

Configuration Manual

MSc Research Project
MSc in Cloud Computing

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Project Submission Sheet
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Configuration Manual

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1 Introduction

The paper provides instructions on how to correctly recreate the project. The project is composed of Python programming.

2 System Requirements

RAM - 4 GB

OS - Window 7 to 10

Python version - 3.8 or above

AWS account - for storing the file

Mail trap account - for sending key over mail

3 Libraries Required

Following libraries were required to run the code. Some libraries are inbuilt with python and some need to be installed.

Boto - Programmers can use Amazon Web Services (AWS Boto3's) Python Software Development Kit (SDK) to connect their Python-based applications to services like Amazon S3.

To install boto3 module following command will be used:

pip install boto3

Cryptography - is the research of widely used cryptographic techniques, such as message digests, key derivation functions, and symmetric cyphers. It includes both low-level interfaces for various approaches and high-level recipes. To install cryptography module following command will be used:

pip install cryptography

4 EncryptionScript

```
import os
import base64
import smtplib
from zipfile import ZipFile
# import the corresponding modules
from email import encoders
from email.mime.base import MIMEBase
from email.mime.multipart import MIMEMultipart
from email.mime.text import MIMEText
import cryptography
from cryptography.fernet import Fernet
from cryptography.hazmat.primitives import hashes
from cryptography.hazmat.primitives.asymmetric import rsa
from cryptography.hazmat.primitives.ciphers import Cipher, algorithms, modes
from cryptography.hazmat.primitives import serialization, hashes
from cryptography.hazmat.primitives.asymmetric import padding, rsa, utils
from cryptography.hazmat.backends import default_backend
import boto3
import time

# get the start time
st = time.process_time()
port = 2525
smtp_server = "smtp.mailtrap.io"
login = "a2329c8a81a8c1" # paste your login generated by Mailtrap
password = "4f33af52abebb7" # paste your password generated by Mailtrap

subject = "Encrypted Key Received"
sender_email = "suyashtripathi.in@gmail.com"
receiver_email = "suyashtripathi.in@gmail.com"

message = MIMEMultipart()
message["From"] = sender_email
message["To"] = receiver_email
message["Subject"] = subject

# Add body to email
body = "New Encryption key received"
message.attach(MIMEText(body, "plain"))
```

```
# Add body to email
body = "New Encryption key received"
message.attach(MIMEText(body, "plain"))
# Generate a private/public key pair
private_key = rsa.generate_private_key(
    public_exponent=65537,
    key_size=2048
)

public_key = private_key.public_key()

# Save the RSA private key to a PEM file
pem = private_key.private_bytes(
    encoding=serialization.Encoding.PEM,
    format=serialization.PrivateFormat.PKCS8,
    encryption_algorithm=serialization.NoEncryption()
)
with open("private_key.pem", "wb") as file:
    file.write(pem)

# Get the file name from the user
file_name = input('Enter the file name: ')

# Read the contents of the file
with open(file_name, 'rb') as f:
    file_data = f.read()

# Encrypt the file using AES
key = Fernet.generate_key()
fernet = Fernet(key)
encrypted_data = fernet.encrypt(file_data)

# Encrypt the AES key using RSA
encrypted_key = public_key.encrypt(
    key,
    padding.OAEP(
        mgf=padding.MGF1(algorithm=hashes.SHA256()),
        algorithm=hashes.SHA256(),
        label=None
```

```

filename = "Keysfile.zip"
# We assume that the file is in the directory where you run your Python script from
with open(filename, "rb") as attachment:
    # The content type "application/octet-stream" means that a MIME attachment is a binary file
    part = MIMEBase("application", "octet-stream")
    part.set_payload(attachment.read())

# Encode to base64
encoders.encode_base64(part)

# Add header
part.add_header(
    "Content-Disposition",
    f"attachment; filename= {filename}",
)

# Add attachment to your message and convert it to string
message.attach(part)
text = message.as_string()

# send your email
with smtplib.SMTP("smtp.mailtrap.io", 2525) as server:
    server.login(login, password)
    server.sendmail(
        sender_email, receiver_email, text
    )
print('Encrypted key sent on mail')

# Set up the S3 client
s3 = boto3.client('s3')

# Upload the encrypted file to S3
s3.upload_file(
    'encrypted_' + file_name,
    'suyashbucket',
    'encrypted_' + file_name
)

print('File successfully uploaded to S3')

