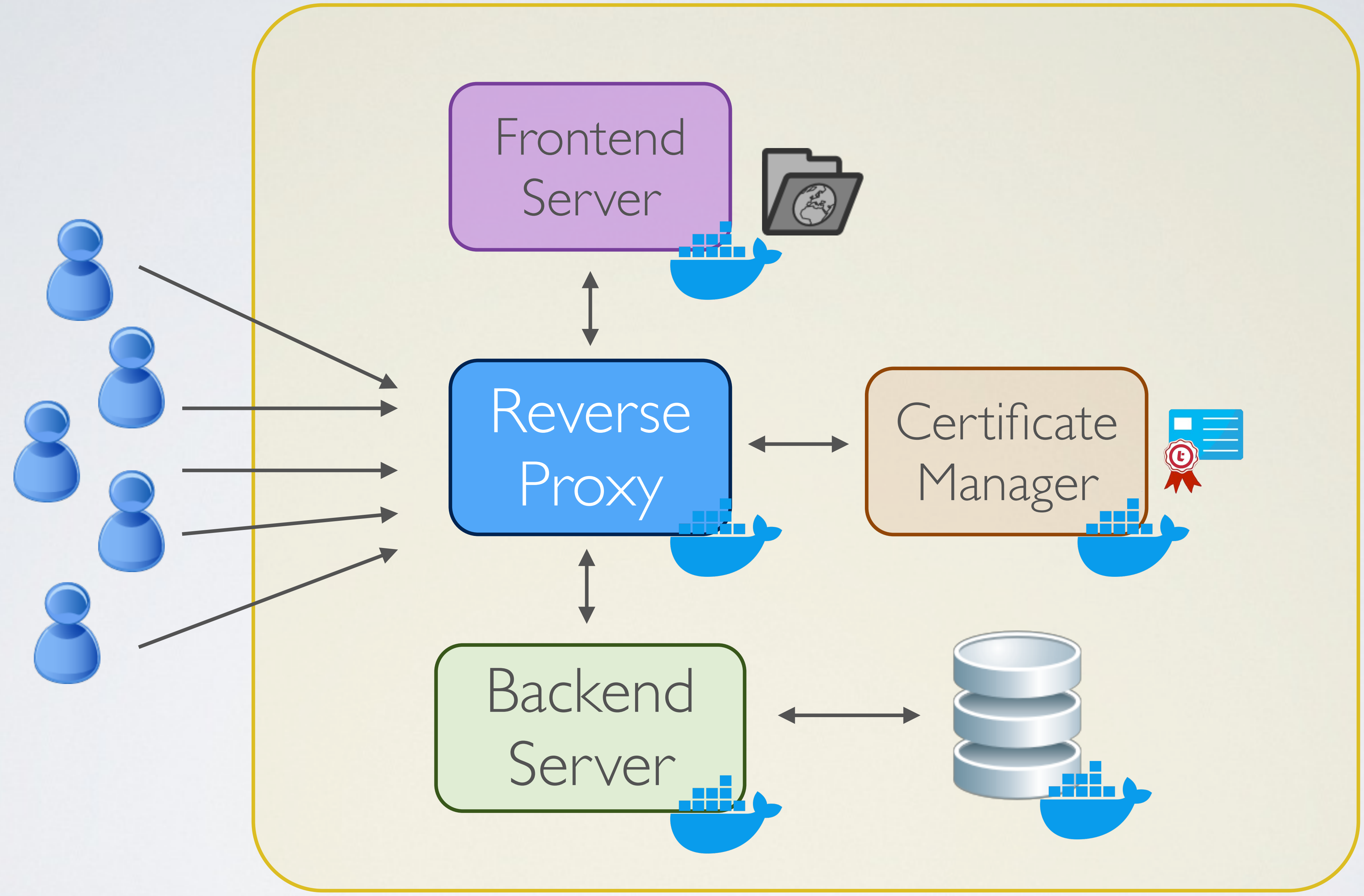
Users respond to speed

"Amazon found every 100ms of latency cost them 1% in sales"

"Google found an extra .5 seconds in search page generation time dropped traffic by 20%"

http://blog.gigaspaces.com/amazon-found-every-100ms-of-latency-cost-them-1-in-sales/

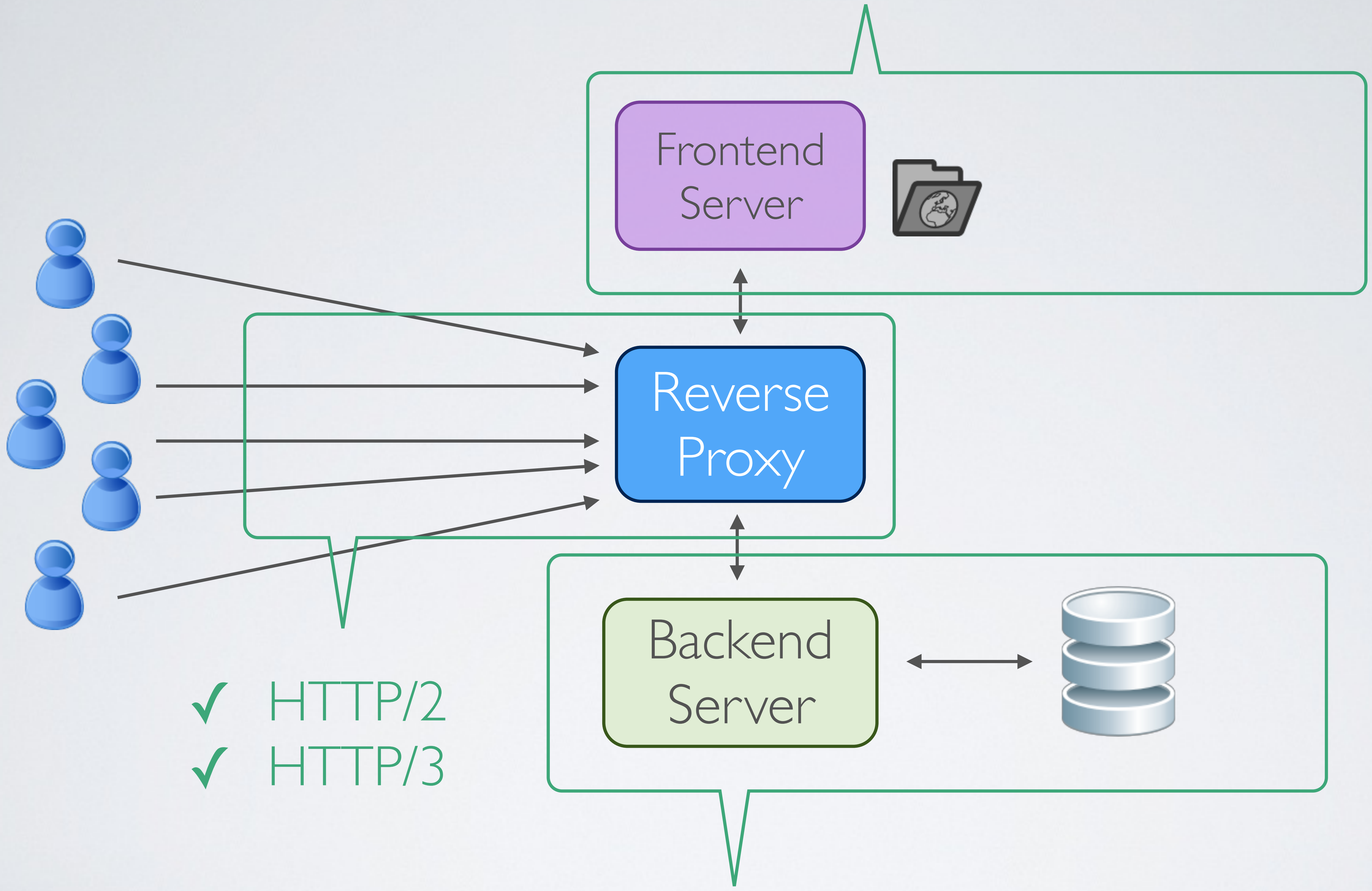
Our deployment (so far)



Problems

- How to increase the throughput?
- How to scale to serve millions of users?

