

# Scaling ↑↓



## Derek Stride

- **Studied @ Carleton**
  - graduated 2018
- Intern @ Shopify for 18 months
- **Full-time @ Shopify** since 2018
  - Worked on Product:Orders
  - Last 6 years: Scaling Shopify's Storefront

## Josh Faigan

- Career pivot from banking
- **Studied @ Dominican University of California**
  - graduated 2025
- DevDegree Intern @ Shopify
  - Aug 2022 - April 2025
- **Full-time @ Shopify** since May 2025
  - Worked with Derek in Storefronts
  - Currently working with Developer Tools

Scalability is the property of a system to handle a growing amount of work.

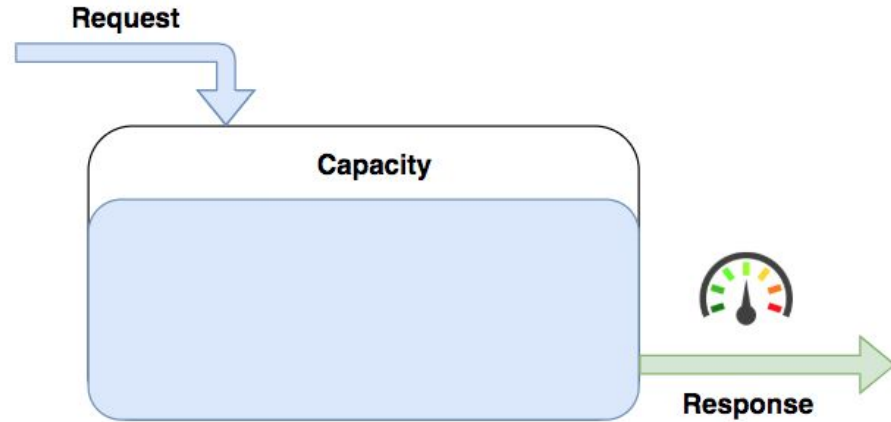
# System Capacity

Exit rate:

- How many requests you can serve per unit of time (Requests per Second - RPS)

Service time:

- The average response time for a request (Latency - measured in units of time)



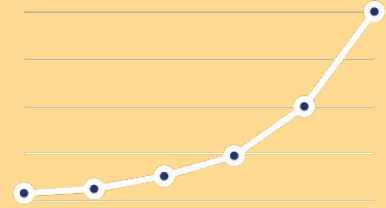
# How do you increase your capacity?

**Horizontal  
&  
Vertical  
Scaling**

**Caching**

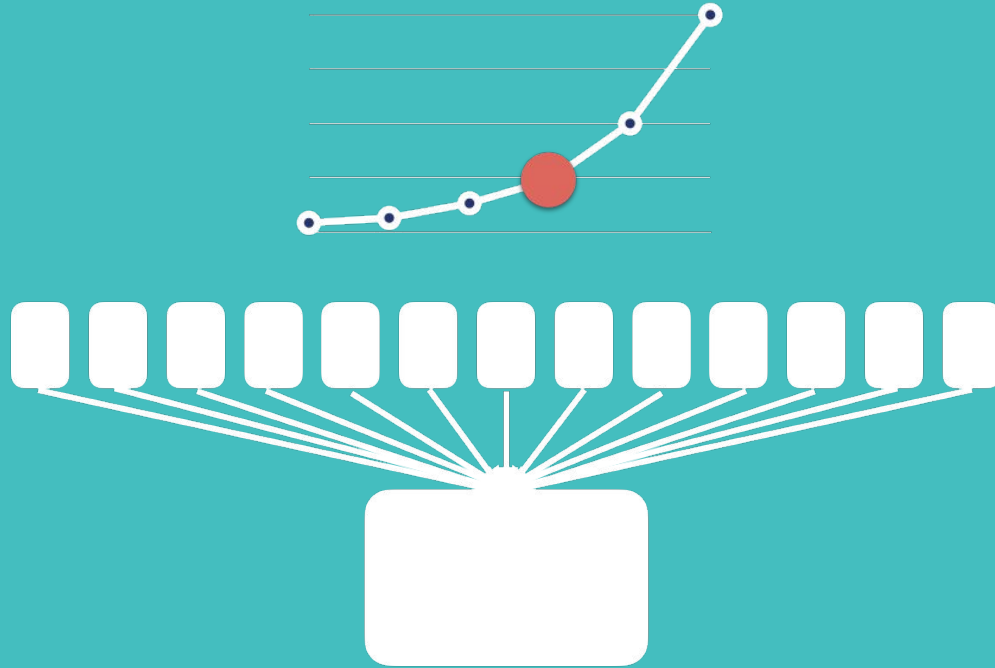
**Load  
Control**

**Sharding**



# Horizontal & Vertical Scaling

# Vertically Scaling

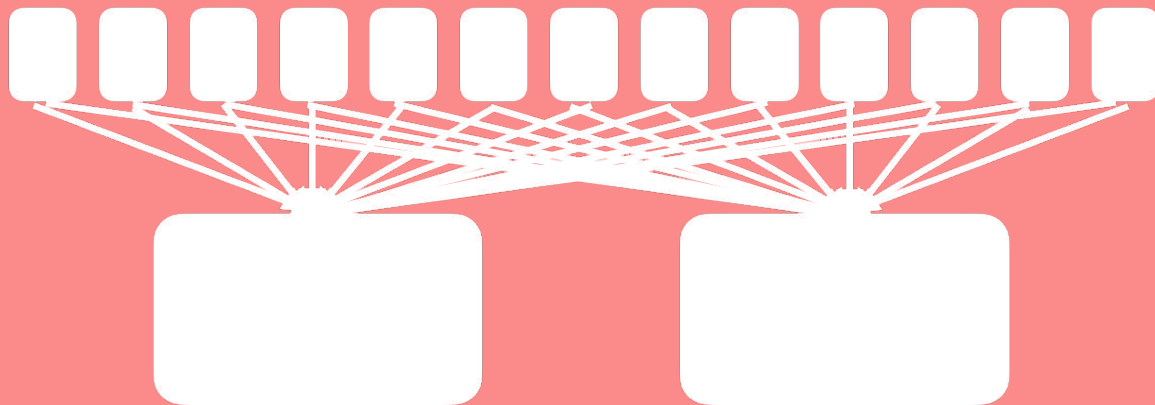
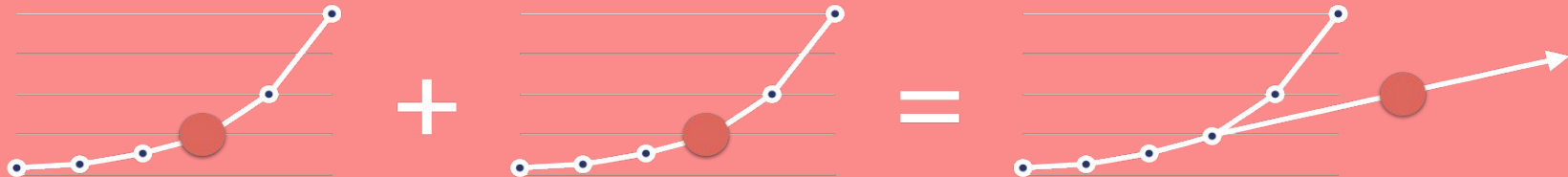


# Vertically Scaling





# Horizontally Scaling



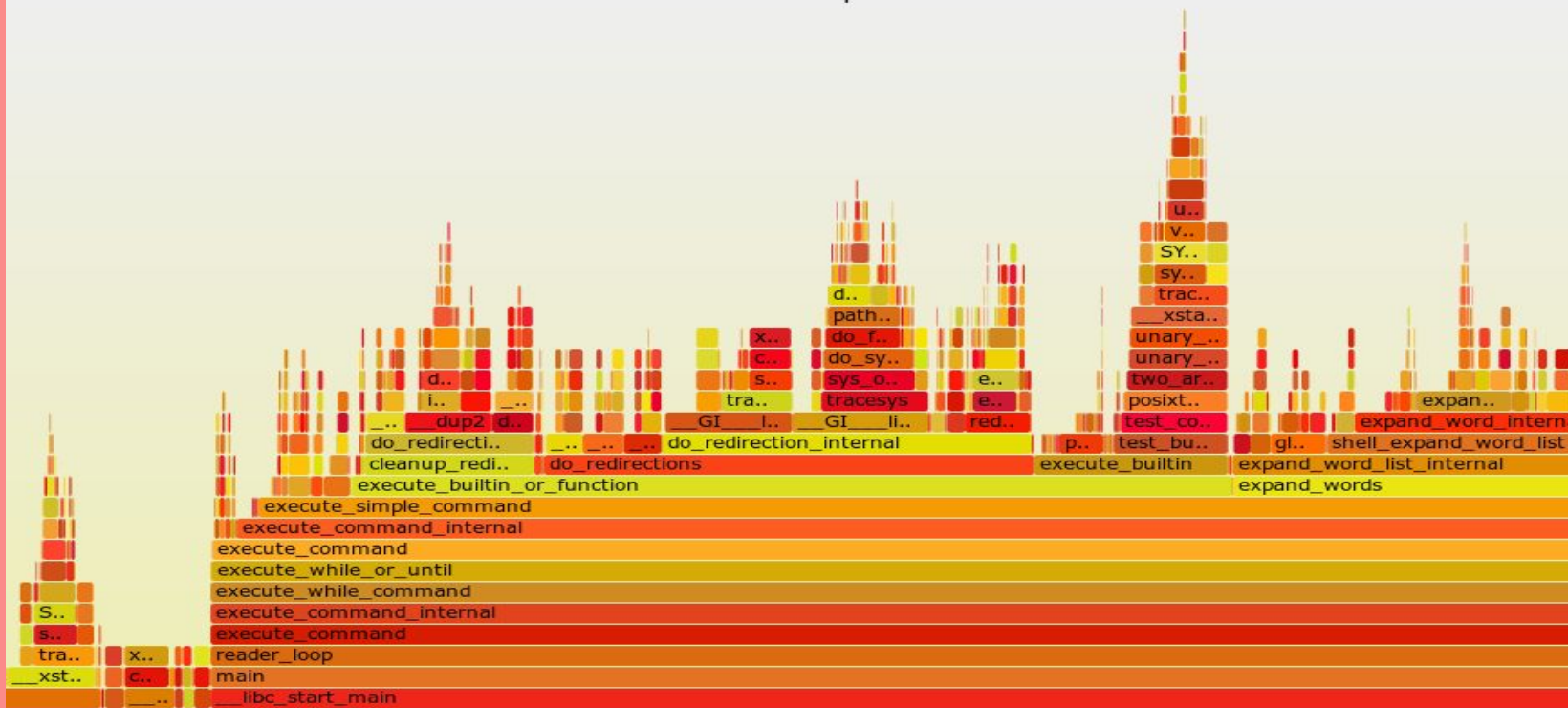
# Reducing Service Time (performance tuning)

