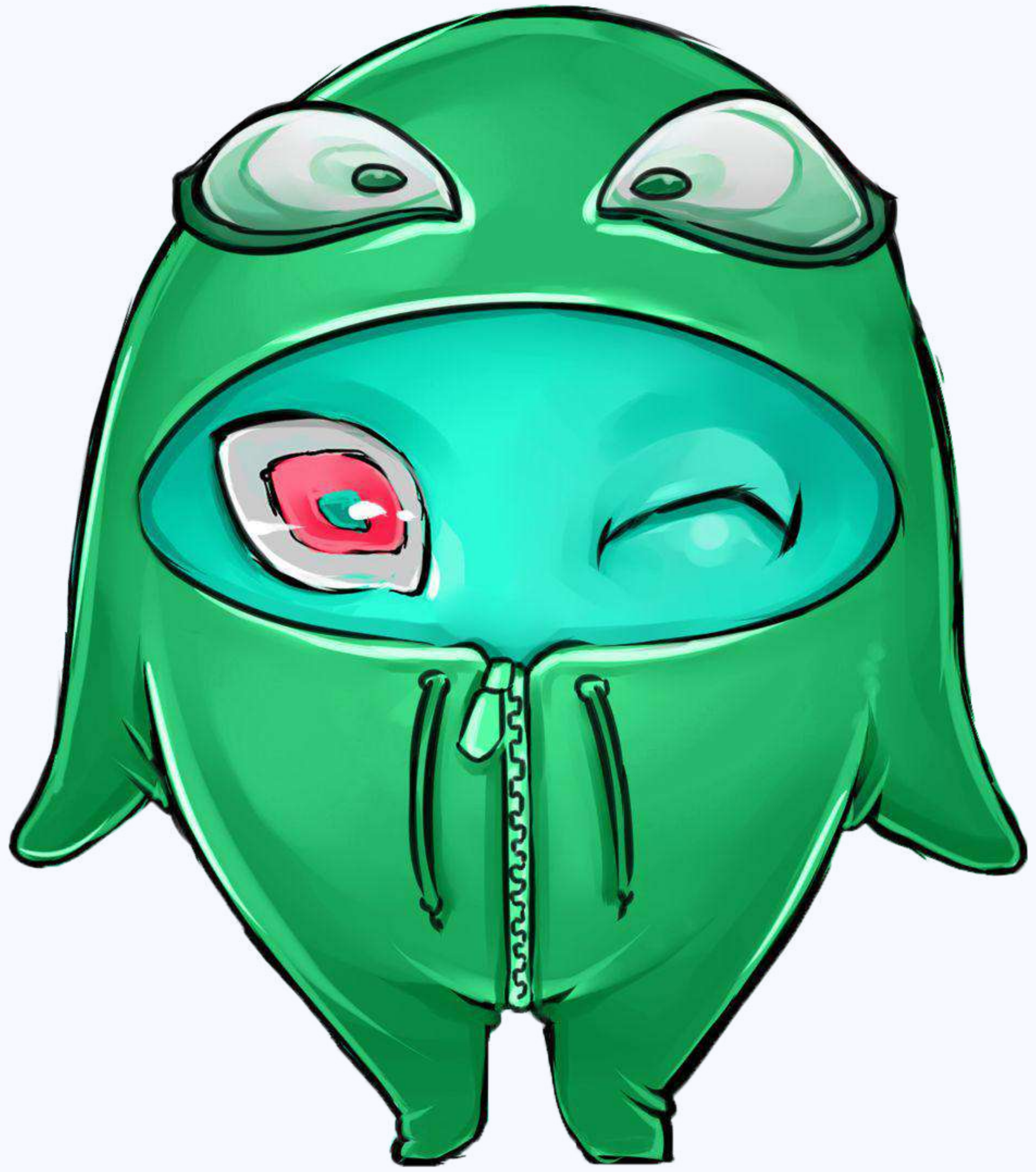
Instrumenting Tyk API Gateway with OpenTelemetry

Tyk

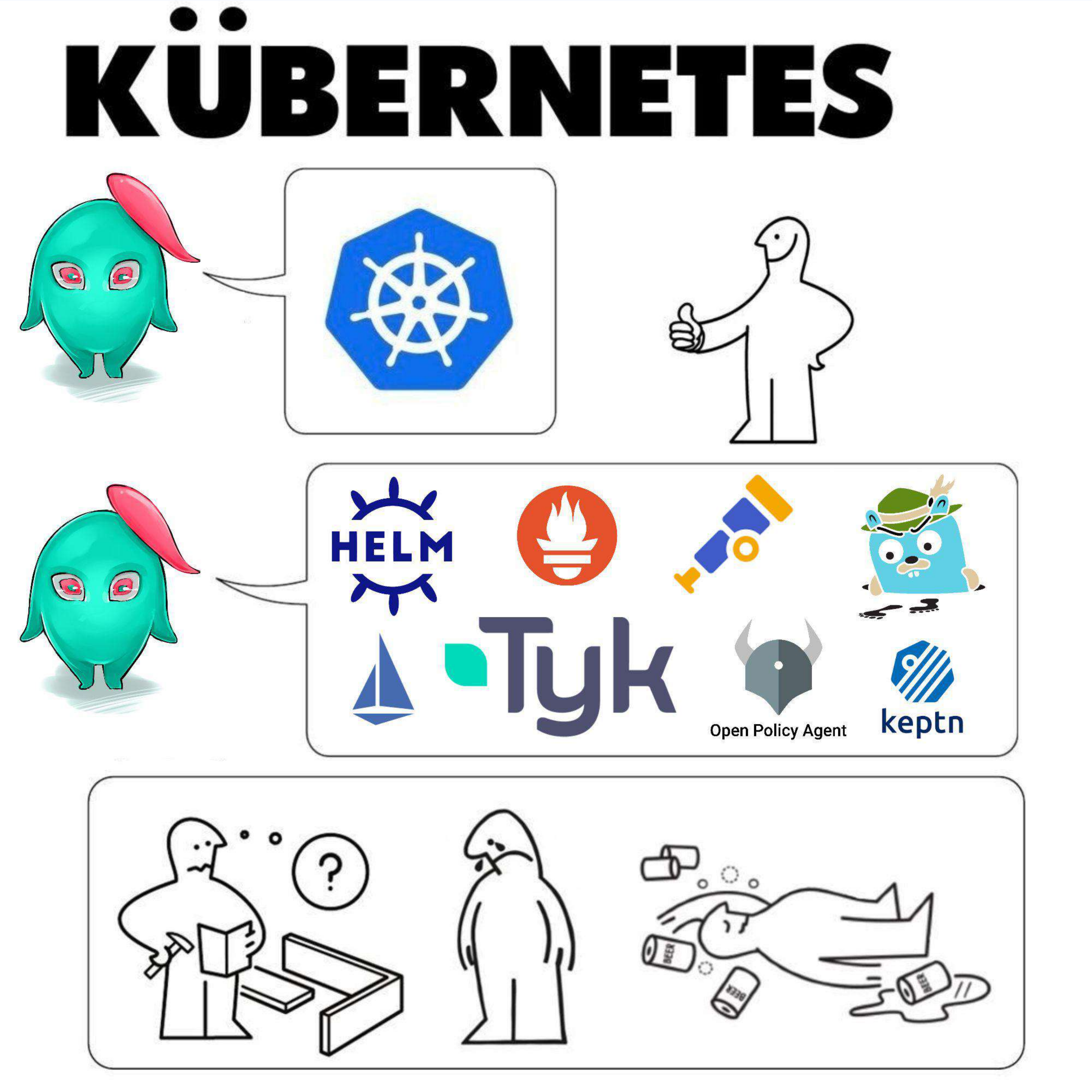


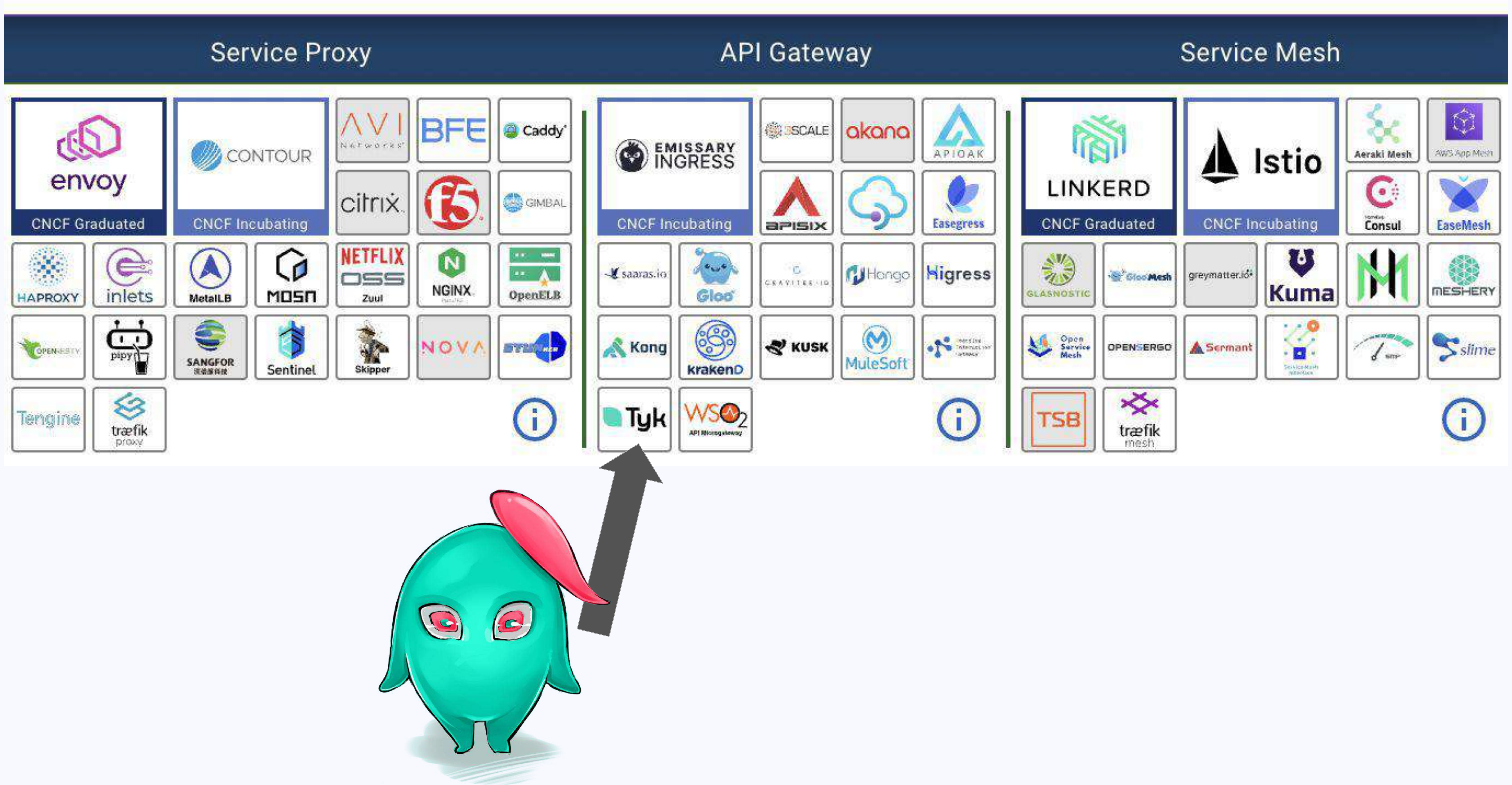
Hey Linz,
I’m Sonja 👋

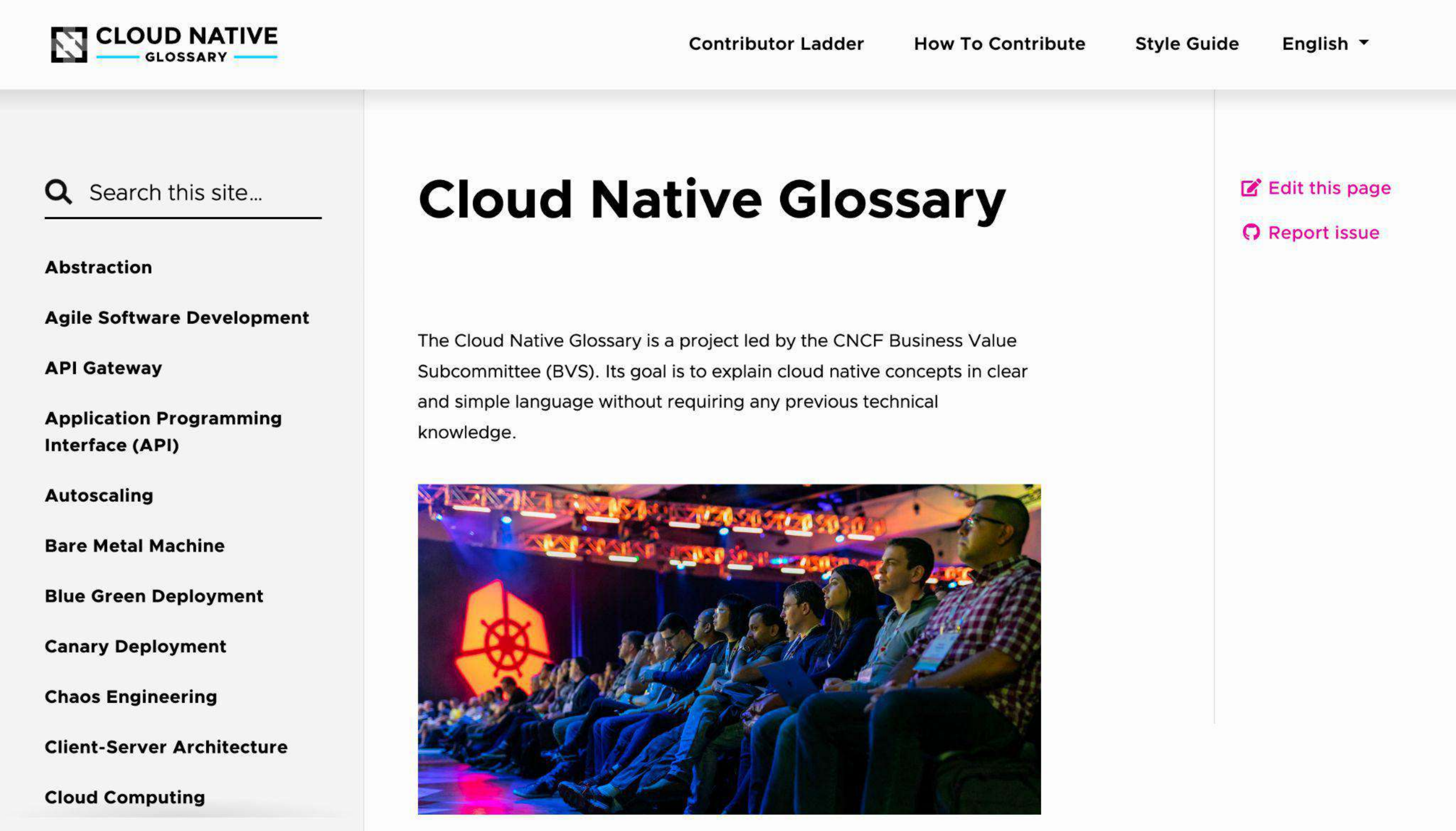
https://www.linkedin.com/in/sonjachevre/
https://twitter.com/SonjaChevre

30 different nationalities residing in over 27 countries

CNCF Cloud Native Landscape
Overwhelmed? Please see the CNCF Trail Map. That and the interactive landscape are at l.cncf.io
Platform
Observability and Analysis
FX


KÜBERNETES
HELM
Tyk
Open Policy Agent
keptn
BEER
BEER
BEER


Service Proxy
API Gateway
Service Mesh
envoy
CNCF Graduated
CONTOUR
CNCF Incubating
AVI Networks
BFE
Caddy
citrix
f5
GIMBAL
HAPROXY
inlets
MetalLB
MOSN
NETFLIX OSS Zuul
NGINX
OpenELB
OPENRESTY
pipy
SANGFOR
Sentinel
Skipper
NOVA
Tengine
træfik proxy
EMISSARY INGRESS
CNCF Incubating
3SCALE
akana
APIOAK
APISIX
Easegress
saaras.io
Gloo
GRAVITEE.IO
Hango
Higress
Kong
krakenD
KUSK
MuleSoft
Tyk
WSO2 API Microgateway
LINKERD
CNCF Graduated
Istio
CNCF Incubating
Aeraki Mesh
AWS App Mesh
Consul
EaseMesh
GLASNOSTIC
Gloo Mesh
greymatter.io
Kuma
MESHERY
Open Service Mesh
OPENSERGO
Sermant
slime
TSB
træfik mesh



Cloud Native Glossary

The Cloud Native Glossary is a project led by the CNCF Business Value Subcommittee (BVS). Its goal is to explain cloud native concepts in clear and simple language without requiring any previous technical knowledge.

