

# Configuration Manual

MSc Research Project  
MSc in CyberSecurity

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National College of Ireland  
Project Submission Sheet  
School of Computing



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<b>Programme:</b>	MSc in CyberSecurity
<b>Year:</b>	2024-2025
<b>Module:</b>	MSc Research Project
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<b>Submission Due Date:</b>	12/12/2024
<b>Project Title:</b>	Configuration Manual
<b>Word Count:</b>	XXX
<b>Page Count:</b>	24

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<b>Date:</b>	27th January 2025

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# Configuration Manual

Mahesh Gavhane  
23111984

## 1 Introduction

The purpose of this document is to provide the basic information regarding the Logic App cloud setup which had been taken place, required systems specification for this project and the tools like Wireshark for testing purpose, PROM and Jupyter Notebook for visualization. With an aim to increase security and execution of Secure File Transfer in multi cloud (Azure to AWS) and within cloud (Azure to Azure) with log analysis and process mining. This configuration manual is created for the one who wants to replicate the same project as it contains all the steps for setting up the Cloud environment to implementation steps along with all the snapshots which will assist the user. This manual has all the information such as from where all the tools downloaded with software versions, and the URLs are added for reference.

## 2 System Specification

This Project uses a combination of tools, all are mentioned below:

Tool Version	Version
Visual Studio	Visual Studio 2022 (64-bit) - Version 17.11.5
Postman	Version - 11.21.0
PROM Tool	PROM 6.14 with 64 bit JRE8
Jupyter Notebook	v7.2.3 version
Wireshark	Version 4.4.2
WINSCP	Version 6.3.5

Figure 1: List of tools used

## 3 Environment Setups and Installation Steps Along with Scenario-based results

To execute the proposed solution, commence with Azure Environment Setup, AWS cloud setup, and install the tool required for executing the process, testing, and visualization.

- Step 1: Create an Azure Resource Group with details like subscriptions name and the name of the Resource Group with Azure Region, for this project, North Europe has been selected as Azure Region.

Microsoft Azure

Search resources, services, and docs (G+/I)

Home > Resource groups >

## Create a resource group

Basics Tags Review + create

**Resource group** - A container that holds related resources for an Azure solution. The resource group can include all the resources for the solution, or only those resources that you want to manage as a group. You decide how you want to allocate resources to resource groups based on what makes the most sense for your organization. [Learn more](#)

**Project details**

Subscription \* Azure for Students

Resource group \*

**Resource details**

Region \* (US) East US

- Step 2: After Resource Group, create an Integration Account with the details like Subscription and select the resource group that is already created in Step 1. Give the name of the Integration Account select the pricing tier and Azure Region and enable the Log Analytics Workspace for further analysis.

Microsoft Azure

Search resources, services, and docs (G+/I)

Home > Integration accounts >

## Create an integration account

Build enterprise integration and B2B/EDI solutions with logic apps. [Learn more](#)

**Project details**

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription \* Azure for Students

Resource group \* rg\_x23111984 [Create new](#)

**Instance details**

Integration account name \* Enter name...

Pricing Tier \*

Region \* North Europe

Associate with integration service environment ☐

Integration service environment

Enable log analytics ☒

Review + create < Previous : Basics Next : Tags > Download a template for automation

- Step 3: Create a Storage Account for hosting SFTP and setting up a Container for storing files, set up a Storage Account with a Subscription and existing Resource Group and give the proper Storage Account name.

Microsoft Azure

Search resources, services, and docs

Home

>

Storage accounts

>

## Create a storage account

Azure Storage is a Microsoft-managed service providing cloud storage that is highly available, secure, durable, scalable, and redundant. Azure Storage includes Azure Blobs (objects), Azure Data Lake Storage Gen2, Azure Files, Azure Queues, and Azure Tables. The cost of your storage account depends on the usage and the options you choose below. [Learn more about Azure storage accounts](#)

### Project details

Select the subscription in which to create the new storage account. Choose a new or existing resource group to organize and manage your storage account together with other resources.

Subscription \*

Azure for Students

Resource group \*

DefaultResourceGroup-NEU

Create new

### Instance details

Storage account name \*

Region \*

(Europe) North Europe

Deploy to an Azure Extended Zone

Primary service

Select a primary service

Performance \*

☒ **Standard:** Recommended for most scenarios (general-purpose v2 account)
   
☐ **Premium:** Recommended for scenarios that require low latency.

Previous

Next

Review + create

- Step 4: Set up SFTP server in Storage Account, Add 2 “Local User” and their “Authentication Method” and “Home Landing Directory”. One is for the source directory and the second is for the destination Directory.

Microsoft Azure

Search resources, services, and docs (G+)

Home

>

Storage accounts

>

x23111984

Storage accounts

<

x23111984 | SFTP

☆

...

Filter for any field...

Name

rgp231119843e5

rgp231119849dc

x23111984

SFTP

Search

Unignore and solve problems

Access Control (IAM)

Data migration

Events

Storage browser

Partner solutions

Favorites

SFTP

Containers

Data storage

+

Add local user

✓

Enable SFTP

✗

Disable local users

↺

Refresh

Local users and/or SFTP is disabled for this account. To connect to storage account via SFTP endpoint, enable Local users and SFTP.

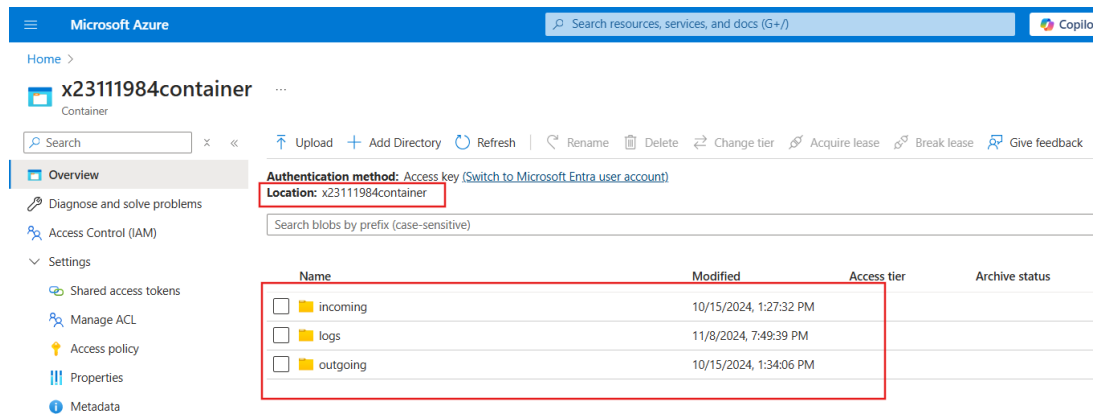
Create or edit local users below in order to utilize SSH File Transfer Protocol (SFTP). [Learn more](#)

Filter local users by prefix (case-sensitive)

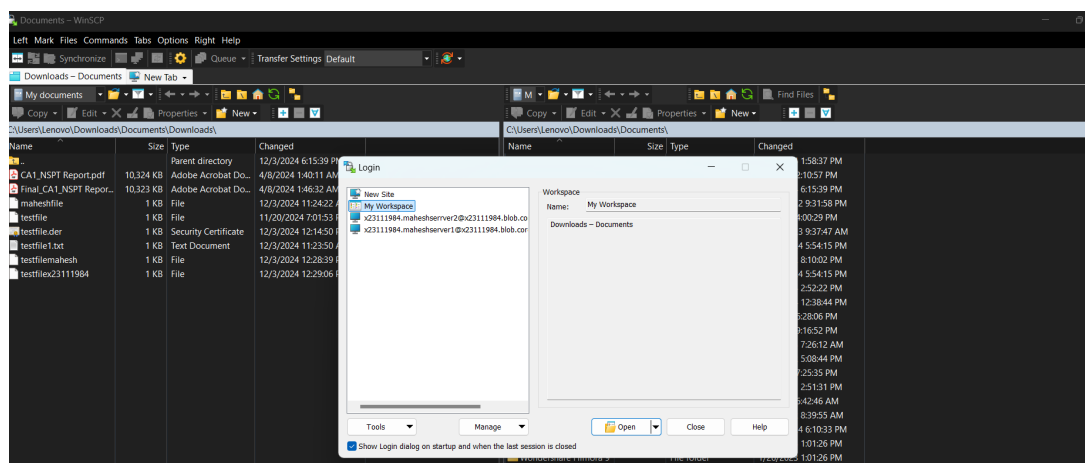
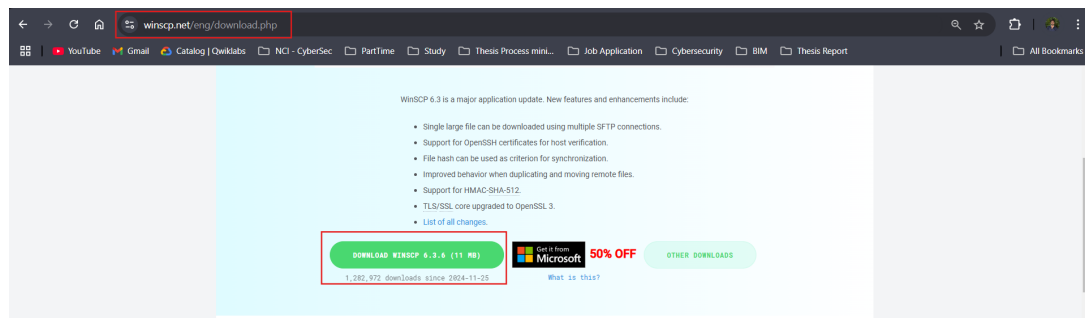
Connection string	Authentication method	Permissions	Home (landing) directory
x23111984.maheshserver2@x23111984.bl...	SSH Password (Regenerate)	Set	x23111984container/outgoing
x23111984.maheshserver1@x23111984.bl...	SSH Password (Regenerate)	Set	x23111984container/incoming

- Step 5: Setup Azure Container using a storage account for storing and processing purposes. After creating the container, create different directories for dropping and uploading the file in the source and destination directories. For this project, 3 directories have been created Incoming, Outgoing, and Logs for dropping, uploading and storing the generated logs.

