Cloud9 & SAM 101

Goals

- Create your first SAM app using the Cloud9 IDE

Dependencies:

- Access to the Red Team Student Environment in AWS

Code & Files:

- https://github.com/Stage2Sec/CaptureTheCloud/tree/master/train_aws_sam

Login to the Student AWS Red Team Account

AWS Login: **https://console.aws.amazon.com/ (https://console.aws.amazon.com/)**

IAM Username: <red_team_###>

IAM Password: <password>

Create the VPCs and Subnets

Region: US East (N. Virginia) us-east-1

Service: CloudFormation

Click the "Create stack" button

Select the "Amazon S3 URL" radio button

https://github.com/Stage2Sec/CaptureTheCloud/blob/master/train_aws_sam/cloudfront_serverless_apps-003.yaml

(https://github.com/Stage2Sec/CaptureTheCloud/blob/master/train_aws_sam/cloudfront_serverless_apps-003.yaml)

Click the "Next" button

Stack Name: VPCsSubnetsServerlessRedTeamApps001

Click the "Next" button

Click the "Next" button

Click the "Create stack" button

Once the stack has finished being created, the "Status" of the stack should be set to "CREATE_COMPLETE". This can take up to 5 minutes, on average. If you see a fail message, click on the stack name, and then click the "Events" link, and look for errors to see why the stack creation failed.

Create the Cloud9 IDE Environment

Region: US East (N. Virginia) us-east-1

Service: Cloud9

Click the "Create environment" button

Name: HelloWorld101

Click the "Next step" button

Environment type: Select the "Create a new EC2 instance for environment (direct access)" radio button

Instance type: Select the "t2.micro (1 GiB RAM + 1 vCPU)" radio button

Platform: Select the "Ubuntu Server 18.04 LTS" radio button

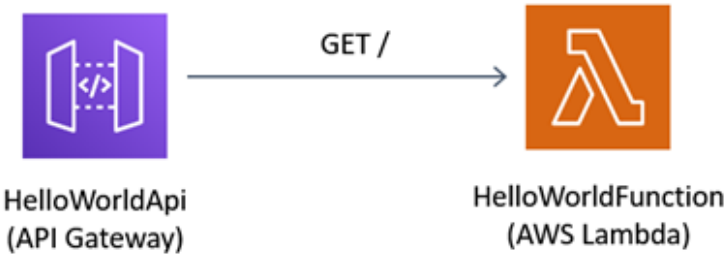
Click the "Next step" button

Click the "Create enviroment" button

This will take a few minutes to create, on average around 5 minutes.

Download the Sample SAM App

We will build a simple SAM app with the following components:



In the terminal, run the following command(s) to install python **3.6**:

```
sam init
1
1
11
sam-app-001
1
```

We should see output similar to the following:

```
red_team_040:~/environment $ sam init
Which template source would you like to use?
```

```
1 - AWS Quick Start Templates
2 - Custom Template Location

Choice: 1

What package type would you like to use?
1 - Zip (artifact is a zip uploaded to S3)
2 - Image (artifact is an image uploaded to an ECR image repository)

Package type: 1

Which runtime would you like to use?
...
11 - python3.6
...

Runtime: 11

Project name [sam-app]: sam-app-001

Cloning app templates from https://github.com/aws/aws-sam-cli-app-templates

AWS quick start application templates:
1 - Hello World Example
2 - EventBridge Hello World
3 - EventBridge App from scratch (100+ Event Schemas)
4 - Step Functions Sample App (Stock Trader)'

Template selection: 1

-----------------------
Generating application:
-----------------------
Name: sam-app-001
Runtime: python3.6
Dependency Manager: pip
```

```
Application Template: hello-world
Output Directory: .

Next steps can be found in the README file at ./sam-app-001/README.md

red_team_040:~/environment $
```

Inspect the source code of the following files

- template.yaml -> /home/ubuntu/environment/sam-app-001/template.yaml

-- SAM Template that defines your application's AWS resources

- app.py -> /home/ubuntu/environment/sam-app-001/hello_world/app.py

-- Contains the logic/code for your lambda application

- requirements.txt -> /home/ubuntu/environment/sam-app-001/hello_world/app.py

-- Required python imports/dependencies

Build the App

Change into the directory with the template.yaml file and build...