- Buy faster machines
- Profiling and optimization
- ~~Caching~~

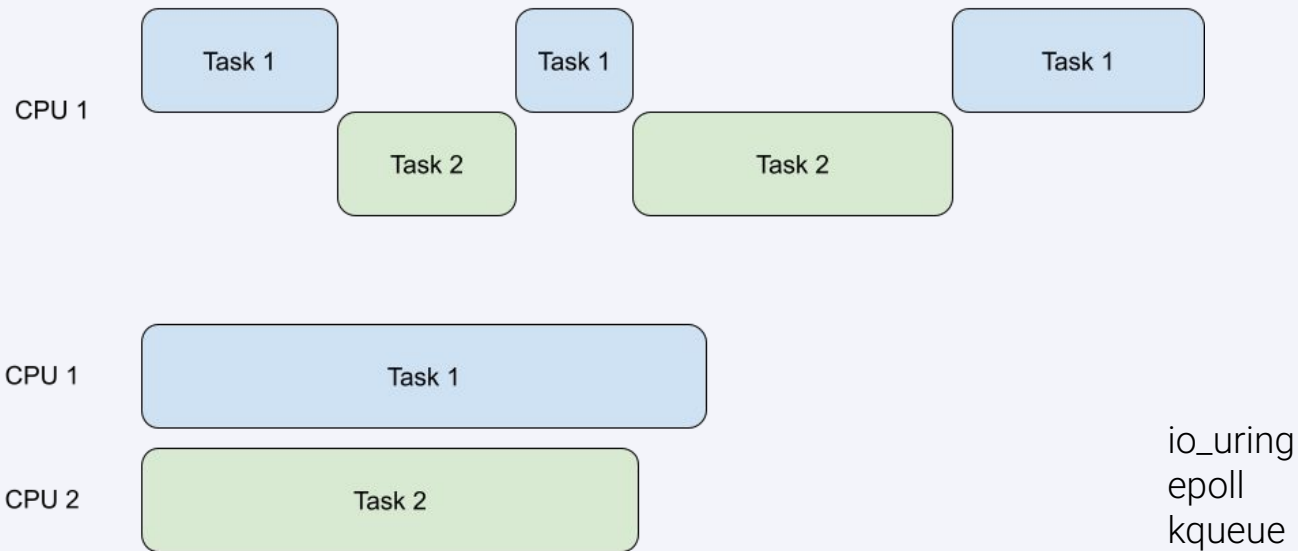
Vertical scaling has a limit and is expensive

