AWS Builders Online Series

Increase availability with AWS observability solutions

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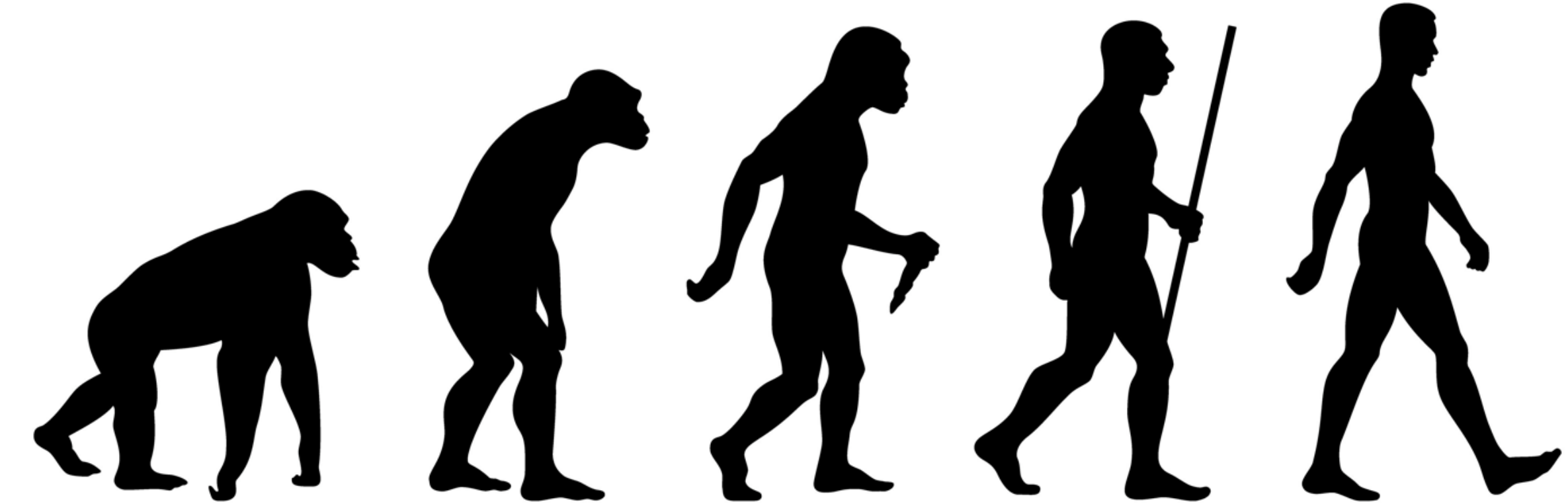
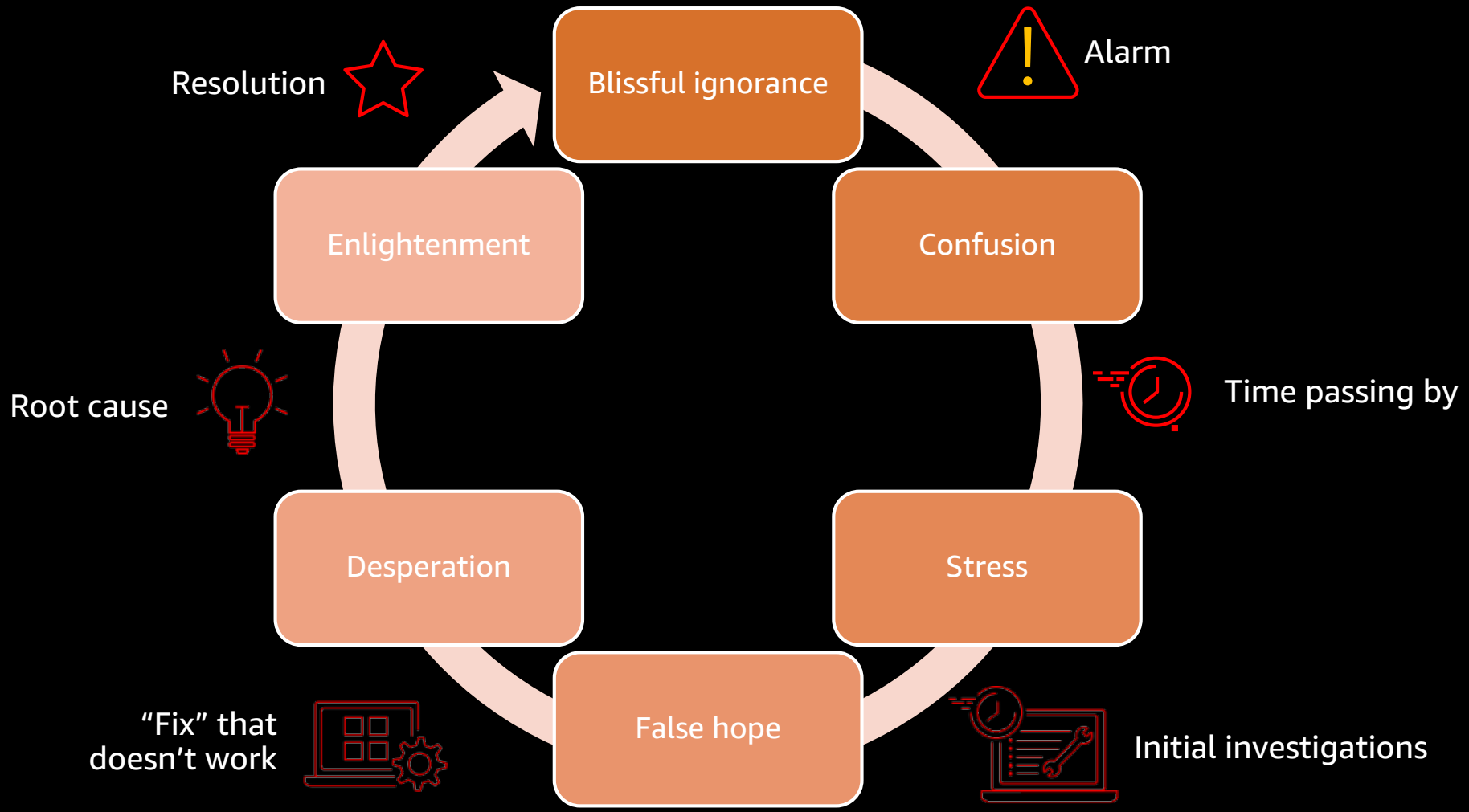
Sr. Developer Advocate
Amazon Web Services

Monitoring must evolve



Reactive monitoring

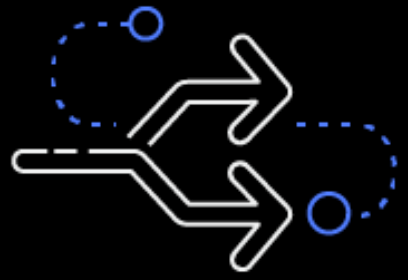


Monitoring must evolve

Monolithic to microservices

Short-lived resources

^Devices
^Data



Faster release velocity

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

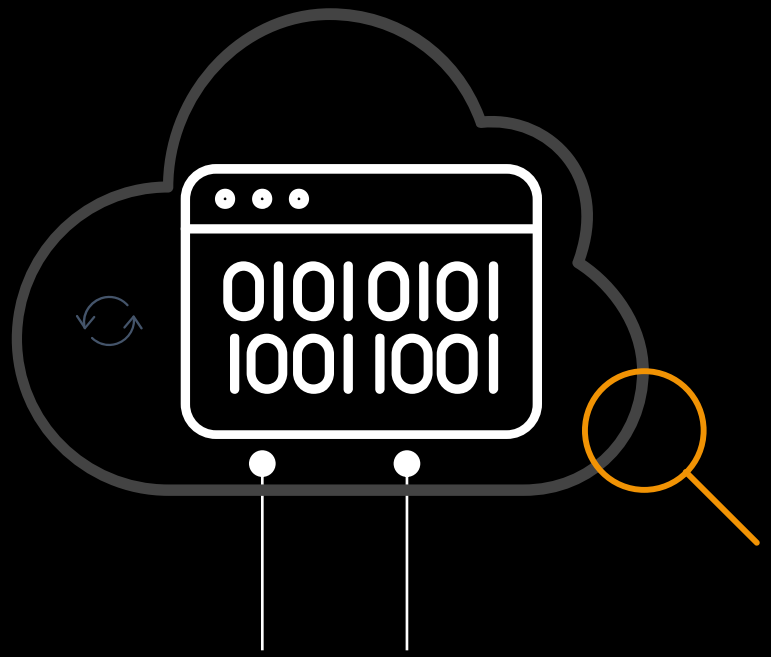
Real-time troubleshooting

Customer experience

Applications = $$

Operational → **Business**

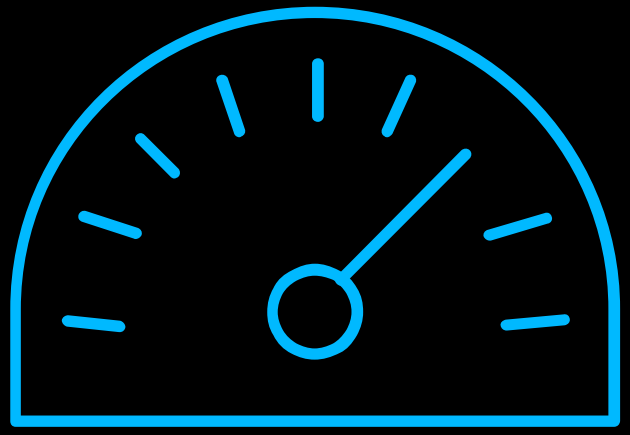
What is Instrumentation?



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

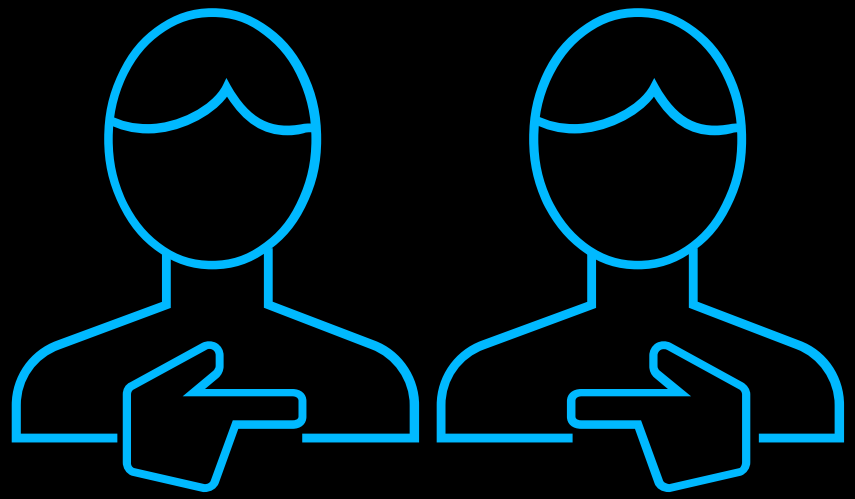
Instrumentation: measuring events in software using code
(a type of white-box monitoring)

Good data can help with the technical shift to new systems



- 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



- 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?

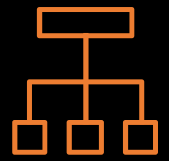
#1: Observable systems should emit events: Metrics, logs, and traces

Logs

"The database won't start after the update"

Metrics

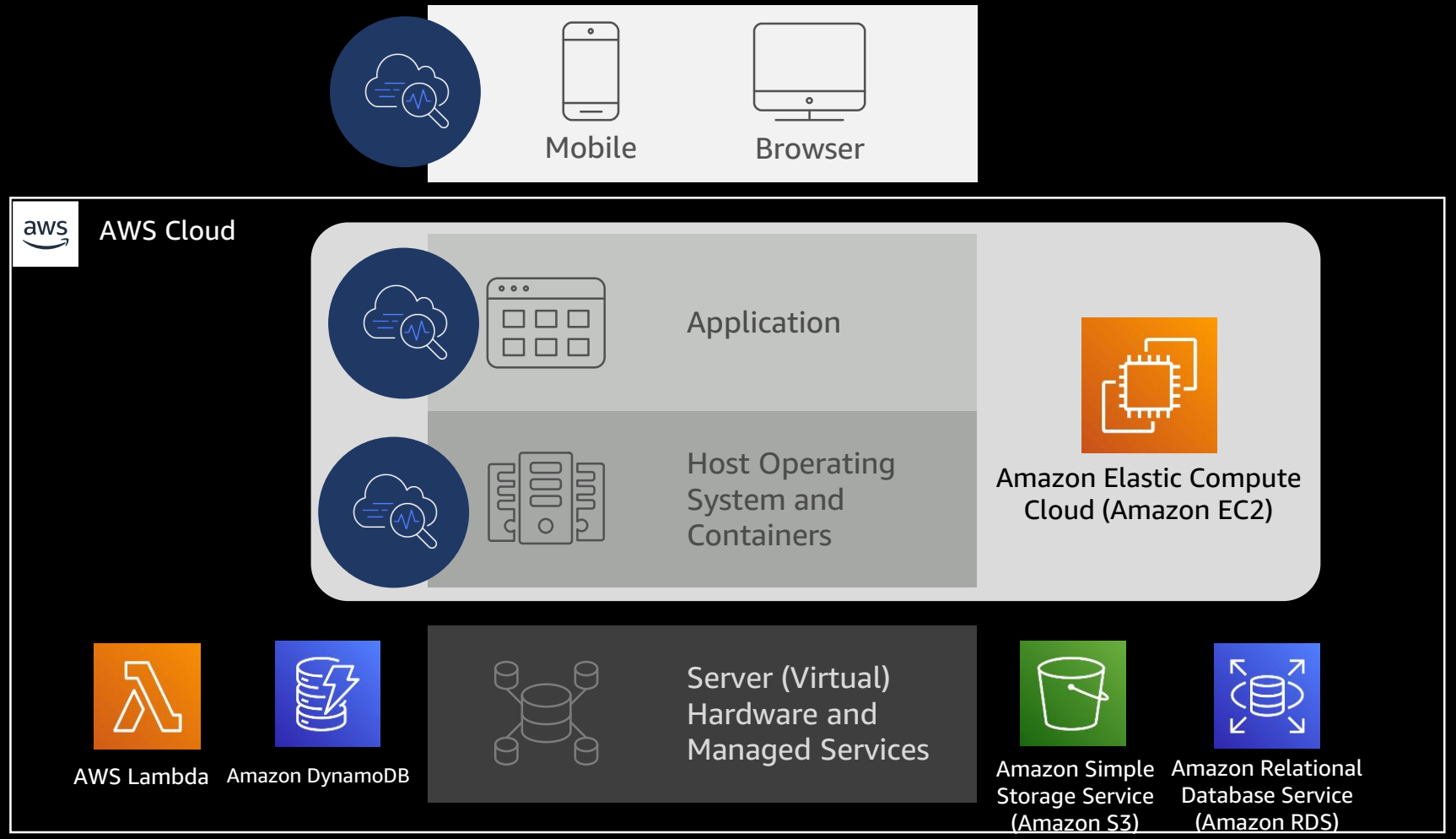
"Our application is 35% slower than last week after this configuration change"