```

```

# Encrypt the AES key using RSA
encrypted_key = public_key.encrypt(
    key,
    padding.OAEP(
        mgf=padding.MGF1(algorithm=hashes.SHA256()),
        algorithm=hashes.SHA256(),
        label=None
    )
)

# Save the encrypted key to a file
with open('encrypted_key.txt', 'wb') as f:
    f.write(encrypted_key)

# Save the encrypted file to a new file
with open('encrypted_' + file_name, 'wb') as f:
    f.write(encrypted_data)
# get the end time

time.sleep(3)
print('File successfully encrypted and key saved to encrypted_key.txt')

et = time.process_time()
# get execution time
res = et - st
print('CPU Execution time:', res, 'seconds')

with ZipFile('Keysfile.zip', 'w') as zip_object:
    # Adding files that need to be zipped
    zip_object.write('encrypted_key.txt')
    zip_object.write('private_key.pem')

filename = "Keysfile.zip"

```

5 Decryption Script

```
import os
from cryptography.hazmat.primitives.ciphers import Cipher, algorithms, modes
from cryptography.hazmat.primitives import serialization, hashes
from cryptography.hazmat.primitives.asymmetric import padding, rsa, utils
from cryptography.hazmat.backends import default_backend
from cryptography.fernet import Fernet
from cryptography.hazmat.primitives import hashes
from cryptography.hazmat.primitives.asymmetric import padding
from cryptography.hazmat.primitives.asymmetric import rsa

# Read the RSA private key from the PEM file
with open("private_key.pem", "rb") as file:
    pem = file.read()
    private_key = serialization.load_pem_private_key(
        pem,
        password=None,
        backend=default_backend()
    )

# Read the encrypted key from the file
with open('encrypted_key.txt', 'rb') as f:
    encrypted_key = f.read()

# Decrypt the key using the RSA private key
key = private_key.decrypt(
    encrypted_key,
    padding.OAEP(
        mgf=padding.MGF1(algorithm=hashes.SHA256()),
        algorithm=hashes.SHA256(),
        label=None
    )
)
```

```
# Decrypt the key using the RSA private key
key = private_key.decrypt(
    encrypted_key,
    padding.OAEP(
        mgf=padding.MGF1(algorithm=hashes.SHA256()),
        algorithm=hashes.SHA256(),
        label=None
    )
)

# Decrypt the file using the decrypted AES key
fernet = Fernet(key)
encrypted_data = open("encrypted_plain.txt", "rb").read()
decrypted_data = fernet.decrypt(encrypted_data)

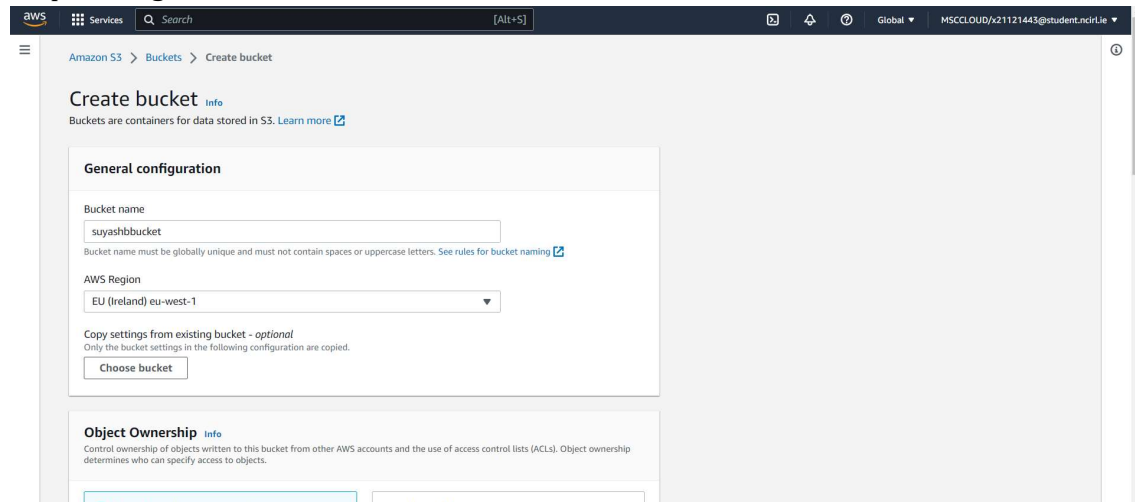
# Save the decrypted file to a new file
with open('decrypted_data.txt', 'wb') as f:
    f.write(decrypted_data)

print('File successfully decrypted')
```

