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Monitoring and Observability for Modernized Applications

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Agenda

- Observability Best Practices
- AWS Observability Tools
- Open Source Observability Tools

What is Observability?

A measure of how well we can understand a system from the work it does

"90% of the methods in this service complete in under 200 milliseconds

"This API is handling 203HTTP requests per second"

"CPU utilization for this service is at 85%"

Observability matters because …

Visibility

Real-time troubleshooting

Customer experience

Applications = $$

Operational → **Business**

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What is Instrumentation?

"Calls to this database took, on average, took 50 milliseconds"

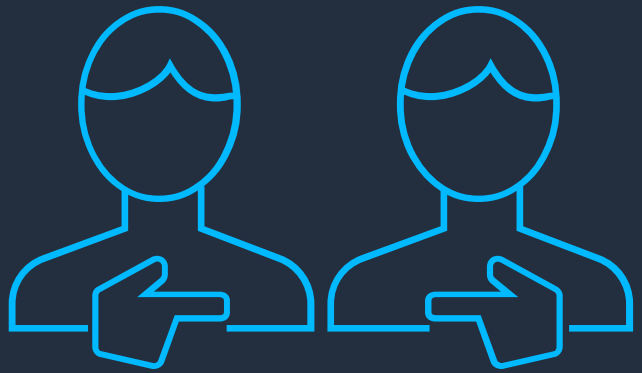
Instrumentation: measuring events in software using code
(a type of white-box monitoring)

Good data can help with the technical shift to new systems

Technical

- Improved debugging and troubleshooting
- Designs validated with data
- Reduced defects; more issues caught proactively
- Improved feature velocity

Good data can help with the cultural shift to new systems



Cultural

- Builds transparency across teams
- Shared understanding of complex components
- Decisions not (entirely) driven or explained by gut feelings or guessing
- Freedom to experiment
- Blameless culture
- Context not control

But...

How do we make
microservices and serverless functions
observable?

#1: Observable systems should emit events: Metrics, logs, and traces

Logs

"The database won't start after the update"

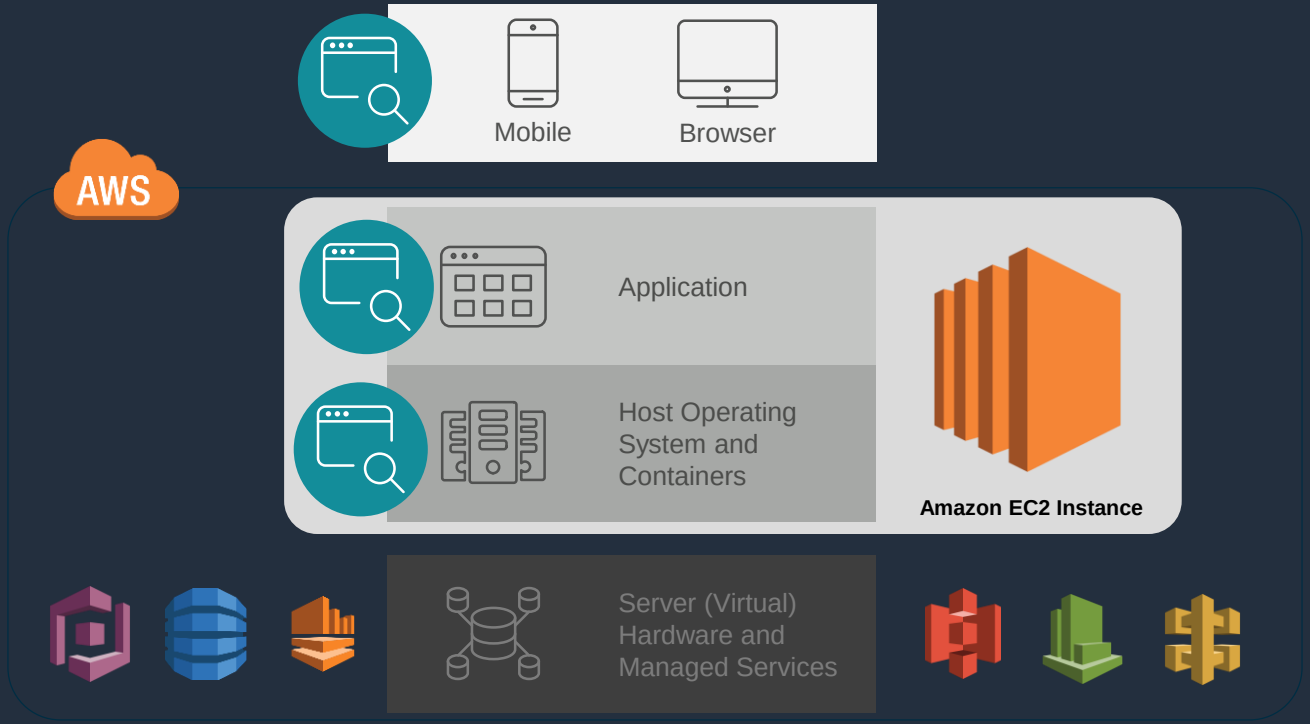
Metrics

"Our application is 35% slower than last week after this configuration change"

Traces

"What are the dependencies for this service?"

#2: All components should be instrumented



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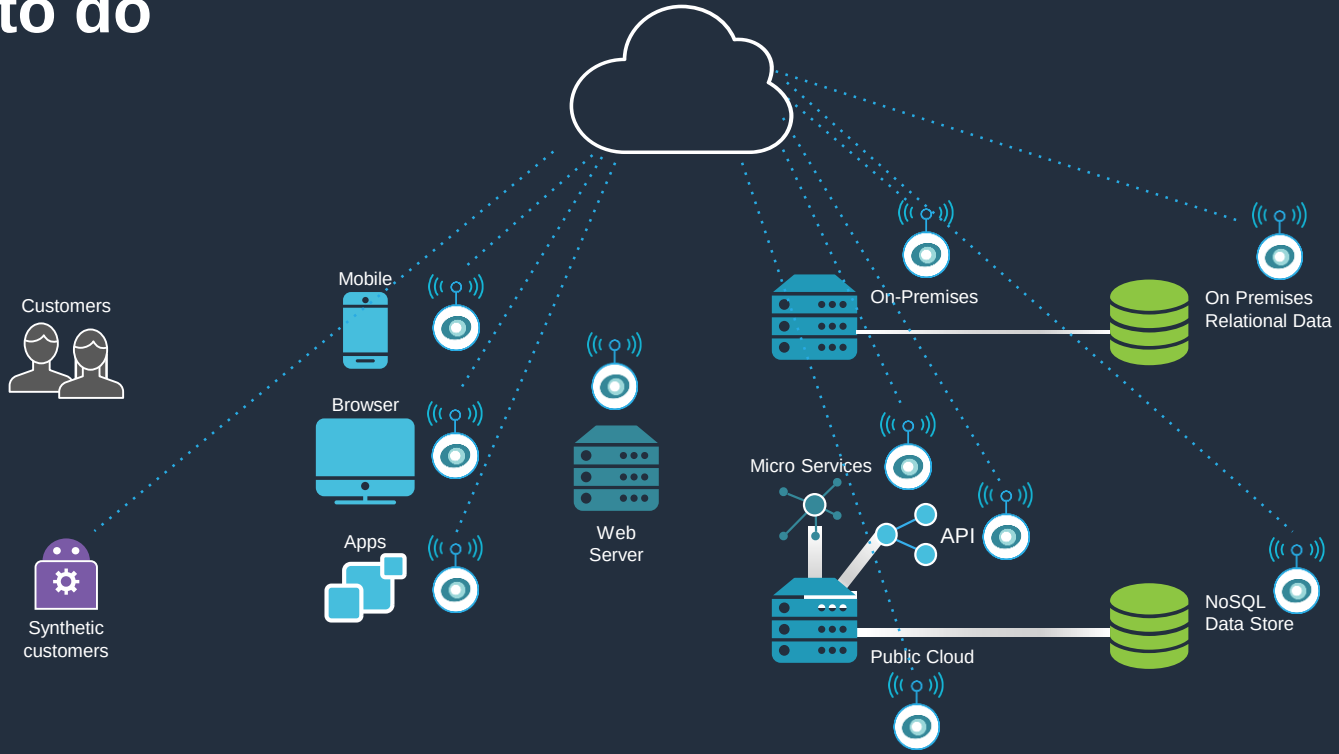
#3: Instrumentation should not be opt-in, manual, or hard to do



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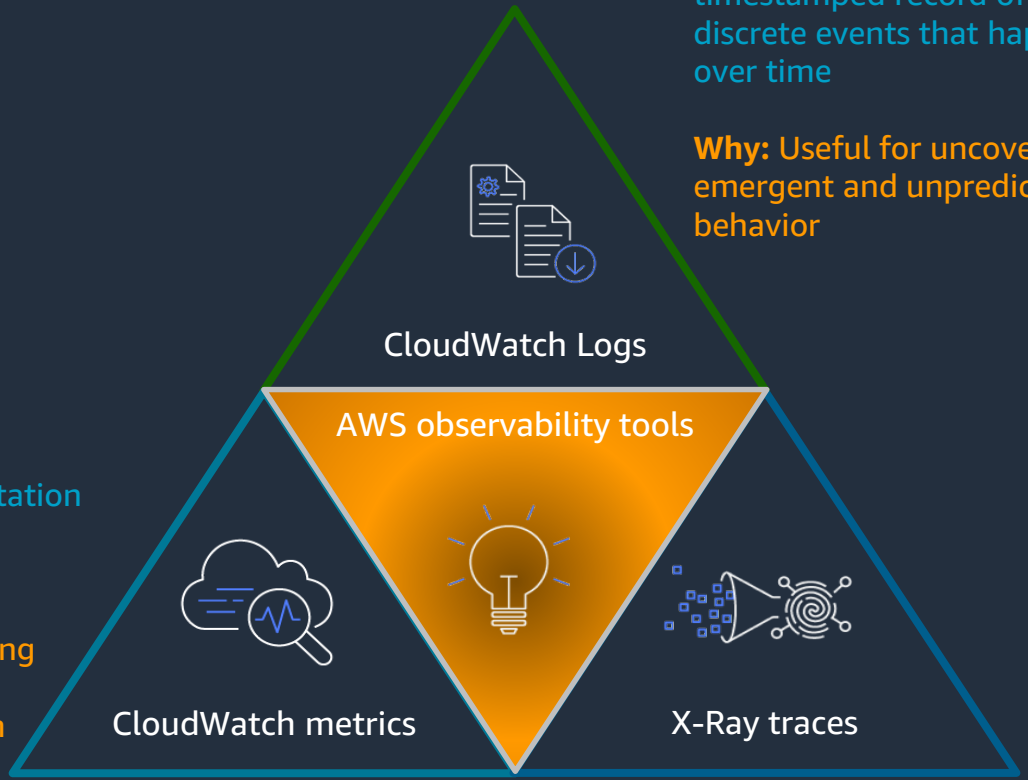
AWS Observability tools

