Tracing Kafka with OpenTelemetry

Daniel Kim, Lead Developer Relations Engineer @ New Relic

New Relic.

Daniel Kim

Lead Developer Advocate, New Relic

- Likes spicy food (hotpot)
- Likes spicy talks
- Likes spicy tweets
- Follow me on **@learnwdaniel**

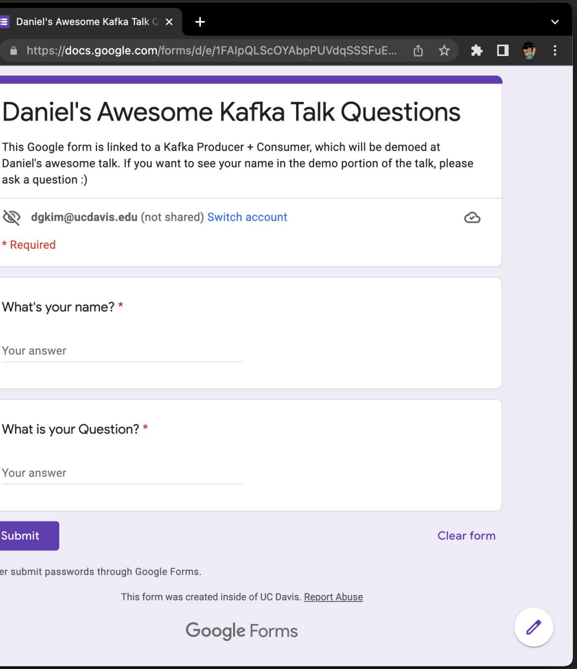
New Relic.

Agenda

- Why trace Kafka
- What is Distributed Tracing?
- What is OpenTelemetry?
- Implementing OpenTelemetry with Kafka
- Live Demo

I decided to do a live demo

Live Demo



Daniel's Awesome Kafka Talk C
https://docs.google.com/forms/d/e/1FAIpQLScOYAbpPUVdqSSSFuE...

Daniel's Awesome Kafka Talk Questions

This Google form is linked to a Kafka Producer + Consumer, which will be demoed at Daniel's awesome talk. If you want to see your name in the demo portion of the talk, please ask a question :)

dgkim@ucdavis.edu (not shared) Switch account

* Required

What's your name? *

Your answer

What is your Question? *

Your answer

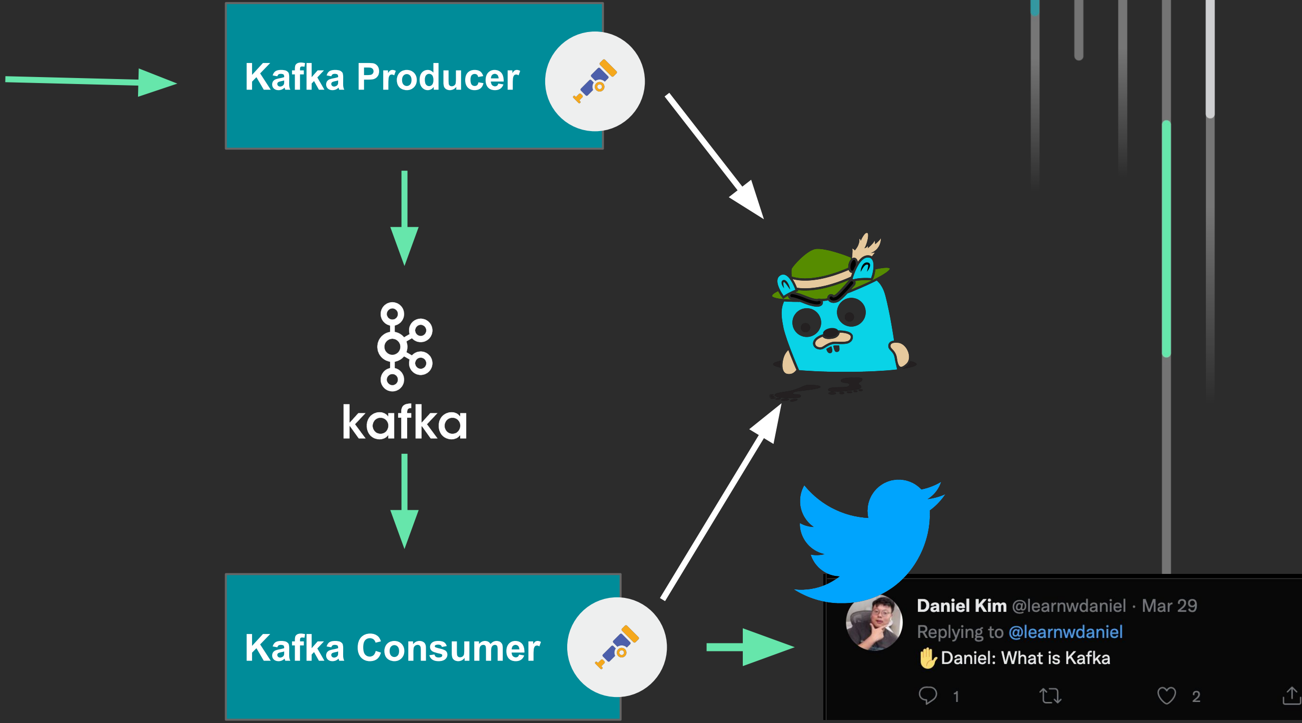
Submit

Clear form

er submit passwords through Google Forms.

This form was created inside of UC Davis. Report Abuse

Google Forms

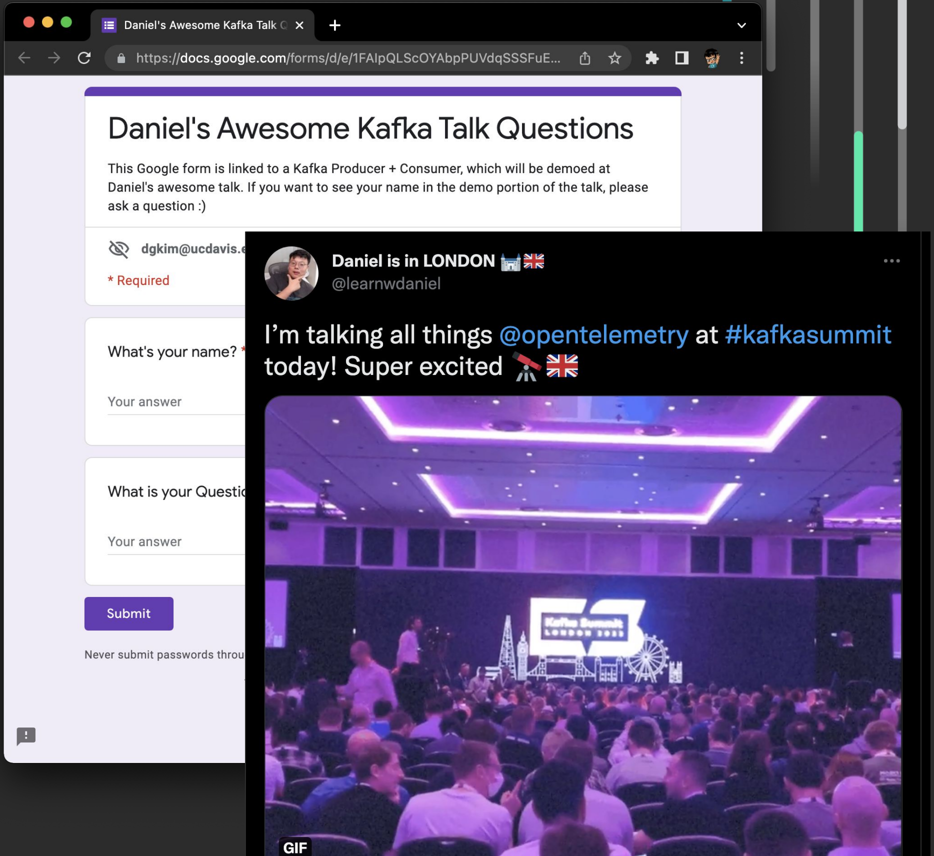


Daniel Kim @learnwdaniel · Mar 29
Replying to @learnwdaniel
✋Daniel: What is Kafka

New Relic.

We need test data - so please ask questions!

ask.danielkim.fun



Daniel's Awesome Kafka Talk Q

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Daniel's Awesome Kafka Talk Questions

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* Required

What's your name? *

Your answer

What is your Questic

Your answer

Submit

Never submit passwords throu

Daniel is in LONDON 🏰🇬🇧
@learnwdaniel

I'm talking all things @opentelemetry at #kafkasummit today! Super excited 🔭🇬🇧

Why Trace Kafka?

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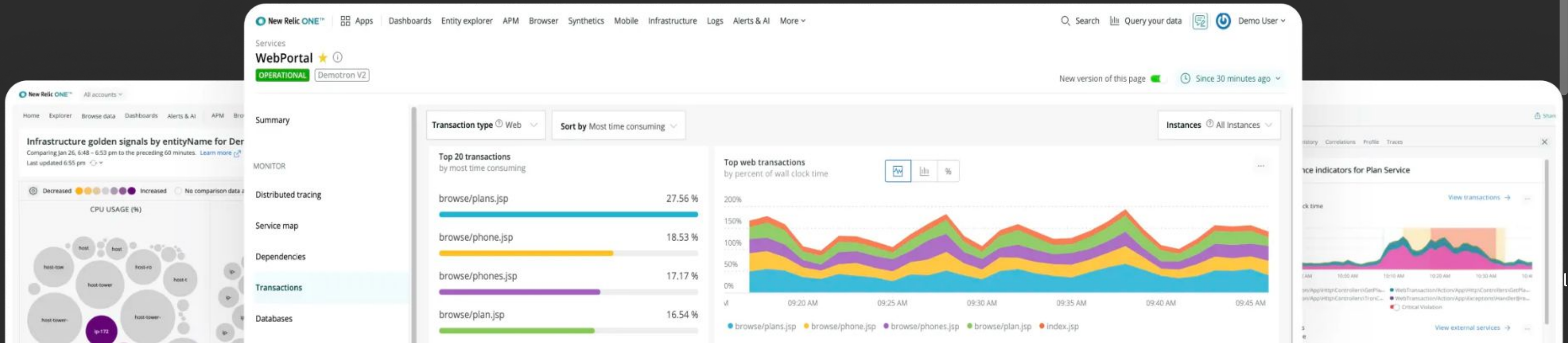
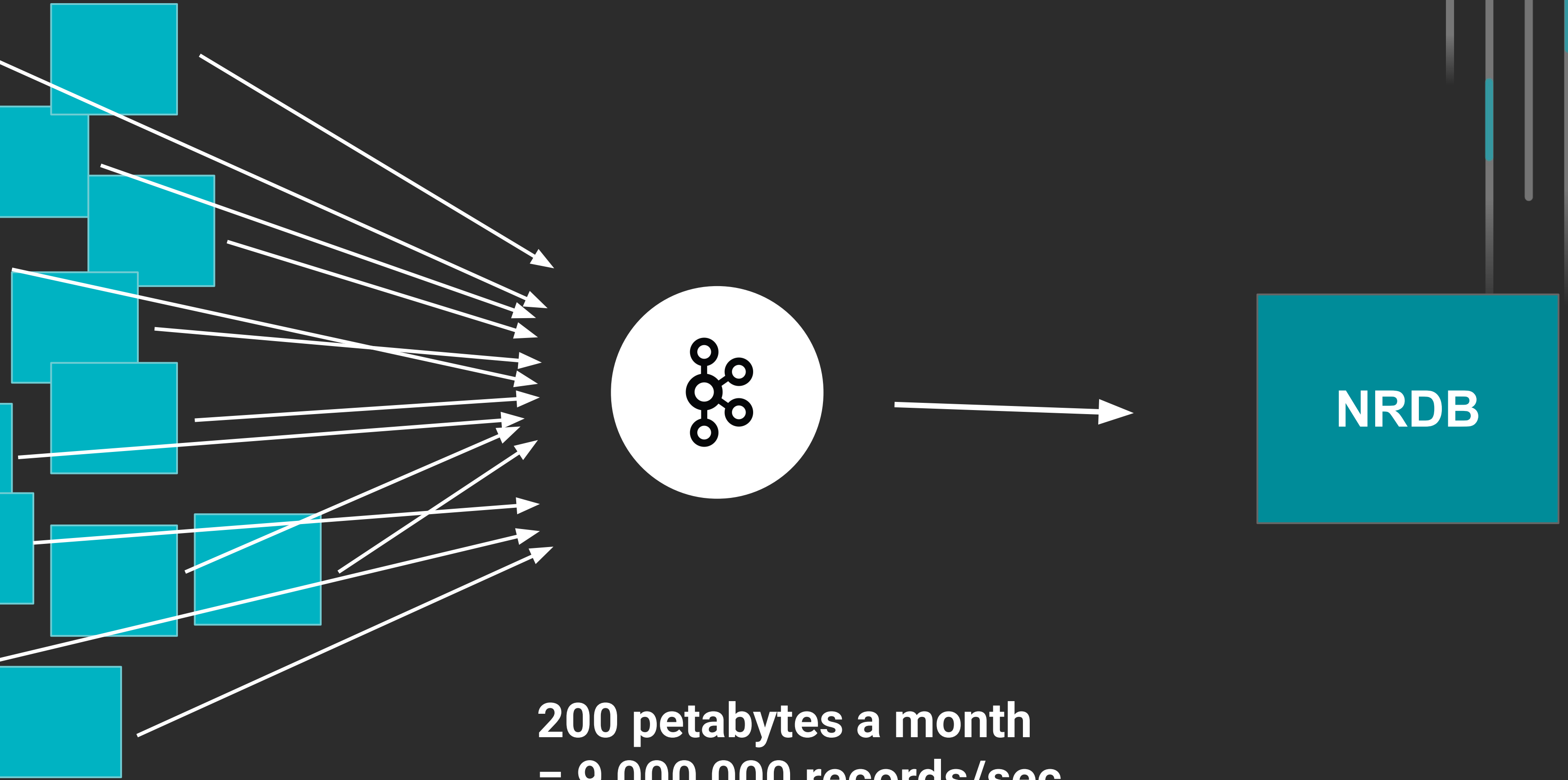
New Relic



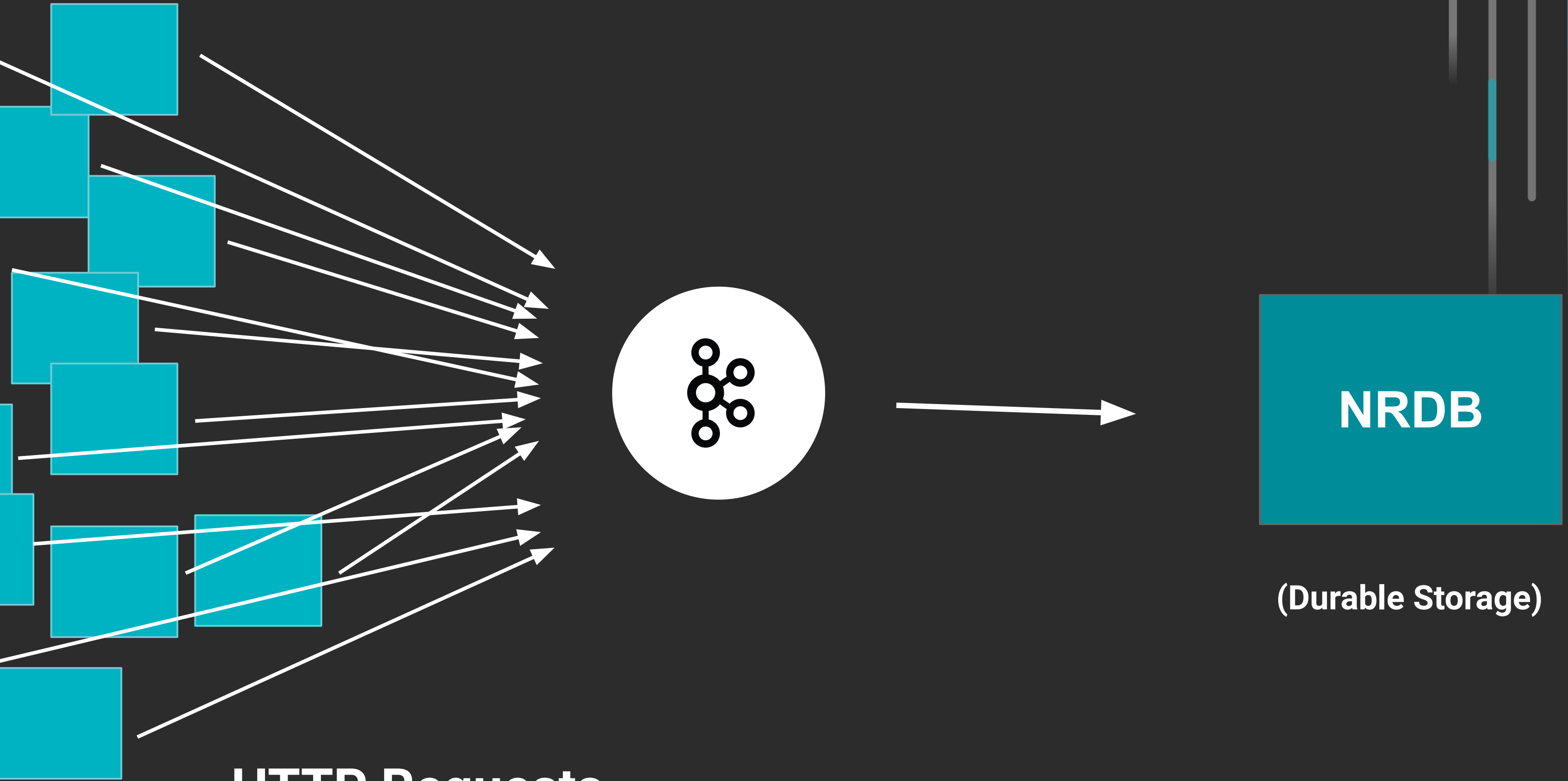
Top 20 transactions
by most time consuming

browse/plans.jsp	27.56 %
browse/phone.jsp	18.53 %
browse/phones.jsp	17.17 %
browse/plan.jsp	16.54 %

