Hive Case Study

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Problem Synopsis: With online sales gaining popularity, tech companies are exploring ways to improve their sales by analysing customer behaviour and gaining insights about product trends. Furthermore, the websites make it easier for customers to find the products they require without much scavenging. This is done by tracking their clicks on the website and searching for patterns within them. The clickstream data contains all the logs as to how the customer navigated through the website. It also contains other details such as time spent on every page, etc. From this, tech companies make use of data ingesting frameworks such as Apache Kafka or AWS Kinesis in order to store it in frameworks such as Hadoop. From there, machine learning engineers or business analysts use this data to derive valuable insights.

Objective: To extract data and gather insights from a real-life data set of an e-commerce company for analysing and gaining insights about customer behaviour.

The steps involved in the entire process are as follows:

The implementation phase can be divided into the following parts:

- Copying the data set into the HDFS:
    - Launch an EMR cluster that utilizes the Hive services, and
    - Move the data from the S3 bucket into the HDFS
- Creating the database and launching Hive queries on your EMR cluster:
    - Create the structure of your database,
    - Use optimized techniques to run your queries as efficiently as possible
    - Show the improvement of the performance after using optimization on any single query.
    - Run Hive queries to answer the questions given below.
- Cleaning up
    - Drop your database, and
    - Terminate your cluster

Launching an EMR Cluster:

In order to launch a cluster, following steps are followed:

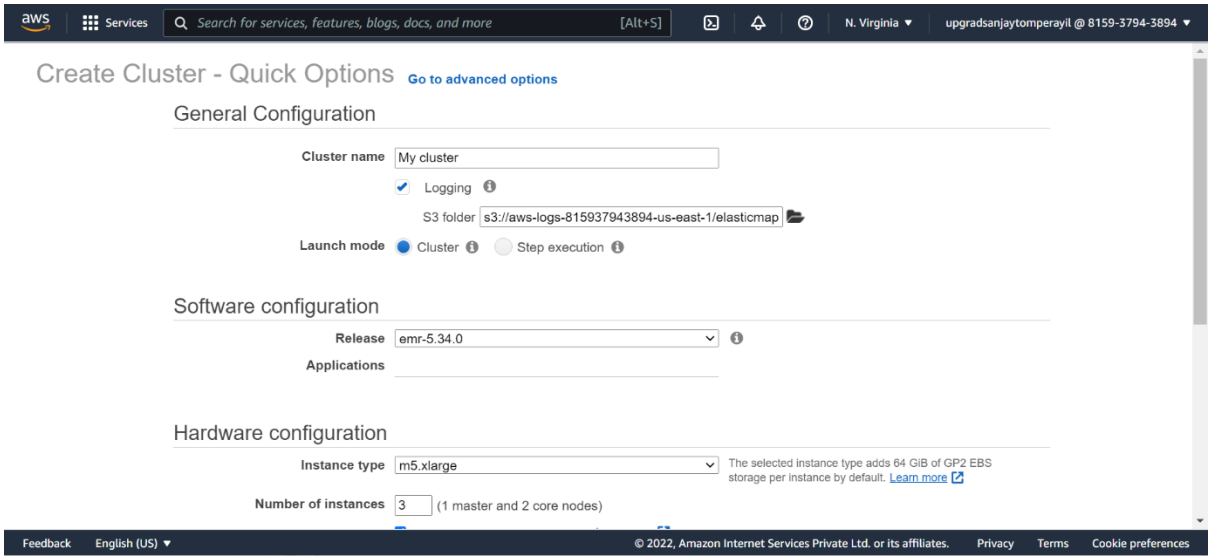
Key-pair creation:

we need to create an EC2 key-pair file - **private170498** and download it as .ppk file.

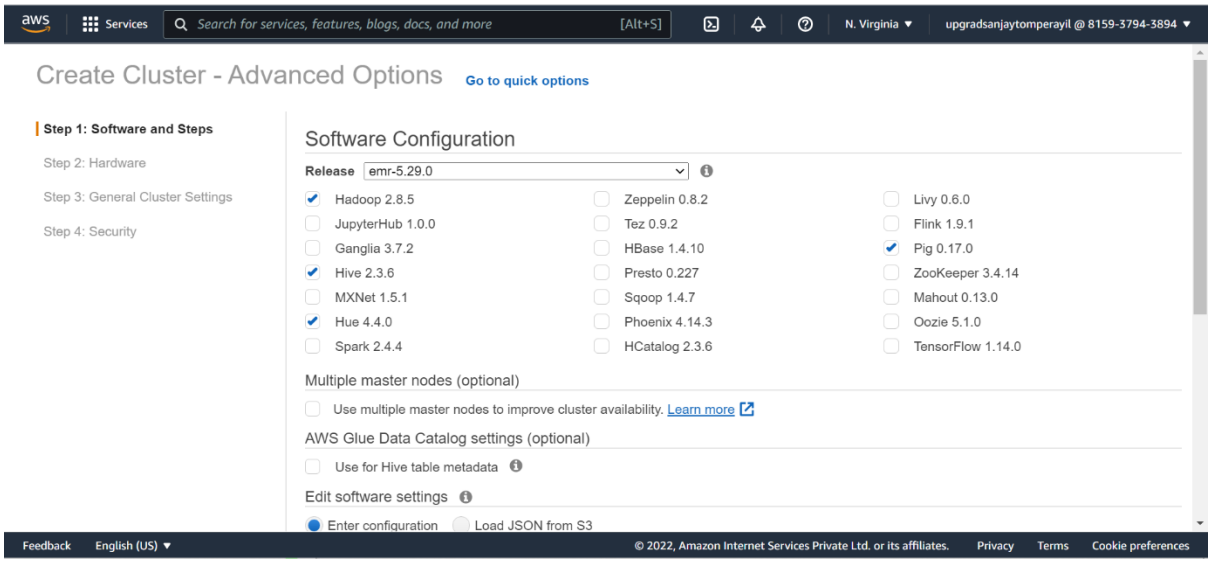
EMR Cluster creation:

Click on "Create cluster" button to create the EMR cluster.

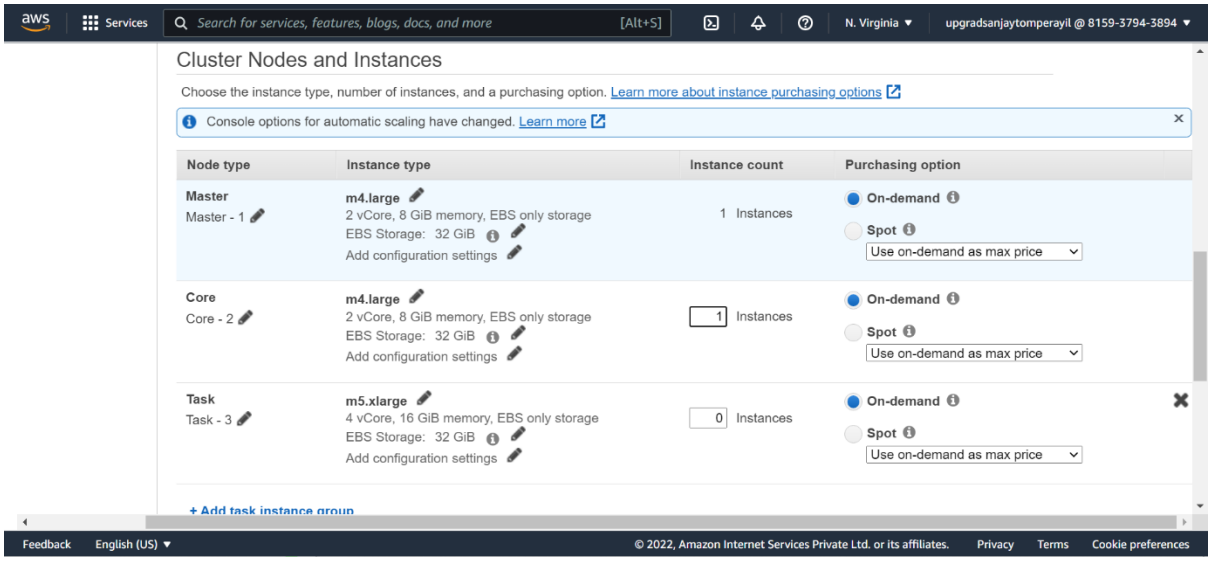
Creating clusters with advanced options.



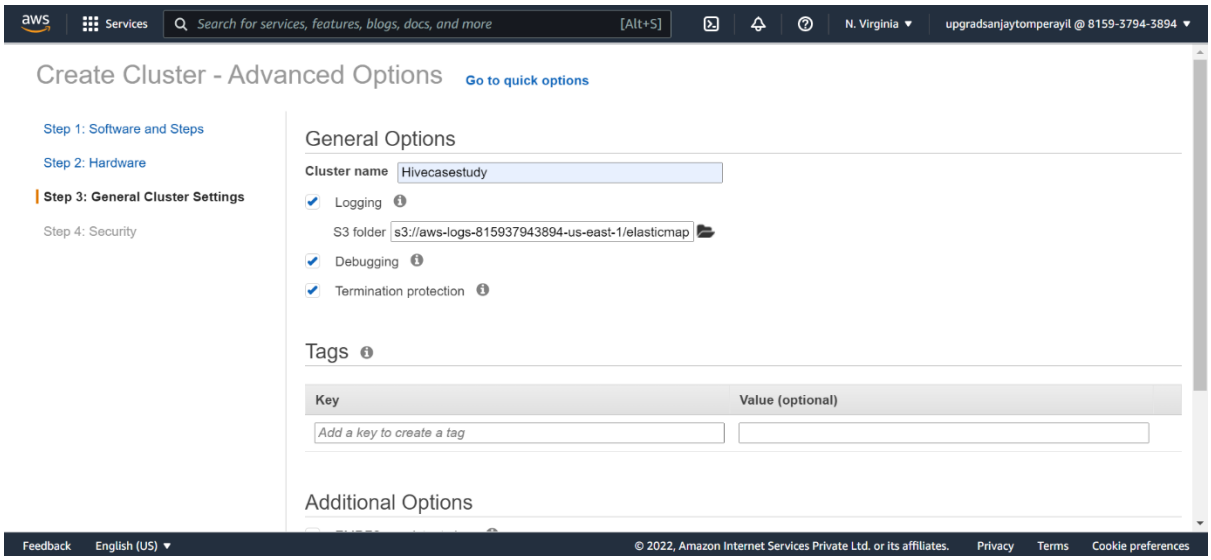
Change the software release from **emr-5.34.0** to **emr-5.29.0**.



