Title of the project
Aviation Data Analysis

- Create an account in AWS
- Create an instance.
- Connect to the instance from your local machine using SSH command with the corresponding pem/key file for the instance.
- Install Hadoop in ec2 instance – ubuntu.
- Ubuntu version used 22.04.
- Steps to install Hadoop in ubuntu server.

- Java Installation:

```
sudo apt update
sudo apt install openjdk-8-jdk -y
java -version
```

- Hadoop Installation:
- Run the following command to create a new user with the name “hadoop”:

```
sudo adduser Hadoop
```

Note: click enter with all the default values while adding a user.

- Switch to the newly created hadoop user

```
su – Hadoop
```

- Now configure password-less SSH access for the newly created hadoop user. Generate an SSH keypair first:

```
ssh-keygen -t rsa
```

- Copy the generated public key to the authorized key file and set the proper permissions:

```
cat ~/.ssh/id_rsa.pub >> ~/.ssh/authorized_keys

chmod 640 ~/.ssh/authorized_keys
```

- Now try to SSH to the localhost.

```
ssh localhost
```

- Use the following command to download Hadoop 3.3.4:

```
wget https://dlcdn.apache.org/hadoop/common/hadoop-3.3.4/hadoop-3.3.4.tar.gz
```

- Once you've downloaded the file, you can unzip it to a folder on your hard drive:

```
tar xzf hadoop-3.3.4.tar.gz
```

- Rename the extracted folder to remove version information. This is an optional step, but if you don't want to rename, then adjust the remaining configuration paths.

```
mv hadoop-3.3.4 hadoop
```

- Next, you will need to configure Hadoop and Java Environment Variables on your system.
- Open the ~/.bashrc file in your favorite text editor:

```
nano ~/.bashrc
```

- Append the below lines to the file. You can find the JAVA_HOME location by running dirname $(dirname $(readlink -f $(which java))) command on the terminal.

```
export JAVA_HOME= /usr/lib/jvm/java-8-openjdk-amd64/

export HADOOP_HOME=/home/hadoop/hadoop

export HADOOP_INSTALL=$HADOOP_HOME

export HADOOP_MAPRED_HOME=$HADOOP_HOME

export HADOOP_COMMON_HOME=$HADOOP_HOME

export HADOOP_HDFS_HOME=$HADOOP_HOME

export HADOOP_YARN_HOME=$HADOOP_HOME

exportHADOOP_COMMON_LIB_NATIVE_DIR=$HADOOP_HOME/lib/native

export PATH=$PATH:$HADOOP_HOME/sbin:$HADOOP_HOME/bin

export HADOOP_OPTS="-Djava.library.path=$HADOOP_HOME/lib/native"
```

- Save the file and close it.
- Load the above configuration in the current environment.

```
source ~/.bashrc
```

- You also need to configure JAVA_HOME in hadoop-env.sh file. Edit the Hadoop environment variable file in the text editor:

```
nano $HADOOP_HOME/etc/hadoop/hadoop-env.sh
```

- Search for the "export JAVA_HOME" and configure it.
- Next is to configure Hadoop configuration files available under etc directory.

- First, you will need to create the namenode and datanode directories inside the Hadoop user home directory. Run the following command to create both directories:

```
mkdir -p ~/hadoopdata/hdfs/{namenode,datanode}
```

- Next, edit the core-site.xml file and update with your system hostname:

```
nano $HADOOP_HOME/etc/hadoop/core-site.xml
```

- Change the following name as per your system hostname:

```
<configuration>
    <property>
        <name>fs.defaultFS</name>
        <value>hdfs://localhost:9000</value>
    </property>
</configuration>
```

- Save and close the file.
- Then, edit the hdfs-site.xml file.

```
nano $HADOOP_HOME/etc/hadoop/hdfs-site.xml
```

- Change the NameNode and DataNode directory paths as shown below:

```
<configuration>
    <property>
        <name>dfs.replication</name>
        <value>1</value>
    </property>

    <property>
        <name>dfs.name.dir</name>
        <value>file:///home/hadoop/hadoopdata
        /hdfs/namenode</value>
    </property>
    <property>
```

```
<name>dfs.data.dir</name>
<value>file:///home/hadoop/hadoopdata
/hdfs/datanode</value>
</property>
</configuration>
```

- Save and close the file.
- Then, edit the mapred-site.xml file.

```
nano $HADOOP_HOME/etc/hadoop/mapred-site.xml
```

- Make the following changes:

```
<configuration>
<property>
<name>mapreduce.framework.name</name>
<value>yarn</value>
</property>
</configuration>
```

- Save and close the file.
- Then, edit the yarn-site.xml file:

```
nano $HADOOP_HOME/etc/hadoop/yarn-site.xml
```

- Make the following changes:

```
<configuration>
<property>
<name>yarn.nodemanager.aux-services</name>
<value>mapreduce_shuffle</value>
</property>
</configuration>
```

- Save the file and close it.

- Before starting the Hadoop cluster. You will need to format the Namenode as a hadoop user.
- Run the following command to format the Hadoop Namenode.

