AWS re:Invent

NOV. 29 – DEC. 3, 2021 | LAS VEGAS, NV

OPN207

Top 10 observability challenges and how open source can help

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Amazon Web Services

aws

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Motivation

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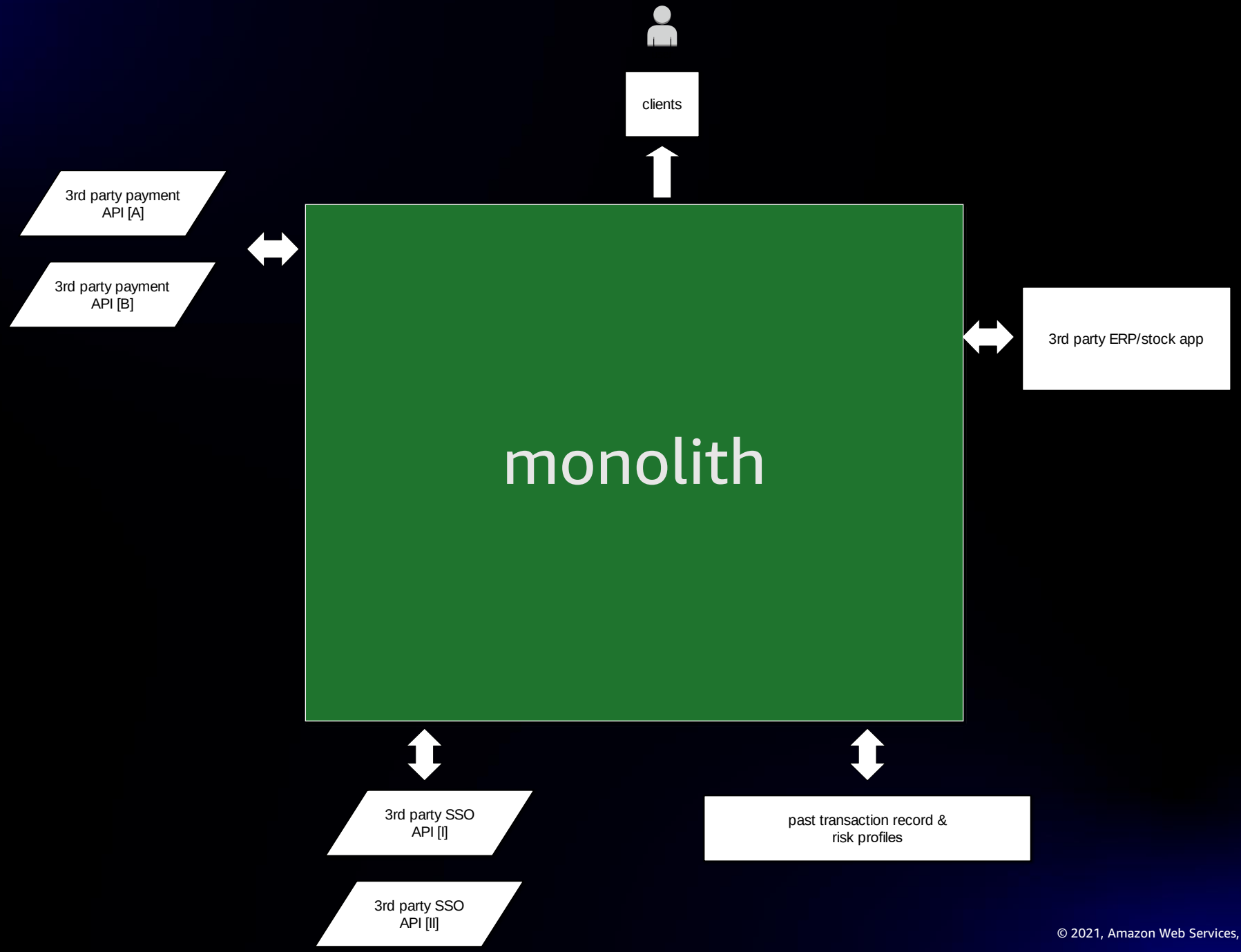


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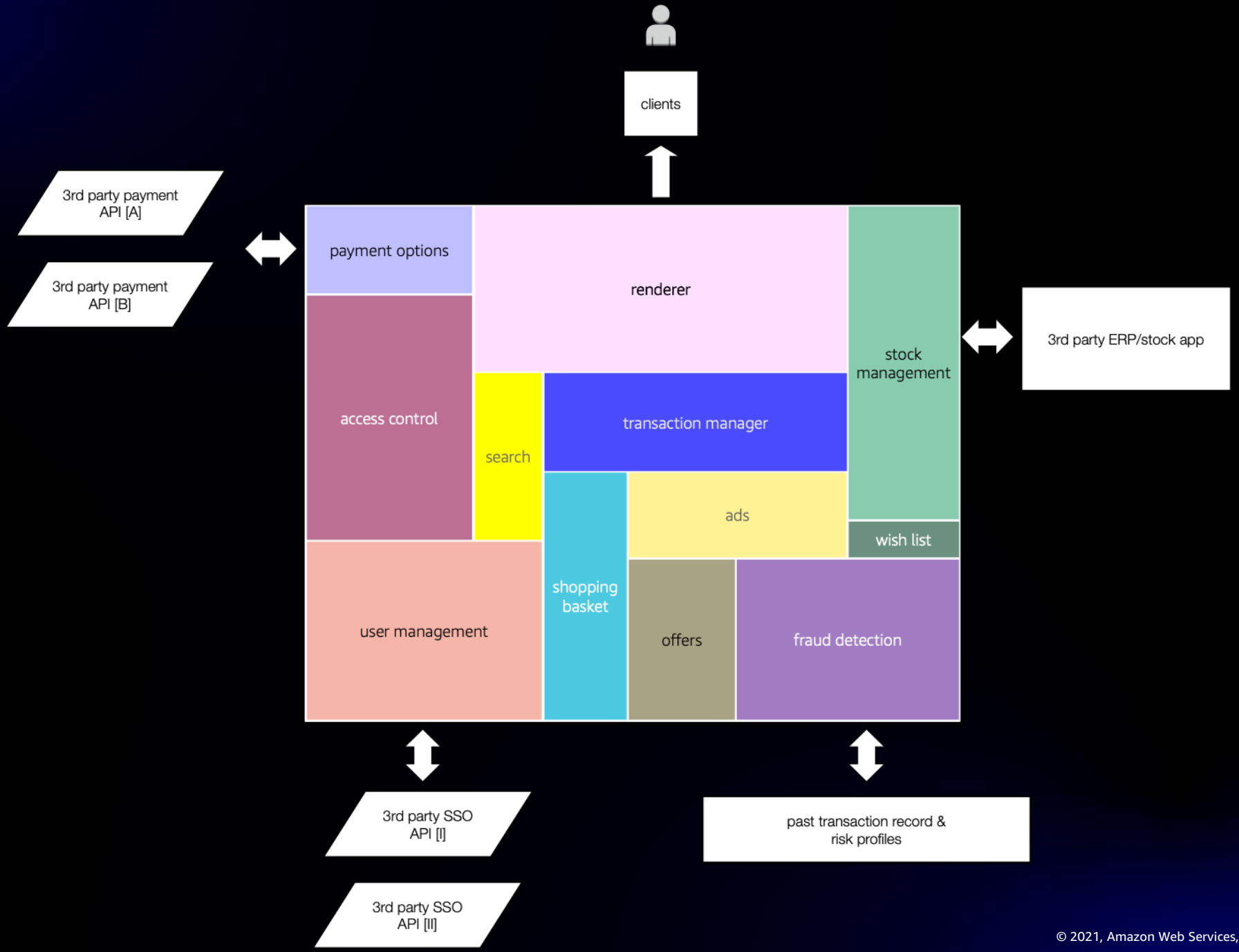


