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TRACK  
Architectures You've Always Wondered About

SESSION

## Shopify's Architecture to Handle the World's Biggest Flash Sales

**Bart de Water**  
Manager @Shopify Payments Team



Bart de Water walks through how Shopify works under the hood, diving into their multi-tenant architecture that allows them to prevent failures and prepare for a multi-flash sale event: Black Friday Cyber Monday.

# Shopify's architecture to handle the world's biggest flash sales

Bart de Water  
QCon London - April 4, 2022



Shopify handles  
some of the largest  
flash sales in the  
world





+ MySQL + Redis + memcached



React (Native) + GraphQL

40

deploys per day



Working fully remote

Search

[Log in](#) [Sign up](#)

Cart (1) [Check Out](#)

## T-shirt Hero

[Home](#)

[Home](#) > [Your Shopping Cart](#)

[Catalog](#)

**Product**

**Price**

**Quantity**

**Total**



2017 Summer Top quality clothing  
KSTBK / 10T

[Remove](#)

\$12.78

1

\$12.78

Special instructions for seller

Subtotal \$12.78

*Shipping & taxes calculated at checkout*



CONTINUE SHOPPING

CHECK OUT

## T-shirt Hero

[Cart](#) > [Information](#) > [Shipping](#) > [Payment](#) > [Review](#)

Express checkout

OR

Contact information

[Already have an account? Log in](#)

Email or mobile phone number  
jamie.adams.email@user.email.com

☐ Email me with news and offers

Shipping address

First name (optional)  
Jamie

Last name  
Adams

Address  
151 Rue O'Connor Street

Apartment, suite, etc. (optional)

City  
Ottawa

Country/region  
Canada

Province  
Ontario

Postal code  
K2P 2L8

Continue to shipping

[Return to cart](#)



2017 Summer Top quality clothing  
KSTBK / 10T

\$12.78

Gift card or discount code

[Apply](#)

Subtotal

\$12.78

Shipping

Calculated at next step

Total

CAD \$12.78

# T-shirt Hero

Cart > Information > Shipping > Payment > Review

Contact	jamie.adams.email@user.email.com	Change
Ship to	151 Rue O'Connor Street, Ottawa ON K2P 2L8, Canada	Change

## Shipping method

Getting available shipping rates...

Continue to payment

Return to information

1

2017 Summer Top quality clothing

KSTBK / 10T

\$12.78

Gift card or discount code

Apply

Subtotal

\$12.78

Shipping

Calculating...

Total

CAD \$12.78

# T-shirt Hero




Cart > Information > Shipping > Payment > Review

Contact	jamie.adams.email@user.email.com	Change
Ship to	151 Rue O'Connor Street, Ottawa ON K2P 2L8, Canada	Change
Method	Free Shipping - Free	Change

## Payment

All transactions are secure and encrypted.

Credit card

VISA    and more...

Card number

Name on card

Expiry date (MM / YY)

Security code

## Billing address

Select the address that matches your card or payment method.

☒ Same as shipping address

☐ Use a different billing address

1

2017 Summer Top quality clothing

KSTBK / 10T

\$12.78

Gift card or discount code

Apply

Subtotal

\$12.78

Shipping

Free

Total

CAD \$12.78

Ship to	151 Rue O'Connor Street, Ottawa ON K2P 2L8, Canada	<a href="#">Change</a>
Method	Free Shipping - Free	<a href="#">Change</a>

### Payment

All transactions are secure and encrypted.

Credit card		VISA	MasterCard	Discover	and more...
Card number					
4242 4242 4242 4242					
Name on card					
jamie adams					
Expiration date (MM / YY)			Security code		
02 / 22			000		

### Billing address

Select the address that matches your card or payment method.

