

# Deploying Fast and Large Scale Web Applications

Thierry Sans

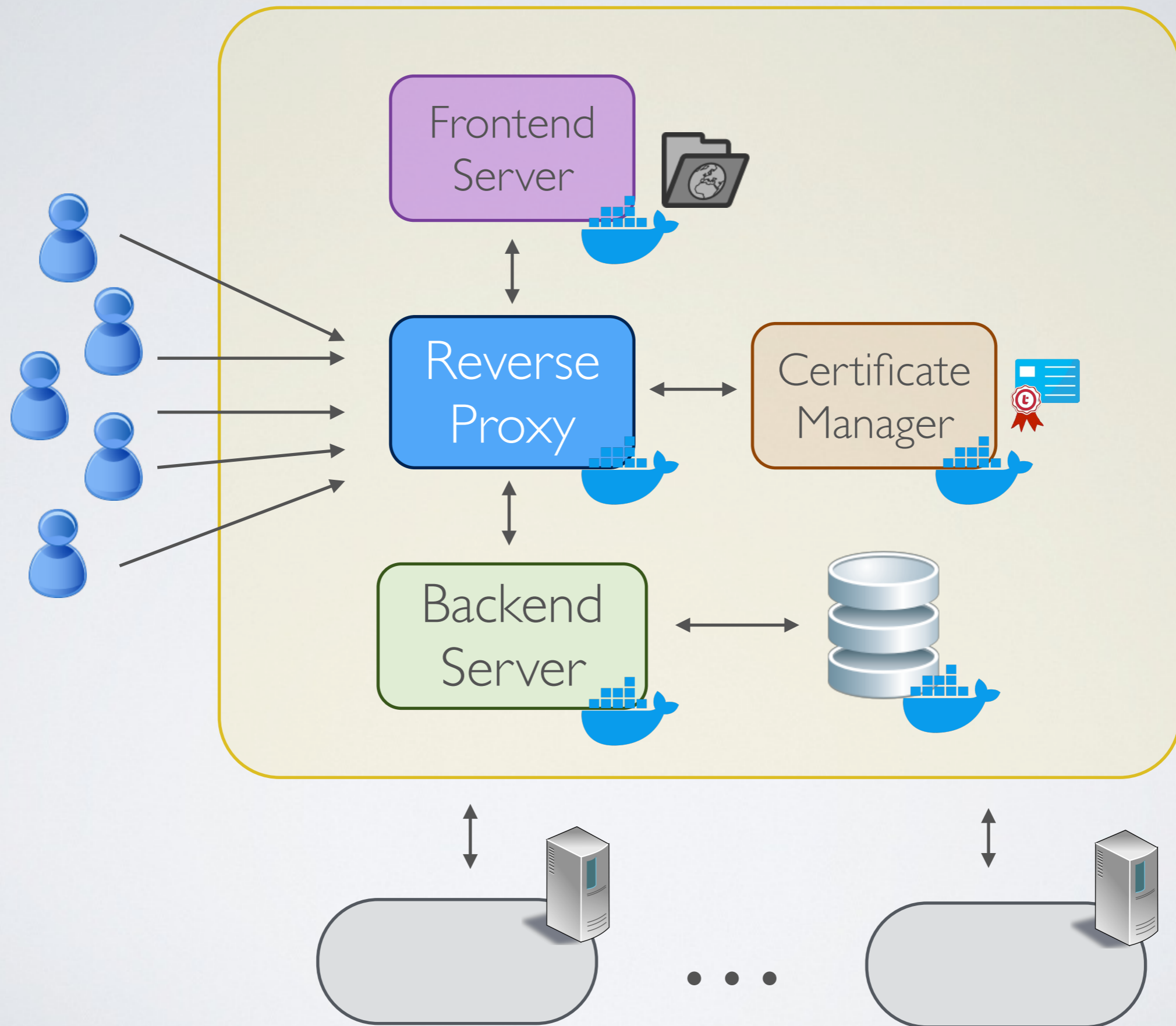
# Users respond to speed

*“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.gigaspace.com/amazon-found-every-100ms-of-latency-cost-them-1-in-sales/>

