CS594: Responsible AI Engineering
Lab-3: Apache Kafka

Name: Meka Vamsi Dath
UIN: 660130568

Approach to the Lab Assignment – 3

Step-1: Installation of required packages

- Initialized a conda environment and installed '*python*' and activated it.

```
$ conda create --name cs594 python=3.10
$ conda activate cs594
```

- Installed '*kafka-python*' and '*kcat*'

```
$ python -m pip install kafka-python
$ brew install kcat
```

Step-2: Established a secure SSH tunnel to the Kafka server

- Used SSH to create a tunnel to the Kafka server and ran it in background using -NTf and local port forwarding -L

```
$ ssh -o ServerAliveInterval=60 -L 9092:localhost:9092 vmeka@cs594.cs.uic.edu -NTf
```

- entered the password for my NetID after issuing the command and did the demo for lab.

Step-3: Implemented the Producer Mode

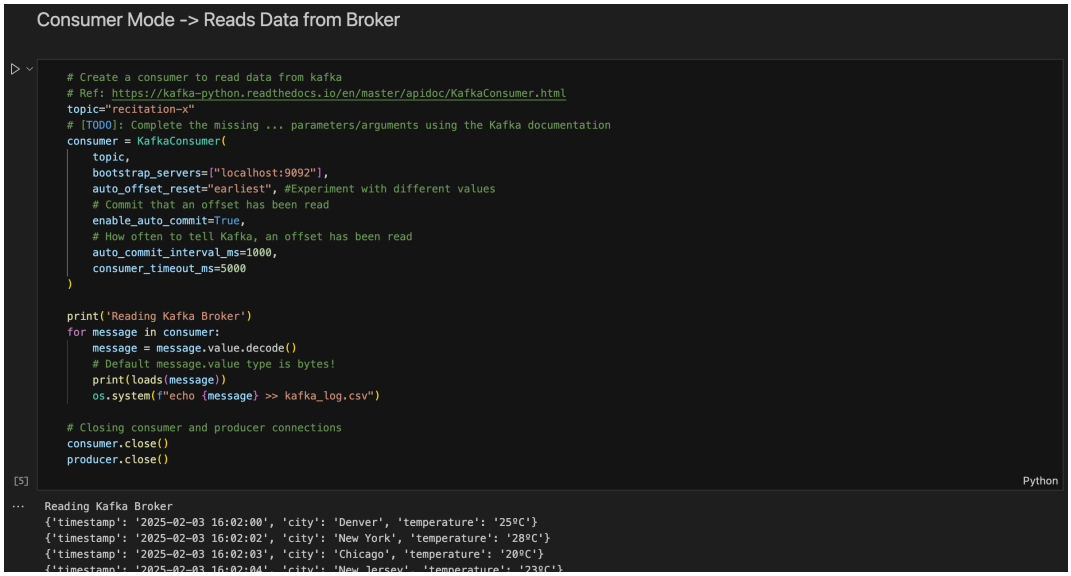
Producer Mode -> Writes Data to Broker

```
# Create a producer to write data to kafka
# Ref: https://kafka-python.readthedocs.io/en/master/apidoc/KafkaProducer.html

# [TODO]: Replace '...' with the address of your Kafka bootstrap server
producer = KafkaProducer(bootstrap_servers=["localhost:9092"],
                         value_serializer=lambda x: dumps(x).encode('utf-8'))

# [TODO]: Add cities of your choice
cities = ["Mumbai", "Delhi", "Hyderabad", "Kolkata", "Banglore", "Chennai", "Vizag"]

# Write data via the producer
print("Writing to Kafka Broker")
for i in range(10):
    data = f'{datetime.now().strftime("%Y-%m-%d %H:%M:%S")},{cities[randint(0,len(cities)-1)]},{randint(18, 32)}ºC'
    print(f"Writing: {data}")
    producer.send(topic=topic, value=data)
    sleep(1)
```