3



- Step 6: Install WinSCP to login to SFTP local user created in step 4 using credential and check if credentials are working properly and are able to login to WinSCP. <sup>1</sup>



- Step 7: Create Azure Log Analytics Workspace and check Enable Log Analytics checkbox is ticked while creating the integration account. Give your workspace a proper name and select the same Resource Group, which is used while creating the Storage Account and Integration Account.

<sup>1</sup><https://winscp.net/eng/download.php>

Microsoft Azure

Home > Log Analytics workspaces >

## Create Log Analytics workspace

Basics Tags Review + Create

**Project details**  
Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription \* Azure for Students

Resource group \* [Create new](#)

**Instance details**

Name \*

Region \* North Europe

[Review + Create](#) < Previous Next : Tags >

- Step 8: Search for Logic App in the Azure portal, and click on the Add option to create the New Logic App. While creating the LA, select a Hosting Option – Consumption. Use Subscription, Resource Group and give proper name to Logic App.

Microsoft Azure

Home > Logic apps > Create Logic App >

## Create Logic App (Multi-tenant)

Basics Tags Review + create

Create a logic app, which lets you group workflows as a logical unit for easier management, deployment and sharing of resources. Workflows let you connect your business-critical apps and services with Azure Logic Apps, automating your workflows without writing a single line of code.

**Project Details**  
Select a subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription \* Azure for Students

Resource Group \* (New) Resource group [Create new](#)

**Instance Details**

Logic App name \* Logic App name

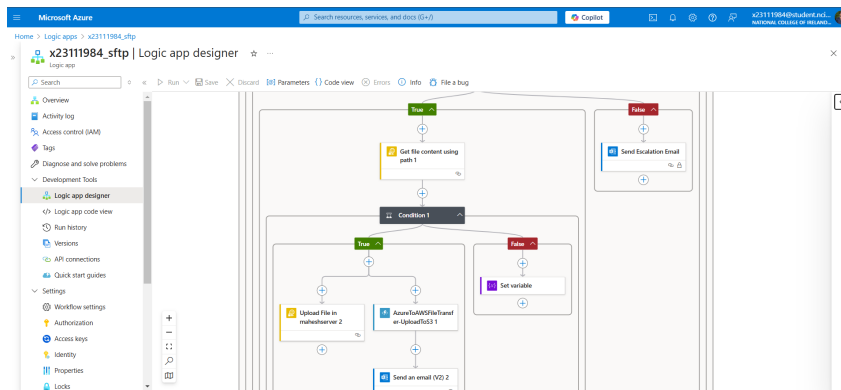
Region \* North Central US

Enable log analytics \* ☐ Yes ☒ No

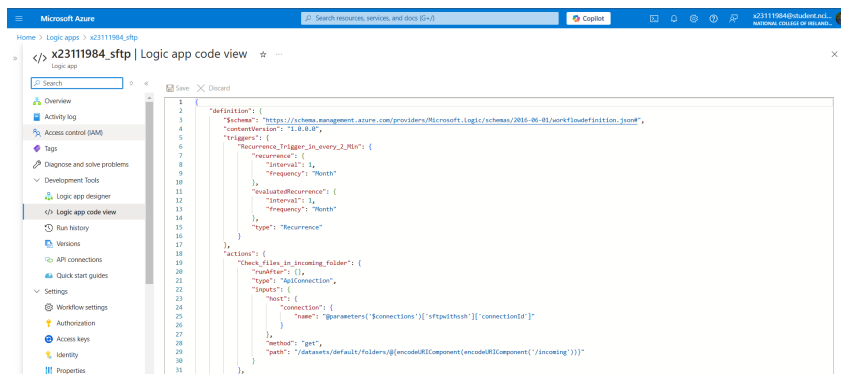
**Looking for the classic consumption create experience? [Click here](#)**

[Review + create](#) < Previous Next : Tags >

- A. Logic App – “x23111984\_sftp” is created by using designer and codeview. In the designer view click on add action to add action as shown below. For this project, the below flow has been created, if want to replicate the flow the same workflow. **Designer View**



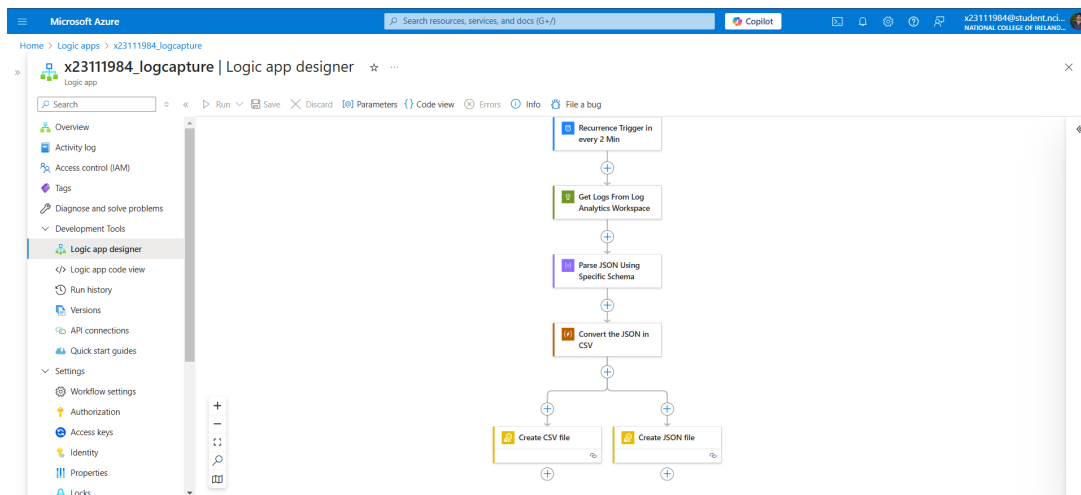
## Code View



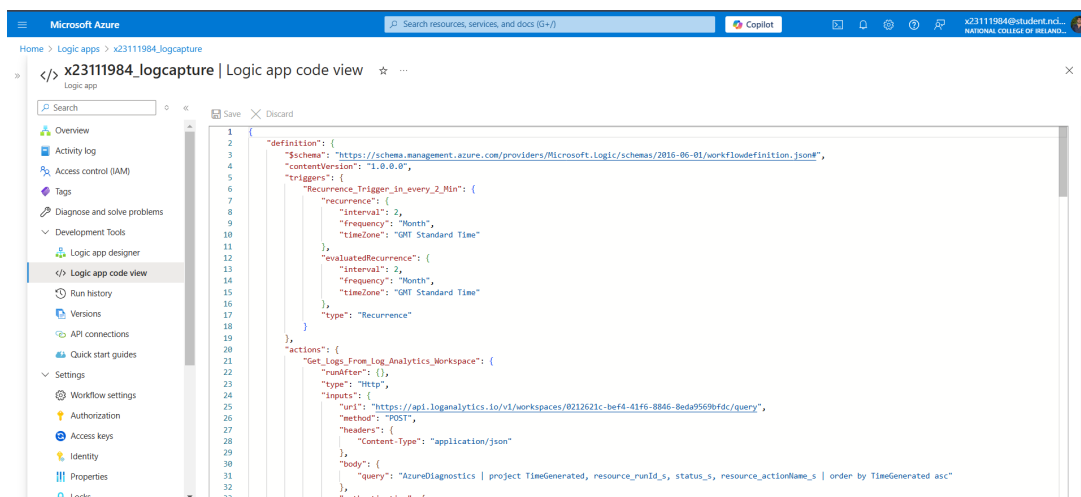
- B. Logic App: “x23111984.logcapture” is created by using designer and codeview. Click on Logic App Designer and select an action to create a flow as shown below. For this project, the below flow has been created, if want to replicate the flow of the same workflow. This flow helps in capturing all logs and saving the generated logs in JSON and CSV format and uses the director created in the storage account to the logs in the “Logs Folder”.