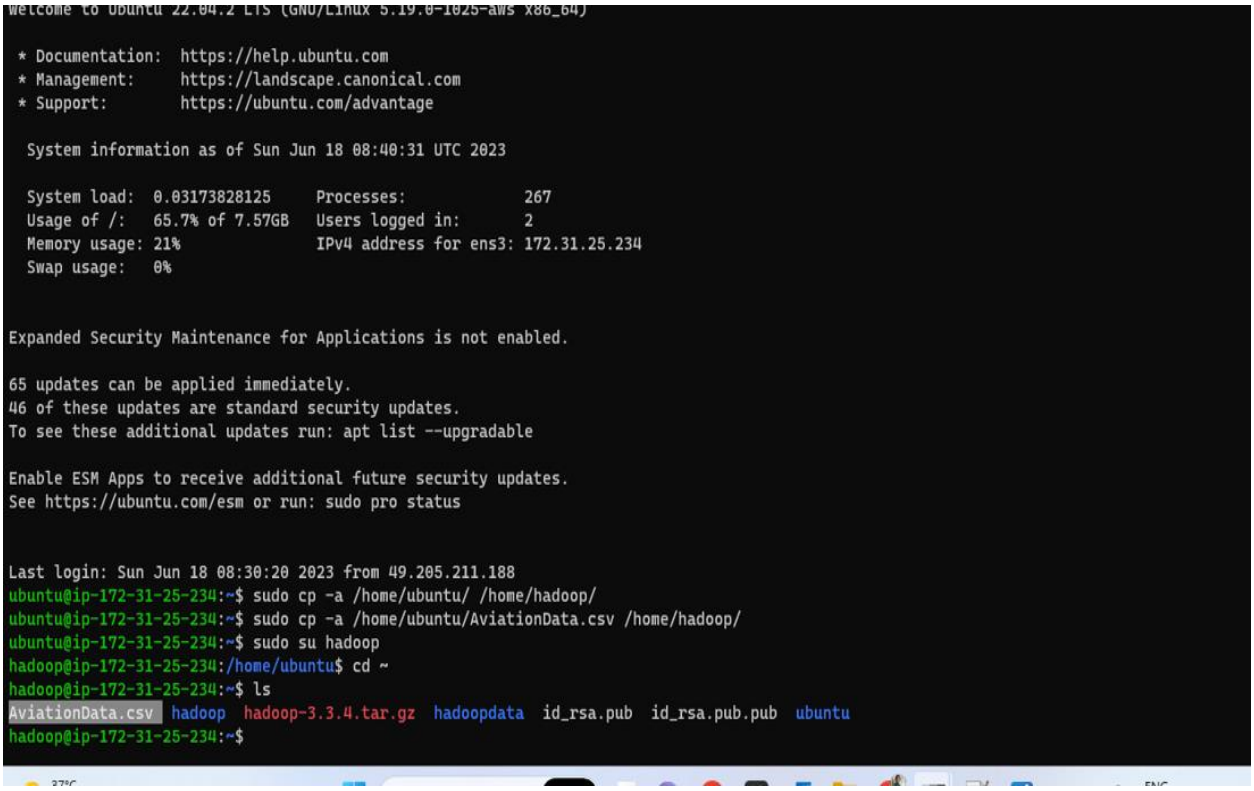
  hdfs namenode -format

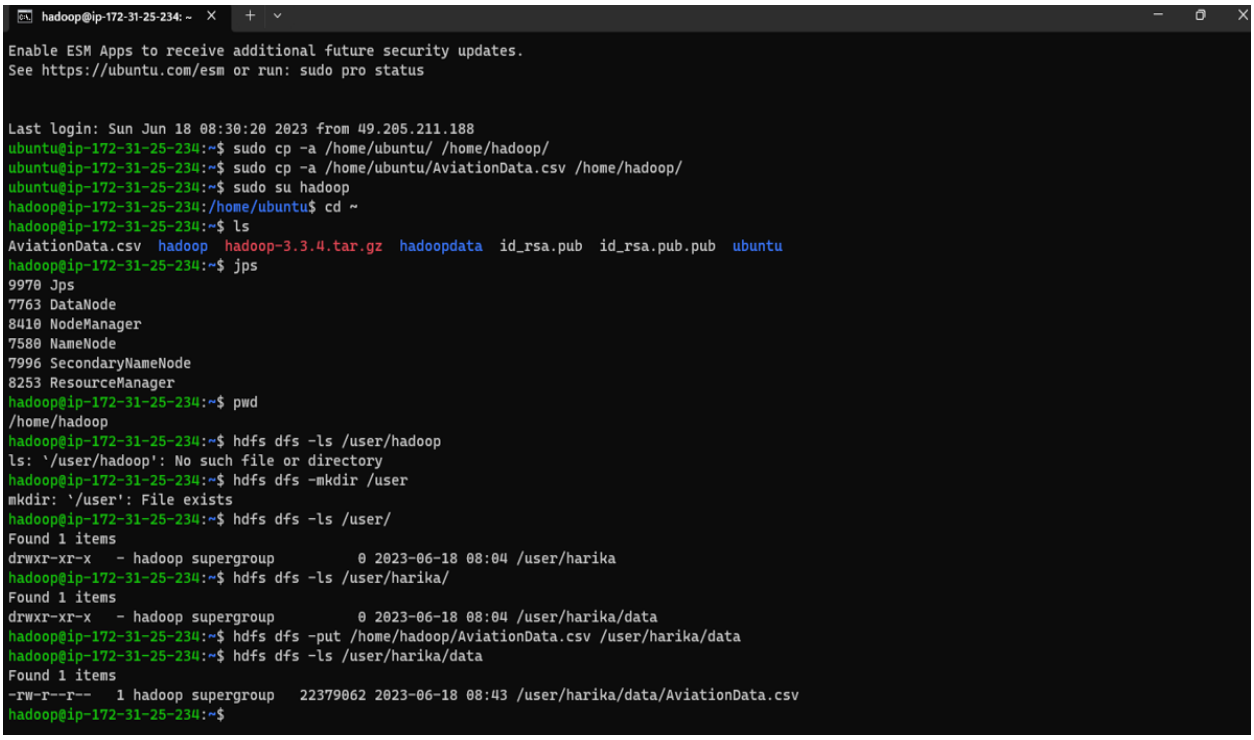
- Once the namenode directory is successfully formatted with hdfs file system, you will see the message “Storage directory /home/hadoop/hadoopdata/hdfs/namenode has been successfully formatted“.
- Then start the Hadoop cluster with the following command.

  start-all.sh

- Use the below command to copy the data.

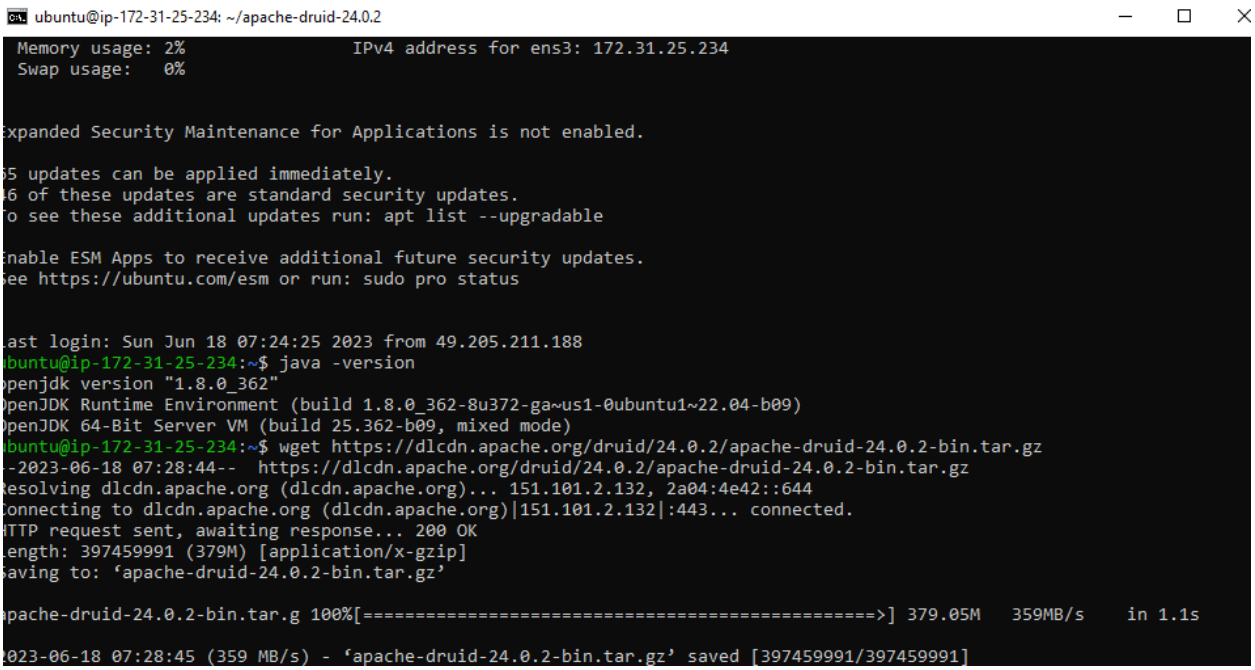
  scp -i "aviationproject.pem" -A AviationData.csv ubuntu@ec2-3-90-199-230.compute-1.amazonaws.com:/home/ubuntu