<input checked="" type="radio"/> Same as shipping address
<input type="radio"/> Use a different billing address

### Remember me

<input type="checkbox"/> Save my information for a faster checkout
--

[Review order](#) [Return to shipping](#)

Gift card or discount code	<a href="#">Apply</a>
----------------------------	-----------------------

Subtotal	\$12.78
Shipping	Free
<hr/>	
Total	CAD \$12.78

## T-shirt Hero


[Cart](#) > [Information](#) > [Shipping](#) > [Payment](#) > [Review](#)

### Review order

Contact	jamie.adams.email@user.email.com	<a href="#">Change</a>
Ship to	Jamie Adams 151 Rue O'Connor Street Ottawa ON K2P 2L8 Canada	<a href="#">Change</a>
Method	Free Shipping - Free 1 other method available at \$10.00	<a href="#">Change</a>
Payment	VISA ending with 4242 151 Rue O'Connor Street, Ottawa ON K2P 2L8, Canada	<a href="#">Change</a>

Subtotal	\$12.78
Shipping	Free
<hr/>	
Total	CAD \$12.78

[Pay now](#) [Return to payment](#)

	2017 Summer Top quality clothing KSTBK / 10T	\$12.78
---	---	---------

Gift card or discount code	<a href="#">Apply</a>
----------------------------	-----------------------

Subtotal	\$12.78
Shipping	Free
<hr/>	
Total	CAD \$12.78



Your order's being processed.  
If you're not automatically redirected, [refresh this page](#).

## T-shirt Hero



Order #1058

Thank you Jamie!



### Your order is confirmed

You'll receive a confirmation email with your order number shortly.

[Download Shop to track package](#)

### Customer information

#### Contact information

jami.adams.email@user.email.com

#### Payment method

VISA ending with 4242 - \$12.78

#### Shipping address

Jamie Adams  
151 Rue O'Connor Street  
Ottawa ON K2P 2L8  
Canada

#### Billing address

Jamie Adams  
151 Rue O'Connor Street  
Ottawa ON K2P 2L8  
Canada

#### Shipping method

Free Shipping



2017 Summer Top quality clothing  
KSTBK / 10T

\$12.78

Subtotal

\$12.78

Shipping

Free

Total

CAD \$12.78

T-shirt Hero

Search

Fayçal Sabaou

Home

Orders47

Drafts

Abandoned checkouts

Products

Customers

Analytics

Marketing

Discounts

Apps

Sales channels

Online Store

Point of Sale

Google

Facebook

Shop

Settings

Shipping Label Replies

#1058PaidUnfulfilled

December 7, 2021 at 4:50 a.m. from Online Store

RefundEditMore actions

Unfulfilled (1)

Location test

2017 Summer Top quality clothing

KSTBK / 10T

SKU: 11190149-kstbk-10t

\$12.78 x 1\$12.78

Fulfill item

Paid

Subtotal1 item\$12.78

ShippingFree Shipping (0.0 kg)\$0.00

Total\$12.78

Paid by customer\$12.78

Timeline

Show comments

Leave a comment...

