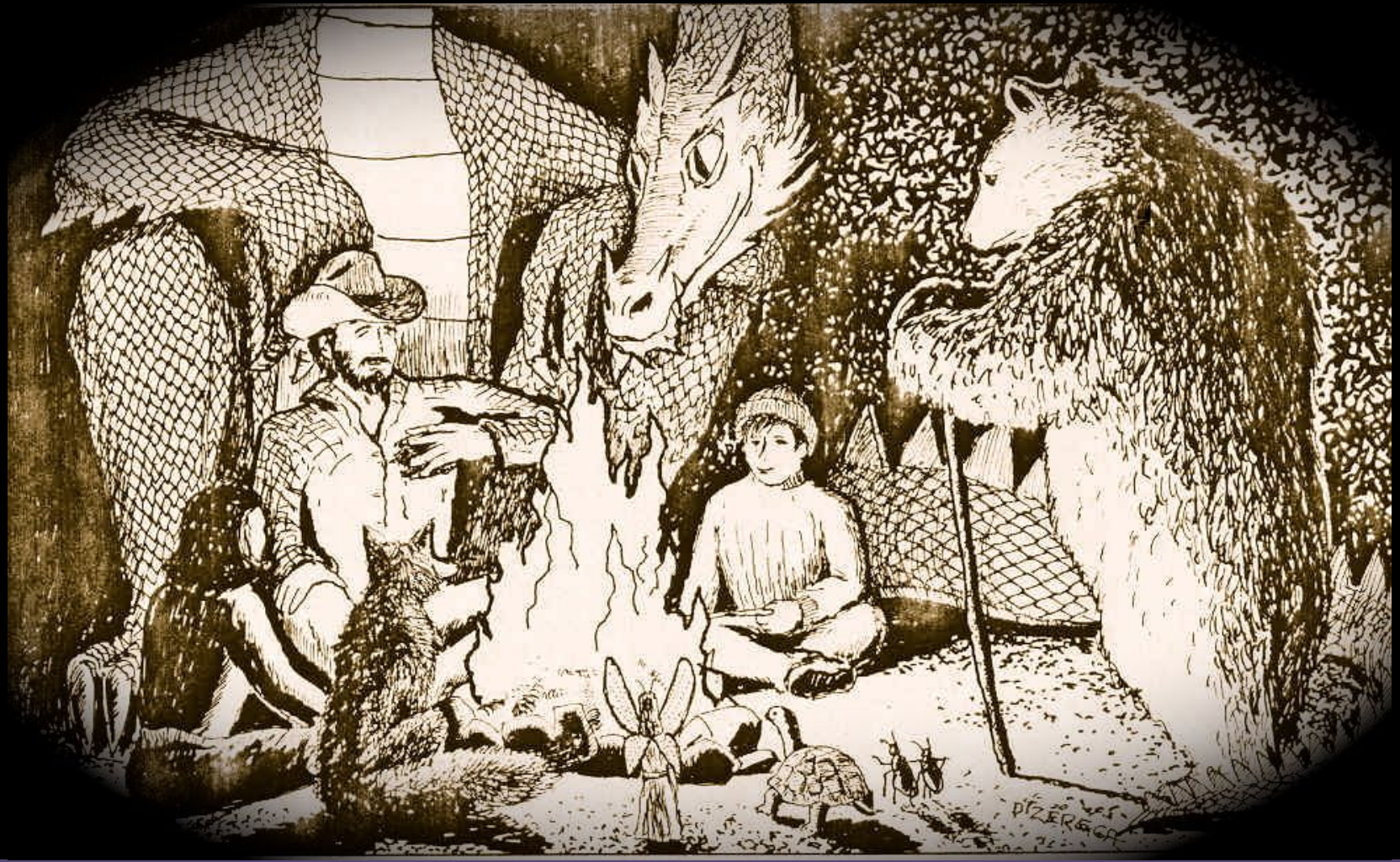
A pragmatic primer to

Distributed Tracing & OpenTelemetry

Daniel Khan
@dkhan



About me

Mühlviertel, 4 Kids, 1 puppy (since last Friday)

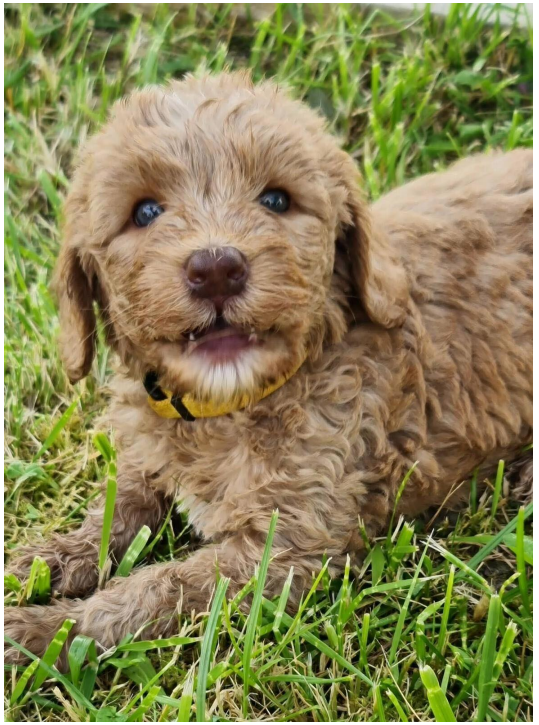
dynatrace — 2015 - 2021: Director Technology Strategy

LinkedIn Learning — since 2016: Course Author

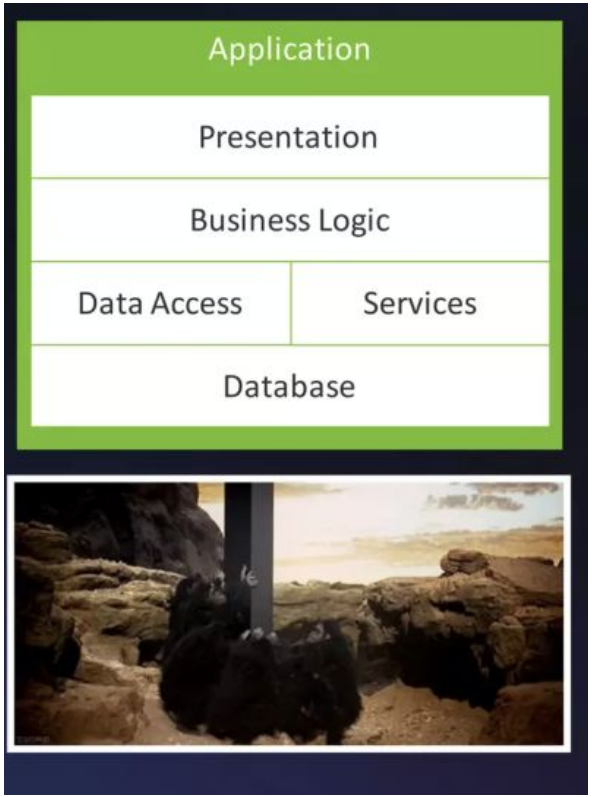
W3C — 2019 - 2021: Co-Chair of W3C Distributed Tracing

elastic — 2021-2022: Director Product Management, Unified Observability

SENTRY — since 2022: Director Product Management, Telemetry



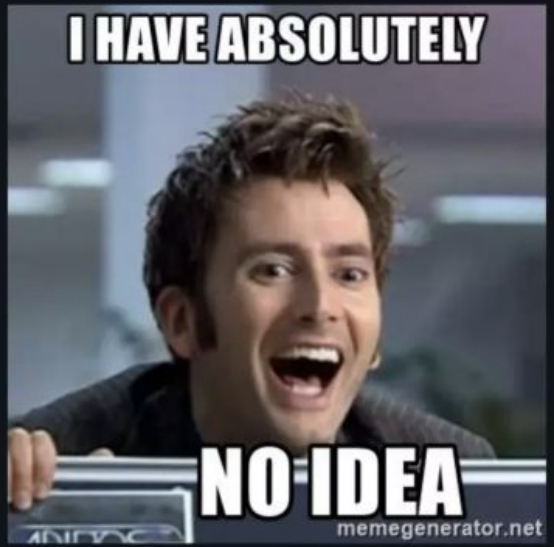
A brief history of (distributed) tracing