API Gateway

Networking

What it is

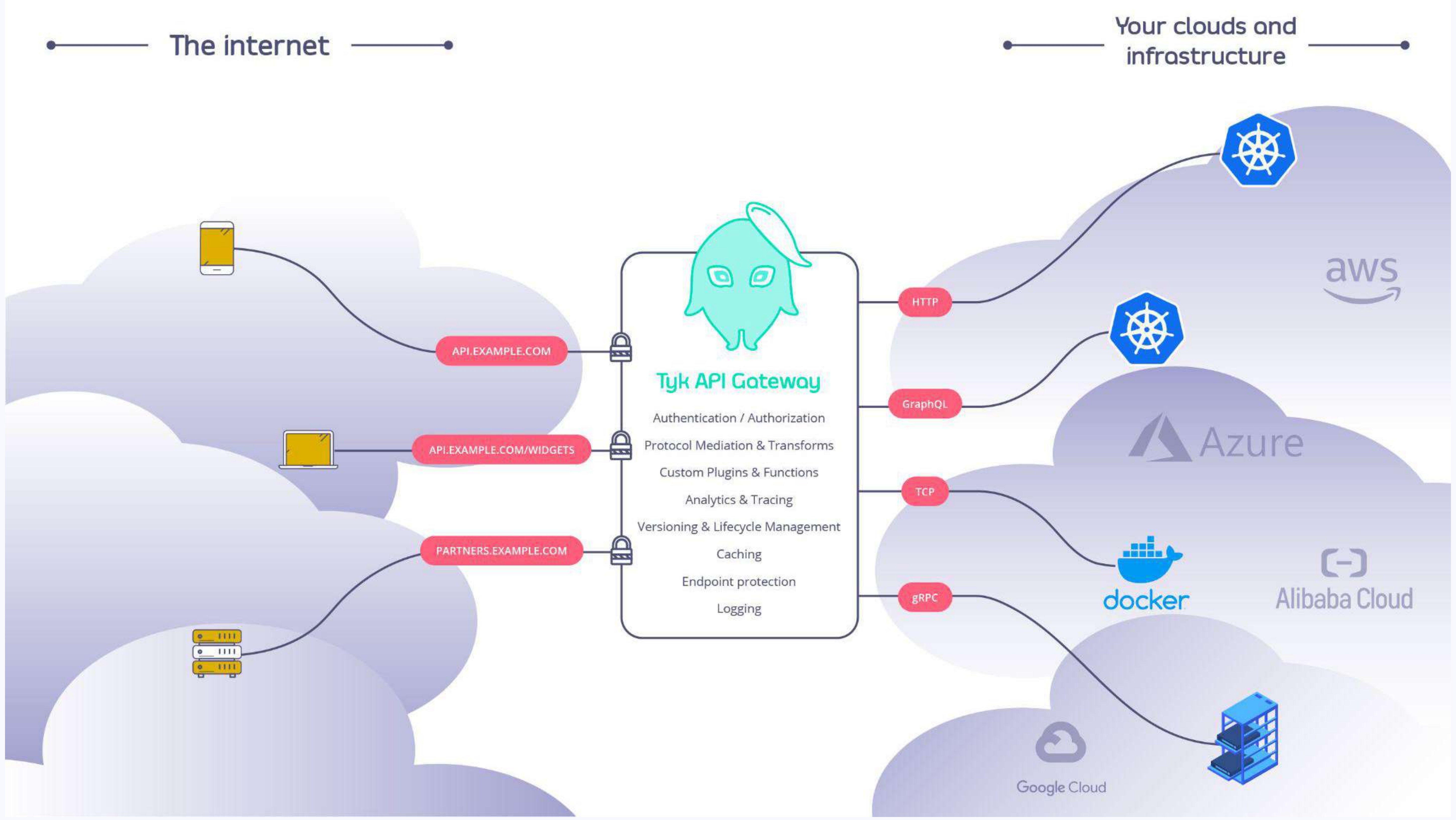
An **API** gateway is a tool that aggregates unique application APIs, making them all available in one place. It allows organizations to move key functions, such as authentication and authorization or limiting the number of requests between applications, to a centrally managed location. An API gateway functions as a common interface to (often external) API consumers.

Problem it addresses

If you're making APIs available to external consumers, you'll want one entry point to manage and control all access. Additionally, if you need to apply functionality on those interactions, an API gateway allows you to uniformly apply it to all traffic without requiring any app code changes.

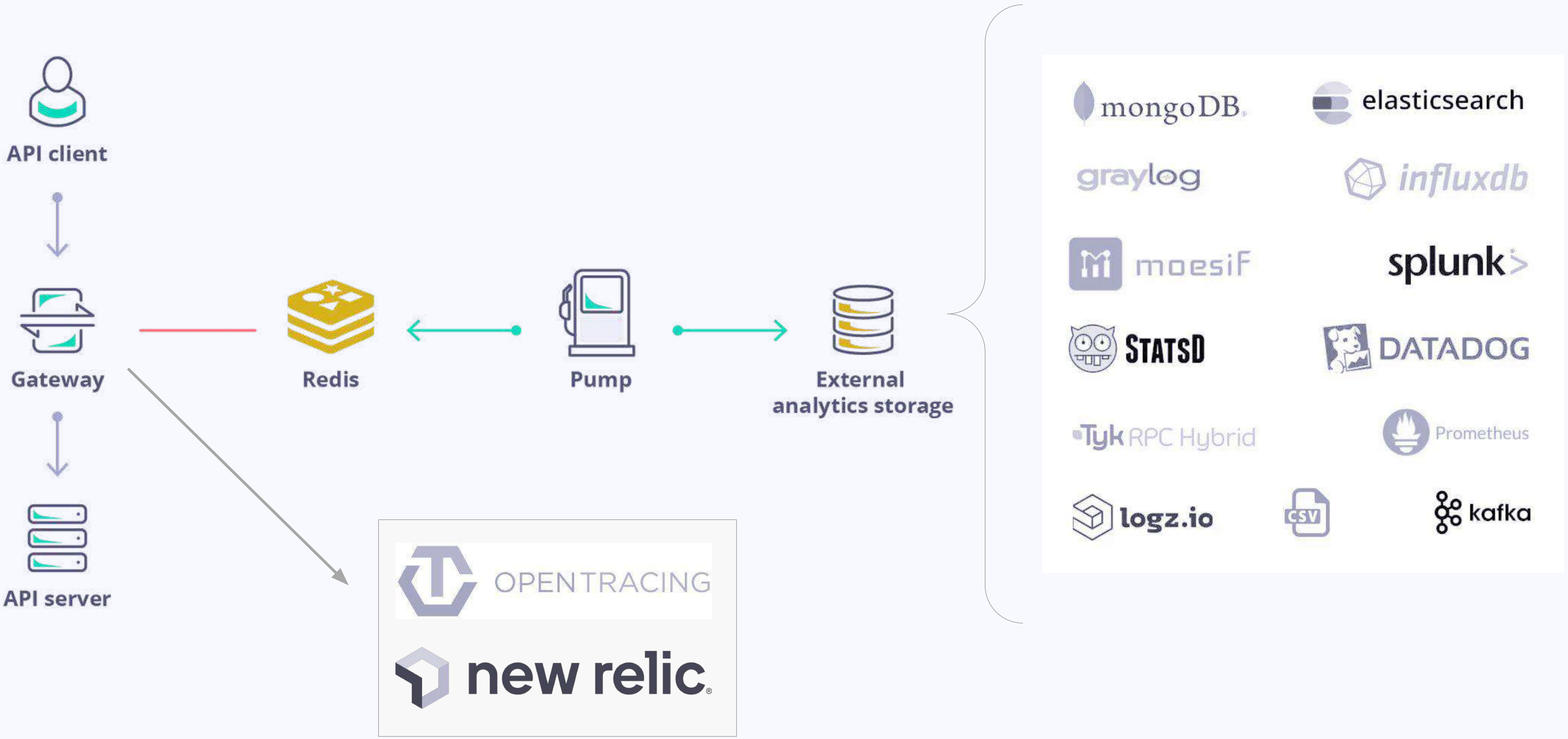
How it helps

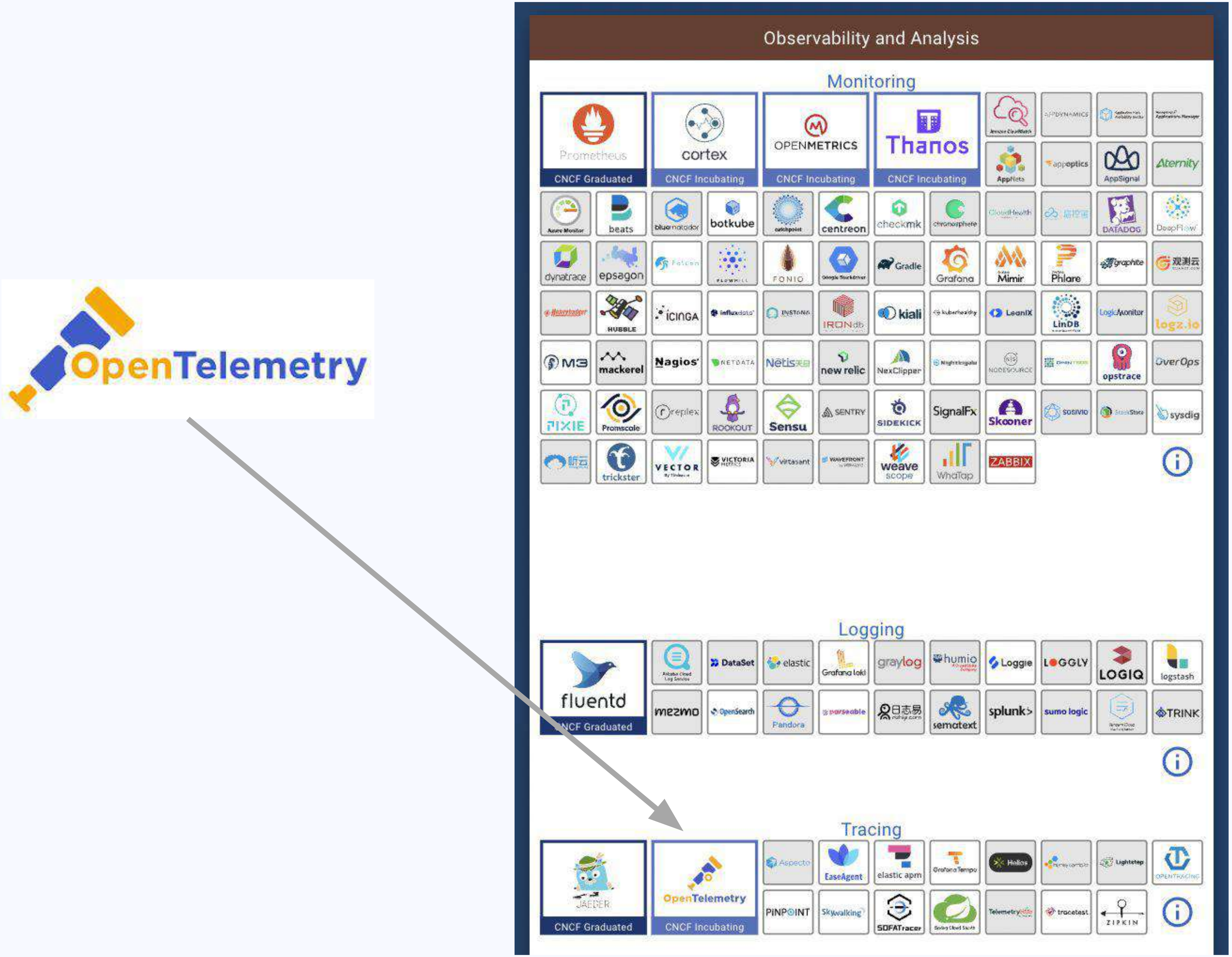
Providing one single access point for various APIs in an application, API gateways make it easier for organizations to apply cross-cutting business or security logic in a central location. They also allow application consumers to go to a single address for all their needs. An API gateway can simplify operational concerns like security and **observability** by providing a single access point for requests to all web services in a system. As all requests flow through the API gateway, it presents a single place to add functionality like metrics-gathering, rate-limiting, and authorization.