## Logic App Designer View



## Logic App CodeView



- Step 10: Search for Function App in Azure Portal, create Function App, give proper function name, select Runtime Stack, and make sure was to select the same resource group that created while setting up the Integration Account.

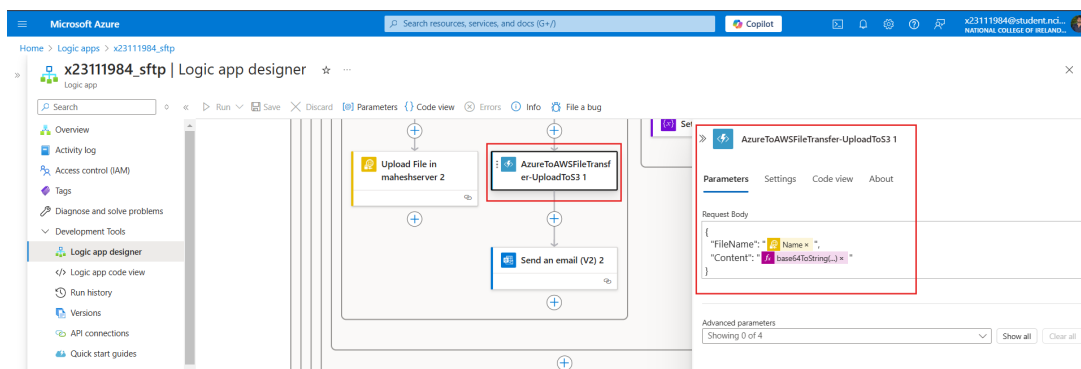
*Upload the created function in Azure Function App under the name of the created function.*

```

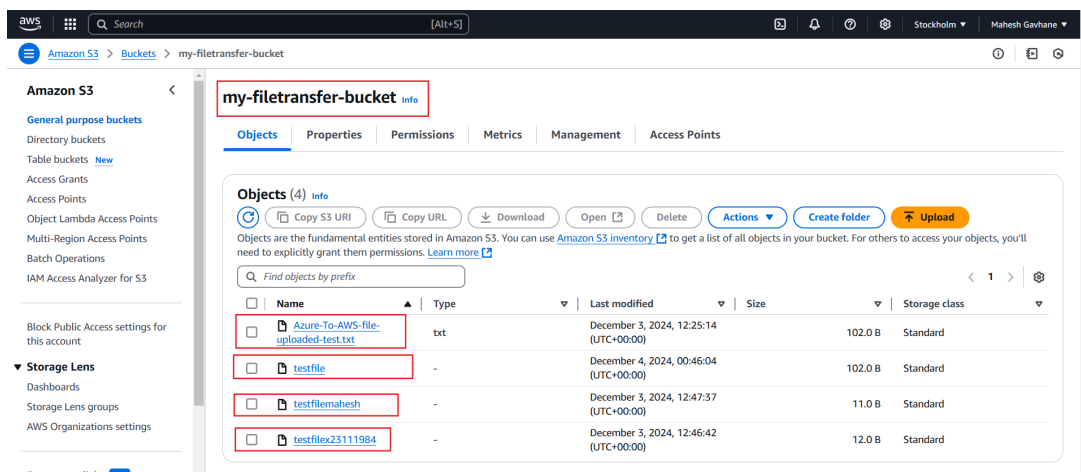
1 using System.IO;
2 using System.Net;
3 using System.Text.Json;
4 using System.Threading.Tasks;
5 using Microsoft.AspNetCore.Mvc;
6 using Microsoft.Azure.Functions.Worker;
7 using Microsoft.Extensions.Logging;
8 using Amazon.S3;
9 using Amazon.S3.Model;
10 using System;
11
12
13
14 public class UploadToS3Function
15 {
16     private static readonly string bucketName = "my-filetransfer-bucket"; // Replace with your bucket name
17     private static readonly string accessKey = "AKIAIOSFODNN7EXAMPLE"; // Replace with your AWS Access Key
18     private static readonly string secretKey = "wJalrXU3WhMbzKhpS6O3r3jz9zBq4kVnL"; // Replace with your AWS Secret Key
19     private static readonly Amazon.RegionEndpoint region = Amazon.RegionEndpoint.USEast1; // Replace with your AWS region
20
21     [Function("UploadToS3")]
22     public async Task<HttpResponseData> Run(
23         [HttpTrigger(AuthorizationLevel.Function, "post", Route = null)] HttpRequestData req,
24         FunctionContext executionContext)
25     {
26         var log = executionContext.GetLogger("UploadToS3Function");
27         log.LogInformation("C# HTTP trigger function processed a request.");
28
29         // Read the request body
30         string requestBody;
31         using (var reader = new StreamReader(req.Body))
32         {
33             requestBody = await reader.ReadToEndAsync();
34         }
35
36         // Deserialize the request body to get filename and content
37         FileUploadRequest fileUploadRequest;
38         try
39         {
40             fileUploadRequest = JsonSerializer.Deserialize<FileUploadRequest>(requestBody);
41             if (string.IsNullOrEmpty(fileUploadRequest.FileName) || string.IsNullOrEmpty(fileUploadRequest.Content))
42             {
43                 return req.CreateResponse(HttpStatusCode.BadRequest);
44             }
45         }
46         catch { }
47
48         // Upload the file to S3
49         using (var client = new AmazonS3Client(new BasicAWSCredentials(accessKey, secretKey), region))
50         {
51             var uploadRequest = new PutObjectRequest
52             {
53                 BucketName = bucketName,
54                 Key = fileUploadRequest.FileName,
55                 InputStream = new MemoryStream(Encoding.UTF8.GetBytes(requestBody))
56             };
57             client.PutObject(uploadRequest);
58         }
59
60         return req.CreateResponse(HttpStatusCode.OK);
61     }
62 }

```

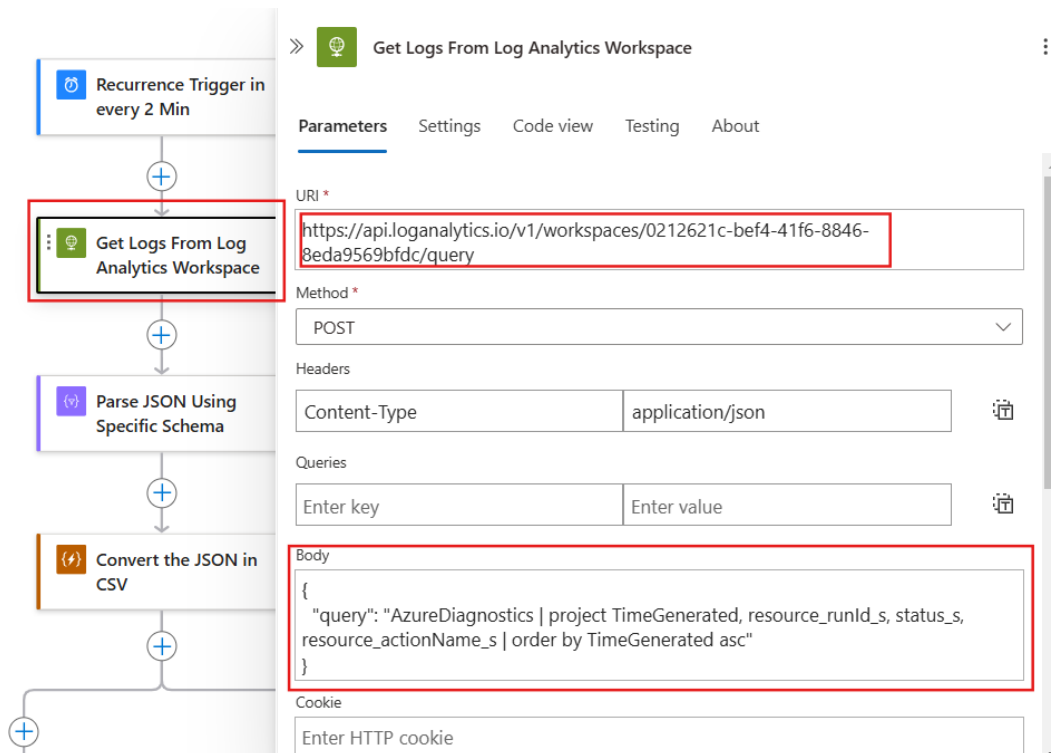
*Add Function App Action in Azure Logic App, select the created Function App, add the request body to execute, and call the function from the logic app only.*