What: Immutable, timestamped record of discrete events that happened over time

Why: Useful for uncovering emergent and unpredictable behavior



What: Numeric representation of data measured over intervals of time

Why: Useful for identifying trends, mathematical modeling, and prediction

What: Representation of a series of related distributed events that encode the end-to-end request flow through a distributed system

Why: Provides visibility into both the path traversed by a request as well as the structure of a request

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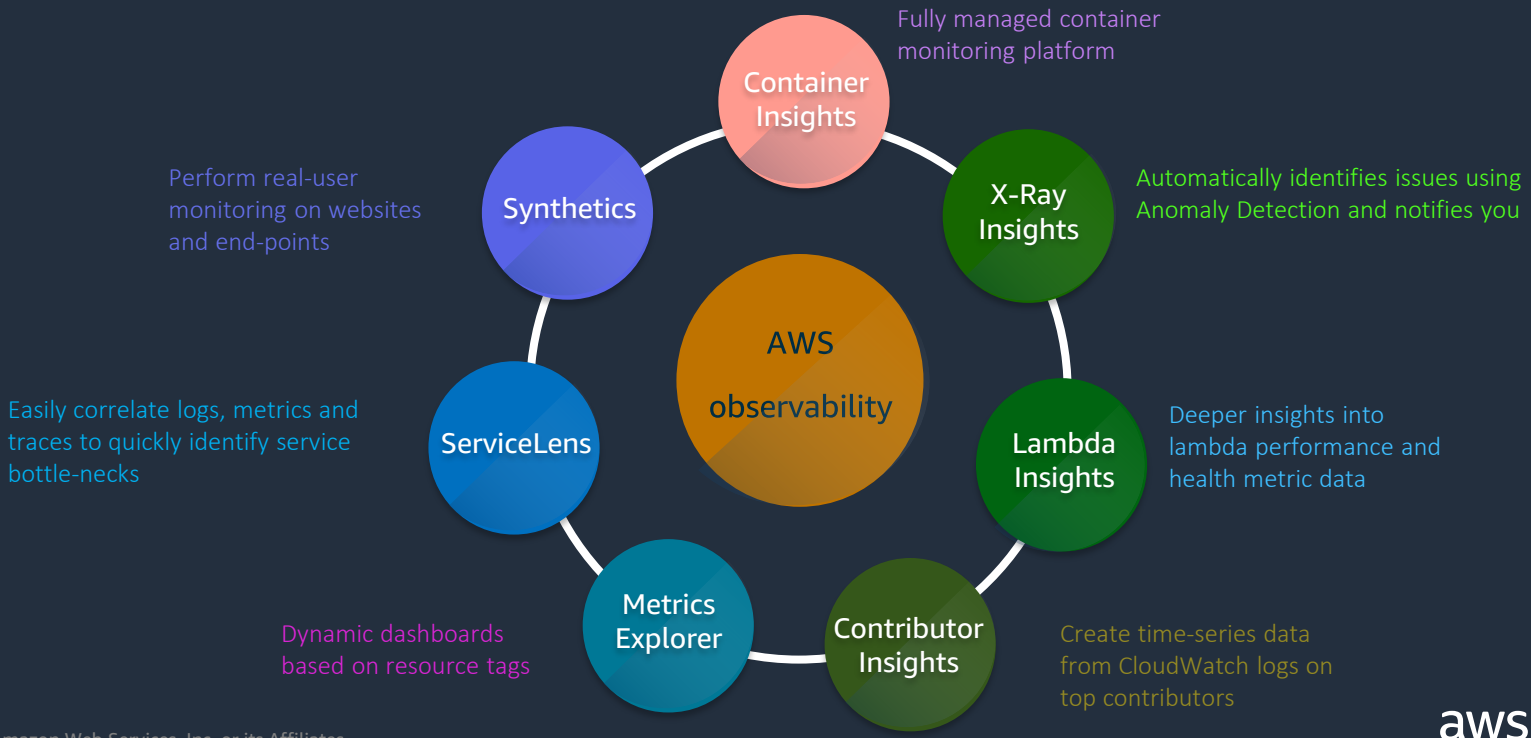
AWS Observability tools

- Infrastructure monitoring
- Application monitoring
- Synthetic monitoring



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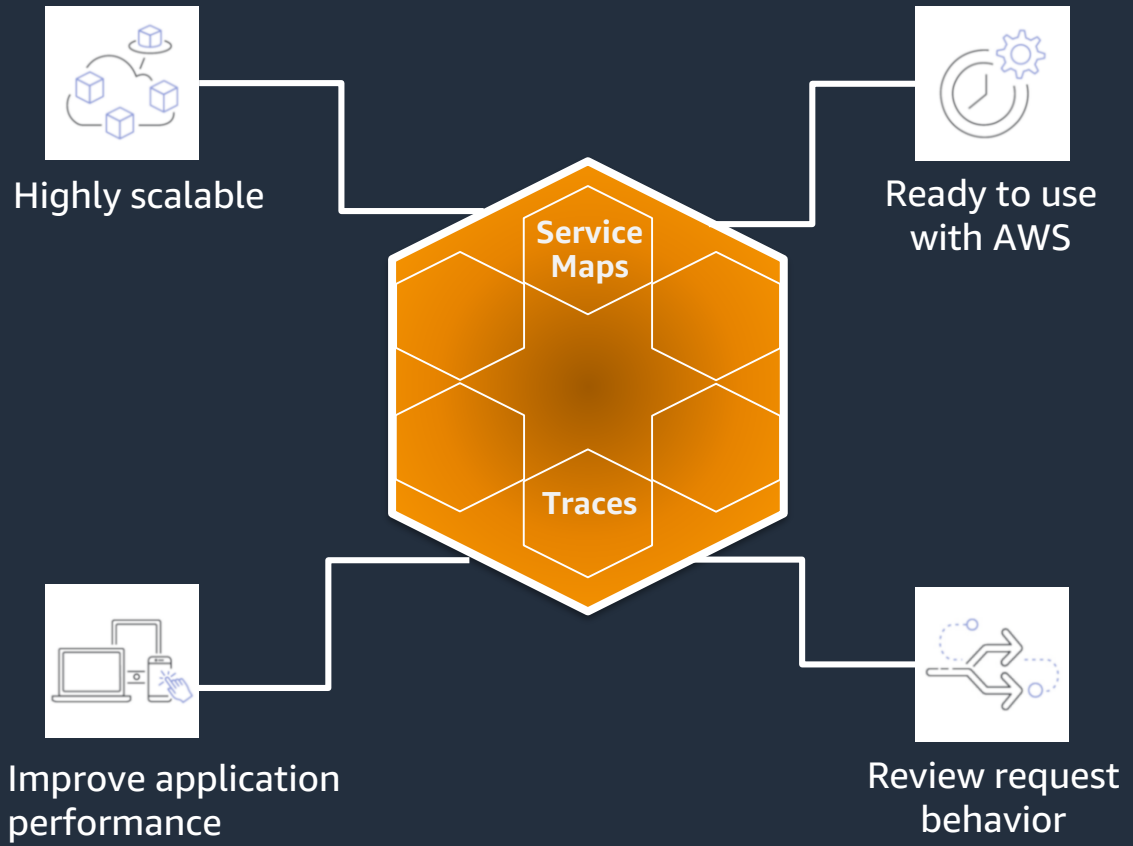
AWS X-Ray

Analyze and debug production, distributed applications



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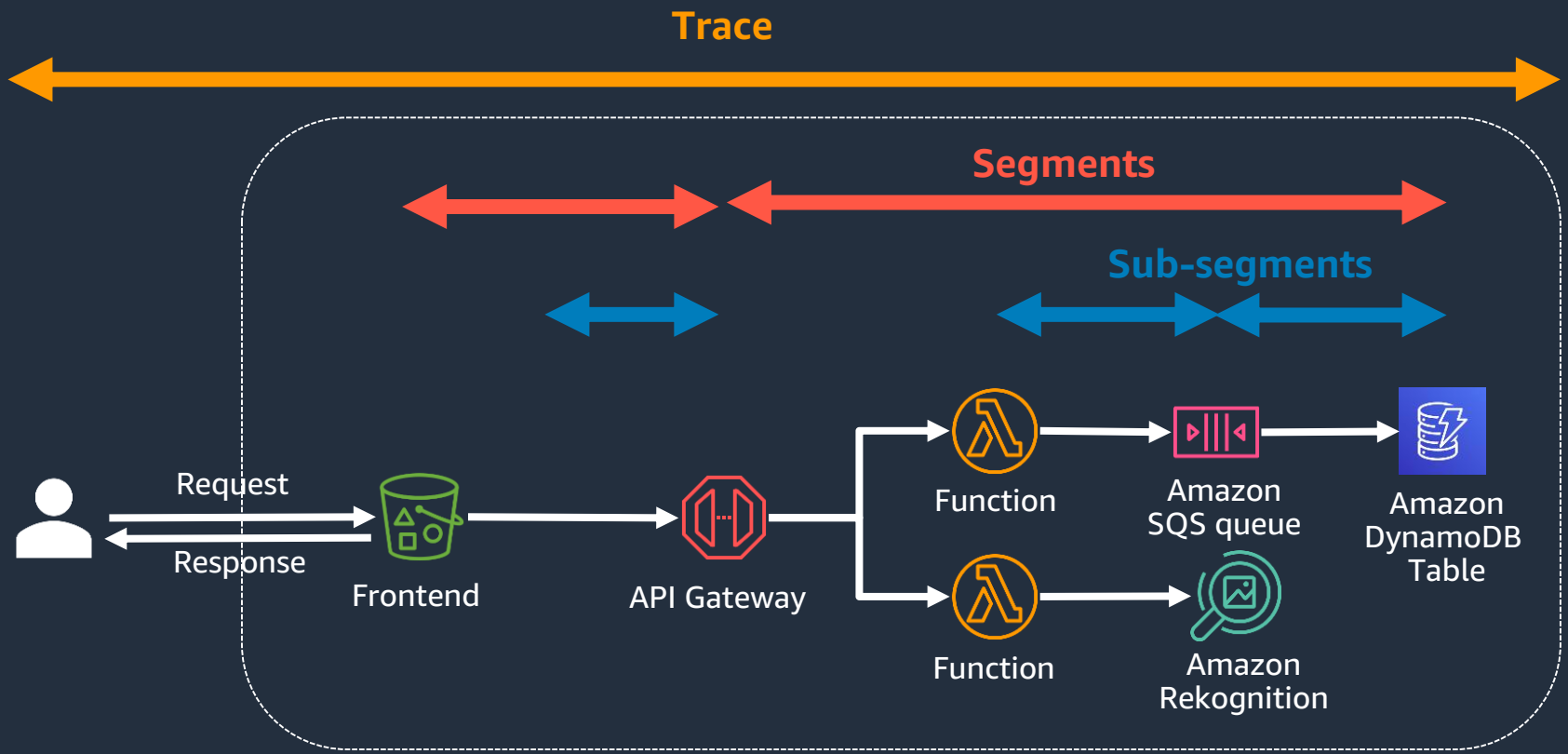
How does AWS X-Ray help?