# Reducing Service Time

Flame Graph



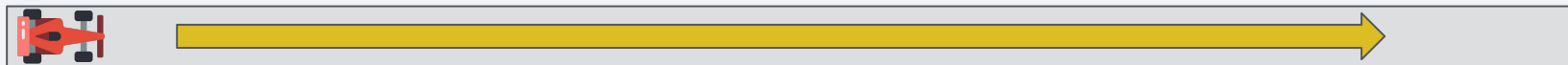
# Concurrency & Parallelism



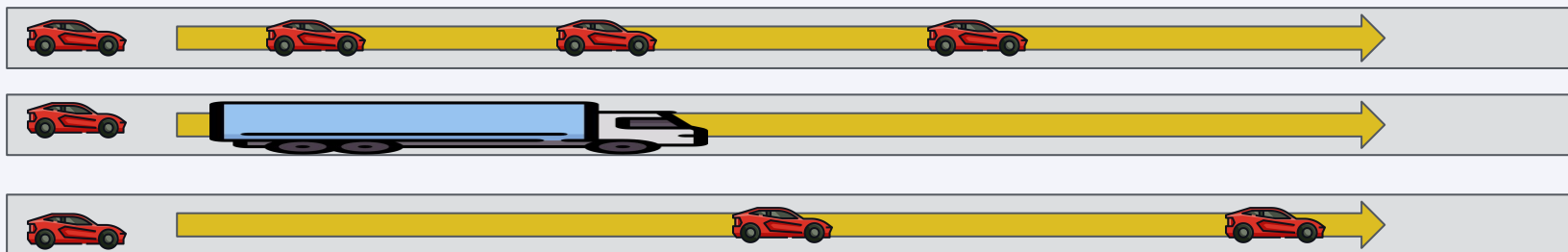
# Unicorn and Falcon

## Single vs Multi threaded

Unicorn - One Worker | One Lane



Falcon - Multi Worker | Multi Lane





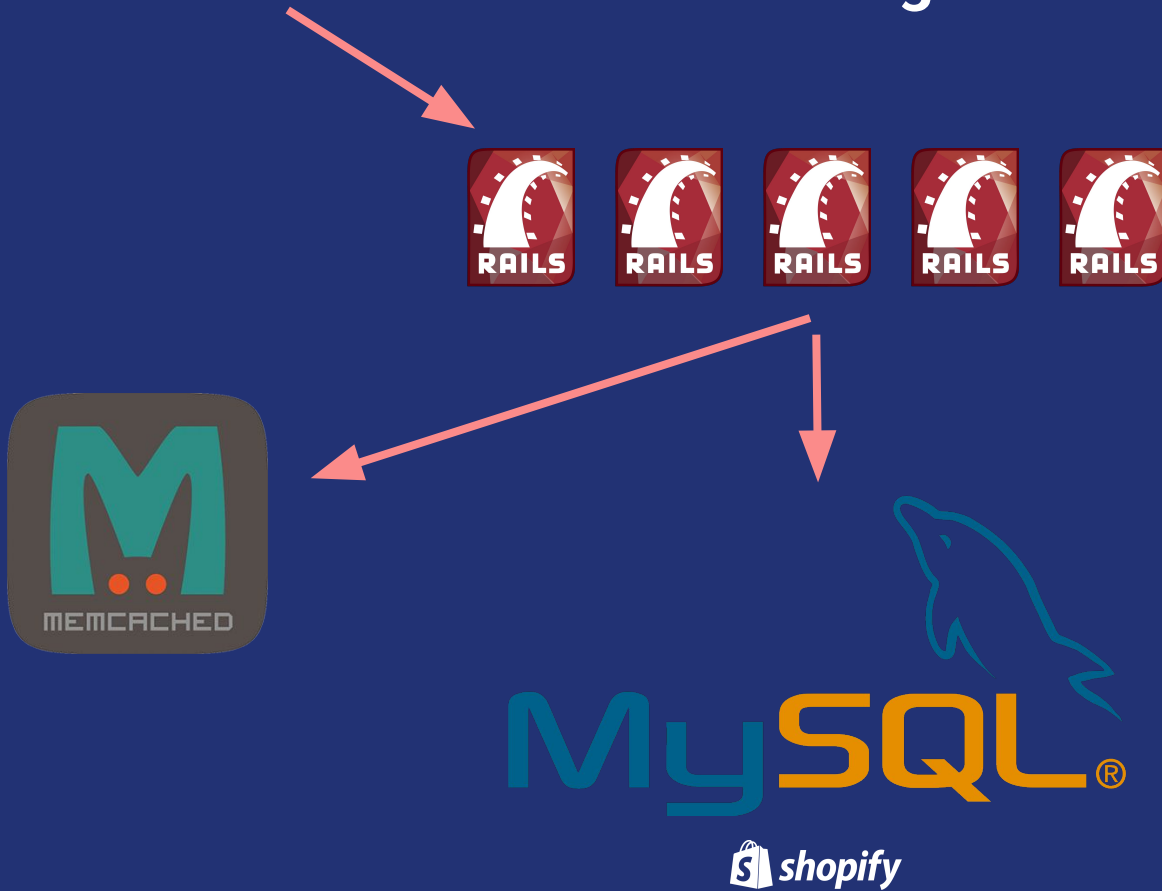
# Caching



# Caching

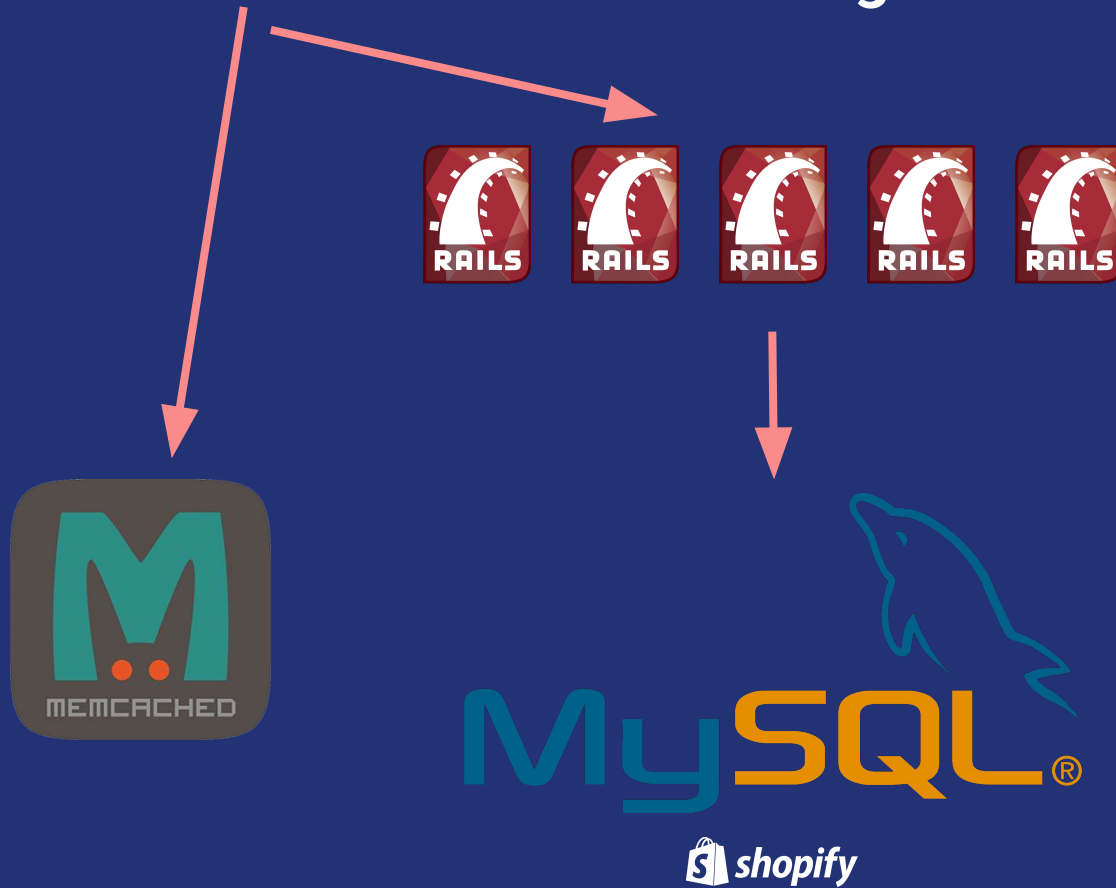


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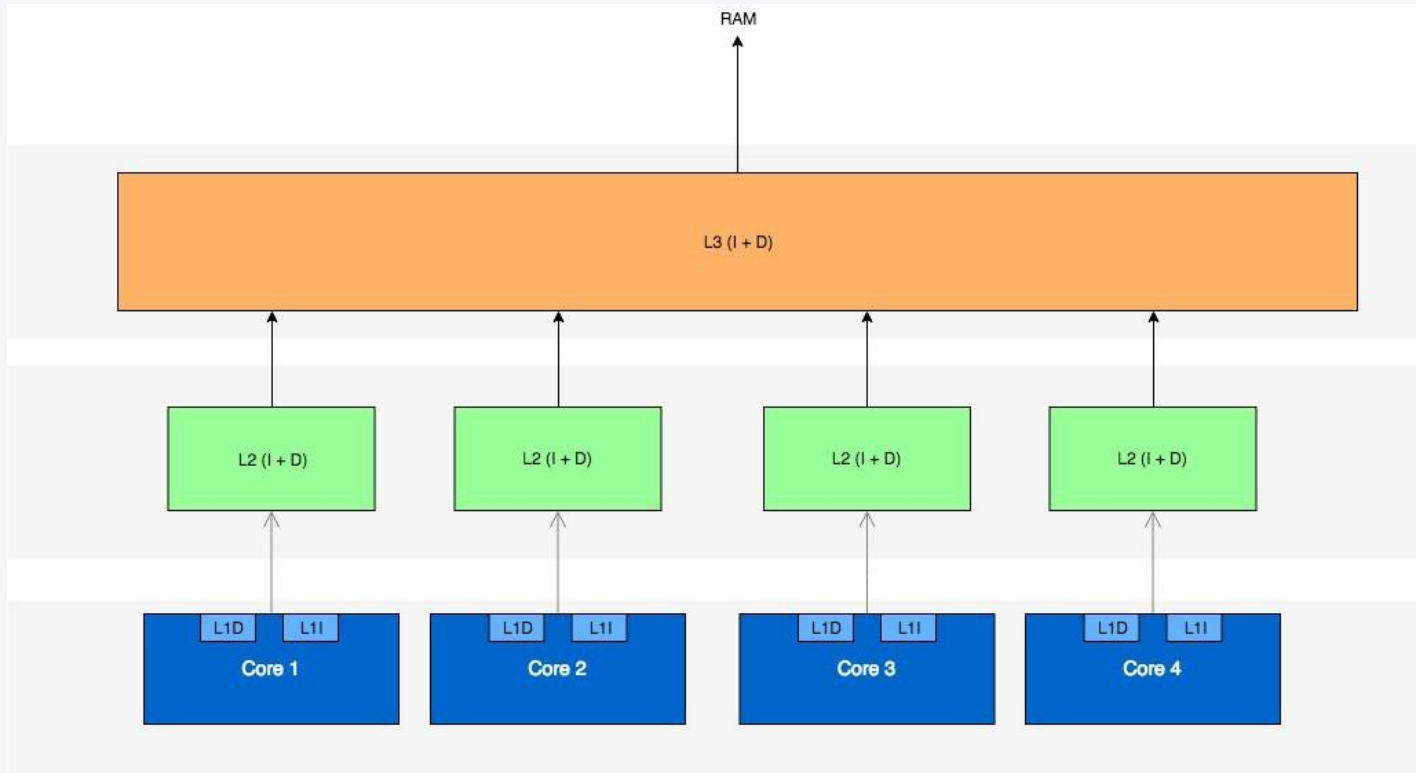




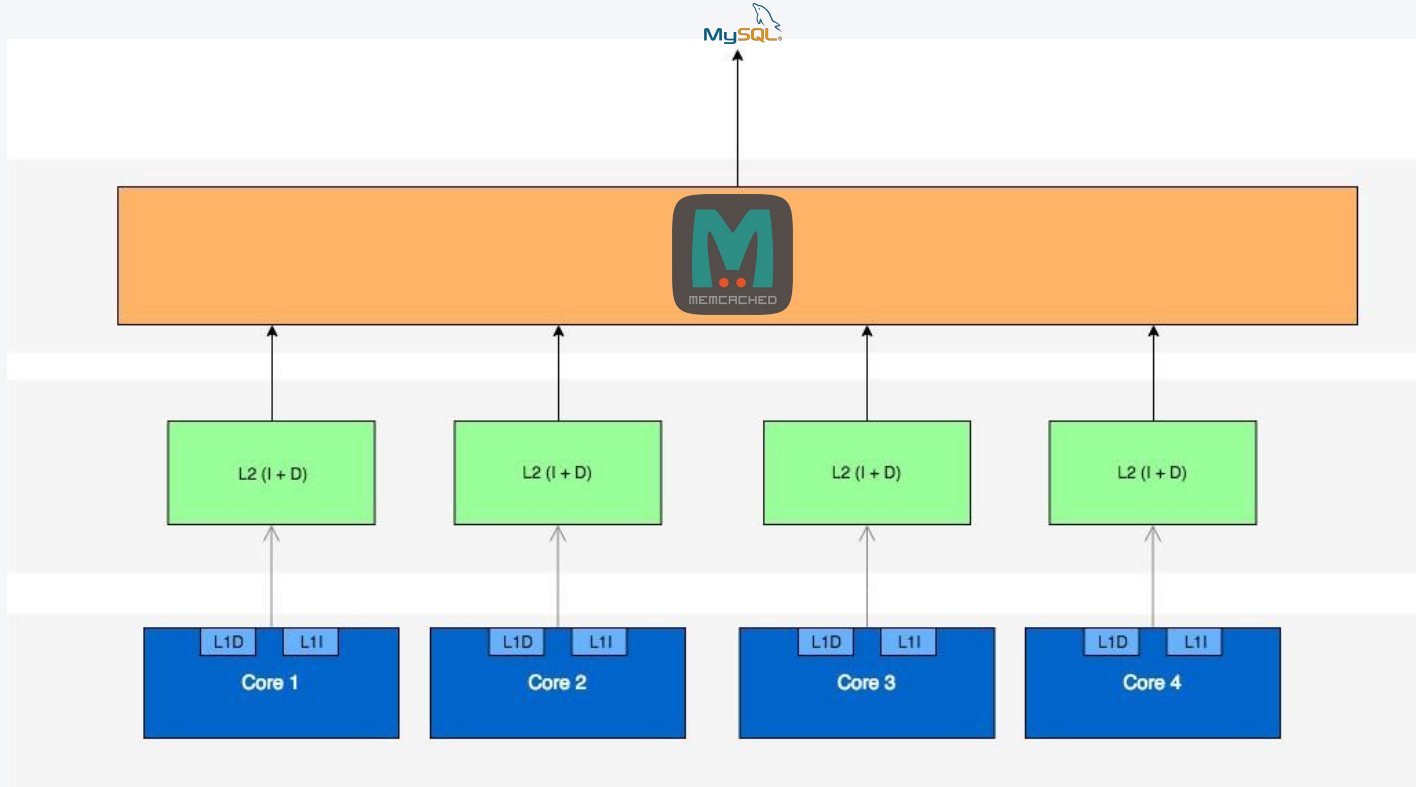
# Caching



# Caching



# Caching



# Load Control

# Load shedding (handling overload)

Without a doubt, your system **will** experience capacity overload.

- More demand than you can handle
- Slower response times
- Combination of both

No amount of scaling or capacity planning will save you

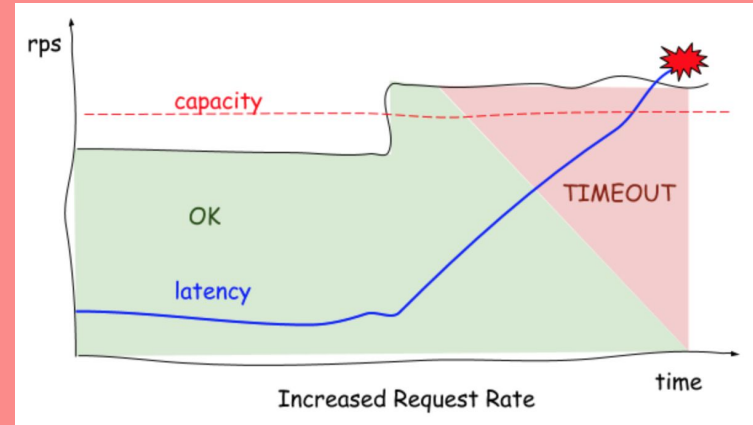
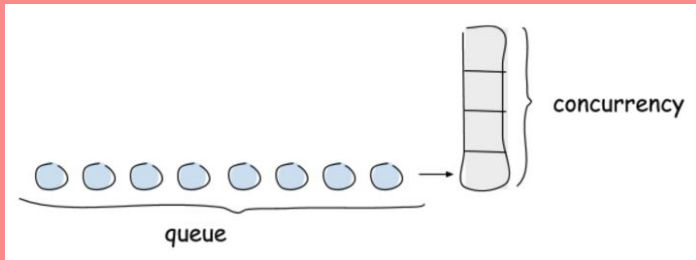
At Shopify, this happens almost every day

- Flash sales (too much demand)
- Unoptimized endpoints (known problems)
- System failures (unknown problems)

# Load shedding

What happens when you have more demand than you can handle?