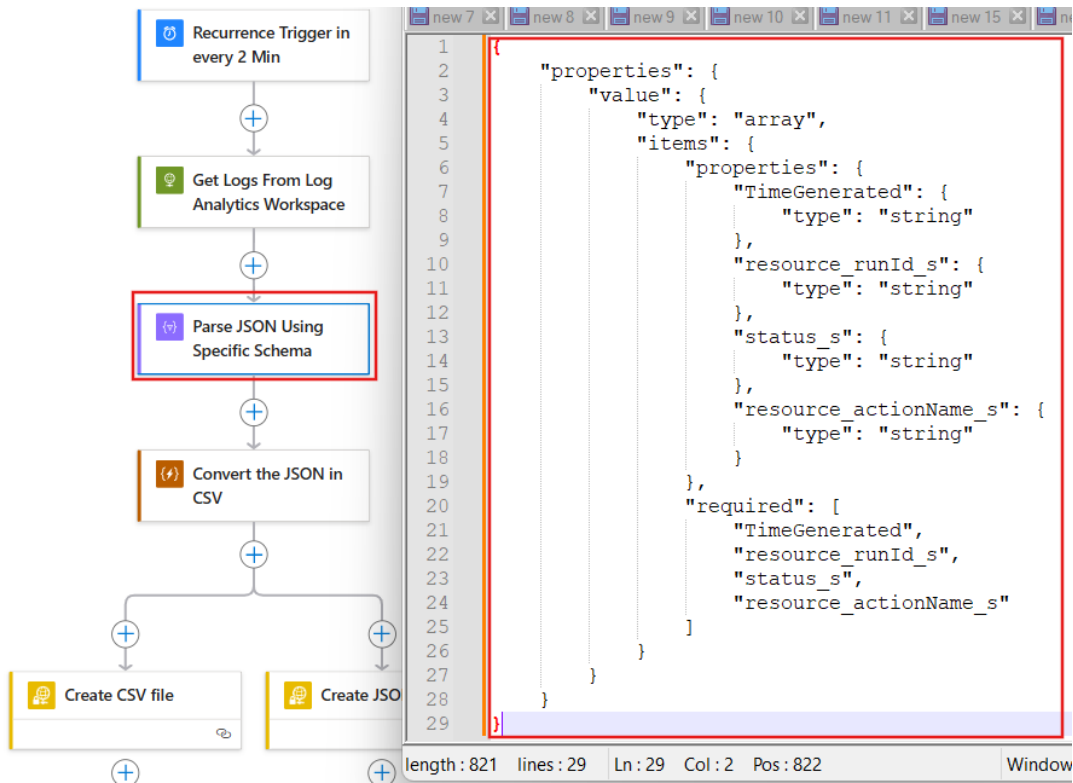
*Setup AWS environment for storing processed file, create AWS S3 bucket with proper S3 bucket name. In this project, AWS S3 bucket is created to store the transmitted file which shows Azure to AWS workflow.*



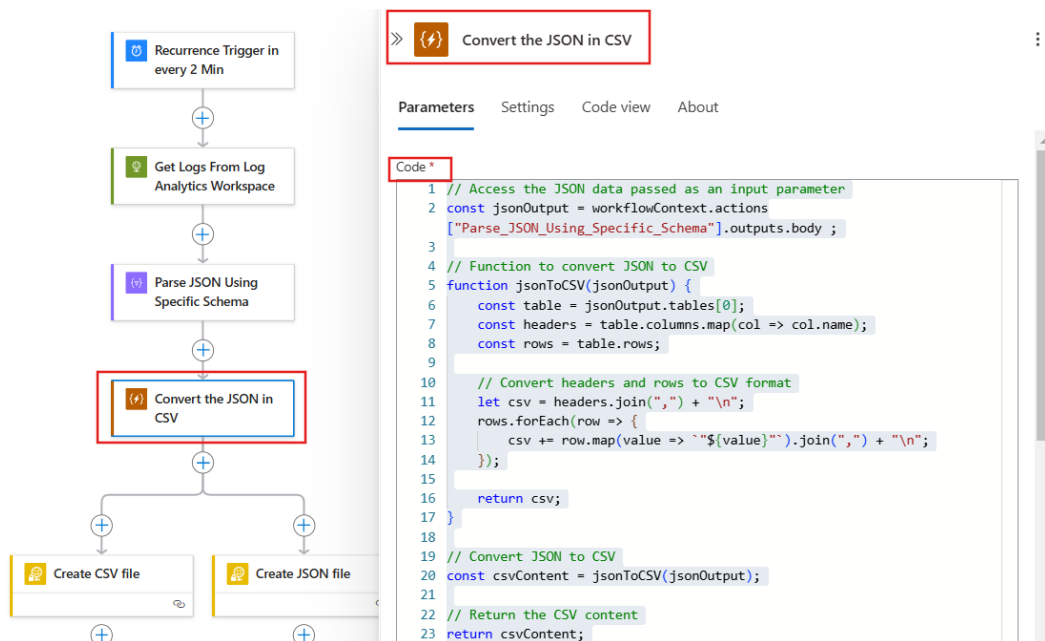
- Step 11: Using Logic App – “x23111984logcapture”, generate the logs and once created, download them from Storage Account for further analysis. Below is the CSV structure generated by Logic App. To capture the logs from Log Analytics Workspace and to convert the required JSON format into CVS format KQL query, Schema, and JavaScript code have been used as shown below.
  - Use Action called “Log Analytics Workspace” with their URI and KQL query to capture the log from the workspace.



- Use the action “Parse JSON” with the given schema to convert the JSON into format JSON format.



- For converting JSON to CSV format, use the “JavaScript” action with the code shown below.

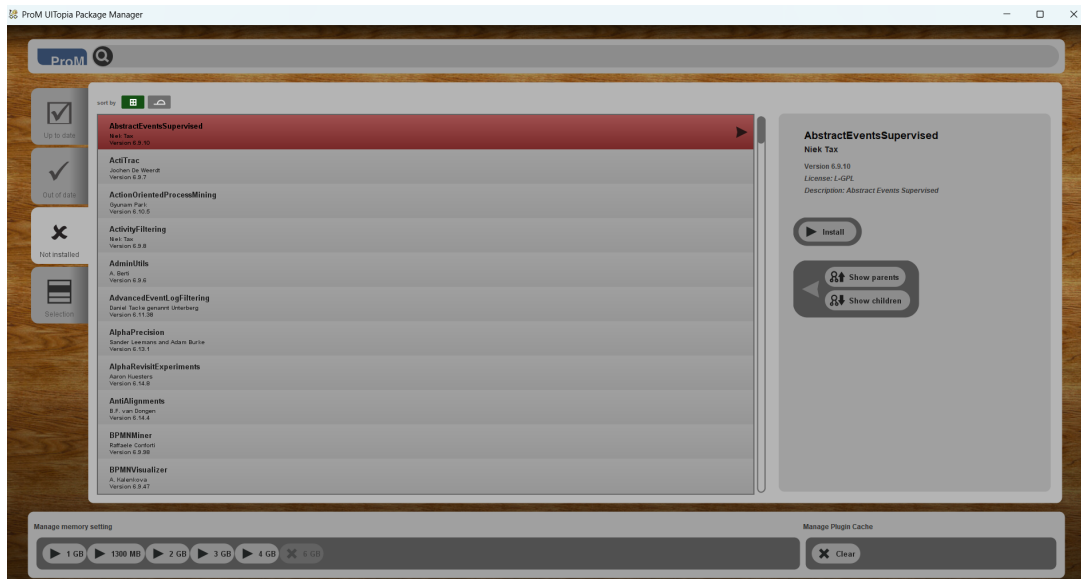


- After converting JSON to CSV, Logic App stores both 'logs.json' and 'logs.csv' in the storage account as shown below.

