

# Configuration Manual

MSc Research Project  
Cloud Computing

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**MSc Project Submission Sheet**  
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**Programme:** Cloud Computing **Year:** 2022  
**Module:** MSc Research Project  
**Lecturer:** 15-12-2022  
**Submission Due Date:**  
**Project Title:** Configuration Manual  
**Word Count:** 1450 **Page Count:** 13

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# Configuration Manual

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## 1 Overview

### 1.1 Purpose of this document

This section of configuration manual describes step-by-step procedure for implementing automation approach for encrypting S3 bucket using AWS Lambda. This manual will contain detailed explanation of each AWS service to achieve this automation. This research project includes AWS services like CloudFormation, Lambda, S3 Bucket, CloudTrail, CloudWatch and so on.

## 2 Requirement

- AWS Cloud Knowledge.
- Basic Python programming knowledge.
- AWS IAM role access to create user role and update policies if required.

This project is configured on AWS account. Steps for building automation infrastructure are mentioned in further sections below. To create new AWS account, need to visit below mentioned URL.

- AWS Account URL: <https://aws.amazon.com>

## 3 Procedure

### 3.1 Create AWS CloudTrail

First, in order to capture every detail of this process. User needs to enable CloudTrail.

CloudTrail allows user to capture each and every log during the operation in form of API gateway logs.

To enable AWS CloudTrail log, follow below steps:

- Go to CloudTrail from AWS console and click on 'create a trail'.
- Provide a name to trail as shown in [figure 1](#).
- Click apply to all multi region trail, in order to collect all API requests.

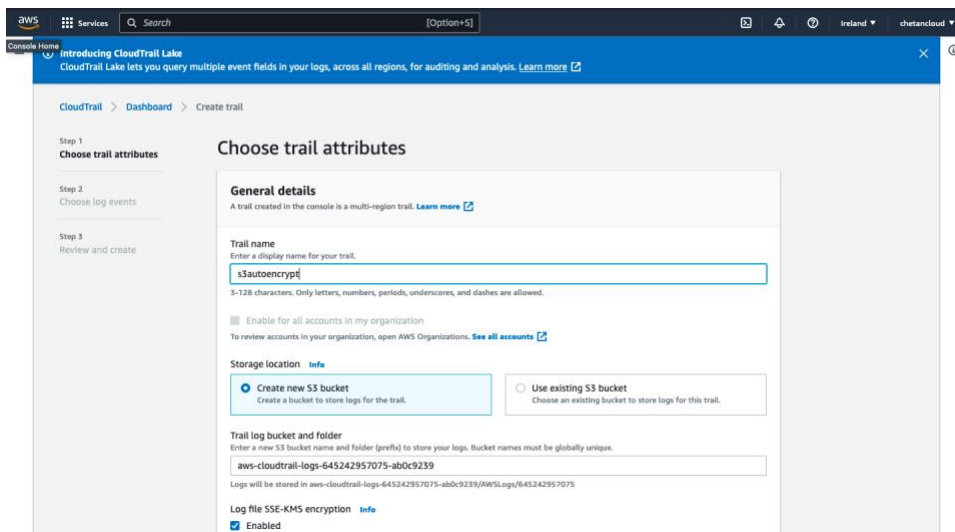


Figure 1: AWS CloudTrail

### 3.2 AWS CloudFormation

Now, once CloudTrail log option is enabled, Go to CloudFormation on AWS console and create a stack as shown in [figure 2](#).

AWS CloudFormation works based on template file. User can provide all AWS resources configuration along with role to be created, event to be added and their dependencies are added in this template .yaml file so that user can deploy and set up them together in separate stack. Template file help to provision all required resources. This technique also known as ‘Infrastructure as Code’.

- Upload the CloudFormation template file and click ‘Next’

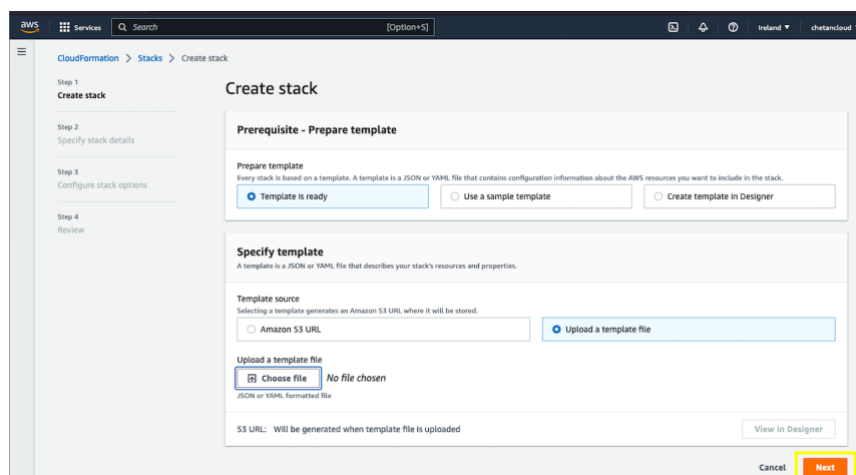


Figure 2: AWS CloudFormation template upload

- Provide name to CloudFormation stack as depicted in [figure 3](#) and click ‘Next’.