Solutions



✓ Web Packing
✓ Progressive Web Applications (PWA)

✓ HTTP/2
✓ HTTP/3

✓ Faster web caching
✓ Better scalability with load balancer and CDN

HTTP/2

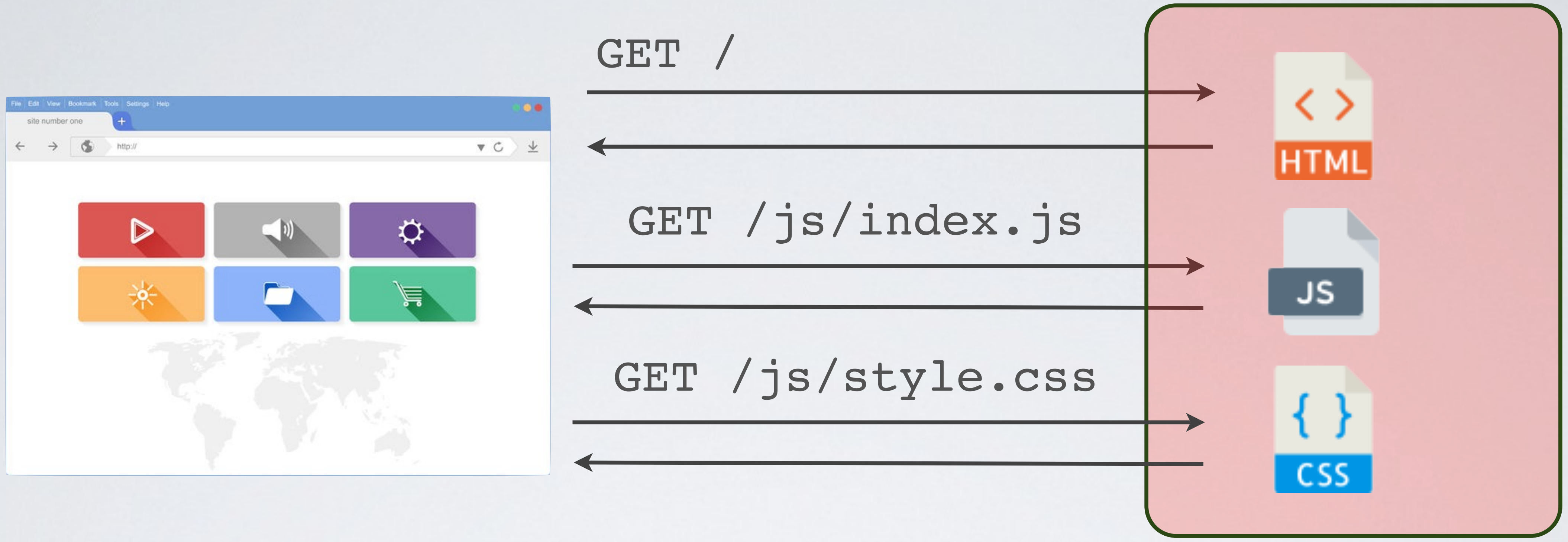
HTTP/2

HTTP/2 enables multiplexing

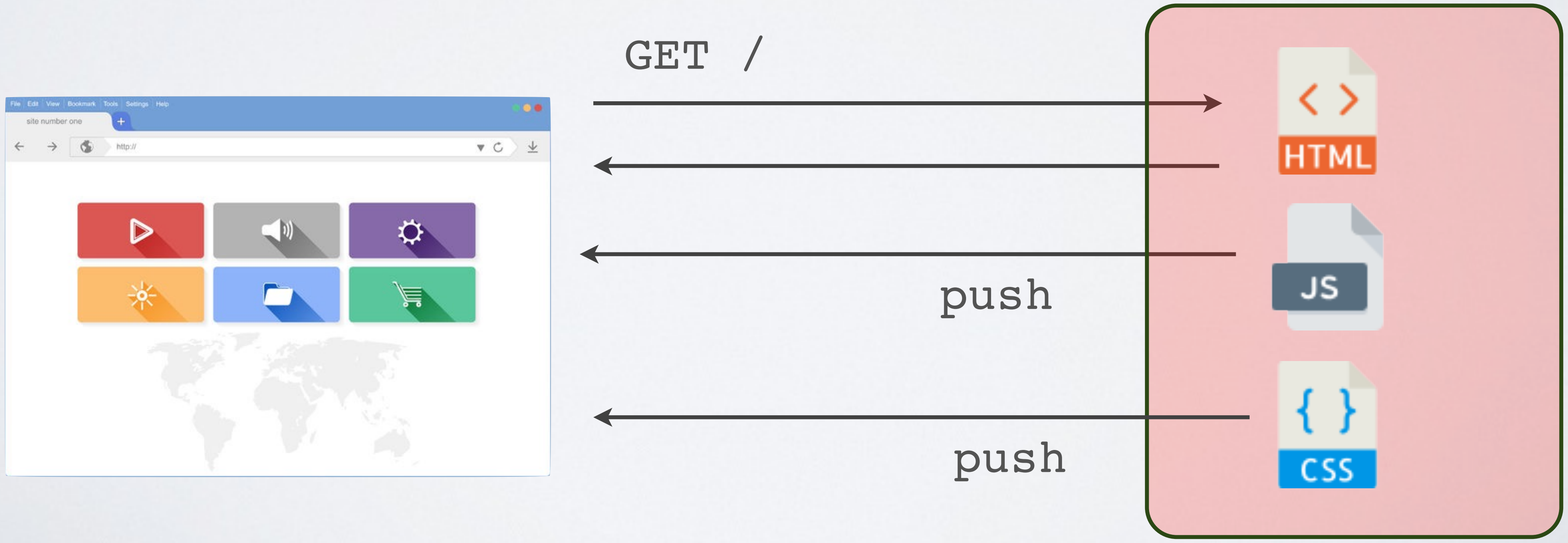
➡ send multiple HTTP responses for a given request (a.ka `push`)

- Proposed by Google (called SPDY)
- Adopted as an standard in 2015 (RFC 7540)
- HTTP/2 is compatible with HTTP/1 (same protocol)

