



M A D O 1

Event-driven architecture

Danilo Poccia
Chief Evangelist (EMEA)
Amazon Web Services

Agenda

From APIs to events

Event-driven choreography with Amazon EventBridge

Customer case study

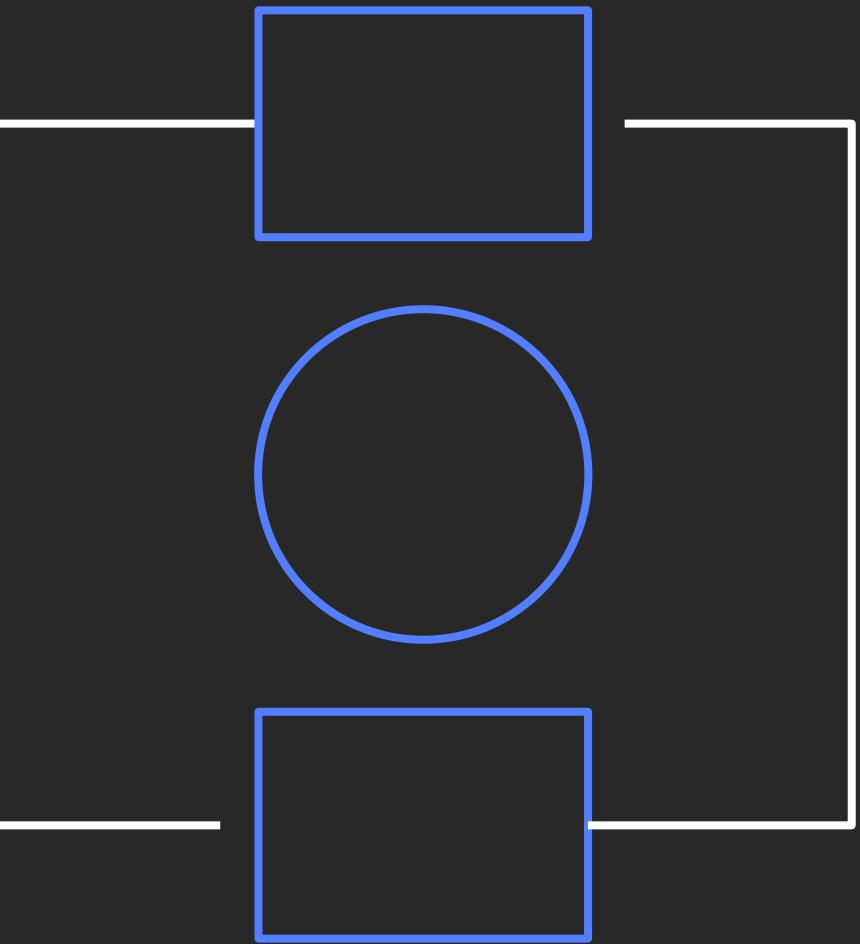
Orchestration with AWS Step Functions

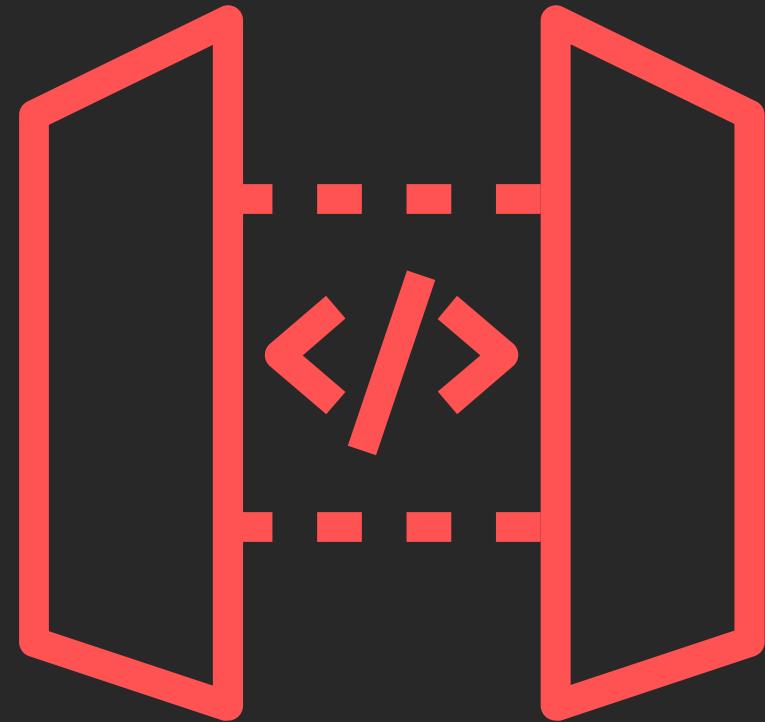
Tracing and observability

From APIs to events

Small pieces loosely joined

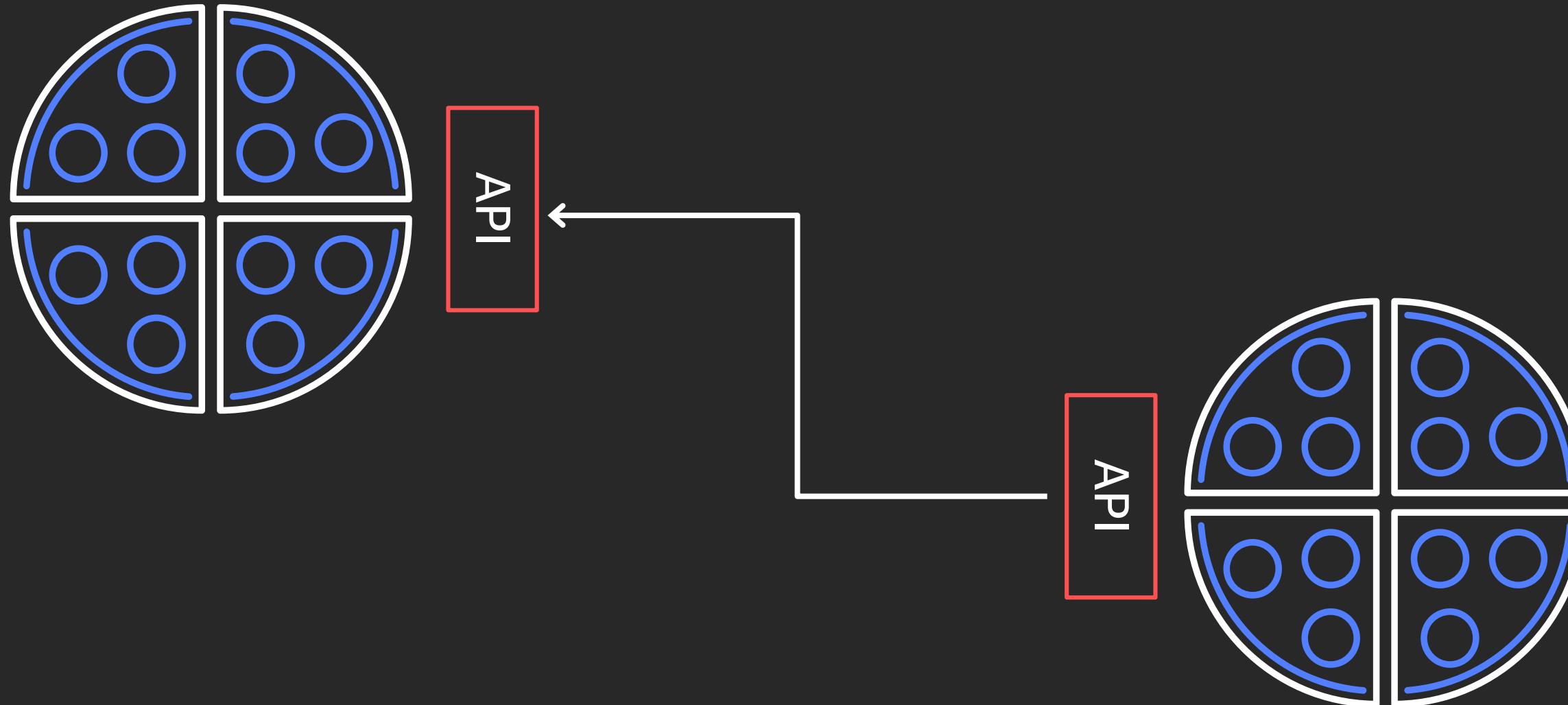
Cloud-native architectures are
small pieces, loosely joined



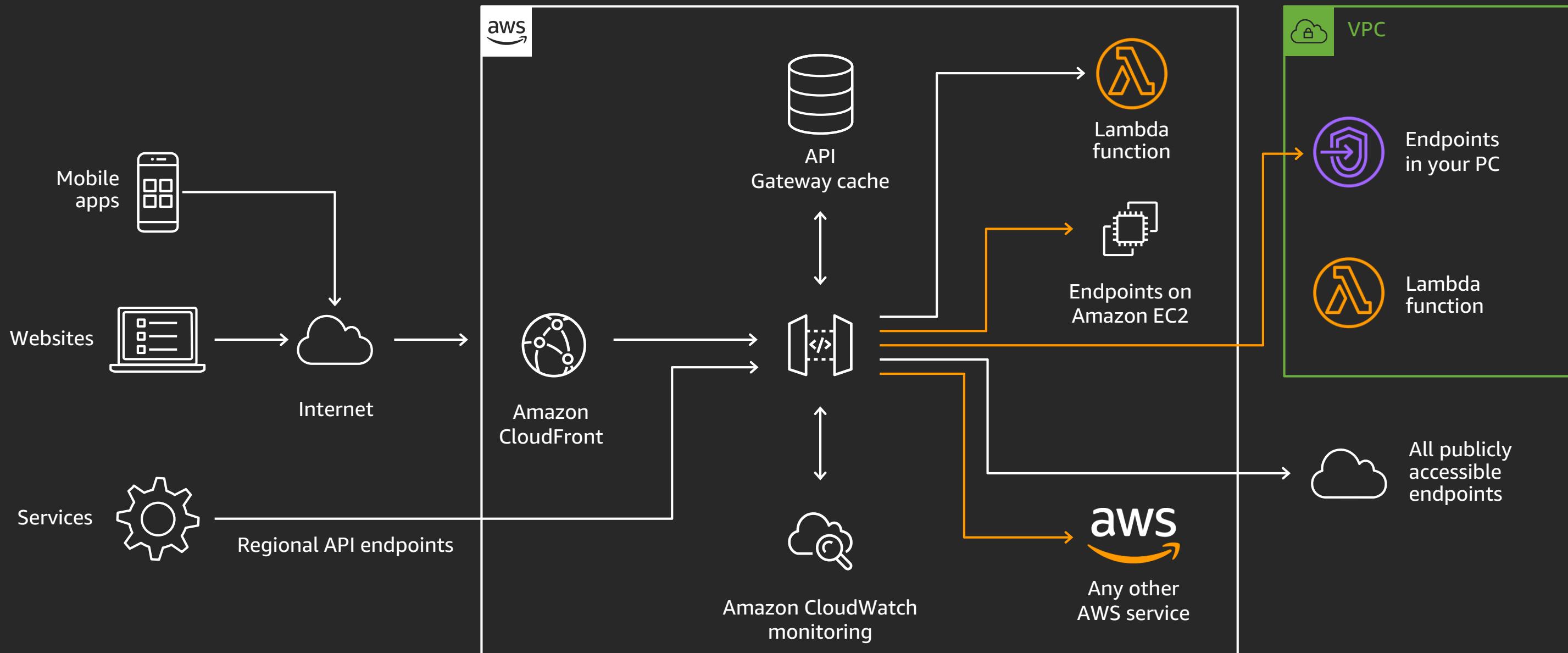


APIs are the front door
of microservices

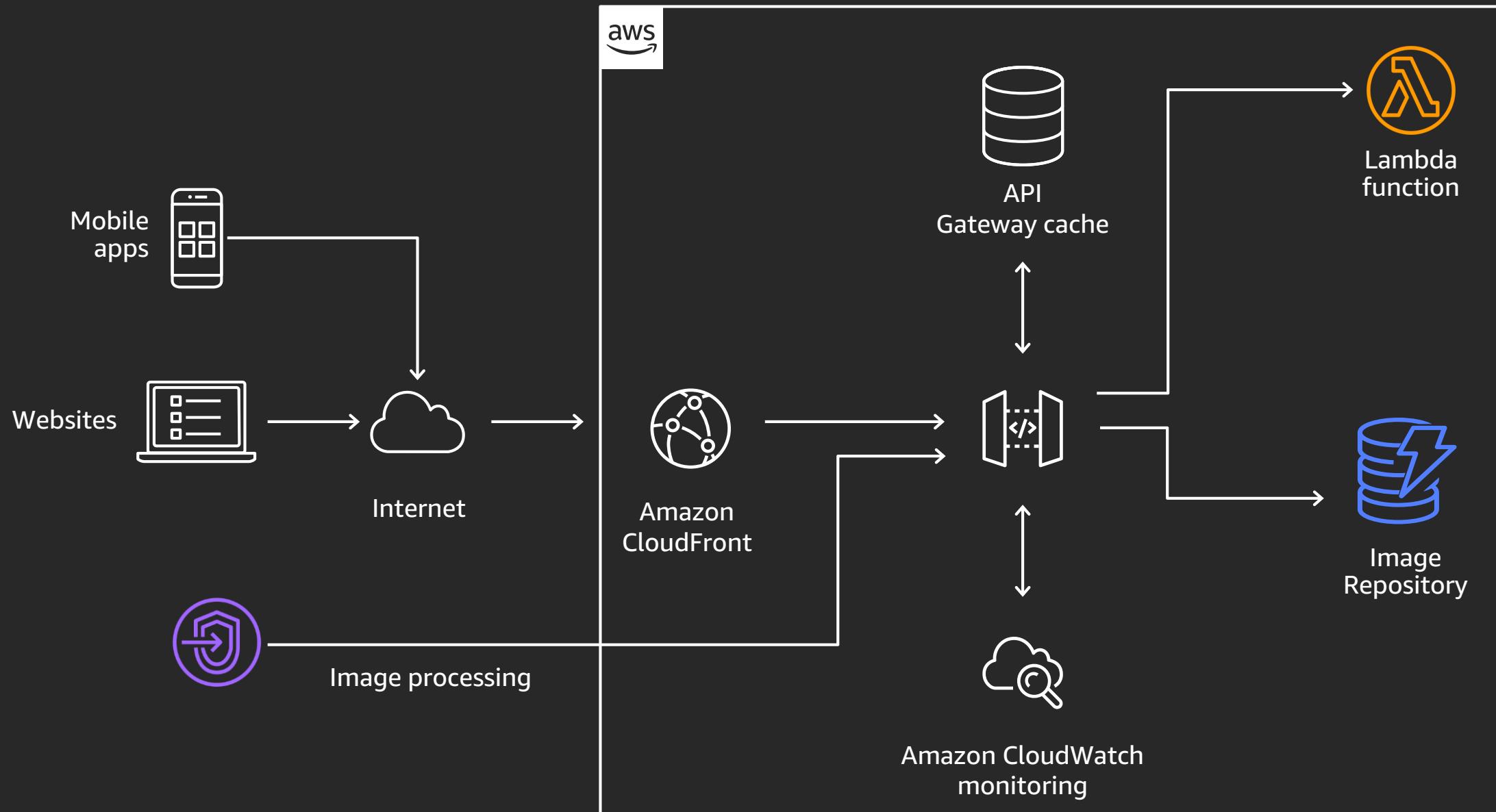
APIs are hardened contracts



Manage APIs with Amazon API Gateway



Realtor.com uses APIs between services



"We process 800 million images per day through Amazon API Gateway..."

