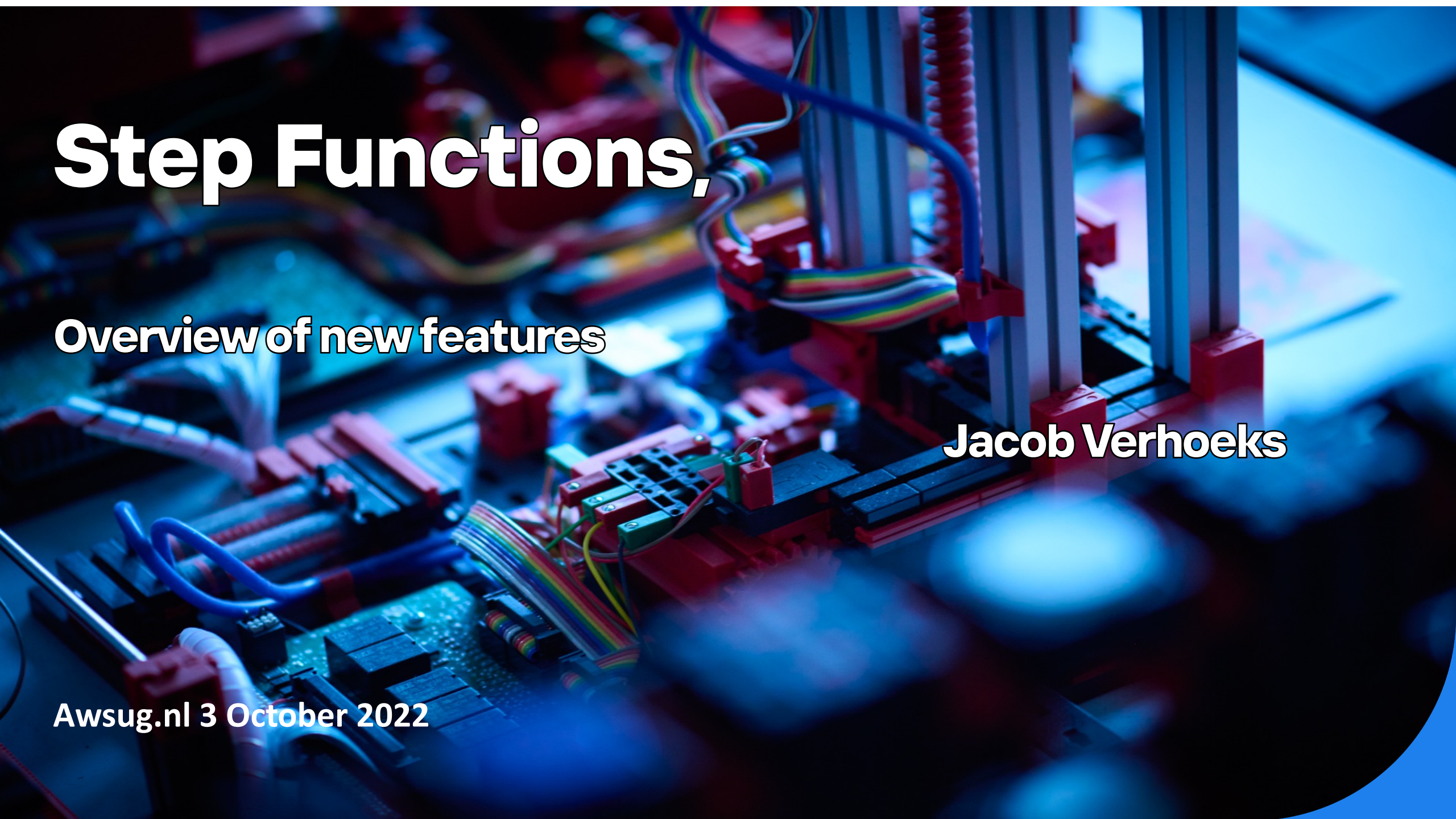

Step Functions,
Overview of new features
Jacob Verhoeks
Awsug.nl 3 October 2022

Jacob Verhoeks

Schuberg Philis

AWS Architect / Data Engineer

https://www.linkedin.com/in/jacobverhoeks/
https://github.com/jverhoeks
https://jacob.verhoeks.org/

AWS community builders

SCHUBERG PHILIS

Schuberg Philis

My colleagues will be having sessions too, so make sure you do not miss out

14.30 Enri Peters – ***"Build your first CRUD API in 60 minutes with AWS CDK!"***

16.45 Martijn van Dongen – ***"Fireside Chat with Dr. Werner Vogels"***

19.00 Costas Tyfoxylos and Sayantan Khanra – ***"What's your landing zone energy label? Visualising your risk level using Security Hub"***

19.45 Enri Peters – ***"How I failed to become an AWS Community Builder (but how I will succeed next time and how you could as well)"***

20.30 Martijn van Dongen – ***"Cloud Education At Scale"***

20.30 Jos Vliegenthart – ***"Cloud exit as a service (CEaaS): strategized and stress-free"***

We are hiring

Visit our booth

Step functions

Overview
History
Designs

For today

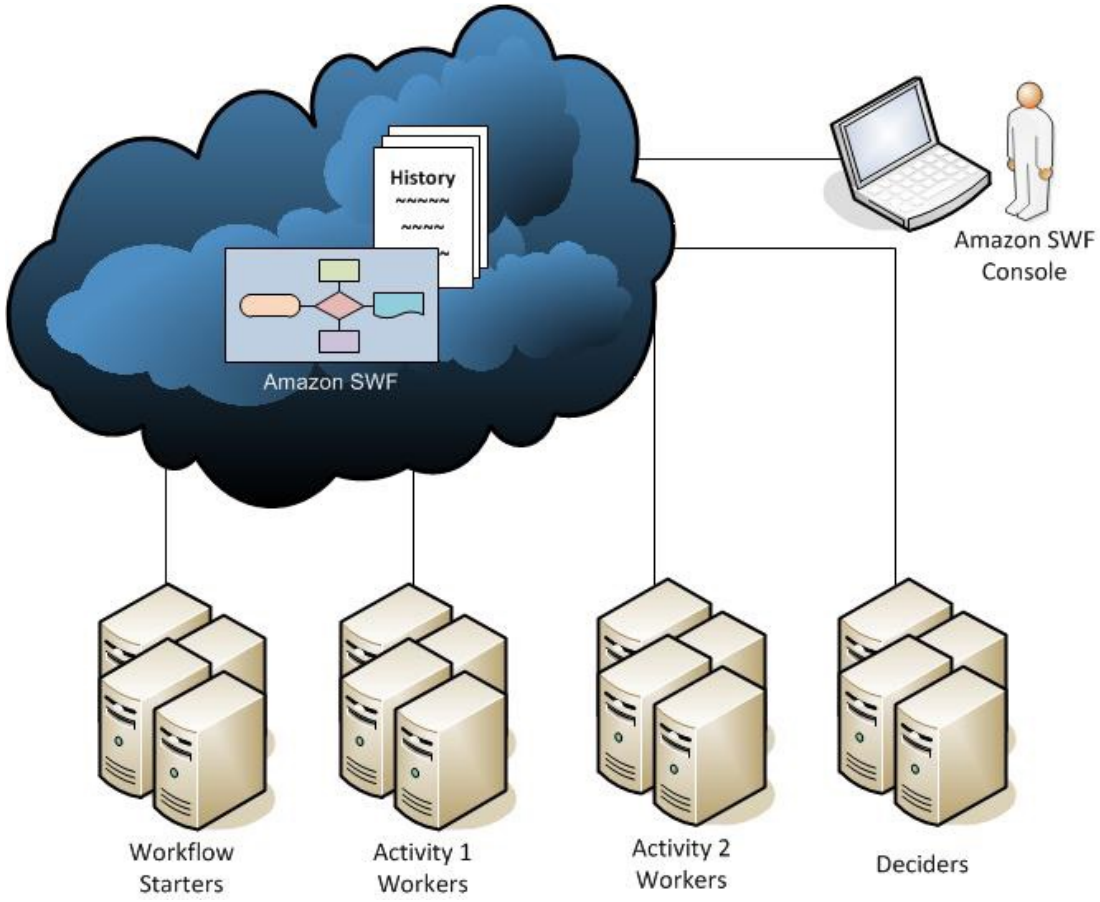
Before Step Functions

AWS Simple Workflow , released in Feb 2012.
One month after Dynamodb

Workflow orchestration tool

Decouple applications, based on tasks
Running on servers

Then came Lambda in Nov 2014



Step Functions was released at reinvent:2016

At the same time as CodeBuild, Rekognition, Athena and more

Serverless Orchestration

https://www.awsgeek.com/AWS-History/

Why

- **Serverless** Application across multiple AWS services
- Sequential actions
- Manage state between aws service calls
- Human intervention required

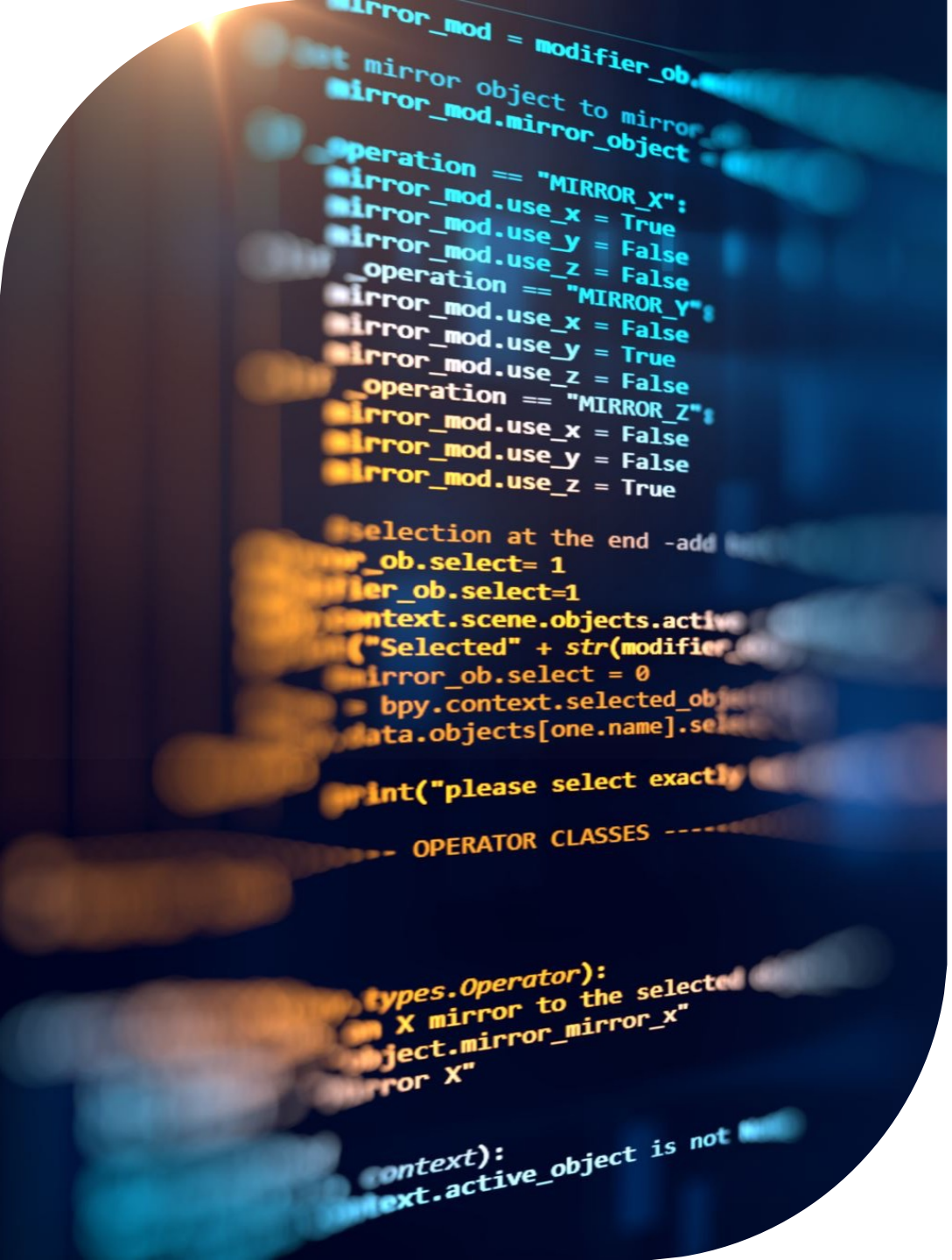
Use Case

- Data Processing
- Machine Learning
- Microservice Orchestration
- IT and security automation
- ....

