
AWS
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NOV. 28 – DEC. 2, 2022 | LAS VEGAS, NV

OPN201

An introduction to open-source monitoring with AWS

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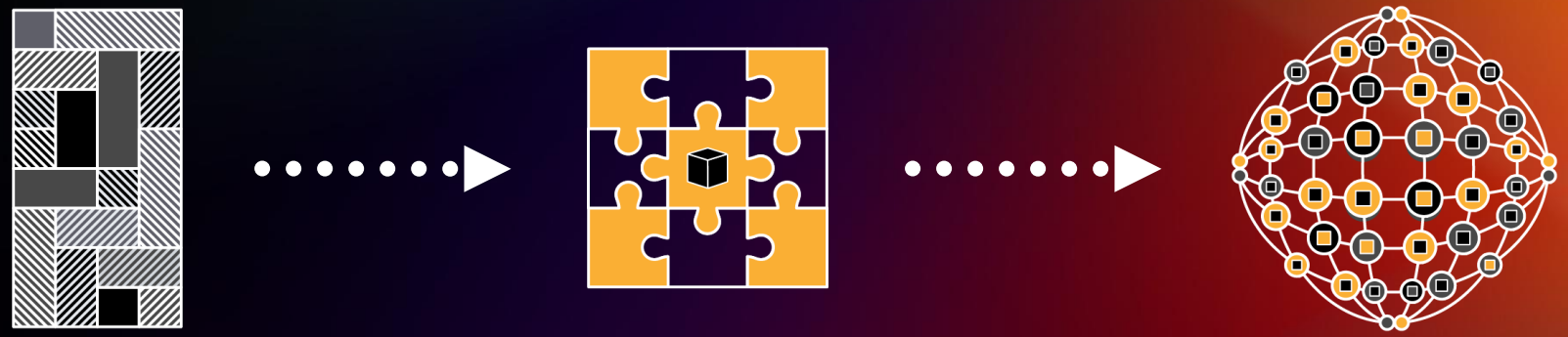
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Agenda

- What is observability?
- Observability pillars
- Maturity model
- Observability components
- Making observability tool choices
- Automating observability for Amazon EKS

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Modern application complexity



Monolithic application

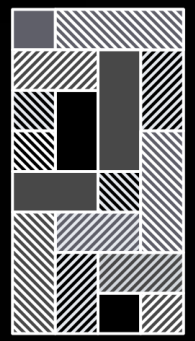
Services

Microservices

aws

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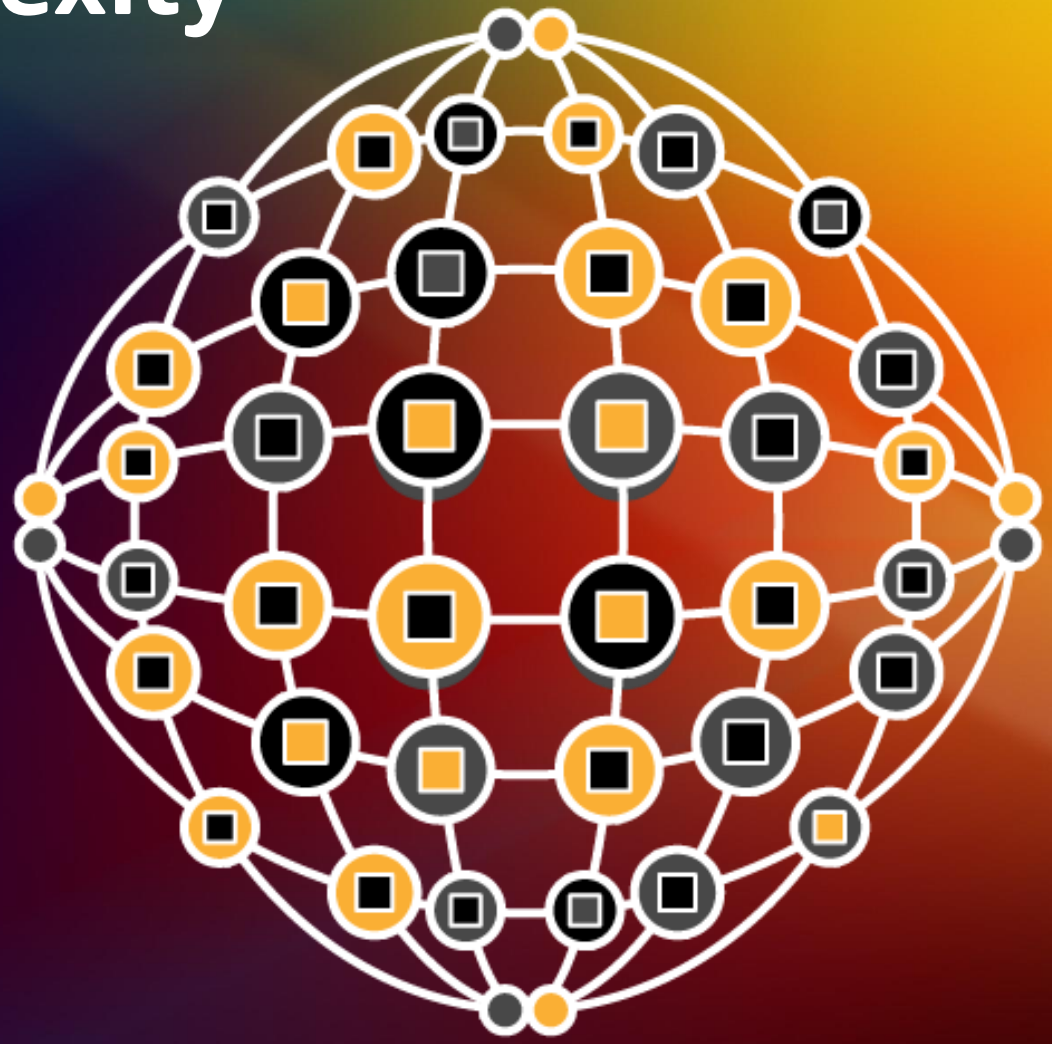
Modern application complexity



