ASSIGNMENT - 06

Traffic Monitoring Application using Spark, Kafka, and MapReduce Technology

IS 41248

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Traffic Data Monitoring Application

This document shows the development of IoT data processing and monitoring application using Spark Stream. This application takes real-time IoT data sent by connected vehicles and monitors traffic in a variety of ways. This application will be divided into three modules.

They are,

- IoT Data Producer
- IoT Data Processor
- IoT Data Dashboard

These modules are standalone Java Maven programs that can be generated and operated on their own.

IoT Data Producer

IoT messages are generated by connected vehicles. These are captured by a news broker before being processed and sent to the streaming application. IoT Data Maker is a simulator application for vehicles connected to this type of application, and it generates IoT data events using Apache Kafka.

IoT Data Processor

This application is a spark streaming application. It uses IoT data streams and processes them for traffic data analysis. The following measurements are provided by the IoT data processor.

- Get the total number of cars for various sorts of vehicles on various routes and store them in a Cassandra database.
- For the last 30 seconds, get a car count for different types of vehicles on various routes and save it in the Cassandra database.
- Obtain information about vehicles within a certain perimeter of specified Point of Interest (POI) and store it in the Cassandra database

IoT Data Dashboard

It is a spring boot application that takes data from the Cassandra database and sends it to a webpage. This program uses web sockets and jQuery to push data into the web page at predetermined intervals, ensuring that the data is updated automatically. The data is shown in the tables and diagrams in the dashboard.

The following figure 1 shows the architecture of the Traffic Data Monitoring Application.

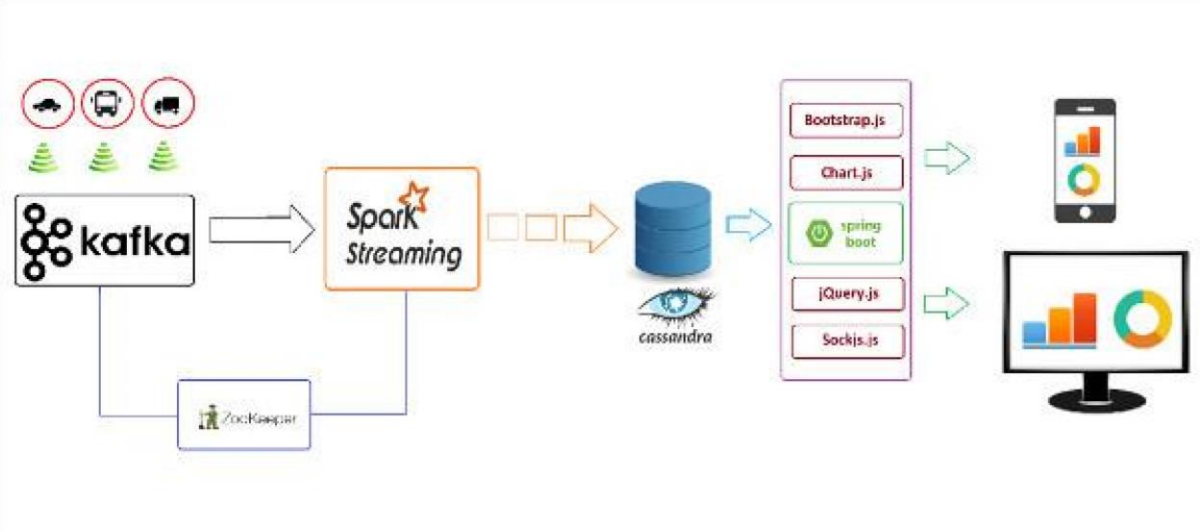

Figure 1 Architecture of Traffic Data Monitoring Application

1.1 Technologies and Tools

The following are the tools and technologies used in this traffic monitoring application.

- JDK
- Cassandra
- ZooKeeper
- Kafka
- Spark
- Spring Boot
- Maven

1.2 Java installation.

- *$ sudo apt install openjdk-8-jdk –y (*install java*)*
- *$ java -version (*Check the version of java*)*
- *$ nano .bashrc*
- *Add the java path to .bashrc file.*

```
export JAVA_HOME=/usr/lib/jvm/java-1.8.0-openjdk-amd64
export PATH=$PATH:$JAVA_HOME/bin
```

In my case, already installed java so no need to install. Use the following command to verify it.

```
saji@saji-VB:~$ java -version
openjdk version "1.8.0_292"
OpenJDK Runtime Environment (build 1.8.0_292-8u292-b10-0ubuntu1~16.04.1-b10)
OpenJDK 64-Bit Server VM (build 25.292-b10, mixed mode)
```

Figure 2 Verifying Java Installation

Output shows that successfully installed because we can see the version of the installed java.

Set path

Then to set path and JAVA_HOME variables, add the following commands to **.bashrc** file.

- Use **"pwd"** command to get java path.
- Use **nano .bashrc** command to edit the .bashrc file
- **Source .bashrc** Use this command to apply changes into current running system.

```
saji@saji-VBox:~$ nano .bashrc
saji@saji-VBox:~$ source .bashrc
saji@saji-VBox:~$
```

Figure 3 edit the bashrc file

```
saji@saji-VB:/usr/lib/jvm/java-1.8.0-openjdk-amd64$ pwd
/usr/lib/jvm/java-1.8.0-openjdk-amd64
```

Figure 4 get java path

Edit the file as you see,

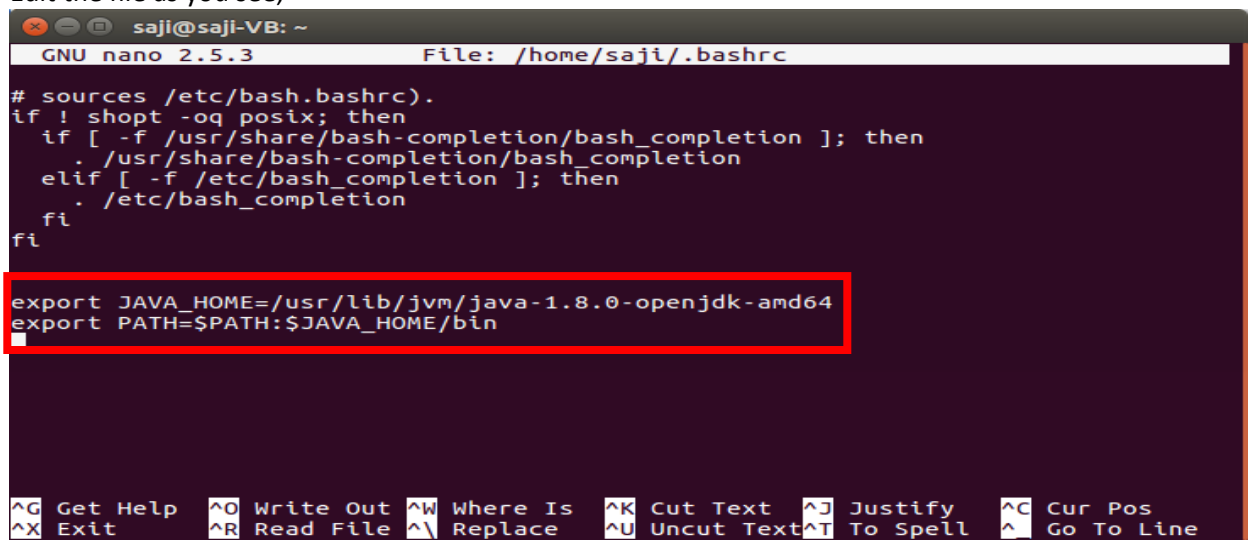

Figure 5 Set path and JAVA_HOME variables

1.3 Install Cassandra.

- *$ mkdir cassandra*
- *$ cd cassandra*
- *$ wget https://archive.apache.org/dist/cassandra/2.2.6/apache-cassandra-2.2.6bin.tar.gz*
- *$ tar xvf apache-cassandra-2.2.6-bin.tar.gz*
- *$ nano .bashrc*
- *Add the cassandra path to .bashrc file.*

  export CASSANDRA_HOME=/home/saji/cassandra/apache-cassandra-2.2.6
  export PATH=$PATH:$CASSANDRA_HOME/bin

- *$ source .bashrc*
- *$ cd cassandra/apache-cassandra-2.2.6/bin*
- *$ cassandra*
- *$ cqlsh*

```
saji@saji-VBox:~$ mkdir cassandra
saji@saji-VBox:~$ cd cassandra
saji@saji-VBox:~/cassandra$ wget https://archive.apache.org/dist/cassandra/2.2.6/apache-cassandra-2.2.6-bin.tar.gz
--2021-08-12 21:47:58--  https://archive.apache.org/dist/cassandra/2.2.6/apache-cassandra-2.2.6-bin.tar.gz
Resolving archive.apache.org (archive.apache.org)... 138.201.131.134, 2a01:4f8:172:2ec5::2
Connecting to archive.apache.org (archive.apache.org)|138.201.131.134|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 29553283 (28M) [application/x-gzip]
Saving to: 'apache-cassandra-2.2.6-bin.tar.gz'

apache-cassandra-2. 100%[===================>]  28.18M   241KB/s    in 2m 3s

2021-08-12 21:50:05 (235 KB/s) - 'apache-cassandra-2.2.6-bin.tar.gz' saved [29553283/29553283]

saji@saji-VBox:~/cassandra$ tar xvf apache-cassandra-2.2.6-bin.tar.gz
apache-cassandra-2.2.6/bin/
apache-cassandra-2.2.6/conf/
apache-cassandra-2.2.6/conf/triggers/
apache-cassandra-2.2.6/doc/
apache-cassandra-2.2.6/doc/cql3/
apache-cassandra-2.2.6/interface/
apache-cassandra-2.2.6/javadoc/
apache-cassandra-2.2.6/javadoc/org/
apache-cassandra-2.2.6/javadoc/org/apache/
apache-cassandra-2.2.6/javadoc/org/apache/cassandra/
apache-cassandra-2.2.6/javadoc/org/apache/cassandra/auth/
apache-cassandra-2.2.6/javadoc/org/apache/cassandra/auth/class-use/
apache-cassandra-2.2.6/javadoc/org/apache/cassandra/cache/
apache-cassandra-2.2.6/javadoc/org/apache/cassandra/cache/class-use/
apache-cassandra-2.2.6/javadoc/org/apache/cassandra/client/
apache-cassandra-2.2.6/javadoc/org/apache/cassandra/client/class-use/
apache-cassandra-2.2.6/javadoc/org/apache/cassandra/concurrent/
apache-cassandra-2.2.6/javadoc/org/apache/cassandra/concurrent/class-use/
apache-cassandra-2.2.6/javadoc/org/apache/cassandra/config/
apache-cassandra-2.2.6/javadoc/org/apache/cassandra/config/class-use/
apache-cassandra-2.2.6/javadoc/org/apache/cassandra/cql3/
apache-cassandra-2.2.6/javadoc/org/apache/cassandra/cql3/class-use/
```