DRY and Lean

- Move error Handling outside
- Don’t Repeat Yourself
- Use less libraries = less memory
- Speed up

https://en.wikipedia.org/wiki/Workflow_pattern



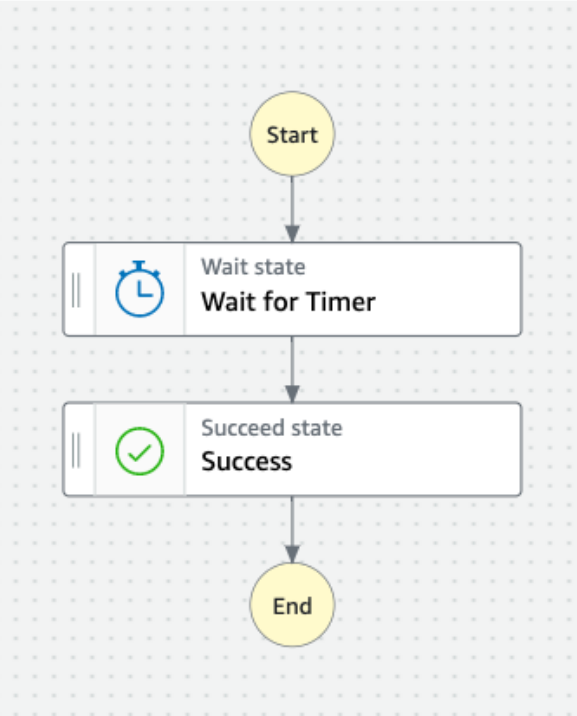
Patterns

Sequence
Retry failed
Parallel
Choose task based on result
Error handling
Many more

Step Functions States

Pass	Forward Input to Output, for debugging
Task	A unit of work , calling a lambda, an API call etc
Task.Activity	Run work on a worker (ec2/ecs/etc)
Choice	Conditional Logic
Wait	Add a delay
Succeed	Stops with Success
Fail	Stops with Failure
Parallel	Create parallel execution branches
Map	Run a set of Step for each element in the input map

Sample Workflow




```
{
  "Comment": "An example of the Amazon States Language for scheduling a task.",
  "StartAt": "Wait for Timer",
  "States": {
    "Wait for Timer": {
      "Type": "Wait",
      "SecondsPath": "$.timer_seconds",
      "Next": "Success"
    },
    "Success": {
      "Type": "Succeed"
    }
  }
}
```

Start execution

Start an execution using the latest definition of the state machine. Learn more

Name - *optional*

d062cb04-6032-8c1b-1f25-877a703fd40a

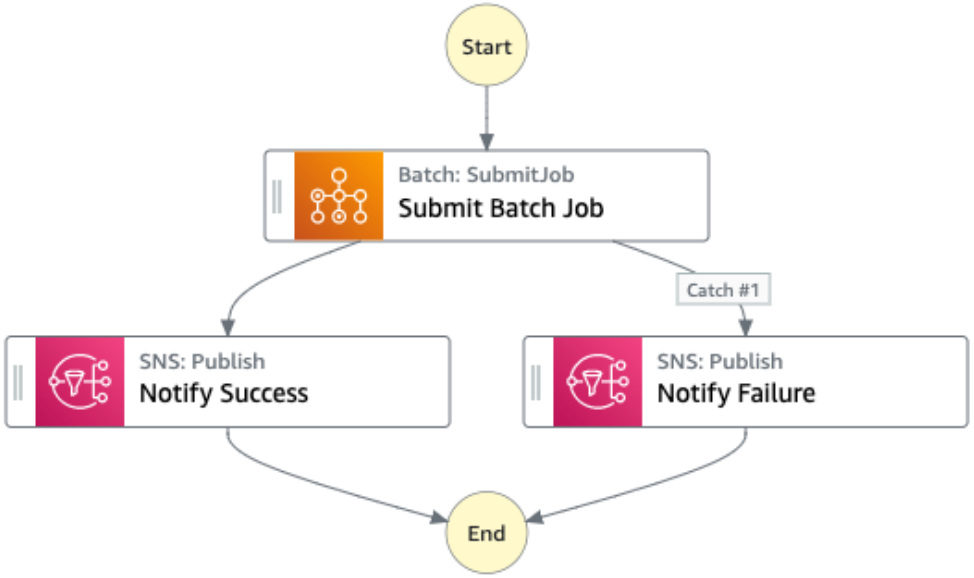
Input - *optional*

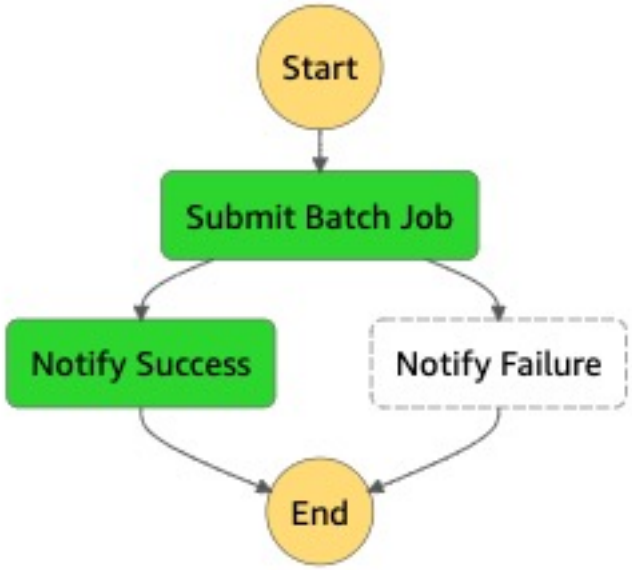
Enter input values for this execution in JSON format

```
1 { "timer_seconds": 5 }
```

https://catalog.us-east-1.prod.workshops.aws/workshops/9e0368c0-8c49-4bec-a210-8480b51a34ac/en-US/module-1/step-2

Sample Workflow





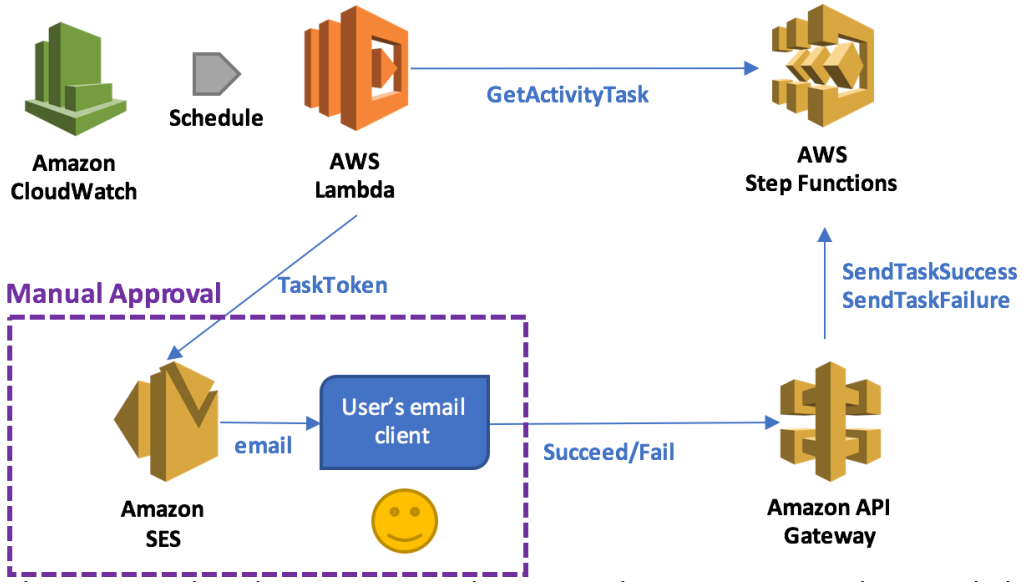
https://docs.aws.amazon.com/step-functions/latest/dg/create-sample-projects.html

Back to the Future

2017

Cloud Formation Support
Api gateway Integration
Custom Errors for lambda
Cloudwatch Events as Target

Support for Updating state machines



https://aws.amazon.com/blogs/compute/implementing-serverless-manual-approval-steps-in-aws-step-functions-and-amazon-api-gateway/

2018

Higher Throughput

Integration:

- Amazon ECS
- AWS Fargate
- Amazon DynamoDB
- Amazon SNS
- Amazon SQS
- AWS Batch
- AWS Glue
- Amazon SageMaker.

https://aws.amazon.com/about-aws/whats-new/2018/11/aws-step-functions-adds-eight-more-service-integrations/

2019 Feb Develop and Test Local

Docker or Jar
Override Endpoints for other local testing

```
docker run -p 8083:8083 amazon/aws-stepfunctions-local
```

```
aws stepfunctions --endpoint-url http://localhost:8083 create-state-machine --definition "{\
  \"Comment\": \"A Hello World example of the Amazon States Language using a Pass state\",\
  \"StartAt\": \"HelloWorld\",\
  \"States\": {\
    \"HelloWorld\": {\
      \"Type\": \"Pass\",\
      \"End\": true\
    }\
  }}" --name "HelloWorld" --role-arn "arn:aws:iam::012345678901:role/DummyRole"
```

