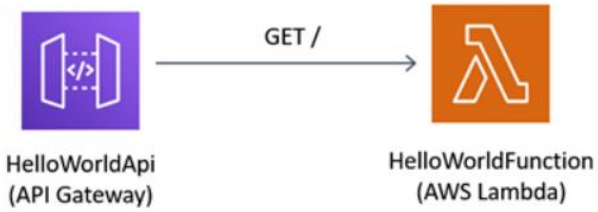
Assignment 8

Submitted by :	
Name	Naman Panchal
E-mail	naman.panchal.ce@gmail.com

Que: Explain the below AWS architecture diagram in detail, also deploy the same AWS architecture

- **For this assignment you need to take a look and study the documentation for SAM CLI, you need to deploy a Hello, World application on aws lambda.**
- **Make sure when you test the lambda url it will respond as Hello, World.**



Answer:

Here to implement above AWS architecture, I have used AWS SAM (Serverless Application Model) CLI to build and deploy serverless application on AWS.

A serverless application is a combination of Lambda functions, event sources, and other resources that work together to perform tasks. Ref: https://docs.aws.amazon.com/serverless-application-model/latest/developerguide/serverless-getting-started-hello-world.html

Here, I have deployed Hello World application using AWS SAM. This application implements a basic API backend. It consists of an Amazon API Gateway endpoint and an AWS Lambda function. When you send a GET request to the API Gateway endpoint, the Lambda function is invoked. This function returns a hello world message.

Please find below attached screenshots for this implementation.

AWS SAM prerequisites:

- Install the latest release of the AWS Serverless Application Model Command Line Interface (AWS SAM CLI)

#Step 1 - Download a sample AWS SAM application

- sam init

```
PS C:\Users\naman> sam init

You can preselect a particular runtime or package type when using the `sam init` experience.
Call `sam init --help` to learn more.

Which template source would you like to use?
        1 - AWS Quick Start Templates
        2 - Custom Template Location
Choice: 1

Choose an AWS Quick Start application template
        1 - Hello World Example
        2 - Multi-step workflow
        3 - Serverless API
        4 - Scheduled task
        5 - Standalone function
        6 - Data processing
        7 - Infrastructure event management
        8 - Serverless Connector Hello World Example
        9 - Multi-step workflow with Connectors
        10 - Lambda EFS example
        11 - Machine Learning
Template: 1

Use the most popular runtime and package type? (Python and zip) [y/N]: N

Which runtime would you like to use?
        1 - aot.dotnet7 (provided.al2)
        2 - dotnet6
        3 - dotnet5.0
        4 - dotnetcore3.1
        5 - go1.x
        6 - go (provided.al2)
        7 - graalvm.java11 (provided.al2)
        8 - graalvm.java17 (provided.al2)
        9 - java11
        10 - java8.al2
        11 - java8
        12 - nodejs18.x
        13 - nodejs16.x
        14 - nodejs14.x
        15 - nodejs12.x
```

```
Project name [sam-app]:

Cloning from https://github.com/aws/aws-sam-cli-app-templates (process may take a moment)

    -----------------------
    Generating application:
    -----------------------
    Name: sam-app
    Runtime: nodejs16.x
    Architectures: x86_64
    Dependency Manager: npm
    Application Template: hello-world-powertools-typescript
    Output Directory: .

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


Commands you can use next
=========================
[*] Create pipeline: cd sam-app && sam pipeline init --bootstrap
[*] Validate SAM template: cd sam-app && sam validate
[*] Test Function in the Cloud: cd sam-app && sam sync --stack-name {stack-name} --watch
```

#Step 2 - Build your application

- cd sam-app
- sam build

```
PS C:\Users\naman> cd .\sam-app\
PS C:\Users\naman\sam-app> sam build
Building codeuri: C:\Users\naman\sam-app\hello-world runtime: nodejs16.x metadata: {'BuildMethod': 'esbuild', 'BuildProperties': {'Minify': True, 'Target': 'es2020', 'Ent
Points': ['app.ts']}} architecture: x86_64 functions: HelloWorldFunction
Running NodejsNpmEsbuildBuilder:CopySource
Running NodejsNpmEsbuildBuilder:NpmInstall
Running NodejsNpmEsbuildBuilder:EsbuildBundle

Build Succeeded

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

Commands you can use next
=========================
[*] Validate SAM template: sam validate
[*] Invoke Function: sam local invoke
[*] Test Function in the Cloud: sam sync --stack-name {{stack-name}} --watch
[*] Deploy: sam deploy --guided
```