6 Installation and Code Run Procedures

Following steps need to be followed for running the code.

Step 1 – Login to AWS account and create S3 bucket.



Step 2 – Open the AWS programmatic access

Copy the environment variables and paste it on the command prompt it will allow to connect with AWS.

```
C:\Windows\System32\cmd.e x + v
Microsoft Windows [Version 10.0.22621.819]
(c) Microsoft Corporation. All rights reserved.

D:\Code\Suyash\Final updated with mail>SET AWS_ACCESS_KEY_ID=ASIATUYJP7SUPEJZUQVT
D:\Code\Suyash\Final updated with mail>SET AWS_SECRET_ACCESS_KEY=aytljQiSmzs0illBU6fxZeIgpQ1xAZ2z2jMN9RAc
D:\Code\Suyash\Final updated with mail>SET AWS_SESSION_TOKEN=IqoJb3JpZ2luX2VjEKr/////////wEaCXVzLWVhc3QtMSJHMEUCIFJe95V
/miVq2kt+wpCyEUBp9lhBcNfKx4gPufX9HXIEAIEAoHn0c3KoZR4nN+E/sVd6vdUHD0ISsa3iMx39a0t7JasqkQI0/////////ARADGgwyNTA3Mzg2Mzc
SOTI1DA0RyCU0pxAk9v1XhirmA90dymeXX0ENm0YJgOLXoZo1qu4gNLUs45T5fnhZ/A8ZvfpHzTdQbCTu02towt79CaeXz0PMAmrLI0PnlkYq0oK02kXZsEr
oDMqjuoVva/I3Bv+4mE8eKI7dvP5BwWh5j5UQqIcRFq5aD5urHIkS9ThMYMkF+cQauE4Fukw0ppIwmBMXj2sag3oTzLeLtk4+cv7sLh3r9uT7QLgn7+44063
/kMZwgNEwZM7E8dWvGKBMxurLqz/AvofNIDAieUxR0Fd3xh94LkBMH6zQcvc0xGrwJuD1p0LRXErD0arbzKFCJ+DTh0qpcZ6/fh3fBVE/CiKnUZA4SjbCLNDE
fBferAj9YBTIOUY8dqZAous0Vi0PUooFWZP4quvEYnrMiN9pf6UL1cAJ6ToaKu/eMYA07xZ2raNAvK/mv5ZT0wgAdkys0xwFN0So39pkkUPIEJjP8kXtgoc
oi8+NI-fGYWvhEuhQv5wbwoKkAva090k02utqz1e+J5/tvb9G3dmpc5nH8Ga/OW4nB4LTMl2u3dFdKA71esV1j5/iFIQFSgRUZJyB+mmiKkWLzFHHSSK1nEB2
yijh5UkLaYxdBHvi+Ngc6yKX+q9iCTVilYVkvVjQMrjxCbICYH3bq0TVZSmweG/ZIXrI0bq6JHDCSt0acBjqmAT+Zsoco4G6r1a+DsJ704iCfVMHmcZicGch
GRWdtEU17gx2QiMyTLdnM68i9tJxHlvvIUiFmlhuHBU1xBhXDA+gChs339fQwec0Dbhh3B970Xt55KjTINLW+Qz3ja+12hvtCOLtkIjoVpvgwgmCK7HDOCRv
/1EtX+51WwMuEVPe0z2Td4sPL9eIXD2KQsZzWfHzQ9tjc6iVSIozDtszrd14RrIt7+I=
D:\Code\Suyash\Final updated with mail>
```

Step 3 – Setup the Mailtrap account

Signup for the mail trap account and paste the login and username in the script provided by the Mailtrap.