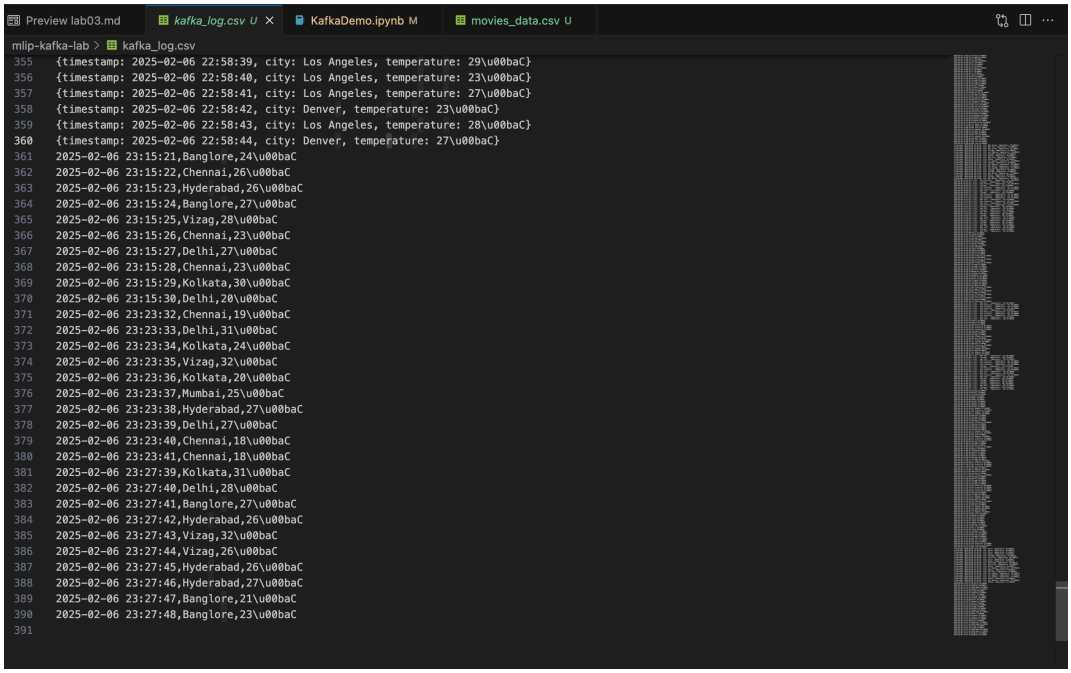
[2] Python

```
Writing to Kafka Broker
Writing: 2025-02-06 23:27:39,Kolkata,31ºC
Writing: 2025-02-06 23:27:40,Delhi,28ºC
Writing: 2025-02-06 23:27:41,Banglore,27ºC
Writing: 2025-02-06 23:27:42,Hyderabad,26ºC
Writing: 2025-02-06 23:27:43,Vizag,32ºC
Writing: 2025-02-06 23:27:44,Vizag,26ºC
Writing: 2025-02-06 23:27:45,Hyderabad,26ºC
Writing: 2025-02-06 23:27:46,Hyderabad,27ºC
Writing: 2025-02-06 23:27:47,Banglore,21ºC
Writing: 2025-02-06 23:27:48,Banglore,23ºC
```