Kuntal Shah
SVP Engineering
Realtor.com

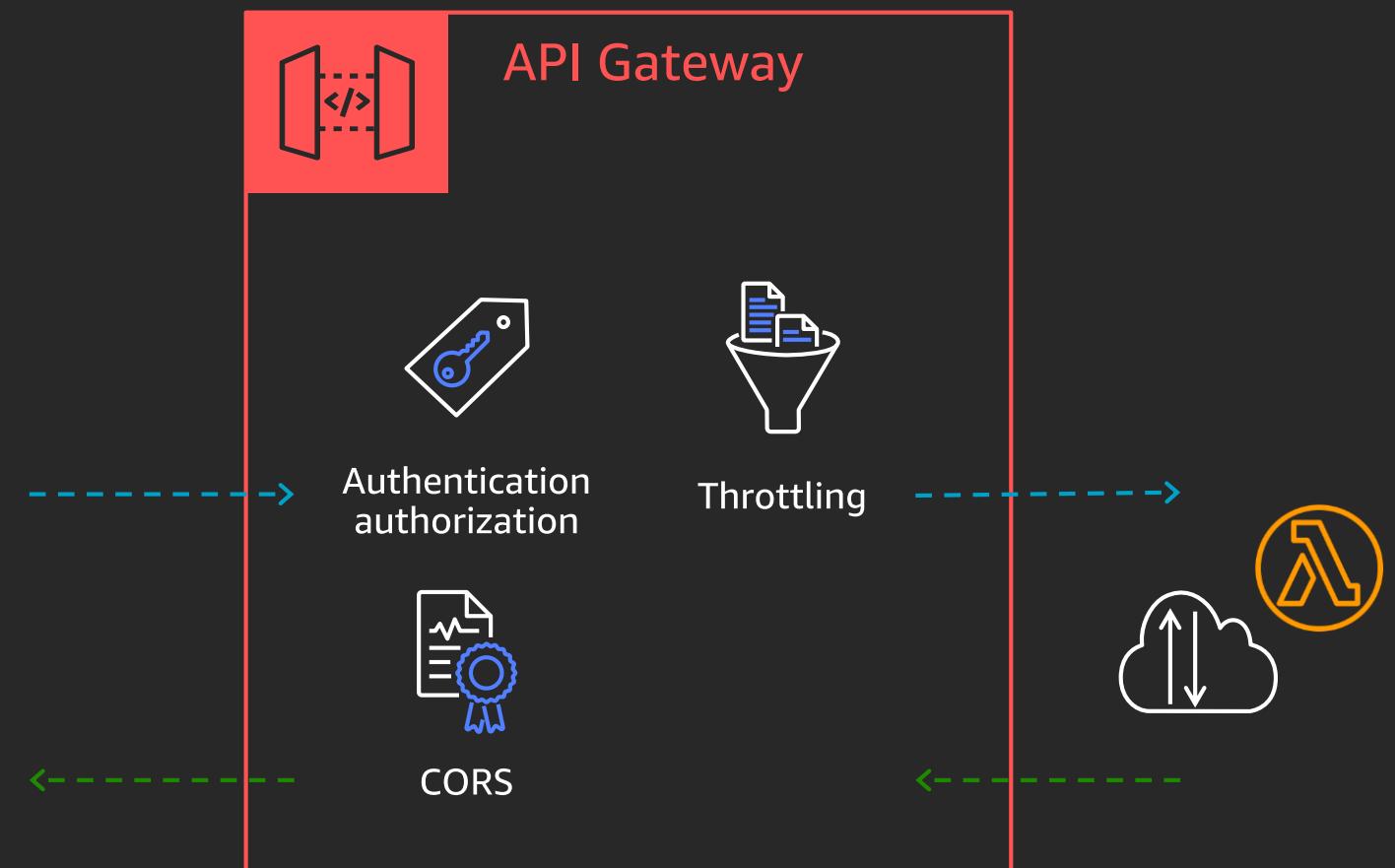
realtor.com®

HTTP APIs

Up to 70% lower cost

50% lower latency

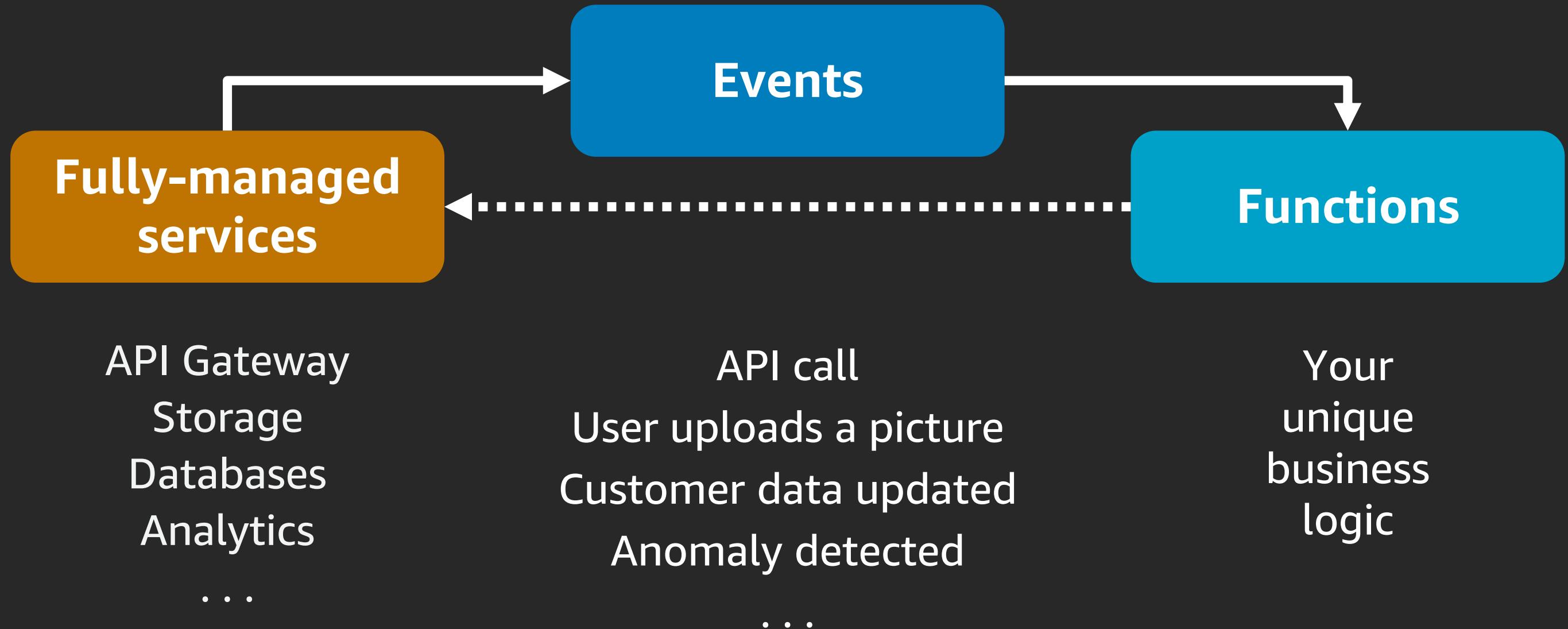
Standard authentication



Serverless application

... comprised of
decoupled services
that scale independently
and trigger execution
using events

How do Serverless applications work?



Concise function logic

- Use functions to **transform**, not **transport**
 - Use purposefully built services for communication fan-out, message handling, data replication, and writing to data stores/databases
- Leave retry and error handling to the services themselves
- Read only what you need, for example:
 - Message filters in Amazon SNS
 - Fine-grained rules in Amazon EventBridge
 - Query filters in Amazon RDS & Amazon Aurora
 - Use Amazon S3 Select
 - Properly indexed databases
- Leverage Synchronous Vs Asynchronous invocations

Event-driven choreography with Amazon EventBridge

What is an “event”?



“something that happens”

Events tell us a fact

Immutable time-series



Time	What
2019 06 21 08 07 06	CustomerCreated
2019 06 21 08 07 09	OrderCreated
2019 06 21 08 07 13	PaymentSuccessful
2019 06 21 08 07 17	CustomerUpdated
...	...

Commands Vs Events

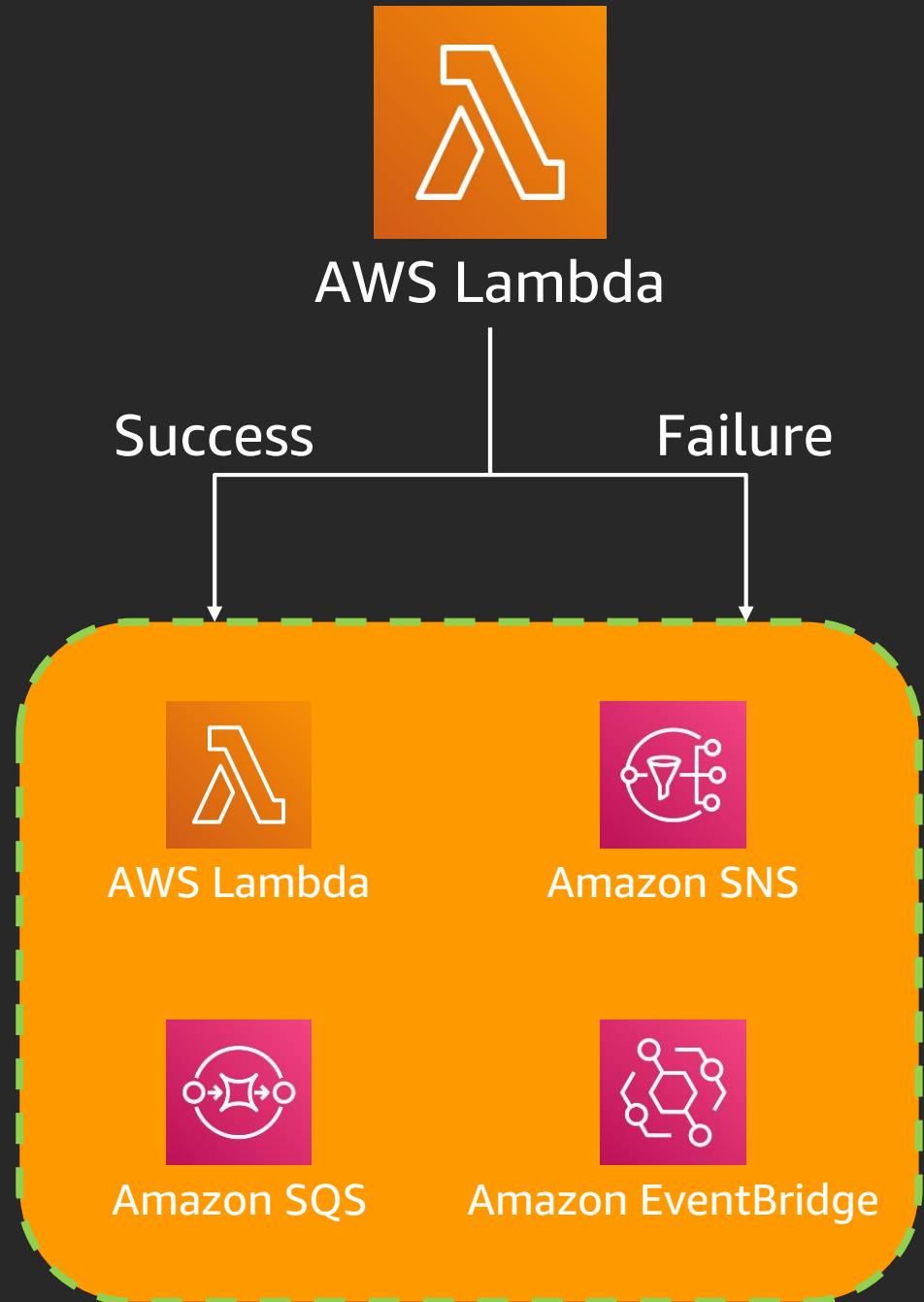
Command	Event
<p>Has an intent Directed to a target Personal communication</p>	<p>It's a fact For others to observe Broadcast one to many</p>
<p>“CreateAccount” “AddProduct”</p>	<p>“AccountCreated” “ProductAdded”</p>

NEW!!!

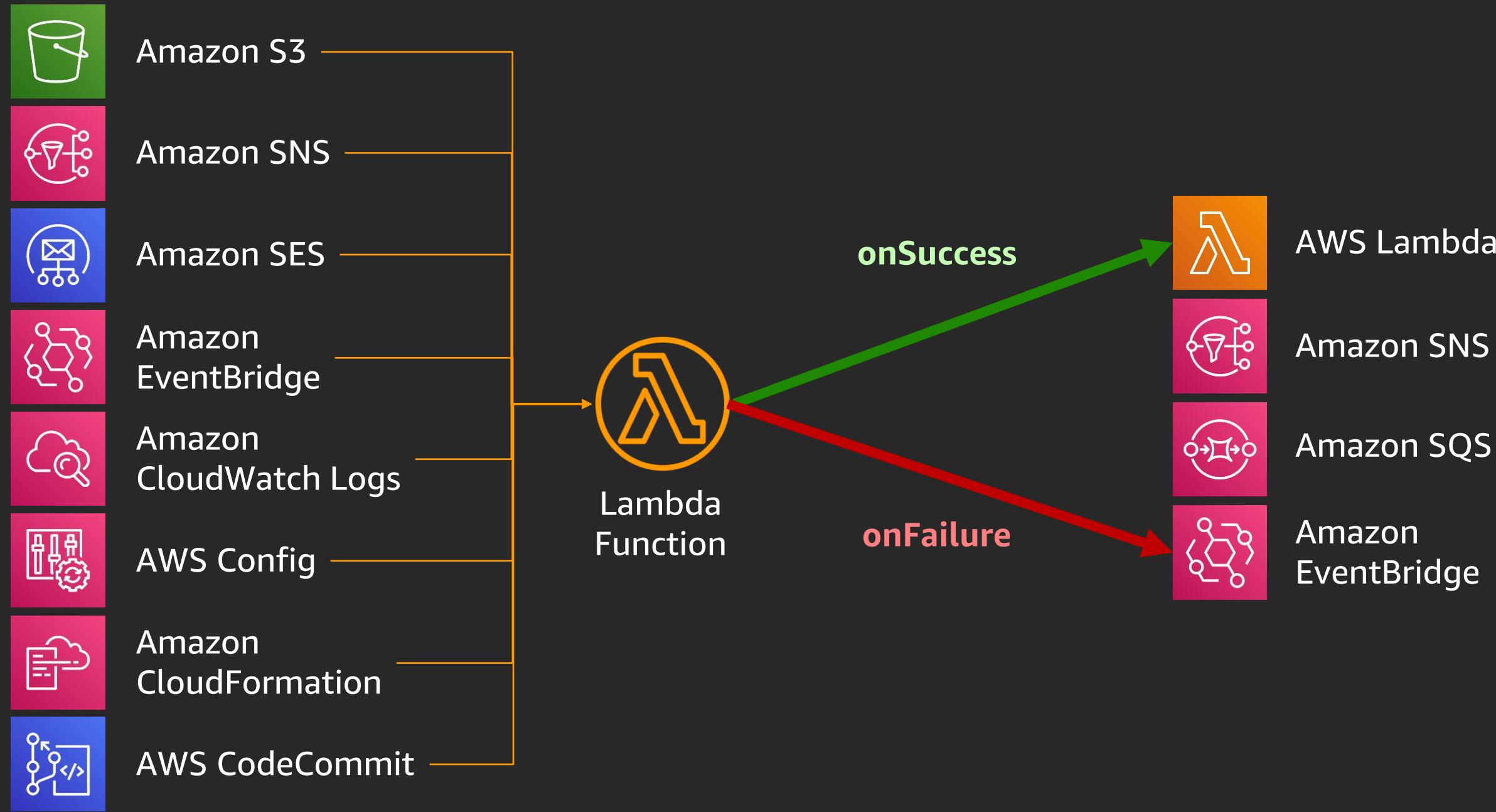
Introducing AWS Lambda Event Destinations

