Indian Institute of Technology Madras

Twitter Data Streaming Using Kafka and Analysis Using Spark

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EE17B113

1. Overview :

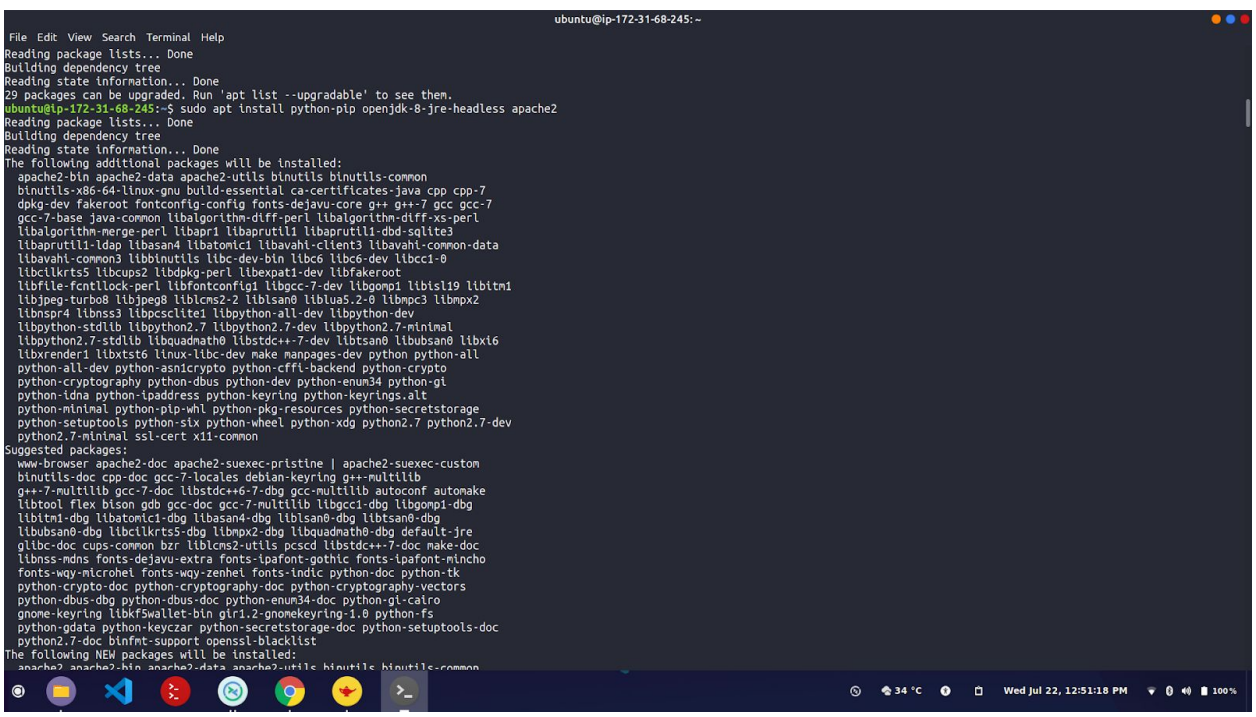
The assignment consists of analysing Twitter data by streaming the tweets using Kafka and analysing the tweets using Spark. The analysis consists of counting the number of tweets in a 10-minute interval and finding the frequently occurring word sets using FPGrowth Algorithm.

2. Approach :

The tweets are first read using the Twitter API credentials provided to us and using the python libraries `tweepy` (to download the tweets) and `kafka-python` (to publish the tweets to the respective Kafka topic). After this setup, the tweets are then consumed by a Spark application which then reads all the tweets in a 10-minute batch interval. These tweets are converted into an RDD and the count of the tweets is got by counting the number of rows in RDD and the FPGrowth algorithm is applied on the RDD to extract the frequent sets.