Figure 6 install cassandra

```
saji@saji-VBox:~$ nano .bashrc
saji@saji-VBox:~$ source .bashrc
saji@saji-VBox:~$
```

Figure 7 edit .bashrc and update editing

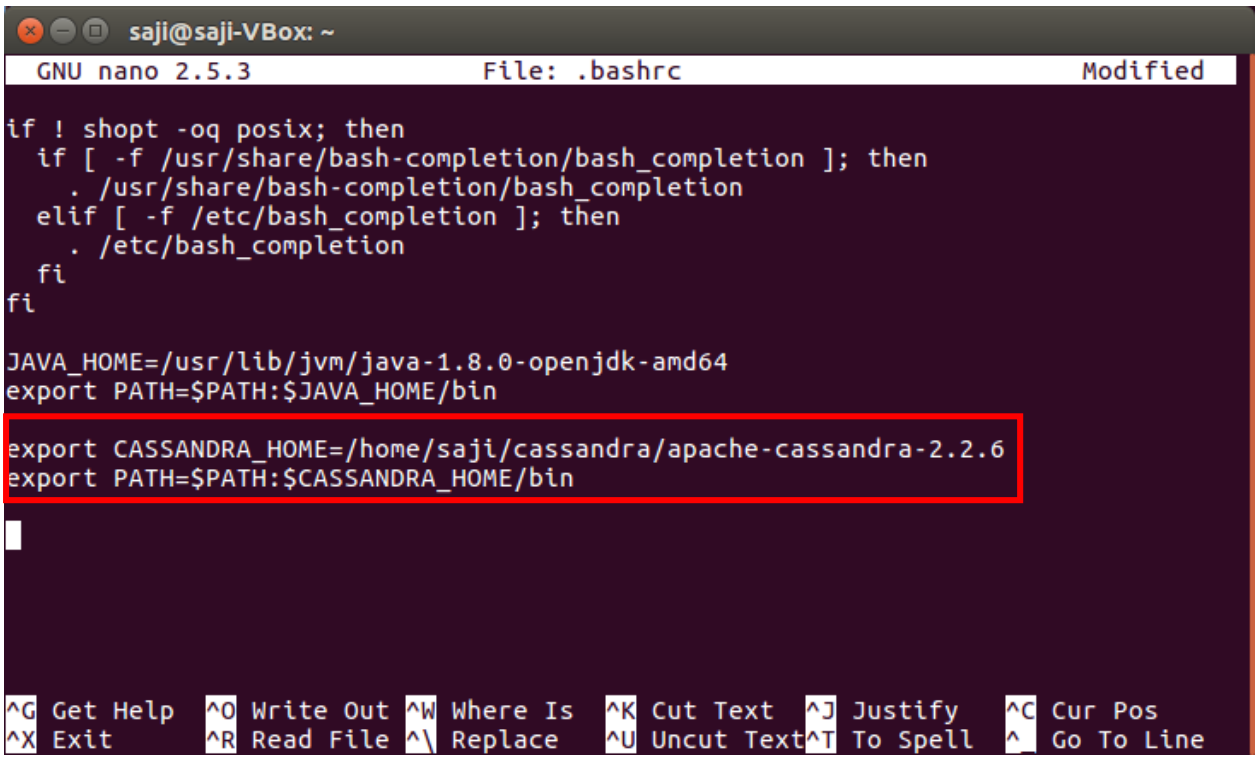

Figure 8 insert cassandra directory path

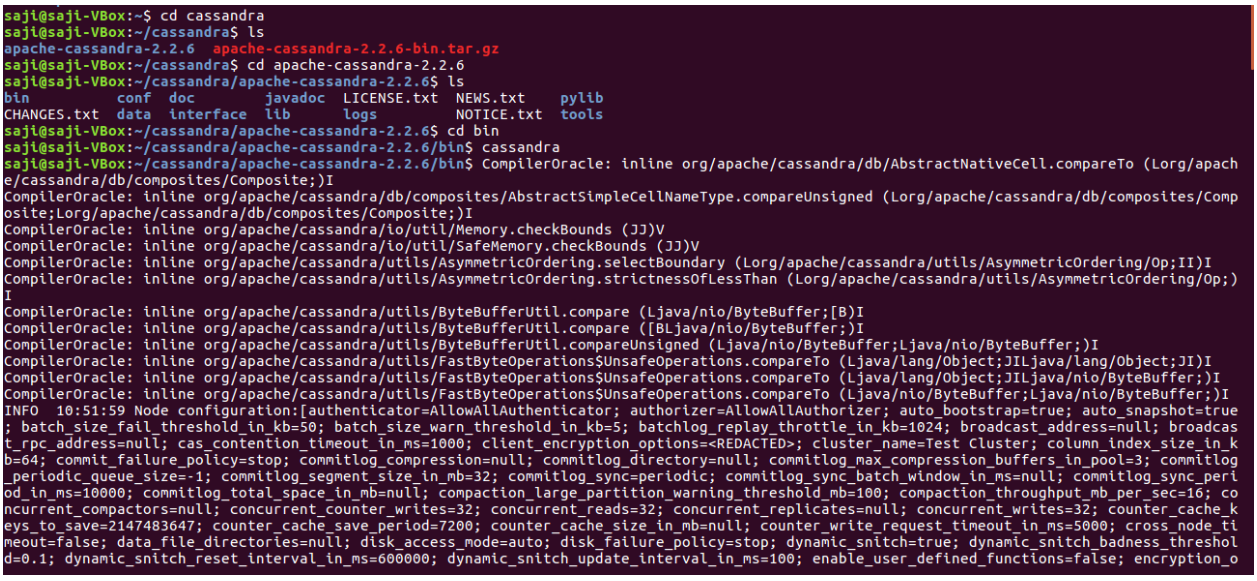

Figure 9 Run cassandra

Figure 10 Connected to test cluster

1.4 Create tables in the Cassandra database.

// Create keyspace

CREATE KEYSPACE IF NOT EXISTS TrafficKeySpace WITH replication = {'class':'SimpleStrategy', 'replication_factor':1};

CREATE TABLE TrafficKeySpace.Total_Traffic (routeId text, vehicleType text, totalCount bigint, timeStamp timestamp,recordDate text,PRIMARY KEY (routeId,recordDate,vehicleType));

// Create table

CREATE TABLE TrafficKeySpace.Window_Traffic (routeId text, vehicleType text, totalCount bigint, timeStamp timestamp,recordDate text,PRIMARY KEY (routeId,recordDate,vehicleType));

CREATE TABLE TrafficKeySpace.poi_traffic(vehicleid text , vehicletype text , distance bigint, timeStamp timestamp,PRIMARY KEY (vehicleid));

```
saji@saji-VBox:~$ cd cassandra
saji@saji-VBox:~/cassandra$ ls
apache-cassandra-2.2.6  apache-cassandra-2.2.6-bin.tar.gz
saji@saji-VBox:~/cassandra$ cd apache-cassandra-2.2.6/bin
saji@saji-VBox:~/cassandra/apache-cassandra-2.2.6/bin$ cqlsh
Connected to Test Cluster at 127.0.0.1:9042.
[cqlsh 5.0.1 | Cassandra 2.2.6 | CQL spec 3.3.1 | Native protocol v4]
Use HELP for help.
cqlsh> //Create keyspace
cqlsh> CREATE KEYSPACE IF NOT EXISTS TrafficKeySpace WITH replication = {'class':'SimpleStrategy', 'replication_factor':1};
cqlsh>
cqlsh> //Create table
cqlsh> CREATE TABLE TrafficKeySpace.Total_Traffic (routeId text ,  vehicleType text,  totalCount bigint, timeStamp timestamp,recordDate text,P
RIMARY KEY (routeId,recordDate,vehicleType));
cqlsh> CREATE TABLE TrafficKeySpace.Window_Traffic (routeId text , vehicleType text,  totalCount bigint, timeStamp timestamp,recordDate text,P
RIMARY KEY (routeId,recordDate,vehicleType));
cqlsh> CREATE TABLE TrafficKeySpace.Poi_Traffic(vehicleid text , vehicletype text , distance bigint,  timeStamp timestamp,PRIMARY KEY (vehicle
id));
cqlsh>
```

Figure 11 Create tables in the Cassandra database

// Select tables

- *SELECT * FROM TrafficKeySpace.Total_Traffic;*
- *SELECT * FROM TrafficKeySpace.Window_Traffic;*
- *SELECT * FROM TrafficKeySpace.Poi_Traffic;*

```
cqlsh>
cqlsh> //Select from table
cqlsh> SELECT * FROM TrafficKeySpace.Total_Traffic;

 routeid | recorddate | vehicletype | timestamp | totalcount
---------+------------+-------------+-----------+------------

(0 rows)
cqlsh> SELECT * FROM TrafficKeySpace.Window_Traffic;

 routeid | recorddate | vehicletype | timestamp | totalcount
---------+------------+-------------+-----------+------------

(0 rows)
cqlsh> SELECT * FROM TrafficKeySpace.Poi_Traffic;
```

Figure 12 Select tables

// Truncate table

- *TRUNCATE TABLE TrafficKeySpace.Total_Traffic;*
- *TRUNCATE TABLE TrafficKeySpace.Window_Traffic;*
- *TRUNCATE TABLE TrafficKeySpace.Poi_Traffic;*

```
(0 rows)
cqlsh>
cqlsh> //Truncate table
cqlsh> TRUNCATE TABLE TrafficKeySpace.Total_Traffic;
cqlsh> TRUNCATE TABLE TrafficKeySpace.Window_Traffic;
cqlsh> TRUNCATE TABLE TrafficKeySpace.Poi_Traffic;
```

Figure 13 Truncate table

1.5 Install Spark

type the following commands to install spark.