For asynchronous invocations, capture success or failure

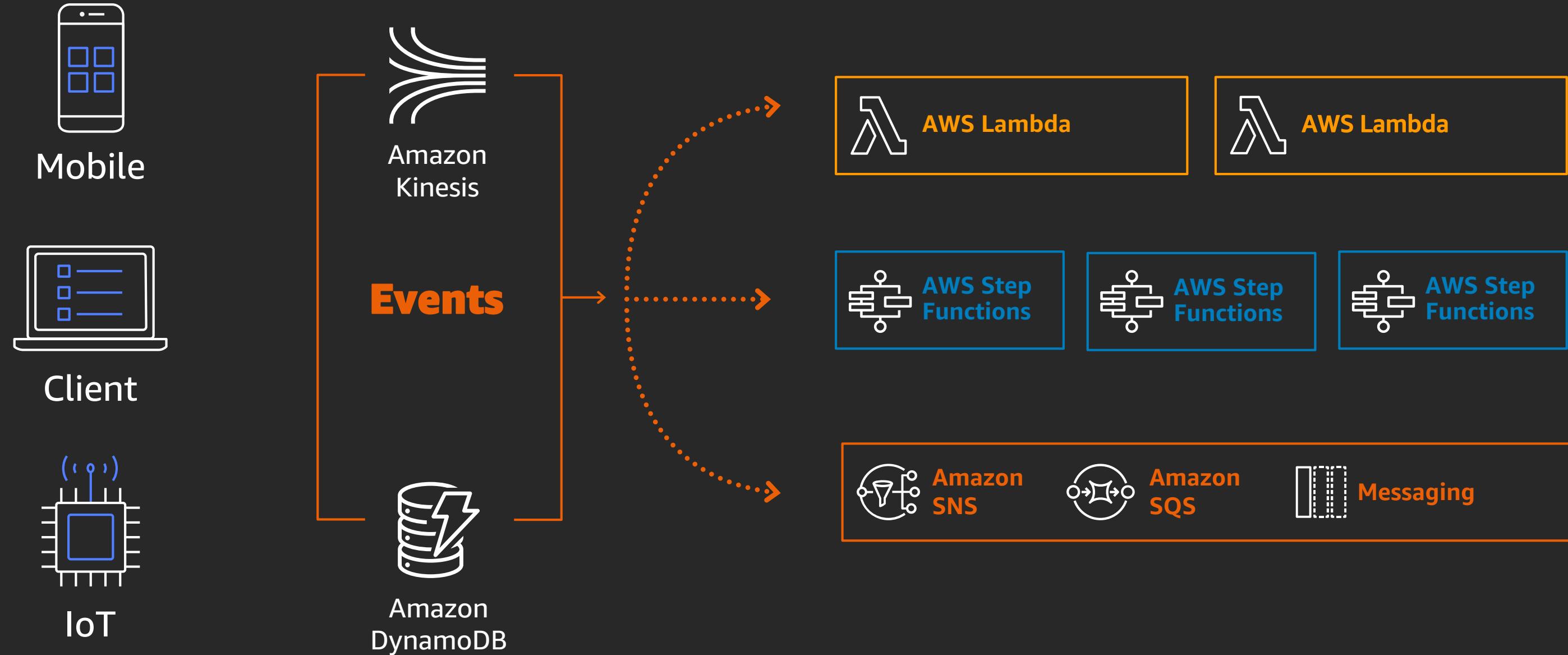
- Record contains details about the request and response in JSON format
- Contains more information than data sent to a DLQ
- Can send both outcomes to the same destination or
- Can send success to one destination, failure to another



AWS Lambda – Destinations for Async Invocations

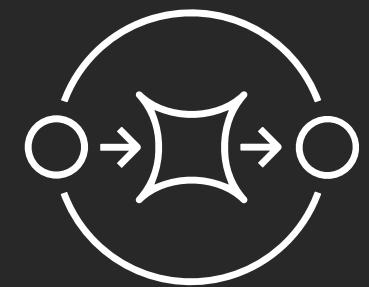


Event-driven architectures



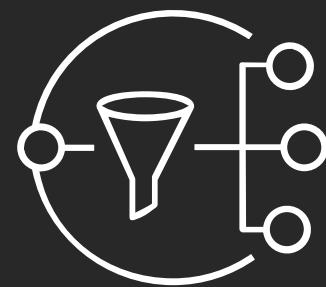
Connecting AWS event sources

Messaging



Amazon SQS

Queues



Amazon SNS

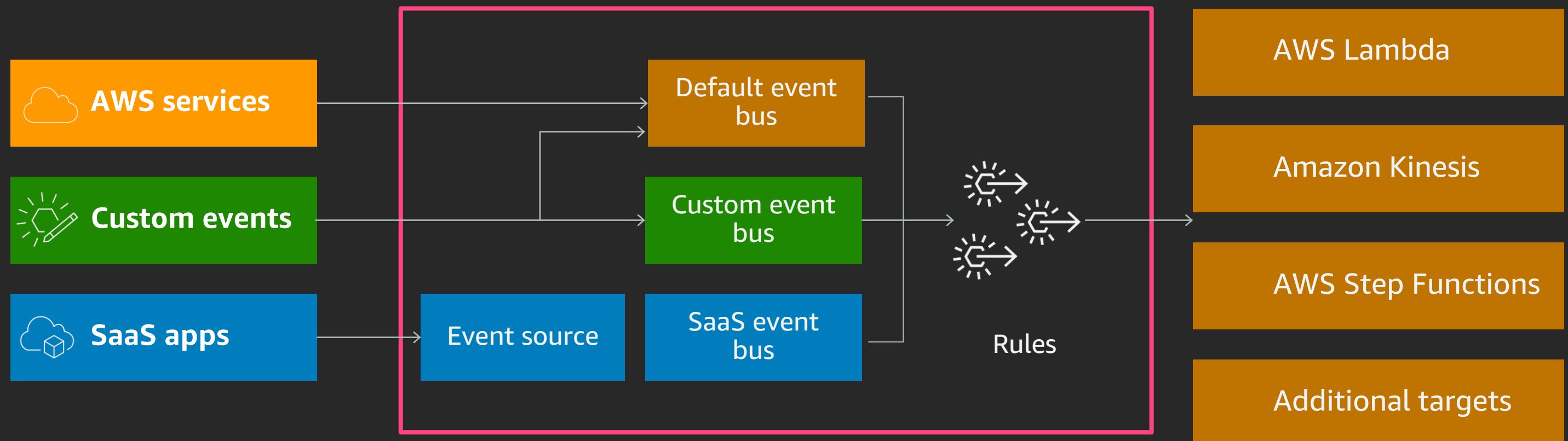
Pub/Sub



Amazon EventBridge

Event Bus

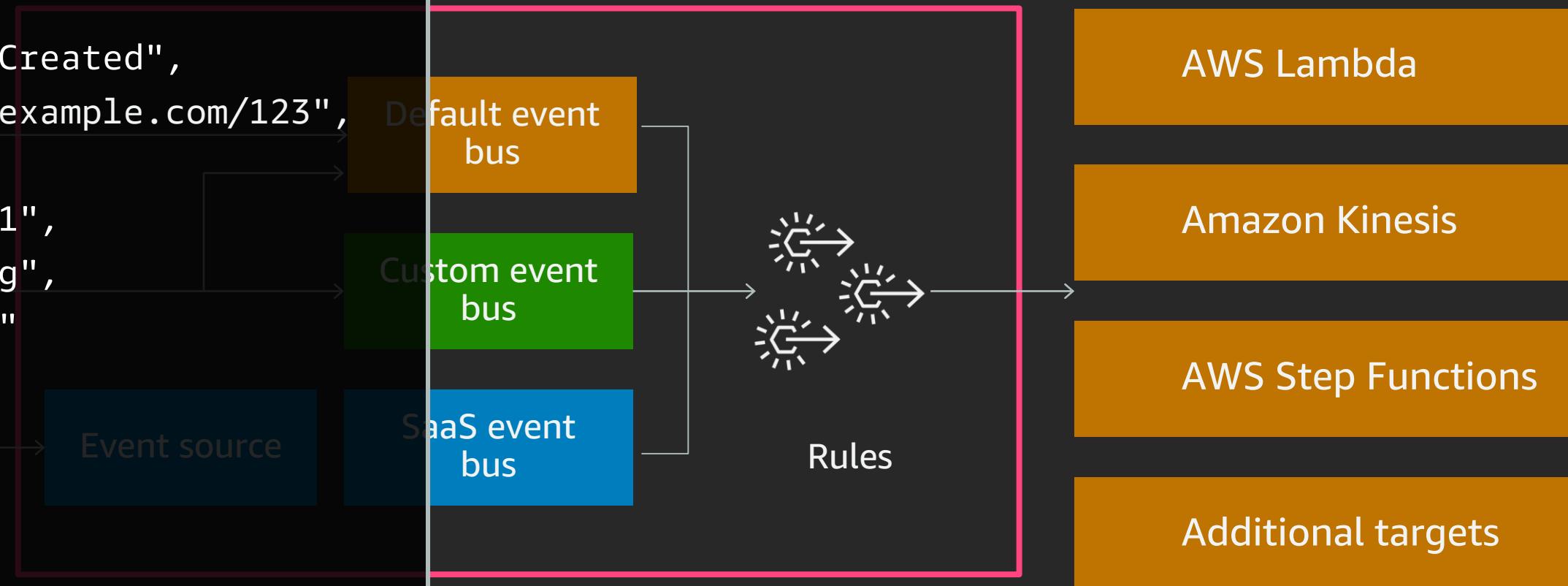
Amazon EventBridge



Amazon EventBridge

Example event:

```
{  
  "detail-type": "Ticket Created",  
  "source": "aws.partner/example.com/123",  
  "detail": {  
    "ticketId": "987654321",  
    "department": "billing",  
    "creator": "user12345"  
    ...  
  }  
}
```

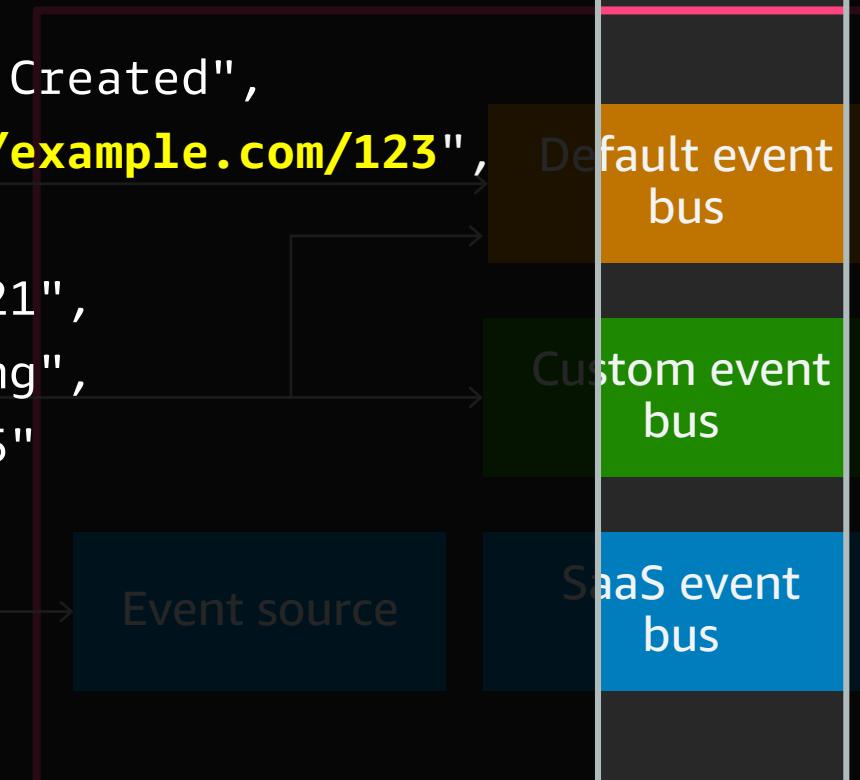


Amazon EventBridge

Example event:

```
{  
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  "source": "aws.partner/example.com/123",  
  "detail": {  
    "ticketId": "987654321",  
    "department": "billing",  
    "creator": "user12345"  
  },  
  ...  
}
```

SaaS apps

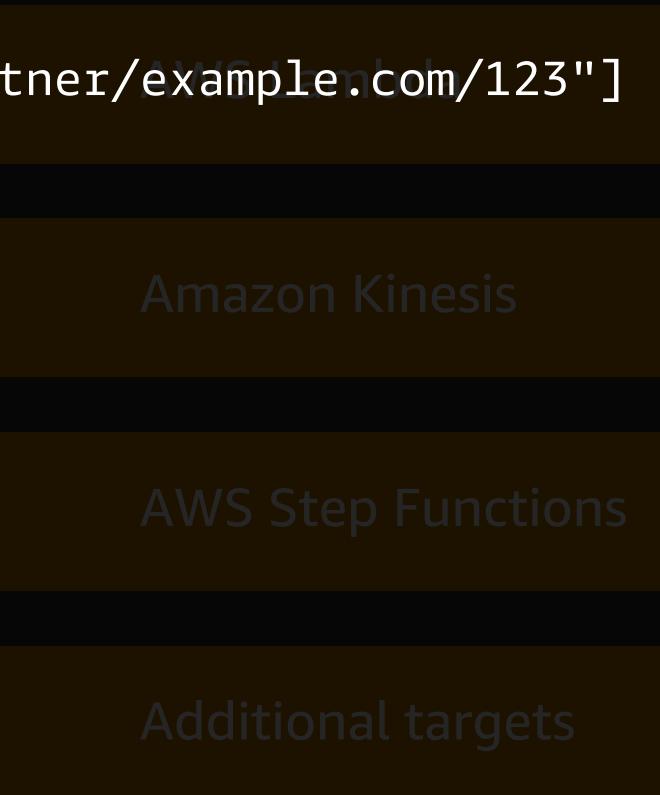


Example rule:

```
{  
  "source": ["aws.partner/example.com/123"]  
}
```



Rules

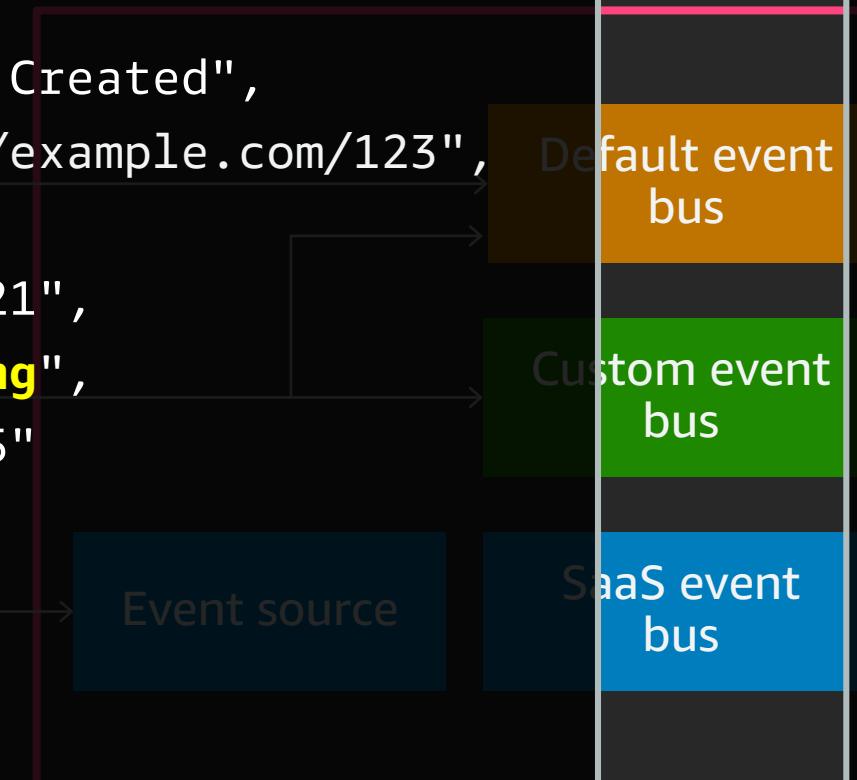


Amazon EventBridge

Example event:

```
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    "ticketId": "987654321",  
    "department": "billing",  
    "creator": "user12345"  
  }  
  ...  
}
```

SaaS apps



Example rule:

```
{  
  "detail": {  
    "department": ["billing", "fulfillment"]  
  }  
}
```



Rules



Amazon EventBridge

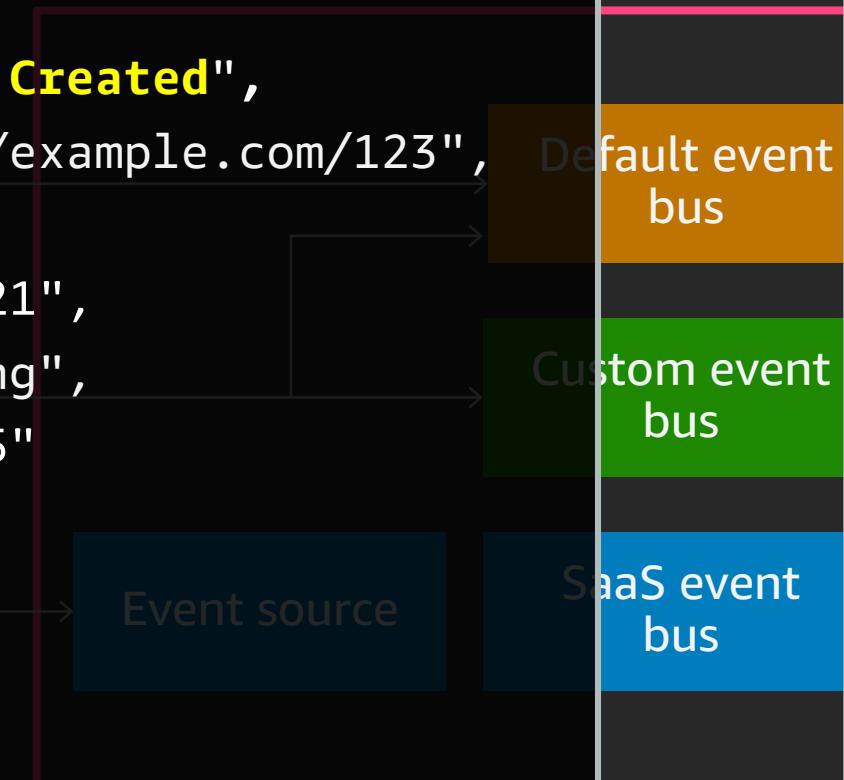
Example event:

```
{  
  "detail-type": "Ticket Created",  
  "source": "aws.partner/example.com/123",  
  "detail": {  
    "ticketId": "987654321",  
    "department": "billing",  
    "creator": "user12345"  
  }  
  ...  
}
```

