AWS X-Ray

(with Fargate and Lambda)

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AWS DC Meetup

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Agenda

- What is it
- Why use it
- What does it cost
- How does it work
- Where did it help me
- How did I use it
- Demo
- Lessons learned
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What is it

“AWS X-Ray helps developers analyze and debug production, distributed applications, such as those built using a microservices architecture. With X-Ray, you can understand how your application and its underlying services are performing to identify and troubleshoot the root cause of performance issues and errors. X-Ray provides an end-to-end view of requests as they travel through your application, and shows a map of your application’s underlying components. You can use X-Ray to analyze both applications in development and in production, from simple three-tier applications to complex microservices applications consisting of thousands of services.”

https://aws.amazon.com/xray/

Why use it

- Collect and display application performance metrics
- Gives insight into how an application is performing and at granular levels
- Metrics comparison after deployments provides immediate indication of performance differences or where issues might be occurring
- Very cost effective
- If it saves any labor/time in awareness or while troubleshooting it is worth the cost
- Cost can be dialed up/down by changing sampling level

What does it cost

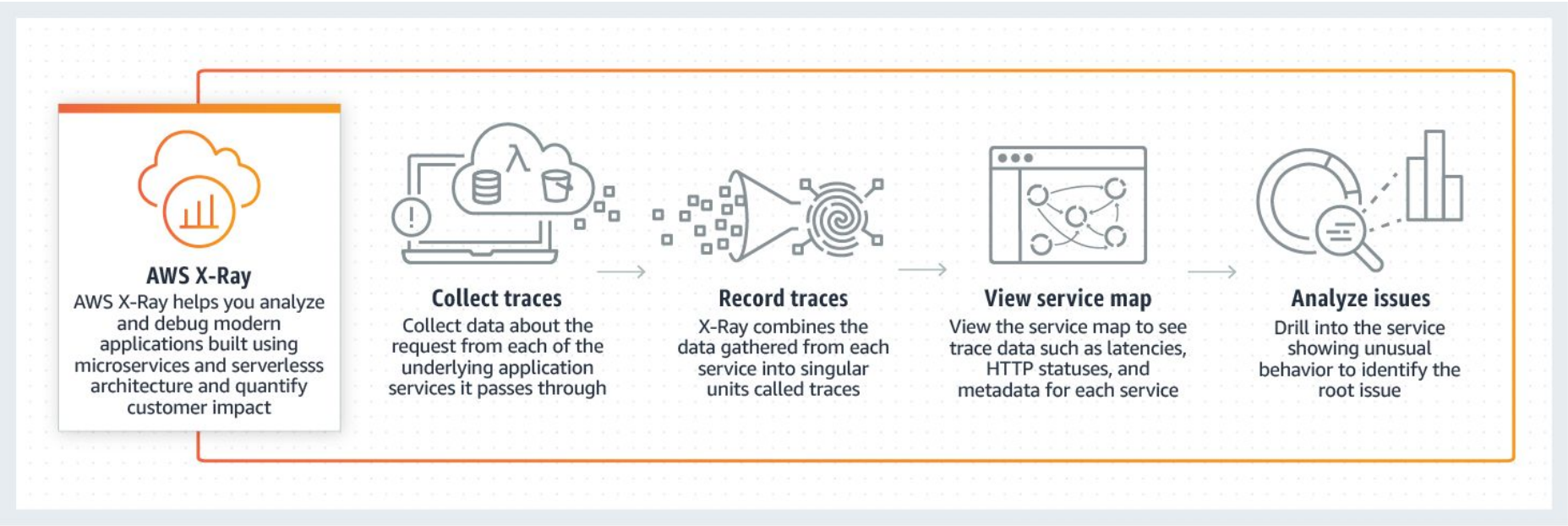
- The first 100,000 traces recorded each month are free.
- The first 1,000,000 traces retrieved or scanned each month are free.
- If you have an application which receives 2,000 incoming requests per hour and you're using a 10% sampling rate, then your cost would be calculated as follows:
- Traces Recorded
  - Traces Recorded per Month = 2,000 requests per hour x 24 hours x 31 days x 10% = 148,800 traces
  - Billable Traces Recorded per Month = 148,800 traces - 100,000 traces in free tier = 48,800 traces
  - Monthly Traces Recorded Charges = 48,800 traces * $0.000005 = $0.24

https://aws.amazon.com/xray/pricing/

How does it work

- Container, my Python Flask use example
  - Instrumentation data sent to an agent installed in the container, it could have been an independent container in the Fargate task
  - Agent forwards to service
- Lambda, my email processing function
- EC-2
  - Agent installed on instance and forwards to service
- Non-AWS resource, such as your machine
  - Agent installed and running
- Application can send directly to service without using an agent

