CLOUD NATIVE
COMPUTING FOUNDATION

Jaeger
Project Intro

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CloudNativeCon NA, Seattle, Dec-12-2018

Agenda

- What is tracing
- Demo
- Project status
- New Features
- Roadmap
- Q & A

About

- Pavol Loffay (https://github.com/pavolloffay)
  - Software engineer at Red Hat
  - Working on tracing & observability

- Yuri Shkuro (https://github.com/yurishkuro)
  - Software engineer at Uber
  - Working on tracing & observability

What is Tracing & Why?

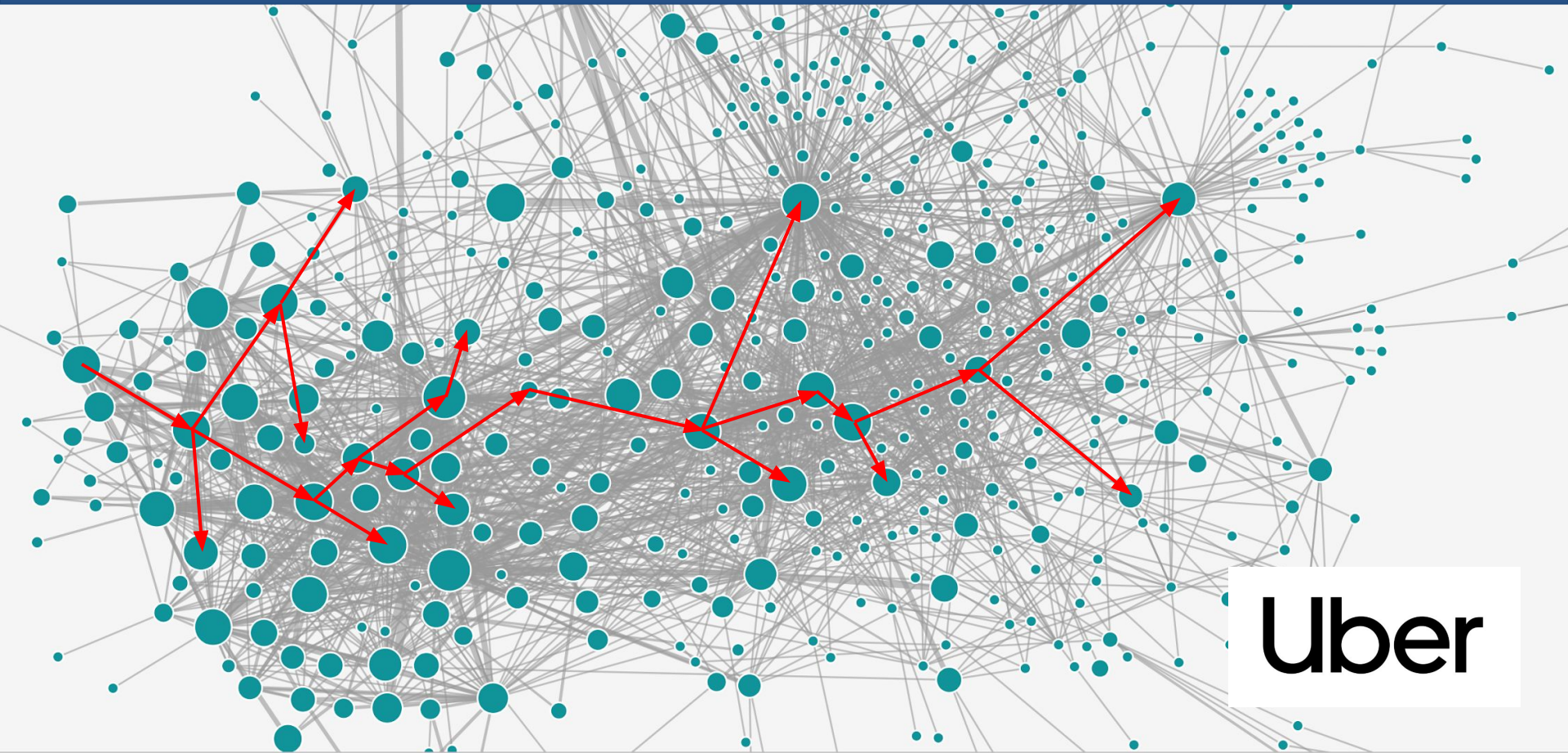
Concepts and terminology

Modern Distributed Systems are COMPLEX

Loading Netflix or Facebook home page ⇒

dozens of microservices, 100s of nodes

BILLIONS of times a day!

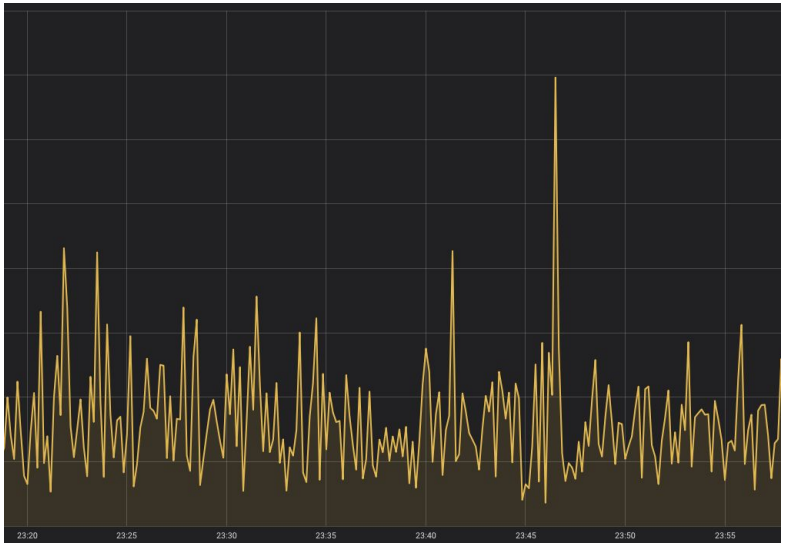


How can we tell what is going on?