Post

Notes

No notes from customer

Customer

Jamie Adams

No orders

CONTACT INFORMATION

jami.adams.email@user.ema

il.com

No phone number

SHIPPING ADDRESS

Jamie Adams

151 Rue O'Connor Street

Ottawa ON K2P 2L8

Canada

View map


BILLING ADDRESS

Same as shipping address



### Storefront

Read heavy  
Availability  
Cacheable



### Checkout

Write heavy  
Consistency  
External services



### Admin

R/W mix  
Consistency

**A Shopify Pod**  
contains data for  
one to many shops

Pod 1

Memcached

Redis

MySQL

Pod 2

Memcached

Redis

MySQL

Region A

Web worker

Job worker

Web worker

Job worker

Pod 1

Memcached

Redis

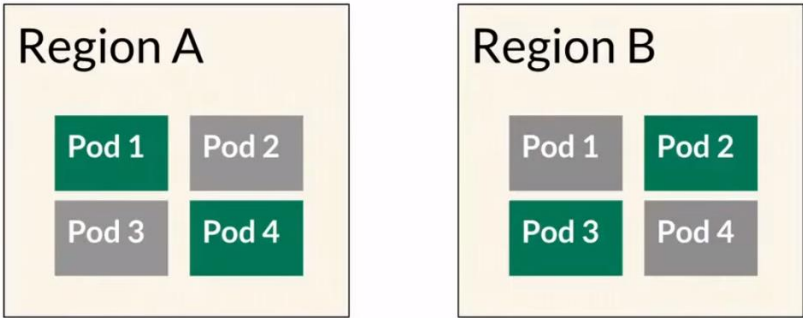
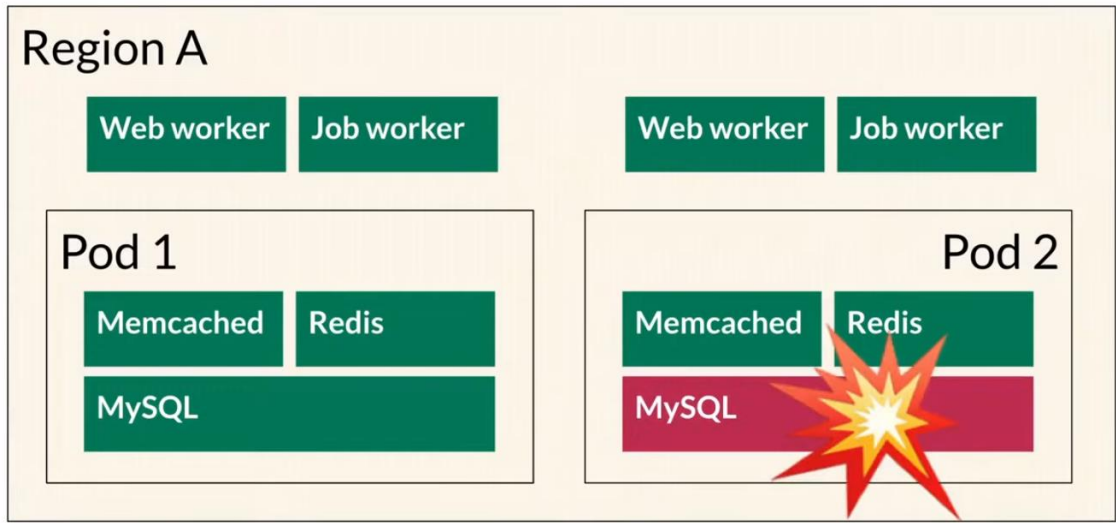
MySQL

Pod 2

Memcached

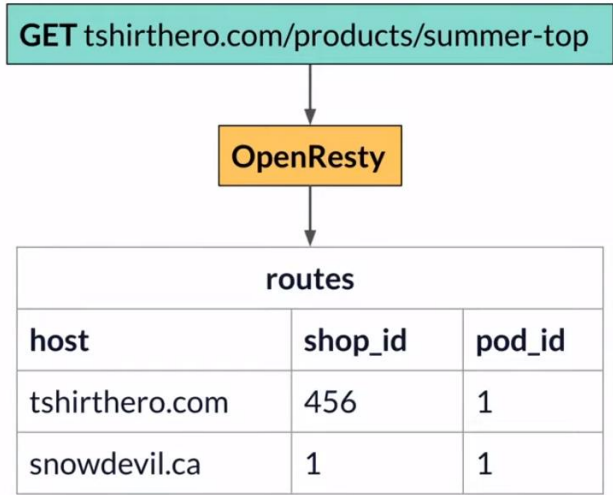
Redis

MySQL



# Domains

- Branding!
- Permanent domain: cooltshirts.myshopify.com
- Custom domains: tshirthero.com





GET tshirthero.com/products/summer-top

OpenResty

routes

host	shop_id	pod_id
tshirthero.com	456	1
snowdevil.ca	1	1

Pod 1

Pod 2

Pod 3

Pod 4



Merchandise

Pricing



Payments



Checkout



Inventory



Taxes



Shipping

Payment  
Card Industry  
Data Security  
Standard


- Build and Maintain a Secure Network and Systems
- Protect Cardholder Data
- Maintain a Vulnerability Management Program
- Implement Strong Access Control Measures
- Regularly Monitor and Test Networks
- Maintain an Information Security Policy










## Payment

All transactions are secure and encrypted.