HTTP 1.1



HTTP 2.0

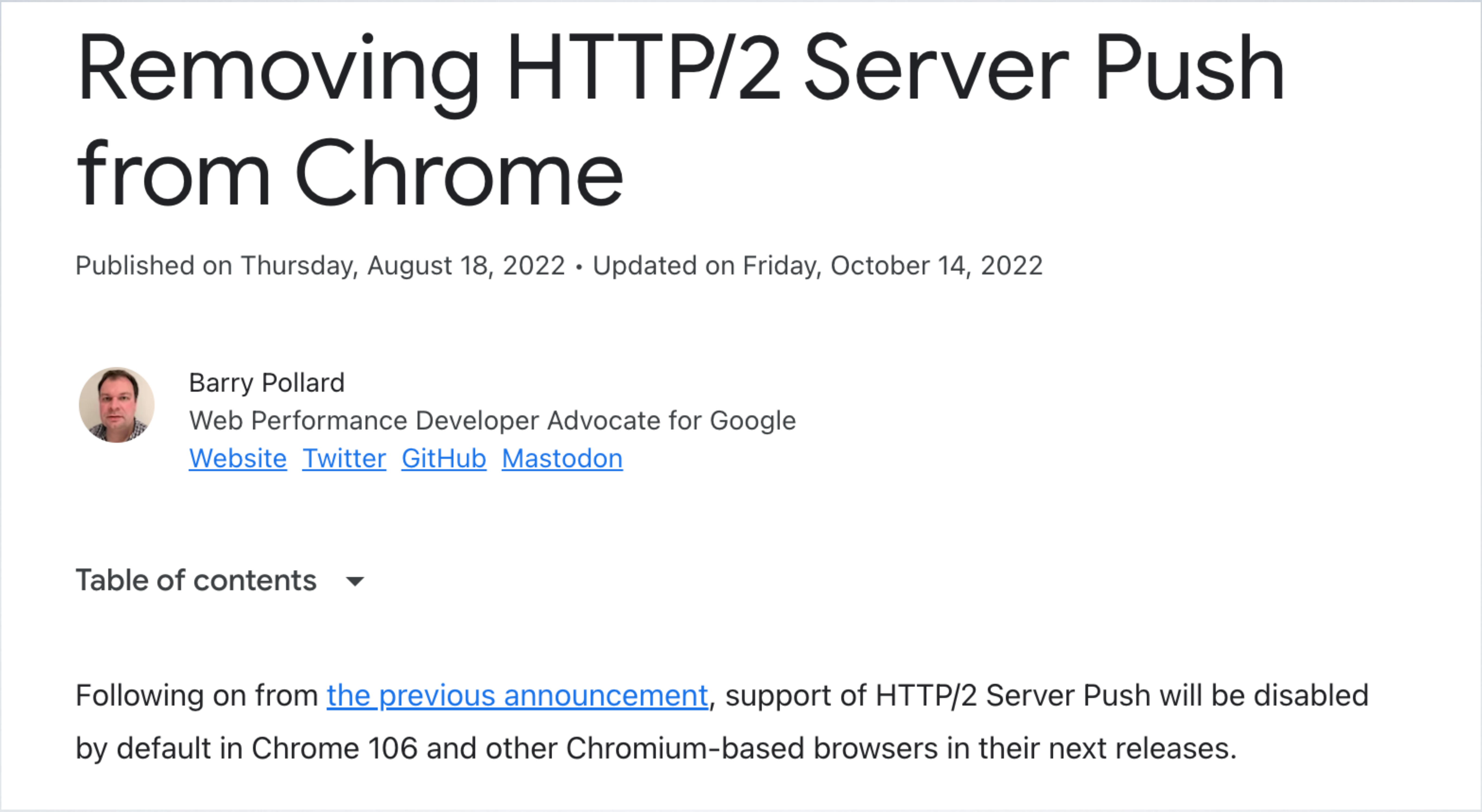


Great technology ... but nobody uses it!

Google is planning to remove the push feature from Chrome!

"Almost five and a half years after the publication of the HTTP/2 RFC, server push is still extremely rarely used. Over the past 28 days, 99.95% of HTTP/2 connections created by Chrome never received a pushed stream, and 99.97% of connections never received a pushed stream that got matched with a request. These numbers are exactly the same as in June 2019"

source https://groups.google.com/a/chromium.org/g/blink-dev/c/K3rYLvmQUBY/m/vOWBKZGoAQAJ?pli=1



Removing HTTP/2 Server Push from Chrome

Published on Thursday, August 18, 2022 • Updated on Friday, October 14, 2022

Barry Pollard
Web Performance Developer Advocate for Google
Website Twitter GitHub Mastodon