CloudFormation > Stacks > Create stack

Step 1: Create stack

Step 2: Specify stack details

Step 3: Configure stack options

Step 4: Review S3AutoEncrypt

### Specify stack details

**Stack name**

Stack name

S3AutoEncrypt

Stack name can include letters (A-Z and a-z), numbers (0-9), and dashes (-).

**Parameters**

Parameters are defined in your template and allow you to input custom values when you create or update a stack.

No parameters

There are no parameters defined in your template

Cancel Previous Next

Figure 3: AWS CloudFormation stack

- Now, keep all default values as it is and mark it checked the acknowledge as illustrated in [figure 4](#), to allow CloudFormation to create role if required.

SNS topic ARN

No notification options

There are no notification options defined

**Stack creation options**

Timeout

-

Termination protection

Disabled

► Quick-create link

Capabilities

The following resource(s) require capabilities: [AWS::IAM::Role]

This template contains Identity and Access Management (IAM) resources that might provide entities access to make changes to your AWS account. Check that you want to create each of these resources and that they have the minimum required permissions. [Learn more](#)

☒ I acknowledge that AWS CloudFormation might create IAM resources.

Create change set

Cancel Previous Submit

Figure 4: AWS CloudFormation submission

- Then click on 'Submit' and wait for stack deployment to finish.

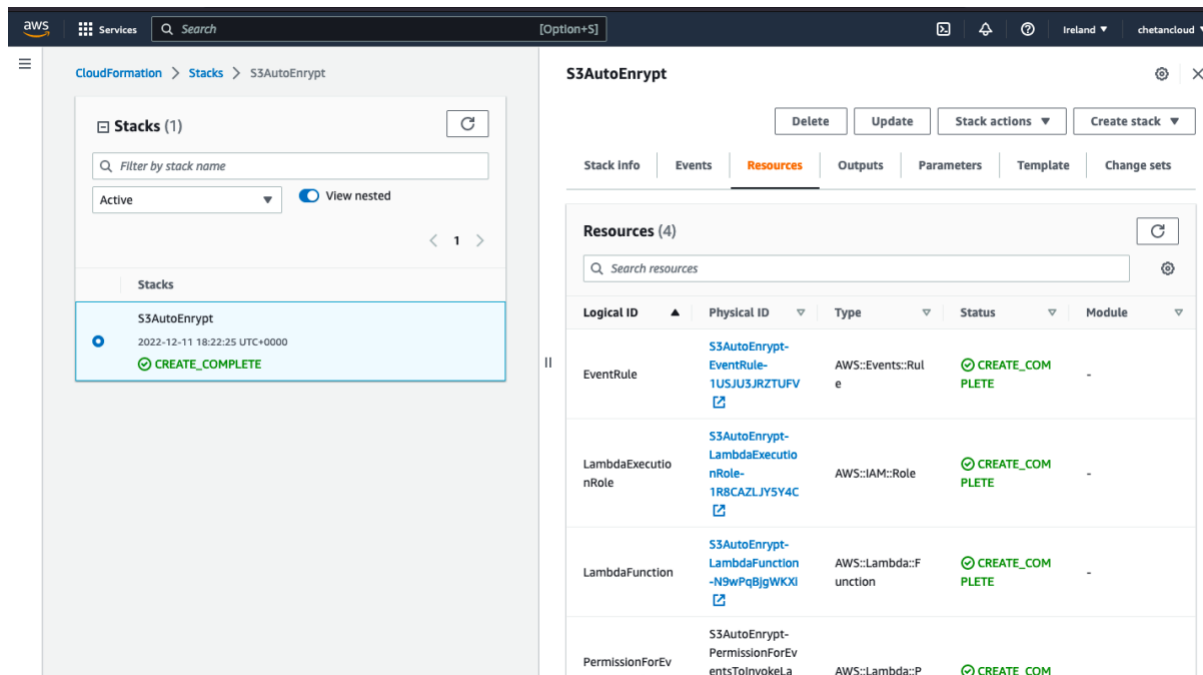


Figure 5: CloudFormation Resource Status.

- As per [figure 5](#), In the Resource tab user can monitor status of each resource like EventRule, ExecutionRole, LambdaFunction and PermissionForEventsToInvokeLambda if status is 'CREATE\_COMPLETE' means deployment is successful.
- Once template deployment is successful. As [figure 6](#), user can check template on CloudFormation where Lambda function written using python programming to encrypt S3 bucket automatically as soon as it is created by user.

