Building an End-to-End Streaming Project with Spark, Kafka, and Cassandra

In this article we will walk through the process of setting up and running an end-to-end streaming project using Spark, Kafka, and Cassandra. This project enables the consumption of messages from a Kafka topic, processing the data using Spark, and storing the results in Cassandra. Let's get started!

1. Running Servers

First, we need to start the required servers. Follow the instructions below to start Spark, Kafka, and Cassandra.

Start Spark

Navigate to the Spark directory and run the following command:

```
sbin/start-all.sh
```

Use the `jps` command to verify that Spark has started successfully.

Start Kafka

Navigate to the Kafka directory.
Start **Zookeeper** by running the following command:

```
nohup bin/zookeeper-server-start.sh config/zookeeper.properties >> nohup.out &
```

Start **Kafka** by running the following command:

```
nohup bin/kafka-server-start.sh config/server.properties >> nohup.out &
```

Create a **Kafka topic** by running the following commands:

```
bin/kafka-topics.sh --create --bootstrap-server localhost:9092 --replication-factor 1 --partitions 1 --topic mytopic

bin/kafka-topics.sh --list --zookeeper localhost:2181
```

Start Cassandra

Navigate to the Cassandra directory.
Start **Cassandra** by running the following command:

```
nohup bin/cassandra -f &
```

Open the **Cassandra shell** by running the following command:

```
bin/cqlsh
```

Create a keyspace and table by executing the following commands:

```
create keyspace sparkdata with replication ={'class':'SimpleStrategy','replication_factor':1};
use sparkdata;

CREATE TABLE cust_data (fname text, lname text, url text, product text, cnt counter, primary key (fname, lname, url, product));
select * from cust_data;
```

2. Spark Kafka Cassandra Streaming Code

Configure Spark to connect with Cassandra and Kafka:

- Go to the Spark installation directory and navigate to the `conf` folder.
- Copy the `spark-env.sh.template` file and rename it as `spark-env.sh`.
- Open the `spark-env.sh` file using a text editor.
- Add the following lines at the end of the file to configure the necessary dependencies:

```
export SPARK_CLASSPATH="/home/fayssal/apache-cassandra-4.0.10/lib/*:/home/fayssal/kafka_2.12-3.5.0/*"
export SPARK_EXTRA_CLASSPATH="/home/fayssal/apache-cassandra-4.0.10/lib/*:/home/fayssal/kafka_2.12-3.5.0/*"
```

Now, Navigate to the Spark directory and run the following command to start the Spark Shell:

```
bin/spark-shell --packages "com.datastax.spark:spark-cassandra-connector_2.12:3.3.0","org.apache.spark:spark-sql-kafka-0-10_2.12:3.4.0"
```

Inside the Spark Shell, execute the following code:

```
import org.apache.spark.sql.SparkSession
import org.apache.spark.sql.functions._
import org.apache.spark.sql.streaming.Trigger

val spark = SparkSession
  .builder()
  .appName("KafkaStructuredStreaming")
  .config("spark.cassandra.connection.host", "127.0.0.1")
  .getOrCreate()

import spark.implicits._

val kafkaBrokers = "localhost:9092"
val kafkaTopic = "mytopic"

val kafkaDF = spark
  .readStream
  .format("kafka")
  .option("kafka.bootstrap.servers", kafkaBrokers)
  .option("subscribe", kafkaTopic)
  .load()
  .selectExpr("CAST(value AS STRING)")
  .as[String]

val dataDF = kafkaDF
  .map(line => {
    val arr = line.split(",")
    (arr(0), arr(1), arr(2), arr(3), arr(4))
  })
```

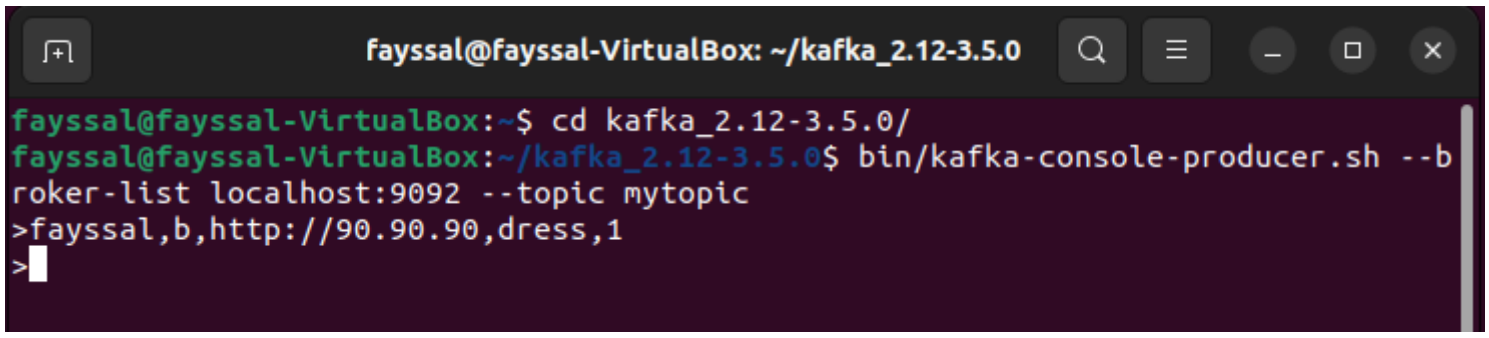
```
  .toDF("fname", "lname", "url", "product", "cnt")

dataDF
  .writeStream
  .format("org.apache.spark.sql.cassandra")
  .option("keyspace", "sparkdata")
  .option("table", "cust_data")
  .option("checkpointLocation", "/home/fayssal/spark-3.4.0-bin-hadoop3/checkpoint")
  .start()

spark.streams.awaitAnyTermination()
```

3. Testing

Now that we have set up the streaming pipeline, let's test it by creating a Kafka consumer and producer.

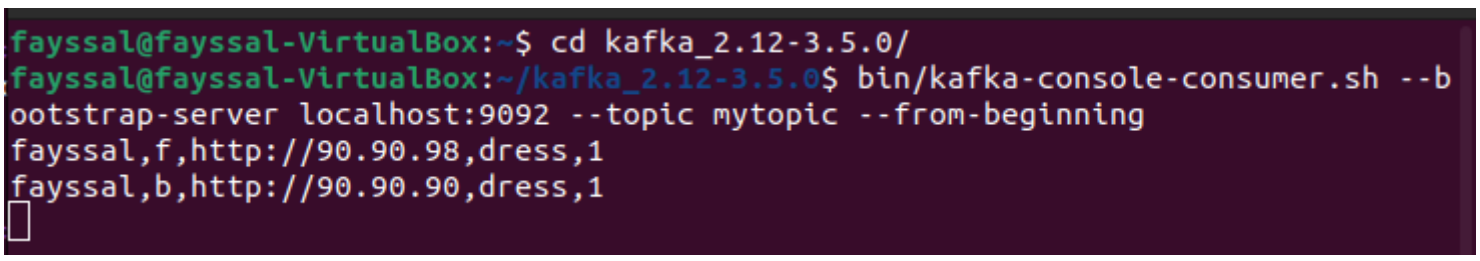
Create a Producer

```
bin/kafka-console-producer.sh --broker-list localhost:9092 --topic mytopic
```



Create a Consumer

```
bin/kafka-console-consumer.sh --bootstrap-server localhost:9092 --topic mytopic --from-beginning
```



Check Cassandra Keyspace