The screenshot shows the Mailtrap web interface. On the left is a dark sidebar with navigation options: Home, Email API (new), Sandbox, Inboxes (selected), Billing, User Management, API, and Account Settings. A Help button is at the bottom. The main content area is titled "My Inbox" and shows "Your inbox is empty". Below this are tabs for SMTP Settings, Email Address, Auto Forward, Manual Forward, and Access Rights. The SMTP / POP3 section provides instructions and a warning not to disclose credentials. A "Show Credentials" dropdown is visible. The Integrations section has a "cURL" dropdown. A code block contains a cURL command for sending an email via SMTP, with a "Copy" button to its right.

```

curl --ssl-reqd \
--url 'smtp://smtp.mailtrap.io:2525' \
--user '5bf5c569f9889c:a3d2f93bef439' \
--mail-from from@example.com \
--mail-rcpt to@example.com \
--upload-file - <<EOF
From: Magic Elves <from@example.com>
To: Mailtrap Inbox <to@example.com>
Subject: You are awesome!
Content-Type: multipart/alternative; boundary="boundary-string"

--boundary-string
Content-Type: text/plain; charset="utf-8"
Content-Transfer-Encoding: quoted-printable

```

Step 4 – Run the script using command prompt

The screenshot shows a Windows command prompt window with the title "C:\Windows\System32\cmd.exe - python encryption.py". The user has entered the following commands:

```

C:\completeUpdate\Encrytion>SET AWS_SECRET_ACCESS_KEY=Ii4apuqZngFrNhpnjEcPyK+qG6aGbGpN/bCZygc

C:\completeUpdate\Encrytion>SET AWS_SESSION_TOKEN=IQoJb3JpZ2luX2VjElN////////wEaCXVzLWVhc3QtMSJHMEUCIQ7Jhvvv1/xCXic74
ZO/bpy5gMythjnWeQJKt6H1aByvwIgeA67Z6FIpuih+ZHu+9ju1Z1Ygt/Q/HG6kGCZ1CeGFS8qkQI4f////////ARADGgwyNTA3Mzg2Mzc50TIidMrB1Z
960WdDFUiIWyrmA1yv1GTgDkQtDoZCzaYdB9D02RVthaIxUQHZH1EeUyvtpYdF/IKU9xNeHuJBM+mnKwpcRtsIIDI3g0s2kiu/fs4mq4JiIhstTbfYmJ3R
gLL8V3GIitkp1HkQx08IqX1EB153am79he9nq+VORcBrfeLdnxRPF6NqoimYGzMMT9amBpuJ8Cv57MAGdn14i183g8eBdN4fJ3IzZQiwndeX02UtjZQTEsm0
Bregxrp6iHAwpNCCmz0zD331VFOP0/J+lg71GT2HPgcVhDLSkpRGC0kdSuVwulwz2g2p21fAZVrGhNnWfklwv2Qh0VbACvalvz4zsjh7rfcefJQqiYkRXOnS
kRLesY7JGeTc1CG1ISOTVfU4bYi++MbxLmpotZRYau3d2/+j6doxg6u1GYoI1w9Jw1A5RFci4JQLow236hzXi0uVb59IKXCoPMrJEQVYGVewF0/fsU1UiMu
X4WvDmacxmnxASgqrrekt8Bw7GFP4rq9UL/3QcVi1vn13w1vpx0xvQWZ/Bvn/NHDKT0UK0YtdY3aGYqPR1TRjCzWcCnvROs3RKHny1wiqSpOrHkQkhapa5G
I9g1TwpL8H68518dQU0iYzbnLwwU6MfRYI4pTohLLbwwm+PEUe/pf9oXOC3RTCjyemcBjqmAWHjv/GmHCdkv0gjY5MKyWbe1kaES7377ttWYDinAZvcp/
aI06P/Vj4gHGZupM+134+eQCae1M2jGHE05e1cNBS+2fyMN8JXdAWGHR65HdXmfbpVe2/o590QJscX19vww66L/AX0pG7TyhI7T//WRocBRJdZWZ4cRtjAM
6HU55x0jQTEsecot+vsWASGnJHLUueeeOUew1dqRBfsnS8k1AicQzRKST=

C:\completeUpdate\Encrytion>python encryption.py
Enter the file name:

```


Step 5 – Enter the File name with its type, The file will get uploaded to the cloud and following message will be printed with the execution time.

```
C:\Windows\System32\cmd.exe

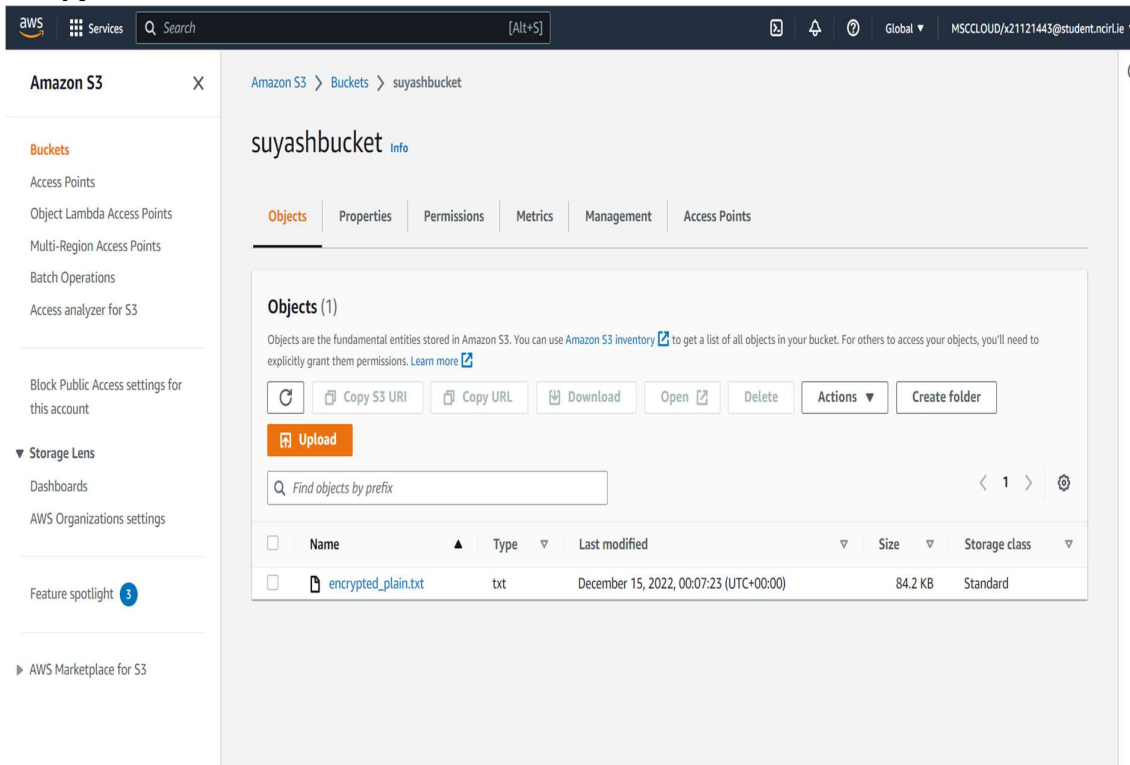
C:\completeUpdate\Encrytion>SET AWS_SECRET_ACCESS_KEY=Ii4apuqZngFrNHpnjEcPyK+qG6aGbGpN/bCZygc

C:\completeUpdate\Encrytion>SET AWS_SESSION_TOKEN=IQoJb3JpZ2luX2VjElN////////wEaCXVzLWVhc3QEM3JHMEUCIQ7Jhvvv1/xCxC74
ZO/bpy5gMytHjnWeQJKt6HLaByvwIgeEA67Z6FIpuih+ZHu+9ju1Z1Ygt/Q/HG6kGCZ1CeGFS8qkgQI4f////////ARADGgwyNTA3Mzg2Mzc50TIIDMrB1Z
960WdDFUiIwYrma1yv1GTgDkQtdoZCzaYdB9D02RVthaIxUQH2TH1EeUyvtpYdF/IKU9xNeHuJBM+mnKwpcRtsIIDI3g0s2kiu/fs4mq4JiIhstTbfYmJ3R
gl18V3GIitkp1HkQx08IqX1EB153am79he9nq+VORcBrfeLdnxRPF6NqoimYGzmmT9amBpuJ8Cv57MAGdn14i183g8eBdn4f3IzZQiwndeX02UtjZQTEsm0
8regxrp6iHAWpNCcmz0zD331VFOP0/J+1g71GTZ2HPgcVhDLSkpRG0k0dSuVuwuz2g2p21fAZVrGwNnWfkwv2Qh0VbACvaWZv4zsjh7rfceFJQqiYkRX0nS