Monolithic application



Services

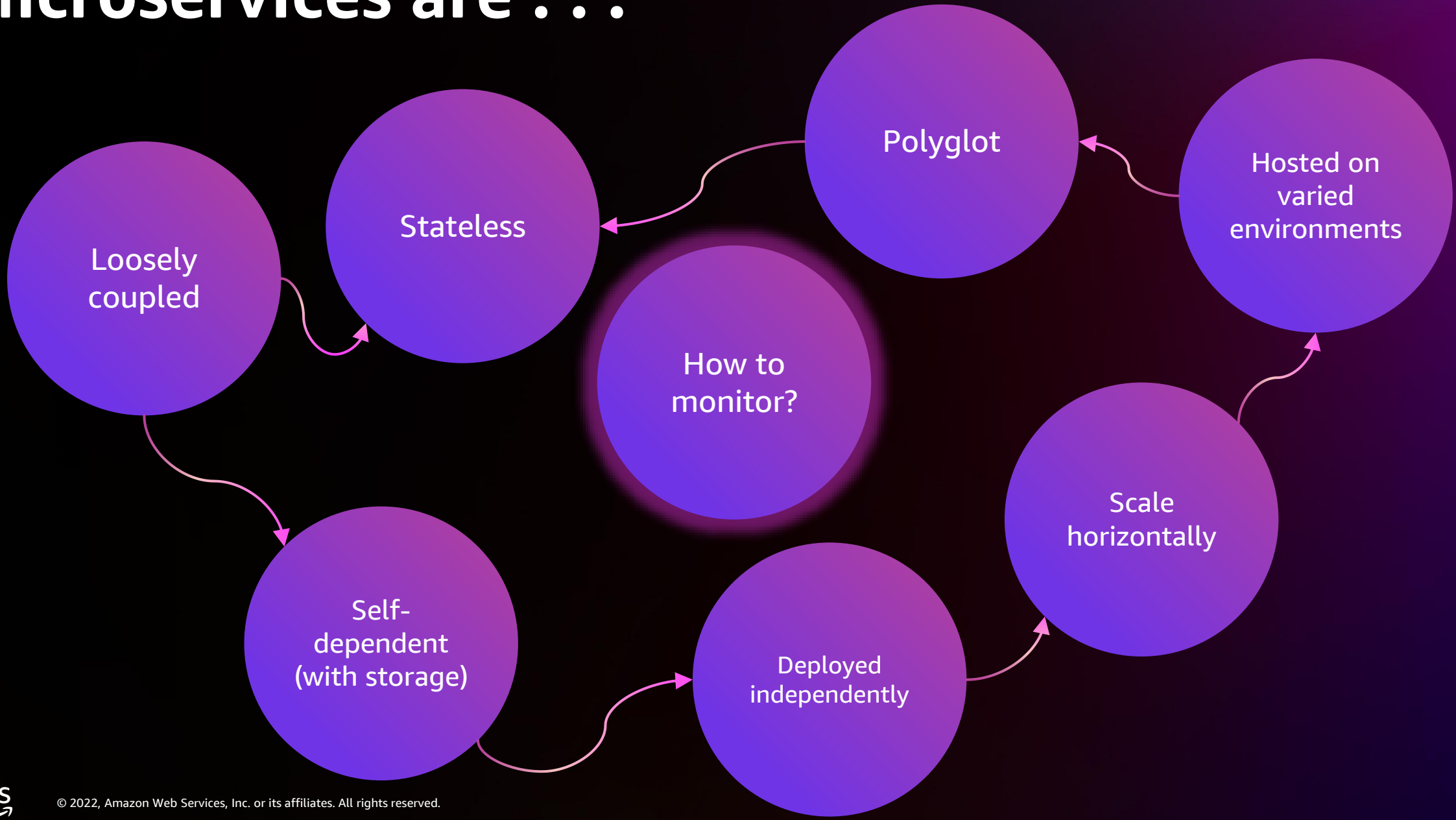


Microservices

aws

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Microservices are . . .



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“Everything fails, all the time.”

Dr. Werner Vogels

VP and CTO, Amazon.com

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Observability

Observability is a measure of how well internal states of a system can be inferred from knowledge of its external outputs

In control theory, the observability and controllability of a linear system are mathematical duals



The concept of observability was introduced by the Hungarian American engineer Rudolf E. Kálmán for linear dynamic systems

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Observability in software

In software systems, observability is the ability to collect, correlate, and analyze data about program execution, internal states of modules, and communication between components

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Observability matters because of . . .



Visibility



Real-time troubleshooting



Customer experience



Applications = $



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The question is . . .

How do we **make** applications **observable**?

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Observability signals

Metrics

Logs

Traces

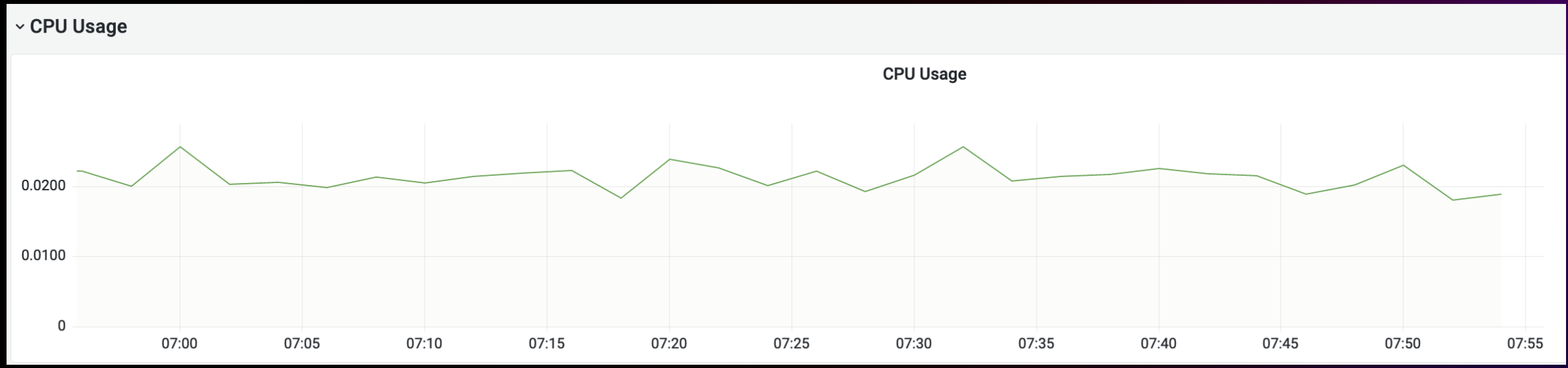
Profiles

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Metrics

Time series measurement of system performance, health, or business data over a period