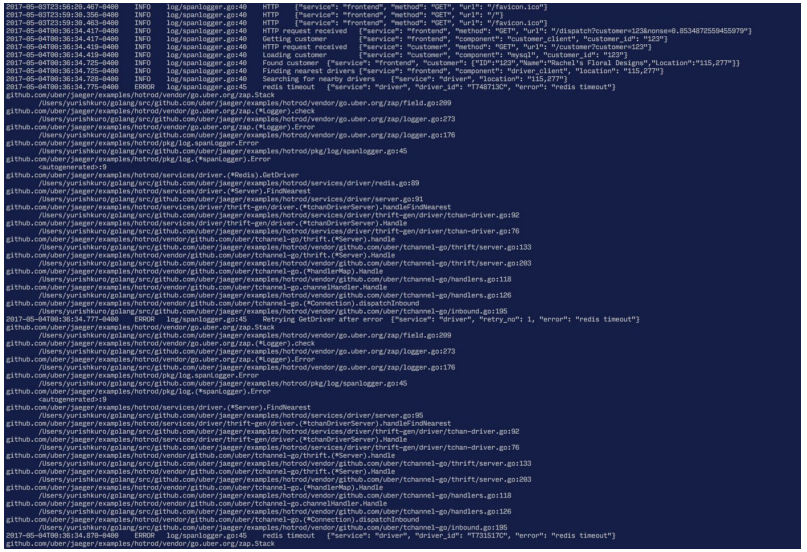
Which service is to blame

when things go wrong or become slow?

Traditional monitoring tools don't help



Metrics show something is wrong, but do not explain why.



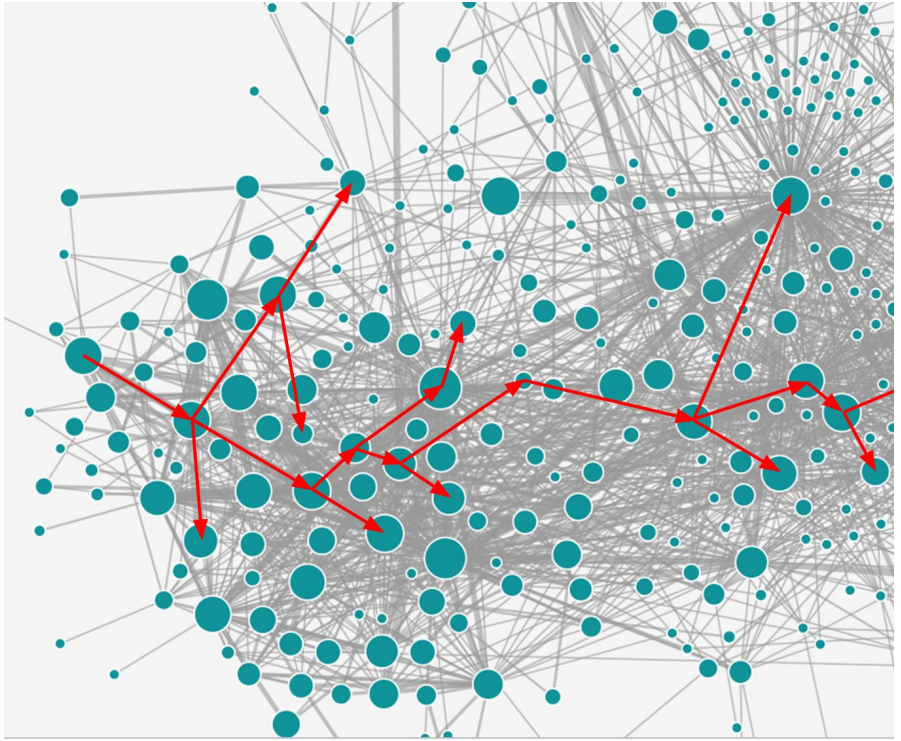
Logs are a mess: concurrent requests, multiple hosts, impossible to correlate.

Monitoring tools must tell stories!

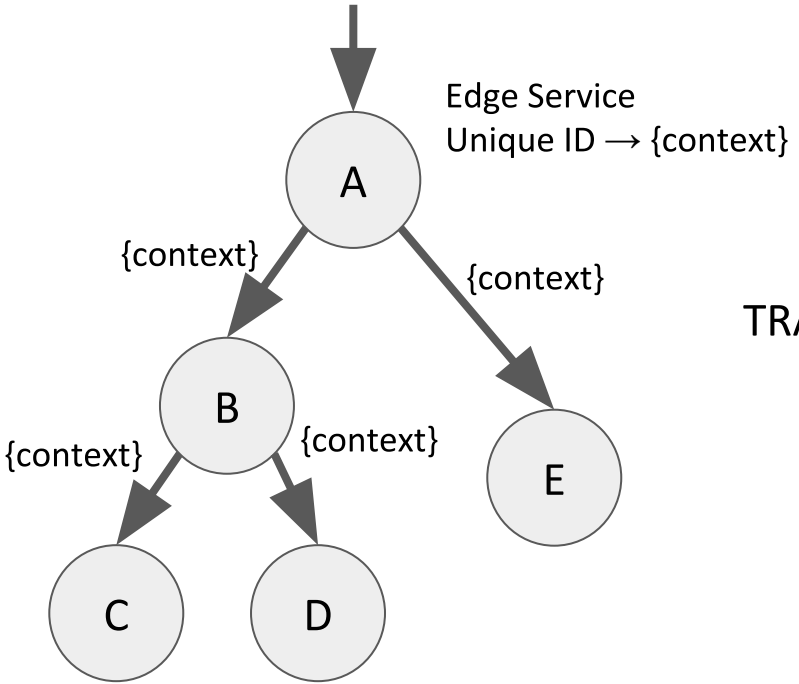
Do you like debugging without a stack trace?

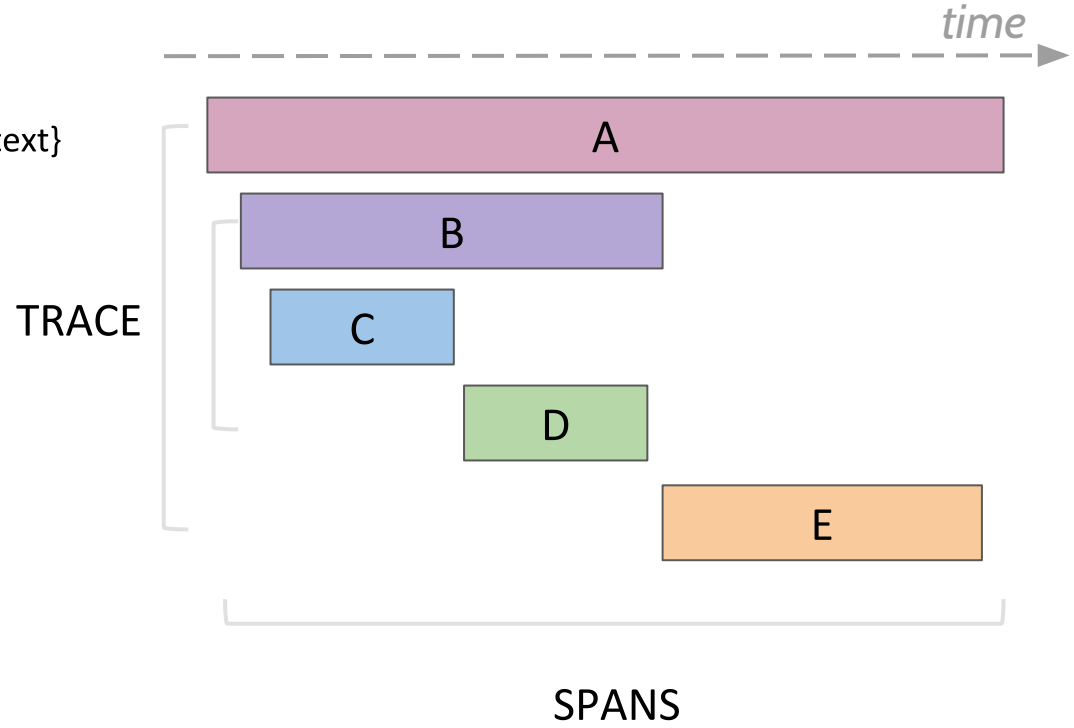
We need to monitor distributed transactions