3. Implementation :

a) First we have to install java, pip and apache in the instance :



```
File  Edit  View  Search  Terminal  Help
Adding debian:Amazon_Root_CA_1.pem
Adding debian:DigiCert_Assured_ID_Root_G3.pem
Adding debian:Cybertrust_Global_Root.pem
Adding debian:GlobalSign_Root_CA.pem
Adding debian:Starfield_Class_2_CA.pem
Adding debian:T-TeleSec_GlobalRoot_Class_3.pem
Adding debian:Go_Daddy_Root_Certificate_Authority_-_G2.pem
Adding debian:COMODO_Certification_Authority.pem
Adding debian:ACCVRAIZ1.pem
Adding debian:Entrust.net_Premium_2048_Secure_Server_CA.pem
Adding debian:Autoridad_de_Certificacion_Firmaprofesional_CIF_A62634068.pem
Adding debian:T-TeleSec_GlobalRoot_Class_2.pem
Adding debian:Go_Daddy_Class_2_CA.pem
Adding debian:TeliaSonera_Root_CA_v1.pem
Adding debian:Certum_Trusted_Network_CA.pem
Adding debian:TrustCor_ECA-1.pem
done.
Processing triggers for mime-support (3.60ubuntu1) ...
Processing triggers for ureadahead (0.100.0-21) ...
Processing triggers for libc-bin (2.27-3ubuntu1) ...
Processing triggers for systemd (237-3ubuntu10.41) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for ca-certificates (20190110~18.04.1) ...
Updating certificates in /etc/ssl/certs...
0 added, 0 removed; done.
Running hooks in /etc/ca-certificates/update.d...

done.
done.
Setting up openjdk-8-jre-headless:amd64 (8u252-b09-1~18.04) ...
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/jre/bin/rmid to provide /usr/bin/rmid (rmid) in auto mode
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/jre/bin/java to provide /usr/bin/java (java) in auto mode
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/jre/bin/keytool to provide /usr/bin/keytool (keytool) in auto mode
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/jre/bin/jjs to provide /usr/bin/jjs (jjs) in auto mode
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/jre/bin/pack200 to provide /usr/bin/pack200 (pack200) in auto mode
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/jre/bin/rmiregistry to provide /usr/bin/rmiregistry (rmiregistry) in auto mode
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update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/jre/bin/tnameserv to provide /usr/bin/tnameserv (tnameserv) in auto mode
update-alternatives: using /usr/lib/jvm/java-8-openjdk-amd64/jre/lib/jexec to provide /usr/bin/jexec (jexec) in auto mode
Processing triggers for ufw (0.36-0ubuntu0.18.04.1) ...
ubuntu@ip-172-31-68-245:~$
```

b) Next, we download the latest build of Kafka and unzip it :

```
ubuntu@ip-172-31-68-245: ~
File  Edit  View  Search  Terminal  Help
Adding debian:TeliaSonera_Root_CA_v1.pem
Adding debian:Certum_Trusted_Network_CA.pem
Adding debian:TrustCor_ECA-1.pem
done.
Processing triggers for mime-support (3.60ubuntu1) ...
Processing triggers for ureadahead (0.100.0-21) ...
Processing triggers for libc-bin (2.27-3ubuntu1) ...
Processing triggers for systemd (237-3ubuntu10.41) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for ca-certificates (20190110~18.04.1) ...
Updating certificates in /etc/ssl/certs...
0 added, 0 removed; done.
Running hooks in /etc/ca-certificates/update.d...

done.
done.
Setting up openjdk-8-jre-headless:amd64 (8u252-b09-1~18.04) ...
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Processing triggers for ufw (0.36-0ubuntu0.18.04.1) ...
ubuntu@ip-172-31-68-245:~$ wget https://downloads.apache.org/kafka/2.5.0/kafka_2.13-2.5.0.tgz
--2020-07-22 07:23:45--  https://downloads.apache.org/kafka/2.5.0/kafka_2.13-2.5.0.tgz
Resolving downloads.apache.org (downloads.apache.org)... 88.99.95.219, 2a01:4f8:10a:201a::2
Connecting to downloads.apache.org (downloads.apache.org)|88.99.95.219|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 61459093 (59M) [application/x-gzip]
Saving to: ‘kafka_2.13-2.5.0.tgz’

kafka_2.13-2.5.0.tgz                100%[===================================================================================>]  58.61M  15.8MB/s    in 7.6s

2020-07-22 07:23:53 (7.69 MB/s) - ‘kafka_2.13-2.5.0.tgz’ saved [61459093/61459093]

ubuntu@ip-172-31-68-245:~$ tar -xzf kafka_2.13-2.5.0.tgz
ubuntu@ip-172-31-68-245:~$ rm kafka_2.13-2.5.0.tgz
ubuntu@ip-172-31-68-245:~$
ubuntu@ip-172-31-68-245:~$
```