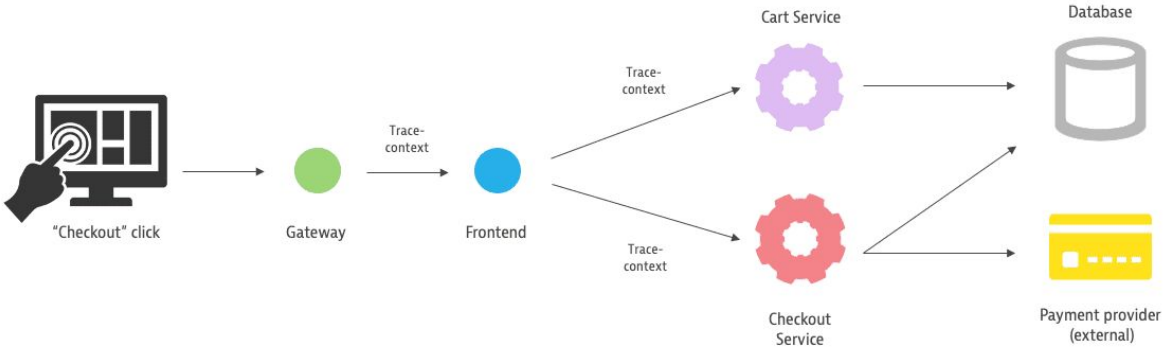
Cart Service

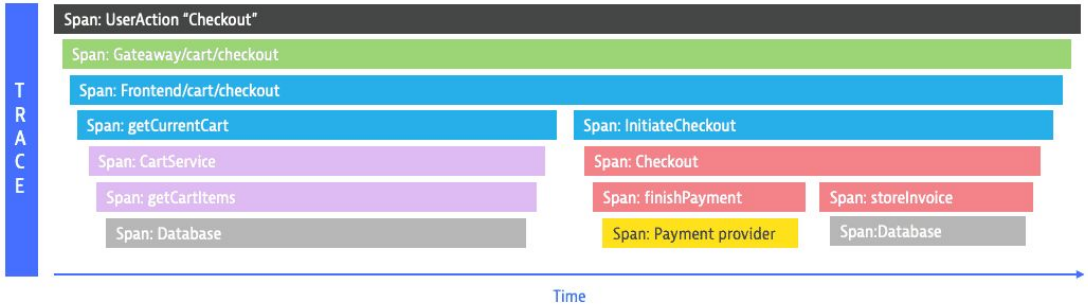
Error
242

Success
1302



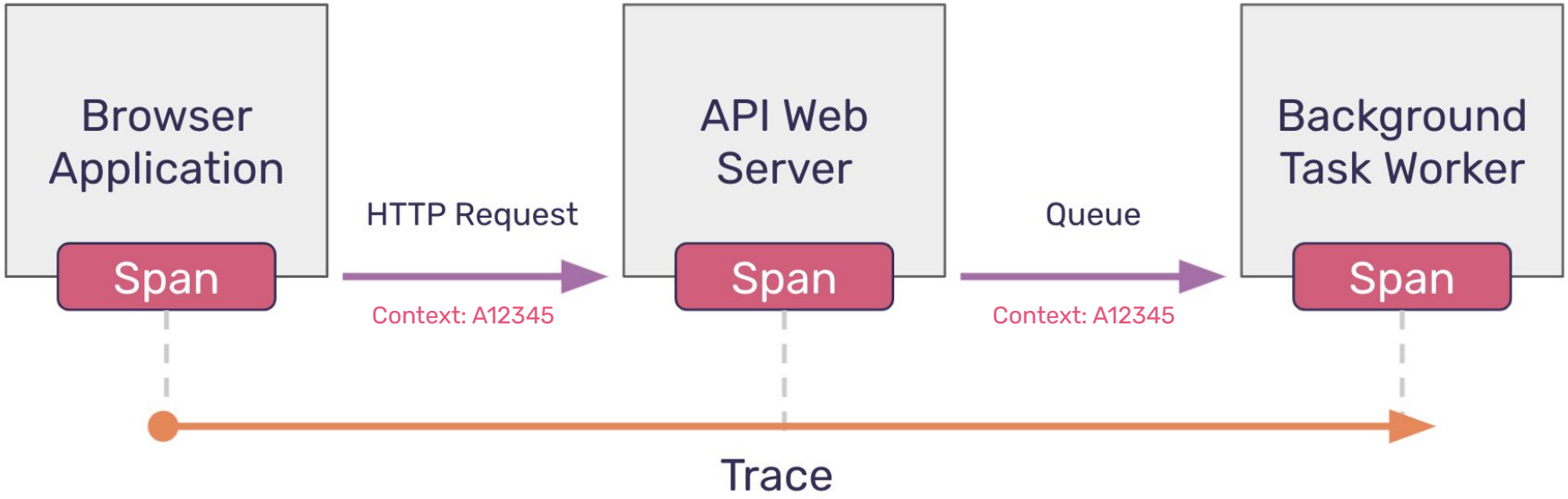
Understanding distributed execution



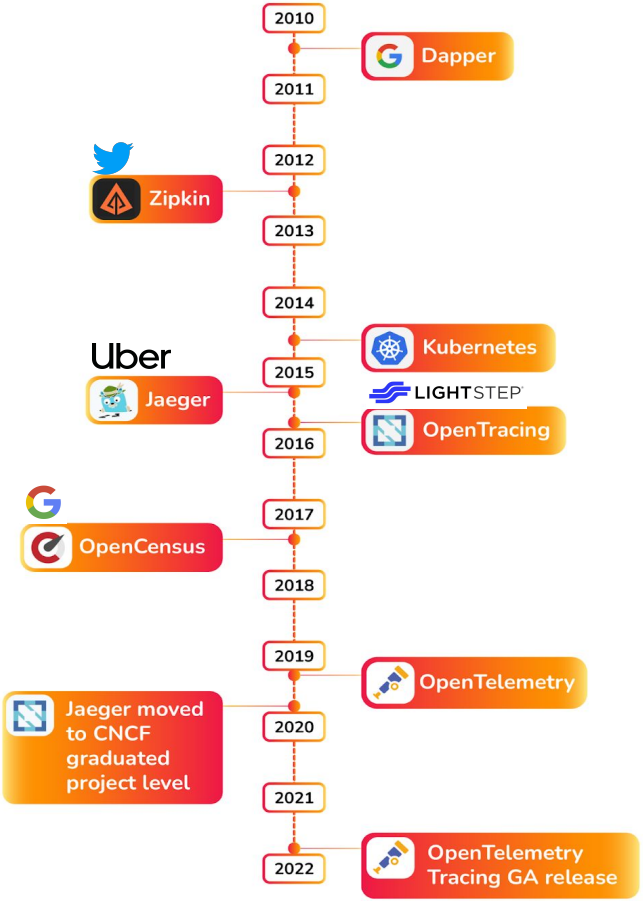


Source: https://www.dynatrace.com/support/help/observe-and-explore/purepath-distributed-traces

