Last Updated: 26 Feb 2022

1. Kafka with Spring Boot – Producer – 60 Minutes

- Create a topic: users
- Producer: Send a String Message

You will have a Spring Boot application with a Kafka producer to publish messages to your Kafka topic, as well as with a Kafka consumer to read those messages.

Create a Maven Project with the following GAV:
GroupID: com.tos
Artifact : Springkafka

Update the pom.xml.

Publish/read messages from the Kafka topic
Now, you can see what it looks like. Let's move on to publishing/reading messages from the Kafka topic.

Create a topic using CLI.

```
#kafka-topics.sh --create \
 --bootstrap-server kafka0:9092 \
 --replication-factor 1 --partitions 8 \
 --topic users
```

Update the config/application.yaml in the resources folder with the following:

```
#server:
# port: 9000
spring:
   kafka:
     consumer:
        bootstrap-servers: localhost:8082
        group-id: group_id
        auto-offset-reset: earliest
        key-deserializer:
org.apache.kafka.common.serialization.StringDeserializer
        value-deserializer:
org.apache.kafka.common.serialization.StringDeserializer
     producer:
        bootstrap-servers: localhost:8082
        key-serializer:
org.apache.kafka.common.serialization.LongSerializer
```

```
        value-serializer:
org.apache.kafka.common.serialization.StringSerializer


### Config End Here.
```

Create a Producer : `Producer.java`

Import the following packages and classes.

```
import org.slf4j.Logger;
import org.slf4j.LoggerFactory;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.kafka.core.KafkaTemplate;
import org.springframework.stereotype.Service;
```

Update with the following code:

```
@Service
public class Producer {

    private static final Logger logger =
LoggerFactory.getLogger(Producer.class);
    private static final String TOPIC = "users";

    @Autowired
    private KafkaTemplate<String, String> kafkaTemplate;

    public void sendMessage(String message) {
        logger.info(String.format("#### -> Producing message ->
%s", message));
        this.kafkaTemplate.send(TOPIC, message);
    }
}
```

Create a REST controller: `KafkaController.java`

Import the following:

```
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.web.bind.annotation.PostMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RequestParam;
import org.springframework.web.bind.annotation.RestController;
```

Update with the following:

```
@RestController
@RequestMapping(value = "/kafka")
public class KafkaController {

    private final Producer producer;

    @Autowired
    KafkaController(Producer producer) {
        this.producer = producer;
    }

    @PostMapping(value = "/publish")
```

```
    public void sendMessageToKafkaTopic(@RequestParam("message")
String message) {
        this.producer.sendMessage(message);
    }
}
```

Create an Application and update with the following:

```
import org.springframework.boot.CommandLineRunner;
import org.springframework.boot.SpringApplication;
import
org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.context.ApplicationContext;
import org.springframework.context.annotation.Bean;

@SpringBootApplication
public class Application {

    public static void main(String[] args) {
        SpringApplication.run(Application.class, args);
    }

    @Bean
    public CommandLineRunner commandLineRunner(ApplicationContext
ctx) {
```

```
        return args -> {

            System.out.println("Spring Boot - Kafka Started:");


        };
    }

}
```

Execute the producer i.e Application and verify the record using CLI

Execute the REST controller: It will send a message: test

#curl -X POST -F 'message=test' http://localhost:8080/kafka/publish

```
        transactional.id = null
        value.serializer = class org.apache.kafka.common.serialization.StringSerializer

2022-03-01 22:10:22.086  INFO 2716 --- [nio-8080-exec-1]
o.a.kafka.common.utils.AppInfoParser     : Kafka version: 2.6.0
2022-03-01 22:10:22.094  INFO 2716 --- [nio-8080-exec-1]
o.a.kafka.common.utils.AppInfoParser     : Kafka commitId: 62abe01bee039651
2022-03-01 22:10:22.095  INFO 2716 --- [nio-8080-exec-1]
o.a.kafka.common.utils.AppInfoParser     : Kafka startTimeMs: 1646152822078
2022-03-01 22:10:23.095  INFO 2716 --- [ad | producer-1]
org.apache.kafka.clients.Metadata        : [Producer clientId=producer-1] Cluster ID:
ZY0qPxI4T1iIFwfGODnuCQ
```

If everything goes well, your output should be as shown above.

Verify that topic exist with the following command.

```
#kafka-topics.sh --list \
   --bootstrap-server kafka0:9092
```

```
[root@kafka0 code]# kafka-topics.sh --list \
>     --bootstrap-server kafka0:9092
PAGEVIEWS_ENRICHED
PAGEVIEWS_ENRICHED1
PAGEVIEWS_FEMALE
__consumer_offsets
__transaction_state
_confluent-ksql-default__command_topic
_confluent-ksql-default_query_CSAS_PAGEVIEWS_ENRICHED_21-Join-repartition
_confluent-ksql-default_query_CSAS_PAGEVIEWS_ENRICHED_21-KafkaTopic_Right-Reduce-changelog
_confluent-ksql-default_query_CTAS_PAGEVIEWS_REGIONS_27-Aggregate-Aggregate-Materialize-changelog
_confluent-ksql-default_query_CTAS_PAGEVIEWS_REGIONS_27-Aggregate-GroupBy-repartition
_schemas
default_ksql_processing_log
my-kafka
my-perf-test
my-perf-test1
my-perf-test2
my-perf-test4
pageviews
pageviews_enriched_r8_r9
pageviews_regions
transactions
users
[root@kafka0 code]#
```

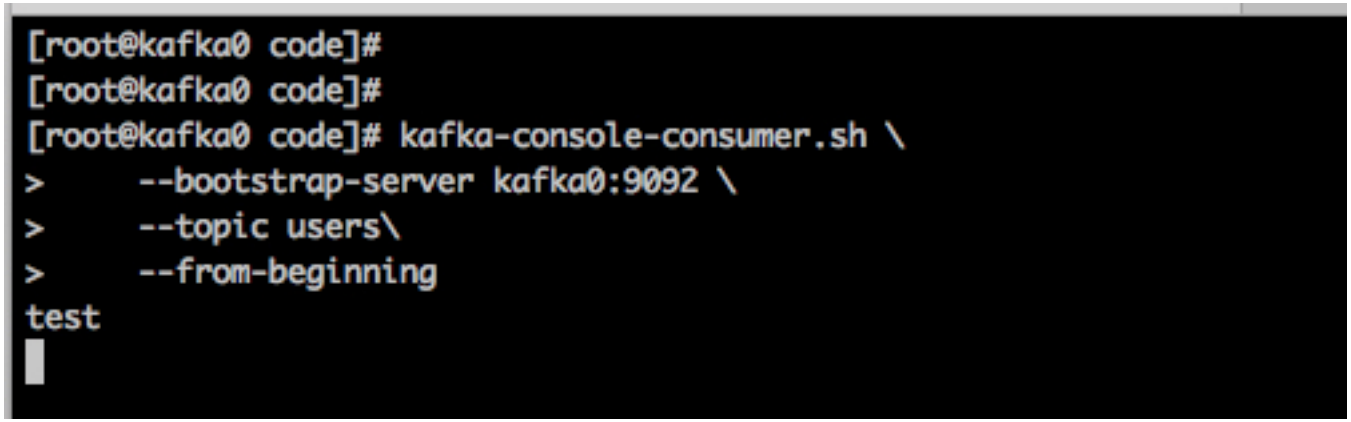
--------- Lab Ends Here----------

2. Kafka with Spring Boot – consumer – 30 Minutes

- Consumer : Listen to topic using @kafkalistener

Execute the following and verify that the record has been published to the topic.

```
#kafka-console-consumer.sh \
   --bootstrap-server kafka0:9092 \
   --topic users\
   --from-beginning
```



Your output should be as shown above.
Read messages from the Kafka topic

Now, you can see what it looks like. Let's move on reading messages from the Kafka topic.

Consumer is the service that will be responsible for reading messages processing them according to the needs of your own business logic. To set it up:

Create a class Consumer and enter the following.

```
@Service
public class Consumer {

   private final Logger logger = LoggerFactory.getLogger(Producer.class);

   @KafkaListener(topics = "users", groupId = "group_id")
   public void consume(String message) throws IOException {
      logger.info(String.format("#### -> Consumed message -> %s", message));
   }
}
```

Import the following packages:

```
import java.io.IOException;

import org.slf4j.Logger;
import org.slf4j.LoggerFactory;
import org.springframework.kafka.annotation.KafkaListener;
import org.springframework.stereotype.Service;
```

Here, we told our method void consume (String message) to subscribe to the user's topic and just emit every message to the application log. In your real application, you can handle messages the way your business requires you to.