How does it work



https://aws.amazon.com/xray/

Where did it help me

- Within the first 2 days of use it revealed where performance bottlenecks in aws s3 calls were occurring
- On 3 other occasions it provided an immediate indication of where performance issues were occuring or improvements had appeared after a deployment

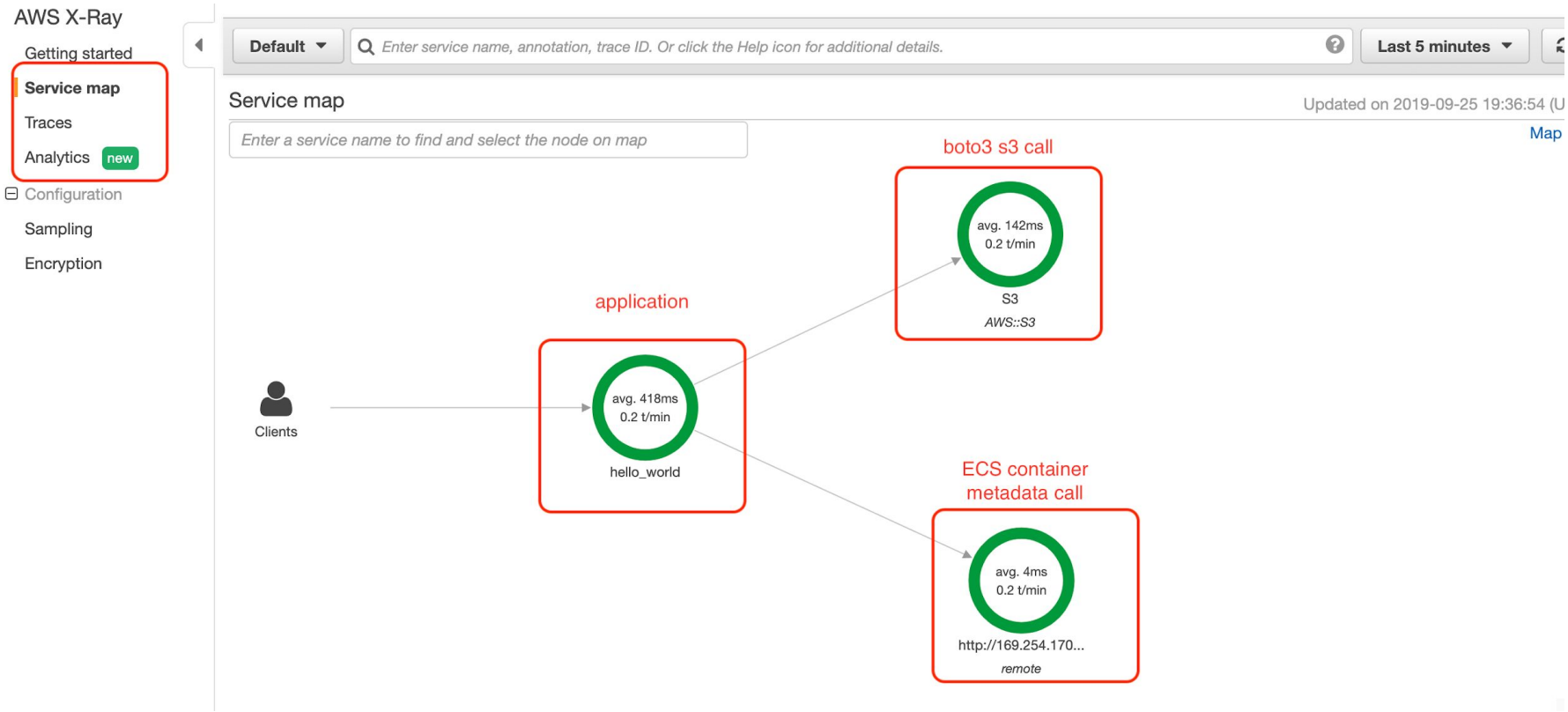
How did I use it

- Python Flask apps running in Fargate
  - S3
  - DynamoDB
  - SNS/SQS
- Lambda functions
  - S3
  - SES