Context Propagation

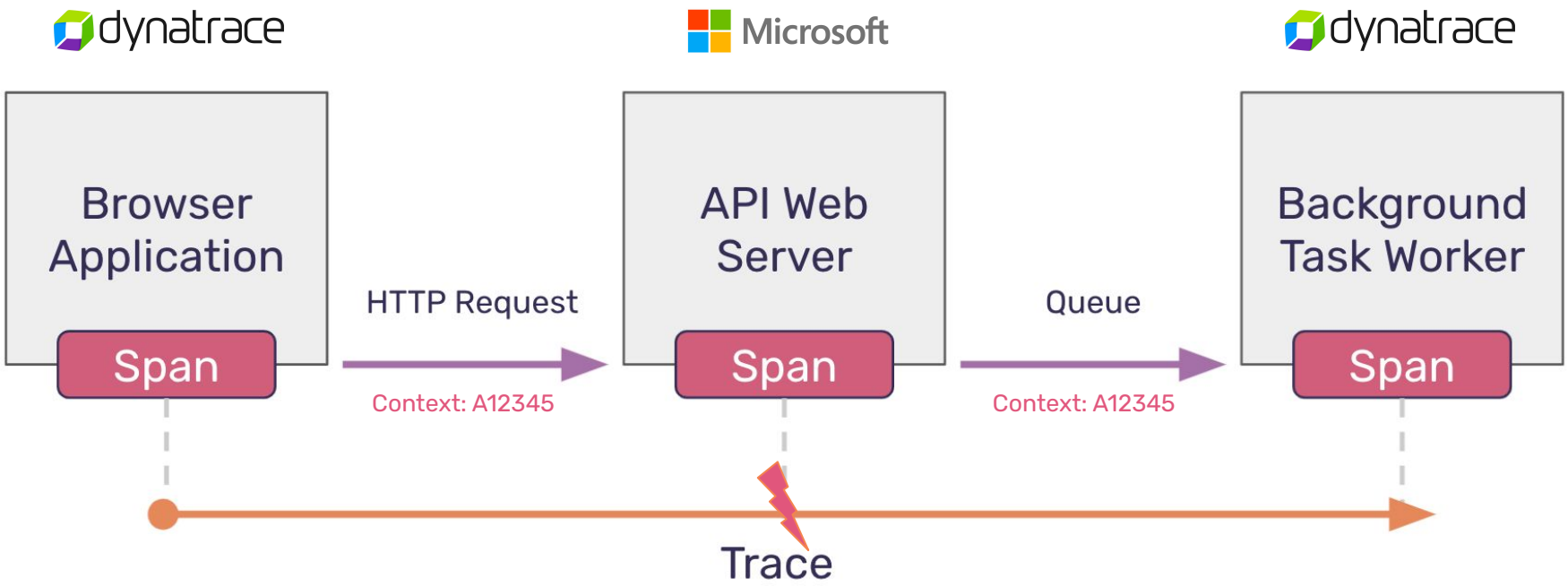


History



Source: https://tracetest.io/blog/tracing-the-history-of-distributed-tracing-opentelemetry

Multi Vendor Scenarios



W3C Distributed Tracing

Microsoft aws Google Cloud dynatrace cisco AppDynamics New Relic. LIGHTSTEP

W3C Recommendation

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Trace Context

W3C Recommendation 23 November 2021

▼ More details about this document

This version:
https://www.w3.org/TR/2021/REC-trace-context-1-20211123/

Latest published version:
https://www.w3.org/TR/trace-context-1/

Latest editor's draft:
https://w3c.github.io/trace-context/

History:
https://www.w3.org/standards/history/trace-context-1
Commit history

Implementation report:
https://github.com/w3c/trace-context/#reference-implementations

Editors:
Sergey Kanzhelev (Microsoft)
Morgan McLean (Google)
Alois Reitbauer (Dynatrace)
Bogdan Drutu (Google)
Nik Molnar (Microsoft)
Yuri Shkuro (Invited Expert)

Feedback:
GitHub w3c/trace-context (pull requests, new issue, open issues)
public-trace-context@w3.org with subject line `trace-context` (archives)

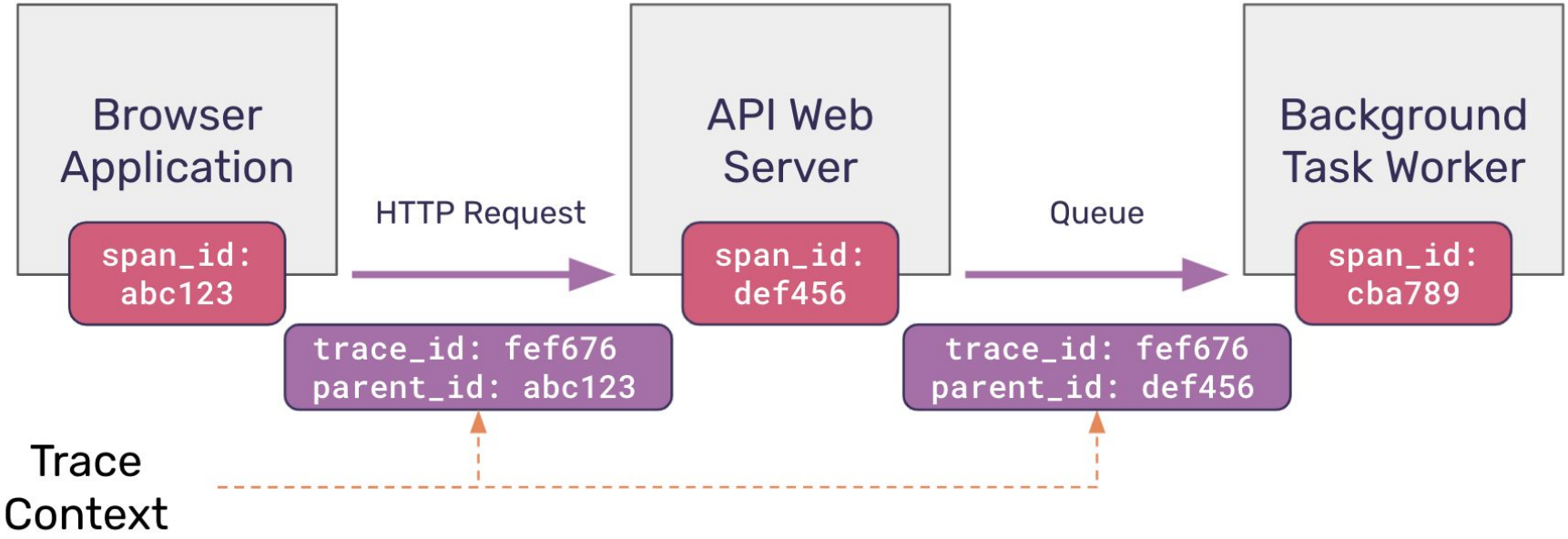
Errata:
Errata exists.