SaaS apps

AWS services

Custom events



Example rule:

```
{  
  "detail-type": ["Ticket Resolved"]  
}
```

Rules

Ticket Resolved

Amazon Kinesis

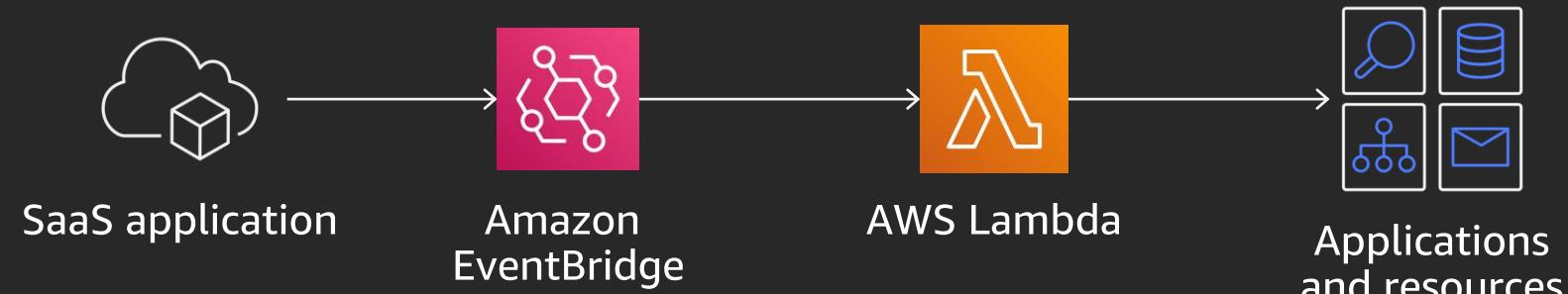
AWS Step Functions

Additional targets

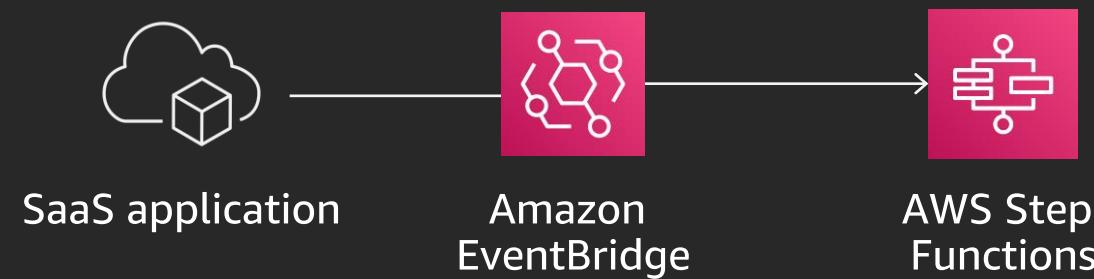


Common use cases

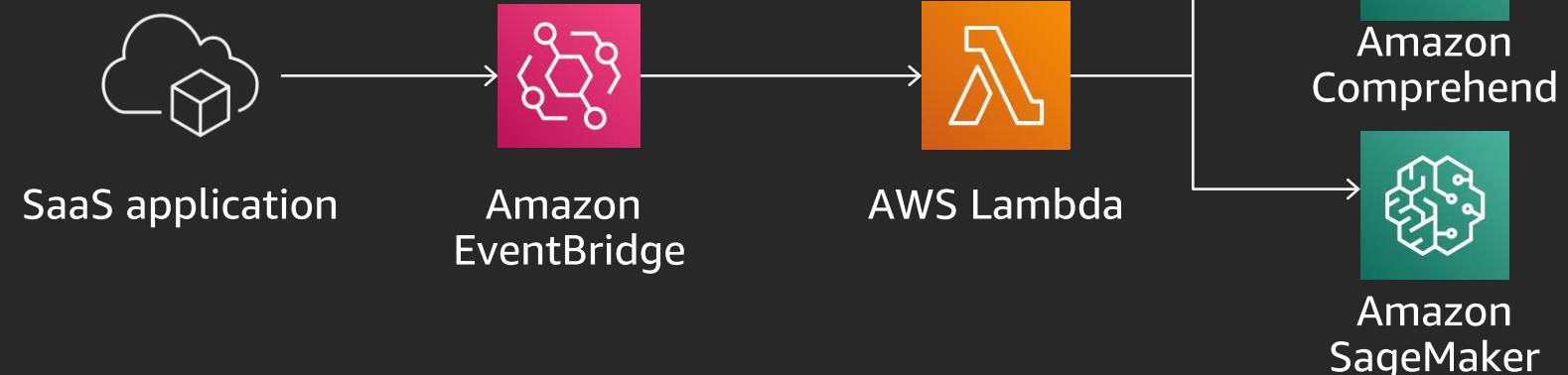
Take action



Run workflows



Apply intelligence

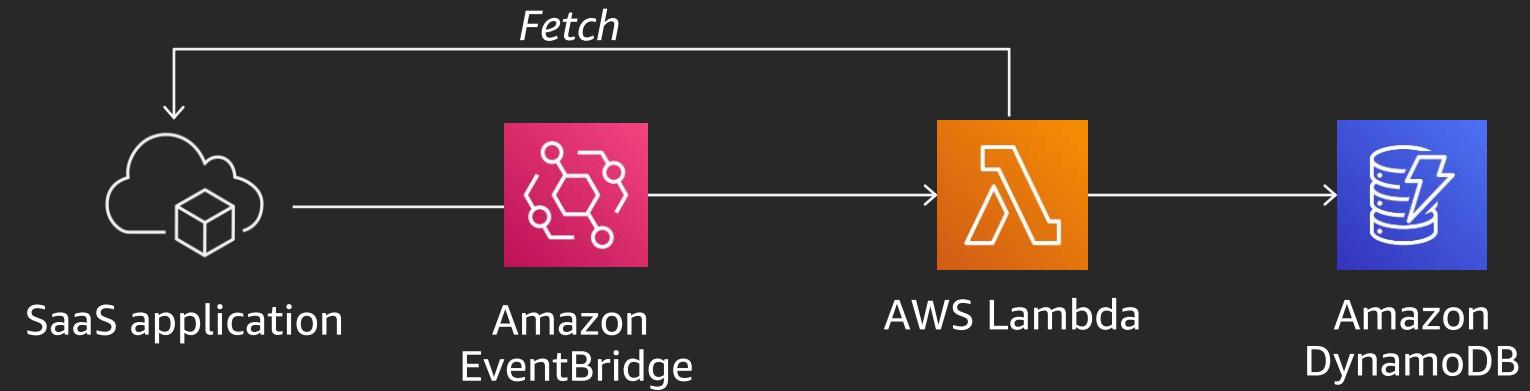


Common use cases

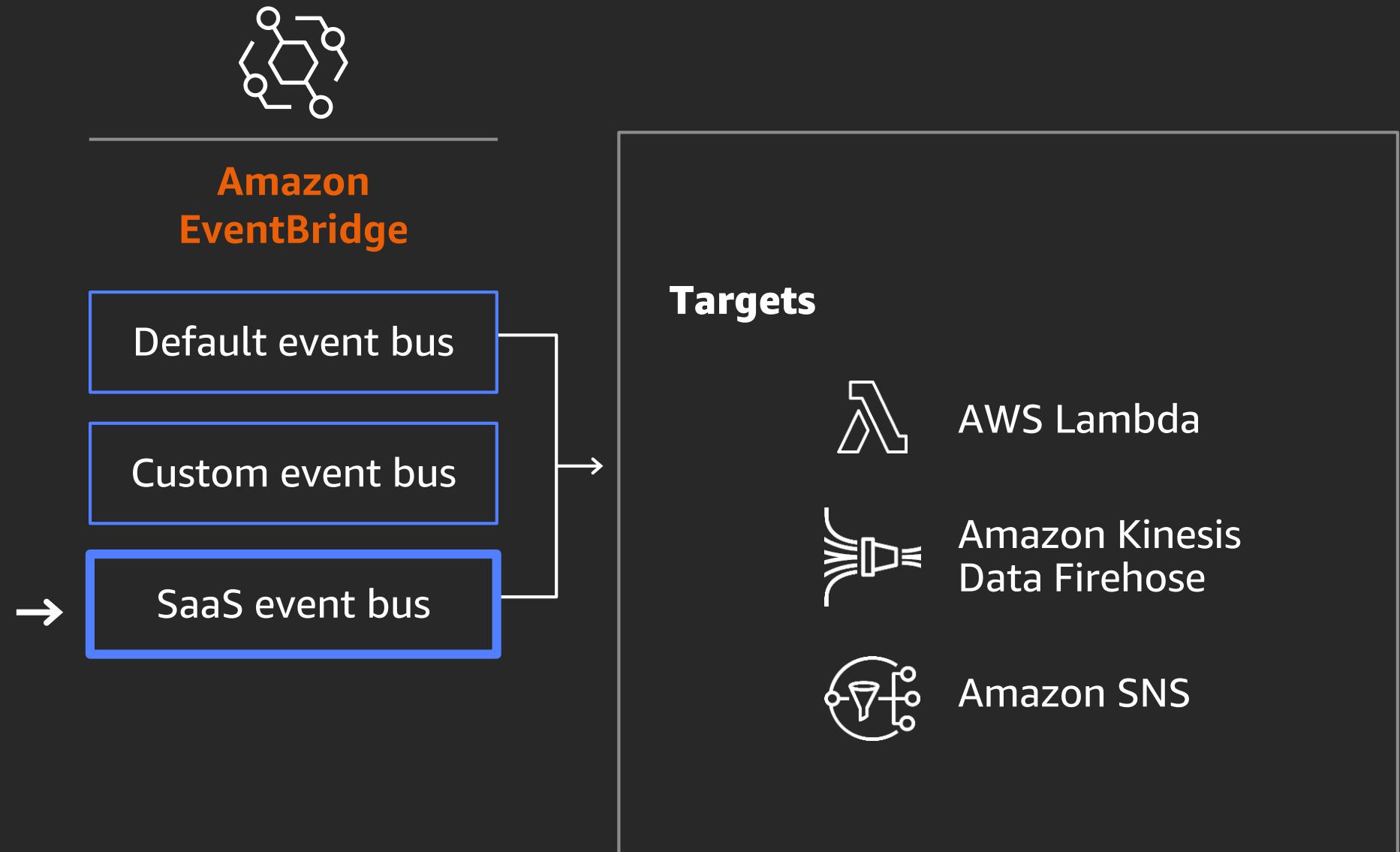
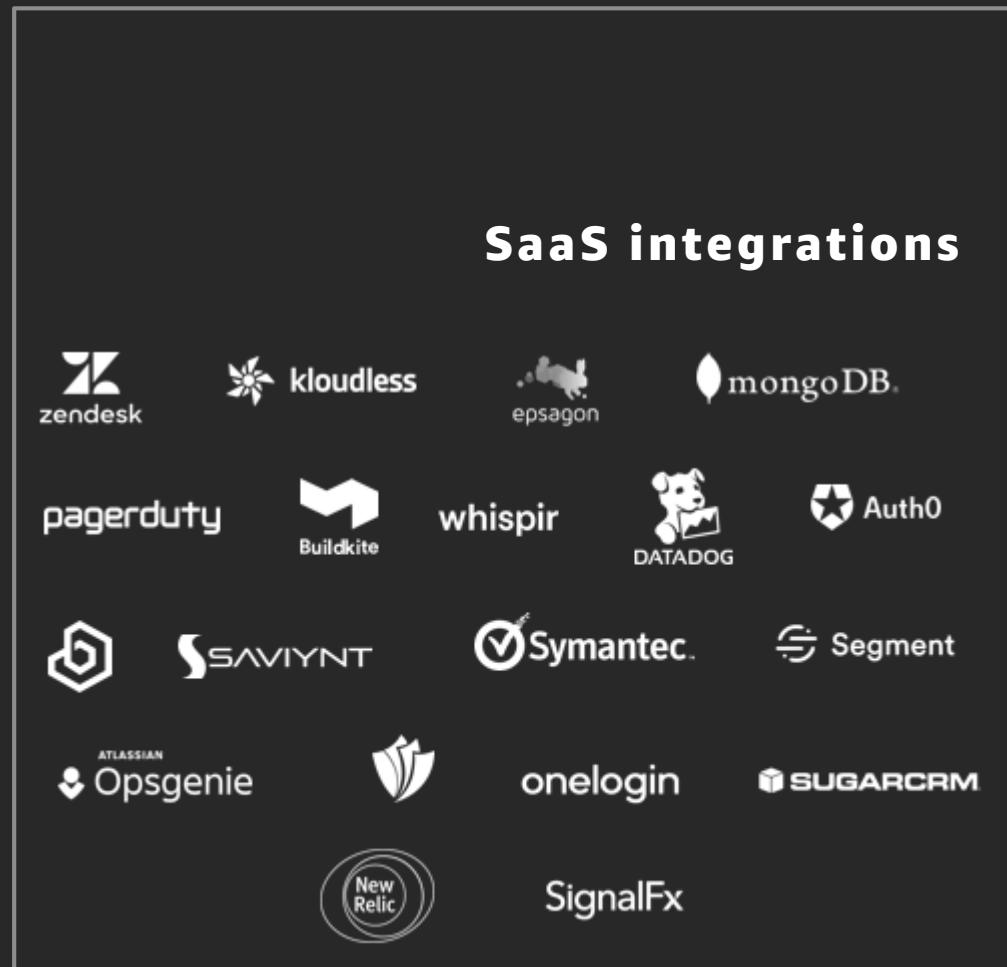
Audit and analyze



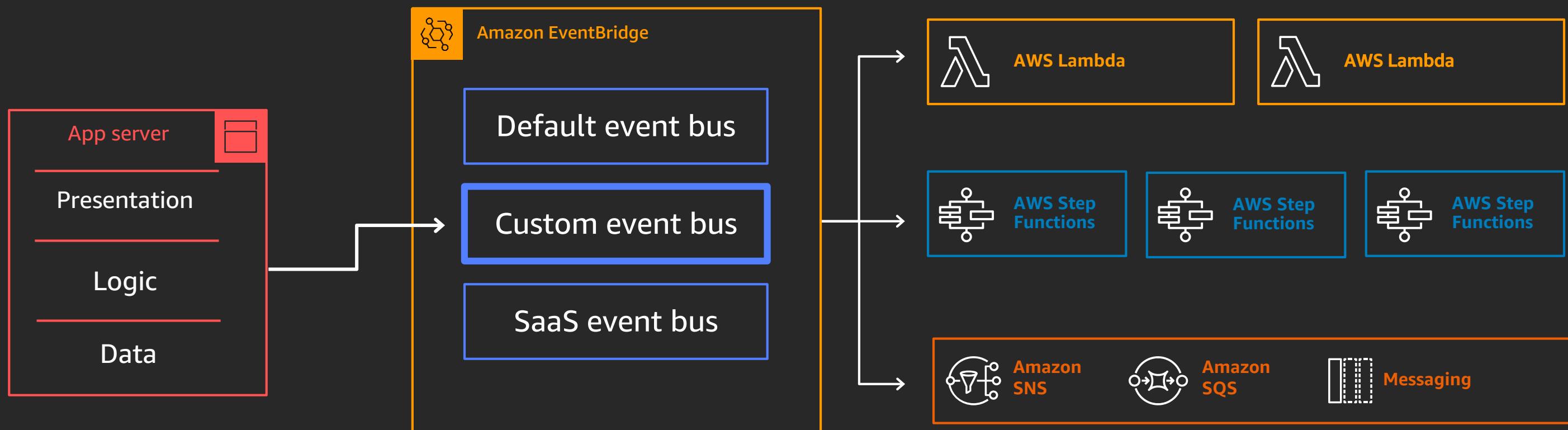
Synchronize data



Expanding event sources



Developing with events



Schema registry and discovery



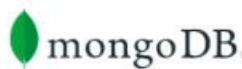
**Amazon
EventBridge**

Source of truth for sharing schema

Explicitly publish and discover

Integrations for JetBrains and VS Code

**Language bindings for Java, Python,
and TypeScript**



MongoDB Stitch

The serverless platform from MongoDB

[Get started free](#)[Watch the intro](#)[Services](#)[Features](#)[Pricing](#)[FAQ](#)

Build better apps, faster with MongoDB Stitch services

[Stitch QueryAnywhere](#)

Exposes the full power of working with

[Stitch Functions](#)

Allows developers to run simple

[Stitch Triggers](#)

Executes functions in real time in



Customer case study

July 10, 2019

shop.LEGO.com was switched to serverless on AWS

The screenshot shows the top navigation bar of the LEGO.com website. It includes a 'MENU' icon, the LEGO logo, and icons for a shopping bag (0 items), a heart (0 likes), and a search function. A yellow header bar contains a search input field and a magnifying glass icon. Below the header, there are several promotional sections. One section features four small images: a helicopter, a Star Destroyer, a winter-themed set, and a SERIOUS PLAY box. Below these are links for 'New', 'Exclusives', 'Promotions', 'SERIOUS PLAY®', 'VIP', and 'Pick a Brick'. Another section titled 'Our top-selling exclusives' shows three large images: a gingerbread house set, a Disney train set, and the Millennium Falcon. Each image has a title, a brief description, and a 'Shop now >' button.