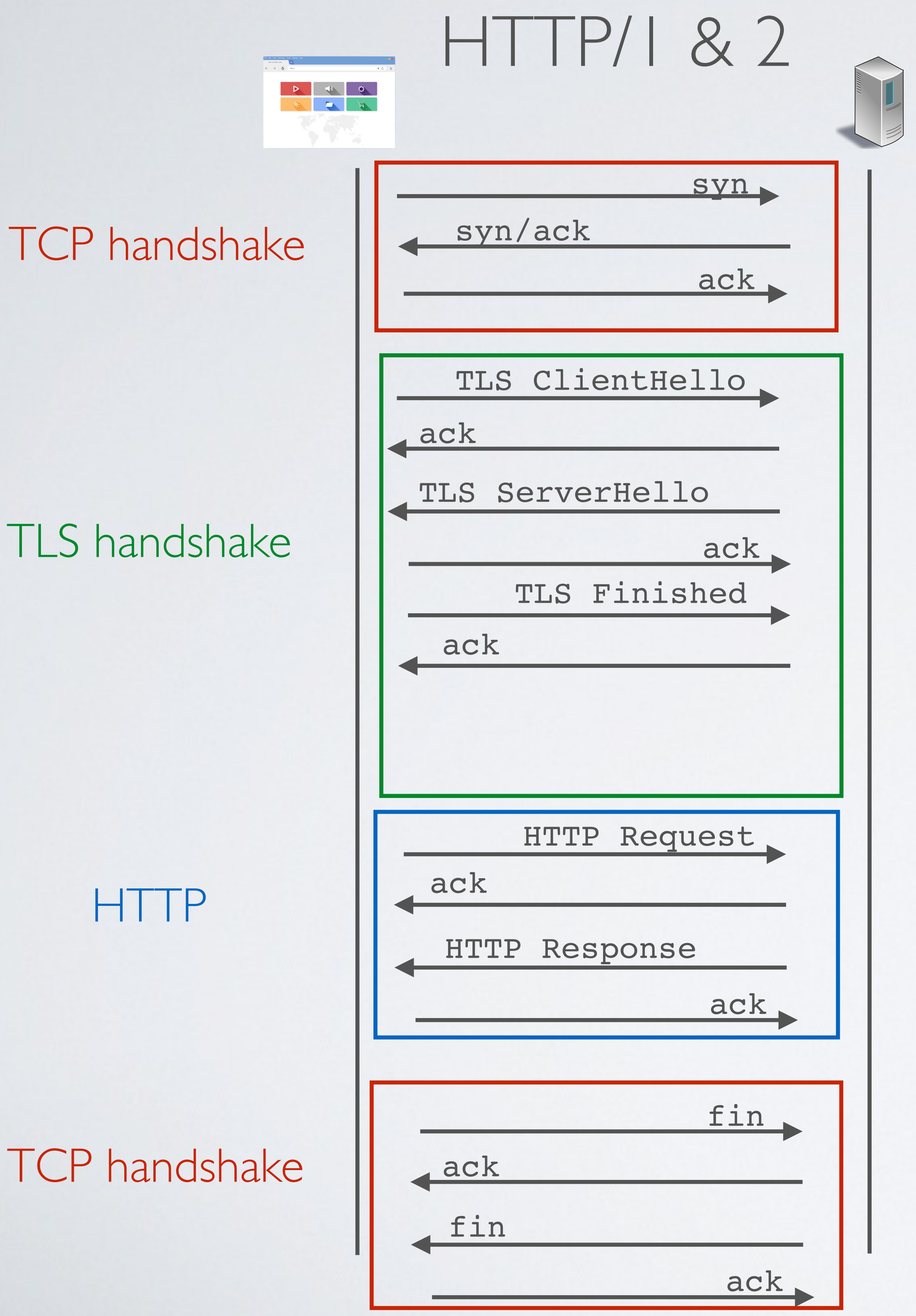
Table of contents

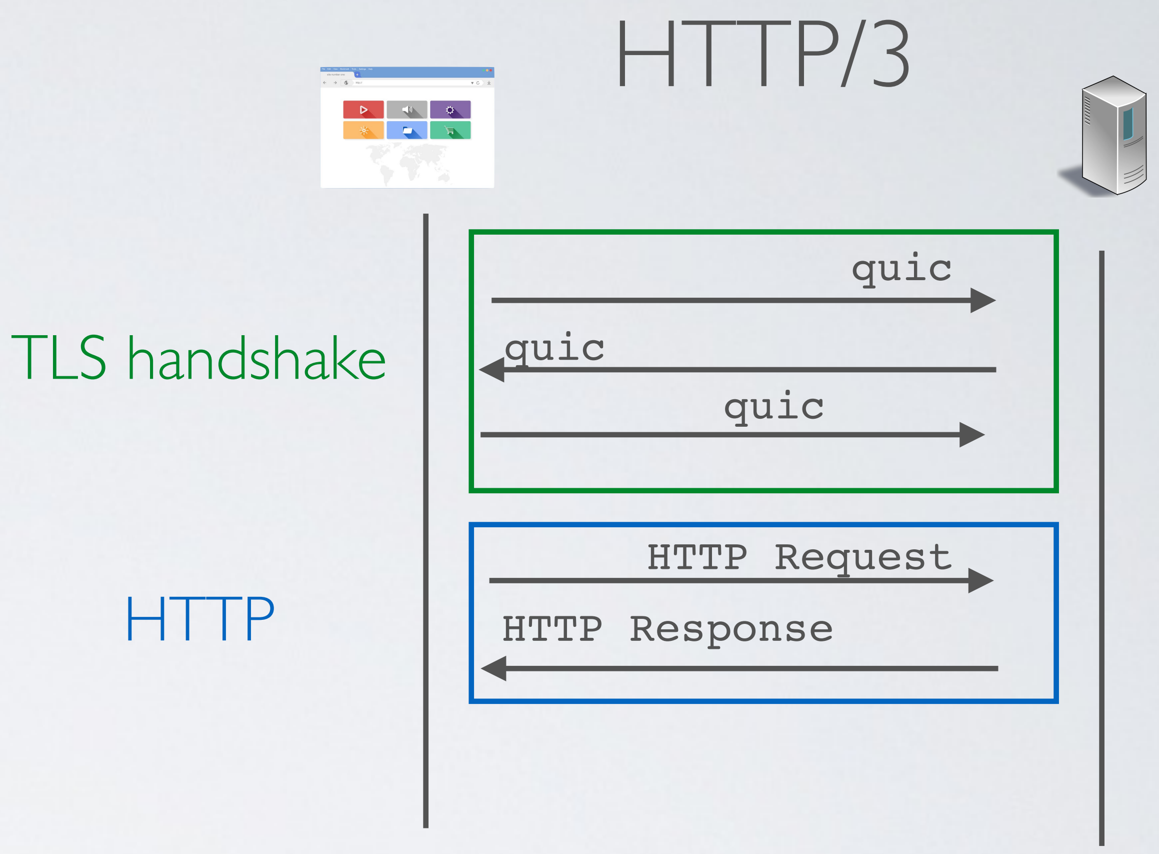
Following on from the previous announcement, support of HTTP/2 Server Push will be disabled by default in Chrome 106 and other Chromium-based browsers in their next releases.

HTTP/3

(work in progress)

HTTP/3 (standard draft)





➡ Use UDP instead of TCP

Still Experimental

- Chrome v85 (Apr'20)
- NodeJS v15 (Oct'20) - but still an experimental feature https://github.com/nodejs/node/issues/57281
- Firefox v88 (Apr'21)
- IETF Standard (June'22)
- Nginx v1.25 (May'23) - but module not built by default