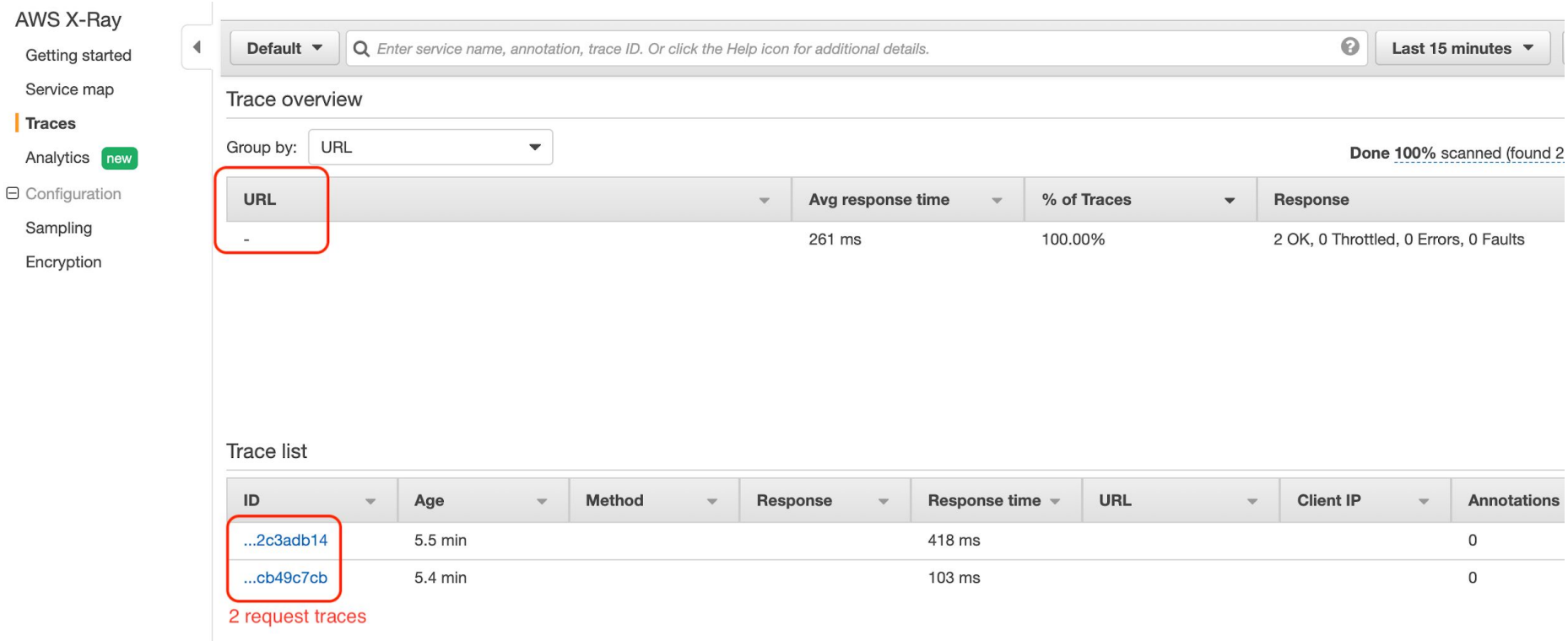
Demo

- Python Flask application running in Fargate
  - Created and deployed using the AWS Fargate cli
- Lambda function
  - Created and deployed using AWS cli