Our top-selling exclusives

Home sweet home
Spread holiday cheer with the exclusive Gingerbread House!
[Shop now >](#)

New exclusive Disney Train and Station
Celebrate the magic of Disney and trains with this new set.
[Shop now >](#)

Travel the LEGO® galaxy in the ultimate Millennium Falcon™!
Take on the challenge of the largest, most detailed LEGO® Star Wars™ Millennium Falcon™ model we've ever created!
[Shop now >](#)

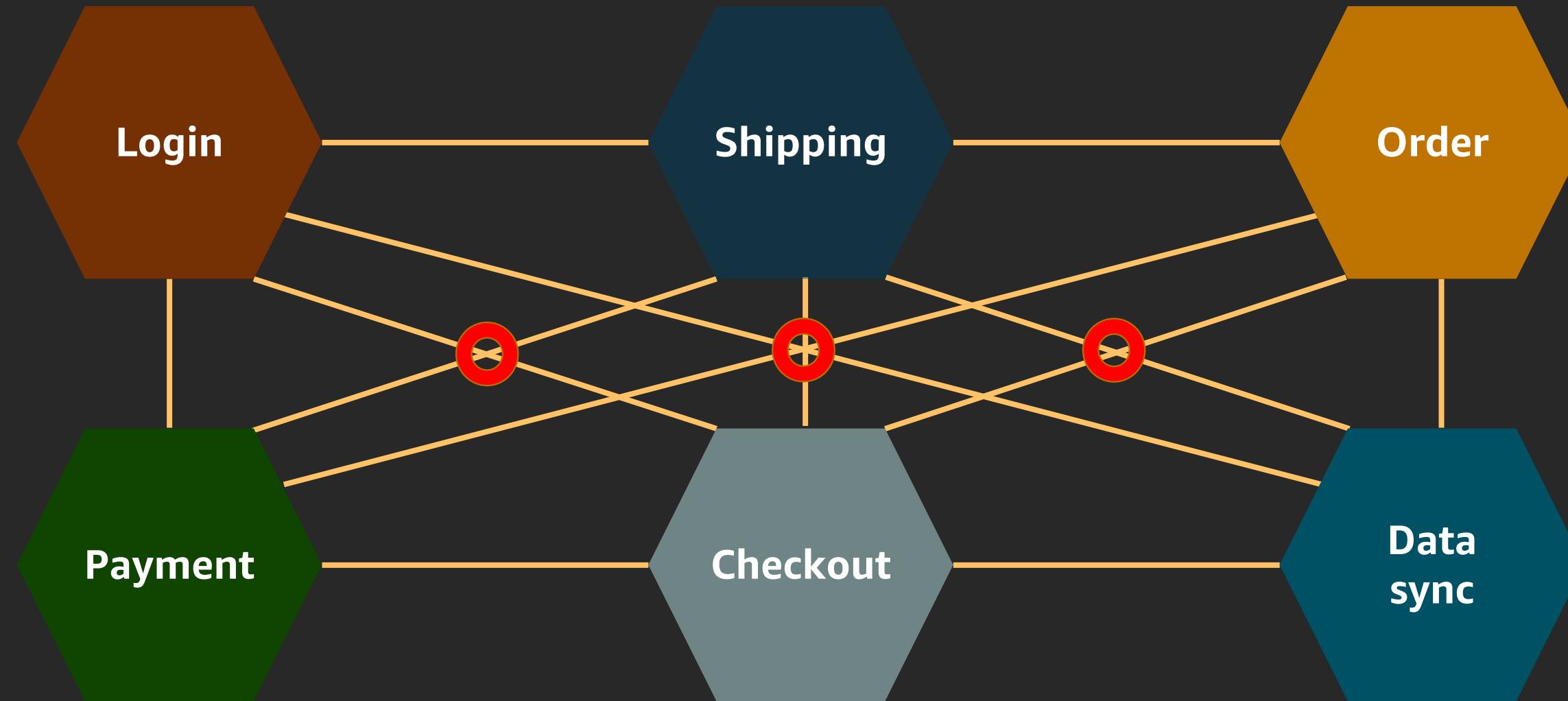
July 11, 2019



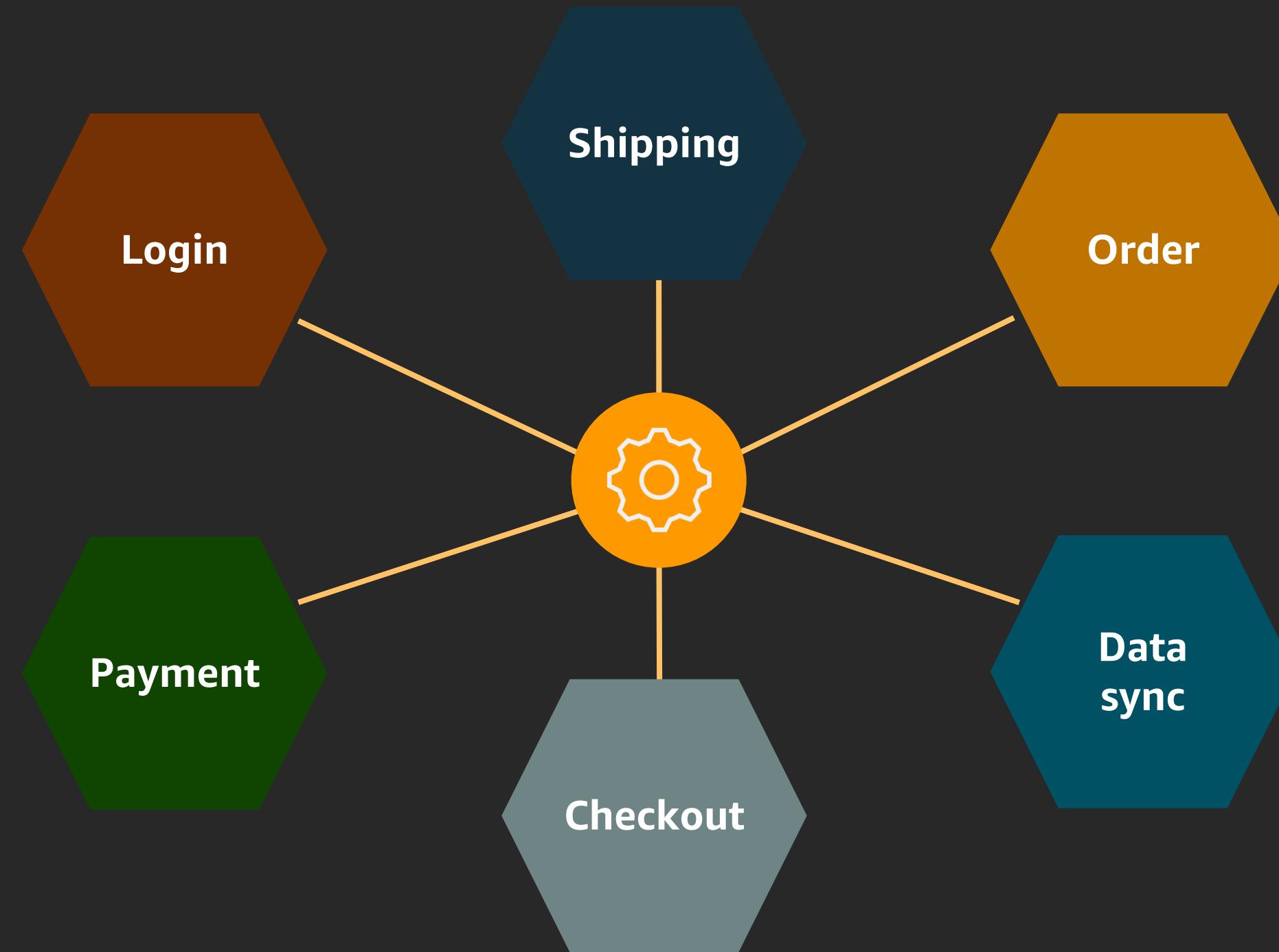
The day after,
Amazon EventBridge
was launched