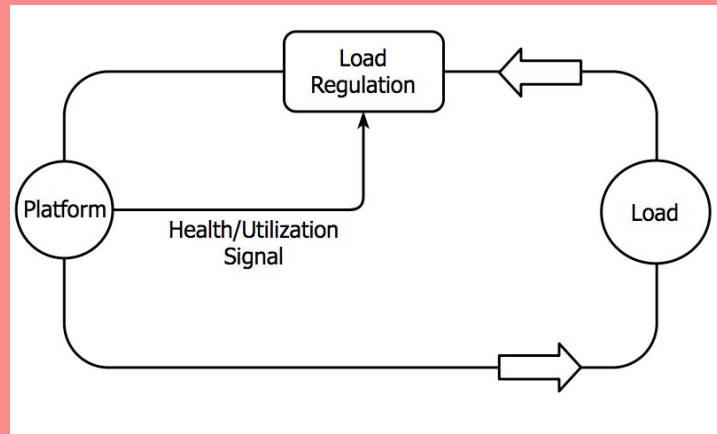
- New requests get queued (increased end-user latency)
  - Eventual timeouts (error response)



# Load shedding

To gracefully protect from overload scenarios:

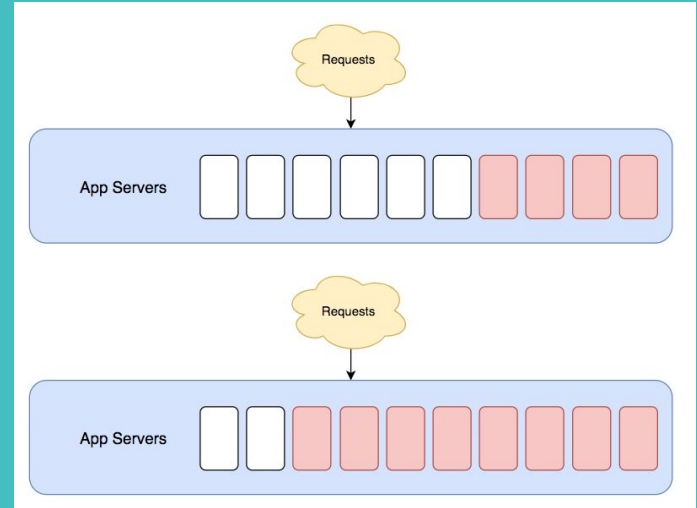
- Monitor capacity usage (utilization)
- Take action when overload does occur



Handling overload is especially important in a **multi-tenant** environment!

# Measuring your capacity

- Utilization: a ratio of how close you are to your capacity

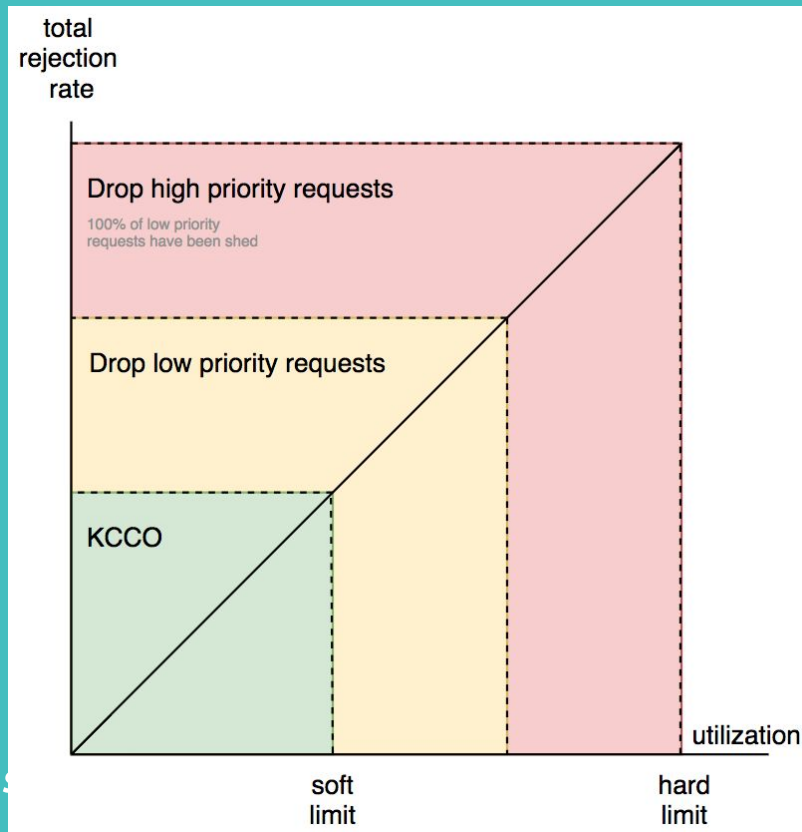




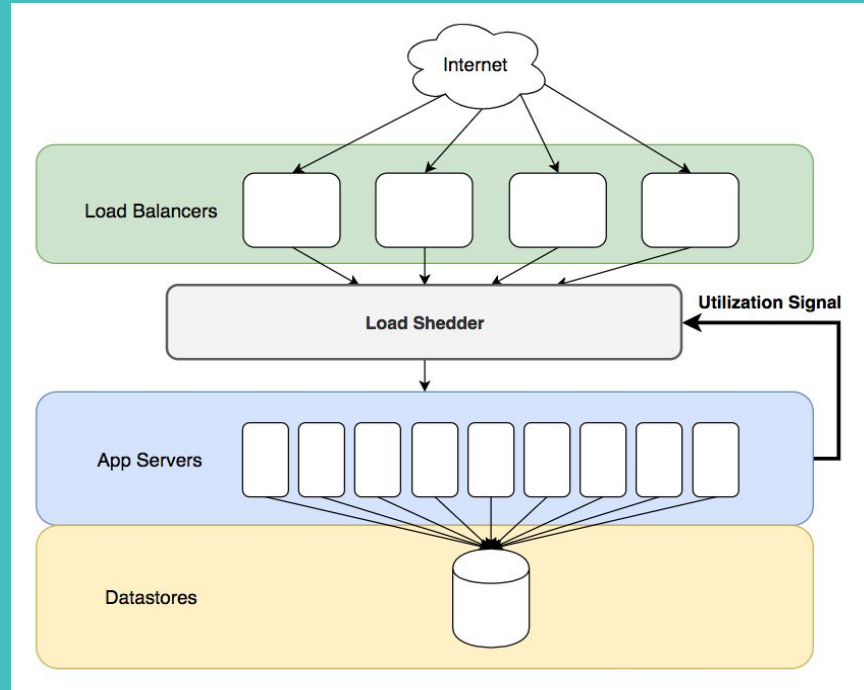
# Priority-aware load shedding

The limits range can be divided into equal parts to achieve a priority bucketing scheme:

- Each bucket is 100% dropped before we shed any requests from the next bucket



# Implementation in Practice

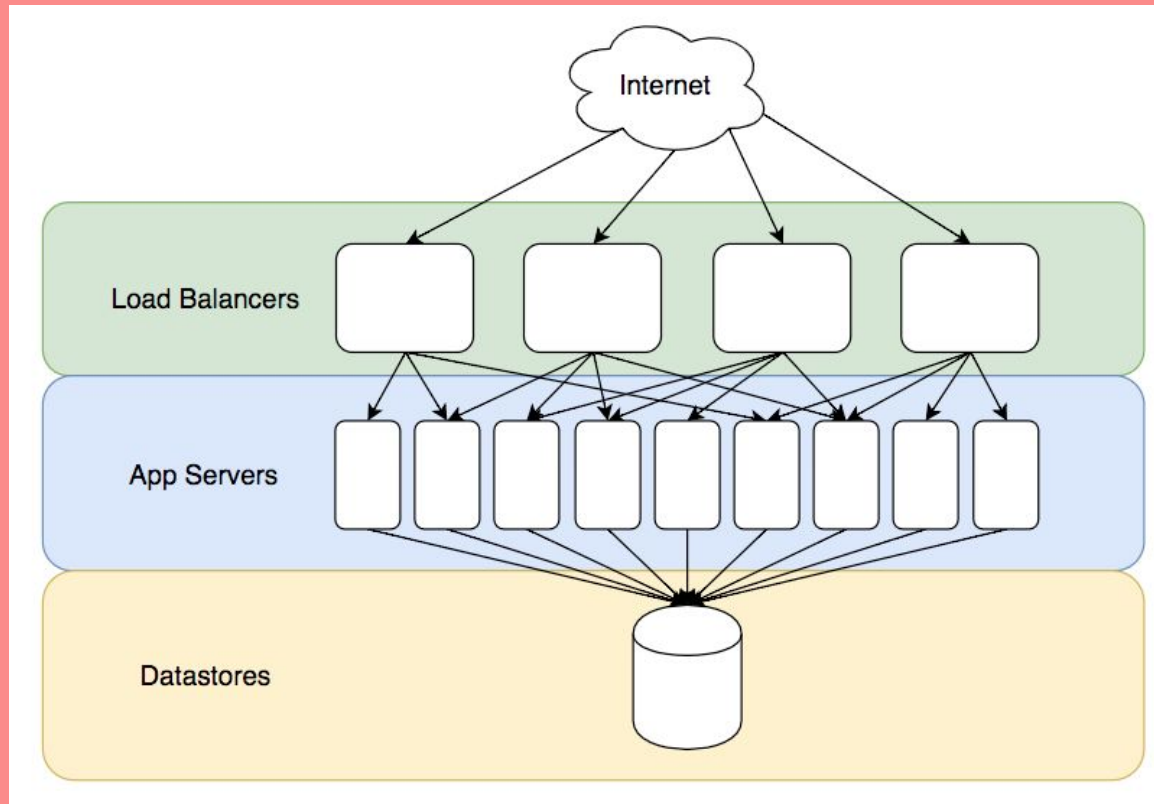


# Sharding

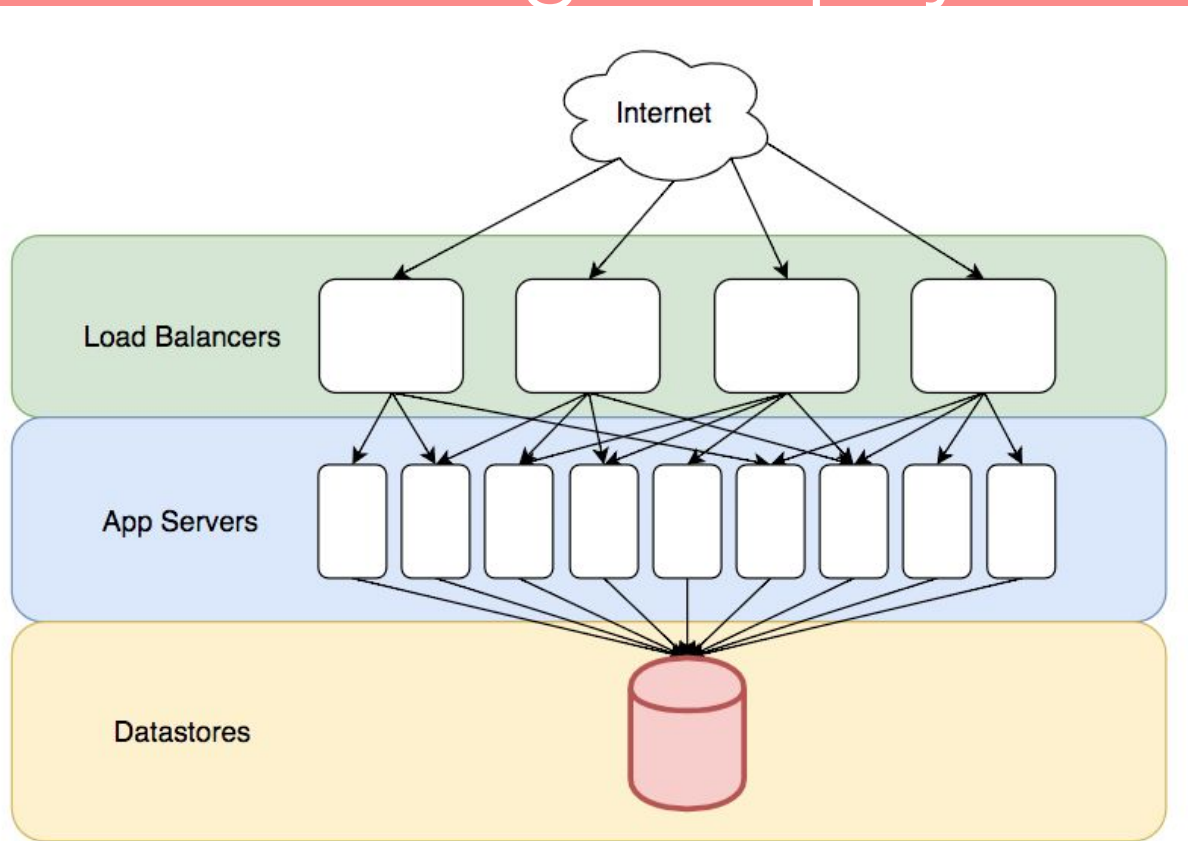
# Scaling Shopify

- 2004: Snowdevil (single-tenant)
- 2005: Shopify (multi-tenant)
- **2013: Database split into multiple shards**
- 2015: Backup datacenter for disaster recovery
- 2016: Multiple active datacenters
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- 2025: Data Shaping

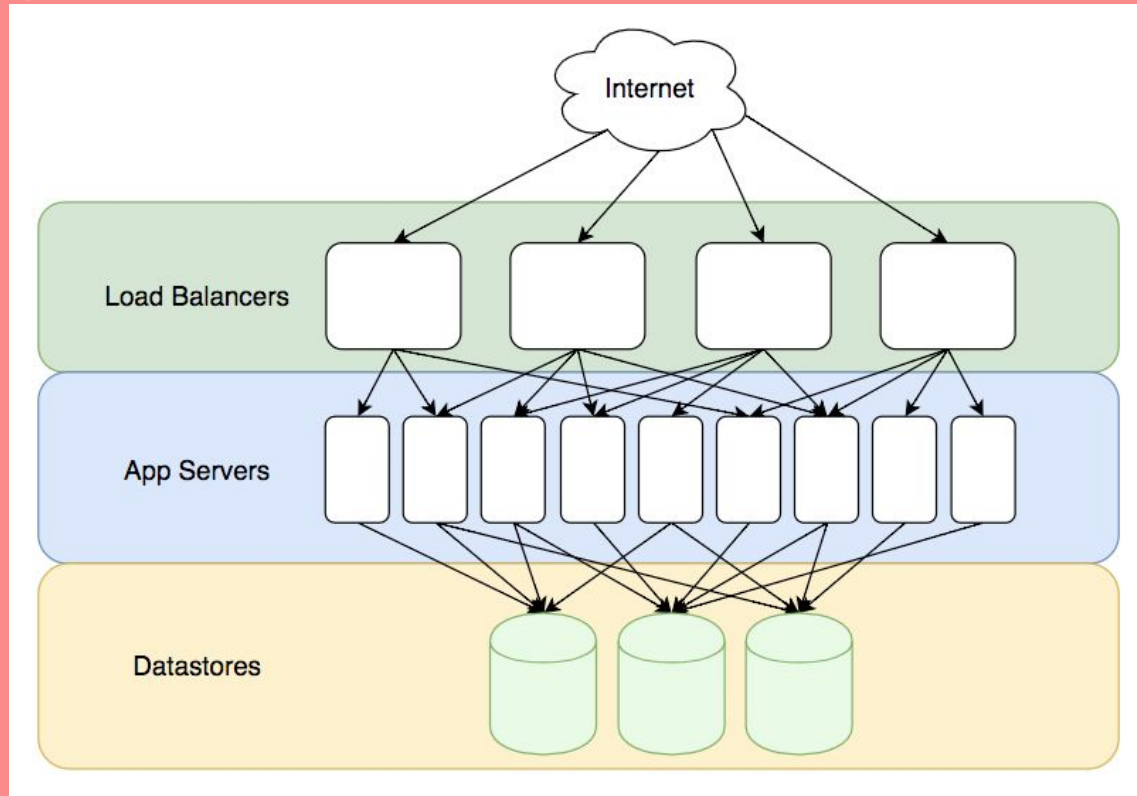
# Scaling Shopify



# Scaling Shopify



# Scaling Shopify (database sharding)

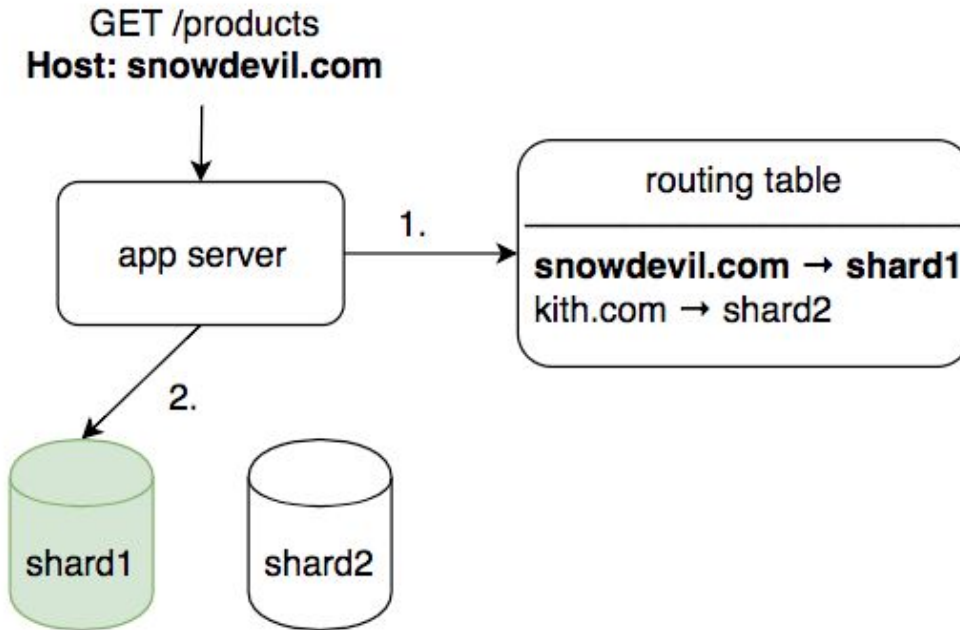


# Sharding in Practice

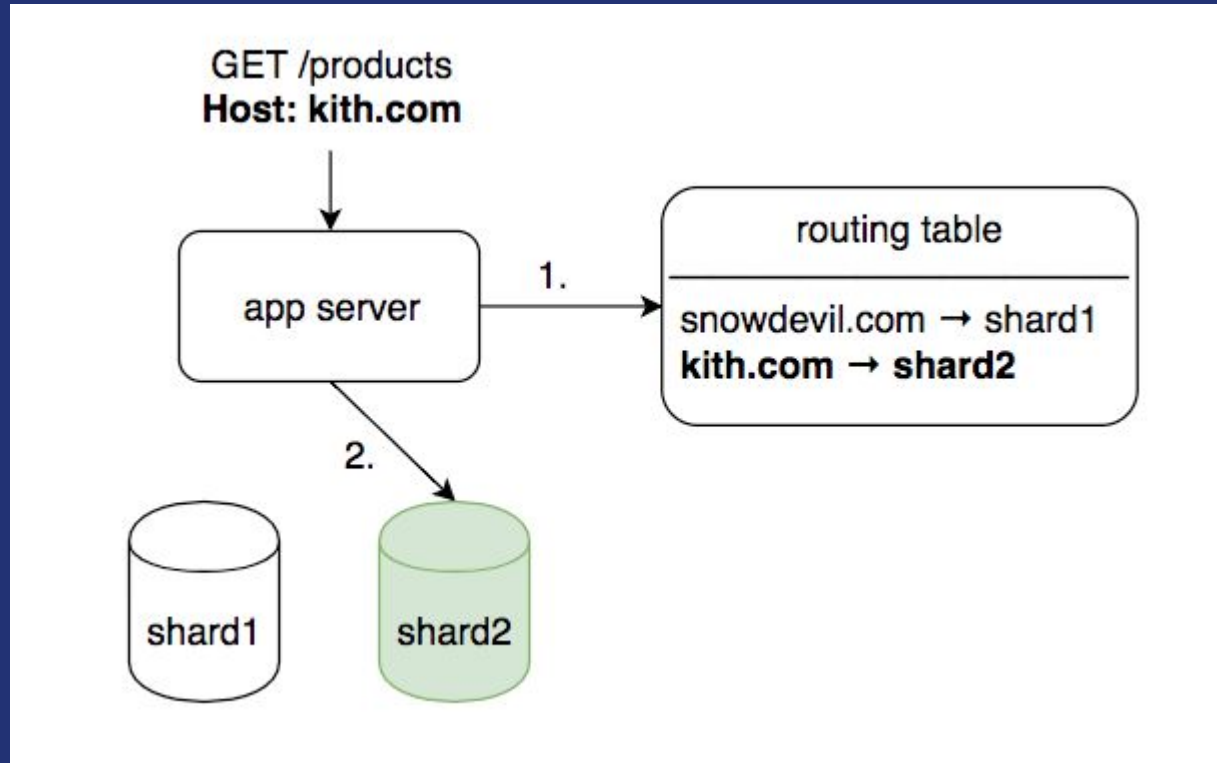
1. Choose a good sharding key (shop\_id, user\_id, hash(id))
2. Spread data among multiple shards
3. Route requests to correct shard
4. Keep shards well-balanced