 Credit card

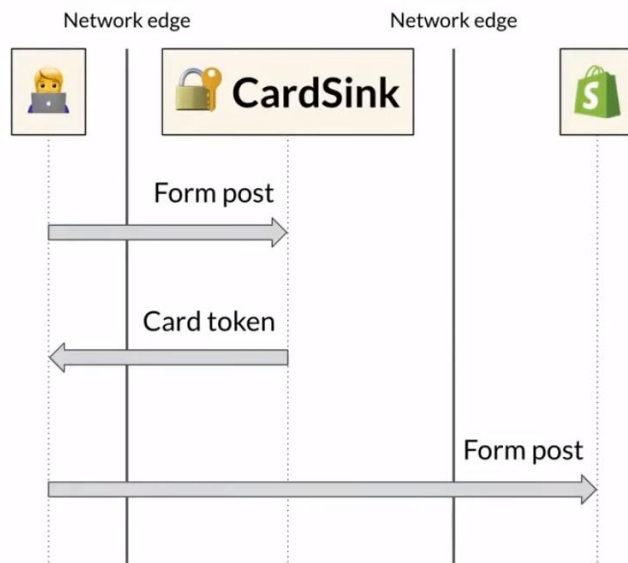
 and more...

Card number 

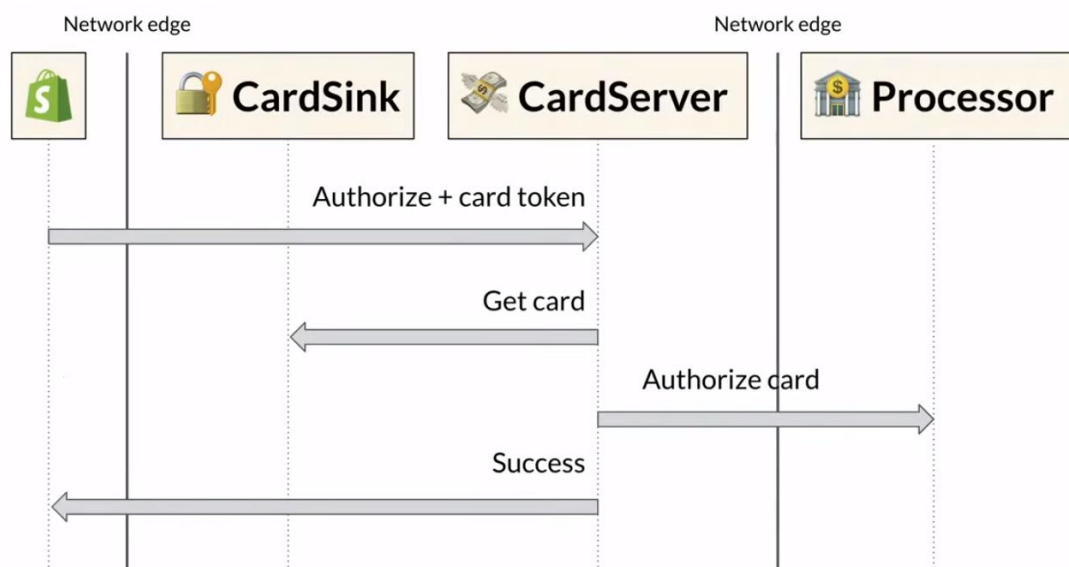
Name on card

Expiration date (MM / YY)

Security code 



25



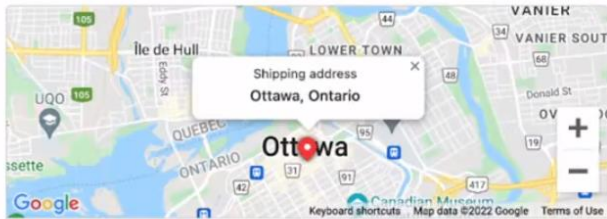
26

## T-shirt Hero



Order #1058

Thank you Jamie!