Step-4: Implemented the Consumer Mode



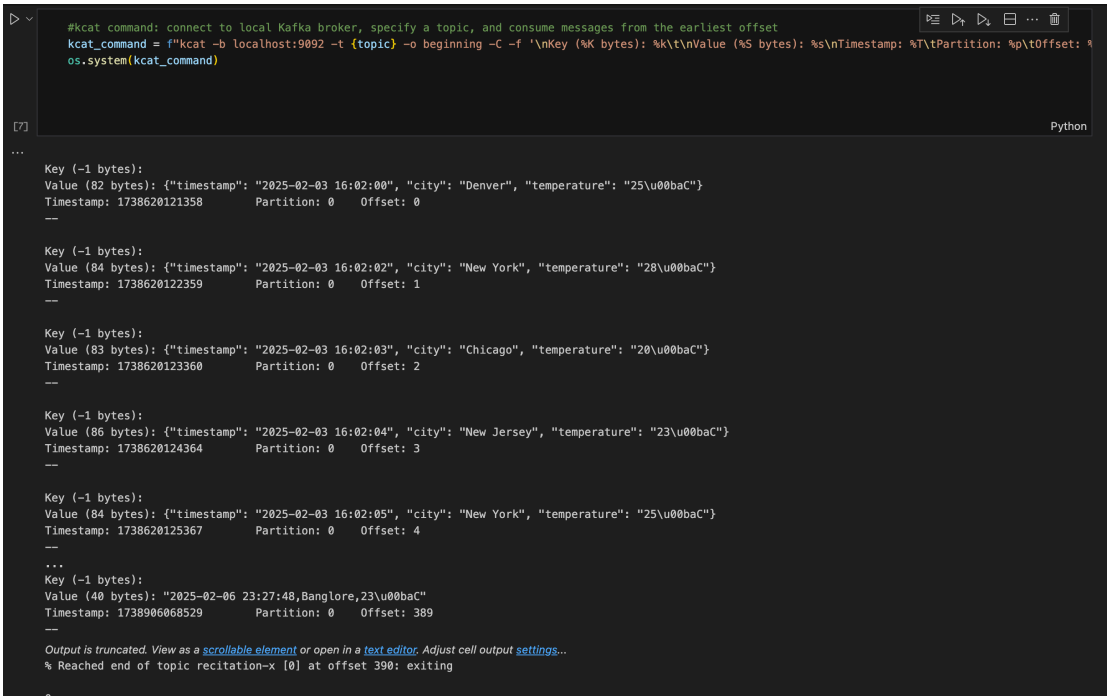
Step-5 Verified Kafka_log.csv



Step-6: Used Kafka's CLI tool kcat to manage and monitor Kafka topics and messages

---

$ kcat -b localhost:9092 -t recitation-x -o beginning -C -f '\nKey (%K bytes): %k\t\nValue (%S bytes): %s\nTimestamp: %T\tPartition: %p\tOffset: %o\n--\n' -e

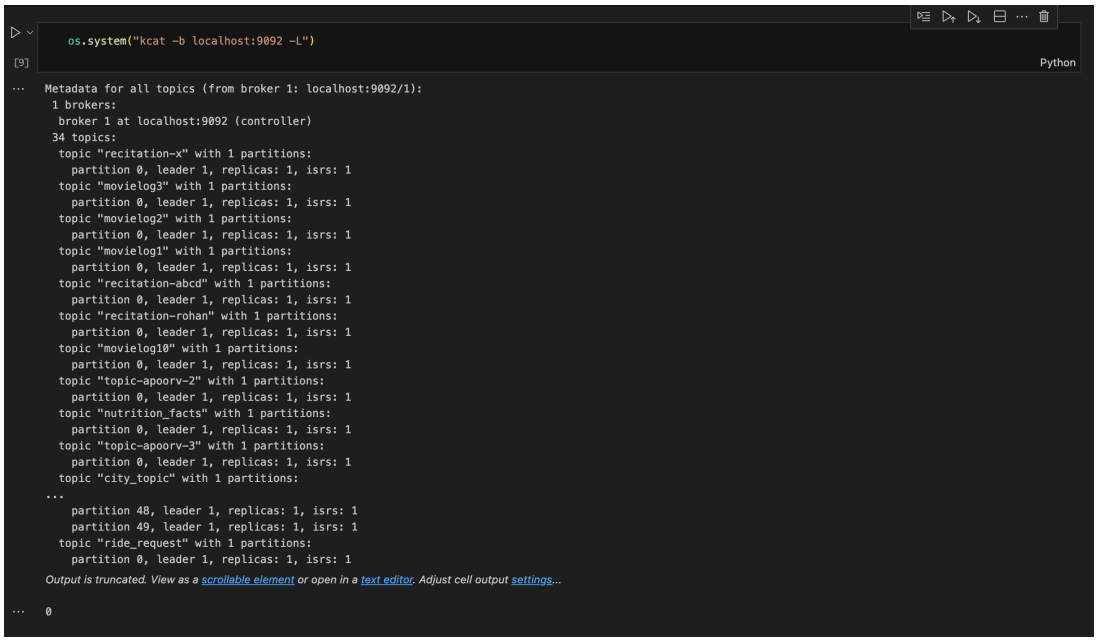


```
#kcat command: connect to local Kafka broker, specify a topic, and consume messages from the earliest offset
kcat_command = f"kcat -b localhost:9092 -t {topic} -o beginning -C -f '\nKey (%K bytes): %k\t\nValue (%S bytes): %s\nTimestamp: %T\tPartition: %p\tOffset: %
os.system(kcat_command)
```