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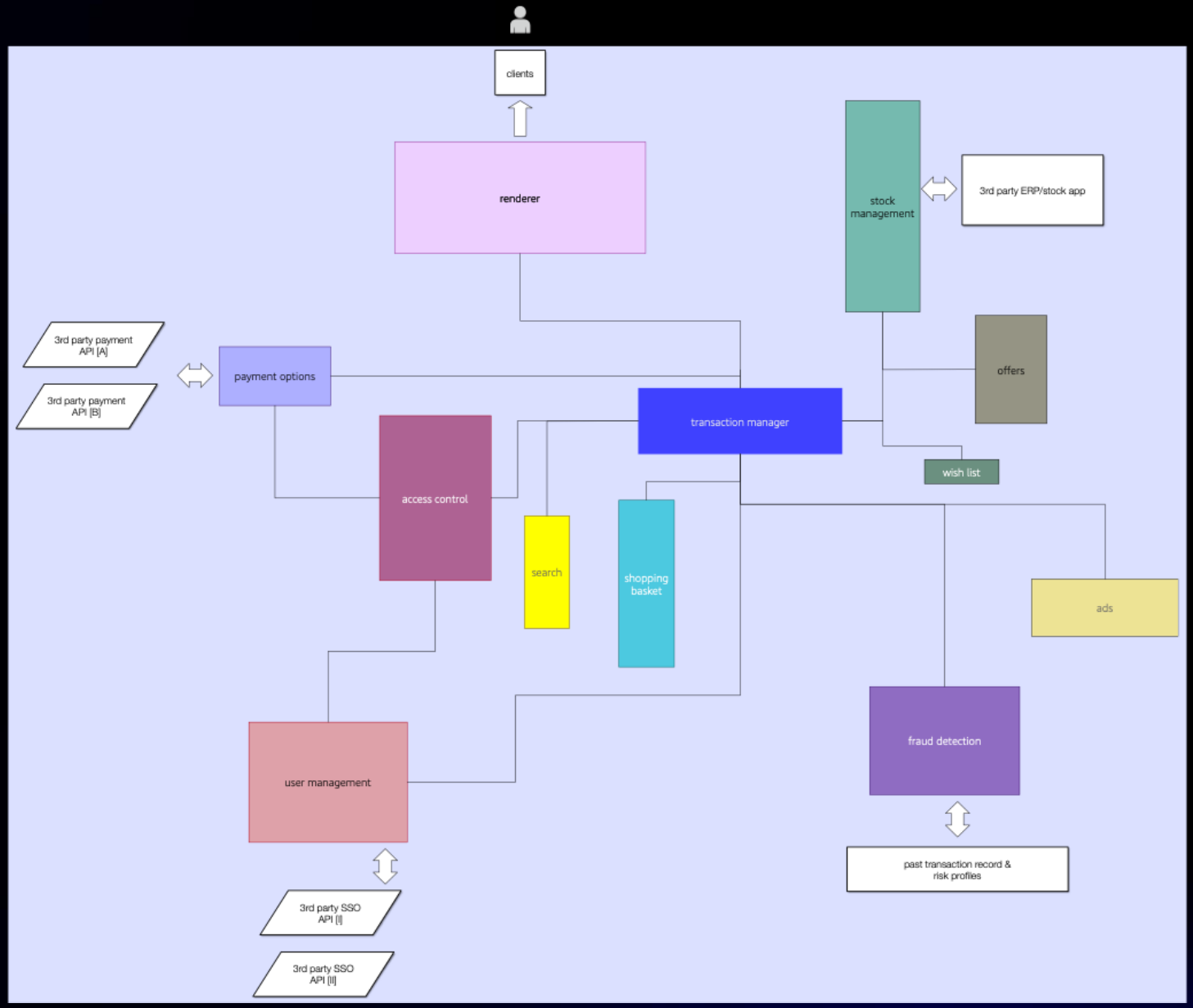
Pros

- Feature velocity
- Polyglot systems

  (language & data stores)
- Partial HA for overall application

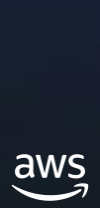
Cons

- Distributed system
- Complexity
- Observability



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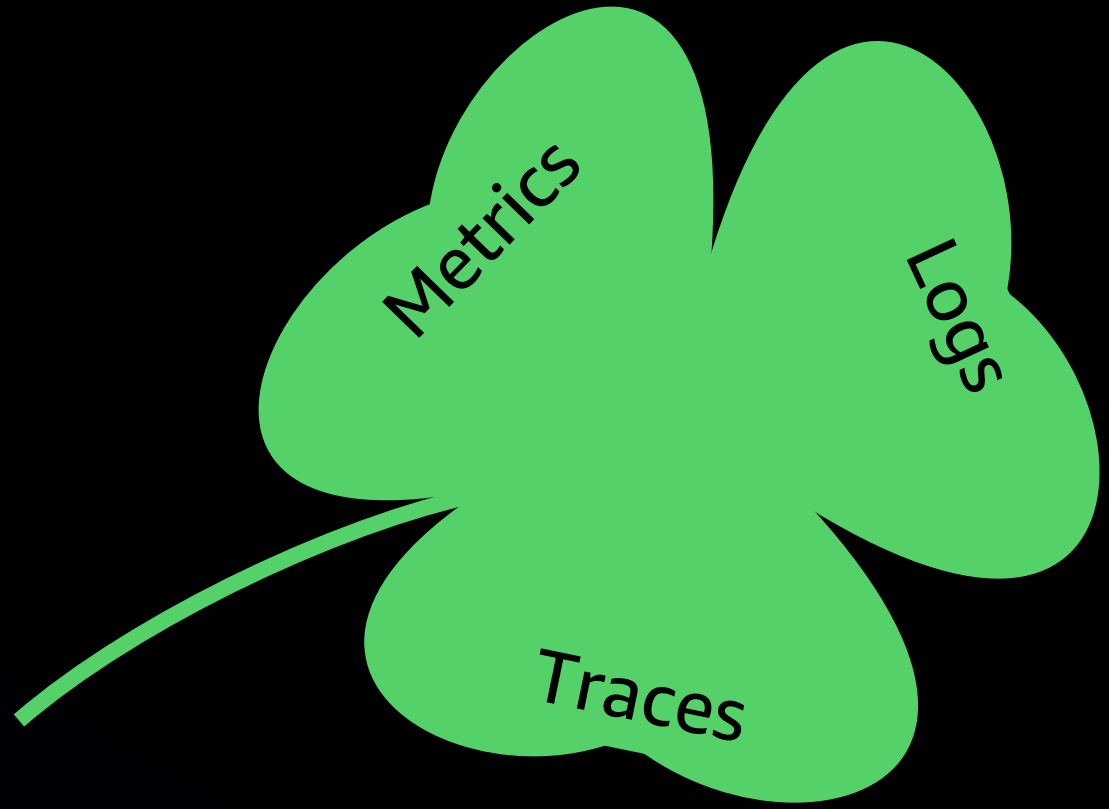
Observability 101



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What is observability?