c) Next, we start the Kafka and Zookeeper servers in the instance.

```
ubuntu@ip-172-31-68-245: ~
File  Edit  View  Search  Terminal  Help
Processing triggers for systemd (237-3ubuntu10.41) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for ca-certificates (20190110~18.04.1) ...
Updating certificates in /etc/ssl/certs...
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Processing triggers for ufw (0.36-0ubuntu0.18.04.1) ...
ubuntu@ip-172-31-68-245:~$ wget https://downloads.apache.org/kafka/2.5.0/kafka_2.13-2.5.0.tgz
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Resolving downloads.apache.org (downloads.apache.org)... 88.99.95.219, 2a01:4f8:10a:201a::2
Connecting to downloads.apache.org (downloads.apache.org)|88.99.95.219|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 61459093 (59M) [application/x-gzip]
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kafka_2.13-2.5.0.tgz                          100%[===================================================================================================>]  58.61M  15.8MB/s    in 7.6s

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ubuntu@ip-172-31-68-245:~$ rm kafka_2.13-2.5.0.tgz
ubuntu@ip-172-31-68-245:~$
ubuntu@ip-172-31-68-245:~$ nohup ~/kafka_2.13-2.5.0/bin/zookeeper-server-start.sh ~/kafka_2.13-2.5.0/config/zookeeper.properties > ~/zookeeper-logs &
[1] 10445
ubuntu@ip-172-31-68-245:~$ nohup ~/kafka_2.13-2.5.0/bin/kafka-server-start.sh ~/kafka_2.13-2.5.0/config/server.properties > ~/kafka-logs &
[2] 10446
ubuntu@ip-172-31-68-245:~$ nohup: ignoring input and redirecting stderr to stdout
nohup: ignoring input and redirecting stderr to stdout

ubuntu@ip-172-31-68-245:~$
```

d) We then create the required topic in Kafka.

```
ubuntu@ip-172-31-68-245: ~
File  Edit  View  Search  Terminal  Help
0 added, 0 removed; done.
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done.
done.
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Resolving downloads.apache.org (downloads.apache.org)... 88.99.95.219, 2a01:4f8:10a:201a::2
Connecting to downloads.apache.org (downloads.apache.org)|88.99.95.219|:443... connected.
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Saving to: ‘kafka_2.13-2.5.0.tgz’

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[1] 10445
ubuntu@ip-172-31-68-245:~$ nohup ~/kafka_2.13-2.5.0/bin/kafka-server-start.sh ~/kafka_2.13-2.5.0/config/server.properties > ~/kafka-logs &
[2] 10446
ubuntu@ip-172-31-68-245:~$ nohup: ignoring input and redirecting stderr to stdout
nohup: ignoring input and redirecting stderr to stdout

ubuntu@ip-172-31-68-245:~$ ~/kafka_2.13-2.5.0/bin/kafka-topics.sh --create --zookeeper localhost:2181 --replication-factor 1 --partitions 1 --topic newyork

Created topic newyork.
ubuntu@ip-172-31-68-245:~$
ubuntu@ip-172-31-68-245:~$
```
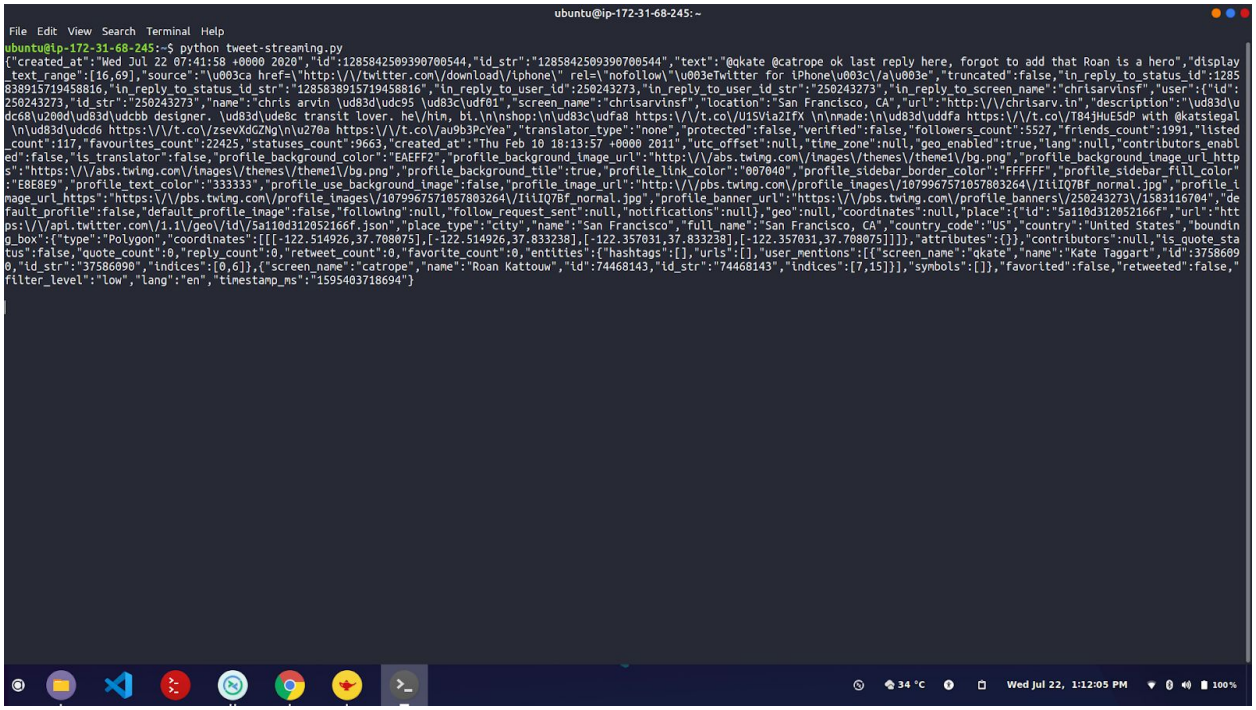