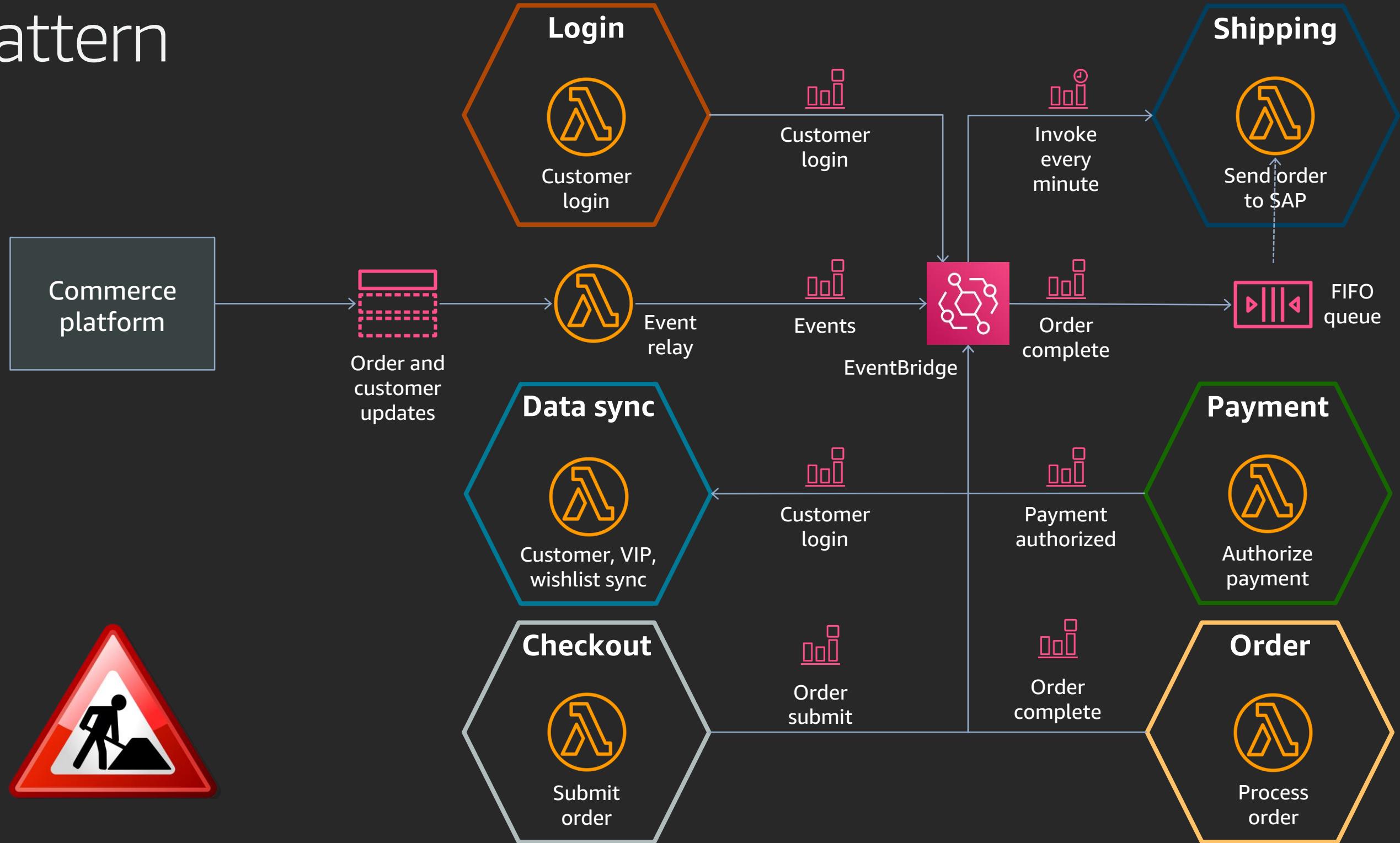
Checkout event processing



Hub-and-spoke event bus

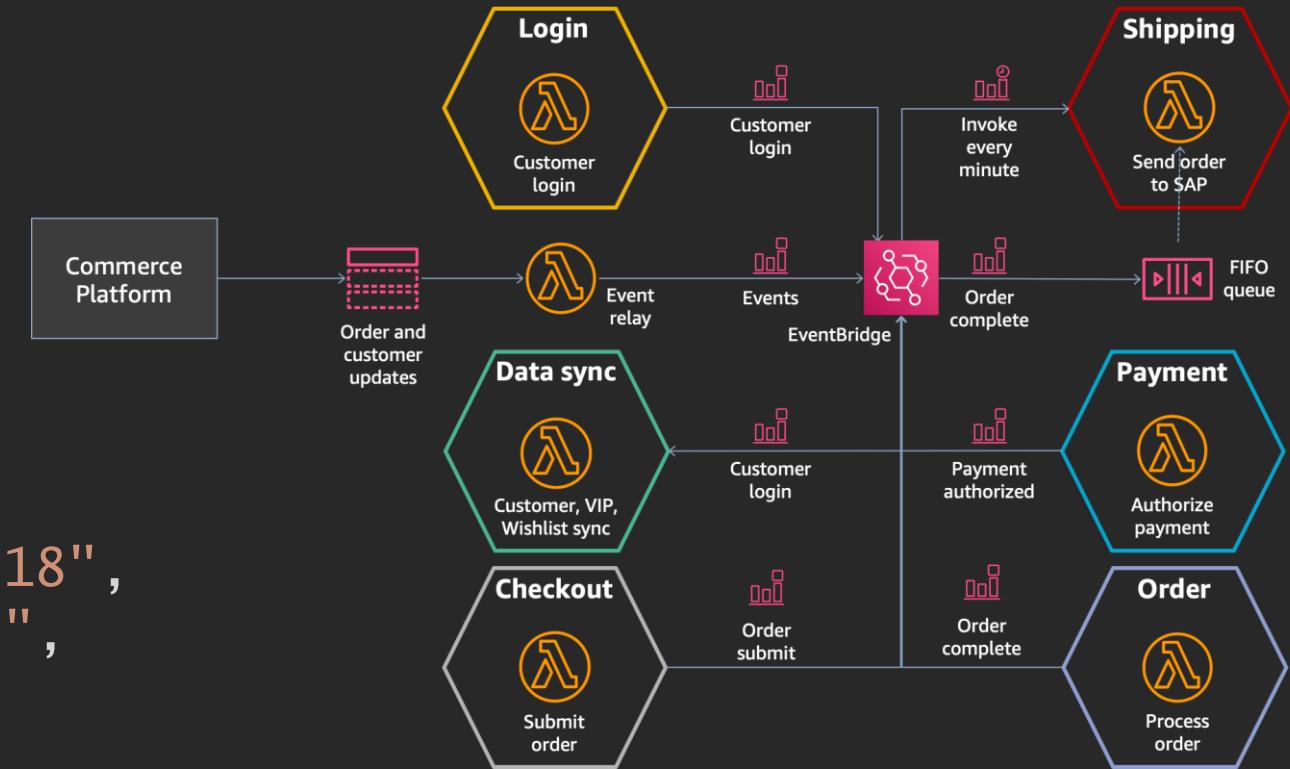


Pattern



Pattern – Hub-and-spoke event bus

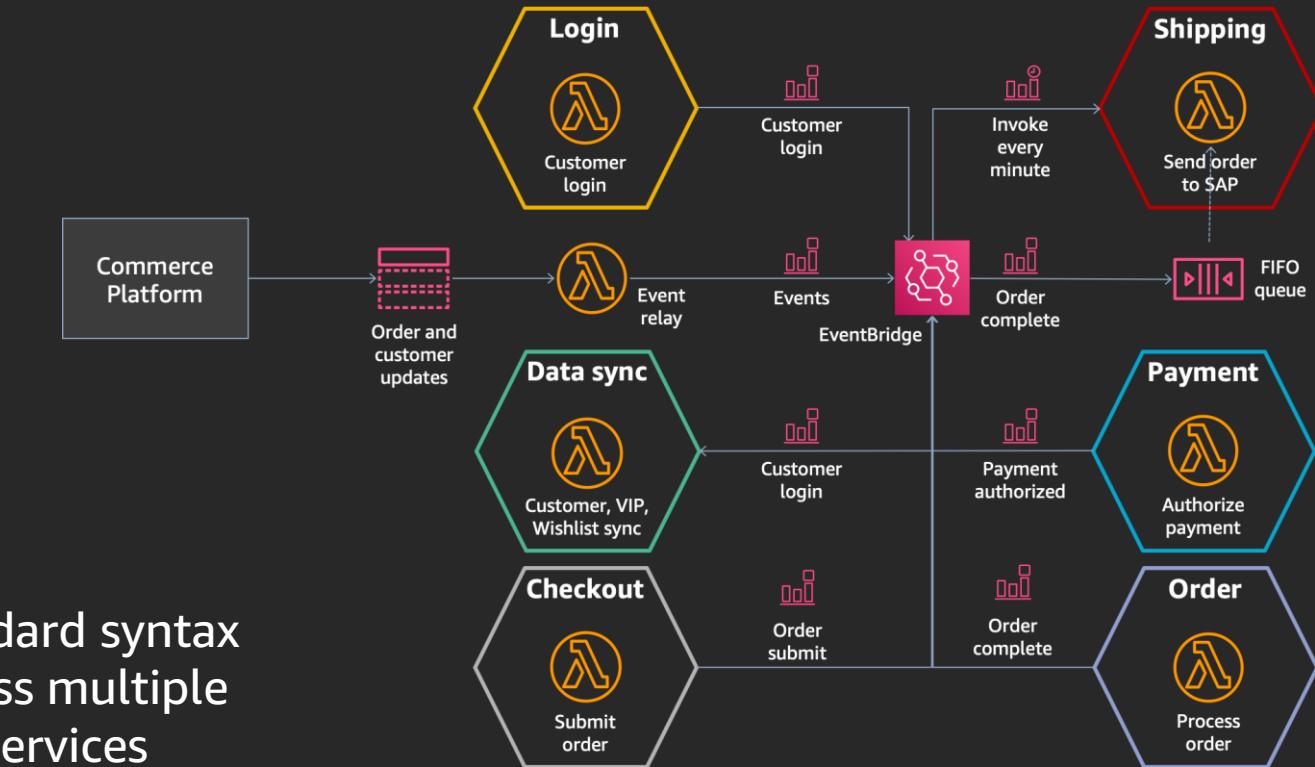
```
{  
  "version": "0",  
  "id": "6a7e8feb-b491-4cf7-a9f1-bf3703467718",  
  "detail-type": "State change Notification",  
  "source": "service-order-submit-dev",  
  "account": "111122223333",  
  "time": "2019-08-29T12:10:21Z",  
  "region": "eu-central-1",  
  "resources": [  
    "arn:aws:events:event-bus/checkout-bus"  
  ],  
  "detail": {}  
}
```



Customer-specific
data goes in the
"detail"

Pattern – Hub-and-spoke event bus

```
{  
  "version": "0",  
  "id": "6a7e8feb-b491-4cf7-a9f1-bf3703467718",  
  "detail-type": "State change Notification",  
  "source": "service-order-submit-dev",  
  "account": "123456789012",  
  "time": "2019-08-29T12:10:21Z",  
  "region": "eu-central-1",  
  "resources": ["arn:aws:events:event-bus/checkout-bus"],  
  "detail": {  
    "event": {  
      "meta_data": {  
        "site_id": "LEGO Shop",  
        "type": "CHECKOUT",  
        "subtype": "ORDER",  
        "status": "COMPLETE"  
      },  
      "data": {  
        "order_number": "T123456789",  
        "customer_id": "bf3703467718-29T12-6a7e8feb"  
      }  
    }  
  }  
}
```



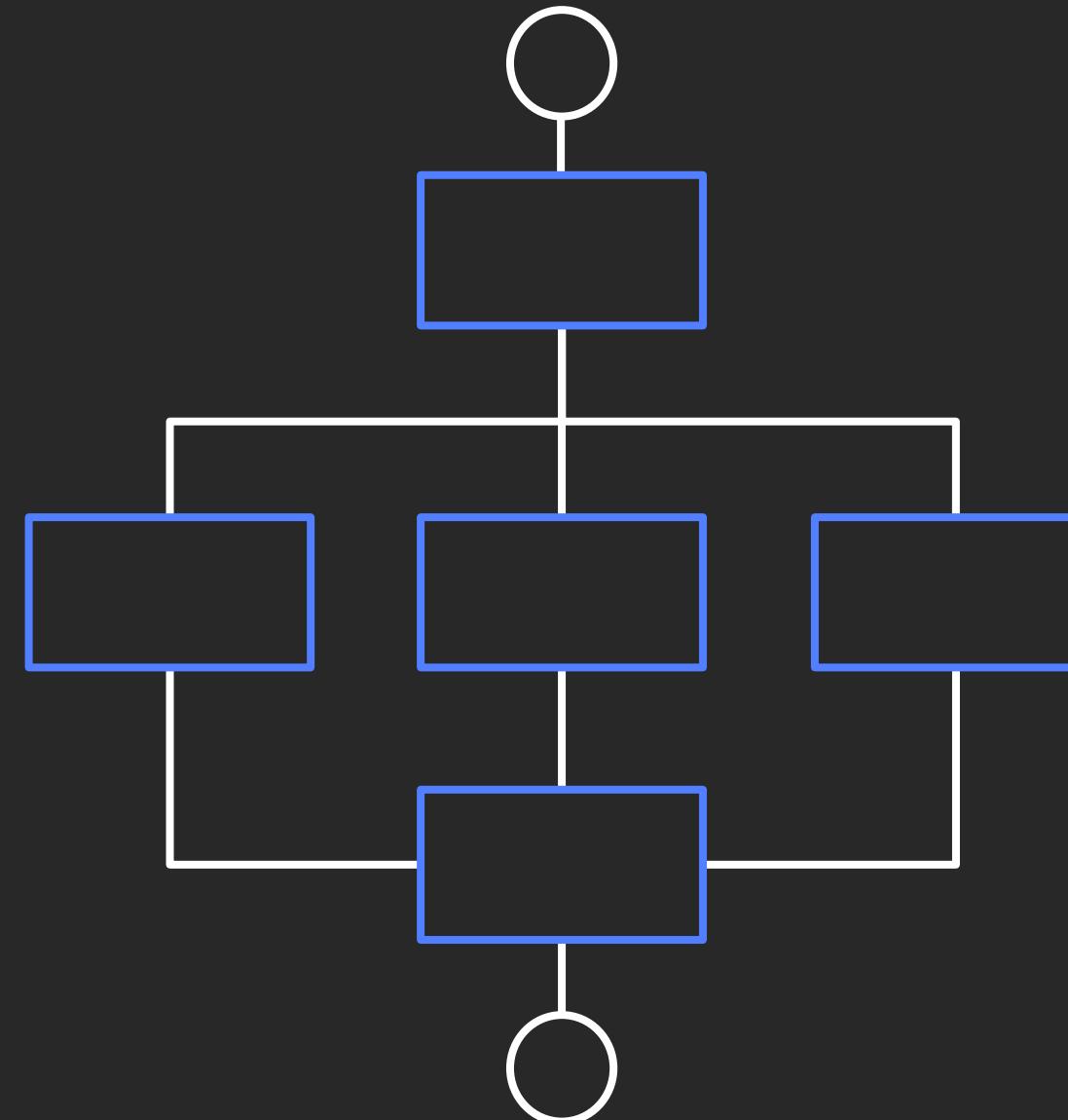
Standard syntax
across multiple
services

Custom for each
service

Orchestration with AWS Step Functions

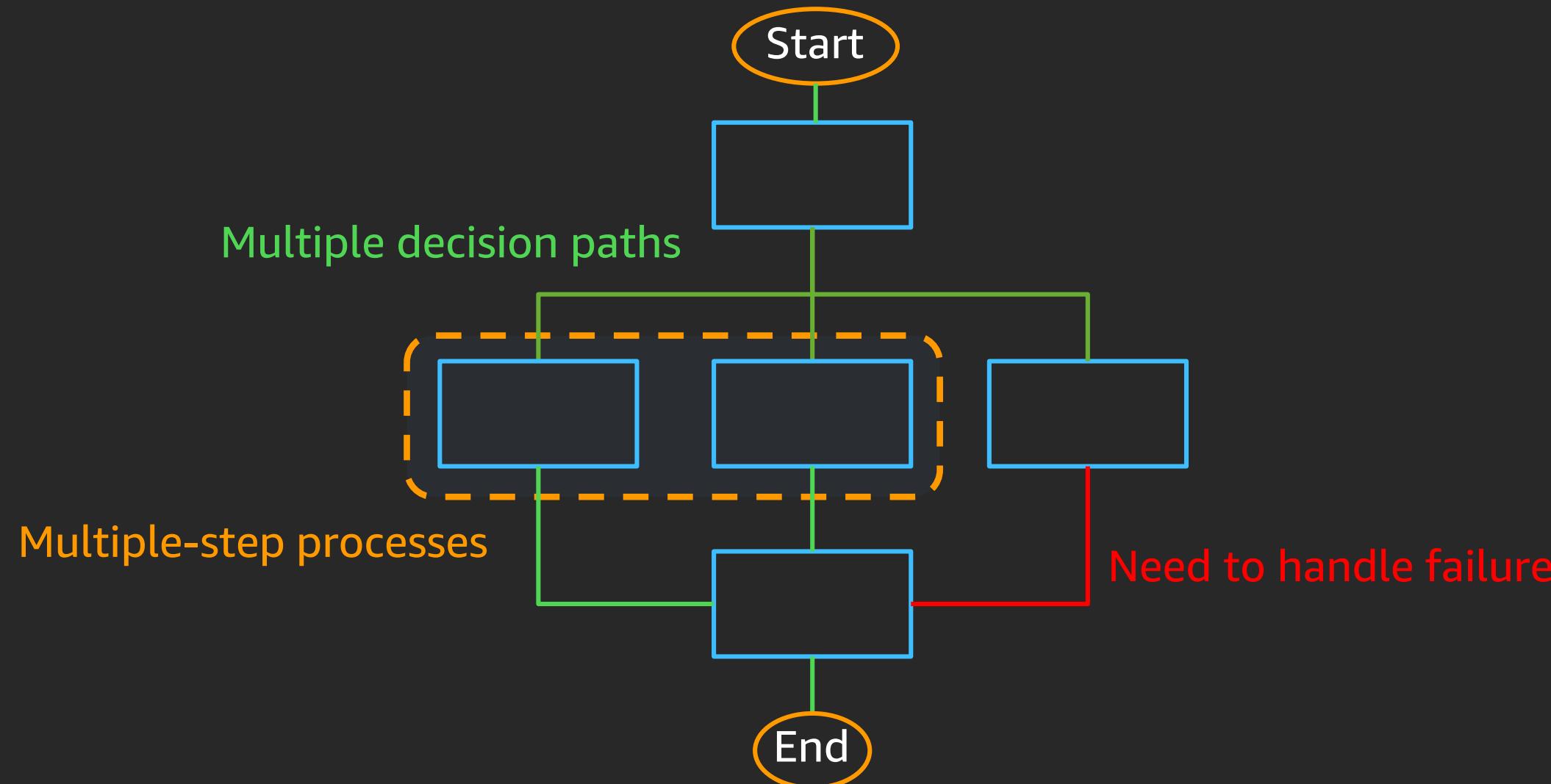
Coordinate function execution

Track status
of data and
execution



Remove
redundant code

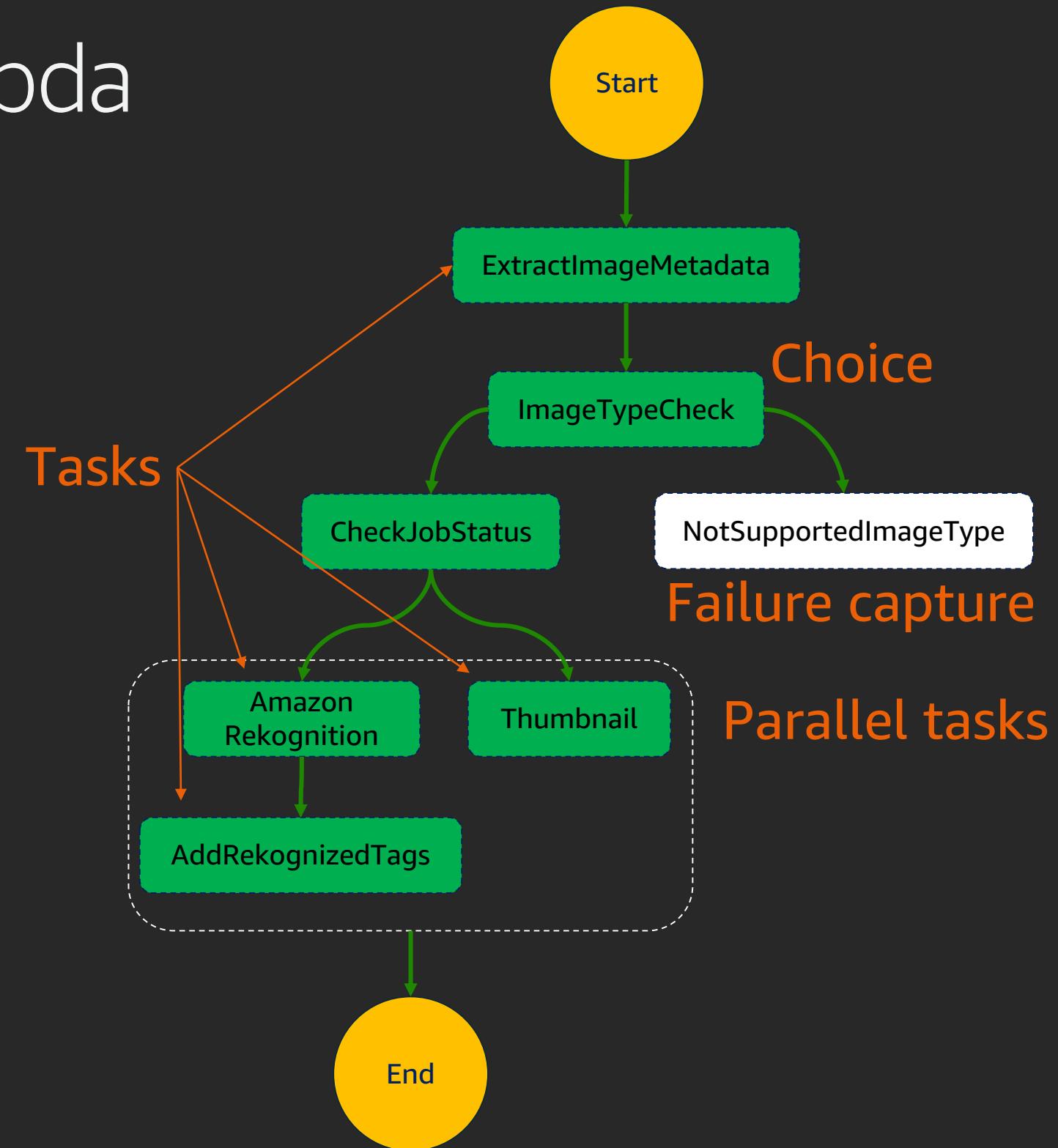
Business workflow is rarely sequential start to finish



AWS Step Functions + Lambda

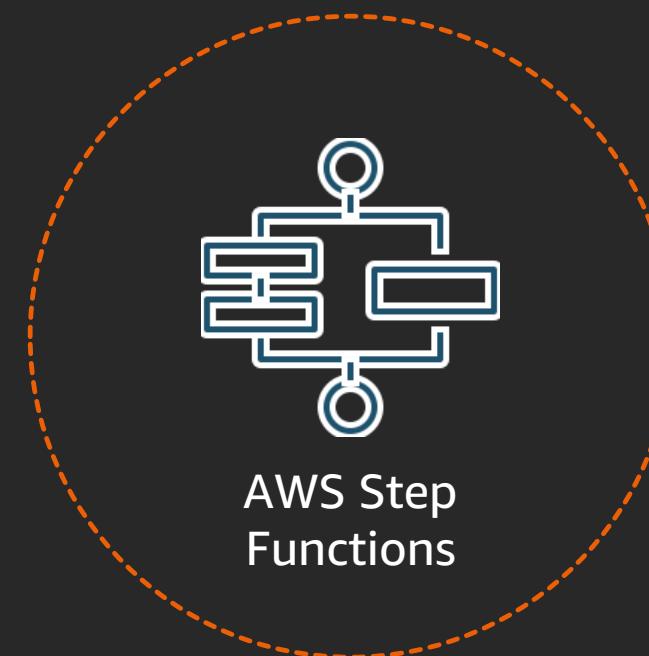
“Serverless” workflow management with zero administration:

- Makes it easy to coordinate the components of distributed applications and microservices using visual workflows
- Automatically triggers and tracks each step and retries when there are errors, so your application executes in order and as expected
- Logs the state of each step, so when things do go wrong, you can quickly diagnose and debug problems



AWS Step Functions: Integrations

Simplify building workloads, such as order processing, report generation, and data analysis



Write and maintain less code; add services in minutes

More service integrations:



Amazon SNS



Amazon SQS



Amazon
SageMaker



AWS Glue



AWS Batch



Amazon ECS



AWS Fargate



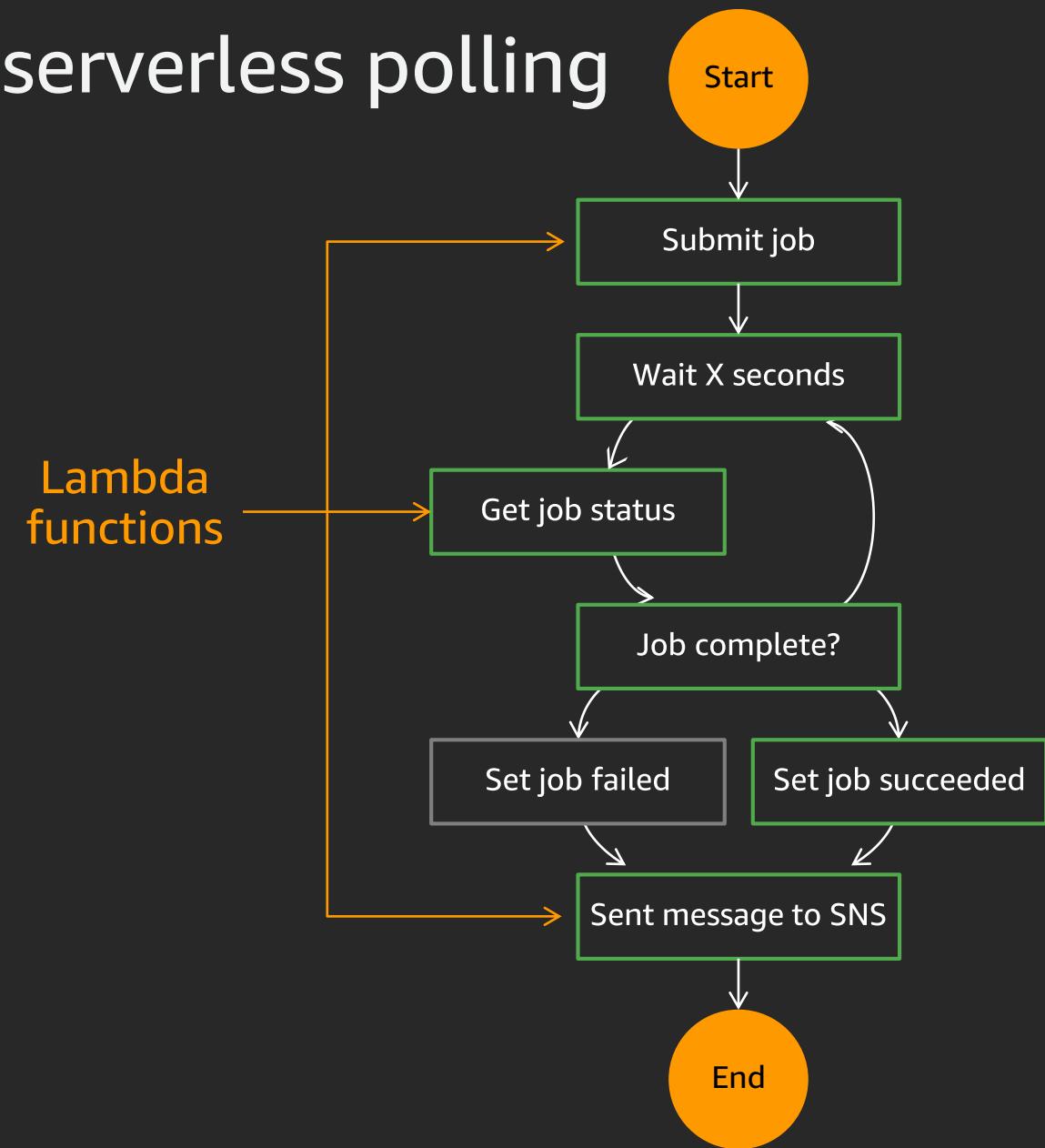
Amazon EMR

New!

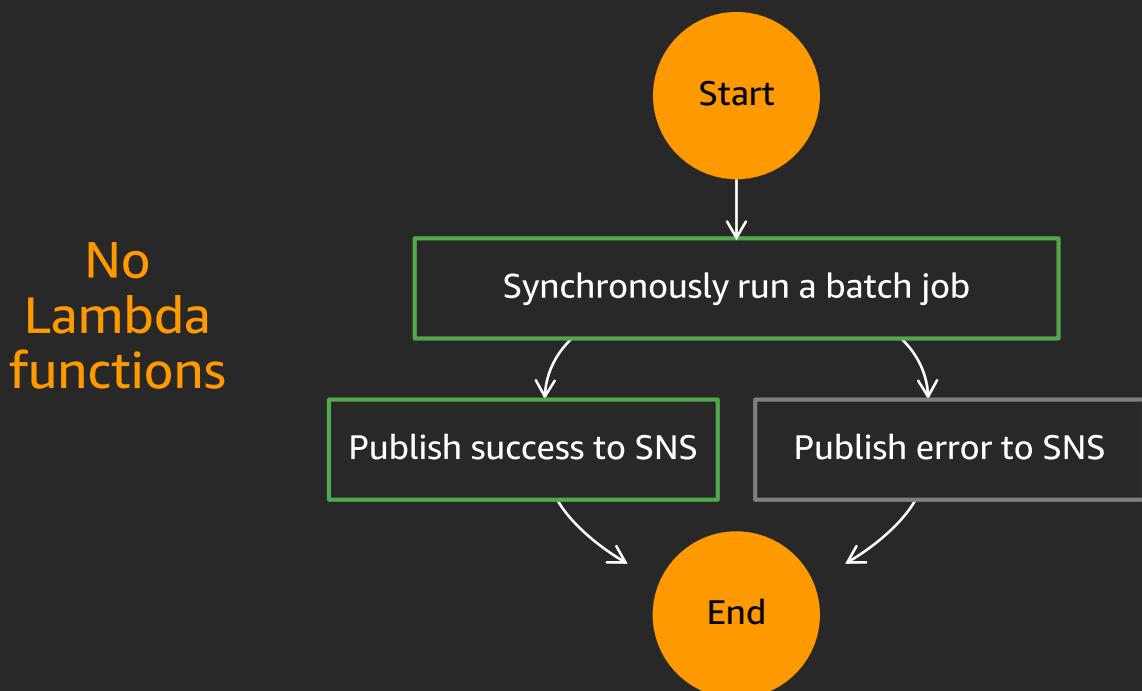
NEW!!!

Simpler integration, less code

With serverless polling



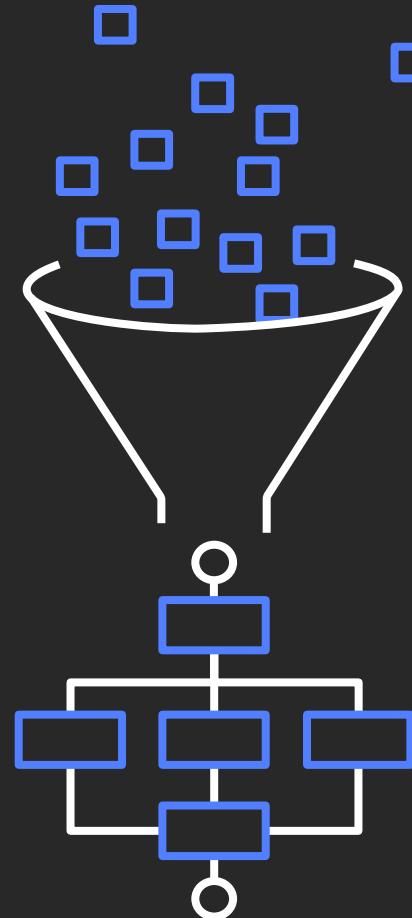
With direct service integration



Lambda
functions

No
Lambda
functions

Express workflows



Event streams over 100,000 per second

High volume, short duration

Cost effective at scale

**Streaming data processing –
IoT ingestion**

AWS Step Functions – AWS Toolkit for Visual Studio Code

The screenshot shows the AWS Toolkit for Visual Studio Code interface. On the left, the code editor displays the `Hello-World.asl.json` file with the following content:

```
1 "Comment": "A Hello World example demonstrating various\n2 \"StartAt\": \"Pass\",           \n3 \"States\": {\n4     \"Pass\": {\n5         \"Comment\": \"A Pass state passes its input to its ou\n6         \"Type\": \"Pass\",          \n7         \"Next\": \"MapState\"\n8     },\n9     \"MapState\": {\n10        \"Type\": \"Map\",          \n11        \"ItemsPath\": \"$\\.array\", \n12        \"MaxConcurrency\": 0,\n13        \"Iterator\": {\n14            \"StartAt\": \"Hello World example?\", \n15            \"States\": {\n16                \"Hello World example?\": {\n17                    \"Comment\": \"A Choice state adds branching log\n18                    \"Type\": \"Choice\", \n19                    \"Choices\": [\n20                        {\n21                            \"Variable\": \"$\\.IsHelloWorldExample\", \n22                            \"BooleanEquals\": true,\n23                            \"Next\": \"Yes\"\n24                        },\n25                        {\n26                            \"Variable\": \"$\\.IsHelloWorldExample\", \n27                            \"BooleanEquals\": false,\n28                            \"Next\": \"No\"\n29                        }\n30                    ]\n31                }\n32            }\n33        }\n34    }\n35 }
```

On the right, the state machine graph is displayed, showing the execution flow:

```
graph TD; Start((Start)) --> Pass[Pass]; Pass --> Decision{Hello World example?}; Decision -- Yes --> Wait[Wait 3 sec]; Wait --> Hello[Hello]; Wait --> World[World]; Hello --> HelloWorld[Hello World]; World --> HelloWorld; HelloWorld --> End((End)); Decision -- No --> End;
```

A tooltip at the bottom indicates: "Previewing ASL document. [View](#)".

Bottom status bar: Ln 1, Col 1 | Spaces: 2 | UTF-8 | LF | Amazon States Language | AWS Credentials: profile:office-hours | 🔍 | 📡

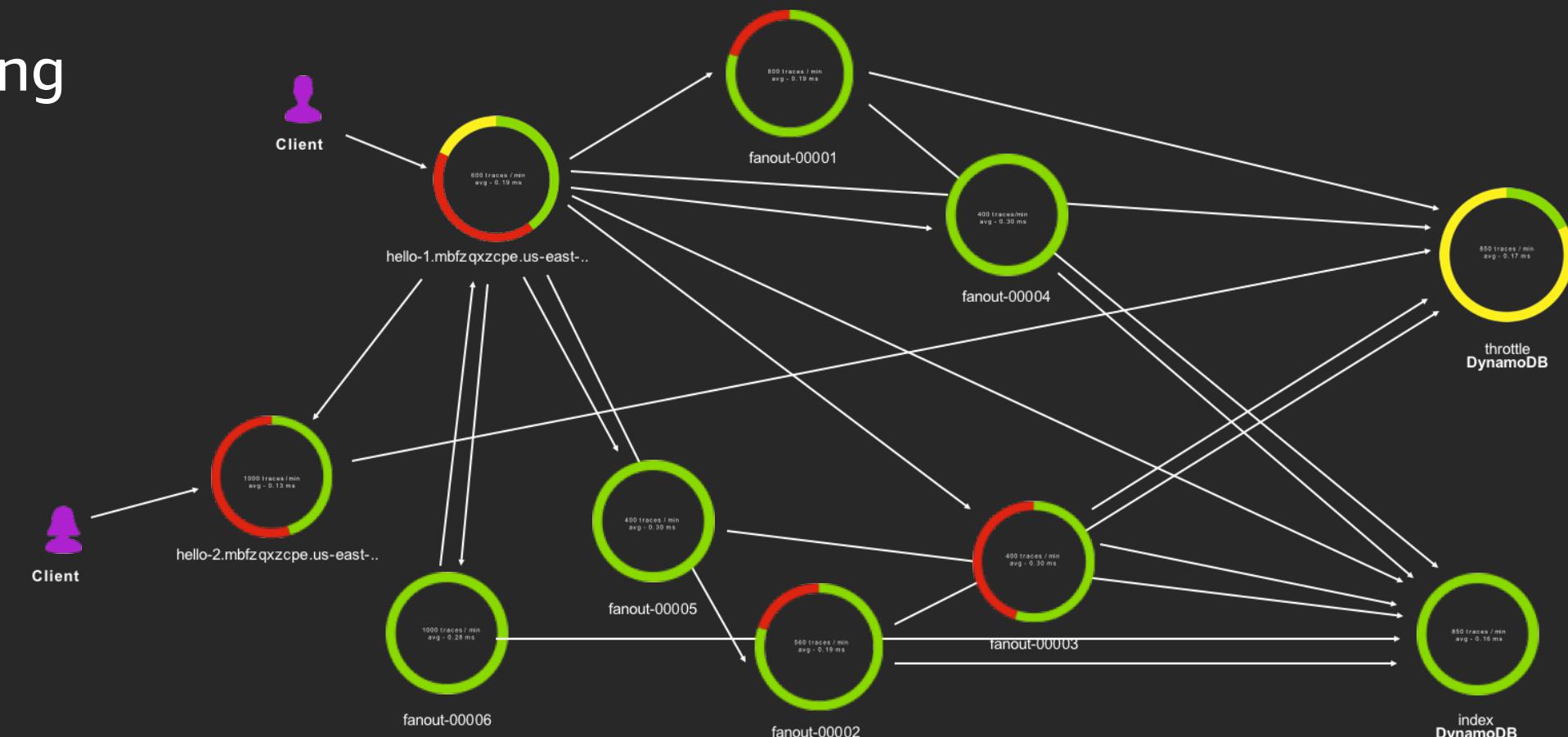
Tracing and observability

AWS X-Ray

Profile and troubleshoot distributed applications:

- Lambda instruments incoming requests for all supported languages and can capture calls made in code
- Amazon API Gateway inserts a tracing header into HTTP calls and reports data back to X-Ray

```
var AWSXRay = require('aws-xray-sdk-core');
var AWS = AWSXRay.captureAWS(require('aws-sdk'));
s3client = AWS.S3();
```