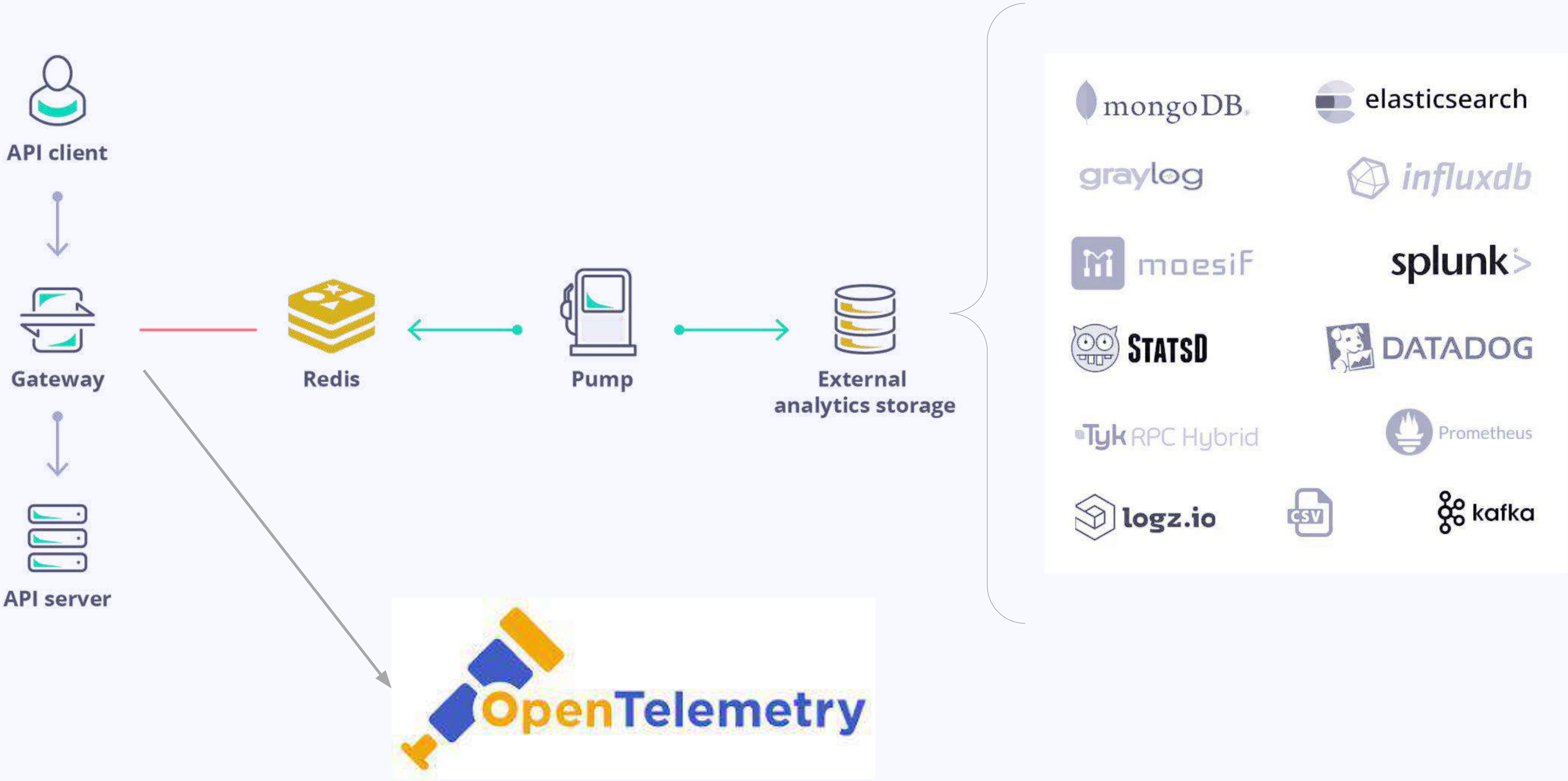


Observability is a **must-have feature** of cloud native software

Observability in Tyk API Gateway before OpenTelemetry


API client
Gateway
API server
Redis
Pump
External analytics storage
OPENTRACING
new relic
mongoDB
elasticsearch
graylog
influxdb
moesif
splunk>
STATSD
DATADOG
Tyk RPC Hybrid
Prometheus
logz.io
CSV
kafka


OpenTelemetry
Observability and Analysis
Monitoring
Prometheus
CNCF Graduated
cortex
CNCF Incubating
OPENMETRICS
CNCF Incubating
Thanos
CNCF Incubating
Logging
fluentd
CNCF Graduated
Tracing
JAEGER
CNCF Graduated
OpenTelemetry
CNCF Incubating



API client

Gateway

API server

Redis

Pump

External analytics storage

mongoDB

elasticsearch

graylog

influxdb

moesif

splunk>

StatsD

DATADOG

Tyk RPC Hybrid

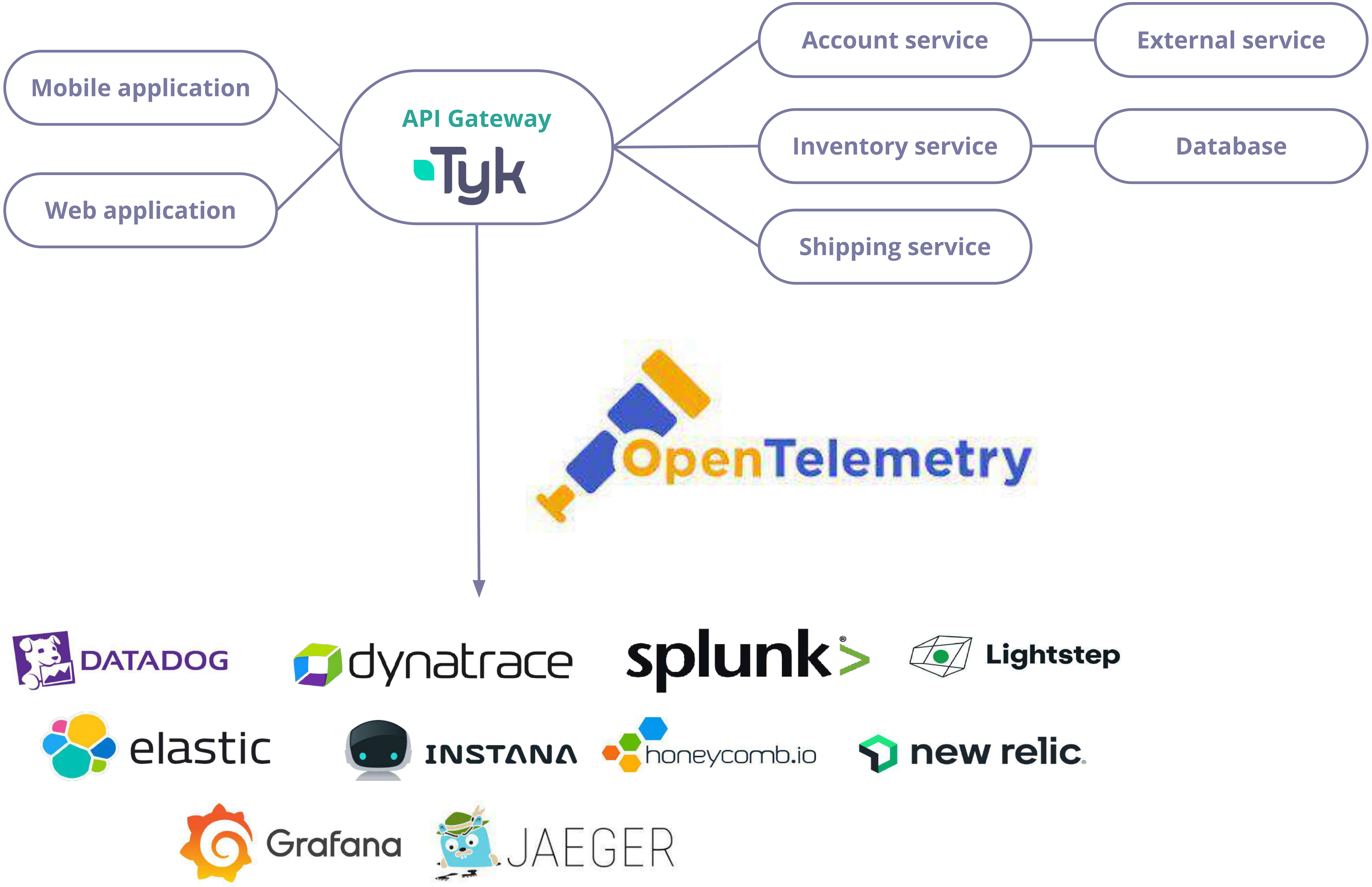
Prometheus

logz.io

CSV

kafka

OpenTelemetry



Mobile application

Web application

API Gateway

Tyk

Account service

External service

Inventory service

Database

Shipping service

OpenTelemetry

DATADOG

dynatrace

splunk>

Lightstep

elastic

INSTANA

honeycomb.io

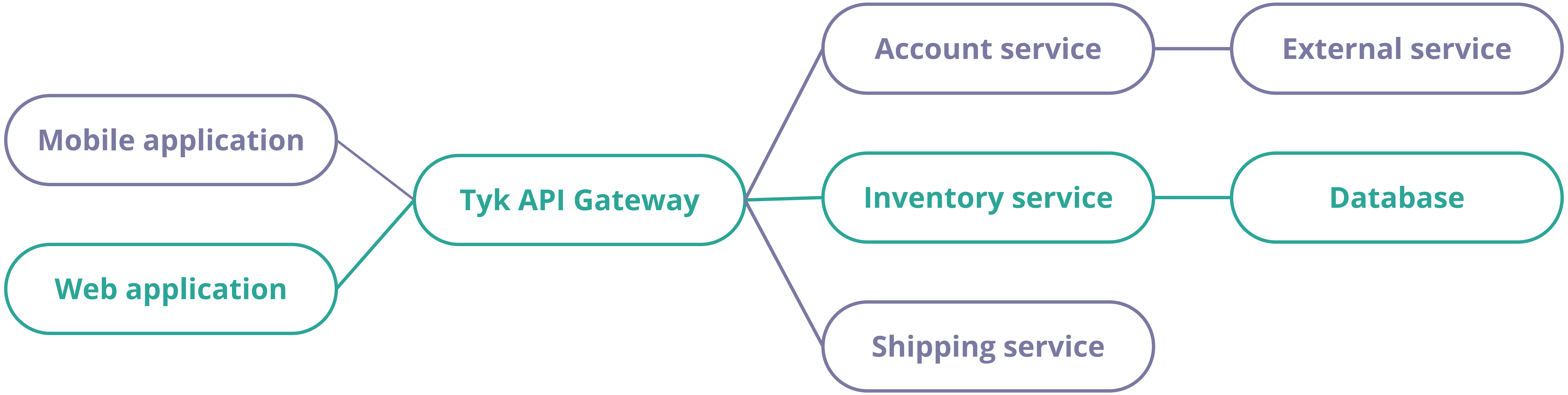
new relic.