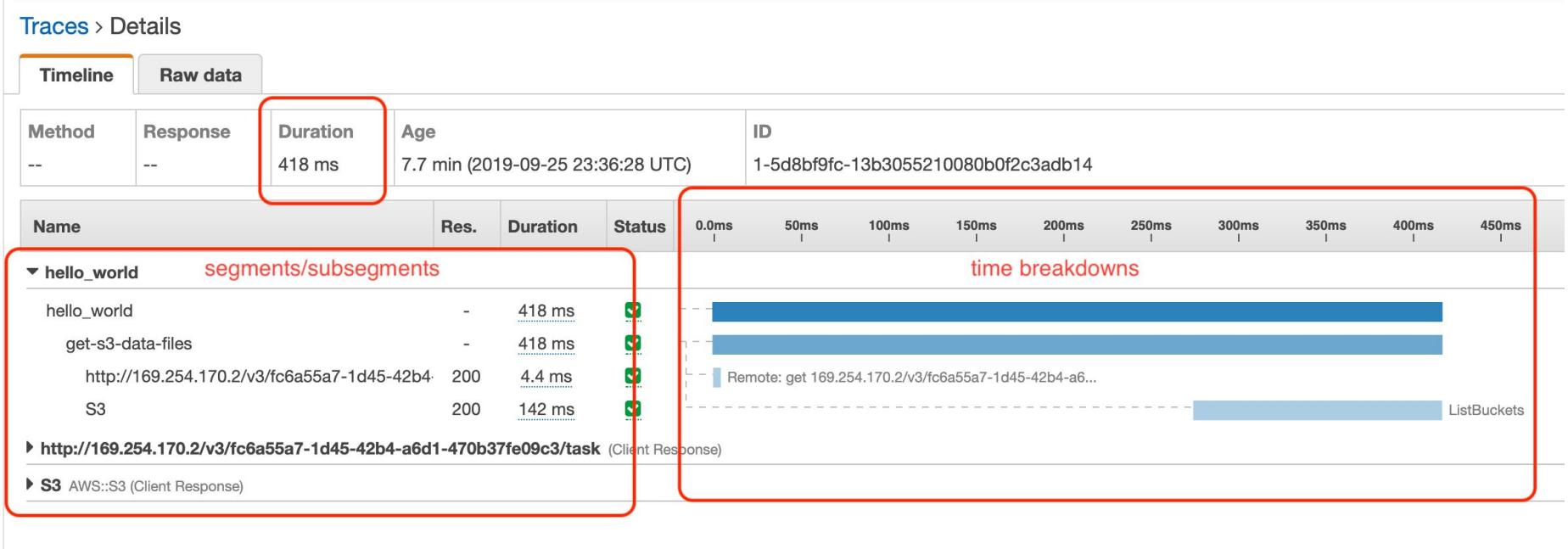
Demo system map



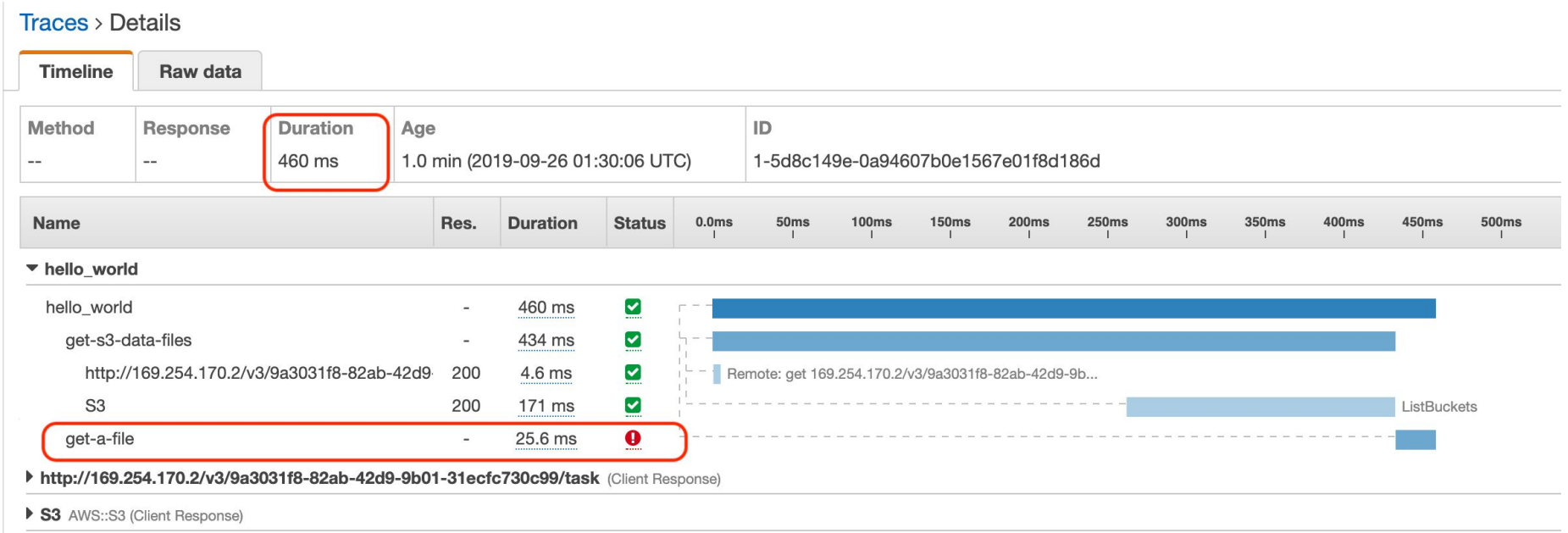
Demo traces


AWS X-Ray
Getting started
Service map
Traces
Analytics
new
Configuration
Sampling
Encryption
Default
Enter service name, annotation, trace ID. Or click the Help icon for additional details.
Last 15 minutes
Trace overview
Group by:
URL
Done 100% scanned (found 2
URL
Avg response time
% of Traces
Response
-
261 ms
100.00%
2 OK, 0 Throttled, 0 Errors, 0 Faults
Trace list
ID
Age
Method
Response
Response time
URL
Client IP
Annotations
...2c3adb14
5.5 min
418 ms
0
...cb49c7cb
5.4 min
103 ms
0
2 request traces

Demo trace


Traces › Details
Timeline
Raw data
Method
--
Response
--
Duration
418 ms
Age
7.7 min (2019-09-25 23:36:28 UTC)
ID
1-5d8bf9fc-13b3055210080b0f2c3adb14
Name
Res.
Duration
Status
0.0ms
50ms
100ms
150ms
200ms
250ms
300ms
350ms
400ms
450ms
segments/subsegments
time breakdowns
hello_world
hello_world - 418 ms
get-s3-data-files - 418 ms
http://169.254.170.2/v3/fc6a55a7-1d45-42b4 200 4.4 ms
S3 200 142 ms
Remote: get 169.254.170.2/v3/fc6a55a7-1d45-42b4-a6...
ListBuckets
http://169.254.170.2/v3/fc6a55a7-1d45-42b4-a6d1-470b37fe09c3/task (Client Response)
S3 AWS::S3 (Client Response)