Typically visualized on graphical charts for human consumption



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Logs

Textual data captured from applications indicating an event happened at that time

Log events are queried to perform deep analysis or troubleshooting

[eCommerce] Orders

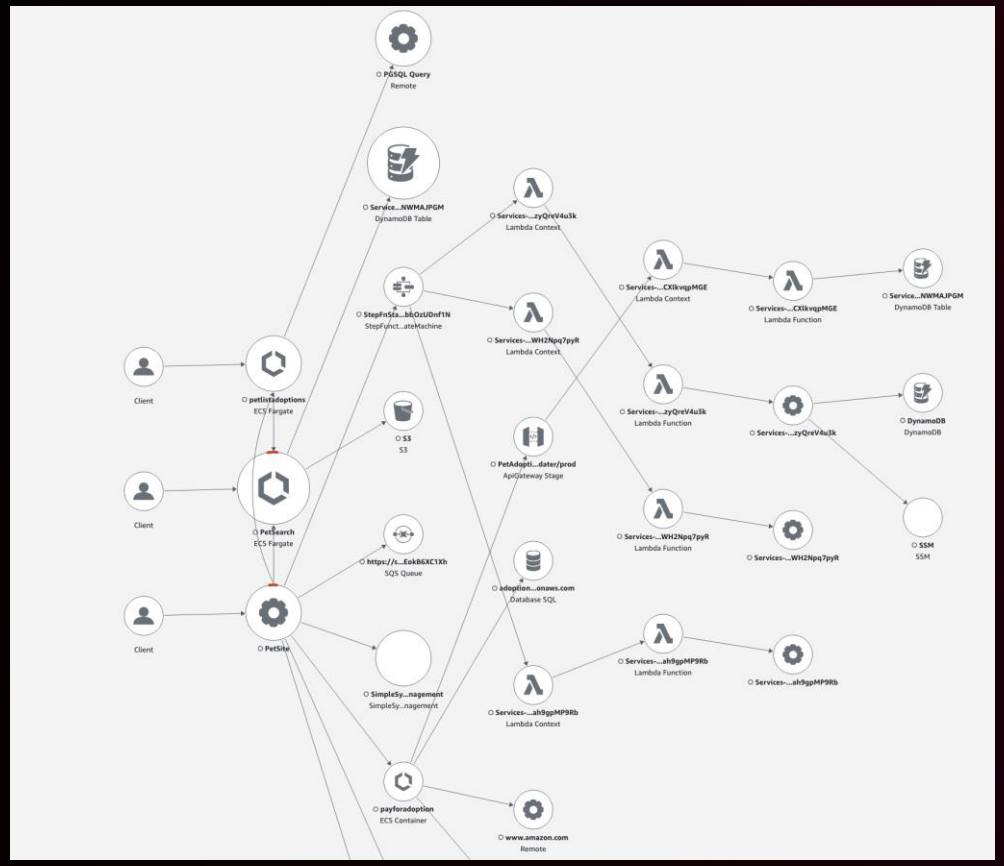
1–50 of 1034

Time	category	sku	taxful_total_price	total_quantity
Oct 14, 2022 @ 10:57:07.000	Women's Clothing	ZO0060600606, ZO0052600526	$49.98	2
Oct 14, 2022 @ 10:47:02.000	Women's Shoes	ZO0371303713, ZO0030600306	$66.98	2
Oct 14, 2022 @ 10:38:24.000	Men's Clothing	ZO0583405834, ZO0458504585	$45.98	2
Oct 14, 2022 @ 10:19:41.000	Women's Clothing	ZO0265702657, ZO0706107061	$49.98	2
Oct 14, 2022 @ 10:13:12.000	Men's Clothing	ZO0130201302	$6.99	1
Oct 14, 2022 @ 10:03:50.000	Women's Clothing, Women's Shoes	ZO0032600326, ZO0014000140	$49.98	2
Oct 14, 2022 @ 09:56:38.000	Women's Shoes, Women's Clothing	ZO0019900199, ZO0643606436	$52.98	2
Oct 14, 2022 @ 09:49:26.000	Men's Shoes, Men's Clothing	ZO0690206902, ZO0297302973, ZO0565905659, ZO0621806218	$153.96	4
Oct 14, 2022 @ 09:43:41.000	Women's Shoes	ZO0019300193, ZO0367503675	$79.98	2
Oct 14, 2022 @ 09:43:41.000	Men's Accessories, Men's Clothing	ZO0467104671, ZO0424404244, ZO0571305713, ZO0274602746	$223.96	4
Oct 14, 2022 @ 09:37:55.000	Women's Shoes	ZO0367603676, ZO0704407044	$154.98	2

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Traces

A record of the end-to-end journey of user requests, from the user-interface through the entire distributed system and back to the user

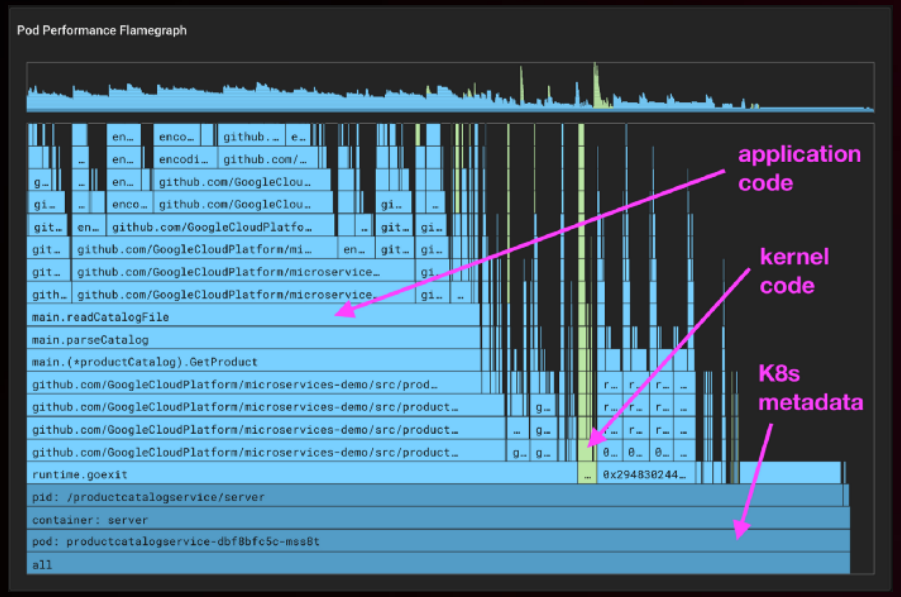


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Profiles/continuous profiling

Analyzing application code complexity dynamically by tracking function calls, resource utilization, errors, etc.