# Our microservice deployment (so far)

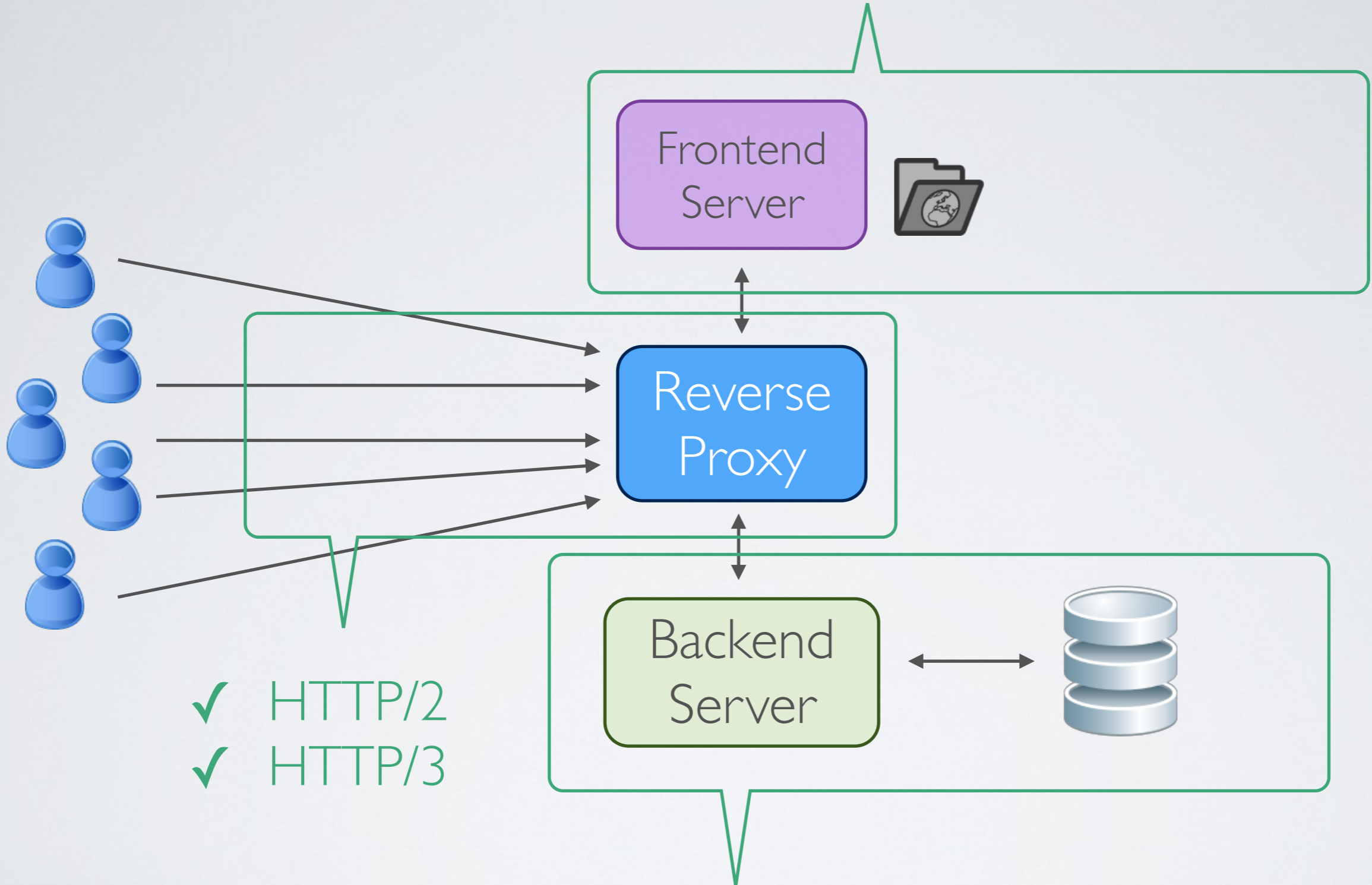


# Problems

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

# Solutions

- ✓ Web Packing
- ✓ Progressive Web Applications (PWA)