#Step 3 - Deploy your application

- sam deploy –guided

```
PS C:\Users\naman\sam-app> sam deploy --guided

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

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

        Setting default arguments for 'sam deploy'
        =========================================
        Stack Name [sam-app]:
        AWS Region [ap-south-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
        #Preserves the state of previously provisioned resources when an operation fails
        Disable rollback [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:
        Creating the required resources...
        Successfully created!
         Managed S3 bucket: aws-sam-cli-managed-default-samclisourcebucket-df36mtnio6wr
         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/6d7b0549c31940143c45f724d6ca0486  45249 / 45249  (100.00%)

        Deploying with following values
        ===============================
        Stack name                   : sam-app
        Region                       : ap-south-1
```

```
Uploading to sam-app/6d7b0549c31940143c45f724d6ca0486  45249 / 45249  (100.00%)

        Deploying with following values
        ===============================
        Stack name                 : sam-app
        Region                     : ap-south-1
        Confirm changeset          : True
        Disable rollback           : True
        Deployment s3 bucket       : aws-sam-cli-managed-default-samclisourcebucket-df36mtnio6wr
        Capabilities               : ["CAPABILITY_IAM"]
        Parameter overrides        : {}
        Signing Profiles           : {}

Initiating deployment
=====================
Uploading to sam-app/21b30b55e061d36479ec52eaaa980660.template  1568 / 1568  (100.00%)

Waiting for changeset to be created..
CloudFormation stack changeset
---------------------------------------------------------------------------------------------------------------------------------------------------------------------
Operation                                 LogicalResourceId                         ResourceType                              Replacement
---------------------------------------------------------------------------------------------------------------------------------------------------------------------
+ Add                                     HelloWorldFunctionHelloWorldPermissionPr  AWS::Lambda::Permission                   N/A
                                          od
+ 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:ap-south-1:166639039766:changeSet/samcli-deploy1673174959/27bb0685-87c6-4a75-83af-707305e0f124


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

2023-01-08 16:19:39 - Waiting for stack create/update to complete
```