e) We then install the required python libraries :

```
ubuntu@ip-172-31-68-245: ~
File  Edit  View  Search  Terminal  Help
Collecting requests-oauthlib (from python-twitter)
  Downloading https://files.pythonhosted.org/packages/a3/12/b92740d845ab62ea4edf04d2f4164d82532b5a0b03836d4d4e71c6f3d379/requests_oauthlib-1.3.0-py2.py3-none-any.whl
Collecting requests (from python-twitter)
  Downloading https://files.pythonhosted.org/packages/45/1e/0c169c6a5381e241ba7404532c16a21d86ab872c9bed8bdcd4c423954103/requests-2.24.0-py2.py3-none-any.whl (61kB)
    100% |                                | 71kB 11.6MB/s
Collecting six>=1.10.0 (from tweepy)
  Downloading https://files.pythonhosted.org/packages/ee/ff/48bde5c0f013094d729fe4b0316ba2a24774b3ff1c52d924a8a4cb04078a/six-1.15.0-py2.py3-none-any.whl
Collecting click>=5.1 (from flask)
  Downloading https://files.pythonhosted.org/packages/d2/3d/fa76db83bf75c4f8d338c2fd15c8d33fdd7ad23a9b5e57eb6c5de26b430e/click-7.1.2-py2.py3-none-any.whl (82kB)
    100% |                                | 92kB 11.7MB/s
Collecting Werkzeug>=0.15 (from flask)
  Downloading https://files.pythonhosted.org/packages/cc/94/5f7079a0e00bd6863ef8f1da638721e9da21e5bacee597595b318f71d62e/Werkzeug-1.0.1-py2.py3-none-any.whl (298kB)
    100% |                                | 307kB 4.1MB/s
Collecting itsdangerous>=0.24 (from flask)
  Downloading https://files.pythonhosted.org/packages/76/ae/44b03b253d6fade317f32c24d100b3b35c2239807046a4c953c7b89fa49e/itsdangerous-1.1.0-py2.py3-none-any.whl
Collecting Jinja2>=2.10.1 (from flask)
  Downloading https://files.pythonhosted.org/packages/30/9e/f663a2aa66a09d838042ae1a2c5659828bb9b41ea3a6efa20a20fd92b121/Jinja2-2.11.2-py2.py3-none-any.whl (125kB)
    100% |                                | 133kB 9.4MB/s
Collecting oauthlib>=3.0.0 (from requests-oauthlib->python-twitter)
  Downloading https://files.pythonhosted.org/packages/05/57/ce2e7a8fa7c0afb54a0581b14a65b56e62b5759dbc98e80627142b8a3704/oauthlib-3.1.0-py2.py3-none-any.whl (147kB)
    100% |                                | 153kB 8.2MB/s
Collecting urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 (from requests->python-twitter)
  Downloading https://files.pythonhosted.org/packages/e1/e5/df302e8017440f111cc11cc41a6b432838672f5a70aa29227bf58149dc72f/urllib3-1.25.9-py2.py3-none-any.whl (126kB)
    100% |                                | 133kB 9.3MB/s
Collecting chardet<4,>=3.0.2 (from requests->python-twitter)
  Downloading https://files.pythonhosted.org/packages/bc/a9/01ffebfb562e4274b6487b4bb1ddec7ca55ec7510b22e4c51f14098443b8/chardet-3.0.4-py2.py3-none-any.whl (133kB)
    100% |                                | 143kB 9.0MB/s
Collecting certifi>=2017.4.17 (from requests->python-twitter)
  Downloading https://files.pythonhosted.org/packages/5e/c4/6c4fe722df5343c33226f0b4e0bb042e4dc13483228b4718baf286f86d87/certifi-2020.6.20-py2.py3-none-any.whl (156kB)
    100% |                                | 163kB 7.7MB/s
Collecting idna<3,>=2.5 (from requests->python-twitter)
  Downloading https://files.pythonhosted.org/packages/a2/38/928ddce2273eaa564f6f50de919327bf3a00f091b5baba8dfa9460f3a8a8/idna-2.10-py2.py3-none-any.whl (58kB)
    100% |                                | 61kB 11.2MB/s
Collecting MarkupSafe>=0.23 (from Jinja2>=2.10.1->flask)
  Downloading https://files.pythonhosted.org/packages/fb/40/f3adb7cf24a8012813c5edb20329eb22d5d8e2a0ecf73d21d6b85865da11/MarkupSafe-1.1.1-cp27-cp27mu-manylinux1_x86_64.whl
Building wheels for collected packages: future
  Running setup.py bdist_wheel for future ... done
  Stored in directory: /home/ubuntu/.cache/pip/wheels/8b/99/a0/81daf51dcd359a9377b110a8a886b3895921802d2fc1b2397e
Successfully built future
Installing collected packages: kafka-python, future, oauthlib, urllib3, chardet, certifi, idna, requests, requests-oauthlib, python-twitter, six, tweepy, numpy, click, Werkzeug, itsdangerous
, MarkupSafe, Jinja2, flask
Successfully installed Jinja2-2.11.2 MarkupSafe-1.1.1 Werkzeug-1.0.1 certifi-2020.6.20 chardet-3.0.4 click-7.1.2 flask-1.1.2 future-0.18.2 idna-2.10 itsdangerous-1.1.0 kafka-python-2.0.1 num
py-1.16.6 oauthlib-3.1.0 python-twitter-3.5 requests-2.24.0 requests-oauthlib-1.3.0 six-1.15.0 tweepy-3.9.0 urllib3-1.25.9
ubuntu@ip-172-31-68-245:~$
ubuntu@ip-172-31-68-245:~$
```

