

Going Serverless



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Serverless?

A photograph of Steve Carell as Michael Scott from the TV show "The Office". He is wearing a red pinstripe suit, a white shirt, and a striped tie. He is standing behind a microphone, gesturing with his hands as if he is speaking or performing. The background is dark and out of focus.

Serverless



framework for building
web, mobile and IoT applications on
AWS Lambda, API Gateway, and related services



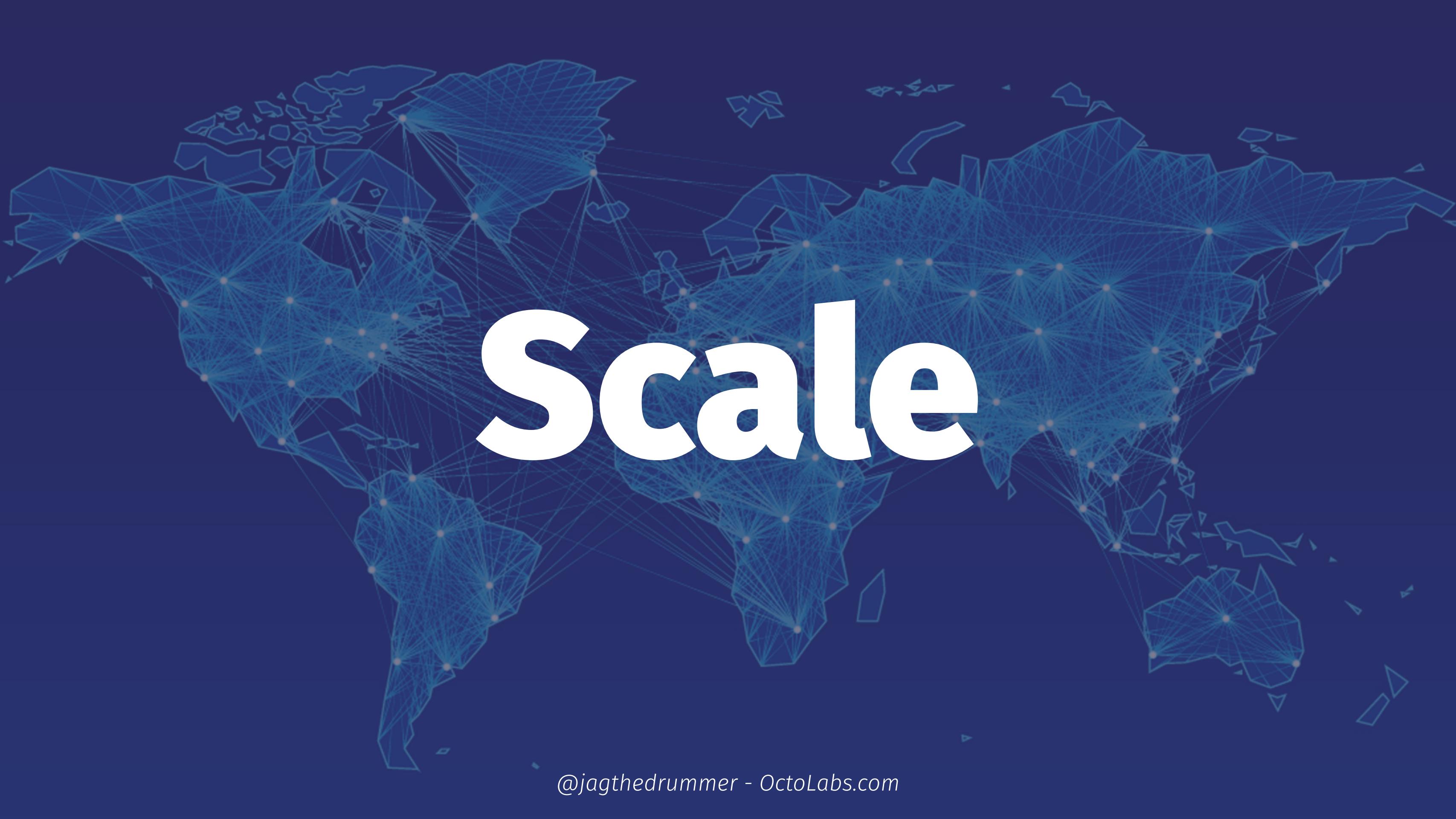
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Vendor Lock-in 😟

A photograph of two hands, belonging to different people, joined together by a pair of silver handcuffs. The hands are positioned with the palms facing each other. The background is a clear blue sky with some wispy white clouds. The overall composition suggests a sense of confinement or dependency.



OPS



Scale



Money

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The Plan

- Understand the Pieces
- Serverless

Jeremy Green

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IndependentConsultingManual.com