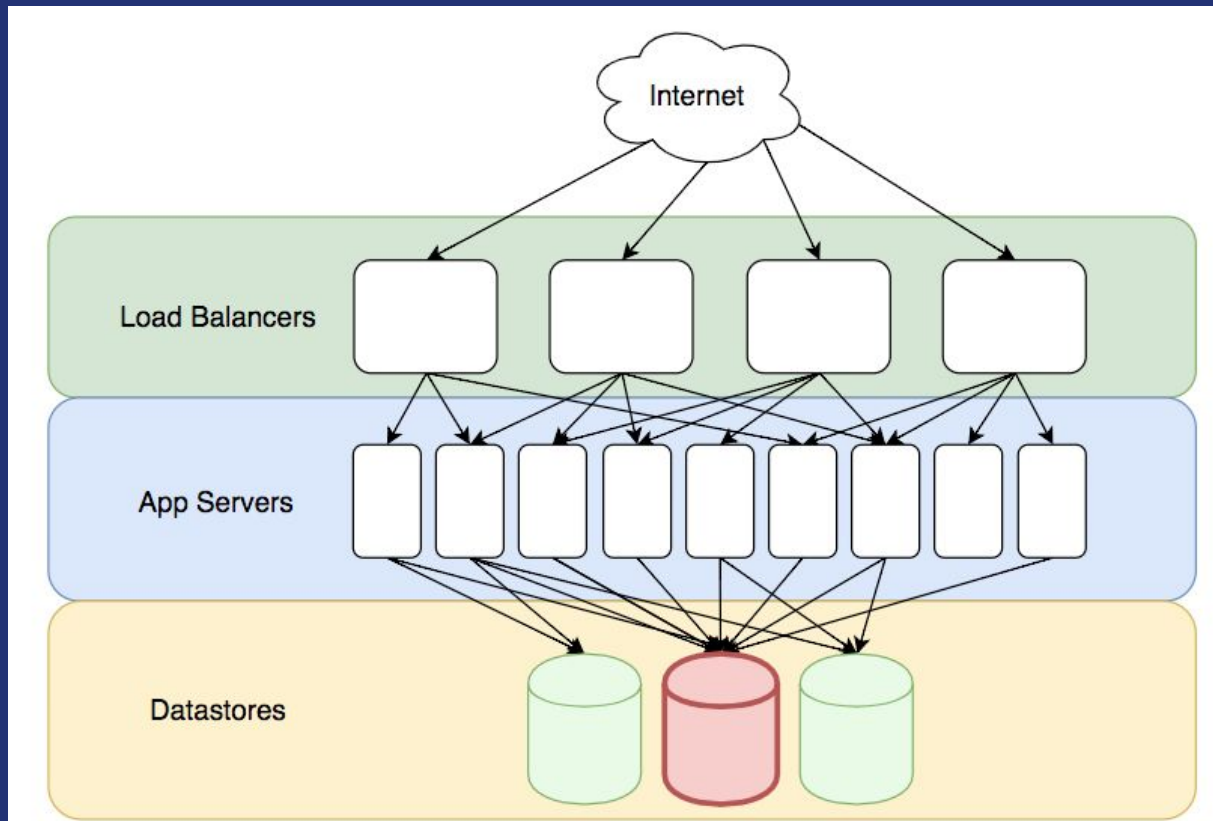
# Sharding in Practice (routing)



# Sharding in Practice (routing)



# Sharding in Practice (balancing)



# Sharding in Practice (balancing)

How do you move a shop like snowdevil.com?

- Copy data from shard1 to shard2
- Make shop read-only (acquire a lock on shop writes)
- Update routing table (UPDATE domains SET shard\_id=2 WHERE ...)
- Unlock shop

| db0 |         |        |
|-----|---------|--------|
| id  | shop_id | data   |
| 1   | 42      | socks  |
| 3   | 77      | laptop |
| 5   | 42      | hat    |
| 7   | 42      | shirt  |
| 9   | 77      | watch  |

| db1 |         |          |
|-----|---------|----------|
| id  | shop_id | data     |
| 2   | 58      | umbrella |
| 4   | 58      | vase     |
|     |         |          |
|     |         |          |
|     |         |          |

| db0 |         |        |
|-----|---------|--------|
| id  | shop_id | data   |
| 1   | 42      | socks  |
| 3   | 77      | laptop |
| 5   | 42      | hat    |
| 7   | 42      | shirt  |
| 9   | 77      | watch  |

| db1 |         |          |
|-----|---------|----------|
| id  | shop_id | data     |
| 2   | 58      | umbrella |
| 4   | 58      | vase     |
|     |         |          |
|     |         |          |
|     |         |          |

| db0 |         |        |
|-----|---------|--------|
| id  | shop_id | data   |
| 1   | 42      | socks  |
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| db1 |         |          |
|-----|---------|----------|
| id  | shop_id | data     |
| 1   | 42      | socks    |
| 2   | 58      | umbrella |
| 4   | 58      | vase     |
| 5   | 42      | hat      |
| 7   | 42      | shirt    |

| db0 |         |        |
|-----|---------|--------|
| id  | shop_id | data   |
| 3   | 77      | laptop |
| 9   | 77      | watch  |
|     |         |        |
|     |         |        |
|     |         |        |

| db1 |         |          |
|-----|---------|----------|
| id  | shop_id | data     |
| 1   | 42      | socks    |
| 2   | 58      | umbrella |
| 4   | 58      | vase     |
| 5   | 42      | hat      |
| 7   | 42      | shirt    |



| db0 |         |        |
|-----|---------|--------|
| id  | shop_id | data   |
| 1   | 42      | socks  |
| 3   | 77      | laptop |
| 5   | 42      | hat    |
| 7   | 42      | shirt  |
| 9   | 77      | watch  |

| db0 binlog |  |
|------------|--|
|            |  |
|            |  |
|            |  |
|            |  |

| db1 |         |          |
|-----|---------|----------|
| id  | shop_id | data     |
| 2   | 58      | umbrella |
| 4   | 58      | vase     |
|     |         |          |
|     |         |          |
|     |         |          |

| db0 |         |        |
|-----|---------|--------|
| id  | shop_id | data   |
| 1   | 42      | socks  |
| 3   | 77      | laptop |
| 5   | 42      | hat    |
| 7   | 42      | shirt  |
| 9   | 77      | watch  |

| db0 binlog |                           |
|------------|---------------------------|
| 1          | 1 42 socks<br>1 42 gloves |
|            |                           |
|            |                           |
|            |                           |

| db1 |         |          |
|-----|---------|----------|
| id  | shop_id | data     |
| 2   | 58      | umbrella |
| 4   | 58      | vase     |
|     |         |          |
|     |         |          |
|     |         |          |

| db0 |         |        |
|-----|---------|--------|
| id  | shop_id | data   |
| 1   | 42      | socks  |
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| 5   | 42      | hat    |
| 7   | 42      | shirt  |
| 9   | 77      | watch  |

| db0 binlog |                           |
|------------|---------------------------|
| 1          | 1 42 socks<br>1 42 gloves |
|            |                           |
|            |                           |
|            |                           |

| db1 |         |          |
|-----|---------|----------|
| id  | shop_id | data     |
| 1   | 42      | gloves   |
| 2   | 58      | umbrella |
| 4   | 58      | vase     |
|     |         |          |
|     |         |          |

| db0 |         |        |
|-----|---------|--------|
| id  | shop_id | data   |
| 1   | 42      | mitts  |
| 3   | 77      | laptop |
| 5   | 42      | hat    |
| 7   | 42      | shirt  |
| 9   | 77      | watch  |

| db0 binlog |                           |
|------------|---------------------------|
| 1          | 1 42 socks<br>1 42 gloves |
| 2          | 1 42 gloves<br>1 42 mitts |
|            |                           |
|            |                           |

| db1 |         |          |
|-----|---------|----------|
| id  | shop_id | data     |
| 1   | 42      | gloves   |
| 2   | 58      | umbrella |
| 4   | 58      | vase     |
|     |         |          |
|     |         |          |

| db0 |         |        |
|-----|---------|--------|
| id  | shop_id | data   |
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| 3   | 77      | laptop |
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| 7   | 42      | shirt  |
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| db0 binlog |                           |
|------------|---------------------------|
| 1          | 1 42 socks<br>1 42 gloves |
| 2          | 1 42 gloves<br>1 42 mitts |
|            |                           |
|            |                           |

| db1 |         |          |
|-----|---------|----------|
| id  | shop_id | data     |
| 1   | 42      | mitts    |
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| 4   | 58      | vase     |
|     |         |          |
|     |         |          |

| db0 |         |        |
|-----|---------|--------|
| id  | shop_id | data   |
| 1   | 42      | mitts  |
| 3   | 77      | laptop |
| 5   | 42      | hat    |
| 7   | 42      | pants  |
| 9   | 77      | watch  |

| db0 binlog |                           |
|------------|---------------------------|
| 1          | 1 42 socks<br>1 42 gloves |
| 2          | 1 42 gloves<br>1 42 mitts |
| 3          | 7 42 shirt<br>7 42 pants  |
|            |                           |

| db1 |         |          |
|-----|---------|----------|
| id  | shop_id | data     |
| 1   | 42      | mitts    |
| 2   | 58      | umbrella |
| 4   | 58      | vase     |
| 5   | 42      | hat      |
| 7   | 42      | shirt    |

| db0 |         |        |
|-----|---------|--------|
| id  | shop_id | data   |
| 1   | 42      | mitts  |
| 3   | 77      | laptop |
| 5   | 42      | hat    |
| 7   | 42      | pants  |
| 9   | 77      | watch  |

| db0 binlog                 |                           |
|----------------------------|---------------------------|
| 1                          | 1 42 socks<br>1 42 gloves |
| 2                          | 1 42 gloves<br>1 42 mitts |
| 3                          | 7 42 shirt<br>7 42 pants  |
| shop locked, no new writes |                           |

| db1 |         |          |
|-----|---------|----------|
| id  | shop_id | data     |
| 1   | 42      | mitts    |
| 2   | 58      | umbrella |
| 4   | 58      | vase     |
| 5   | 42      | hat      |
| 7   | 42      | pants    |