Discussions
We are on Gitter.

See also **translations**.

Abstract

W3C Trace Context



Hide Details | JSON (92.5 KiB)

GET /api/recommendations

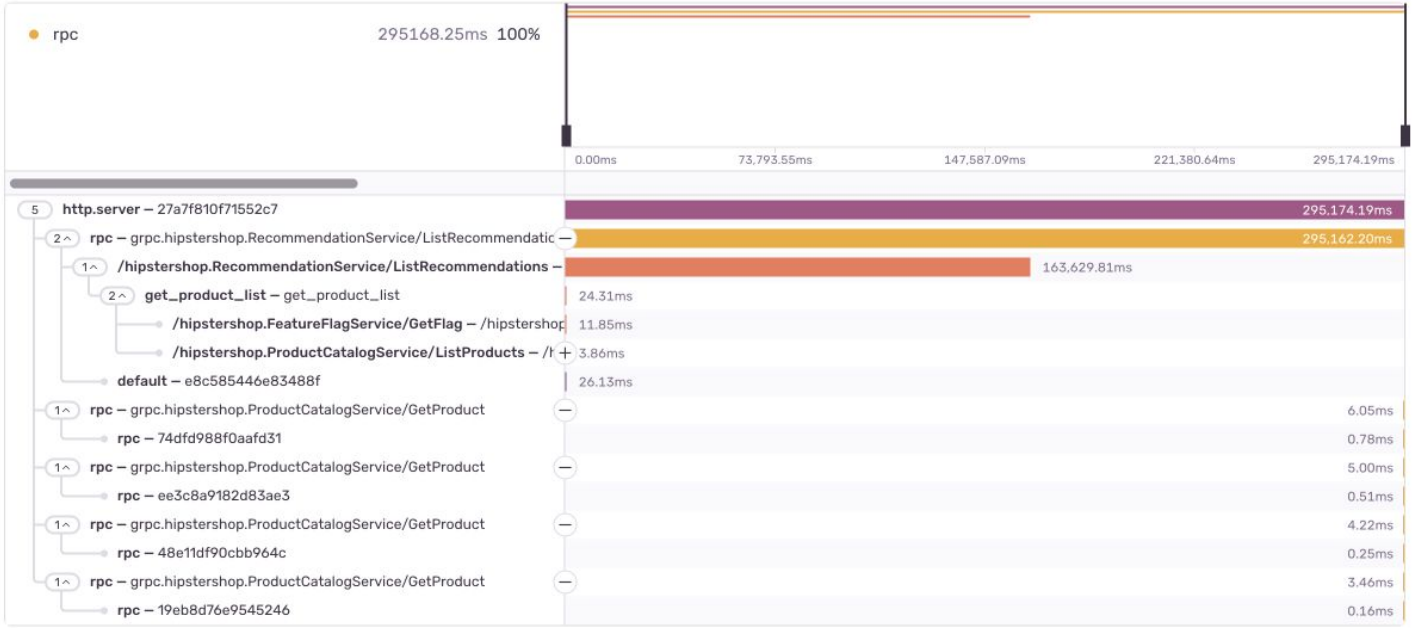
Event ID
39d50c0b
otel-demo-fronten...

Event Duration
4.92min
5 days ago

Browser
Python Requests
2.28

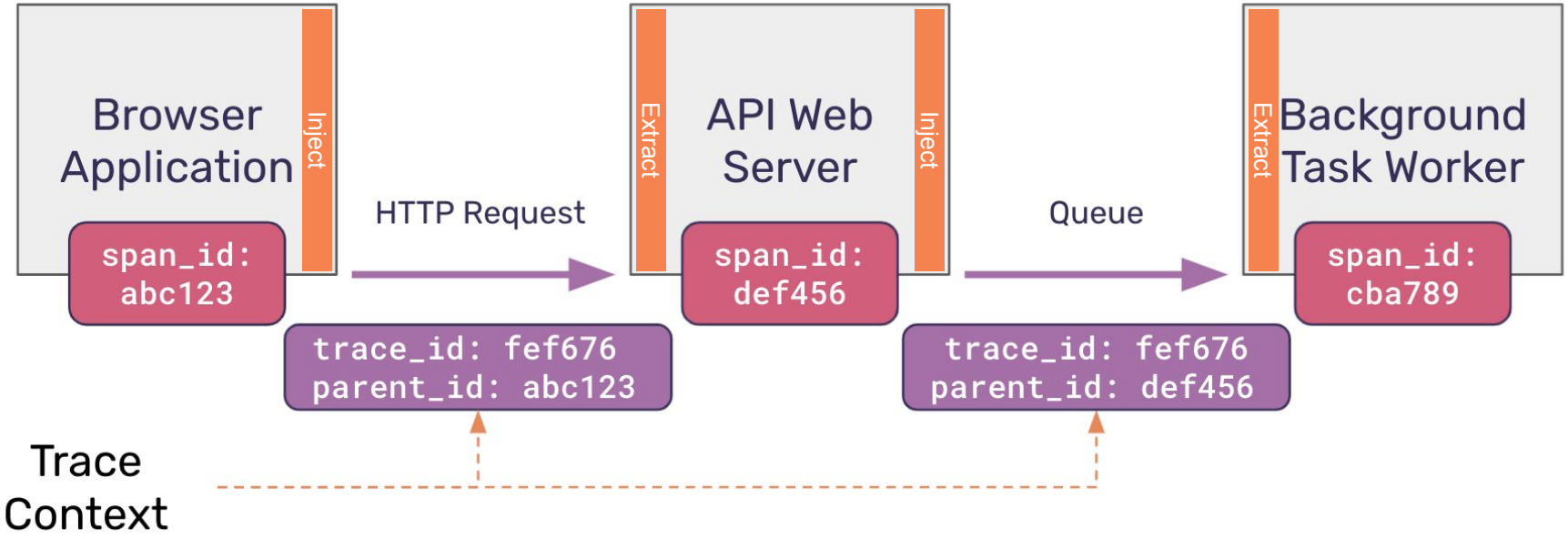
Trace Navigator
This Event | 6 Children | 1 Descendant
View Full Trace: 92567a85 (8 events)

Filter | Search for spans



Tag Details

browser	Python Requests 2.28
browser.name	Python Requests
environment	production-dev
level	info
os	Alpine Linux 3.17.3
os.name	Alpine Linux
release	6NRrBDwJzzLQFyrp...
runtime	node v18.16.0
runtime.name	node
server_name	otel-demo-frontend...
transaction	GET /api/recommen...
url	http://otel-demo...