Run the Spring Boot. You should have the following in the console.

```
o.a.k.c.c.internals.SubscriptionState    : [Consumer clientId=consumer-group_id-1,
groupId=group_id] Resetting offset for partition users-0 to offset 0.
2022-03-02 08:40:02.050  INFO 784 --- [ntainer#0-0-C-1]
o.s.k.l.KafkaMessageListenerContainer    : group_id: partitions assigned: [users-0]
2022-03-02 08:40:02.328  INFO 784 --- [ntainer#0-0-C-1]
com.tos.simple.Producer                  : #### -> Consumed message -> test
```

Try sending one more message and verify in the main console of the IDE.
curl -X POST -F 'message=Another message' http://localhost:8080/kafka/publish

```
Henrys-MacBook-Air:~ henrypotsangbam$ curl -X POST -F 'message=Another message' http://localhost:8080/kafka/publish
Henrys-MacBook-Air:~ henrypotsangbam$
```

```
11 public class Consumer {
12     private final Logger logger = LoggerFactory.getLogger(Producer.class);
13
14     @KafkaListener(topics = "users", groupId = "group_id")
15     public void consume(String message) throws IOException {
16         logger.info(String.format("#### -> Consumed message -> %s", message));
17     }
18
19 }
```

Console

```
Application (1) [Java Application] /Library/Java/JavaVirtualMachines/jdk1.8.0_271.jdk/Contents/Home/bin/java  (02-Mar-2022, 8:38:08 AM)

2022-03-02 08:44:09.474  INFO 784 --- [nio-8080-exec-1]
o.a.kafka.common.utils.AppInfoParser     : Kafka version: 2.6.0
2022-03-02 08:44:09.474  INFO 784 --- [nio-8080-exec-1]
o.a.kafka.common.utils.AppInfoParser     : Kafka commitId: 62abe01bee039651
2022-03-02 08:44:09.474  INFO 784 --- [nio-8080-exec-1]
o.a.kafka.common.utils.AppInfoParser     : Kafka startTimeMs: 1646190849473
2022-03-02 08:44:09.499  INFO 784 --- [ad | producer-1]
org.apache.kafka.clients.Metadata        : [Producer clientId=producer-1] Cluster ID:
ZY0qPxI4T1iIFwfGODnuCQ
2022-03-02 08:44:09.667  INFO 784 --- [ntainer#0-0-C-1]
com.tos.simple.Producer                  : #### -> Consumed message -> Another message
```

---------- Lab Ends Here ----------

3. Producer in Java – 60 Minutes

Learning outcome:

- Sending Message Synchronously
- Understanding RecordMetadata
- Using ProducerRecord of Java API

In this tutorial, we are going to create a simple Java Kafka producer. You need to create a new replicated Kafka topic called my-kafka-topic, then you will develop code for Kafka producer using Java API that send records to this topic.
You will send records by the Kafka producer synchronously.
You need to start the zookeeper and three nodes brokers before going ahead.

Here, as shown above three Kafka broker services and ZK service need to be started.

Create Replicated/Unreplicated Kafka Topic. If you have three nodes cluster, change the replication factor to 3 else 1.

Create topic
#/opt/kafka/bin/kafka-topics.sh --create --replication-factor 1 --partitions 13 --topic my-kafka-topic --bootstrap-server kafka0:9092

Above we created a topic named my-kafka-topic with 13 partitions and a replication factor of 3. Then we list the Kafka topics.

```
[root@tos scripts]# /opt/kafka/bin/kafka-topics.sh --create     --replication-fa
ctor 3    --partitions 13    --topic my-kafka-topic     --zookeeper  localhost:2
181
Created topic "my-kafka-topic".
[root@tos scripts]#
```

List created topics, you can verify the topic now
/opt/kafka/bin/kafka-topics.sh --list --bootstrap-server kafka0:9092

```
[root@tos scripts]# /opt/kafka/bin/kafka-topics.sh --list    --zookeeper localhost:2181
__consumer_offsets
my-failsafe-topic
my-kafka-topic
test
[root@tos scripts]#
```

We will use maven to create the java project. (You can refer the Annexure I – How to create Maven project).

Maven java project Details:
Group ID: com.tos.kafka
Artifact ID: my-kafka-producer.

After you create a maven java project, include the dependency in pom.xml.

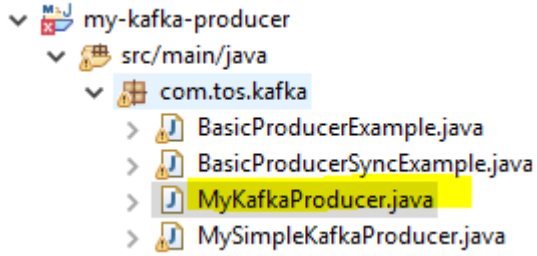
Construct a Kafka Producer

To create a Kafka producer, you will need to pass it a list of bootstrap servers (a list of Kafka brokers). You will also specify a client.id that uniquely identifies this Producer client. In this example, we are going to send messages with ids. The message body is a string, so we need a record value serializer as we will send the message body in the Kafka's records value field. The message id (long), will be sent as the Kafka's records key. You will need to specify a Key serializer and a value serializer, which Kafka will use to encode the message id as a Kafka record key, and the message body as the Kafka record value.

Create a java class with the following package name:

Class : MyKafkaProducer
Package Name : com.tos.kafka

At the end of this lab, you will have a project structure as shown below:



Next, we will import the Kafka packages and define a constant for the topic and a constant to define the list of bootstrap servers that the producer will connect.
Add the following imports in your code.

```
import org.apache.kafka.clients.producer.*;
import org.apache.kafka.common.serialization.LongSerializer;
import org.apache.kafka.common.serialization.StringSerializer;
import org.springframework.stereotype.Service;

import java.util.Properties;
```

Notice that we have imports LongSerializer which gets configured as the Kafka record key serializer, and imports StringSerializer which gets configured as the record value serializer.

Then, let us define some constant variables as stated below,
BOOTSTRAP_SERVERS is set to tos.master.com:9092, tos.master.com:9093, tos.master.com:9094 which is the three Kafka servers that we started up in the last lesson. Go ahead and make sure all three Kafka servers are running.
Note: If you are using docker replace the BOOTSTRAP_SERVERS with “localhost:8081” – which is the advertise listeners for the broker from outside the container.

The constant TOPIC is set to the replicated Kafka topic that we just created.

```
@Service
public class MyKafkaProducer
```

Add the following variables in your code.

```
 private final static String TOPIC = "my-kafka-topic";
   private final static String BOOTSTRAP_SERVERS =
         "localhost:8082,tos.master.com:9093,tos.master.com:9094";
```

Create Kafka Producer to send records
Now, that we imported the Kafka classes and defined some constants, let's create a Kafka producer.
Add the following function in the code.

```
private static Producer<Long, String> createProducer() {
      Properties props = new Properties();

props.put(ProducerConfig.BOOTSTRAP_SERVERS_CONFIG,BOOTSTRAP_SERVERS);
      props.put(ProducerConfig.CLIENT_ID_CONFIG, "KafkaExampleProducer");

props.put(ProducerConfig.KEY_SERIALIZER_CLASS_CONFIG,LongSerializer.class.getName());
      props.put(ProducerConfig.VALUE_SERIALIZER_CLASS_CONFIG,
                              StringSerializer.class.getName());
```

```
        return new KafkaProducer<>(props);
    }
```

To create a Kafka producer, you use **java.util.Properties** and define certain properties that we pass to the constructor of a **KafkaProducer**.

Above **createProducer** sets the **BOOTSTRAP_SERVERS_CONFIG** ("bootstrap.servers) property to the list of broker addresses we defined earlier. **BOOTSTRAP_SERVERS_CONFIG** value is a comma separated list of host/port pairs that the Producer uses to establish an initial connection to the Kafka cluster. The producer uses of all servers in the cluster no matter which ones we list here. This list only specifies the initial Kafka brokers used to discover the full set of servers of the Kafka cluster. If a server in this list is down, the producer will just go to the next broker in the list to discover the full topology of the Kafka cluster.

The CLIENT_ID_CONFIG ("client.id") is an id to pass to the server when making requests so the server can track the source of requests beyond just IP/port by passing a producer name for things like server-side request logging.

The **KEY_SERIALIZER_CLASS_CONFIG** ("key.serializer") is a Kafka **Serializer** class for Kafka record keys that implements the Kafka Serializer interface. Notice that we set this to **LongSerializer** as the message ids in our example are longs.

The **VALUE_SERIALIZER_CLASS_CONFIG** (“value.serializer”) is a Kafka **Serializer** class for Kafka record values that implements the Kafka **Serializer** interface. Notice that we set this to **StringSerializer** as the message body in our example are strings.

Send records synchronously with Kafka Producer
Kafka provides a synchronous send method to send a record to a topic. Let’s use this method to send some message ids and messages to the Kafka topic we created earlier.

Add the following in your code.

```
static void runProducer(final int sendMessageCount) throws Exception {
        final Producer<Long, String> producer = createProducer();
        long time = System.currentTimeMillis();

        try {
            for (long index = time; index < time + sendMessageCount; index++) {
                final ProducerRecord<Long, String> record = new
ProducerRecord<>(TOPIC, index, "Hello Kafka " + index);

                RecordMetadata metadata = producer.send(record).get();

            long elapsedTime = System.currentTimeMillis() - time;
                System.out.printf("Sent record(key=%s value=%s) " +
"meta(partition=%d, offset=%d) time=%d\n",
                        record.key(), record.value(), metadata.partition(),
metadata.offset(), elapsedTime);


            }
        } catch (Exception e) {

            e.printStackTrace();
```

```
        } finally {
            producer.flush();
            producer.close();
        }
    }
```

The above just iterates through a for loop, creating a ProducerRecord sending an example message ("Hello Kafka " + index) as the record value and the for loop index as the record key. For each iteration, runProducer calls the send method of the producer (RecordMetadata metadata = producer.send(record).get()). The send method returns a Java Future.