- *$ mkdir spark*
- *$ cd spark*
- *$ wget http://downloads.typesafe.com/scala/2.11.7/scala-2.11.7.tgz*
- *$ tar xvf scala-2.11.7.tgz*
- *$ sudo mv scala-2.11.7 /usr/lib*
- *$ sudo ln -s /usr/lib/scala-2.11.7 /usr/lib/scala*
- *$ export PATH=$PATH:/usr/lib/scala/bin*
- *$ scala -version*
- *$ wget http://d3kbcqa49mib13.cloudfront.net/spark-1.6.0-bin-hadoop2.6.tgz*
- *$ tar xvf spark-1.6.0-bin-hadoop2.6.tgz*
- *export SPARK_HOME=$HOME/spark/spark-1.6.0-bin-hadoop2.6*
- *export PATH=$PATH:$SPARK_HOME/bin*
- *$ echo 'export PATH=$PATH:/usr/lib/scala/bin' >> .bash_profile*
- *$ echo 'export SPARK_HOME=$HOME/spark/spark-1.6.0-bin-hadoop2.6' >> .bash_profile*
- *$ echo 'export PATH=$PATH:$SPARK_HOME/bin' >> .bash_profile*
- *cd $SPARK_HOME*
- *cd bin*
- *spark-shell*

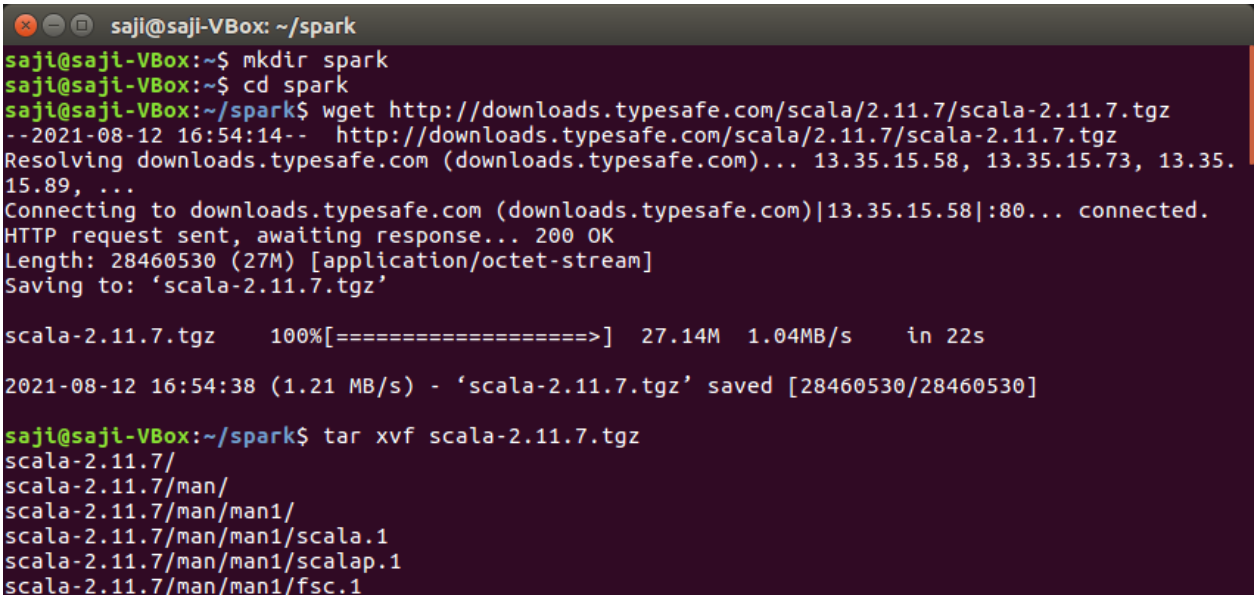

Figure 14 Install and extract Scala

```
saji@saji-VBox: ~/spark
scala-2.11.7/lib/scala-compiler.jar
scala-2.11.7/lib/scala-swing_2.11-1.0.2.jar
scala-2.11.7/lib/scala-actors-2.11.0.jar
saji@saji-VBox:~/spark$ sudo mv scala-2.11.7 /usr/lib
[sudo] password for saji:
saji@saji-VBox:~/spark$ sudo ln -s /usr/lib/scala-2.11.7 /usr/lib/scala
saji@saji-VBox:~/spark$ export PATH=$PATH:/usr/lib/scala/bin
saji@saji-VBox:~/spark$ scala -version
Scala code runner version 2.11.7 -- Copyright 2002-2013, LAMP/EPFL
```

Figure 15 move scala and check whether the scala was installed or not

```
saji@saji-VBox:~/spark$ wget http://d3kbcqa49mib13.cloudfront.net/spark-1.6.0-bin-hadoop2.6.tgz
--2021-08-12 17:03:20--  http://d3kbcqa49mib13.cloudfront.net/spark-1.6.0-bin-hadoop2.6.tgz
Resolving d3kbcqa49mib13.cloudfront.net (d3kbcqa49mib13.cloudfront.net)... 13.224.250.207, 13.224.250.84, 13.224.250.202, ...
Connecting to d3kbcqa49mib13.cloudfront.net (d3kbcqa49mib13.cloudfront.net)|13.224.250.207|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 289160984 (276M) [application/x-compressed]
Saving to: ‘spark-1.6.0-bin-hadoop2.6.tgz’

spark-1.6.0-bin-hadoop2.6.tgz         4%[=>                                  spark-1.6.0-bin-ha    5%[           spark-1.6.0-bin-hadoop2.6.  11%[==
=>                                     ]  32spark-1.6.0-bin-hadoop2 100%[============================>] 275.76M  1.54MB/s    in 3m 44s

2021-08-12 17:07:06 (1.23 MB/s) - ‘spark-1.6.0-bin-hadoop2.6.tgz’ saved [289160984/289160984]

saji@saji-VBox:~/spark$ tar xvf spark-1.6.0-bin-hadoop2.6.tgz
spark-1.6.0-bin-hadoop2.6/
spark-1.6.0-bin-hadoop2.6/LICENSE
spark-1.6.0-bin-hadoop2.6/ec2/
spark-1.6.0-bin-hadoop2.6/ec2/README
spark-1.6.0-bin-hadoop2.6/ec2/deploy.generic/
spark-1.6.0-bin-hadoop2.6/ec2/deploy.generic/root/
spark-1.6.0-bin-hadoop2.6/ec2/deploy.generic/root/spark-ec2/
spark-1.6.0-bin-hadoop2.6/ec2/deploy.generic/root/spark-ec2/ec2-variables.sh
```

Figure 16 install spark

```
saji@saji-VBox:~/spark$ export SPARK_HOME=$HOME/spark/spark-1.6.0-bin-hadoop2.6
saji@saji-VBox:~/spark$ export PATH=$PATH:$SPARK_HOME/bin
saji@saji-VBox:~/spark$ echo 'export PATH=$PATH:/usr/lib/scala/bin' >> .bash_profile
saji@saji-VBox:~/spark$ echo 'export SPARK_HOME=$HOME/spark/spark-1.6.0-bin-hadoop2.6' >> .bash_profile
saji@saji-VBox:~/spark$ echo 'export PATH=$PATH:$SPARK_HOME/bin' >> .bash_profile
```

Figure 17 export and echo spark path

```
saji@saji-VBox:~$ cd $SPARK_HOME
saji@saji-VBox:~/spark/spark-1.6.0-bin-hadoop2.6$ cd bin
saji@saji-VBox:~/spark/spark-1.6.0-bin-hadoop2.6/bin$ spark-shell
log4j:WARN No appenders could be found for logger (org.apache.hadoop.metrics2.lib.MutableMetricsFactory).
log4j:WARN Please initialize the log4j system properly.
log4j:WARN See http://logging.apache.org/log4j/1.2/faq.html#noconfig for more info.
Using Spark's repl log4j profile: org/apache/spark/log4j-defaults-repl.properties
To adjust logging level use sc.setLogLevel("INFO")
Welcome to
      ____              __
     / __/__  ___ _____/ /__
    _\ \/ _ \/ _ `/ __/  '_/
   /___/ .__/\_,_/_/ /_/\_\   version 1.6.0
      /_/

Using Scala version 2.10.5 (OpenJDK 64-Bit Server VM, Java 1.8.0_292)
Type in expressions to have them evaluated.
Type :help for more information.
21/08/12 17:12:35 WARN Utils: Your hostname, saji-VBox resolves to a loopback address: 127.0.1.1; using 10.0.2.15 instead (on interface enp0s3
)
21/08/12 17:12:35 WARN Utils: Set SPARK_LOCAL_IP if you need to bind to another address
Spark context available as sc.
21/08/12 17:12:42 WARN Connection: BoneCP specified but not present in CLASSPATH (or one of dependencies)
21/08/12 17:12:43 WARN Connection: BoneCP specified but not present in CLASSPATH (or one of dependencies)
21/08/12 17:12:51 WARN ObjectStore: Version information not found in metastore. hive.metastore.schema.verification is not enabled so recording
 the schema version 1.2.0
21/08/12 17:12:52 WARN ObjectStore: Failed to get database default, returning NoSuchObjectException
21/08/12 17:12:55 WARN Connection: BoneCP specified but not present in CLASSPATH (or one of dependencies)
21/08/12 17:12:56 WARN Connection: BoneCP specified but not present in CLASSPATH (or one of dependencies)
21/08/12 17:13:02 WARN ObjectStore: Version information not found in metastore. hive.metastore.schema.verification is not enabled so recording
 the schema version 1.2.0
21/08/12 17:13:03 WARN ObjectStore: Failed to get database default, returning NoSuchObjectException
SQL context available as sqlContext.

scala>
```

Figure 18 Spark shell

1.6 Install Zookeeper

- *$ mkdir zookeeper*
- *$ cd zookeeper(*navigate into the zookeeper directory*)*
- *$ sudo wget* *https://downloads.apache.org/zookeeper/zookeeper-3.7.0/apachezookeeper-3.7.0-bin.tar.gz*
- *$ sudo tar -xvf apache-zookeeper-3.7.0-bin.tar.gz*
- *$ cd apache-zookeeper-3.7.0-bin*
- *$ sudo mkdir data (*create data directory*)*
- *$ cd conf*
- *$ cp zoo_sample.cfg zoo.cfg(*copy the zoo.sample file and create zoo.cfg file*)*
- *$ nano zoo.cfg (*edit the zoo.cfg file as you see*)*

  tickTime=2000
  dataDir=/home/saji/zookeeper/apache-zookeeper-3.7.0-bin/data
  clientPort=2181
  initLimit=10
  syncLimit=5

```
saji@saji-VBox:~$ mkdir zookeeper
saji@saji-VBox:~$ ls
cassandra  Documents  examples.desktop  Pictures  spark      Videos
Desktop    Downloads  Music             Public    Templates  zookeeper
saji@saji-VBox:~$ cd zookeeper
saji@saji-VBox:~/zookeeper$ sudo wget https://downloads.apache.org/zookeeper/zookeeper-3.7.0/apache-zookeeper-3.7.0-bin.tar.gz
[sudo] password for saji:
--2021-08-12 17:23:26--  https://downloads.apache.org/zookeeper/zookeeper-3.7.0/apache-zookeeper-3.7.0-bin.tar.gz
Resolving downloads.apache.org (downloads.apache.org)... 135.181.209.10, 135.181.214.104, 88.99.95.219, ...
Connecting to downloads.apache.org (downloads.apache.org)|135.181.209.10|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 12387614 (12M) [application/x-gzip]
Saving to: 'apache-zookeeper-3.7.0-bin.tar.gz'

apache-zookeeper-3. 100%[================>]  11.81M  2.23MB/s    in 9.8s

2021-08-12 17:23:38 (1.21 MB/s) - 'apache-zookeeper-3.7.0-bin.tar.gz' saved [12387614/12387614]

saji@saji-VBox:~/zookeeper$ sudo tar -xvf apache-zookeeper-3.7.0-bin.tar.gz
apache-zookeeper-3.7.0-bin/docs/
apache-zookeeper-3.7.0-bin/docs/skin/
apache-zookeeper-3.7.0-bin/docs/images/
apache-zookeeper-3.7.0-bin/docs/skin/basic.css
apache-zookeeper-3.7.0-bin/docs/skin/chapter.gif
```