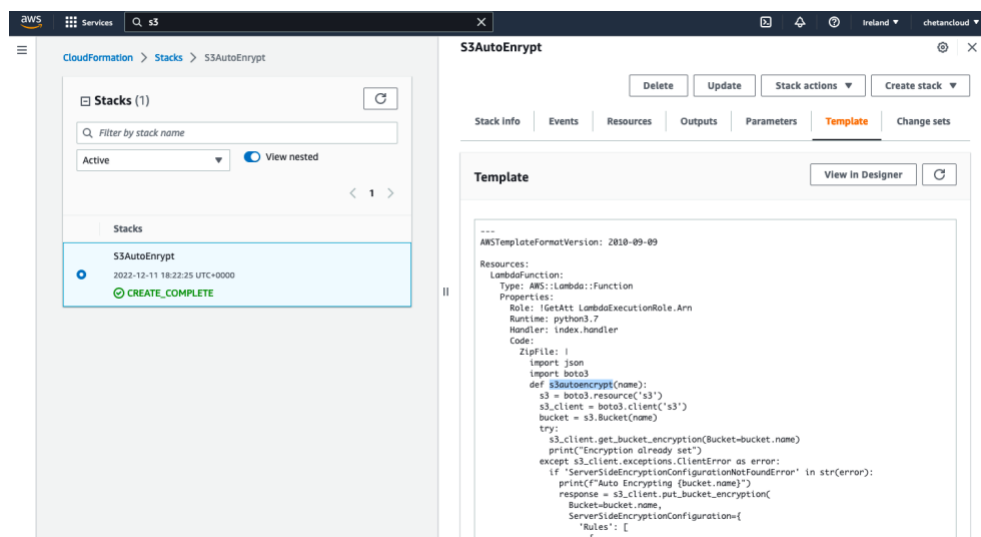


Figure 6: AWS Lambda function and other resources on CloudFormation template

### 3.3 Create AWS S3 Bucket.

- Now go to S3 bucket from AWS console to create S3 bucket.
- As presented in [figure 7](#), provide bucket name and keep all other details unchanged.

The screenshot shows the 'Create bucket' page in the AWS Management Console. The breadcrumb trail is 'Amazon S3 > Buckets > Create bucket'. The page title is 'Create bucket' with an 'info' icon. Below the title, it says 'Buckets are containers for data stored in S3. [Learn more](#)'. The 'General configuration' section contains a 'Bucket name' field with the value 'projectsearch108' and a note: 'Bucket name must be globally unique and must not contain spaces or uppercase letters. [See rules for bucket naming](#)'. Below this is the 'AWS Region' dropdown menu set to 'EU (Ireland) eu-west-1'. There is a section for 'Copy settings from existing bucket - optional' with a 'Choose bucket' button. The 'Object Ownership' section has two options: 'ACLs disabled (recommended)' (selected) and 'ACLs enabled'. A 'Cancel' button and an orange 'Create bucket' button are at the bottom right.

Figure 7: S3 Bucket Creation.

This screenshot shows the 'Advanced settings' section of the 'Create bucket' page. The 'Bucket Versioning' section has 'Disable' selected. The 'Tags (0) - optional' section shows 'No tags associated with this bucket.' and an 'Add tag' button. The 'Default encryption' section has 'Server-side encryption' set to 'Disable'. The 'Advanced settings' section is expanded, showing a note: 'After creating the bucket you can upload files and folders to the bucket, and configure additional bucket settings.' At the bottom, there are 'Cancel' and 'Create bucket' buttons.

Figure 8: Encryption disable while creating bucket

- As illustrated in [figure 8](#), maintain default encryption as disable so that bucket encryption can be happen through AWS Lambda automatically. Now click 'Create bucket'.
- Now, once S3 bucket is created. Head over to CloudFormation console and go to Resource tab click on Lambda function as shown in [figure 9](#).

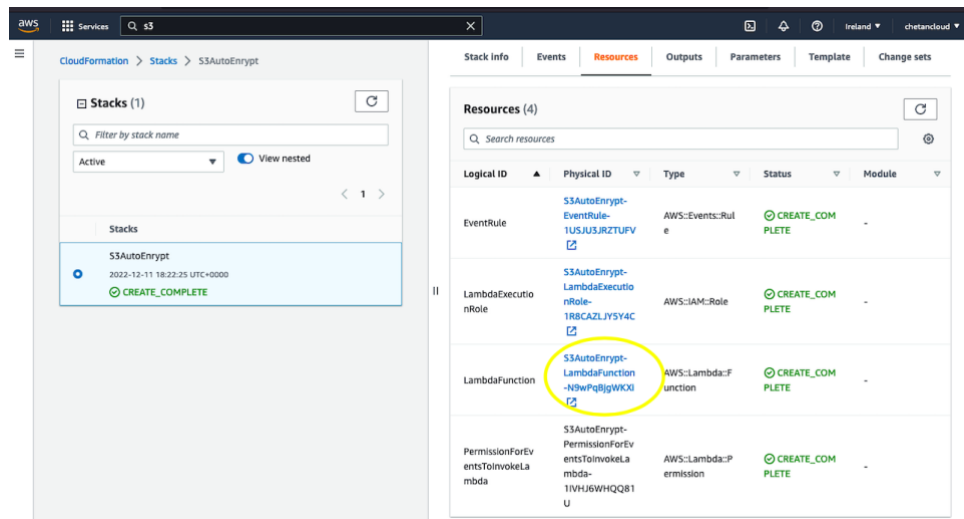


Figure 9: Lambda Function link on CloudFormation stack

- As presented in [figure 10](#), it is clearly visible that EventBridge (CloudWatch Events) is triggering our Lambda function 'S3AutoEncrypt'.
- It means that, S3 bucket 'projectresearch108' creation event captured by CloudWatch events that leads to Lambda function 'S3AutoEncrypt' to run.