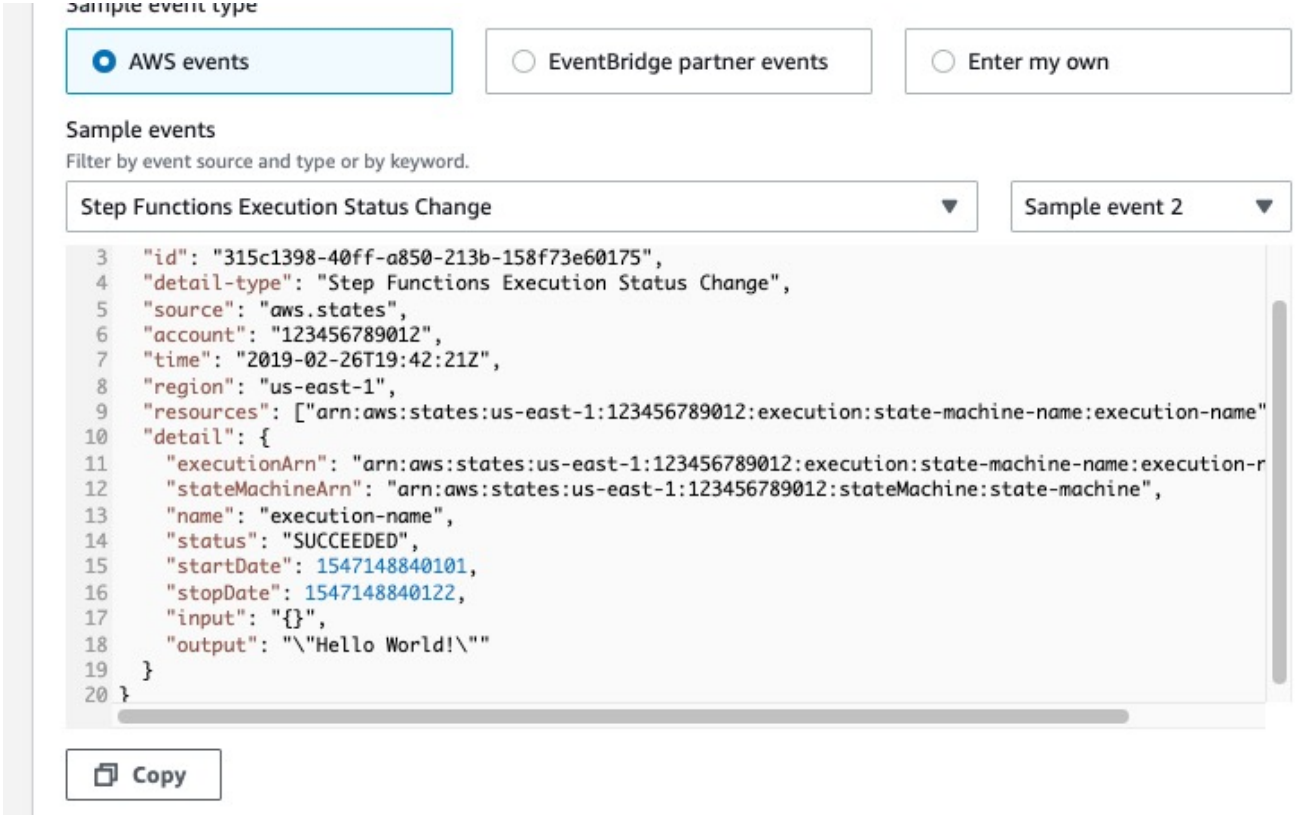
https://aws.amazon.com/about-aws/whats-new/2019/02/develop-and-test-aws-step-functions-workflows-locally/

2019 May Workflow execution Events

Integration with Cloudwatch Events , now Event bridge

Have an event if the Step Function

Works
Error
Timeout

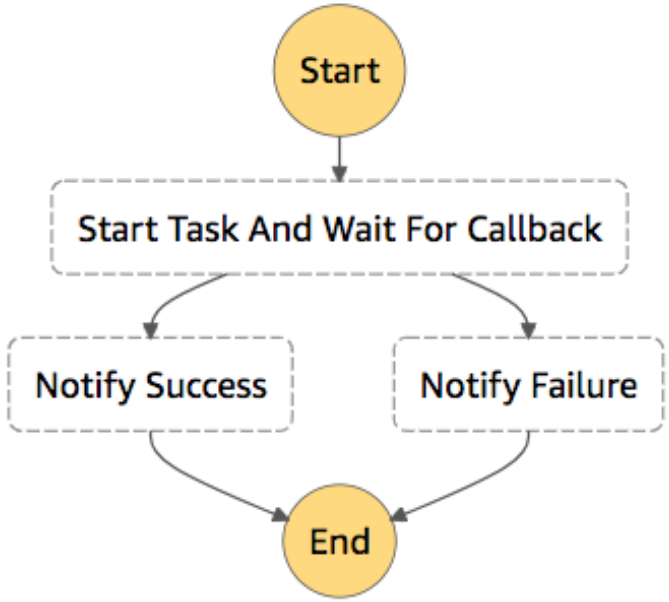


https://aws.amazon.com/about-aws/whats-new/2019/05/aws-step-functions-adds-support-for-workflow-execution-events/

2019 May Callback Patterns

Pause the Workflow and pass the token to other service

Example:
pass token to SQS
Wait for the application to pass
back the token

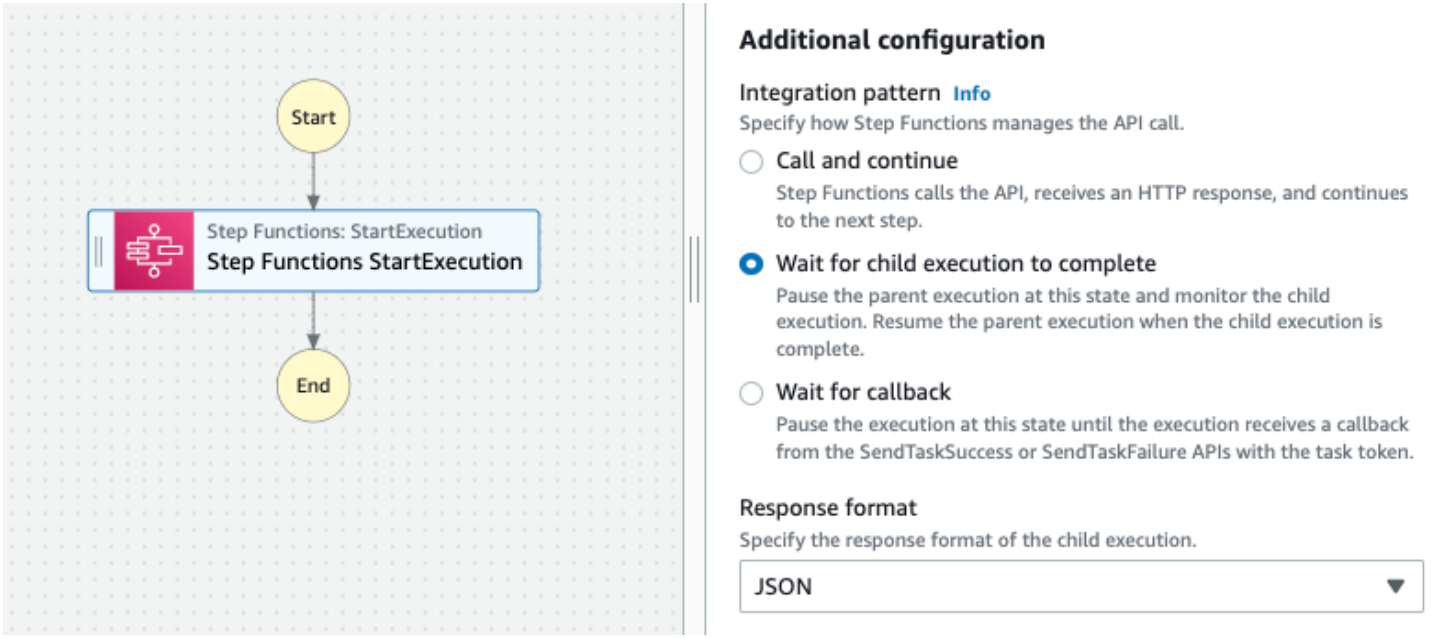


https://aws.amazon.com/about-aws/whats-new/2019/05/aws-step-functions-support-callback-patterns/

2019 Aug Nested Workflows

Build larger and complexer workflows

Re-use reoccuring parts as building blocks

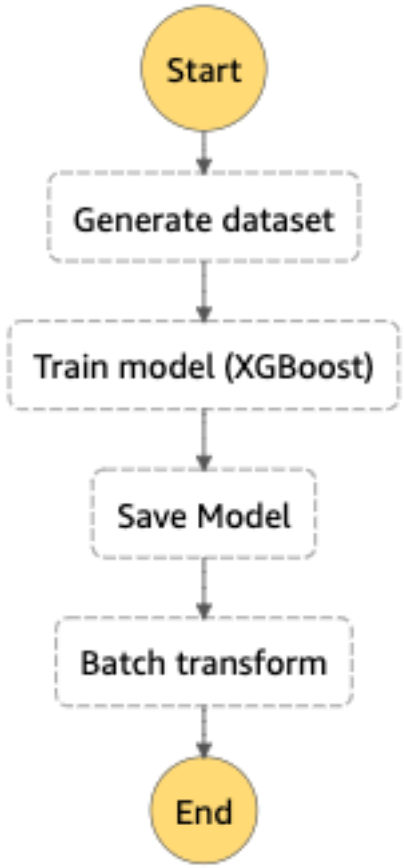


https://aws.amazon.com/about-aws/whats-new/2019/08/aws-step-function-adds-support-for-nested-workflows/

2019 Oct Sagemaker Integration

Move from Jupyter Notebooks to
Serverless machine learning workflow

ML-Ops



https://aws.amazon.com/about-aws/whats-new/2019/10/aws-step-functions-expands-amazon-sagemaker-service-integration/

2019 Nov Data Science SDK

Build a Step Function Workflow in Python
Predefined templates , TrainingPipeline, Inference Pipeline

Export to CloudFormation

Replaced by CDK?

Create the `TrainingStep` for the Workflow

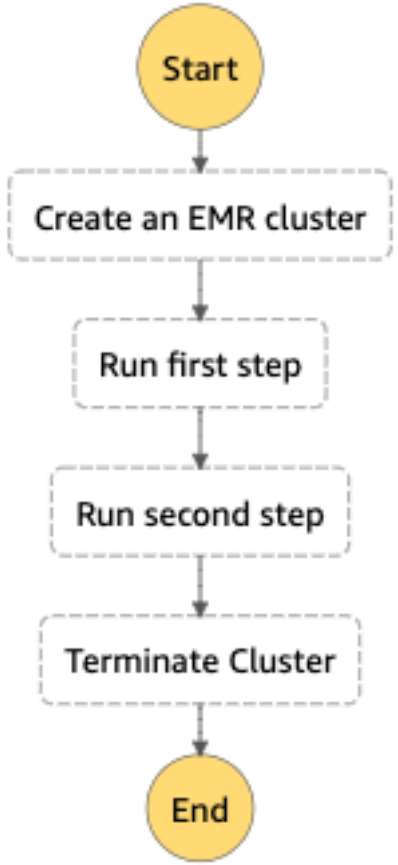
```
training_step = steps.TrainingStep(
    "SageMaker Training Step",
    estimator=sklearn,
    data={"train": sagemaker.TrainingInput(preprocessed_training_data, content_type="text/csv")},
    job_name=execution_input["TrainingJobName"],
    wait_for_completion=True,
)
```

https://aws.amazon.com/about-aws/whats-new/2019/11/introducing-aws-step-functions-data-science-sdk-amazon-sagemaker/

2019 Nov EMR Integration

Control EMR from Step Functions

On-Demand



https://aws.amazon.com/about-aws/whats-new/2019/11/aws-step-functions-adds-amazon-emr-service-integration/