- Signal types

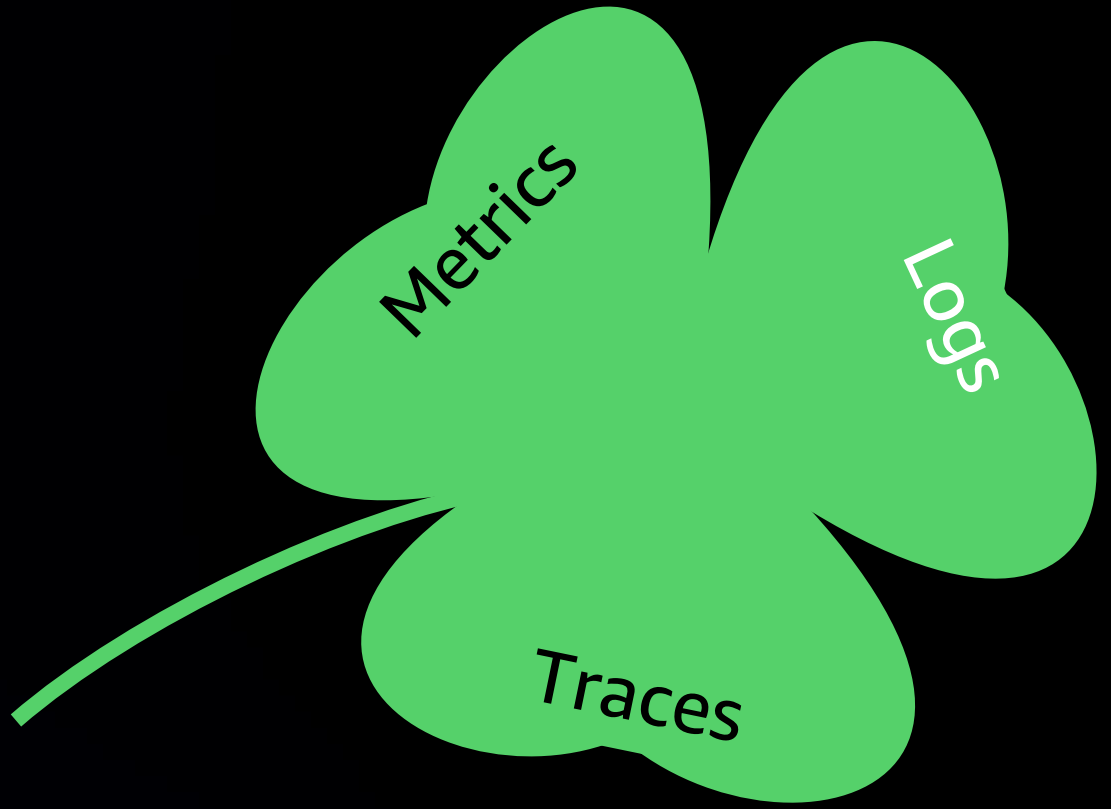


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What is observability?