Figure 19 install & extract zookeeper

```
saji@saji-VBox:~/zookeeper$ cd apache-zookeeper-3.7.0-bin
saji@saji-VBox:~/zookeeper/apache-zookeeper-3.7.0-bin$ sudo mkdir data
saji@saji-VBox:~/zookeeper/apache-zookeeper-3.7.0-bin$ cd conf
saji@saji-VBox:~/zookeeper/apache-zookeeper-3.7.0-bin/conf$ ls
configuration.xsl  log4j.properties  zoo_sample.cfg
saji@saji-VBox:~/zookeeper/apache-zookeeper-3.7.0-bin/conf$ cp zoo_sample.cfg zoo.cfg
saji@saji-VBox:~/zookeeper/apache-zookeeper-3.7.0-bin/conf$ nano zoo.cfg
```

Figure 20 create zoo.cfg file

```
saji@saji-VBox:~$ cd zookeeper
saji@saji-VBox:~/zookeeper$ cd apache-zookeeper-3.7.0-bin
saji@saji-VBox:~/zookeeper/apache-zookeeper-3.7.0-bin$ cd data
saji@saji-VBox:~/zookeeper/apache-zookeeper-3.7.0-bin/data$ pwd
/home/saji/zookeeper/apache-zookeeper-3.7.0-bin/data
saji@saji-VBox:~/zookeeper/apache-zookeeper-3.7.0-bin/data$
```

Figure 21 get the data directory

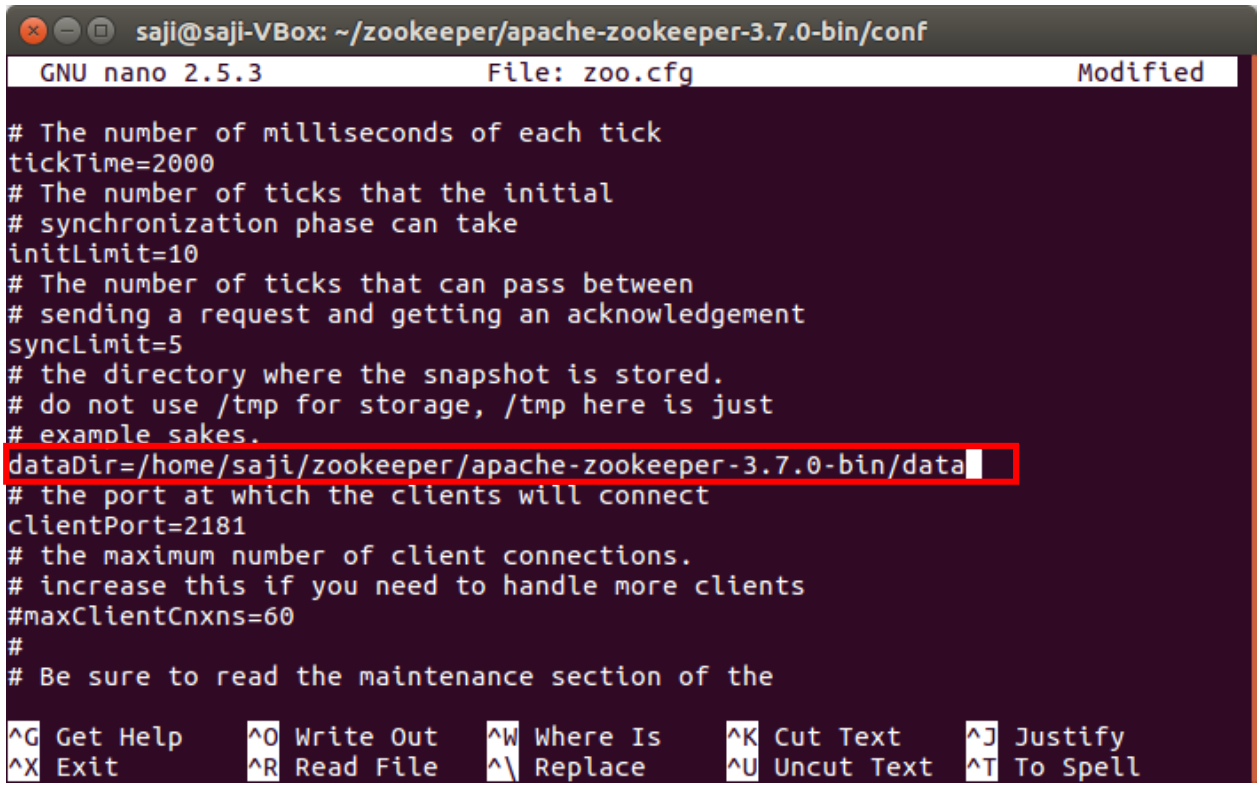

Figure 22 edit zoo.cfg file

1.7 Install Kafka

- *$ sudo mkdir kafka*
- *$ cd kafka (navigate into kafka directory)*
- *$ sudo wget https://mirrors.estointernet.in/apache/kafka/2.8.0/kafka_2.13-2.8.0.tgz*
- *$ sudo tar -xvf kafka_2.13-2.8.0.tgz*
- *$ cd kafka_2.13-2.8.0*

Start the Zookeeper

- *$ bin/zookeeper-server-start.sh config/zookeeper.properties*

Start the Kafka

- *$ bin/kafka-server-start.sh config/server.properties*

```
saji@saji-VBox: ~/kafka
saji@saji-VBox:~$ sudo mkdir kafka
[sudo] password for saji:
saji@saji-VBox:~$ cd kafka
saji@saji-VBox:~/kafka$ sudo wget https://mirrors.estointernet.in/apache/kafka/2
.8.0/kafka_2.13-2.8.0.tgz
--2021-08-12 17:28:10--  https://mirrors.estointernet.in/apache/kafka/2.8.0/kafk
a_2.13-2.8.0.tgz
Resolving mirrors.estointernet.in (mirrors.estointernet.in)... 43.255.166.254, 2
403:8940:3:1::f
Connecting to mirrors.estointernet.in (mirrors.estointernet.in)|43.255.166.254|:
443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 71403603 (68M) [application/octet-stream]
Saving to: ‘kafka_2.13-2.8.0.tgz’

kafka_2.13-2.8.0.tg 100%[===================>]  68.10M  2.09MB/s    in 28s

2021-08-12 17:28:42 (2.41 MB/s) - ‘kafka_2.13-2.8.0.tgz’ saved [71403603/7140360
3]
```

Figure 23 install kafka

```
saji@saji-VBox:~/kafka$ sudo tar -xvf kafka_2.13-2.8.0.tgz
kafka_2.13-2.8.0/
kafka_2.13-2.8.0/LICENSE
kafka_2.13-2.8.0/NOTICE
kafka_2.13-2.8.0/bin/
kafka_2.13-2.8.0/bin/zookeeper-shell.sh
kafka_2.13-2.8.0/bin/kafka-log-dirs.sh
kafka_2.13-2.8.0/bin/zookeeper-server-stop.sh
kafka_2.13-2.8.0/bin/kafka-configs.sh
```

Figure 24 extract kafka

```
saji@saji-VBox:~/kafka$ cd kafka_2.13-2.8.0
saji@saji-VBox:~/kafka/kafka_2.13-2.8.0$ bin/zookeeper-server-start.sh config/zookeeper.properties
mkdir: cannot create directory ‘/home/saji/kafka/kafka_2.13-2.8.0/bin/../logs’: Permission denied
OpenJDK 64-Bit Server VM warning: Cannot open file /home/saji/kafka/kafka_2.13-2.8.0/bin/../logs/zookeeper-gc.log due to No such file or direc
tory

log4j:ERROR setFile(null,true) call failed.
java.io.FileNotFoundException: /home/saji/kafka/kafka_2.13-2.8.0/bin/../logs/server.log (No such file or directory)
        at java.io.FileOutputStream.open0(Native Method)
        at java.io.FileOutputStream.open(FileOutputStream.java:270)
        at java.io.FileOutputStream.<init>(FileOutputStream.java:213)
        at java.io.FileOutputStream.<init>(FileOutputStream.java:133)
        at org.apache.log4j.FileAppender.setFile(FileAppender.java:294)
        at org.apache.log4j.FileAppender.activateOptions(FileAppender.java:165)
```

Figure 25 start zookeeper

```
saji@saji-VBox:~$ ls
cassandra  examples.desktop           maven     spark
Desktop    iot-traffic-monitor-master  Music     Templates
Documents  kafka                       Pictures  Videos
Downloads  master.zip                  Public    zookeeper
saji@saji-VBox:~$ cd kafka
saji@saji-VBox:~/kafka$ ls
kafka_2.13-2.8.0  kafka_2.13-2.8.0.tgz
saji@saji-VBox:~/kafka$ cd kafka_2.13-2.8.0
saji@saji-VBox:~/kafka/kafka_2.13-2.8.0$ bin/kafka-server-start.sh config/server.properties
mkdir: cannot create directory ‘/home/saji/kafka/kafka_2.13-2.8.0/bin/../logs’: Permission denied
OpenJDK 64-Bit Server VM warning: Cannot open file /home/saji/kafka/kafka_2.13-2.8.0/bin/../logs/kafkaServer-gc.log due to No such file or dir
ectory

log4j:ERROR setFile(null,true) call failed.
java.io.FileNotFoundException: /home/saji/kafka/kafka_2.13-2.8.0/bin/../logs/server.log (No such file or directory)
        at java.io.FileOutputStream.open0(Native Method)
        at java.io.FileOutputStream.open(FileOutputStream.java:270)
```

Figure 26 start kafka

1.8 Install Maven.

- *$ mkdir maven (*create maven directory*)*
- *$ cd maven (*navigate to maven directory*)*
- *$ wget https://archive.apache.org/dist/maven/maven-3/3.3.9/binaries/apache-maven-3.3.9-bin.tar.gz*
- *$ tar xvf apache-maven-3.3.9-bin.tar.gz*
- *$ cd apache-maven-3.3.9*
- *Add the maven path to .bachrc file*

```
export MAVEN_HOME=/home/saji/maven/apache-maven-3.3.9
export PATH=$PATH:$MAVEN_HOME/bin
```

```
saji@saji-VBox:~$ cd maven
saji@saji-VBox:~/maven$ wget https://archive.apache.org/dist/maven/maven-3/3.3.9/binaries/apache-maven-3.3.9-bin.tar.gz
--2021-08-12 17:37:48--  https://archive.apache.org/dist/maven/maven-3/3.3.9/binaries/apache-maven-3.3.9-bin.tar.gz
Resolving archive.apache.org (archive.apache.org)... 138.201.131.134, 2a01:4f8:172:2ec5::2
Connecting to archive.apache.org (archive.apache.org)|138.201.131.134|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 8491533 (8.1M) [application/x-gzip]
Saving to: 'apache-maven-3.3.9-bin.tar.gz'

apache-maven-3.3.9- 100%[================>]   8.10M   183KB/s    in 45s

2021-08-12 17:38:36 (186 KB/s) - 'apache-maven-3.3.9-bin.tar.gz' saved [8491533/8491533]
```