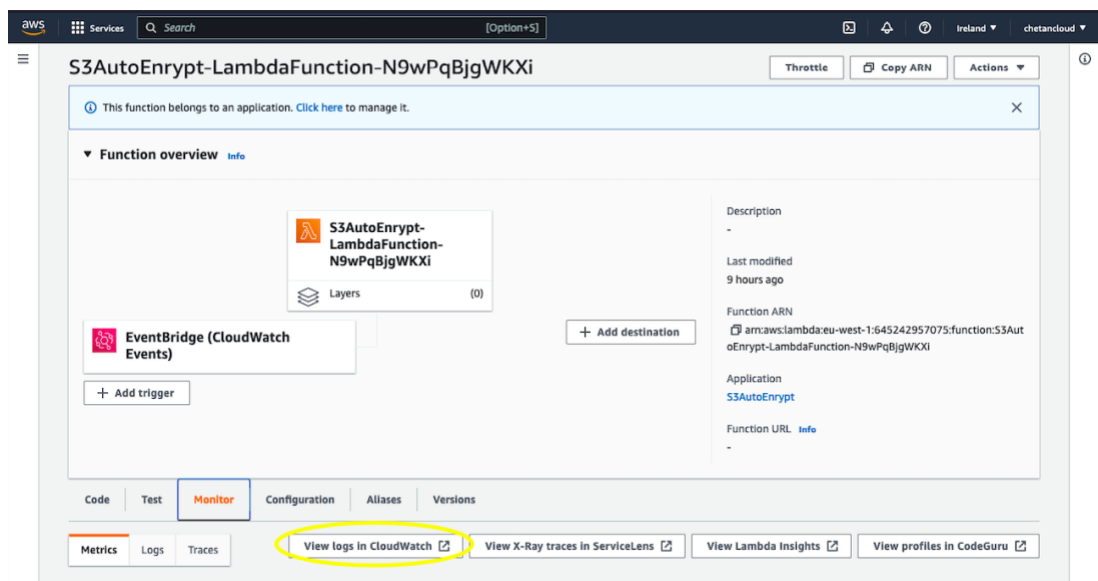


Figure 10: EventBridge (CloudWatch Events) cause Lambda Function to run.

- To gain more information about Lambda function and to check encryption validation. User need to click on 'view logs in CloudWatch' as depicted in figure 10.
- As illustrated in [figure 11](#), user can scroll down and see logs that bucket name 'projectresearch108' is encrypted automatically.
- As per CloudFormation template, method for lambda function is added to trigger lambda function and provide becket name through API request.



- Also, user can see response logs where status code for http is 200 which describe as a successful response. Hence, objective of this research work to encrypt S3 bucket automatically using AWS Lambda function is achieved.

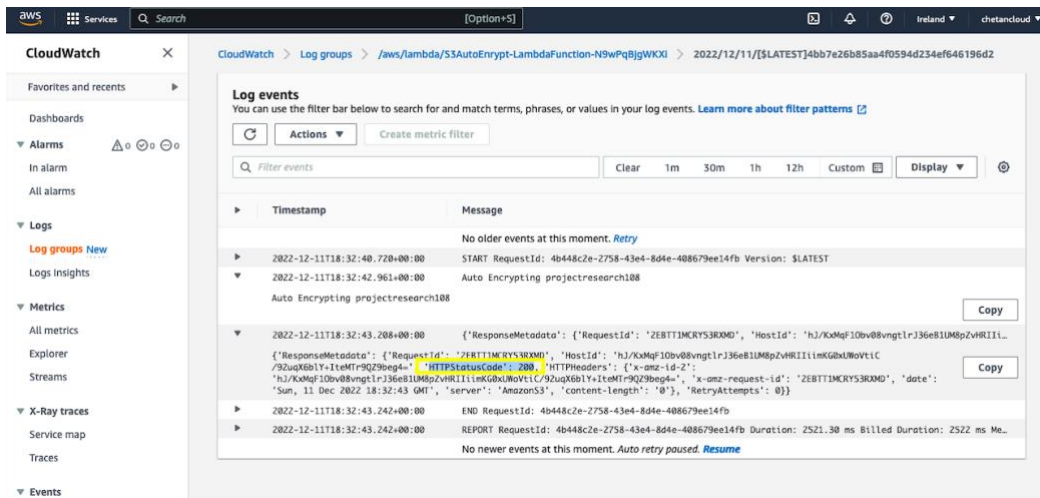


Figure 11: Encryption result of S3 bucket.

- Now, Bucket ‘projectresearch108’ is encrypted. On top this, user can even receive notification of S3 object insertion or deletion over mail using Simple Notification Service of AWS.

### 3.4 S3 SNS (Simple Notification Service) Notification

- Go to Simple Notification Service (SNS) from AWS console.
- Click on ‘Next Step’ this will lead to create topic page as depicted in [figure 12](#).