Your order is confirmed

You'll receive an email when your order is ready.

[Track order with Shop](#)

☐ Email me with news and offers

### Customer information

#### Contact information

jamie.adams.email@user.email.com

#### Payment method

VISA ending with 4242 - \$12.78

Shipping address

Billing address



2017 Summer Top quality clothing  
KSTBK / 10T

\$12.78

Subtotal

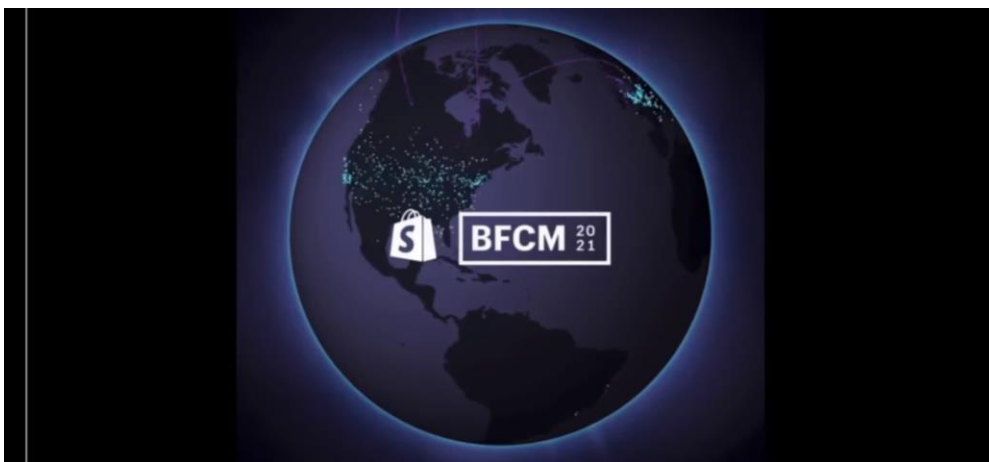
\$12.78

Shipping

Free

Total

CAD **\$12.78**



Black Friday  
Cyber Monday  
2021

**6.3B**

USD total sales

**3.1M**

USD sales per minute (peak)

**32M**

Requests per minute (peak)

**11M**

MySQL queries per minute (peak)

**24B**

Background jobs performed

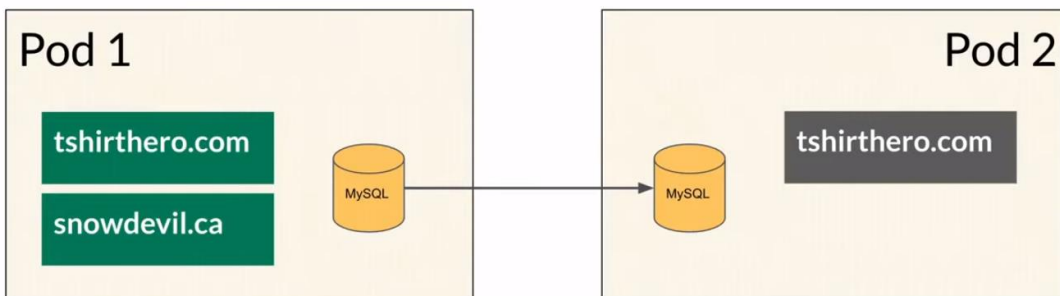
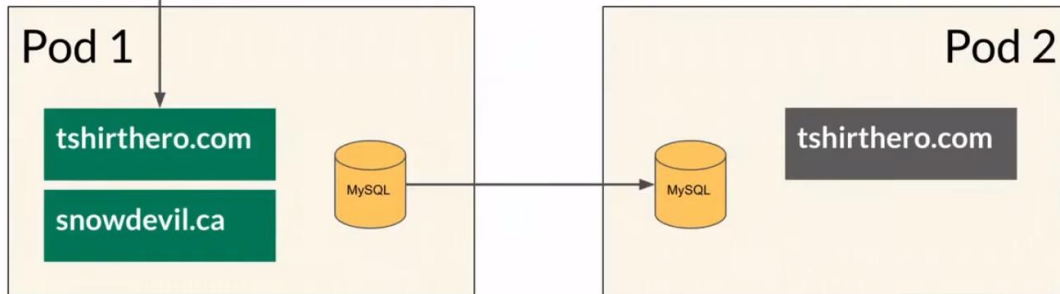
**42B**