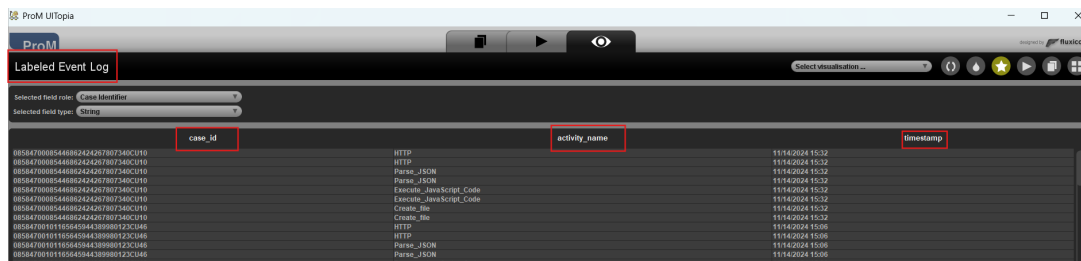
**Result: Logic App generates Logs.csv**



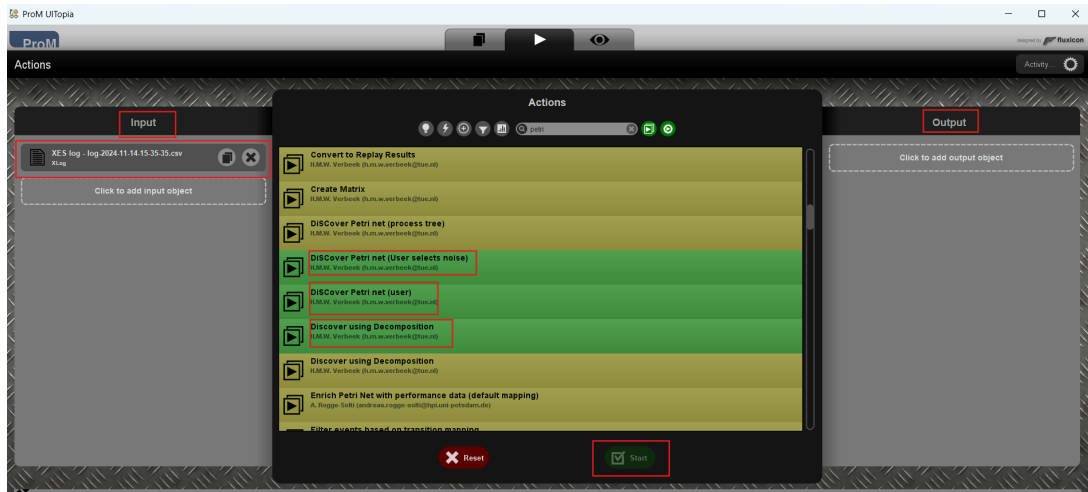
- a) Installing PROM tool, Open the Process Mining PROM tool package manager to import packages like CSV import and required packages based on Process Mining methods.



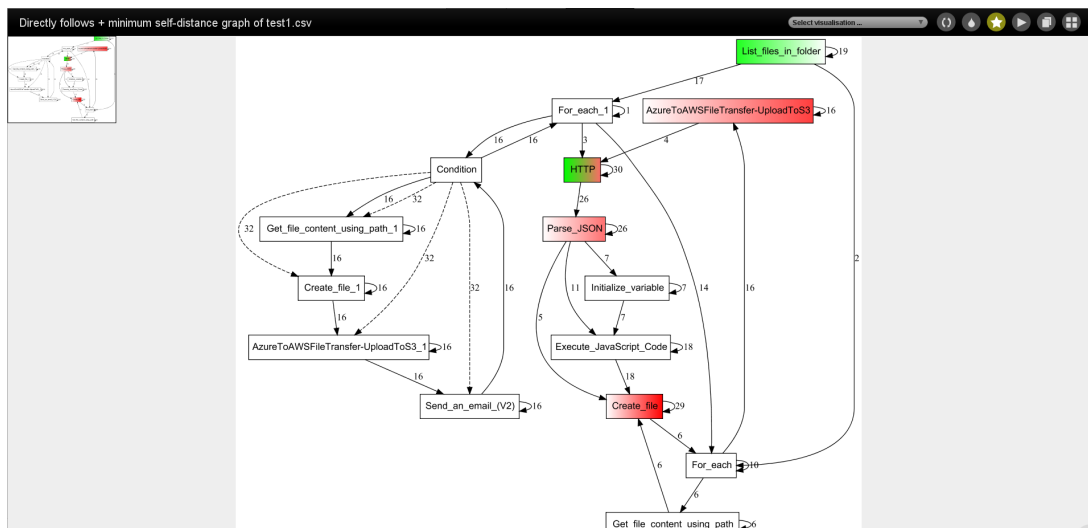
- b) By using generated logs.CSV from log capture Logic App, import that CSV file in the PROM tool and create Labelled Event Logs by using the action – “Infer Case ID”, select the attribute and click on continue. The structure of Labeled Event Logs are shown below.



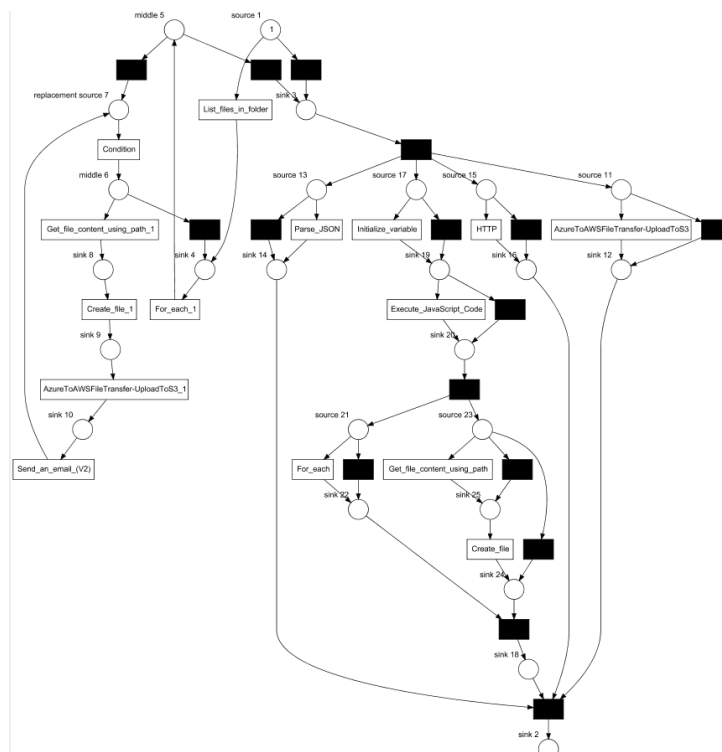
- c) Export log to workspace with name starts “XESLog” and using that created Event Log in input, apply the method which can create a graph for analyzing the workflow. For this project, we use the “Petri Net Flow method” and “Direct Follow method” as shown below.



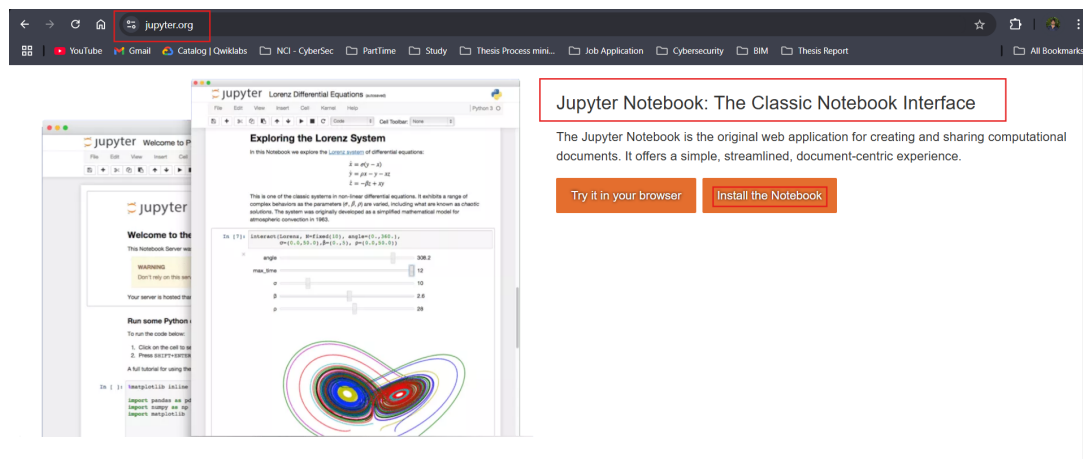
## Direct Follow Graph :



## Petri Net Flow Graph:



- Step 13: For visualization, install Jupyter Notebook from the official website, and use Python libraries for visualizing the graphs.<sup>3</sup>



- a) Import Python libraries like “Pandas” and “Numpy” as shown below.