- Analyze and debug performance of your distributed applications.
- View latency distribution and pinpoint performance bottlenecks.
- Identify specific user impact across your applications.
- Works across different AWS and non-AWS services.
- Ready to use in production with low latency in real-time.

Enables you to get started quickly without having to manually instrument your application code to log metadata about requests

AWS X-Ray concepts



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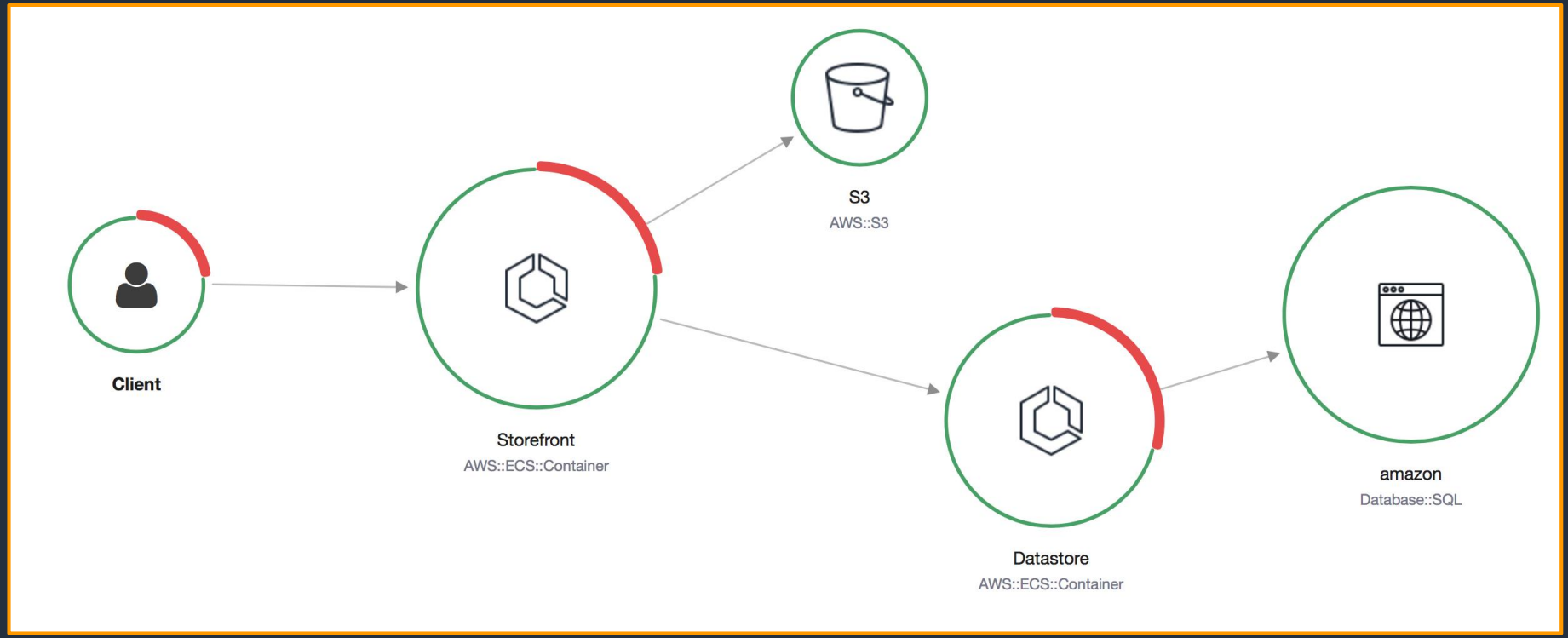
Visualize service graph



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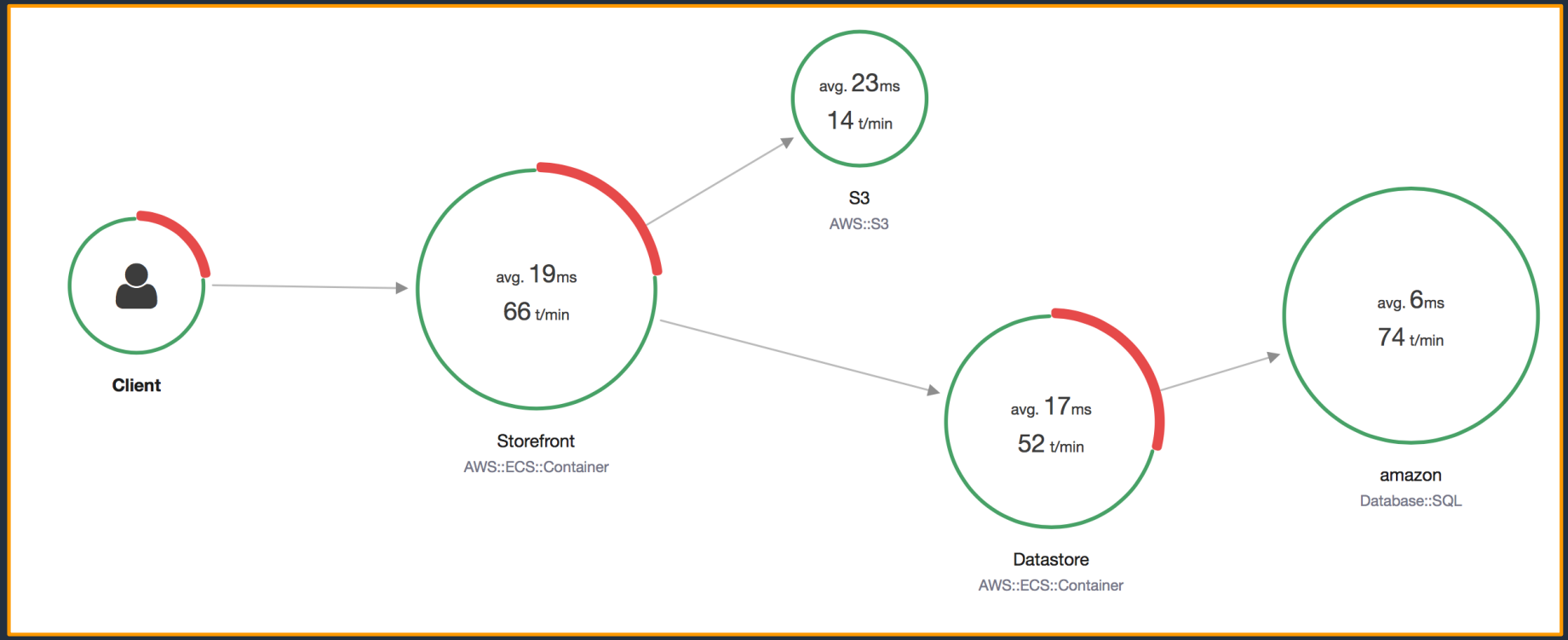
Visualize service graph



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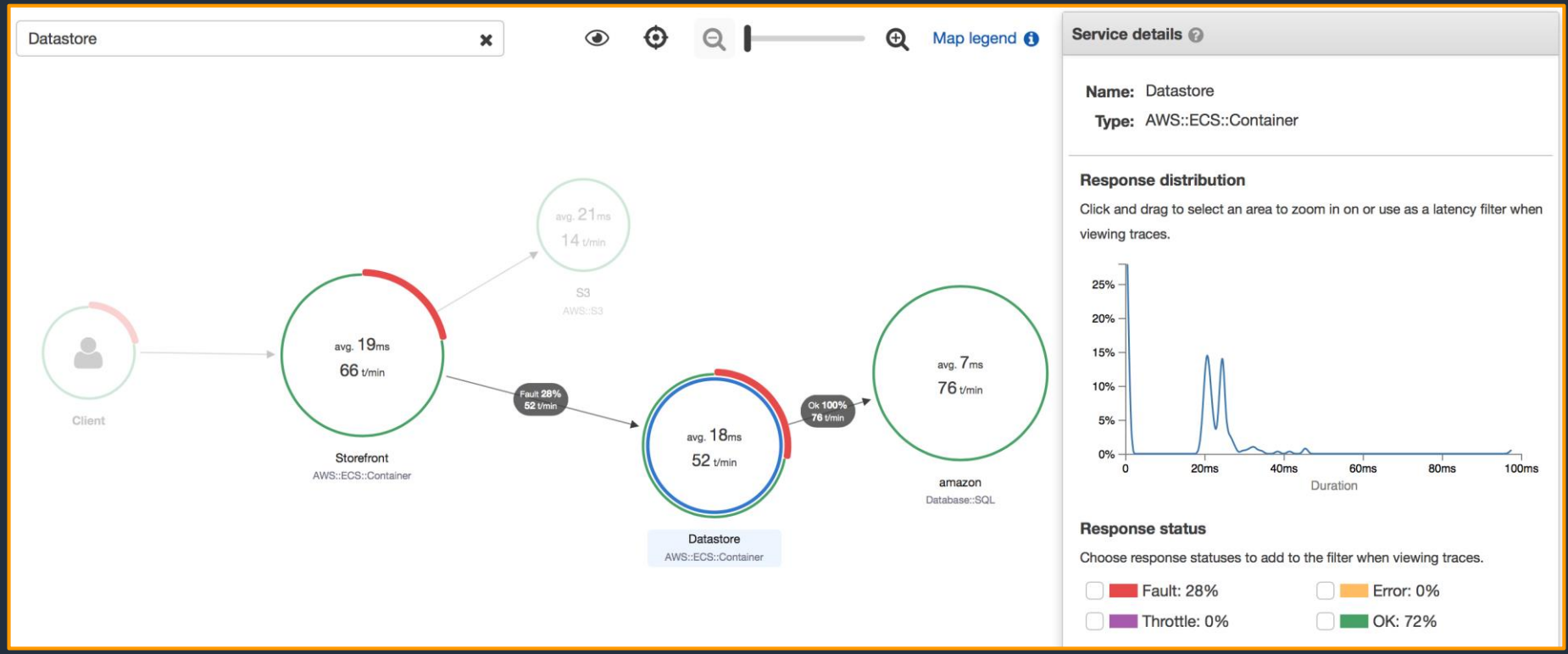
Identify performance bottlenecks