Figure 27 install maven

```
saji@saji-VBox:~/maven$ tar xvf apache-maven-3.3.9-bin.tar.gz
apache-maven-3.3.9/boot/plexus-classworlds-2.5.2.jar
apache-maven-3.3.9/lib/maven-embedder-3.3.9.jar
apache-maven-3.3.9/lib/maven-settings-3.3.9.jar
apache-maven-3.3.9/lib/plexus-utils-3.0.22.jar
apache-maven-3.3.9/lib/maven-core-3.3.9.jar
apache-maven-3.3.9/lib/maven-model-3.3.9.jar
apache-maven-3.3.9/lib/commons-lang3-3.4.jar
apache-maven-3.3.9/lib/maven-settings-builder-3.3.9.jar
apache-maven-3.3.9/lib/maven-builder-support-3.3.9.jar
apache-maven-3.3.9/lib/plexus-interpolation-1.21.jar
apache-maven-3.3.9/lib/plexus-component-annotations-1.6.jar
apache-maven-3.3.9/lib/plexus-sec-dispatcher-1.3.jar
apache-maven-3.3.9/lib/plexus-cipher-1.7.jar
apache-maven-3.3.9/lib/maven-repository-metadata-3.3.9.jar
apache-maven-3.3.9/lib/maven-artifact-3.3.9.jar
apache-maven-3.3.9/lib/maven-plugin-api-3.3.9.jar
apache-maven-3.3.9/lib/org.eclipse.sisu.plexus-0.3.2.jar
apache-maven-3.3.9/lib/cdi-api-1.0.jar
apache-maven-3.3.9/lib/jsr250-api-1.0.jar
```

Figure 28 extract maven

```
saji@saji-VBox:~/maven$ cd apache-maven-3.3.9-bin
bash: cd: apache-maven-3.3.9-bin: No such file or directory
saji@saji-VBox:~/maven$ ls
apache-maven-3.3.9  apache-maven-3.3.9-bin.tar.gz
saji@saji-VBox:~/maven$ cd apache-maven-3.3.9
saji@saji-VBox:~/maven/apache-maven-3.3.9$ pwd
/home/saji/maven/apache-maven-3.3.9
saji@saji-VBox:~/maven/apache-maven-3.3.9$ cd
saji@saji-VBox:~$ nano .bashrc
```

Figure 29 get maven directory

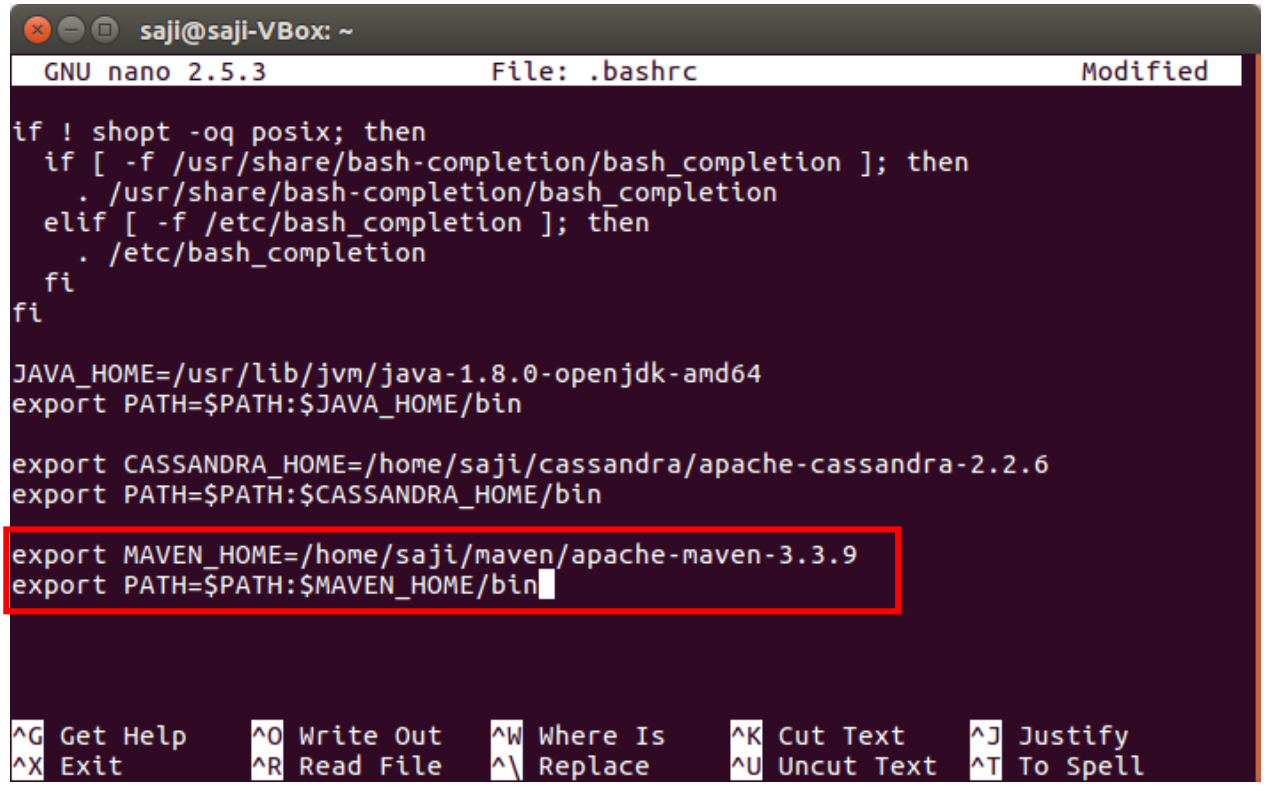

Figure 30 edit .bashrc file and insert maven directory

1.9 Download master.zip

Download master.zip from GitHub with the appropriate files to configure using the following command:

- *$ wget https://github.com/baghelamit/iot-traffic-monitor/archive/refs/heads/master.zip*
- *$ unzip master.zip*

```
saji@saji-VBox:~$ wget https://github.com/baghelamit/iot-traffic-monitor/archive/refs/heads/master.zip
--2021-08-12 17:42:30--  https://github.com/baghelamit/iot-traffic-monitor/archive/refs/heads/master.zip
Resolving github.com (github.com)... 20.205.243.166
Connecting to github.com (github.com)|20.205.243.166|:443... connected.
Unable to establish SSL connection.
saji@saji-VBox:~$ wget https://github.com/baghelamit/iot-traffic-monitor/archive/refs/heads/master.zip
--2021-08-12 17:45:06--  https://github.com/baghelamit/iot-traffic-monitor/archive/refs/heads/master.zip
Resolving github.com (github.com)... 13.250.177.223
Connecting to github.com (github.com)|13.250.177.223|:443... connected.
HTTP request sent, awaiting response... 302 Found
Location: https://codeload.github.com/baghelamit/iot-traffic-monitor/zip/refs/heads/master [following]
--2021-08-12 17:45:09--  https://codeload.github.com/baghelamit/iot-traffic-monitor/zip/refs/heads/master
Resolving codeload.github.com (codeload.github.com)... 20.205.243.165
Connecting to codeload.github.com (codeload.github.com)|20.205.243.165|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: unspecified [application/zip]
Saving to: 'master.zip'

master.zip              [     <=>         ] 449.13K   485KB/s    in 0.9s

2021-08-12 17:45:13 (485 KB/s) - 'master.zip' saved [459914]
```

Figure 31 download master zip from GitHub

```
saji@saji-VBox:~$ unzip master.zip
Archive:  master.zip
868346d98d4f7e265f780e481ca4c3ed988fdafe
   creating: iot-traffic-monitor-master/
  inflating: iot-traffic-monitor-master/LICENSE
  inflating: iot-traffic-monitor-master/README.md
  inflating: iot-traffic-monitor-master/iot-architecture.png
   creating: iot-traffic-monitor-master/iot-kafka-producer/
  inflating: iot-traffic-monitor-master/iot-kafka-producer/README.md
  inflating: iot-traffic-monitor-master/iot-kafka-producer/pom.xml
   creating: iot-traffic-monitor-master/iot-kafka-producer/src/
   creating: iot-traffic-monitor-master/iot-kafka-producer/src/main/
   creating: iot-traffic-monitor-master/iot-kafka-producer/src/main/java/
   creating: iot-traffic-monitor-master/iot-kafka-producer/src/main/java/com/
   creating: iot-traffic-monitor-master/iot-kafka-producer/src/main/java/com/iot/
   creating: iot-traffic-monitor-master/iot-kafka-producer/src/main/java/com/iot/app/
   creating: iot-traffic-monitor-master/iot-kafka-producer/src/main/java/com/iot/app/kafka/
   creating: iot-traffic-monitor-master/iot-kafka-producer/src/main/java/com/iot/app/kafka/producer/
  inflating: iot-traffic-monitor-master/iot-kafka-producer/src/main/java/com/iot/app/kafka/producer/IoTDataProducer.java
   creating: iot-traffic-monitor-master/iot-kafka-producer/src/main/java/com/iot/app/kafka/util/
  inflating: iot-traffic-monitor-master/iot-kafka-producer/src/main/java/com/iot/app/kafka/util/IoTDataEncoder.java
  inflating: iot-traffic-monitor-master/iot-kafka-producer/src/main/java/com/iot/app/kafka/util/PropertyFileReader.java
   creating: iot-traffic-monitor-master/iot-kafka-producer/src/main/java/com/iot/app/kafka/vo/
  inflating: iot-traffic-monitor-master/iot-kafka-producer/src/main/java/com/iot/app/kafka/vo/IoTData.java
   creating: iot-traffic-monitor-master/iot-kafka-producer/src/main/resources/
  inflating: iot-traffic-monitor-master/iot-kafka-producer/src/main/resources/iot-kafka.properties
  inflating: iot-traffic-monitor-master/iot-kafka-producer/src/main/resources/log4j.properties
   creating: iot-traffic-monitor-master/iot-spark-processor/
  inflating: iot-traffic-monitor-master/iot-spark-processor/IoTData.cql
  inflating: iot-traffic-monitor-master/iot-spark-processor/README.md
  inflating: iot-traffic-monitor-master/iot-spark-processor/pom.xml
   creating: iot-traffic-monitor-master/iot-spark-processor/src/
   creating: iot-traffic-monitor-master/iot-spark-processor/src/main/
   creating: iot-traffic-monitor-master/iot-spark-processor/src/main/java/
```

Figure 32 unzip master zip

As shown in the image above, downloading master.zip includes IoT Kafka Maker, IoT Spark Maker, IoT Spring Boot Dashboard and IoT Traffic Monitor.