<sup>3</sup><https://jupyter.org/>



```
[210]: import pandas as pd
import numpy as np
from sklearn.preprocessing import LabelEncoder
import matplotlib.pyplot as plt

[212]: data = pd.read_csv("C:\\Users\\Lenovo\\Desktop\\Thesis Part 2\\implementation\\log-2024-11-14-15-35.csv")

[214]: print(data.head())
```

	TimeGenerated	resource_runId_s	status_s
0	2024-10-25T00:30:48.7130657Z	08584717906367962677905454645CU14	Running
1	2024-10-25T00:30:48.7184385Z	08584717906367962677905454645CU14	Succeeded
2	2024-10-25T00:30:48.7276286Z	08584717906367962677905454645CU14	Succeeded
3	2024-10-25T00:30:48.7776523Z	08584717906367962677905454645CU14	Running
4	2024-10-25T00:30:48.9728565Z	08584717906367962677905454645CU14	Succeeded

	resource_actionName_s
0	NaN
1	NaN
2	NaN
3	List_files_in_folder
4	List_files_in_folder

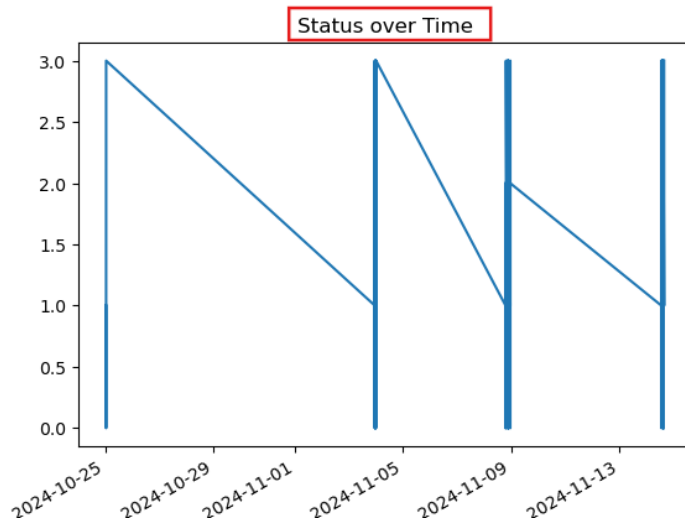
- b) After installing the jupyter and importing libraries, generate various graph which helps in analyzing the overall workflow and any irregularities and deviation in the graphs. For this project, various graphs has been generated as shown below.

```
# Calculate the duration for each `resource_runId_s`
data['duration'] = data.groupby('resource_runId_s')['TimeGenerated'].transform(lambda x: x.max() - x.min())

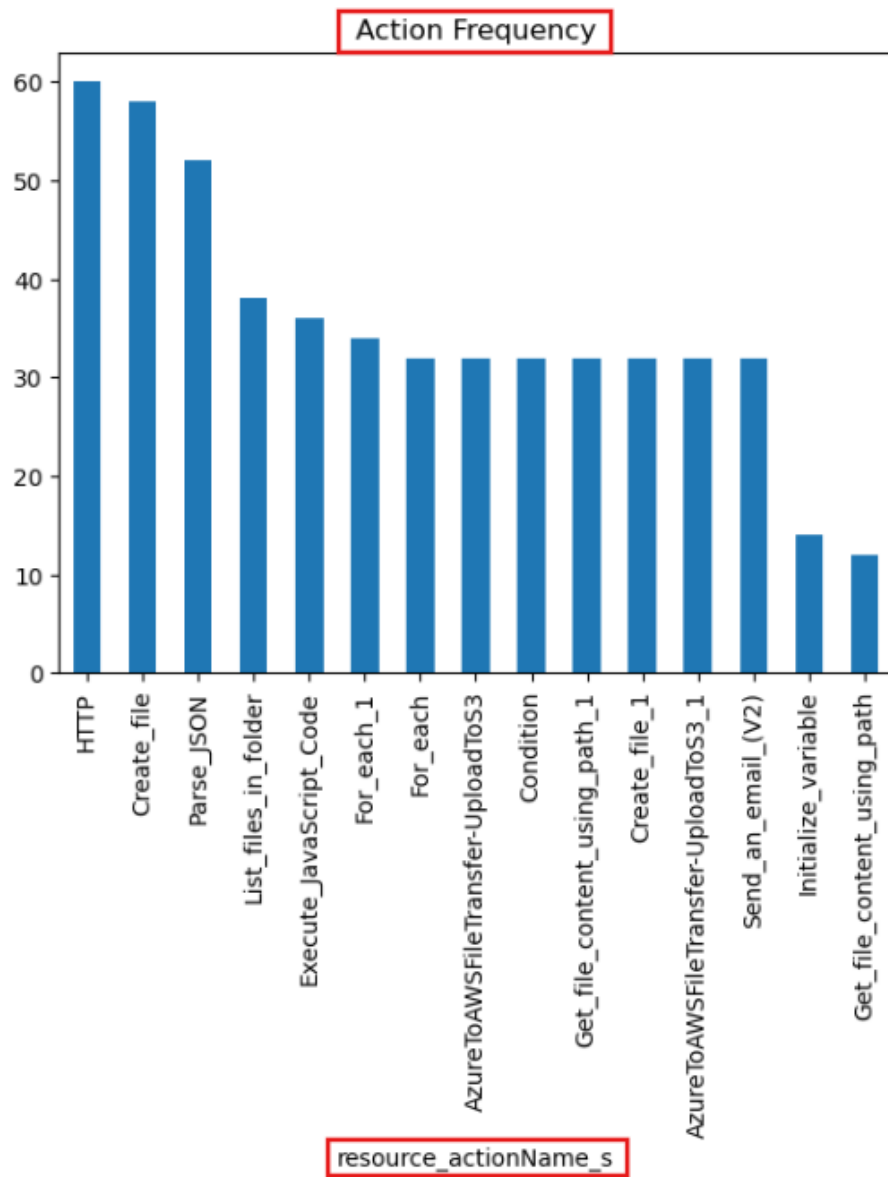
# Count action occurrences per run ID
action_counts = data.groupby('resource_runId_s')['resource_actionName_s'].value_counts().unstack(fill_value=0)

# Merge counts back to the dataset
data = data.merge(action_counts, on='resource_runId_s', how='left')

# Time-series analysis: Plot activity over time
data.set_index('TimeGenerated')['status_encoded'].plot(title='Status over Time')
plt.show()
```



```
# Action frequency distribution
data['resource_actionName_s'].value_counts().plot(kind='bar', title='Action Frequency')
plt.show()
```



```

# Extract hour and day from the `TimeGenerated` column
data['hour'] = data['TimeGenerated'].dt.hour
data['day'] = data['TimeGenerated'].dt.date

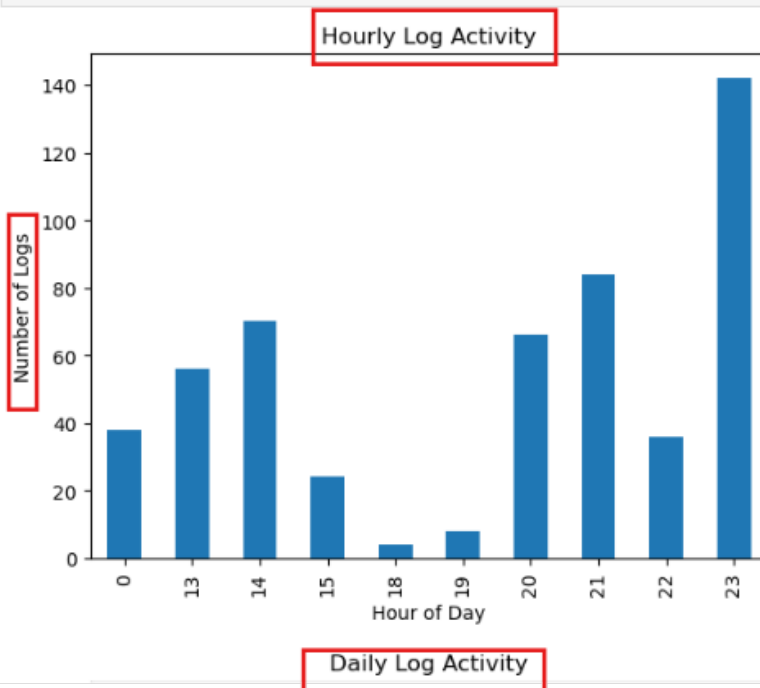
# Group by hour to detect hourly patterns
hourly_activity = data.groupby('hour').size()

# Plot hourly patterns
import matplotlib.pyplot as plt
hourly_activity.plot(kind='bar', title='Hourly Log Activity')
plt.xlabel('Hour of Day')
plt.ylabel('Number of Logs')
plt.show()

# Group by day to detect daily activity patterns
daily_activity = data.groupby('day').size()

# Plot daily patterns
daily_activity.plot(title='Daily Log Activity')
plt.xlabel('Date')
plt.ylabel('Number of Logs')
plt.show()