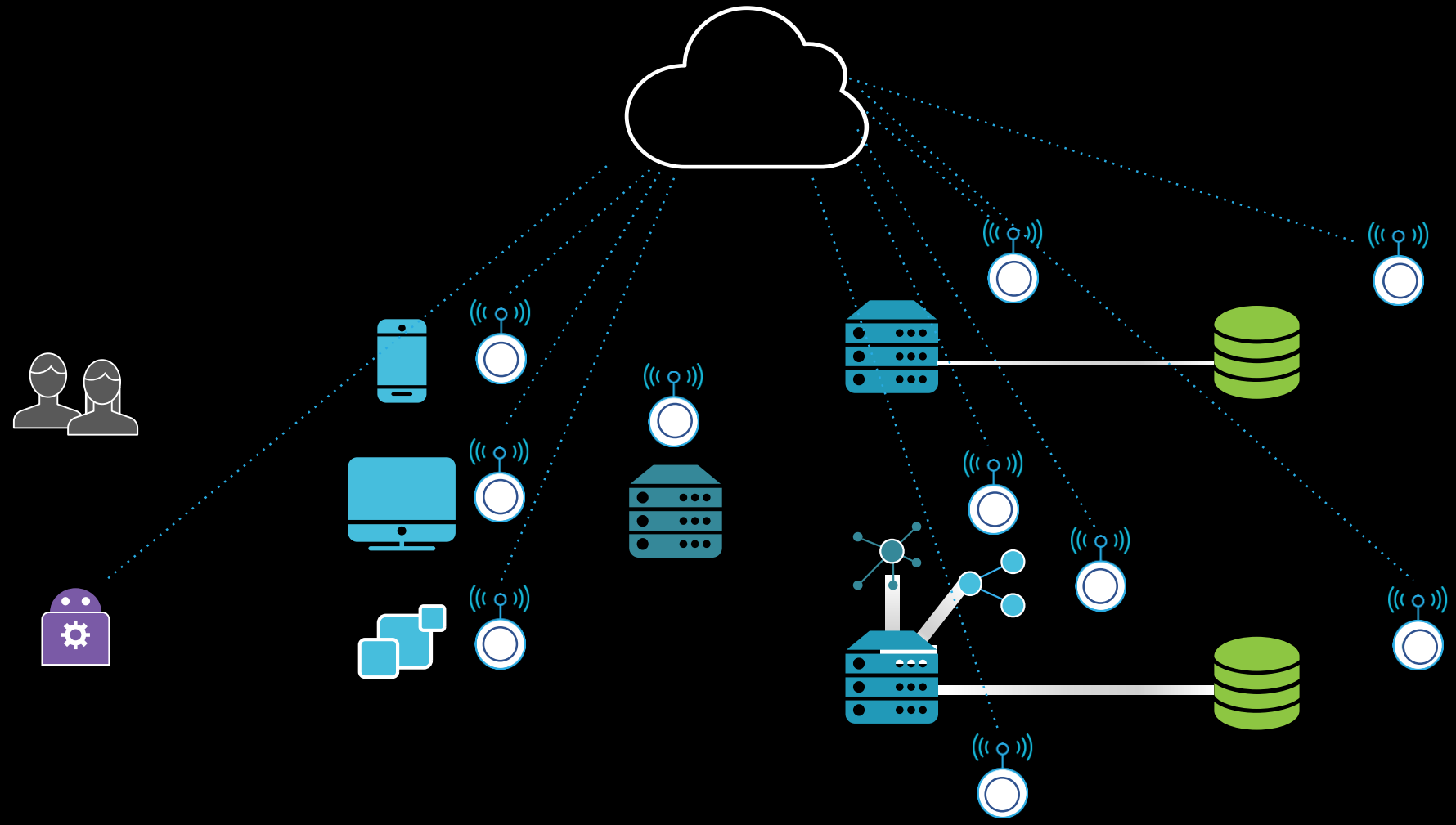
Traces

"What are the dependencies for this service?"

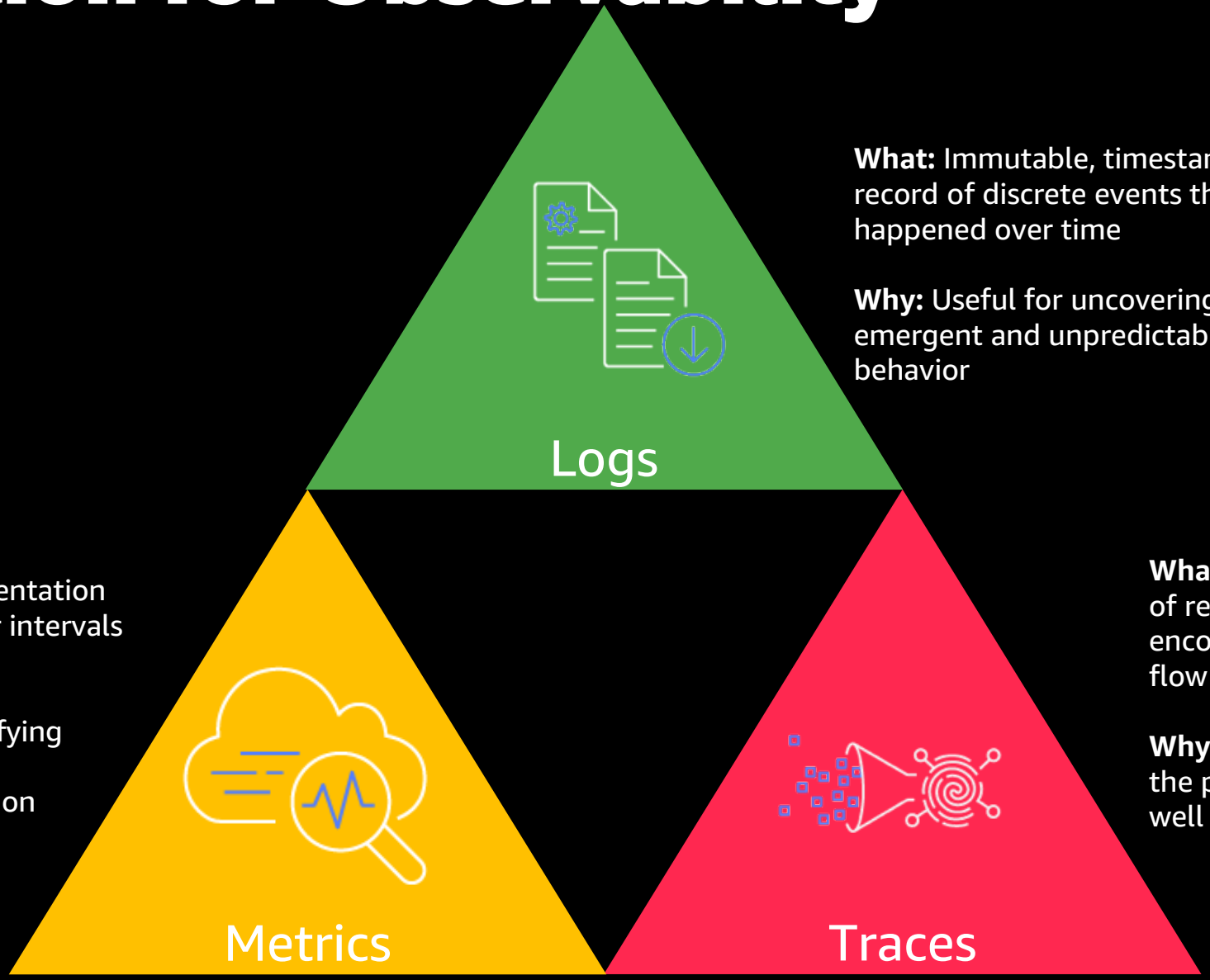
#2: All components should be instrumented



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



Foundation for Observability



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

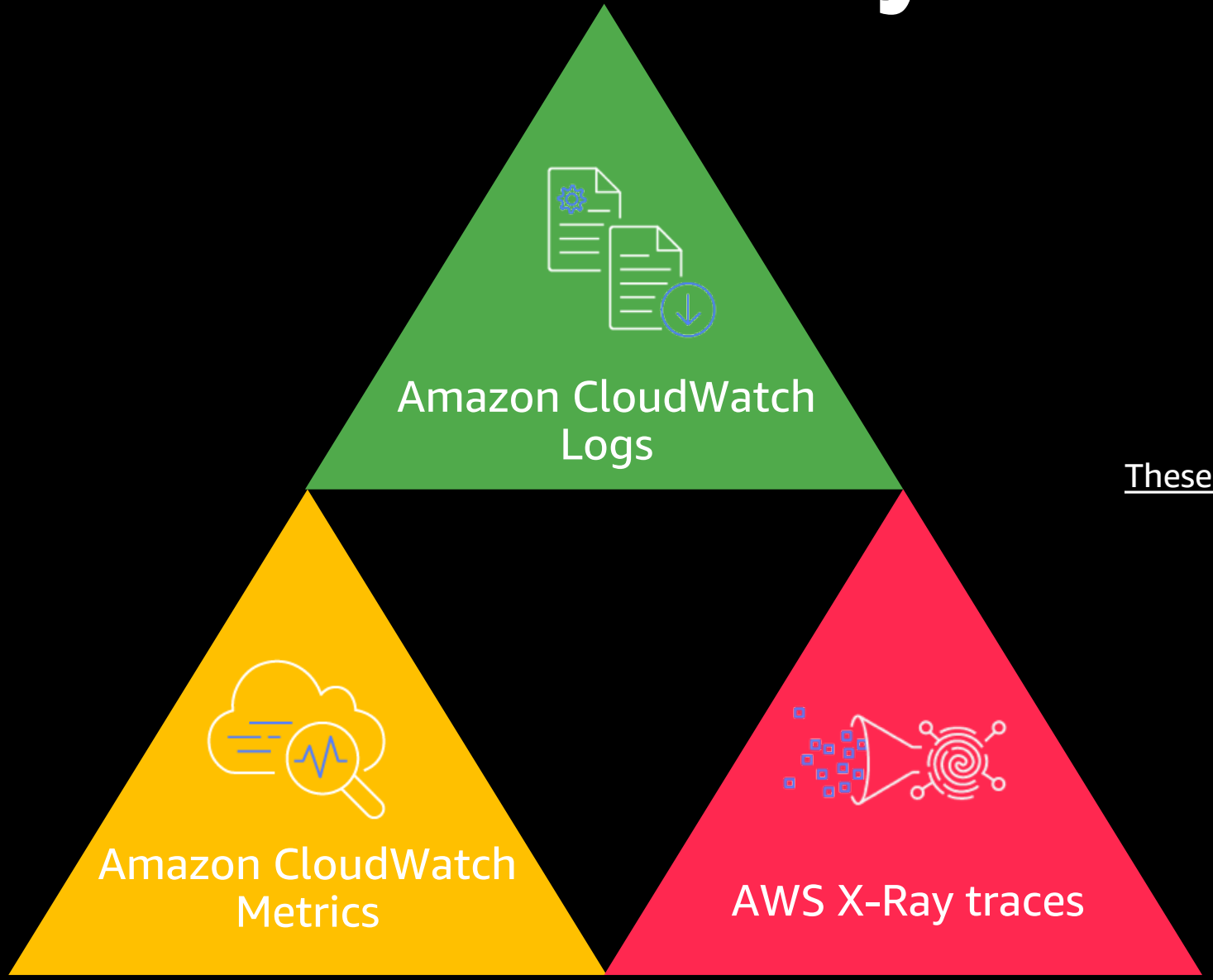
Why: Provides visibility into both the path traversed by a request as well as the structure of a request

aws

AWS services for Observability

Amazon CloudWatch

AWS X-Ray



These are the tools

Amazon CloudWatch

OBSERVABILITY OF YOUR AWS RESOURCES AND APPLICATIONS

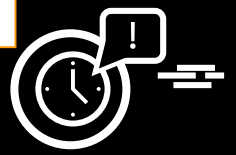
Amazon CloudWatch

Dashboards
Logs
Metrics
Alarms
Events

Amazon CloudWatch
Complete visibility into your cloud resources and applications

Collect
Metrics and logs from all your AWS resources, applications and services that run on AWS and on-premise servers

Monitor
Visualize applications and infrastructure with CloudWatch dashboards; corelate logs and metrics side-by-side to troubleshoot and set alarms with CloudWatch alarms



Act
Automate response to operational changes with CloudWatch Events and Autoscaling.