API calls made to partner apps

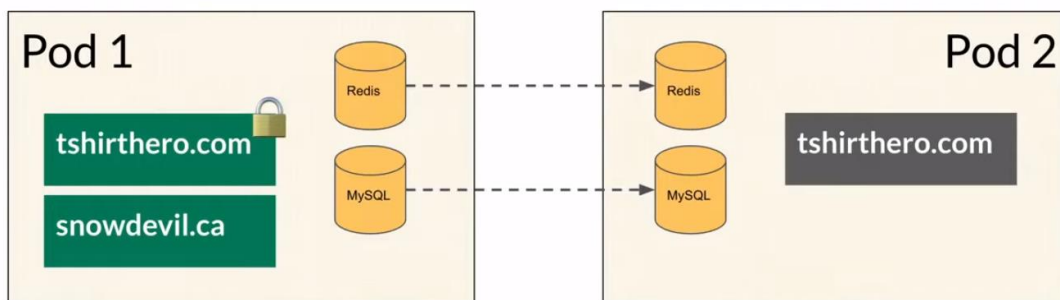
# Tenant isolation principle

Each shop shouldn't know about any of the others

GET products/summer-top



<https://github.com/Shopify/ghostferry>



routes		
host	shop_id	pod_id
tshirthero.com	456	1
snowdevil.ca	1	1

GET products/summer-top

Pod 1

tshirthero.com

snowdevil.ca



Pod 2

tshirthero.com



GET products/summer-top

Pod 1

snowdevil.ca



Pod 2

tshirthero.com



**Storefront**

Read heavy  
Availability  
Cacheable



**Checkout**

Write heavy  
Consistency  
External services



**Admin**

R/W mix  
Consistency



**Checkout**

Write heavy  
Consistency  
External services



**Admin**

R/W mix  
Consistency





RECEIPT

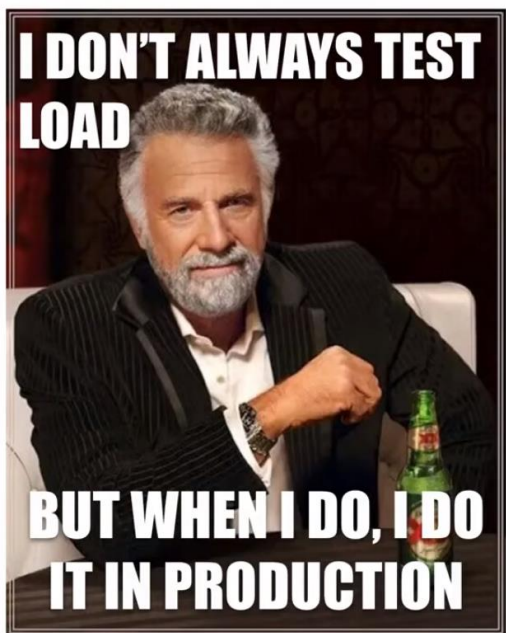
## Checkout

Write heavy  
Consistency  
External services



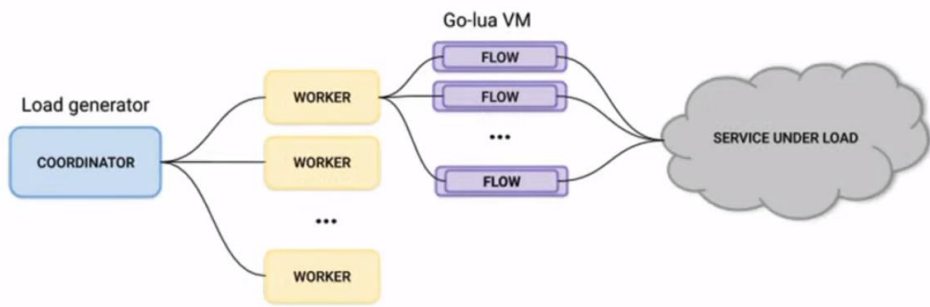
## Admin

R/W mix  
Consistency

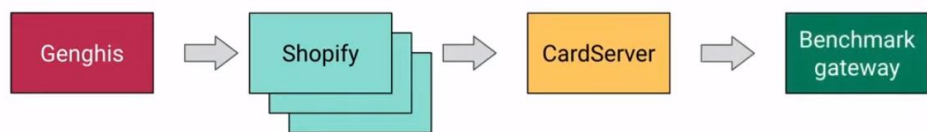


42

### Genghis



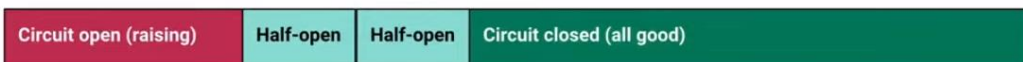
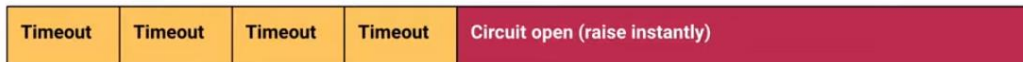
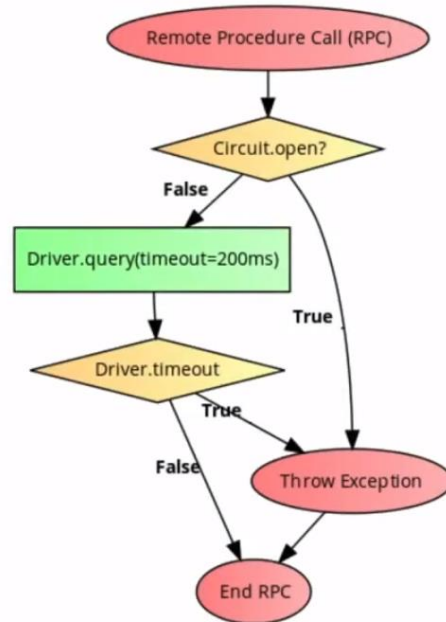
### Load testing setup



		Expected User Experience		