The response RecordMetadata has 'partition' where the record was written and the 'offset' of the record in that partition.

Notice the call to flush and close. Kafka will auto flush on its own, but you can also call flush explicitly which will send the accumulated records now. It is polite to close the connection when we are done.

Running the Kafka Producer.

Create a controller: `KafkaController.java`

Import the following packages:

```
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.web.bind.annotation.PostMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RequestParam;
import org.springframework.web.bind.annotation.RestController;
```

Update the following code:

```
@RestController
@RequestMapping(value = "/kafka")
public class KafkaController {

    private final MyKafkaProducer producer;

    @Autowired
    KafkaController(MyKafkaProducer producer) {
        this.producer = producer;
    }
```

```
    @PostMapping(value = "/hello")
    public void sendMessageToKafkaTopic(@RequestParam("count") int
count) {
        try {
            this.producer.runProducer(count);
        } catch (Exception e) {
            // TODO Auto-generated catch block
            e.printStackTrace();
        }
    }
}
```

Next you define the Application.

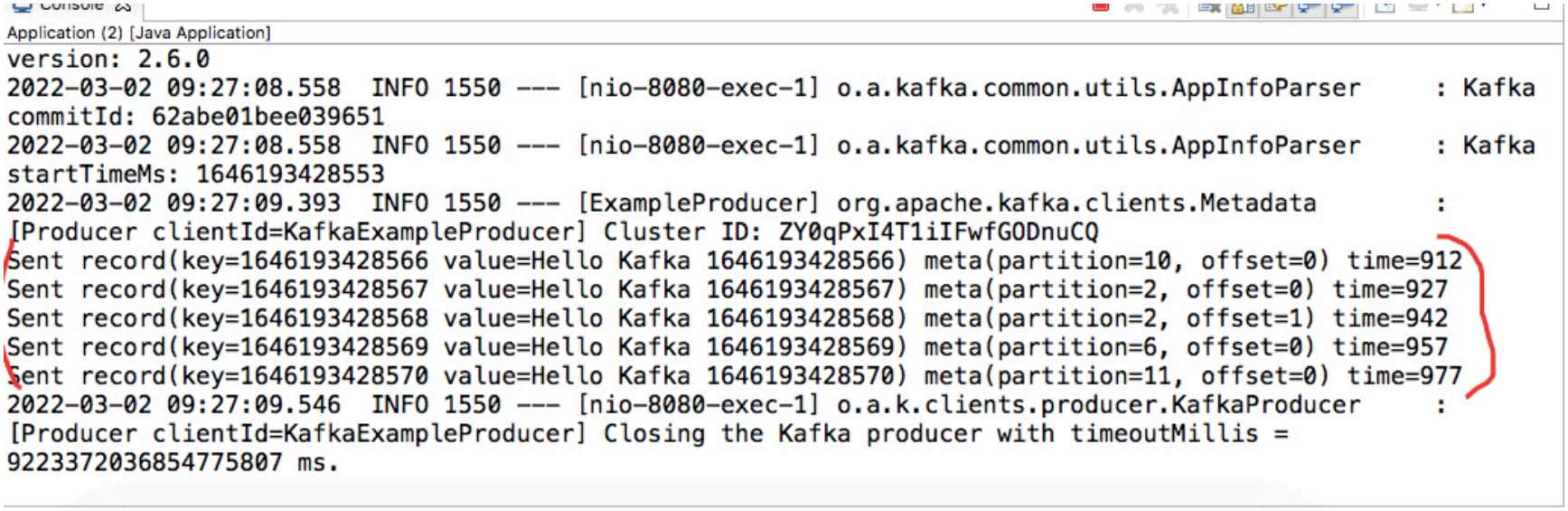
```
import org.springframework.boot.CommandLineRunner;
import org.springframework.boot.SpringApplication;
import
org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.context.ApplicationContext;
import org.springframework.context.annotation.Bean;

@SpringBootApplication
```

```
public class Application {

    public static void main(String[] args) {
        SpringApplication.run(Application.class, args);
    }

    @Bean
    public CommandLineRunner commandLineRunner(ApplicationContext
ctx) {
        return args -> {

            System.out.println("Spring Boot - Kafka Started:");



        };
    }

}
```

Start the application.

Invoke the producer url:

curl -X POST -F 'count=5' http://localhost:8080/kafka/hello



Start a consumer console so that you can consume the messages sent by this producer.

#/opt/kafka/bin/kafka-console-consumer.sh --bootstrap-server localhost:8082:9094,localhost:9092 --topic my-kafka-topic --from-beginning

```
-bash: hi: command not found
[root@tos scripts]# /opt/kafka/bin/kafka-console-consumer.sh --bootstrap-server
tos.master.com:9094,tos.master.com:9092 --topic my-kafka-topic   --from-beginnin
g
How are you
Hope it works
hello
how
France
Hello Kafka 1529148792457
Hello Kafka 1529148792458
Hello Kafka 1529148792459
Hello Kafka 1529148792460
Hello Kafka 1529148792461
Hello Kafka 1529149269560
Hello Kafka 1529149269561
Hello Kafka 1529149269562
Hello Kafka 1529149269563
Hello Kafka 1529149269564
```

You should be able to view the message as shown above.
You can verify from the consumer console that whatever messages that were sent from the producer was consumed in the consumer console as shown below. In the next lab we will consume this from a Java client.

Conclusion Kafka Producer example
We created a simple example that creates a Kafka Producer. First, we created a new replicated Kafka topic; then we created Kafka Producer in Java that uses the Kafka replicated topic to send records. We sent records with the Kafka Producer using sync send method.

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Lab End here

4. Consumer – Java API – 45 Minutes

In this tutorial, you are going to create simple *Kafka Consumer*. This consumer consumes messages from the Kafka Producer you wrote in the last tutorial. This tutorial demonstrates how to process records from a *Kafka topic* with a *Kafka Consumer*.
This tutorial describes how *Kafka Consumers* in the same group divide up and share partitions while each *consumer group* appears to get its own copy of the same data.
In the last tutorial, we created simple Java example that creates a Kafka producer. We also created replicated Kafka topic called my-example-topic, then you used the Kafka producer to send records (synchronously). Now, the consumer you create will consume those messages.

Construct a Kafka Consumer.
Just like we did with the producer, you need to specify bootstrap servers. You also need to define a group.id that identifies which consumer group this consumer belongs. Then you need to designate a Kafka record key deserializer and a record value deserializer. Then you need to subscribe the consumer to the topic you created in the producer tutorial.

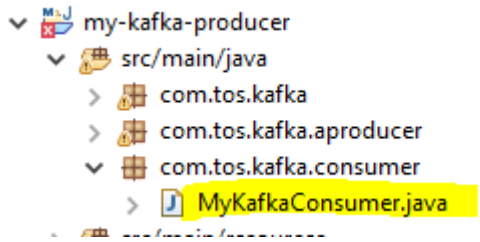
Kafka Consumer imports and constants

Next, you import the Kafka packages and define a constant for the topic and a constant to set the list of bootstrap servers that the consumer will connect.

KafkaConsumerExample.java - imports and constants

You can use the earlier java project.
In that create a separate package and the following class.

Package name : com.tos.kafka.consumer
MyKafkaConsumer.java




```
package com.tos.kafka.consumer;

import org.apache.kafka.clients.consumer.*;
import org.apache.kafka.clients.consumer.Consumer;
import org.apache.kafka.common.serialization.LongDeserializer;
import org.apache.kafka.common.serialization.StringDeserializer;
import org.springframework.stereotype.Service;

import java.time.Duration;
import java.util.Collections;
import java.util.Properties;

@Service
public class MyKafkaConsumer {
   private final static String TOPIC = "my-kafka-topic";
   private final static String BOOTSTRAP_SERVERS =
```

```
        "localhost:8082,10.10.20.24:9093,10.10.20.24:9094";
```

Notice that KafkaConsumerExample imports LongDeserializer which gets configured as the Kafka record key deserializer, and imports StringDeserializer which gets set up as the record value deserializer. The constant BOOTSTRAP_SERVERS gets set to localhost:9092,localhost:9093,localhost:9094 which is the three Kafka servers that we started up in the last lesson. Go ahead and make sure all three Kafka servers are running. The constant TOPIC gets set to the replicated Kafka topic that you created in the last tutorial.