[7] Python

```
Key (-1 bytes):
Value (82 bytes): {"timestamp": "2025-02-03 16:02:00", "city": "Denver", "temperature": "25\u00baC"}
Timestamp: 1738620121358        Partition: 0    Offset: 0
--

Key (-1 bytes):
Value (84 bytes): {"timestamp": "2025-02-03 16:02:02", "city": "New York", "temperature": "28\u00baC"}
Timestamp: 1738620122359        Partition: 0    Offset: 1
--

Key (-1 bytes):
Value (83 bytes): {"timestamp": "2025-02-03 16:02:03", "city": "Chicago", "temperature": "20\u00baC"}
Timestamp: 1738620123360        Partition: 0    Offset: 2
--

Key (-1 bytes):
Value (86 bytes): {"timestamp": "2025-02-03 16:02:04", "city": "New Jersey", "temperature": "23\u00baC"}
Timestamp: 1738620124364        Partition: 0    Offset: 3
--

Key (-1 bytes):
Value (84 bytes): {"timestamp": "2025-02-03 16:02:05", "city": "New York", "temperature": "25\u00baC"}
Timestamp: 1738620125367        Partition: 0    Offset: 4
--
...
Key (-1 bytes):
Value (40 bytes): "2025-02-06 23:27:48,Banglore,23\u00baC"
Timestamp: 1738906068529        Partition: 0    Offset: 389
--
Output is truncated. View as a scrollable element or open in a text editor. Adjust cell output settings...
% Reached end of topic recitation-x [0] at offset 390: exiting
```

$ kcat -b localhost:9092 -L



```
os.system("kcat -b localhost:9092 -L")
```

[9] Python

```
Metadata for all topics (from broker 1: localhost:9092/1):
 1 brokers:
  broker 1 at localhost:9092 (controller)
 34 topics:
  topic "recitation-x" with 1 partitions:
    partition 0, leader 1, replicas: 1, isrs: 1
  topic "movielog3" with 1 partitions:
    partition 0, leader 1, replicas: 1, isrs: 1
  topic "movielog2" with 1 partitions:
    partition 0, leader 1, replicas: 1, isrs: 1
  topic "movielog1" with 1 partitions:
    partition 0, leader 1, replicas: 1, isrs: 1
  topic "recitation-abcd" with 1 partitions:
    partition 0, leader 1, replicas: 1, isrs: 1
  topic "recitation-rohan" with 1 partitions:
    partition 0, leader 1, replicas: 1, isrs: 1
  topic "movielog10" with 1 partitions:
    partition 0, leader 1, replicas: 1, isrs: 1
  topic "topic-apoorv-2" with 1 partitions:
    partition 0, leader 1, replicas: 1, isrs: 1
  topic "nutrition_facts" with 1 partitions:
    partition 0, leader 1, replicas: 1, isrs: 1
  topic "topic-apoorv-3" with 1 partitions:
    partition 0, leader 1, replicas: 1, isrs: 1
  topic "city_topic" with 1 partitions:
 ...
    partition 48, leader 1, replicas: 1, isrs: 1
    partition 49, leader 1, replicas: 1, isrs: 1
  topic "ride_request" with 1 partitions:
    partition 0, leader 1, replicas: 1, isrs: 1
Output is truncated. View as a scrollable element or open in a text editor. Adjust cell output settings...
0
```

Step-7: (Optional) Reading movielog streams

- found the list of all topics and then read some movielog streams to get an idea of what the data looks like and saved them into a csv file