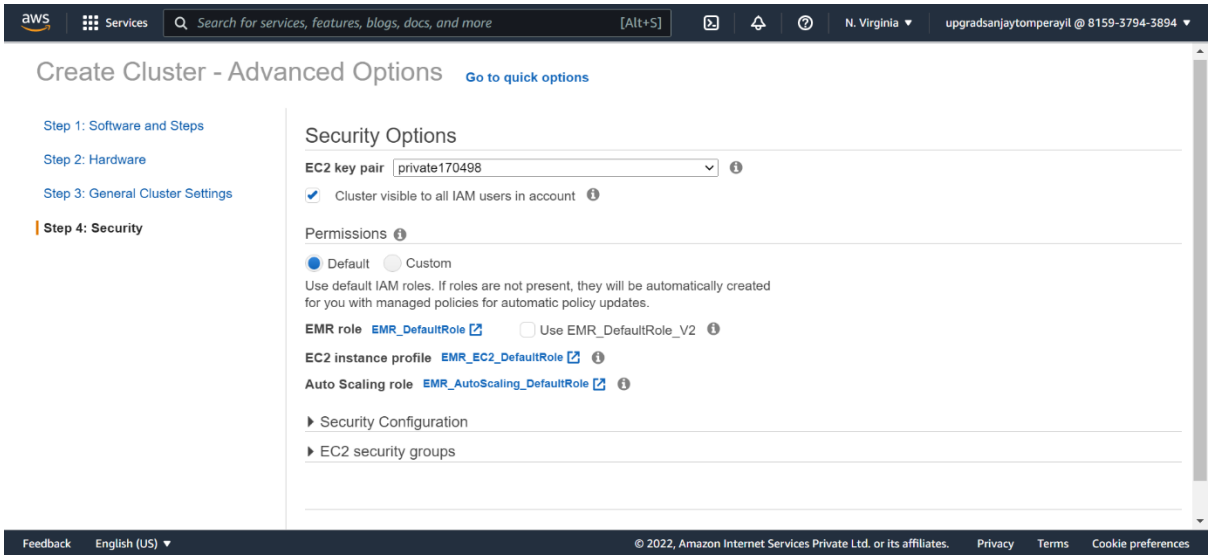
Change the Master and Core nodes from **m5.xlarge** to **m4.large**.



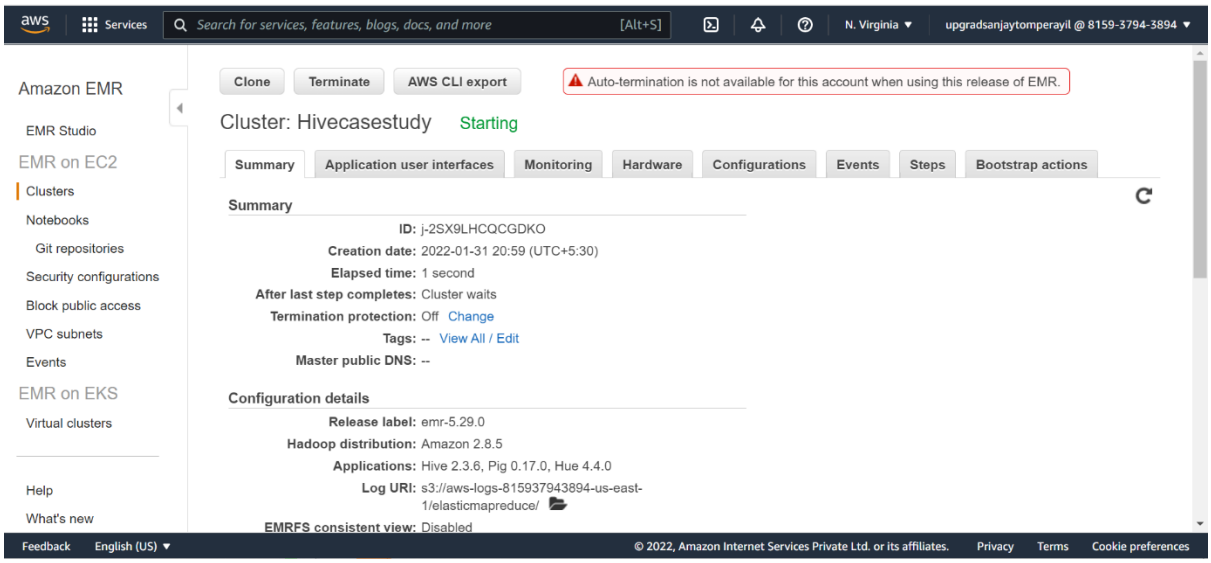
Create a new cluster named **Hivecasestudy.**



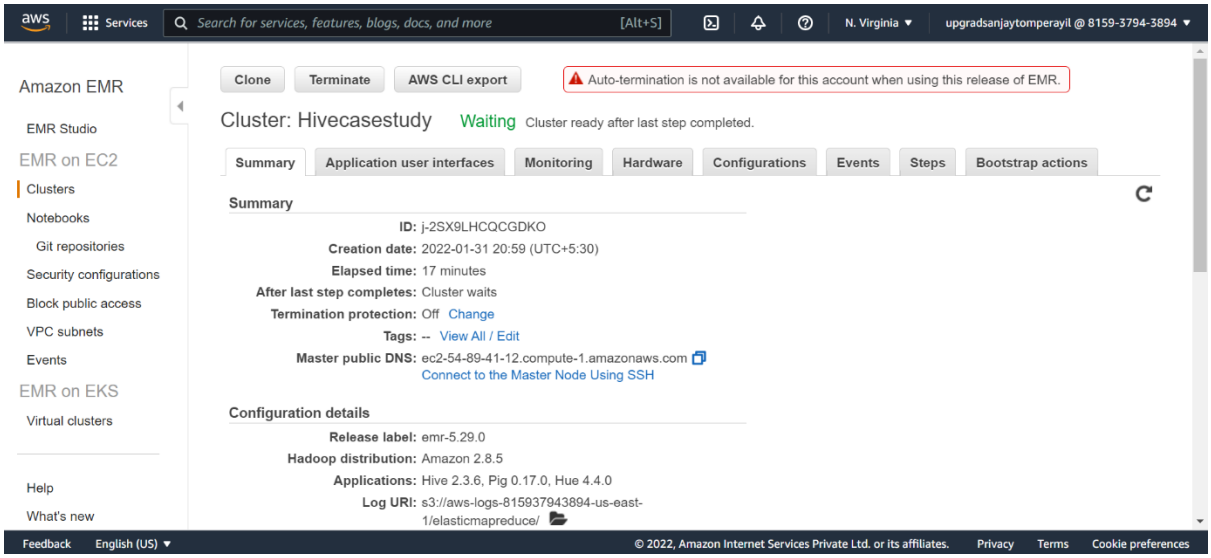
Change the EC2 key pair option to our newly created key pair - **private170498.ppk.**



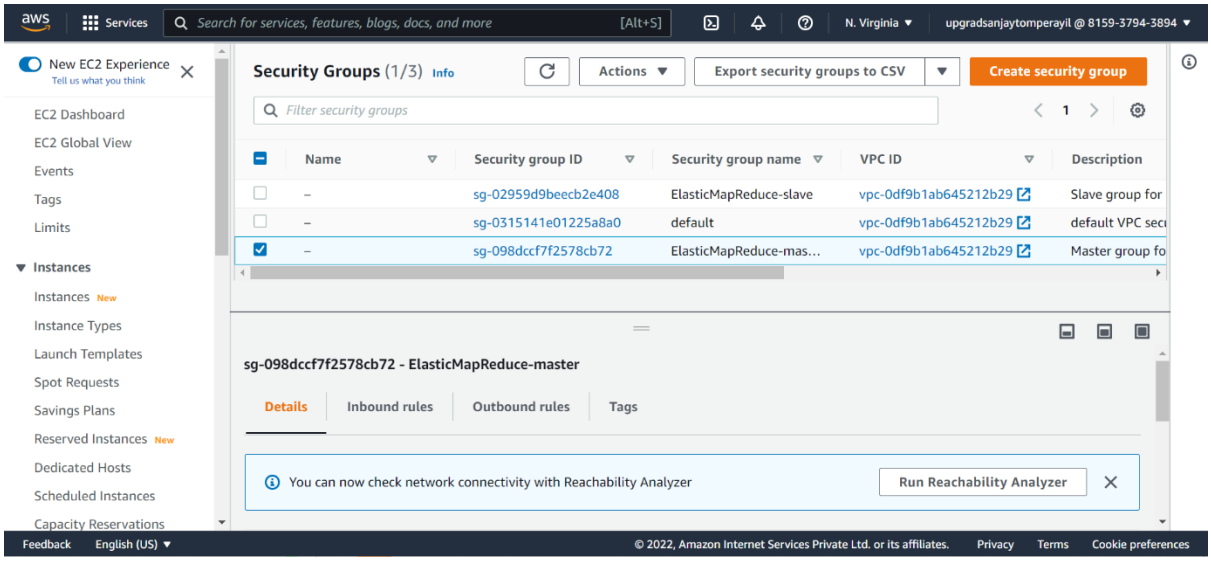
And finally, click on create cluster option.



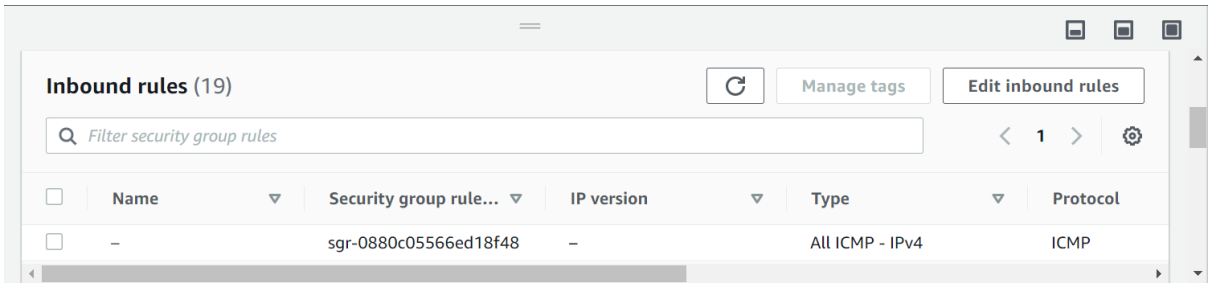
Once ready, the cluster it displays the message **Waiting**.