Remarq.io

CloudHdr.com

Things I Enjoy:
Dopamine, Serotonin

Other Interests:
Drumming, Photography, and Brewing

The Pieces

Lambda

API Gateway

DynamoDB

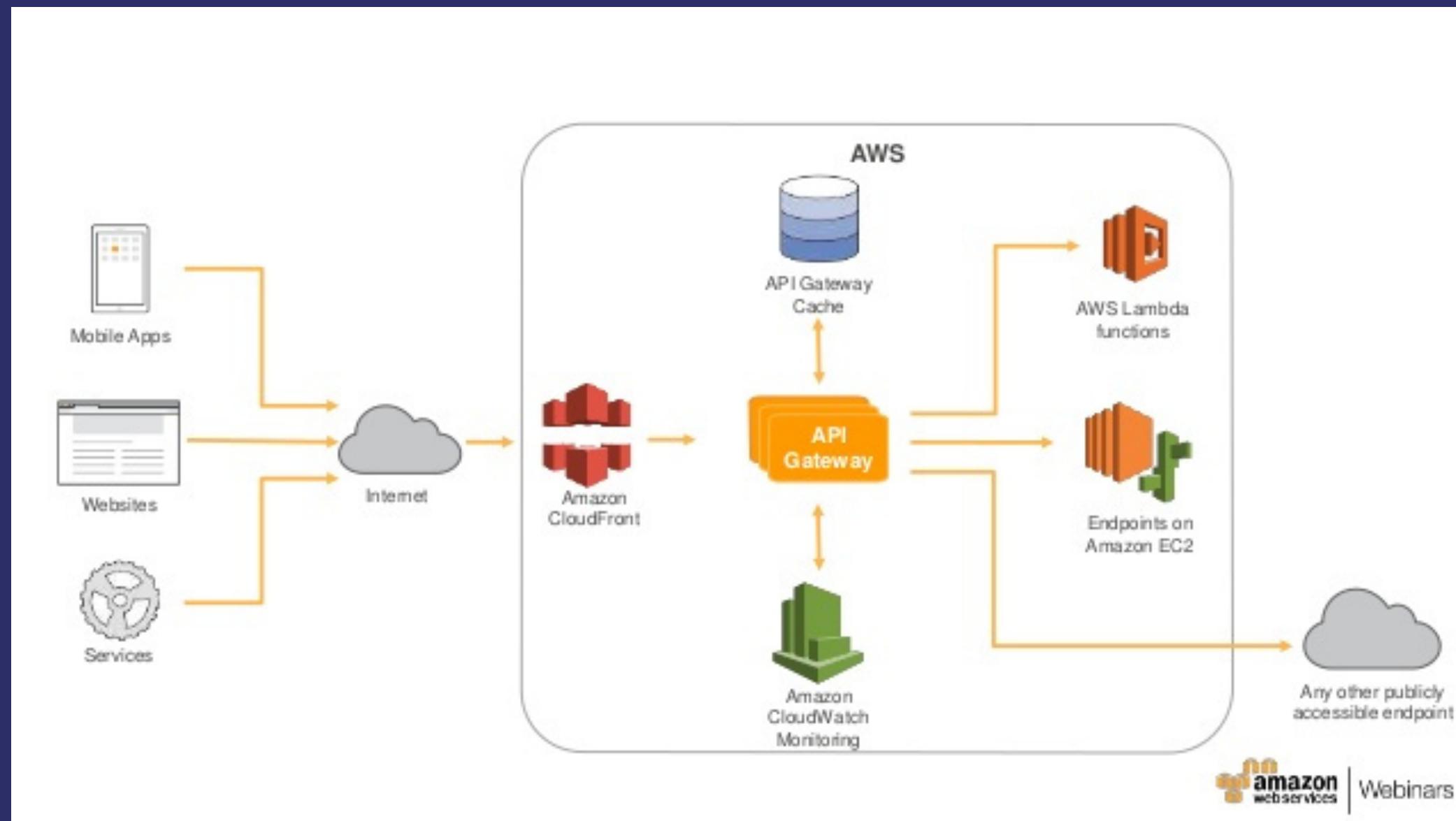
RDS

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CloudFormation

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Putting it all together



Lambda

Supported Runtimes

Node
JAVA
Python

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https://console.aws.amazon.com/lambda/home?region=us-east-1#/functions

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Lambda > Functions ?

You have 16 Lambda function(s) using 59.1 MB of code storage. Choose any Lambda function to view details on invocation requests, duration, and errors (metrics may take up to 60 seconds to appear).

Create a Lambda function Actions

Filter Viewing 1-12 of 16

	Function name	Description	Code size	Memory (MB)	Timeout (s)
○	serverlessDynamoCrudExample-u...	Serverless Lambda function for project: serverlessD...	665.9 kB	1024	6
○	serverlessDynamoCrudExample-c...	Serverless Lambda function for project: serverlessD...	665.9 kB	1024	6
○	serverlessDynamoCrudExample-c...	Serverless Lambda function for project: serverlessD...	665.9 kB	1024	6
○	serverlessDynamoCrudExample-d...	Serverless Lambda function for project: serverlessD...	665.9 kB	1024	6
○	serverlessDynamoCrudExample-in...	Serverless Lambda function for project: serverlessD...	665.9 kB	1024	6
○	serverlessDynamoCrudExample-s...	Serverless Lambda function for project: serverlessD...	665.9 kB	1024	6
○	serverlessTest2-createeasy	Serverless Lambda function for project: serverlessT...	805.7 kB	1024	6
○	serverlessTest2-indexeasy	Serverless Lambda function for project: serverlessT...	805.7 kB	1024	6
○	serverlessTest2-index	Serverless Lambda function for project: serverlessT...	805.7 kB	1024	6
○	serverlessTest2-hellopost	Serverless Lambda function for project: serverlessT...	805.7 kB	1024	6
○	serverlessTest2-hello	Serverless Lambda function for project: serverlessT...	805.7 kB	1024	6
○	serverlessTest2-deletetable	Serverless Lambda function for project: serverlessT...	805.7 kB	1024	6

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Deckset for Mac: Turn your ... aws dynamodb - Google S... Google Image Result for ht... Google Image Result for ht... Lambda Management Con... Backstory Jeremy Green

https://console.aws.amazon.com/lambda/home?region=us-east-1#/create?step=1

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Lambda > New function

Step 1: Select blueprint

Select blueprint

Blueprints are sample configurations of event sources and Lambda functions. Choose a blueprint that best aligns with your desired scenario and customize as needed, or skip this step if you want to author a Lambda function and configure an event source separately. Except where otherwise noted, blueprints are licensed under CC0.