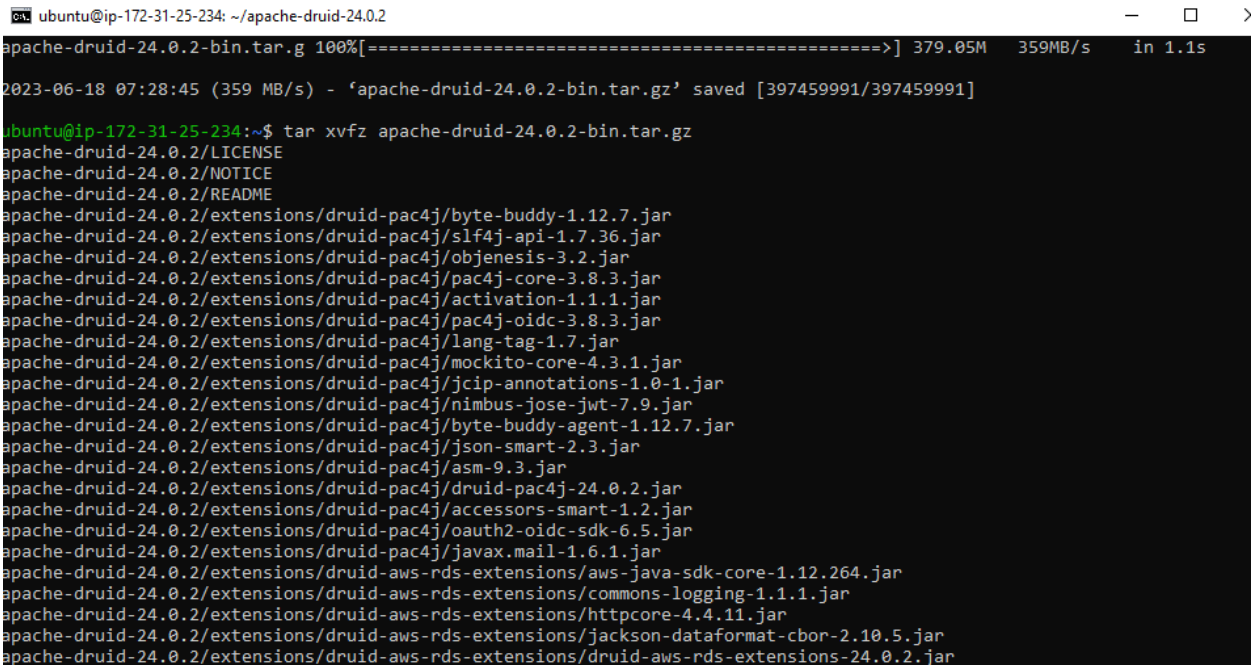


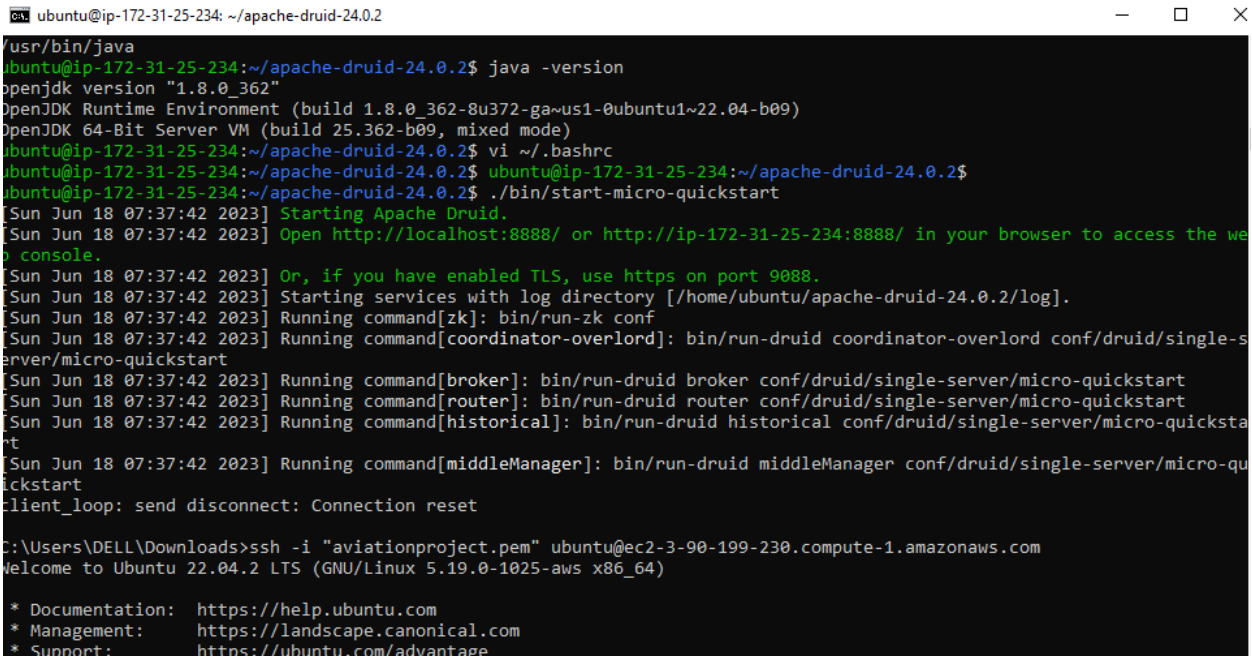


- Next install druid in ec2 instance – ubuntu.
- Below are the steps to install the druid in ubuntu:

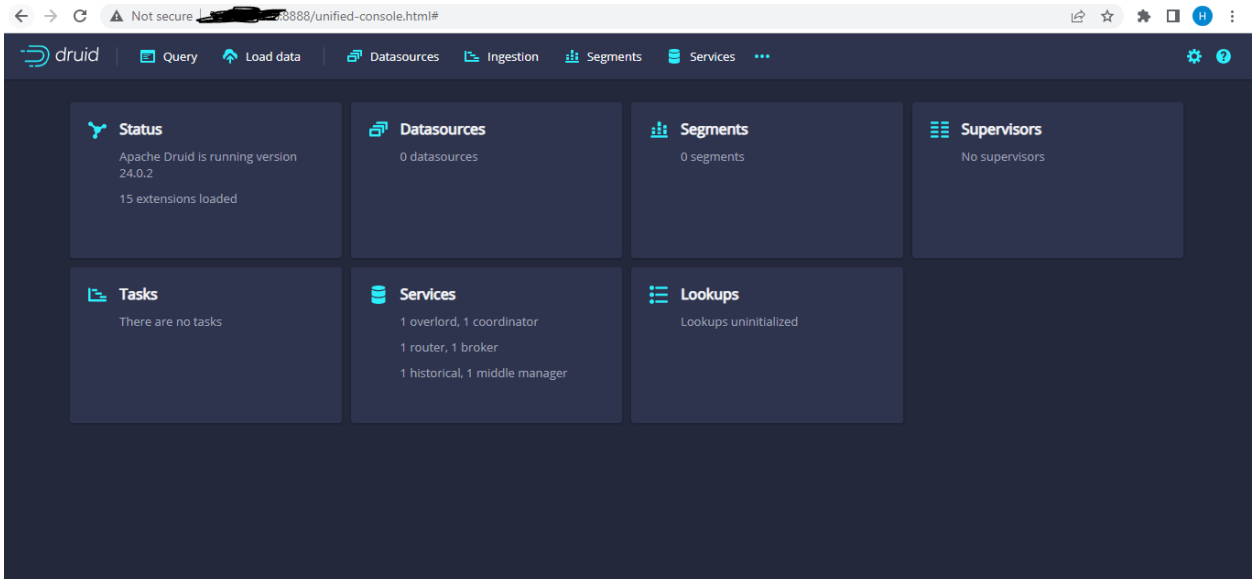
```
wget https://dlcdn.apache.org/druid/24.0.2/apache-druid-24.0.2-bin.tar.gz
tar xvfz apache-druid-24.0.2-bin.tar.gz
cd apache-druid-24.0.2
export DRUID_HOME=/home/ubuntu/apache-druid-24.0.2
./bin/start-micro-quickstart
```


ubuntu@ip-172-31-25-234: ~/apache-druid-24.0.2
Memory usage: 2%
IPv4 address for ens3: 172.31.25.234
Swap usage: 0%
xpanded Security Maintenance for Applications is not enabled.
5 updates can be applied immediately.
6 of these updates are standard security updates.
o see these additional updates run: apt list --upgradable
nable ESM Apps to receive additional future security updates.
ee https://ubuntu.com/esm or run: sudo pro status
ast login: Sun Jun 18 07:24:25 2023 from 49.205.211.188
buntu@ip-172-31-25-234:~$ java -version
penjdk version "1.8.0_362"
penJDK Runtime Environment (build 1.8.0_362-8u372-ga~us1-0ubuntu1~22.04-b09)
penJDK 64-Bit Server VM (build 25.362-b09, mixed mode)
buntu@ip-172-31-25-234:~$ wget https://dlcdn.apache.org/druid/24.0.2/apache-druid-24.0.2-bin.tar.gz
-2023-06-18 07:28:44-- https://dlcdn.apache.org/druid/24.0.2/apache-druid-24.0.2-bin.tar.gz
esolving dlcdn.apache.org (dlcdn.apache.org)... 151.101.2.132, 2a04:4e42::644
onnecting to dlcdn.apache.org (dlcdn.apache.org)|151.101.2.132|:443... connected.
TTP request sent, awaiting response... 200 OK
ength: 397459991 (379M) [application/x-gzip]
aving to: ‘apache-druid-24.0.2-bin.tar.gz’
pache-druid-24.0.2-bin.tar.g 100%[=====>] 379.05M 359MB/s in 1.1s
023-06-18 07:28:45 (359 MB/s) - ‘apache-druid-24.0.2-bin.tar.gz’ saved [397459991/397459991]