⇒ **distributed tracing**!



Context Propagation & Distributed Tracing





Jaeger, a Distributed Tracing Platform

trace collection backend

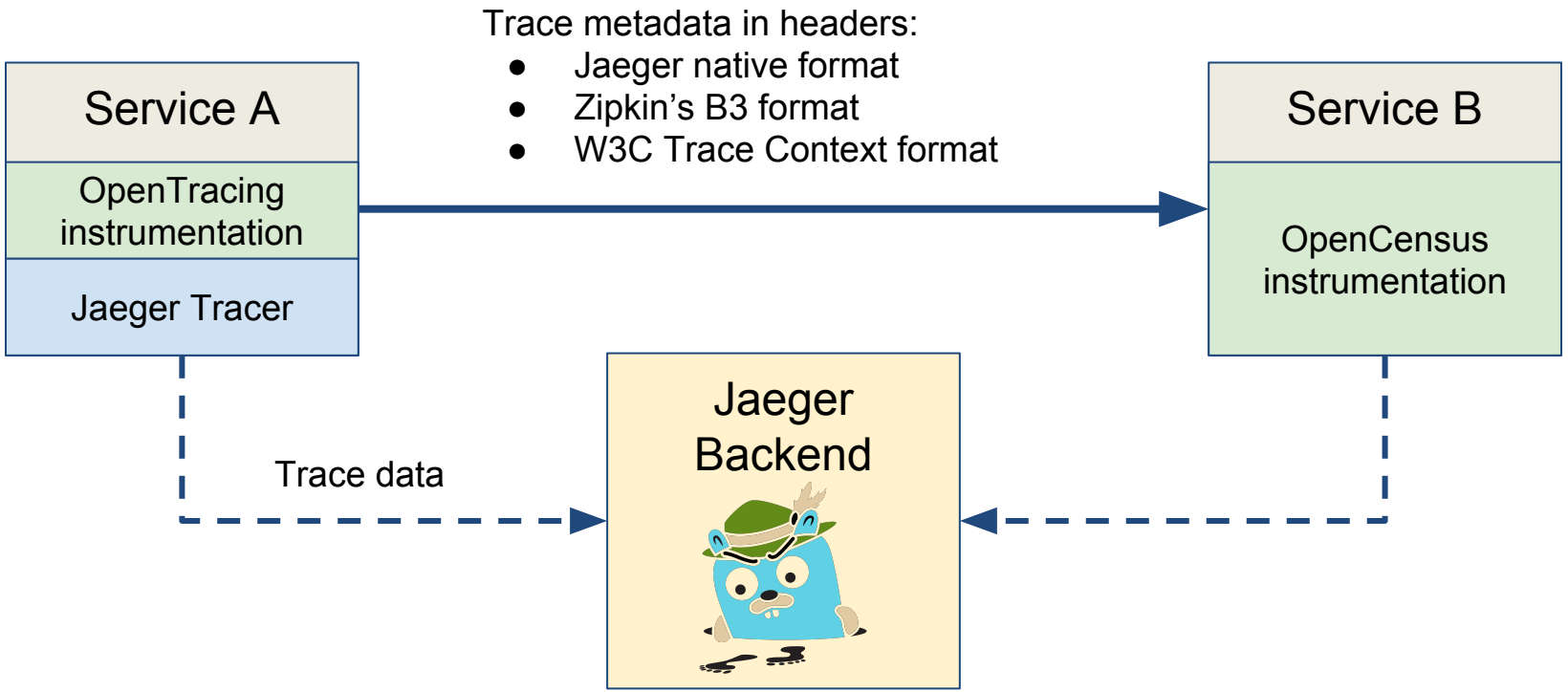
visualization frontend

instrumentation libraries

data mining platform

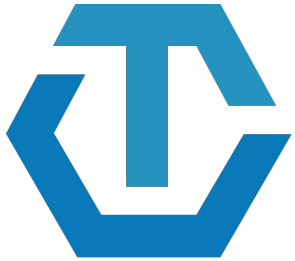
https://jaegertracing.io

Jaeger Integrations



OpenTracing

- **Instrumentation API**
  - Context propagation
  - Distributed tracing
  - Contextualized logging
  - Contextualized metrics
- Vendor neutral
- Cross language
- CNCF member project



OPENTRACING

http://opentracing.io

CLOUD NATIVE COMPUTING FOUNDATION

Jaeger - /ˈyāgər/, *noun*: hunter

- Inspired by Google's Dapper and OpenZipkin
- Started at Uber in August 2015
- Open sourced in April 2017
- Joined CNCF in Sep 2017 (incubating)
- Applying for graduation

  https://github.com/cncf/toc/pull/171

Technology Stack

- Go backend
- Pluggable storage
  - Cassandra, Elasticsearch, memory, ...
- React/Javascript frontend
- OpenTracing Instrumentation libraries
- Integration with Kafka, Apache Flink

Project & Community

- 7 maintainers, from Uber and Red Hat
- GitHub stats
  - >6,600 stars, >880 forks
  - >580 contributors
    - >220 authors of commits and pull requests
    - >350 issue creators