- Signal types

Logs are signals with a textual payload capturing events



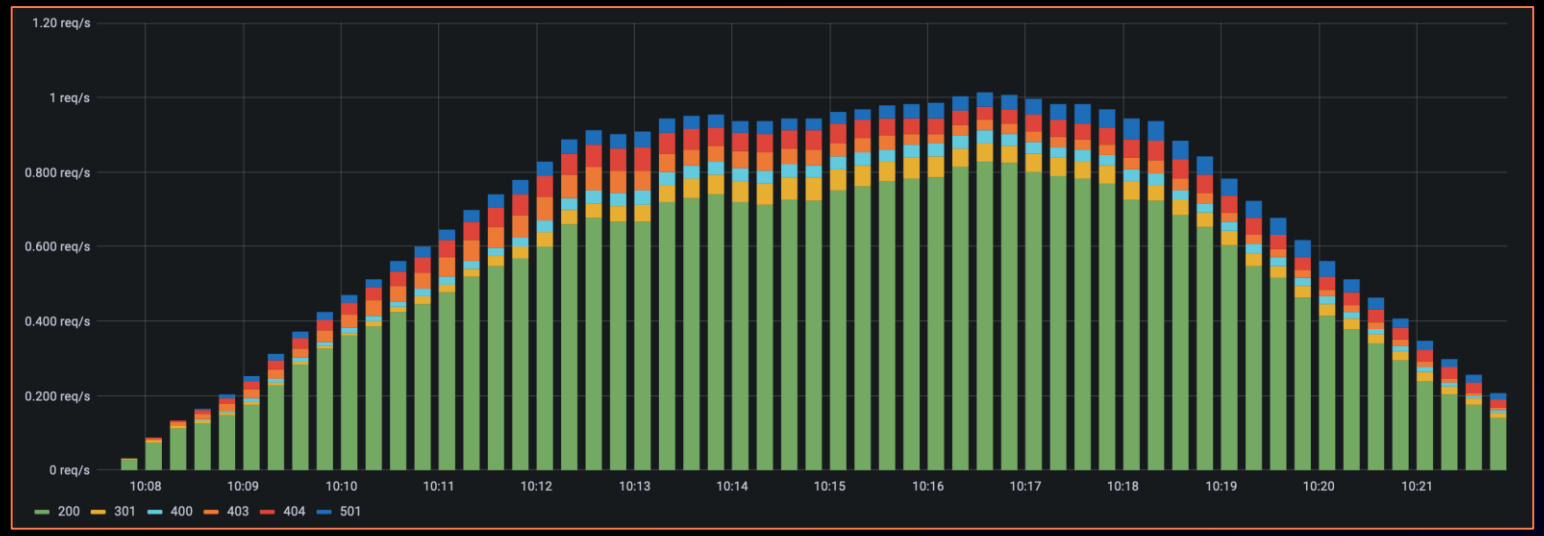

```
> {"log":"2021-10-21T09:18:02.374513821Z stdout F {\"body_bytes\":49,\"duration_sec\":0.001322526,\"event\":\"downstream\",\"level\":\"info\",\"msg\":\"ho11y invoked http://downstream1\",\"time\":\"2021-10-21T09:18:02Z\"}"}
> {"log":"2021-10-21T09:18:02.371016908Z stdout F {\"body_bytes\":13312,\"duration_sec\":0.002,\"event\":\"downstream\",\"level\":\"info\",\"msg\":\"ho11y invoked DUMMY:13kB:2ms\",\"time\":\"2021-10-21T09:18:02Z\"}"}
> {"log":"2021-10-21T09:18:02.368677701Z stdout F {\"body_bytes\":191488,\"duration_sec\":0.042,\"event\":\"downstream\",\"level\":\"info\",\"msg\":\"ho11y invoked DUMMY:187kB:42ms\",\"time\":\"2021-10-21T09:18:02Z\"}"}
> {"log":"2021-10-21T09:18:02.325457547Z stdout F {\"body_bytes\":29497,\"duration_sec\":0.001633293,\"event\":\"downstream\",\"level\":\"info\",\"msg\":\"ho11y invoked https://o11y.news/2021-03-01/\",\"time\":\"2021-10-21T09:18:02Z\"}"}
> {"log":"2021-10-21T09:18:02.31019034Z stdout F {\"event\":\"invoke\",\"level\":\"info\",\"msg\":\"ho11y was invoked\",\"remote\":\"192.168.120.234:34138\",\"time\":\"2021-10-21T09:18:02Z\",\"traceID\":\"1-6171304a-b095f046146c7d3dafc3aecb\"}"}
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> {"log":"2021-10-21T09:18:02.306678063Z stdout F {\"body_bytes\":17956,\"duration_sec\":0.001639619,\"event\":\"downstream\",\"level\":\"info\",\"msg\":\"ho11y invoked https://mhausenblas.info/\",\"time\":\"2021-10-21T09:18:02Z\"}"}
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```

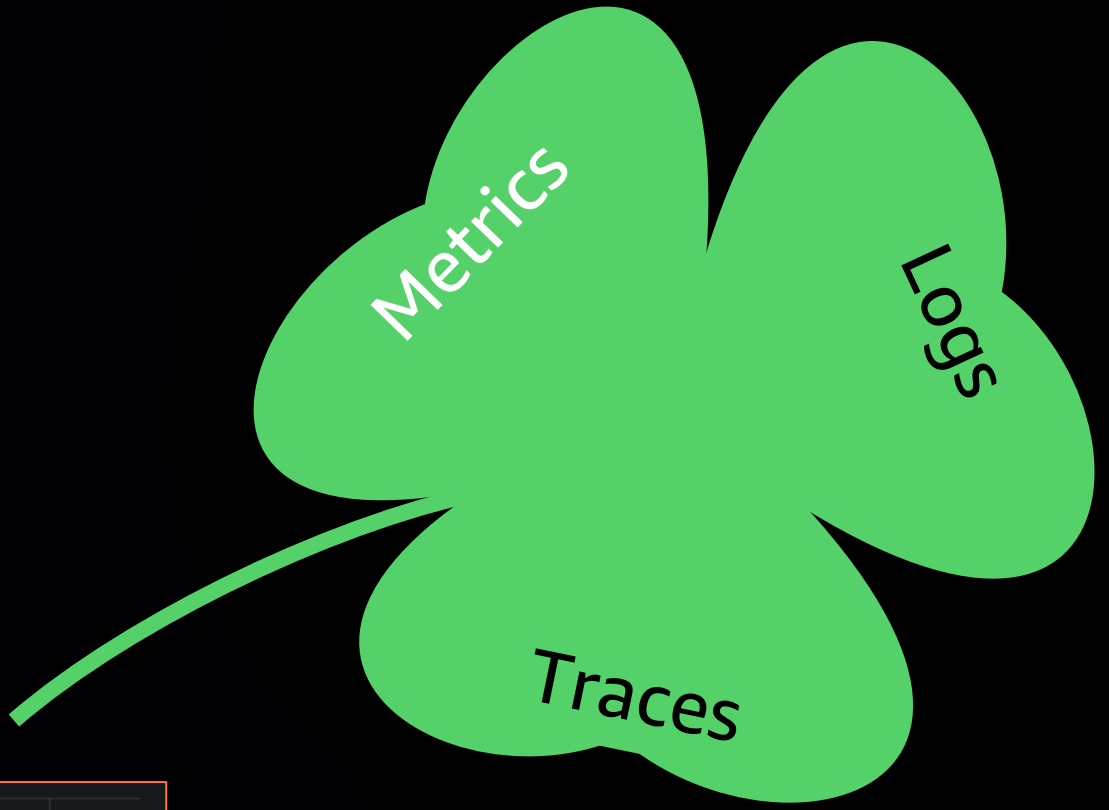

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What is observability?

- Signal types

Metrics are numerical signals at regular time intervals with semantics encoded in the name or via labels



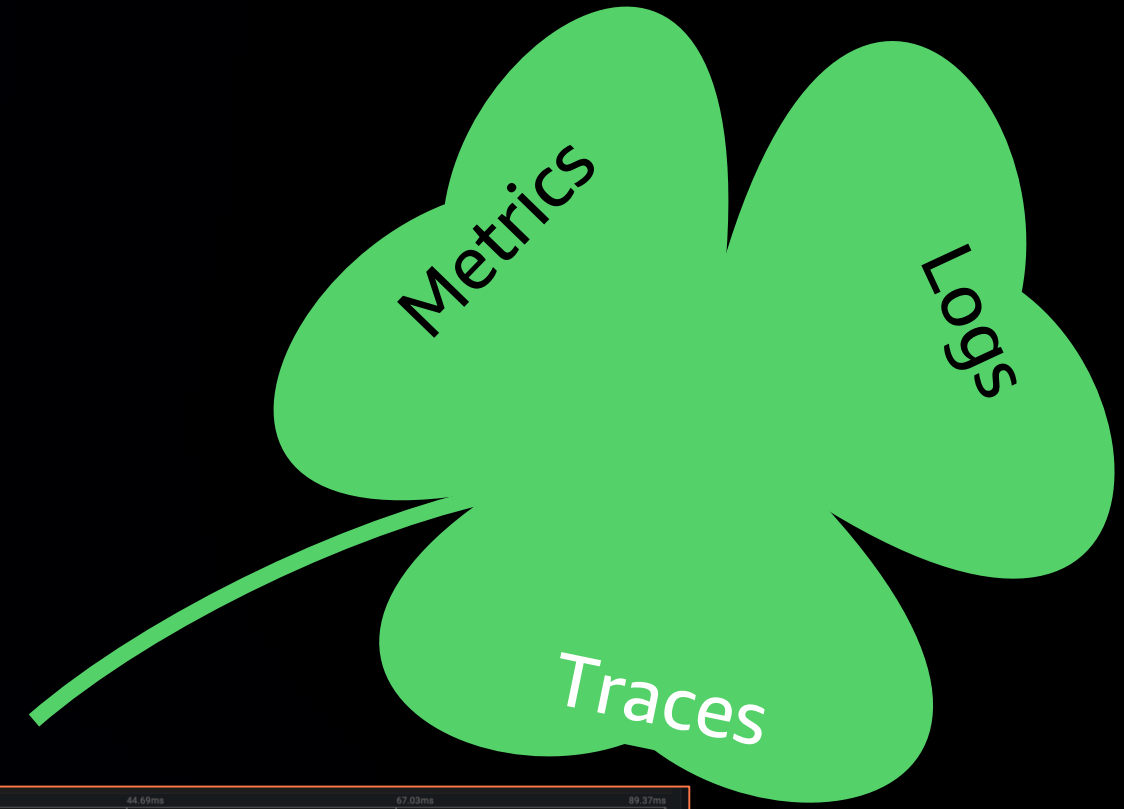


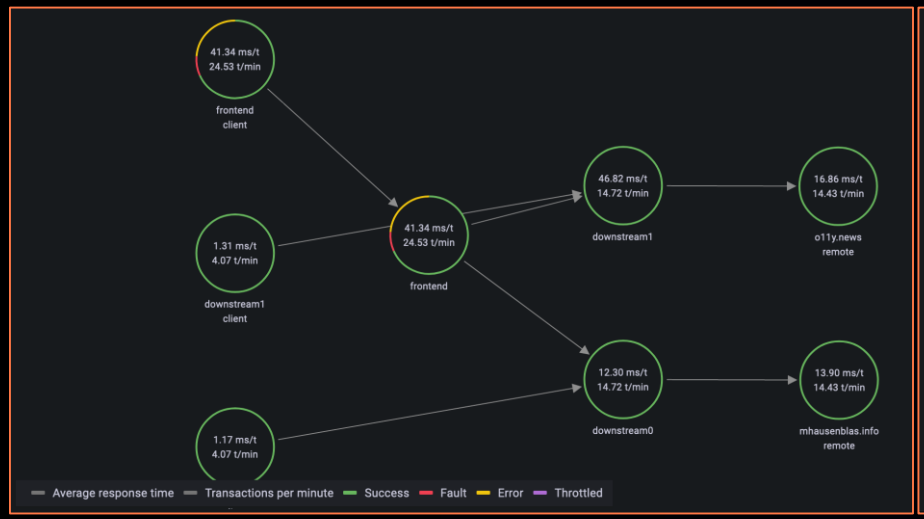
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What is observability?

- Signal types

Traces are about propagating an execution context along a request path







More: AWS re:Invent 2020: Open-source observability at AWS

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What is observability?

- Signal types
- Telemetry



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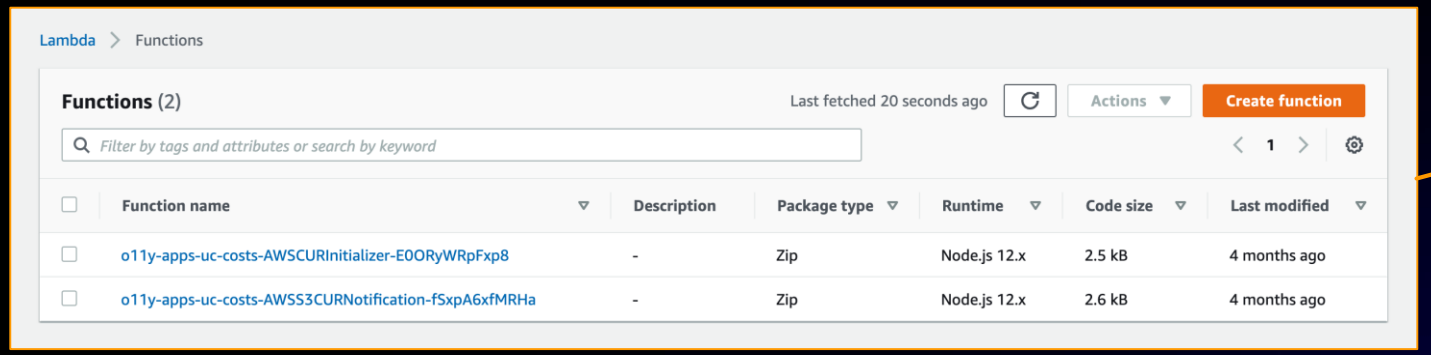
What is observability?

- Signal types
- Telemetry