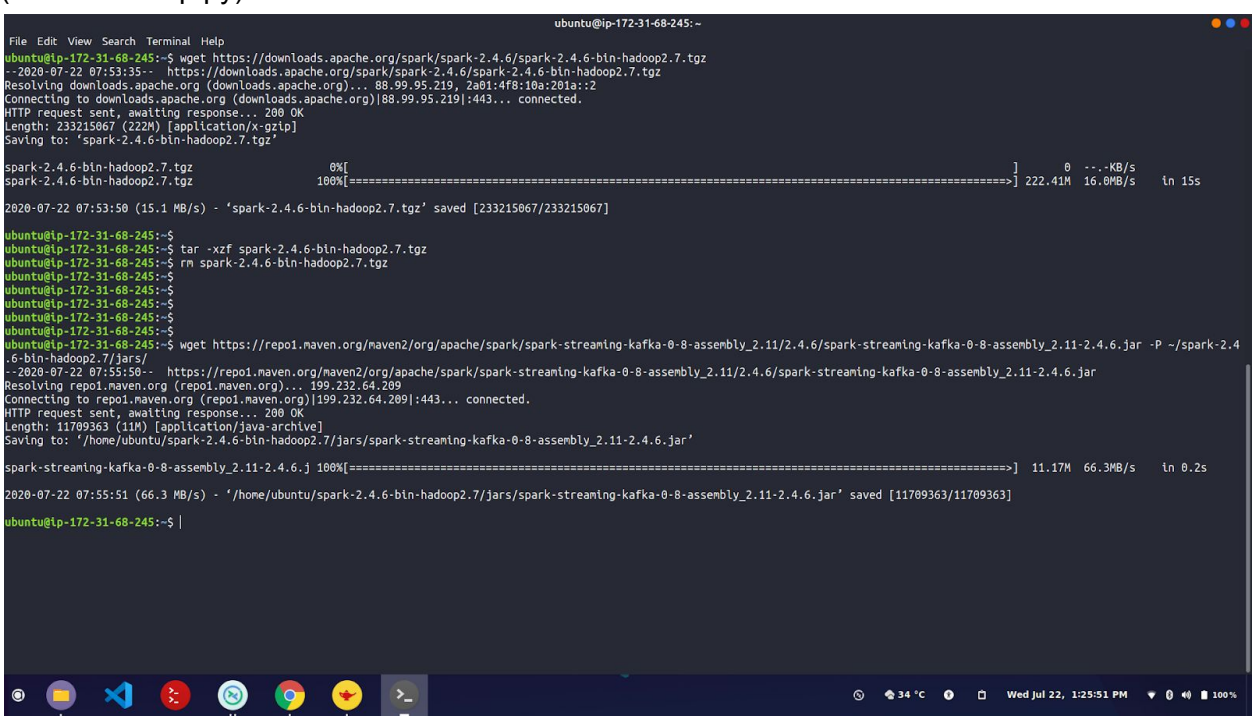
f) We then upload the tweet-streaming.py code and run it. (The API keys are removed in image)