kRLesY7JGeTc1CG1IS0TVfU4bYi++MbxLmpotZRYau3d2/+j6doxg6u1GYoI1w9JwIA5RFc14JQLow236hzXi0uVb59IKXCoPmrJEQVYGVeVf0/fsU1U1iMu
X4WdMacmxmxA8gqrrekT8Bw7GFP4rq9UL/3QcVi1vn13wlvpx0xVQWZ/Bvn/NHDKCT0UK0YtdY3aGYqPR1TRjCzWcCnvROs3RKHny1wiqSpOrHkQKhapA5G
I9g1TWPL8H68518dQU0iY8iznbLwwU6MFRYI4pTohLLbbwm+PEUpe/pf9oXOC3RTCjyemcBjqmAWHjv/GmHCdkv0gjY5MKyWbelkaES737tttWYDinAZvcp/
aI06P/Vj4gHGZupM+134+eQCAeIM2jGHE05e1cNBSe+2fyMN8JXdAWGHR65HdXmfPVe2/o590QJscX19vww66L/AXOpG7TyhI7T//WRocbRjDZwZ4cRtjAM
6HU55x0jQTeSecot+vsWASGnJHLUueeeOUew1dqRBfsnS8k1AiCQzRKST=

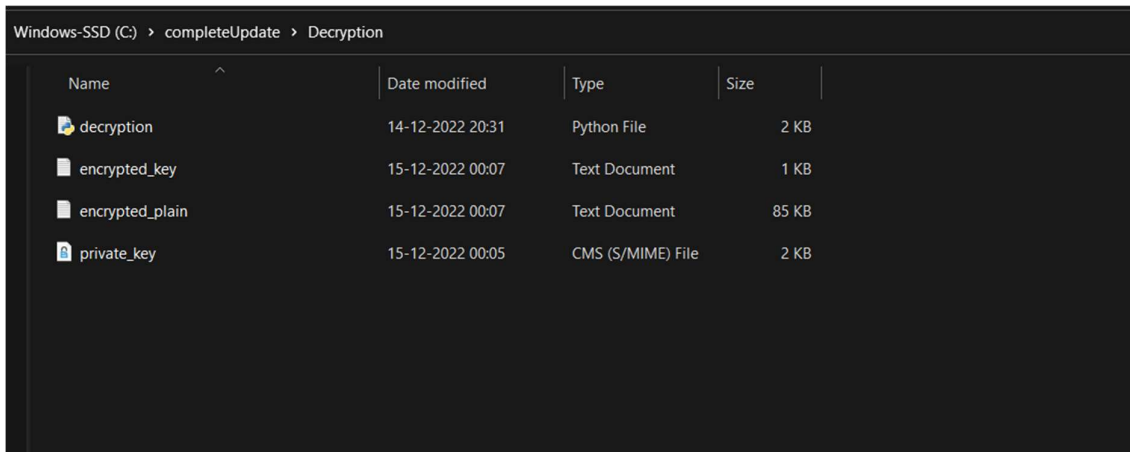
C:\completeUpdate\Encrytion>python encryption.py
Enter the file name: plain.txt
File successfully encrypted and key saved to encrypted_key.txt
CPU Execution time: 0.125 seconds
Encrypted key sent on mail
File successfully uploaded to S3

C:\completeUpdate\Encrytion>
```