```



```

import plotly.graph_objects as go

# Prepare data for Sankey diagram
sankey_data = data.groupby(['resource_actionName_s', 'status_s']).size().reset_index(name='count')

# Create mappings for source and target nodes
all_nodes = list(set(sankey_data['resource_actionName_s']).union(set(sankey_data['status_s'])))
node_map = {node: i for i, node in enumerate(all_nodes)} # Map node names to indices

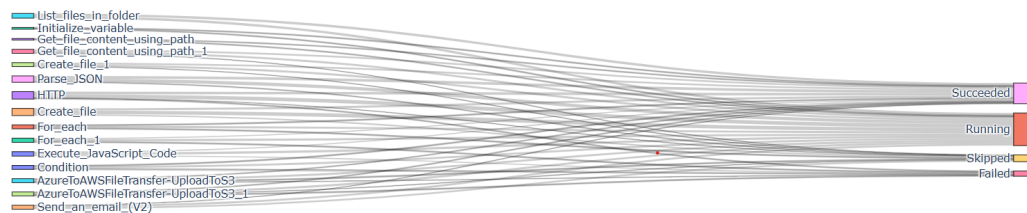
# Map source and target columns to their indices
sankey_data['source'] = sankey_data['resource_actionName_s'].map(node_map)
sankey_data['target'] = sankey_data['status_s'].map(node_map)

# Build the Sankey diagram
fig = go.Figure(go.Sankey(
    node=dict(
        pad=15,
        thickness=20,
        line=dict(color="black", width=0.5),
        label=all_nodes # Use all unique nodes as labels
    ),
    link=dict(
        source=sankey_data['source'], # Map sources
        target=sankey_data['target'], # Map targets
        value=sankey_data['count'] # Use count as the weight
    )
))

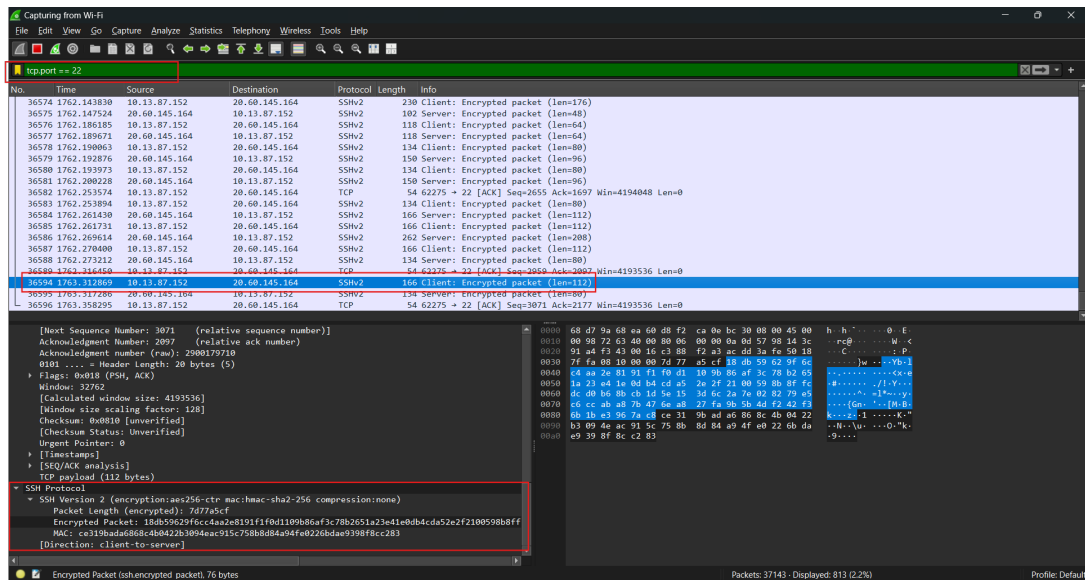
# Set title and display the figure
fig.update_layout(title_text="Sankey Diagram: Actions to Statuses", font_size=10)
fig.show()

```

Sankey Diagram: Actions to Statuses







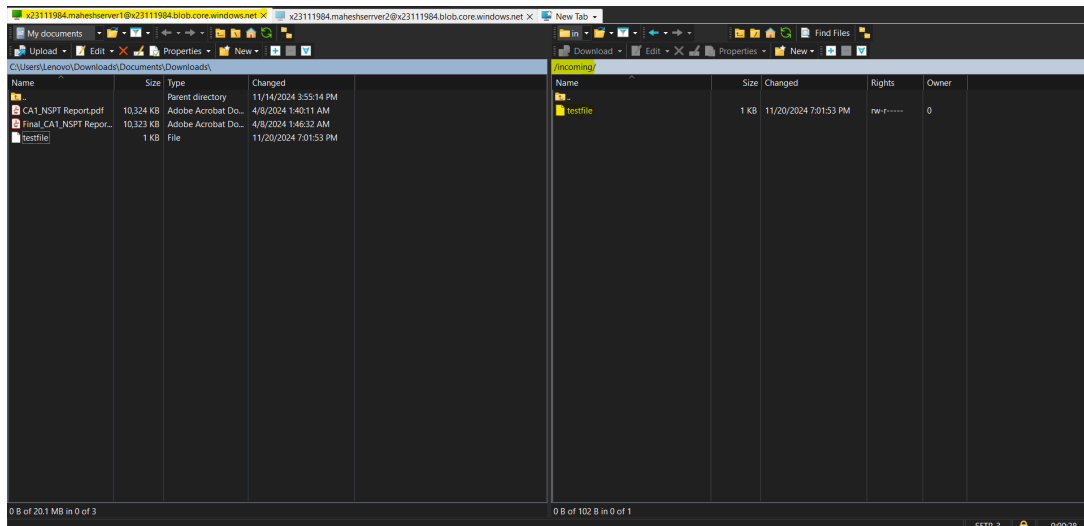
## 4 Senario Based Results

### 4.1 Senario I

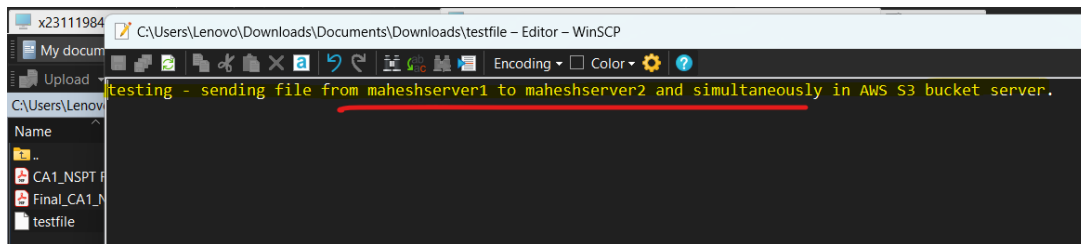
–Within Azure: From the SFTP server to designated storage folders.

**RunId - 08584688499449355123761745814CU47**

**File Name - testfile drops in maheshserver1 (Home Directory x23111984container/incoming)**



–Logic App successfully triggered and after processing the file content is encoded during transit. Initially, the file Content of test file shown below:

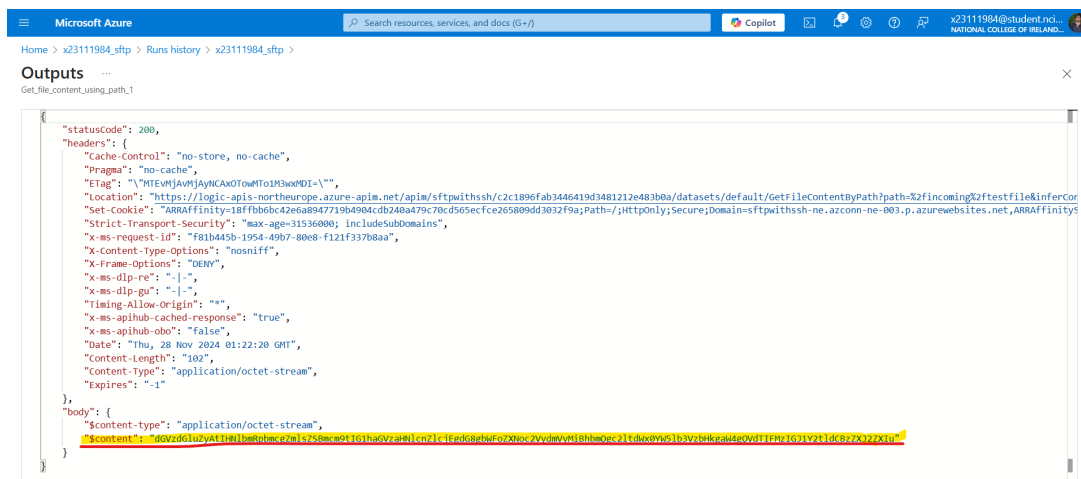


### Encoded Content:

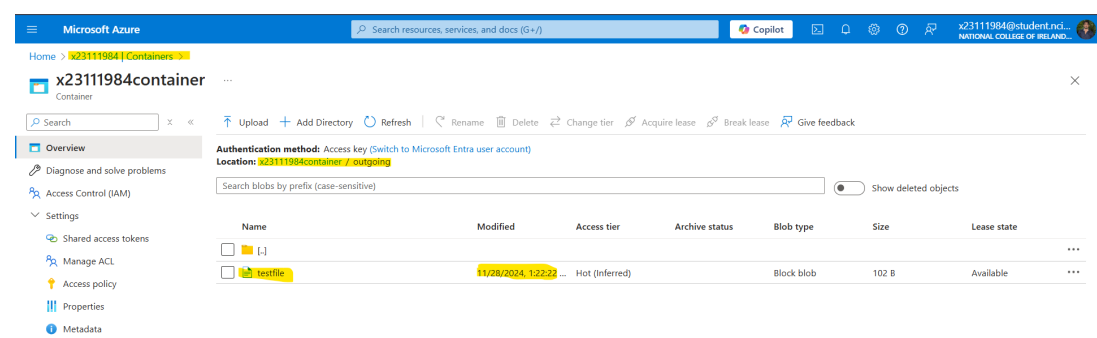
”\$content”: ”dGVzdGluZyAtIHNlbmRpbmcgZmlsZSBmcm9tIG1haGVzaHNlcnZlcjEgdG8gbWFOZXNoc2VydMvYMiBhbmQgc2ltdWx0YW5lb3VzbHkgaW4gQVdTIFMzIGJ1Y2tldCBzZXJ2ZXIu”

### Decode Content:

Testing - Sending file from maheshserver1 to maheshserver2 and simultaneously in AWS S3 bucket server.