Analyze
Up to 1-second metrics, extended data retention (15 months), and real time analysis with CloudWatch Metric-Math

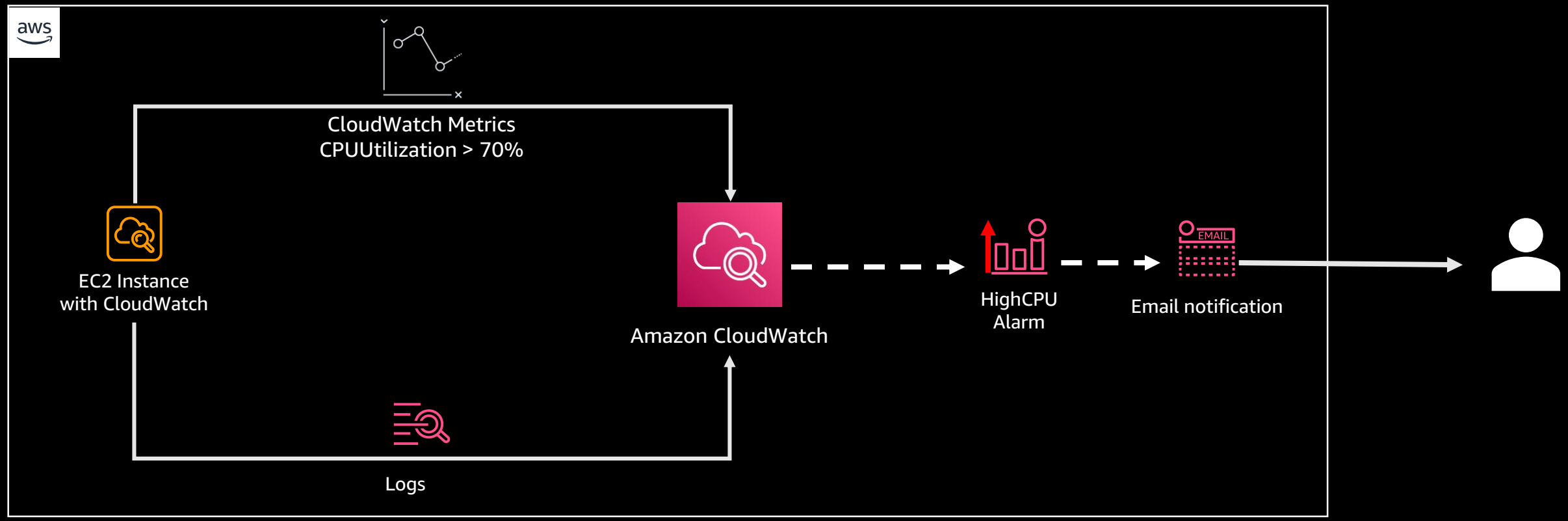
Application monitoring

System-wide visibility

Resource optimization

Unified operational health

Amazon CloudWatch Metrics



Metric Alarm States

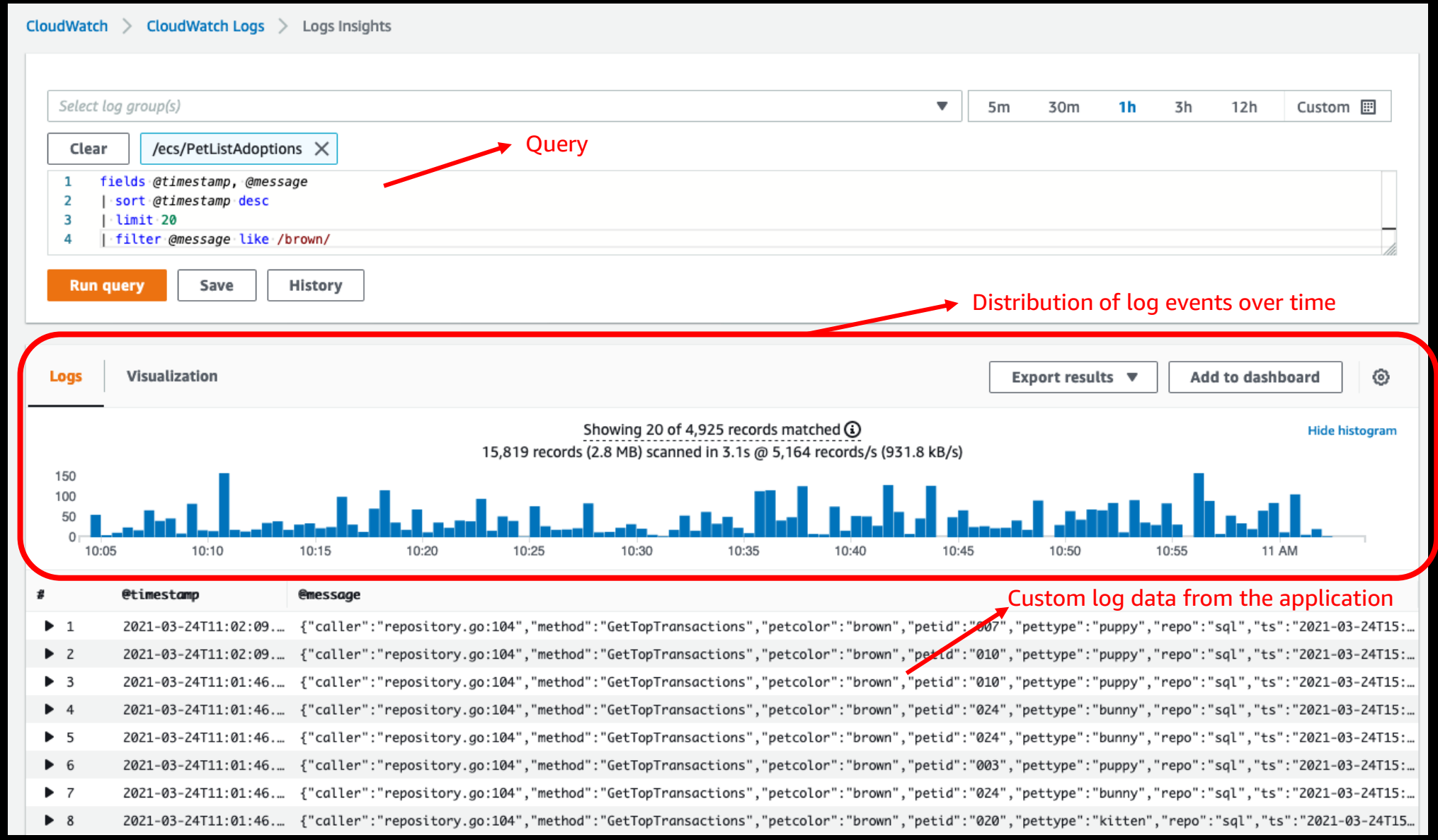
OK – The metric or expression is within the defined threshold.

ALARM – The metric or expression is outside of the defined threshold.

INSUFFICIENT_DATA – The alarm has just started, the metric is not available, or not enough data is available for the metric to determine the alarm state.

CloudWatch Logs & Logs Insights

- Move logs off host
- Store in secure, scalable and durable storage
- Create Metrics and Alarms
- Analyse logs



AWS X-Ray

ANALYZE AND DEBUG PRODUCTION, DISTRIBUTED APPLICATIONS

AWS X-Ray

Traces
Analytics
Service map

AWS X-Ray

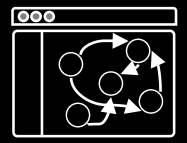
AWS X-Ray helps you analyze and debug modern applications built using microservices and serverless architecture and quantify impact

Collect traces

Collect data about the request from each underlying application service it passes through

Record traces

X-Ray combines the data gathered from each service into singular units called traces



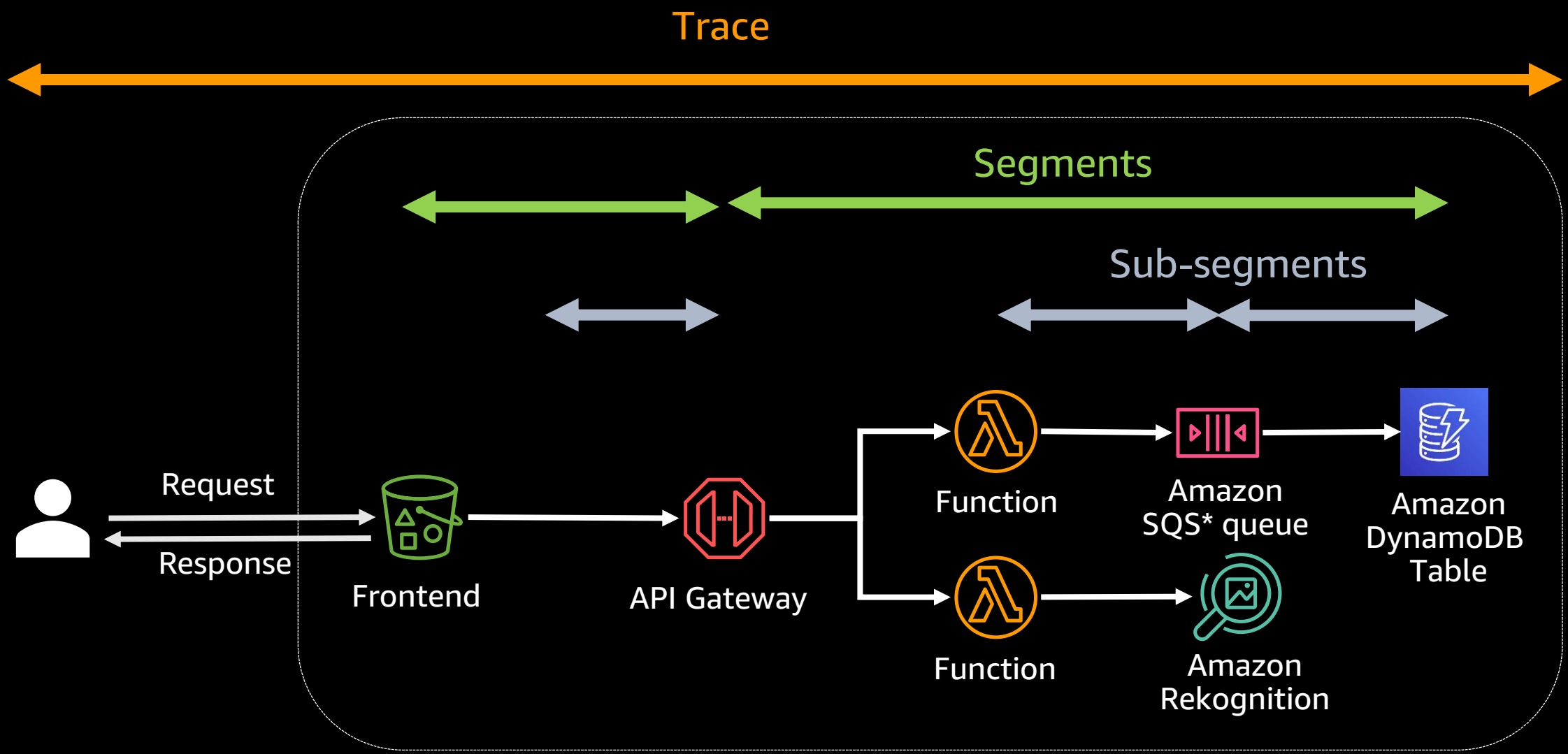
View service map

View the service map to see trace data such as latencies, HTTP statuses, and metadata for each service