Browser Application
Inject
span_id: abc123
HTTP Request
Extract
API Web Server
Inject
span_id: def456
Queue
Extract
Background Task Worker
span_id: cba789
trace_id: fef676
parent_id: abc123
trace_id: fef676
parent_id: def456
Trace Context

2018/2019: OpenTelemetry enters the stage

Google

OpenCensus
(Metrics, Traces)

+

LIGHTSTEP

OpenTracing
(Traces)

=

CLOUD NATIVE
COMPUTING FOUNDATION

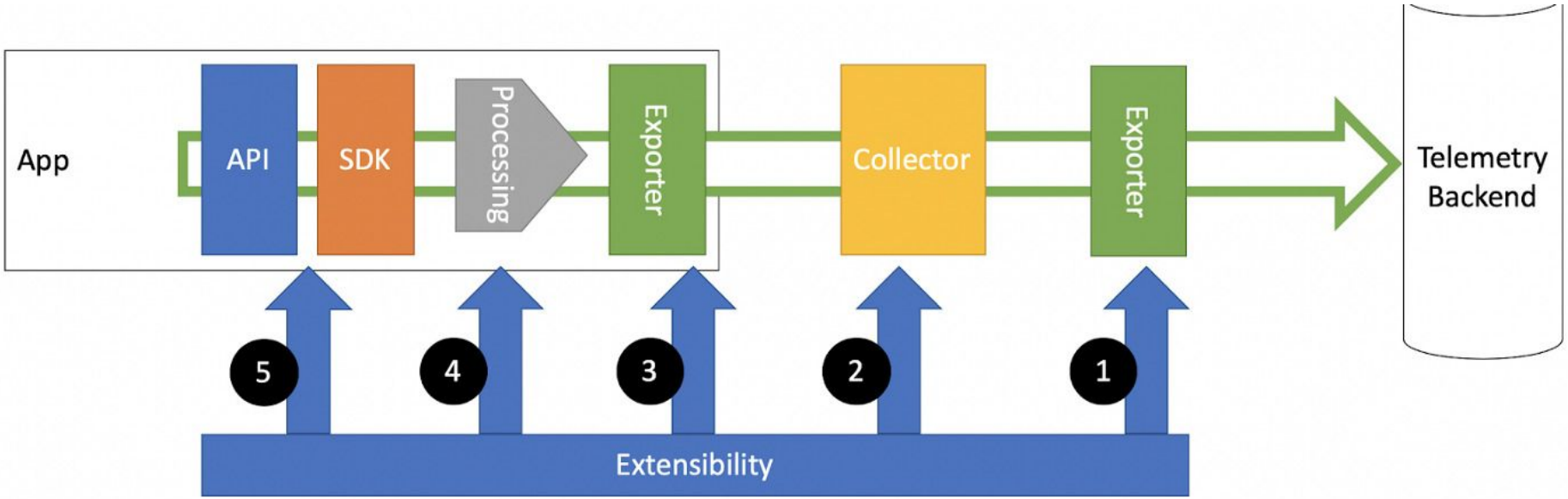
OpenTelemetry
(Metrics, Logs,
Traces)

Jaeger
(Tracing UI)