The core idea of continuous profiling is to capture CPU, memory, I/O, and networking usage over time, connecting it with the code base in a manner so that it’s possible to directly locate a certain line of source code



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Putting all of these together

Signal type	Information collected (examples)	Context
Metrics	Resource utilization	Are my resources optimally allocated?
Logs	Business context, web traffic	Is my server healthy?
Traces	Service fault, latency	Which of my services is slow?
Profiles	Function calls, code execution	What line of code is causing issues? Is there a memory leak?

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Whose responsibility is “observability”?

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The core responsibility lies with the developers



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Instrumentation is key

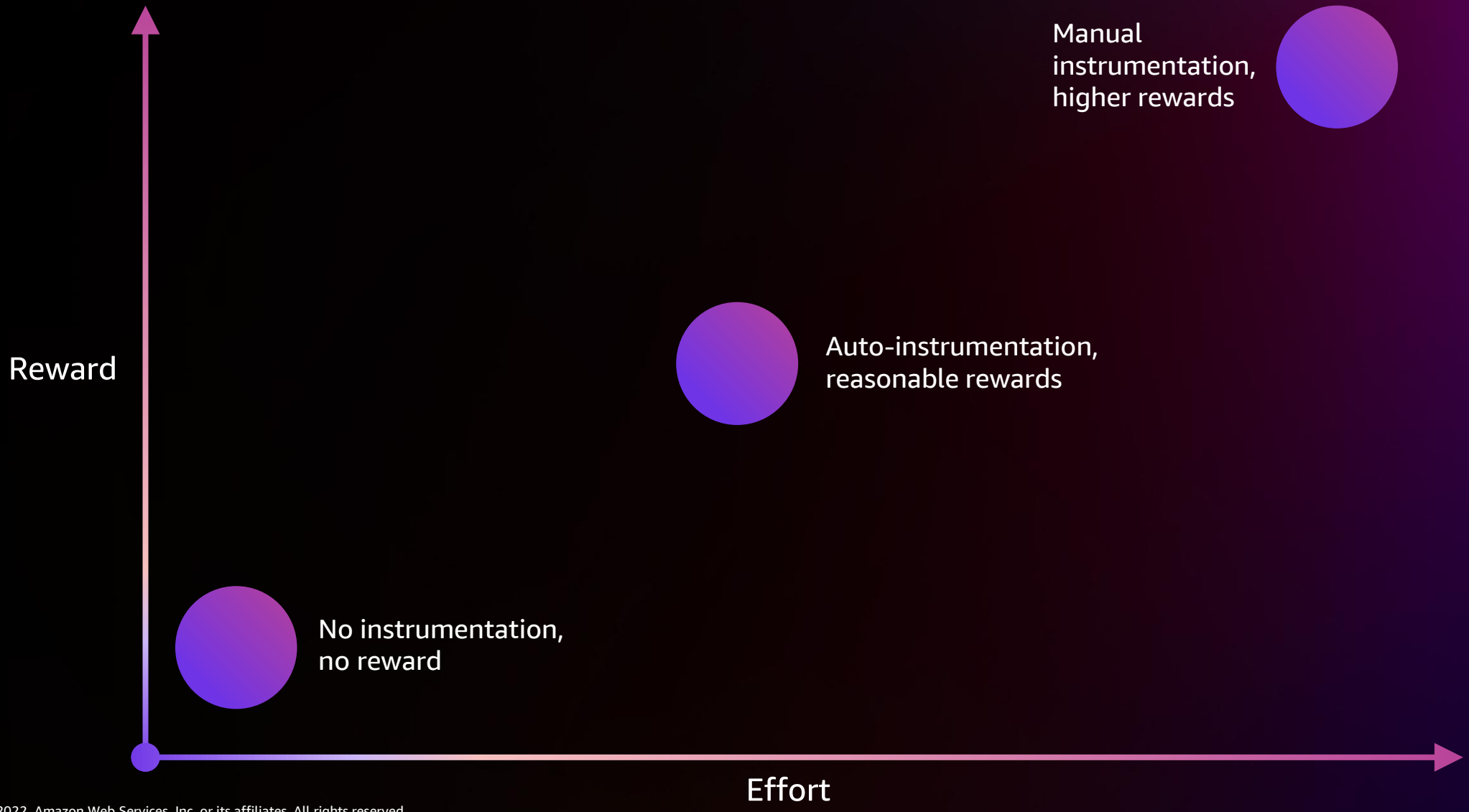
- Be intentional in instrumenting your applications
- Use the right SDKs, agents, and targets to collect information
- Enrich signals through metadata from resources

  Example – Amazon EKS cluster name, application name, node IP
- Propagate context across signals to enable correlation of data in order to reduce the mean time to identification (MTTI)

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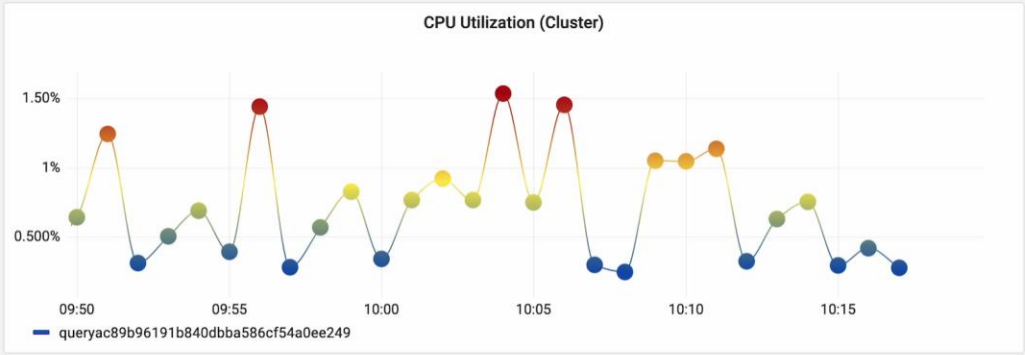
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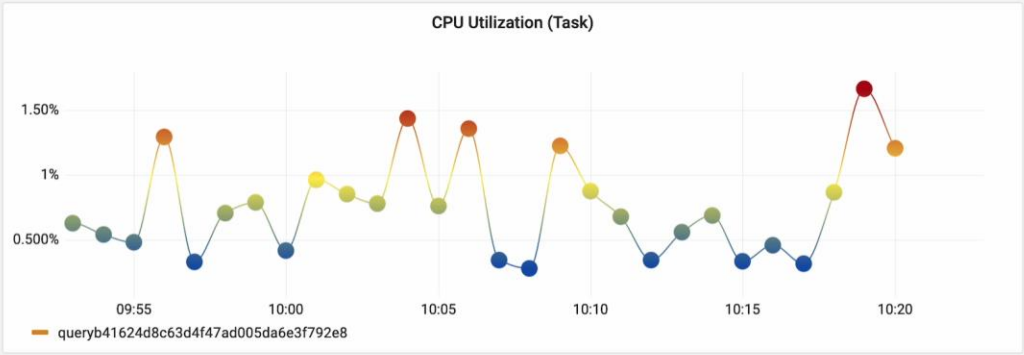
Instrumentation choice