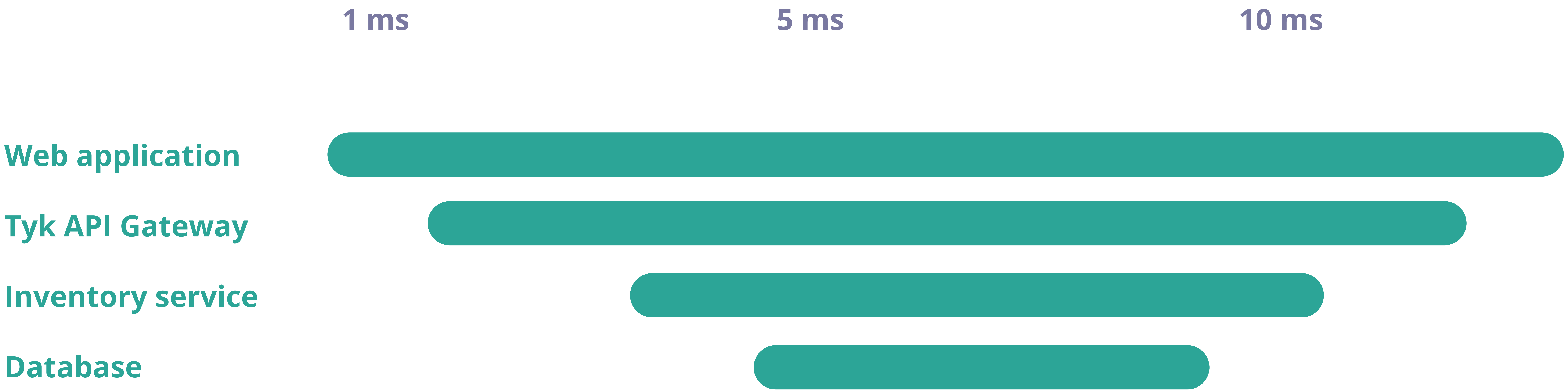
Grafana

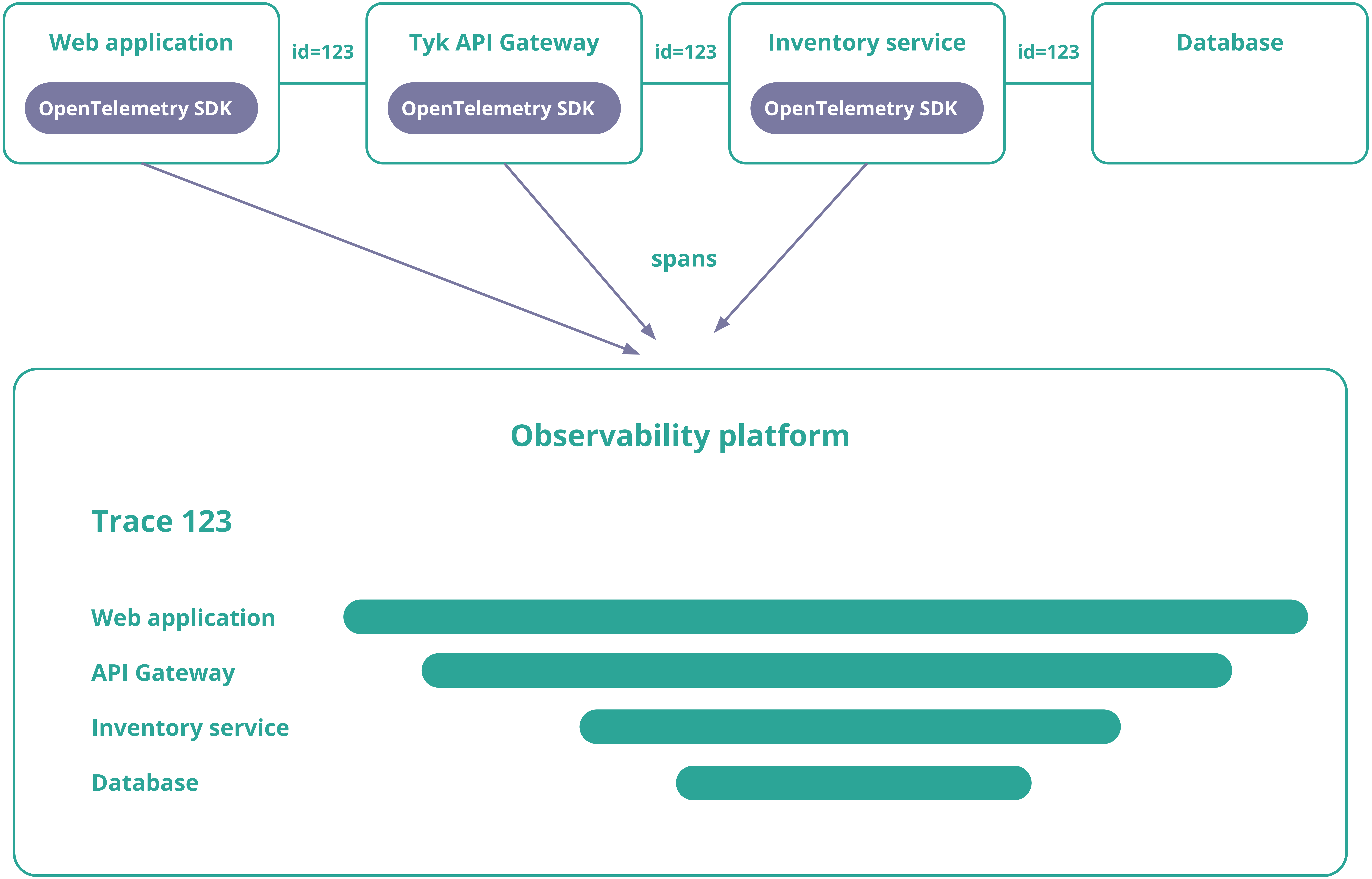
JAEGER

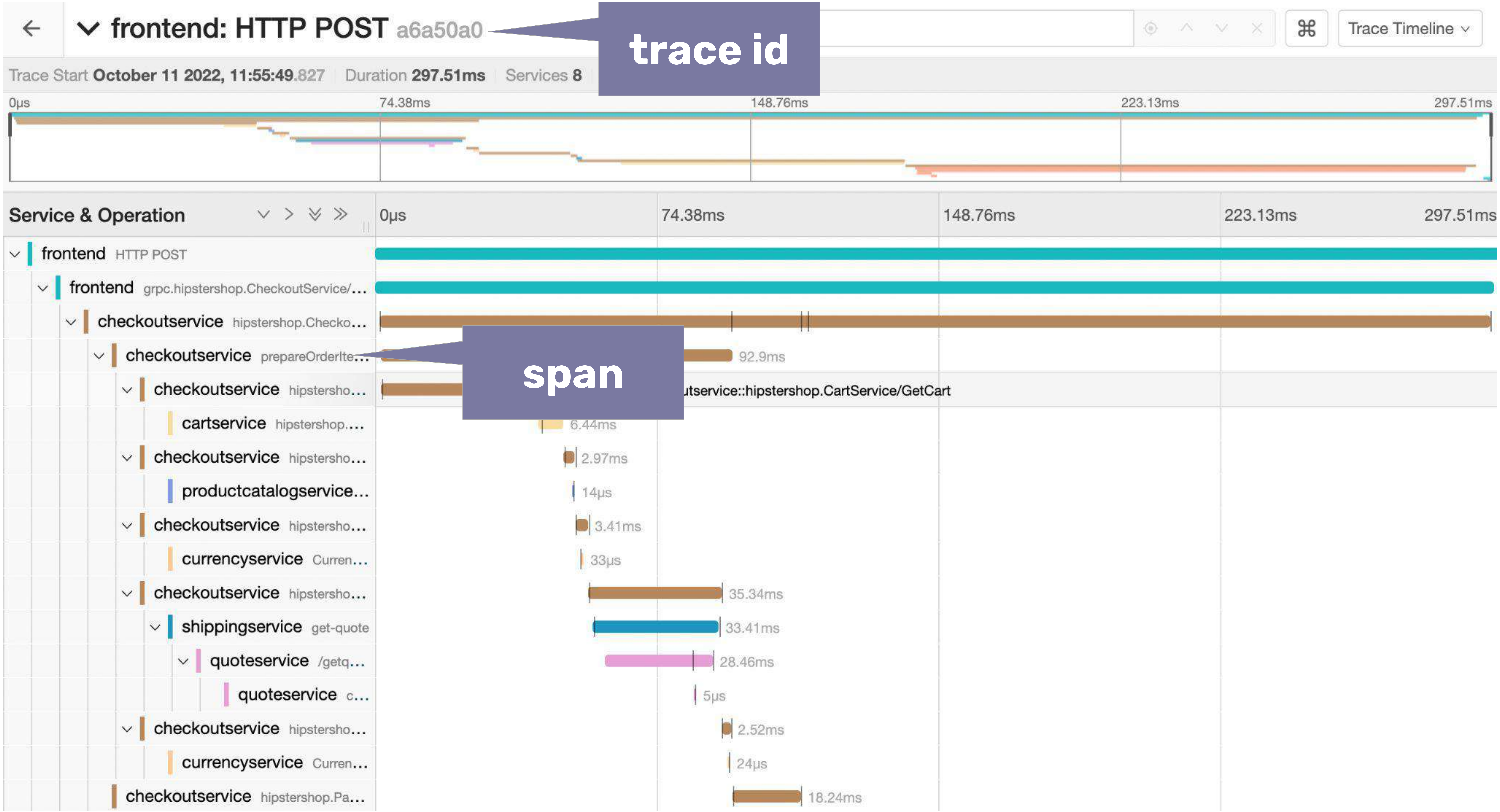
Exploring OpenTelemetry

What is distributed tracing?
and how does it work?


Mobile application
Web application
Tyk API Gateway
Account service
Inventory service
Shipping service
External service
Database


1 ms
5 ms
10 ms
Web application
Tyk API Gateway
Inventory service
Database


Web application
OpenTelemetry SDK
id=123
Tyk API Gateway
OpenTelemetry SDK
id=123
Inventory service
OpenTelemetry SDK
id=123
Database
spans
Observability platform
Trace 123
Web application
API Gateway
Inventory service
Database



frontend: HTTP POST a6a50a0

trace id

Trace Start October 11 2022, 11:55:49.827 | Duration 297.51ms | Services 8

Service & Operation

frontend HTTP POST

frontend grpc.hipstershop.CheckoutService/…

checkoutservice hipstershop.Checko…

checkoutservice prepareOrderIte… 92.9ms

span

checkoutservice hipstersho… …tservice::hipstershop.CartService/GetCart

cartservice hipstershop.… 6.44ms

checkoutservice hipstersho… 2.97ms

productcatalogservice… 14µs

checkoutservice hipstersho… 3.41ms

currencyservice Curren… 33µs

checkoutservice hipstersho… 35.34ms

shippingservice get-quote 33.41ms

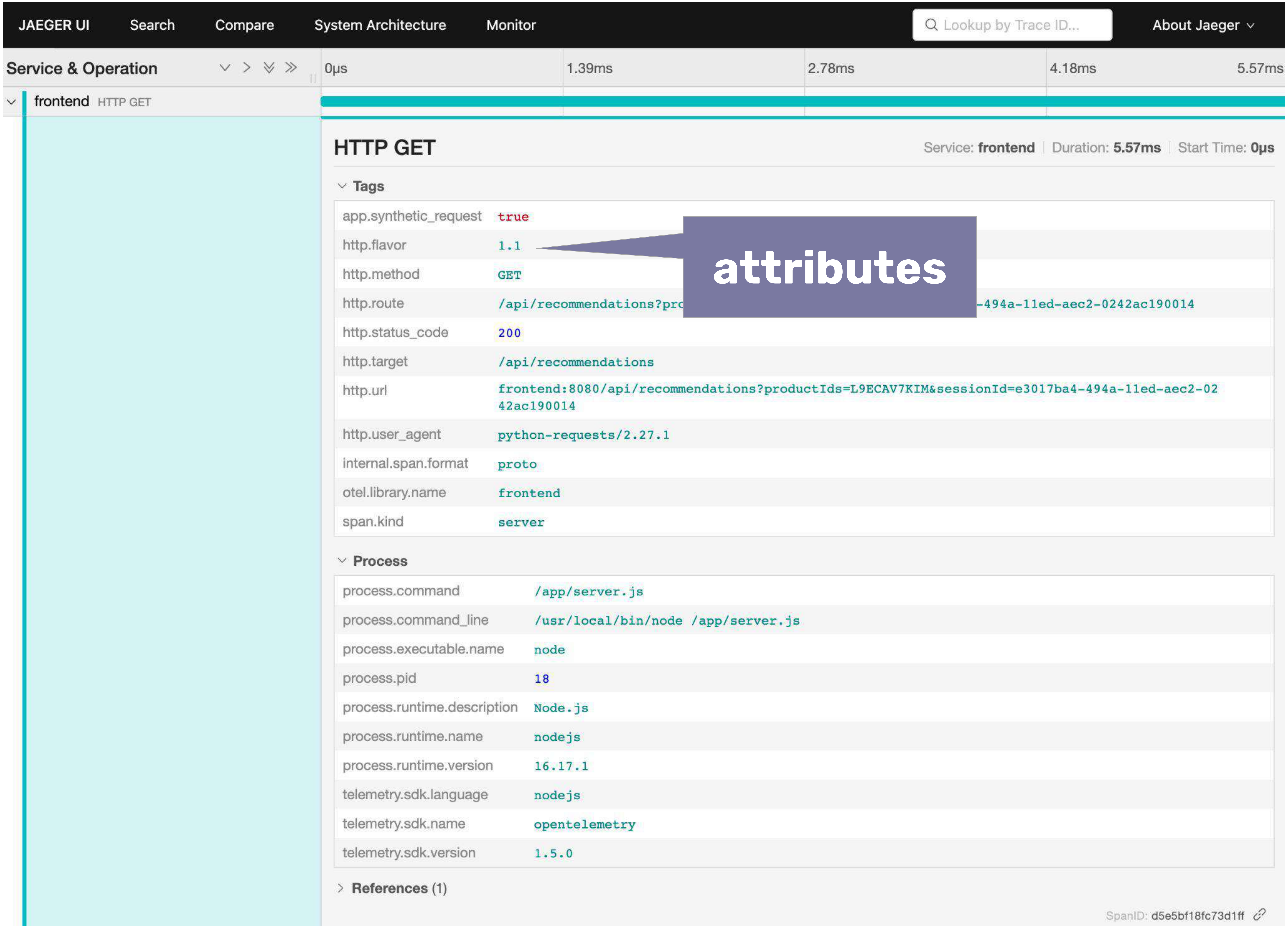
quoteservice /getq… 28.46ms

quoteservice c… 5µs

checkoutservice hipstersho… 2.52ms

currencyservice Curren… 24µs

checkoutservice hipstershop.Pa… 18.24ms



HTTP GET

Service: **frontend** | Duration: **5.57ms** | Start Time: **0μs**

Tags

app.synthetic_request	`true`
http.flavor	`1.1`
http.method	`GET`
http.route	`/api/recommendations?pro` `-494a-11ed-aec2-0242ac190014`
http.status_code	`200`
http.target	`/api/recommendations`
http.url	`frontend:8080/api/recommendations?productIds=L9ECAV7KIM&sessionId=e3017ba4-494a-11ed-aec2-0242ac190014`
http.user_agent	`python-requests/2.27.1`
internal.span.format	`proto`
otel.library.name	`frontend`
span.kind	`server`

Process

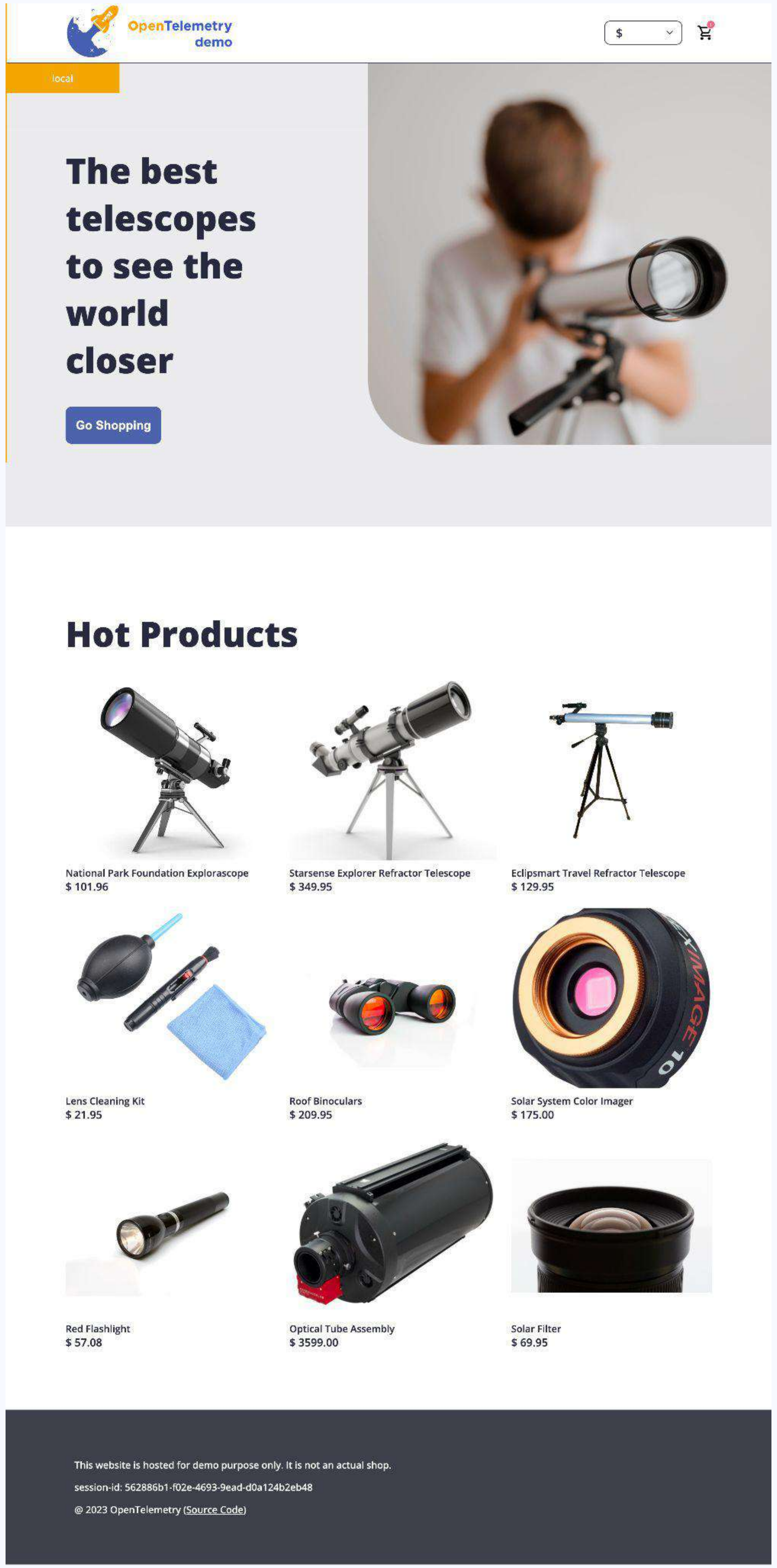
process.command	`/app/server.js`
process.command_line	`/usr/local/bin/node /app/server.js`
process.executable.name	`node`
process.pid	`18`
process.runtime.description	`Node.js`
process.runtime.name	`nodejs`
process.runtime.version	`16.17.1`
telemetry.sdk.language	`nodejs`
telemetry.sdk.name	`opentelemetry`
telemetry.sdk.version	`1.5.0`

References (1)