1.10 Create a Kafka topic.

Using the following command, you need to create a Kafka topic.

- *$ bin/kafka-topics.sh --create --zookeeper localhost:2181 --replication-factor 1 --partitions 1 --topic iot-data-event*

```
saji@saji-VBox:~/kafka/kafka_2.13-2.8.0$ bin/kafka-topics.sh --create --zookeeper localhost:2181 --replication-factor 1 --partitions 1 --topic
 iot-data-event
Created topic iot-data-event.
```

Figure 33 create kafka topics

1.11 IoT Kafka Producer

Then go to the Kafka producer and follow the instructions below to install the Maven packages.

- *$ cd iot-traffic-monitor-master/*
- *$ cd iot-kafka-producer/*
- *$ mvn package*
- *$ mvn exec:java -Dexec.mainClass="com.iot.app.kafka.producer.IoTDataProducer"*

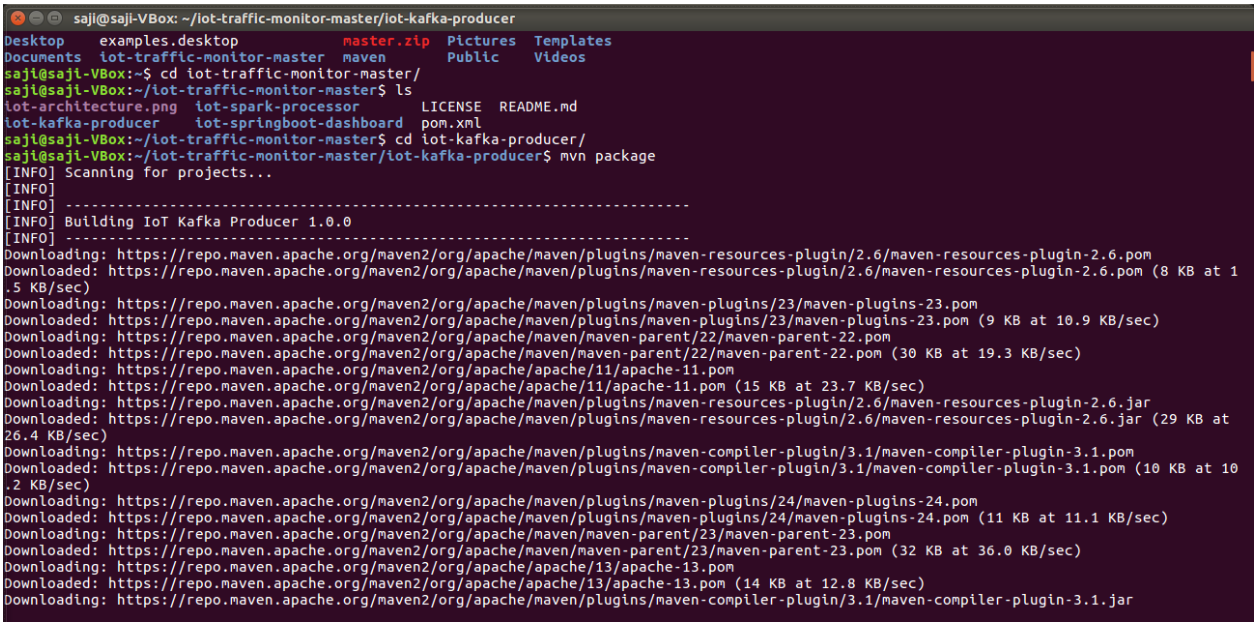

Figure 34 move to Kafka producer install maven packages

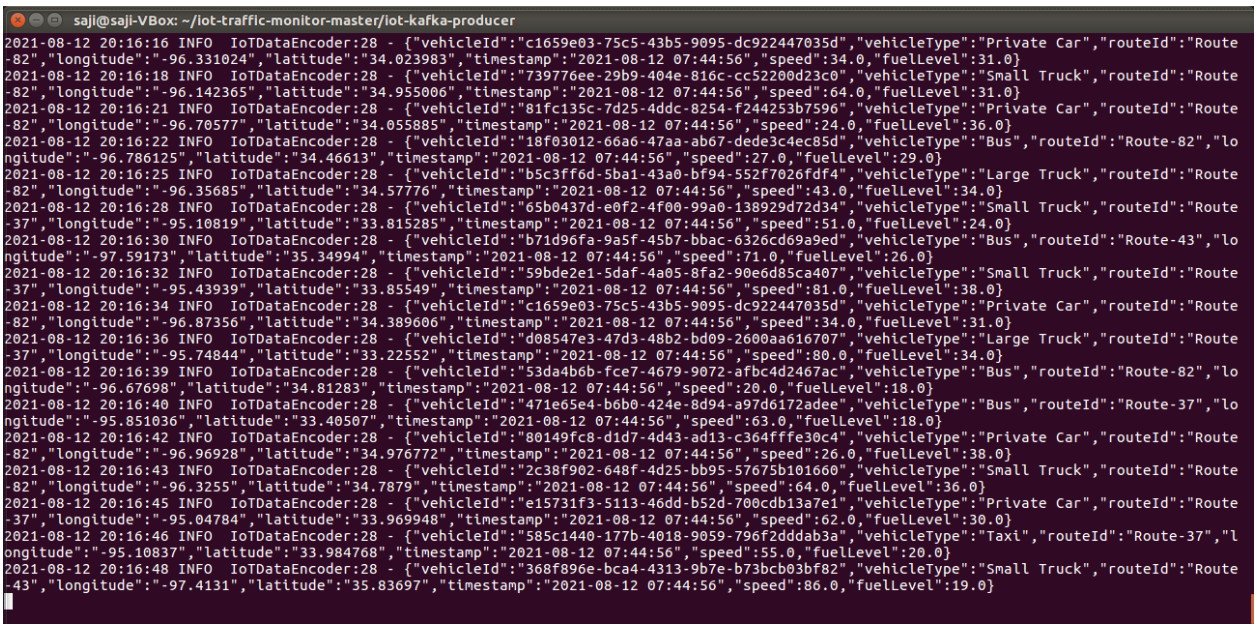

Figure 35 installing maven packages

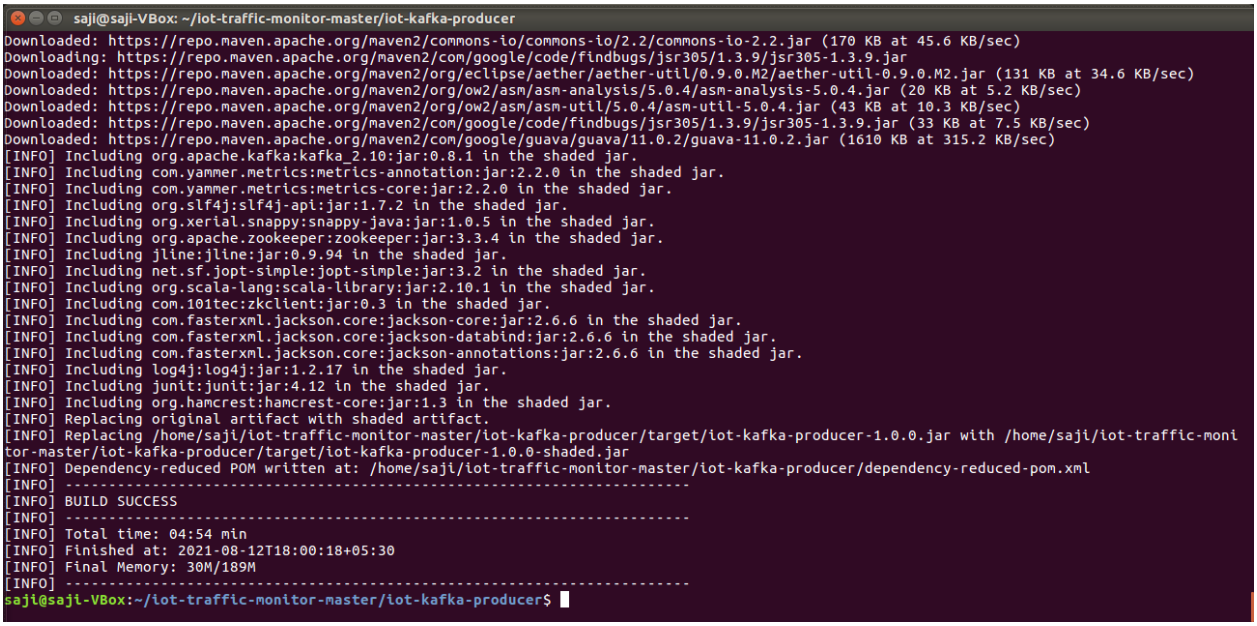

Figure 36 maven package installed success

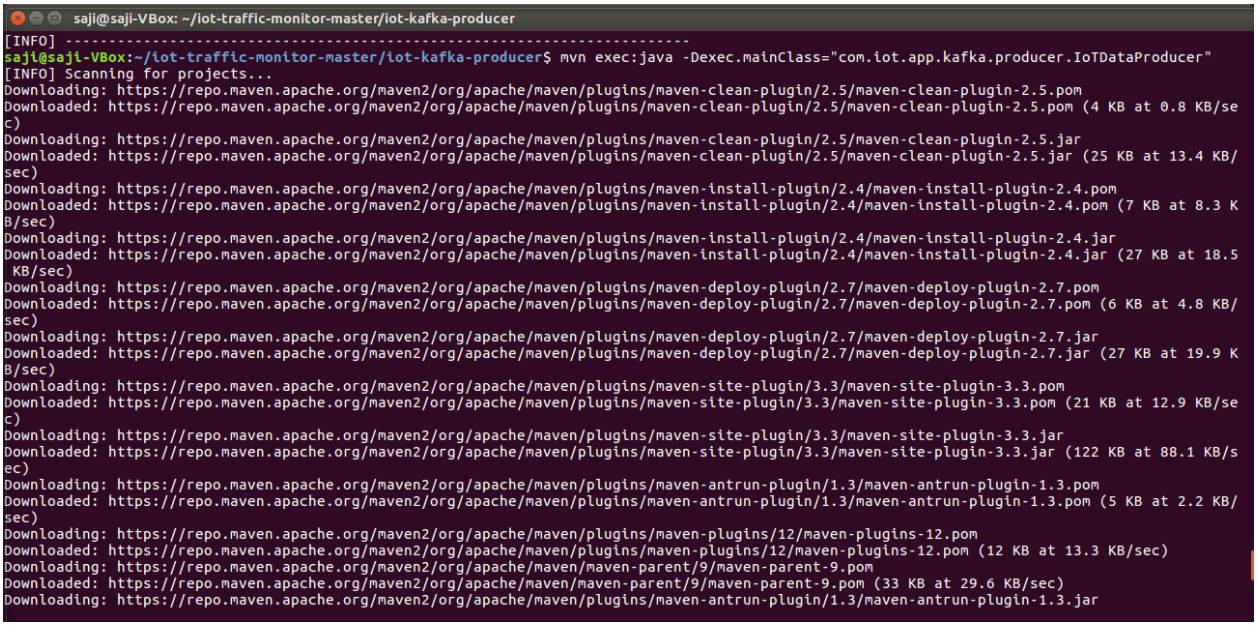

Figure 37 iot kafka producer run

1.12 Iot Spark Processor

Now move onto the iot-spark-processor directory and use the following commands.