Analyze issues

Drill into the service showing unusual behavior to identify root issue

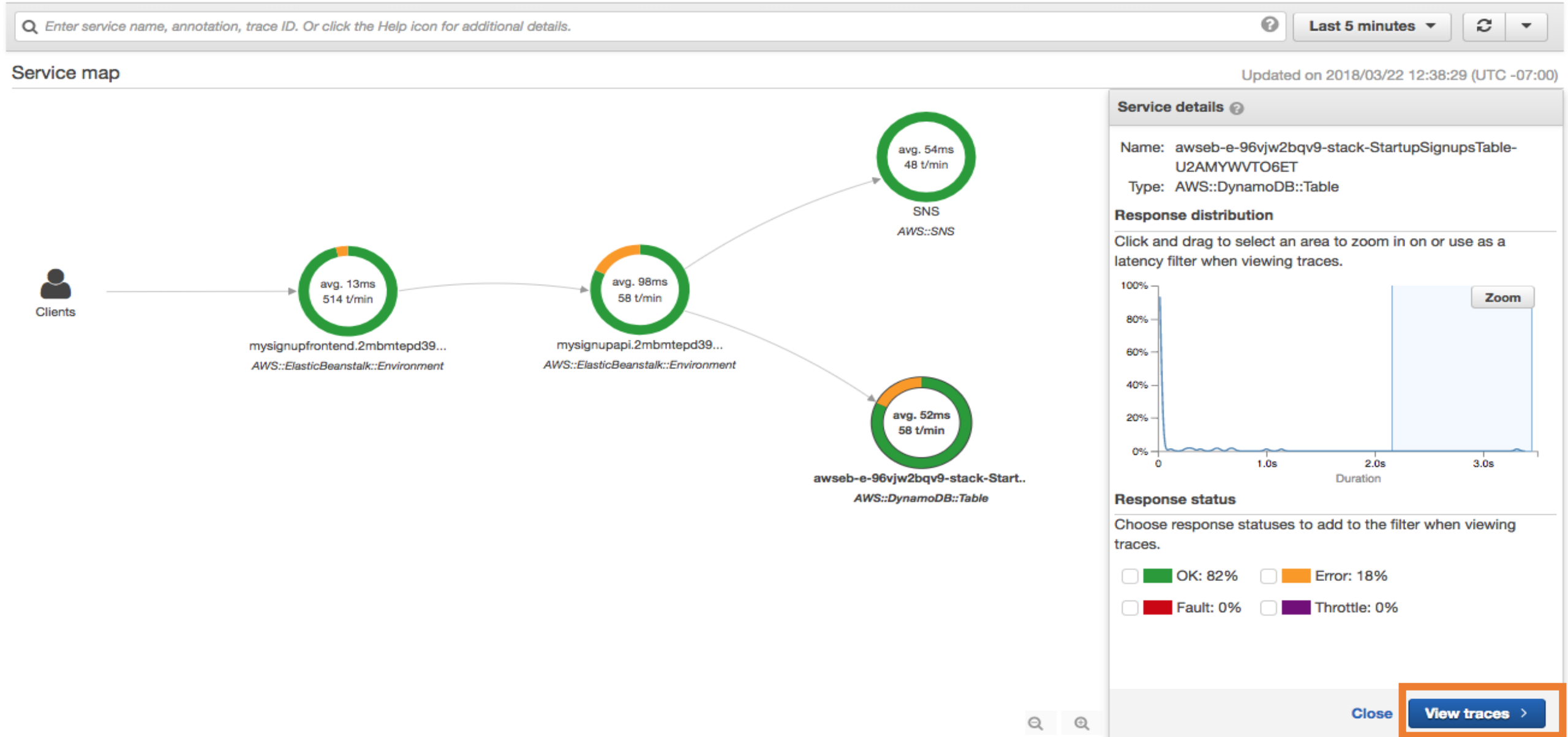
AWS X-Ray concepts



***Amazon Simple Queue** Service (Amazon SQS)

AWS X-ray service maps

IDENTIFY PERFORMANCE BOTTLENECKS



AWS X-ray traces

IDENTIFY PERFORMANCE BOTTLENECKS

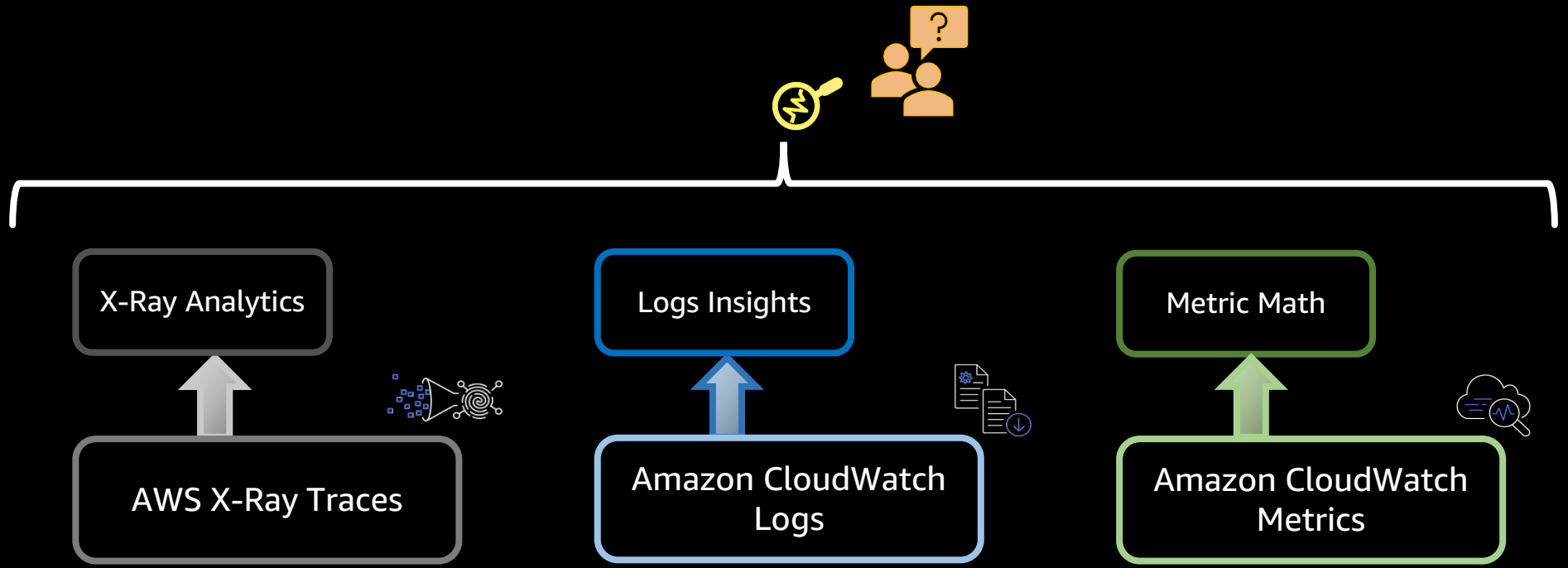
Tools and challenges

Want to be able to get a 360^0 view of a problem

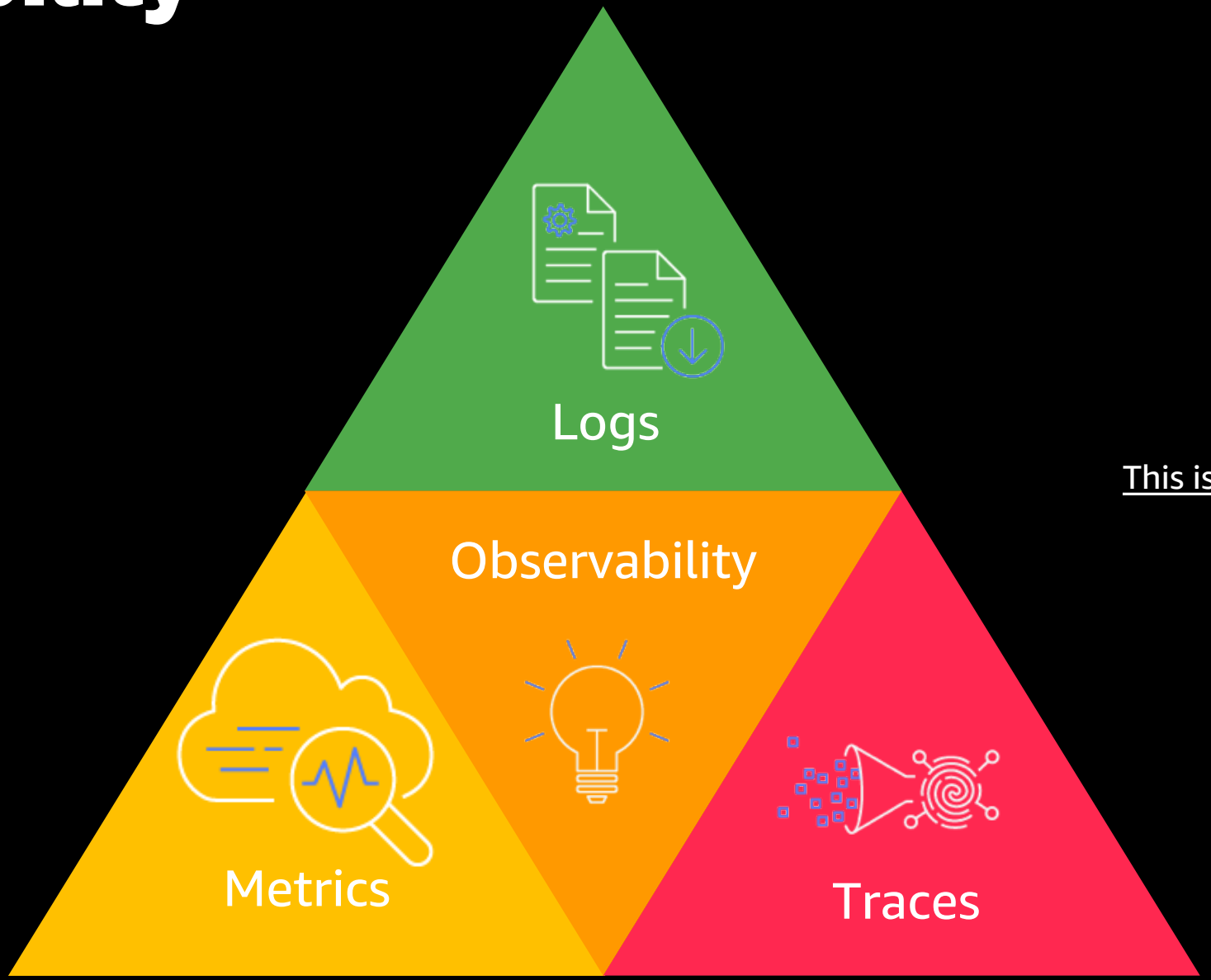
Need to correlate logs, metrics and traces to get deeper insights