Let's look at some traces

demo time: http://bit.do/jaeger-hotrod

Distributed Tracing Systems

distributed transaction monitoring

performance and latency optimization

root cause analysis

service dependency analysis

distributed context propagation

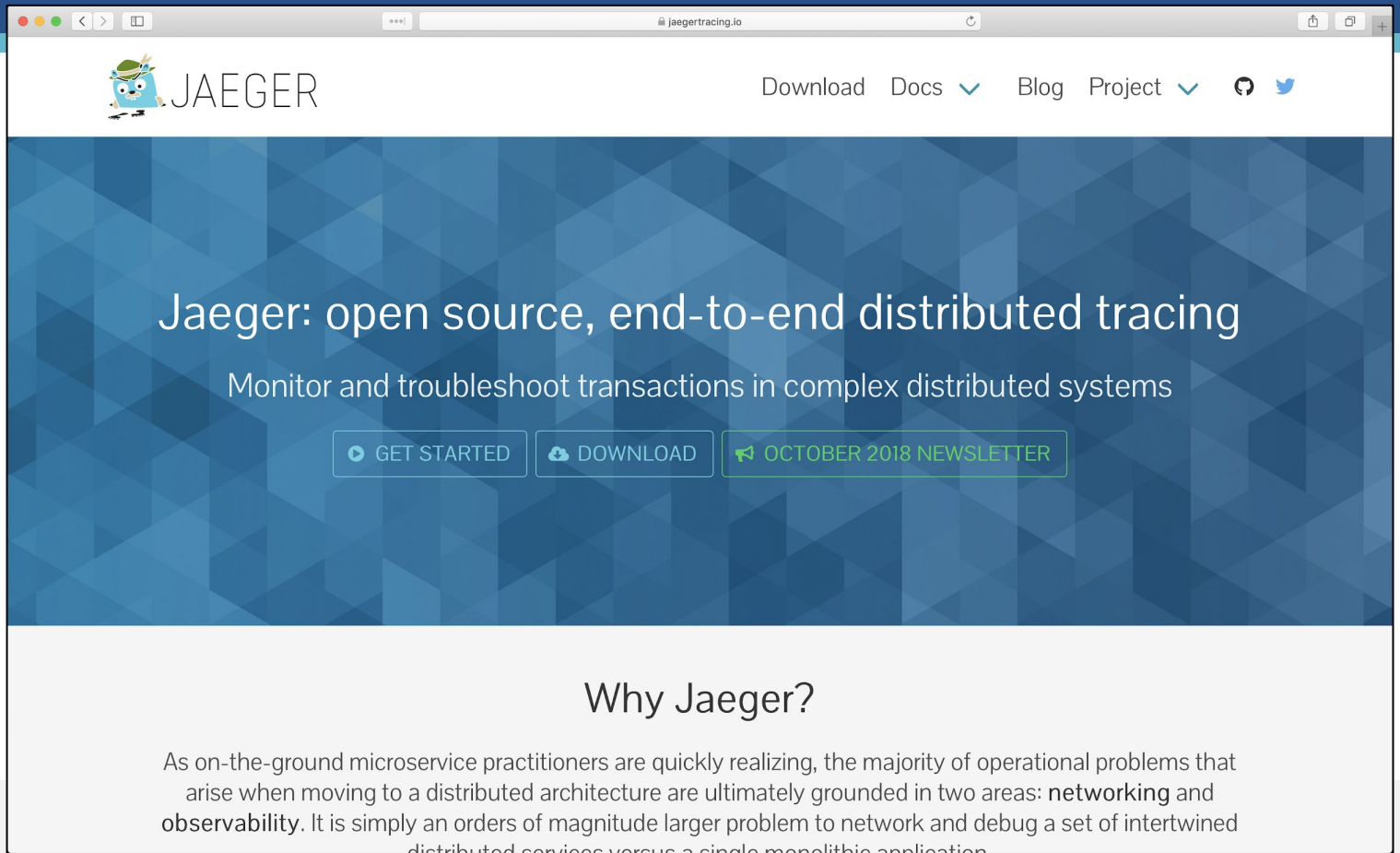
Jaeger 1.8 - 1.9