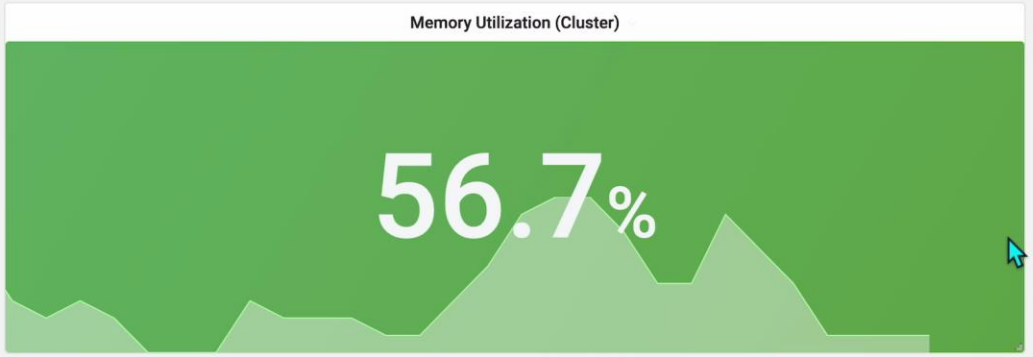


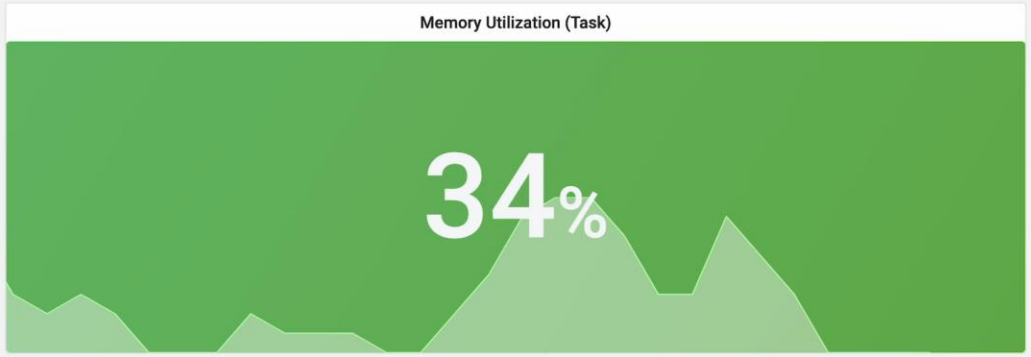
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Last 30 minutes









Log events from PetListAdoptions service


```
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> GET /api/adoptionlist/ HTTP/1.1 11.0.123.182:50092 200
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> GET /api/adoptionlist/ HTTP/1.1 11.0.123.182:50106 200
```

Popular open-source options to collect signals















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OpenTelemetry (OTel)

CHALLENGE

Increasing management and cost overhead

Increased time to resolve issues as metrics

SOLUTION

Standardized open-source APIs, SDKs, and agents

Correlate metrics and traces at ingestion, along with contextual information, reducing time to resolution

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OpenTelemetry provides...

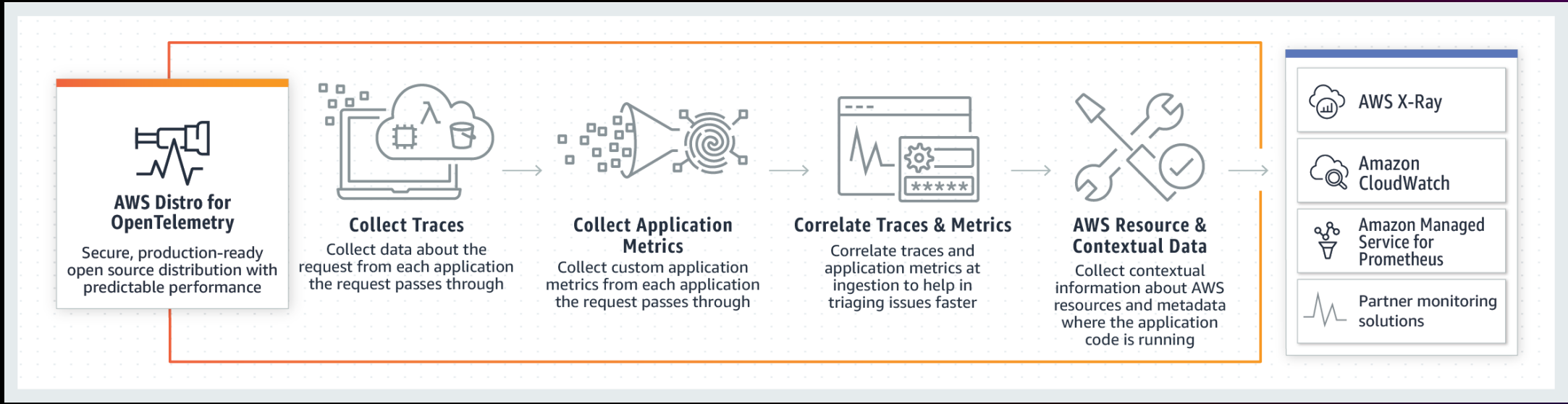
- Single binary to collect all signals
- Support for a variety of open-source and commercial protocols
- Collector binary that can be deployed in a variety of ways
- Vendor-agnostic instrumentation
- Support for multiple context propagation formats
- Ability to send data to multiple destinations in parallel