```
└─> $ kubectl get pod,deploy,svc
NAME                                  READY   STATUS    RESTARTS   AGE
pod/carts-7c9df6fdb4-84fpk            1/1     Running   0          2d19h
pod/carts-db-6c6c68b747-4rvcr         1/1     Running   0          2d19h
pod/catalogue-7c6dcb64f7-qsthx        1/1     Running   0          2d19h
pod/catalogue-db-96f6f6b4c-mhnxc      1/1     Running   0          2d19h
pod/front-end-7b8bcd59cb-ljjcx        1/1     Running   0          2d19h
pod/orders-c9994cff9-49pwf            1/1     Running   0          2d19h
pod/orders-db-659949975f-m5srm        1/1     Running   0          2d19h
pod/payment-8576977df5-mz4bd          1/1     Running   0          2d19h
pod/queue-master-bbb6c4b9d-q2qw6      1/1     Running   14         43h
pod/rabbitmq-6d77f74dc-p5b8m          1/1     Running   0          2d19h
pod/shipping-5d7c4f8bbf-j4z27         1/1     Running   0          2d19h
pod/user-846f474c46-f4bxh             1/1     Running   0          2d19h
pod/user-db-5f68d7b558-82gvl          1/1     Running   0          2d19h

NAME                                  READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/carts                 1/1     1            1           2d19h
deployment.apps/carts-db              1/1     1            1           2d19h
deployment.apps/catalogue             1/1     1            1           2d19h
deployment.apps/catalogue-db          1/1     1            1           2d19h
deployment.apps/front-end             1/1     1            1           2d19h
deployment.apps/orders                1/1     1            1           2d19h
deployment.apps/orders-db             1/1     1            1           2d19h
deployment.apps/payment               1/1     1            1           2d19h
deployment.apps/queue-master          1/1     1            1           2d19h
deployment.apps/rabbitmq              1/1     1            1           2d19h
deployment.apps/shipping              1/1     1            1           2d19h
deployment.apps/user                  1/1     1            1           2d19h
deployment.apps/user-db               1/1     1            1           2d19h