New Features

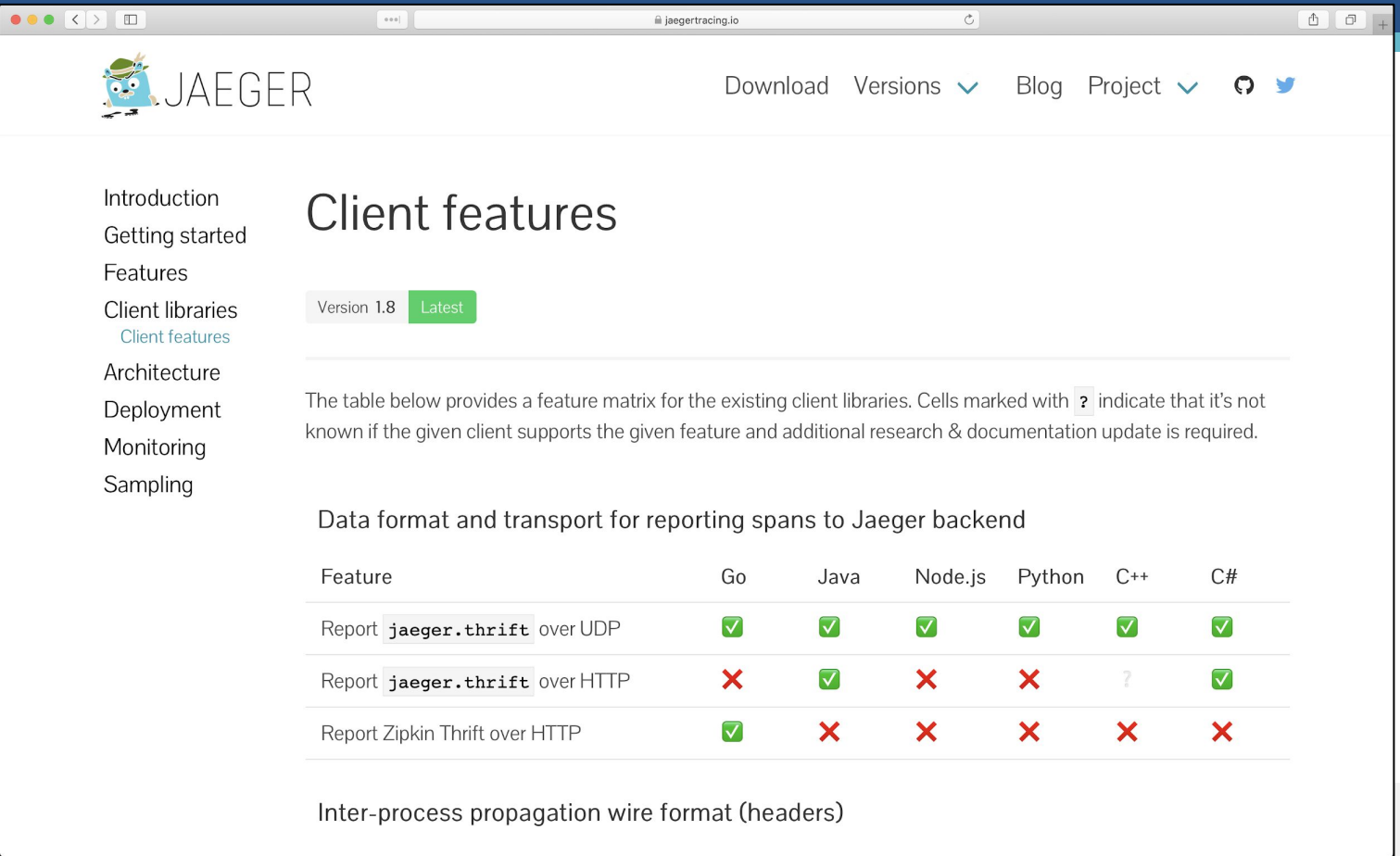
New Features

- New website, distributions
- Graph visualizations, trace diffs
- Integrations with other projects
- Async ingestion
- Protobuf & gRPC
- Better Zipkin compatibility

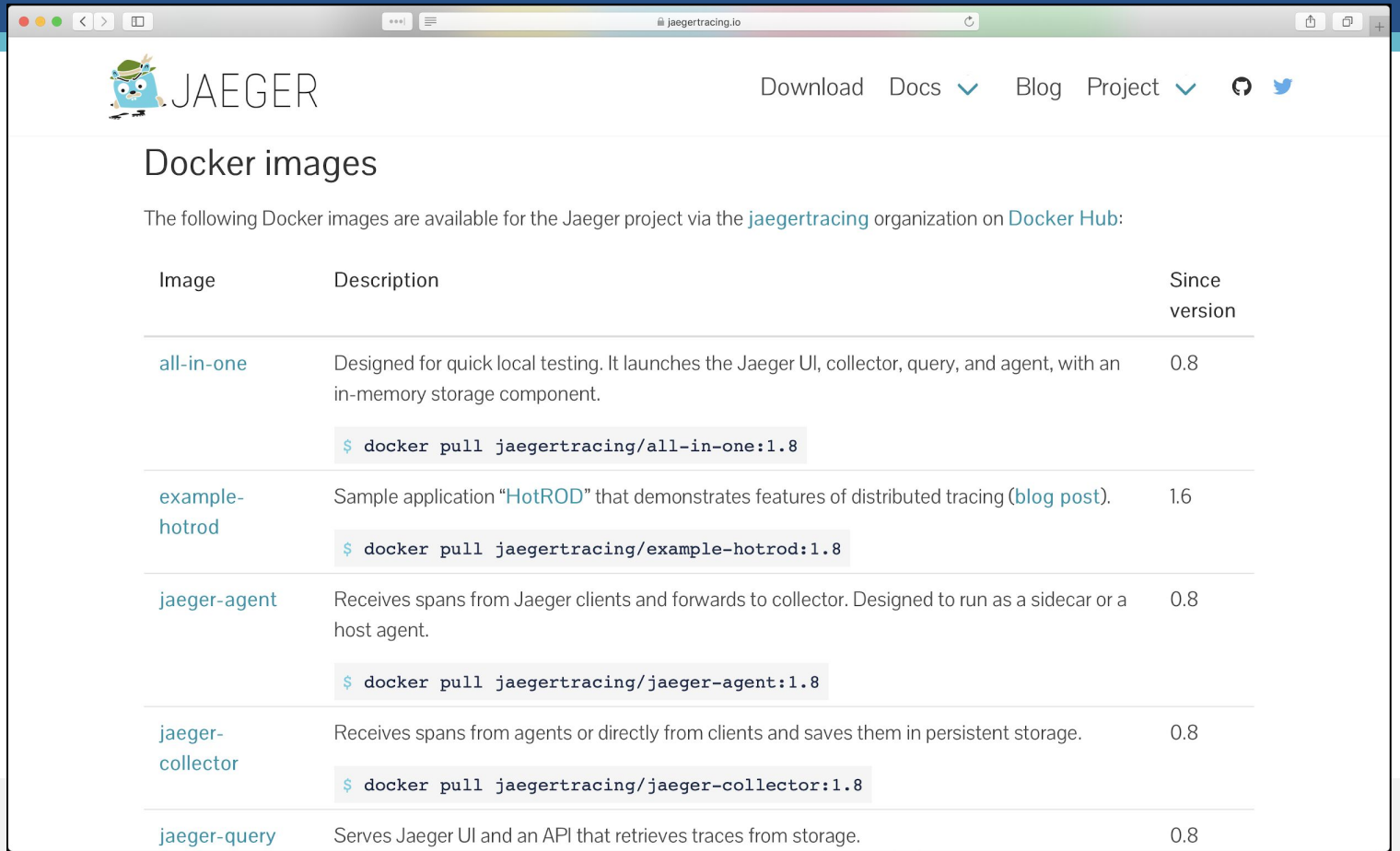
New Website (easy to contribute)