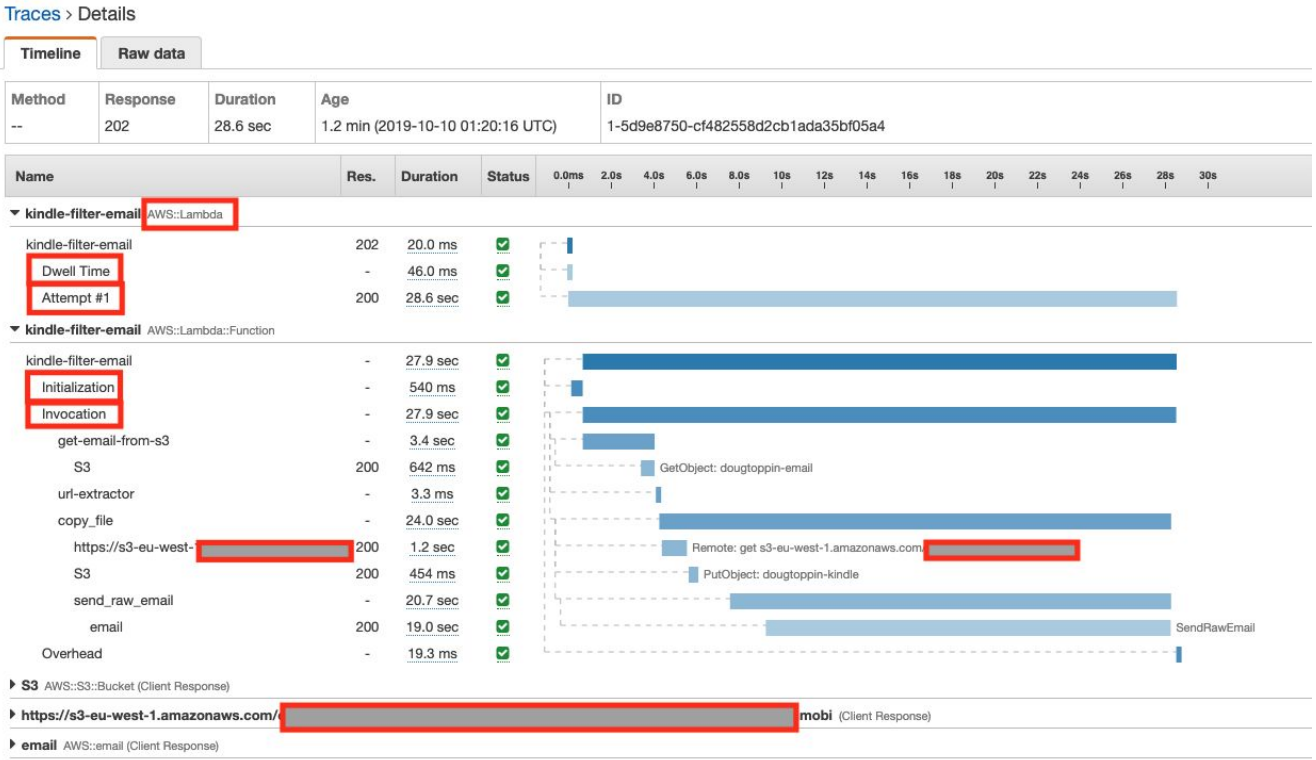
Demo comparisons after a deployment



Demo Lambda


Service map
Updated on 2019-10-09 21:21:20 (UTC -04:00)
Enter a service name to find and select the node on map
Map legend
avg. 1.18s
0.2 t/min
https://s3-eu-west-1...
remote
avg. 454ms
0.2 t/min
dougtoppin-kindle
AWS::S3::Bucket
Clients
avg. 20ms
0.2 t/min
kindle-filter-email
AWS::Lambda
avg. 27.9s
0.2 t/min
kindle-filter-email
AWS::Lambda::Function
avg. 642ms
0.2 t/min
dougtoppin-email
AWS::S3::Bucket
avg. 19s
0.2 t/min
email
AWS::email