Create Kafka Consumer consuming Topic to Receive Records
Now, that you imported the Kafka classes and defined some constants, let's create the Kafka consumer.
KafkaConsumerExample.java - Create Consumer to process Records

Add the following method that will initialize the consumer parameters.

```
 private static Consumer<Long, String> createConsumer() {
            final Properties props = new Properties();
            props.put(ConsumerConfig.BOOTSTRAP_SERVERS_CONFIG,
BOOTSTRAP_SERVERS);
            props.put(ConsumerConfig.GROUP_ID_CONFIG,
"KafkaExampleConsumer");
```

```
        props.put(ConsumerConfig.KEY_DESERIALIZER_CLASS_CONFIG,
LongDeserializer.class.getName());
        props.put(ConsumerConfig.VALUE_DESERIALIZER_CLASS_CONFIG,
StringDeserializer.class.getName());

        // Create the consumer using props.
        final Consumer<Long, String> consumer = new KafkaConsumer<>(props);

        // Subscribe to the topic.
        consumer.subscribe(Collections.singletonList(TOPIC));
        return consumer;
}
```

To create a Kafka consumer, you use java.util.Properties and define certain properties that we pass to the constructor of a KafkaConsumer.
Above KafkaConsumerExample.createConsumer sets the BOOTSTRAP_SERVERS_CONFIG ("bootstrap.servers") property to the list of broker addresses we defined earlier. BOOTSTRAP_SERVERS_CONFIG value is a comma separated list of host/port pairs that the Consumer uses to establish an initial connection to the Kafka cluster. Just like the producer, the consumer uses of all servers in the cluster no matter which ones we list here.
The GROUP_ID_CONFIG identifies the consumer group of this consumer.
The KEY_DESERIALIZER_CLASS_CONFIG ("key.deserializer") is a Kafka Deserializer class for Kafka record keys that implements the Kafka Deserializer interface. Notice that we set this to LongDeserializer as the message ids in our example are longs.

The VALUE_DESERIALIZER_CLASS_CONFIG ("value.deserializer") is a Kafka Serializer class for Kafka record values that implements the Kafka Deserializer interface. Notice that we set this to StringDeserializer as the message body in our example are strings.
Important notice that you need to subscribe the consumer to the topic consumer.subscribe(Collections.singletonList(TOPIC));. The subscribe method takes a list of topics to subscribe to, and this list will replace the current subscriptions if any.
Process messages from Kafka with Consumer
Now, let's process some records with our Kafka Producer.

Add the following code that will process the message from the topic;

```
  static void runConsumer() throws InterruptedException {
        final Consumer<Long, String> consumer = createConsumer();

        final int giveUp = 100;
        int noRecordsCount = 0;

        while (true) {
            final ConsumerRecords<Long, String> consumerRecords =
consumer.poll(Duration.ofMillis(1000));

            if (consumerRecords.count() == 0) {
                noRecordsCount++;
                if (noRecordsCount > giveUp)
```

```
                    break;
                else
                    continue;
            }

            consumerRecords.forEach(record -> {
                System.out.printf("Consumer Record:(%d, %s, %d, %d)\n",
record.key(), record.value(),
                        record.partition(), record.offset());
            });

            consumer.commitAsync();
        }
        consumer.close();
        System.out.println("DONE");
    }

}
```

Notice you use ConsumerRecords which is a group of records from a Kafka topic partition. The ConsumerRecords class is a container that holds a list of ConsumerRecord(s) per partition for a particular topic. There is one ConsumerRecord list for every topic partition returned by a the consumer.poll().

Notice if you receive records (consumerRecords.count()!=0), then runConsumer method calls consumer.commitAsync() which commit offsets returned on the last call to consumer.poll(...) for all the subscribed list of topic partitions.
Kafka Consumer Poll method
The poll method returns fetched records based on current partition offset. The poll method is a blocking method waiting for specified time in seconds. If no records are available after the time period specified, the poll method returns an empty ConsumerRecords.
When new records become available, the poll method returns straight away.
You can control the maximum records returned by the poll()
with props.put(ConsumerConfig.MAX_POLL_RECORDS_CONFIG, 100);. The poll method is not thread safe and is not meant to get called from multiple threads.
Running the define Kafka Consumer Controller.

```
package com.tos.kafka.consumer;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;

@RestController
@RequestMapping(value = "/kafka")
public class ConsumerController {

    private final MyKafkaConsumer consumer;
```

```
    @Autowired
    ConsumerController(MyKafkaConsumer consumer) {
        this.consumer = consumer;
    }

    @GetMapping(value = "/consumer")
    public void consumeMessageFromKafkaTopic() {
        try {
            this.consumer.runConsumer();
        } catch (Exception e) {
            // TODO Auto-generated catch block
            e.printStackTrace();
        }
    }
}
```

The main method just invokes runConsumer.

Execute the Spring Boot Application.

Try running the consumer.
http://localhost:8080/kafka/consumer

Run the consumer from your IDE.

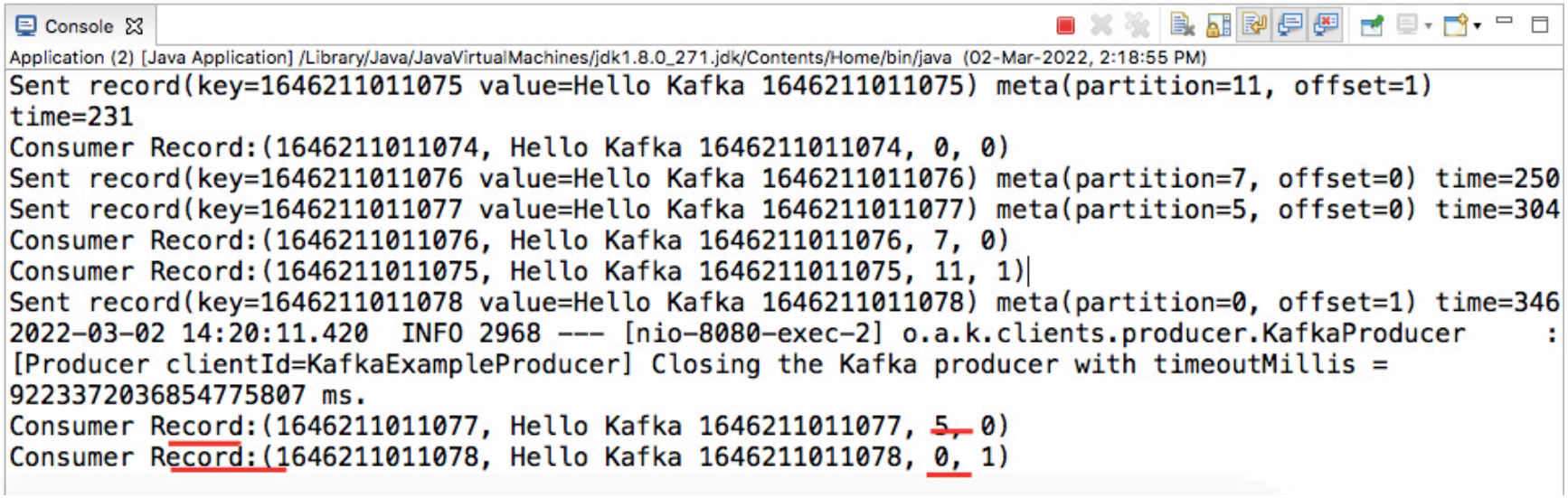
```
2022-03-02 12:31:55.694  INFO 1540 --- [nio-8080-exec-1] o.a.k.c.c.internals.SubscriptionState    :
[Consumer clientId=consumer-KafkaExampleConsumer-1, groupId=KafkaExampleConsumer] Resetting offset
for partition my-kafka-topic-9 to offset 0.
2022-03-02 12:33:35.884  INFO 1540 --- [nio-8080-exec-1] o.a.k.c.c.internals.ConsumerCoordinator  :
[Consumer clientId=consumer-KafkaExampleConsumer-1, groupId=KafkaExampleConsumer] Revoke previously
assigned partitions my-kafka-topic-8, my-kafka-topic-7, my-kafka-topic-6, my-kafka-topic-5, my-
kafka-topic-4, my-kafka-topic-3, my-kafka-topic-2, my-kafka-topic-1, my-kafka-topic-0, my-kafka-
topic-12, my-kafka-topic-11, my-kafka-topic-10, my-kafka-topic-9
2022-03-02 12:33:35.888  INFO 1540 --- [nio-8080-exec-1] o.a.k.c.c.internals.AbstractCoordinator  :
[Consumer clientId=consumer-KafkaExampleConsumer-1, groupId=KafkaExampleConsumer] Member consumer-
KafkaExampleConsumer-1-6d340a2d-ff07-45ea-808a-33afe4b27ffe sending LeaveGroup request to
coordinator localhost:8082 (id: 2147483647 rack: null) due to the consumer is being closed
DONE
```

As you can see there are no records. Why?? It was already consumed by the terminal windows which offsets are committed.
Stop the consumer console.

Execute the Producer and then execute the consumer

#curl -X POST -F 'count=5' http://localhost:8080/kafka/hello

The above will push 5 more messages to the Topic.



Logging set up for Kafka

If you don't set up logging well, it might be hard to see the consumer get the messages. Kafka like most Java libs these days uses sl4j. You can use Kafka with Log4j, Logback or JDK logging. We used logback in our maven build (compile 'ch.qos.logback:logback-classic:1.2.2').

src/main/resources/logback.xml

```
<configuration>

    <appender name="STDOUT"
        class="ch.qos.logback.core.ConsoleAppender">
        <encoder>
```

```
            <pattern>%d{HH:mm:ss.SSS} [%thread] %-5level %logger{36} - %msg%n
            </pattern>
        </encoder>
    </appender>


    <logger name="org.apache.kafka" level="INFO" />
    <logger name="org.apache.kafka.common.metrics" level="INFO" />

    <root level="debug">
        <appender-ref ref="STDOUT" />
    </root>
</configuration>
```

Notice that we set org.apache.kafka to INFO, otherwise we will get a lot of log messages. You should run it set to debug and read through the log messages. It gives you a flavor of what Kafka is doing under the covers. Leave org.apache.kafka.common.metrics or what Kafka is doing under the covers is drowned by metrics logging.