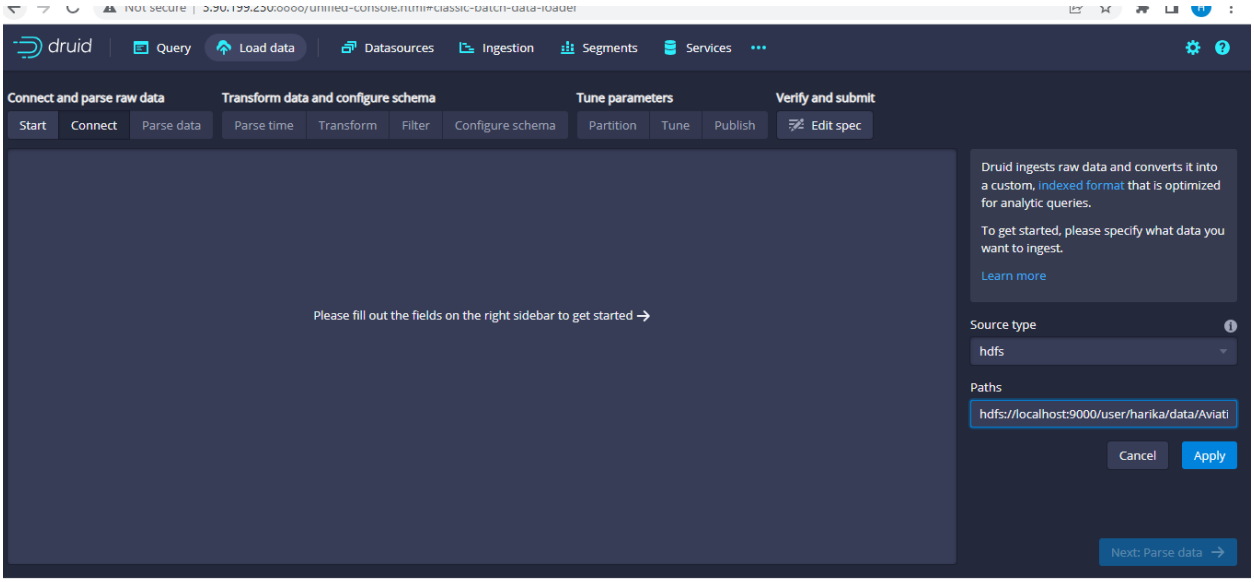

ubuntu@ip-172-31-25-234: ~/apache-druid-24.0.2
apache-druid-24.0.2-bin.tar.g 100%[=====>] 379.05M 359MB/s in 1.1s
2023-06-18 07:28:45 (359 MB/s) - ‘apache-druid-24.0.2-bin.tar.gz’ saved [397459991/397459991]
ubuntu@ip-172-31-25-234:~$ tar xvfz apache-druid-24.0.2-bin.tar.gz
apache-druid-24.0.2/LICENSE
apache-druid-24.0.2/NOTICE
apache-druid-24.0.2/README
apache-druid-24.0.2/extensions/druid-pac4j/byte-buddy-1.12.7.jar
apache-druid-24.0.2/extensions/druid-pac4j/slf4j-api-1.7.36.jar
apache-druid-24.0.2/extensions/druid-pac4j/objenesis-3.2.jar
apache-druid-24.0.2/extensions/druid-pac4j/pac4j-core-3.8.3.jar
apache-druid-24.0.2/extensions/druid-pac4j/activation-1.1.1.jar
apache-druid-24.0.2/extensions/druid-pac4j/pac4j-oidc-3.8.3.jar
apache-druid-24.0.2/extensions/druid-pac4j/lang-tag-1.7.jar
apache-druid-24.0.2/extensions/druid-pac4j/mockito-core-4.3.1.jar
apache-druid-24.0.2/extensions/druid-pac4j/jcip-annotations-1.0-1.jar
apache-druid-24.0.2/extensions/druid-pac4j/nimbus-jose-jwt-7.9.jar
apache-druid-24.0.2/extensions/druid-pac4j/byte-buddy-agent-1.12.7.jar
apache-druid-24.0.2/extensions/druid-pac4j/json-smart-2.3.jar
apache-druid-24.0.2/extensions/druid-pac4j/asm-9.3.jar
apache-druid-24.0.2/extensions/druid-pac4j/druid-pac4j-24.0.2.jar
apache-druid-24.0.2/extensions/druid-pac4j/accessors-smart-1.2.jar
apache-druid-24.0.2/extensions/druid-pac4j/oauth2-oidc-sdk-6.5.jar
apache-druid-24.0.2/extensions/druid-pac4j/javax.mail-1.6.1.jar
apache-druid-24.0.2/extensions/druid-aws-rds-extensions/aws-java-sdk-core-1.12.264.jar
apache-druid-24.0.2/extensions/druid-aws-rds-extensions/commons-logging-1.1.1.jar
apache-druid-24.0.2/extensions/druid-aws-rds-extensions/httpcore-4.4.11.jar
apache-druid-24.0.2/extensions/druid-aws-rds-extensions/jackson-dataformat-cbor-2.10.5.jar
apache-druid-24.0.2/extensions/druid-aws-rds-extensions/druid-aws-rds-extensions-24.0.2.jar



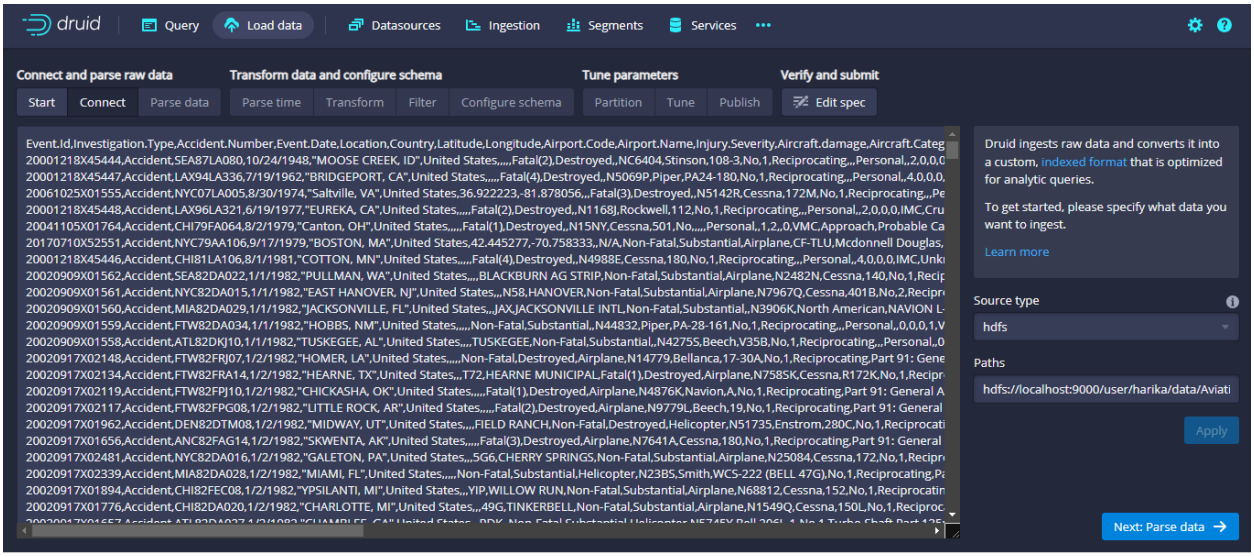
- Open the druid UI



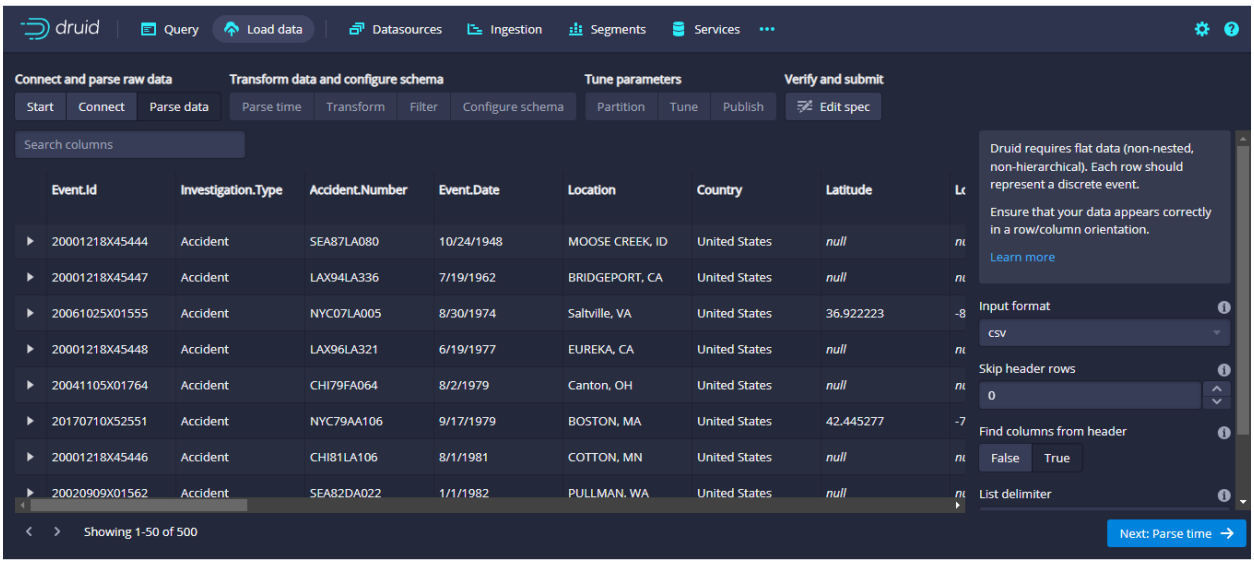
- Load the data into druid from hdfs.



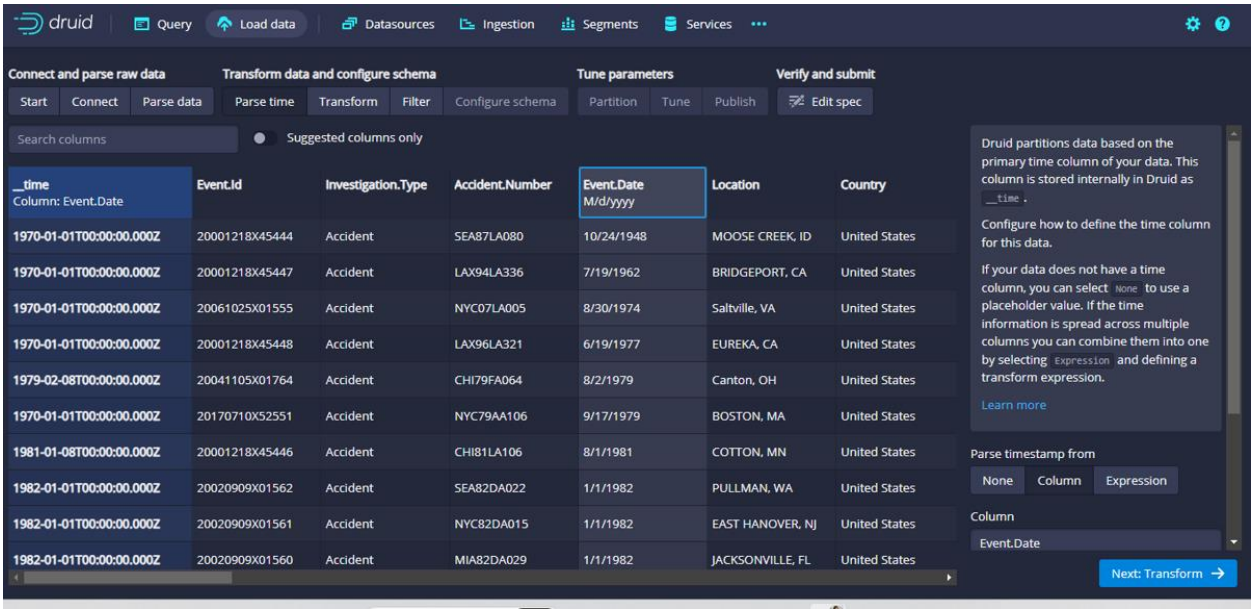
- Click on apply.