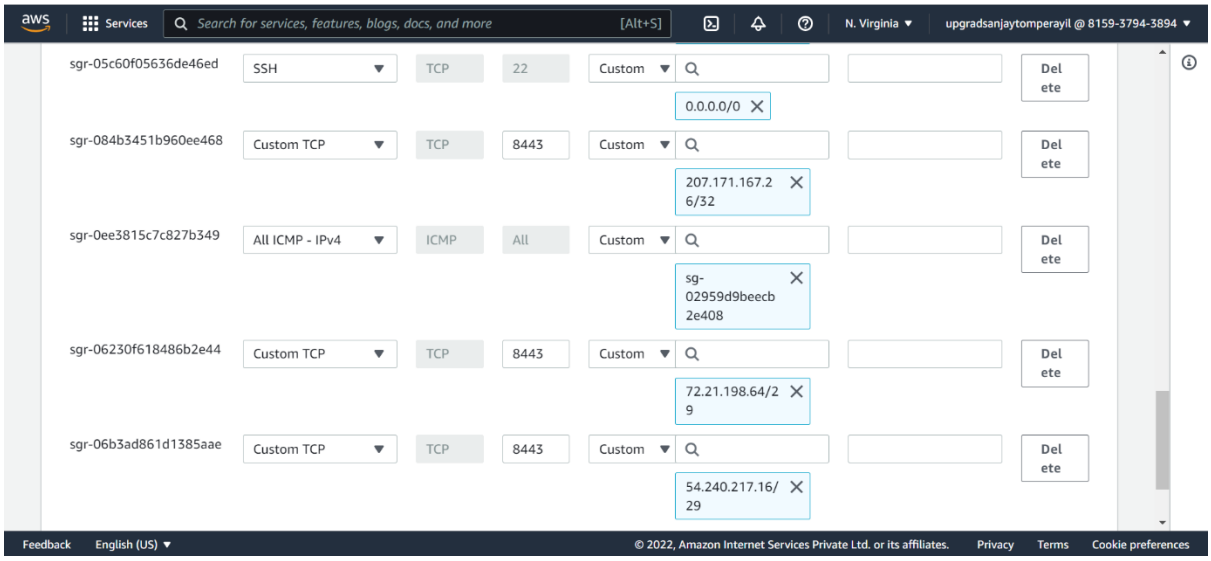
We need to make sure before connecting to SSH, ensure that the port is open to establish a connection. For this, click on **Security groups** for Master node.



Click on edit Inbound rules.

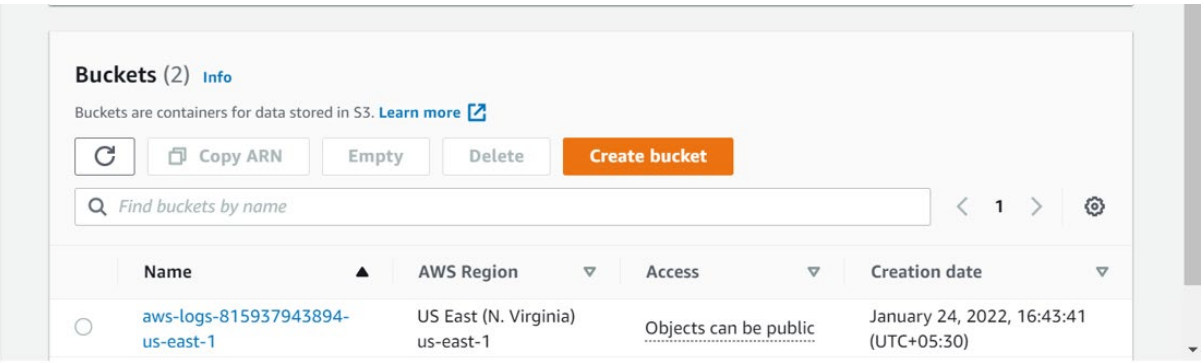


Add a new rule by selecting SSH and change the IP address to Anywhere.

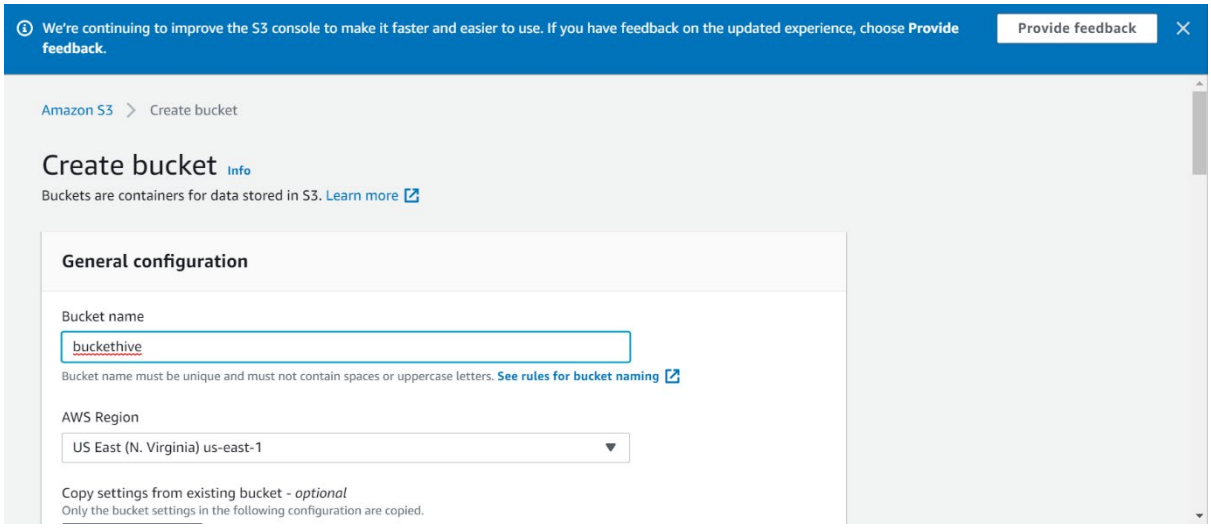


S3 bucket creation:

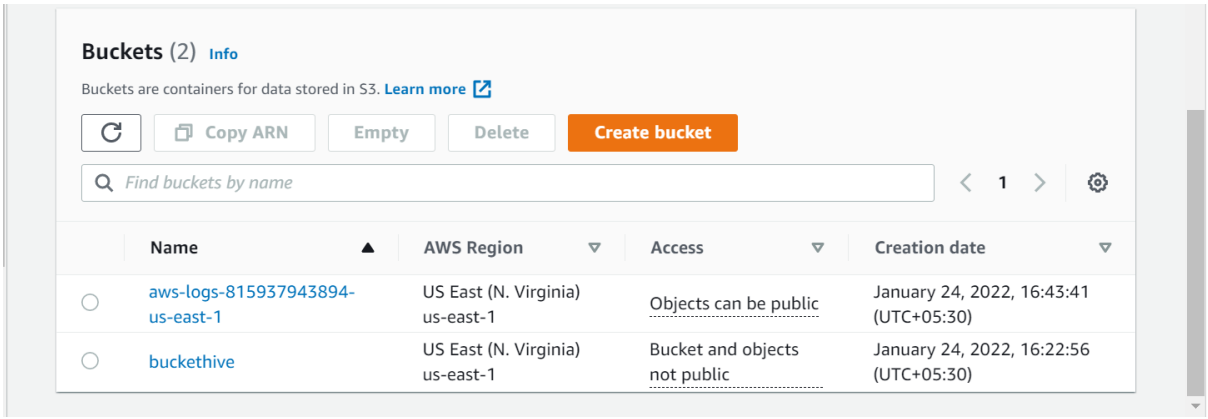
Click on create bucket.



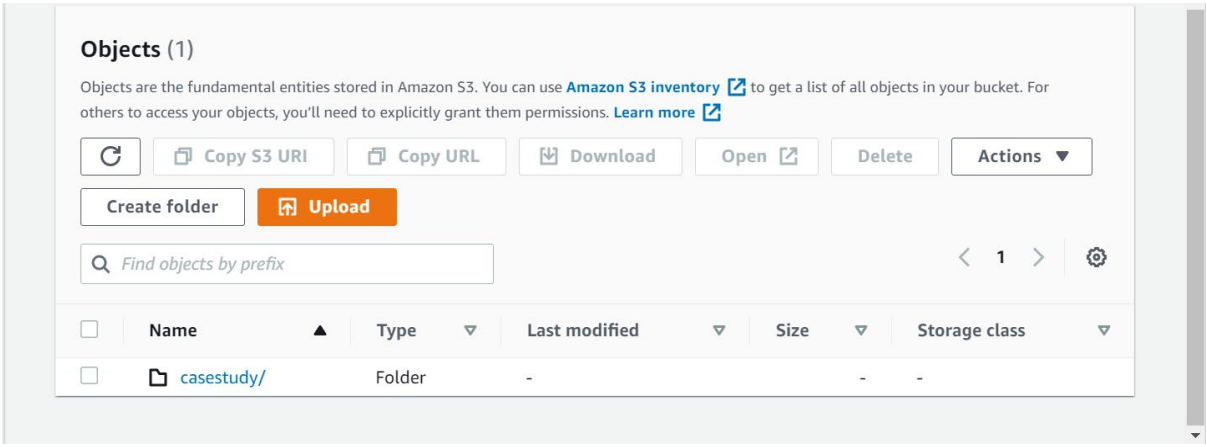
Creating a new bucket named **buckethive** with default options.



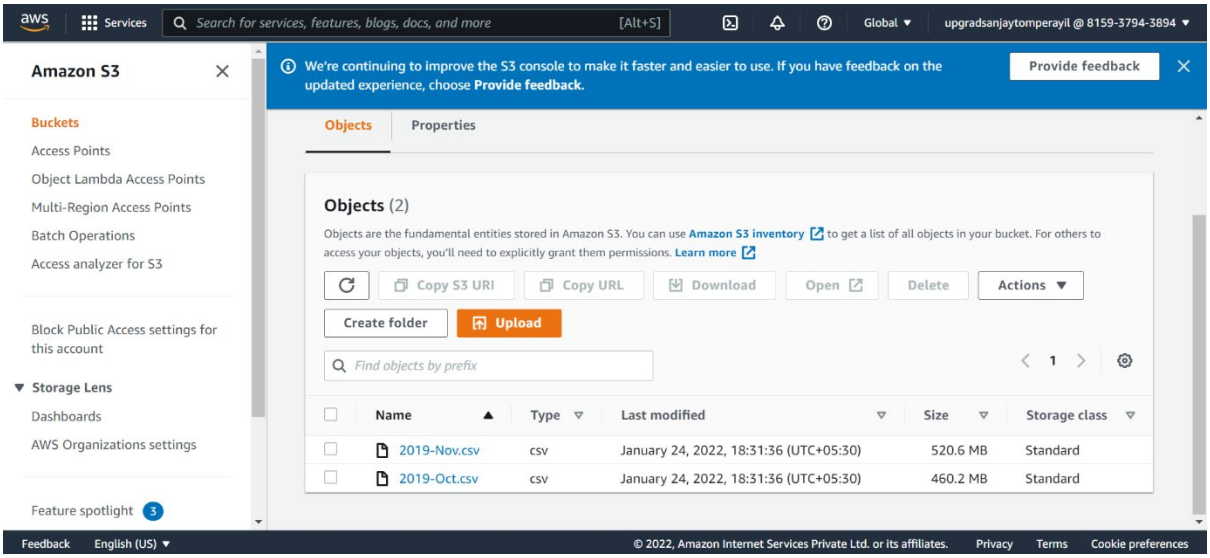
New bucket named **buckethive** successfully created.