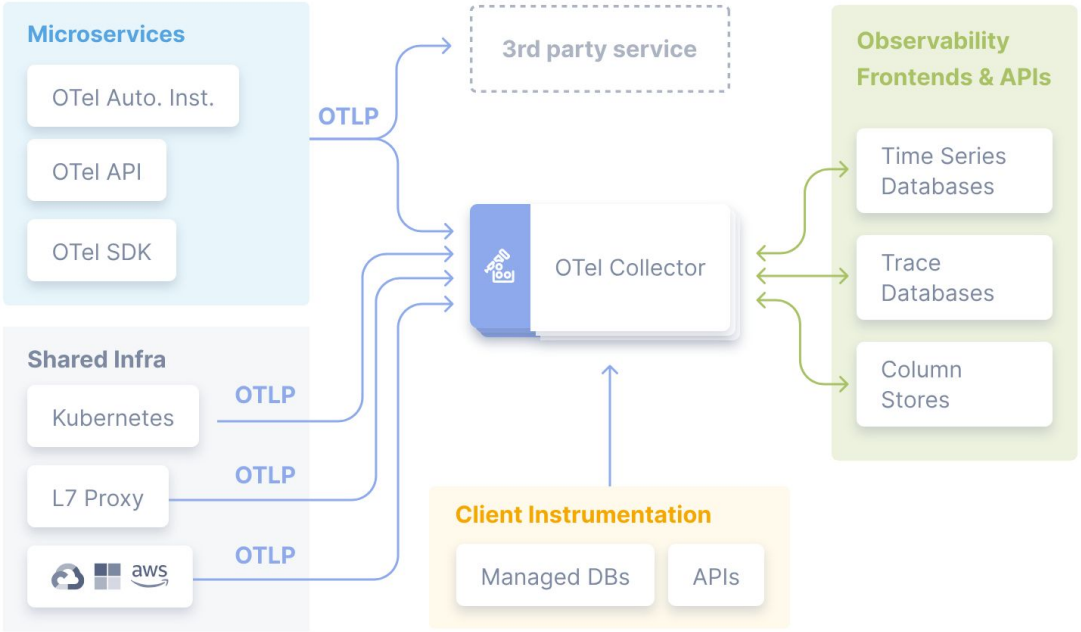
Morgan McLean

Ted Young

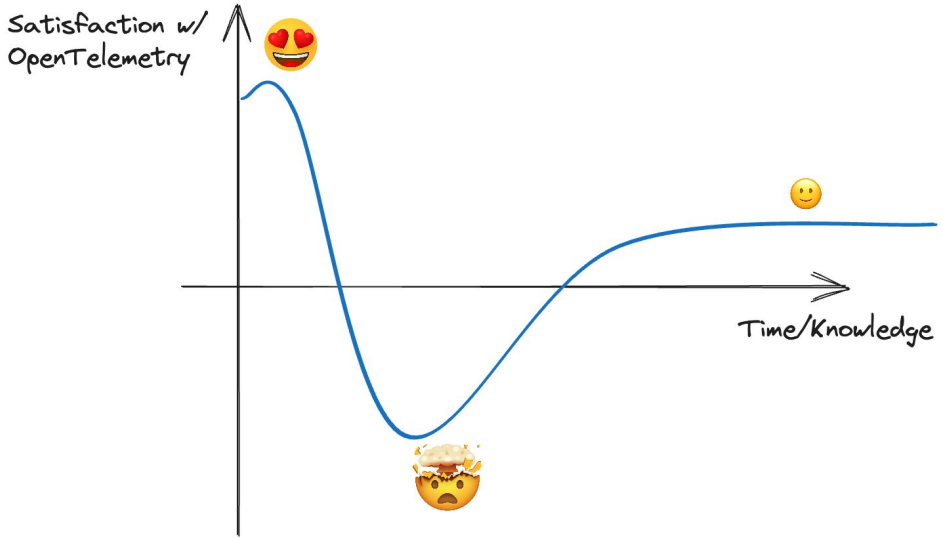
Yuri Shkuro

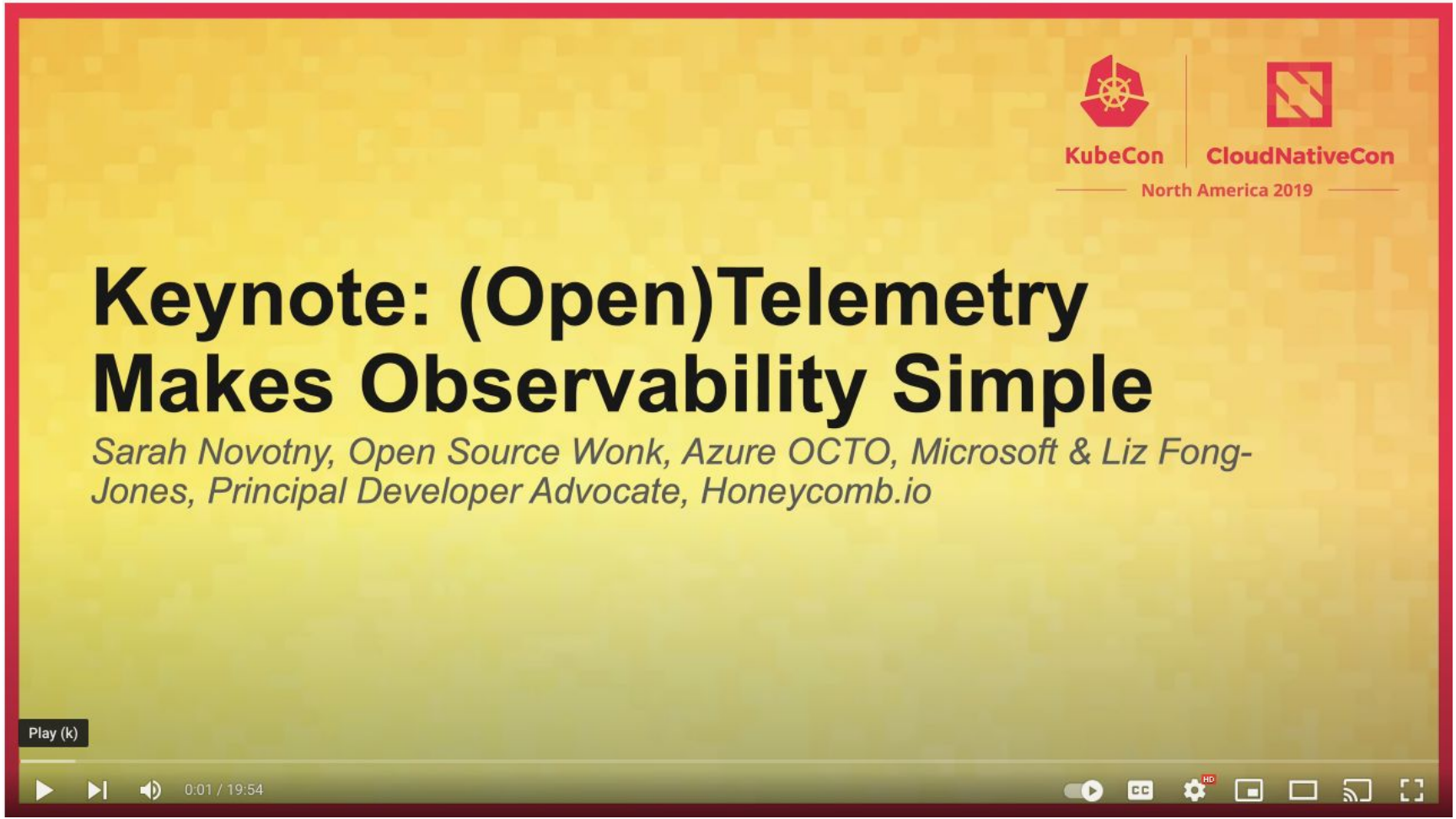

App
API
SDK
Processing
Exporter
Collector
Exporter
Telemetry Backend
5
4
3
2
1
Extensibility

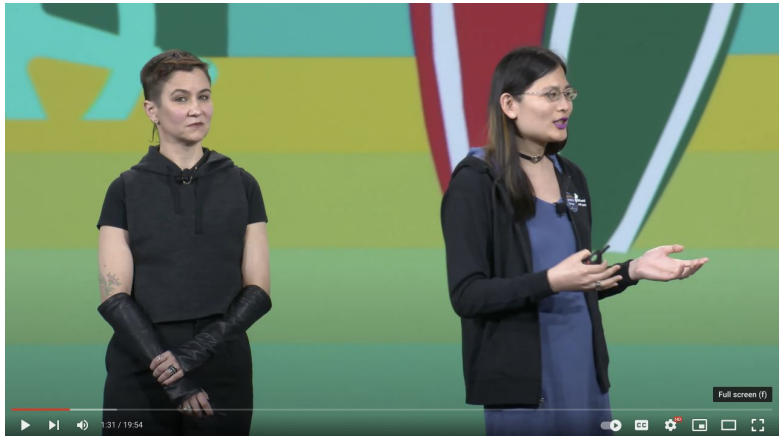
OTel as open, extendable standard



OpenTelemetry




KubeCon
CloudNativeCon
North America 2019
Keynote: (Open)Telemetry Makes Observability Simple
Sarah Novotny, Open Source Wonk, Azure OCTO, Microsoft & Liz Fong-Jones, Principal Developer Advocate, Honeycomb.io
Play (k)
0:01 / 19:54



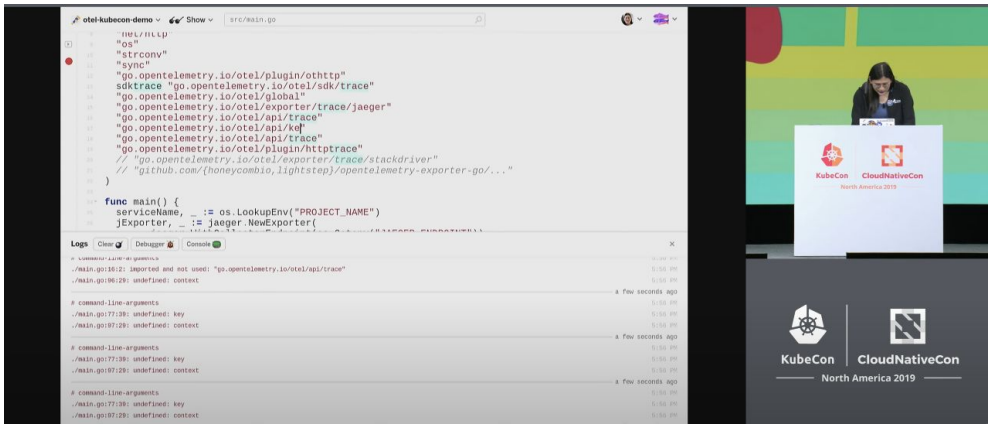
Source: https://www.youtube.com/watch?v=W_8MHdtrgZE

We need new tooling and we need the ability to observe and to look inside our systems so that we know what's happening under the hood.