# How do you increase your capacity?

**Horizontal  
&  
Vertical  
Scaling**

**Caching**

**Load  
Control**

**Sharding**



# Scaling Shopify

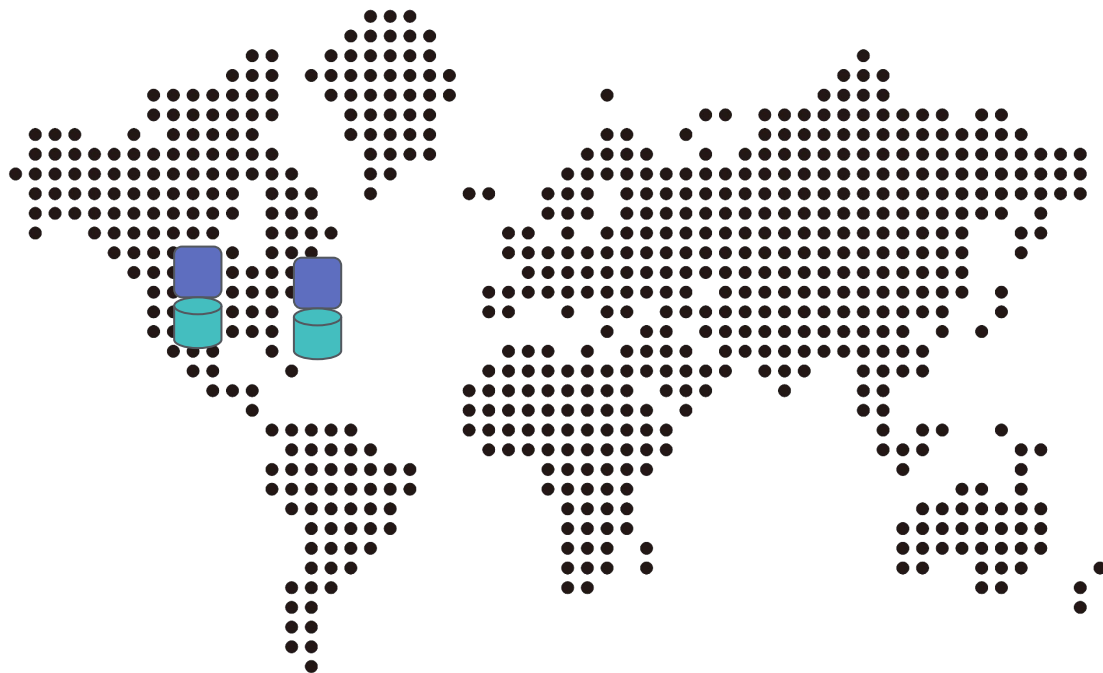
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App Servers



Databases



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Here's what's happening with your store today.

No store activity

Your sales, orders, and sessions will show here.

Facebook Shop is not connected. Select a Facebook Page to use this sales channel.

Dismiss

Learn more

Congratulations! It's time to get paid.

To receive money owed to you, we need a bit more information about your business

Submit details

50+ orders to fulfill

15 payments to capture

3 expiring soon

Keep your account secure by verifying your email address

...

If you get locked out of your account, Shopify can email you instructions to reset your password. To verify your email address, follow these steps:

Send a verification email to derek.stride@shopify.com

This confirms that Shopify can reach you.

Follow the link in the verification email

This confirms that you can access your email account.

Send verification email

Edit email address

All channels

Today

TOTAL SALES

Today

There were no sales during this time.

TOTAL SALES BREAKDOWN

Today

There were no sales during this time.

TOTAL SALES BY CHANNEL

Today

There were no sales during this time.

TOP PRODUCTS

Today

There were no products sold during this time.

PAYOUT SCHEDULE

Balance

CA\$0.00

View all payouts

ACTIVITY

Online Store hid a theme: [Venture](#).

November 6, 2019, 2:28 PM EST

Online Store published a theme: [Jumpstart](#).

November 6, 2019, 2:28 PM EST

You published a collection: [Custom 2](#).

October 23, 2019, 5:26 PM EDT

View all recent activity

←

6.7s

Women

Curve

Men

FASHIONNOVAMEN

Search



NEW ARRIVALS ▾

JEANS ▾

GRAPHIC TEES ▾

ACTIVE ▾

TOPS ▾

JACKETS & SWEATERS ▾

BOTTOMS ▾

BASICS ▾

ACCESSORIES ▾

PLUS+ ▾

SHOP ALL MENS ▾ SALE ▾

SPRING IT ON

30-80%  
OFF

SITEWIDE\*  
USE CODE: **FLIRTY80**

SHOP NOW

\*T&Cs apply (visit [fashionnova.com](https://fashionnova.com/promo) promo T&Cs tab)



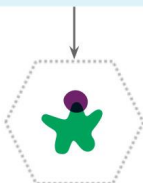
Monolith



Old  
authentication  
capability



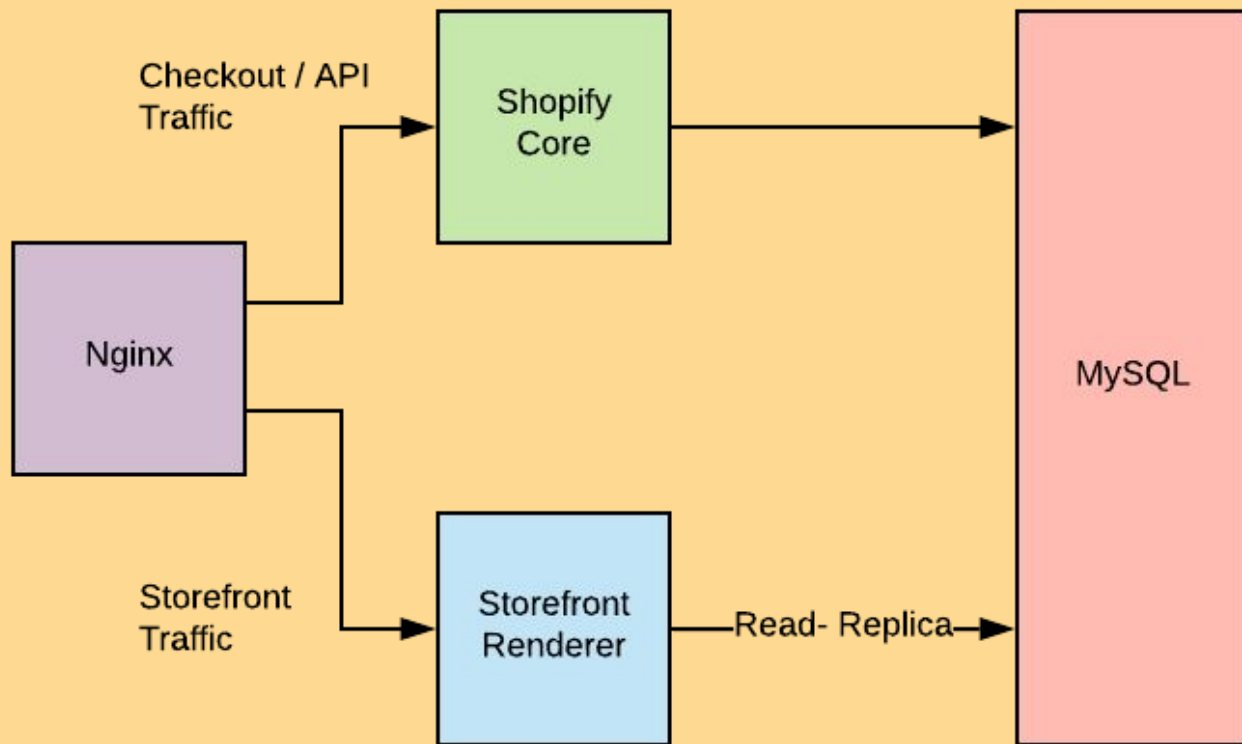
Monolith



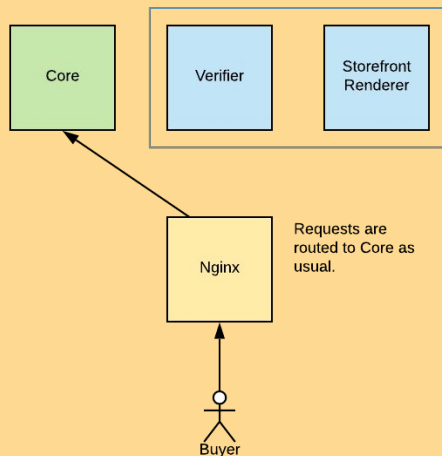
New  
authentication  
service

New Delivery Infrastructure

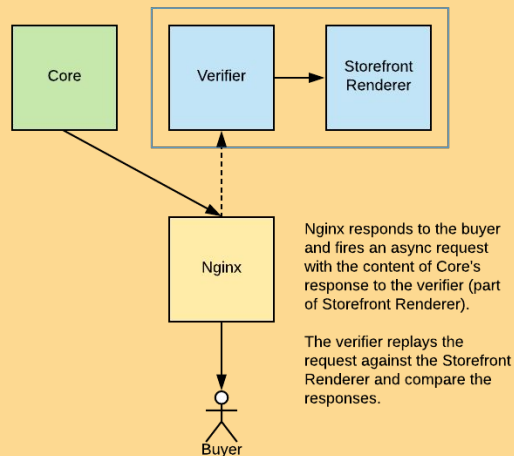
## Splitting the Monolith



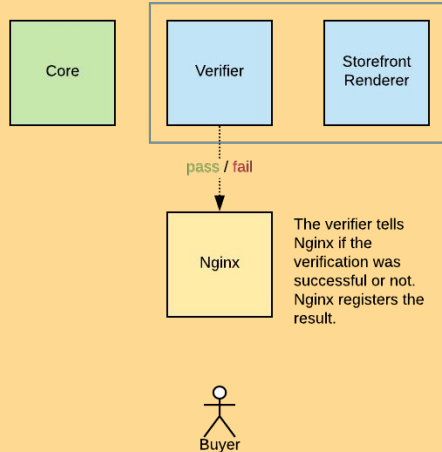
1.



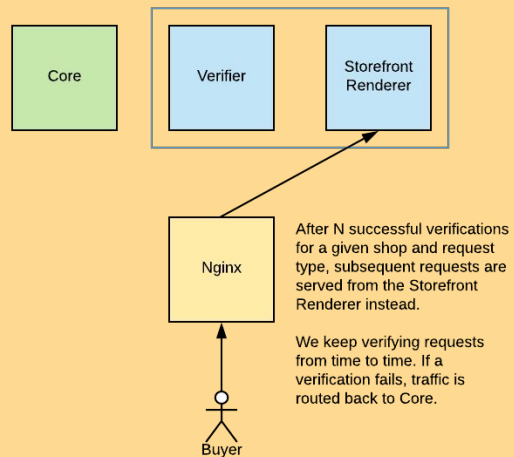
2.



3.



4.