Lab End Here ----------

5. Java API – Producer – JSON Object - 60 Minutes

Learning Outcomes:

- JSON Messages Serialization
- Async and Sync Mode.
- Callback method

In this lab, we will be sending a JSON object using a custom serialize and in async mode. The Stock Price Producer example has the following classes:

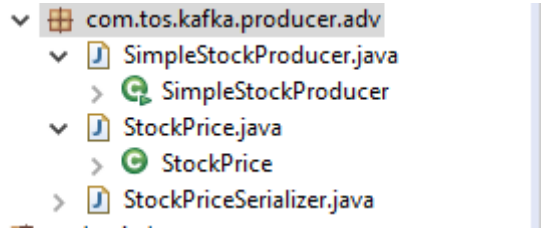
- StockPrice - holds a stock price has a name, dollar, and cents
- SimpleStockProducer - Configures and creates KafkaProducer, StockSender list, ThreadPool (ExecutorService), starts StockSender runnable into thread pool
- StockPriceSerializer - can serialize a StockPrice into byte[]

You can use the same maven project we have created in the producer example. In order to categorize the tutorials, let us create a package com.tos.kafka.aproducer, all the classes created for this lab will be stored inside this package.

Package Name:

com.tos.kafka.producer.adv

At the end of this lab we will have the following class.


com.tos.kafka.producer.adv
SimpleStockProducer.java
SimpleStockProducer
StockPrice.java
StockPrice
StockPriceSerializer.java

Define all dependencies in the pom.xml as shown below:

StockPrice

The StockPrice is a simple domain object that holds a stock price has a name, dollar, and cents. The StockPrice knows how to convert itself into a JSON string.

```
package com.tos.kafka.producer.adv;
import org.springframework.stereotype.Component;

import com.google.gson.Gson;
@Component
public class StockPrice {

    private final int dollars;
    private final int cents;
    private final String name;
    static Gson jfactory = new Gson();
    public StockPrice(final String json) {

        this(jfactory.fromJson( json, StockPrice.class));
    }

    public StockPrice() {
        dollars = 0;
        cents = 0;
```

```
            name = "";
        }

        public StockPrice(final String name, final int dollars, final
    int cents) {
            this.dollars = dollars;
            this.cents = cents;
            this.name = name;
        }


        public StockPrice(final StockPrice stockPrice) {
            this.cents = stockPrice.cents;
            this.dollars = stockPrice.dollars;
            this.name = stockPrice.name;
        }


        public int getDollars() {
            return dollars;
        }


        public int getCents() {
            return cents;
```

```
    }


    public String getName() {
        return name;
    }


    @Override
    public String toString() {
        return "StockPrice{" +
                "dollars=" + dollars +
                ", cents=" + cents +
                ", name='" + name + '\'' +
                '}';
    }


    @Override
    public boolean equals(Object o) {
        if (this == o) return true;
        if (o == null || getClass() != o.getClass()) return false;

        StockPrice that = (StockPrice) o;
```

```
        if (dollars != that.dollars) return false;
        if (cents != that.cents) return false;
        return name != null ? name.equals(that.name) : that.name ==
null;
    }

    @Override
    public int hashCode() {
        int result = dollars;
        result = 31 * result + cents;
        result = 31 * result + (name != null ? name.hashCode() :
0);
        return result;
    }


    public String toJson() {
        return "{" +
                "\"dollars\": " + dollars +
                ", \"cents\": " + cents +
                ", \"name\": \"" + name + '\"' +
                '}';
    }
}
```

Create a class SimpleStockProducer, which will be our main program that will send records to Broker. Here we will demonstrate the pushing of JSON document using serialize component. SimpleStockProducer import classes and sets up a logger. It has a main() method to create a KafkaProducer instance. It has a initProducer() method to initialize bootstrap servers, client id, key serializer and custom serializer (StockPriceSerializer). It has a main() method that creates the producer, creates a StockSender list passing each instance the producer, and then it runs each stockSender in its own thread.

```
package com.tos.kafka.producer.adv;

@Service
public class SimpleStockProducer
```

Add the following import in the above class.

```
import java.util.Properties;
import java.util.concurrent.CountDownLatch;
import java.util.concurrent.ExecutionException;
import java.util.concurrent.TimeUnit;

import org.apache.kafka.clients.producer.KafkaProducer;
import org.apache.kafka.clients.producer.Producer;
import org.apache.kafka.clients.producer.ProducerRecord;
import org.apache.kafka.clients.producer.RecordMetadata;
```

```
import org.springframework.stereotype.Service;
```

Add the following method to initialize the properties of the Producer.

```
public final static String TOPIC = "stock-prices";

    public static Properties initProducer() {
        // Assign topicName to string variable

        // create instance for properties to access producer configs
        Properties props = new Properties();

        // Assign localhost id
        props.put("bootstrap.servers", "localhost:8082");
        // props.put("bootstrap.servers", "localhost:9092");

        // Set acknowledgements for producer requests.
        // props.put("acks", "all");
        props.put("enable.auto.commit", "true");
        // If the request fails, the producer can automatically retry,
        props.put("retries", 1);

        // Specify buffer size in config
        props.put("batch.size", 1);
```

```
            // Reduce the no of requests less than 0
            props.put("linger.ms", 100);

            // The buffer.memory controls the total amount of memory available to the
            // producer for buffering.
            props.put("buffer.memory", 302);

            props.put("key.serializer",
"org.apache.kafka.common.serialization.StringSerializer");

            props.put("value.serializer", StockPriceSerializer.class.getName());
            // props.put("transactional.id", "my-transactional-id");
            return props;

      }
```

The main method that will create the producer and send message to Broker

```
      public static void invokeSync () {
            Properties props = initProducer();
            Producer<String, StockPrice> producer = new KafkaProducer<String,
StockPrice>(props);
            sendMessage(producer, TOPIC);
```

```
    }

public static void invokeAsync () {
        Properties props = initProducer();
        Producer<String, StockPrice> producer = new KafkaProducer<String,
StockPrice>(props);

        sendMessageAsync(producer, TOPIC);

    }
```

Add the following function in the main class to send records synchronously to Kafka Producer.

```
 public static void sendMessage(Producer<String, StockPrice> producer, String topic) {

        for (int i = 0; i < 2; i++) {
            try {
                ProducerRecord <String, StockPrice> record =
createRandomRecord(i);
                RecordMetadata future = producer.send(record).get();
                System.out.println(">>>" + future.topic() + " Offset:" +
future.offset());
            } catch (InterruptedException e) {
```

```
                    // TODO Auto-generated catch block
                    e.printStackTrace();
                } catch (ExecutionException e) {
                    // TODO Auto-generated catch block
                    e.printStackTrace();
                }
                producer.flush();
                System.out.println("Message sent successfully");
            }
            producer.close();
            // test(producer);
            System.out.println("Message sent successfully & Close");
        }
```

Method that will create Two Producer records using StockPrice class

```
    private static ProducerRecord<String, StockPrice> createRandomRecord(int i) {
        final int dollarAmount = i* 200;
        final int centAmount = i * 1000;
        final StockPrice stockPrice = new StockPrice(" STOCK"+ i, dollarAmount,
centAmount);
        return new ProducerRecord<>(TOPIC, stockPrice.getName(), stockPrice);
    }
```

To send records asynchronously with Kafka Producer the following method needs to be added.
Kafka provides an asynchronous send method to send a record to a topic. Let's use this method to send some message ids and messages to the Kafka topic we created earlier. The big difference here will be that we use a lambda expression to define a callback.

```
// Sending Message Asynchronously
      public static void sendMessageAsync(Producer<String, StockPrice> producer,
String topic) {
            final CountDownLatch countDownLatch = new CountDownLatch(2);
            for (int i = 0; i < 2; i++) {
                  try {
                        ProducerRecord <String, StockPrice> record =
createRandomAsyncRecord(i);

                              long time = System.currentTimeMillis();
                                 // Register a call back.
                                       producer.send(record, (metadata, exception) -> {
                                    long elapsedTime = System.currentTimeMillis() - time;
                                    if (metadata != null) {
                                       System.out.printf("sent record(key=%s value=%s) " +
                                                "meta(partition=%d, offset=%d) time=%d\n",
                                          record.key(), record.value(), metadata.partition(),
                                          metadata.offset(), elapsedTime);
                                    } else {
```

```
                                exception.printStackTrace();
                            }
                            countDownLatch.countDown();
                        });

                            countDownLatch.await(25, TimeUnit.SECONDS);

                } catch (InterruptedException e) {
                        // TODO Auto-generated catch block
                        e.printStackTrace();
                } catch (Exception e) {
                        // TODO Auto-generated catch block
                        e.printStackTrace();
                }
                producer.flush();
                System.out.println("Message sent successfully");
        }
        producer.close();
        // test(producer);
        System.out.println("Message sent successfully & Close");
}
```

Notice the use of a CountDownLatch so we can send all N messages and then wait for them all to send.