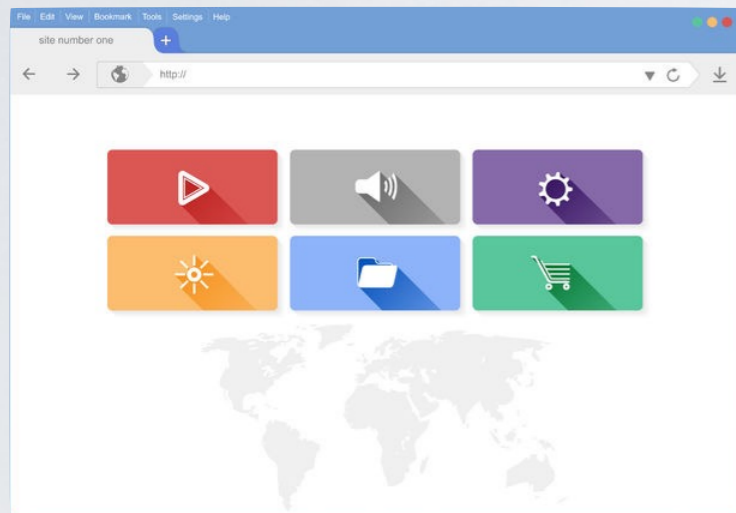
- ✓ HTTP/2
- ✓ HTTP/3

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

# Frontend packing

# The problem

## Browser



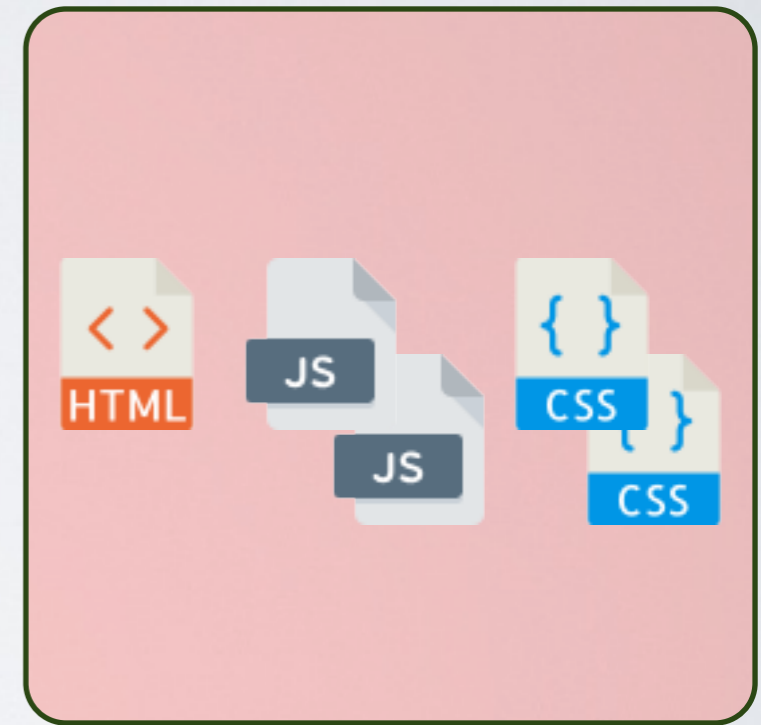
GET /

GET /js/lib.js

GET /js/index.js

GET /style/index.css

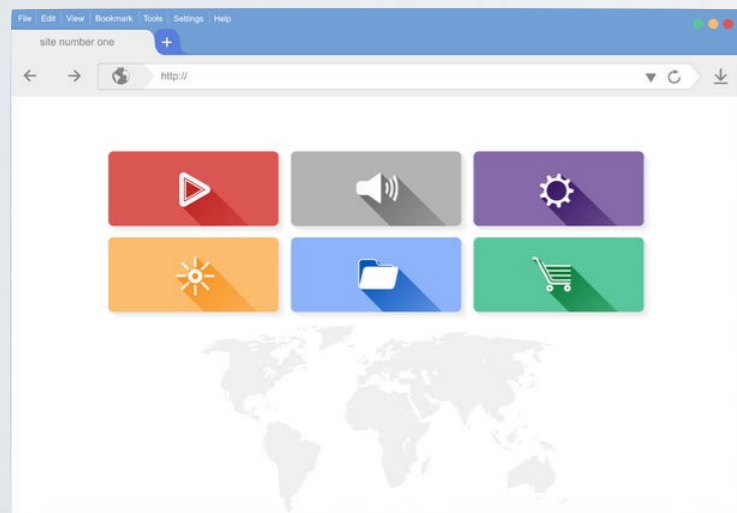
GET /style/generic.css



Frontend Server

# The solution - using a frontend packer

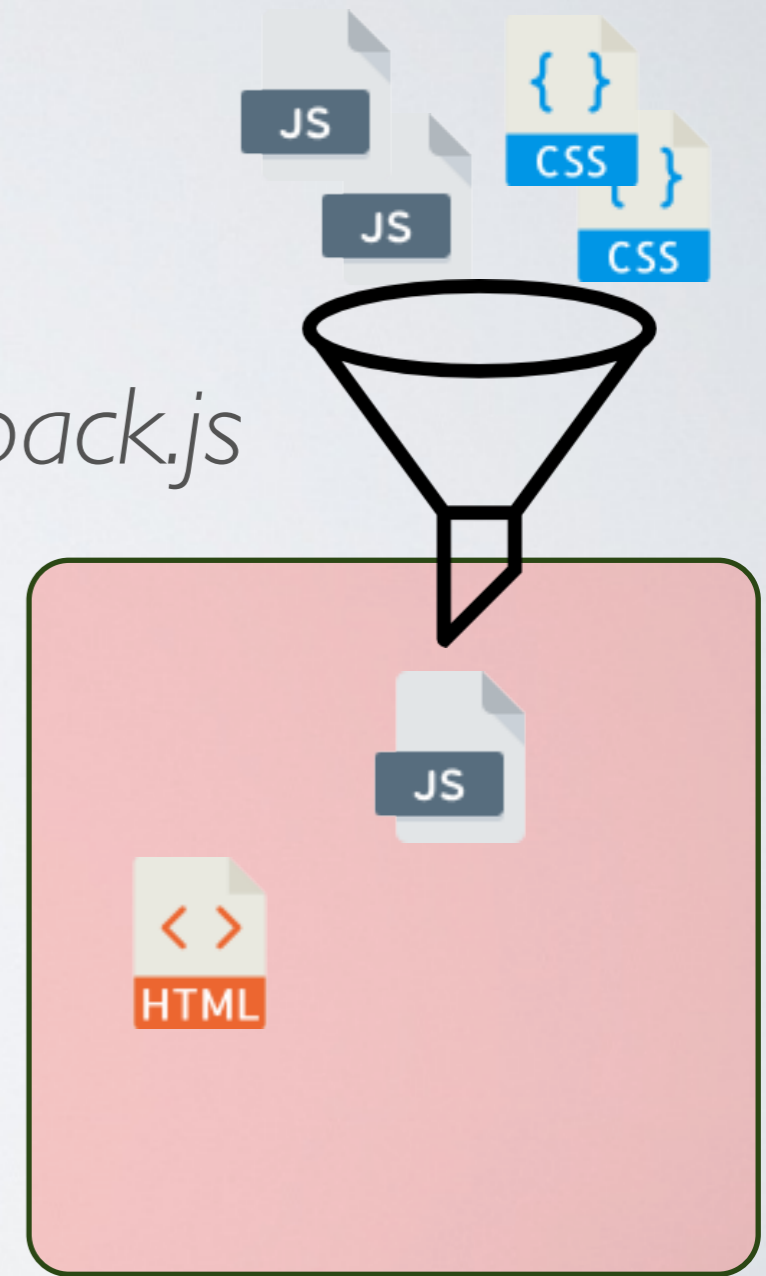
Browser



GET /

GET /js/bundle.js

e.g. *webpack.js*



Frontend Server



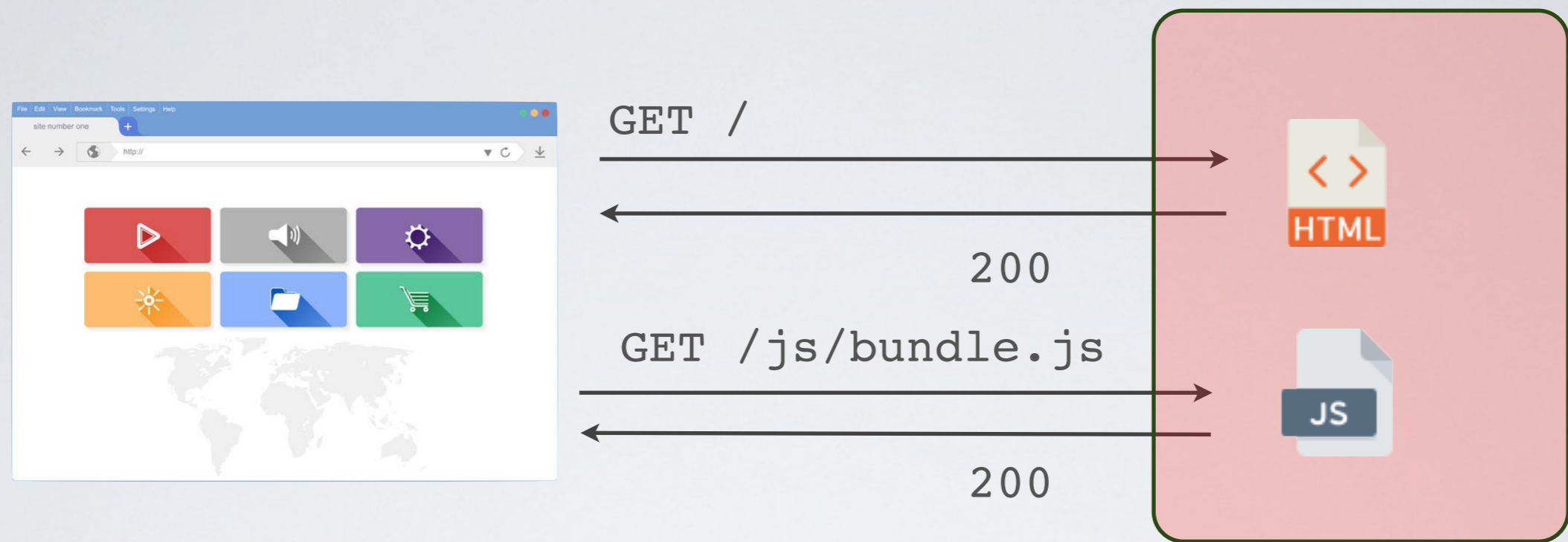
HTTP/2

# HTTP/2

## **HTTP/2 enables multiplexing**

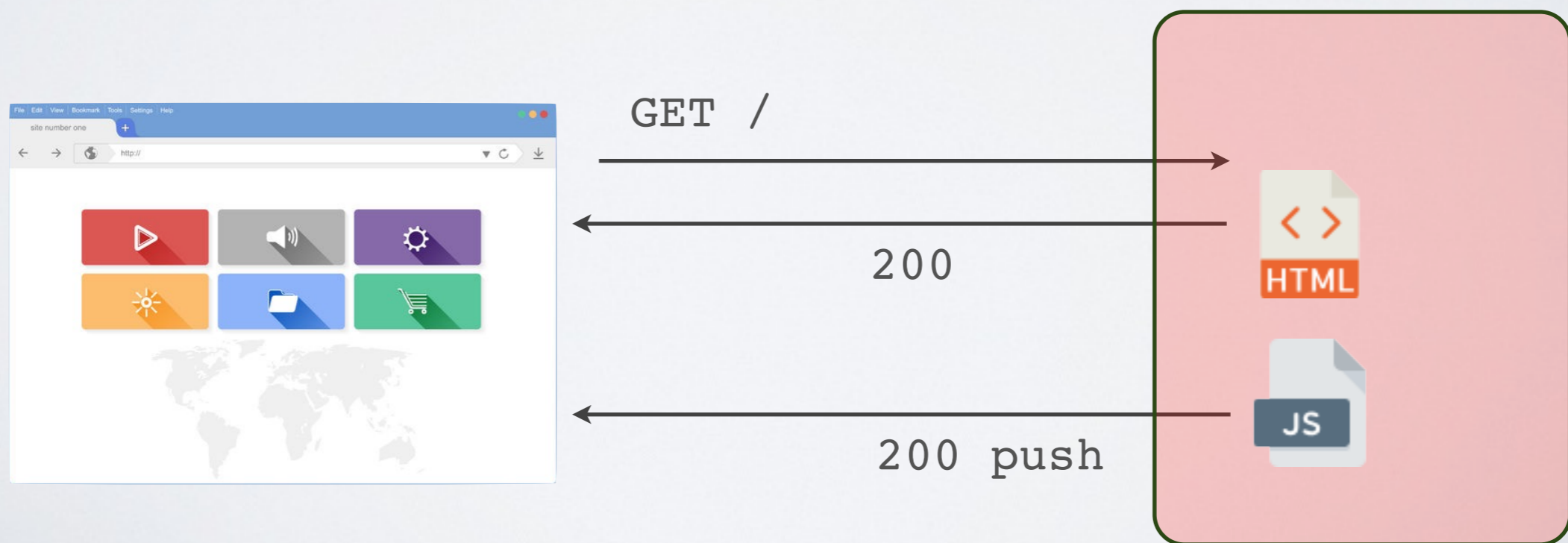
- ➔ send multiple HTTP responses for a given request (a.k.a push)
- Proposed by Google (called SPDY)
- Adopted as an standard in 2015 (RFC 7540)
- HTTP/2 is compatible with HTTP/1 (same protocol)