Repetitive troubleshooting process

Data introspection

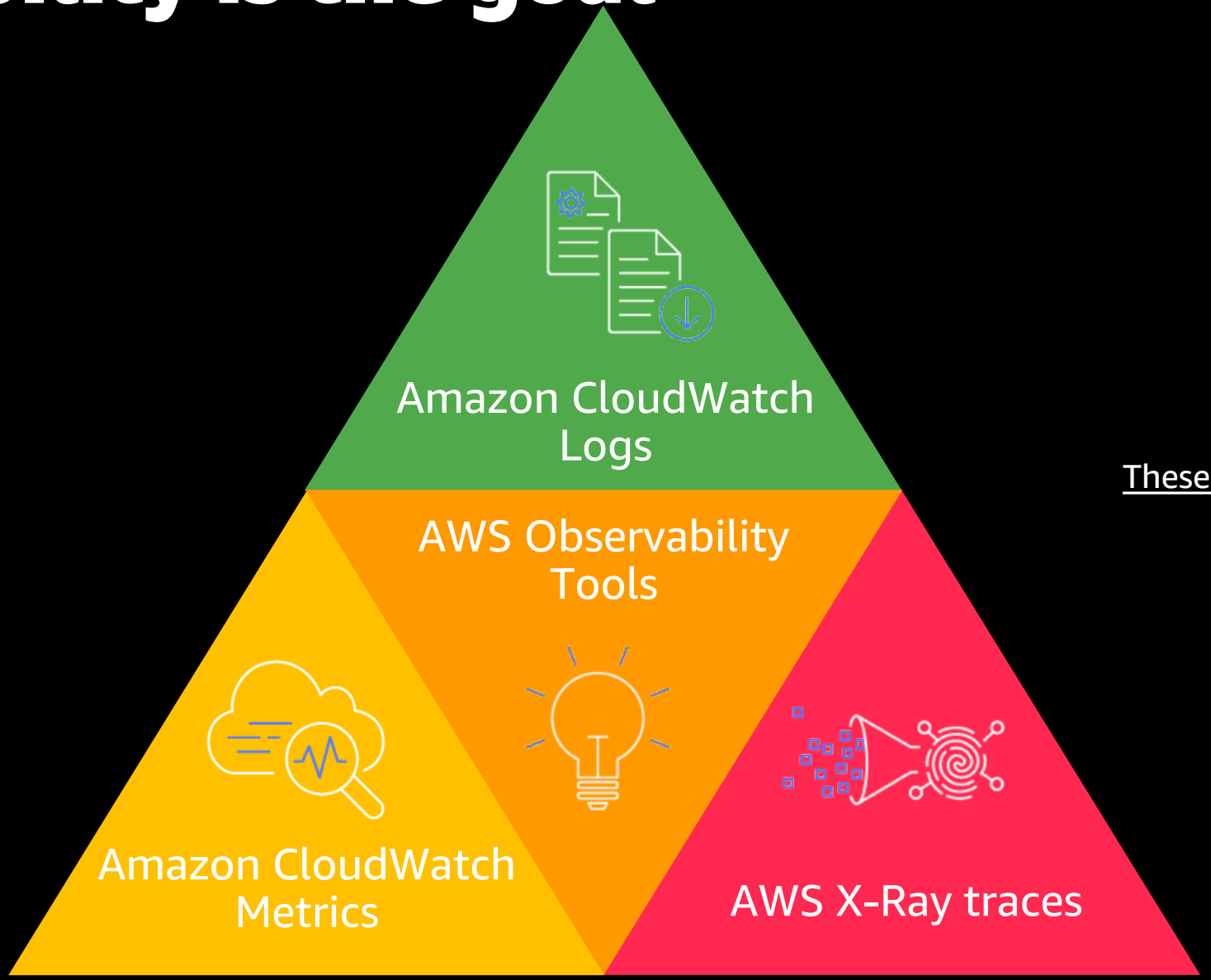


Observability



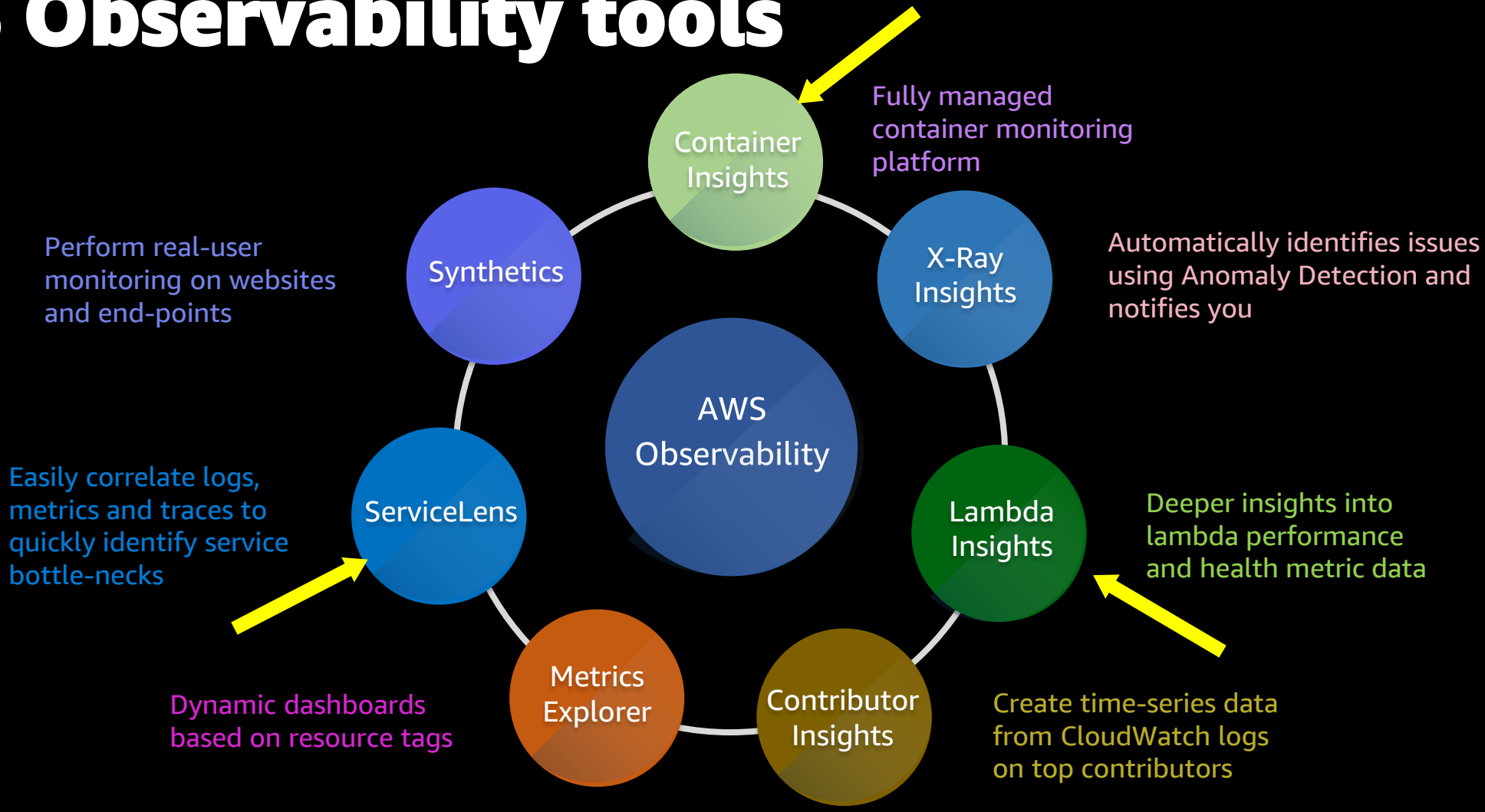
This is the goal

Observability is the goal

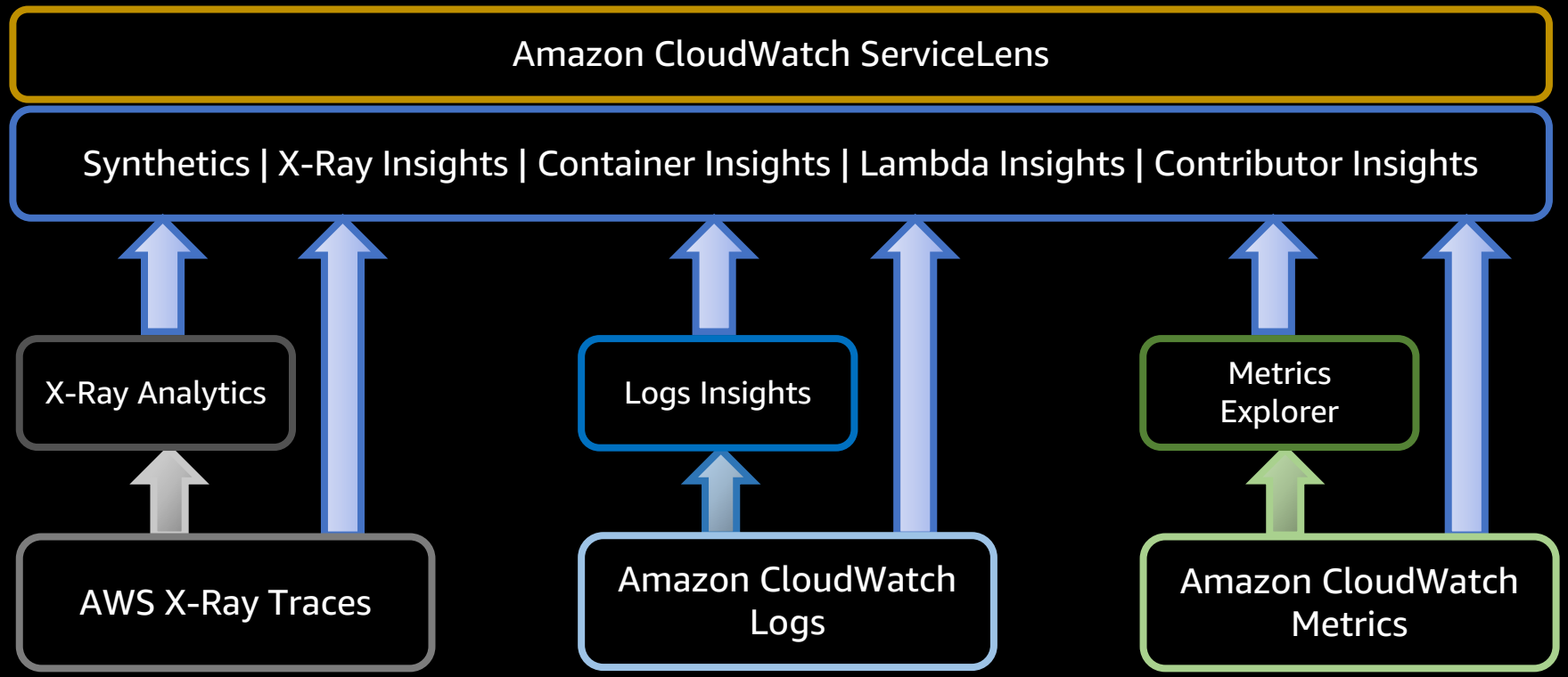


These are the tools

AWS Observability tools



Insights into apps and infrastructure



Amazon CloudWatch ServiceLens Demo

Example Scenario – Simple Microservice


```python
def get_item(id):
    """
    Returns item from the table
    """

    # Fake error
    if random.randrange(2) == 0:
        raise Exception("Fake error")

    item = table.get_item(Key={"id": id})
    if "Item" not in item:
        raise ValueError("Item not found")
    return item["Item"]["content"]
```

AWS X-Ray Serverless Samples - https://github.com/aws-samples/aws-xray-serverless-samples

Lambda > Applications > sample-xray-dev

sample-xray-dev

Overview | Deployments | Monitoring

API endpoint

Endpoint
https://faycxwpqeg.execute-api.ap-southeast-1.amazonaws.com/Prod

Resources (10)

Filter by tags and attributes or search by keyword

Logical ID	Physical ID	Type	Last modified
GetItemFunction	sample-xray-dev-GetItemFunction-VWEfOSWHhw3C	Lambda Function	33 minutes ago
PutItemFunction	sample-xray-dev-PutItemFunction-Fj9A5hvBRflG	Lambda Function	33 minutes ago
ServerlessRestApi	faycxwpqeg	ApiGateway RestApi	32 minutes ago
Table	sample-xray-dev-Table-ICJHWK9H6H0X	DynamoDB Table	33 minutes ago

sample-xray-dev

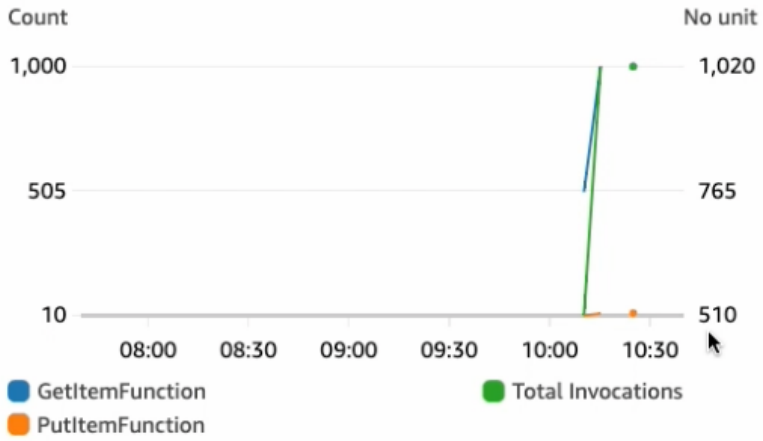
Overview | Deployments | Monitoring

Dashboard: AWS Lambda Info

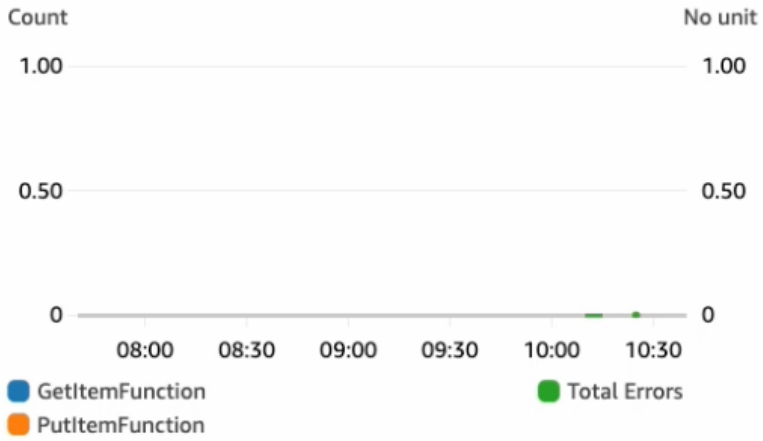
Select a dashboard AWS Lambda

Add to dashboard 1h 3h 12h 1d 3d 1w custom

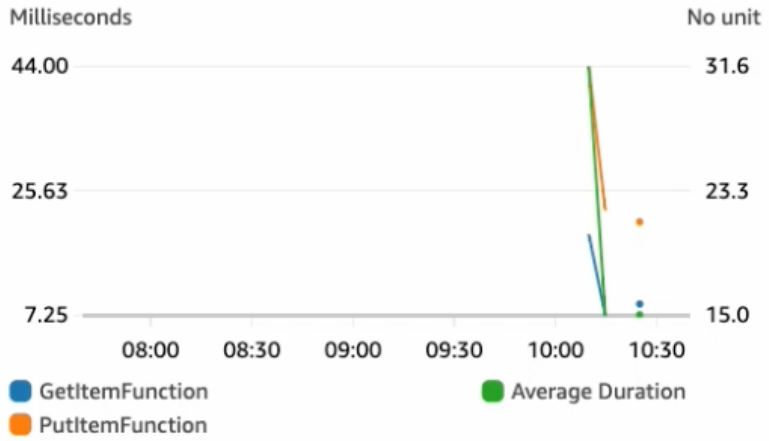
Invocations



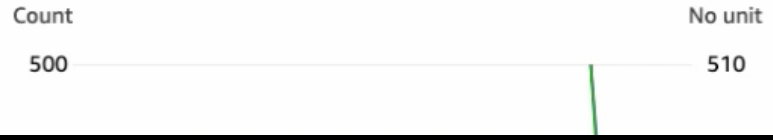
Errors



Duration (average)