Create a new folder under the bucket – **buckethive.**

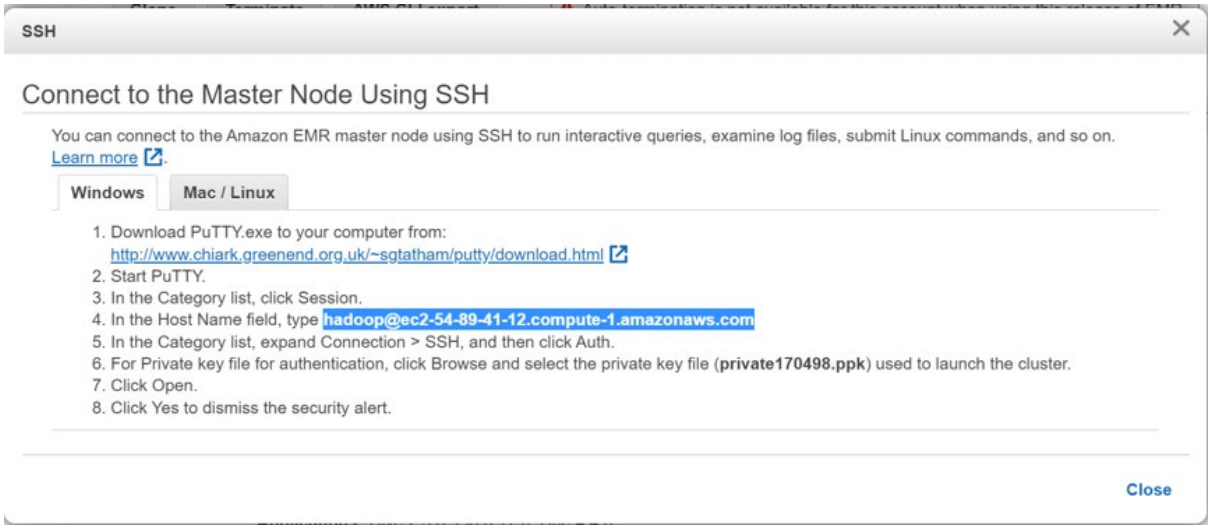


Upload 2 csv files2019-Oct.csv and 2019-Nov.csv under the folder **casestudy**.



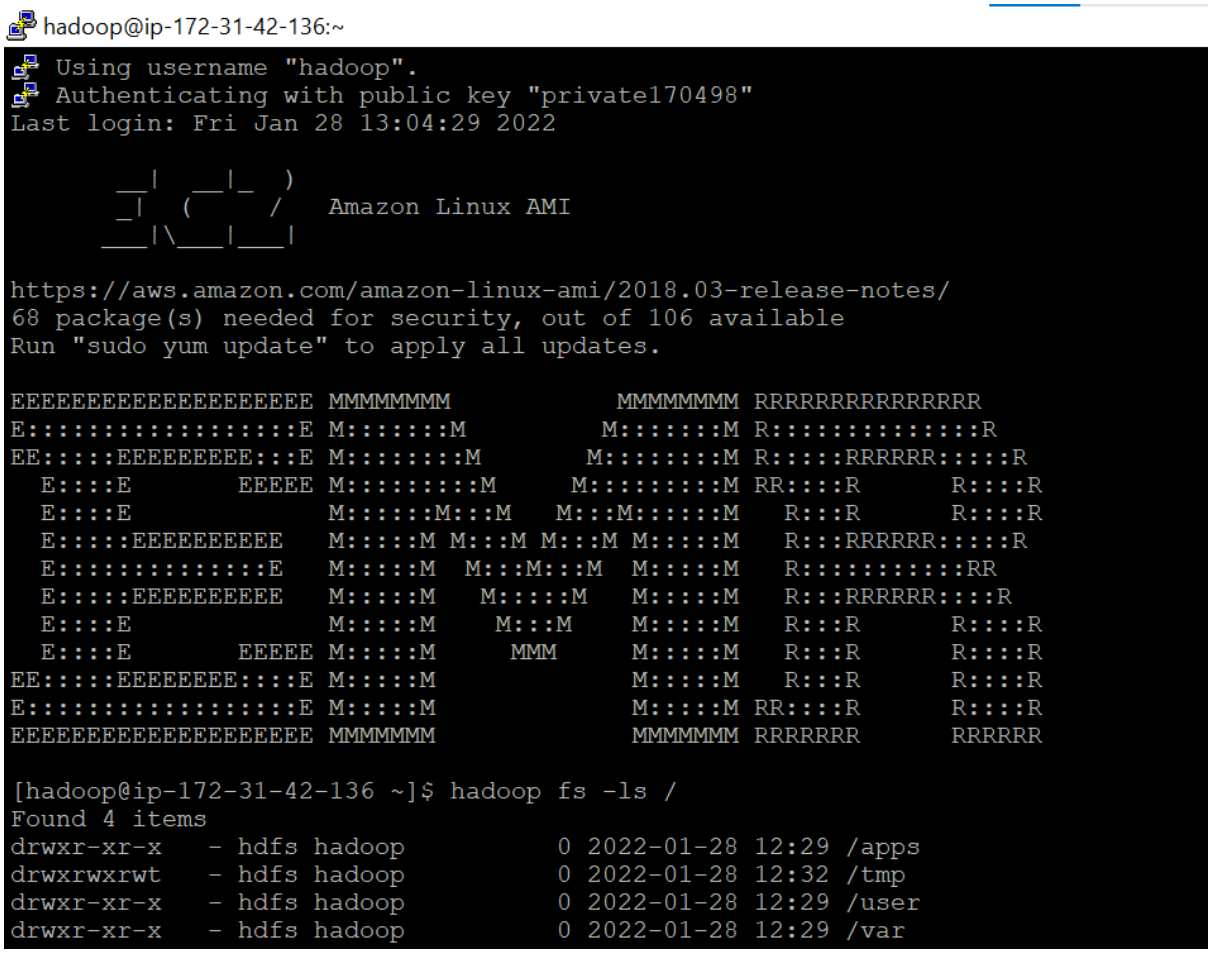
Connect to Master node using SSH:

Open Putty application and connect to host by using the highlighted code shown on the screenshot.



Navigate to Connection and move to Auth under SSH, then provide the private key pair - **private170498.ppk** which was created earlier.

Master node connected and Hive shell Launched.



All of the above are inbuilt directories in the HDFS.

Creating a temporary directory in the HDFS

hadoop fs -mkdir /user/hivecasestudy

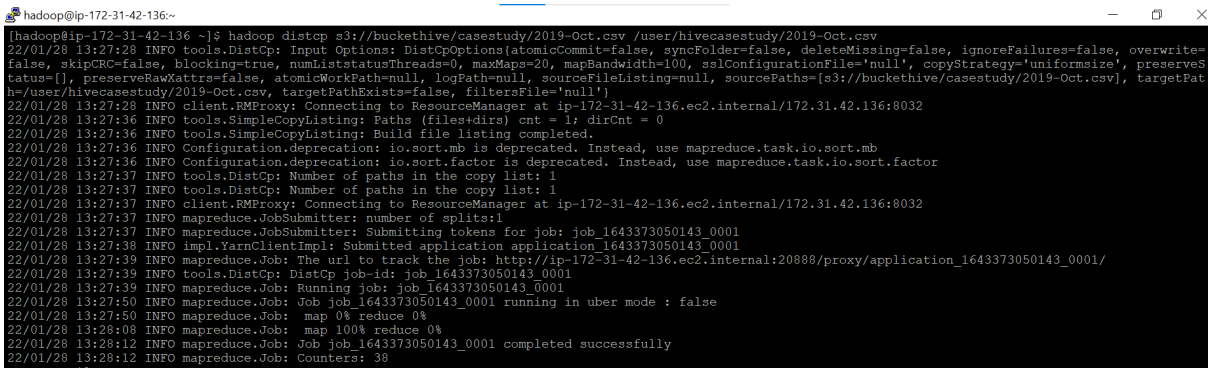
hadoop fs -ls /user/

```
[hadoop@ip-172-31-42-136 ~]$ hadoop fs -mkdir /user/hivecasestudy
[hadoop@ip-172-31-42-136 ~]$ hadoop fs -ls /user/
Found 7 items
drwxrwxrwx   - hadoop hadoop          0 2022-01-28 12:29 /user/hadoop
drwxr-xr-x   - mapred mapred          0 2022-01-28 12:29 /user/history
drwxrwxrwx   - hdfs   hadoop          0 2022-01-28 12:29 /user/hive
drwxr-xr-x   - hadoop hadoop          0 2022-01-28 13:27 /user/hivecasestudy
drwxrwxrwx   - hue    hue             0 2022-01-28 12:29 /user/hue
drwxrwxrwx   - oozie  oozie           0 2022-01-28 12:29 /user/oozie
drwxrwxrwx   - root   hadoop          0 2022-01-28 12:29 /user/root
```

New directory – **hivecasestudy** is successfully created.

Loading the data into the HDFS:

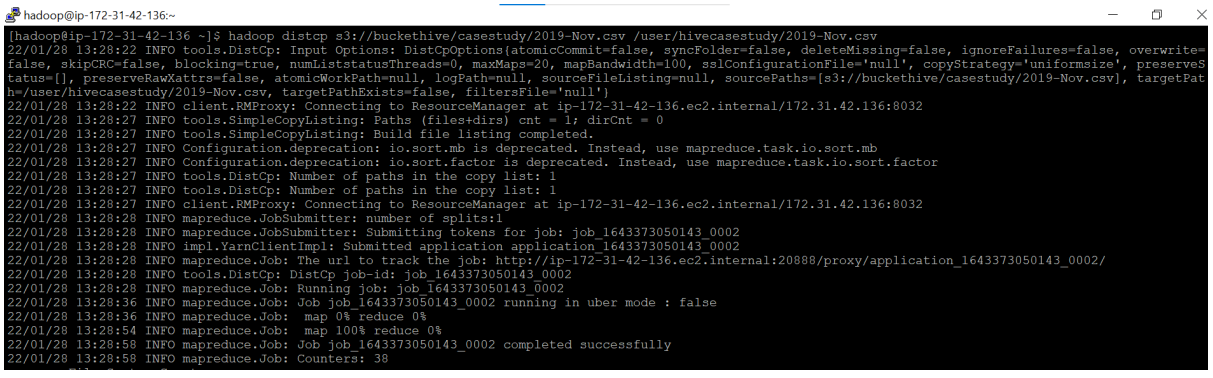
hadoop distcp s3://buckethive/casestudy/2019-Oct.csv /user/hivecasestudy/2019-Oct.csv



hadoop@ip-172-31-42-136:~

```
        File System Counters
                FILE: Number of bytes read=0
                FILE: Number of bytes written=172494
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=358
                HDFS: Number of bytes written=482542278
                HDFS: Number of read operations=12
                HDFS: Number of large read operations=0
                HDFS: Number of write operations=4
                S3: Number of bytes read=482542278
                S3: Number of bytes written=0
                S3: Number of read operations=0
                S3: Number of large read operations=0
                S3: Number of write operations=0
        Job Counters
                Launched map tasks=1
                Other local map tasks=1
                Total time spent by all maps in occupied slots (ms)=595360
                Total time spent by all reduces in occupied slots (ms)=0
                Total time spent by all map tasks (ms)=18605
                Total vcore-milliseconds taken by all map tasks=18605
                Total megabyte-milliseconds taken by all map tasks=19051520
        Map-Reduce Framework
                Map input records=1
                Map output records=0
                Input split bytes=135
                Spilled Records=0
                Failed Shuffles=0
                Merged Map outputs=0
                GC time elapsed (ms)=396
                CPU time spent (ms)=19120
                Physical memory (bytes) snapshot=577859584
                Virtual memory (bytes) snapshot=3296989184
                Total committed heap usage (bytes)=503316480
        File Input Format Counters
                Bytes Read=223
        File Output Format Counters
                Bytes Written=0
        DistCp Counters
                Bytes Copied=482542278
                Bytes Expected=482542278
                Files Copied=1
```