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X-Ray SDK

Available for Java, .NET, .NET Core, Ruby, Python, Go, and Node.js

Adds filters to automatically capture metadata for calls to

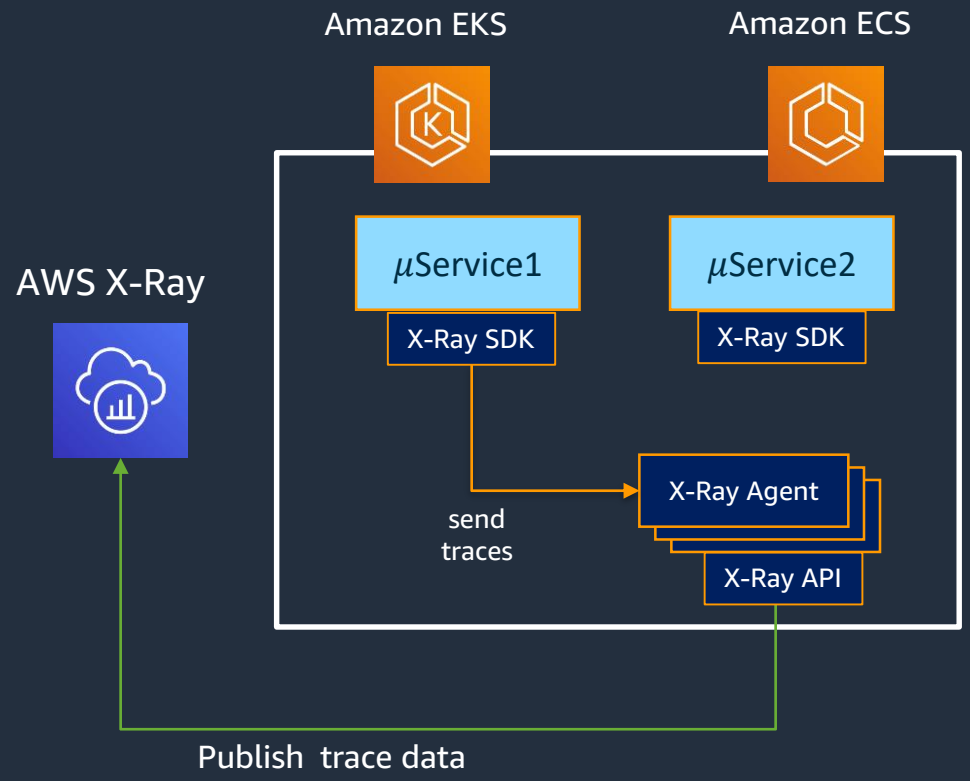
- AWS services using the AWS SDK
- Non-AWS services over HTTP and HTTPS (third-party APIs)
- Databases (MySQL, PostgreSQL, and Amazon DynamoDB)
- Queues (Amazon SQS)

AWS X-Ray for Lambda

- X-Ray agent is natively built into Lambda
- Identify initialization and cold starts in Lambda
- Pinpoint issues in downstream services called from your Lambda function
- Happens with low latency in real time; can see traces in seconds

AWS X-Ray for Amazon ECS/EKS

- Microservices instrumented with X-Ray SDK send segment data to X-Ray agent in the cluster
- X-Ray agent buffers segments in a queue and uploads them to X-Ray in batches
- X-Ray groups segments that have a common request into traces which are used to generate a service graph that provides a visual representation of your application



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CloudWatch metrics for Lambda

- Runtime metrics for Lambda functions are available in CloudWatch across three different categories
- Invocation Metrics

- **Invocations**
- **Errors**
- **DeadLetterErrors**
- **Throttles**

CloudWatch metrics for Lambda

- Runtime metrics for Lambda functions are available in CloudWatch across three different categories
- Invocation Metrics
- Performance Metrics

- **Duration**
- **IteratorAge**

CloudWatch metrics for Lambda

- Runtime metrics for Lambda functions are available in CloudWatch across three different categories
- Invocation Metrics
- Performance Metrics
- Concurrency Metrics

- **ConcurrentExecutions**
- **ProvisionedConcurrentExecutions**

CloudWatch metrics for Serverless

API Gateway	DynamoDB	SQS
Count	Read Throttle Events	Approximate Age Of Oldest Message
Cache Hit Cache Miss	Write Throttle Events	Approximate Number Of Messages Visible
Latency Integration Latency	System Errors	Number Of Messages Sent
4XX Errors 5XX Errors		Number Of Messages Received

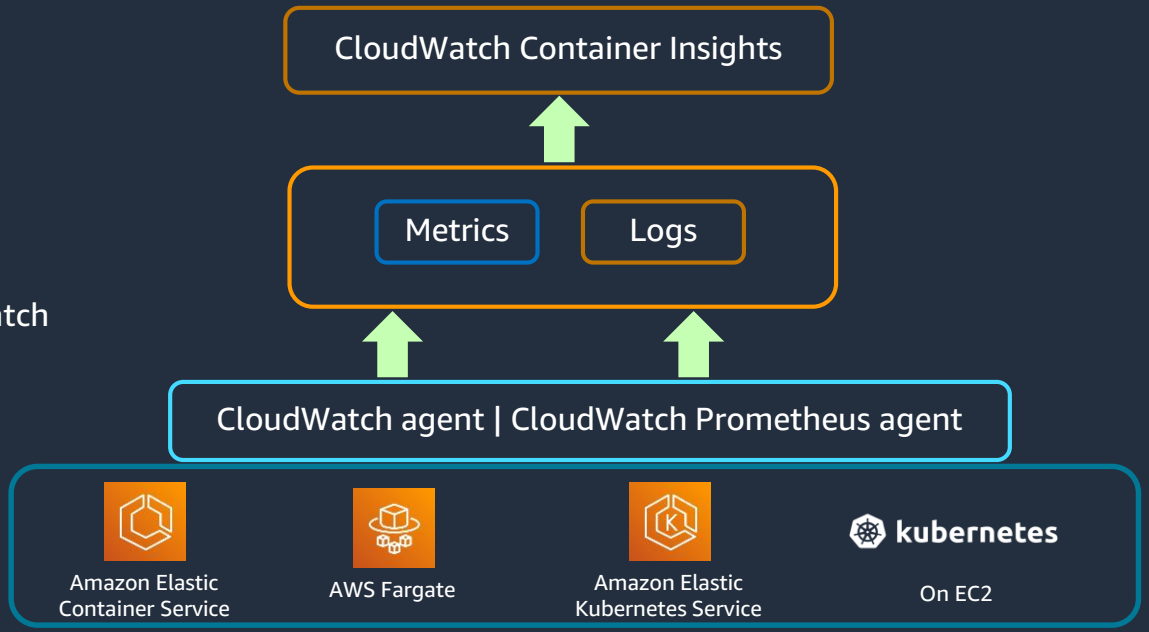
CloudWatch Container Insights

Built-in dashboards to see performance metrics for cluster resources at different levels

Out of the box dashboards for popular workloads such as AppMesh, Java/JMX, NGINX, HAProxy etc

Collect Prometheus metrics from workloads

Amazon CloudWatch



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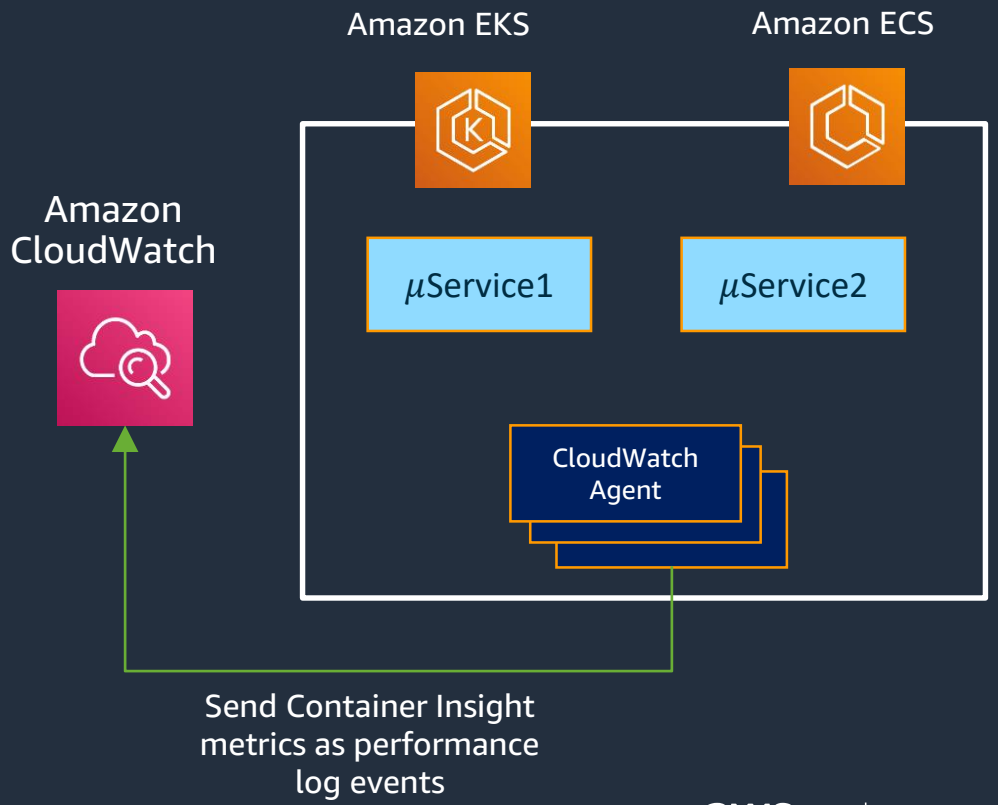
CloudWatch Container Insights

- Collect, aggregate and summarize metrics and logs from containerized applications
- Collect collect instance-level metrics such as CPU, memory, disk and network usage
- Operational data collected as performance log events with EMF from which metrics are extracted



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CloudWatch Container Insights for Prometheus

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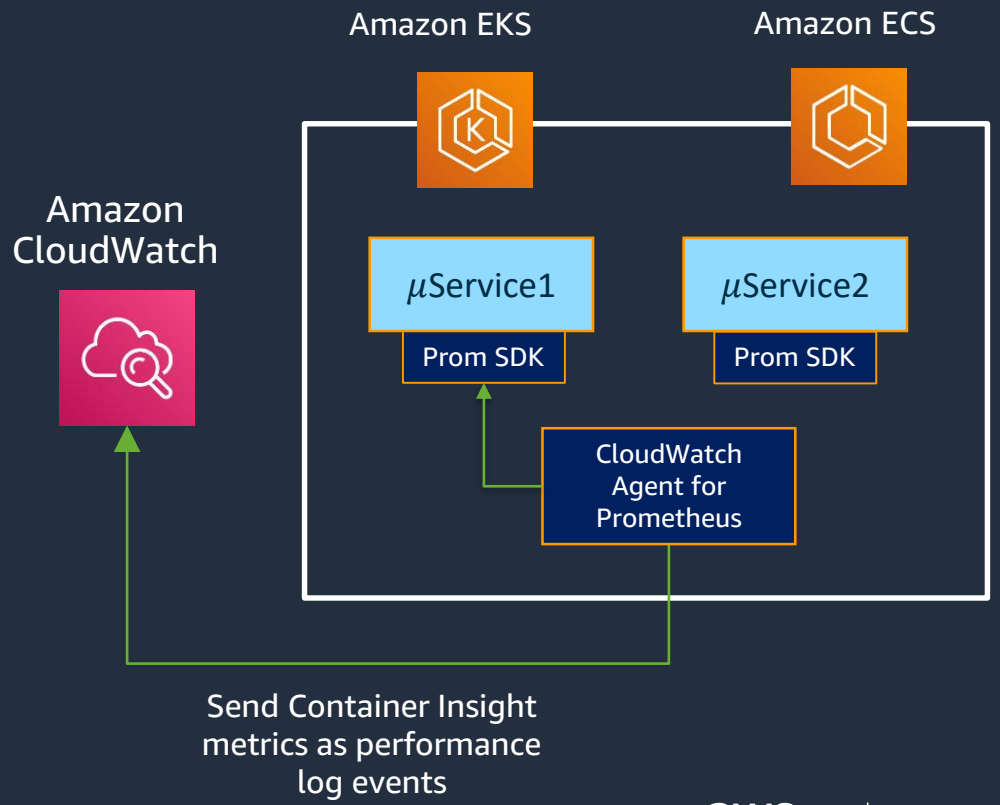