ConcurrentExecutions



CloudWatch Logs Insights Info

Select a Lambda function GetItemFunction

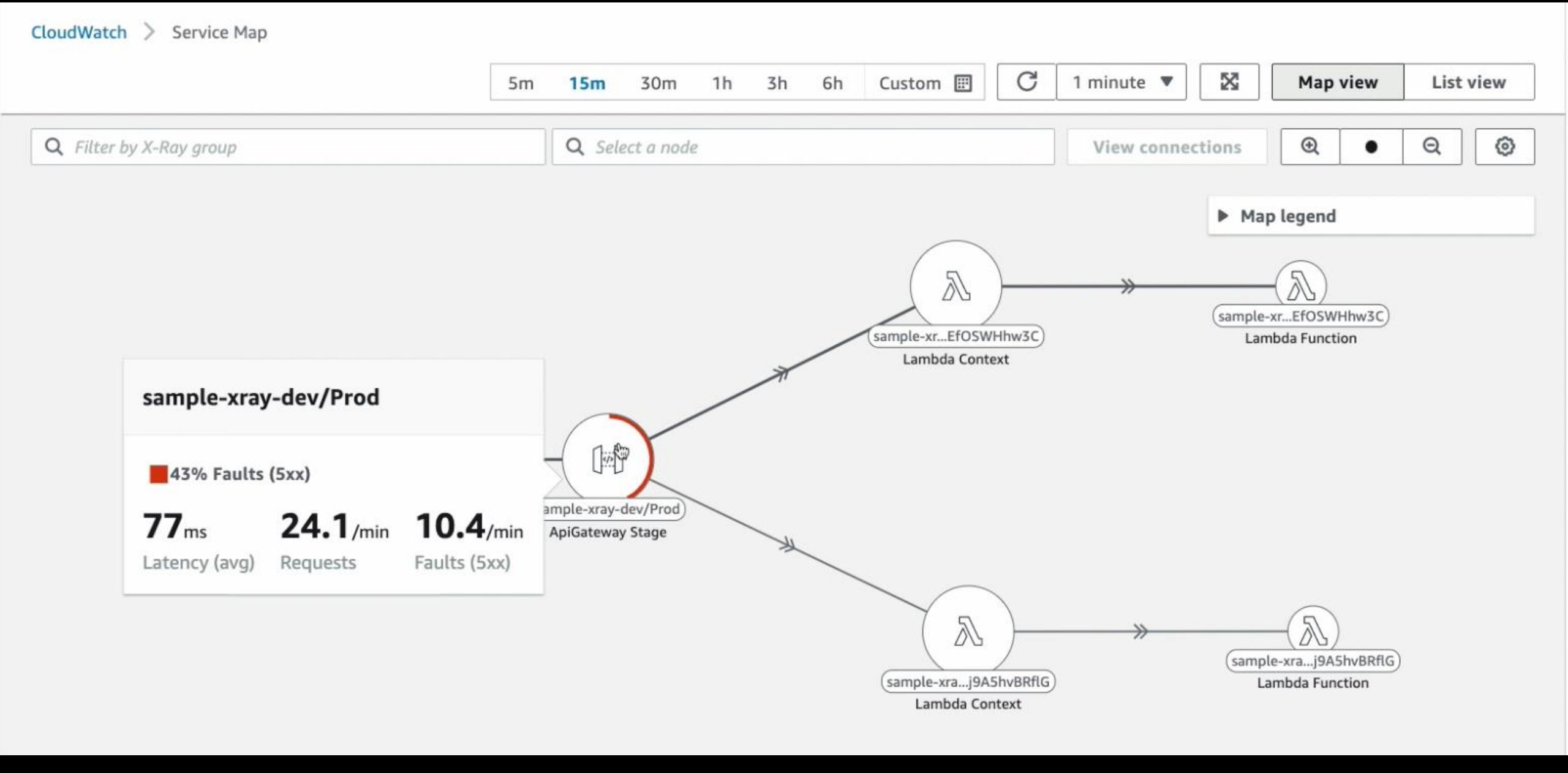
Add to dashboard | 1h | 3h | 12h | 1d | 3d | 1w | custom

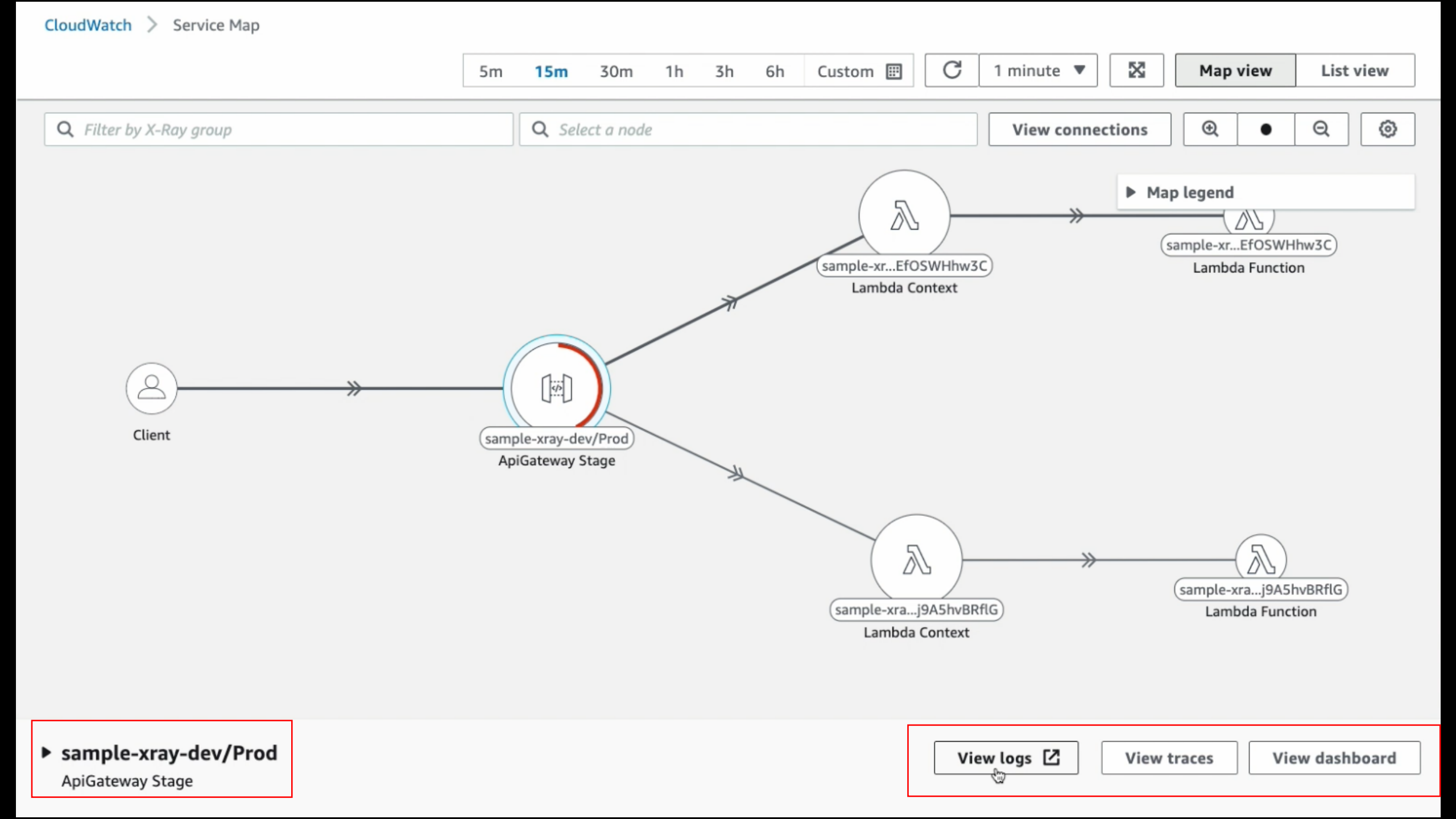
Recent invocations

#	Timestamp	RequestID	LogStream	DurationInMS	BilledDurationInMS	MemorySet
1	2021-05-18T10:42:33.561Z	eed543ba-e2c4-475d-b7b0-6c2087f635d7	2021/05/18/[$LATEST]c829e025f7664742aea7bd70fa3669d8	29.13	30	1024
2	2021-05-18T10:42:33.519Z	668d0af7-2611-4514-974e-f4a5009b81aa	2021/05/18/[$LATEST]e13e094979dc496f8ce34d1e46673562	49.48	50	1024
3	2021-05-18T10:42:33.506Z	67a84051-dfe0-4e97-8fe8-1de0e6d25432	2021/05/18/[$LATEST]355321ea40e742ac833b4b06e0aedbaf	28.01	29	1024
4	2021-05-18T10:42:33.472Z	a0fd465d-f0a6-4da5-b0c1-bb64bd22c5ca	2021/05/18/[$LATEST]a4e24bca14974afca4279c2bc566cb06	35.37	36	1024
5	2021-05-18T10:42:33.471Z	081bdf62-d3a1-46c3-a5a8-f481b2f347cd	2021/05/18/[$LATEST]1f78755217a041b39a9c176065921cc0	30.91	31	1024
6	2021-05-18T10:42:33.469Z	04bbda82-ecad-4091-b440-9572b0e3ce5a	2021/05/18/[$LATEST]74390e8838294949af733d766b3f8686	1.85	2	1024
7	2021-05-18T10:42:33.464Z	73c5d1a0-f964-44b5-b3fe-09eeef4999eb	2021/05/18/[$LATEST]026d11b516094494bf400817bd4d1762	35.35	36	1024
8	2021-05-18T10:42:33.456Z	a45f228b-e796-4209-8d66-adb374600152	2021/05/18/[$LATEST]651bf058bb434b7e95e9b04c67e5f6fa	34.16	35	1024
9	2021-05-18T10:42:33.454Z	f828a1e6-17bd-4b66-b696-1ee6a7f29d4d	2021/05/18/[$LATEST]11be1efda7384ff18dab086b335de0ac	1.64	2	1024

Most expensive invocations in GB-seconds (memory assigned * billed duration)

#	Timestamp	RequestID	LogStream	BilledDurationInMS	MemorySetInMB	BilledDura
1	2021-05-18T10:19:00.765Z	5ce3320c-7231-4791-abdb-0564e4fb2456	2021/05/18/[$LATEST]cebe5d0609864a268e4a7a1a106c6b43	83	1024	0.083
2	2021-05-18T10:26:29.687Z	f10c251b-25d1-4b23-8084-9a48cd2a4a84	2021/05/18/[$LATEST]609c75adcfac4963b7599ad64d49d3d7	66	1024	0.066
3	2021-05-18T10:26:25.450Z	bf9d15f7-f805-4f4e-9af8-95afa8a68382	2021/05/18/[$LATEST]750aa31dffc846029f1406842281ca26	59	1024	0.059
4	2021-05-18T10:14:01.116Z	c5d65490-7100-4c0d-b8b4-5ebdaaa1e65b	2021/05/18/[$LATEST]1958ecc3ce8a416f8a9130e4534d1d67	58	1024	0.058
5	2021-05-18T10:26:25.116Z	2a14f8d9-ee65-4e40-b9cb-0f8f69663de6	2021/05/18/[$LATEST]51616dd52d904777a678998d163ae312	58	1024	0.058
6	2021-05-18T10:26:25.116Z	2e217d51-7963-4c6c-86f8-f8a6f855dd91	2021/05/18/[$LATEST]bff5709fdadf418b9b66fc7e0d8eefb9	56	1024	0.056
7	2021-05-18T10:26:25.110Z	08a44d16-361d-4bad-a13e-be4596d0985e	2021/05/18/[$LATEST]7224b78a761d4a2db7ab49fadae4b5d3	54	1024	0.054
8	2021-05-18T10:26:25.099Z	aa10ef58-e380-40b2-8dd3-9e303cfaa838	2021/05/18/[$LATEST]f2af2a6be50b417985c029bbe851682f	54	1024	0.054
9	2021-05-18T10:14:01.132Z	ef441111-8e91-441b-a3dd-2d51f9db7c9a	2021/05/18/[$LATEST]8019a71ada5144b394c08219fb1e4475	53	1024	0.053


CloudWatch
Service Map
5m
15m
30m
1h
3h
6h
Custom
1 minute
Map view
List view
Filter by X-Ray group
Select a node
View connections
Map legend
sample-xray-dev/Prod
43% Faults (5xx)
77 ms
Latency (avg)
24.1 /min
Requests
10.4 /min
Faults (5xx)
ample-xray-dev/Prod
ApiGateway Stage
sample-xr...EfOSWHhw3C
Lambda Context
sample-xr...EfOSWHhw3C
Lambda Function
sample-xra...j9A5hvBRflG
Lambda Context
sample-xra...j9A5hvBRflG
Lambda Function