In the terminal, run the following command(s):

```
pwd

ls -alF

cd sam-app-001

ls -alF


sam build
```

We should see output similar to the following:

```
red_team_040:~/environment $ pwd
/home/ubuntu/environment


red_team_040:~/environment $ ls -alF
total 20
drwxr-xr-x 4 ubuntu ubuntu 4096 Sep 21 20:10 ./
drwxr-xr-x 14 ubuntu ubuntu 4096 Sep 21 20:10 ../
drwxrwxr-x 4 ubuntu ubuntu 4096 Sep 21 20:12 .c9/
-rw-r--r-- 1 ubuntu ubuntu 569 Sep 16 10:02 README.md
drwxrwxr-x 5 ubuntu ubuntu 4096 Sep 21 20:12 sam-app-001/


red_team_040:~/environment $ cd sam-app-001/

red_team_040:~/environment/sam-app-001 $ ls -alF
total 40
drwxrwxr-x 5 ubuntu ubuntu 4096 Sep 21 20:12 ./
drwxr-xr-x 4 ubuntu ubuntu 4096 Sep 21 20:10 ../
-rw-rw-r-- 1 ubuntu ubuntu 3730 Sep 21 20:10 .gitignore
-rw-rw-r-- 1 ubuntu ubuntu 8393 Sep 21 20:10 README.md
-rw-rw-r-- 1 ubuntu ubuntu 0 Sep 21 20:10 __init__.py
drwxrwxr-x 2 ubuntu ubuntu 4096 Sep 21 20:10 events/
drwxrwxr-x 2 ubuntu ubuntu 4096 Sep 21 20:16 hello_world/
-rw-rw-r-- 1 ubuntu ubuntu 1631 Sep 21 20:10 template.yaml
drwxrwxr-x 4 ubuntu ubuntu 4096 Sep 21 20:10 tests/


red_team_040:~/environment/sam-app-001 $ sam build
Building codeuri: hello_world/ runtime: python3.6 metadata: {} functions: ['HelloWorldFunction']
Running PythonPipBuilder:ResolveDependencies
Running PythonPipBuilder:CopySource

Build Succeeded

Built Artifacts : .aws-sam/build
Built Template : .aws-sam/build/template.yaml

Commands you can use next
=========================
[*] Invoke Function: sam local invoke
[*] Deploy: sam deploy --guided

red_team_040:~/environment/sam-app-001 $
```

This will build any dependencies and then copy your source code to the ".aws-sam/build" directory to be packaged up into a ZIP file, which will be uploaded to Lambda and S3.

Deploy the SAM App

Next, we will deploy our new SAM App! :)

In the terminal, run the following command(s):

```
sam deploy --guided


sam-app-001

[ENTER]

y

Y

y

Y

[ENTER]

[ENTER]

y
```

We should see output similar to the following:

```
red_team_040:~/environment/sam-app-001 $ sam deploy --guided

Configuring SAM deploy
======================

Looking for config file [samconfig.toml] : Not found

Setting default arguments for 'sam deploy'
=========================================
```

Stack Name [sam-app]: sam-app-001

AWS Region [us-east-1]:

#Shows you resources changes to be deployed and require a 'Y' to initiate deploy

Confirm changes before deploy [y/N]: y

#SAM needs permission to be able to create roles to connect to the resources in your template
Allow SAM CLI IAM role creation [Y/n]: Y

HelloWorldFunction may not have authorization defined, Is this okay? [y/N]: y

Save arguments to configuration file [Y/n]: Y

SAM configuration file [samconfig.toml]:

SAM configuration environment [default]:

Looking for resources needed for deployment: Not found.

Creating the required resources...

Looking for resources needed for deployment: Not found.
Creating the required resources...
Successfully created!