Filter All languages Viewing 1-9 of 42

s3-get-object-python An Amazon S3 trigger that retrieves metadata for the object that has been updated. python2.7 · s3	config-rule-change-triggered An AWS Config rule that is triggered by configuration changes to EC2 instances. Checks instance types. nodejs · config	dynamodb-process-stream An Amazon DynamoDB trigger that logs the updates made to a table. nodejs · dynamodb
microservice-http-endpoint A simple backend (read/write to DynamoDB) with a RESTful API endpoint using Amazon API Gateway. nodejs · api-gateway	node-exec Demonstrates running an external process using the Node.js child_process module. nodejs	slack-echo-command-python A function that handles a Slack slash command and echoes the details back to the user. python2.7 · api-gateway · slack
simple-mobile-backend A simple mobile backend (read/write to DynamoDB). nodejs · mobile	kinesis-process-record-python An Amazon Kinesis stream processor that logs the data being published. python2.7 · kinesis	splunk-kinesis-logging Demonstrates logging events streamed from AWS Kinesis to Splunk's HTTP Event Collector. nodejs · splunk · kinesis

Deckset for Mac: Turn your x Google Image Result for ht Google Image Result for ht Lambda Management Con Backstory Jeremy Green

https://console.aws.amazon.com/lambda/home?region=us-east-1#/create?step=1

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Lambda > New function

Step 1: Select blueprint

Select blueprint ?

Blueprints are sample configurations of event sources and Lambda functions. Choose a blueprint that best aligns with your desired scenario and customize as needed, or skip this step if you want to author a Lambda function and configure an event source separately. Except where otherwise noted, blueprints are licensed under CC0.

hello All languages Viewing 1-2 of 2

hello-world A starter AWS Lambda function. nodejs

hello-world-python A starter AWS Lambda function. python2.7

Cancel Skip

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https://console.aws.amazon.com/lambda/home?region=us-east-1#/create?bp=hello-world&step=2

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Lambda > New function using blueprint hello-world

Step 1: Select blueprint

Step 2: Configure function

Step 3: Review

Configure function

A Lambda function consists of the custom code you want to execute. [Learn more](#) about Lambda functions.

Name* myFunctionName

Description A starter AWS Lambda function.

Runtime* Node.js 4.3

Lambda function code

Provide the code for your function. Use the editor if your code does not require custom libraries (other than the aws-sdk). If you need custom libraries, you can upload your code and libraries as a .ZIP file. [Learn more](#) about deploying Lambda functions.

Code entry type Edit code inline Upload a .ZIP file Upload a file from Amazon S3

```
1 'use strict';
2 console.log('Loading function');
3
4 exports.handler = (event, context, callback) => {
5     //console.log('Received event:', JSON.stringify(event, null, 2));
6     console.log('value1 =', event.key1);
7     console.log('value2 =', event.key2);
8     console.log('value3 =', event.key3);
9     callback(null, event.key1); // Echo back the first key value
10    // callback('Something went wrong');
11};
```

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https://console.aws.amazon.com/lambda/home?region=us-east-1#/create?bp=hello-world&step=2

Lambda function handler and role

Handler* index.handler

Role*

Ensure that popups are enabled to create a new role. Suggested role: Basic execution role

Advanced settings

These settings allow you to control the code execution performance and costs for your Lambda function. Changing your resource settings (by selecting memory) or changing the timeout may impact your function cost. [Learn more](#) about how Lambda pricing works.

Memory (MB)* 128

Timeout* 0 min 3 sec

All AWS Lambda functions run securely inside a default system-managed VPC. However, you can optionally configure Lambda to access resources, such as databases, within your custom VPC. [Learn more](#) about accessing VPCs within Lambda. **Please ensure your role has appropriate permissions to configure VPC. Select "Basic with VPC" in the role dropdown above to add these permissions.**

VPC No VPC

* These fields are required.

Cancel Previous Next

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https://console.aws.amazon.com/lambda/home?region=us-east-1#/functions/HelloWorld?tab=endpoints

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Lambda > Functions > HelloWorld ARN - arn:aws:lambda:us-east-1:852612687751:function:HelloWorld

Add API endpoint

Please go to the [IAM console](#) to configure the security for your API endpoint.

Configure your Lambda function to be invoked on requests made to an API endpoint.

API endpoint type: API Gateway

API name: LambdaMicroservice

Resource name: /HelloWorld

Method: GET

Deployment stage: prod

Security: AWS IAM

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https://console.aws.amazon.com/lambda/home?region=us-east-1#/functions/HelloWorld?tab=eventSources

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Lambda > Functions > HelloWorld ARN - arn:aws:lambda:us-east-1:852612687751:function:HelloWorld

Add event source

Configure your Lambda function to respond to events from the event sources listed below. You may also call your Lambda function directly using the AWS mobile SDK for [Android](#) and [iOS](#).