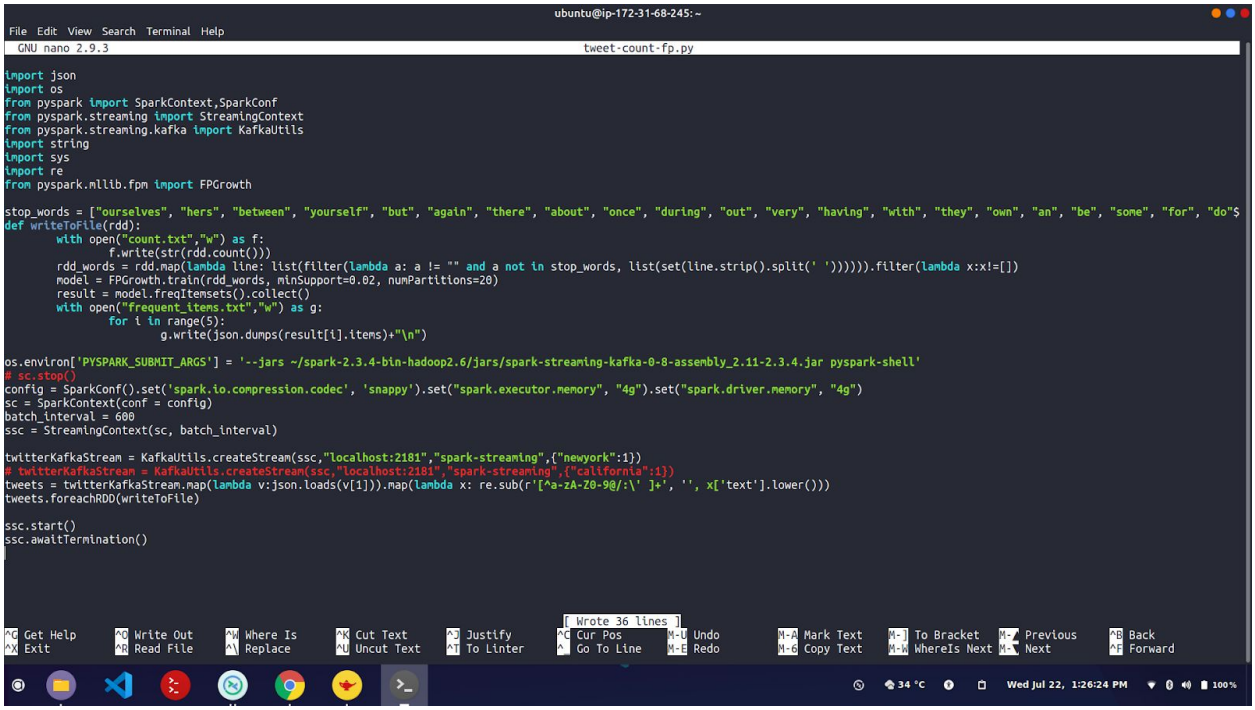
```
ubuntu@ip-172-31-68-245: ~
File  Edit  View  Search  Terminal  Help
  GNU nano 2.9.3                                    python-streaming.py

'''
Tweet Streaming to Kafka Producer

Run the command using "python tweet-streaming.py"

Make sure you create a topic called "newyork" before running the code
'''

from tweepy.streaming import StreamListener
from tweepy import OAuthHandler
from tweepy import Stream
from kafka import KafkaProducer, KafkaClient

access_token = "<fill access_token>"
access_token_secret =  "<fill access_token_secret>"
consumer_key =  "<fill consumer_key>"
consumer_secret =  "<fill consumer_secret>"

class StdOutListener(StreamListener):
    def on_data(self, data):
        # producer.send("newyork", data.encode('utf-8'))
        producer.send("california", data.encode('utf-8'))
        print (data)
        return True
    def on_error(self, status):
        print (status)

kafka = KafkaClient()
producer = KafkaProducer()
l = StdOutListener()
auth = OAuthHandler(consumer_key, consumer_secret)
auth.set_access_token(access_token, access_token_secret)
stream = Stream(auth, l)
# stream.filter(locations=[-79.762152,40.496103,-71.856214,45.01585]) # New York
stream.filter(locations=[-124.409591,32.534156,-114.131211,42.009518]) # California
producer.flush()
producer.close()

                                                [ Wrote 38 lines ]
^G Get Help   ^O Write Out   ^W Where Is   ^K Cut Text   ^J Justify   ^C Cur Pos     M-U Undo      M-A Mark Text   M-] To Bracket   M-/ Previous   ^B Back
^X Exit       ^R Read File   ^\ Replace   ^U Uncut Text ^T To Linter  ^_ Go To Line  M-E Redo      M-6 Copy Text   M-W WhereIs Next M-\ Next       ^F Forward
```