NAME                  TYPE        CLUSTER-IP       EXTERNAL-IP   PORT(S)          AGE
service/carts         ClusterIP   10.100.43.186    <none>        80/TCP           2d19h
service/carts-db      ClusterIP   10.100.101.127   <none>        27017/TCP        2d19h
service/catalogue     ClusterIP   10.100.143.124   <none>        80/TCP           2d19h
service/catalogue-db  ClusterIP   10.100.64.93     <none>        3306/TCP         2d19h
service/front-end     NodePort    10.100.2.56      <none>        80:30001/TCP     2d19h
service/orders        ClusterIP   10.100.55.99     <none>        80/TCP           2d19h
service/orders-db     ClusterIP   10.100.69.241    <none>        27017/TCP        2d19h
service/payment       ClusterIP   10.100.218.17    <none>        80/TCP           2d19h
service/queue-master  ClusterIP   10.100.14.19     <none>        80/TCP           2d19h
service/rabbitmq      ClusterIP   10.100.10.72     <none>        5672/TCP         2d19h
service/shipping      ClusterIP   10.100.6.63      <none>        80/TCP           2d19h
service/user          ClusterIP   10.100.19.182    <none>        80/TCP           2d19h
service/user-db       ClusterIP   10.100.143.4     <none>        27017/TCP        2d19h
```

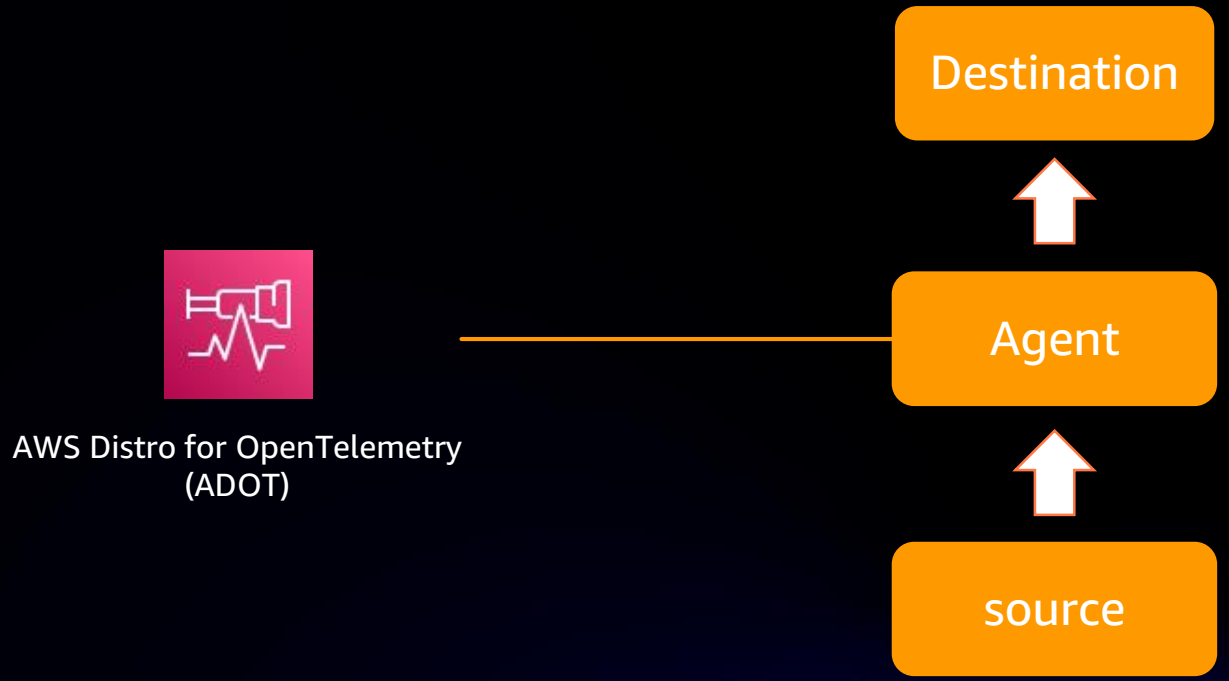




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What is observability?

- Signal types
- Telemetry



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What is observability?

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What is observability?

- Signal types
- Telemetry
- Feedback loop



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What is observability?

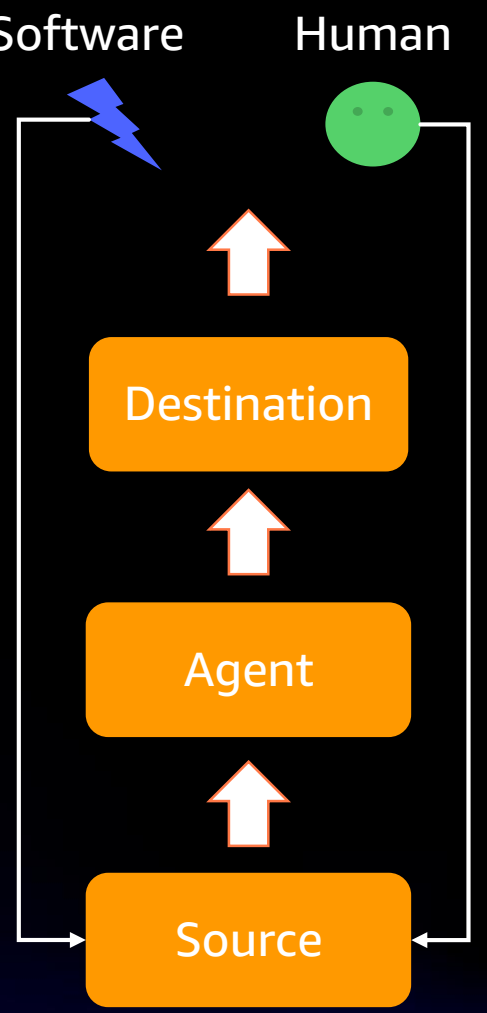
- Signal types
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What is observability?

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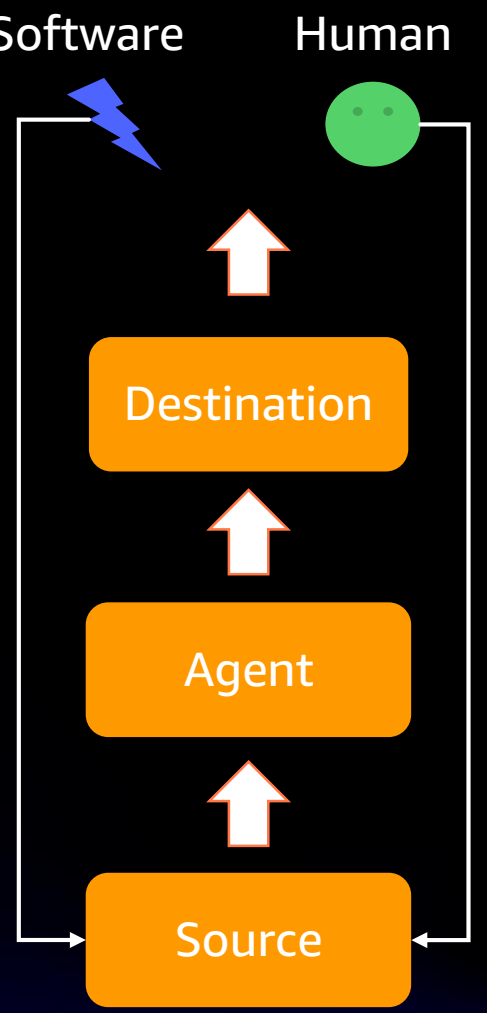


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What is observability?

. . . the capability to ***continuously*** *generate and* ***discover actionable insights*** *based on* ***signals*** *from the system under observation with the* ***goal*** *to* ***influence*** *the system*