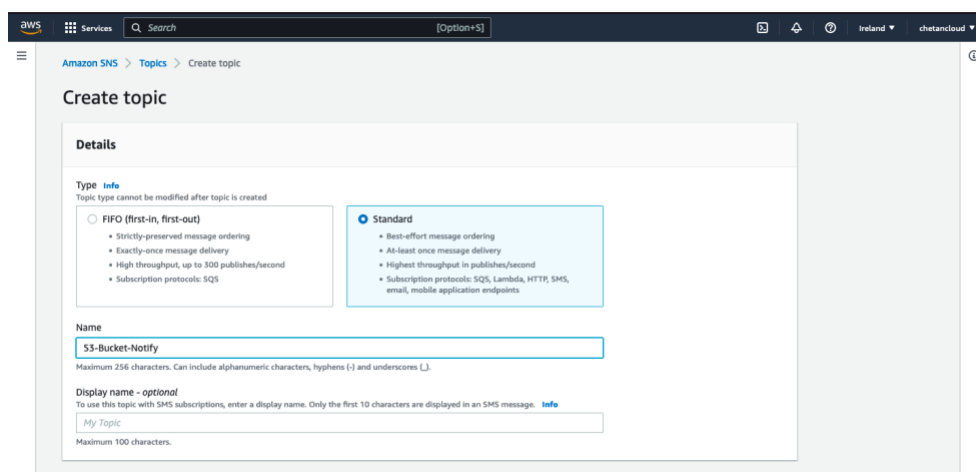


Figure 12: AWS SNS Notification

- User can provide topic name and scroll down to click on ‘Create topic’
- Once topic is created then user need to create subscription to avail email notification service. Therefore, click on ‘Create subscription’ as shown in [figure 13](#).

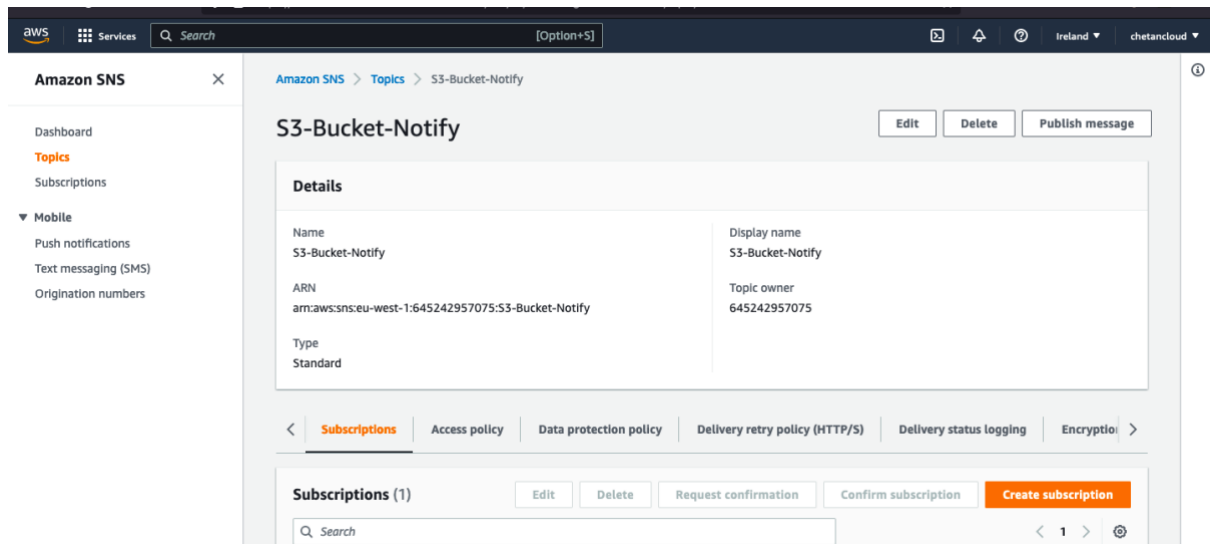


Figure 13: Create subscription to topic

- As illustrated in the [figure 14](#), select protocol as 'Email' from drop-down menu.
- User needs to provide email address on which notification can be sent from AWS and then scroll down to click 'Create subscription'.