# 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

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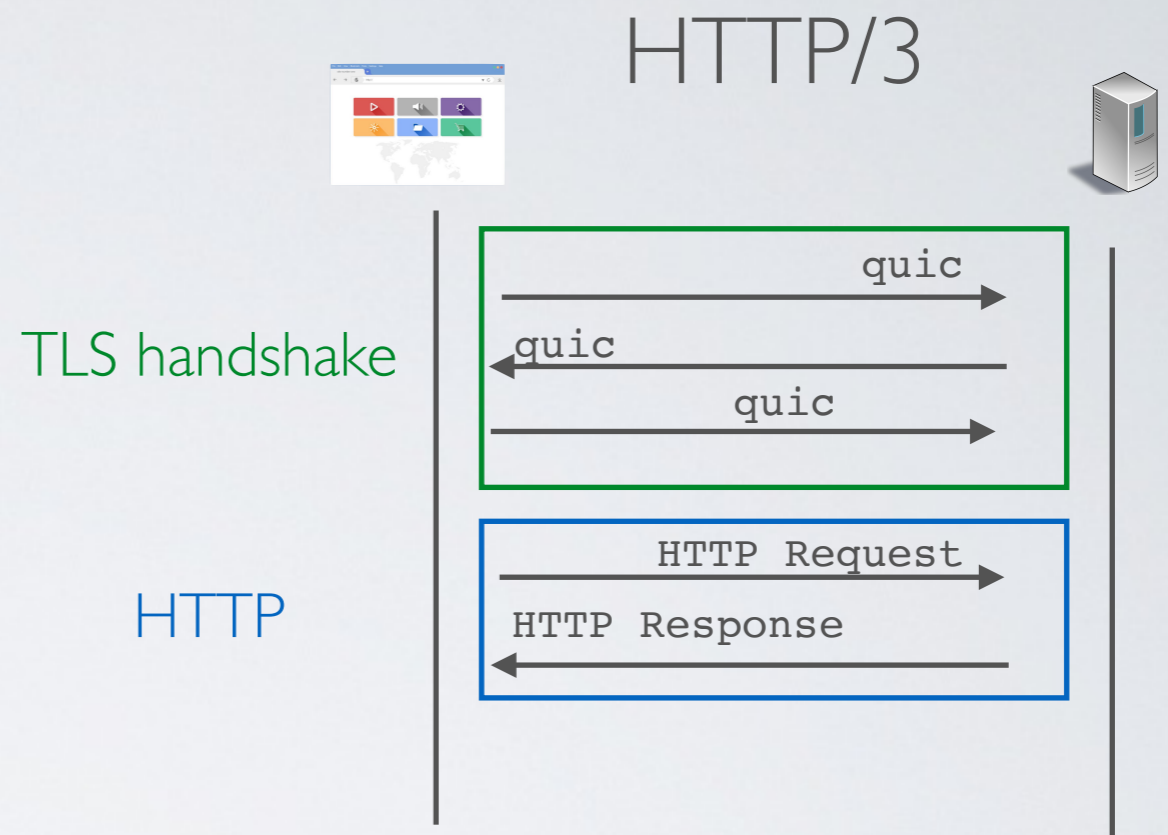
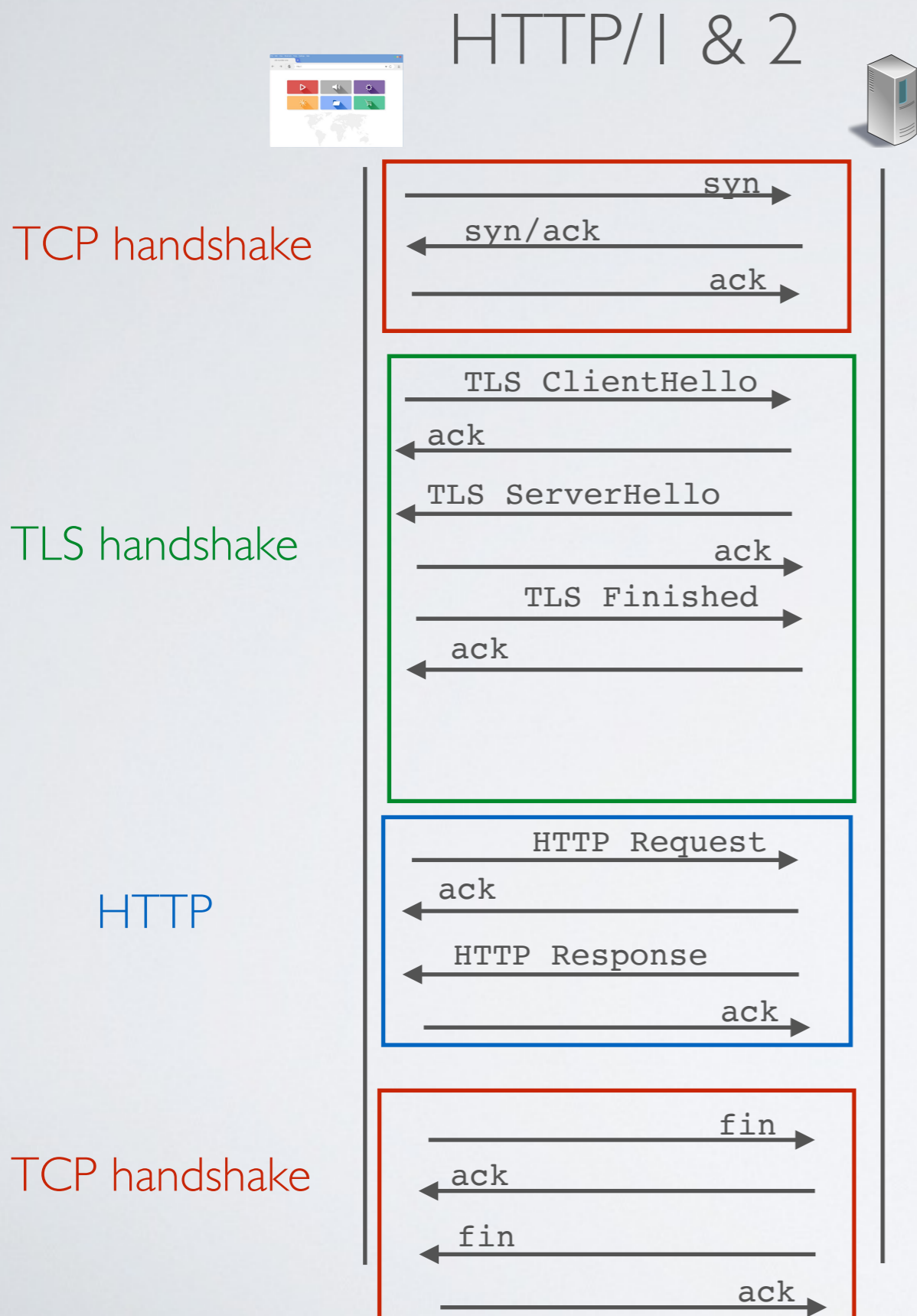
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Following on from [the previous announcement](#), support of HTTP/2 Server Push will be disabled by default in Chrome 106 and other Chromium-based browsers in their next releases.