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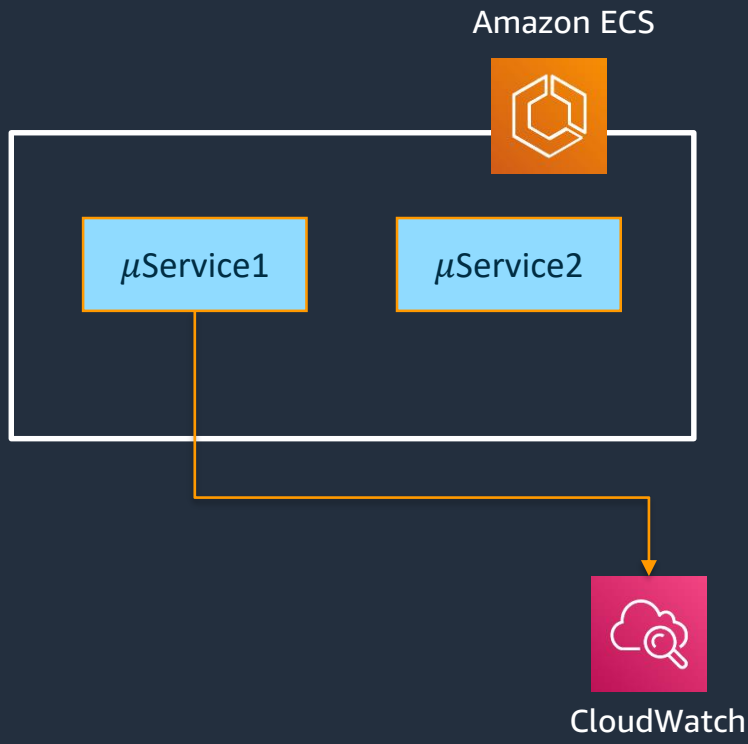
CloudWatch logs for Amazon ECS

- Microservices running on Amazon ECS can send application logs directly to CloudWatch Logs using awslogs driver



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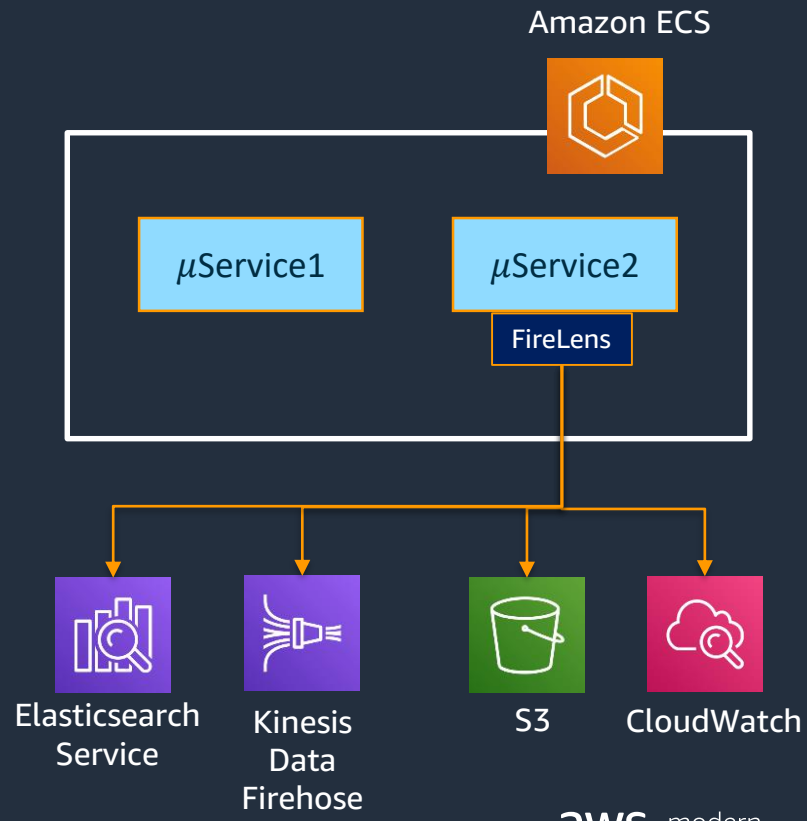
CloudWatch logs for Amazon ECS

- Microservices running on Amazon ECS can send application logs directly to CloudWatch Logs using awslogs driver
- FireLens for ECS enables applications to send logs to many other destinations by using the awsfirelens driver; works with both FluentD and FluentBit
- Both methods work on EC2 and Fargate



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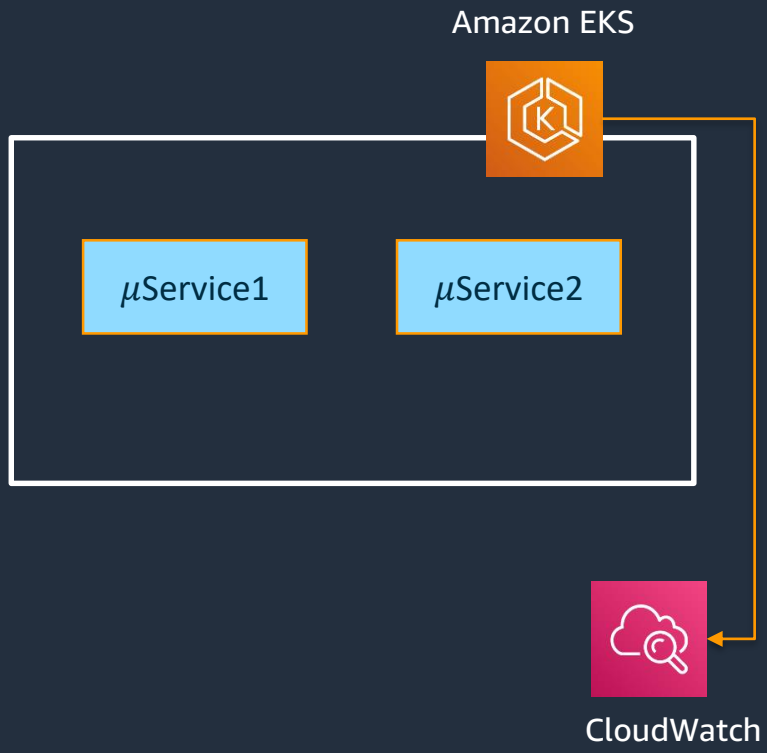
CloudWatch logs for Amazon EKS

- Audit and diagnostic logs from Amazon EKS Control Plane can be sent to CloudWatch



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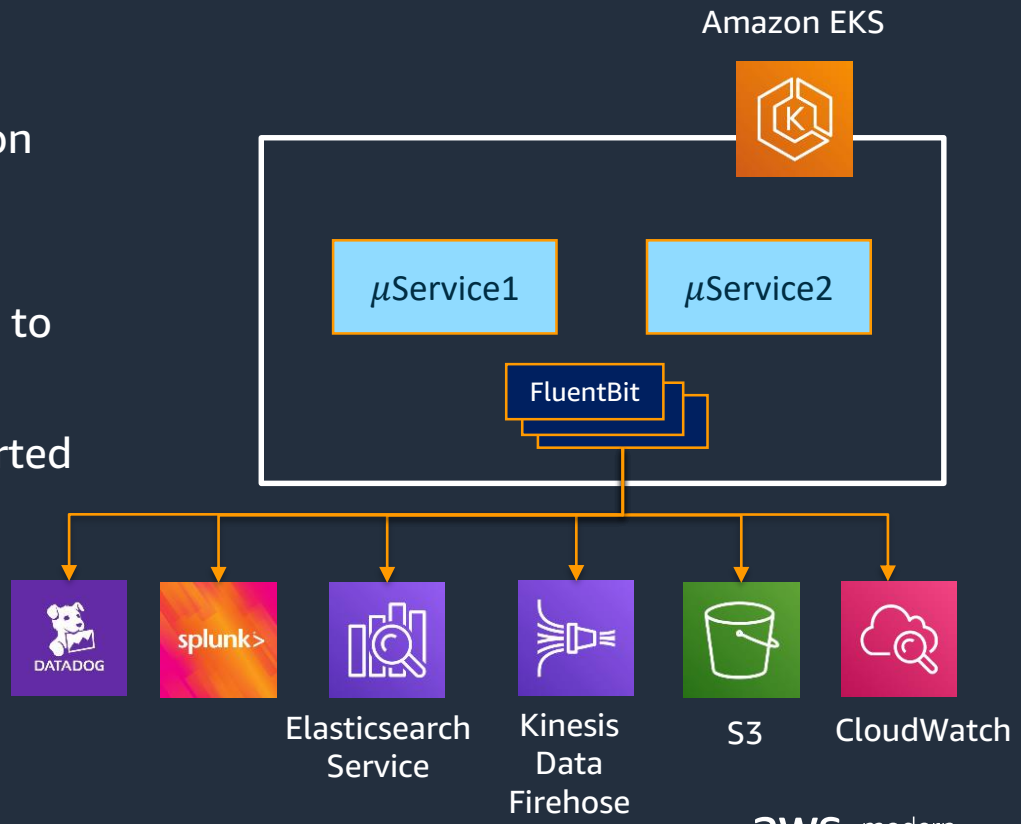
CloudWatch logs for Amazon EKS

- Audit and diagnostic logs from Amazon EKS Control Plane can be sent to CloudWatch
- Use FluentBit to send application logs to destination of your choosing
- FluentBit-based logging is also supported in EKS on Fargate