Demo Lambda metrics

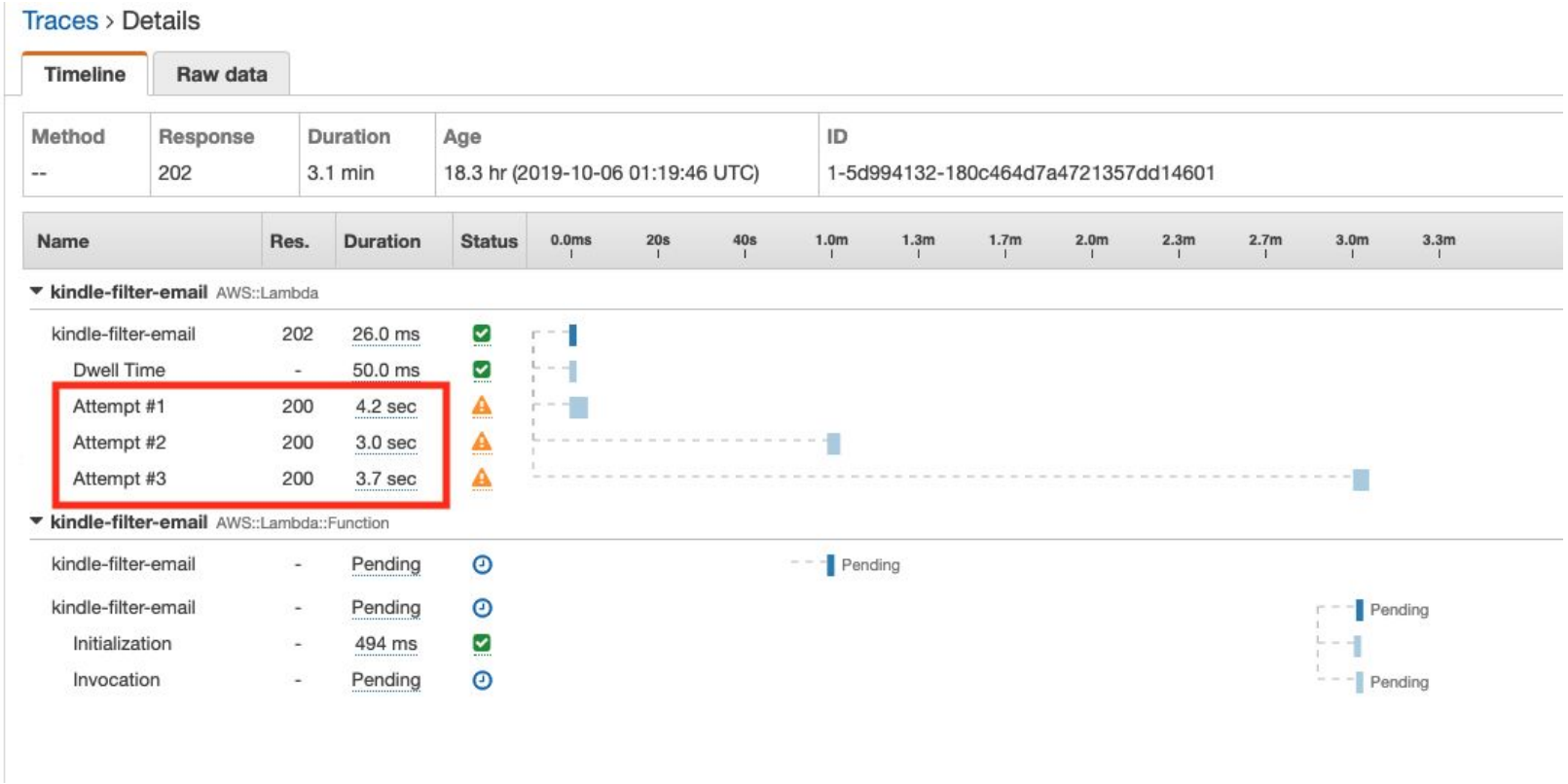


Demo Lambda metrics definitions

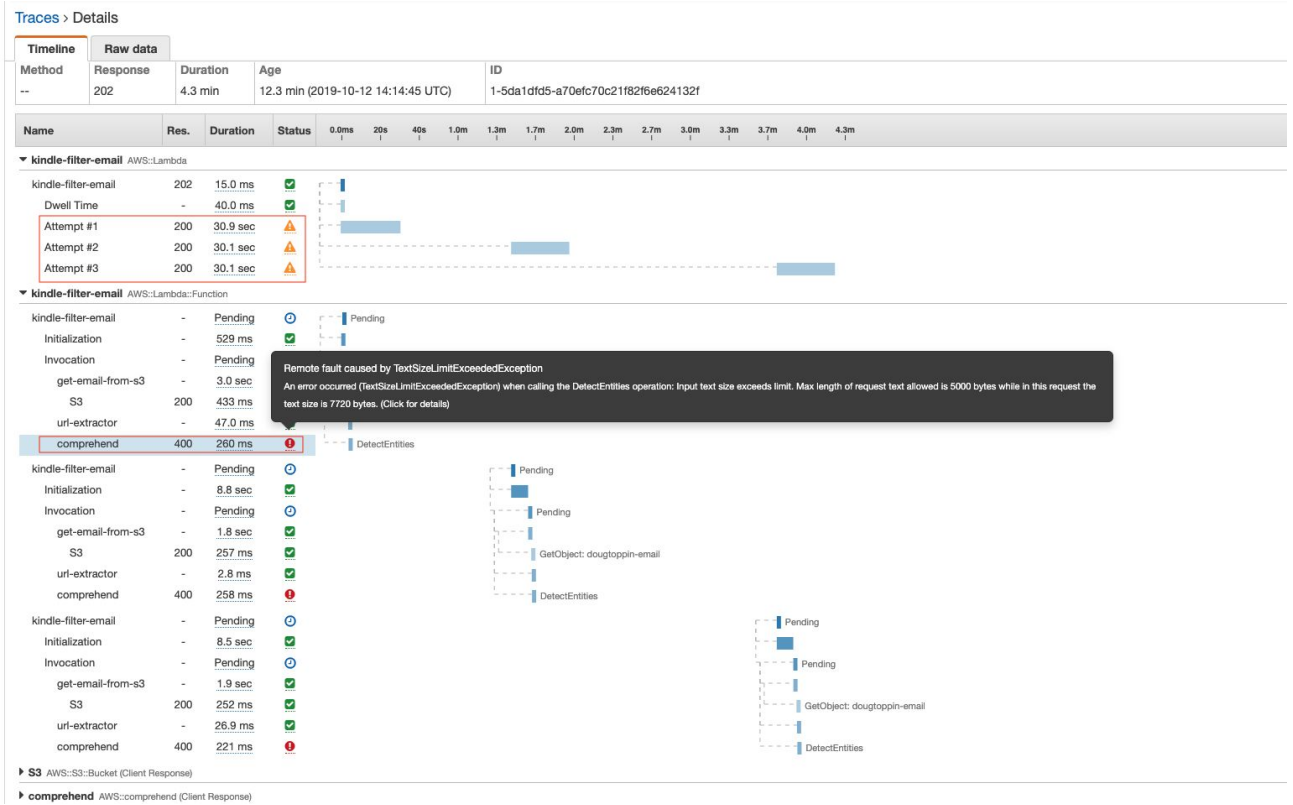
- Dwell time - time spent in Lambda service queue
- Invocation attempts - retries
  - https://docs.aws.amazon.com/lambda/latest/dg/retries-on-errors.html
  - “**Asynchronous Invocation** – Lambda retries function errors twice. If the function doesn't have enough capacity to handle all incoming requests, events may wait in the queue for hours or days to be sent to the function. You can configure a dead-letter queue on the function to capture events that were not successfully processed. For more information, see Asynchronous Invocation.”
- Initialization - function initialization code run before the handler