+ Add event source

Event source type

- AWS IoT
- Alexa Skills Kit
- Alexa Smart Home
- CloudWatch Events - Schedule
- CloudWatch Logs
- Cognito Sync Trigger
- DynamoDB

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https://console.aws.amazon.com/lambda/home?region=us-east-1#/functions/HelloWorld?tab=monitoring

AWS Lambda Functions Input test event

It looks like you have not configured a test event for this function yet. Use the editor below to enter an event to test your function with (please remember that this will actually execute the code!). You can always edit the event later by choosing **Configure test event** in the Actions list. Note that changes to the event will only be saved locally.

Sample event template Hello World

```
1 {  
2   "key3": "value3",  
3   "key2": "value2",  
4   "key1": "value1"  
5 }
```

CloudWatch metrics

Invocations

0 21:00 5:00 00 13:00

Other monitoring

Feedback

Cancel Save Save and test Policy Terms of Use

virginia Support 7751:function:HelloWorld

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https://console.aws.amazon.com/lambda/home?region=us-east-1#/functions/HelloWorld?tab=monitoring

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Lambda > Functions > HelloWorld ARN - arn:aws:lambda:us-east-1:852612687751:function:HelloWorld

Test Actions ▾

Code Configuration Event sources API endpoints Monitoring ?

CloudWatch metrics at a glance (last 24 hours) View logs in CloudWatch

Invocations

Duration

Errors

Throttles

Other monitoring information

Last modified date 2016-04-13T01:22:52.066+0000

Execution result: succeeded ([logs](#))

The area below shows the result returned by your function execution using the context methods. [Learn more](#) about returning results from your function.

<https://console.aws.amazon.com/cloudwatch/home#metrics:graph=!D04!E05!ET7!MN6!NS2!PD1!SS3!ST0!VA-PT1D~300~AWS%252FLambda~Average~FunctionName~HelloWorld~Duration~P0DDuration>

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https://console.aws.amazon.com/lambda/home?region=us-east-1#/functions>HelloWorld?tab=monitoring

Other monitoring information

Last modified date 2016-04-13T01:22:52.066+0000

Execution result: succeeded ([logs](#))

The area below shows the result returned by your function execution using the context methods. [Learn more](#) about returning results from your function.

```
"value1"
```

Summary

Code SHA-256 k9vpIFwWkoOXD5Melm7p9XSudlZp
RhUV8mluux1gDog=

Request ID 9630b9ac-0117-11e6-907c-392cdc9c3d86

Duration 15.63 ms

Billed duration 100 ms

Resources 128 MB configured

Max memory 36 MB used

Log output

The area below shows the logging calls in your code. These correspond to a single row within the CloudWatch log group corresponding to this Lambda function. [Click here](#) to view the CloudWatch log group.

```
START RequestId: 9630b9ac-0117-11e6-907c-392cdc9c3d86 Version: $LATEST
2016-04-13T01:32:30.683Z 9630b9ac-0117-11e6-907c-392cdc9c3d86 value1 = value1
2016-04-13T01:32:30.684Z 9630b9ac-0117-11e6-907c-392cdc9c3d86 value2 = value2
2016-04-13T01:32:30.696Z 9630b9ac-0117-11e6-907c-392cdc9c3d86 value3 = value3
END RequestId: 9630b9ac-0117-11e6-907c-392cdc9c3d86
REPORT RequestId: 9630b9ac-0117-11e6-907c-392cdc9c3d86 Duration: 15.63 ms Billed Duration: 100 ms
```

Anatomy of a Lambda Function

```
'use strict';
module.exports.handler = (event, context, callback) => {
    console.log('value1 =', event.key1);
    console.log('value2 =', event.key2);
    callback(null, event.key1); // Echo back the first key value
    // callback('Something went wrong');
};
```

event

used to pass data to the function

```
{  
  key1: 'value1',  
  key2: 'value2',  
  key3: 'value3'  
}
```

context

provides runtime information

```
{  
  getRemainingTimeInMillis: function(){},  
  functionName: 'handler',  
  functionVersion: 'xyz',  
  awsRequestId: '12345',  
  logGroupName: 'abcde',  
  identity: {...},  
  clientContext: {...}  
}
```

callback

used to return data or an error

```
// signature  
callback(error,data);  
// call with error  
callback("some error message");  
//or call with data  
callback(null, someData);
```

Lambda Lifecycle



1. You upload your code
2. Amazon doesn't do anything

Lambda Cold Start ❄️

1. AWS Receives Execution Request
2. Container is provisioned
3. Container is loaded with your code
4. Your code begins execution
5. Your code returns a result

Time Passes



(But not too much)

Lambda Container Reuse

1. AWS Receives Execution Request
2. Your code begins execution
3. Your code returns a result

Lambda Pricing 💰

Charged by:

- # of requests
- length of execution

Lambda Request Pricing

First 1 million requests per month are free

\$0.20 per 1 million requests thereafter
(\$0.0000002 per request)

Lambda Execution Pricing

First 400,000 GB-seconds per month are free
\$0.00001667 for per GB-second thereafter

GB-second

=

LambdaMemoryInGigabytes * ExecutionTime

1GB * 1sec = 1 GB-sec

0.5GB * 2sec = 1 GB-sec

0.1GB * 0.5sec * 20executions = 1 GB-sec

Lambda Pricing Example

3 million executions per month

512MB of memory

1 second execution time

\$18.74 per month

Lambda Pricing Example

3 million executions per month

512MB of memory

0.5 second execution time

\$6.24 per month

Lambda Pricing Example

3 million executions per month

512MB of memory

0.2 second execution time

\$0.40 per month

API Gateway

Installing Serverless serverless Pricing API Gateway Jeremy Green ▲

https://console.aws.amazon.com/apigateway/home?region=us-east-1#/apis

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Amazon API Gateway APIs Show all hints ?