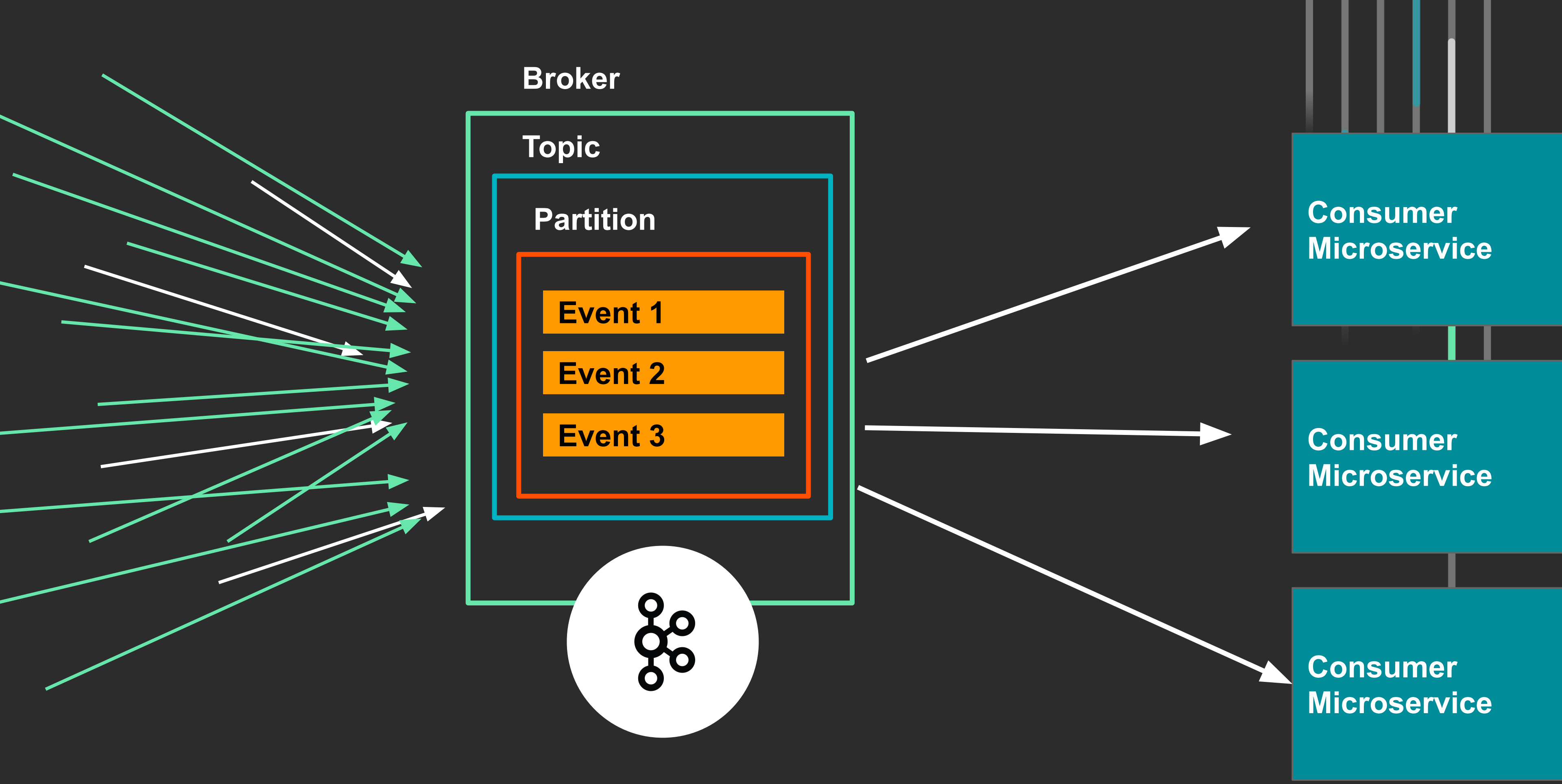


200 petabytes a month
= 9,000,000 records/sec

ask.danielkim.fun



HTTP Requests



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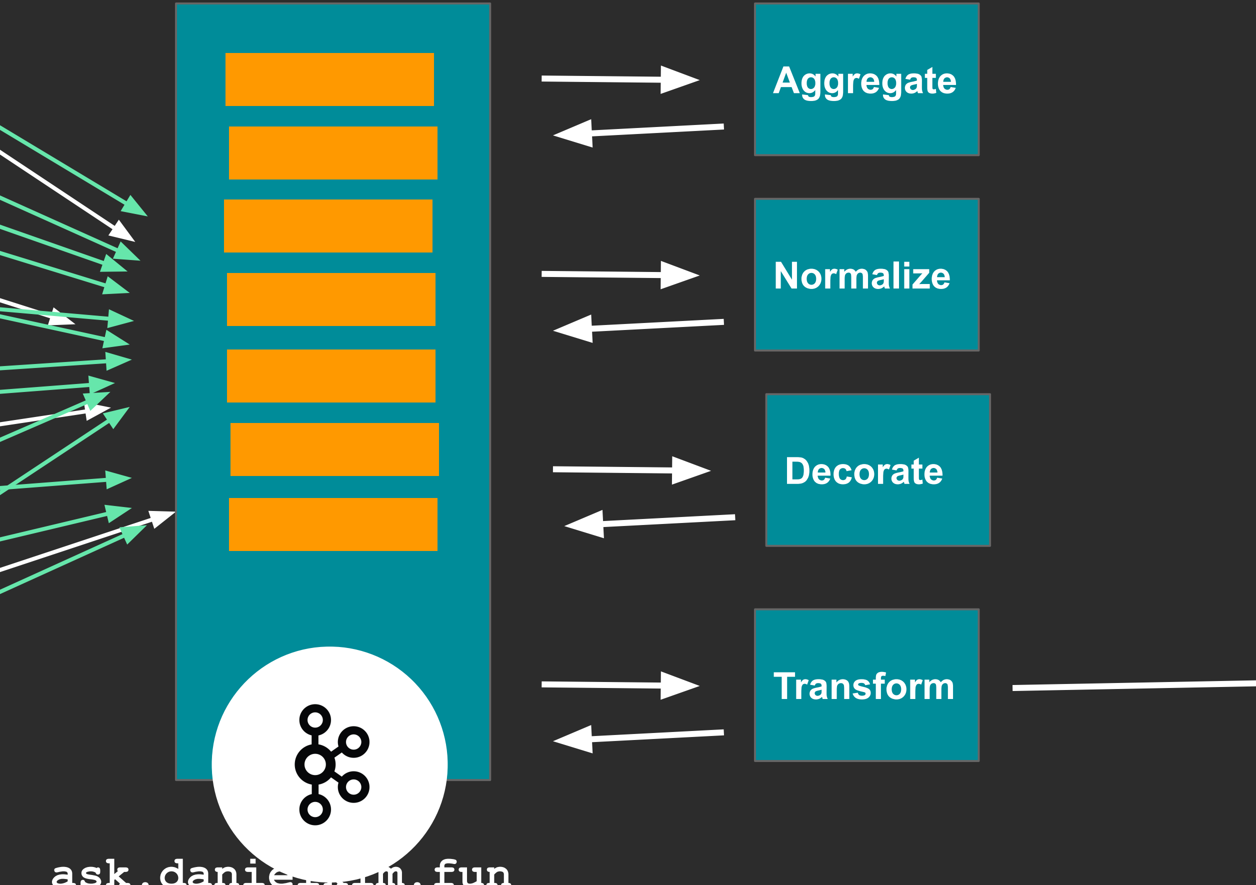
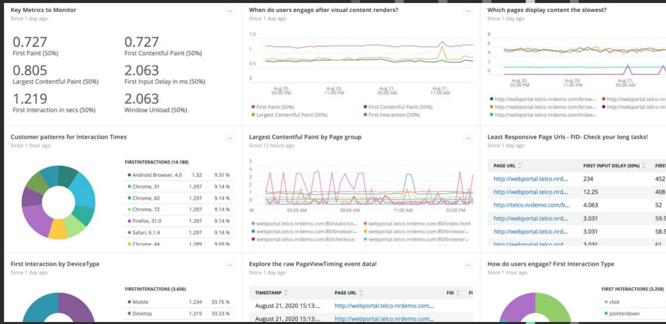
New Relic.





Key Metrics to Monitor
Since 1 day ago

0.727
First Paint (50%)

0.727
First Contentful Paint (50%)

0.805
Largest Contentful Paint (50%)

2.063
First Input Delay in ms (50%)

1.219
First Interaction in secs (50%)

2.063
Window Unload (50%)

When do users engage after visual content renders?
Since 1 day ago

1.5
1
0.5
0
Aug 20, 05:00 PM
Aug 20, 11:00 PM
Aug 21, 05:00 AM
Aug 21, 11:00 AM
First Paint (50%)
Largest Contentful Paint (50%)
First Contentful Paint (50%)
First Interaction (50%)

Which pages display content the slowest?
Since 1 day ago

8
6
4
2
0
Aug 20, 05:00 PM
Aug 20, 11:00 PM
Aug 21, 05:00 AM
http://webportal.telco.nrdemo.com/brow...
http://webportal.telco.nrdemo.com/brow...
http://webportal.telco.nrdemo.com/index...
http://webportal.telco.nrd
http://webportal.telco.nrd

Customer patterns for Interaction Times
Since 1 hour ago

FIRSTINTERACTIONS (14.188)		
● Android Browser, 4.0	1.32	9.31 %
● Chrome, 31	1.297	9.14 %
● Chrome, 60	1.297	9.14 %
● Chrome, 72	1.297	9.14 %
● Firefox, 31.0	1.297	9.14 %
● Safari, 6.1.4	1.297	9.14 %
● Chrome, 44	1.289	9.09 %

Largest Contentful Paint by Page group
Since 12 hours ago

5
4
3
2
1
0
M
05:00 AM
08:00 AM
11:00 AM
02:00 PM
webportal.telco.nrdemo.com:80/static/co...
webportal.telco.nrdemo.com:80/browse/...
webportal.telco.nrdemo.com:80/checkout
webportal.telco.nrdemo.com:80/index.html
webportal.telco.nrdemo.com:80/browse/...
webportal.telco.nrdemo.com:80/browse/...

Least Responsive Page Urls - FID- Check your long tasks!
Since 1 day ago

PAGE URL	FIRST INPUT DELAY (50%)	FIRST
http://webportal.telco.nrd...	234	452
http://webportal.telco.nrd...	12.25	408
http://telco.nrdemo.com/b...	4.063	52
http://webportal.telco.nrd...	3.031	59.5
http://webportal.telco.nrd...	3.031	58.5
http://webportal.telco.nrd	3.031	61

First Interaction by DeviceType
Since 1 day ago

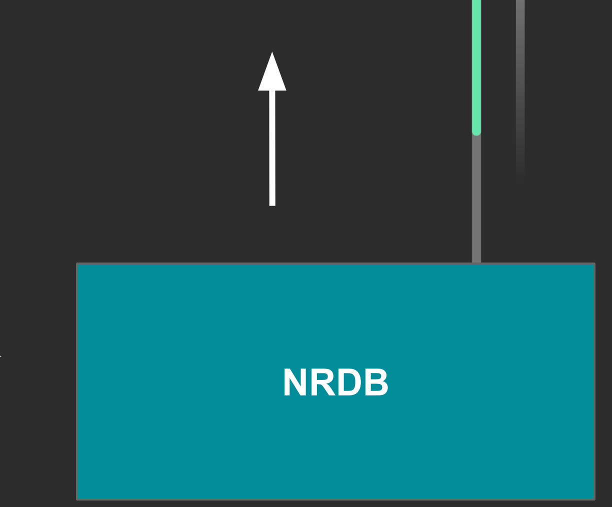
FIRSTINTERACTIONS (3.656)		
● Mobile	1.234	33.76 %
● Desktop	1.219	33.33 %

Explore the raw PageViewTiming event data!
Since 1 day ago

TIMESTAMP	PAGE URL	FID	FI
August 21, 2020 15:13:...	http://webportal.telco.nrdemo.com...		
August 21, 2020 15:13:...	http://webportal.telco.nrdemo.com...		

How do users engage? First Interaction Type
Since 1 hour ago

FIRST INTERACTIONS (3.258)
● click
● pointerdown



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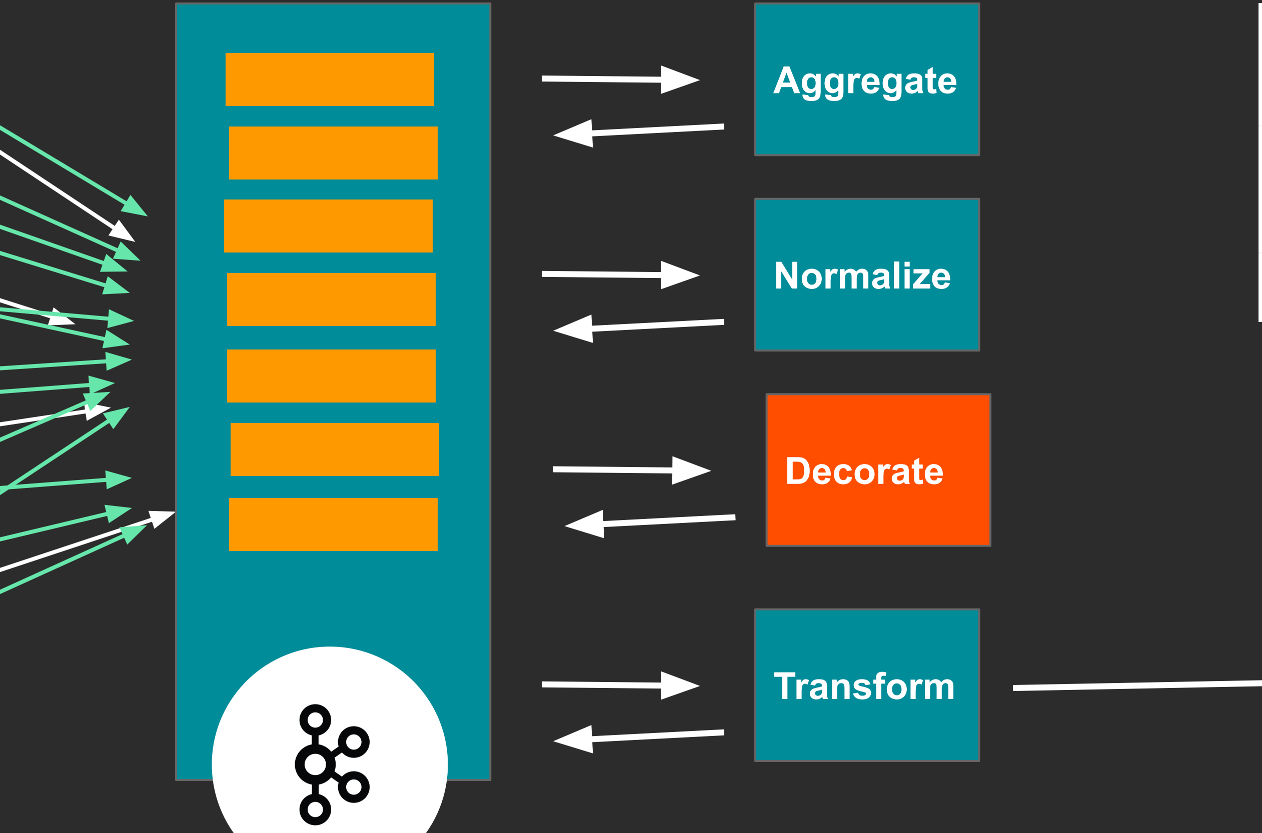