Managed S3 bucket: aws-sam-cli-managed-default-samclisourcebucket-1f4bfkwdfnlan
A different default S3 bucket can be set in samconfig.toml

Saved arguments to config file
Running 'sam deploy' for future deployments will use the parameters saved above.
The above parameters can be changed by modifying samconfig.toml
Learn more about samconfig.toml syntax at

```
https://docs.aws.amazon.com/serverless-application-model/latest/developerguide/serverless-sam-cli-config.html

Uploading to sam-app-001/4de18c6e8dcbeb886cc6a81038231b3e 444598 / 444598 (100.00%)

Deploying with following values
================================
Stack name : sam-app-001
Region : us-east-1
Confirm changeset : True
Deployment s3 bucket : aws-sam-cli-managed-default-samclisourcebucket-1f4bfkwdfnlan
Capabilities : ["CAPABILITY_IAM"]
Parameter overrides : {}
Signing Profiles : {}

Initiating deployment
=====================
HelloWorldFunction may not have authorization defined.
Uploading to sam-app-001/e3716963b6c3d181c36b7d8c62e961a0.template 1102 / 1102 (100.00%)

Waiting for changeset to be created..

CloudFormation stack changeset
---------------------------------------------------------------------------------------------------------------------------------------------------------
Operation LogicalResourceId ResourceType Replacement
---------------------------------------------------------------------------------------------------------------------------------------------------------
+ Add HelloWorldFunctionHelloWorldPermissionProd AWS::Lambda::Permission N/A
+ Add HelloWorldFunctionRole AWS::IAM::Role N/A
+ Add HelloWorldFunction AWS::Lambda::Function N/A
+ Add ServerlessRestApiDeployment47fc2d5f9d AWS::ApiGateway::Deployment N/A
+ Add ServerlessRestApiProdStage AWS::ApiGateway::Stage N/A
+ Add ServerlessRestApi AWS::ApiGateway::RestApi N/A
---------------------------------------------------------------------------------------------------------------------------------------------------------

Changeset created successfully. arn:aws:cloudformation:us-east-1:580299357056:changeSet/samcli-deploy1632257390/3b36608e-145e-49d5-9cf8-996068e26f3e


Previewing CloudFormation changeset before deployment
======================================================
Deploy this changeset? [y/N]: y
```

```
2021-09-21 20:52:28 - Waiting for stack create/update to complete

CloudFormation events from changeset
-----------------------------------------------------------------------------------------------------------------------------------------------------------
-----------------------------------------------------
ResourceStatus ResourceType LogicalResourceId ResourceStatusReason
-----------------------------------------------------------------------------------------------------------------------------------------------------------
-----------------------------------------------------
CREATE_IN_PROGRESS AWS::IAM::Role HelloWorldFunctionRole -
CREATE_IN_PROGRESS AWS::IAM::Role HelloWorldFunctionRole Resource creation Initiated
CREATE_COMPLETE AWS::IAM::Role HelloWorldFunctionRole -
CREATE_IN_PROGRESS AWS::Lambda::Function HelloWorldFunction -
CREATE_IN_PROGRESS AWS::Lambda::Function HelloWorldFunction Resource creation Initiated
CREATE_COMPLETE AWS::Lambda::Function HelloWorldFunction -
CREATE_IN_PROGRESS AWS::ApiGateway::RestApi ServerlessRestApi -
CREATE_IN_PROGRESS AWS::ApiGateway::RestApi ServerlessRestApi Resource creation Initiated
CREATE_COMPLETE AWS::ApiGateway::RestApi ServerlessRestApi -
CREATE_IN_PROGRESS AWS::Lambda::Permission HelloWorldFunctionHelloWorldPermissionProd -
CREATE_IN_PROGRESS AWS::ApiGateway::Deployment ServerlessRestApiDeployment47fc2d5f9d -
CREATE_IN_PROGRESS AWS::Lambda::Permission HelloWorldFunctionHelloWorldPermissionProd
Resource creation Initiated
CREATE_IN_PROGRESS AWS::ApiGateway::Deployment ServerlessRestApiDeployment47fc2d5f9d
Resource creation Initiated
CREATE_COMPLETE AWS::ApiGateway::Deployment ServerlessRestApiDeployment47fc2d5f9d -
CREATE_IN_PROGRESS AWS::ApiGateway::Stage ServerlessRestApiProdStage -
CREATE_COMPLETE AWS::ApiGateway::Stage ServerlessRestApiProdStage -
CREATE_IN_PROGRESS AWS::ApiGateway::Stage ServerlessRestApiProdStage Resource creation
Initiated
CREATE_COMPLETE AWS::Lambda::Permission HelloWorldFunctionHelloWorldPermissionProd -
CREATE_COMPLETE AWS::CloudFormation::Stack sam-app-001 -
-----------------------------------------------------------------------------------------------------------------------------------------------------------
-----------------------------------------------------

CloudFormation outputs from deployed stack
-----------------------------------------------------------------------------------------------------------------------------------------------------------
-----------------------------------------------------
Outputs
-----------------------------------------------------------------------------------------------------------------------------------------------------------
-----------------------------------------------------
Key HelloWorldFunctionIamRole
Description Implicit IAM Role created for Hello World function
Value arn:aws:iam::580299357056:role/sam-app-001-HelloWorldFunctionRole-1ESFPWWK2RDO
```

```
Key HelloWorldApi
Description API Gateway endpoint URL for Prod stage for Hello World function
Value https://ehao9x6fb9.execute-api.us-east-1.amazonaws.com/Prod/hello/

Key HelloWorldFunction
Description Hello World Lambda Function ARN
Value arn:aws:lambda:us-east-1:580299357056:function:sam-app-001-HelloWorldFunction-
A4J8xToGWUHK
------------------------------------------------------------------------------------------------------------------------
------------------------------------------------------------

Successfully created/updated stack - sam-app-001 in us-east-1

red_team_040:~/environment/sam-app-001 $
```