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AWS Distro for OpenTelemetry

AWS Distro for OpenTelemetry is a secure, production-ready, AWS-supported distribution of the OpenTelemetry project



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Handling metrics

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Prometheus



Dimensional data



Powerful queries



Rich visualization options



Efficient Storage



Precise alerting

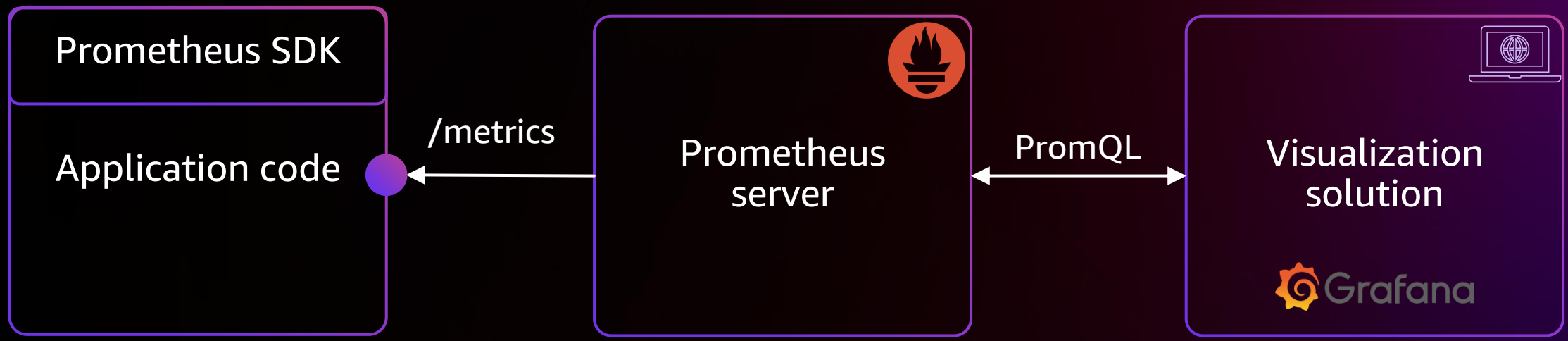


Integrations

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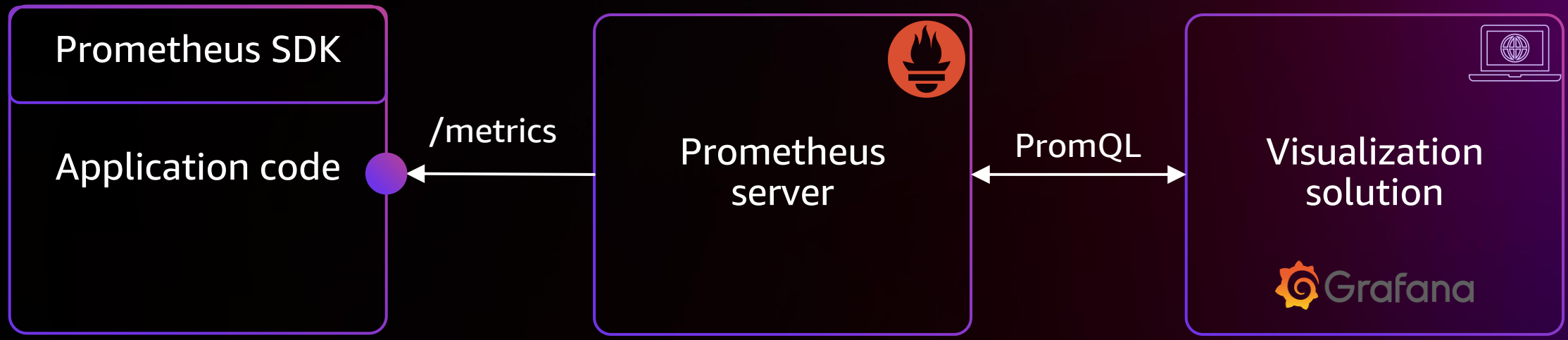
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How Prometheus works



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How Prometheus works



Autoscaling issues
Storage challenges
Query performance
Single point of failure
Risk of losing data

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Prometheus long-term storage options

- CNCF projects
- Provides long term storage for Prometheus metrics
- Supports very large-scale deployments
- Multi-tenant
- PromQL-compatible
- Alerts
- Prometheus rules
- Fast query response through caching



Cortex

Thanos

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Amazon Managed Service for Prometheus



HIGHLY AVAILABLE, SECURE, AND MANAGED METRIC MONITORING

A serverless Prometheus-compatible monitoring service for metrics to securely monitor container environments at scale

Fully managed, secure, and highly available using multi-AZ deployments

Use the same open-source Prometheus data model and query language as they do today to monitor the performance of their containerized workloads

No up-front investments required to use the service, and customers only pay for the number of metrics ingested

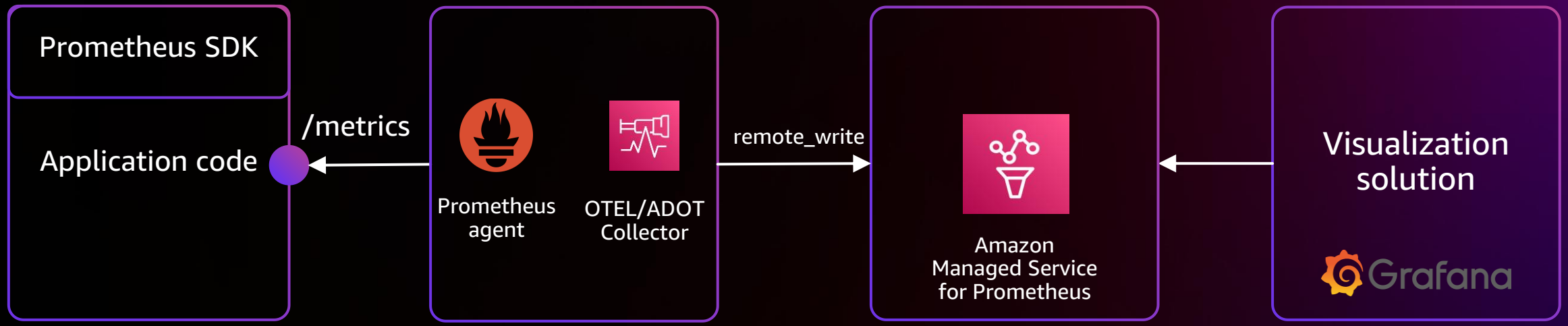
Improved scalability, availability, and security without having to manage the underlying infrastructure