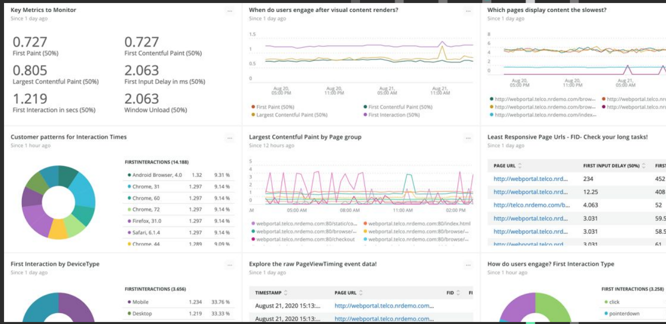

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1.219 First Interaction in secs (50%)	2.063 Window Unload (50%)

When do users engage after visual content renders?
Since 1 day ago

1.5
1
0.5
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Aug 20, 05:00 PM
Aug 20, 11:00 PM
Aug 21, 05:00 AM
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● First Contentful Paint (50%)
● Largest Contentful Paint (50%)
● First Interaction (50%)

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Since 1 day ago

8
6
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2
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Aug 20, 05:00 PM
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● http://webportal.telco.nrd
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● Chrome, 44	1.289	9.09 %

Largest Contentful Paint by Page group
Since 12 hours ago

5
4
3
2
1
0
M
05:00 AM
08:00 AM
11:00 AM
02:00 PM
● webportal.telco.nrdemo.com:80/static/co...
● webportal.telco.nrdemo.com:80/index.html
● webportal.telco.nrdemo.com:80/browse/...
● webportal.telco.nrdemo.com:80/browse/...
● webportal.telco.nrdemo.com:80/checkout
● webportal.telco.nrdemo.com:80/browse/...

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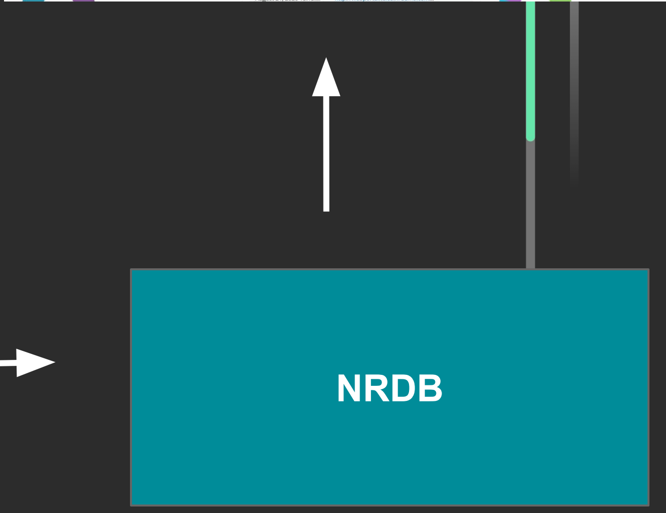

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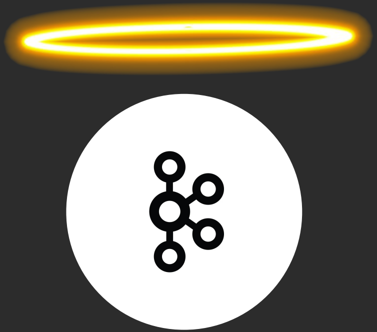
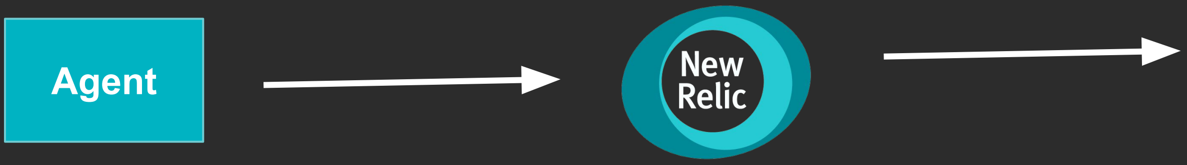
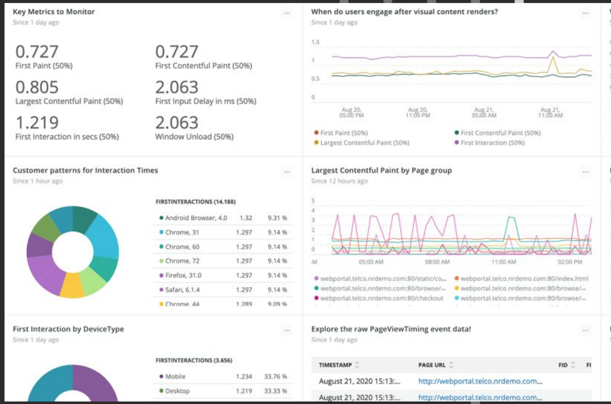
New Relic.



Kafka retains messages for a set amount of time so consumers can potentially go down or lag behind incoming data and recover without data loss

Why do you need to trace Kafka?





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Since 12 hours ago

5
4
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2
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M
05:00 AM
08:00 AM
11:00 AM
02:00 PM
● webportal.telco.nrdemo.com:80/static/co...
● webportal.telco.nrdemo.com:80/index.html
● webportal.telco.nrdemo.com:80/browse/...
● webportal.telco.nrdemo.com:80/browse/...
● webportal.telco.nrdemo.com:80/checkout
● webportal.telco.nrdemo.com:80/browse/...

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Since 1 day ago

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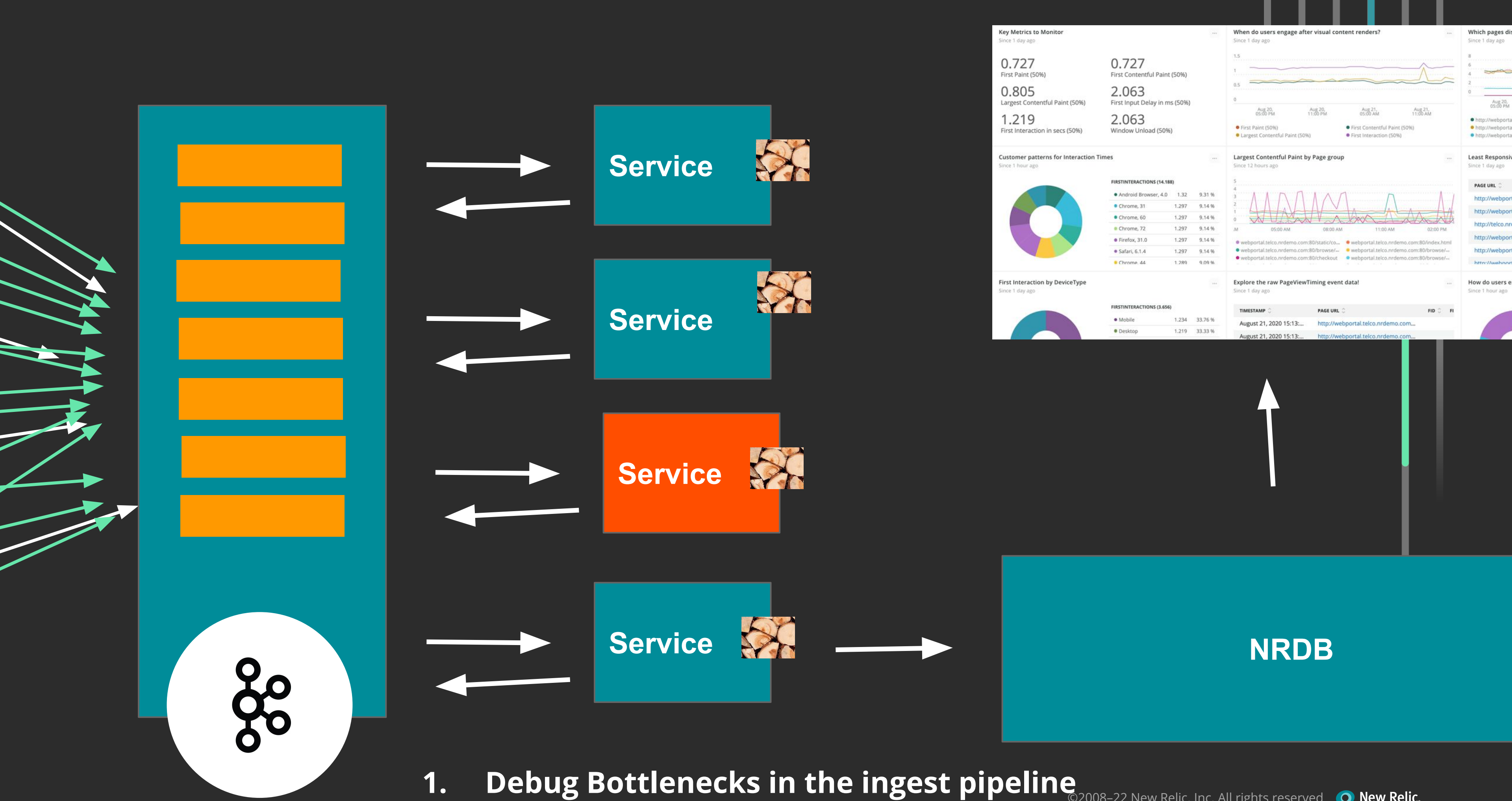
August 21, 2020 15:13:...	http://webportal.telco.nrdemo.com...		
August 21, 2020 15:13:...	http://webportal.telco.nrdemo.com...		

How do we optimize “time to glass”?



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When do users engage after visual content renders?
Since 1 day ago

Which pages di
Since 1 day ago

Customer patterns for Interaction Times
Since 1 hour ago

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webportal.telco.nrdemo.com:80/static/co...
webportal.telco.nrdemo.com:80/index.html
webportal.telco.nrdemo.com:80/browse/...
webportal.telco.nrdemo.com:80/browse/...
webportal.telco.nrdemo.com:80/checkout
webportal.telco.nrdemo.com:80/browse/...

Least Responsiv
Since 1 day ago

PAGE URL
http://webpor
http://webpor
http://telco.nr
http://webpor
http://webpor
http://webpor

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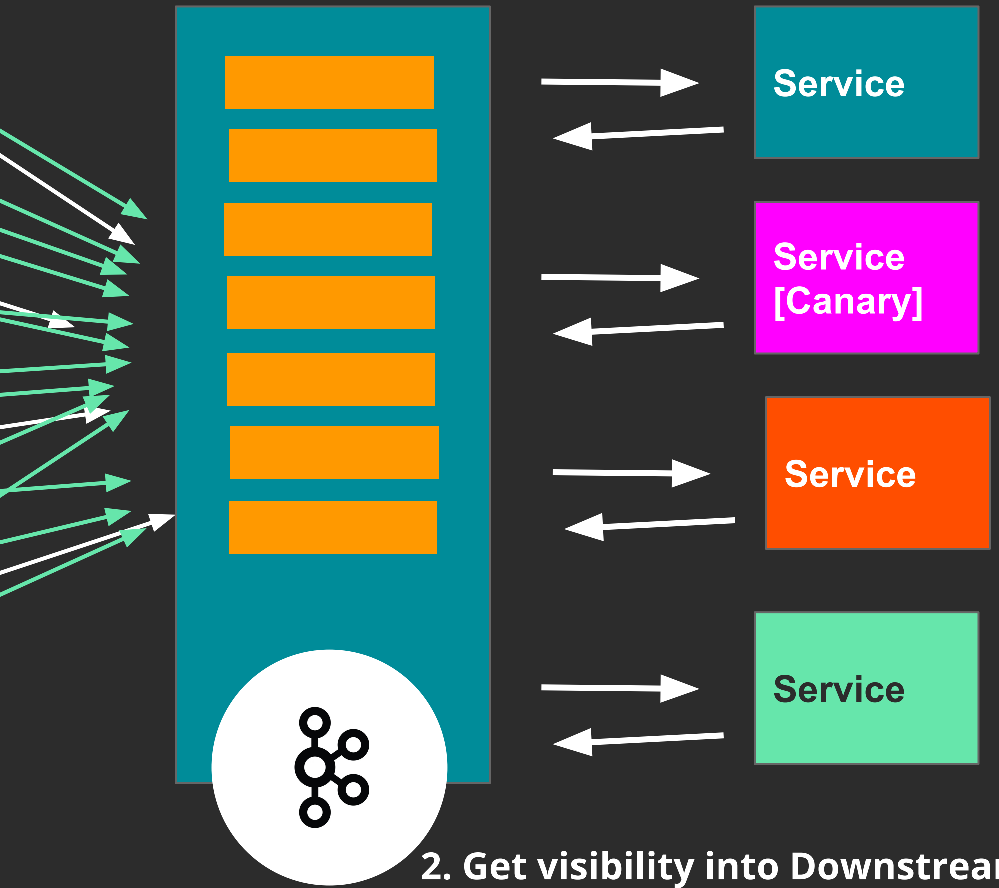
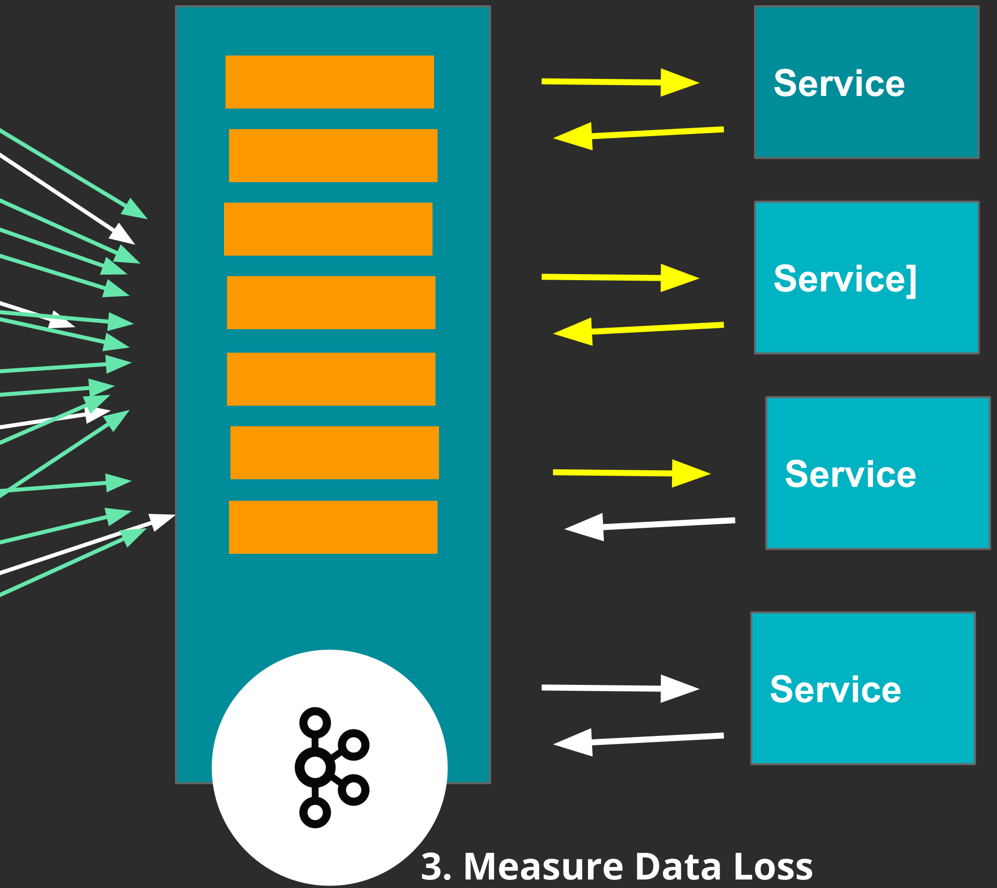
August 21, 2020 15:13:...	http://webportal.telco.nrdemo.com...		