- Click on Parse data.



- The data can be transformed as per the requirement.



- Next below are the steps to be followed to install HIVE in ubuntu.
- Access your Ubuntu command line and download the compressed Hive files using and the wget command followed by the download path:

  wget https://downloads.apache.org/hive/hive-3.1.2/apache-hive-3.1.2-bin.tar.gz
- Once the download process is complete, untar the compressed Hive package:

  tar xzf apache-hive-3.1.2-bin.tar.gz

- The Hive binary files are now located in the apache-hive-3.1.2-bin directory.
- Configure Hive Environment Variables (bashrc)
- The $HIVE_HOME environment variable needs to direct the client shell to the apache-hive-3.1.2-bin directory. Edit the .bashrc shell configuration file using a text editor of your choice (we will be using nano):

  sudo nano .bashrc
- Append the following Hive environment variables to the .bashrc file:

  export HIVE_HOME= "home/hdoop/apache-hive-3.1.2-bin"

  export PATH=$PATH:$HIVE_HOME/bin
- The Hadoop environment variables are located within the same file.
- Save and exit the .bashrc file once you add the Hive variables. Apply the changes to the current environment with the following command:

  source ~/.bashrc
- Edit hive-config.sh file
- Apache Hive needs to be able to interact with the Hadoop Distributed File System. Access the hive-config.sh file using the previously created $HIVE_HOME variable:

  sudo nano $HIVE_HOME/bin/hive-config.sh
- Add the HADOOP_HOME variable and the full path to your Hadoop directory:

  export HADOOP_HOME=/home/hdoop/hadoop-3.2.1
- Save the edits and exit the hive-config.sh file.
- Create Hive Directories in HDFS
- Create two separate directories to store data in the HDFS layer:
- The temporary, tmp directory is going to store the intermediate results of Hive processes.
- The warehouse directory is going to store the Hive related tables.
- Create tmp Directory.
- Create a tmp directory within the HDFS storage layer. This directory is going to store the intermediary data Hive sends to the HDFS:

  hdfs dfs -mkdir /tmp
- Add write and execute permissions to tmp group members:

  hdfs dfs -chmod g+w /tmp
- Check if the permissions were added correctly:

  hdfs dfs -ls /
- The output confirms that users now have write and execute permissions.
- Create warehouse Directory
- Create the warehouse directory within the /user/hive/ parent directory:

  hdfs dfs -mkdir -p /user/hive/warehouse
- Add write and execute permissions to warehouse group members:

  hdfs dfs -chmod g+w /user/hive/warehouse
- Check if the permissions were added correctly:

hdfs dfs -ls /user/hive

- The output confirms that users now have write and execute permissions.
- Configure hive-site.xml File (Optional)
- Use the following command to locate the correct file:

  cd $HIVE_HOME/conf
- List the files contained in the folder using the ls command.
- Create file hive.site.xml in conf folder
- Access the hive-site.xml file using the nano text editor:

  sudo nano hive-site.xml
- Copy below lines of code in hive-site.xml file and save the file

```
<?xml version="1.0"?>

<?xml-stylesheet type="text/xsl" href="configuration.xsl"?>

<configuration><property> <name>javax.jdo.option.ConnectionURL</name>

<value>jdbc:derby://localhost:1527/metastore_db;create=true</value>

<description>JDBC connect string for a JDBC metastore</description>

</property><property>

<name>javax.jdo.option.ConnectionDriverName</name>

<value>org.apache.derby.jdbc.ClientDriver</value>

<description>Driver class name for a JDBC metastore</description>

</property>

<property>

<name>hive.server2.enable.impersonation</name>

<description>Enable user impersonation for HiveServer2</description>

<value>true</value>

</property>

<property>

<name>hive.server2.authentication</name>

<value>NONE</value>

<description> Client authentication types. NONE: no authentication check LDAP: LDAP/AD
based authentication KERBEROS: Kerberos/GSSAPI authentication CUSTOM: Custom
```

```
authentication provider (Use with property hive.server2.custom.authentication.class)
</description>

</property>

<property>

<name>datanucleus.autoCreateTables</name>

<value>True</value>

</property>

</configuration>
```

- Using Hive in a stand-alone mode rather than in a real-life Apache Hadoop cluster is a safe option for newcomers. You can configure the system to use your local storage rather than the HDFS layer by setting the hive.metastore.warehouse.dir parameter value to the location of your Hive warehouse directory.
- Next Initiate Derby Database.
- Apache Hive uses the Derby database to store metadata. Initiate the Derby database, from the Hive bin directory using the schema tool command:

  ```
  $HIVE_HOME/bin/schematool -dbType derby -initSchema
  ```
- The process can take a few moments to complete.
- Derby is the default metadata store for Hive. If you plan to use a different database solution, such as MySQL or PostgreSQL, you can specify a database type in the hive-site.xml file.
- How to Fix guava Incompatibility Error in Hive.
- Locate the guava jar file in the Hive lib directory:

  ```
  ls $HIVE_HOME/lib
  ```
- Locate the guava jar file in the Hadoop lib directory as well:

  ```
  ls $HADOOP_HOME/share/hadoop/hdfs/lib
  ```
- The two listed versions are not compatible and are causing the error. Remove the existing guava file from the Hive lib directory:

  ```
  rm $HIVE_HOME/lib/guava-19.0.jar
  ```
- Copy the guava file from the Hadoop lib directory to the Hive lib directory:

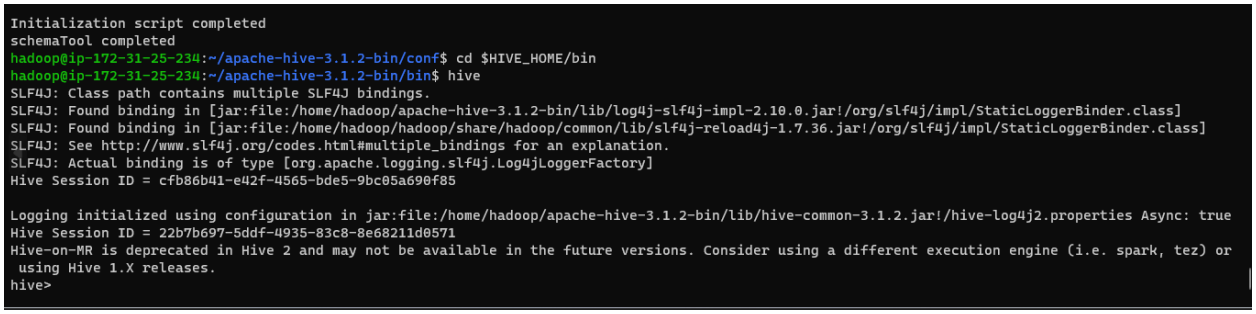
  ```
  cp $HADOOP_HOME/share/hadoop/hdfs/lib/guava-27.0-jre.jar $HIVE_HOME/lib/
  ```
- Use the schematool command once again to initiate the Derby database:

  ```
  $HIVE_HOME/bin/schematool -dbType derby -initSchema
  ```
- Launch Hive Client Shell on Ubuntu
- Start the Hive command-line interface using the following commands:

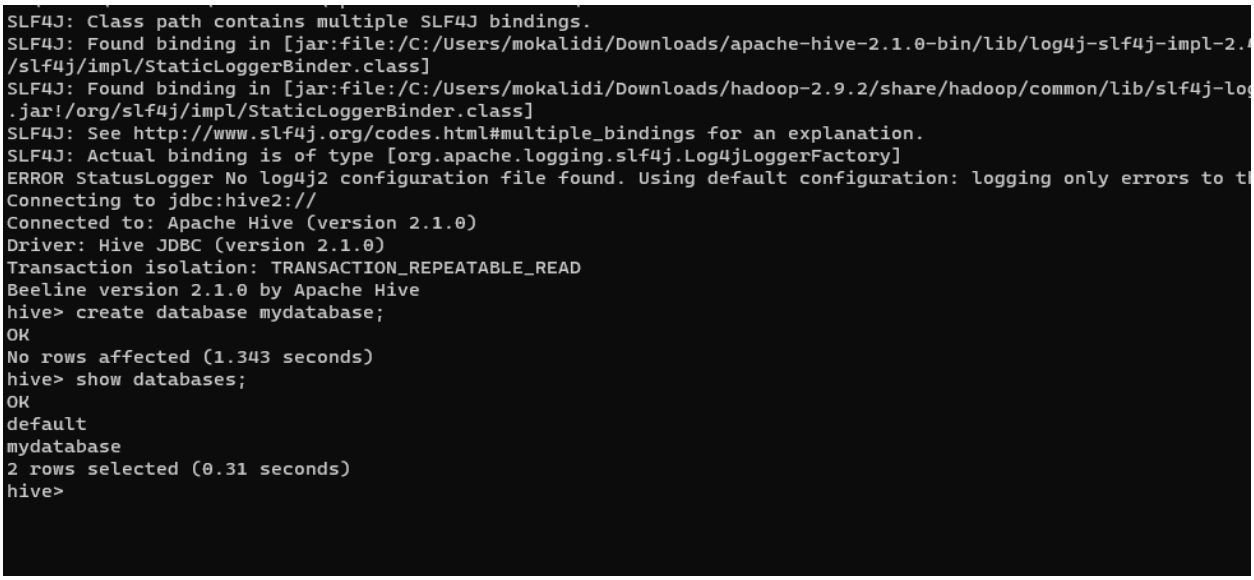
  ```
  cd $HIVE_HOME/bin
  ```

hive

- You are now able to issue SQL-like commands and directly interact with HDFS.