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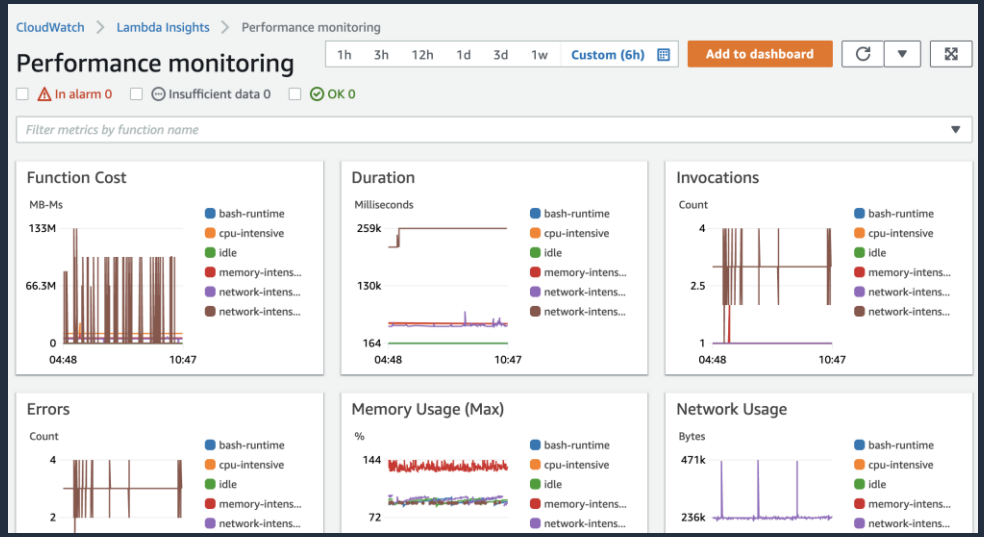
CloudWatch Lambda insights

- Get deeper insights into Lambda function executions using system-level metrics.
- Easily enabled on a per-function basis.
- Review KPIs using CloudWatch dashboard; either multi-function overview, or focus on a single function.
- Metrics are sent to CloudWatch as a single performance log event with EMF for every execution



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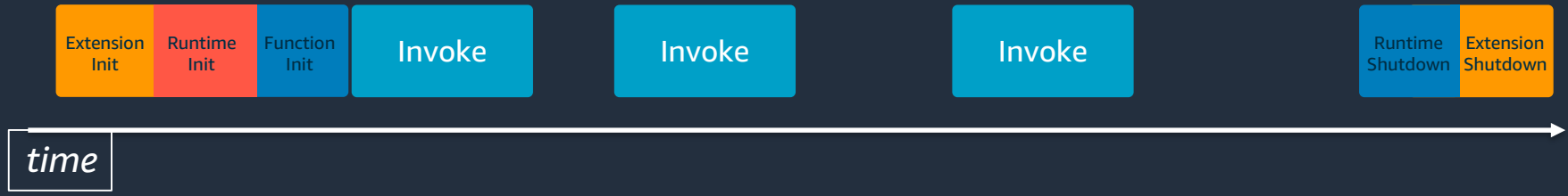
Lambda extensions

Receive and control Lambda lifecycle events

- Delivered via Lambda Layers
- Register via Extensions API for lifecycle events:
  - Init
  - Invoke
  - shutdown

Primary use cases:

- Monitoring
- Configuration
- Security



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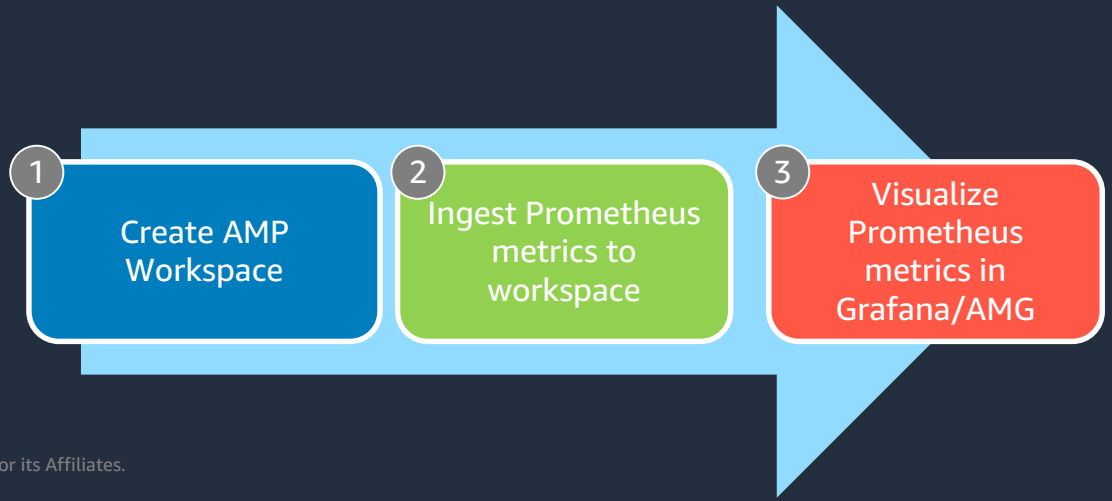
Lambda logs API

- Send log streams to preferred destinations directly from Lambda execution environment
- Build your own
- Partner integrations:
  - Datadog
  - Lumigo
  - New Relic
  - Coralogix
  - Honeycomb
  - Sumo Logic
- Optionally disable logging to CloudWatch Logs via IAM permissions

Amazon Managed Service for Prometheus (AMP)

- Serverless Prometheus-compatible 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
- Improved scalability, availability, and security without managing the underlying infrastructure



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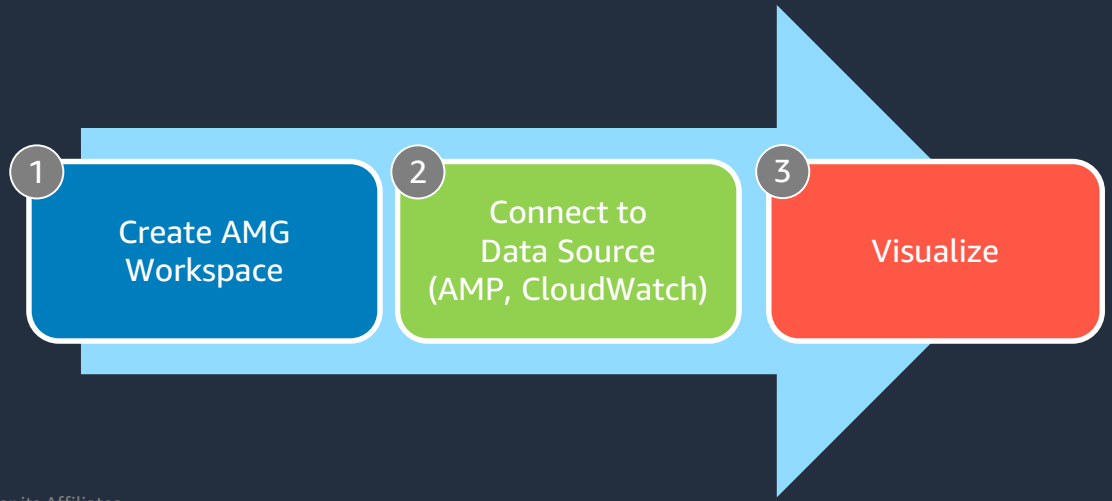
Amazon Managed Service for Grafana (AMG)

- Scalable, secure and highly available fully-managed Grafana service
- Analyze, monitor, and alarm across multiple data sources; native AWS as well as 3rd party
- Native integration with multiple AWS Services for enterprise-ready security
- Easily upgrade to Grafana Enterprise from AWS marketplace



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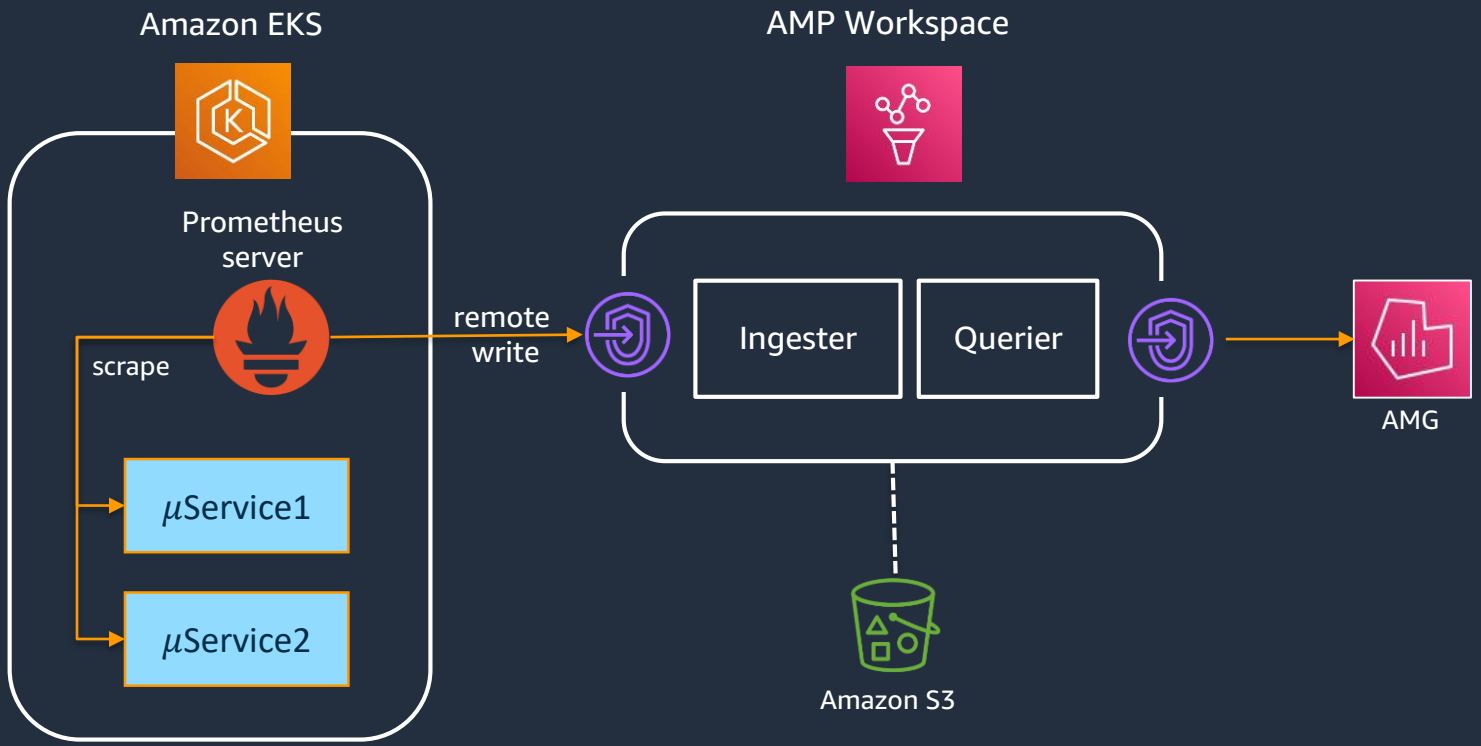
Observability with AMP & AMG