How do users e
Since 1 hour ago

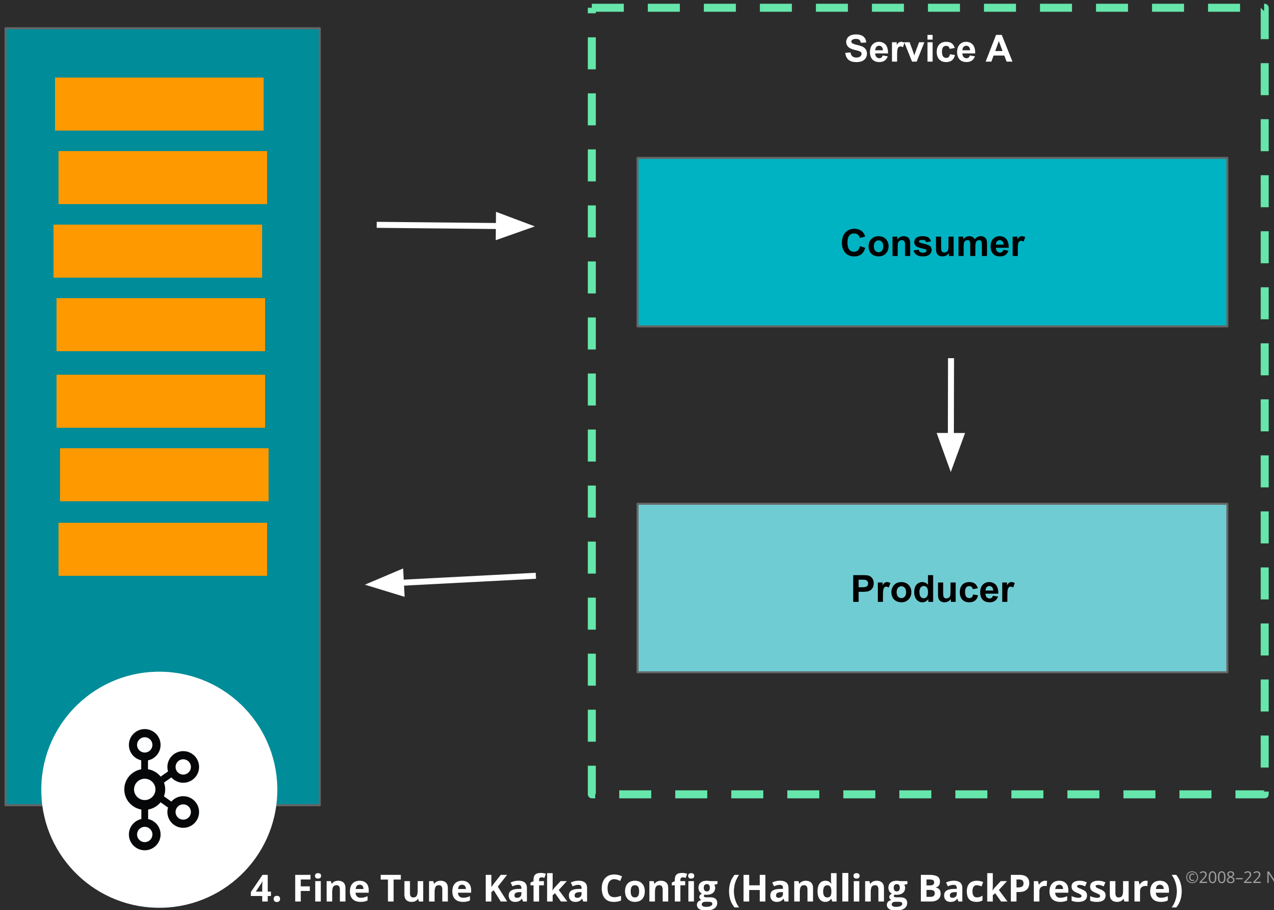
1. **Debug Bottlenecks in the ingest pipeline**



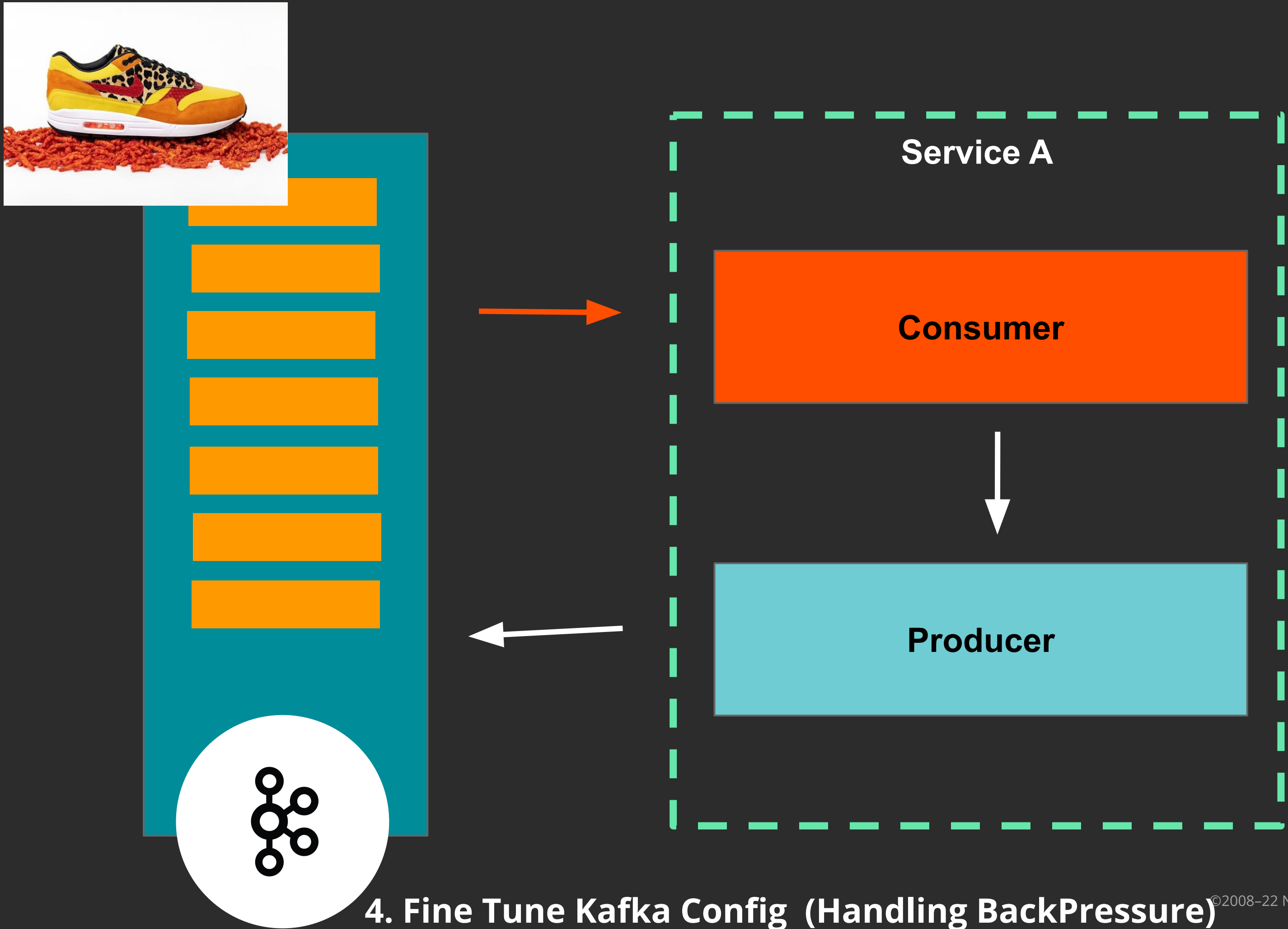
2. Get visibility into Downstream impacts of your service



3. Measure Data Loss



4. Fine Tune Kafka Config (Handling BackPressure)



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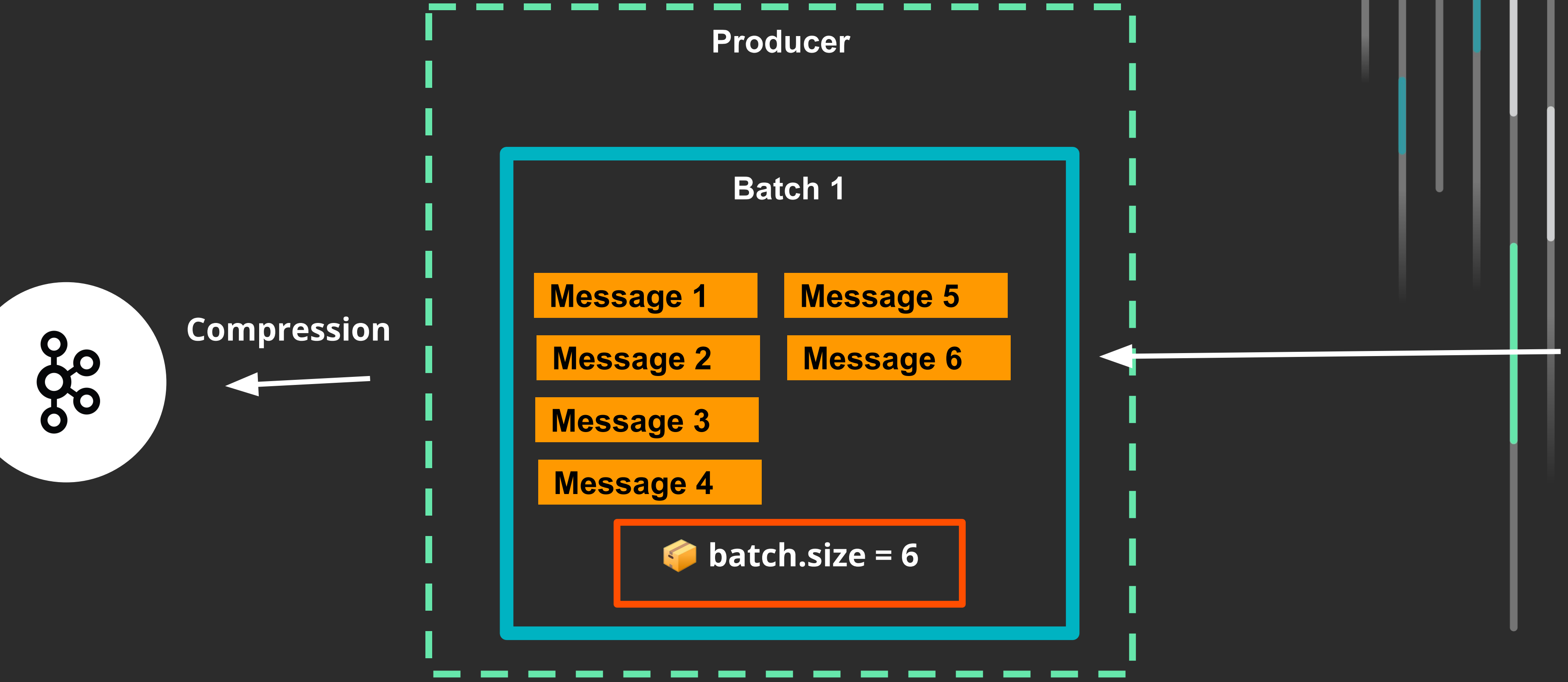


Producer

Batch 1

Message 1

Message 2

Message 3

Message 4

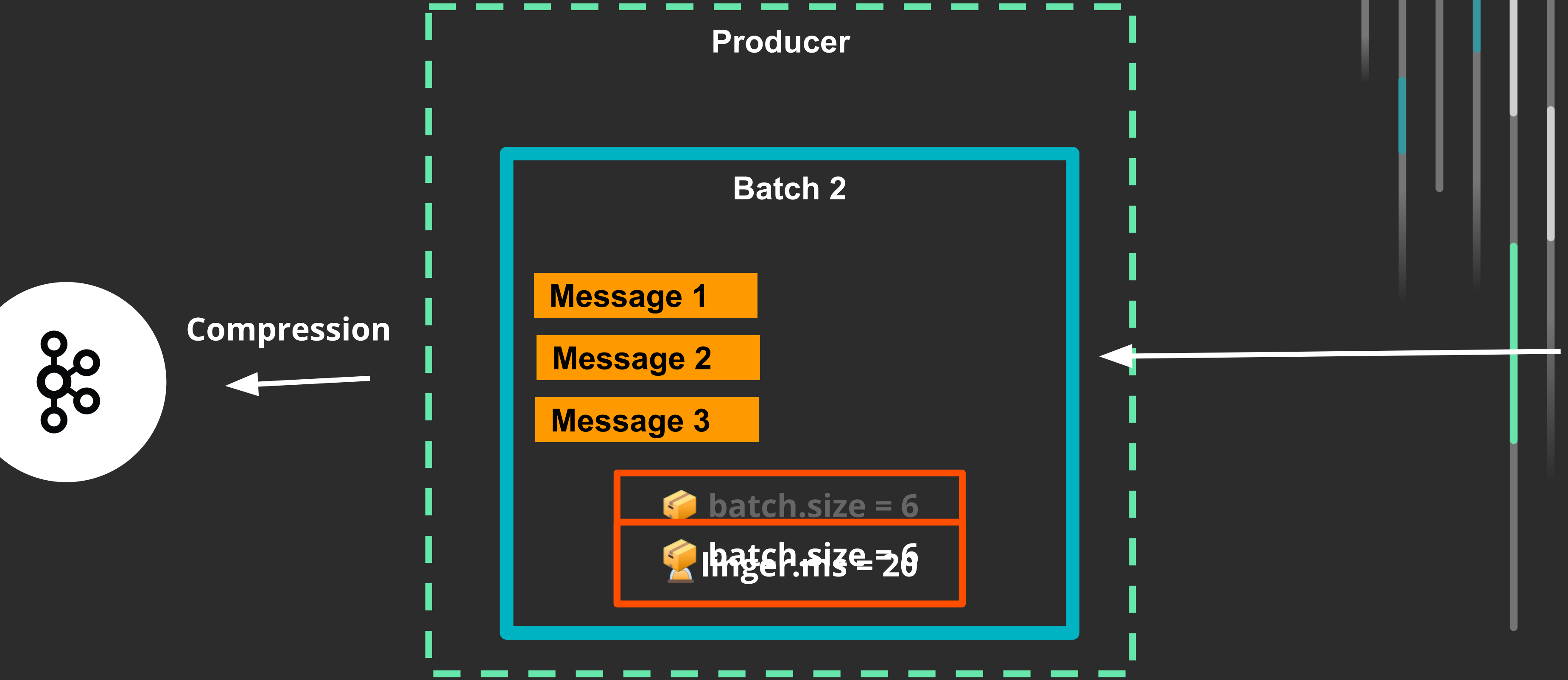
Message 5

Message 6

📦 batch.size = 6

Compression

5. Fine Tune Kafka Config (Batching/Compressing Messages)



5. Fine Tune Kafka Config (Batching/Compressing Messages)

What is Distributed Tracing?