2019 Re:invent Express Workflows

Cost Effective
Faster

- Api-gateway
- IOT
- Event Bridge

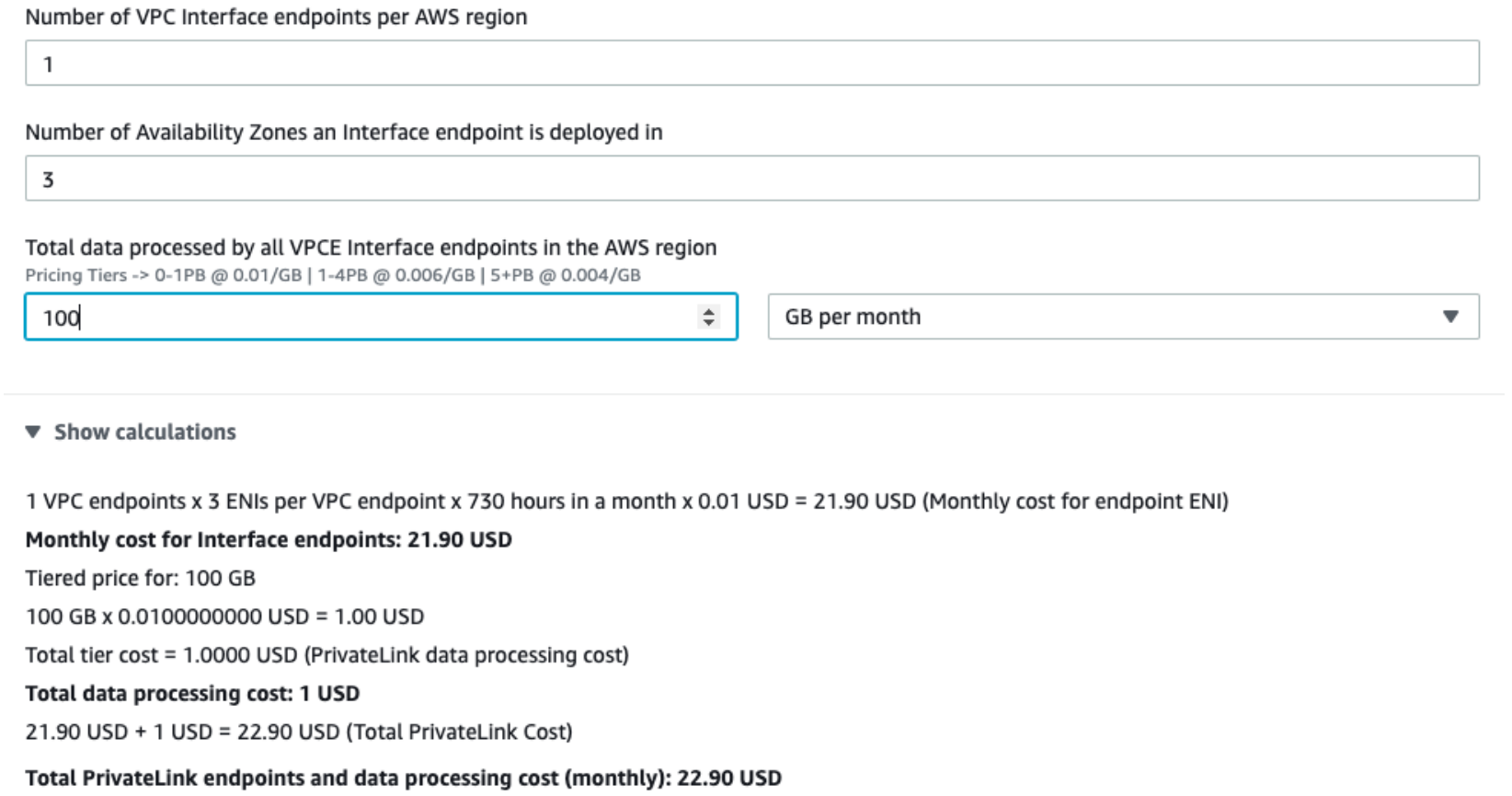
	Standard	Express
Maximum duration	1 year	5 minutes
Supported execution start rate	Over 2,000 per second*	Over 100,000 per second*
Supported state transition rate	Over 4,000 per second*	Nearly unlimited*
Pricing	Priced per state transition. A state transition is counted each time a step in your execution is completed. You are charged $25 per million state transitions.**	Priced by the number of executions you run, their duration, and memory consumption. You are charged $1 per million executions, and duration price from $0.000004 to $0.00001 per GB-second.
Execution history	Executions can be listed and described with Step Functions APIs, and visually debugged in the console.	Executions can be inspected in CloudWatch Logs by enabling logging on your state machine.
Execution semantics	Exactly-once workflow execution.	At-least-once workflow execution.
Service integrations	Supports all service integrations and patterns.	Supports all service integrations. Does not support Job-run (.sync) or Callback (.waitForTaskToken) patterns.
Step Functions activities	Supports Step Functions activities.	Does not support Step Functions activities.

https://aws.amazon.com/about-aws/whats-new/2019/12/introducing-aws-step-functions-express-workflows/

2019 Re:invent Private Link

Reach step function from inside the VPC

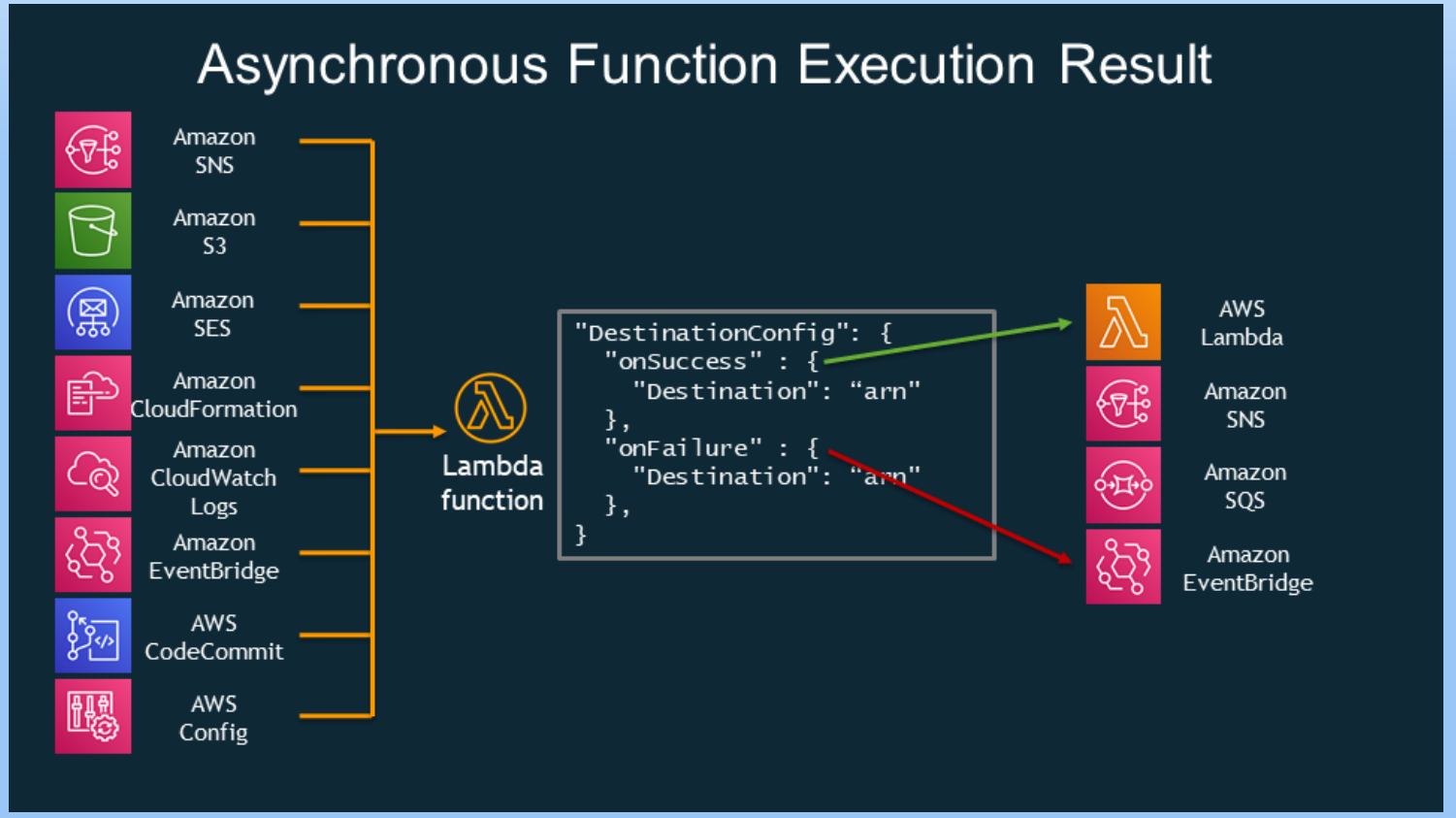
No need to traverse out to the internet



https://aws.amazon.com/about-aws/whats-new/2019/12/aws-step-functions-now-supports-aws-privatelink/

2019 Re:invent Lambda Destinations

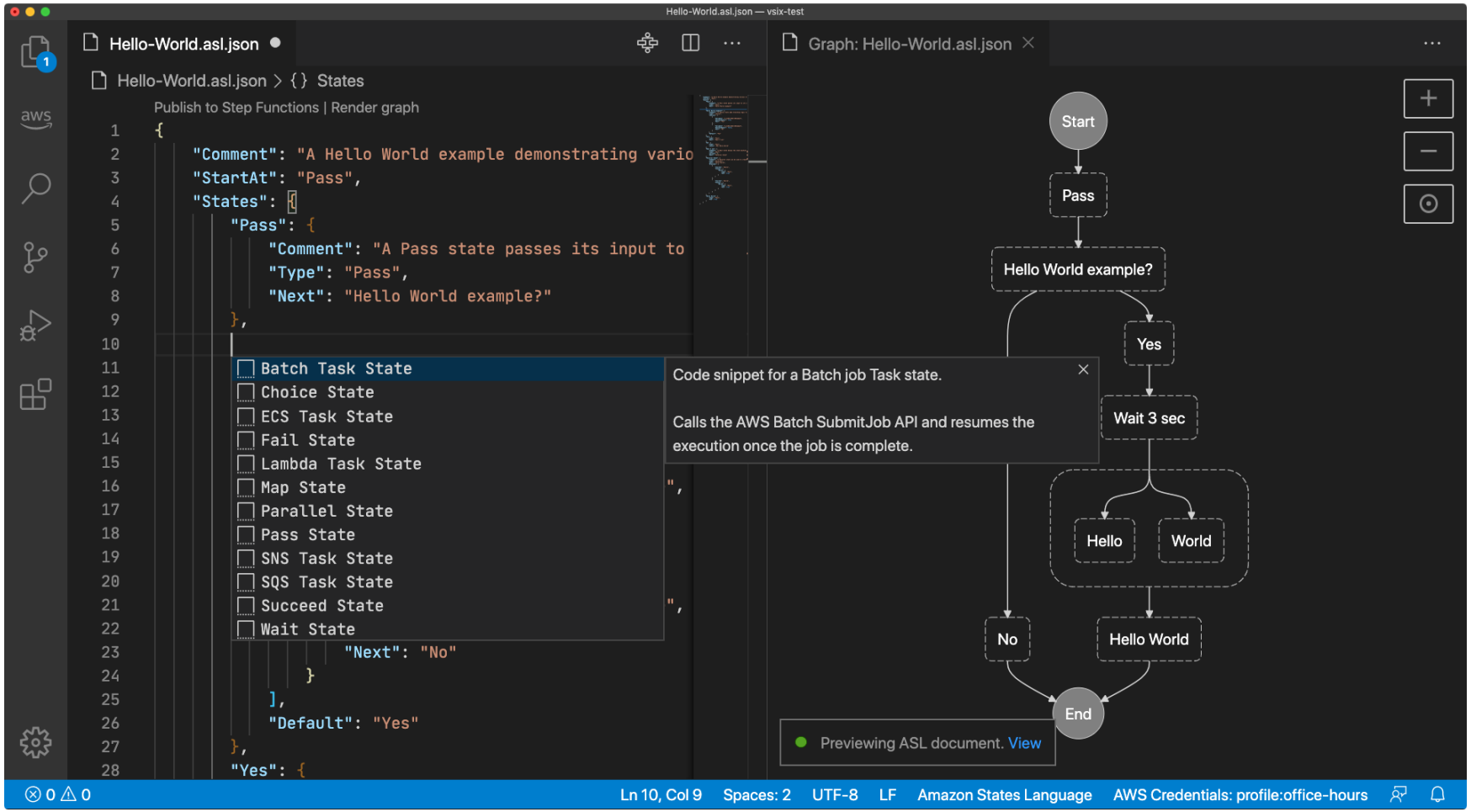
Simple workflow for Lambda's Asynchronous