Async Interface Callback and Async Send Method

Kafka defines a Callback interface that you use for asynchronous operations. The callback interface allows code to execute when the request is complete. The callback executes in a background I/O thread so it should be fast (don't block it).
The onCompletion(RecordMetadata metadata, Exception exception) gets called when the asynchronous operation completes. The metadata gets set (not null) if the operation was a success, and the exception gets set (not null) if the operation had an error.
The async send method is used to send a record to a topic, and the provided callback gets called when the send is acknowledged. The send method is asynchronous, and when called returns immediately once the record gets stored in the buffer of records waiting to post to the Kafka broker. The send method allows sending many records in parallel without blocking to wait for the response after each one.
Since the send call is asynchronous it returns a Future for the RecordMetadata that will be assigned to this record. Invoking get() on this future will block until the associated request completes and then return the metadata for the record or throw any exception that occurred while sending the record. KafkaProducer

In the above code, the following line overrides the onCompletion(RecordMetadata metadata, Exception exception) method.
producer.send(record, (metadata, exception)
-------- ------------------ ------------------- -------------------

Add the following code that will create Record for sending to broker.

```
private static ProducerRecord<String, StockPrice> createRandomAsyncRecord(int i) {
        final int dollarAmount = i* 200;
        final int centAmount = i * 1000;
        final StockPrice stockPrice = new StockPrice(" Async STOCK "+ i,
dollarAmount, centAmount);
        return new ProducerRecord<>(TOPIC, stockPrice.getName(), stockPrice);
    }
```

Custom Serializers

We are not using built-in Kafka serializers. We are writing your own custom serializer. You just need to be able to convert your custom keys and values using the serializer convert to and convert from byte arrays (byte[]). Serializers work for keys and values, and you set them up with the Kafka Producer properties value.serializer, and key.serializer. The StockPriceSerializer will serialize StockPrice into bytes.

Create the following Custom Serializer class

```
package com.tos.kafka.producer.adv;


import java.nio.charset.StandardCharsets;
import java.util.Map;

import org.apache.kafka.common.serialization.Serializer;



public class StockPriceSerializer implements Serializer<StockPrice> {

    @Override
    public byte[] serialize(String topic, StockPrice data) {
        return data.toJson().getBytes(StandardCharsets.UTF_8);
    }
```

```
    @Override
    public void configure(Map<String, ?> configs, boolean isKey) {
    }

    @Override
    public void close() {
    }
}
```

You need to override the serialize method to convert JSON to bytes so that it can stream the stock price json document to broker.
Let us test the application now.
Start the broker and create the topic if not created ()

#sh start3Brokers.sh

```
[root@tos scripts]# sh start3Brokers.sh
ZooKeeper JMX enabled by default
Using config: /opt/zookeeper/bin/../conf/zoo.cfg
Starting zookeeper ... STARTED
Start zookeeper & 3 Brokers Successfully
[root@tos scripts]# jps
3025 QuorumPeerMain
3041 Kafka
3042 Kafka
3043 Kafka
3854 Jps
[root@tos scripts]# jps
```

/opt/kafka/bin/kafka-topics.sh --create --bootstrap-server kafka0:8082 --replication-factor 1 --partitions 2 --topic stock-prices

We will send the JSON message synchronously.

Add the packages in the Component Scan attributes of the Spring App class.

```
@ComponentScan({"com.tos.kafka","com.tos.kafka.consumer","com.tos.kafka.producer.adv"})
```

Start the Spring App.

Access the sync controller.

#curl -X POST http://localhost:8080/kafka/stock/sync

```
Message sent successfully
>>>stock-prices Offset:1
Message sent successfully
18:27:08.580 [http-nio-8080-exec-2] INFO  o.a.k.clients.producer.KafkaProducer -
[Producer clientId=producer-1] Closing the Kafka producer with timeoutMillis =
9223372036854775807 ms.
Message sent successfully & Close
18:27:08.603 [http-nio-8080-exec-2] DEBUG
o.s.w.s.m.m.a.RequestResponseBodyMethodProcessor - Using 'application/json', given [*/
*] and supported [application/json, application/*+json, application/json, application/
*+json]
18:27:08.604 [http-nio-8080-exec-2] DEBUG
o.s.w.s.m.m.a.RequestResponseBodyMethodProcessor - Nothing to write: null body
18:27:08.604 [http-nio-8080-exec-2] DEBUG o.s.web.servlet.DispatcherServlet -
Completed 200 OK
```

Open a terminal and execute the following command to consume the message:
#/opt/kafka/bin/kafka-console-consumer.sh --bootstrap-server kafka0:9092 --topic stock-prices --from-beginning

```
[root@kafka0 code]# /opt/kafka/bin/kafka-console-consumer.sh --bootstrap-server kafka0:9092 --topic stock-prices --from
-beginning
{"dollars": 0, "cents": 0, "name": " STOCK0"}
{"dollars": 200, "cents": 1000, "name": " STOCK1"}
```

The offset of the message will be printed in the console of the producer. (Ensure that kafka server IP and port are mention accordingly to your setting)

You should be able to view 2 json messages on the consumer console.

Let us execute the send message in ascync mode.

#curl -X POST http://localhost:8080/kafka/stock/async

After a couple of seconds, you should have console as shown below:

```
18:33:25.898 [kafka-producer-network-thread | producer-2] INFO  org.apache.kafka.clients.Metadata -
[Producer clientId=producer-2] Cluster ID: ZY0qPxI4T1iIFwfGODnuCQ
sent record(key= Async STOCK 0 value=StockPrice{dollars=0, cents=0, name=' Async STOCK 0'})
meta(partition=0, offset=0) time=182
Message sent successfully
sent record(key= Async STOCK 1 value=StockPrice{dollars=200, cents=1000, name=' Async STOCK 1'})
meta(partition=1, offset=2) time=123
Message sent successfully
```

We have printed the meta data of the record in the call back method. Here it mentions the partition also.
You can verify from the consume console also.

Here you can see two asnyc stock being consume from the topic, stock-prices.

```
[root@tos scripts]# /opt/kafka/bin/kafka-console-consumer.sh --bootstrap-server
tos.master.com:9093 --topic stock-prices
{"dollars": 0, "cents": 0, "name": " STOCK0"}
{"dollars": 200, "cents": 1000, "name": " STOCK1"}
{"dollars": 0, "cents": 0, "name": " Async STOCK 0"}
{"dollars": 200, "cents": 1000, "name": " Async STOCK 1"}
```

Let us verify the Partitioning of message too.

Create a topic with 4 partitions as shown below:
/opt/kafka/bin/kafka-topics.sh --create --bootstrap-server kafka0:9092 --replication-factor 2 --partitions 4 --topic mystock-prices

```
[root@tos scripts]# /opt/kafka/bin/kafka-topics.sh --create --zookeeper tos.mast
er.com:2181 --replication-factor 2 --partitions 4 --topic mystock-prices
Created topic "mystock-prices".
```

Update the topic name as shown below in the SimpleStockProducer.

```
14
15 public class SimpleStockProducer {
16
17     public final static String TOPIC = "mystock-prices";
18
19     public static Properties initProducer() {
```

We have created the topic, mystock-prices with 4 partitions so that messages will be distributed across the partition.

We will send 4 messages as shown, updated the counter to 4.

```
// Sending Message Asynchronously
public static void sendMessageAsync(Producer<String, StockPrice> producer, String
    final CountDownLatch countDownLatch = new CountDownLatch(2);
    for (int i = 0; i < 4; i++) {
        try {
             ProducerRecord <String, StockPrice> record =  createRandomAsyncRecord

                long time = System.currentTimeMillis();
                    // Register a call back.
                     producer.send(record, (metadata, exception) -> {
                            long elapsedTime = System.currentTimeMillis() - time;
                            if (metadata != null) {
                                System.out.printf("sent record(key=%s value=%s) "
                                                  "meta(partition=%d, offset=%d) tim
                                        record.key(), record.value(), metadata.par
                                        metadata.offset(), elapsedTime);
                            } else {
                                exception.printStackTrace();
                            }
```

Restart the Spring App.