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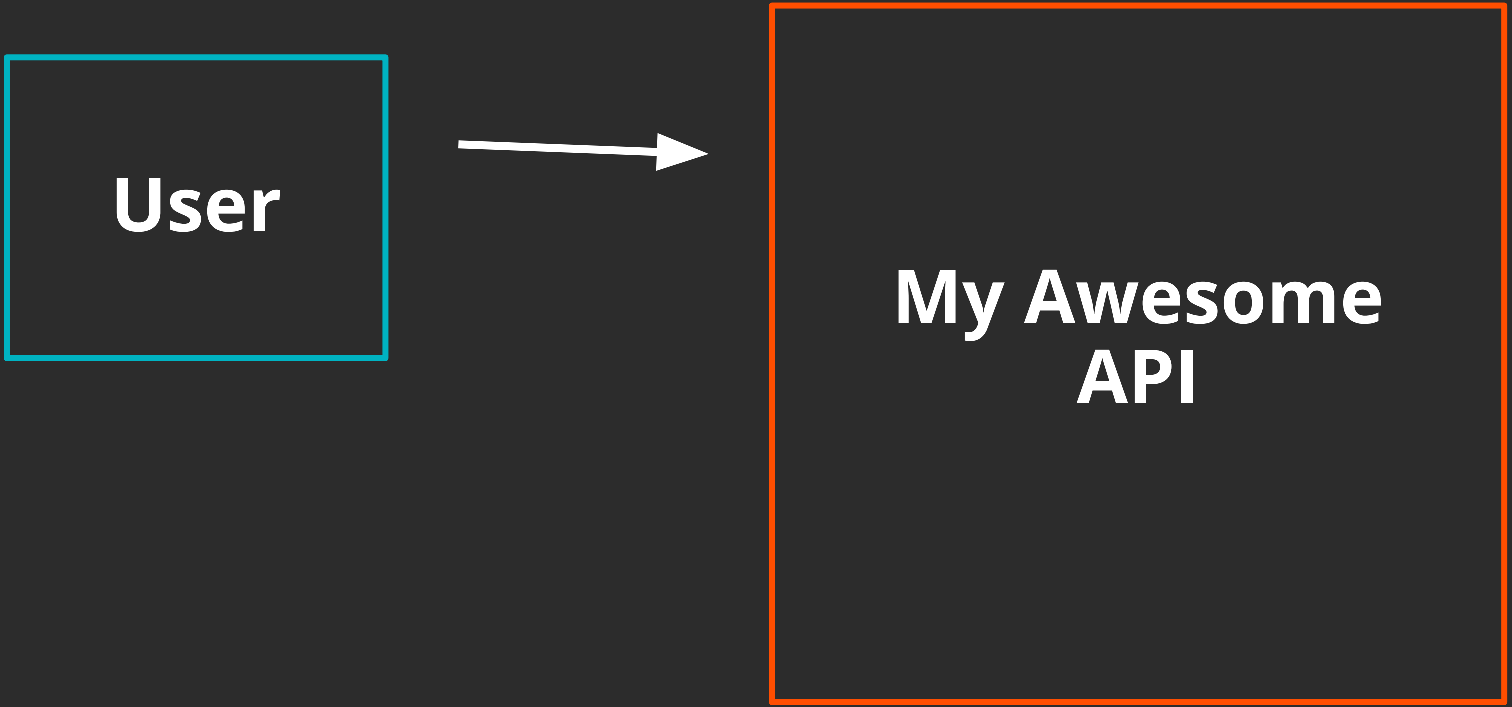
New Relic.

What is Distributed Tracing?



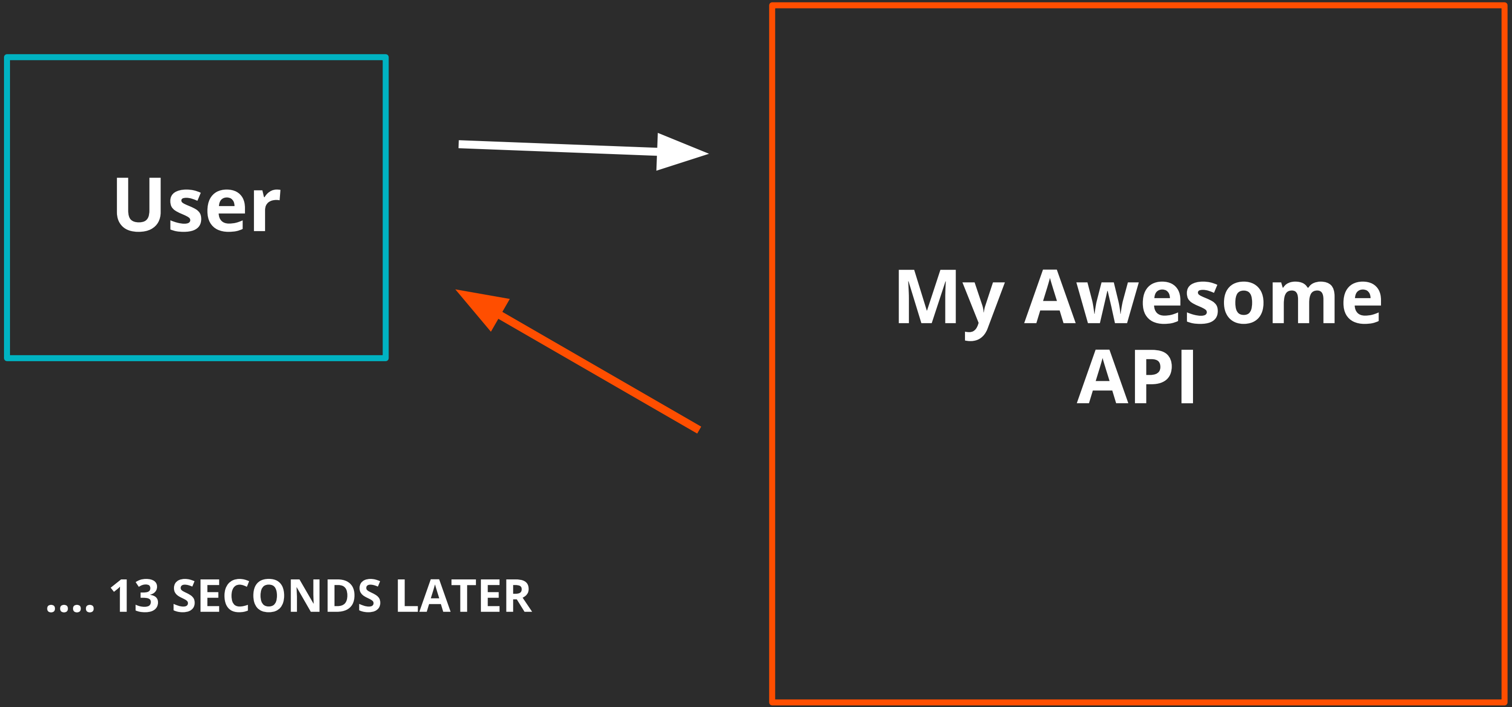
User

My Awesome API

ask.danielkim.fun

New Relic.

What is Distributed Tracing?

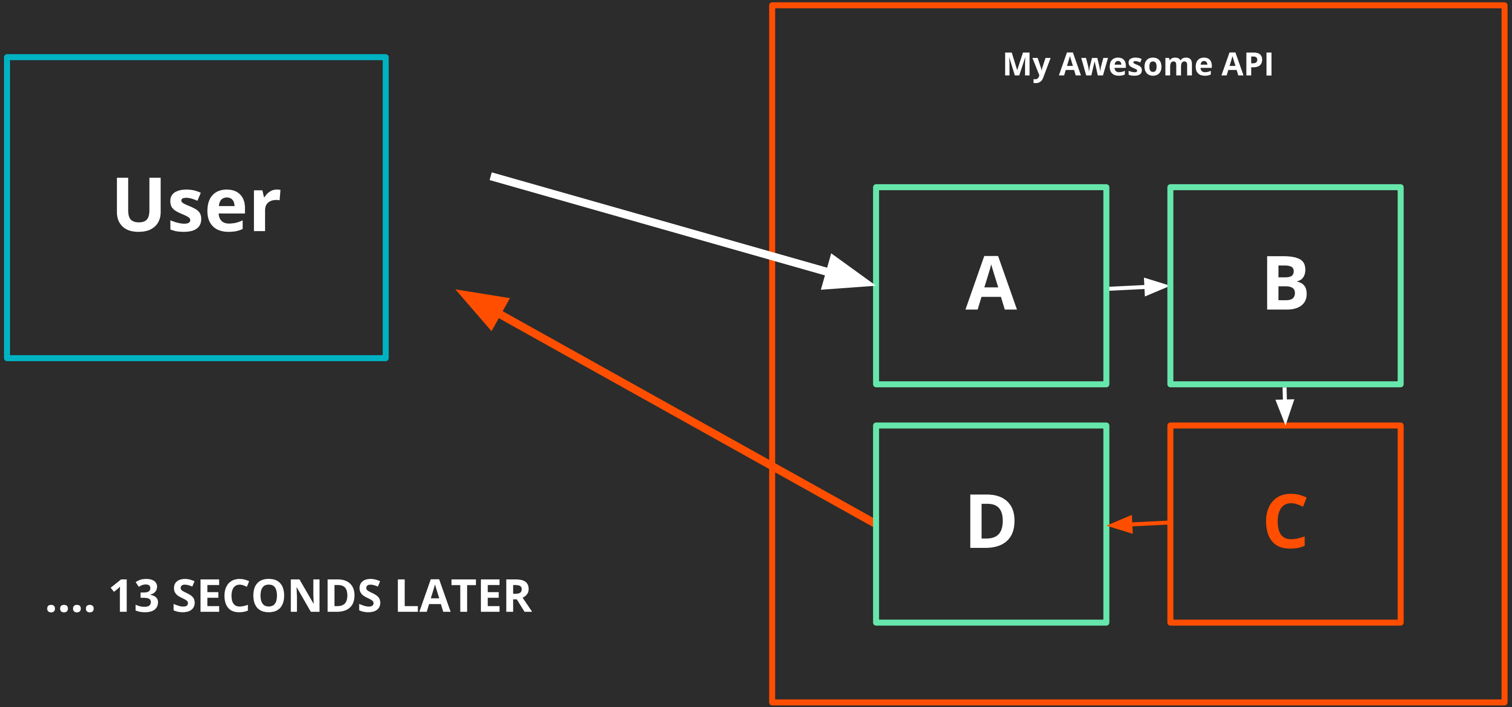


User

My Awesome API

.... 13 SECONDS LATER

What is Distributed Tracing?



.... 13 SECONDS LATER

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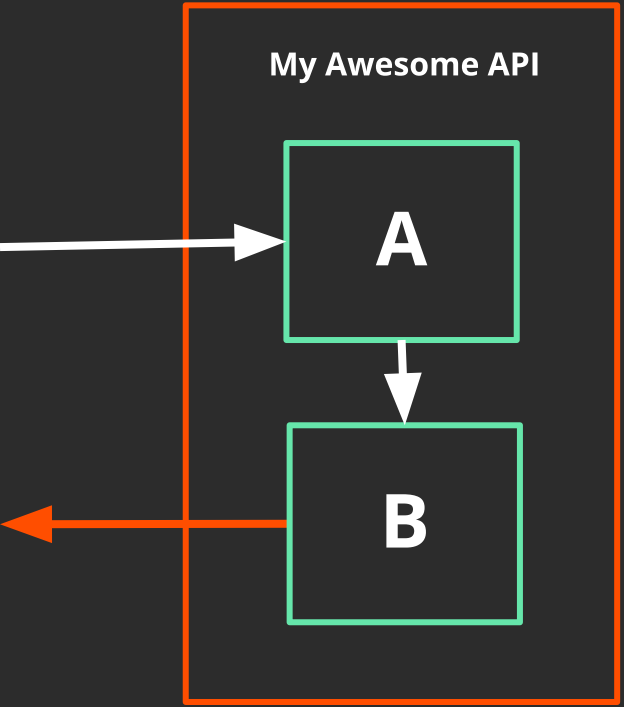
How do we connect the dots?

Context

Context in action



We only see one side of the transaction.

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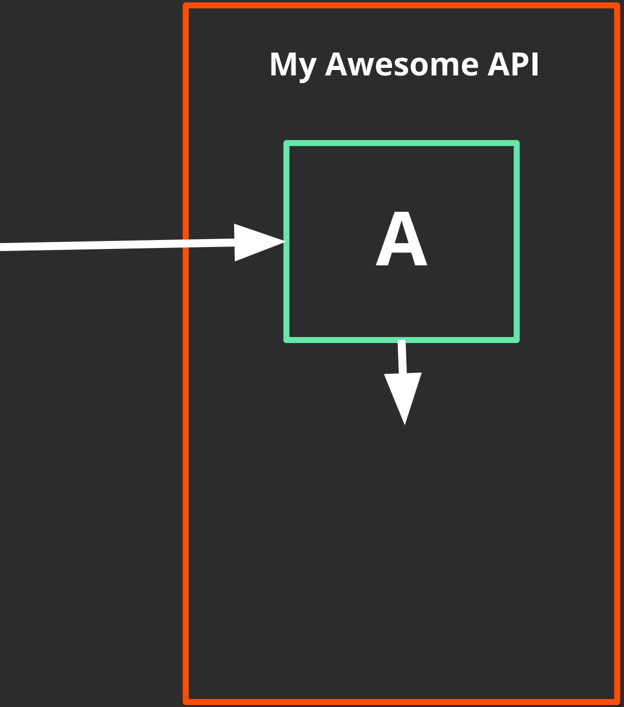
Context in action



.Here A is sending a payload to somewhere.

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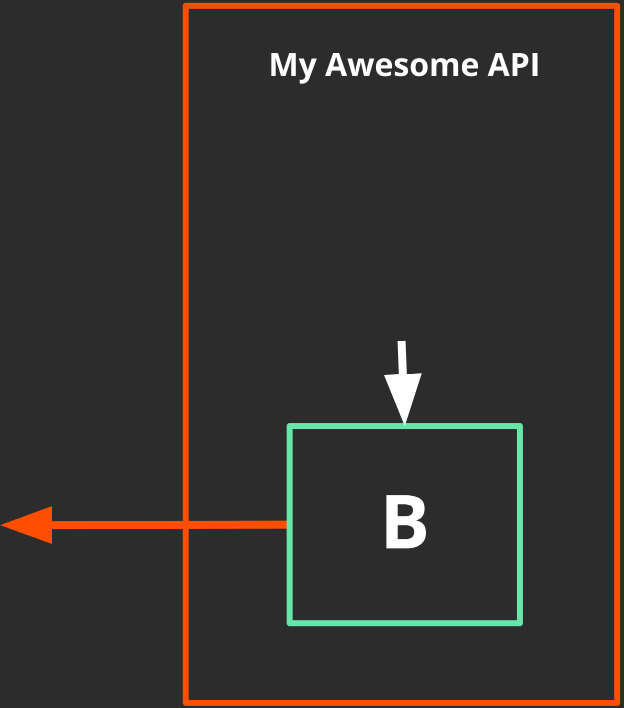
Context in action



Here B is receiving a payload from somewhere

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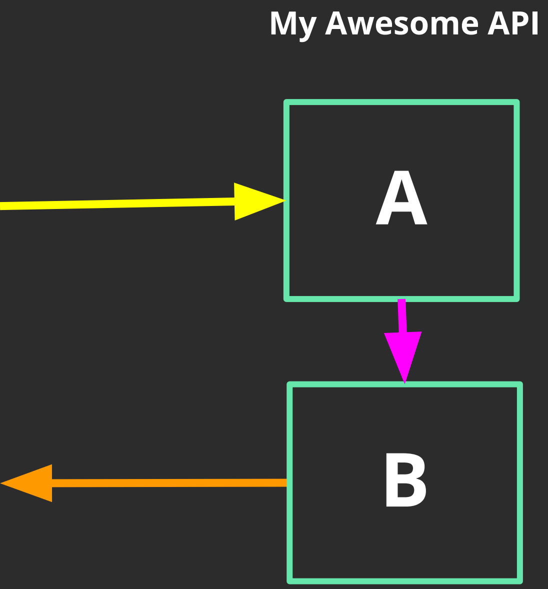
Context in action



Each Individual Span gets its own id

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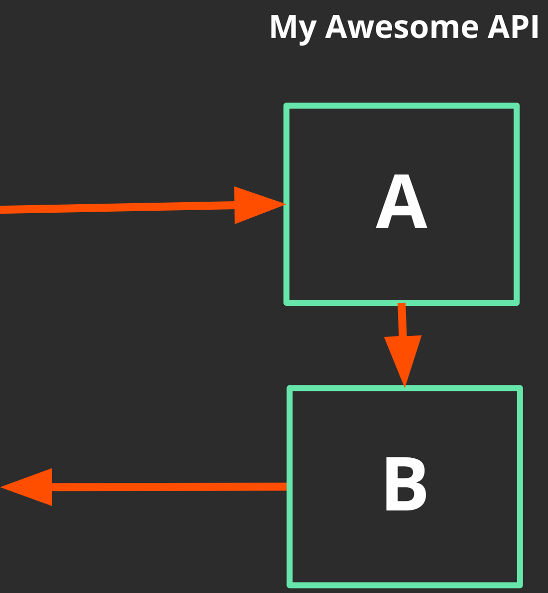
Context in action