HTTP/3

(work in progress)

# HTTP/3 (standard draft)



- ➔ Use UDP instead of TCP
- Chrome in Dec'19
- Firefox in Jan'20

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

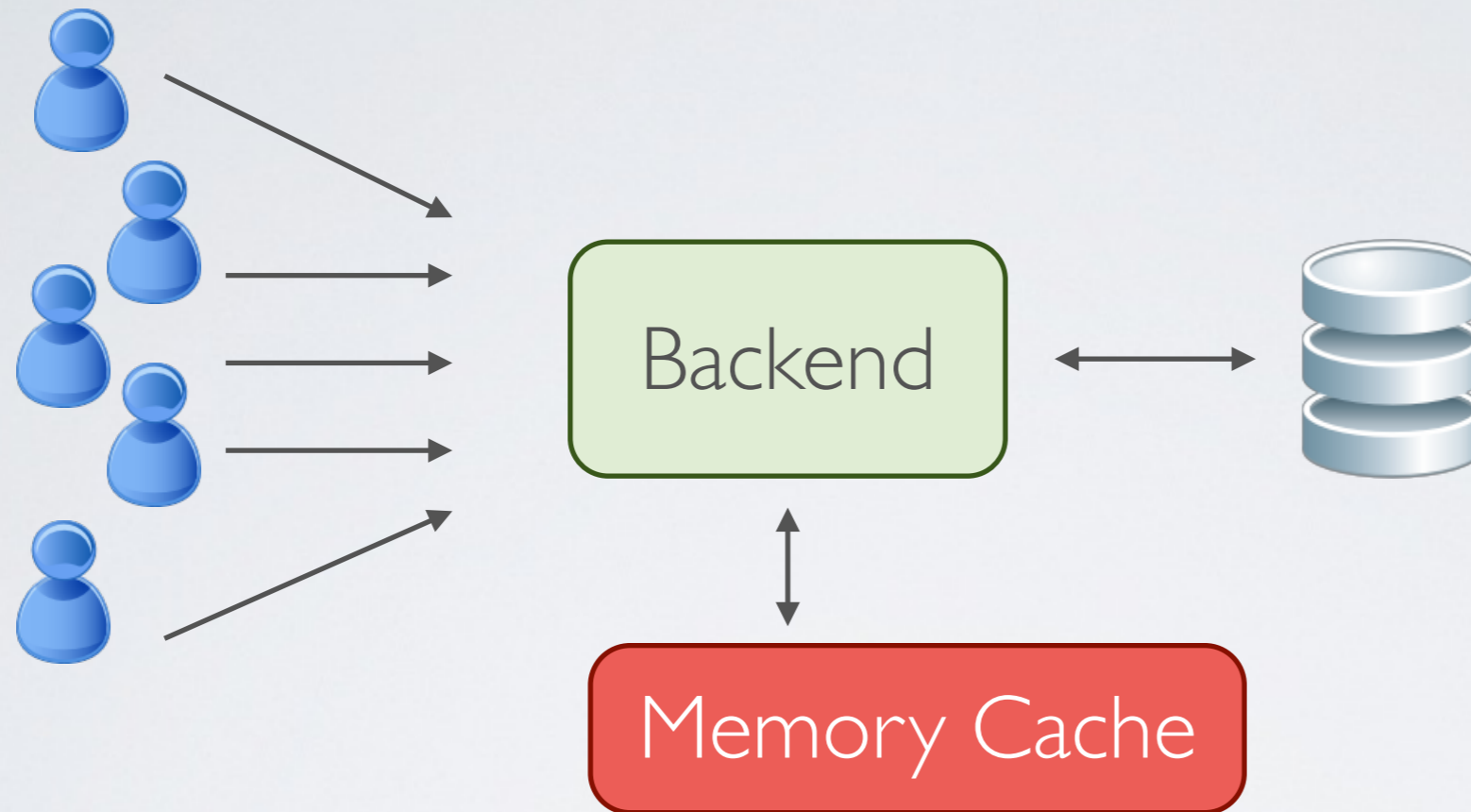
# How to improve response time?

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 (time and 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