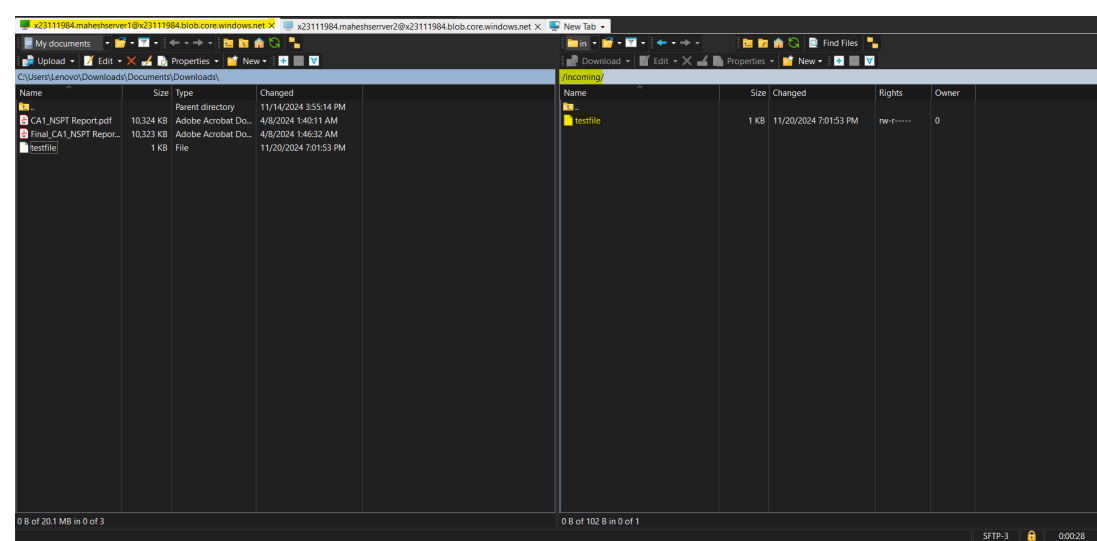
–After processing, the file is in the destination (Outgoing) folder.



## 4.2 Senario II

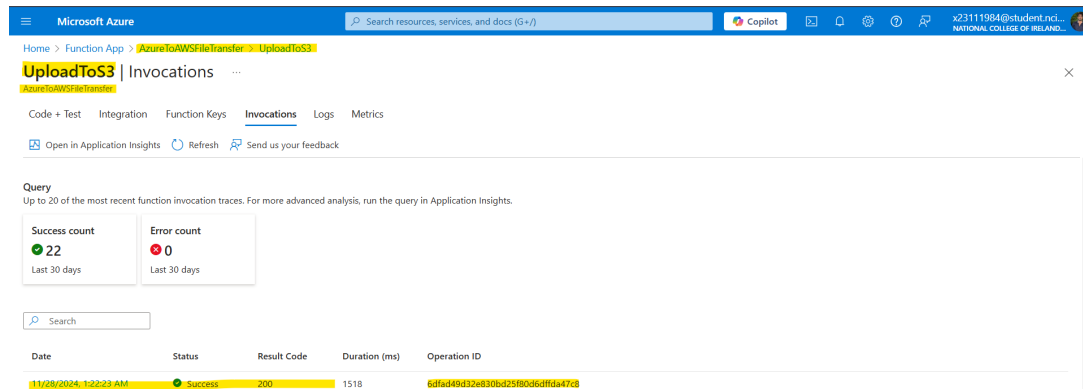
Across Clouds: From Azure to AWS S3 using Azure Functions and the AWS S3 client.

–Same test file has been dropped in an incoming folder.



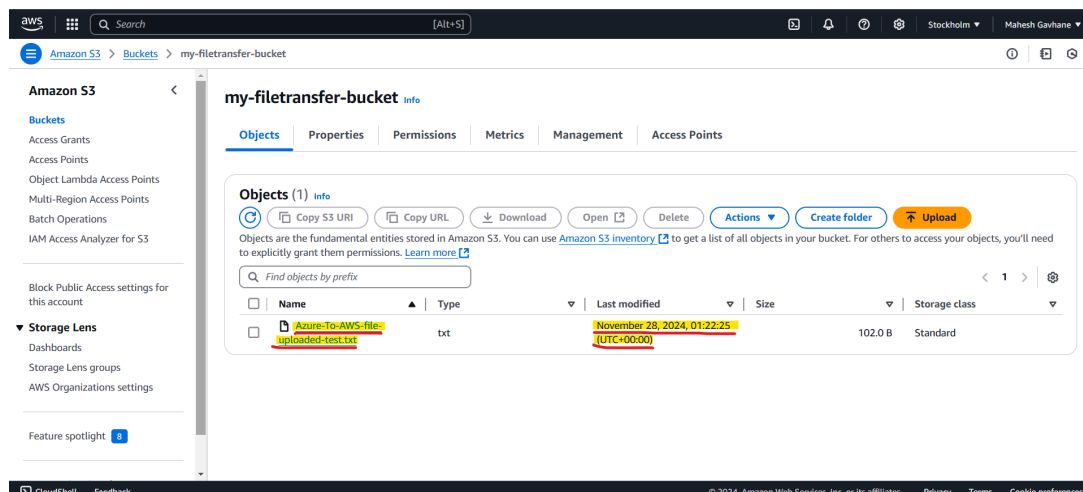


–Azure Logic App, Action - Azure Function App is triggered and invoked function – UploadToS3 as shown below.

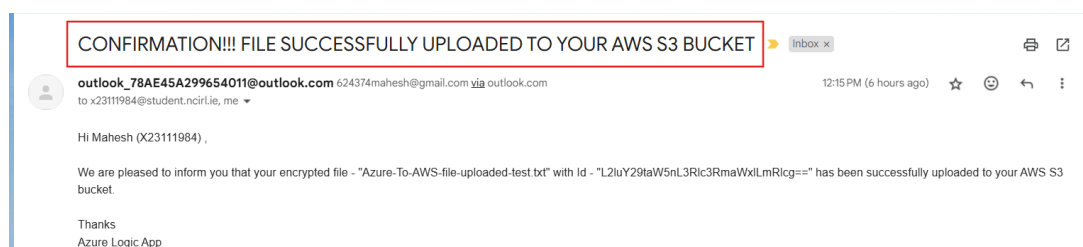


Date	Status	Result Code	Duration (ms)	Operation ID
11/28/2024, 1:22:23 AM	Success	200	1518	cd1a449d32e830b2d25f80d6dffd447c3

–After successfully processing the logic app, testfile uploaded to AWS S3 Bucket and Logic App sent confirmation email as shown below.



Name	Type	Last modified	Size	Storage class
Azure-To-AWS-file-uploaded-test.txt	txt	November 28, 2024, 01:22:25 UTC	102.0 B	Standard



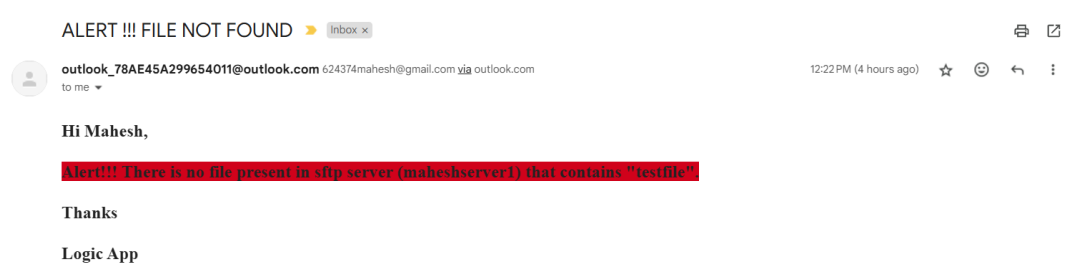
**CONFIRMATION!!! FILE SUCCESSFULLY UPLOADED TO YOUR AWS S3 BUCKET**

Hi Mahesh (X23111984) ,

We are pleased to inform you that your encrypted file - "Azure-To-AWS-file-uploaded-test.txt" with Id - "L2luY29taW5nL3Ric3RmaWxLmRic==" has been successfully uploaded to your AWS S3 bucket.

Thanks  
Azure Logic App

–If Logic App terminates, send alert mail with subject line “Alert File Not Found”.



After processing the file successfully and capturing the log, generate the graphs for Visualization using PROM Tool and Jupyter Notebook as mentioned in Step 3.