- Create database and create a table.



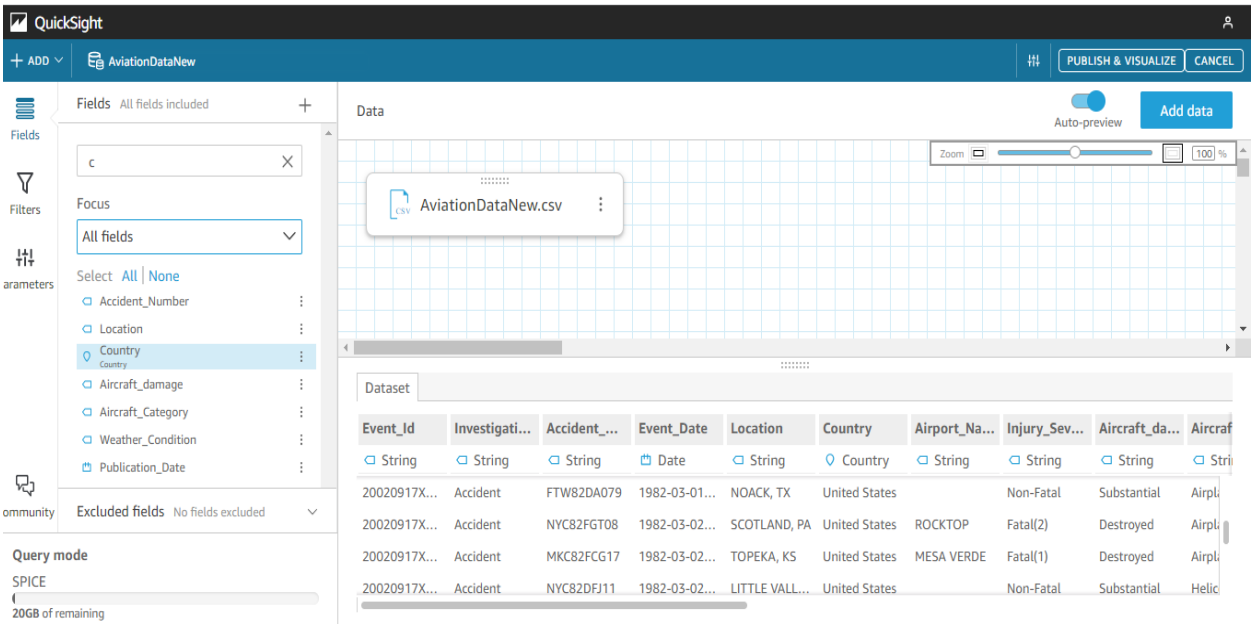
```
hive> CREATE TABLE AVIATION(Event_Date VARCHAR(255),
    > Location VARCHAR(255),
    > Injury_Severity VARCHAR(255),
    > Total_Fatal_Injuries VARCHAR(255),
    > Total_Serious_Injuries VARCHAR(255),
    > Total_Minor_Injuries VARCHAR(255),
    > Total_Uninjured VARCHAR(255),
    > Weather_Condition VARCHAR(255),
    > Event_Id VARCHAR(255),
    > Investigation_Type VARCHAR(255),
    > Accident_Number VARCHAR(255),
    > Country VARCHAR(255),
    > Latitude VARCHAR(255),
    > Longitude VARCHAR(255),
    > Airport_Code VARCHAR(255),
    > Airport_Name VARCHAR(255),
    > Aircraft_damage VARCHAR(255),
    > Aircraft_Category VARCHAR(255),
    > Registration_Number VARCHAR(255),
    > Make VARCHAR(255),
    > Model VARCHAR(255),
    > Amateur_Built VARCHAR(255),
    > Number_of_Engines VARCHAR(255),
    > Engine_Type VARCHAR(255),
    > FAR_Description VARCHAR(255),
    > Schedule VARCHAR(255),
    > Purpose_of_flight VARCHAR(255),
    > Air_carrier VARCHAR(255),
    > Broad_phase_of_flight VARCHAR(255),
    > Report_Status VARCHAR(255)
    > );
OK
Time taken: 0.757 seconds
hive>
```

- Load data from HDFS to hive.

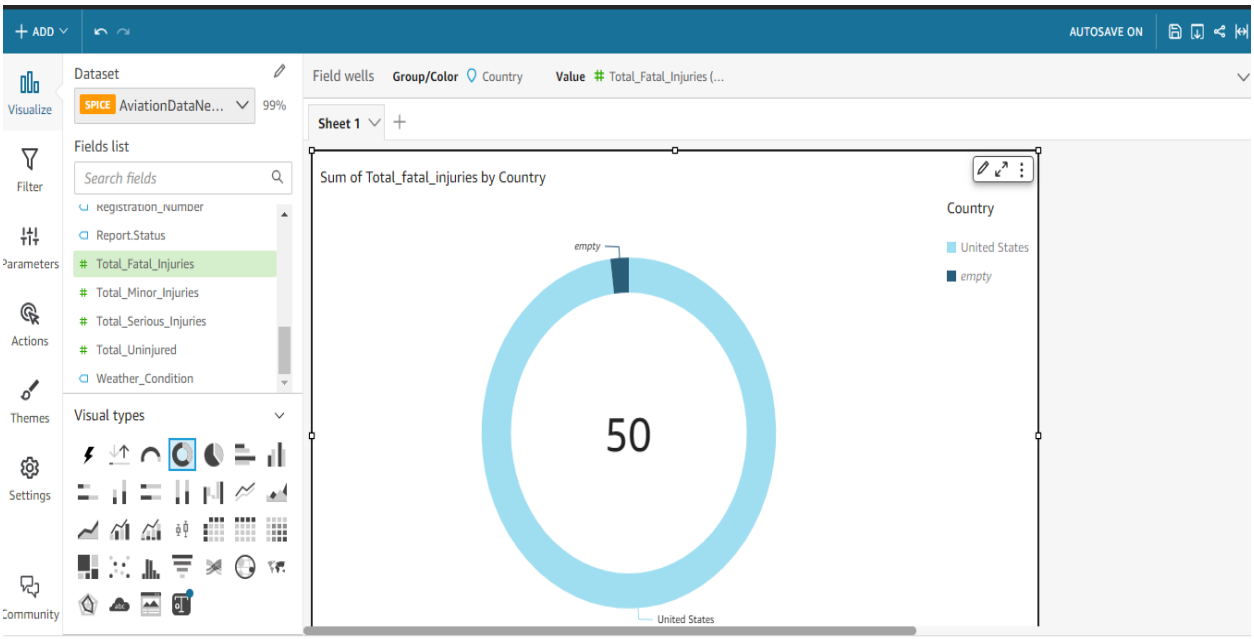
```
hive> LOAD DATA INPATH 'hdfs://localhost:9000/user/harika/data/AviationDataNew.csv' OVERWRITE INTO TABLE accidentData;
Loading data to table mydatabase.accidentdata
OK
Time taken: 0.65 seconds
hive>
```