https://aws.amazon.com/blogs/compute/introducing-aws-lambda-destinations/

2020 Mar Visual Studio Code Support

Create, Edit, Debug



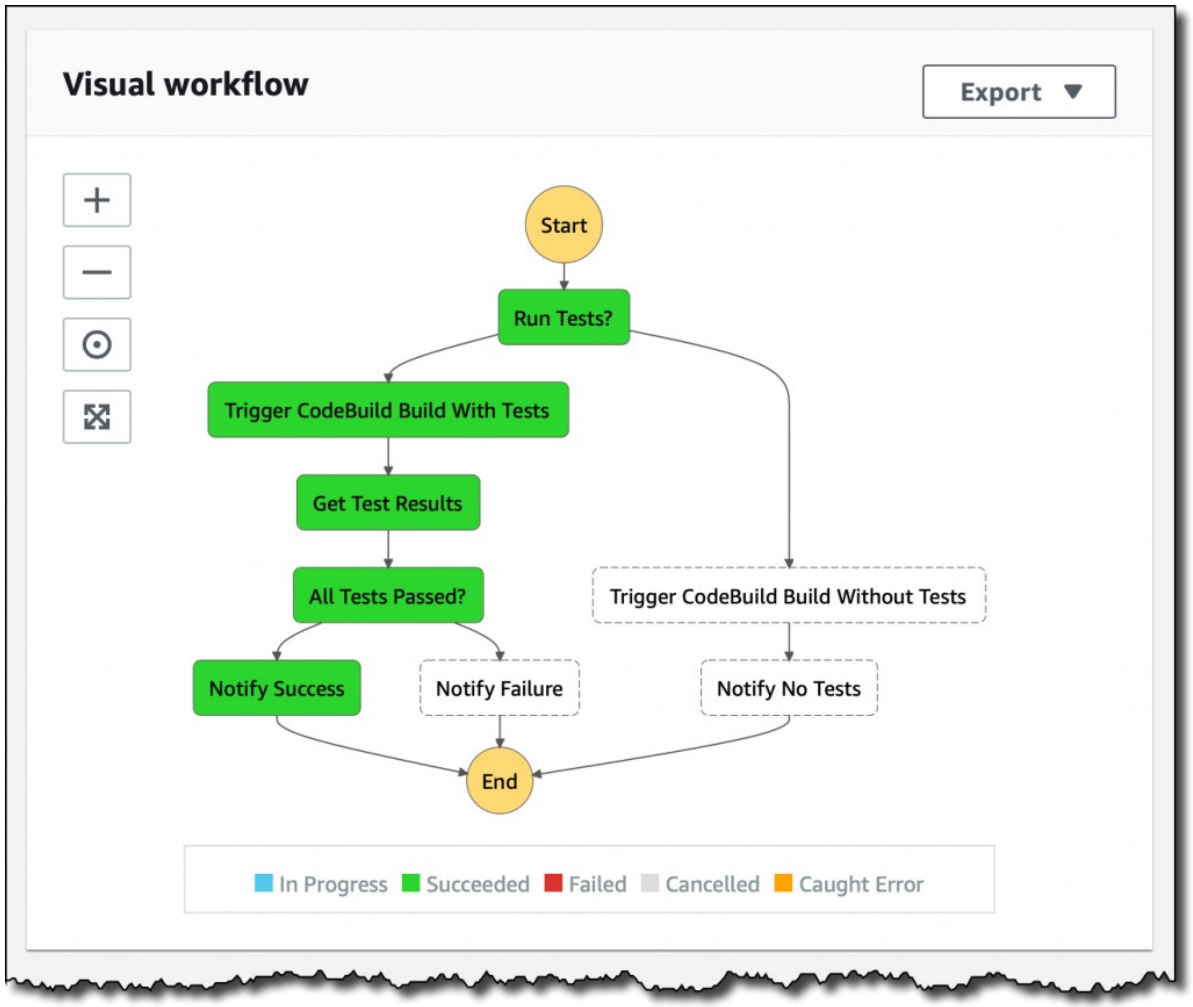
https://aws.amazon.com/about-aws/whats-new/2020/03/aws-toolkit-for-visual-studio-code-supports-aws-step-functions/

2020 May Code Build Support

Create a webhook, called from Github to run CodeBuild

Use Cloudwatch Events/Event Bridge

to schedule builds



https://aws.amazon.com/about-aws/whats-new/2020/05/aws-step-functions-supports-aws-codebuild-service-integration/

2020 May AWS Sam Support

Use SAM to deploy
your serverless workloads

YAML

```yaml
Resources:
  SAMLogs:
    Type: AWS::Logs::LogGroup

  SimpleStateMachine:
    Type: AWS::Serverless::StateMachine
    Properties:
      Definition: {…}
      Logging:
        Destinations:
          - CloudWatchLogsLogGroup:
              LogGroupArn: !GetAtt SAMLogs.Arn
        IncludeExecutionData: true
        Level: ALL
      Policies:
        - CloudWatchLogsFullAccess
      Type: EXPRESS
```

https://aws.amazon.com/about-aws/whats-new/2020/05/aws-sam-adds-support-for-aws-step-functions/

2020 Aug

New Choice State Operators

- Test if Null
- Variable Exists
- Wildcarding
- Compare variables

- Dynamic Timeouts

- String and Array Construction
- String to Json
- Json to String

```
{
  "Parameters": {
    "foo.$": "States.Format('Hello, {} {}', $.firstName, $.lastName)"
  }
}
```

```
{
  "Type": "Task",
  "Resource": "arn:aws:states:::some.future.integration:run.sync",
  "Parameters": {
    "FieldThatNeedsToBeAString.$":
"States.JsonToString($.JSONInputField)",
  }
}
```

https://aws.amazon.com/about-aws/whats-new/2020/08/aws-step-functions-support-string-manipulation-comparison-operators-improved-output-processing/

2020 Sep increase Payload to 256K

From 32K to 256K

Handle more data in one execution

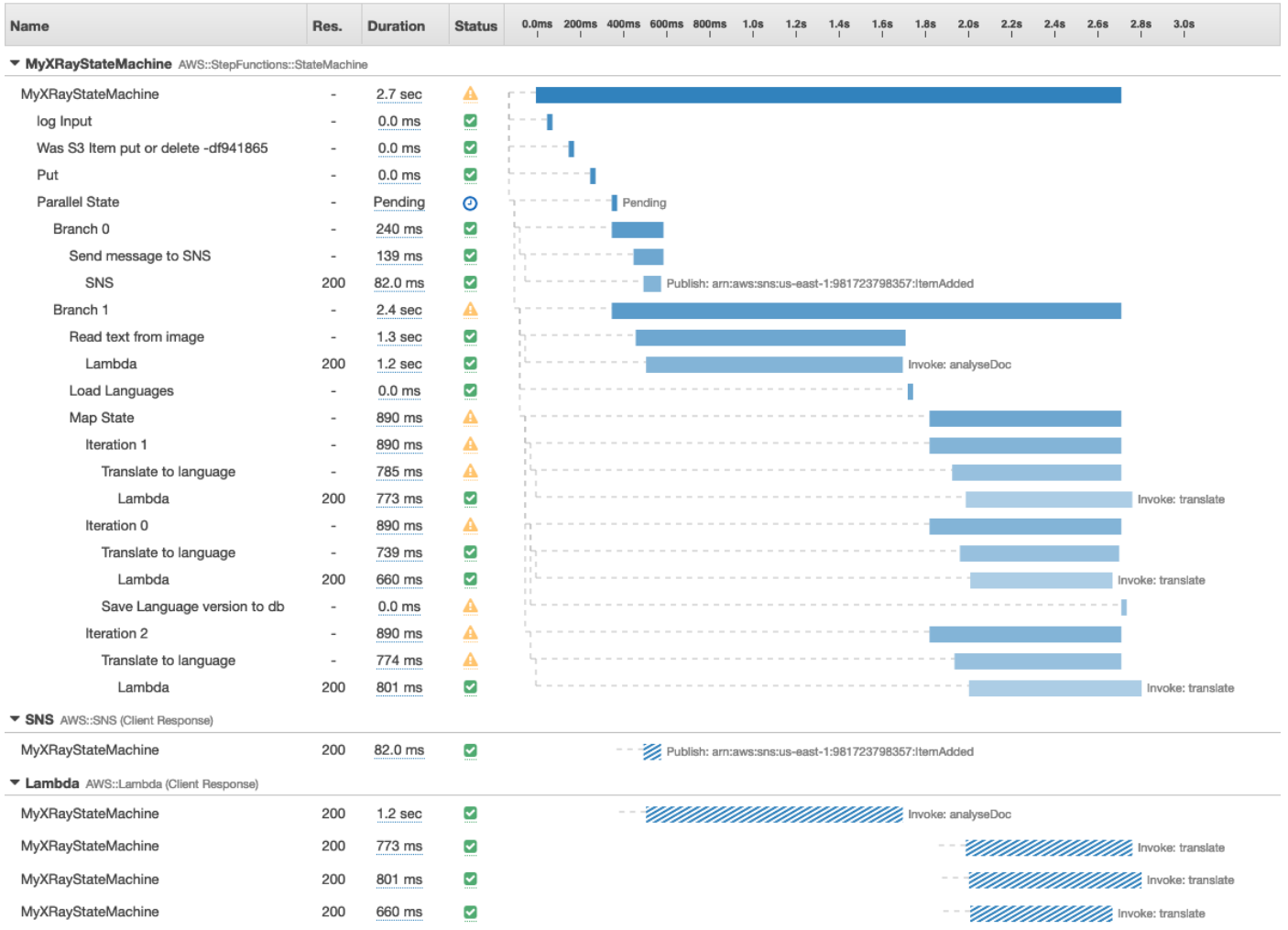
Same as services like DynamoDB, Lambda, SNS, SQS

li

2020 Sep AWS X-Ray Support

Detailed insights

Faster Troubleshooting



https://aws.amazon.com/about-aws/whats-new/2020/09/aws-step-functions-adds-support-for-aws-x-ray/

2020 Oct Amazon Athena Integration

Query Data
use for other processes

```
"Start an Athena query": {
  "Type": "Task",
  "Resource": "arn:aws:states:::athena:startQueryExecution.sync",
  "Parameters": {
    "QueryString": "SELECT * FROM \"myDatabase\".\"myTable\" limit 1",
    "WorkGroup": "primary",
    "ResultConfiguration": {
       "OutputLocation": "s3://athenaQueryResult"
    }
  },
  "Next": "Get results of the query"
}
```