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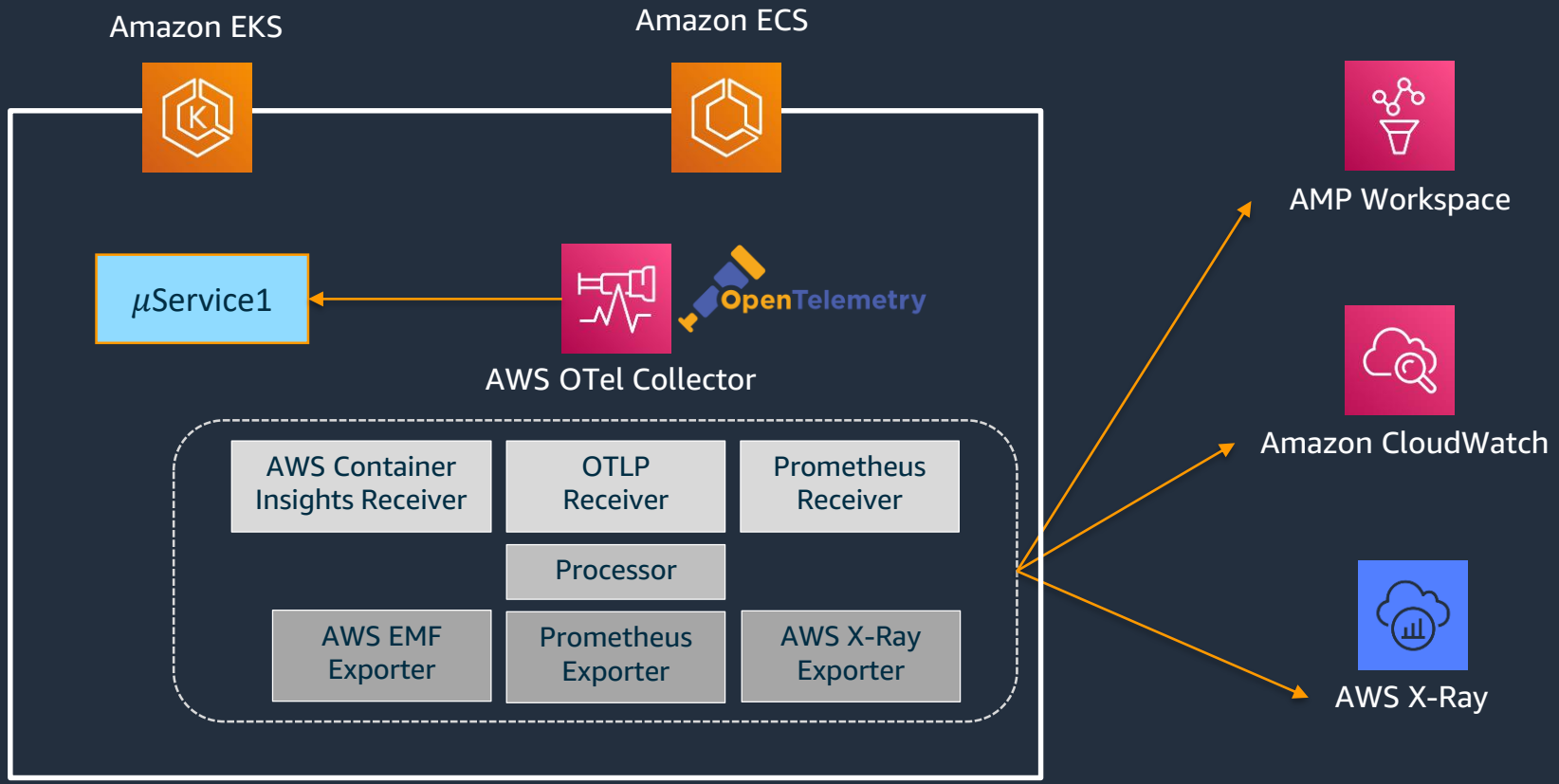
AWS Distro for Open Telemetry (ADOT)

- OpenTelemetry provides open source APIs, libraries, and agents to collect distributed traces and metrics for application monitoring.

- AWS Distro for OpenTelemetry
  - Secure, production-ready AWS-supported distribution of OpenTelemetry project
  - Instrument your applications just once to send correlated metrics and traces to multiple monitoring solutions
  - Use auto-instrumentation agents to collect traces without changing your code

Observability with ADOT (a.k.a OTel)



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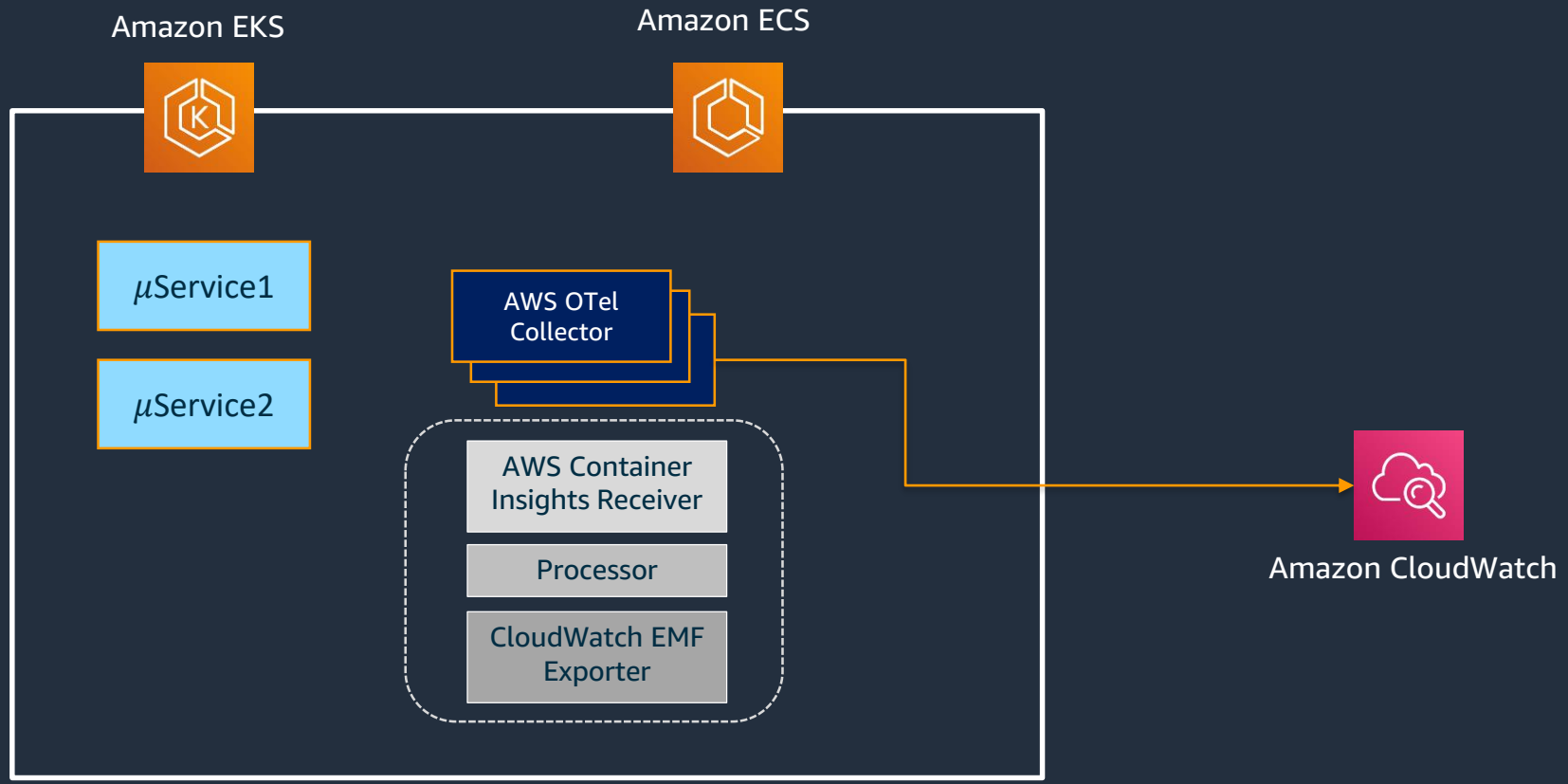
CloudWatch Container Insights with ADOT



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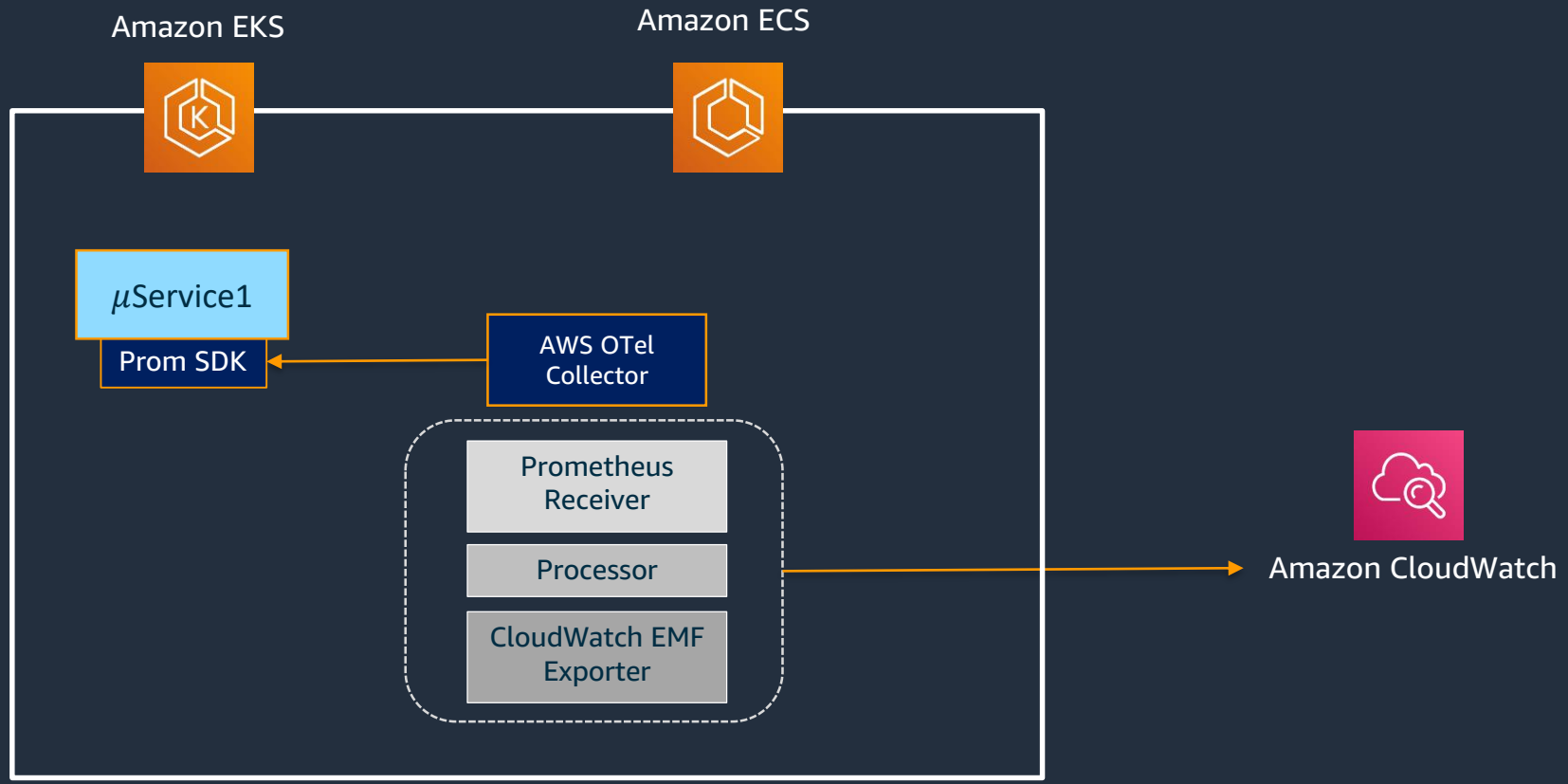
CloudWatch Container Insights for Prometheus with ADOT