Invoke the Async Method.
#curl -X POST http://localhost:8080/kafka/stock/async

As you can see from the console, there are distributed across different partition.

```
<terminated> SimpleStockProducer [Java Application] D:\Apps\Java\jdk1.8.0_171\bin\javaw.exe (26-Jun-2018, 4:58:35 PM)
SLF4J: Failed to load class "org.slf4j.impl.StaticLoggerBinder".
SLF4J: Defaulting to no-operation (NOP) logger implementation
SLF4J: See http://www.slf4j.org/codes.html#StaticLoggerBinder for further details.
sent record(key= Async STOCK 0 value=StockPrice{dollars=0, cents=0, name=' Async STOCK 0'}) meta(partition=2, offset=0) time=340
Message sent successfully
sent record(key= Async STOCK 1 value=StockPrice{dollars=200, cents=1000, name=' Async STOCK 1'}) meta(partition=3, offset=0) time=158
Message sent successfully
sent record(key= Async STOCK 2 value=StockPrice{dollars=400, cents=2000, name=' Async STOCK 2'}) meta(partition=2, offset=1) time=10
Message sent successfully
sent record(key= Async STOCK 3 value=StockPrice{dollars=600, cents=3000, name=' Async STOCK 3'}) meta(partition=1, offset=0) time=20
Message sent successfully
Message sent successfully & Close
```

You can describe the partition as shown below:
/opt/kafka/bin/kafka-topics.sh --describe --bootstrap-server kafka0:9092 --topic mystock-prices

```
[root@tos scripts]# /opt/kafka/bin/kafka-topics.sh --describe --zookeeper tos.master.com:2181  --topic mystock-pric
es
Topic:mystock-prices    PartitionCount:4        ReplicationFactor:2     Configs:
        Topic: mystock-prices   Partition: 0    Leader: 0       Replicas: 0,1   Isr: 0,1
        Topic: mystock-prices   Partition: 1    Leader: 1       Replicas: 1,2   Isr: 1,2
        Topic: mystock-prices   Partition: 2    Leader: 2       Replicas: 2,0   Isr: 2,0
        Topic: mystock-prices   Partition: 3    Leader: 0       Replicas: 0,2   Isr: 0,2
[root@tos scripts]#
```

Consumer:
#/opt/kafka/bin/kafka-console-consumer.sh --bootstrap-server kafka0:9092 --topic mystock-prices --from-beginning

```
[root@kafka0 /]# /opt/kafka/bin/kafka-console-consumer.sh --bootstrap-server kafka0:9092 --topic mystock-prices --from-beginning

{"dollars": 0, "cents": 0, "name": " Async STOCK 0"}
{"dollars": 200, "cents": 1000, "name": " Async STOCK 1"}
{"dollars": 400, "cents": 2000, "name": " Async STOCK 2"}
{"dollars": 600, "cents": 3000, "name": " Async STOCK 3"}
```

Lab Ends here

6. Java API – Consumer – Json Deserialzation - 60 Minutes

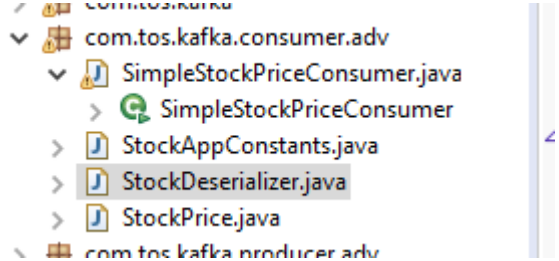
Learning outcome:

- JSON deserialization and retry option

We will use the same Maven project that was created earlier.
Let us create a separate package for storing all the classes that will be created in this tutorial.

Package : com.tos.kafka.consumer.adv

We will demonstrate how to use JSON deserialization and retry option.
At the end of the lab you should have the project structure as shown below:



The Stock Price Consumer example has the following classes:

- StockPrice - holds a stock price has a name, dollar, and cents
- SimpleStockPriceConsumer - consumes StockPrices and display batch lengths for poll
- StockAppConstants - holds topic and broker list
- StockDeserializer - can deserialize a StockPrice from byte[]

StockDeserializer

The StockDeserializer just calls the JSON parser to parse JSON in bytes to a StockPrice object. Create the following class.

```
package com.tos.kafka.consumer.adv;

import org.apache.kafka.common.serialization.Deserializer;

import java.nio.charset.StandardCharsets;
import java.util.Map;

public class StockDeserializer implements Deserializer<StockPrice> {

   @Override
   public StockPrice deserialize(final String topic, final byte[] data) {
      return new StockPrice(new String(data, StandardCharsets.UTF_8));
   }

   @Override
   public void configure(Map<String, ?> configs, boolean isKey) {
   }

   @Override
   public void close() {
   }
}
```

We just need to override the deserialize() that convert the JSON bytes to Stock Price.

Create the following class which will be our data or domain value object.

```
package com.tos.kafka.consumer.adv;


import com.google.gson.Gson;

public class StockPrice {

   private final int dollars ;
    private final int cents ;
    private final String name ;
    static Gson gson = new Gson();

    public StockPrice(final String json) {
        this(gson.fromJson(json, StockPrice.class));
    }


    public StockPrice() {
        dollars = 0;
        cents = 0;
        name = "";
    }
```

```
    public StockPrice(final String name, final int dollars, final
int cents) {
        this.dollars = dollars;
        this.cents = cents;
        this.name = name;
    }


    public StockPrice(final StockPrice stockPrice) {
        this.cents = stockPrice.cents;
        this.dollars = stockPrice.dollars;
        this.name = stockPrice.name;
    }


    public int getDollars() {
        return dollars;
    }


    public int getCents() {
        return cents;
    }
```

```
    public String getName() {
        return name;
    }


    @Override
    public String toString() {
        return "StockPrice{" +
                "dollars=" + dollars +
                ", cents=" + cents +
                ", name='" + name + '\'' +
                '}';
    }


    @Override
    public boolean equals(Object o) {
        if (this == o) return true;
        if (o == null || getClass() != o.getClass()) return false;

        StockPrice that = (StockPrice) o;

        if (dollars != that.dollars) return false;
        if (cents != that.cents) return false;
        return name != null ? name.equals(that.name) : that.name ==
```

```
null;
    }

    @Override
    public int hashCode() {
        int result = dollars;
        result = 31 * result + cents;
        result = 31 * result + (name != null ? name.hashCode() :
0);
        return result;
    }


    public String toJson() {
        return "{" +
                "\"dollars\": " + dollars +
                ", \"cents\": " + cents +
                ", \"name\": \"" + name + '\"' +
                '}';
    }
}
```

The application constants that define the servers that we will be connecting by our consumer. Ensure that you change your system broker IP accordingly. Update the code with that of the following.

```
package com.tos.kafka.consumer.adv;

public class StockAppConstants {
        public final static String TOPIC = "stock-prices";
          public final static String BOOTSTRAP_SERVERS =
                "localhost:8082";

}
```

SimpleStockPriceConsumer uses createConsumer method to create a KafkaConsumer instance, subscribes to stock-prices topics and has a custom deserializer.
It has a runConsumer() method that drains topic, creates List of current stocks and calls displayRecordsStatsAndStocks() method.
The method displayRecordsStatsAndStocks() prints out size of each partition read and total record count and prints out each stock at its current price.

Create a class SimpleStockPriceConsumer and import the following class.

```
package com.tos.kafka.consumer.adv;

import java.time.Duration;
import java.util.ArrayList;
import java.util.Collections;
import java.util.List;
import java.util.Properties;
import java.util.UUID;

import org.apache.kafka.clients.consumer.Consumer;
import org.apache.kafka.clients.consumer.ConsumerConfig;
import org.apache.kafka.clients.consumer.ConsumerRecords;
import org.apache.kafka.clients.consumer.KafkaConsumer;
import org.apache.kafka.common.serialization.StringDeserializer;
import org.springframework.stereotype.Service;
```

```
@Service
public class SimpleStockPriceConsumer
```

Add the following method that will create KafkaConsumer.

```
private static Consumer<String, StockPrice> createConsumer() {
        final Properties props = new Properties();
        props.put(ConsumerConfig.BOOTSTRAP_SERVERS_CONFIG,
StockAppConstants.BOOTSTRAP_SERVERS);
        // props.put(ConsumerConfig.GROUP_ID_CONFIG,
"KafkaExampleAdvConsumer");
        props.put(ConsumerConfig.GROUP_ID_CONFIG, "KA" +
UUID.randomUUID().toString());
        props.put(ConsumerConfig.AUTO_OFFSET_RESET_CONFIG,
"earliest");
        // props.put(ConsumerConfig.AUTO_OFFSET_RESET_CONFIG,
        // "KafkaExampleAdvConsumer");
        props.put(ConsumerConfig.KEY_DESERIALIZER_CLASS_CONFIG,
StringDeserializer.class.getName());
        props.put(ConsumerConfig.VALUE_DESERIALIZER_CLASS_CONFIG,
StockDeserializer.class.getName());
        props.put(ConsumerConfig.MAX_POLL_RECORDS_CONFIG, 500);
        // Create the consumer using props.
```

```
        final Consumer<String, StockPrice> consumer = new
KafkaConsumer<>(props);
        // Subscribe to the topic.

    consumer.subscribe(Collections.singletonList(StockAppConstants.
TOPIC));
        return consumer;
    }
```

Add the following method that will call the poll method that will pull the message from the broker

```
static void runConsumer() throws InterruptedException {
        final Consumer<String, StockPrice> consumer =
createConsumer();
        final List<StockPrice> map = new ArrayList<StockPrice>();
        try {
            final int giveUp = 10;
            int noRecordsCount = 0;
            //consumer.seekToBeginning(consumer.assignment());
            while (true) {
                ConsumerRecords<String, StockPrice> consumerRecords
= consumer.poll(Duration.ofMillis(2000));
                if (consumerRecords.count() == 0) {
                    noRecordsCount++;
```

```
                    if (noRecordsCount > giveUp)
                        break;
                    else
                        continue;
                }
                consumerRecords.forEach(record -> {
                    map.add(record.value());
                });
                displayRecordsStatsAndStocks(map, consumerRecords);
                consumer.commitAsync();
            }
        } finally {
            consumer.close();
        }
        System.out.println("DONE");
    }
```