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Amazon Managed Service for Prometheus setup



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AWS Distro for OpenTelemetry collector

RECEIVERS	PROCESSORS	EXPORTERS	EXTENSIONS
prometheusreceiver	attributesprocessor	awsxrayexporter	healthcheckextension
otlpreceiver	resourceprocessor	awsemfexporter	pprofextension
awsecscontainermetricsreceiver	batchprocessor	prometheusremotewriteexporter	zpagesextension
awsxrayreceiver	memorylimiterprocessor	loggingexporter	ecsobserver
statsdreceiver	probabilisticsamplerprocessor	otlpexporter	awsproxy
zipkinreceiver	metricstransformprocessor	fileexporter	ballastextention
jaegerreceiver	spanprocessor	otlphttpexporter	sigv4authextension
awscontainerinsightreceiver	filterprocessor	prometheusexporter	
	resourcedetectionprocessor	datadogexporter	
	metricsgenerationprocessor	dynatraceexporter	
	cumulativetodeltaprocessor	sapmexporter	
	deltatorateprocessor	signalfxexporter	
		logzioexporter	



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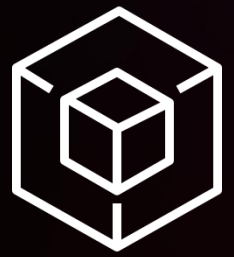
Handling traces

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Jaeger



Open source and community-driven



Instrumentation library supporting OpenTelemetry



User interface to analyze trace data



Out-of-the-box sampling strategy



Storing trace data

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OpenTelemetry & Jaeger

- Wide programming language support
- Ability to correlate context across signals
- Ability to send signal data to destination of choice
- Use a managed tracing solution, allowing you to be free of the need to manage infrastructure

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Handling profile data

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Pixie

kubernetes

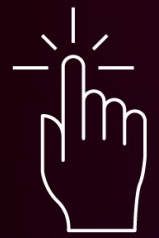
Integrated with Kubernetes

eBPF

Requires no manual instrumentation



Customize data capture through scripts



Simple to deploy with auto-instrumentation support

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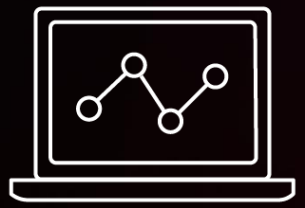
Handling logs

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OpenSearch Service and OpenSearch Service dashboards



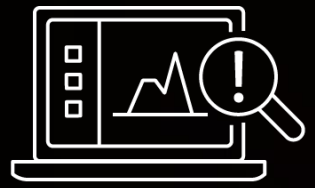
Open source and community-driven



Powerful visualization using Dashboards



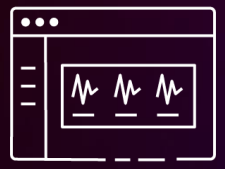
Valuable querying options and a powerful search engine



Anomaly detection and alert plugins



Ingest and secure data through enhanced access control policies



Data correlation abilities

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Amazon OpenSearch Service



Managed service that makes it easy to **deploy**, **operate**, and **scale OpenSearch Service** and legacy Elasticsearch clusters in the AWS Cloud

Built-in observability tooling, such as **trace analytics**, **event analytics**, and **log analytics** to gain insights from logs, metrics, and traces

Anomaly detection features to **detect abnormal events** and built-in alerting

Native integration with **Amazon Kinesis Data Firehose**, **Amazon CloudWatch Logs**, and other tooling



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Visualizing telemetry signals

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Grafana

- Grafana is a popular **community-driven**, **open-source** analytics platform that enables you to query, visualize, alert, and understand your **metrics**, logs, and traces no matter where they are stored
- Third-party enterprise **data source plugins** that give you access to different sources like MongoDB, Dynatrace, ServiceNow, and others
- Ability to **visually define alert rules for import metrics** and send to destinations like Slack, PagerDuty, and OpsGenie
- Split views to compare different time ranges for comparison and query data sources side by side





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Amazon Managed Grafana



Scalable, secure, highly available, and fully managed Grafana service

Automatic scaling, helps offloads operational management

Analyze, monitor, and alarm across multiple data sources; native AWS and third party

Native integration with multiple AWS services for enterprise-ready security

Access to Grafana Enterprise data source via AWS Marketplace directly from the console

Simple pay-as-you-go AWS billing



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AWS observability options

Observability

AWS native services

Amazon CloudWatch ServiceLens

Container Insights | AWS Lambda Insights | Contributor Insights | Application Insights

Synthetics | Dashboards | Alarms | RUM

Metrics | Logs | AWS X-Ray

Open-source managed services

Amazon Managed Grafana

Do it yourself (DIY) – AWS OSS solutions

Amazon OpenSearch Service | Amazon Managed Service for Prometheus | Jaeger and Zipkin tracing

Insights and ML

CloudWatch agent | AWS X-Ray agent | Collectors and SDKs | AWS Distro for OpenTelemetry

Instrumentation

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But . . .

How do we **select** the right **observability tool**?

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How are customers adopting observability tools?

Some will start with a tool (because they are comfortable using it) and won't care about what's underneath (platform)

"I am going to use OpenTelemetry because I love the simplicity (auto instrumentation)."

Others will make a strategic decision underneath (platform) and optionally work backwards to find a proper provisioner(s)

"I have opted to use EKS, but I need to find an easy way for my devs to instrument and store signals (EKS managed add-on for ADOT and Amazon Managed Service for Prometheus seem to fit the bill)"

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AWS customers are broad and diverse

- AWS serves millions of customers and organizations of various sizes
- They are on to solving varied problems in different industries and domains
- They want to optimize their workloads to achieve different goals
  - Simplicity (because they are not an operations powerhouse)
  - Flexibility (because they have unique requirements)
  - Agility (because for them, speed is everything)
  - Hybridity (because they have regulatory requirements)
  - . . . and more
- There is no “one observability solution” that can serve them all

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Dimensions

How can we describe products in a way that can help segment them?