Test the SAM App

We will test the SAM App...

We will want to locate the URL to our newly deployed API gateway, for example in our above output:

```
https://ehao9x6fb9.execute-api.us-east-1.amazonaws.com/Prod/hello/
```

In the terminal, run the following command(s):

```
curl https://ehao9x6fb9.execute-api.us-east-1.amazonaws.com/Prod/hello/
```

We should see output similar to the following:

```
red_team_040:~/environment/sam-app-001 $ curl https://ehao9x6fb9.execute-api.us-east-
1.amazonaws.com/Prod/hello/

{"message": "hello world"}

red_team_040:~/environment/sam-app-001 $
```

Clean Up API Gateway & Lambda Function

SAM uses the AWS CloudFormation service to deploy resources, hence we can use the CloudFormation service to clean up the SAM application deployment. We will need to know the following information:

#1 - Stack Name: e.g. sam-app-001

#2 - AWS Region: e.g. us-east-1

In the terminal, run the following command(s):

```
aws cloudformation delete-stack --stack-name sam-app-001 --region us-east-1
```

We should see output similar to the following:

```
red_team_040:~/environment/sam-app-001 $ aws cloudformation delete-stack --stack-name sam-app-001 --region us-east-1


red_team_040:~/environment/sam-app-001 $
```

Next we can check to ensure the delete was succuessful...

In the terminal, run the following command(s):

```
aws cloudformation list-stacks
```

We should see output similar to the following:

```
red_team_040:~/environment/sam-app-001 $ aws cloudformation list-stacks
{
"StackSummaries": [
{
"StackId": "arn:aws:cloudformation:us-east-1:580299357056:stack/sam-app-001/7704fd60-1b1d-11ec-8228-0eea388cb225",
"StackName": "sam-app-001",
"TemplateDescription": "sam-app-001\nSample SAM Template for sam-app-001\n",
"CreationTime": "2021-09-21T20:49:50.792Z",
"LastUpdatedTime": "2021-09-21T20:52:28.346Z",
"DeletionTime": "2021-09-21T21:00:06.896Z",
```

"StackStatus": "DELETE_COMPLETE",
"DriftInformation": {
"StackDriftStatus": "NOT_CHECKED"
}
},

...

References

- Tutorial: Deploying a Hello World application - **https://docs.aws.amazon.com/serverless-application-model/latest/developerguide/serverless-getting-started-hello-world.html (https://docs.aws.amazon.com/serverless-application-model/latest/developerguide/serverless-getting-started-hello-world.html)**