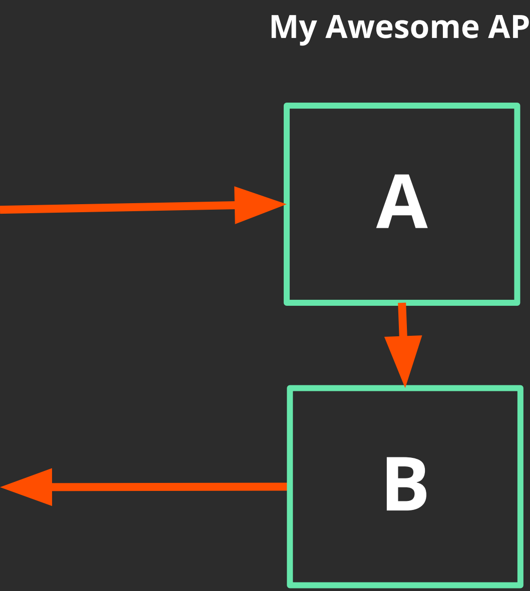


Each Individual Span gets its own id (transaction)

And the whole trace gets its own id (parentid)

ask.danielkim.fun

Context in action



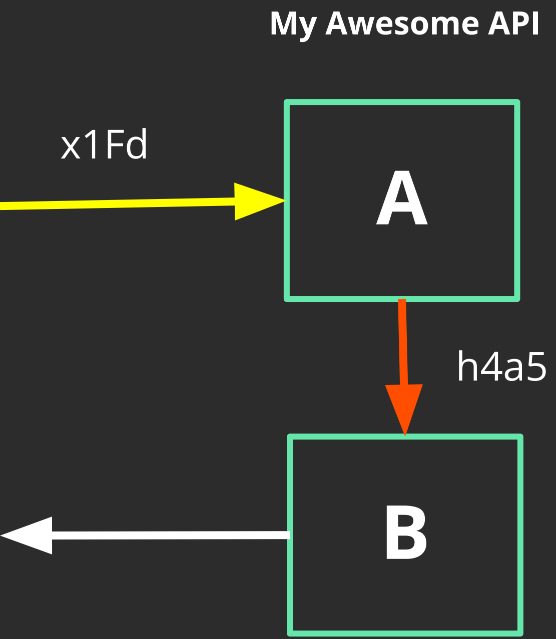
Each Individual Span gets its own id (transaction)

And the whole trace gets its own id (parentid)

Both data points get encoded as a set of HTTP headers

ask.danielkim.fun

Context in action



Context

transaction=12H4
parentid=x1Fd

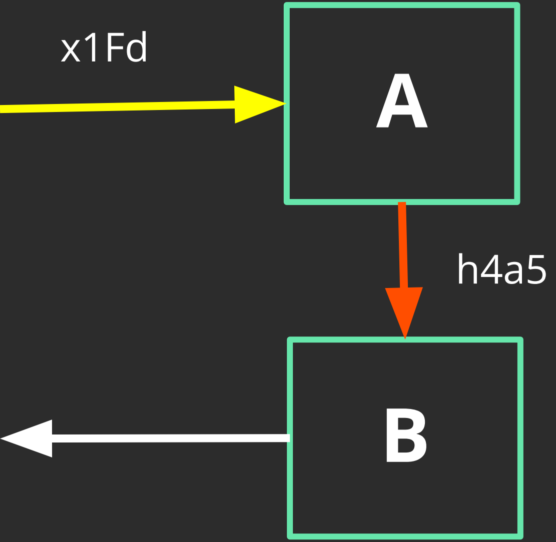
Overall Trace 12H4
And the parent span is x1FD

ask.danielkim.fun

New Relic.

Context in action

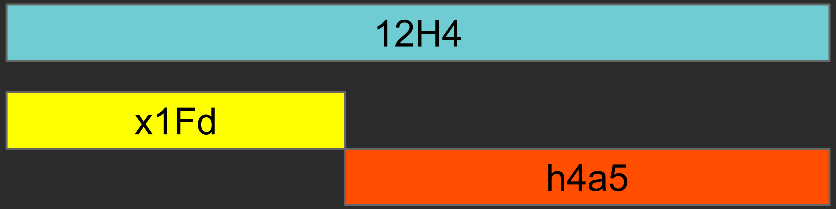
My Awesome API

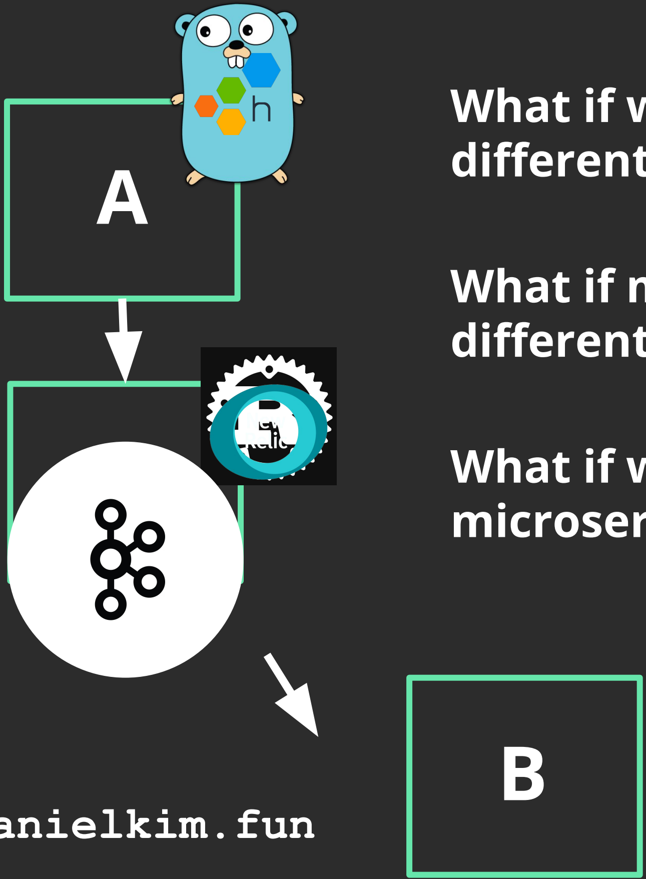


Received by A

transaction=12H4
parentid=x1Fd

Overall Trace 12H4
And the parent span is x1FD





What if we have microservices with different languages or frameworks?

What if microservices are using different observability systems?

What if we have decoupled microservices via Kafka?

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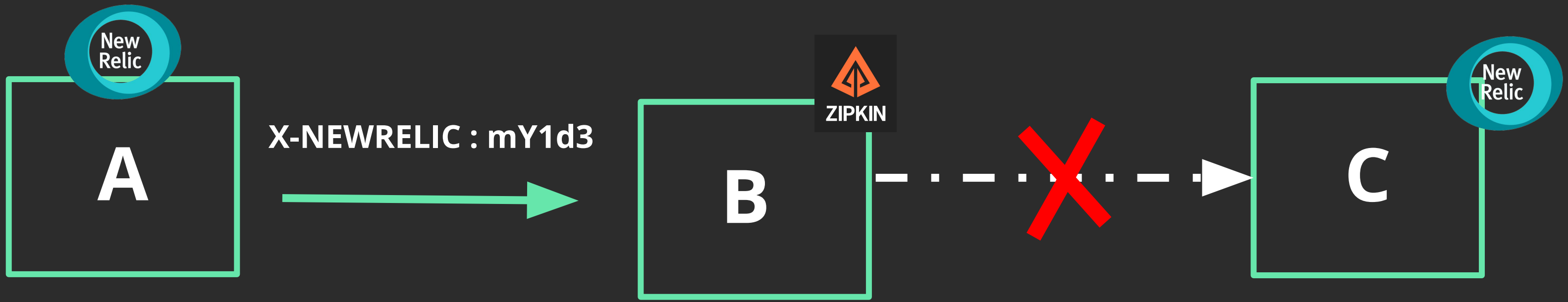
W3C standard



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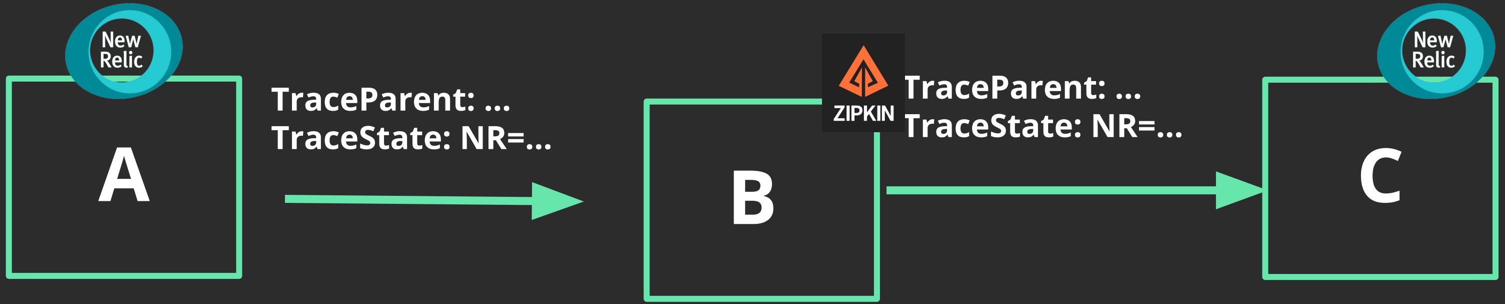

TraceParent: ...
TraceState: NR=...

TraceParent: ...
TraceState: NR=...

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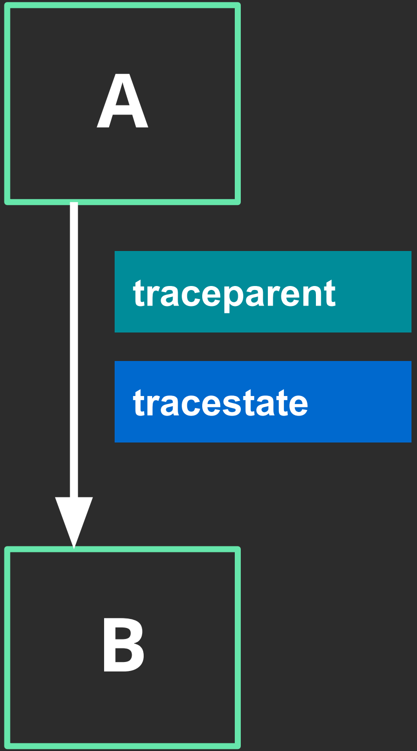
OSS Standard for Context Propagation



W3C Trace Context enables cross-vendor interoperation of traces

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New Relic.

Adoption of W3C Tracing standard

OpenTelemetry

Vendors adopting W3C

New Relic

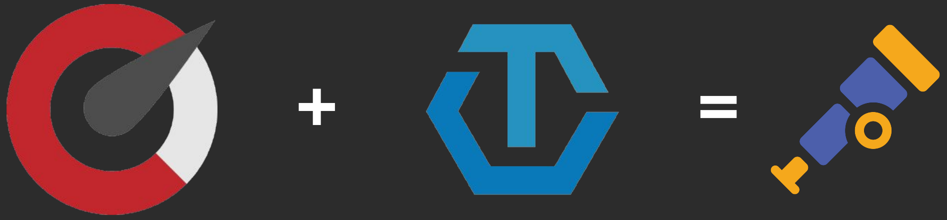
https://github.com/w3c/trace-context/blob/main/implementations.md

What

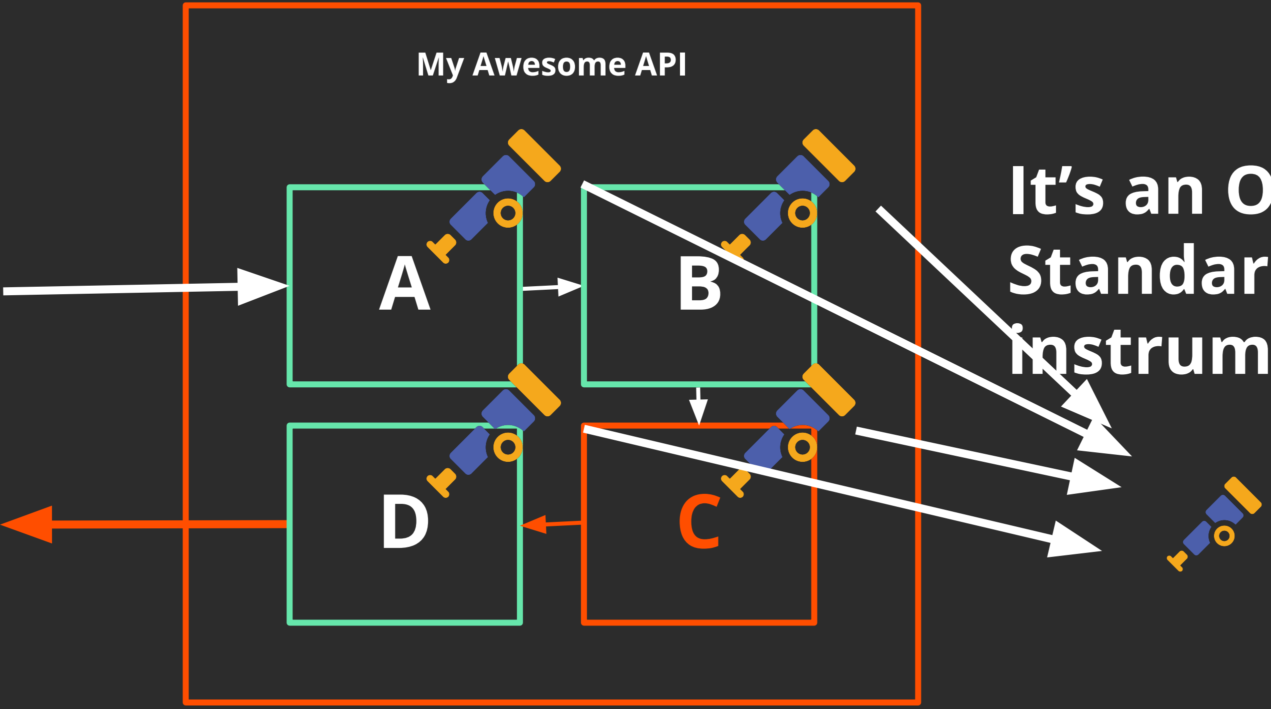
is

OpenTelemetry

What is OpenTelemetry?



What is OpenTelemetry?



It's an Open Source Standard for instrumentation

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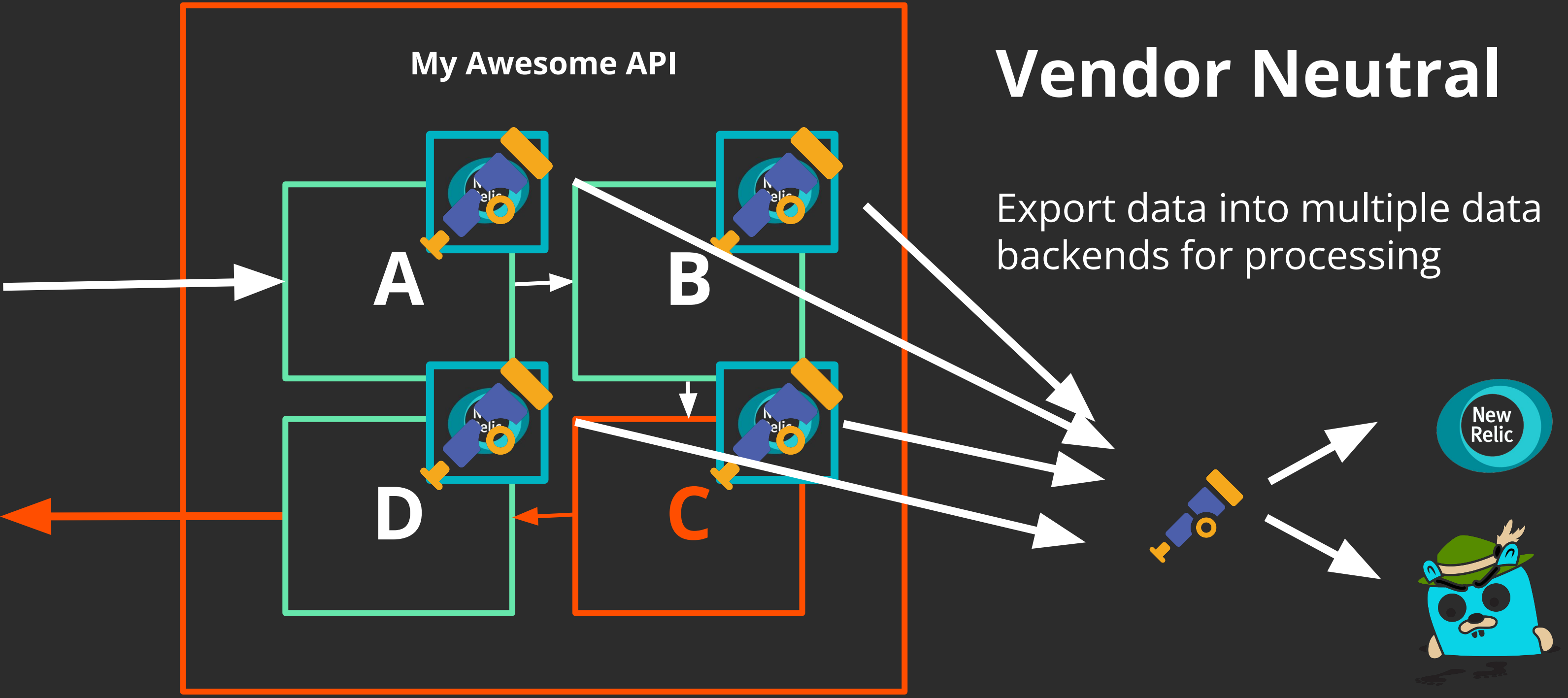
New Relic.