APIs

Create API

serverless.testsuite.octolabs.c...	serverless.testsuite.octolabs.com A REST API for a Serverless project.	s-test-prj A REST API for a Serverless project.
s-test-prj		
serverlessDynamoCrudExample	serverlessDynamoCrudExample A REST API for a Serverless project.	justatest <i>just doinking around</i>
justatest		
ThingyLambdaMicroservice	ThingyLambdaMicroservice <i>Created by AWS Lambda</i>	serverlessTest2 A REST API for a Serverless project.
serverlessTest2		
serverlessTest		
API Keys		
Custom Domain Names		
Client Certificates		
Settings		

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https://console.aws.amazon.com/apigateway/home?region=us-east-1#/apis/create

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Amazon API Gateway APIs > Create Show all hints ?

APIs

serverless.testsuite.octolabs.c...
s-test-prj
serverlessDynamoCrudExample
justatest
ThingyLambdaMicroservice
serverlessTest2
serverlessTest

Create new API

In Amazon API Gateway, an API refers to a collection of resources and methods that can be invoked through HTTPS endpoints.

New API Clone from existing API Import from Swagger Example API

Name and description

Choose a friendly name and description for your API.

API name*

Description

* Required **Create API**

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https://console.aws.amazon.com/apigateway/home?region=us-east-1#/apis/create

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Amazon API Gateway APIs > Create Show all hints ?

APIs

- serverless.testsuite.octolabs.c...
- s-test-prj
- serverlessDynamoCrudExample
- justatest
- ThingyLambdaMicroservice
- serverlessTest2
- serverlessTest

Create new API

In Amazon API Gateway, an API refers to a collection of resources and methods that can be invoked through HTTPS endpoints.

New API Clone from existing API Import from Swagger Example API

Example API

Learn about the service by importing an example API and turning on hints throughout the console.

```
1 {  
2   "swagger": "2.0",  
3   "info": {  
4     "title": "PetStore",  
5     "description": "Your first API with Amazon API Gateway. This is a sample API that integra  
6   },  
7   "schemes": [  
8     "https"  
9   ],  
10  "paths": {  
11    "/": {  
12      "get": {  
13        "consumes": [  
14          "application/json"  
15        ],  
16        "produces": [  
17          "text/html"  
18        ],  
19        "responses": {  
20          "200": {  
21            "description": "A Pet object that was successfully retrieved"  
22          }  
23        }  
24      }  
25    }  
26  }  
27}  
28}
```

Import

Installing Serverless x serverless x Pricing x API Gateway x Jeremy Green ▲

https://console.aws.amazon.com/apigateway/home?region=us-east-1#/apis/bwe2qj71ei/resources/oju234k8ld

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Amazon API Gateway APIs > PetStore (bwe2qj71ei) > Resources > / (oju234k8ld) Show all hints ?

APIs

- Useless Test API
- serverless.testsuite.octolabs.c...
- s-test-prj
- serverlessDynamoCrudExample
- justatest
- ThingyLambdaMicroservice
- serverlessTest2
- serverlessTest
- PetStore
 - Resources**
 - Stages
 - Custom Authorizers
 - Models
- API Keys
- Custom Domain Names
- Client Certificates

Actions ▾

Resources / Methods

- POST
- GET
- OPTIONS

- /pets
 - POST
 - GET
 - OPTIONS
- {petId}
 - GET
 - OPTIONS

POST

http://petstore-demo-endpoint.execute-api.com...