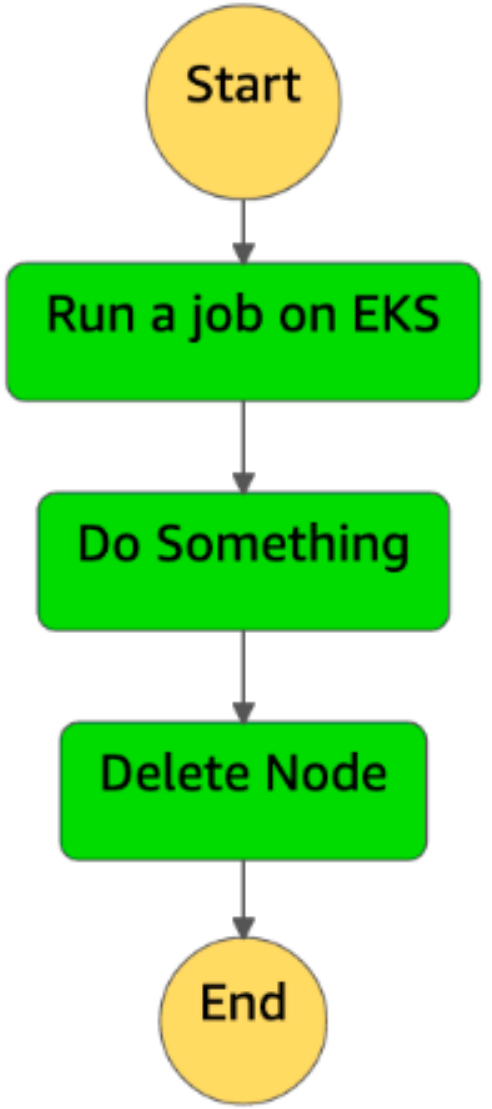
https://aws.amazon.com/about-aws/whats-new/2020/10/aws-step-functions-now-supports-amazon-athena-service-integration/

2020 Nov EKS Integration

Run Job

Call EKS API

Create/DeleteCluster
Create/DeleteNoteGroup

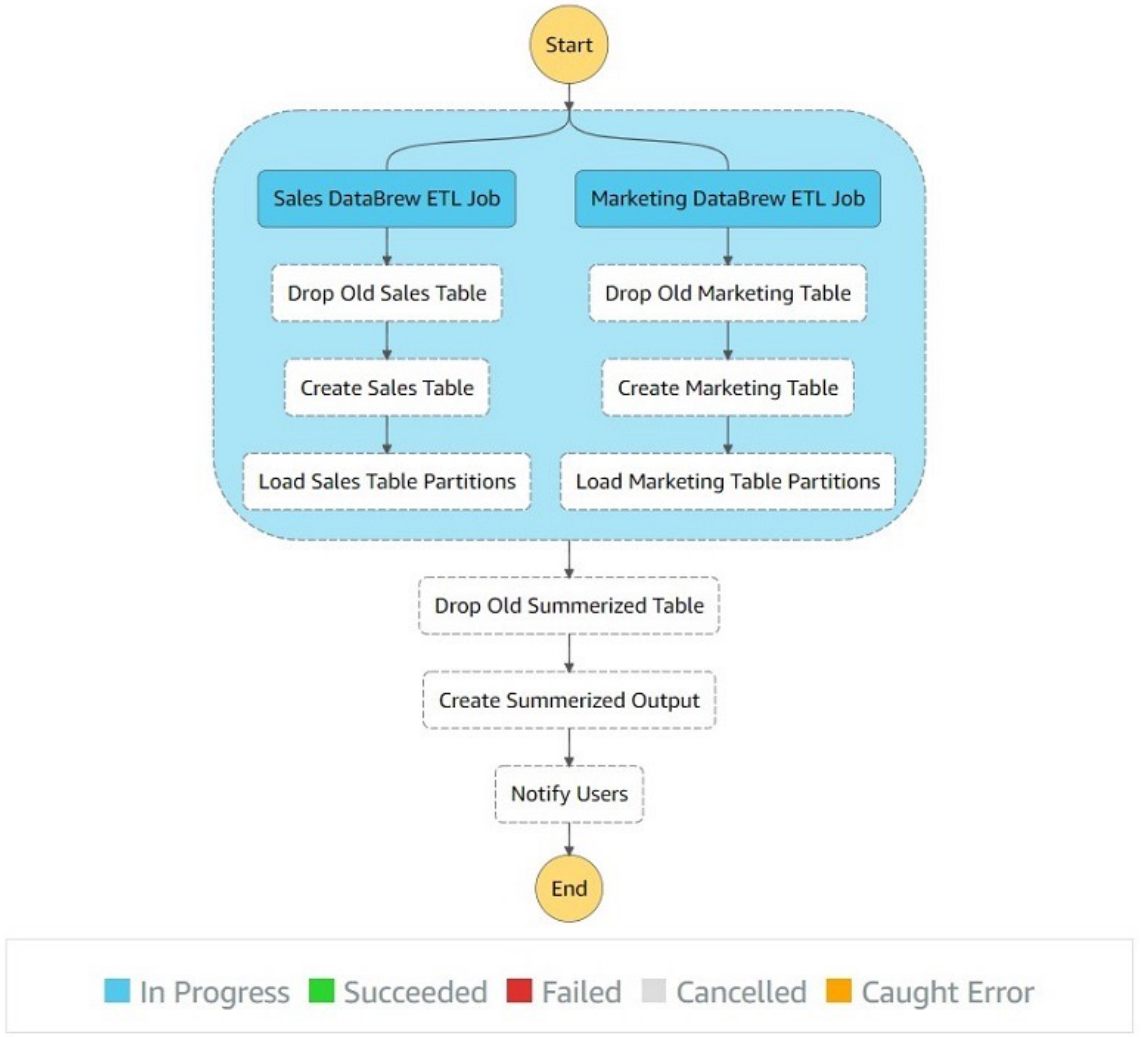


https://aws.amazon.com/about-aws/whats-new/2020/11/aws-ste
functions-now-supports-amazon-eks-service-integration/

2021 Jan Glue DataBrew Support

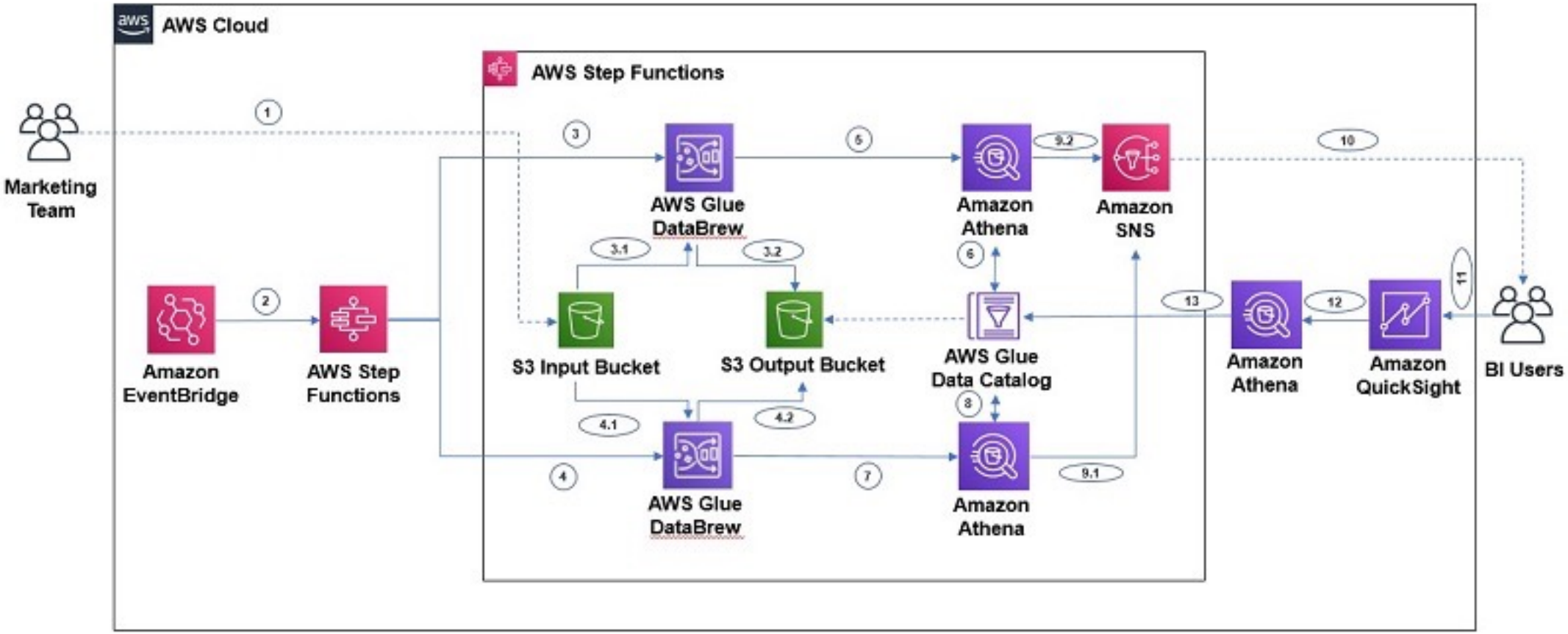
Visual Data Preparation

Separate Responsibility



https://aws.amazon.com/blogs/big-data/orchestrating-an-aws-glue-databrew-job-and-amazon-athena-query-with-aws-step-functions/

2021 Jan Glue Databrew Support



https://aws.amazon.com/about-aws/whats-new/2021/01/aws-step-functions-support-aws-glue-databrew-jobs-data-analytics-machine-learning-workflows/

2021 Mar Yaml Support

Until now only JSON was support

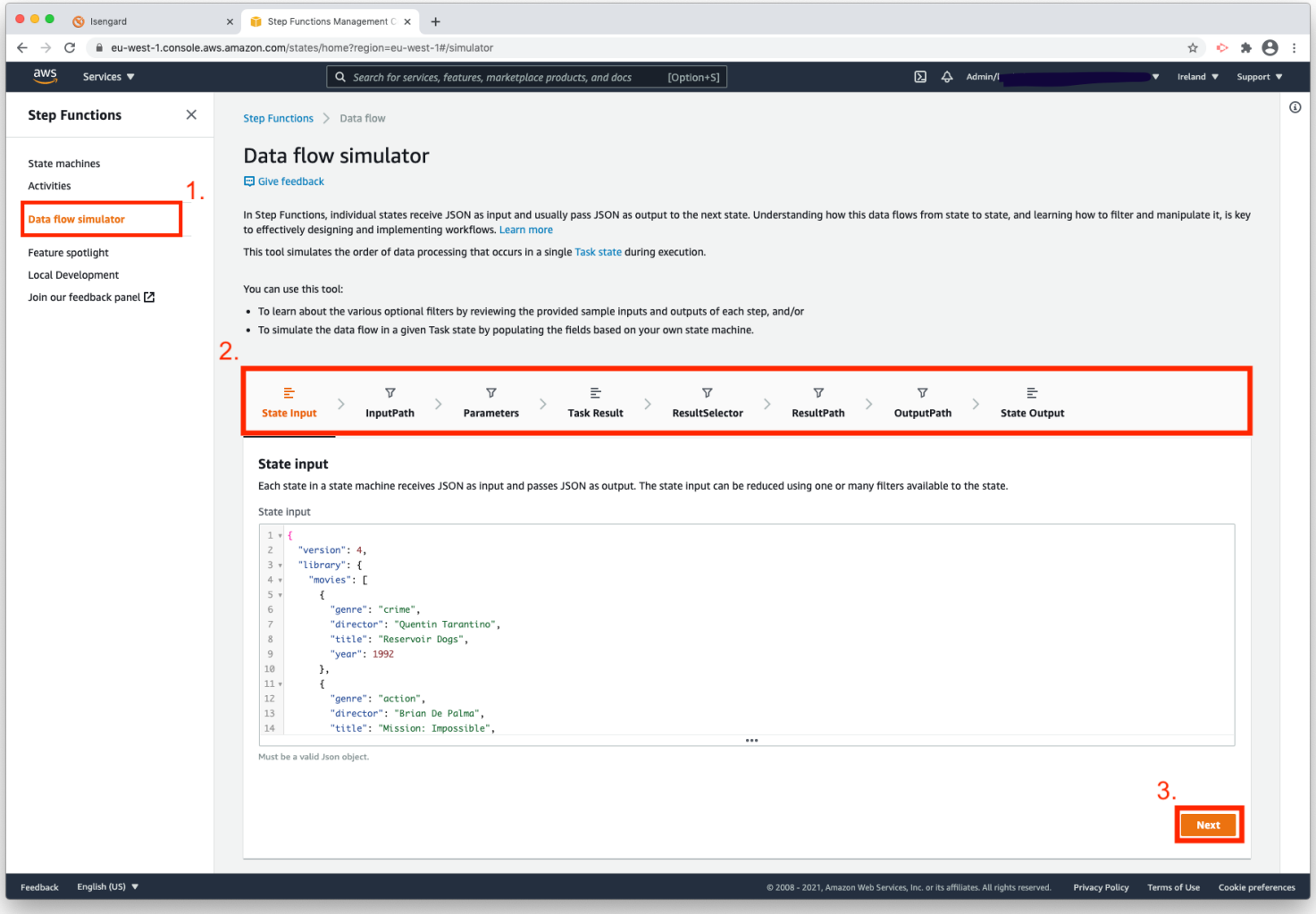
```yaml
Comment: "Example Workflow"
StartAt: exampleStep
States:
 exampleStep:
   Type: Task
   Resource: !GetAtt example-step-lambda.Arn
   TimeoutSeconds: 28
   End: true
```

https://aws.amazon.com/about-aws/whats-new/2021/03/aws-step-functions-adds-tooling-support-for-yaml/