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Observability challenges

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Top 10 observability challenges

1. Too many telemetry agents
2. Instrumentation of applications
3. Cloud-native systems have highly dynamic, small units
4. Find the right retention period per signal type and usage
5. Minimize vendor or feature lock-in

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Top 10 observability challenges

6. Buy vs. build
7. How to transition from monitoring to observability
8. Want single pane of glass for consumption
9. Signal hoarding (prune later, if at all)
10. Correlation of signals

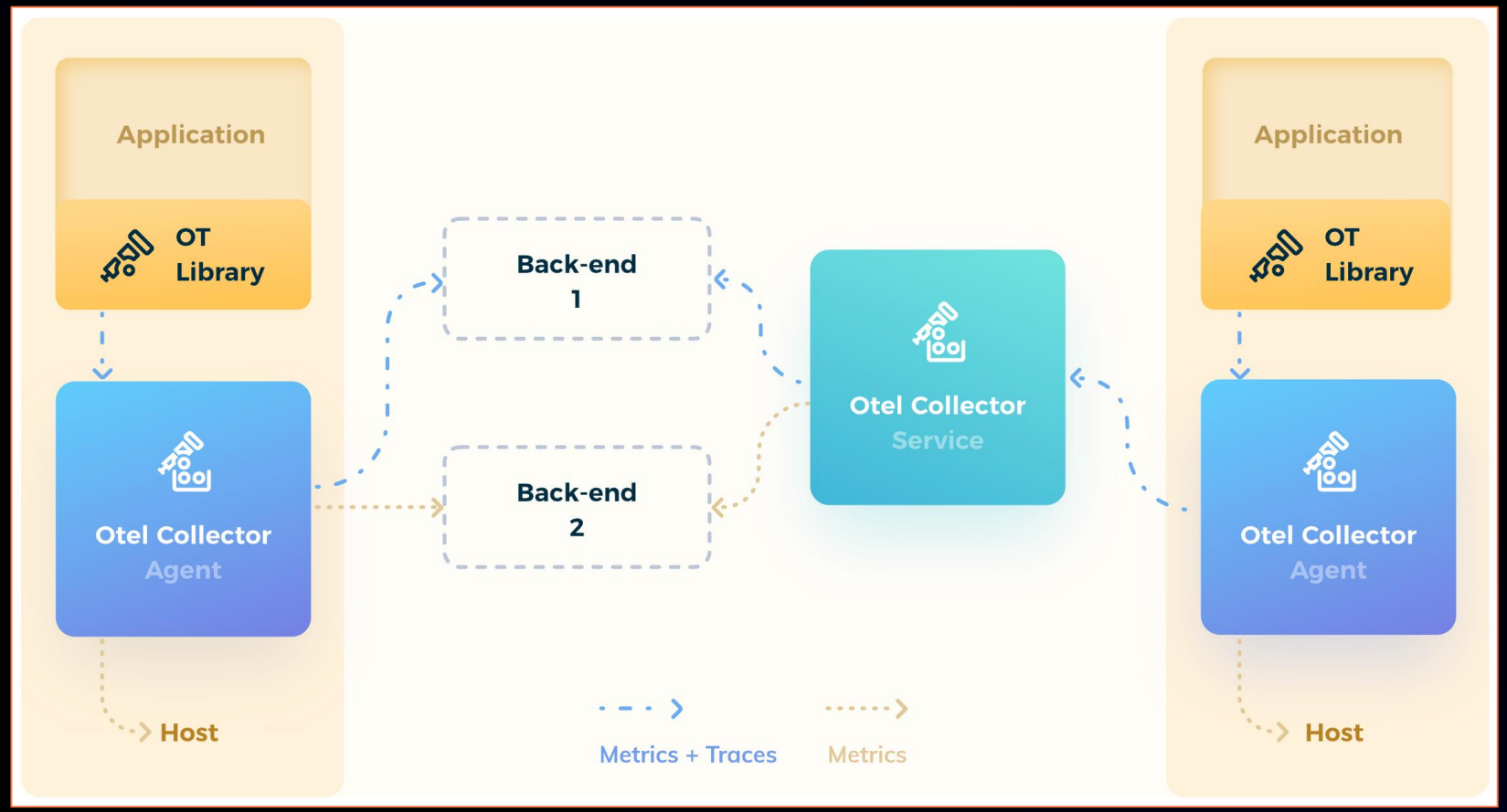
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Open-source projects and open specifications

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OpenTelemetry

opentelemetry.io



C++
A language-specific implementation of OpenTelemetry in C++.

.NET
A language-specific implementation of OpenTelemetry in .NET.

Erlang/Elixir
A language-specific implementation of OpenTelemetry in Erlang/Elixir.

Go
A language-specific implementation of OpenTelemetry in Go.

Java
A language-specific implementation of OpenTelemetry in Java.

Javascript
A language-specific implementation of OpenTelemetry in JavaScript (for Node.JS & the browser).

PHP
A language-specific implementation of OpenTelemetry in PHP.

Python
A language-specific implementation of OpenTelemetry in Python.

Ruby
A language-specific implementation of OpenTelemetry in Ruby.

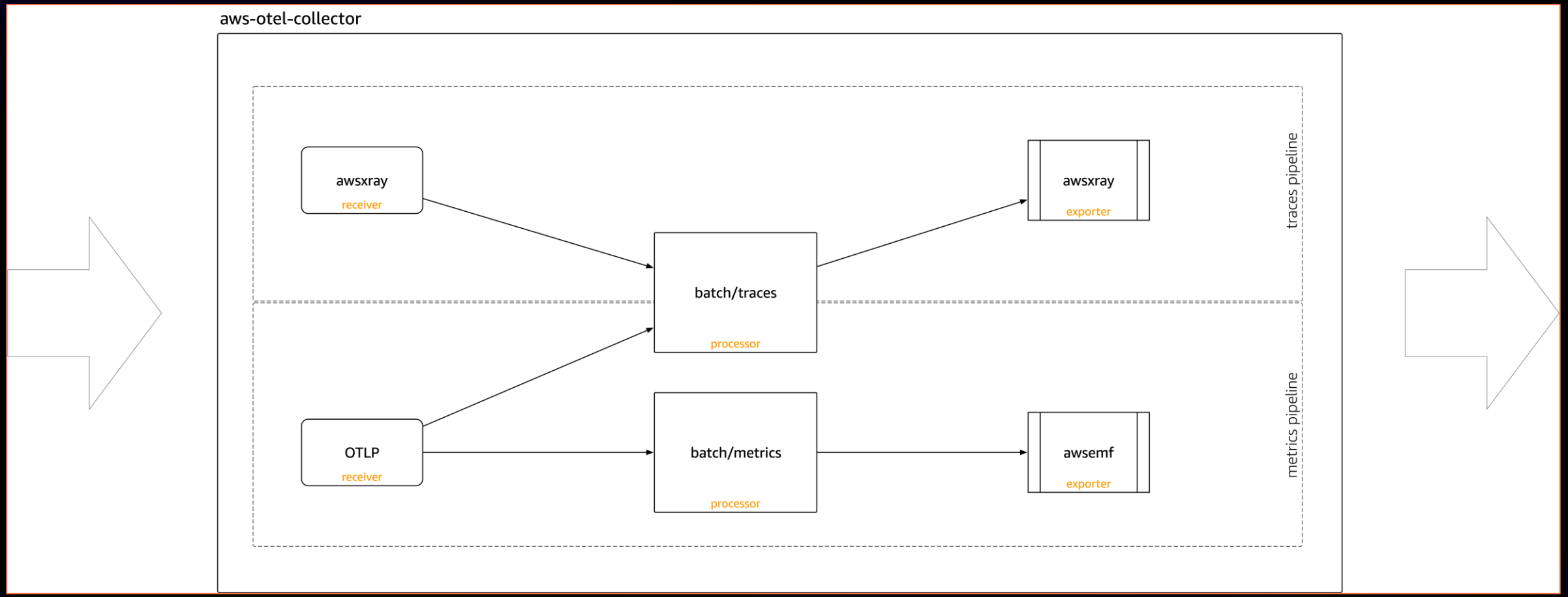
Rust
A language-specific implementation of OpenTelemetry in Rust.

Swift
A language-specific implementation of OpenTelemetry in Swift.

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OpenTelemetry collector (ADOT)



aws-otel.github.io

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Logs



opensearch.org



grafana.com/oss/loki/

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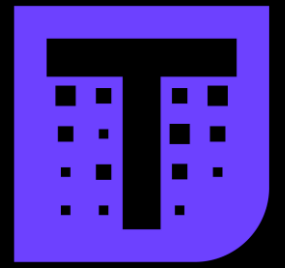