What is OpenTelemetry?



Vendor Neutral

Export data into multiple data backends for processing

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Implementing Distributed Tracing For Kafka

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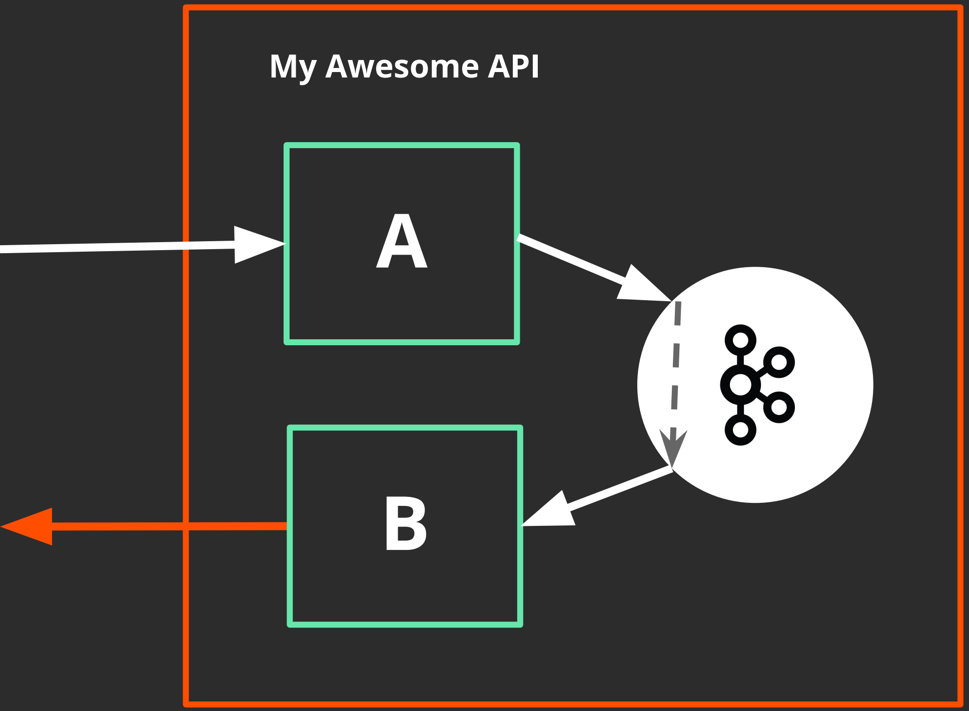
New Relic.

What happens with Kafka?



Context is lost and transaction is broken

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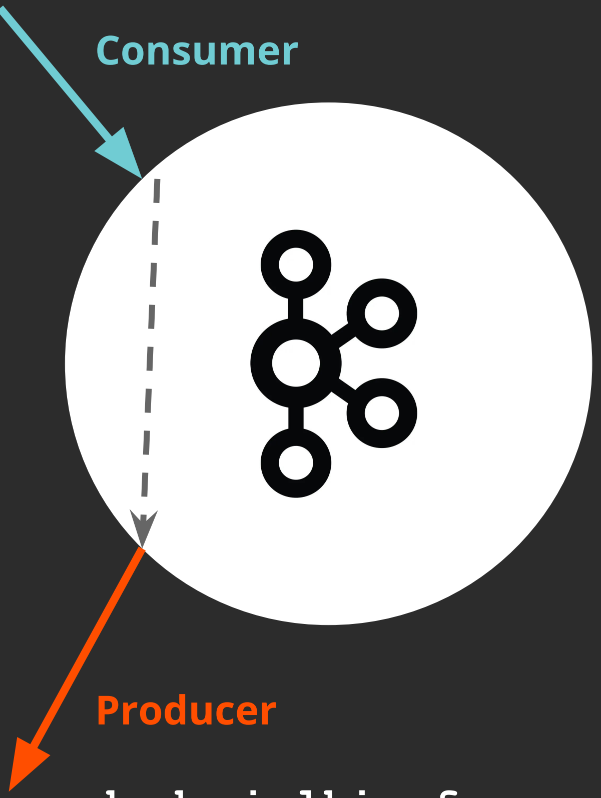
New Relic.

What happens with Kafka?



Kafka decouples producers and consumers

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Adding CONTEXT to traces

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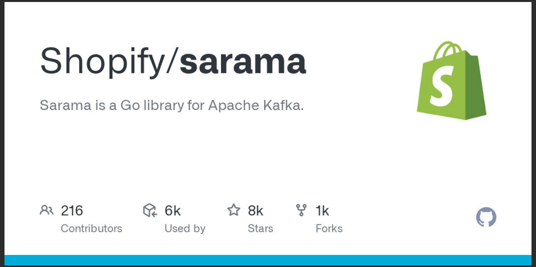
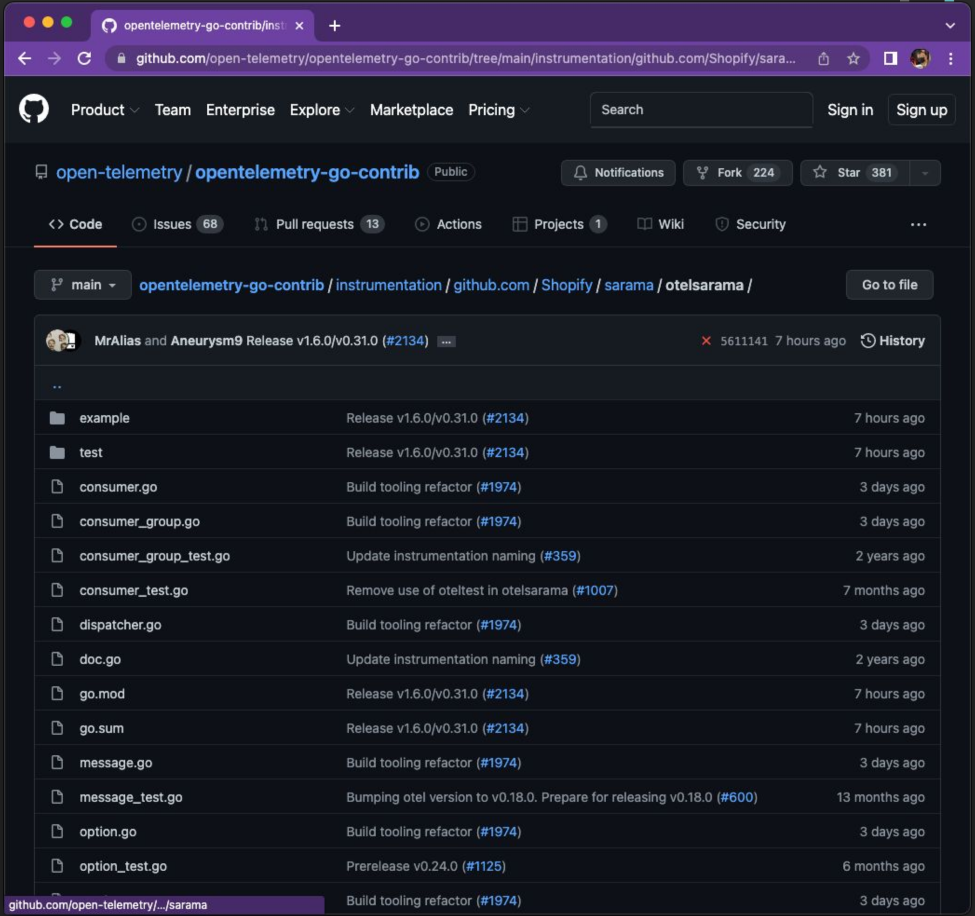
Otelsarama injects context into Kafka messages, allowing you to trace asynchronous messages



Shopify/**sarama**

Sarama is a Go library for Apache Kafka.

216 Contributors · 6k Used by · 8k Stars · 1k Forks



opentelemetry-go-contrib/inst
github.com/open-telemetry/opentelemetry-go-contrib/tree/main/instrumentation/github.com/Shopify/sara...
Product
Team
Enterprise
Explore
Marketplace
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open-telemetry / **opentelemetry-go-contrib** Public

opentelemetry-go-contrib / instrumentation / github.com / Shopify / sarama / **otelsarama** /

MrAlias and **Aneurysm9** Release v1.6.0/v0.31.0 (#2134) ... ✕ 5611141 7 hours ago History

..		
example	Release v1.6.0/v0.31.0 (#2134)	7 hours ago
test	Release v1.6.0/v0.31.0 (#2134)	7 hours ago
consumer.go	Build tooling refactor (#1974)	3 days ago
consumer_group.go	Build tooling refactor (#1974)	3 days ago
consumer_group_test.go	Update instrumentation naming (#359)	2 years ago
consumer_test.go	Remove use of oteltest in otelsarama (#1007)	7 months ago
dispatcher.go	Build tooling refactor (#1974)	3 days ago
doc.go	Update instrumentation naming (#359)	2 years ago
go.mod	Release v1.6.0/v0.31.0 (#2134)	7 hours ago
go.sum	Release v1.6.0/v0.31.0 (#2134)	7 hours ago
message.go	Build tooling refactor (#1974)	3 days ago
message_test.go	Bumping otel version to v0.18.0. Prepare for releasing v0.18.0 (#600)	13 months ago
option.go	Build tooling refactor (#1974)	3 days ago
option_test.go	Prerelease v0.24.0 (#1125)	6 months ago
	Build tooling refactor (#1974)	3 days ago

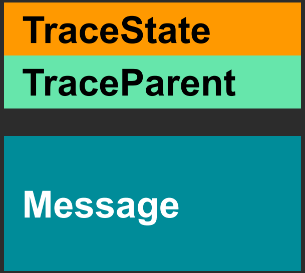
Kafka Headers

HEADER

Message

Add metadata about your record without changing the content of your message

Kafka Headers



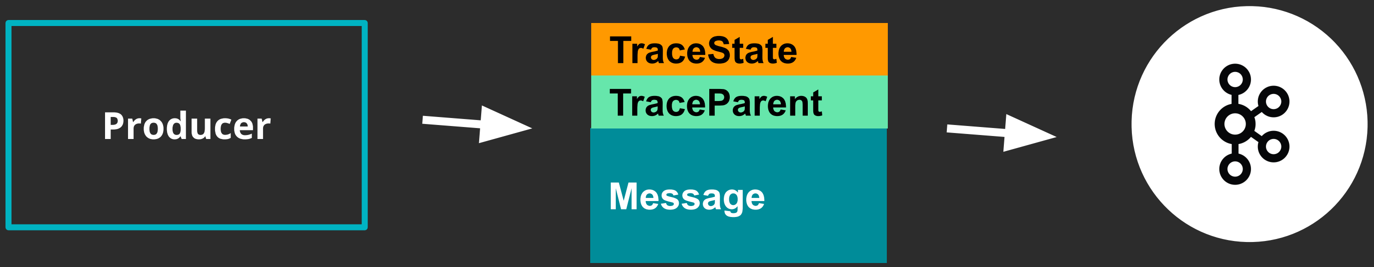
TraceState

TraceParent

Message

Let’s inject context (W3C Tracing Headers)

Kafka Headers



Producer

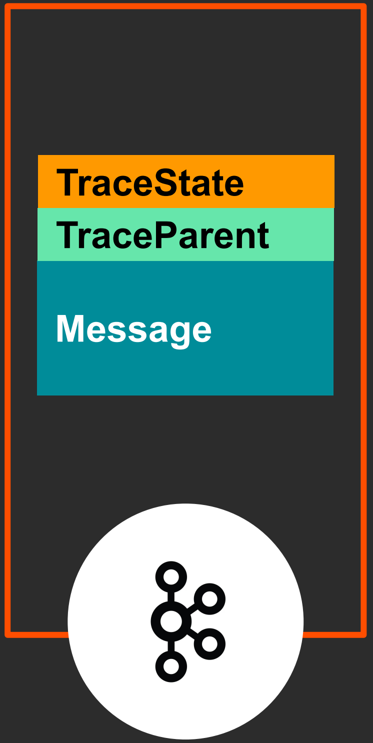
TraceState

TraceParent

Message

Producer needs to Inject context into Kafka Header

Kafka Headers



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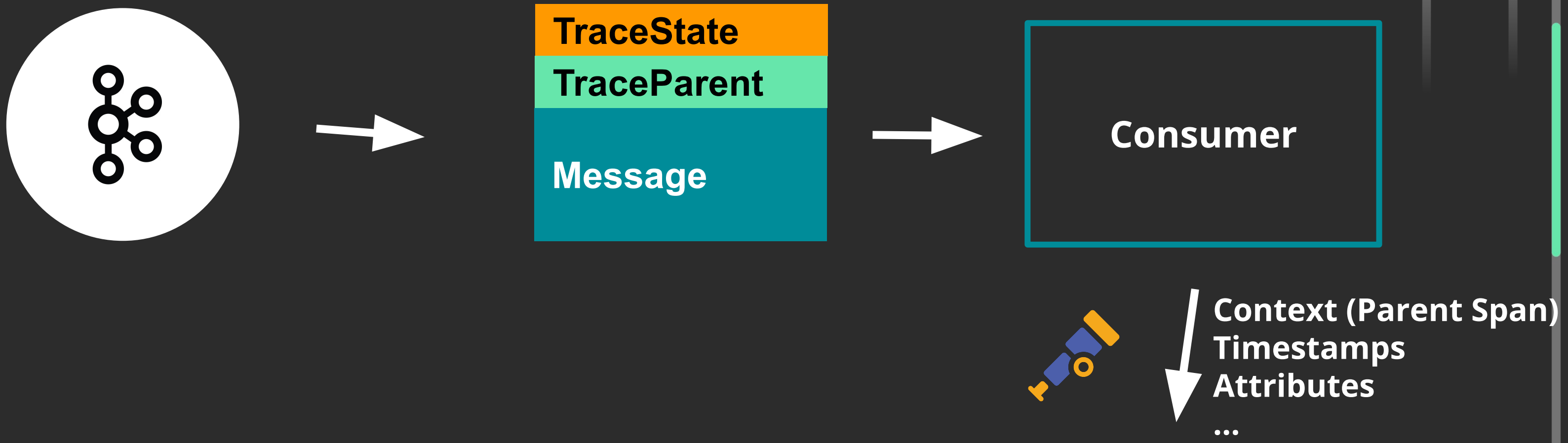
New Relic.