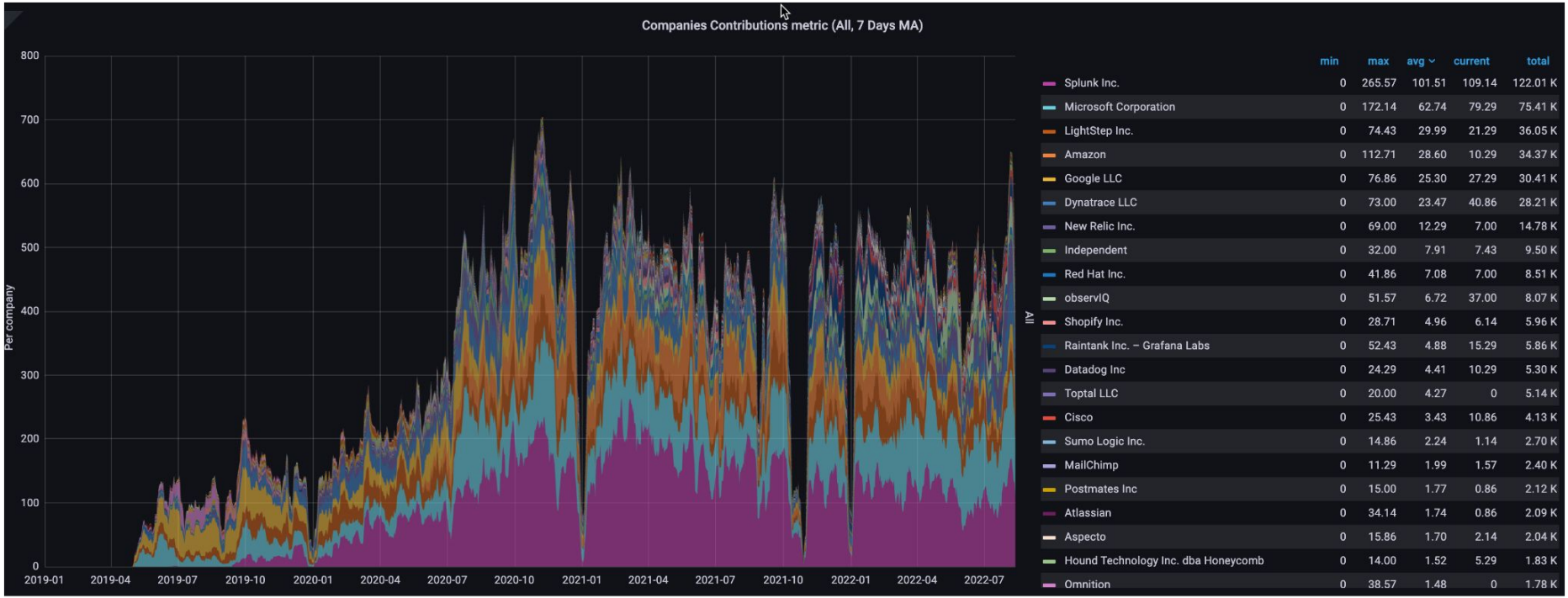
This sounds obvious but if it's so obvious, why haven't we done it already?

Because it's hard.

- Finally the problem of distributed tracing has been solved.
  Despite the problem has been solved more than a decade ago.
- OpenTelemetry is the solution to this.
  Despite having very limited features compared to vendors.
- (We built it.)
  Despite being a community effort.



And then they go on trying to instrument a go app and it doesn't look easy and doesn't work either.


Companies Contributions metric (All, 7 Days MA)
Per company
All
800
700
600
500
400
300
200
100
0
2019-01
2019-04
2019-07
2019-10
2020-01
2020-04
2020-07
2020-10
2021-01
2021-04
2021-07
2021-10
2022-01
2022-04
2022-07
min max avg current total
Splunk Inc. 0 265.57 101.51 109.14 122.01 K
Microsoft Corporation 0 172.14 62.74 79.29 75.41 K
LightStep Inc. 0 74.43 29.99 21.29 36.05 K
Amazon 0 112.71 28.60 10.29 34.37 K
Google LLC 0 76.86 25.30 27.29 30.41 K
Dynatrace LLC 0 73.00 23.47 40.86 28.21 K
New Relic Inc. 0 69.00 12.29 7.00 14.78 K
Independent 0 32.00 7.91 7.43 9.50 K
Red Hat Inc. 0 41.86 7.08 7.00 8.51 K
observIQ 0 51.57 6.72 37.00 8.07 K
Shopify Inc. 0 28.71 4.96 6.14 5.96 K
Raintank Inc. – Grafana Labs 0 52.43 4.88 15.29 5.86 K
Datadog Inc 0 24.29 4.41 10.29 5.30 K
Toptal LLC 0 20.00 4.27 0 5.14 K
Cisco 0 25.43 3.43 10.86 4.13 K
Sumo Logic Inc. 0 14.86 2.24 1.14 2.70 K
MailChimp 0 11.29 1.99 1.57 2.40 K
Postmates Inc 0 15.00 1.77 0.86 2.12 K
Atlassian 0 34.14 1.74 0.86 2.09 K
Aspecto 0 15.86 1.70 2.14 2.04 K
Hound Technology Inc. dba Honeycomb 0 14.00 1.52 5.29 1.83 K
Omnition 0 38.57 1.48 0 1.78 K

Industry Reaction

Since 2019:
Many new vendors enter the market.

September 2019:
Splunk acquires SignalFX and Omnition.

May 2021:
ServiceNow acquires LightStep.

Figure 1. Magic Quadrant for Application Performance Monitoring Suites

Source: Gartner (March 2018)

Figure 1: Magic Quadrant for Application Performance Monitoring and Observability

Source: Gartner (June 2022)

All

	min	max	avg	current	total
Splunk Inc.	55.43	169.14	105.21	137.86	9.47 K
Microsoft Corporation	57.29	142.71	101.50	131.29	9.13 K
LightStep Inc.	21.71	61.14	39.50	29.43	3.55 K
New Relic Inc.	21.00	69.00	37.80	54.86	3.40 K
Dynatrace LLC	13.57	71.43	28.93	57.00	2.60 K
observIQ	5.29	51.57	27.54	30.86	2.48 K
Google LLC	6.00	36.43	17.50	24.71	1.58 K
Cisco	3.43	25.43	14.15	8.57	1.27 K
Independent	5.57	21.71	12.94	5.86	1.16 K
Datadog Inc	1.00	24.29	12.11	11.86	1.09 K
Amazon	3.29	16.71	9.64	11.00	867.77
Red Hat Inc.	0.71	17.29	7.69	10.14	692.20
Shopify Inc.	0.57	15.43	6.82	8.43	614.20
Raintank Inc. — Grafana Labs	0	27.57	6.47	10.86	582.64
Sumo Logic Inc.	0.57	11.71	4.54	0.71	408.69
Atlassian	0	16.57	3.66	0.29	329.60
Tencent	0.29	7.43	2.91	1.00	261.86
Aspecto	0	9.29	2.86	0	257.71
Sentry	0	8.43	2.49	2.29	224.00
DaoCloud Network Technology Co. Ltd.	0	6.57	2.20	0.71	197.56
MailChimp	0	5.00	1.91	0	172.12
Salesforce.com inc.	0	6.71	1.42	0	127.56

THE STATE OF OPENTELEMETRY PER SIGNAL

Generally Available

- API, SDK, & Protocol are stable
- Client libraries v1.0+ exist for Java, Go, .Net, Python, C++, JavaScript, Ruby, Erlang, Swift (and maybe more)
- Long-term support, backwards compatibility, and dependency isolation guarantees

Release Candidate

- RC announced May '22
- GA expected soon
- API, SDK, & Protocol are stable
- Client libraries in Java, .NET, and Python exist in RC (and maybe more)
- Prometheus support

Experimental

- Protocol is stable, API & SDK in draft
- Focusing first on integration with existing logging systems
- Log appenders are under development in many languages
- Next focus: a new strongly-typed and machine-readable format

Source: https://logz.io/learn/opentelemetry-guide/#current

OpenTelemetry does not provide

- A backend to store the data
- Analytics on top of this data
- A user interface
- Proper frontend/mobile monitoring (as of today)