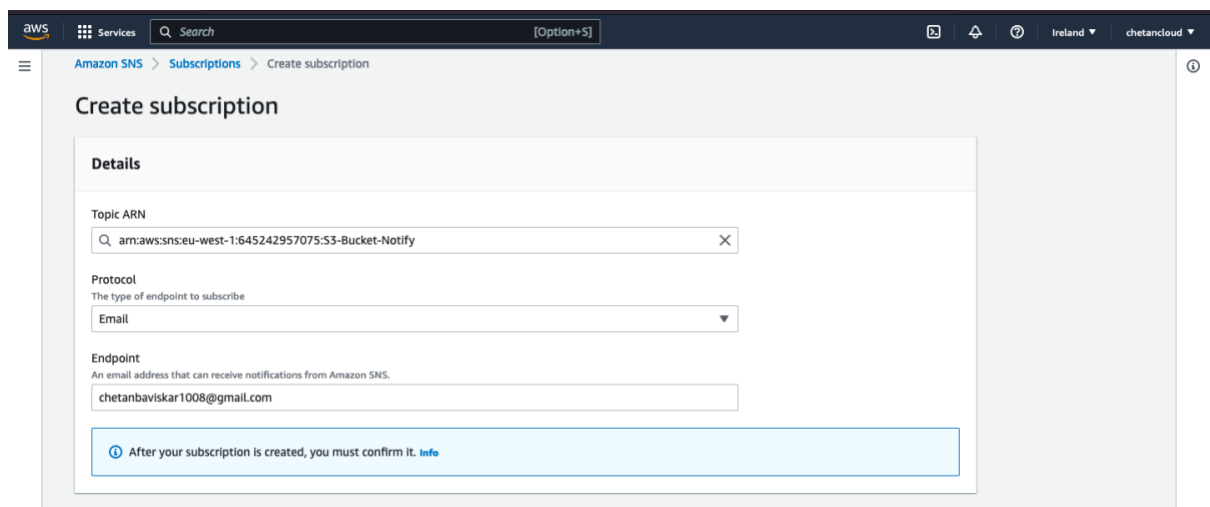


Figure 14: Provide email address to receive notification.

- Once, subscription is created, AWS will send subscription confirmation email to email address provided.
- As shown in [figure 15](#), user need to provide confirmation by clicking 'confirm subscription'

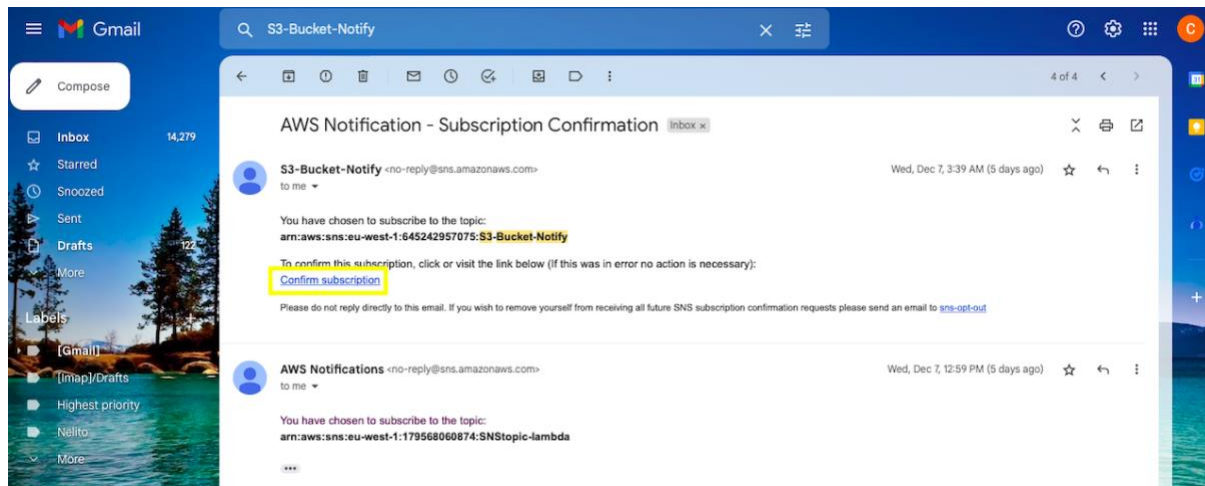


Figure 15: Subscription Confirmation

- Now, here in this research work another lambda function ‘SNS\_Lambda’ is used to avail SNS service on particular S3 bucket. Need to create role for this lambda function.
- Go to IAM (Identity and Access Management) to create role named as ‘SNS\_Role’ as shown in [figure 16](#).