CloudWatch
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1 minute
Map view
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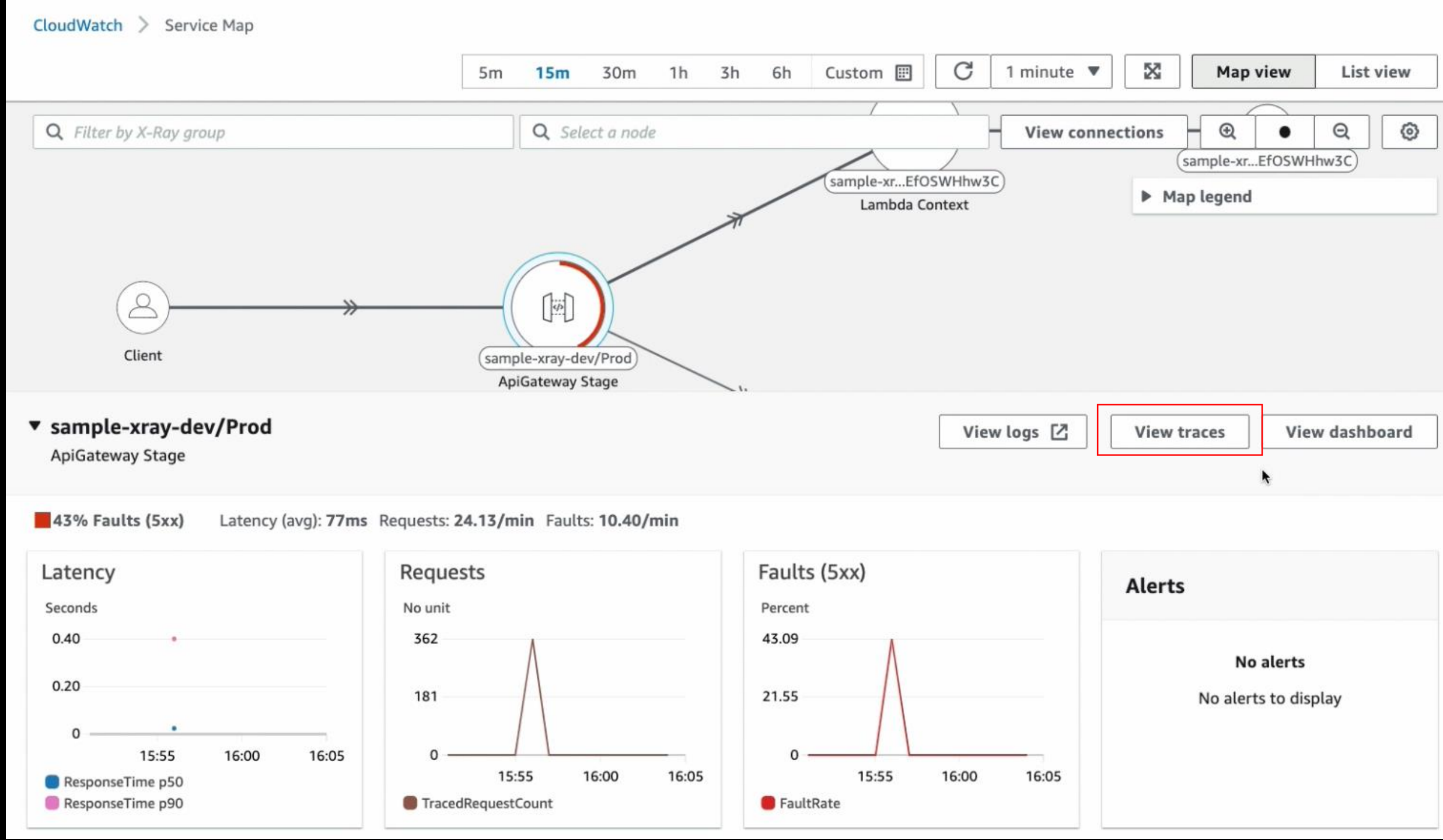
sample-xr...EfOSWHhw3C
Lambda Context
sample-xr...EfOSWHhw3C
Lambda Function
Client
sample-xray-dev/Prod
ApiGateway Stage
sample-xra...j9A5hvBRflG
Lambda Context
sample-xra...j9A5hvBRflG
Lambda Function
sample-xray-dev/Prod
ApiGateway Stage
View logs
View traces
View dashboard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Service Map
5m
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Map view
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sample-xr...EfOSWHhw3C
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Lambda Context
Map legend
Client
sample-xray-dev/Prod
ApiGateway Stage
sample-xray-dev/Prod
ApiGateway Stage
View logs
View traces
View dashboard
43% Faults (5xx)
Latency (avg): 77ms
Requests: 24.13/min
Faults: 10.40/min
Latency
Seconds
0.40
0.20
0
15:55
16:00
16:05
ResponseTime p50
ResponseTime p90
Requests
No unit
362
181
0
15:55
16:00
16:05
TracedRequestCount
Faults (5xx)
Percent
43.09
21.55
0
15:55
16:00
16:05
FaultRate
Alerts
No alerts
No alerts to display

sample-xray-dev/Prod
ApiGateway Stage
Latency (avg): 77ms Requests: 24.13/min Faults: 10.40/min 0 Alarms

View node on map

Filters Info

Choose a set of filters for your traces. The filters are based on fields found in the retrieved traces. To find traces using other filters use the custom query.

View in X-Ray Analytics

Filter type

- Trace status
- Node status
- Response time
- Custom query
- HTTP Method
- Response code
- URL
- Resource ARN
- User
- User agent

Filter traces by HTTP Method

Select rows from the table and add them to your filter

Add HTTP Method to filter

Find HTTP Method

1

HTTP Method	Successful requests	% of retrieved traces	Mean response time
-	0%	0%	0s
POST	0%	0%	0s
DELETE	0%	0%	0s
GET	55.2%	96%	0.08s
PUT	100.0%	4%	0.07s

Summary details of traces

Number of traces
362

Mean response time
80ms

Retrieved 348 traces

Learn more

User agent

Summary details of traces

Number of traces

348

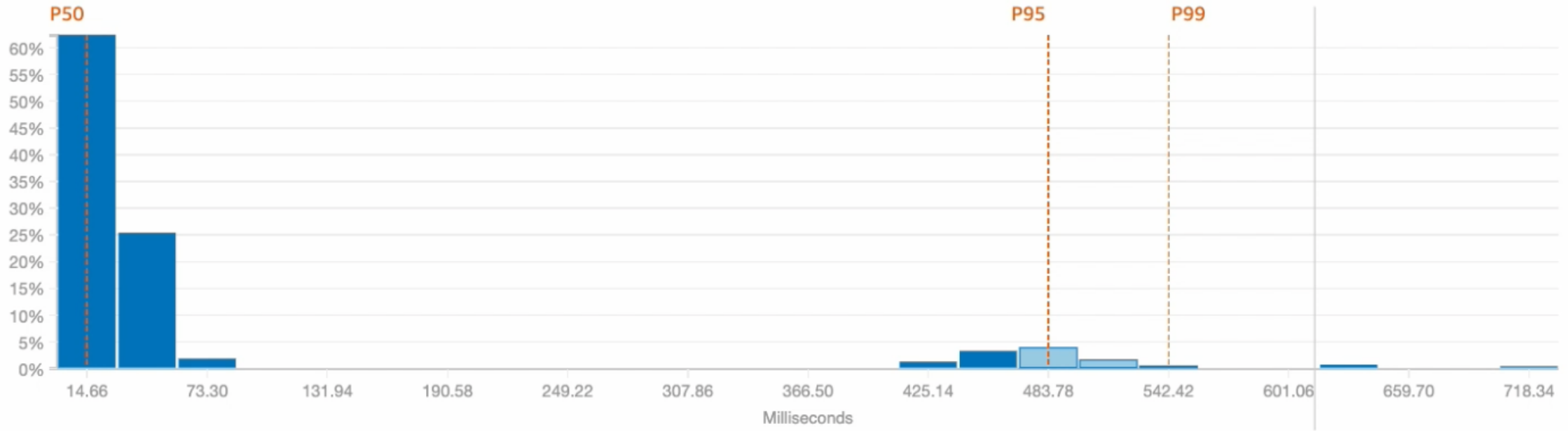
Mean response time

80ms

Response time distribution of traces

Select range to filter by response time

Add selected response times to filter



Retrieved 19 traces

Learn more

Traces (19)

The table only shows up to 1000 most recent traces. Look for any trace ID here.

View details

Find traces

1 2

ID	Trace status	Timestamp	Response code	Response Time	HTTP Method	URL Address
1-60a39650-61110eb916e4b80c57114bdc	Fault	22.0min (2021-05-18 15:56:24)	500	0.529s	GET	https://faycxwpqeg.execute-api.ap-southeast-1.amazonaws.com/Prod/thing02
1-60a39650-0787de9a695f8e742ae5c48b	OK	22.0min (2021-05-18 15:56:24)	200	0.52s	GET	https://faycxwpqeg.execute-api.ap-southeast-1.amazonaws.com/Prod/thing05
1-60a39650-7ee736741992430a41735450	OK	22.0min (2021-05-18 15:56:24)	200	0.507s	GET	https://faycxwpqeg.execute-api.ap-southeast-1.amazonaws.com/Prod/thing04
1-60a39650-1626c9ca400a671275014295	OK	22.0min (2021-05-18 15:56:24)	200	0.503s	GET	https://faycxwpqeg.execute-api.ap-southeast-1.amazonaws.com/Prod/thing01
1-60a39650-592a208244435b732a355c4b	OK	22.0min (2021-05-18 15:56:24)	200	0.503s	GET	https://faycxwpqeg.execute-api.ap-southeast-1.amazonaws.com/Prod/thing08
1-60a39650-31f64b0813dd1c386318be44	OK	22.0min (2021-05-18 15:56:24)	200	0.501s	GET	https://faycxwpqeg.execute-api.ap-southeast-1.amazonaws.com/Prod/thing07
1-60a39650-77a09bca7ac926422de0fc35	Fault	22.0min (2021-05-18 15:56:24)	500	0.493s	GET	https://faycxwpqeg.execute-api.ap-southeast-1.amazonaws.com/Prod/thing02
1-60a39650-01c0086a1c99bfcf0978b0f1	OK	22.0min (2021-05-18 15:56:24)	200	0.488s	GET	https://faycxwpqeg.execute-api.ap-southeast-1.amazonaws.com/Prod/thing02
1-60a39650-54bcdb3f2885f3c60edeccbf	OK	22.0min (2021-05-18 15:56:24)	200	0.486s	GET	https://faycxwpqeg.execute-api.ap-southeast-1.amazonaws.com/Prod/thing06
1-60a39650-0e2b8b561b4c4a4661ae8d2d	OK	22.0min (2021-05-18 15:56:24)	200	0.483s	GET	https://faycxwpqeg.execute-api.ap-southeast-1.amazonaws.com/Prod/thing09
1-60a39650-6408aa913375e8e413c27427	OK	22.0min (2021-05-18 15:56:24)	200	0.482s	GET	https://faycxwpqeg.execute-api.ap-southeast-1.amazonaws.com/Prod/thing06