		User can browse	User can check out	User is served from a passive region
Possible Failures	MySQL (persistent storage dependency)			
	Down	Yes	No	Yes
	Slow	Yes	Yes	Yes
	Shipify (third party application dependency)			
	All providers down	Yes	No	Sometimes
	One provider down	Yes	Yes, except ...	Yes
	Regional (network architecture)			
	Network partition	Yes	Yes	Yes, if ...
	Routing mistake	Yes	No	Yes



Circuit breaker





```
Toxiproxy[:mysql].downstream(:timeout, timeout: 1000).apply do
  assert(Database.unhealthy?)
end
```

```
Toxiproxy[:redis].down do
  user.get_session
end
```



<https://github.com/Shopify/toxiproxy>

```
SEMIAN_DEFAULTS = { success_threshold: 1,
                     error_threshold: 3,
                     error_timeout: 10 }

Semian::NetHTTP.semian_configuration = -> do |host, port|
  SEMIAN_DEFAULTS.merge(name: "#{host}_#{port}")
end
```

#### Idempotent request

```
{
  "amount": {
    "value": 100.00,
    "currency": "EUR"
  },
  "clientAccountId": 1234567,
  "clientBuyerId": 12345,
  "clientTransactionId": 6789,
  "...",
  "test": true,
  "idempotencyKey": "d0814711-91cb-4c4e-bc71-64f4f0a7d27"
}
```