Authorization None

API Key Not Required

GET

Mock Endpoint

Authorization None

API Key Not Required

OPTIONS

Mock Endpoint

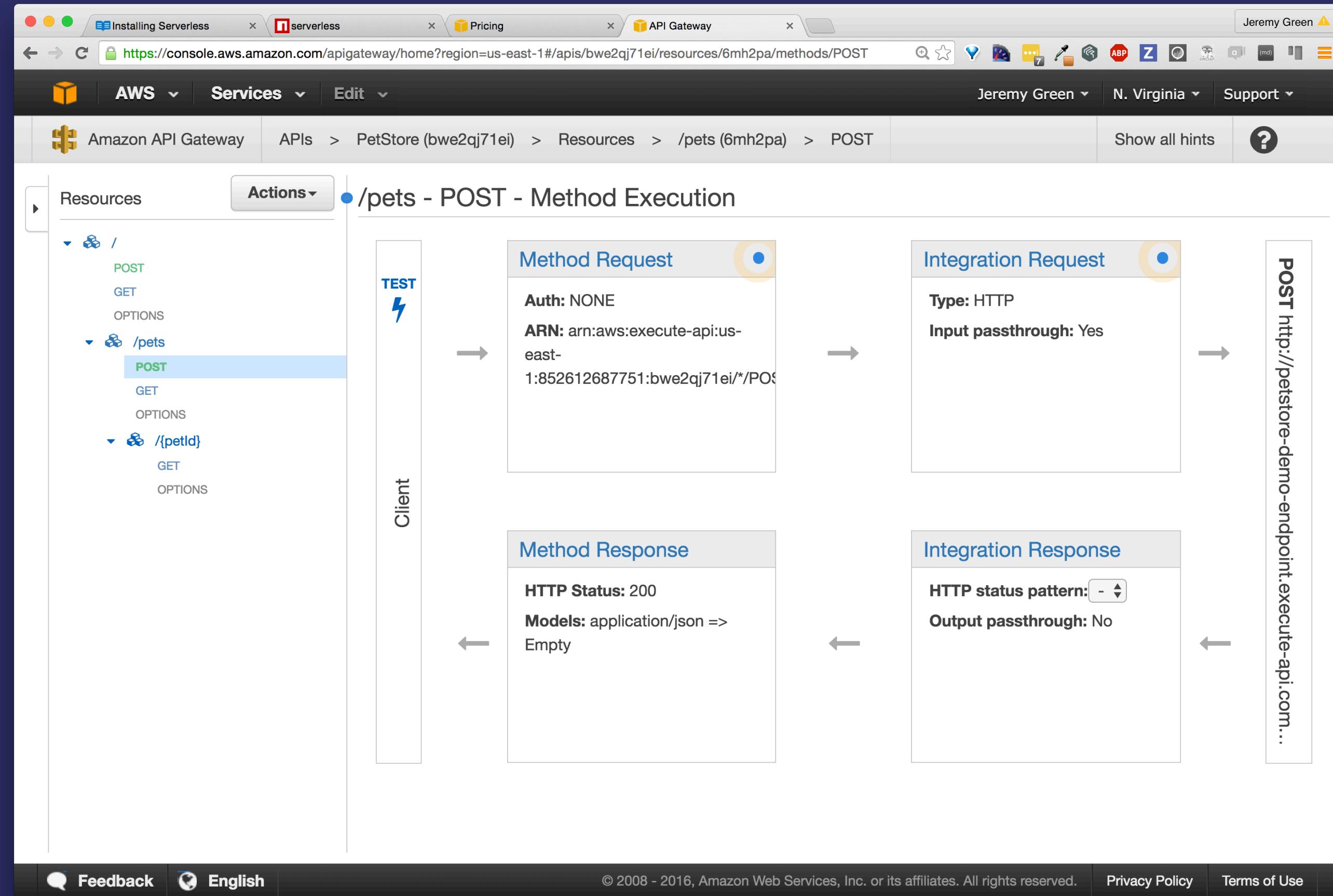
Authorization None

API Key Not Required

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CloudFormation

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Backstory × serverless × Pricing × Create A New S × AWS CloudForm × Application Fra × CloudFormation × AWS CloudForm × Product Details × Jeremy Green ▲

https://console.aws.amazon.com/cloudformation/home?region=us-west-2#stacks?filter=active

AWS Services Edit Jeremy Green Oregon Support

Create Stack Actions Design template C ⚙️

Filter: Active By Name: Showing 0 stacks

Design a template

Templates tell AWS CloudFormation which AWS resources to provision and how to provision them. When you create a CloudFormation stack, you must submit a template.

To build and view templates, you can use the drag-and-drop tool called AWS CloudFormation Designer. You drag-and-drop the resources that you want to add to your template and drag lines between resources to create connections.

To use Designer to create a template or to open and modify a template, choose **Design template**.

Design template

Create a Stack

AWS CloudFormation allows you to quickly and easily deploy your infrastructure resources and applications on AWS. You can use one of the templates we provide to get started quickly with applications like WordPress or Drupal, one of the many sample templates or create your own template.

You do not currently have any stacks. Click the **Create New Stack** button below to create a new AWS CloudFormation Stack.

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Screenshot of the AWS CloudFormation Designer interface showing a template diagram and its JSON code.

Resource types:

- AutoScaling
 - AutoScalingGroup
 - LaunchConfiguration
 - LifecycleHook
 - ScalingPolicy
 - ScheduledAction
- CloudFormation
- CloudFront
- CloudTrail

Diagram: File: 'template1'

Template Editor:

Parameters:

```
template1
1 {
  "Parameters": {
```

Conditions:

Metadata:

Outputs:

Errors:

Components:

Template:

```
1 {
  "Parameters": {
```

Feedback:

English:

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```
{  
  "AWSTemplateFormatVersion": "2010-09-09",  
  "Description": "Simple Rails & local Mysql stack",  
  "Parameters": {  
    "KeyName": {  
      "Description": "Name of an existing EC2 KeyPair to enable SSH access to the instances",  
      "Type": "AWS::EC2::KeyPair::KeyName",  
      "ConstraintDescription": "must be the name of an existing EC2 KeyPair."  
    },  
    "DBName": { ... },  
    "DBUser": { ... },  
    "DBPassword": { ... },  
    "DBRootPassword": { ... },  
    "InstanceType": { ... },  
    "SSHLocation": { ... }  
  },  
  "Resources": {  
    "WebServer": { ... },  
    "WebServerSecurityGroup": { ... }  
  },  
  "Outputs": {  
    "WebsiteURL": { ... }  
  },  
  ...  
}
```

Serverless

serverless.com

Manage Lambda, API Gateway and CloudFormation
via code instead of via GUI.

First step

- **Create a new AWS account!**
- **Srsly!**

```
$ npm install -g serverless
```

```
$ sls project create
```



The Serverless Application Framework

serverless.com, v0.5.5