hadoop distcp s3://buckethive/casestudy/2019-Nov.csv /user/hivecasestudy/2019-Nov.csv



hadoop@ip-172-31-42-136:~

```
        File System Counters
                FILE: Number of bytes read=0
                FILE: Number of bytes written=172500
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=360
                HDFS: Number of bytes written=545839412
                HDFS: Number of read operations=12
                HDFS: Number of large read operations=0
                HDFS: Number of write operations=4
                S3: Number of bytes read=545839412
                S3: Number of bytes written=0
                S3: Number of read operations=0
                S3: Number of large read operations=0
                S3: Number of write operations=0
        Job Counters
                Launched map tasks=1
                Other local map tasks=1
                Total time spent by all maps in occupied slots (ms)=605632
                Total time spent by all reduces in occupied slots (ms)=0
                Total time spent by all map tasks (ms)=18926
                Total vcore-milliseconds taken by all map tasks=18926
                Total megabyte-milliseconds taken by all map tasks=19380224
        Map-Reduce Framework
                Map input records=1
                Map output records=0
                Input split bytes=137
                Spilled Records=0
                Failed Shuffles=0
                Merged Map outputs=0
                GC time elapsed (ms)=352
                CPU time spent (ms)=20120
                Physical memory (bytes) snapshot=574844928
                Virtual memory (bytes) snapshot=3296317440
                Total committed heap usage (bytes)=471859200
        File Input Format Counters
                Bytes Read=223
        File Output Format Counters
                Bytes Written=0
        DistCp Counters
                Bytes Copied=545839412
                Bytes Expected=545839412
                Files Copied=1
```

We have successfully loaded both the files into HDFS.

Checking the successful loading of data files:

hadoop fs -ls /user/hivecasestudy

```
[hadoop@ip-172-31-42-136 ~]$ hadoop fs -ls /user/hivecasestudy
Found 2 items
-rw-r--r--   1 hadoop hadoop  545839412 2022-01-28 13:28 /user/hivecasestudy/2019-Nov.csv
-rw-r--r--   1 hadoop hadoop  482542278 2022-01-28 13:28 /user/hivecasestudy/2019-Oct.csv
```

Now, that we can see the 2 uploaded files present in the directory.

Inspecting the table:

hadoop fs -cat /user/hivecasestudy/2019-Oct.csv | head

```
[hadoop@ip-172-31-42-136 ~]$ hadoop fs -cat /user/hivecasestudy/2019-Oct.csv | head
event_time,event_type,product_id,category_id,category_code,brand,price,user_id,user_session
2019-10-01 00:00:00 UTC,cart,5773203,1487580005134238553,,runail,2.62,463240011,26dd6e6e-4dac-4778-8d2c-92e149dab885
2019-10-01 00:00:03 UTC,cart,5773353,1487580005134238553,,runail,2.62,463240011,26dd6e6e-4dac-4778-8d2c-92e149dab885
2019-10-01 00:00:07 UTC,cart,5881589,2151191071051219817,,lovely,13.48,429681830,49e8d843-adf3-428b-a2c3-fe8bc6a307c9
2019-10-01 00:00:07 UTC,cart,5723490,1487580005134238553,,runail,2.62,463240011,26dd6e6e-4dac-4778-8d2c-92e149dab885
2019-10-01 00:00:15 UTC,cart,5881449,1487580013522845895,,lovely,0.56,429681830,49e8d843-adf3-428b-a2c3-fe8bc6a307c9
2019-10-01 00:00:16 UTC,cart,5857269,1487580005134238553,,runail,2.62,430174032,73deale7-664e-43f4-8b30-d32b9d5af04f
2019-10-01 00:00:19 UTC,cart,5739055,1487580008246412266,,kapous,4.75,377667011,81326ac6-daa4-4f0a-b488-fd0956a78733
2019-10-01 00:00:24 UTC,cart,5825598,1487580009445982239,,,0.56,467916806,2f5b5546-b8cb-9ee7-7ecd-84276f8ef486
2019-10-01 00:00:25 UTC,cart,5698989,1487580006317032337,,,1.27,385985999,d30965e8-1101-44ab-b45d-cc1bb9fae694
cat: Unable to write to output stream.
```

hadoop fs -cat /user/hivecasestudy/2019-Nov.csv | head

```
[hadoop@ip-172-31-42-136 ~]$ hadoop fs -cat /user/hivecasestudy/2019-Nov.csv | head
event_time,event_type,product_id,category_id,category_code,brand,price,user_id,user_session
2019-11-01 00:00:02 UTC,view,5802432,1487580009286598681,,,0.32,562076640,09fafd6c-6c99-46b1-834f-33527f4de241
2019-11-01 00:00:09 UTC,cart,5844397,1487580006317032337,,,2.38,553329724,2067216c-31b5-455d-a1cc-af0575a34ffb
2019-11-01 00:00:10 UTC,view,5837166,1783999064103190764,,pnb,22.22,556138645,57ed222e-a54a-4907-9944-5a875c2d7f4f
2019-11-01 00:00:11 UTC,cart,5876812,1487580010100293687,,jessnail,3.16,564506666,186c1951-8052-4b37-adce-dd9644b1d5f7
2019-11-01 00:00:24 UTC,remove_from_cart,5826182,1487580007483048900,,,3.33,553329724,2067216c-31b5-455d-a1cc-af0575a34ffb
2019-11-01 00:00:24 UTC,remove_from_cart,5826182,1487580007483048900,,,3.33,553329724,2067216c-31b5-455d-a1cc-af0575a34ffb
2019-11-01 00:00:25 UTC,view,5856189,1487580009026551821,,runail,15.71,562076640,09fafd6c-6c99-46b1-834f-33527f4de241
2019-11-01 00:00:32 UTC,view,5837835,1933472286753424063,,,3.49,514649199,432a4e95-375c-4b40-bd36-0fc039e77580
2019-11-01 00:00:34 UTC,remove_from_cart,5870838,1487580007675986893,,milv,0.79,429913900,2f0bff3c-252f-4fe6-afcd-5d8a6a92839a
cat: Unable to write to output stream.
```

Creating Hive Schema & Optimization of tables:

hive

```
[hadoop@ip-172-31-42-136 ~]$ hive

Logging initialized using configuration in file:/etc/hive/conf.dist/hive-log4j2.properties Async: false
```

Creating a new Database for the casestudy:

create database if not exists casestudy;
use casestudy;

```
hive> create database if not exists casestudy;
OK
Time taken: 0.841 seconds
hive> use casestudy;
OK
Time taken: 0.066 seconds
```

Creating an external table in hive to load the data:

CREATE EXTERNAL TABLE IF NOT EXISTS store (event_time timestamp, event_type string, product_id string, category_id string, category_code string, brand string, price float, user_id bigint, user_session string)

ROW FORMAT SERDE 'org.apache.hadoop.hive.serde2.OpenCSVSerde'
STORED AS TEXTFILE LOCATION '/user/hivecasestudy/'
TBLPROPERTIES ("skip.header.line.count"="1");

```
hive> CREATE EXTERNAL TABLE IF NOT EXISTS store (event_time timestamp, event_type string, product_id string, category_id string, category_code string, brand
string, price float, user_id bigint, user_session string)
    > ROW FORMAT SERDE 'org.apache.hadoop.hive.serde2.OpenCSVSerde'
    > STORED AS TEXTFILE LOCATION '/user/hivecasestudy/'
    > TBLPROPERTIES ("skip.header.line.count"="1");
OK
Time taken: 0.338 seconds
```

Checking the table store:

describe store;

```
hive> describe store;
OK
event_time              string                  from deserializer
event_type              string                  from deserializer
product_id              string                  from deserializer
category_id             string                  from deserializer
category_code           string                  from deserializer
brand                   string                  from deserializer
price                   string                  from deserializer
user_id                 string                  from deserializer
user_session            string                  from deserializer
Time taken: 0.461 seconds, Fetched: 9 row(s)
```

LOAD DATA INPATH '/user/hivecasestudy/2019-Oct.csv' INTO TABLE store;

```
hive> LOAD DATA INPATH '/user/hivecasestudy/2019-Oct.csv' INTO TABLE store;
Loading data to table casestudy.store
OK
Time taken: 1.719 seconds
```

LOAD DATA INPATH '/user/hivecasestudy/2019-Oct.csv' INTO TABLE store;

```
hive> LOAD DATA INPATH '/user/hivecasestudy/2019-Nov.csv' INTO TABLE store;
Loading data to table casestudy.store
OK
Time taken: 0.706 seconds
```

Checking the successful creation of table and transfer of data into the table:

SELECT * FROM store
LIMIT 10;

```
hive> SELECT * FROM store
    > LIMIT 10;
OK
2019-11-01 00:00:02 UTC view    5802432 1487580009286598681                     0.32    562076640       09fafd6c-6c99-46b1-834f-33527f4de241
2019-11-01 00:00:09 UTC cart    5844397 1487580006317032337                     2.38    553329724       2067216c-31b5-455d-a1cc-af0575a34ffb
2019-11-01 00:00:10 UTC view    5837166 1783999064103190764             pnb     22.22   556138645       57ed222e-a54a-4907-9944-5a875c2d7f4f
2019-11-01 00:00:11 UTC cart    5876812 1487580010100293687             jessnail        3.16    564506666       186c1951-8052-4b37-adce-dd9644b1d5f7
2019-11-01 00:00:24 UTC remove_from_cart        5826182 14875800074830489000                    3.33    553329724       2067216c-31b5-455d-a1cc-af0575a34ffb
2019-11-01 00:00:24 UTC remove_from_cart        5826182 14875800074830489000                    3.33    553329724       2067216c-31b5-455d-a1cc-af0575a34ffb
2019-11-01 00:00:25 UTC view    5856189 1487580009026551821             runail  15.71   562076640       09fafd6c-6c99-46b1-834f-33527f4de241
2019-11-01 00:00:32 UTC view    5837835 1933472286753424063                     3.49    514649199       432a4e95-375c-4b40-bd36-0fc039e77580
2019-11-01 00:00:34 UTC remove_from_cart        5870838 14875800076759868930            milv    0.79    429913900       2f0bff3c-252f-4fe6-afcd-5d8a6a92839a
2019-11-01 00:00:37 UTC view    5870803 1487580007675986893             milv    0.79    429913900       2f0bff3c-252f-4fe6-afcd-5d8a6a92839a
Time taken: 3.443 seconds, Fetched: 10 row(s)
```

Enabling Dynamic partitioning and Bucketing:

set hive.cli.print.header=true;
set hive.exec.dynamic.partition=true;
set hive.exec.dynamic.partition.mode=nonstrict;
set hive.enforce.bucketing=true;

```
hive> set hive.cli.print.header=true;
hive> set hive.exec.dynamic.partition=true;
hive> set hive.exec.dynamic.partition.mode=nonstrict;
hive> set hive.enforce.bucketing=true;
```