#### Idempotent action

```
class CreateCharge
  include Resumption::Processor

  def initialize(progress:, amount:, currency:); end

  recovery_point run: :create_incoming_records,
    recover: :recover_incoming_records

  recovery_point run: :create_outgoing_records,
    recover: :recover_outgoing_records

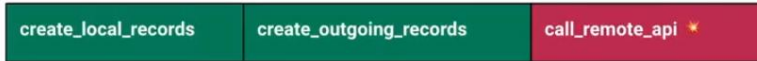
  recovery_point run: :call_remote_api,
    recover: :call_remote_api, transactional: false

  recovery_point run: :handle_remote_response
end
```



## Resumption

idempotency\_key: "d0814711-91cb-4c4e-bc71-64f4f0a7d27"

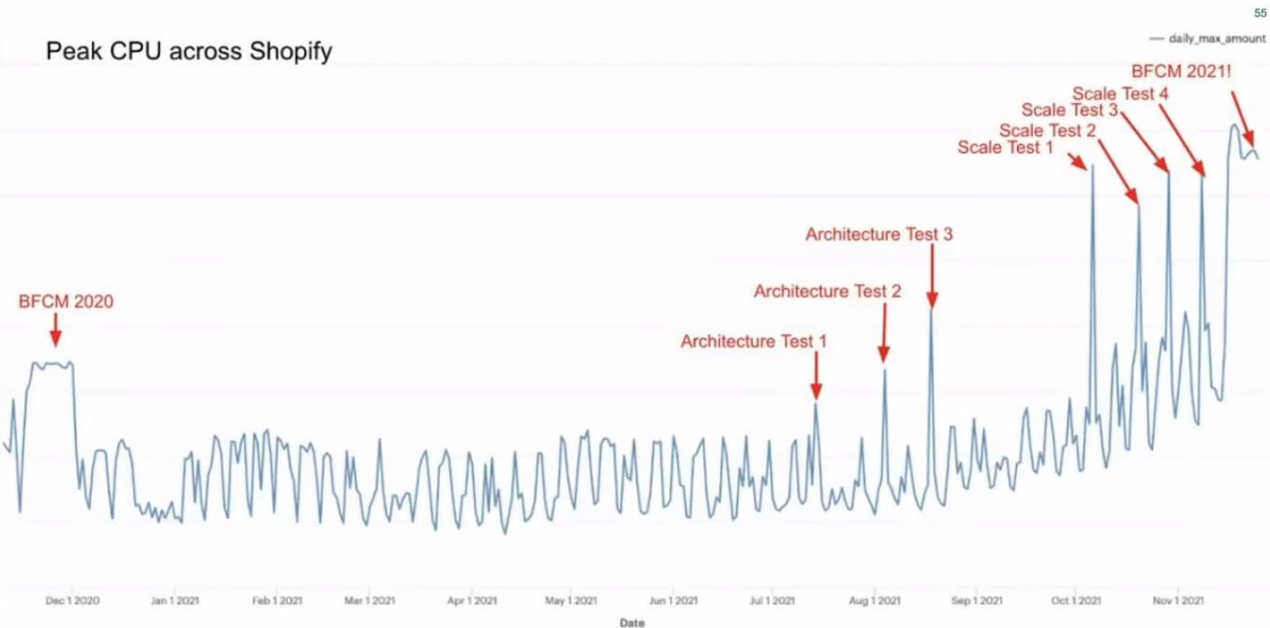


## Resumption

idempotency\_key: "d0814711-91cb-4c4e-bc71-64f4f0a7d27"



## Peak CPU across Shopify



- 01 The story of a single checkout
- 02 Scaling for BFCM
- 03 Testing scale and failure scenarios

# Thanks!

 <https://shopify.engineering>  
 <https://twitter.com/bdewater>