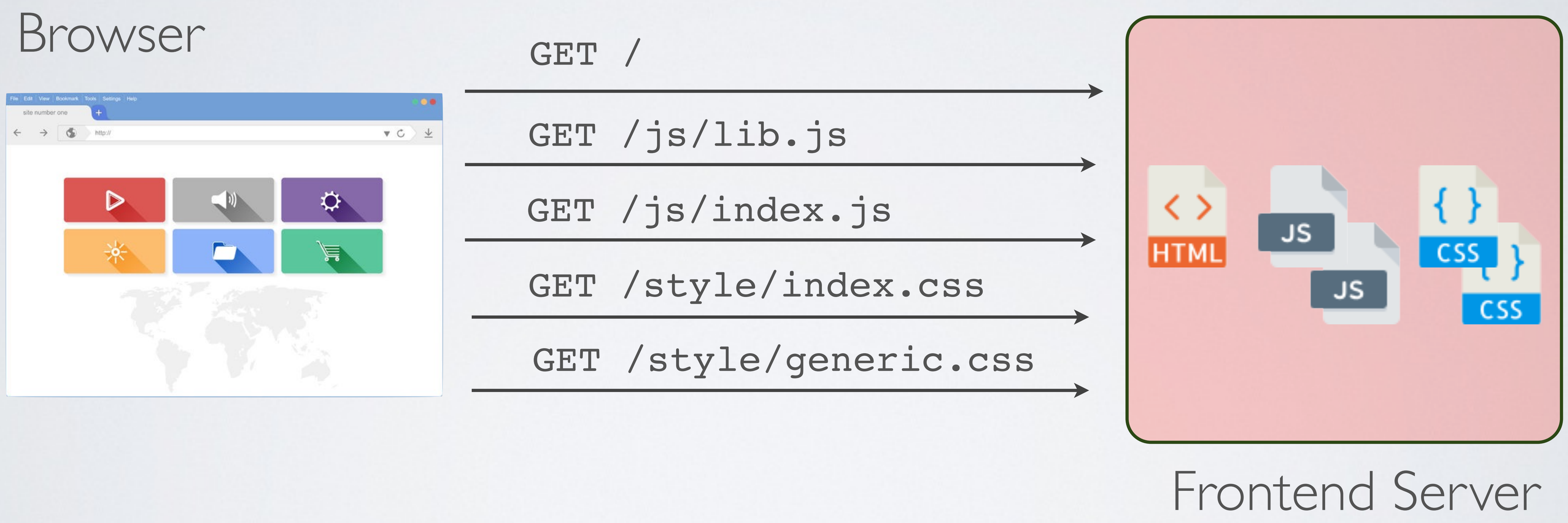
WebTransport API

WebTransport API
a modern version of Web Sockets based on *Quic*

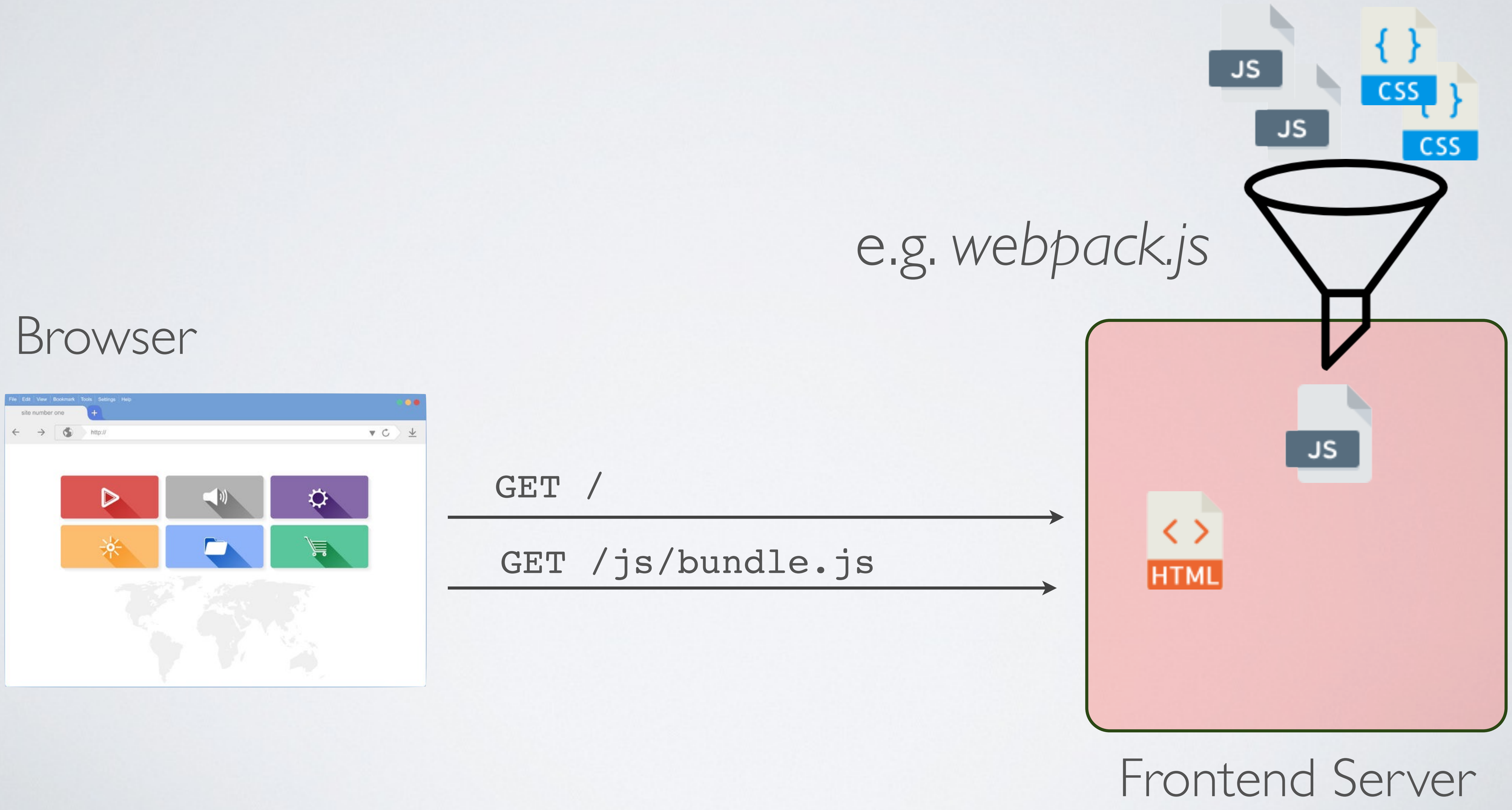
- Faster than WebRTC
- Client/Server full duplex (but no browser P2P yet)

Frontend packing

The problem


Browser
GET /
GET /js/lib.js
GET /js/index.js
GET /style/index.css
GET /style/generic.css
HTML
JS
JS
CSS
CSS
Frontend Server

The solution - using a frontend packer



PWA
Progressive Web Applications

The idea

➡ A web application that can be installed on your system

- Relies on browser local storage to store the frontend (and checks for update with the server)
- Relies on Web-Workers for caching and communication

Backend Web Caching

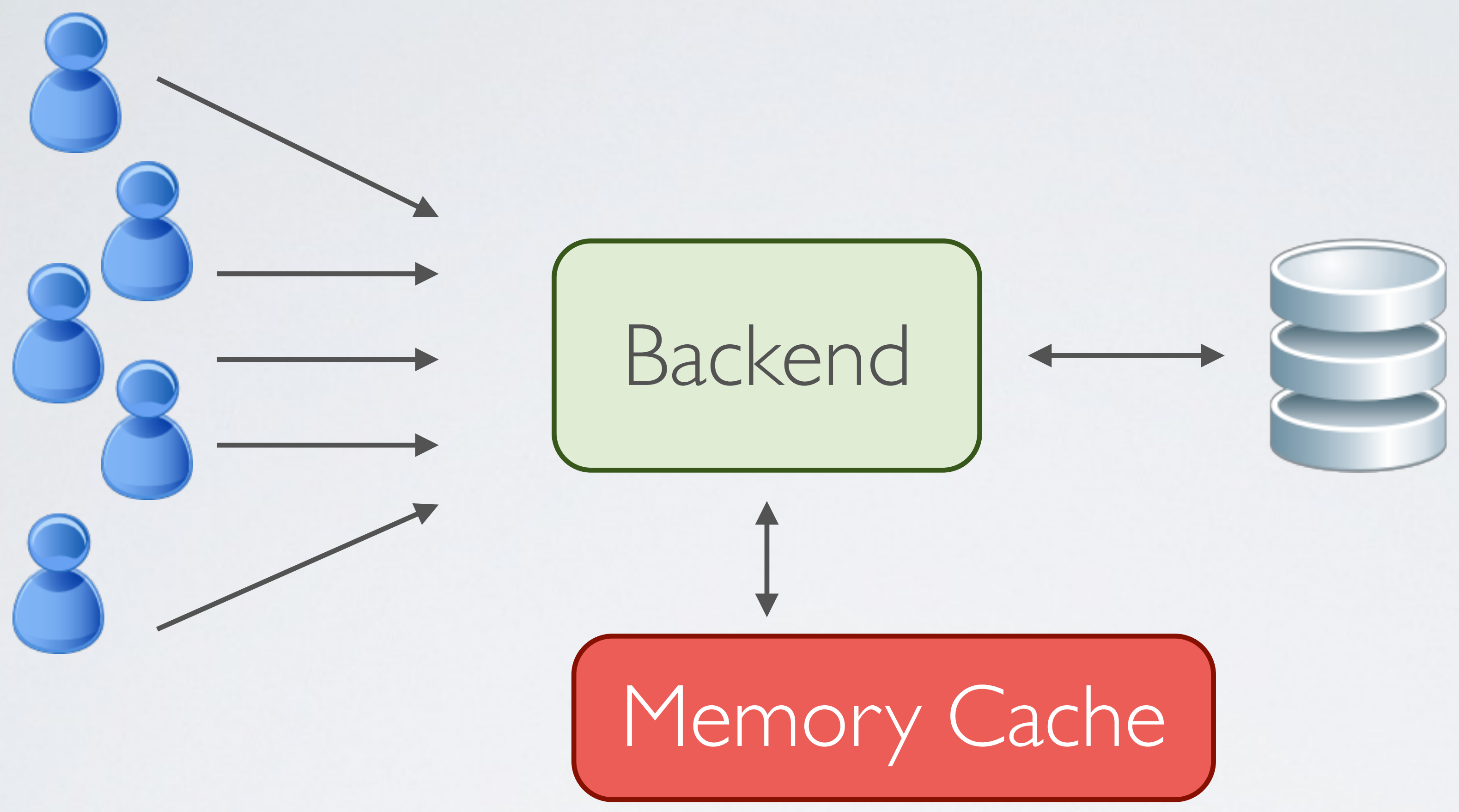
How to improve response time?