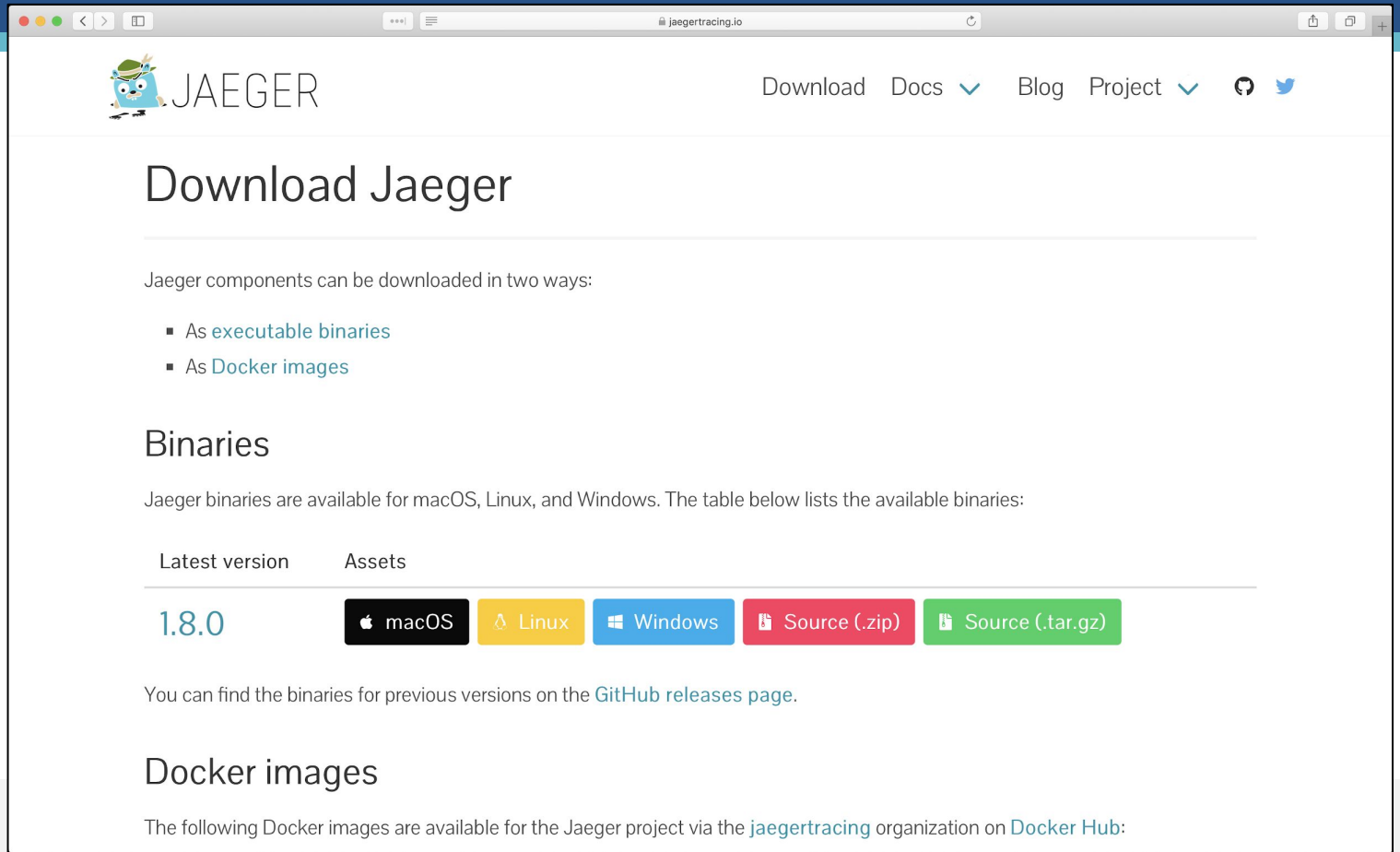
Example: Client Features matrix



Distribution: Docker images



Binaries (Linux, MacOS, Windows)

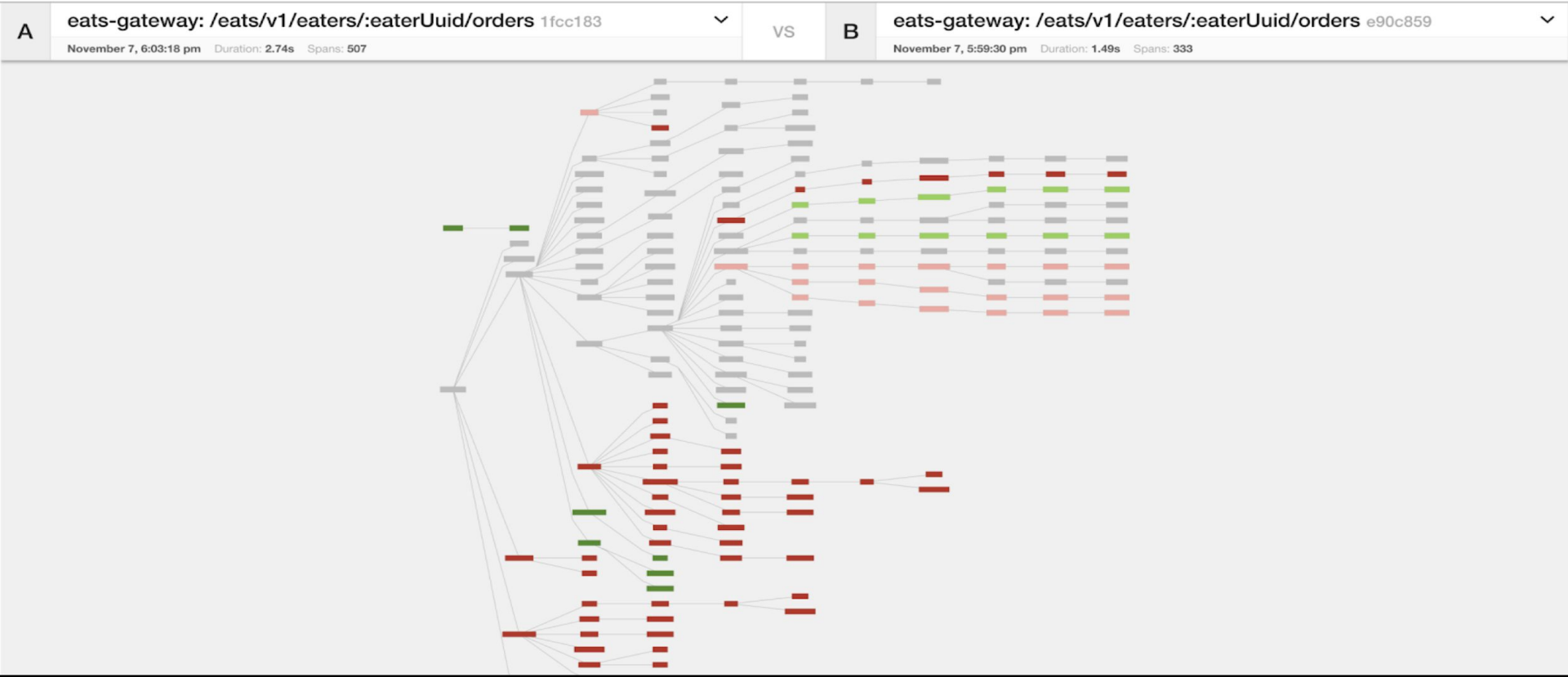


Graph Visualizations

Gantt chart is not great for traces with 10s of thousands of spans

- Trace Diffs
  - Compare two traces
  - Compare one trace against a group of traces (coming soon)
- Trace Graph (coming soon)
  - Call graph visualization with mini-aggregations
  - Showing paths rather than individual RPCs

Comparing trace structures – Unified diff



Graph Visualizations

- Surface less information
- Condense the structural representation
- Emphasize the differences
- Distinct comparison modes simplify the comparisons