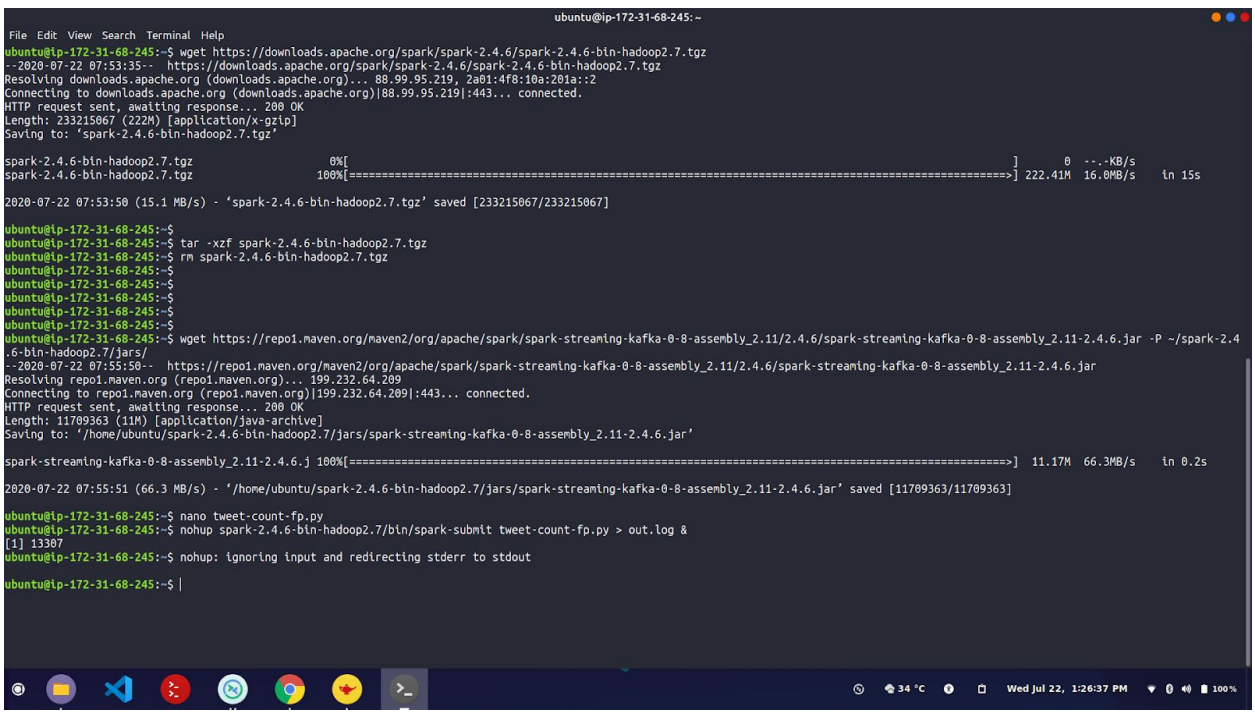


g) Thus the Twitter data is streamed in Kafka

h) Next, we download the prebuilt version of Spark. We then download the library used for streaming. Then we upload the code for counting and getting the frequent sets (tweet-count-fp.py) and run it.