2021 April Data Flow Simulator

Test your workflow

InputPath
Parameters
ResultSelector
OutputPath
ResultPath.



https://aws.amazon.com/about-aws/whats-new/2021/04/aws-step-functions-adds-new-data-flow-simulator-for-modelling-input-and-output-processing/

2021 May Custom Event Bridge Support

YAML

```yaml
Send an EventBridge custom event:
  Type: Task
  Resource: 'arn:aws:states:::events:
  Parameters:
    Entries:
      - Detail:
          Message: 'Hello from Step F
        DetailType: MyDetailType
        EventBusName: MyEventBusName
        Source: MySource
  Next: NEXT_STATE
```

Fire and forget
Standard & Express

YAML

```yaml
Send an EventBridge custom event:
  Type: Task
  Resource: 'arn:aws:states:::events:putEvents.waitForTaskToken'
  Parameters:
    Entries:
      - Detail:
          Message: 'Hello from Step Functions!'
          TaskToken.$: $$.Task.Token
        DetailType: MyDetailType
        EventBusName: MyEventBusName
        Source: MySource
  Next: NEXT_STATE
```

Wait for answer
Standard

https://aws.amazon.com/about-aws/whats-new/2021/05/aws-step-functions-now-supports-amazon-custom-events-eventbridge/

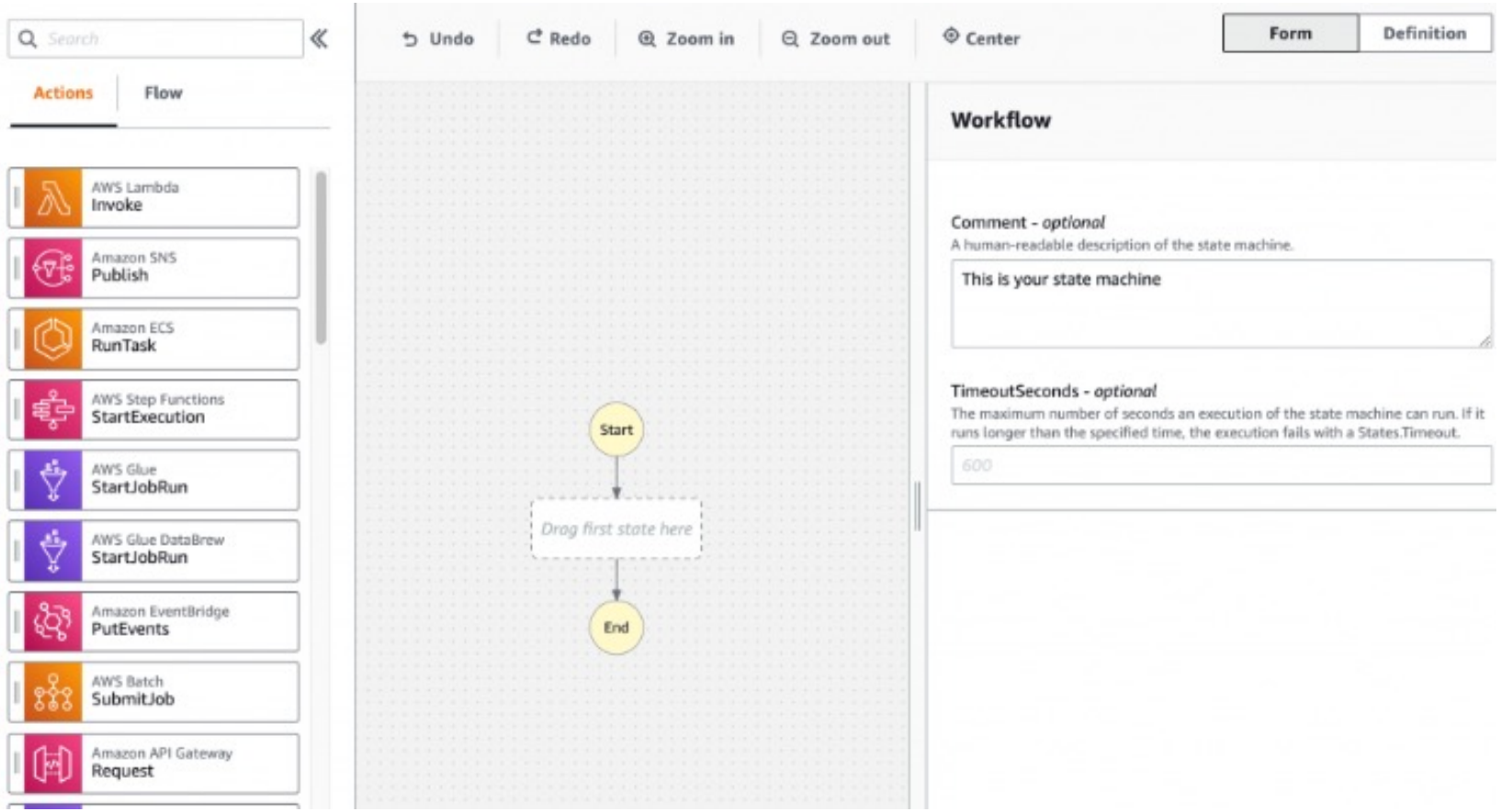
June 2021 Game Changer

SCHUBERG PHILIS

2021 June Workflow Studio

Drag & Drop

All parameters visible



https://aws.amazon.com/about-aws/whats-new/2021/07/announcing-workflow-studio-a-new-low-code-visual-workflow-designer-for-aws-step-functions/

2021 Sept > 200 AWS Services SDK Integrations

Call API directly and work with the response

Example: Dynamodb GetItem, S3 GetObject

```
"GetTranscriptionText": {
        "Type": "Task",
        "Resource": "arn:aws:states:::aws-sdk:s3:getObject",
        "Parameters": {
          "Bucket.$": "$.S3BucketName",
          "Key": "transcribe.json"
        },
        "ResultSelector": {
          "filecontent.$": "States.StringToJson($.Body)"
        },
        "ResultPath": "$.transcription",
        "Next": "PrepareTranscriptTest"
      },
```

arn:aws:states:::aws-sdk:serviceName:apiAction.[serviceIntegrationPattern]

https://aws.amazon.com/about-aws/whats-new/2021/09/aws-step-functions-200-aws-sdk-integration/

2022 Jan Local Mocking for Workflows

Create local mocking

Provide test cases for
All kinds of situations

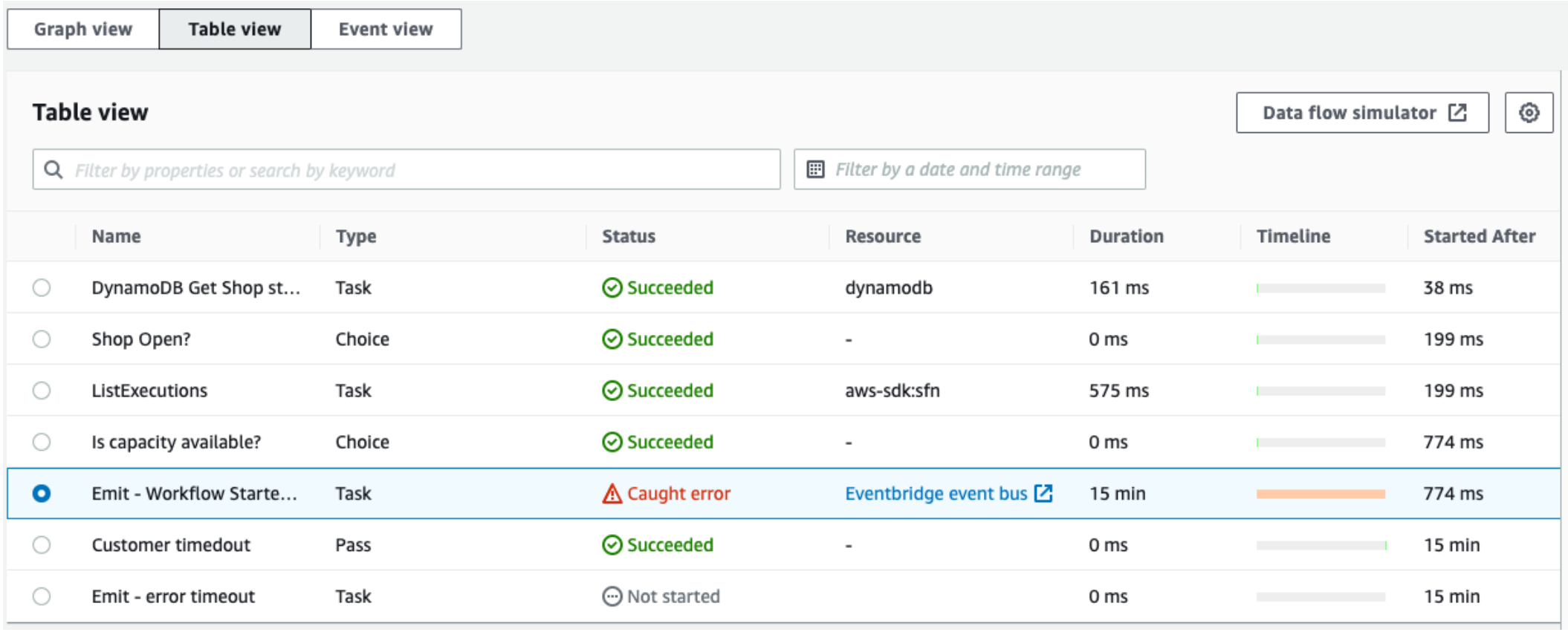
CI/CD

```
{
"StateMachines": {
  "LocalTesting": {
    "TestCases": {
      "HappyPathTest": {
        "Check Identity": "CheckIdentityLambdaMockedSuccess",
        "Check Address": "CheckAddressLambdaMockedSuccess",
        "DetectSentiment": "DetectSentimentPositive",
        "Add to FollowUp": "AddToFollowUpSuccess",
        "CustomerAddedToFollowup": "CustomerAddedToFollowupSuccess"
      },
      "NegativeSentimentTest": {
        "Check Identity": "CheckIdentityLambdaMockedSuccess",
        "Check Address": "CheckAddressLambdaMockedSuccess",
        "DetectSentiment": "DetectSentimentNegative",
        "NegativeSentimentDetected": "NegativeSentimentDetectedSuccess"
      },
```

https://aws.amazon.com/about-aws/whats-new/2022/01/aws-step-functions-support-workflows/