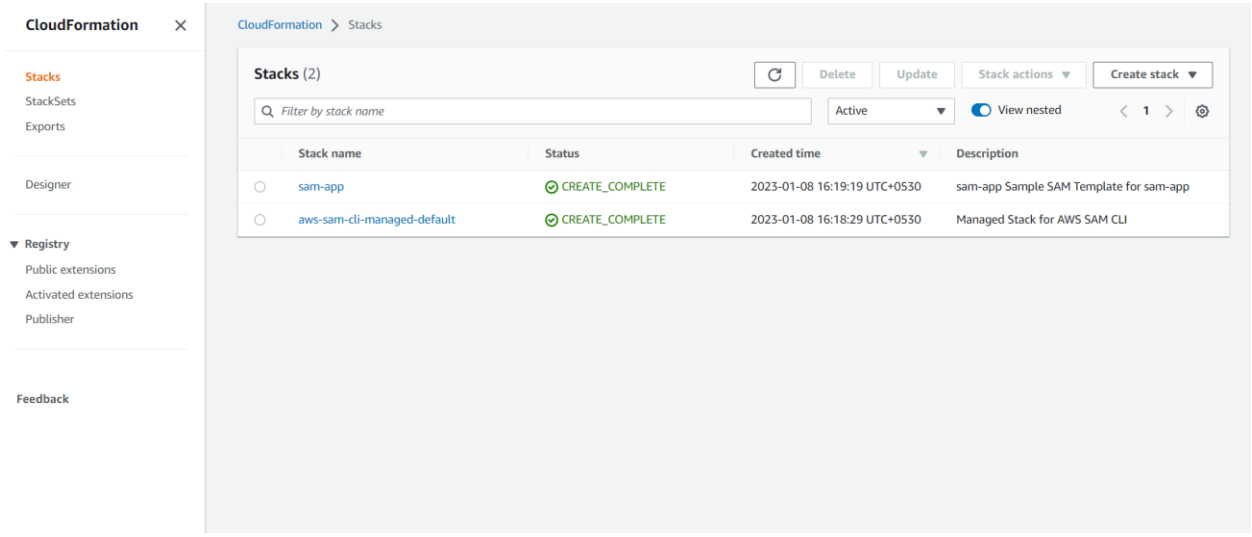
```
2023-01-08 16:19:39 - Waiting for stack create/update to complete

CloudFormation events from stack operations (refresh every 0.5 seconds)
---------------------------------------------------------------------------------------------------------------------------------------------------------------------
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::ApiGateway::Deployment               ServerlessRestApiDeployment47fc2d5f9d     -
CREATE_IN_PROGRESS                        AWS::Lambda::Permission                   HelloWorldFunctionHelloWorldPermissionPr  -
                                                                                    od
CREATE_IN_PROGRESS                        AWS::Lambda::Permission                   HelloWorldFunctionHelloWorldPermissionPr  Resource creation Initiated
                                                                                    od
CREATE_IN_PROGRESS                        AWS::ApiGateway::Deployment               ServerlessRestApiDeployment47fc2d5f9d     Resource creation Initiated
CREATE_COMPLETE                           AWS::ApiGateway::Deployment               ServerlessRestApiDeployment47fc2d5f9d     -
CREATE_IN_PROGRESS                        AWS::ApiGateway::Stage                    ServerlessRestApiProdStage                -
CREATE_IN_PROGRESS                        AWS::ApiGateway::Stage                    ServerlessRestApiProdStage                Resource creation Initiated
CREATE_COMPLETE                           AWS::ApiGateway::Stage                    ServerlessRestApiProdStage                -
CREATE_COMPLETE                           AWS::Lambda::Permission                   HelloWorldFunctionHelloWorldPermissionPr  -
                                                                                    od
CREATE_COMPLETE                           AWS::CloudFormation::Stack                sam-app                                   -
---------------------------------------------------------------------------------------------------------------------------------------------------------------------
CloudFormation outputs from deployed stack
---------------------------------------------------------------------------------------------------------------------------------------------------------------------
```

```
---------------------------------------------------------------------------------------------------------------------------------------------------------------------
CloudFormation outputs from deployed stack
---------------------------------------------------------------------------------------------------------------------------------------------------------------------
Outputs
---------------------------------------------------------------------------------------------------------------------------------------------------------------------
Key                 HelloWorldFunctionIamRole
Description         Implicit IAM Role created for Hello World function
Value               arn:aws:iam::166639039766:role/sam-app-HelloWorldFunctionRole-RMP6EMWZ061B

Key                 HelloWorldApi
Description         API Gateway endpoint URL for Prod stage for Hello World function
Value               https://0voqf7c00i.execute-api.ap-south-1.amazonaws.com/Prod/hello/

Key                 HelloWorldFunction
Description         Hello World Lambda Function ARN
Value               arn:aws:lambda:ap-south-1:166639039766:function:sam-app-HelloWorldFunction-KV7OoSmjLMtR
---------------------------------------------------------------------------------------------------------------------------------------------------------------------

Successfully created/updated stack - sam-app in ap-south-1
```

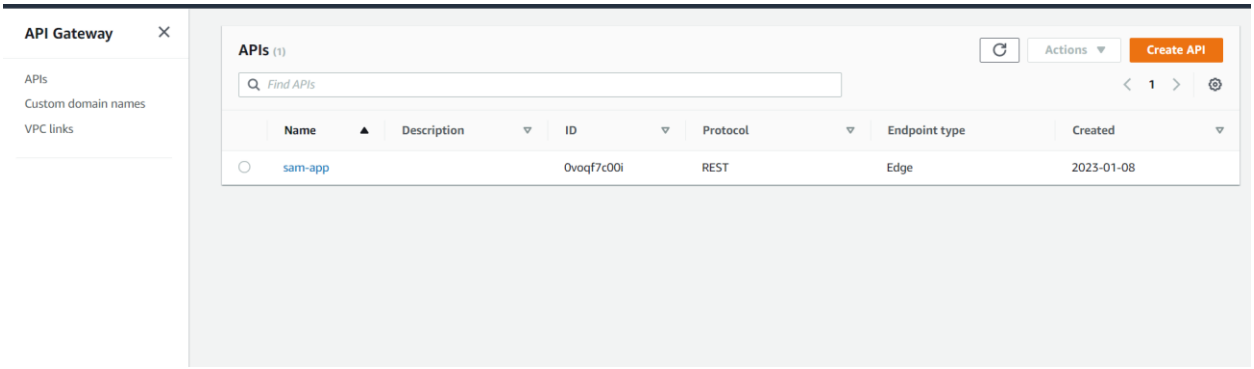
AWS resources:

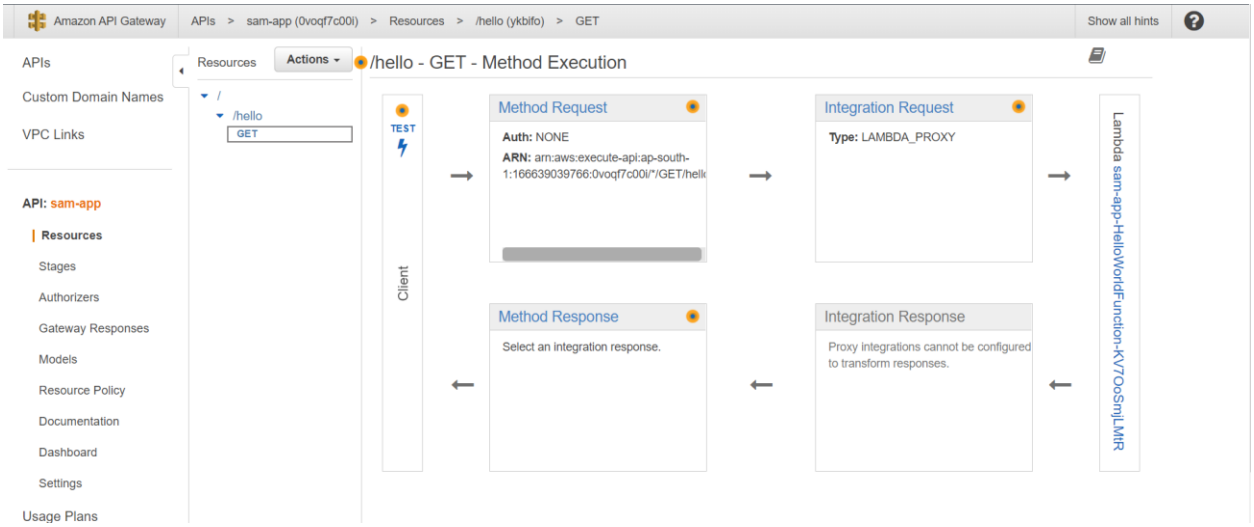
- **CloudFormation**

➢ CloudFormation is creating required components as seen in above screenshots. Same also we can see by logging into AWS management console and then going to CloudFormation.