Products can be scored against these dimensions

- Workload types (Is the product flexible in the type of workloads it supports?)
- Capacity (What type of infrastructure capacity does the product support?)
- Ease of consumption (Are the product's abstractions easy to understand/consume for a developer?)
- Ease of operations (Is the product easy to operate? Is the lifting on the customer or on AWS?)
- Extensibility (Is the product extensible and configurable to a customer's one-time needs?)
- Hybrid support (Can the product be used in a hybrid scenario?)
- Ecosystem (Is the product backed by a strong ecosystem?)
- Scalability (Does the product scale with demand?)

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Making the observability choices

Telemetry signals

- [x] Metrics
- [ ] Logs
- [x] Traces

Platform

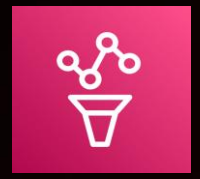
- [ ] Amazon EC2
- [x] Amazon EKS
- [ ] Serverless
- [ ] Edge

Operational model

- [ ] Better Control
- [x] Easy Operations



AWS Distro for OpenTelemetry



Amazon Managed Service for Prometheus



Amazon Managed Grafana

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AWS Observability Accelerator

A TERRAFORM-BASED OPINIONATED SET OF EXAMPLES THAT ALLOW YOU TO CONFIGURE YOUR ENVIRONMENT TO SET UP MONITORING EASILY



1. Deploy OpenTelemetry Operator
2. Set up AWS Certificate Manager
3. Deploy the ADOT collector
4. Create Amazon Managed Service for Prometheus workspace
5. Create recording and alert rules
6. Deploy Grafana dashboards

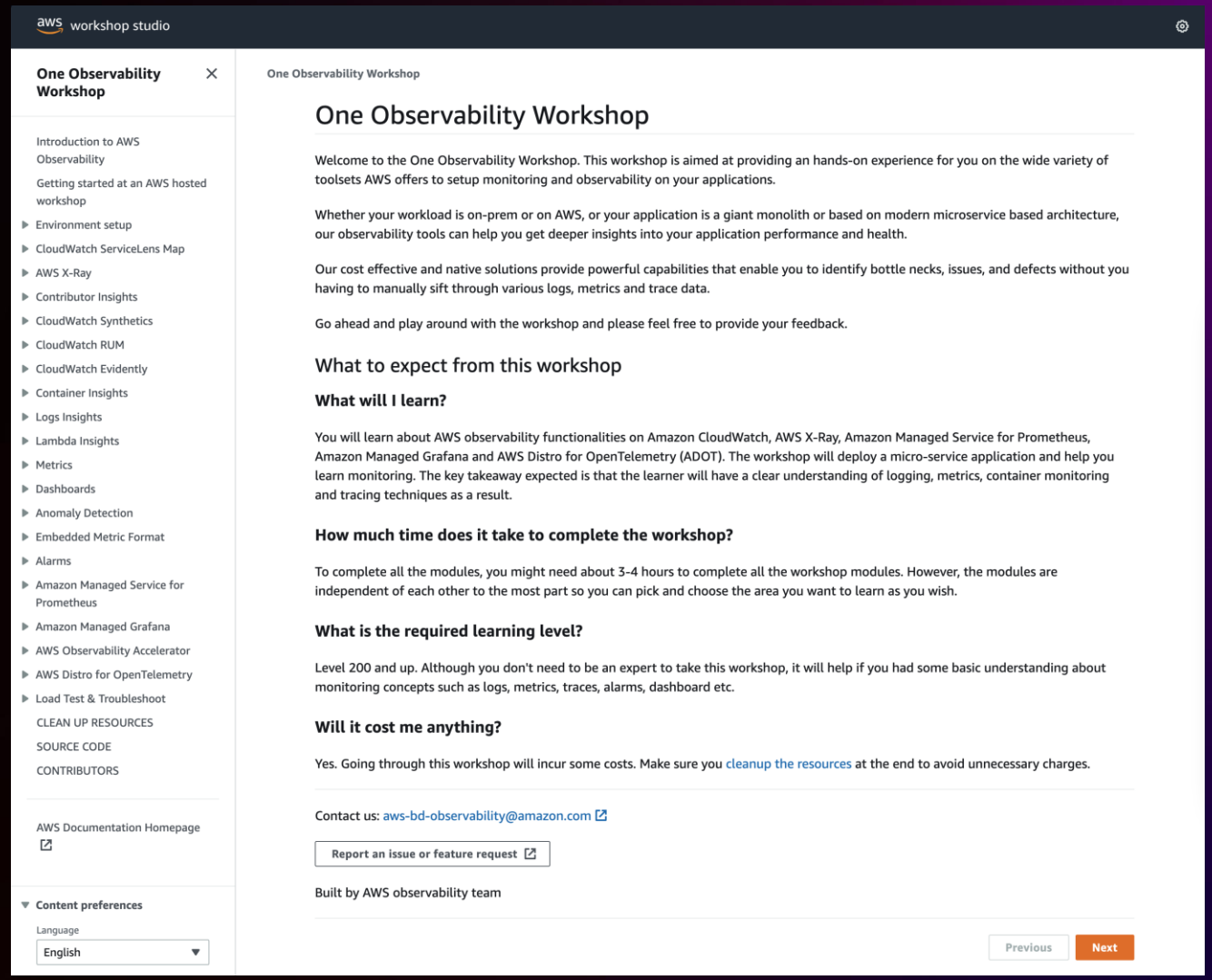
https://github.com/aws-observability/terraform-aws-observability-accelerator

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AWS Observability workshop

HANDS-ON EXPERIENCE WITH AWS OBSERVABILITY SERVICES

https://observability.workshop.aws



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Other sessions on this topic

- COP309 – Accelerate AWS observability for your containers on Tuesday (11/29) (Hands-on workshop)
- COP343 – Observability best practices at Amazon - Wednesday (11/30) (Breakout session)
- COP339 – AWS open-source observability for monitoring Amazon ECS on Wednesday (11/30) (Hands-on builders' session)
- COP308 – Hands-on experience with AWS observability services on Wednesday (11/30) (Hands-on workshop)
- BOA310 – Building observable applications with OpenTelemetry on Thursday (11/30) (Breakout session)
- COP341-R – Get to know your application with OpenTelemetry and AWS X-Ray Friday (12/02) (Hands-on builders' session)

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Thank you!

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