- *$ cd iot-spark-processor/*
- *$ mvn package*
- *$ spark-submit --class "com.iot.app.spark.processor.IoTDataProcessor" iot-sparkprocessor-1.0.0.jar*

```
saji@saji-VBox:~$ cd iot-traffic-monitor-master
saji@saji-VBox:~/iot-traffic-monitor-master$ ls
iot-architecture.png  iot-spark-processor       LICENSE  README.md
iot-kafka-producer    iot-springboot-dashboard  pom.xml
saji@saji-VBox:~/iot-traffic-monitor-master$ cd iot-spark-processor
saji@saji-VBox:~/iot-traffic-monitor-master/iot-spark-processor$ mvn package
[INFO] Scanning for projects...
[INFO]
[INFO] ------------------------------------------------------------------------
[INFO] Building IoT Spark Processor 1.0.0
[INFO] ------------------------------------------------------------------------
Downloading: https://repo.maven.apache.org/maven2/org/apache/spark/spark-core_2.10/1.6.2/spark-core_2.10-1.6.2.pom
Downloaded: https://repo.maven.apache.org/maven2/org/apache/spark/spark-core_2.10/1.6.2/spark-core_2.10-1.6.2.pom (20 KB at 4.3 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/apache/spark/spark-parent_2.10/1.6.2/spark-parent_2.10-1.6.2.pom
Downloaded: https://repo.maven.apache.org/maven2/org/apache/spark/spark-parent_2.10/1.6.2/spark-parent_2.10-1.6.2.pom (90 KB at 41.0 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/apache/avro/avro-mapred/1.7.7/avro-mapred-1.7.7.pom
Downloaded: https://repo.maven.apache.org/maven2/org/apache/avro/avro-mapred/1.7.7/avro-mapred-1.7.7.pom (7 KB at 8.2 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/apache/avro/avro-parent/1.7.7/avro-parent-1.7.7.pom
Downloaded: https://repo.maven.apache.org/maven2/org/apache/avro/avro-parent/1.7.7/avro-parent-1.7.7.pom (19 KB at 12.0 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/apache/avro/avro-toplevel/1.7.7/avro-toplevel-1.7.7.pom
Downloaded: https://repo.maven.apache.org/maven2/org/apache/avro/avro-toplevel/1.7.7/avro-toplevel-1.7.7.pom (10 KB at 11.2 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/apache/avro/avro-ipc/1.7.7/avro-ipc-1.7.7.pom
Downloaded: https://repo.maven.apache.org/maven2/org/apache/avro/avro-ipc/1.7.7/avro-ipc-1.7.7.pom (6 KB at 6.1 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/apache/avro/avro/1.7.7/avro-1.7.7.pom
Downloaded: https://repo.maven.apache.org/maven2/org/apache/avro/avro/1.7.7/avro-1.7.7.pom (6 KB at 5.3 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/codehaus/jackson/jackson-core-asl/1.9.13/jackson-core-asl-1.9.13.pom
Downloaded: https://repo.maven.apache.org/maven2/org/codehaus/jackson/jackson-core-asl/1.9.13/jackson-core-asl-1.9.13.pom (2 KB at 1.1 KB/sec)
```

Figure 38 iot spark processor mvn package

```
[WARNING]   - org.apache.commons.collections.FastHashMap$1
[WARNING]   - org.apache.commons.collections.Buffer
[WARNING]   - org.apache.commons.collections.FastHashMap
[WARNING]   - org.apache.commons.collections.BufferUnderflowException
[WARNING] netty-buffer-4.0.33.Final.jar, netty-all-4.0.29.Final.jar define 79 overlapping classes:
[WARNING]   - io.netty.buffer.ByteBufProcessor$5
[WARNING]   - io.netty.buffer.PoolSubpage
[WARNING]   - io.netty.buffer.PooledHeapByteBuf
[WARNING]   - io.netty.buffer.ReadOnlyByteBuf
[WARNING]   - io.netty.buffer.PooledByteBufAllocator
[WARNING]   - io.netty.buffer.AbstractReferenceCountedByteBuf
[WARNING]   - io.netty.buffer.PoolArenaMetric
[WARNING]   - io.netty.buffer.SimpleLeakAwareByteBuf
[WARNING]   - io.netty.buffer.PoolThreadCache$SubPageMemoryRegionCache
[WARNING]   - io.netty.buffer.ByteBufUtil$ThreadLocalDirectByteBuf$1
[WARNING]   - 69 more...
[WARNING] maven-shade-plugin has detected that some class files are
[WARNING] present in two or more JARs. When this happens, only one
[WARNING] single version of the class is copied to the uber jar.
[WARNING] Usually this is not harmful and you can skip these warnings,
[WARNING] otherwise try to manually exclude artifacts based on
[WARNING] mvn dependency:tree -Ddetail=true and the above output.
[WARNING] See http://maven.apache.org/plugins/maven-shade-plugin/
[INFO] Replacing original artifact with shaded artifact.
[INFO] Replacing /home/saji/iot-traffic-monitor-master/iot-spark-processor/target/iot-spark-processor-1.0.0.jar with /home/saji/iot-traffic-mo
nitor-master/iot-spark-processor/target/iot-spark-processor-1.0.0-shaded.jar
[INFO] Dependency-reduced POM written at: /home/saji/iot-traffic-monitor-master/iot-spark-processor/dependency-reduced-pom.xml
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 06:40 min
[INFO] Finished at: 2021-08-12T22:20:46+05:30
[INFO] Final Memory: 40M/341M
[INFO] ------------------------------------------------------------------------
saji@saji-VBox:~/iot-traffic-monitor-master/iot-spark-processor$ spark-submit --class "com.iot.app.spark.processor.IoTDataProcessor" iot-spark
processor-1.0.0.jar
>
```

Figure 39 iot spark processor mvn package build success

1.13 Iot Spring Boot Dashboard

- *$ cd iot-springoot-dashboard/*
- *$ mvn package*
- *$ mvn exec:java -Dexec.mainClass="com.iot.app.springboot.dashboard.IoTDataDashboard"*

```
saji@saji-VBox:~$ cd iot-springoot-dashboard/
bash: cd: iot-springoot-dashboard/: No such file or directory
saji@saji-VBox:~$ ls
cassandra  examples.desktop            maven     spark
Desktop    iot-traffic-monitor-master  Music     Templates
Documents  kafka                       Pictures  Videos
Downloads  master.zip                  Public    zookeeper
saji@saji-VBox:~$ cd iot-traffic-monitor-master
saji@saji-VBox:~/iot-traffic-monitor-master$ ls
iot-architecture.png  iot-spark-processor       LICENSE  README.md
iot-kafka-producer    iot-springboot-dashboard  pom.xml
saji@saji-VBox:~/iot-traffic-monitor-master$ cd iot-springboot-dashboard
saji@saji-VBox:~/iot-traffic-monitor-master/iot-springboot-dashboard$ mvn package
[INFO] Scanning for projects...
Downloading: https://repo.maven.apache.org/maven2/org/springframework/boot/spring-boot-starter-parent/1.3.5.RELEASE/spring-boot-starter-parent
-1.3.5.RELEASE.pom
Downloaded: https://repo.maven.apache.org/maven2/org/springframework/boot/spring-boot-starter-parent/1.3.5.RELEASE/spring-boot-starter-parent-
1.3.5.RELEASE.pom (7 KB at 4.7 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/springframework/boot/spring-boot-dependencies/1.3.5.RELEASE/spring-boot-dependencies-1.3
.5.RELEASE.pom
Downloaded: https://repo.maven.apache.org/maven2/org/springframework/boot/spring-boot-dependencies/1.3.5.RELEASE/spring-boot-dependencies-1.3.
5.RELEASE.pom (73 KB at 120.6 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/springframework/spring-framework-bom/4.2.6.RELEASE/spring-framework-bom-4.2.6.RELEASE.po
m
Downloaded: https://repo.maven.apache.org/maven2/org/springframework/spring-framework-bom/4.2.6.RELEASE/spring-framework-bom-4.2.6.RELEASE.pom
 (5 KB at 13.1 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/springframework/data/spring-data-releasetrain/Gosling-SR4/spring-data-releasetrain-Gosli
ng-SR4.pom
Downloaded: https://repo.maven.apache.org/maven2/org/springframework/data/spring-data-releasetrain/Gosling-SR4/spring-data-releasetrain-Goslin
g-SR4.pom (5 KB at 10.4 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/springframework/data/build/spring-data-build/1.7.4.RELEASE/spring-data-build-1.7.4.RELEA
SE.pom
Downloaded: https://repo.maven.apache.org/maven2/org/springframework/data/build/spring-data-build/1.7.4.RELEASE/spring-data-build-1.7.4.RELEAS
E.pom (3 KB at 5.9 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/springframework/integration/spring-integration-bom/4.2.5.RELEASE/spring-integration-bom-
4.2.5.RELEASE.pom
Downloaded: https://repo.maven.apache.org/maven2/org/springframework/integration/spring-integration-bom/4.2.5.RELEASE/spring-integration-bom-4
```