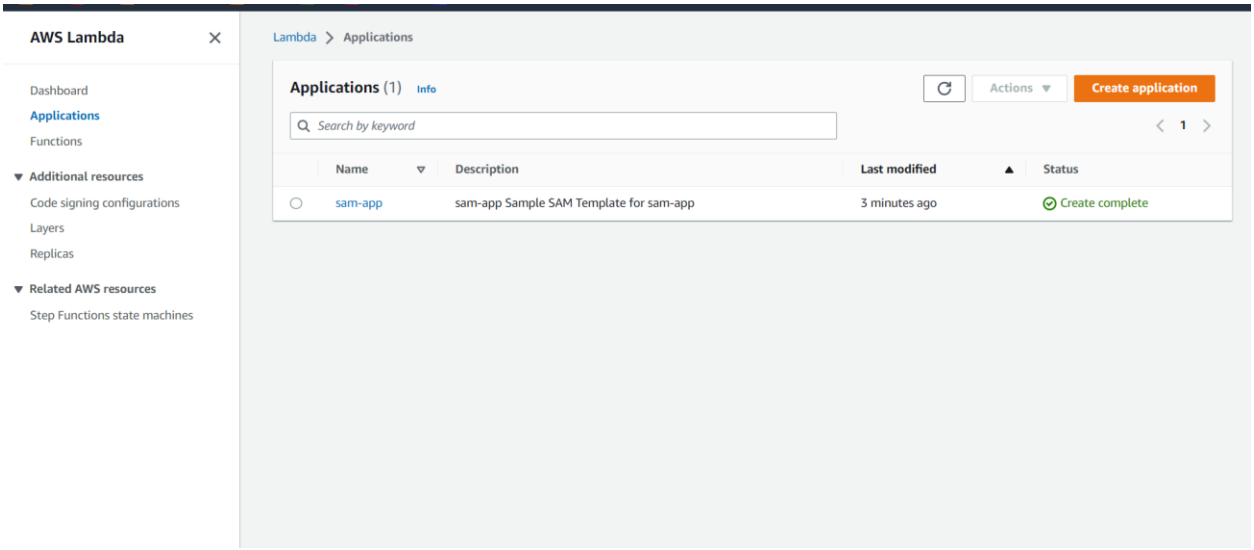


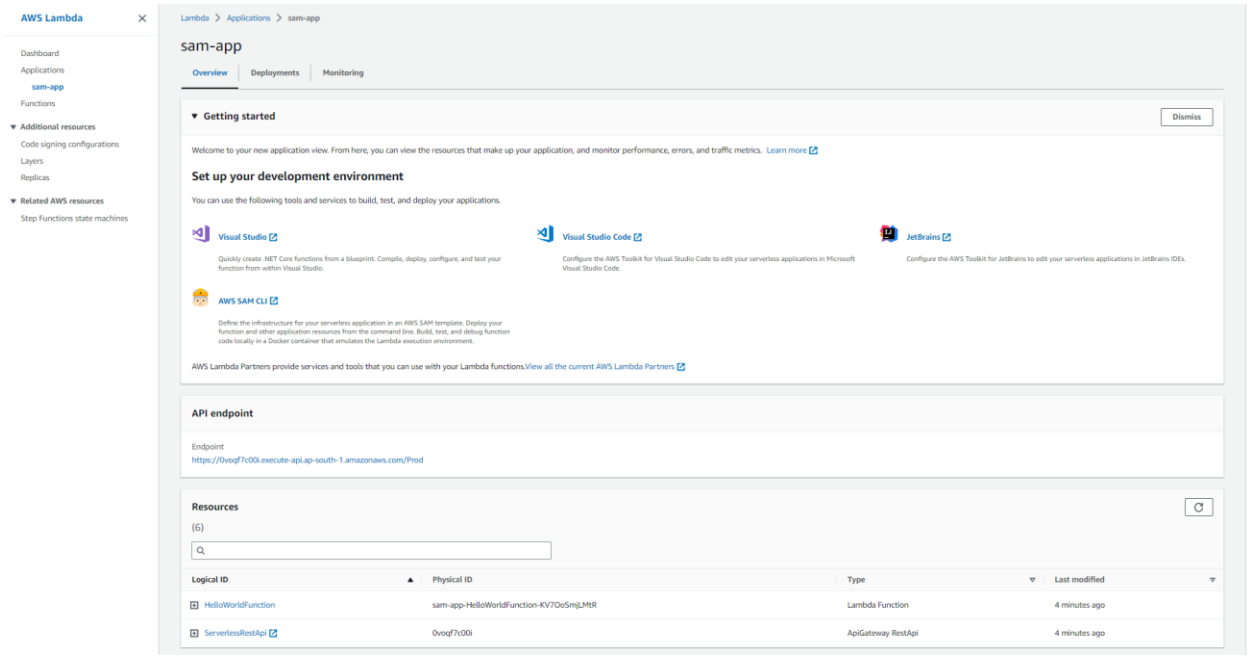
- **API Gateway**



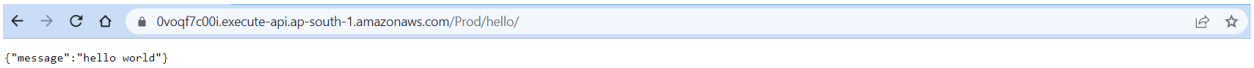

Amazon API Gateway
APIs > sam-app (0voqf7c00i) > Resources > /hello (ykbifo) > GET
Show all hints
APIs
Custom Domain Names
VPC Links
API: sam-app
Resources
Stages
Authorizers
Gateway Responses
Models
Resource Policy
Documentation
Dashboard
Settings
Usage Plans
Resources
Actions
/hello - GET - Method Execution
/
/hello
GET
TEST
Client
Method Request
Auth: NONE
ARN: arn:aws:execute-api:ap-south-1:166639039766:0voqf7c00i/*/GET/hell
Integration Request
Type: LAMBDA_PROXY
Lambda sam-app-HelloWorldFunction-KV7OoSmjLMtR
Method Response
Select an integration response.
Integration Response
Proxy integrations cannot be configured to transform responses.

- **Lambda**


AWS Lambda
Dashboard
Applications
Functions
Additional resources
Code signing configurations
Layers
Replicas
Related AWS resources
Step Functions state machines
Lambda > Applications
Applications (1) Info
Actions
Create application
Search by keyword
1
Name
Description
Last modified
Status
sam-app
sam-app Sample SAM Template for sam-app
3 minutes ago
Create complete



When we hit API gateway endpoint, will get {"message": "hello world"} from our own created backend (using Amazon API Gateway endpoint and an AWS Lambda function) as per below screenshot.



{"message":"hello world"}

So, as per infra diagram I have created and deployed necessary infrastructure on AWS.