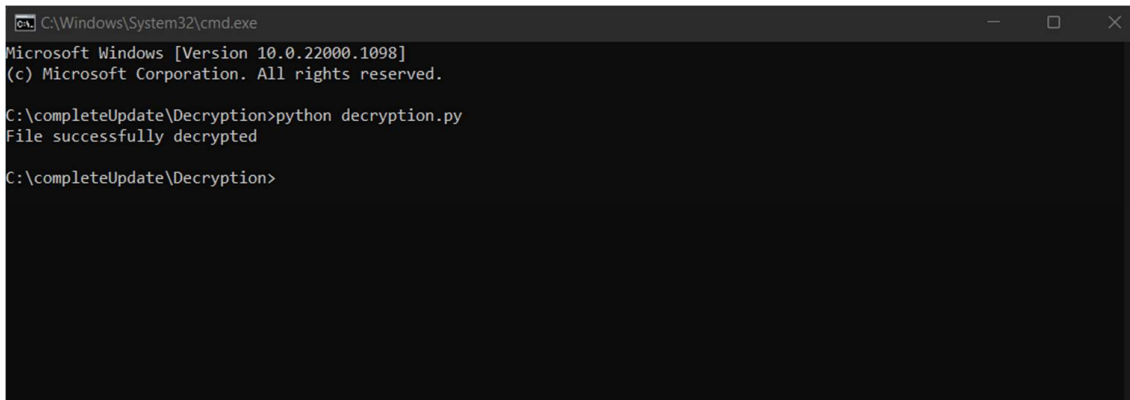
Step 6 – Check the mail trap account for the encryption key and AWS bucket for the encrypted file.



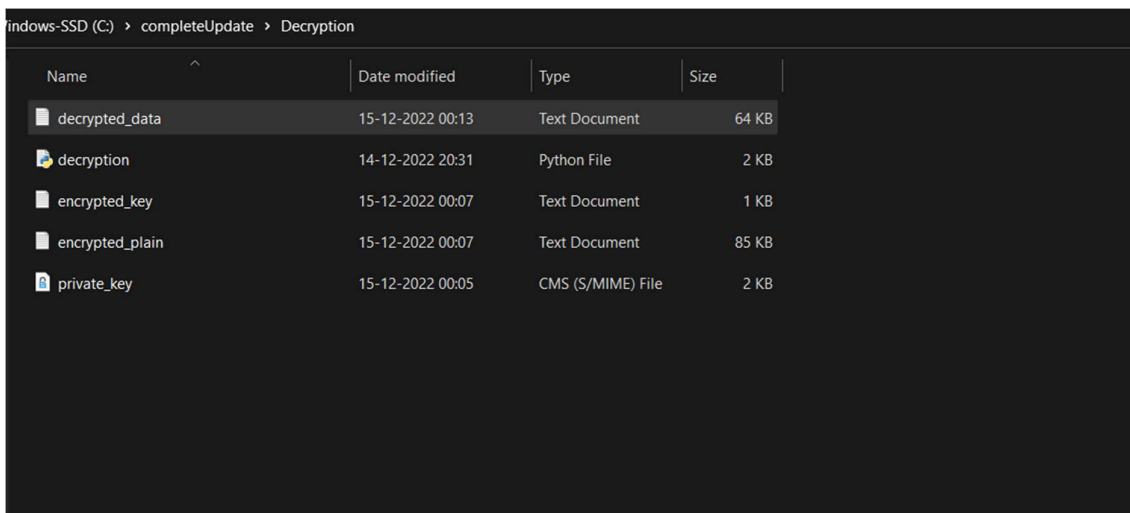
Step 7: Paste the encrypted key received on email and encrypted file from the cloud in the decryption folder for executing decryption.



Step 8: Open this folder in command prompt and run the decryption code for decrypting the file.



Step 9: A decrypted file will be created in the decryption folder.



References

Alla, S., & Adari, S. K. (2021). Deploying in AWS. In *Beginning MLOps with MLFlow* (pp. 229-252). Apress, Berkeley, CA.

Abood, O. G., & Guirguis, S. K. (2018). A survey on cryptography algorithms. *International Journal of Scientific and Research Publications*, 8(7), 495-516.

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<https://docs.modx.com/3.x/en/building-sites/sending-mail/mailtrap>