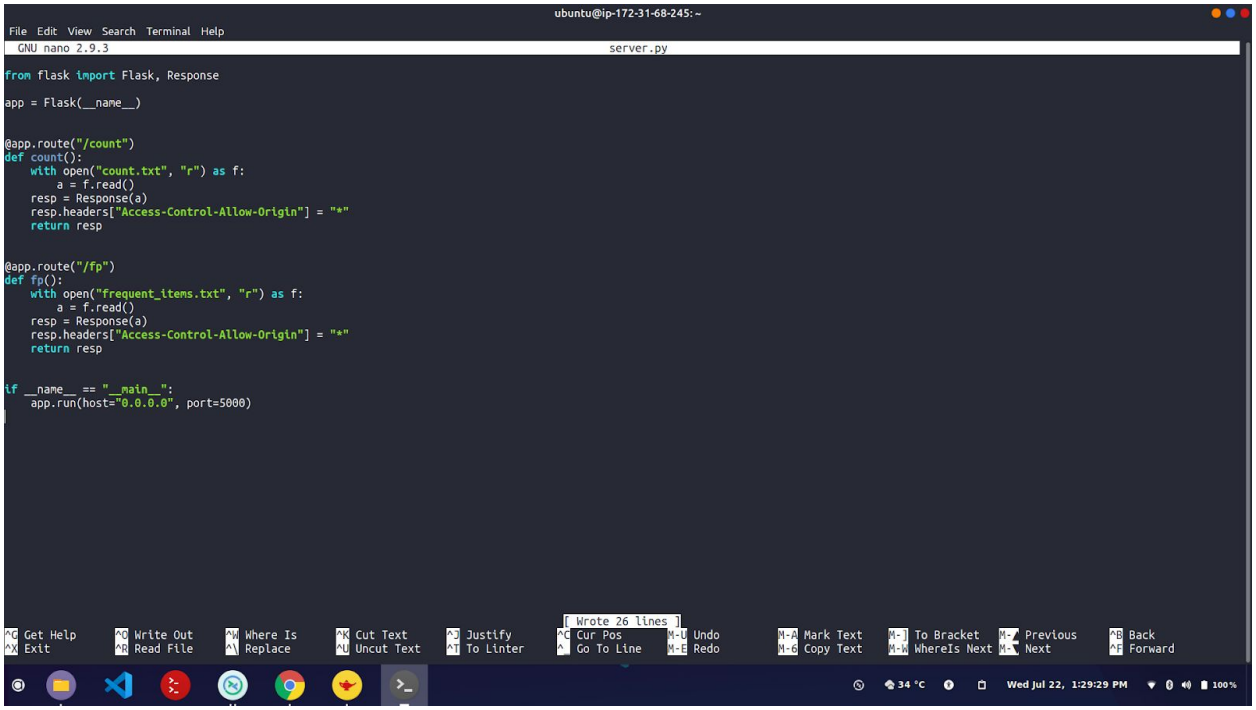


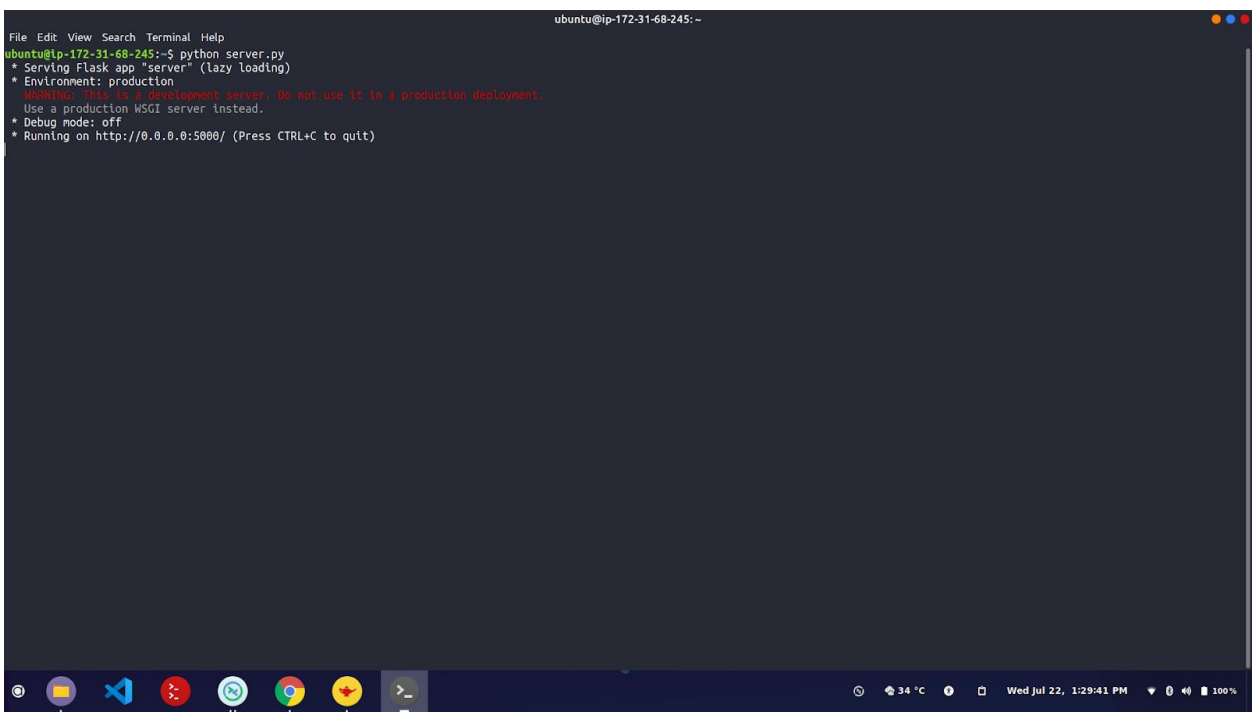




i) The data is stored in files `count.txt` and `frequent_items.txt`.

j) Next, we create a server in the instance by using Flask. We upload the `server.py` and run it.





k) We then do the same above for the other state, and then we upload the `test.html` in one of the instances and then we can see the output.

Number of tweets in New York : 241
Frequent Pairs in New York : ["get"] ["dont"] ["@"] ["directions"] ["im"] ["construction"] ["like"]
New York California