Metrics



prometheus.io



cortexmetrics.io



thanos.io

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Traces



jaegertracing.io



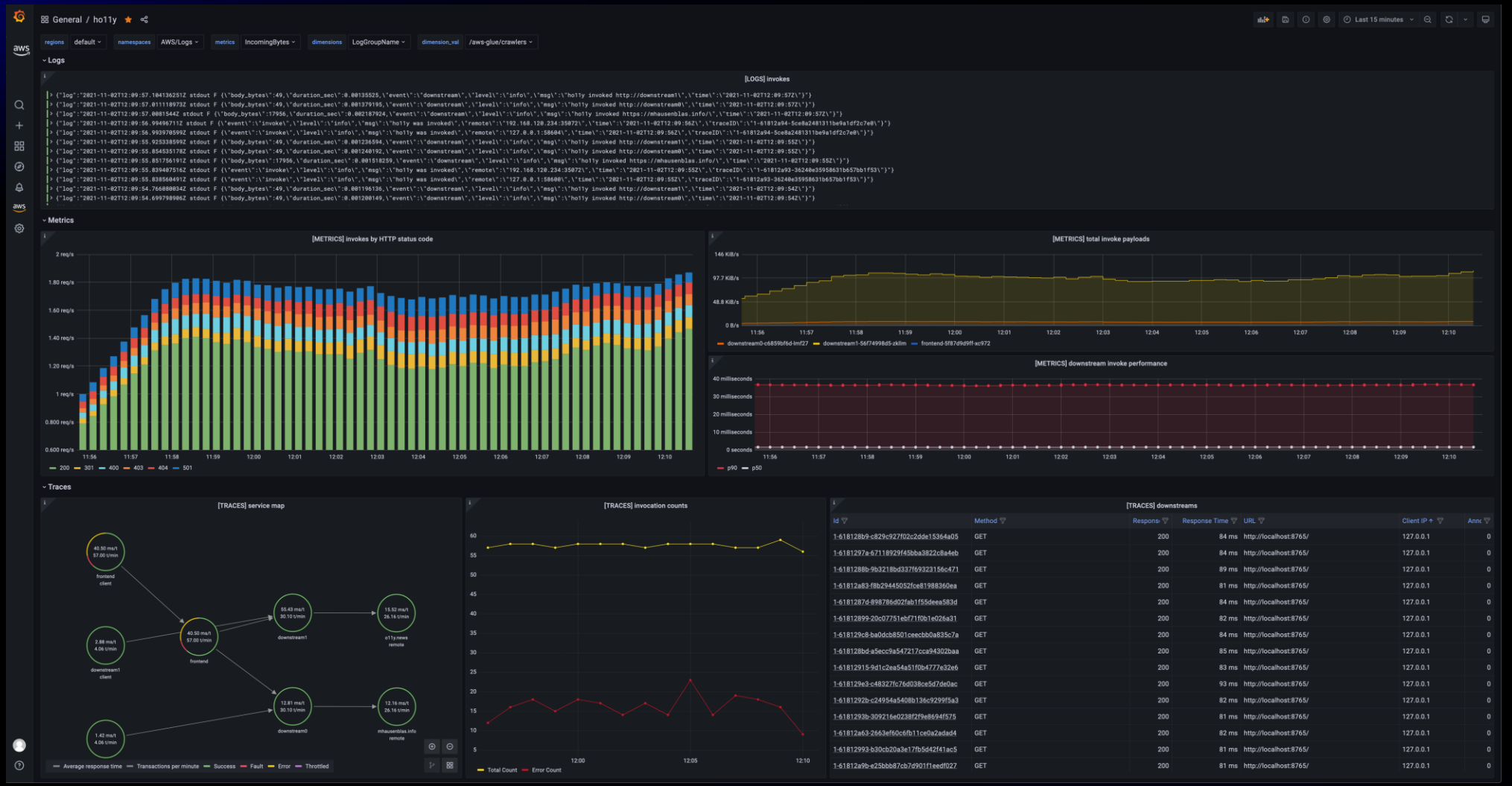
zipkin.io



parca.dev

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Amazon CloudWatch Logs

Prometheus Metrics

AWS X-Ray Traces

grafana.com/oss/grafana/

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traces: GA
metrics: Q4/2021
logs: WIP

see also logz.io/blog/dictionary-open-source-observability-projects-tools/

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How open source can help

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Good practices

- Find and use best-of-class tool for a given use case and role
- Rely on open standards such as OpenTelemetry and OpenMetrics
- Build portable observability systems (for example: on premises to cloud migration)
- Make observability investment decisions ROI-driven (buy vs. build)



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Open source and open specifications addressing the challenges

Challenge	Tooling
Agents overhead	OpenTelemetry collector
Instrumentation, lock-in	Open specifications (OTLP, OpenMetrics)
Logs from cloud-native systems	Loki, OpenSearch
Metrics from cloud-native systems	Prometheus, Cortex, Thanos
Traces from cloud-native systems	OpenTelemetry, Jaeger, Grafana
Signal hoarding	DIY (prune on ingest, RII-driven ingest)
Single pane of glass, correlation	Grafana

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Build vs. buy

AWS native services



CloudWatch Logs



CloudWatch Metrics

Open-source solutions

Managed



Amazon Managed Service for Prometheus (metrics)



Amazon Managed Grafana (metrics, logs, traces)



Amazon OpenSearch Service (logs)

Projects



Prometheus (metrics)



Grafana (metrics, logs, traces)



Jaeger (traces)



Fluent Bit (logs)



OpenSearch (logs)

Instrumentation & telemetry



AWS Distro for OpenTelemetry (ADOT)

Thank you!

Michael Hausenblas

hausenbl@amazon.com
@mhausenblas

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