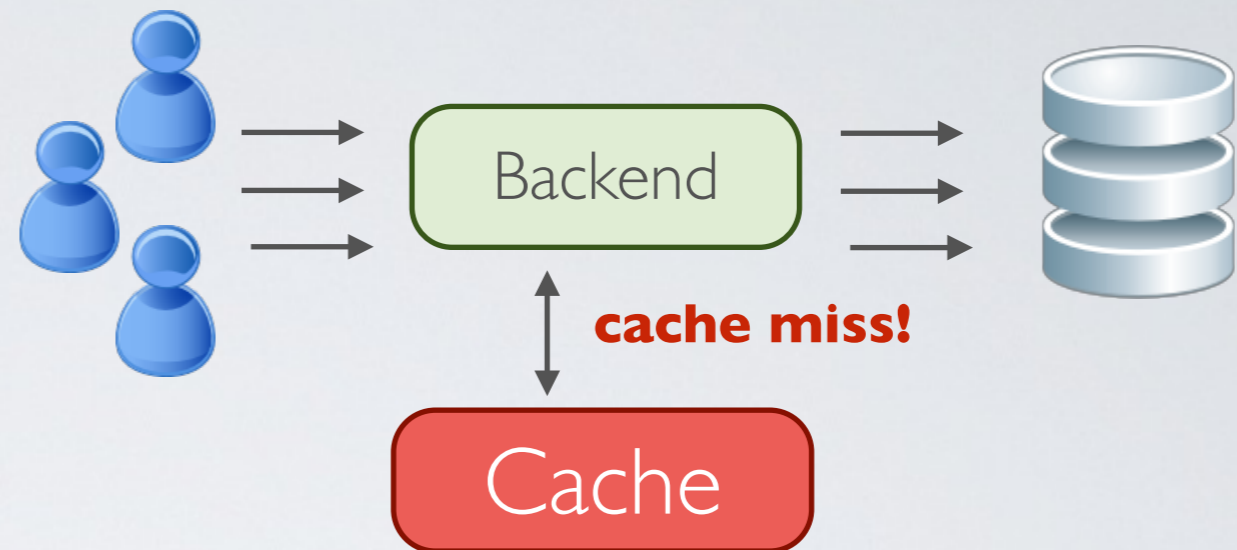
<http://memcached.org/>

- 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

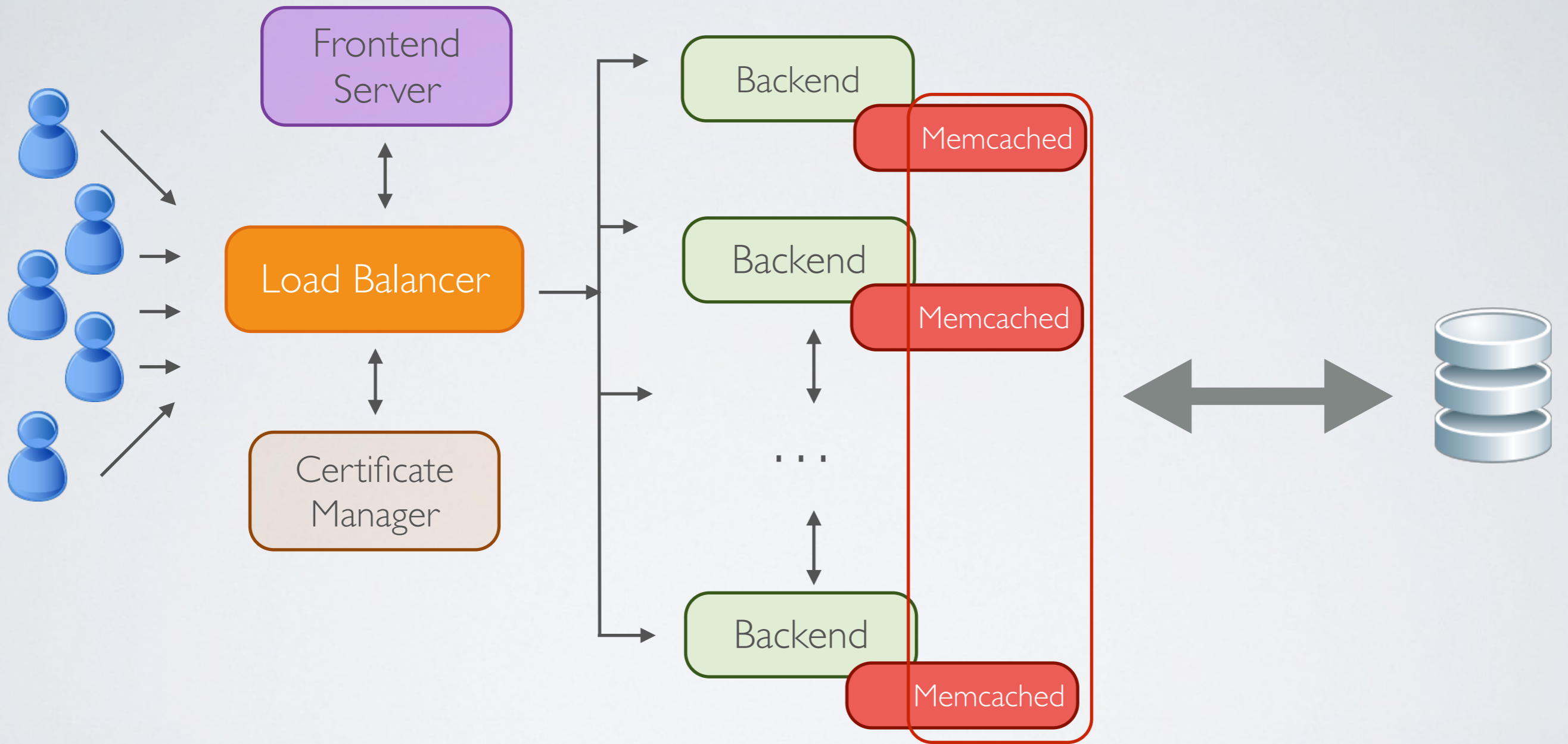
## Solution:

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

# Scaling The Backend

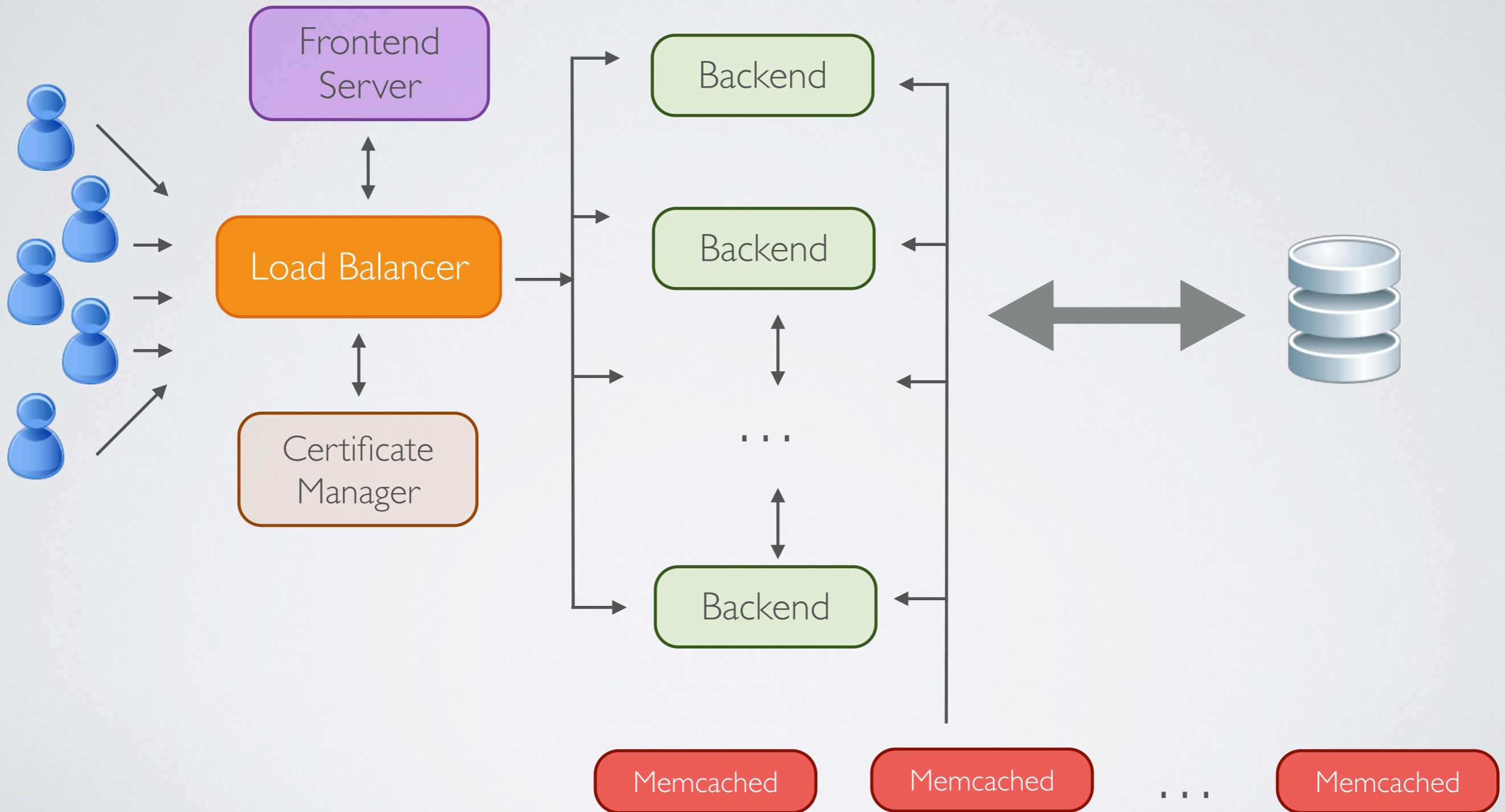


# Serving multiple apps with a load balancer

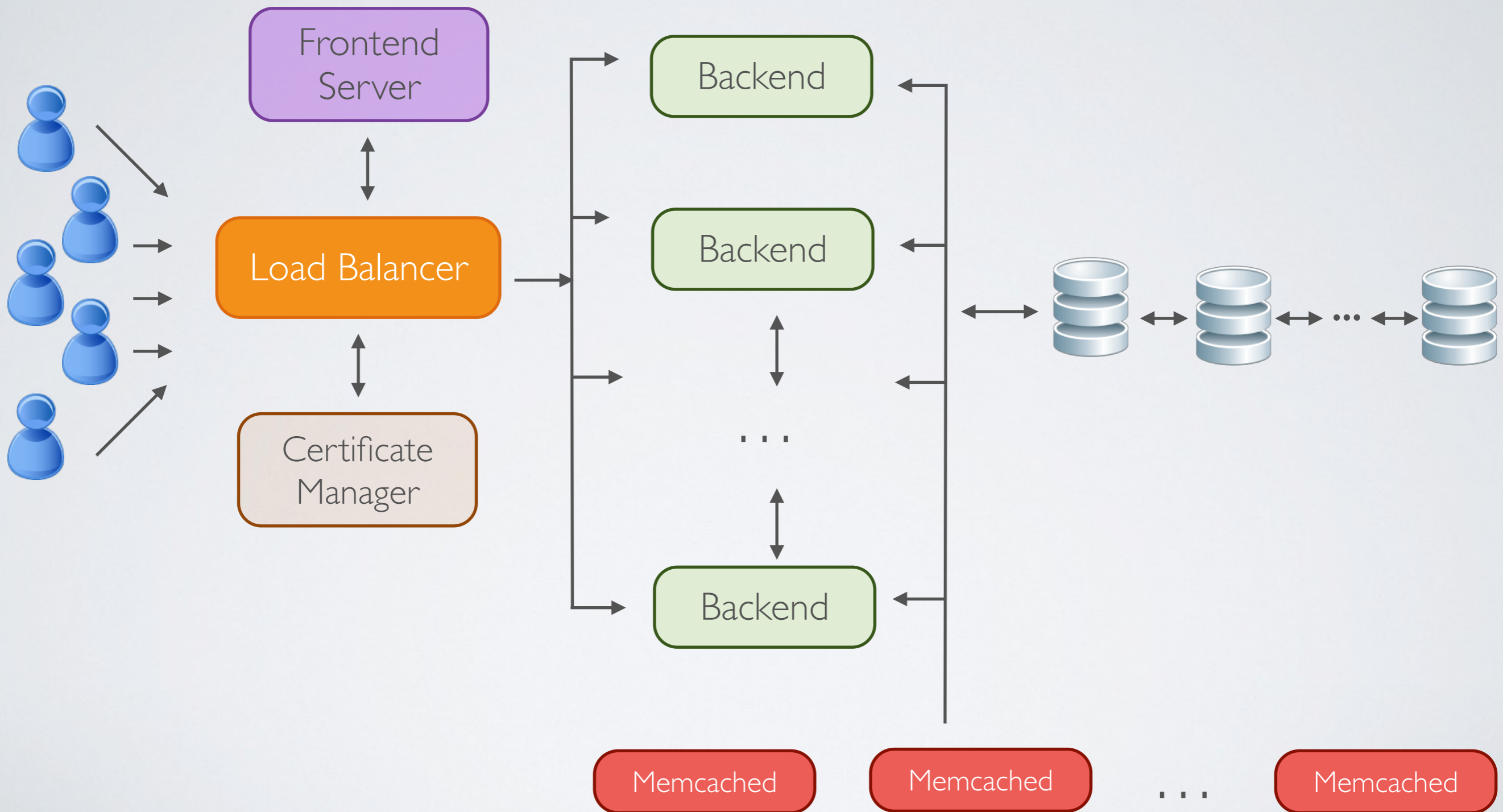


This is not an efficient cache