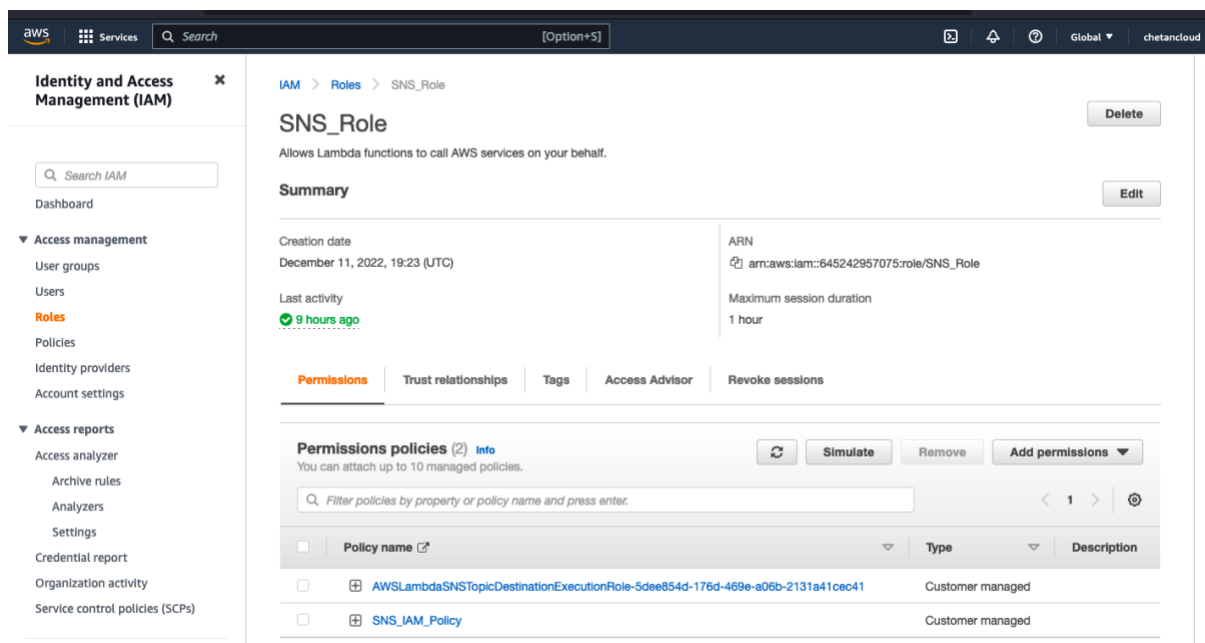


Figure 16: IAM Role creation for SNS Lambda function.

- Go to AWS Lambda from AWS console and create ‘SNS\_Lambda’ with selecting SNS\_Role. Lambda function code is attached into code artifact submission.
- Once Lambda is created. User can go to lambda and click on ‘Add trigger’ to use AWS resource as shown in [figure 17](#). In this research work S3 bucket used hence select S3 bucket from drop-down menu.

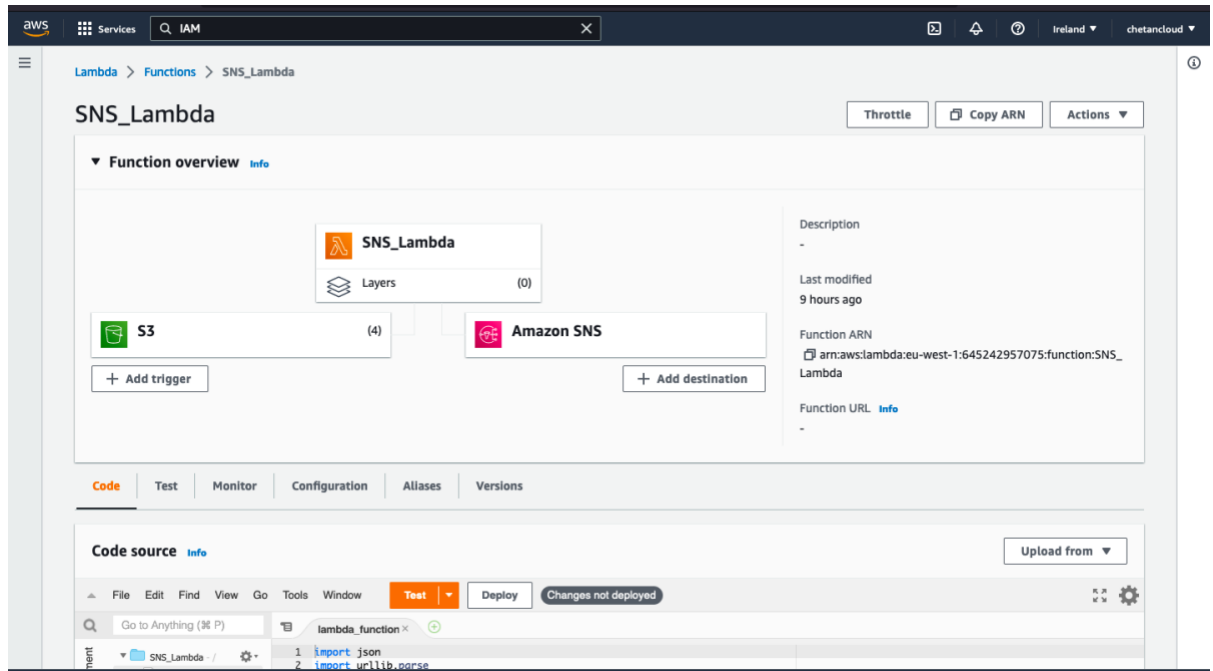


Figure 17: Lambda function for SNS service.

- Once S3 bucket is selected, user can choose particular bucket and event type as per shown in [figure 18](#). Now, scroll down and click 'Add'.
- Here, in this research project Create and Delete event are used so that any object from S3 bucket created or deleted user will receive notification of the same.