```
Serverless: Initializing Serverless Project...
Serverless: Enter a name for this project: (serverless-bkqhpg) going-serverless-demo
Serverless: Enter a new stage name for this project: (dev)
Serverless: For the "dev" stage, do you want to use an existing Amazon Web Services
           profile or create a new one?
> Existing Profile
    Create A New Profile
Serverless: Select a profile for your project:
> lambdatest
Serverless: Creating stage "dev"...
Serverless: Select a new region for your stage:
> us-east-1
  us-west-2
  eu-west-1
  eu-central-1
  ap-northeast-1
Serverless: Creating region "us-east-1" in stage "dev"...
Serverless: Deploying resources to stage "dev" in region "us-east-1" via Cloudformation
           (~3 minutes)...
Serverless: /
```

```
Serverless: Successfully deployed "dev" resources to "us-east-1"
Serverless: Successfully created region "us-east-1" within stage "dev"
Serverless: Successfully created stage "dev"
Serverless: Successfully initialized project "going-serverless-demo"
```

```
$ cd going-serverless-demo
```

```
$ tree
```

```
•
├── admin.env # AWS Profiles - gitignored
├── package.json # npm package file
├── s-project.json # project and author data
└── s-resources-cf.json # CloudFormation template
    └── meta # meta data for stage/regions config and variables - gitignored
        ├── resources
        │   └── s-resources-cf-dev-useast1.json
        └── variables
            ├── s-variables-common.json
            ├── s-variables-dev-useast1.json
            └── s-variables-dev.json
```

3 directories, 8 files

```
$ sls function create
Serverless: Enter a new function name to be created in the CWD: hello-world
Serverless: Please, select a runtime for this new Function
> nodejs4.3
python2.7
nodejs (v0.10, soon to be deprecated)
Serverless: For this new Function, would you like to create an Endpoint, Event, or just the Function?
> Create Endpoint
Create Event
Just the Function...
Serverless: Successfully created function: "hello-world"
```

```
$ tree hello-world/  
hello-world/  
└── event.json # sample event for testing function locally  
└── handler.js # function handler  
└── s-function.json # data for your lambda function, endpoints and event sources  
  
0 directories, 3 files
```

hello-world/handler.js

```
'use strict';

module.exports.handler = function(event, context, cb) {
  return cb(null, {
    message: 'Go Serverless! Your Lambda function executed successfully!'
  });
};
```

hello-world/s-function.json

```
{  
  "name": "hello-world",  
  "runtime": "nodejs4.3",  
  "description": "Serverless Lambda function for project: going-serverless-demo",  
  "customName": false,  
  "customRole": false,  
  "handler": "handler.handler",  
  "timeout": 6,  
  "memorySize": 1024,  
  "authorizer": {},  
  "custom": {  
    "excludePatterns": []  
  },  
  "endpoints": [...],  
  "events": [],  
  "environment": {  
    "SERVERLESS_PROJECT": "${project}",  
    "SERVERLESS_STAGE": "${stage}",  
    "SERVERLESS_REGION": "${region}"  
  },  
  "vpc": {  
    "securityGroupIds": [],  
    "subnetIds": []  
  }  
}
```

hello-world/s-function.json

```
{  
  "endpoints": [  
    {  
      "path": "hello-world",  
      "method": "GET",  
      "type": "AWS",  
      "authorizationType": "none",  
      "authorizerFunction": false,  
      "apiKeyRequired": false,  
      "requestParameters": {},  
      "requestTemplates": { ... },  
      "responses": {  
        "400": { "statusCode": "400" },  
        "default": {  
          "statusCode": "200",  
          "responseParameters": {},  
          "responseModels": { ... },  
          "responseTemplates": { ... }  
        }  
      }  
    }  
  ]  
}
```