Processing the request means:

1. Parse the HTTP request
2. Map the URL to the handler
3. Query the database or third-party API
4. Compute the HTTP response

DB and API accesses are expensive (in time but also money when your host charges you each access)

Fine-grained caching with the web application



Cache controlled by the program

◉ Specific for each app

✓ Good for caching database requests and storing sessions

➡ Popular memory cache : *Memcached*

Distributed Shared Cache : Memcached

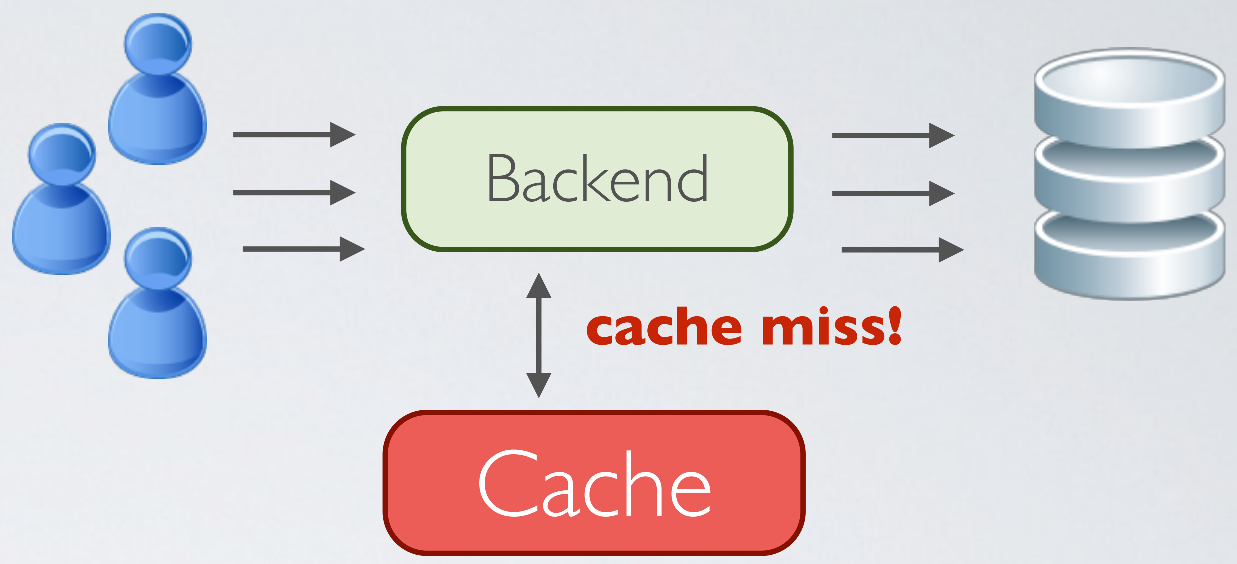
http://memcached.org/

- Store key/value pairs in memory
- Throw away data that is the least recently used

A typical cache algorithm

```
retrieve from cache
if data not in cache:
   # cache miss
   query the database or API
   update the cache
return result
```

Cache Stampede (a.k.a dog piling)



Problem:

Multiple concurrent requests doing the same request because cache was cleared

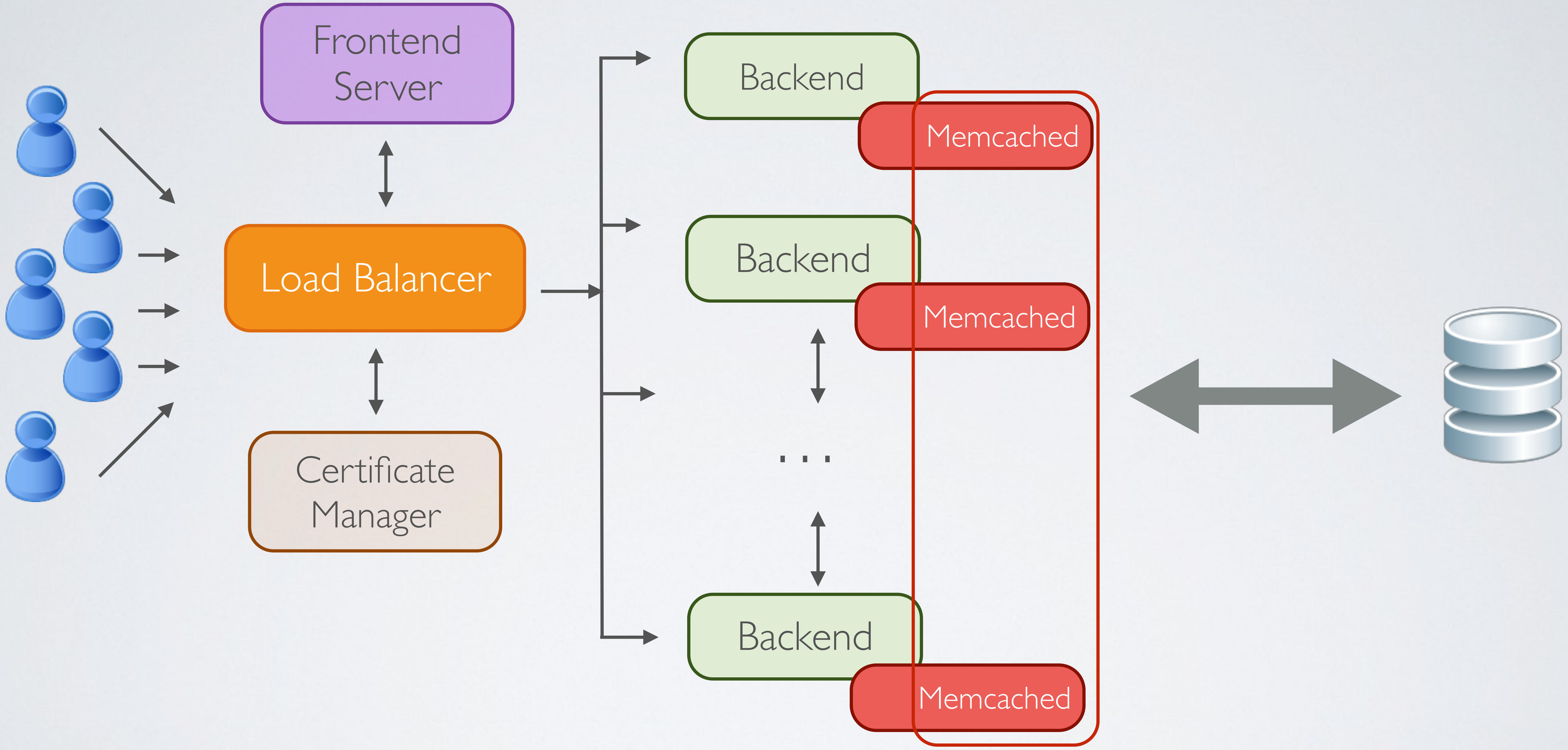
Solution:

- update the cache instead of clearing it after an insert
- a page view will never query the database