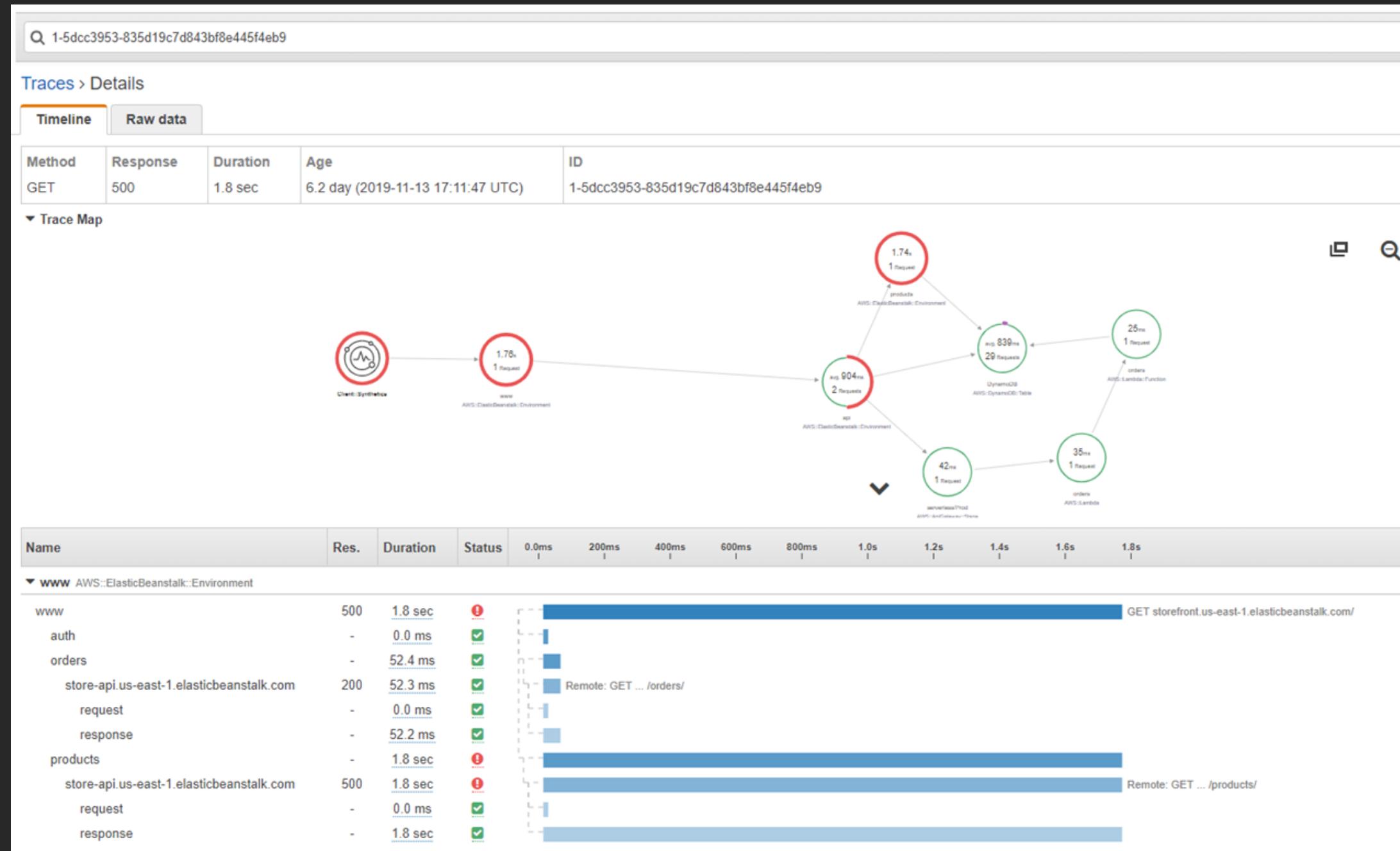


Enable X-Ray Tracing [i](#)

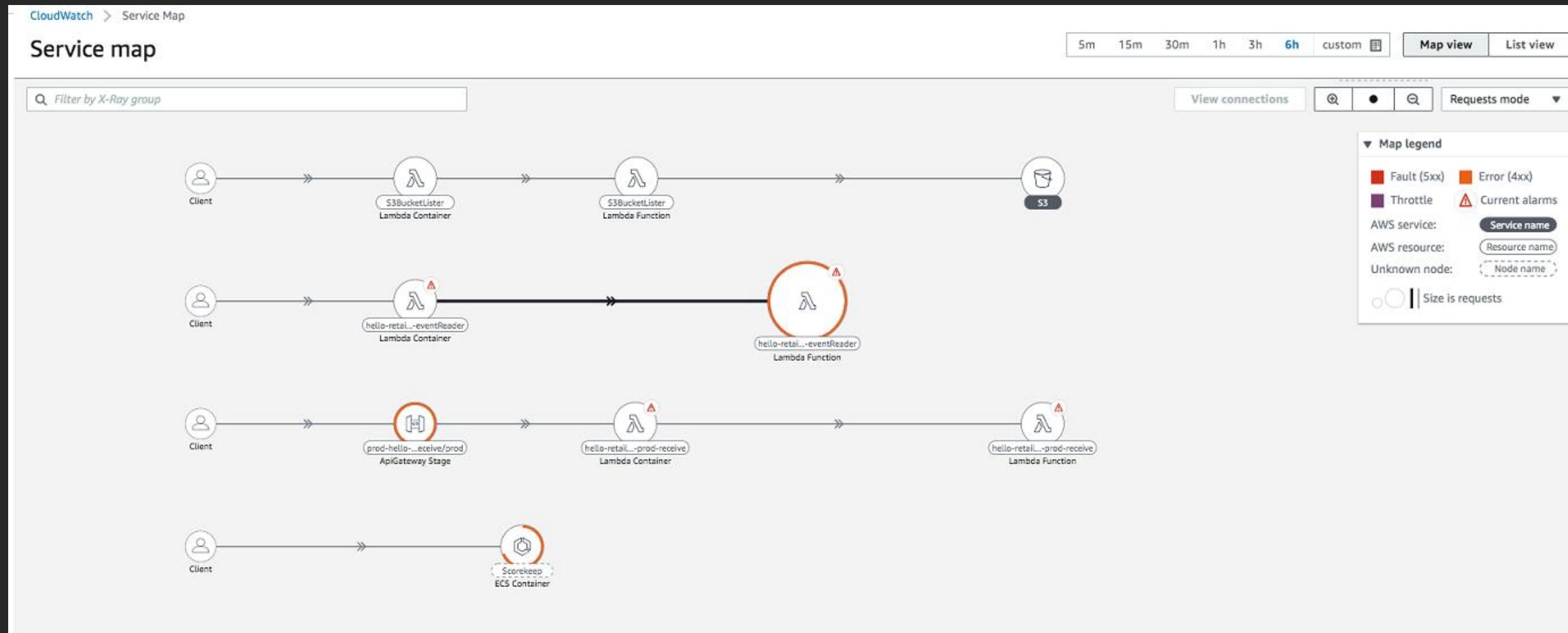
Enable active tracing [Info](#)



X-Ray trace example



CloudWatch ServiceLens – a single interface for traces, metrics, logs, and alarms



CloudWatch Embedded Metric Format – custom metrics from ephemeral resources (functions, containers)

Installation

```
npm install aws-embedded-metrics
```

Usage

To get a metric logger, you can either decorate your function or use the metricScope decorator.

Using the metricScope decorator without function parameters:

```
const { metricScope, Unit } = require("aws-embedded-metrics");

const myFunc = metricScope(metrics =>
  async () => {
    metrics.putDimensions({ Service: "Aggregation" });
    metrics.putMetric("ProcessingLatency", 10, Unit.Milliseconds);
    metrics.setProperty("RequestId", "422b1569-16f6-4a03");
    // ...
  });

await myFunc();
```

Installation

```
pip3 install aws-embedded-metrics
```

Usage

To get a metric logger, you can decorate your function with a `metric_scope`:

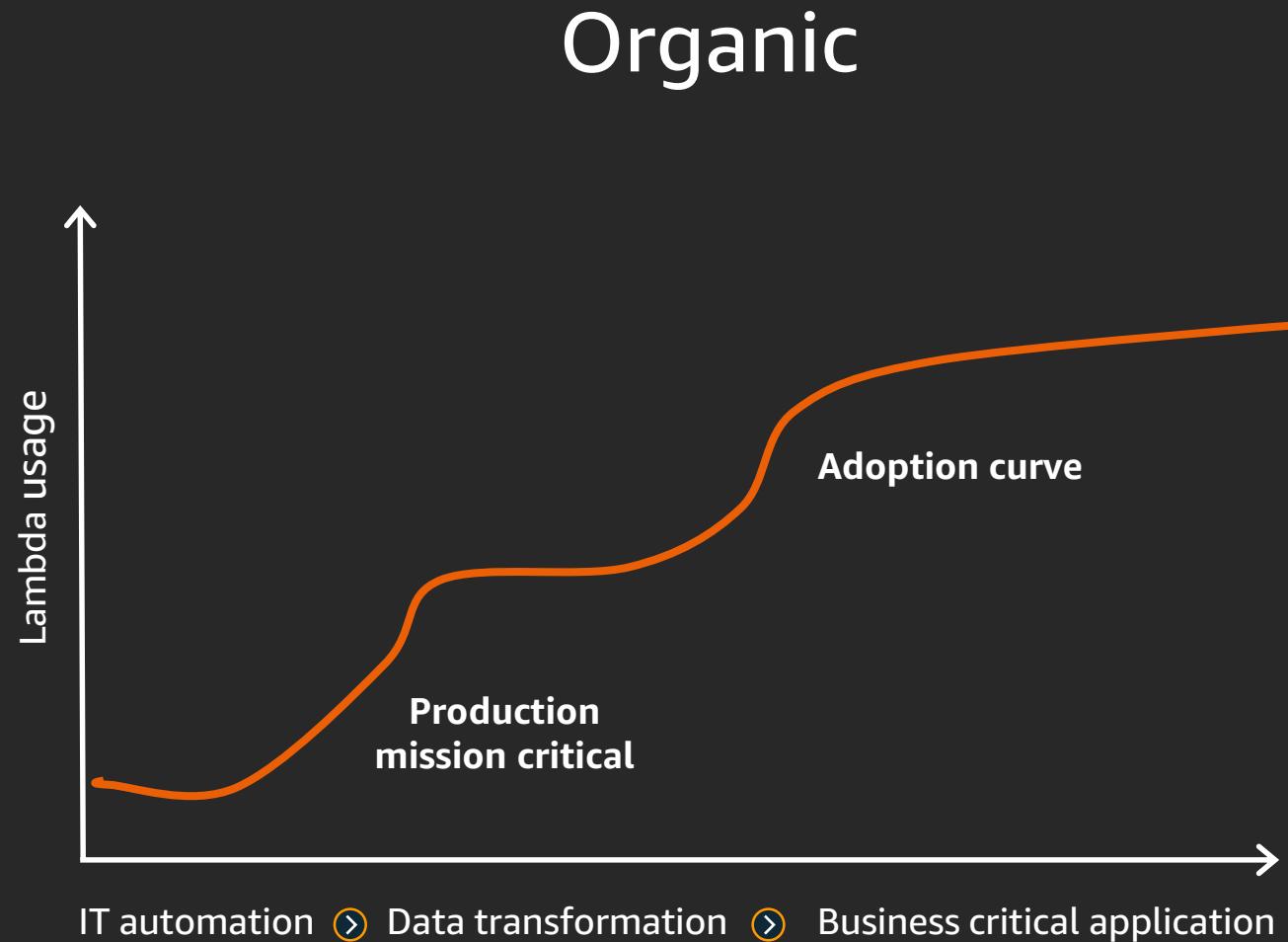
```
from aws_embedded_metrics import metric_scope

@metric_scope
def my_handler(metrics):
    metrics.put_dimensions({"Foo": "Bar"})
    metrics.put_metric("ProcessingLatency", 100, "Milliseconds")
    metrics.set_property("AccountId", "123456789012")
    metrics.set_property("RequestId", "422b1569-16f6-4a03")
    metrics.set_property("DeviceId", "61270781-c6ac-46f1")

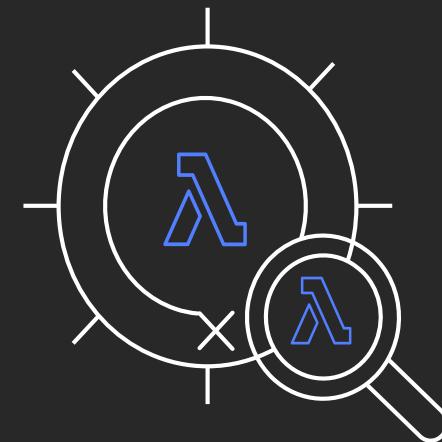
    return {"message": "Hello!"}
```

What now?

Finding success



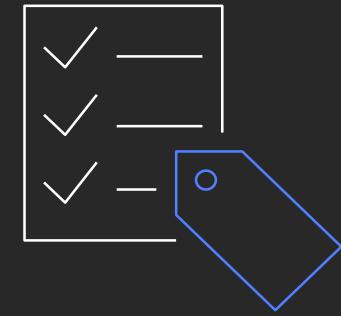
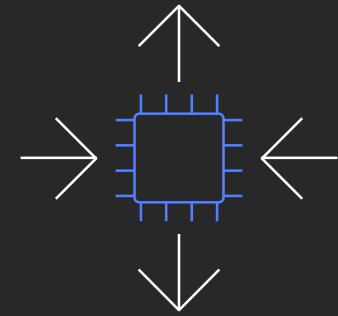
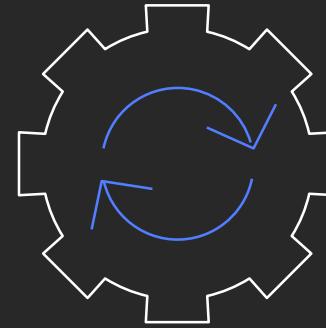
Serverless first



Considerations

- Rapid development
- Time-to-market – agility
- Changing business

Deliver innovation



Agility

"We relied on AWS Lambda to get our platform on the market in under four weeks. Within six months, we had scaled to 40,000 users without running a single server."

- **A Cloud Guru**

"We can have a commit roll into production ... in literally minutes, as well as provide a bunch of flexible routing options dynamically."

- **Pinpoint**

Elasticity

"Using Lambda-based serverless applications, Resnap can run multiple machine learning models on an average of 600 photos, which results in thousands of invocations and still generates a photo book within one minute."

- **Resnap**

"Our serverless-based approaches allow us to serve ads to audiences 60% faster than with instance-based approaches."

- **Infinia Mobile**

Total cost efficiency

"Our costs dropped by more than 25% and our monthly average time to complete data processing dropped to 7 seconds, making the process over 99% faster."

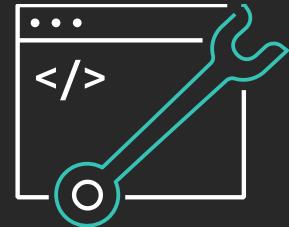
- **Speed Shift Media**

"Using AWS Lambda & AWS Step Functions, we cut customer onboarding times from 20 minutes to 30 seconds and their 'expected costs are \$20 USD per 10,000 orders.'"

- **Mercury**

Learn to build modern applications on AWS

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New

Serverless Lens in AWS Well-Architected Tool

Lens overview

Questions answered
1/9

Risks
✖ High risk 1
⚠ Medium risk 0

Improvement Plan

Measure, evaluate, and select optimum capacity units

- Identify and implement optimum capacity units.
- For AWS Lambda functions, the Lambda Power Tuning application can help you systematically test different memory size configurations and depending on your performance strategy - cost, performance, balanced - it identifies what is the most optimum memory size to use.
- For Amazon DynamoDB, On-Demand Instance can support up to 40 K read/write request units per second. It is recommended for unpredictable application traffic and new tables with unknown workloads. For higher and predictable throughputs, provisioned capacity along with DynamoDB automatic scaling is recommended over On-Demand Instance.
[Understanding when to use Amazon DynamoDB On-Demand Instance and provisioned capacity.](#)
- For high throughput Amazon Kinesis Data Streams with multiple consumers, consider using Enhanced Fan-Out for dedicated 2-MiB throughput per consumer. When possible, use Kinesis Producer Library and Kinesis Consumer Library for effective record aggregation and de-aggregation.
[Amazon Kinesis Data Streams Enhanced Fan-Out](#)
- For Amazon API Gateway, you can use Edge endpoint for geographically distributed clients, Regional endpoints when clients are in the same Region, and Private endpoints for when API consumers should access your API via your Amazon Virtual Private Cloud (VPC).
[Choose an Amazon API Gateway Endpoint type](#)
- Performance load testing is recommended at both sustained and burst rates. Use Amazon CloudWatch Service Dashboards to analyze key performance metrics including load testing results to evaluate the effect of tuning capacity units.
[AWS X-Ray](#)
[Analyzing Log Data with Amazon CloudWatch Logs Insights](#)

Next risk to address

PERF 1. How do you optimize your serverless applications?

✖ High risk

Recommended improvements

- [Measure, evaluate, and select optimum capacity units](#)
- [Measure and optimize function startup time](#)
- [Take advantage of concurrency via async and stream-based function invocations](#)
- [Optimize access patterns and apply caching where applicable](#)
- [Integrate with managed services directly over functions when possible](#)

Apply lenses

Lenses 2/2

Search by lens name

AWS Well-Architected Framework

Description

The AWS Well-Architected Framework is a set of foundational questions for you to answer about all of your cloud architectures.

Measure, evaluate, and select optimum capacity units [Info](#)

Measure and optimize function startup time

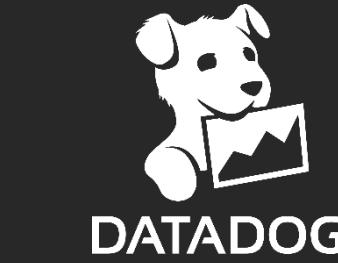
Take advantage of concurrency via async and stream-based function invocations

Optimize access patterns and apply caching where applicable

Integrate with managed services directly over functions when possible

None of these [Info](#)

More tooling available



sumo logic



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Thank you!

Danilo Poccia

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