```
$ sls dash deploy
```



Use the <up>, <down>, <pageup>, <pagedown>, <home>, and <end> keys to navigate.
Press <enter> to select/deselect, or <space> to select/deselect and move down.
Press <ctrl> + a to select all, and <ctrl> + d to deselect all.
Press <ctrl> + f to select all functions, and <ctrl> + e to select all endpoints.
Press <ctrl> + <enter> to immediately deploy selected.
Press <escape> to cancel.

Serverless: Select the assets you wish to deploy:

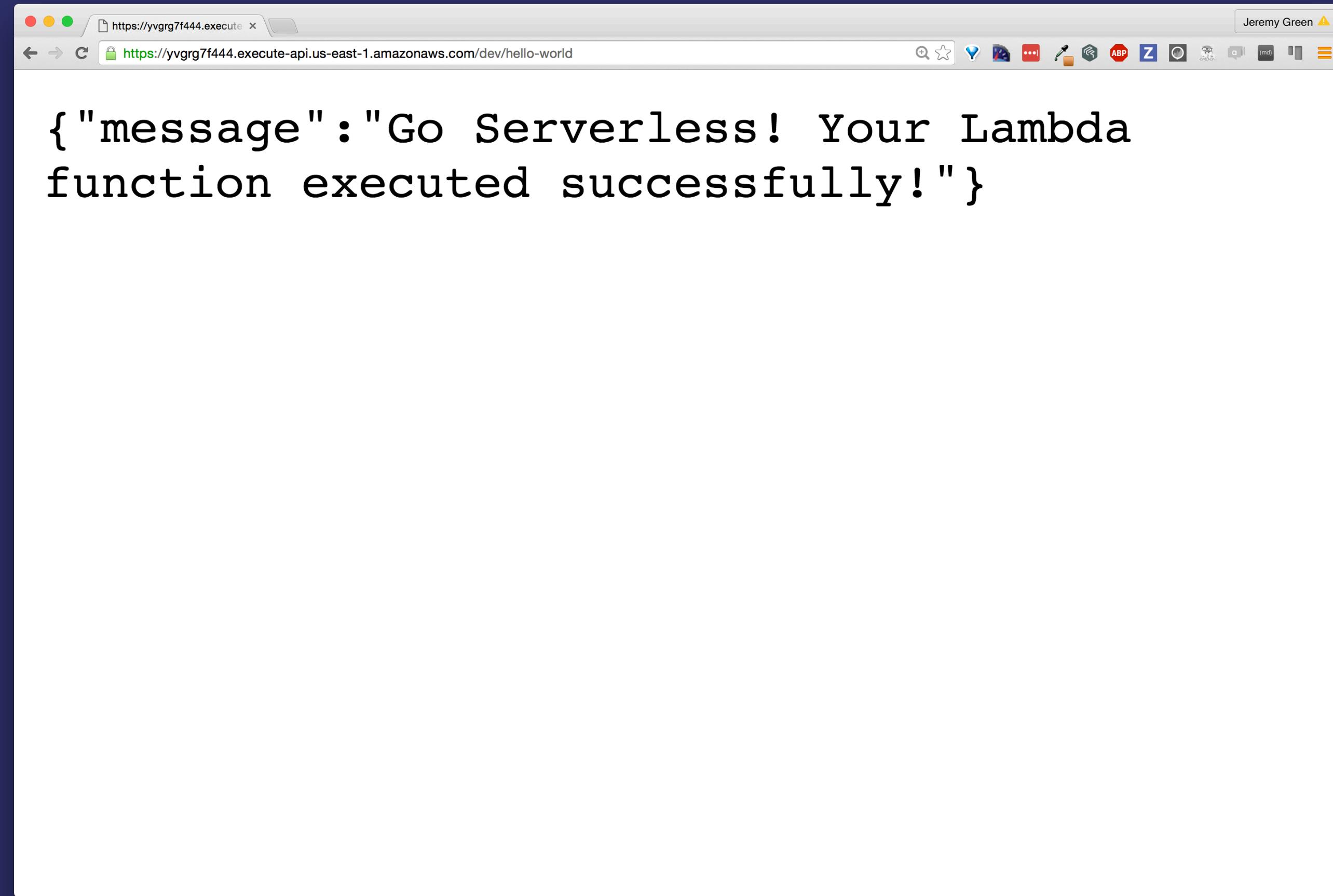
```
hello-world
*   function - hello-world
*   endpoint - hello-world - GET
```

> Deploy

Cancel

```
Serverless: Deploying the specified functions in "dev" to the following regions: us-east-1
Serverless: -----
Serverless: Successfully deployed the following functions in "dev" to the following regions:
Serverless: us-east-1 -----
Serverless:   hello-world (going-serverless-demo-hello-world):
  arn:aws:lambda:us-east-1:852612687751:function:going-serverless-demo-hello-world:dev

Serverless: Deploying endpoints in "dev" to the following regions: us-east-1
Serverless: Successfully deployed endpoints in "dev" to the following regions:
Serverless: us-east-1 -----
Serverless:   GET - hello-world -
  https://yvgrg7f444.execute-api.us-east-1.amazonaws.com/dev/hello-world
```



Possible Architectures

- Monolithic
- Microservices
- Nanoservices

Monolithic Architecture

- A single Lambda function handles multiple concerns
- Multiple API Gateway endpoints map to one Lambda
- Cold start will be slow
- Any interaction with the system keeps Lambda alive

Monolithic Lambda

MyGiantLambda

```
└── Users.[index|show|create|update|delete]  
└── Posts.[index|show|create|update|delete]  
└── Comments.[index|show|create|update|delete]
```

Monolithic API Gateway

/users/*

 └ MyGiantLambda.Users.[index|show|create|update|delete]

/posts/*

 └ MyGiantLambda.Posts.[index|show|create|update|delete]

/comments/*

 └ MyGiantLambda.Comments.[index|show|create|update|delete]

Microservices Architecture

- A single Lambda function for each concern/resource
- Multiple API Gateway endpoints map to multiple Lambdas
 - Cold start not as slow
 - Any interaction with a concern keeps that concern alive

Microservices Lambda

UserLambda
└ Users

PostLambda
└ Posts

CommentLambda
└ Comments

Microservices API Gateway

```
/users/*  
  └── UserLambda.[index|show|create|update|delete]  
  
/posts/*  
  └── PostLambda.[index|show|create|update|delete]  
  
/comments/*  
  └── CommentLambda.[index|show|create|update|delete]
```

Nanoservices Architecture

- A single Lambda function for each logical function
- One-to-one mapping between API Gateway & Lambda
 - Fastest cold start
- Each function has a separate lifecycle

Nanoservices Lambda

UserCreateLambda
└ handler

UserUpdateLambda
└ handler

PostCreateLambda
└ handler

CommentCreateLambda
└ handler

Nanoservices API Gateway

POST /users
└ UserCreateLambda.handler

PUT /users/:user_id
└ UserUpdateLambda.handler

POST /posts
└ PostCreateLambda.handler

POST /comments
└ CommentCreateLambda.handler

**AWS Provides the
Building Blocks**

**Serverless Provides
Structure and Process**

A man in a dark suit and red patterned tie stands in a stadium with his arms raised in triumph. He has a look of exhaustion or intense effort on his face. The background shows stadium lights and a crowd.

Thank you!

octolabs.com/serverless-okcjs

WE DID IT!