➡ Requires cache warming

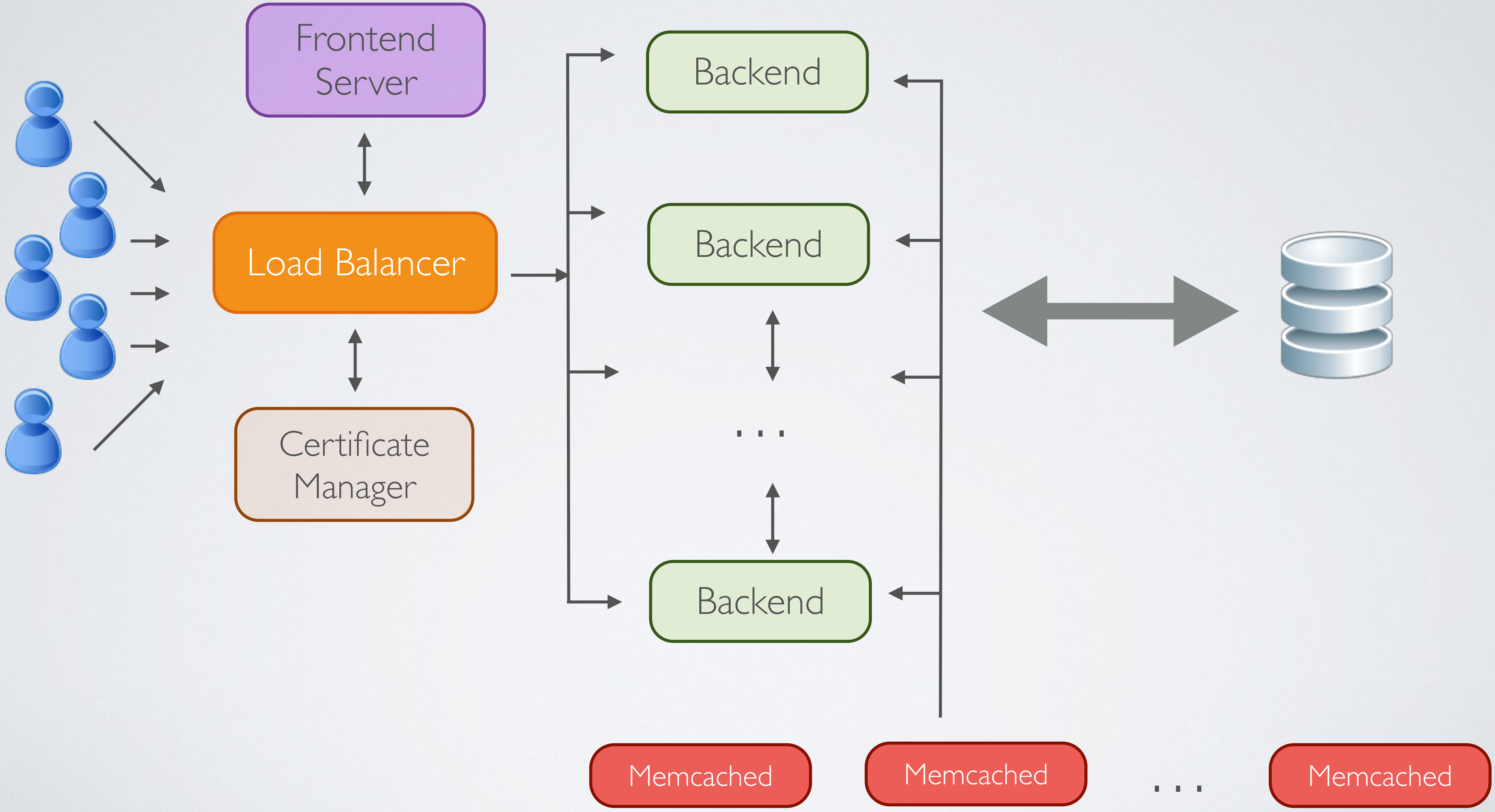
Scaling The Backend

Serving multiple apps with a load balancer

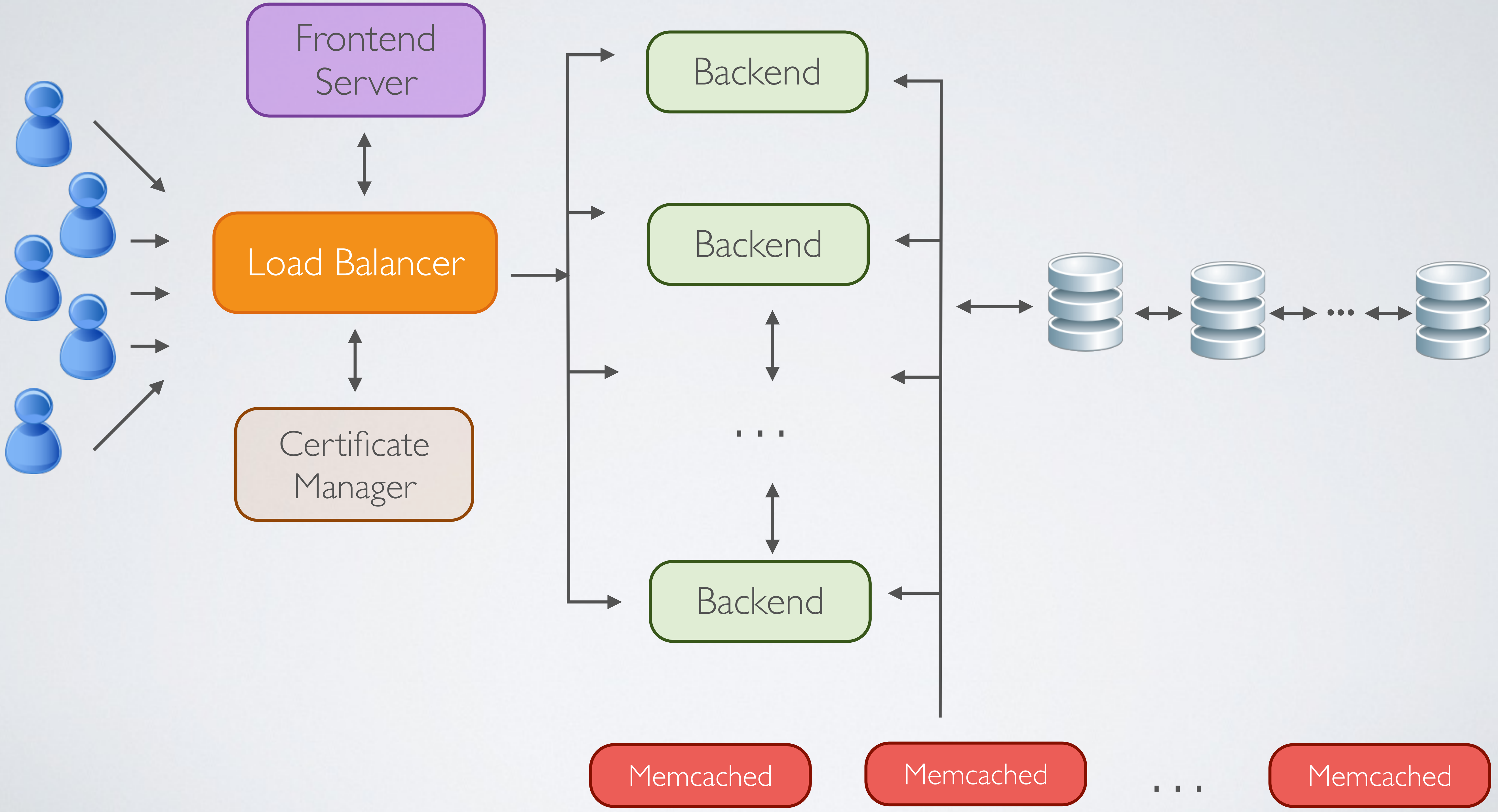


This is not an efficient cache