SpanID: d5e5bf18fc73d1ff

attributes

Integrating with the OpenTelemetry Demo



The best telescopes to see the world closer

Go Shopping

Hot Products

National Park Foundation Explorascope
$ 101.96

Starsense Explorer Refractor Telescope
$ 349.95

Eclipsmart Travel Refractor Telescope
$ 129.95

Lens Cleaning Kit
$ 21.95

Roof Binoculars
$ 209.95

Solar System Color Imager
$ 175.00

Red Flashlight
$ 57.08

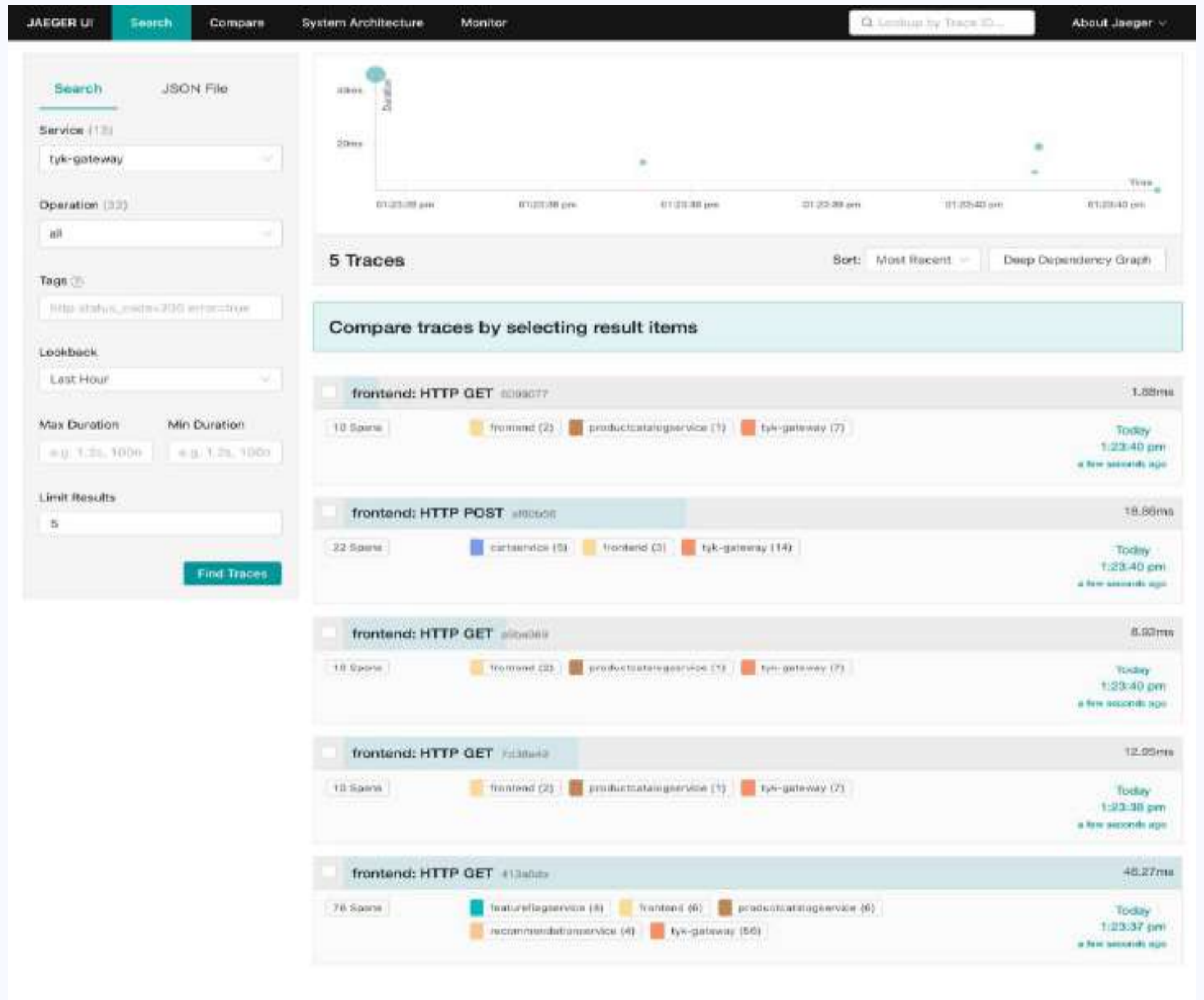
Optical Tube Assembly
$ 3599.00

Solar Filter
$ 69.95

This website is hosted for demo purpose only. It is not an actual shop.

session-id: 562886b1-f02e-4693-9ead-d0a124b2eb48

© 2023 OpenTelemetry (Source Code)



Service (13)
tyk-gateway

Operation (32)
all

Tags
http.status_code=200 error=true

Lookback
Last Hour

Max Duration: e.g. 1.2s, 100ms
Min Duration: e.g. 1.2s, 100ms

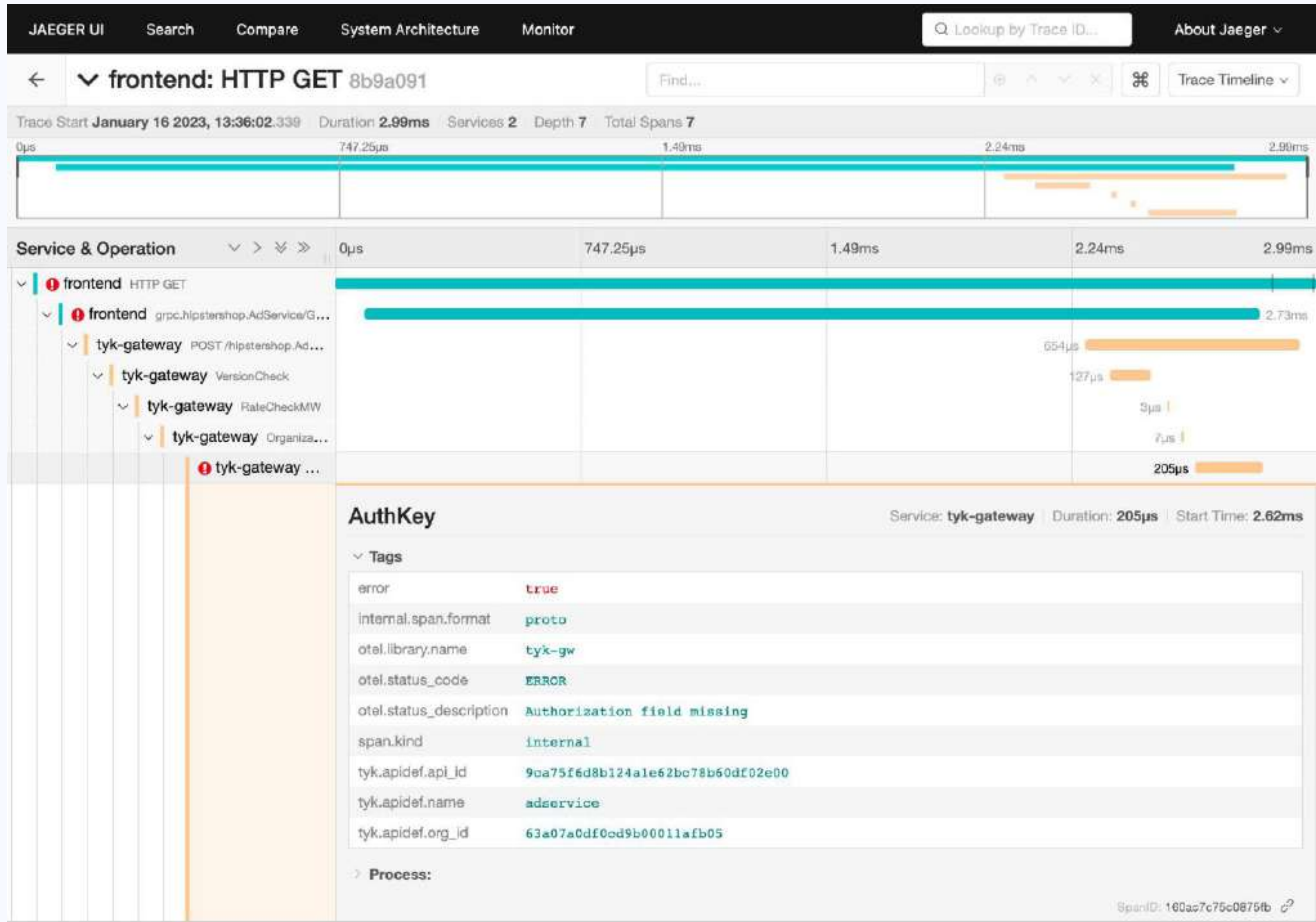
Limit Results
5

Find Traces

5 Traces — Sort: Most Recent — Deep Dependency Graph

Compare traces by selecting result items

Trace	Spans	Services	Duration	Time
frontend: HTTP GET [illegible]	10 Spans	frontend (2) productcatalogservice (1) tyk-gateway (7)	1.88ms	Today 1:23:40 pm a few seconds ago
frontend: HTTP POST [illegible]	22 Spans	cartservice (5) frontend (3) tyk-gateway (14)	18.86ms	Today 1:23:40 pm a few seconds ago
frontend: HTTP GET [illegible]	10 Spans	frontend (2) productcatalogservice (1) tyk-gateway (7)	8.93ms	Today 1:23:40 pm a few seconds ago
frontend: HTTP GET [illegible]	10 Spans	frontend (2) productcatalogservice (1) tyk-gateway (7)	12.95ms	Today 1:23:38 pm a few seconds ago
frontend: HTTP GET [illegible]	76 Spans	featureflagservice (4) frontend (6) productcatalogservice (6) recommendationservice (4) tyk-gateway (56)	46.27ms	Today 1:23:37 pm a few seconds ago



frontend: HTTP GET 8b9a091

Trace Start January 16 2023, 13:36:02.339 Duration 2.99ms Services 2 Depth 7 Total Spans 7

Service & Operation

- frontend HTTP GET
  - frontend grpc.hipstershop.AdService/G...
    - tyk-gateway POST /hipstershop.Ad...
      - tyk-gateway VersionCheck
        - tyk-gateway RateCheckMW
          - tyk-gateway Organiza...
            - tyk-gateway ...

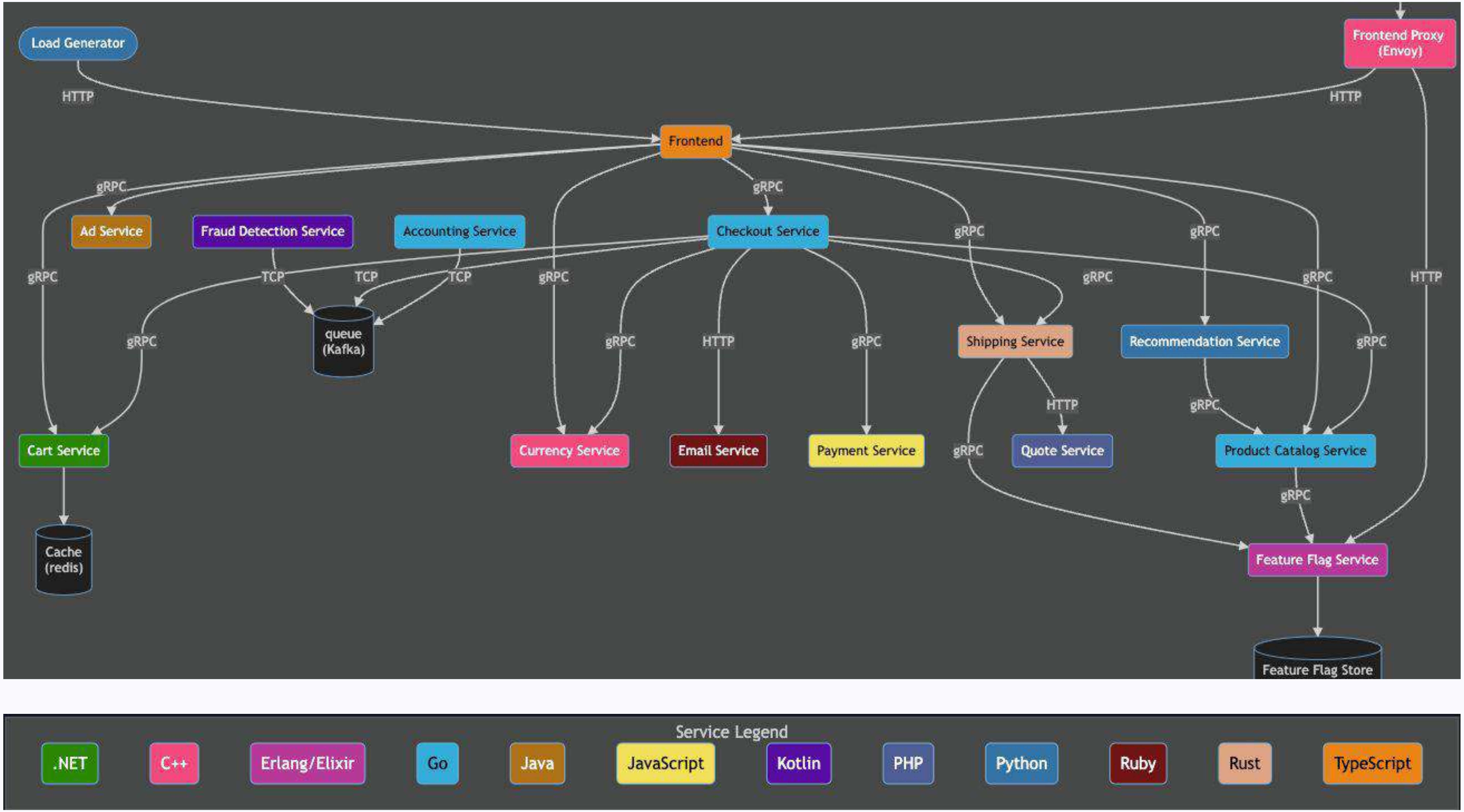
AuthKey — Service: tyk-gateway | Duration: 205μs | Start Time: 2.62ms

Tags

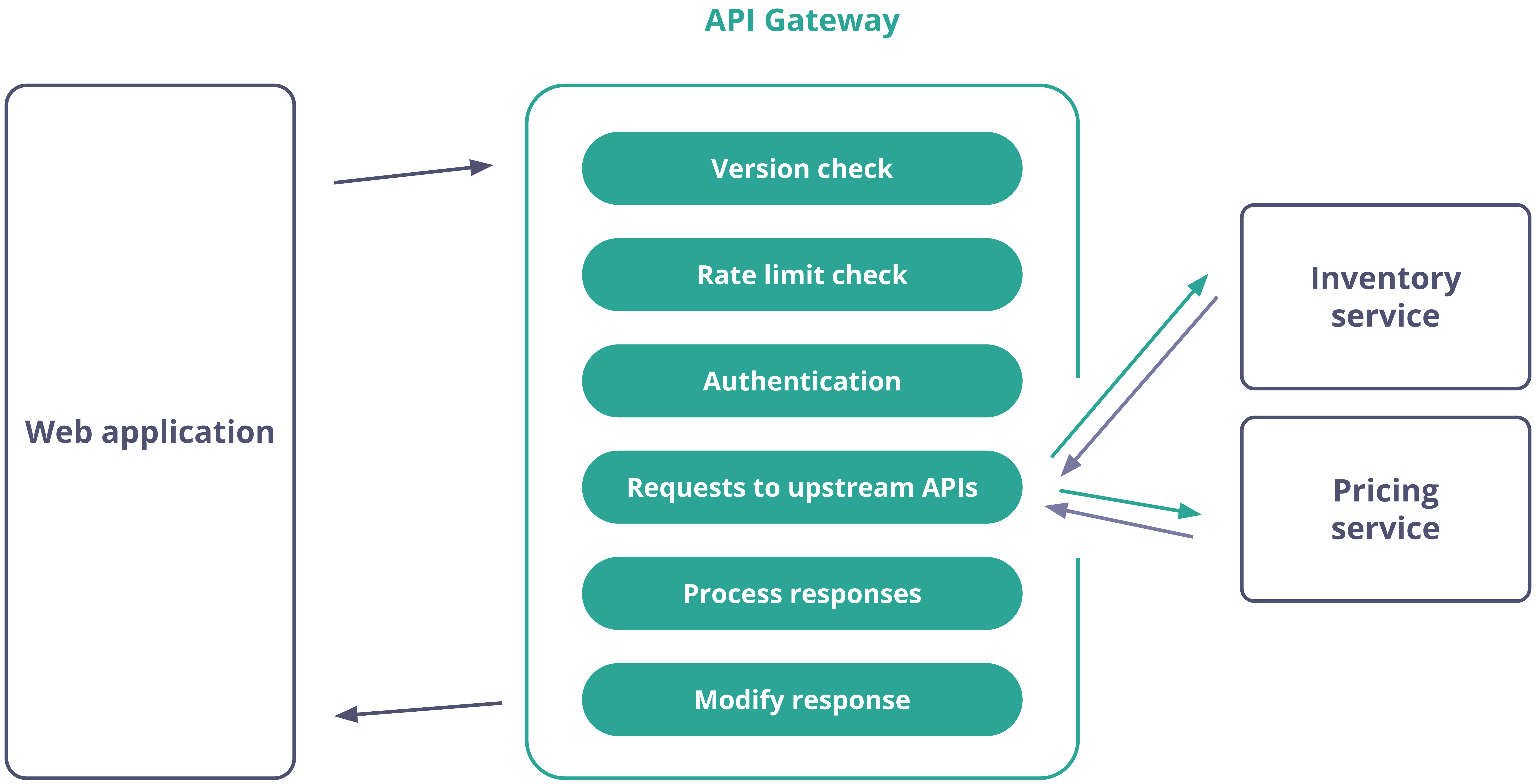
error	true
internal.span.format	proto
otel.library.name	tyk-gw
otel.status_code	ERROR
otel.status_description	Authorization field missing
span.kind	internal
tyk.apidef.api_id	9ca75f6d8b124a1e62bc78b60df02e00
tyk.apidef.name	adservice
tyk.apidef.org_id	63a07a0df0cd9b00011afb05