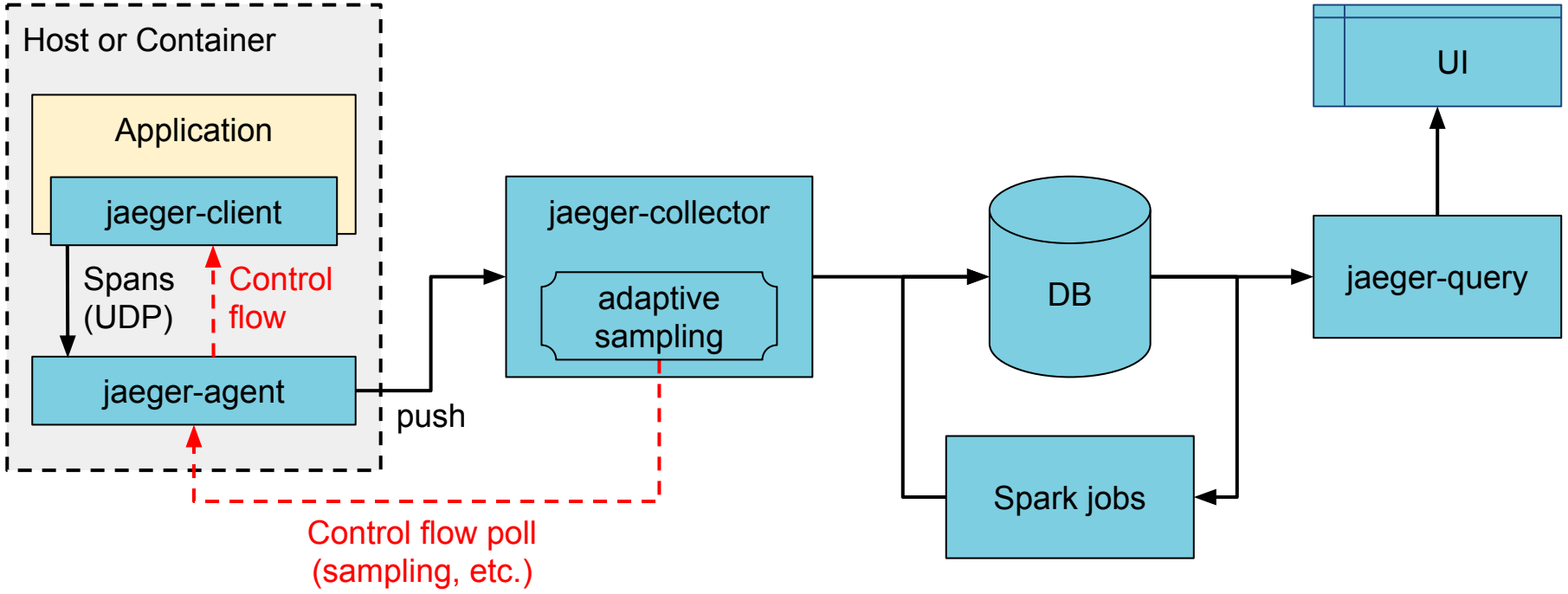
Integrations

- Jaeger Operator for Kubernetes
  - https://github.com/jaegertracing/jaeger-operator
- OpenCensus libraries and agent ship with exporters for Jaeger
  - https://opencensus.io/guides/exporters/supported-exporters/java/jaeger/
- Istio comes with Jaeger included
  - https://istio.io/docs/tasks/telemetry/distributed-tracing/
- Envoy works with Jaeger native C++ client
  - https://www.envoyproxy.io/docs/envoy/latest/start/sandboxes/jaeger_native_tracing
- Eclipse Trace Compass incubator supports importing Jaeger traces
  - https://github.com/tuxology/tracevizlab/tree/master/labs/303-jaeger-opentracing-traces

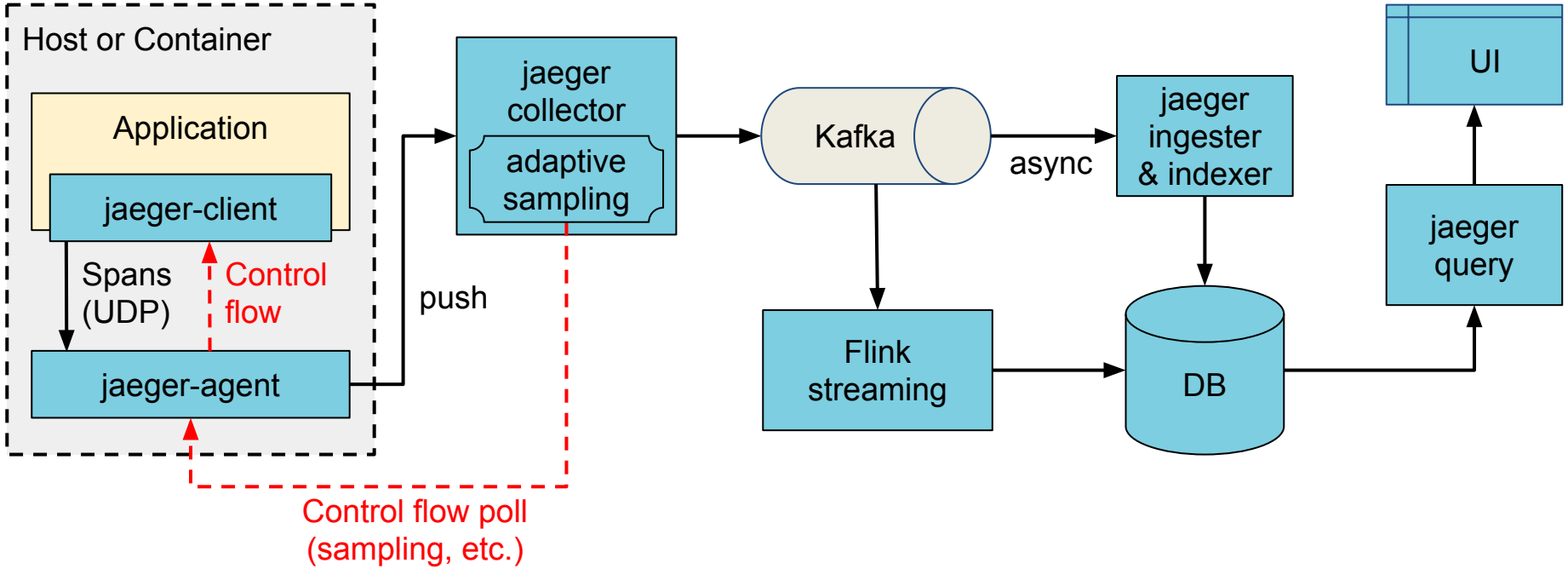
Asynchronous span ingestion

- Push model was struggling to keep up with traffic spikes
  - Because of sync storage writes
  - Collectors had to drop data randomly
- Kafka is much more elastic for writes
  - Just raw bytes, no schema, no indexing
  - A lot less overhead on the write path
- Data in Kafka allows for streaming data mining & aggregations
- Two new components: `jaeger-ingester` and `jaeger-indexer`