https://docs.aws.amazon.com/lambda/latest/dg/lambda-x-ray.html

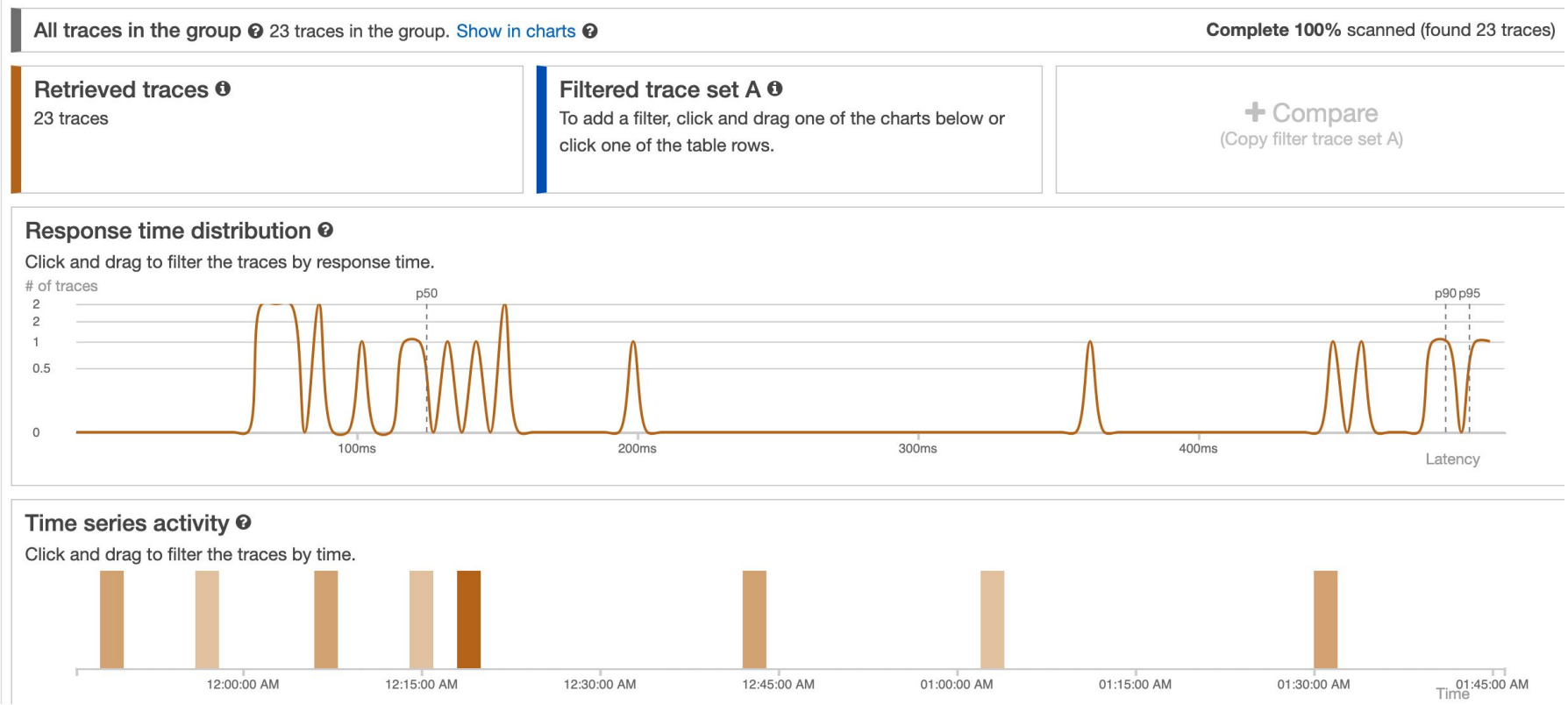
Demo Lambda attempts - default timeout too short



Demo Lambda attempts - service limit exceeded



Demo comparisons over time



Demo Lambda example

```python
import boto3
from aws_xray_sdk.core import xray_recorder
from aws_xray_sdk.core import patch

patch(['boto3'])

s3_client = boto3.client('s3')

def lambda_handler(event, context):
    bucket_name = event['bucket_name']
    bucket_key = event['bucket_key']
    body = event['body']

    put_object_into_s3(bucket_name, bucket_key, body)
    get_object_from_s3(bucket_name, bucket_key)

# Define subsegments manually
def put_object_into_s3(bucket_name, bucket_key, body):
    try:
        xray_recorder.begin_subsegment('put_object')
        response = s3_client.put_object(Bucket=bucket_name, Key=bucket_key, Body=body)
        status_code = response['ResponseMetadata']['HTTPStatusCode']
        xray_recorder.current_subsegment().put_annotation('put_response', status_code)
    finally:
        xray_recorder.end_subsegment()

# Use decorators to automatically set the subsegments
@xray_recorder.capture('get_object')
def get_object_from_s3(bucket_name, bucket_key):
    response = s3_client.get_object(Bucket=bucket_name, Key=bucket_key)
    status_code = response['ResponseMetadata']['HTTPStatusCode']
    xray_recorder.current_subsegment().put_annotation('get_response', status_code)
```

https://docs.aws.amazon.com/lambda/latest/dg/python-tracing.html

Demo deployment with fargate cli

Makefile

```
run:
	fargate task run app  --subnet-id ${SUBNET} --security-group-id ${SG} --task-role ${ROLE}
stop:
	fargate task stop app
info:
	$(eval IP:= $(shell fargate task info app --no-color --no-emoji|grep IP|sed -n 's/^.*: //p'))
	@curl http://${IP}:8080
```

Lessons learned

- Instrument all external service calls
- Instrument all application compute bound functions
- Name segments and subsegments in a fashion that makes sense later
- Name segments in a manner that makes them easy to distinguish or filter on when you have multiple parallel environments, example is cluster name prefixes
- Make sampling level easily configurable to keep cost down
- Plan to include additional metadata in traces to allow more filtering later
- Decide what you want to be a segment, container start or request processing start?
- Filter out health check path using local sampling configuration

Links

- https://github.com/dougtoppin/presentation-aws-xray

- https://aws.amazon.com/xray/
- https://aws.amazon.com/xray/pricing/
- https://docs.aws.amazon.com/xray/latest/devguide/xray-daemon-ecs.html
- https://docs.aws.amazon.com/xray-sdk-for-python/latest/reference/basic.html
- https://docs.aws.amazon.com/xray/latest/devguide/xray-troubleshooting.html

- https://github.com/awslabs/fargatecli
- https://read.iopipe.com/how-far-out-is-aws-fargate-part-2-e87088f3ee26

- https://palletsprojects.com/p/flask/