$ kcat -b localhost:9092 -t movielog2 -C -e > movies_data.csv

```
[ ]  os.system("kcat -b localhost:9092 -t movielog2 -C -e > movies_data.csv")

...  % Reached end of topic movielog2 [0] at offset 3968: exiting

...  0
```

Preview lab03.md | kafka_log.csv U | KafkaDemo.ipynb M | movies_data.csv U

mlip-kafka-lab > movies_data.csv

```
3937  2025-02-01T17:35:38,147936,GET /data/m/likainen+pommi+2011/4.mpg
3938  2025-02-01T17:35:38,148140,GET /data/m/nostalgia+1983/4.mpg
3939  2025-02-01T17:35:38,30385,GET /data/m/different+for+girls+1996/11.mpg
3940  2025-02-01T17:35:38,97902,GET /data/m/house+of+fools+2002/2.mpg
3941  2025-02-01T17:35:38,6884,GET /data/m/mickey_+donald_+goofy+the+three+musketeers+2004/1.mpg
3942  2025-02-01T17:35:38,4416,GET /data/m/interstellar+2014/10.mpg
3943  2025-02-01T17:35:38,134335,GET /data/m/yankee+doodle+dandy+1942/6.mpg
3944  2025-02-01T17:35:38,8922,GET /data/m/river+queen+2005/10.mpg
3945  2025-02-01T17:35:38,137237,GET /data/m/harry+potter+and+the+deathly+hallows+part+2+2011/8.mpg
3946  2025-02-01T17:35:38,139932,GET /data/m/wishful+thinking+1996/5.mpg
3947  2025-02-01T17:35:38,69300,GET /data/m/the+home+of+dark+butterflies+2008/0.mpg
3948  2025-02-01T17:35:39,49549,GET /data/m/confessions+of+a+superhero+2007/4.mpg
3949  2025-02-01T17:35:39,17284,GET /data/m/whiplash+2014/6.mpg
3950  2025-02-01T17:35:39,133133,GET /data/m/pandorum+2009/7.mpg
3951  2025-02-01T17:35:39,32553,GET /data/m/the+gruffalo+2009/2.mpg
3952  2025-02-01T17:35:39,38904,GET /data/m/the+war+within+2005/1.mpg
3953  2025-02-01T17:35:39,133708,GET /data/m/pandoras+promise+2013/9.mpg
3954  2025-02-01T17:35:39,50286,GET /data/m/pulse+2001/8.mpg
3955  2025-02-01T17:35:39,109976,GET /data/m/king+of+hearts+1966/0.mpg
3956  2025-02-01T17:35:40,21152,GET /data/m/a+pain+in+the+ass+2008/4.mpg
3957  2025-02-01T17:35:40,79355,GET /data/m/young+thugs+nostalgia+1998/3.mpg
3958  2025-02-01T17:35:40,108445,GET /data/m/the+princess+and+the+frog+2009/4.mpg
3959  2025-02-01T17:35:40,6992,GET /data/m/blade+runner+1982/3.mpg
3960  2025-02-01T17:35:40,93006,GET /data/m/exists+2014/3.mpg
3961  2025-02-01T17:35:40,3428,GET /data/m/p.s.+2004/5.mpg
3962  2025-02-01T17:35:40,12979,GET /data/m/leave+her+to+heaven+1945/7.mpg
3963  2025-02-01T17:35:40,101504,GET /data/m/burnt+by+the+sun+1994/1.mpg
3964  2025-02-01T17:35:40,57140,GET /data/m/the+war+within+2005/0.mpg
3965  2025-02-01T17:35:40,66929,GET /data/m/inglourious+basterds+2009/0.mpg
3966  2025-02-01T17:35:40,89798,GET /data/m/harry+potter+and+the+prisoner+of+azkaban+2004/0.mpg
3967  2025-02-01T17:35:40,102017,GET /data/m/the+tale+of+zatichi+1962/0.mpg
3968  2025-02-01T17:35:40,36337,GET /data/m/ishq+1997/0.mpg
3969
```

Step-8: Closed the SSH tunnel to the Kafka server

- Killed the connection using the kill command after looking up the process id with the port and passing it as arguments.

$ lsof -ti:9092 | xargs kill -9