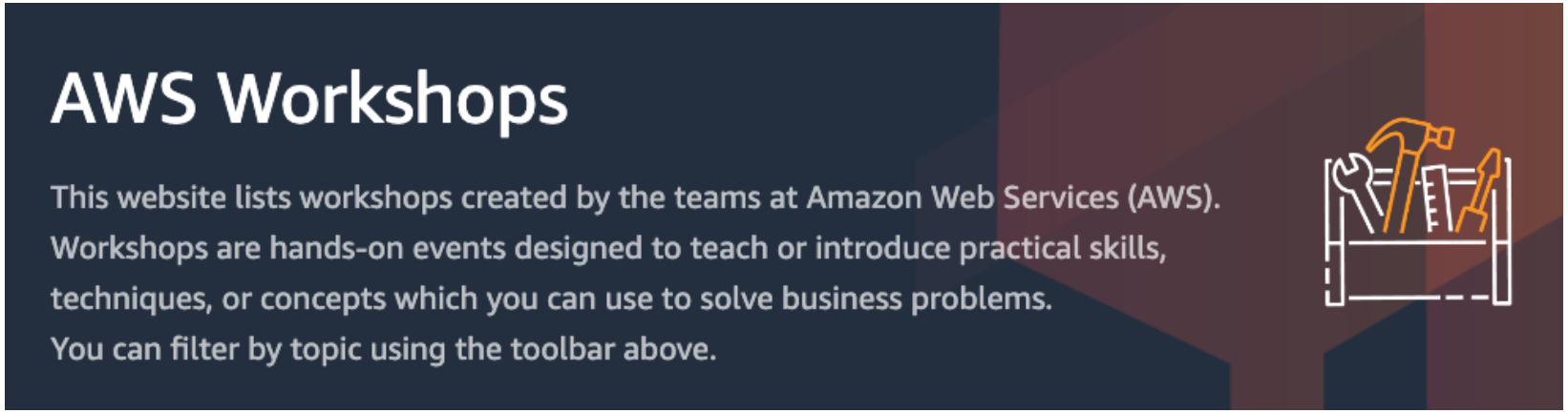
2022 May Observability Features

Advanced insights



https://aws.amazon.com/about-aws/whats-new/2022/05/announcing-new-workflow-observability-features-aws-step-functions/

2022 June Step Functions Workshop



- Module 1 - Hello World
- **Module 2 - Request Response**
- Module 3 - Run a Job (.sync)
- Module 4 - Wait for a Callback with the Task Token
- Module 5 - Choice State and Map State
- Module 6 - Input and Output Processing
- Module 7 - API Gateway, Parallel State, Express workflows
- Module 8 - Error Handling
- Module 9 - AWS SDK service integrations
- Module 10 - Deploy with AWS CDK
- Module 11 - Deploy with AWS SAM

https://aws.amazon.com/about-aws/whats-new/2022/06/aws-step-functions-interactive-workshop-building-deploying-application-workflows/

Aug 2022 14 new intrinsic functions

Support for
220 AWS Services
10.000 API actions
18 intrinsic functions

Array
Json
Math
Strings
UUID
Template

```
States.Format('Hello, my name is {}.', $.name)
```

https://aws.amazon.com/about-aws/whats-new/2022/08/aws-step-functions-14-new-intrinsic-features-process-data-workflows/

Sep 2022 AWS Controllers for Kubernets (ACK)

Deploy AWS Resources from K8S with kubectl/helm

RDS,Lambda, managed Prometheus, KMS
S3, Sagemaker, Dynamodb, ECR, Api Gateway

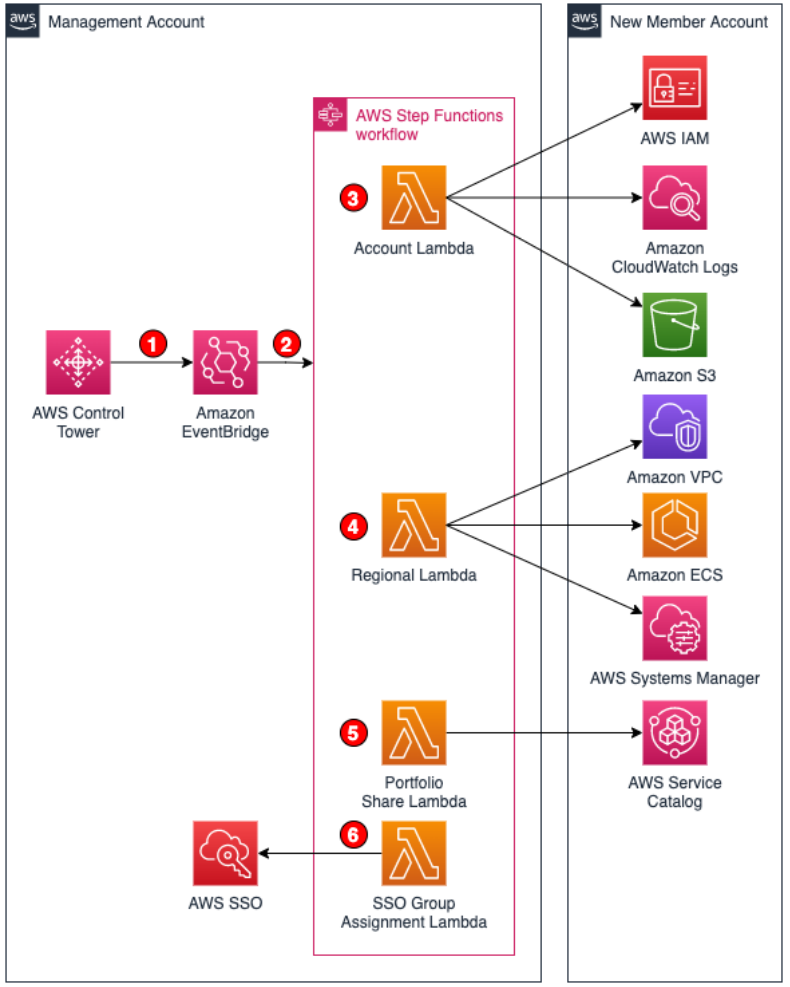
```yaml
apiVersion: sfn.services.k8s.aws/v1alpha1
kind: StateMachine
metadata:
  name: $STATE_MACHINE_NAME
spec:
  name: $STATE_MACHINE_NAME
  roleARN: $SFN_EXECUTION_ROLE_ARN
  definition: "{ \"StartAt\": \"HelloWorld\", \"States\": { \"HelloWorld\": { \"Type\": \"Pass\", \"Result\": \"Hello World!\", \"End\": true }}}"
  tags:
  - key: k1
    value: v1
  - key: k2
    value: v2
  - key: k3
    value: v3
```

https://aws.amazon.com/about-aws/whats-new/2022/09/aws-controllers-kubernetes-ack-rds-lambda-step-functions-prometheus-kms/

MARCH
DAY
APRIL
DNESDAY
TUESDAY
16
AUGUST
SUNDAY
DECEMBER
TUESDAY
MONDAY
FRIDAY

Example: Account Setup

Run a set of actions
After account creation Event is received



https://github.com/aws-samples/aws-control-tower-account-setup-using-step-functions

Functionless

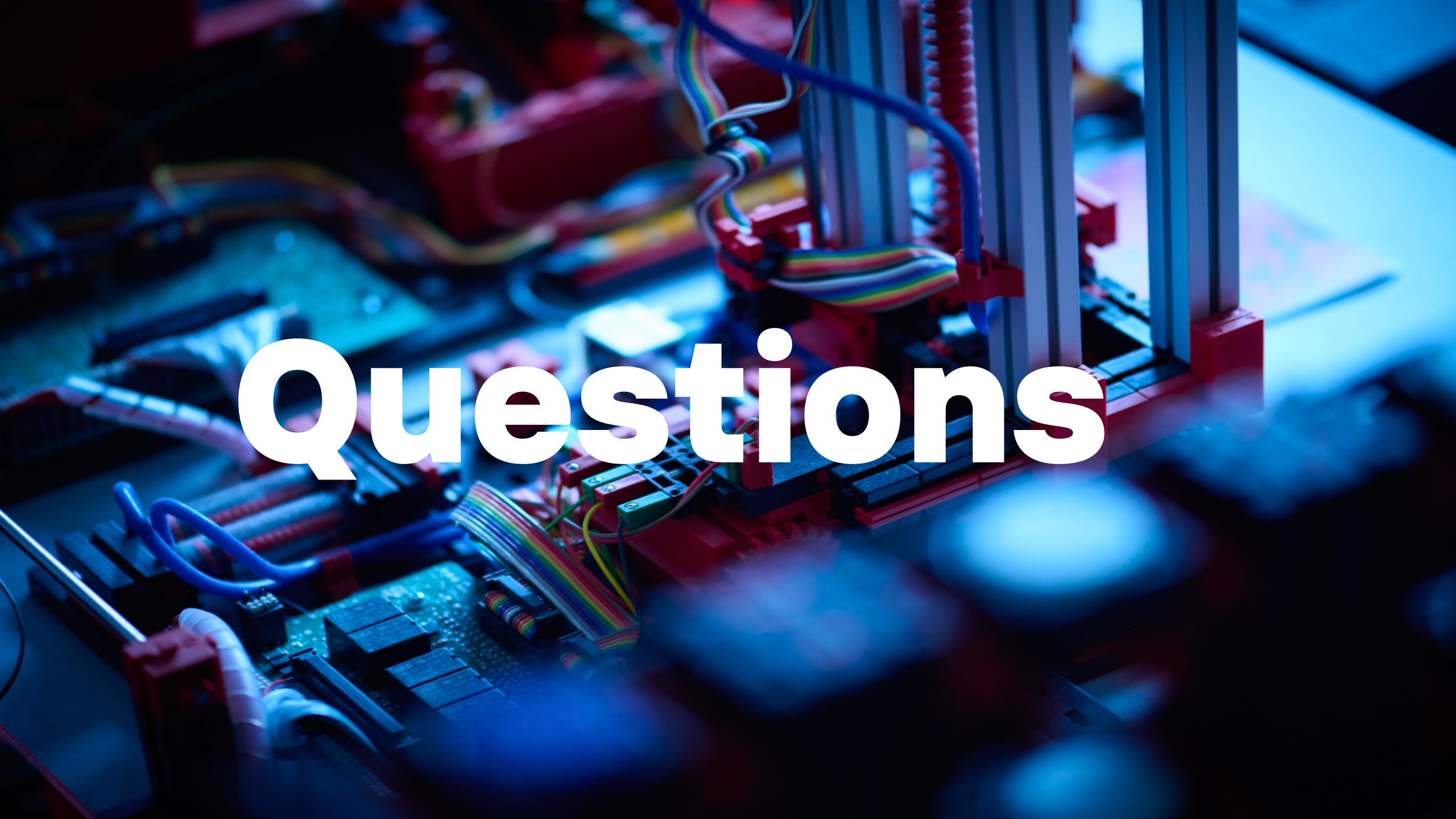
CDK Extension to infer domain specific Languages
Amazon State Language, Velocity Templates, Event Bridge Patterns

```
// Step Function workflow that validates the contents of a Post and deletes it if bad
const validatePostWorkflow = new StepFunction(
  this,
  "ValidatePostWorkflow",
  async (post: Post) => {
    const validationResult = await validatePost(post);
    if (validationResult.status === "Not Cool") {
      await $AWS.DynamoDB.DeleteItem({
        Table: postTable,
        Key: {
          postId: {
            S: post.postId,
          },
        },
      });
    }
  }
);
```

https://functionless.org/

Resume

Conclusions


Questions