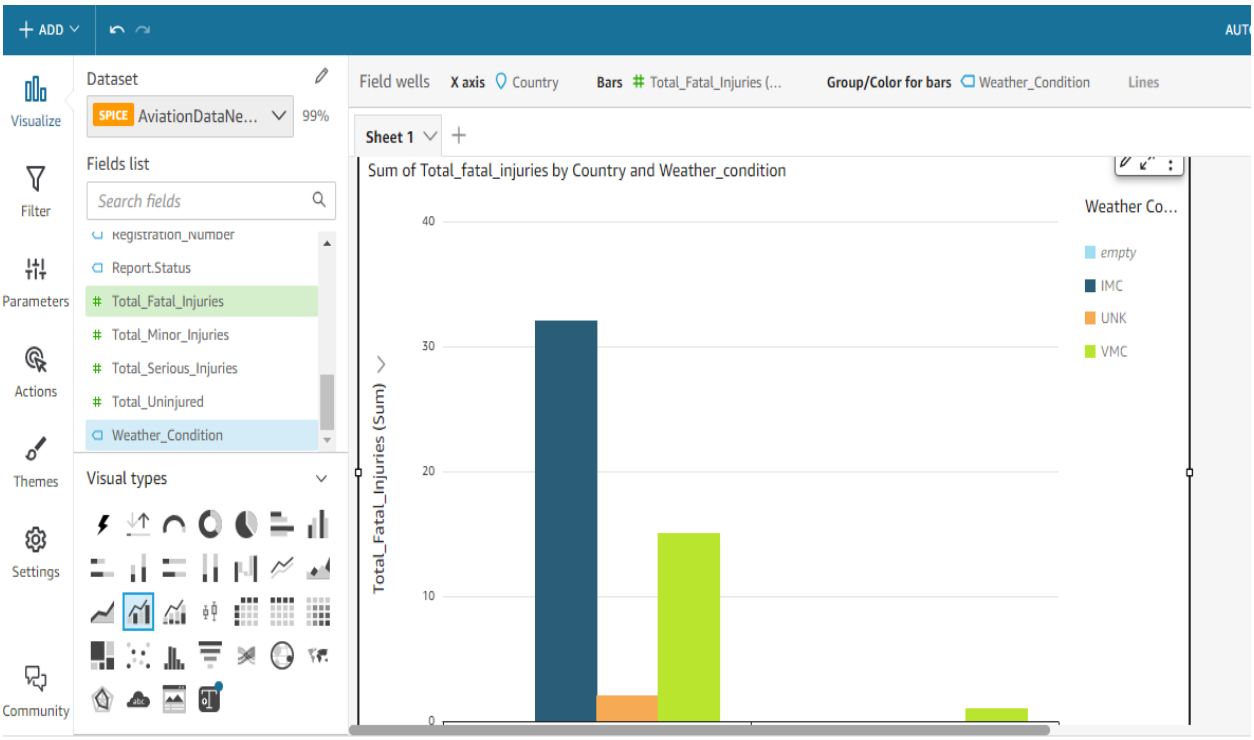
- Perform query operations using the sql commands in hive and save the transformed data into csv and copy it to local/hdfs/s3.
- Use the below path to access hive data:
  hdfs://localhost:9000/user/hive/warehouse/mydatabase.db/accidentdata

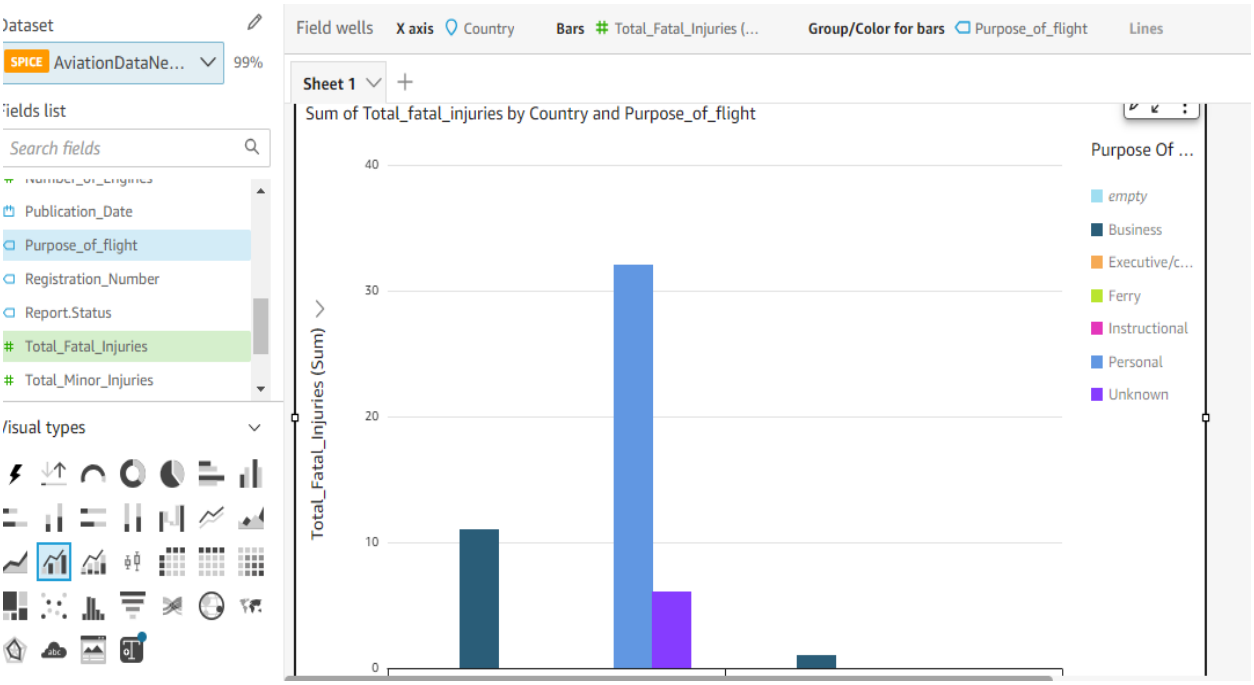
- **Note:** Mydatabase.db is the database name and accidentdata is the table name.
- Load the data into AWS Quick Sight for further analysis.