# Scaling Shopify

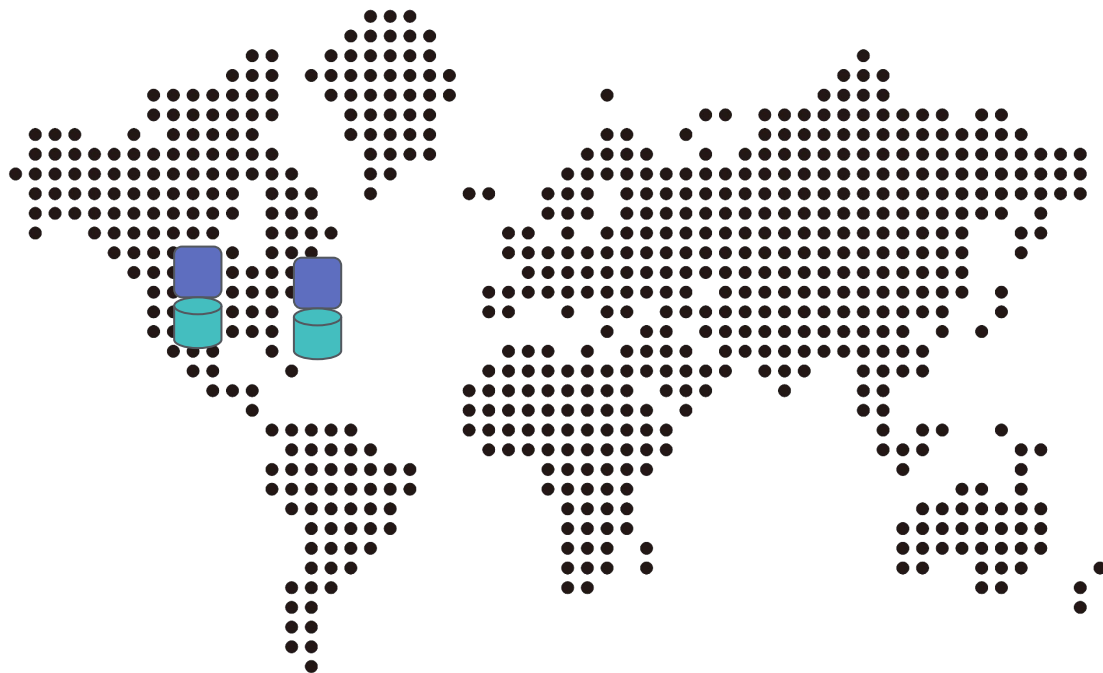
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App Servers



Databases

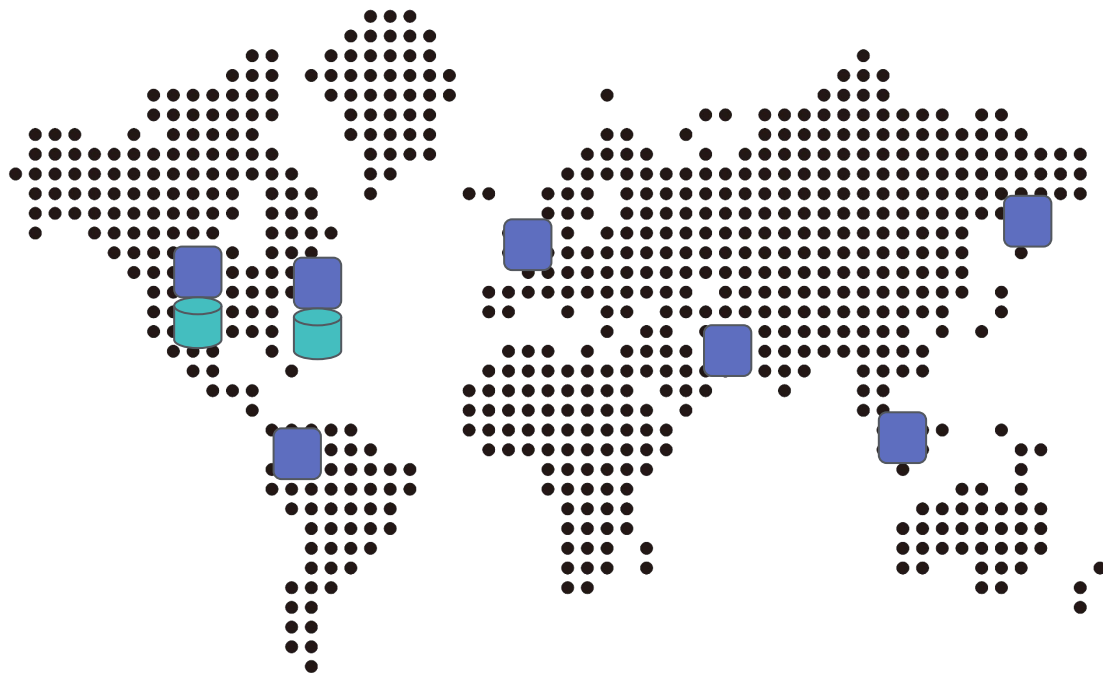


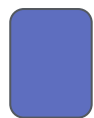


App Servers



Databases





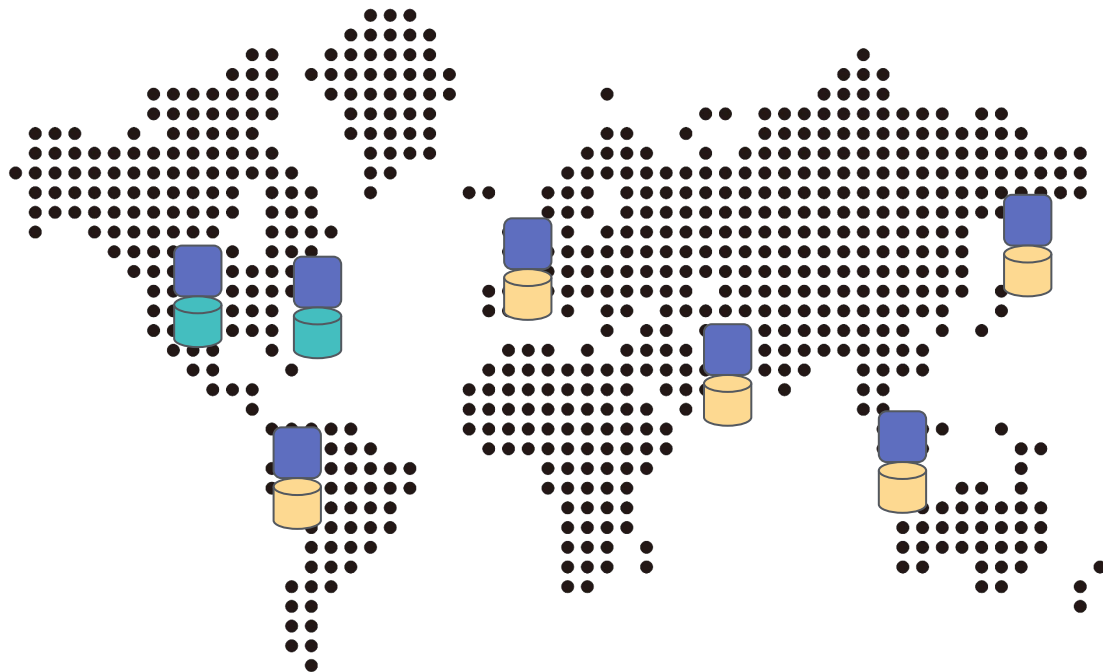
App Servers



Full Databases



Partial Databases



# Scaling Shopify

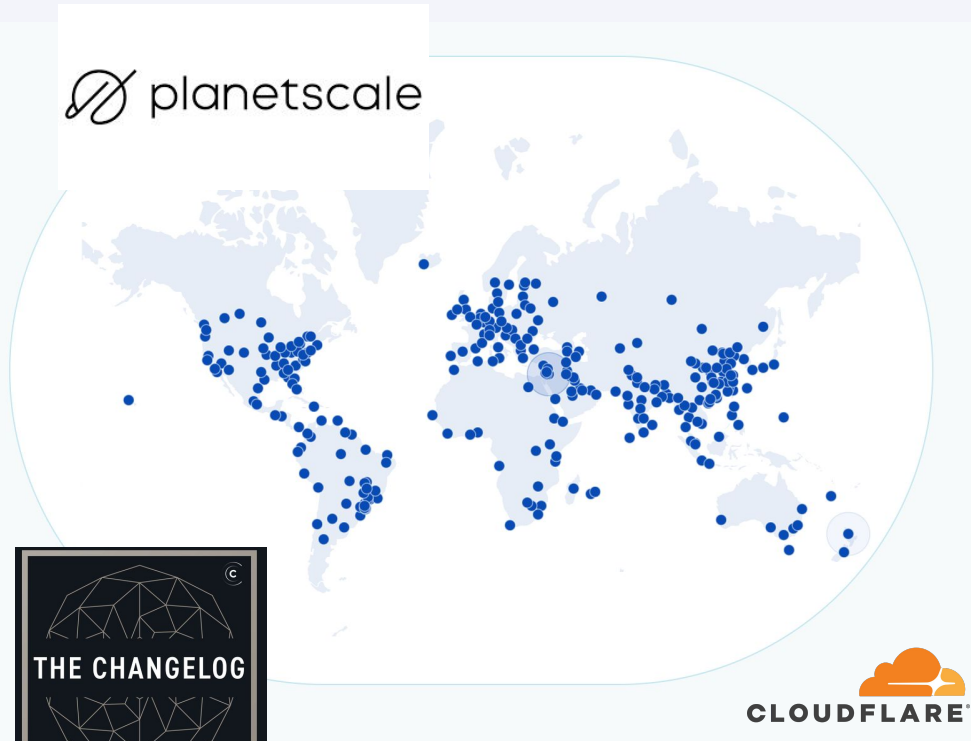
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**Thanks** ↑↓



# Put your servers close to your users

 planetscale



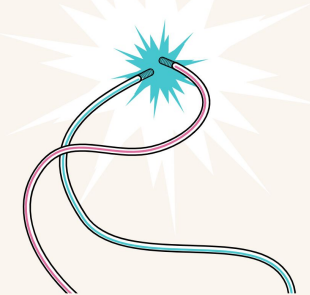
THE CHANGELOG

  
CLOUDFLARE



# Fly.io

**HOTWIRE**  
HTML OVER THE WIRE



**Thanks** ↑↓





# Hi, I'm Derek Stride

**Studied @ Carleton** graduated 2018

- Intern @ Shopify for 16 months

**Full-time @ Shopify** since 2018

- Worked on Product: Orders
- Last 6 years: Scaling Shopify's Storefront