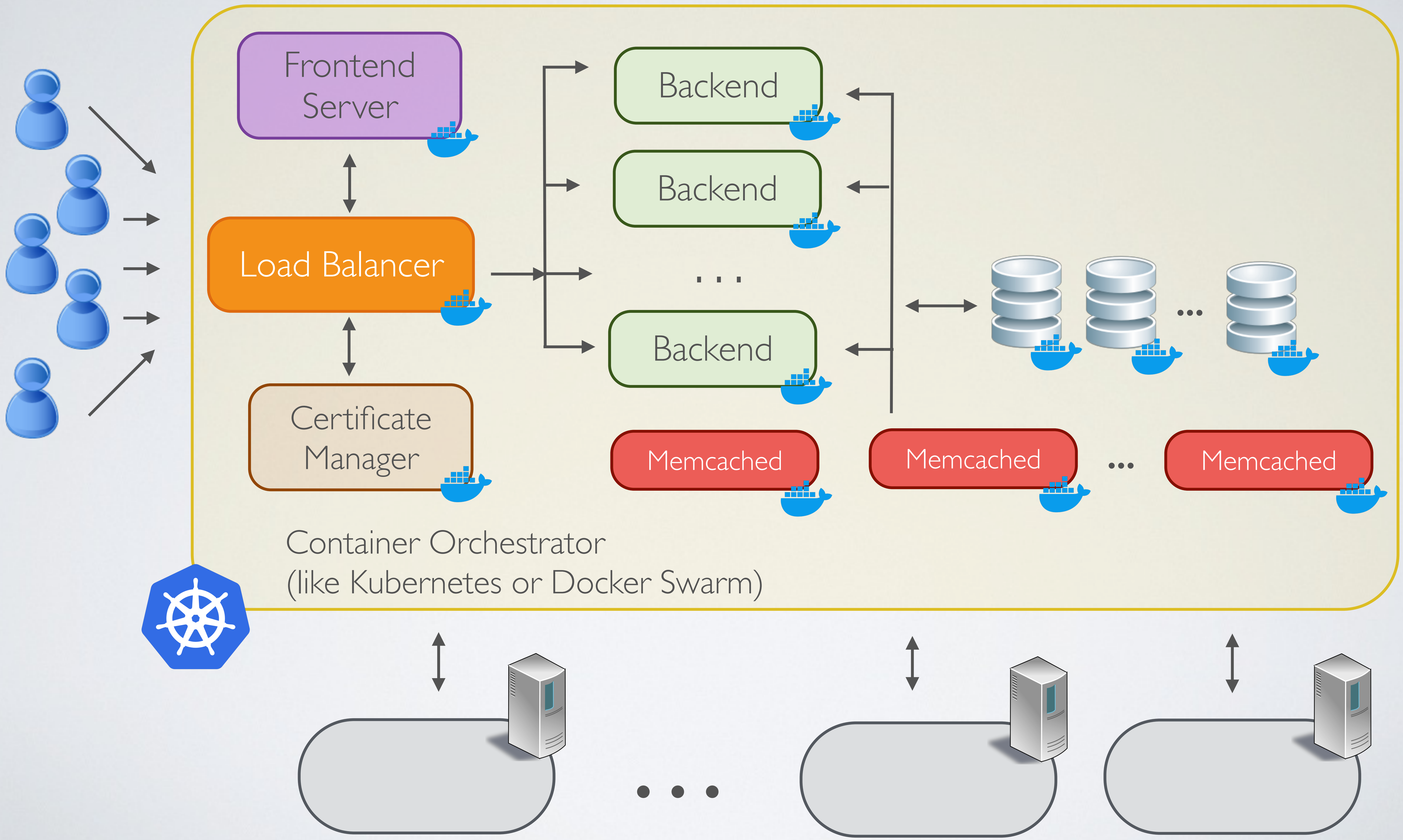
Distributed Shared Cache



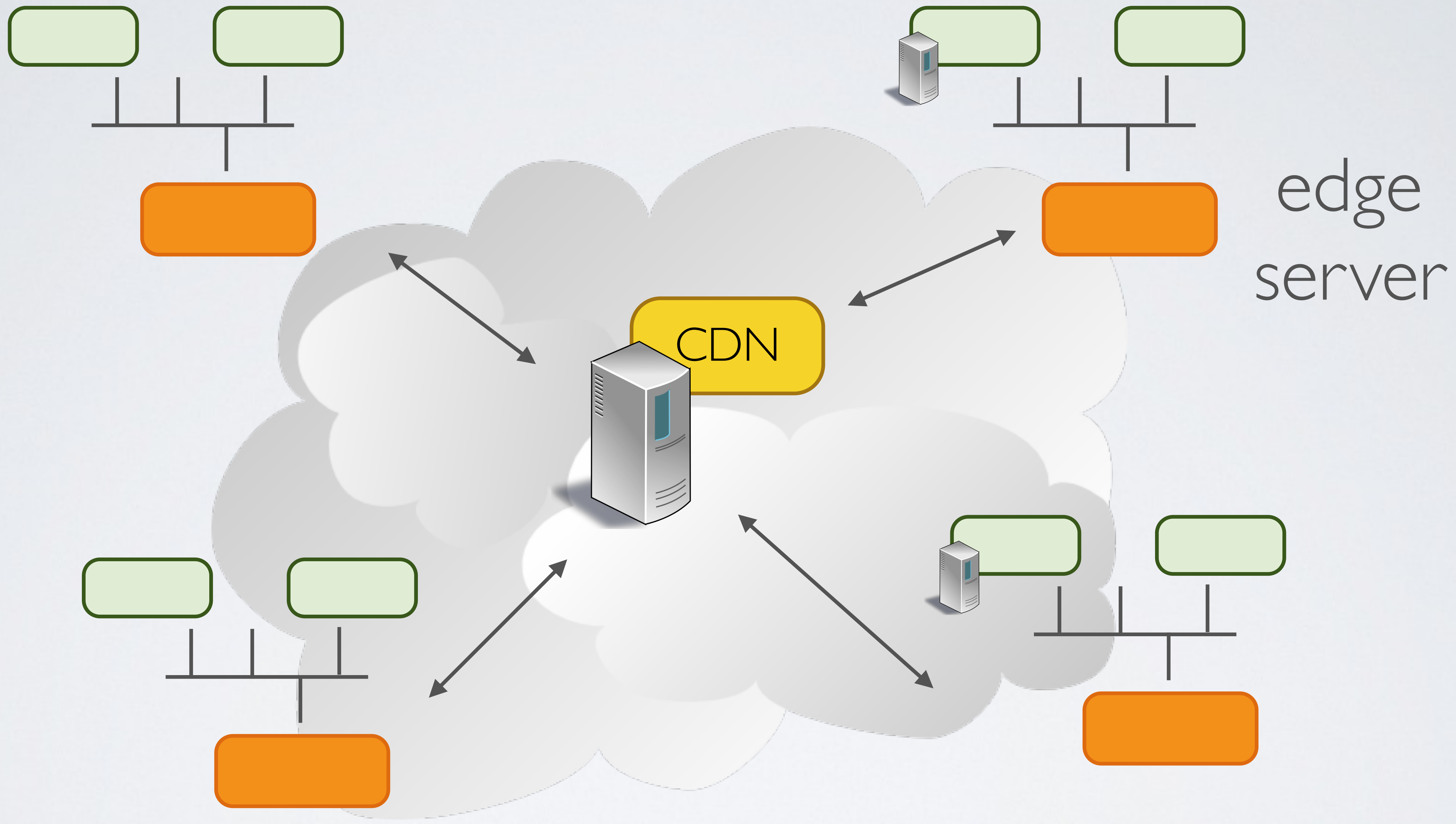
Database Sharding



Automatic Scaling with container Orchestration



CDN : Content Distribution Network



Example : Akamai, Cloudflare