Method	Response Code	Duration	Age
GET	500	529ms	22 minutes

Segments Timeline Info

sample-xray-dev/Prod

Segment details

Overview

Time

Errors and faults

Api gateway

Account id

[redacted]889

Rest api id

faycxwpqeg

Stage

Prod

Request id

627f8dec-a7da-4ec5-b144-1a5ac6fa2fcc

Prod

```
    request_id :  627f8dec-a7da-4ec5-b14
  }
}
```

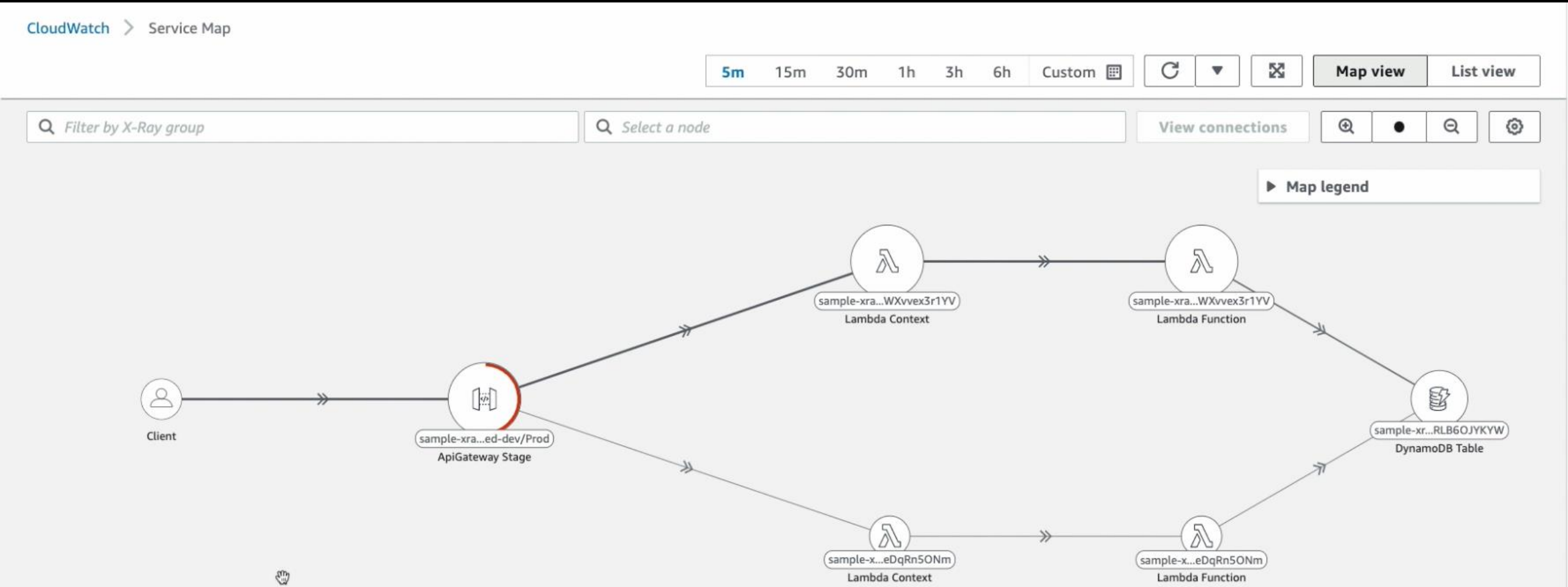
Logs Info

All logs for this trace

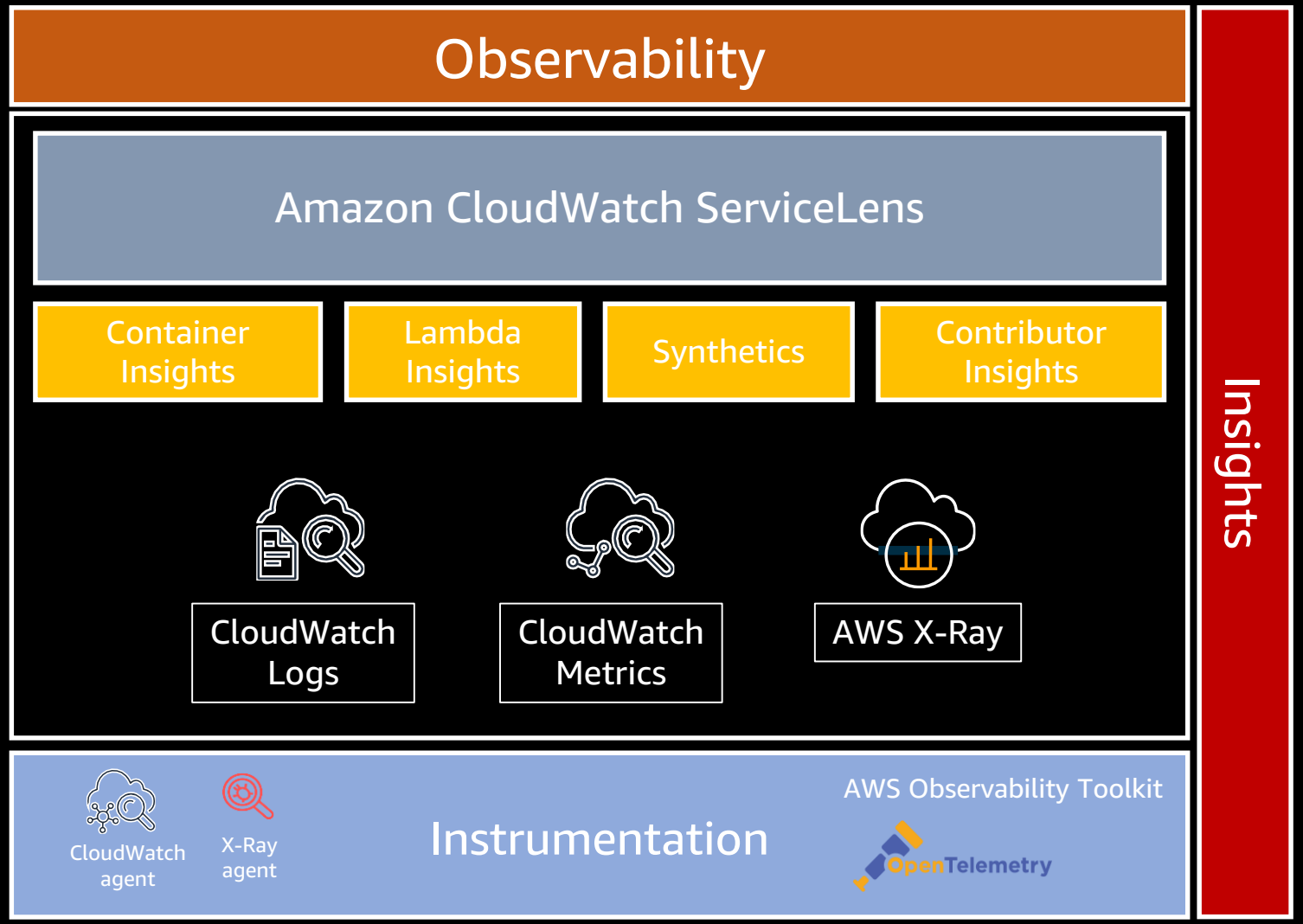
View in CloudWatch Logs Insights

▸ 2	[redacted]889:API-Gateway-Execution-Logs_faycxwpqeg/Prod	2021-05-18T10:26:24.586Z	(627f8dec-a7da-4ec5-b144-1a5ac6fa2fcc) Extended Requ
▸ 3	[redacted]889:API-Gateway-Execution-Logs_faycxwpqeg/Prod	2021-05-18T10:26:24.588Z	(627f8dec-a7da-4ec5-b144-1a5ac6fa2fcc) Usage Plan ch
▸ 4	[redacted]889:API-Gateway-Execution-Logs_faycxwpqeg/Prod	2021-05-18T10:26:24.588Z	(627f8dec-a7da-4ec5-b144-1a5ac6fa2fcc) Starting exec
▸ 5	[redacted]889:API-Gateway-Execution-Logs_faycxwpqeg/Prod	2021-05-18T10:26:24.588Z	(627f8dec-a7da-4ec5-b144-1a5ac6fa2fcc) Method reques
▾ 6	[redacted]889:API-Gateway-Execution-Logs_faycxwpqeg/Prod	2021-05-18T10:26:24.588Z	(627f8dec-a7da-4ec5-b144-1a5ac6fa2fcc) Method reques
	@ingestionTime	1621333604678	
	@log	[redacted]889:API-Gateway-Execution-Logs_faycxwpqeg/Prod	
	@logStream	7c13beca469e0b9a7f7b4ed16cdf4d67	
	@message	(627f8dec-a7da-4ec5-b144-1a5ac6fa2fcc) Method request path: {name=thing02}	
	@timestamp	1621333584588	
▸ 7	[redacted]889:API-Gateway-Execution-Logs_faycxwpqeg/Prod	2021-05-18T10:26:24.588Z	(627f8dec-a7da-4ec5-b144-1a5ac6fa2fcc) Method reques
▸ 8	[redacted]889:API-Gateway-Execution-Logs_faycxwpqeg/Prod	2021-05-18T10:26:24.588Z	(627f8dec-a7da-4ec5-b144-1a5ac6fa2fcc) Method reques
▸ 9	[redacted]889:API-Gateway-Execution-Logs_faycxwpqeg/Prod	2021-05-18T10:26:24.588Z	(627f8dec-a7da-4ec5-b144-1a5ac6fa2fcc) HTTP Method:
▸ 10	[redacted]889:API-Gateway-Execution-Logs_faycxwpqeg/Prod	2021-05-18T10:26:24.588Z	(627f8dec-a7da-4ec5-b144-1a5ac6fa2fcc) API Key autho
▸ 11	[redacted]889:API-Gateway-Execution-Logs_faycxwpqeg/Prod	2021-05-18T10:26:24.589Z	(627f8dec-a7da-4ec5-b144-1a5ac6fa2fcc) Sending reque

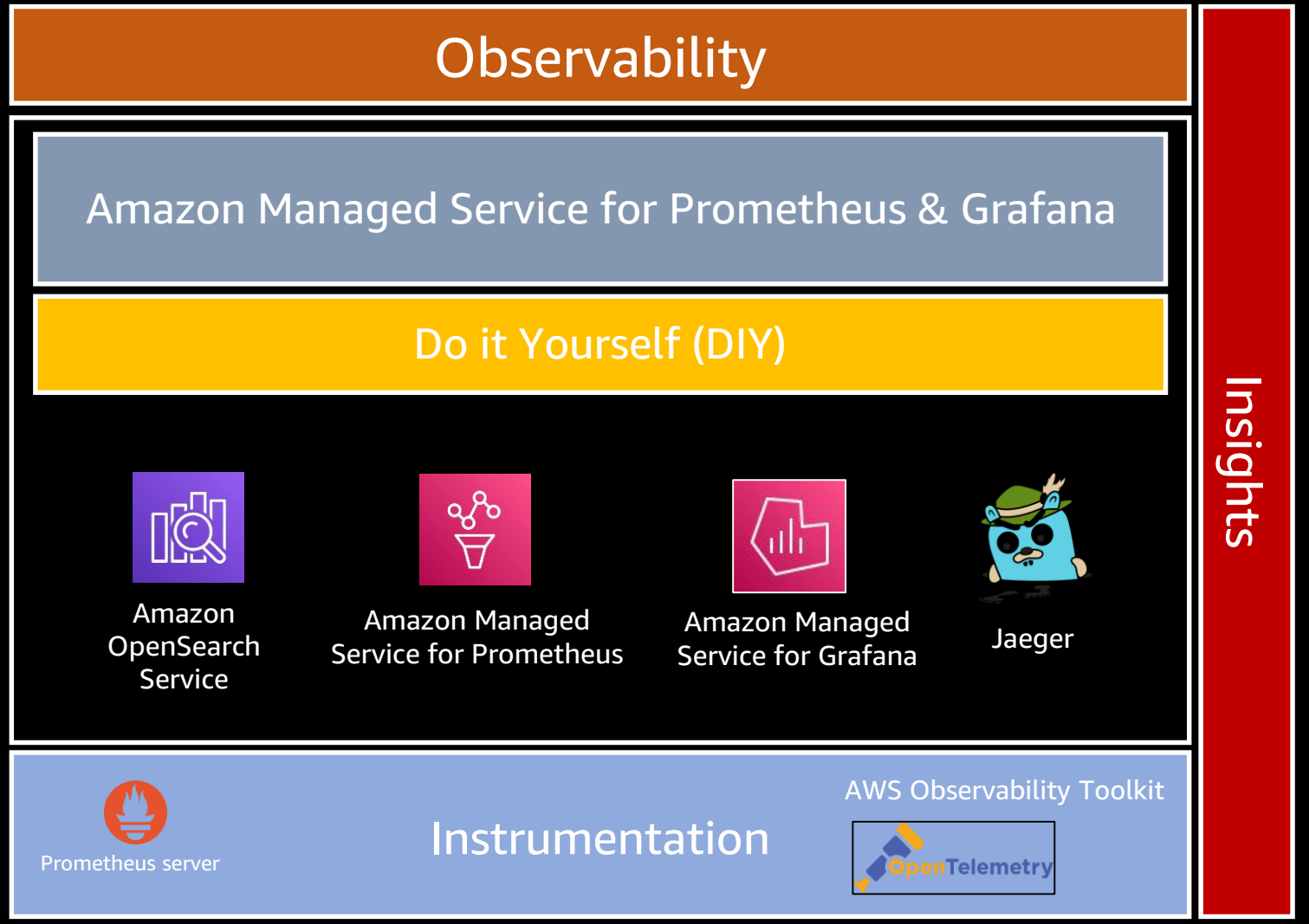
AWS Service Lens



Monitoring options



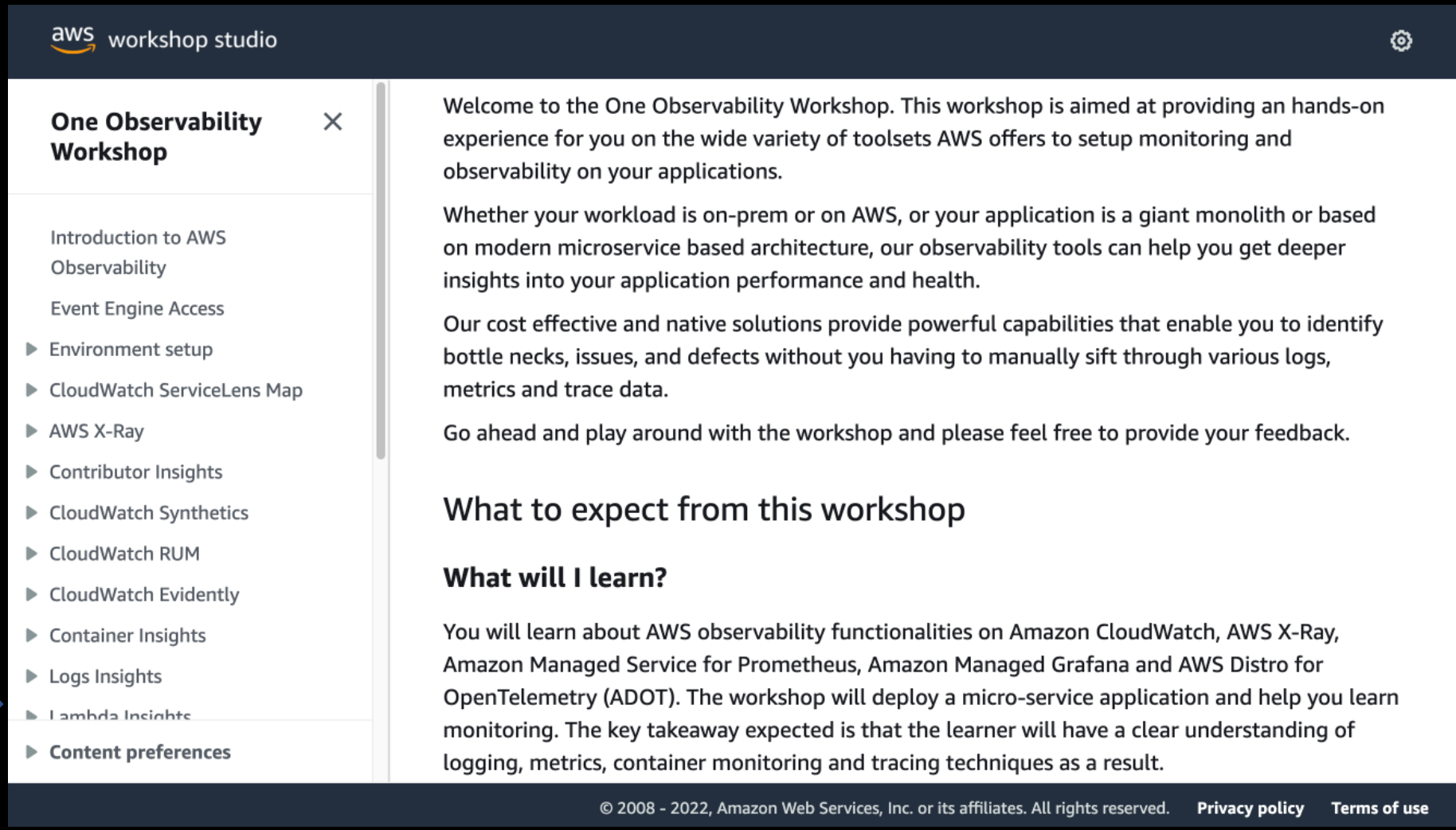
Monitoring options



Hands-on experience

Get a hands-on experience on all AWS Observability features.

Available in English, Japanese, Spanish and Korean languages



https://observability.workshop.aws/en/

Resources

- What is Observability? https://aws.amazon.com/products/management-and-governance/use-cases/monitoring-and-observability/
- AWS X-Ray Serverless Samples https://github.com/aws-samples/aws-xray-serverless-samples
- Amazon CloudWatch Custom Metrics https://aws.amazon.com/premiumsupport/knowledge-center/cloudwatch-push-custom-metrics/

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Thank you!

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