Figure 40 Iot Spring Boot Dashboard install maven package

```
Downloaded: https://repo.maven.apache.org/maven2/org/apache/maven/maven-artifact-manager/2.0.8/maven-artifact-manager-2.0.8.jar (56 KB at 12.1
 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/apache/commons/commons-compress/1.9/commons-compress-1.9.jar
Downloaded: https://repo.maven.apache.org/maven2/org/apache/maven/maven-project/2.0.8/maven-project-2.0.8.jar (114 KB at 24.7 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-shade-plugin/2.2/maven-shade-plugin-2.2.jar
Downloaded: https://repo.maven.apache.org/maven2/org/apache/maven/maven-plugin-registry/2.0.8/maven-plugin-registry-2.0.8.jar (29 KB at 6.1 KB
/sec)
Downloading: https://repo.maven.apache.org/maven2/asm/asm/3.3.1/asm-3.3.1.jar
Downloaded: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-io/2.3.2/plexus-io-2.3.2.jar (73 KB at 14.6 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/asm/asm-commons/3.3.1/asm-commons-3.3.1.jar
Downloaded: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-archiver/2.8.1/plexus-archiver-2.8.1.jar (140 KB at 28.0 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/asm/asm-tree/3.3.1/asm-tree-3.3.1.jar
Downloaded: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-shade-plugin/2.2/maven-shade-plugin-2.2.jar (98 KB at 19.3 KB/
sec)
Downloading: https://repo.maven.apache.org/maven2/org/apache/maven/shared/maven-dependency-tree/2.1/maven-dependency-tree-2.1.jar
Downloaded: https://repo.maven.apache.org/maven2/asm/asm/3.3.1/asm-3.3.1.jar (43 KB at 8.3 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/vafer/jdependency/0.7/jdependency-0.7.jar
Downloaded: https://repo.maven.apache.org/maven2/org/apache/commons/commons-compress/1.9/commons-compress-1.9.jar (370 KB at 71.7 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/commons-io/commons-io/1.3.2/commons-io-1.3.2.jar
Downloaded: https://repo.maven.apache.org/maven2/asm/asm-commons/3.3.1/asm-commons-3.3.1.jar (38 KB at 7.1 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/asm/asm-analysis/3.2/asm-analysis-3.2.jar
Downloaded: https://repo.maven.apache.org/maven2/asm/asm-tree/3.3.1/asm-tree-3.3.1.jar (22 KB at 3.9 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/asm/asm-util/3.2/asm-util-3.2.jar
Downloaded: https://repo.maven.apache.org/maven2/org/apache/maven/shared/maven-dependency-tree/2.1/maven-dependency-tree-2.1.jar (59 KB at 10.
8 KB/sec)
Downloaded: https://repo.maven.apache.org/maven2/org/vafer/jdependency/0.7/jdependency-0.7.jar (12 KB at 2.1 KB/sec)
Downloaded: https://repo.maven.apache.org/maven2/commons-io/commons-io/1.3.2/commons-io-1.3.2.jar (86 KB at 15.5 KB/sec)
Downloaded: https://repo.maven.apache.org/maven2/asm/asm-analysis/3.2/asm-analysis-3.2.jar (18 KB at 3.1 KB/sec)
Downloaded: https://repo.maven.apache.org/maven2/asm/asm-util/3.2/asm-util-3.2.jar (36 KB at 6.2 KB/sec)
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 01:49 min
[INFO] Finished at: 2021-08-12T20:21:45+05:30
[INFO] Final Memory: 28M/138M
[INFO] ------------------------------------------------------------------------
saji@saji-VBox:~/iot-traffic-monitor-master/iot-springboot-dashboard$
```

Figure 41 Iot Spring Boot maven package Build success

```
ocess-sources, generate-resources, process-resources, compile, process-classes, generate-test-sources, process-test-sources, generate-test-res
ources, process-test-resources, test-compile, process-test-classes, test, prepare-package, package, pre-integration-test, integration-test, po
st-integration-test, verify, install, deploy, pre-clean, clean, post-clean, pre-site, site, post-site, site-deploy. -> [Help 1]
[ERROR]
[ERROR] To see the full stack trace of the errors, re-run Maven with the -e switch.
[ERROR] Re-run Maven using the -X switch to enable full debug logging.
[ERROR]
[ERROR] For more information about the errors and possible solutions, please read the following articles:
[ERROR] [Help 1] http://cwiki.apache.org/confluence/display/MAVEN/NoGoalSpecifiedException
saji@saji-VBox:~/iot-traffic-monitor-master/iot-springboot-dashboard$ mvn exec:java -Dexec.mainClass="com.iot.app.springboot.dashboard.IoTData
Dashboard"
[INFO] Scanning for projects...
Downloading: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-help-plugin/2.2/maven-help-plugin-2.2.pom
Downloaded: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-help-plugin/2.2/maven-help-plugin-2.2.pom (9 KB at 5.1 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-help-plugin/2.2/maven-help-plugin-2.2.jar
Downloaded: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-help-plugin/2.2/maven-help-plugin-2.2.jar (67 KB at 115.0 KB/s
ec)
Downloading: https://repo.maven.apache.org/maven2/org/codehaus/mojo/xml-maven-plugin/1.0/xml-maven-plugin-1.0.pom
Downloaded: https://repo.maven.apache.org/maven2/org/codehaus/mojo/xml-maven-plugin/1.0/xml-maven-plugin-1.0.pom (8 KB at 18.5 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/codehaus/mojo/mojo-parent/28/mojo-parent-28.pom
Downloaded: https://repo.maven.apache.org/maven2/org/codehaus/mojo/mojo-parent/28/mojo-parent-28.pom (26 KB at 67.9 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/codehaus/codehaus-parent/3/codehaus-parent-3.pom
Downloaded: https://repo.maven.apache.org/maven2/org/codehaus/codehaus-parent/3/codehaus-parent-3.pom (5 KB at 11.3 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/codehaus/mojo/xml-maven-plugin/1.0/xml-maven-plugin-1.0.jar
Downloaded: https://repo.maven.apache.org/maven2/org/codehaus/mojo/xml-maven-plugin/1.0/xml-maven-plugin-1.0.jar (34 KB at 86.9 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/codehaus/mojo/build-helper-maven-plugin/1.9.1/build-helper-maven-plugin-1.9.1.pom
Downloaded: https://repo.maven.apache.org/maven2/org/codehaus/mojo/build-helper-maven-plugin/1.9.1/build-helper-maven-plugin-1.9.1.pom (7 KB a
t 18.0 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/codehaus/mojo/mojo-parent/33/mojo-parent-33.pom
Downloaded: https://repo.maven.apache.org/maven2/org/codehaus/mojo/mojo-parent/33/mojo-parent-33.pom (26 KB at 69.2 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/codehaus/codehaus-parent/4/codehaus-parent-4.pom
Downloaded: https://repo.maven.apache.org/maven2/org/codehaus/codehaus-parent/4/codehaus-parent-4.pom (5 KB at 12.5 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/codehaus/mojo/build-helper-maven-plugin/1.9.1/build-helper-maven-plugin-1.9.1.jar
Downloaded: https://repo.maven.apache.org/maven2/org/codehaus/mojo/build-helper-maven-plugin/1.9.1/build-helper-maven-plugin-1.9.1.jar (47 KB
at 113.4 KB/sec)
Downloading: https://repo.maven.apache.org/maven2/org/apache/maven/plugins/maven-install-plugin/2.5.2/maven-install-plugin-2.5.2.pom
7/7 KB
```

Figure 42 Iot Spring Boot iot data dashboard

```
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( ( )\___ | '_ | '_| | '_ \/ _` | \ \ \ \
 \\/  ___)| |_)| | | | | || (_| |  ) ) ) )
  '  |____| .__|_| |_|_| |_\__, | / / / /
 =========|_|==============|___/=/_/_/_/
 :: Spring Boot ::        (v1.3.5.RELEASE)

2021-08-12 20:27:43 INFO  Version:30 - HV000001: Hibernate Validator 5.2.4.Final
Aug 12, 2021 8:27:44 PM org.apache.catalina.core.StandardService startInternal
INFO: Starting service Tomcat
Aug 12, 2021 8:27:44 PM org.apache.catalina.core.StandardEngine startInternal
INFO: Starting Servlet Engine: Apache Tomcat/8.0.33
Aug 12, 2021 8:27:44 PM org.apache.catalina.core.ApplicationContext log
INFO: Initializing Spring embedded WebApplicationContext
Aug 12, 2021 8:27:47 PM org.apache.coyote.AbstractProtocol init
INFO: Initializing ProtocolHandler ["http-nio-8080"]
Aug 12, 2021 8:27:47 PM org.apache.coyote.AbstractProtocol start
INFO: Starting ProtocolHandler ["http-nio-8080"]
Aug 12, 2021 8:27:47 PM org.apache.tomcat.util.net.NioSelectorPool getSharedSelector
INFO: Using a shared selector for servlet write/read
2021-08-12 20:27:47 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@574fccbf
2021-08-12 20:27:52 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@547b7408
2021-08-12 20:27:57 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@710f9cbe
2021-08-12 20:28:02 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@73ab60ae
2021-08-12 20:28:07 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@5d5baeaa
2021-08-12 20:28:12 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@3b64c409
2021-08-12 20:28:17 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@6272b00d
2021-08-12 20:28:22 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@685c6317
2021-08-12 20:28:27 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@8739c58
2021-08-12 20:28:32 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@c3de092
2021-08-12 20:28:37 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@13e17d1
2021-08-12 20:28:42 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@402b8a67
2021-08-12 20:28:47 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@90a5618
2021-08-12 20:28:52 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@1a2f9236
2021-08-12 20:28:57 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@57f9ac46
2021-08-12 20:29:02 INFO  TrafficDataService:62 - Sending to UI com.iot.app.springboot.vo.Response@3fd17cb8
```

Figure 43 springboot shell

1.14 IoT Traffic Data Monitoring Dashboard

Run http://localhost:8080 in ubuntu browser. This is the Traffic Data Monitoring Dashboard, after all the above installation and configuration.

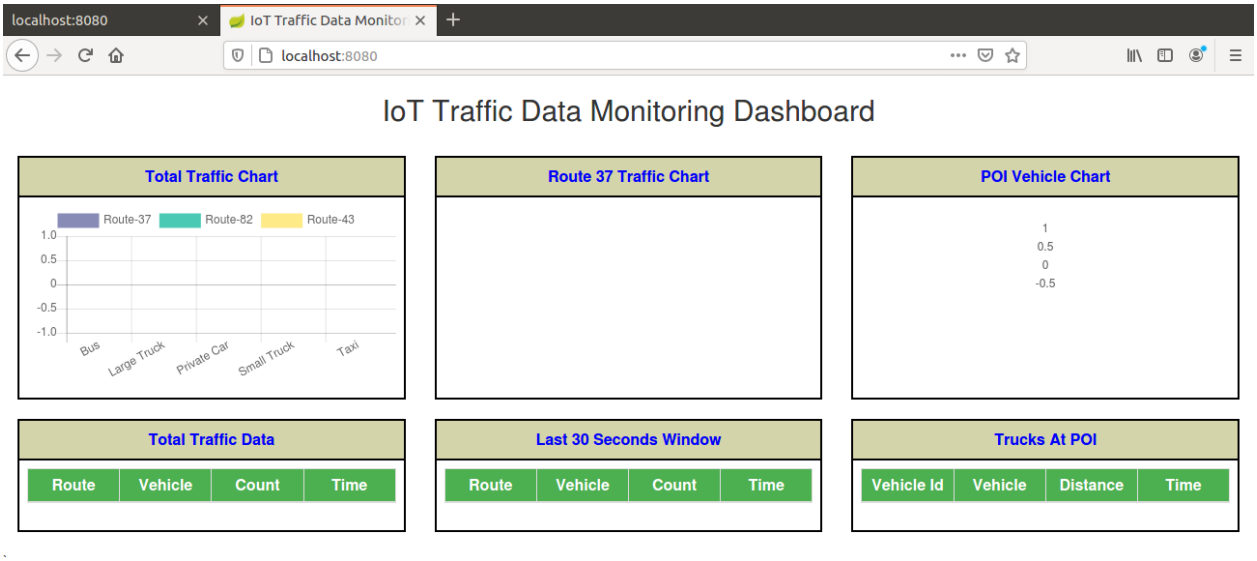

Figure 44 IoT Traffic Data Monitoring Dashboard