Optimization of tables - Partitioning and Bucketing:

We will be using partitioning on **event_type**.
We will be using bucketing and clustering simultaneously on price and will divide it into **20 buckets.**

CREATE EXTERNAL TABLE IF NOT EXISTS store_1 (event_time timestamp, product_id string, category_id string, category_code string, brand string, price float, user_id bigint, user_session string)
PARTITIONED BY (event_type string)
CLUSTERED BY (price) INTO 20 buckets
ROW FORMAT SERDE 'org.apache.hadoop.hive.serde2.OpenCSVSerde'
STORED AS TEXTFILE LOCATION '/user/hivecasestudy/'
TBLPROPERTIES ("skip.header.line.count"="1");

```
hive> CREATE EXTERNAL TABLE IF NOT EXISTS store_1 (event_time timestamp, product_id string, category_id string, category_code string, brand string, price flo
at, user_id bigint, user_session string)
    > PARTITIONED BY (event_type string)
    > CLUSTERED BY (price) INTO 20 buckets
    > ROW FORMAT SERDE 'org.apache.hadoop.hive.serde2.OpenCSVSerde'
    > STORED AS TEXTFILE LOCATION '/user/hivecasestudy/'
    > TBLPROPERTIES ("skip.header.line.count"="1");
OK
Time taken: 0.099 seconds
```

Checking the new table store_1:

describe store_1;

```
hive> describe store_1;
OK
col_name        data_type       comment
event_time              string                  from deserializer
product_id              string                  from deserializer
category_id             string                  from deserializer
category_code           string                  from deserializer
brand                   string                  from deserializer
price                   string                  from deserializer
user_id                 string                  from deserializer
user_session            string                  from deserializer
event_type              string

# Partition Information
# col_name              data_type               comment

event_type              string
Time taken: 0.112 seconds, Fetched: 14 row(s)
```

Inserting data into partitioned and bucketed table:

INSERT INTO TABLE store_1 partition(event_type)
SELECT event_time, product_id, category_id, category_code, brand, price, user_id, user_session, event_type
FROM store;

```
hive> INSERT INTO TABLE store_1 partition(event_type)
    > SELECT event_time, product_id, category_id, category_code, brand, price, user_id, user_session, event_type
    > FROM store;
Query ID = hadoop_20220128133434_30a762aa-c5be-4677-86b0-f170a14ac4fd
Total jobs = 1
Launching Job 1 out of 1
Status: Running (Executing on YARN cluster with App id application_1643373050143_0003)

--------------------------------------------------------------------------------
        VERTICES      MODE        STATUS  TOTAL  COMPLETED  RUNNING  PENDING  FAILED  KILLED
--------------------------------------------------------------------------------
Map 1 ..... container     SUCCEEDED      2          2        0        0       0       0
Reducer 2 ..... container     SUCCEEDED      5          5        0        0       0       0
--------------------------------------------------------------------------------
VERTICES: 02/02  [==========================>>] 100%  ELAPSED TIME: 178.48 s
--------------------------------------------------------------------------------
Loading data to table casestudy.store_1 partition (event_type=null)

Loaded : 4/4 partitions.
        Time taken to load dynamic partitions: 0.507 seconds
        Time taken for adding to write entity : 0.006 seconds
OK
event_time      product_id      category_id     category_code   brand   price   user_id user_session    event_type
Time taken: 182.455 seconds
```

Based on the above screenshot, we can verify that 4 partitions have been created.

Querying Questions:

1. Find the total revenue generated due to purchases made in October.

Non-optimized table

SELECT SUM(price) as Oct_revenue
FROM store
WHERE event_type = 'purchase' AND month(event_time) = 10;

```
hive> SELECT SUM(price) as Oct_revenue
    > FROM store
    > WHERE event_type = 'purchase' AND month(event_time) = 10;
Query ID = hadoop_20220128134242_8a254e32-08b3-495e-8381-c0d37b94b9b7
Total jobs = 1
Launching Job 1 out of 1
Status: Running (Executing on YARN cluster with App id application_1643373050143_0003)

--------------------------------------------------------------------------------
        VERTICES      MODE        STATUS  TOTAL  COMPLETED  RUNNING  PENDING  FAILED  KILLED
--------------------------------------------------------------------------------
Map 1 ..... container     SUCCEEDED      5          5        0        0       0       0
Reducer 2 ..... container     SUCCEEDED      1          1        0        0       0       0
--------------------------------------------------------------------------------
VERTICES: 02/02  [==========================>>] 100%  ELAPSED TIME: 106.88 s
--------------------------------------------------------------------------------
OK
oct_revenue
1211538.4299997438
Time taken: 109.374 seconds, Fetched: 1 row(s)
```

Optimized table

SELECT SUM(price) as Oct_revenue
FROM store_1
WHERE event_type = 'purchase' AND month(event_time) = 10;

```
hive> SELECT SUM(price) as Oct_revenue
    > FROM store_1
    > WHERE event_type = 'purchase' AND month(event_time) = 10;
Query ID = hadoop_20220128134507_3abbd413-4af4-4805-a7c1-b63fc7e2dd0b
Total jobs = 1
Launching Job 1 out of 1
Status: Running (Executing on YARN cluster with App id application_1643373050143_0003)

--------------------------------------------------------------------------------
        VERTICES      MODE        STATUS  TOTAL  COMPLETED  RUNNING  PENDING  FAILED  KILLED
--------------------------------------------------------------------------------
Map 1 .......... container     SUCCEEDED      3          3        0        0       0       0
Reducer 2 ...... container     SUCCEEDED      1          1        0        0       0       0
--------------------------------------------------------------------------------
VERTICES: 02/02  [==========================>>] 100%  ELAPSED TIME: 27.00 s
--------------------------------------------------------------------------------
OK
oct_revenue
1211489.6700001915
Time taken: 28.262 seconds, Fetched: 1 row(s)
```

- We see almost similar results obtained with slight variation through both the ways as the data used is the same for both the cases.
- We observed that, the query execution time for non-optimized table was 109.374 seconds, while incase for optimized query is 28.262 seconds, with a difference of 81.112 seconds. This is a huge variation, as the data size increase the execution time will also increase.

2. Write a query to yield the total sum of purchases per month in a single output.

Non-optimized table

SELECT month(event_time) as Month, SUM(price) as Total_revenue
FROM store
WHERE event_type = 'purchase'
GROUP BY month(event_time);

```
hive> SELECT month(event_time) as Month, SUM(price) as Total_revenue
    > FROM store
    > WHERE event_type = 'purchase'
    > GROUP BY month(event_time);
Query ID = hadoop_20220128134626_595cd7ee-991d-4403-8b00-62f9b6985063
Total jobs = 1
Launching Job 1 out of 1
Status: Running (Executing on YARN cluster with App id application_1643373050143_0003)

--------------------------------------------------------------------------------
        VERTICES      MODE        STATUS  TOTAL  COMPLETED  RUNNING  PENDING  FAILED  KILLED
--------------------------------------------------------------------------------
Map 1 .......... container     SUCCEEDED      5          5        0        0       0       0
Reducer 2 ...... container     SUCCEEDED      3          3        0        0       0       0
--------------------------------------------------------------------------------
VERTICES: 02/02  [==========================>>] 100%  ELAPSED TIME: 107.41 s
--------------------------------------------------------------------------------
OK
month   total_revenue
10      1211538.4299997438
11      1531016.900000122
Time taken: 108.244 seconds, Fetched: 2 row(s)
```

Optimized table

SELECT month(event_time) as Month, SUM(price) as Total_revenue
FROM store_1
WHERE event_type = 'purchase'
GROUP BY month(event_time);

```
hive> SELECT month(event_time) as Month, SUM(price) as Total_revenue
    > FROM store_1
    > WHERE event_type = 'purchase'
    > GROUP BY month(event_time);
Query ID = hadoop_20220128135138_07fbd7fe-d96f-44e0-a3bf-49ad3a67701f
Total jobs = 1
Launching Job 1 out of 1
Status: Running (Executing on YARN cluster with App id application_1643373050143_0003)

--------------------------------------------------------------------------------
        VERTICES      MODE        STATUS  TOTAL  COMPLETED  RUNNING  PENDING  FAILED  KILLED
--------------------------------------------------------------------------------
Map 1 .......... container     SUCCEEDED      3          3        0        0       0       0
Reducer 2 ...... container     SUCCEEDED      1          1        0        0       0       0
--------------------------------------------------------------------------------
VERTICES: 02/02  [==========================>>] 100%  ELAPSED TIME: 26.21 s
--------------------------------------------------------------------------------
OK
month   total_revenue
10      1211489.6700001918
11      1530983.7700001802
Time taken: 26.819 seconds, Fetched: 2 row(s)
```

- Sum of purchases made in the month of October is 1211489 while in the month of November, the sum of purchases is 1530983, which means number of purchases are increased in November month

- We observed that, the query execution time for non-optimized table was 108.244 seconds, while incase for optimized query is 26.819 seconds, with a difference of 81.425 seconds. We can see there is a huge difference in the execution time of the same query.

Hence, with proper partitioning and bucketing on table we can reduce execution time.

3. Write a query to find the change in revenue generated due to purchases from October to November.

```
WITH Monthly_revenue AS (
SELECT
SUM (CASE WHEN date_format(event_time, 'MM')=10 THEN price ELSE 0 END) AS Oct_Revenue,
SUM (CASE WHEN date_format(event_time, 'MM')=11 THEN price ELSE 0 END) AS Nov_Revenue
FROM store_1
WHERE event_type= 'purchase'
AND date_format(event_time, 'MM') in ('10','11')
)
SELECT Nov_revenue, Oct_revenue, (Nov_revenue-Oct_revenue) AS
Difference_Of_revenue FROM Monthly_revenue;
```

```
hive> WITH Monthly_revenue AS (
    > SELECT
    > SUM (CASE WHEN date_format(event_time, 'MM')=10 THEN price ELSE 0 END) AS Oct_Revenue,
    > SUM (CASE WHEN date_format(event_time, 'MM')=11 THEN price ELSE 0 END) AS Nov_Revenue
    > FROM store_1
    > WHERE event_type= 'purchase'
    > AND date_format(event_time, 'MM') in ('10','11')
    > )
    > SELECT Nov_revenue, Oct_revenue, (Nov_revenue-Oct_revenue) AS
    > Difference_Of_revenue FROM Monthly_revenue;
Query ID = hadoop_20220128135256_09b5af88-20a1-4017-b382-d882bfc8d228
Total jobs = 1
Launching Job 1 out of 1
Status: Running (Executing on YARN cluster with App id application_1643373050143_0003)

----------------------------------------------------------------------------------------------
        VERTICES      MODE        STATUS  TOTAL  COMPLETED  RUNNING  PENDING  FAILED  KILLED
----------------------------------------------------------------------------------------------
Map 1 .......... container     SUCCEEDED      3          3        0        0       0       0
Reducer 2 ...... container     SUCCEEDED      1          1        0        0       0       0
----------------------------------------------------------------------------------------------
VERTICES: 02/02  [==========================>>] 100%  ELAPSED TIME: 42.30 s
----------------------------------------------------------------------------------------------
OK
nov_revenue     oct_revenue     difference_of_revenue
1530983.7700001802      1211489.6700001915      319494.0999999887
Time taken: 42.933 seconds, Fetched: 1 row(s)
```

The change in revenue generated due to purchases from October to November is 319494.099.