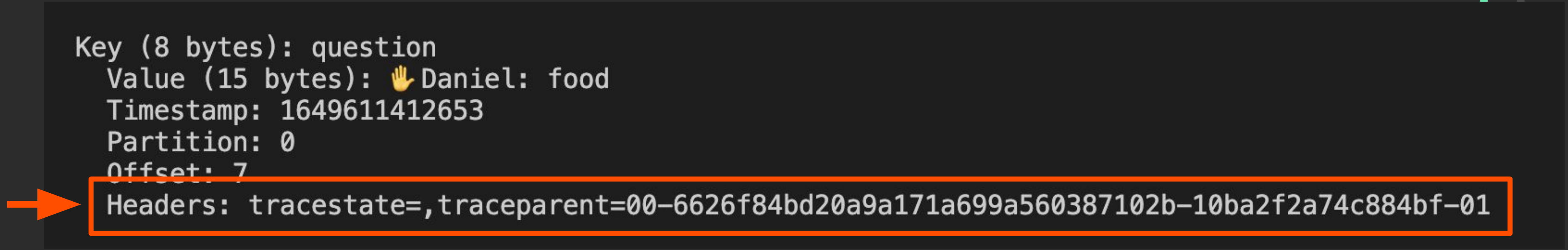
Kafka Headers



Let’s print out what is injected in the header

kcat

https://github.com/edenhill/kcat



```
Key (8 bytes): question
  Value (15 bytes): ✋Daniel: food
  Timestamp: 1649611412653
  Partition: 0
  Offset: 7
  Headers: tracestate=,traceparent=00-6626f84bd20a9a171a699a560387102b-10ba2f2a74c884bf-01
```

New Relic.

Reading the trace headers

```
00-6626f84bd20a9a171a699a560387102b-10ba2f2a74c884bf-01
```

Tracing Standard Version number (Base16)

Reading the trace headers

```
00-6626f84bd20a9a171a699a560387102b-10ba2f2a74c884bf-01
```

Trace ID (Base16)

This is the ID of the whole trace and is used to uniquely identify a distributed trace through a system.

Reading the trace headers

```
00-6626f84bd20a9a171a699a560387102b-10ba2f2a74c884bf-01
```

Trace Parent(Base16)

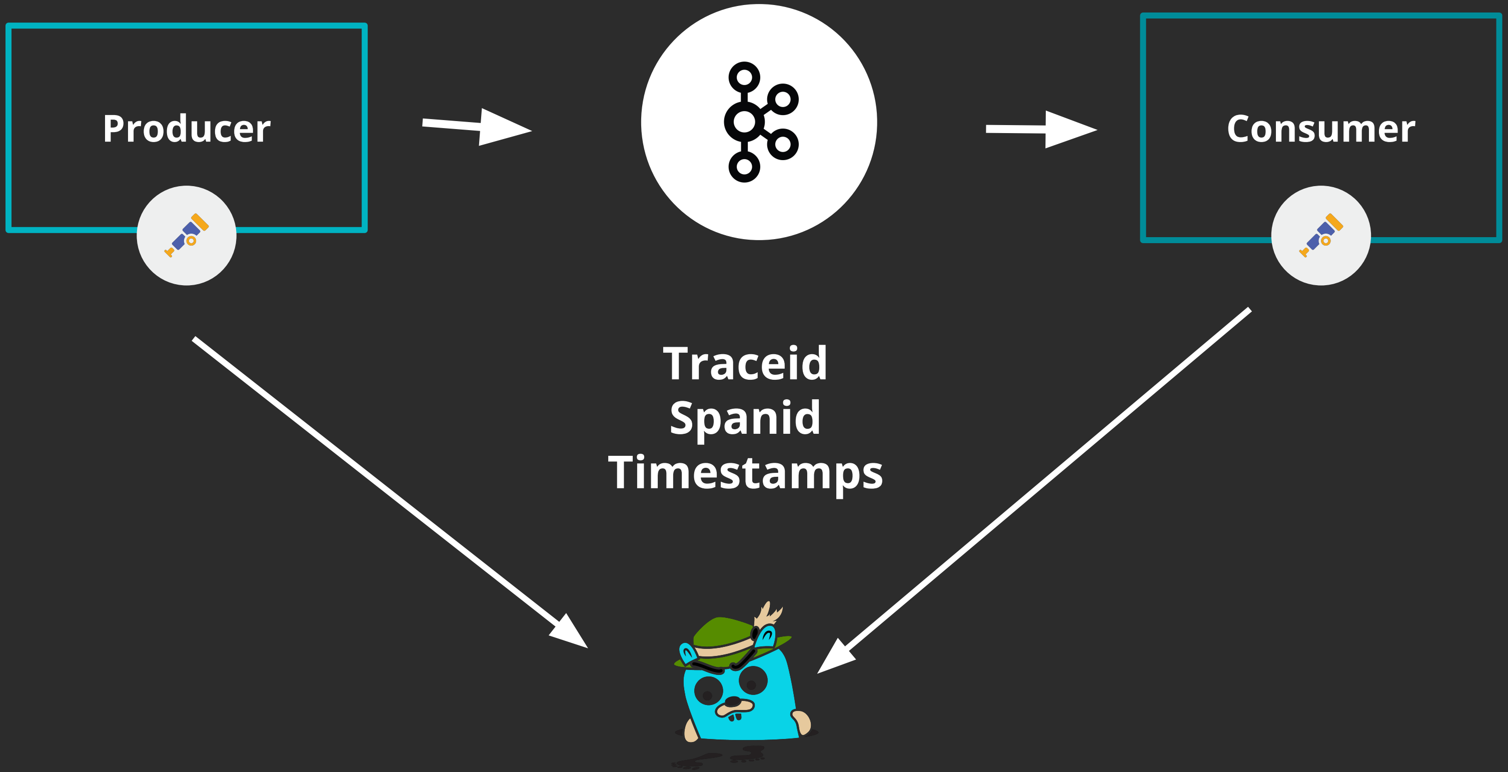
Reading the trace headers

```
00-6626f84bd20a9a171a699a560387102b-10ba2f2a74c884bf-01
```

This flag indicates that the `Span` has been `sampled` and will be exported

Tracing Flags

OTel in Action



Traceid
Spanid
Timestamps

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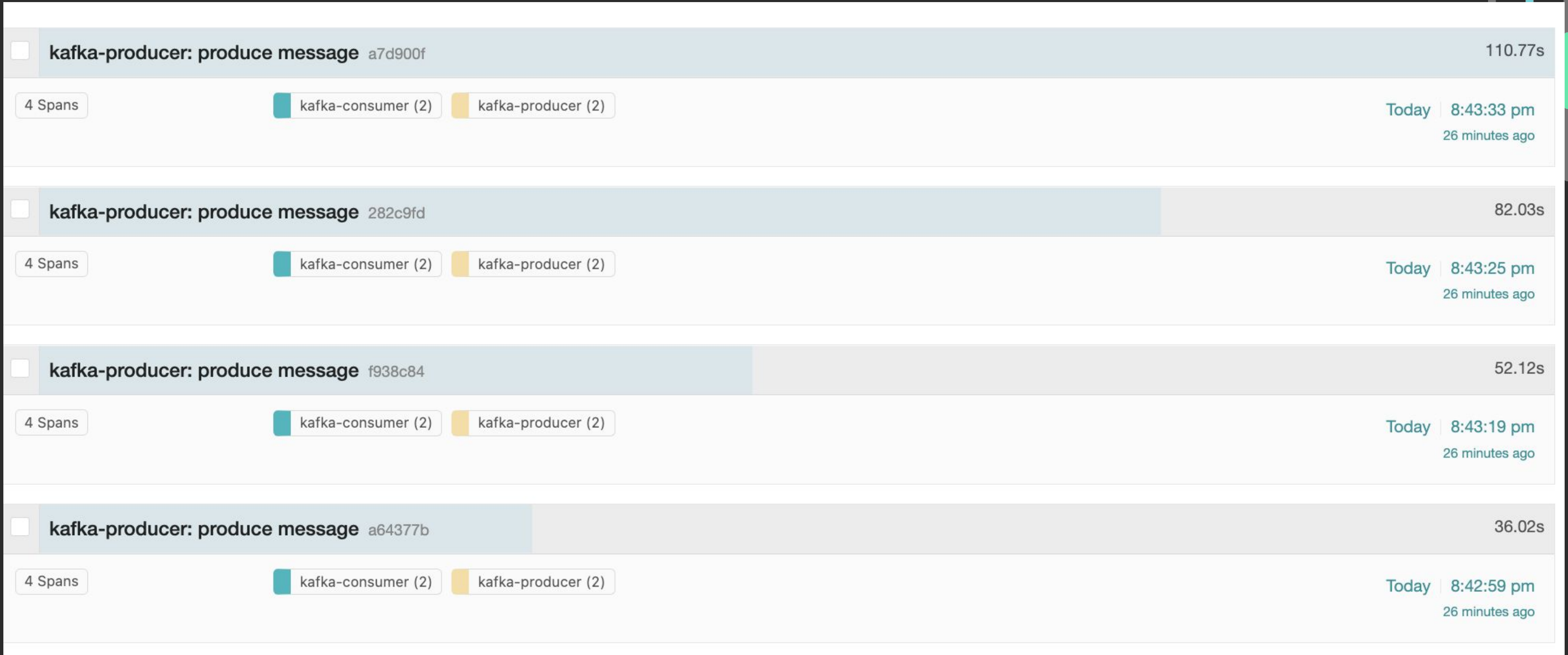
Live Demo

github.com/lazyplatypus/kafka-otel



□ **kafka-producer: produce message** a7d900f 110.77s

4 Spans 🟦 kafka-consumer (2) 🟨 kafka-producer (2) Today | 8:43:33 pm
26 minutes ago

□ **kafka-producer: produce message** 282c9fd 82.03s

4 Spans 🟦 kafka-consumer (2) 🟨 kafka-producer (2) Today | 8:43:25 pm
26 minutes ago

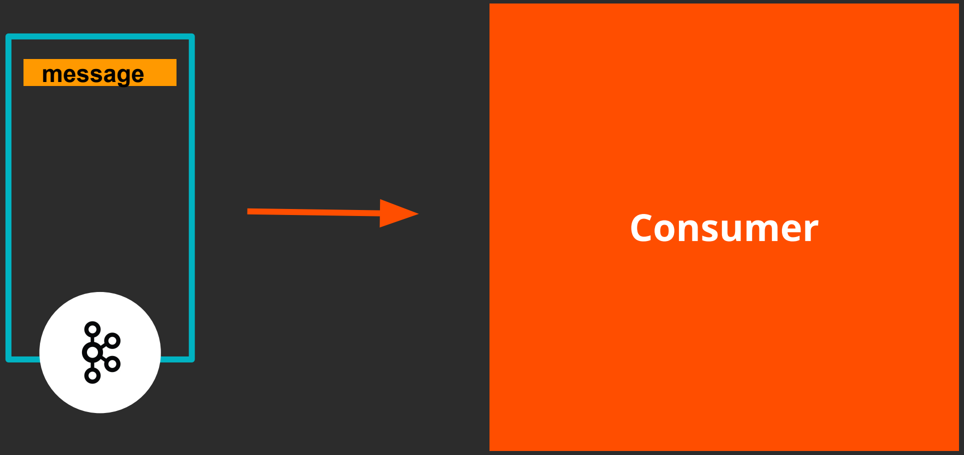
□ **kafka-producer: produce message** f938c84 52.12s

4 Spans 🟦 kafka-consumer (2) 🟨 kafka-producer (2) Today | 8:43:19 pm
26 minutes ago

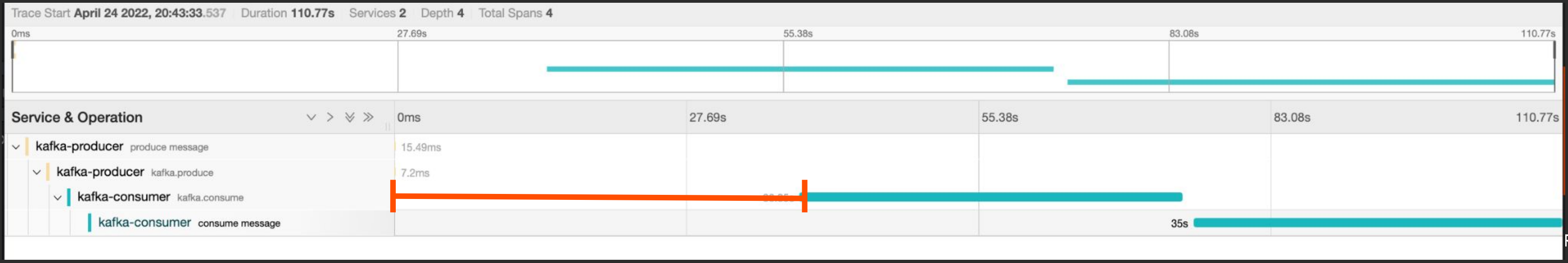
□ **kafka-producer: produce message** a64377b 36.02s

4 Spans 🟦 kafka-consumer (2) 🟨 kafka-producer (2) Today | 8:42:59 pm
26 minutes ago

What’s Happening?



The consumer was busy handling other requests so the message was sitting in the kafka queue

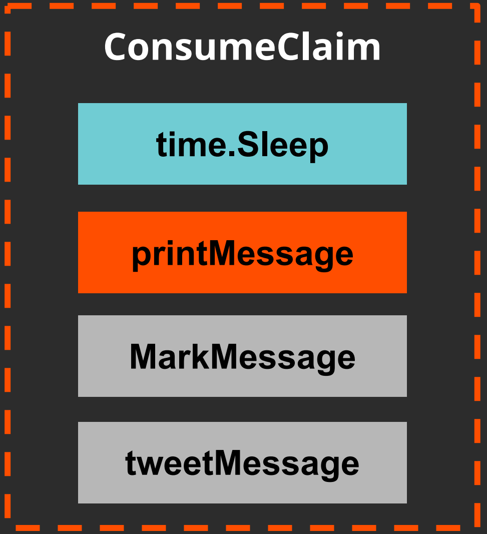


Trace Start **April 24 2022, 20:43:33**.537 | Duration **110.77s** | Services **2** | Depth **4** | Total Spans **4**

Service & Operation	
kafka-producer produce message	15.49ms
kafka-producer kafka.produce	7.2ms
kafka-consumer kafka.consume	
kafka-consumer consume message	35s

Relic.

What’s Happening?



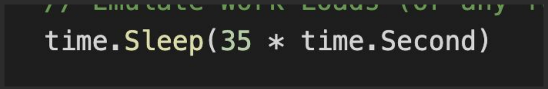
ConsumeClaim

time.Sleep

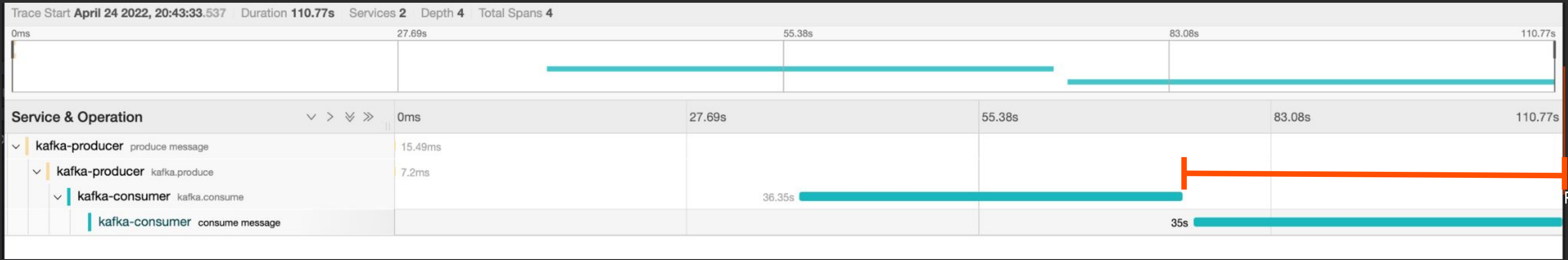
printMessage

MarkMessage

tweetMessage



```
// Emulate Work Loads (or any r
time.Sleep(35 * time.Second)
```



Trace Start **April 24 2022, 20:43:33**.537 Duration **110.77s** Services **2** Depth **4** Total Spans **4**

Service & Operation	0ms	27.69s	55.38s	83.08s	110.77s
kafka-producer produce message	15.49ms				
kafka-producer kafka.produce	7.2ms				
kafka-consumer kafka.consume		36.35s			
kafka-consumer consume message				35s	

What have WE Learned?

Caveat:

Implementing Distributed Tracing is **NOT EASY**

Especially at Scale, a lot of Cross Functional work to make sure tracing is implemented in every microservice in your set up.

It is gonna be a lot of data, even when you sample every 10k, 50k, 100k traces.

Distributed Tracing is AWESOME!

- It gets you better visibility into the WHY on things are behaving funky and helps you optimize your data ingest pipeline
- It helps you be a better neighbor
- Helps you tweak config variables to make your system more performant.
- OSS Instrumentation/standards is the future of observability!

Thank you!

twitter.com/learnwdaniel