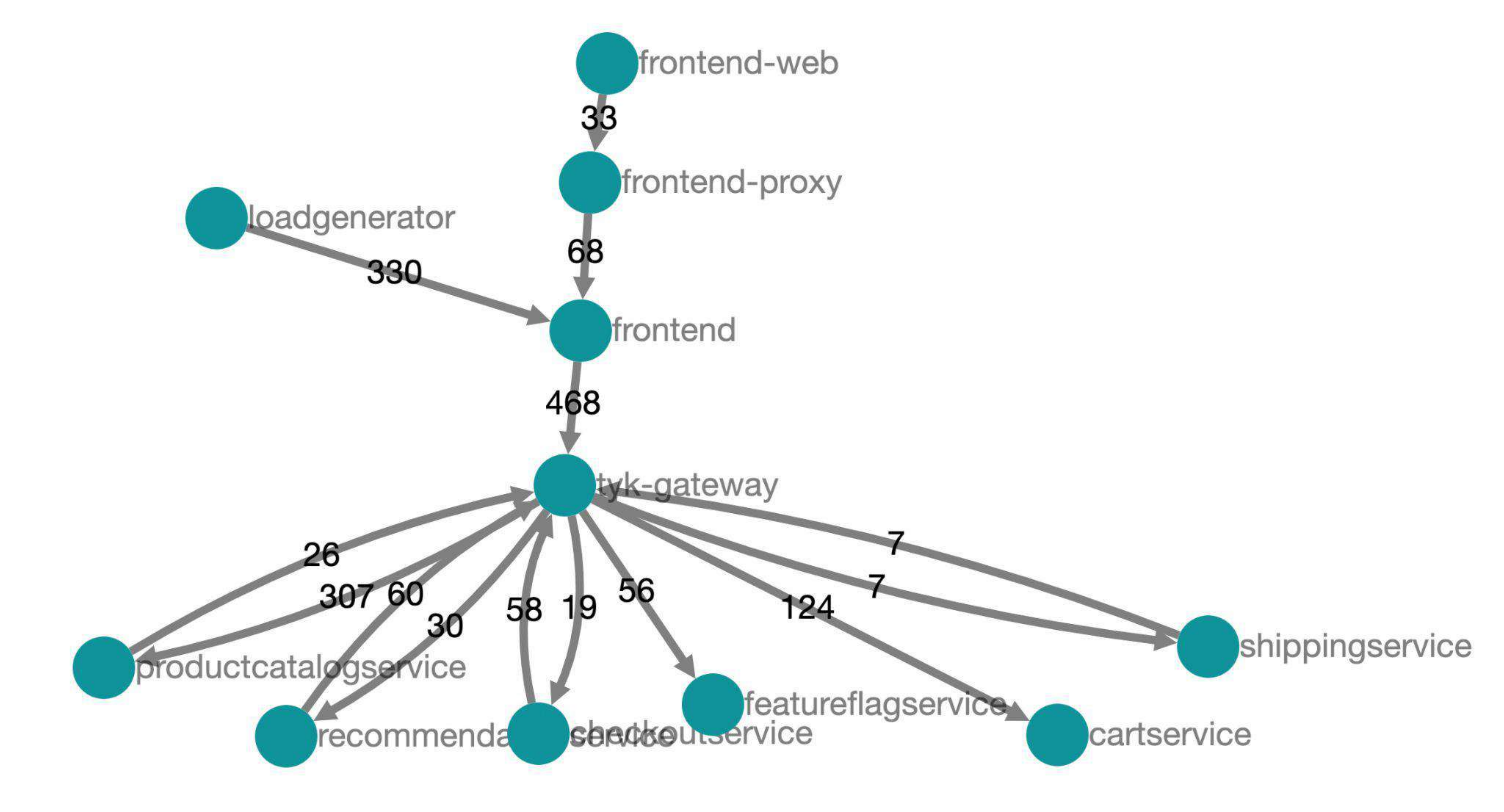
Process:

SpanID: 160ac7c75c0875fb

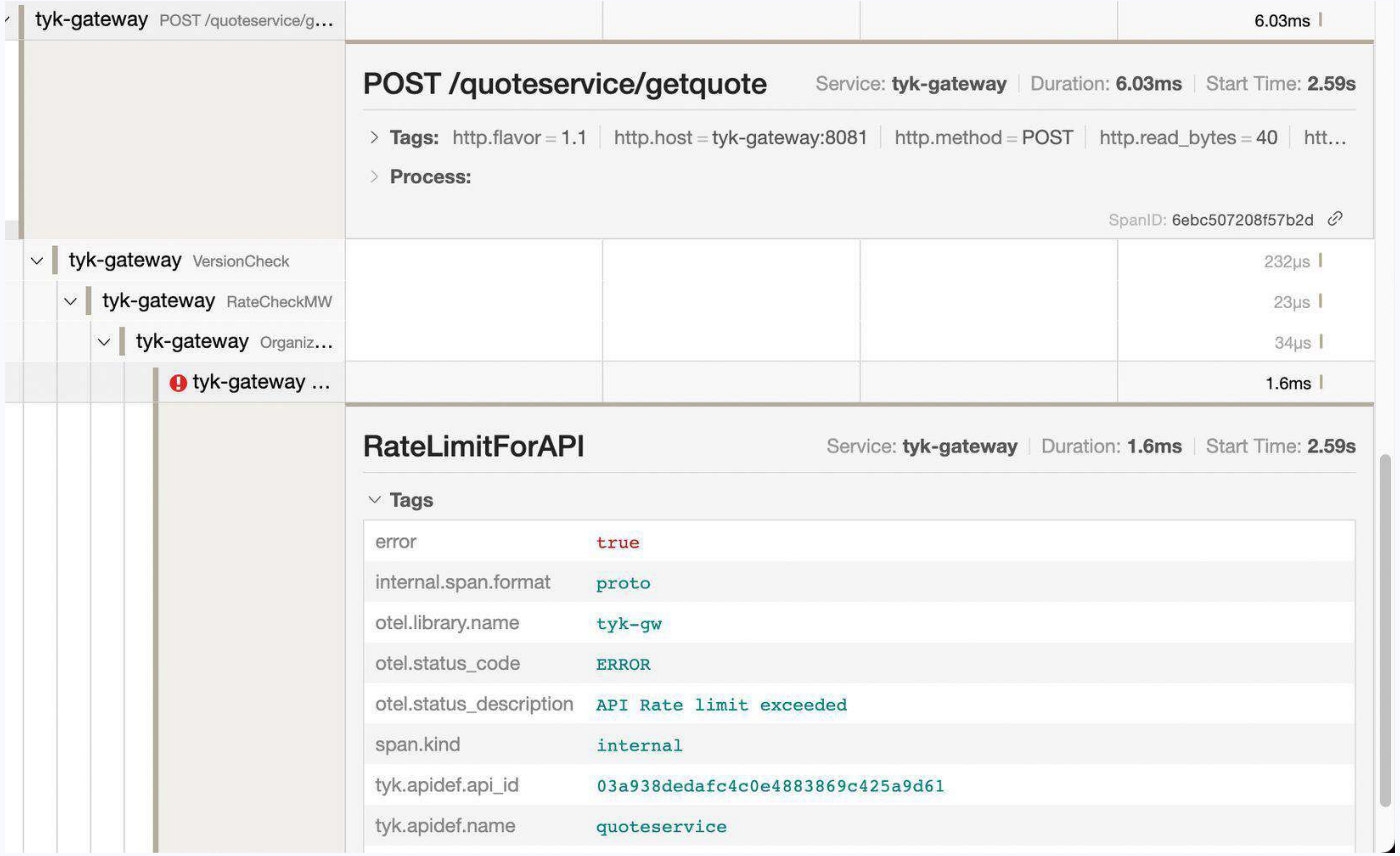

Load Generator
Frontend Proxy (Envoy)
HTTP
HTTP
Frontend
gRPC
gRPC
Ad Service
Fraud Detection Service
Accounting Service
Checkout Service
gRPC
gRPC
gRPC
TCP
TCP
TCP
gRPC
gRPC
gRPC
HTTP
queue (Kafka)
gRPC
gRPC
HTTP
gRPC
Shipping Service
Recommendation Service
gRPC
HTTP
gRPC
Cart Service
Currency Service
Email Service
Payment Service
gRPC
Quote Service
Product Catalog Service
gRPC
Cache (redis)
Feature Flag Service
Feature Flag Store
Service Legend
.NET
C++
Erlang/Elixir
Go
Java
JavaScript
Kotlin
PHP
Python
Ruby
Rust
TypeScript

What happens inside an API Gateway?




frontend-web
33
frontend-proxy
loadgenerator
330
68
frontend
468
tyk-gateway
26
307
60
30
58
19
56
124
7
7
shippingservice
productcatalogservice
recommendationservice
checkoutservice
featureflagservice
cartservice

Rate Limiting



tyk-gateway POST /quoteservice/g… 6.03ms

POST /quoteservice/getquote Service: **tyk-gateway** | Duration: **6.03ms** | Start Time: **2.59s**

> **Tags:** http.flavor = 1.1 | http.host = tyk-gateway:8081 | http.method = POST | http.read_bytes = 40 | htt…

> **Process:**

SpanID: 6ebc507208f57b2d

tyk-gateway VersionCheck 232µs

tyk-gateway RateCheckMW 23µs

tyk-gateway Organiz… 34µs

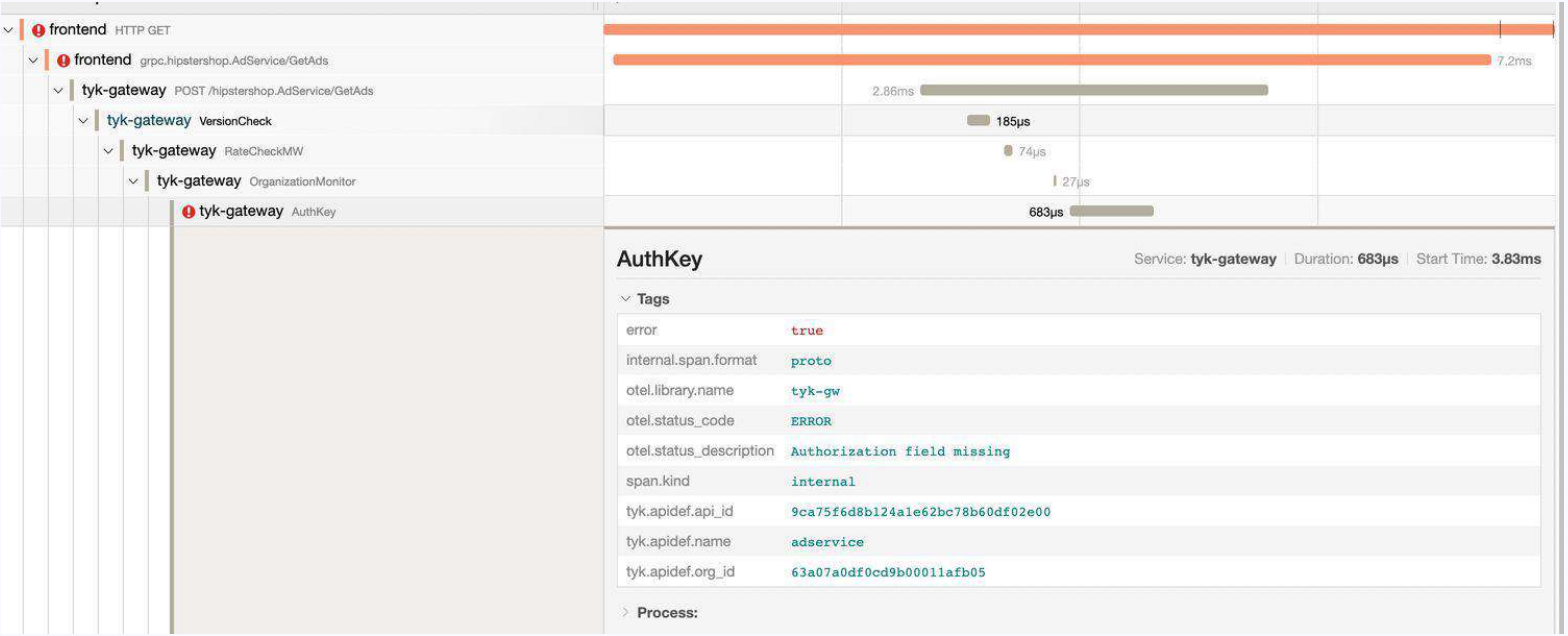
tyk-gateway … 1.6ms

RateLimitForAPI Service: **tyk-gateway** | Duration: **1.6ms** | Start Time: **2.59s**

Tags

error	`true`
internal.span.format	`proto`
otel.library.name	`tyk-gw`
otel.status_code	`ERROR`
otel.status_description	`API Rate limit exceeded`
span.kind	`internal`
tyk.apidef.api_id	`03a938dedafc4c0e4883869c425a9d61`
tyk.apidef.name	`quoteservice`

Authorization



frontend HTTP GET

frontend grpc.hipstershop.AdService/GetAds 7.2ms

tyk-gateway POST /hipstershop.AdService/GetAds 2.86ms

tyk-gateway VersionCheck 185µs

tyk-gateway RateCheckMW 74µs

tyk-gateway OrganizationMonitor 27µs

tyk-gateway AuthKey 683µs

AuthKey

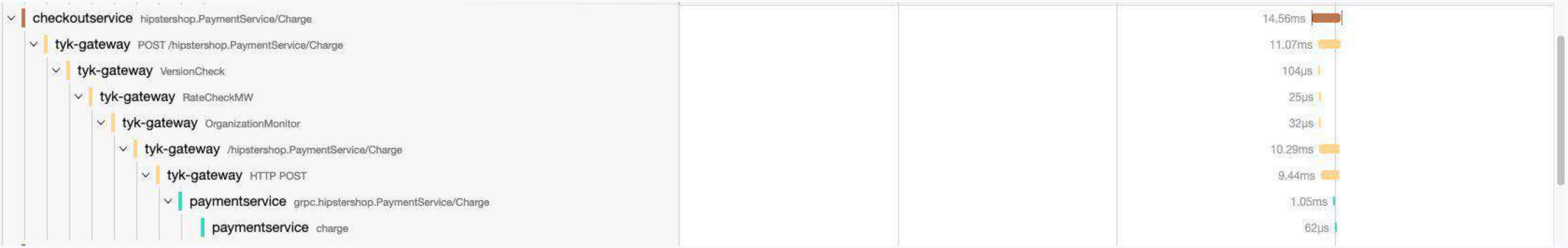
Service: **tyk-gateway** | Duration: **683µs** | Start Time: **3.83ms**