4. Find distinct categories of products. Categories with null category code can be ignored.

```
SELECT DISTINCT SPLIT(category_code,'\\.')[0] AS category
FROM store_1
WHERE SPLIT(category_code,'\\.')[0]<>'';
```

```
hive> SELECT DISTINCT SPLIT(category_code,'\\.')[0] AS category
    > FROM store_1
    > WHERE SPLIT(category_code,'\\.')[0]<>'';
Query ID = hadoop_20220128135452_67d31252-2294-4f82-9355-590c1ab5441a
Total jobs = 1
Launching Job 1 out of 1
Status: Running (Executing on YARN cluster with App id application_1643373050143_0003)

--------------------------------------------------------------------------------
        VERTICES      MODE        STATUS  TOTAL  COMPLETED  RUNNING  PENDING  FAILED  KILLED
--------------------------------------------------------------------------------
Map 1 .......... container     SUCCEEDED      6          6        0        0       0       0
Reducer 2 ...... container     SUCCEEDED      5          5        0        0       0       0
--------------------------------------------------------------------------------
VERTICES: 02/02  [==========================>>] 100%  ELAPSED TIME: 72.71 s
--------------------------------------------------------------------------------
OK
category
furniture
appliances
accessories
apparel
sport
stationery
Time taken: 73.399 seconds, Fetched: 6 row(s)
```

There are 6 Distinct categories of products.

5. Find the total number of products available under each category.

SELECT SPLIT(category_code,'\\.')[0] AS category, COUNT(product_id) AS Total_product
FROM store_1
GROUP BY SPLIT(category_code,'\\.')[0]
ORDER BY Total_product DESC;

```
hive> SELECT SPLIT(category_code,'\\.')[0] AS category, COUNT(product_id) AS Total_product
    > FROM store_1
    > GROUP BY SPLIT(category_code,'\\.')[0]
    > ORDER BY Total_product DESC;
Query ID = hadoop_20220128135639_d4aaa55b-5aff-4e9b-abb9-1b81229e4b12
Total jobs = 1
Launching Job 1 out of 1
Status: Running (Executing on YARN cluster with App id application_1643373050143_0003)

--------------------------------------------------------------------------------
        VERTICES      MODE        STATUS  TOTAL  COMPLETED  RUNNING  PENDING  FAILED  KILLED
--------------------------------------------------------------------------------
Map 1 .......... container     SUCCEEDED      6          6        0        0       0       0
Reducer 2 ...... container     SUCCEEDED      5          5        0        0       0       0
Reducer 3 ...... container     SUCCEEDED      1          1        0        0       0       0
--------------------------------------------------------------------------------
VERTICES: 03/03  [==========================>>] 100%  ELAPSED TIME: 73.95 s
--------------------------------------------------------------------------------
OK
category        total_product
        8594817
appliances      61735
stationery      26721
furniture       23604
apparel 18232
accessories     12929
sport   2
Time taken: 74.596 seconds, Fetched: 7 row(s)
```

There are 8594817 total number of products.

6. Which brand had the maximum sales in October and November combined?

```
SELECT brand, SUM(price) as Total_sales
FROM store_1
WHERE event_type = 'purchase' AND brand!= ''
GROUP BY brand
ORDER BY Total_sales DESC
LIMIT 1;
```

```
hive> SELECT brand, SUM(price) as Total_sales
    > FROM store_1
    > WHERE event_type = 'purchase' AND brand!= ''
    > GROUP BY brand
    > ORDER BY Total_sales DESC
    > LIMIT 1;
Query ID = hadoop_20220128135815_daaa97fa-1d81-4de7-a647-944cc9809d8e
Total jobs = 1
Launching Job 1 out of 1
Status: Running (Executing on YARN cluster with App id application_1643373050143_0003)

----------------------------------------------------------------------------------------------
        VERTICES      MODE        STATUS  TOTAL  COMPLETED  RUNNING  PENDING  FAILED  KILLED
----------------------------------------------------------------------------------------------
Map 1 .......... container     SUCCEEDED      3          3        0        0       0       0
Reducer 2 ...... container     SUCCEEDED      1          1        0        0       0       0
Reducer 3 ...... container     SUCCEEDED      1          1        0        0       0       0
----------------------------------------------------------------------------------------------
VERTICES: 03/03  [==========================>>] 100%  ELAPSED TIME: 24.63 s
----------------------------------------------------------------------------------------------
OK
brand   total_sales
runail  148296.74000000622
Time taken: 25.536 seconds, Fetched: 1 row(s)
```

runail has the maximum number of sales in October and November combined which has collected 148296.74 number of sales.