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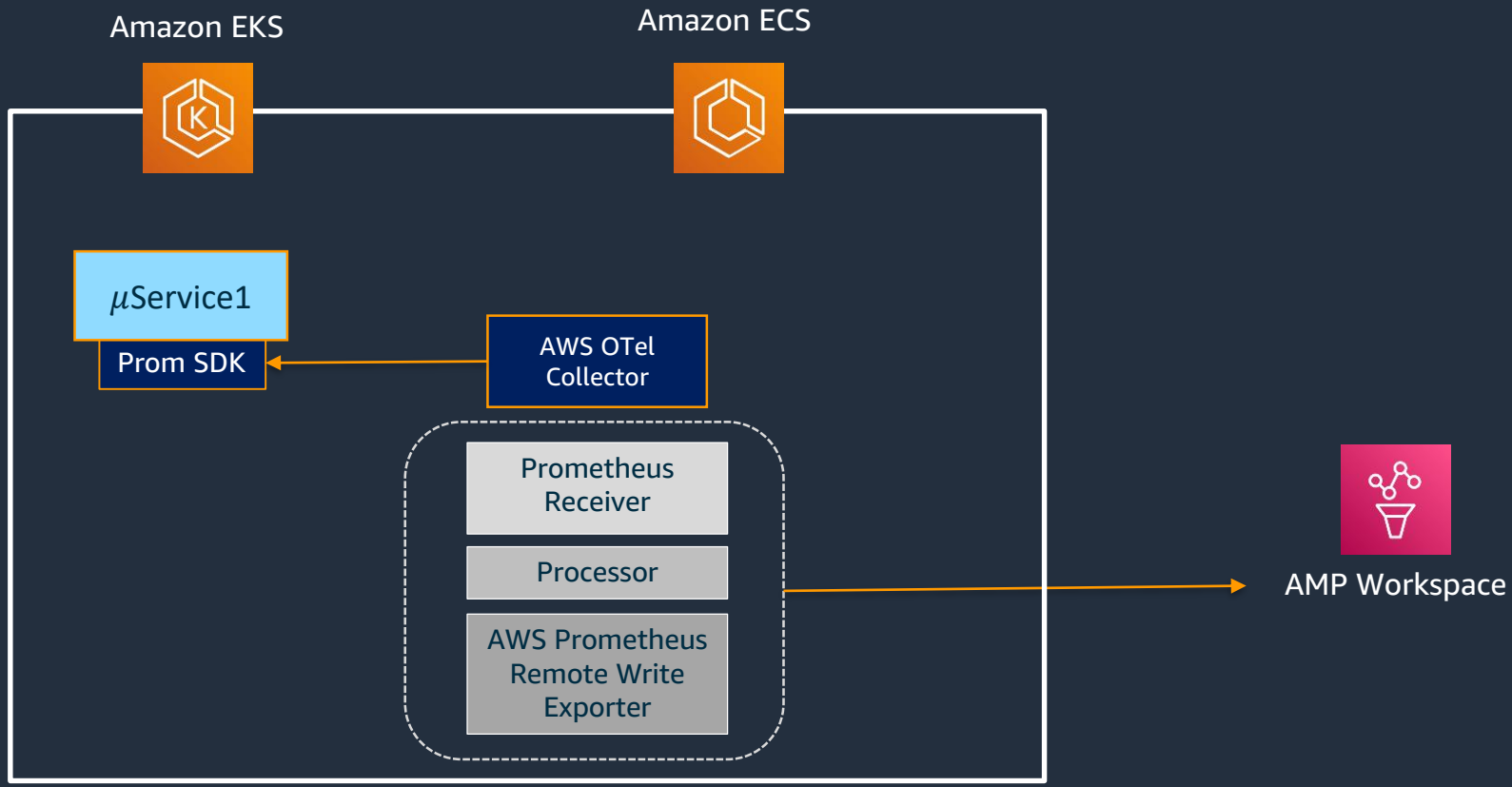
AMP with ADOT



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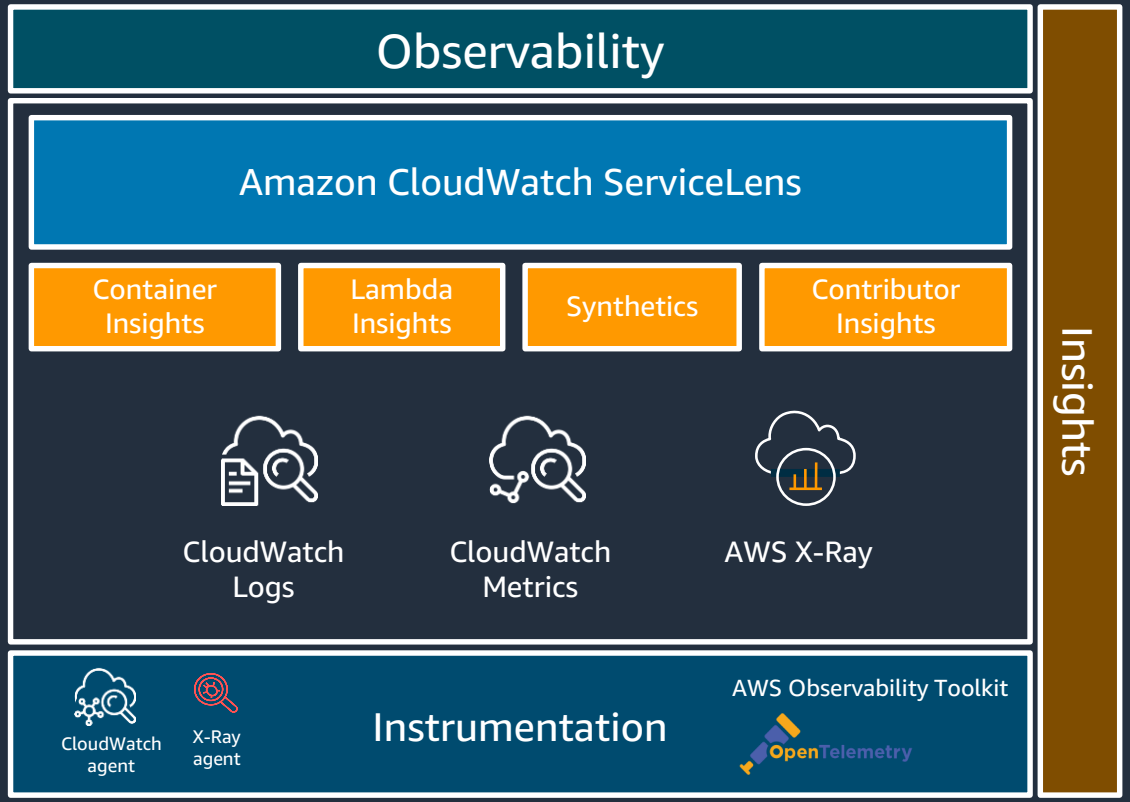
Monitoring options



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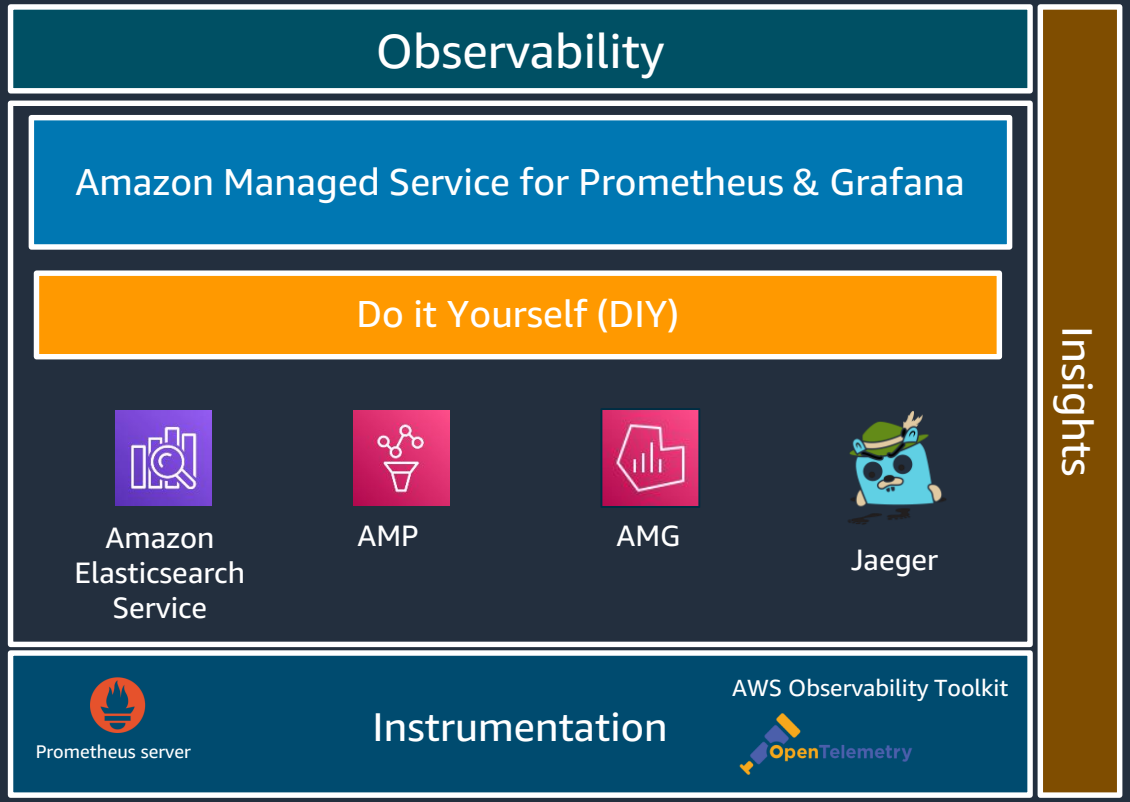

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