Tags

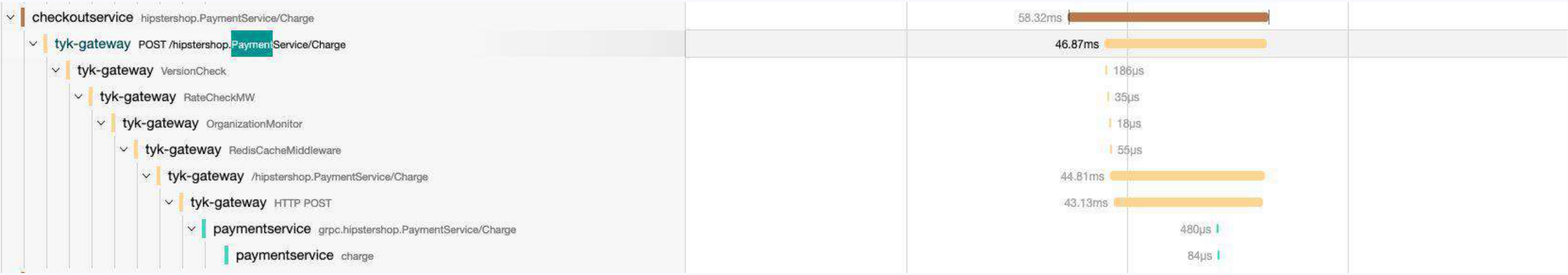
error	true
internal.span.format	proto
otel.library.name	tyk-gw
otel.status_code	ERROR
otel.status_description	Authorization field missing
span.kind	internal
tyk.apidef.api_id	9ca75f6d8b124a1e62bc78b60df02e00
tyk.apidef.name	adservice
tyk.apidef.org_id	63a07a0df0cd9b00011afb05

Process:

Caching

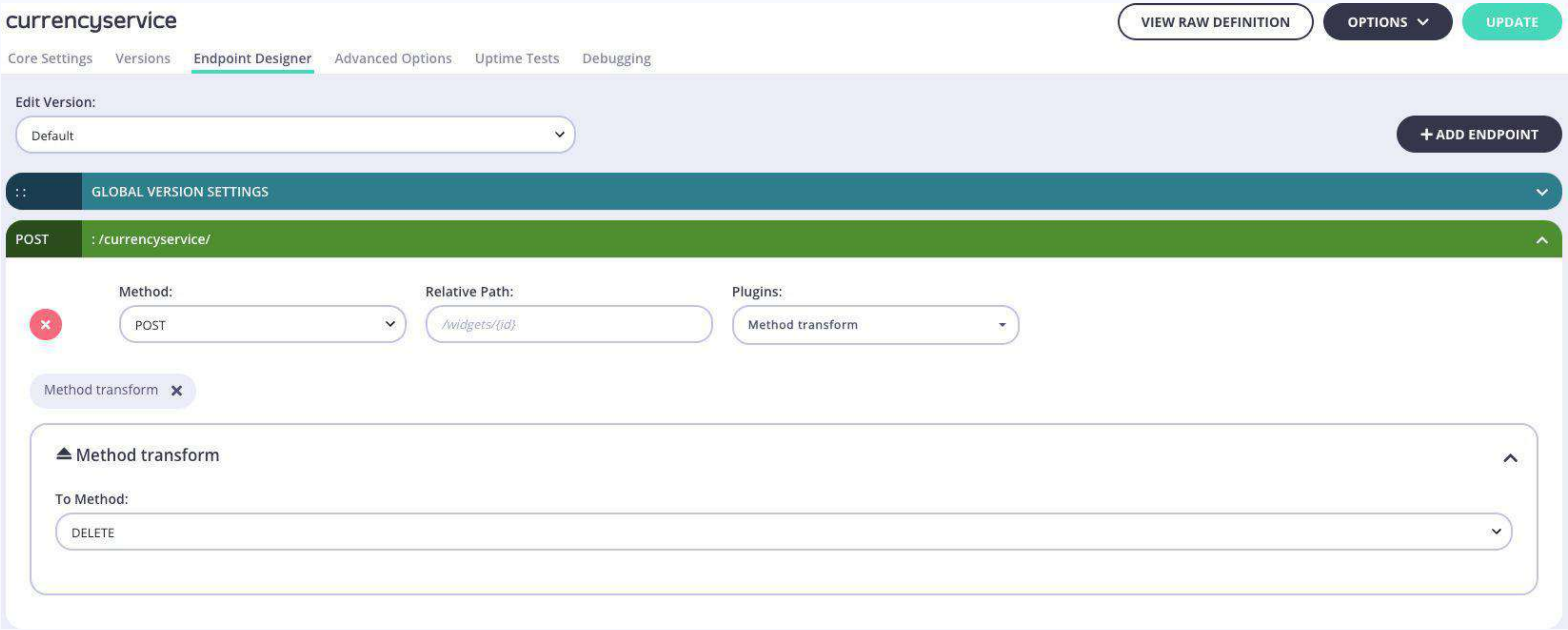


```
checkoutservice hipstershop.PaymentService/Charge                    14.56ms
  tyk-gateway POST /hipstershop.PaymentService/Charge                11.07ms
    tyk-gateway VersionCheck                                         104µs
      tyk-gateway RateCheckMW                                        25µs
        tyk-gateway OrganizationMonitor                              32µs
          tyk-gateway /hipstershop.PaymentService/Charge             10.29ms
            tyk-gateway HTTP POST                                    9.44ms
              paymentservice grpc.hipstershop.PaymentService/Charge  1.05ms
                paymentservice charge                                62µs
```



```
checkoutservice hipstershop.PaymentService/Charge                      58.32ms
  tyk-gateway POST /hipstershop.PaymentService/Charge                  46.87ms
    tyk-gateway VersionCheck                                           186µs
      tyk-gateway RateCheckMW                                          35µs
        tyk-gateway OrganizationMonitor                                18µs
          tyk-gateway RedisCacheMiddleware                             55µs
            tyk-gateway /hipstershop.PaymentService/Charge             44.81ms
              tyk-gateway HTTP POST                                    43.13ms
                paymentservice grpc.hipstershop.PaymentService/Charge  480µs
                  paymentservice charge                                84µs
```

Middleware



Edit Version: Default

POST : /currencyservice/

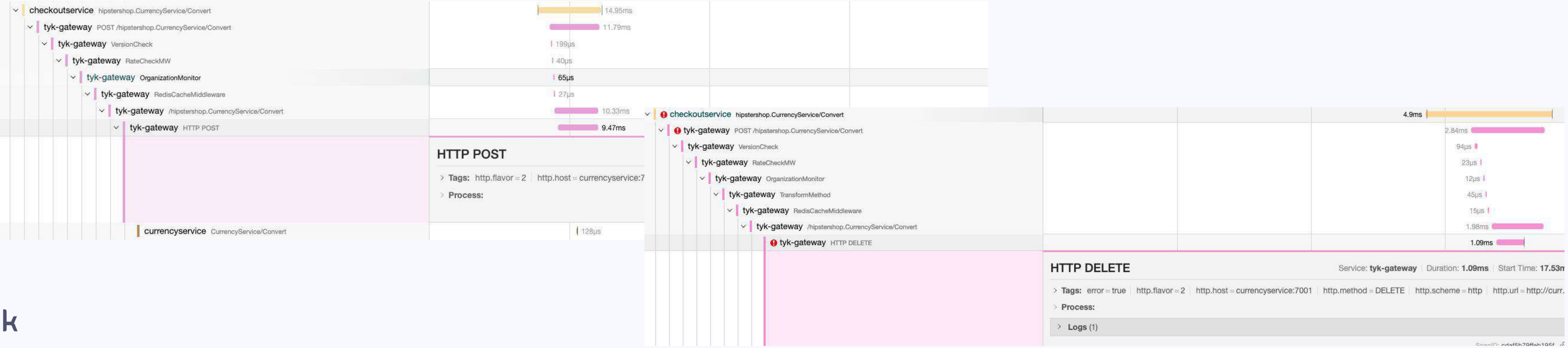
Method: POST

Relative Path: /widgets/{id}

Plugins: Method transform

Method transform

To Method: DELETE

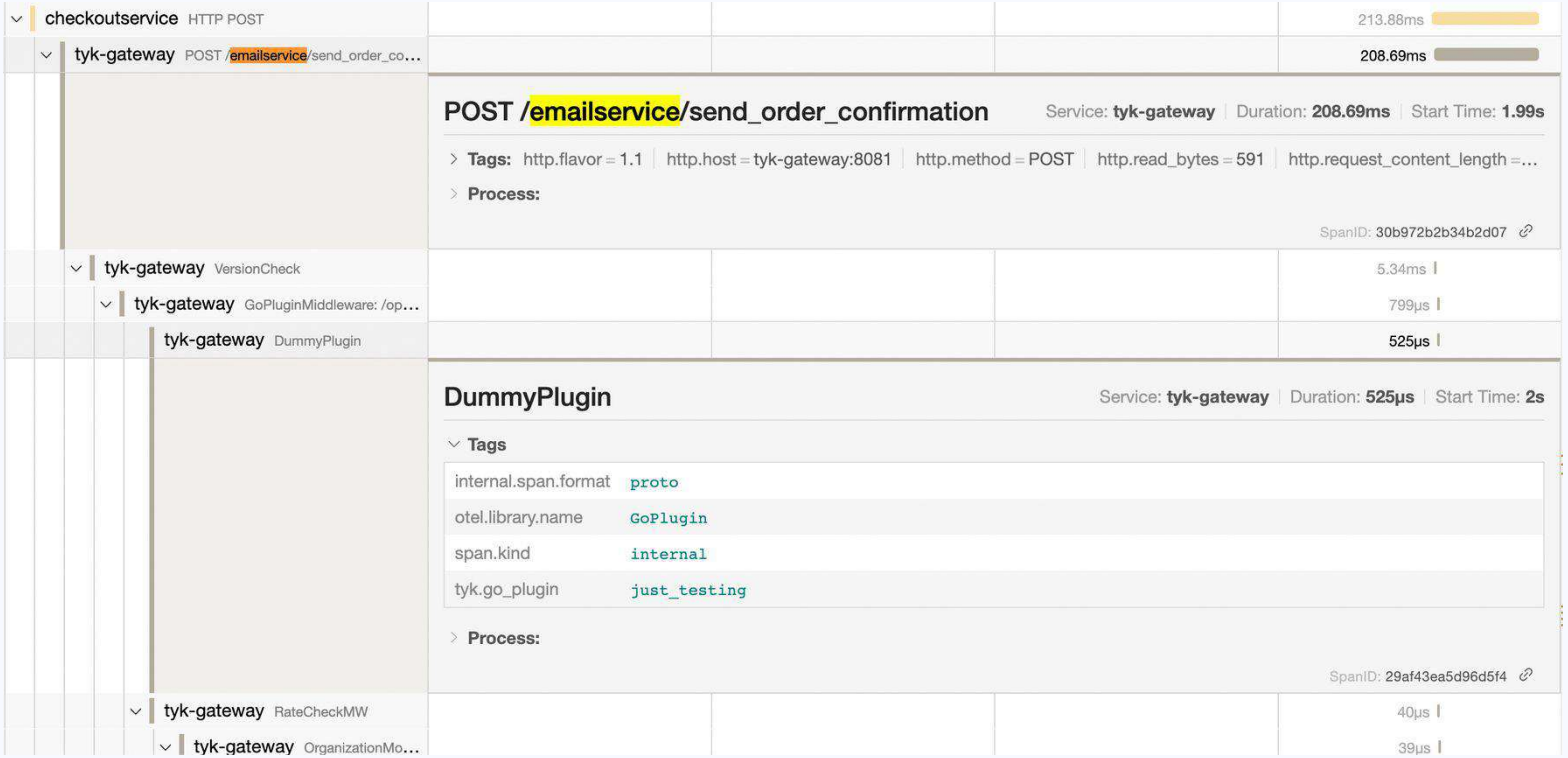


```
checkoutservice hipstershop.CurrencyService/Convert            14.95ms
  tyk-gateway POST /hipstershop.CurrencyService/Convert        11.79ms
    tyk-gateway VersionCheck                                   199µs
      tyk-gateway RateCheckMW                                  40µs
        tyk-gateway OrganizationMonitor                        65µs
          tyk-gateway RedisCacheMiddleware                     27µs
            tyk-gateway /hipstershop.CurrencyService/Convert   10.33ms
              tyk-gateway HTTP POST                            9.47ms
HTTP POST
> Tags: http.flavor = 2 | http.host = currencyservice:7
> Process:
                currencyservice CurrencyService/Convert        128µs
```

```
checkoutservice hipstershop.CurrencyService/Convert            4.9ms
  tyk-gateway POST /hipstershop.CurrencyService/Convert        2.84ms
    tyk-gateway VersionCheck                                   94µs
      tyk-gateway RateCheckMW                                  23µs
        tyk-gateway OrganizationMonitor                        12µs
          tyk-gateway TransformMethod                          45µs
            tyk-gateway RedisCacheMiddleware                   15µs
              tyk-gateway /hipstershop.CurrencyService/Convert 1.98ms
                tyk-gateway HTTP DELETE                        1.09ms
HTTP DELETE                 Service: tyk-gateway | Duration: 1.09ms | Start Time: 17.53m
> Tags: error = true | http.flavor = 2 | http.host = currencyservice:7001 | http.method = DELETE | http.scheme = http | http.url = http://curr.
> Process:
> Logs (1)
```

Tyk

Custom plugin



checkoutservice HTTP POST 213.88ms

tyk-gateway POST /emailservice/send_order_co… 208.69ms

POST /emailservice/send_order_confirmation Service: **tyk-gateway** | Duration: **208.69ms** | Start Time: **1.99s**

› **Tags:** http.flavor = 1.1 | http.host = tyk-gateway:8081 | http.method = POST | http.read_bytes = 591 | http.request_content_length = …

› **Process:**

SpanID: 30b972b2b34b2d07

tyk-gateway VersionCheck 5.34ms

tyk-gateway GoPluginMiddleware: /op… 799μs

tyk-gateway DummyPlugin 525μs

DummyPlugin Service: **tyk-gateway** | Duration: **525μs** | Start Time: **2s**

⌄ **Tags**

internal.span.format	`proto`
otel.library.name	`GoPlugin`
span.kind	`internal`
tyk.go_plugin	`just_testing`

› **Process:**

SpanID: 29af43ea5d96d5f4

tyk-gateway RateCheckMW 40μs

tyk-gateway OrganizationMo… 39μs

Recommendations

Start with the end in mind

Our goals with our OpenTelemetry integration:

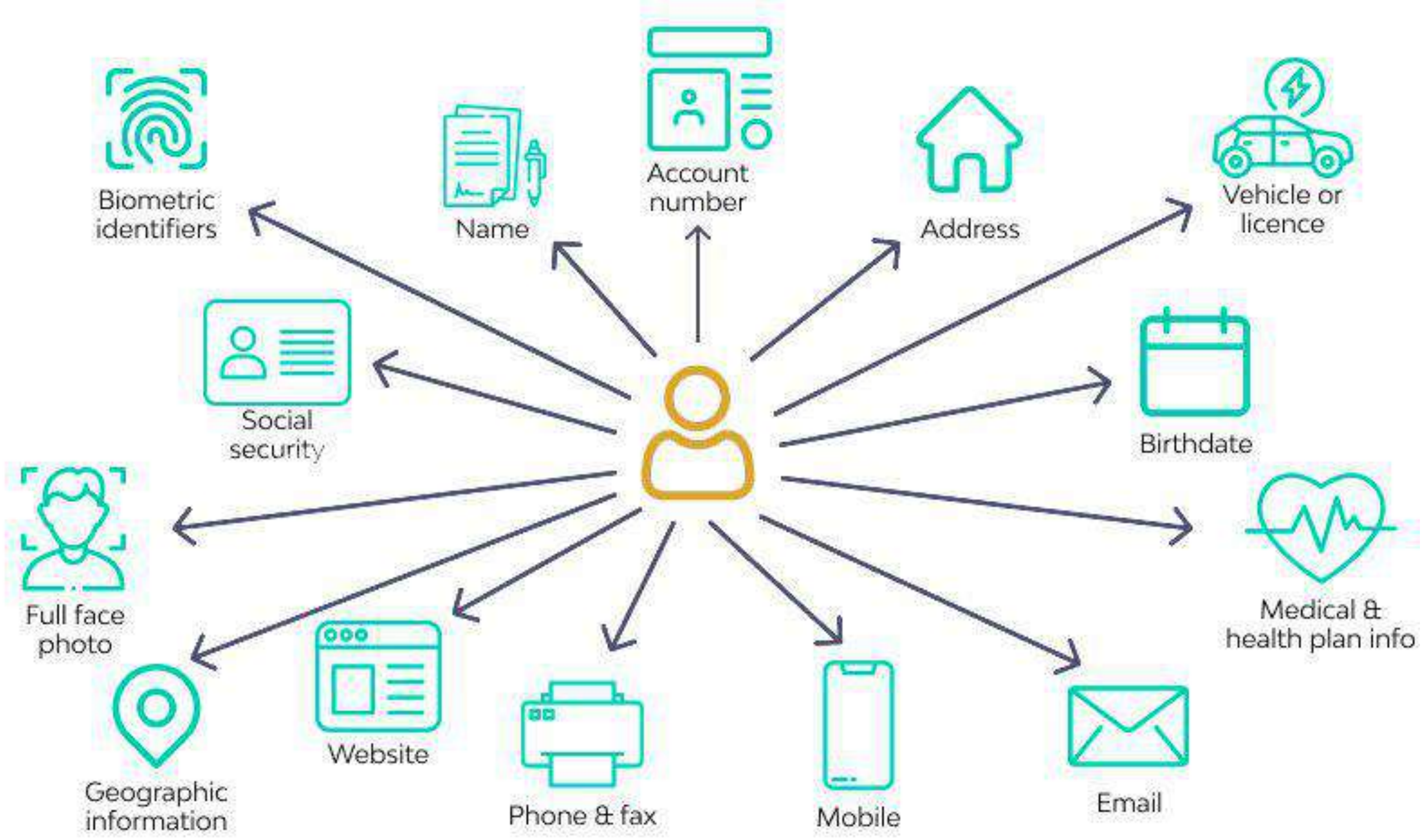
- Monitor APIs for errors and performance
- Troubleshoot issues with APIs end-to-end
- Troubleshoot issues with custom plugins
- Report API usage for the business

Use attributes that can explain performance variation or are useful for the business

- **User-related attributes**
  - Customer segment, customer ID, geo data, device type, OS version
- **Software-related attributes**
  - Deployment ID, A/B-testing, feature flags, version
- **Data-related attributes**
  - Request/response size, whether a cache has been used, caching timestamps
- **Infrastructure-related attributes**
  - Host ID, OS, data centre, orchestration (cluster, pod, or node IDs)

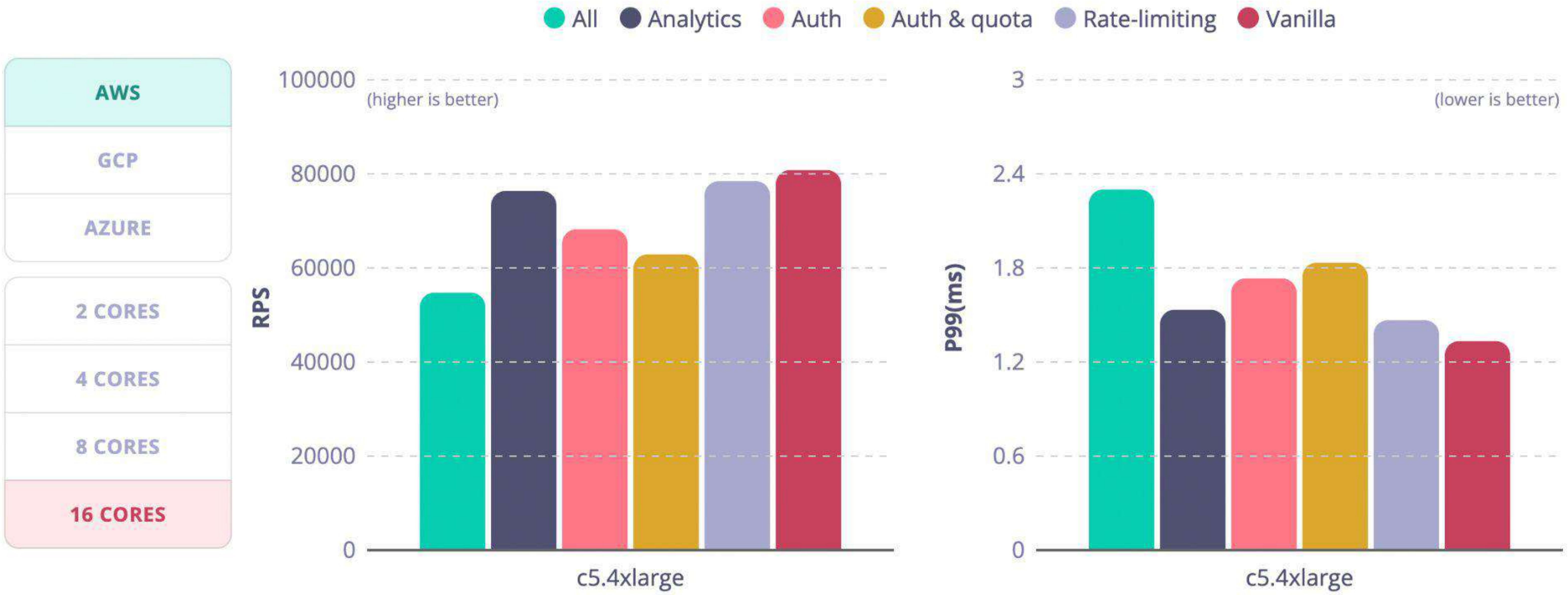
Do not expose PII data

You should pay careful attention to exactly what data is added to your spans as they can potentially contain personally identifiable information (PII)



Tyk

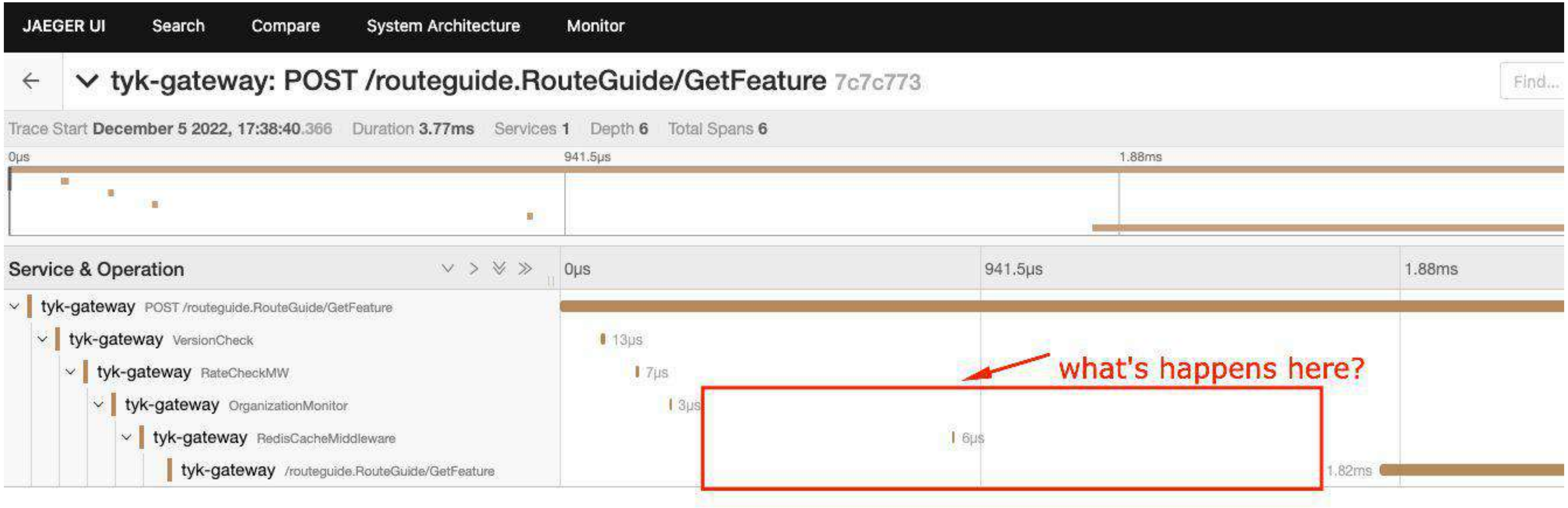
Run performance tests to check the instrumentation overhead



Configuration options - which options to offer to your users?

- **Sampling**
  - AlwaysSample, NeverSample ,TraceIDRatioBased, and ParentBased
- **Context propagation**
  - W3C (default) or B3 (older standard)
- **Exporter**
  - OTLP/HTTP or OTLP/GRPC endpoint
- **Spans**
  - detailed span tracing at the API level (false)
  - configurable list of attributes

You will discover new bugs while implementing OpenTelemetry

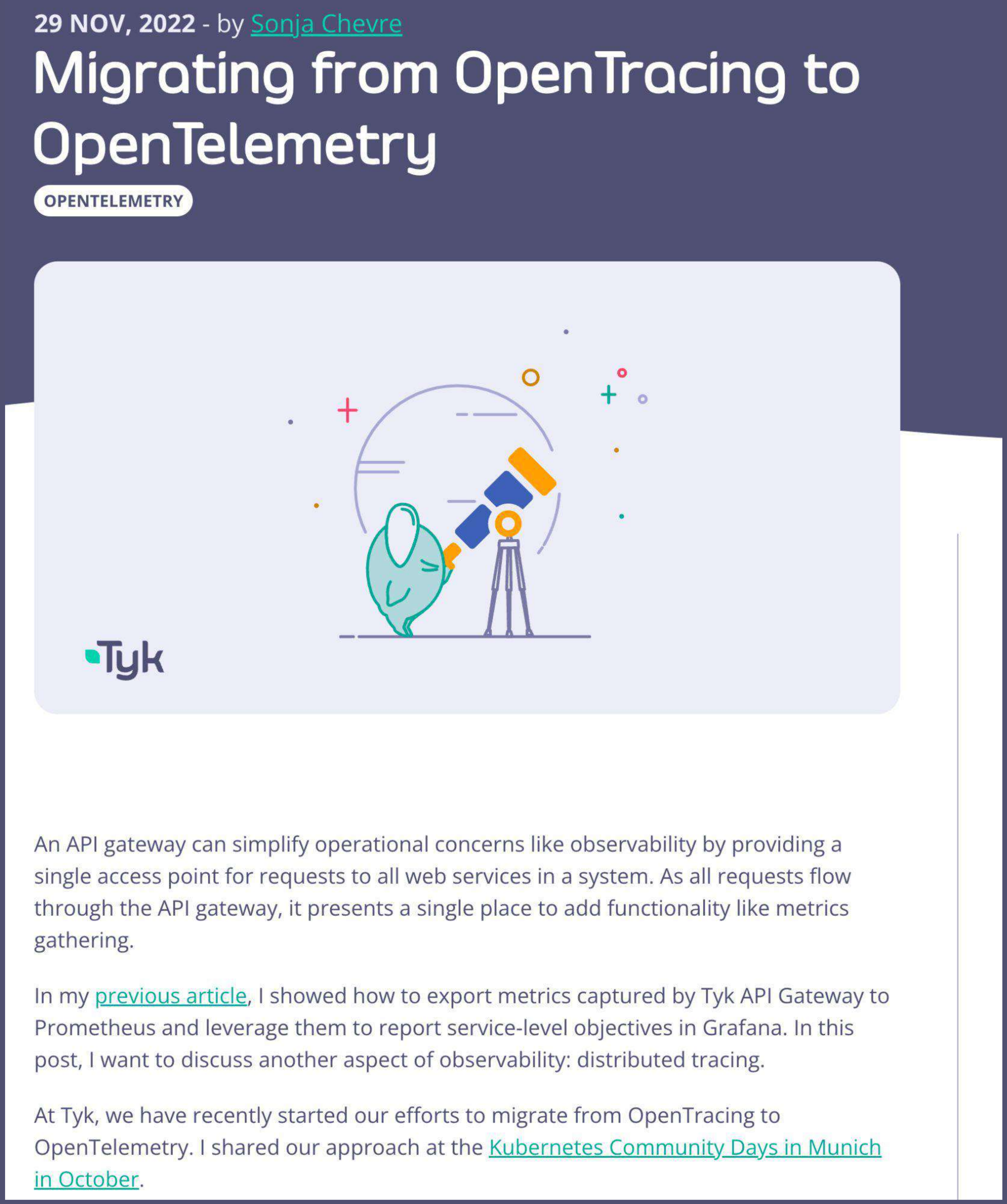


tyk-gateway: POST /routeguide.RouteGuide/GetFeature 7c7c773

Trace Start **December 5 2022, 17:38:40**.366 Duration **3.77ms** Services **1** Depth **6** Total Spans **6**

Service & Operation	Duration
tyk-gateway POST /routeguide.RouteGuide/GetFeature	
tyk-gateway VersionCheck	13μs
tyk-gateway RateCheckMW	7μs
tyk-gateway OrganizationMonitor	3μs
tyk-gateway RedisCacheMiddleware	6μs
tyk-gateway /routeguide.RouteGuide/GetFeature	1.82ms

what's happens here?



29 NOV, 2022 - by Sonja Chevre

Migrating from OpenTracing to OpenTelemetry

OPENTELEMETRY

An API gateway can simplify operational concerns like observability by providing a single access point for requests to all web services in a system. As all requests flow through the API gateway, it presents a single place to add functionality like metrics gathering.

In my previous article, I showed how to export metrics captured by Tyk API Gateway to Prometheus and leverage them to report service-level objectives in Grafana. In this post, I want to discuss another aspect of observability: distributed tracing.

At Tyk, we have recently started our efforts to migrate from OpenTracing to OpenTelemetry. I shared our approach at the Kubernetes Community Days in Munich in October.

Danke Linz 🤍