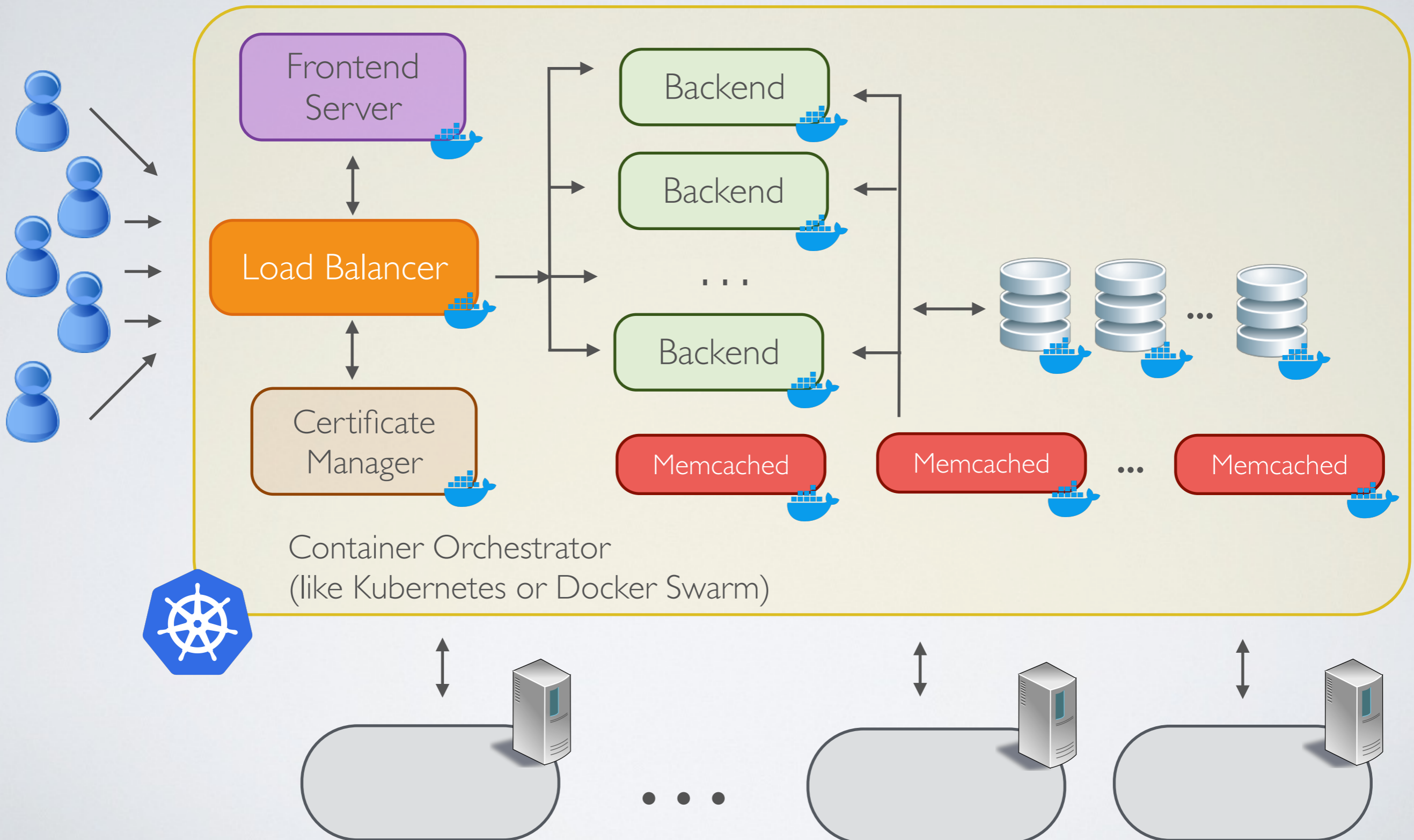
# Distributed Shared Cache



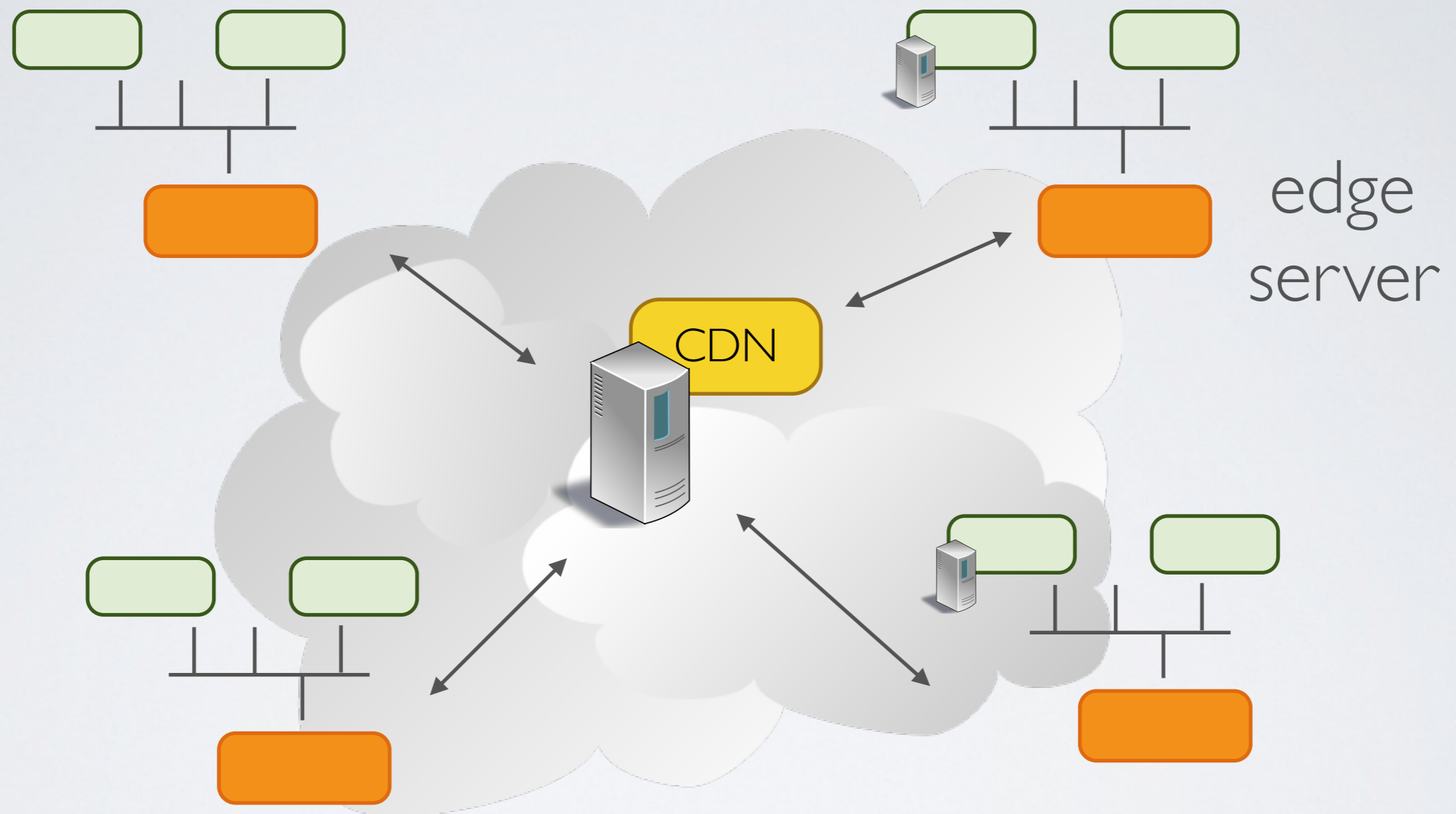
# Database Sharding



# Automatic Scaling with container Orchestration



# CDN : Content Distribution Network



Example : Akamai, Cloudflare