7. Which brands increased their sales from October to November?

```
WITH Brand_sales AS (
SELECT brand,
SUM(CASE WHEN date_format(event_time, 'MM')=10 THEN price ELSE 0 END) AS Oct_revenue,
SUM(CASE WHEN date_format(event_time, 'MM')=11 THEN price ELSE 0 END) AS Nov_revenue
FROM store_1
WHERE event_type = 'purchase' AND
date_format(event_time, 'MM') IN ('10', '11')
GROUP BY brand
)
SELECT brand, Oct_revenue, Nov_revenue, (Nov_revenue - Oct_revenue) AS Difference_Of_revenue
FROM Brand_sales
WHERE (Nov_revenue-Oct_revenue) > 0
ORDER BY Difference_Of_revenue DESC;
```

```
hive> WITH Brand_sales AS (
    > SELECT brand,
    > SUM(CASE WHEN date_format(event_time, 'MM')=10 THEN price ELSE 0 END) AS Oct_revenue,
    > SUM(CASE WHEN date_format(event_time, 'MM')=11 THEN price ELSE 0 END) AS Nov_revenue
    > FROM store_1
    > WHERE event_type = 'purchase' AND
    > date_format(event_time, 'MM') IN ('10', '11')
    > GROUP BY brand
    > )
    > SELECT brand, Oct_revenue, Nov_revenue, (Nov_revenue - Oct_revenue) AS Difference_Of_revenue
    > FROM Brand_sales
    > WHERE (Nov_revenue-Oct_revenue) > 0
    > ORDER BY Difference_Of_revenue DESC;
Query ID = hadoop_20220128135847_945f7169-9d92-48b5-9712-a58b117d5d20
Total jobs = 1
Launching Job 1 out of 1
Status: Running (Executing on YARN cluster with App id application_1643373050143_0003)

----------------------------------------------------------------------------------------------
        VERTICES      MODE        STATUS  TOTAL  COMPLETED  RUNNING  PENDING  FAILED  KILLED
----------------------------------------------------------------------------------------------
Map 1 .......... container     SUCCEEDED      3          3        0        0       0       0
Reducer 2 ...... container     SUCCEEDED      1          1        0        0       0       0
Reducer 3 ...... container     SUCCEEDED      1          1        0        0       0       0
----------------------------------------------------------------------------------------------
VERTICES: 03/03  [==========================>>] 100%  ELAPSED TIME: 44.74 s
----------------------------------------------------------------------------------------------
OK
brand   oct_revenue     nov_revenue     difference_of_revenue
        474655.96999994945      619492.2199999489       144836.24999999942
grattol 35445.53999999818       71466.44000000754       36020.90000000936
uno     35302.02999999994       51039.750000000175      15737.720000000234
lianail 5892.840000000006       16394.24000000062       10501.400000000614
ingarden        23161.390000000323      33566.21000000024       10404.819999999916
strong  29196.630000000012      38671.26999999993       9474.63999999992
jessnail        26287.839999999997      33345.22999999998       7057.389999999985
cosmoprofi      8322.810000000038       14536.990000000143      6214.180000000106
polarus 6013.719999999999       11371.929999999997      5358.209999999997
runail  71538.32999999075       76758.40999999596       5220.080000005211
freedecor       3421.7800000000334      7671.799999999905       4250.019999999871
staleks 8519.730000000027       11869.580000000027      3349.8500000000004
bpw.style       11572.150000000098      14837.4400000002        3265.2900000001027
lovely  8704.379999999957       11939.060000000001      3234.680000000044
marathon        7280.749999999997       10273.099999999997      2992.3499999999995
haruyama        9390.690000000088       12352.910000000198      2962.2200000001103
yoko    8756.909999999993       11707.880000000005      2950.970000000012
italwax 21940.239999999816      24797.239999999816      2857.0
benovy  409.62000000000023      3259.9700000000057      2850.3500000000054
kaypro  881.3399999999999       3268.7000000000007      2387.3600000000006
estel   21756.749999999924      24142.67000000012       2385.9200000001947
concept 11032.140000000043      13380.400000000027      2348.259999999984
kapous  11927.159999999902      14093.079999999994      2165.920000000093
f.o.x   6624.230000000092       8577.280000000022       1953.0499999999302
masura  31261.97999999773       33058.46999999869       1796.490000000962
milv    3904.9399999999728      5642.009999999998       1737.0700000000256
beautix 10493.94999999998       12222.949999999997      1729.0000000000164
artex   2730.639999999998       4327.250000000007       1596.6100000000092
domix   10472.049999999988      12009.170000000062      1537.1200000000736
shik    3341.200000000002       4839.720000000004       1498.5200000000018
smart   4457.259999999988       5902.139999999993       1444.8800000000047
roubloff        3491.359999999993       4913.7699999999995      1422.4100000000067
levrana 2243.5599999999968      3664.1000000000054      1420.5400000000086
oniq    8425.41000000001        9841.650000000061       1416.2400000000507
irisk   45591.959999998624      46946.03999999895       1354.0800000003292
severina        4775.880000000005       6120.48000000001        1344.600000000005
joico   705.52  2015.1000000000004      1309.5800000000004
zeitun  708.6599999999999       2009.630000000001       1300.9700000000012
beauty-free     554.1700000000002       1782.860000000001       1228.690000000001
swarovski       1887.9299999999814      3043.159999999984       1155.2300000000025
de.lux  1659.6999999999678      2775.5099999999807      1115.810000000013
metzger 5373.450000000001       6457.160000000009       1083.7100000000082
markell 1768.7499999999977      2834.4300000000044      1065.6800000000067
sanoto  157.14  1209.6799999999998       1052.54
nagaraku        4369.740000000019       5327.680000000017       957.9399999999978
ecolab  262.85  1214.2999999999997       951.4499999999997
art-visage      2092.71000000001        2997.8000000000056      905.0899999999956
levissime       2227.5000000000064      3085.3099999999804      857.809999999974
missha  1293.8299999999992      2150.28 856.450000000001
solomeya        1899.6999999999957      2685.799999999994       786.0999999999981
rosi    3077.03999999999        3841.5599999999863      764.5199999999963
refectocil      2716.1800000000076      3475.5800000000095      759.4000000000019
kaaral  4412.430000000004       5086.07000000001        673.6400000000058
kosmekka        1181.4399999999996      1813.3700000000008      631.9300000000012
kinetics        6334.250000000048       6945.260000000029       611.0099999999811
browxenna       14331.369999999994      14916.729999999952      585.3599999999587
airnails        5118.900000000095       5691.520000000056       572.6199999999608
uskusi  5142.269999999936       5690.30999999998        548.0400000000445
coifin  903.0   1428.4899999999998      525.4899999999998
```

```
s.care  412.68  913.0699999999999       500.38999999999993
limoni  1308.9000000000005      1796.6  487.69999999999936
matrix  3243.250000000002       3726.7400000000007      483.4899999999989
gehwol  1089.07 1557.6799999999994      468.60999999999945
greymy  29.21   489.49  460.28000000000003
bioaqua 942.89  1398.1199999999994      455.22999999999945
farmavita       837.3700000000001       1291.9699999999998      454.5999999999997
sophin  1062.3200000000006      1515.5200000000004      453.1999999999998
yu-r    271.41  673.71  402.3
kiss    421.5500000000001       817.3299999999992       395.7799999999991
naomi   0.0     388.99999999999994      388.99999999999994
lador   2083.6100000000024      2471.529999999996       387.9199999999937
ellips  245.84999999999997      606.0399999999998       360.1899999999999
jas     3318.96 3657.4300000000026      338.4700000000025
lowence 242.84000000000003      567.7499999999999       324.90999999999985
nitrile 847.279999999999        1162.679999999999       315.4
shary   871.9599999999998       1176.489999999999       304.5299999999993
kims    330.04  632.0400000000001       302.00000000000006
happyfons       801.9200000000004       1091.5900000000006      289.6700000000002
kocostar        310.84999999999997      594.9300000000004       284.08000000000044
insight 1443.7000000000007      1721.9600000000005      278.25999999999976
candy   534.9599999999998       799.3799999999994       264.4199999999996
bluesky 10307.240000000105      10565.530000000063      258.2899999999572
beauugreen      511.51000000000016      768.3499999999999       256.83999999999975
protokeratin    201.24999999999997      456.78999999999996      255.54
trind   298.0700000000001       542.9600000000003       244.89000000000016
entity  479.71000000000225      719.2599999999995       239.54999999999728
skinlite        651.94  889.0199999999998       237.0799999999997
provoc  827.9900000000004       1063.8200000000024      235.8300000000021
fedua   52.38   263.81  211.43
ecocraft        41.160000000000004      241.95000000000005      200.79000000000005
keen    236.35  435.62000000000006      199.27000000000007
mane    66.78999999999999       260.26  193.47
freshbubble     318.70000000000005      502.34000000000003      183.64
matreshka       0.0     182.67000000000007      182.67000000000007
chi     358.94000000000005      538.61  179.66999999999996
cristalinas     427.6299999999999       584.95  157.32000000000016
farmona 1692.46 1843.43 150.97000000000003
latinoil        249.52000000000004      384.59000000000015      135.0700000000001
miskin  158.04000000000002      293.06999999999994      135.02999999999992
elizavecca      70.53   204.3   133.77
nefertiti       233.52000000000007      366.64  133.11999999999992
finish  98.38   230.38  132.0
igrobeauty      513.660000000001        645.0700000000008       131.40999999999985
dizao   819.130000000001        945.5100000000023       126.38000000000125
```

```
cutrin  299.37000000000006      367.62  68.24999999999994
laboratorium    246.5   312.5200000000001       66.0200000000001
inm     288.01999999999987      351.21  63.190000000000011
dewal   0.0     61.29   61.29
marutaka-foot   49.21999999999999       109.33000000000001      60.110000000000002
kares   0.0     59.45   59.45
profhenna       679.2299999999994       736.8499999999997       57.620000000000023
koelcia 55.5    112.75  57.25
balbcare        155.32999999999996      212.37999999999997      57.050000000000001
elskin  251.09000000000043       307.6500000000003       56.55999999999989
foamie  35.04   80.49   45.449999999999996
ladykin 125.64999999999999      170.57  44.92
likato  296.0599999999999       340.96999999999997      44.910000000000008
mavala  409.0400000000001       446.32000000000005      37.27999999999997
vilenta 197.59999999999994      231.20999999999992      33.609999999999985
beautyblender   78.74000000000001       109.41  30.669999999999987
biore   60.650000000000006      90.31   29.659999999999997
orly    902.3799999999997       931.0899999999995       28.70999999999981
estelare        444.81000000000006      471.8699999999999       27.059999999999983
profepil        93.360000000000001      118.020000000000002      24.660000000000001
blixz   38.95   63.39999999999999       24.44999999999999
binacil 0.0     24.259999999999998      24.259999999999998
godefroy        401.22000000000001      425.12  23.899999999999992
glysolid        69.72999999999996       91.58999999999999       21.860000000000028
veraclara       50.109999999999985      71.20999999999998       21.099999999999994
juno    0.0     21.08   21.08
kamill  63.010000000000005      81.490000000000001      18.480000000000004
treaclemoon     163.37  181.48999999999998      18.119999999999976
supertan        50.37   66.51   16.140000000000008
barbie  0.0     12.39   12.39
deoproce        316.84000000000001      329.17000000000001      12.329999999999984
rasyan  18.799999999999997      28.939999999999998      10.14
fly     17.14   27.169999999999998      10.029999999999998
tertio  236.16000000000025      245.80000000000013      9.639999999999873
jaguar  1102.11 1110.6499999999999      8.539999999999964
soleo   204.1999999999998       212.52999999999972      8.329999999999927
neoleor 43.41   51.7    8.290000000000006
moyou   5.71    10.280000000000001      4.570000000000001
bodyton 1376.3400000000001      1380.6400000000006      4.300000000000409
skinity 8.88    12.440000000000001      3.5600000000000005
helloganic      0.0     3.1     3.1
grace   100.92000000000002      102.60999999999999      1.6899999999999693
cosima  20.23   20.929999999999996      0.6999999999999957
ovale   2.54    3.1     0.56
Time taken: 45.378 seconds, Fetched: 161 row(s)
```

There are 161 brands which has increased their sales from October to November.

8. **Your company wants to reward the top 10 users of its website with a Golden Customer plan. Write a query to generate a list of top 10 users who spend the most.**

```
SELECT user_id, SUM(price) as Total_spend
FROM store_1
WHERE event_type = 'purchase'
GROUP BY user_id
ORDER BY Total_spend DESC
LIMIT 10;
```

```
hive> SELECT user_id, SUM(price) as Total_spend
    > FROM store_1
    > WHERE event_type = 'purchase'
    > GROUP BY user_id
    > ORDER BY Total_spend DESC
    > LIMIT 10;
Query ID = hadoop_20220128140006_a751f084-3ea5-4a1a-ba17-3fe0cfc40bae
Total jobs = 1
Launching Job 1 out of 1
Status: Running (Executing on YARN cluster with App id application_1643373050143_0003)

----------------------------------------------------------------------------------------------
        VERTICES      MODE        STATUS  TOTAL  COMPLETED  RUNNING  PENDING  FAILED  KILLED
----------------------------------------------------------------------------------------------
Map 1 .......... container     SUCCEEDED      3          3        0        0       0       0
Reducer 2 ...... container     SUCCEEDED      1          1        0        0       0       0
Reducer 3 ...... container     SUCCEEDED      1          1        0        0       0       0
----------------------------------------------------------------------------------------------
VERTICES: 03/03  [==========================>>] 100%  ELAPSED TIME: 28.51 s
----------------------------------------------------------------------------------------------
OK
user_id total_spend
557790271       2715.869999999995
150318419       1645.9699999999996
562167663       1352.8499999999995
531900924       1329.4499999999998
557850743       1295.48
522130011       1185.3900000000003
561592095       1109.7000000000003
431950134       1097.5899999999995
566576008       1056.3600000000001
521347209       1040.9099999999996
Time taken: 29.214 seconds, Fetched: 10 row(s)
```

Cleaning up:

Once the analysis is completed, we should drop the tables.

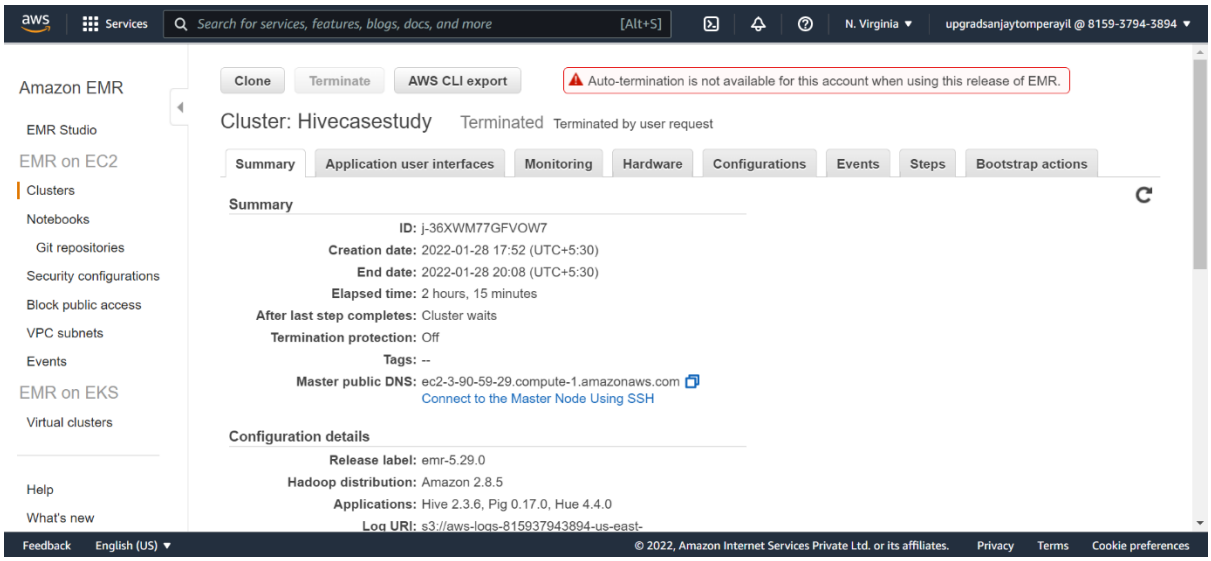
```
hive> show tables;
OK
tab_name
store
store_1
Time taken: 0.041 seconds, Fetched: 2 row(s)
hive> drop table store;
OK
Time taken: 0.133 seconds
hive> drop table store_1;
OK
Time taken: 0.326 seconds
```

Drop the database.

```
hive> show databases;
OK
database_name
casestudy
default
Time taken: 0.042 seconds, Fetched: 2 row(s)
hive> drop database casestudy;
OK
Time taken: 0.199 seconds
hive> show databases;
OK
database_name
default
Time taken: 0.012 seconds, Fetched: 1 row(s)
```

Terminate your cluster:

After dropping the database, we should terminate the cluster.



Cluster is terminated.