Architecture 2017: Push



Architecture now: Push+Async+Streaming



Protobuf & gRPC

- Internal data model generated from Protobuf IDL
- gRPC connection between `jaeger-agent` and `jaeger-collector`

Why

- gRPC plays better with modern routing than TChannel
- Path to official data model and collector/query APIs
- Protobuf-based JSON API
- Unblock development of storage plugins
- (Thrift still supported for backwards compatibility)

Zipkin Compatibility

- Clients
  - Zipkin `B3-***` headers for context propagation
  - Interop between Jaeger-instrumented and Zipkin-instrumented apps
- Collector
  - Zipkin Thrift and JSON v2 span format
  - Use Zipkin instrumentation (e.g. Brave) to send traces to Jaeger
- Outstanding
  - Accept Zipkin spans from Kafka stream

Roadmap

http://bit.do/jaeger-roadmap

Adaptive Sampling

Problem

- APIs have endpoints with different QPS
- Service owners do not know the full impact of sampling probability

Adaptive Sampling is per service + endpoint,

decided by Jaeger backend based on traffic

Adaptive Sampling Status

- Jaeger clients support per service/endpoint sampling strategies
- Can be statically configured in collector
- Pull requests for dynamic recalculations

Data Pipeline

- Based on Kafka and Apache Flink
- Support aggregations and data mining
- Examples:
  - Pairwise dependencies diagram
  - Path-based dependencies diagram
  - Latency histograms

Storage plugins

- Based on gRPC/Protobuf work
- PRs in progress for proof of concept
- Community support for different storage backends

Partial Spans (community driven)

- Add ability to store/retrieve partial spans
- Use case:
  - Certain workflows are hours long. Unfortunately spans are only emitted once after it's Finished(). "Root span" is missing until the complete workflow is finished.

Learn More

Website: jaegertracing.io/

Blog: medium.com/jaegertracing

Getting in Touch

- GitHub: https://github.com/jaegertracing
- Chat: https://gitter.im/jaegertracing/
- Mailing List - jaeger-tracing@googlegroups.com
- Blog: https://medium.com/jaegertracing
- Twitter: https://twitter.com/JaegerTracing
- Bi-Weekly Community Meetings

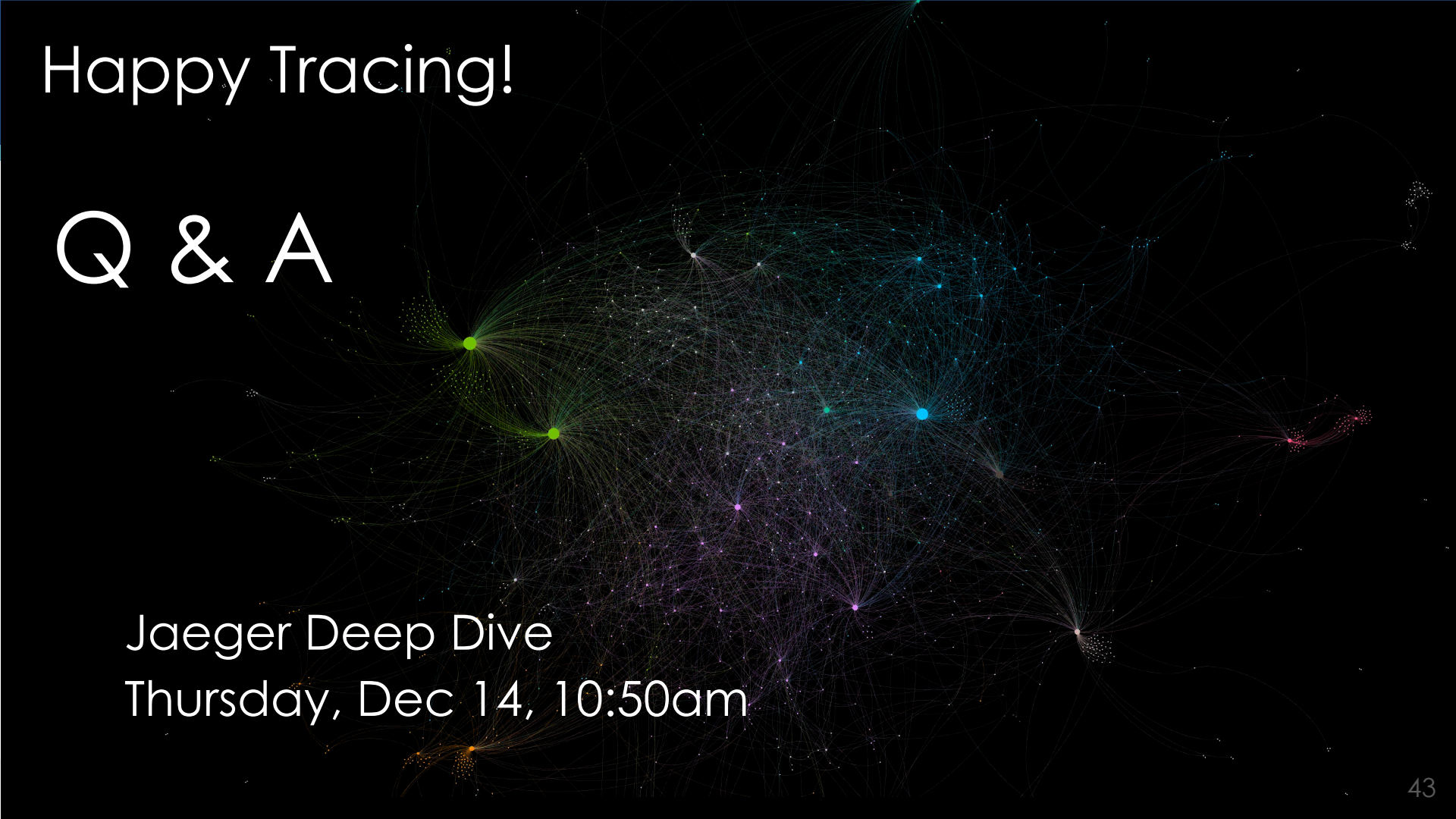
Q&A

- Jaeger Deep Dive - Thursday, Dec 14, 10:50am

https://jaegertracing.io

Happy Tracing!

Q & A



Jaeger Deep Dive
Thursday, Dec 14, 10:50am