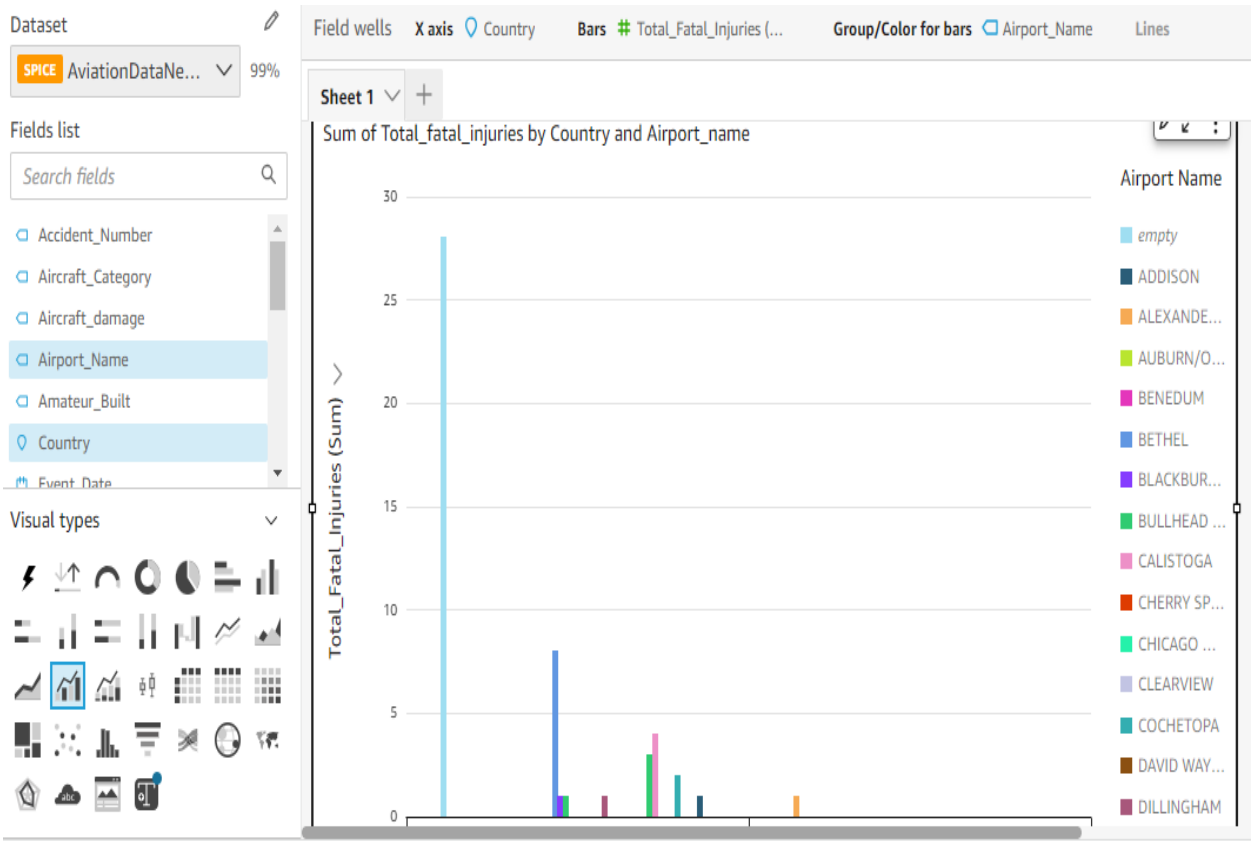


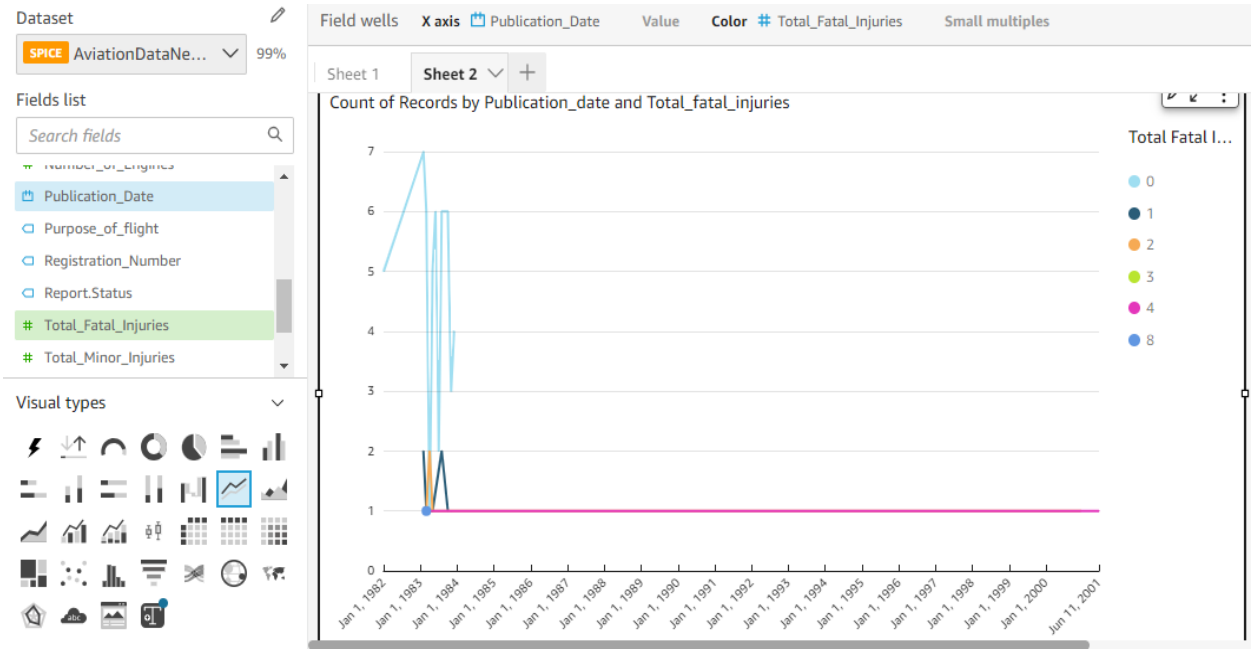
- Perform the analysis on top of the table as per the requirement.

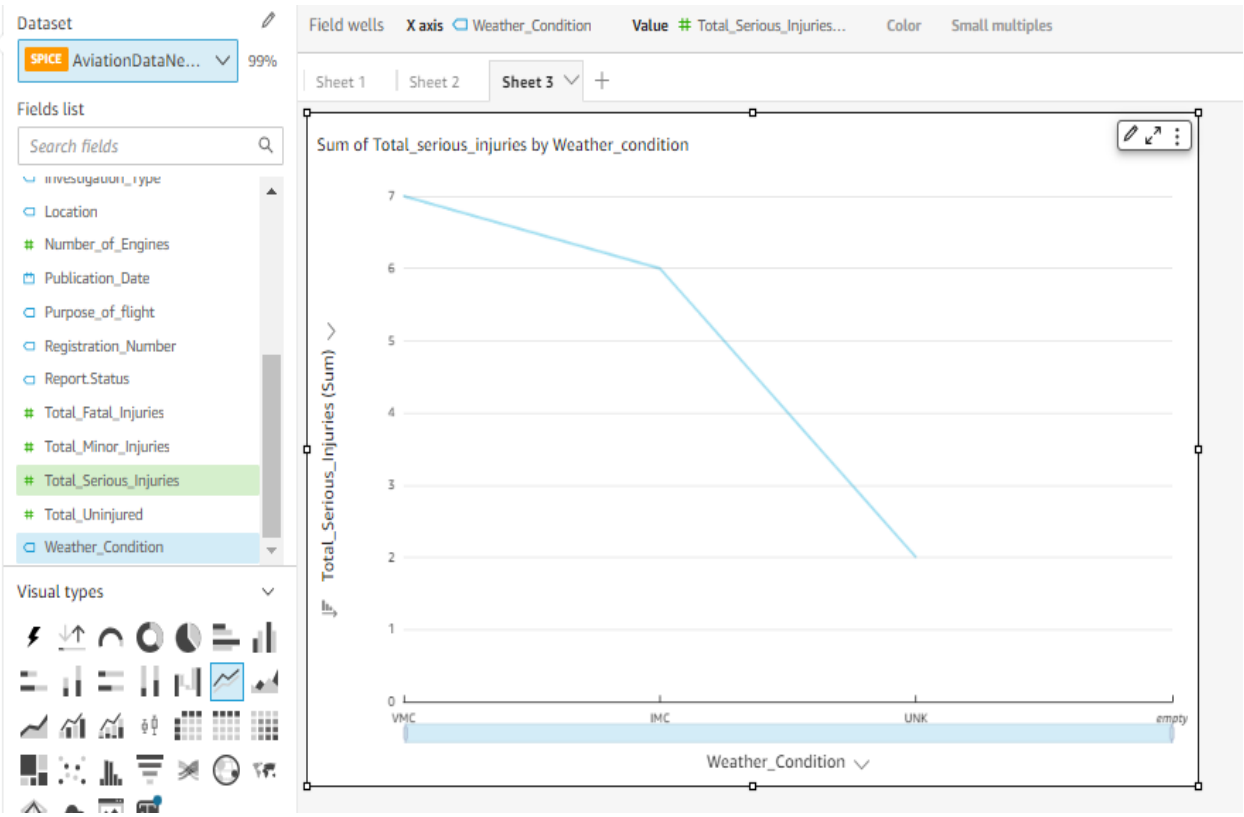



+ ADD
Visualize
Filter
Parameters
Actions
Themes
Settings
Community
Dataset
SPICE AviationDataNe...
99%
Fields list
Search fields
Registration_Number
Report.Status
Total_Fatal_Injuries
Total_Minor_Injuries
Total_Serious_Injuries
Total_Uninjured
Weather_Condition
Visual types
Field wells
X axis
Country
Bars
Total_Fatal_Injuries (...
Group/Color for bars
Weather_Condition
Lines
Sheet 1
Sum of Total_fatal_injuries by Country and Weather_condition
Total_Fatal_Injuries (Sum)
40
30
20
10
0
Weather Co...
empty
IMC
UNK
VMC


Dataset
SPICE AviationDataNe...
99%
Fields list
Search fields
Publication_Date
Purpose_of_flight
Registration_Number
Report.Status
Total_Fatal_Injuries
Total_Minor_Injuries
Visual types
Field wells
X axis
Country
Bars
Total_Fatal_Injuries (...
Group/Color for bars
Purpose_of_flight
Lines
Sheet 1
Sum of Total_fatal_injuries by Country and Purpose_of_flight
Total_Fatal_Injuries (Sum)
40
30
20
10
0
Purpose Of ...
empty
Business
Executive/c...
Ferry
Instructional
Personal
Unknown


Dataset
SPICE AviationDataNe...
99%
Fields list
Search fields
Accident_Number
Aircraft_Category
Aircraft_damage
Airport_Name
Amateur_Built
Country
Visual types
Field wells
X axis
Country
Bars
Total_Fatal_Injuries (...
Group/Color for bars
Airport_Name
Lines
Sheet 1
Sum of Total_fatal_injuries by Country and Airport_name
Total_Fatal_Injuries (Sum)
Airport Name
empty
ADDISON
ALEXANDE...
AUBURN/O...
BENEDUM
BETHEL
BLACKBUR...
BULLHEAD ...
CALISTOGA
CHERRY SP...
CHICAGO ...
CLEARVIEW
COCHETOPA
DAVID WAY...
DILLINGHAM


Dataset
SPICE AviationDataNe...
99%
Fields list
Search fields
Publication_Date
Purpose_of_flight
Registration_Number
Report.Status
Total_Fatal_Injuries
Total_Minor_Injuries
Visual types
Field wells
X axis
Publication_Date
Value
Color
Total_Fatal_Injuries
Small multiples
Sheet 1
Sheet 2
Count of Records by Publication_date and Total_fatal_injuries
Total Fatal I...
0
1
2
3
4
8


Dataset
SPICE AviationDataNe...
99%
Fields list
Search fields
Location
Number_of_Engines
Publication_Date
Purpose_of_flight
Registration_Number
Report.Status
Total_Fatal_Injuries
Total_Minor_Injuries
Total_Serious_Injuries
Total_Uninjured
Weather_Condition
Visual types
Field wells
X axis
Weather_Condition
Value
Total_Serious_Injuries...
Color
Small multiples
Sheet 1
Sheet 2
Sheet 3
Sum of Total_serious_injuries by Weather_condition
Total_Serious_Injuries (Sum)
0
1
2
3
4
5
6
7
VMC
IMC
UNK
empty
Weather_Condition