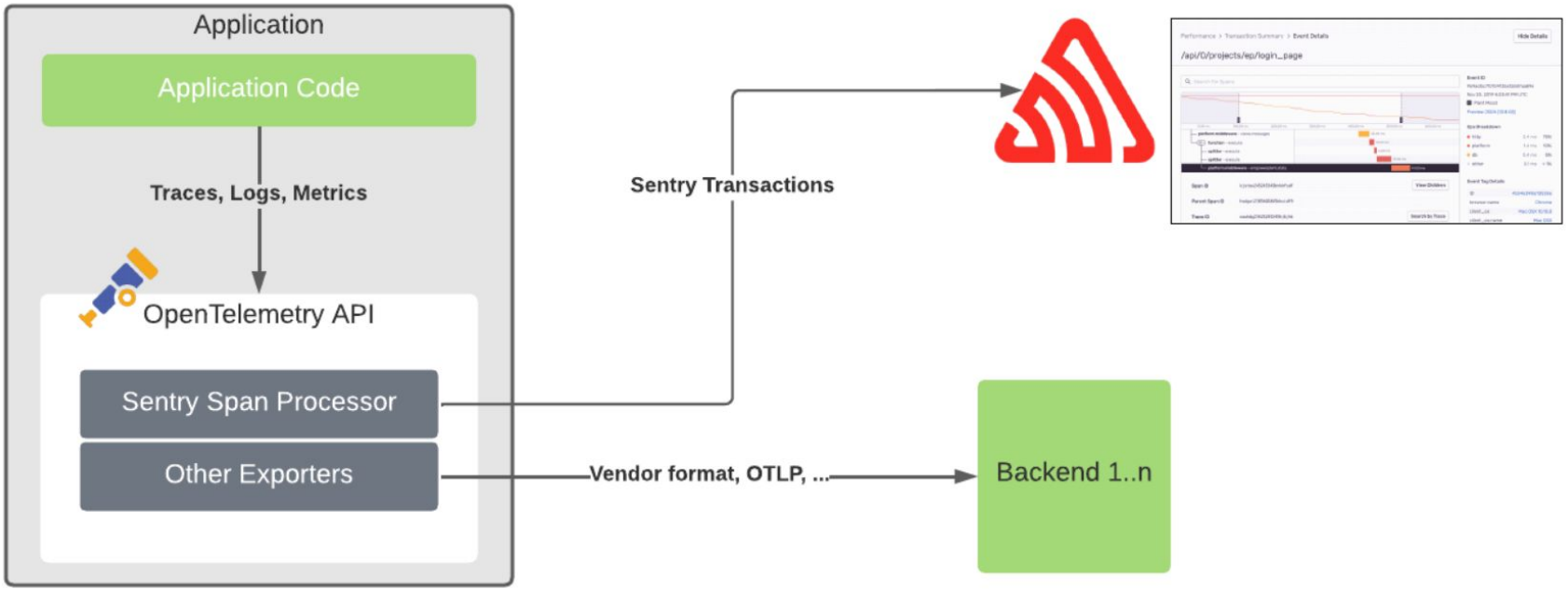
OpenTelemetry provides

- A unified way for libraries and components to add observability
- Auto-Instrumentation for many platforms and frameworks
- A SDK for vendor neutral manual instrumentation
- A data format (OTLP) to exchange telemetry data
- A way to send data to multiple observability backends

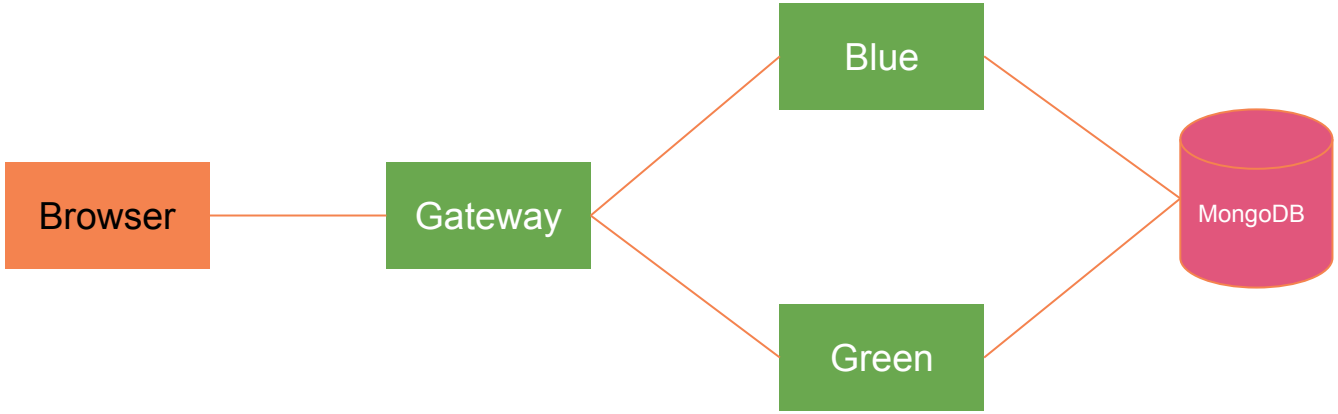
“We want every platform and library to be pre-instrumented with OpenTelemetry and we’re committed to making this as easy as possible.”

Sergey Kanzhelev (Google)

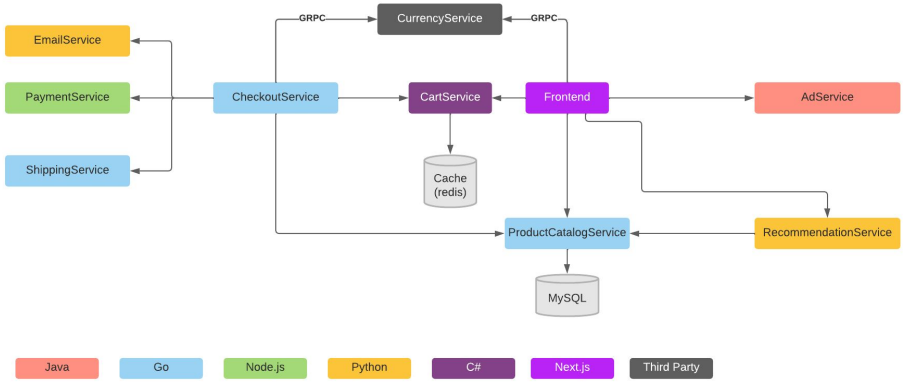
OpenTelemetry at Sentry

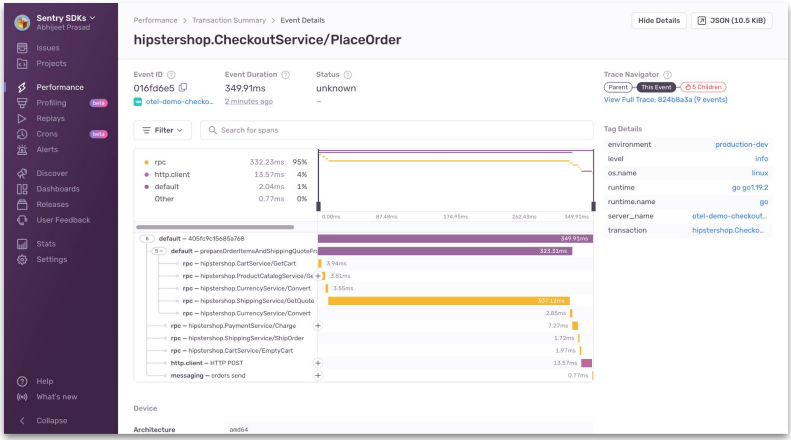


Demo



Official OTel Microservices Demo





https://github.com/getsentry/opentelemetry-demo

Thank you!
Questions?