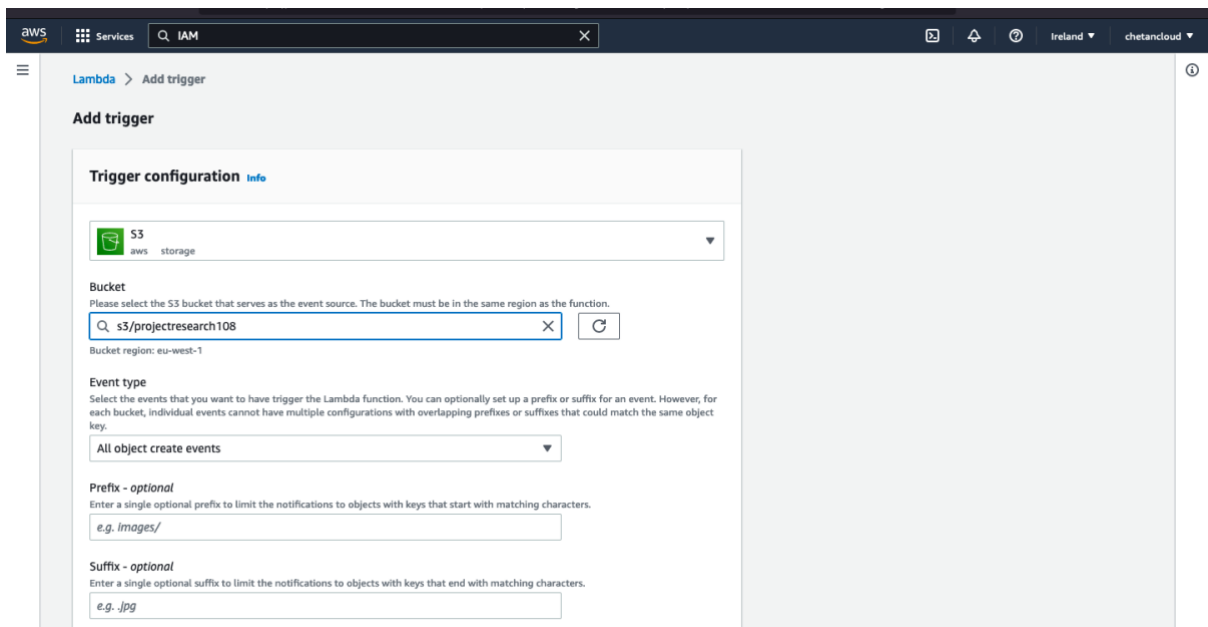


Figure 18: Adding object create event trigger for SNS service.

- Now, user can upload any object on mentioned bucket 'projectresearch108' to check SNS service working or not.
- As shown in [figure 19](#), email notification of topic 'S3-Bucket-Notify' that object creation on S3 bucket 'projectresearch108' that means SNS service working successfully.

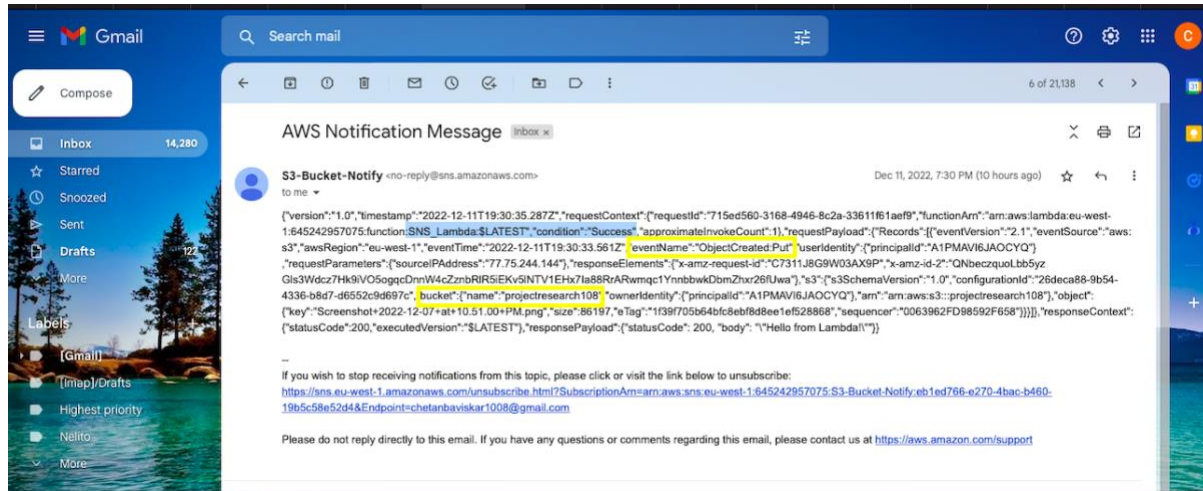


Figure 19: SNS topic S3-Bucket-Notify email notification to user

Therefore, even if user forgot to encrypt S3 bucket, using this approach bucket can be secured as lambda will trigger immediately if S3 bucket is created and provide encryption to secure the bucket.

In this way, AWS Cloud based automated encryption approach and alert notification of S3 bucket using lambda is configured and implemented to protect not only security of S3 bucket but also privacy of S3 objects in the bucket.

## References

CloudFormation, A. (2022) AWS CloudFormation Features, Amazon Web Services, Inc. Available at: <https://aws.amazon.com/cloudformation/features/>.

CloudTrail, A. (2022) AWS CloudTrail Features - Amazon Web Services, Amazon Web Services, Inc. Available at: <https://aws.amazon.com/cloudtrail/features/>.

SNS, A. (2022) Amazon Simple Notification Service (SNS) Features | Messaging Service | AWS, Amazon Web Services, Inc. Available at: <https://aws.amazon.com/sns/features/>.