The following method will print the records fetch from the Topic.

```
    private static void displayRecordsStatsAndStocks(final List<StockPrice>
stockPriceMap,
                final ConsumerRecords<String, StockPrice> consumerRecords) {
        System.out.printf("New ConsumerRecords partition count: %d Message count:
%d\n",
                consumerRecords.partitions().size(), consumerRecords.count());
        stockPriceMap.forEach((stockPrice) -> System.out.printf("ticker %s price
%d.%d \n", stockPrice.getName(),
                stockPrice.getDollars(), stockPrice.getCents()));
        System.out.println();
    }
```

Finally update the following in a StockConsumerController.java

```
package com.tos.kafka.consumer.adv;

import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RestController;

@RestController
```

```
@RequestMapping(value = "/kafka")
public class StockConsumerController {

    private final SimpleStockPriceConsumer consumer;

    @Autowired
    StockConsumerController(SimpleStockPriceConsumer consumer) {
        this.consumer = consumer;
    }

    @GetMapping(value = "/stock/consumer")
    public void consumeMessageFromKafkaTopic() {
        try {
            this.consumer.runConsumer();
        } catch (Exception e) {
            // TODO Auto-generated catch block
            e.printStackTrace();
        }
    }
}
```

You can execute the Spring App main method now.

Ensure that you have started the broker before going ahead.
#start3Brokers.sh

```
[root@tos scripts]#
[root@tos scripts]# sh start3Brokers.sh
ZooKeeper JMX enabled by default
Using config: /opt/zookeeper/bin/../conf/zoo.cfg
Starting zookeeper ... STARTED
Start zookeeper & 3 Brokers Successfully
[root@tos scripts]# jps
2675 Kafka
2676 Kafka
2661 QuorumPeerMain
3429 -- process information unavailable
3386 Jps
[root@tos scripts]#
```

Execute the main/URL program
curl -X GET http://localhost:8080/kafka/stock/consumer

```
partition stock-prices-0 to offset 0.
New ConsumerRecords partition count: 2 Message count: 6
ticker  STOCK0 price 0.0
ticker  STOCK1 price 200.1000
ticker  Async STOCK 1 price 200.1000
ticker  Async STOCK 1 price 200.1000
ticker  Async STOCK 0 price 0.0
ticker  Async STOCK 0 price 0.0

21:29:29.004 [http-nio-8080-exec-1] INFO  o.a.k.c.c.i.ConsumerCoordinator - [Consumer clientI
```

As you can see above, it printed the number of partition count and the number of messages. It may vary depending on the number of messages that was pushed by your producer.
---------- ----------Lab Ends here ----------
----

7. Streaming – Exactly Once API – 60 Minutes

Case:

It will demonstrate Transactional consume-transform-produce Loop:

For our example, we're going to consume messages from an input topic, **input**.
Then for each sentence, we'll count every word and send the individual word counts to an output topic, **output**.
In the example, we'll assume that there is already transactional data available in the **input** topic.

Create a maven Java Project or use the existing project

Create and copy the following two classes.

TransactionalWordCount.java create in the following package:

```
package com.ostech.transaction;
```

Import the following packages.

```
import static java.time.Duration.ofSeconds;
import static java.util.Collections.singleton;
import static
org.apache.kafka.clients.consumer.ConsumerConfig.BOOTSTRAP_SERVERS_
CONFIG;
import static
org.apache.kafka.clients.consumer.ConsumerConfig.ENABLE_AUTO_COMMIT
_CONFIG;
import static
org.apache.kafka.clients.consumer.ConsumerConfig.GROUP_ID_CONFIG;
import static
org.apache.kafka.clients.consumer.ConsumerConfig.ISOLATION_LEVEL_CO
NFIG;
import static
org.apache.kafka.clients.consumer.ConsumerConfig.KEY_DESERIALIZER_C
```

```
LASS_CONFIG;
import static
org.apache.kafka.clients.consumer.ConsumerConfig.VALUE_DESERIALIZER
_CLASS_CONFIG;
import static
org.apache.kafka.clients.producer.ProducerConfig.ENABLE_IDEMPOTENCE
_CONFIG;
import static
org.apache.kafka.clients.producer.ProducerConfig.KEY_SERIALIZER_CLA
SS_CONFIG;
import static
org.apache.kafka.clients.producer.ProducerConfig.TRANSACTIONAL_ID_C
ONFIG;
import static
org.apache.kafka.clients.producer.ProducerConfig.VALUE_SERIALIZER_C
LASS_CONFIG;

import java.util.HashMap;
import java.util.List;
import java.util.Map;
import java.util.Properties;
import java.util.stream.Collectors;
import java.util.stream.Stream;

import org.apache.kafka.clients.consumer.ConsumerRecord;
```

```
import org.apache.kafka.clients.consumer.ConsumerRecords;
import org.apache.kafka.clients.consumer.KafkaConsumer;
import org.apache.kafka.clients.consumer.OffsetAndMetadata;
import org.apache.kafka.clients.producer.KafkaProducer;
import org.apache.kafka.clients.producer.ProducerRecord;
import org.apache.kafka.common.KafkaException;
import org.apache.kafka.common.TopicPartition;
```

Add the following properties for Producer and Consumer Object. It defines the topics for producer and consumer.

```
    private static final String CONSUMER_GROUP_ID = "my-group-id";
    private static final String OUTPUT_TOPIC = "output";
    private static final String INPUT_TOPIC = "input";
```

Define the following method for pushing message to the broker. Changes the boostral server config property with that of your broker ip and port no.

```
    private static KafkaProducer<String, String>
createKafkaProducer() {

        Properties props = new Properties();
        props.put(BOOTSTRAP_SERVERS_CONFIG, "localhost:8082");
```

```
        props.put(ENABLE_IDEMPOTENCE_CONFIG, "true");
        props.put(TRANSACTIONAL_ID_CONFIG, "prod-1");
        props.put(KEY_SERIALIZER_CLASS_CONFIG,
"org.apache.kafka.common.serialization.StringSerializer");
        props.put(VALUE_SERIALIZER_CLASS_CONFIG,
"org.apache.kafka.common.serialization.StringSerializer");

        return new KafkaProducer(props);

    }
```

Additionally, though, we need to specify a *transactional.id* and enable *idempotence*:
Because we've enabled idempotence, Kafka will use this transaction id as part of its algorithm to **deduplicate any message this producer sends**, ensuring idempotency.

Simply put, if the producer accidentally sends the same message to Kafka more than once, these settings enable it to notice.

All that we need to do is **make sure the transaction id is distinct for each producer**, though consistent across restarts

The following method define the code for connecting to the topic for transactional read. Its as transactional aware customer. When we consume, we can read all the messages on a topic partition in order. Though, we can indicate with **isolation.level** that we should wait to read transactional messages until the associated transaction has been committed:

```
private static KafkaConsumer<String, String> createKafkaConsumer()
{
        Properties props = new Properties();
        props.put(BOOTSTRAP_SERVERS_CONFIG, "localhost:8082");
        props.put(GROUP_ID_CONFIG, CONSUMER_GROUP_ID);
        props.put(ENABLE_AUTO_COMMIT_CONFIG, "false");
        props.put(ISOLATION_LEVEL_CONFIG, "read_committed");
        props.put(KEY_DESERIALIZER_CLASS_CONFIG,
"org.apache.kafka.common.serialization.StringDeserializer");
        props.put(VALUE_DESERIALIZER_CLASS_CONFIG,
"org.apache.kafka.common.serialization.StringDeserializer");

        KafkaConsumer<String, String> consumer = new
KafkaConsumer<>(props);
        consumer.subscribe(singleton(INPUT_TOPIC));
        return consumer;
    }
```

Using a value of ***read_committed*** ensures that we don't read any transactional messages before the transaction completes.

The default value of ***isolation.level*** is ***read_uncommitted***.

The following code enables the producer for transaction.

```
    public static void main(String[] args) {

        KafkaConsumer<String, String> consumer =
createKafkaConsumer();
        KafkaProducer<String, String> producer =
createKafkaProducer();

        producer.initTransactions();

        try {

            while (true) {

                ConsumerRecords<String, String> records =
consumer.poll(ofSeconds(60));

                Map<String, Integer> wordCountMap =
records.records(new TopicPartition(INPUT_TOPIC, 0))
                        .stream()
                        .flatMap(record ->
Stream.of(record.value().split(" ")))
```

```
                        .map(word -> Tuple.of(word, 1))
                        .collect(Collectors.toMap(tuple ->
tuple.getKey(), t1 -> t1.getValue(), (v1, v2) -> v1 + v2));

                producer.beginTransaction();

                wordCountMap.forEach((key, value) ->
producer.send(new ProducerRecord<String, String>(OUTPUT_TOPIC, key,
value.toString())));

                Map<TopicPartition, OffsetAndMetadata>
offsetsToCommit = new HashMap<>();

                for (TopicPartition partition :
records.partitions()) {
                    List<ConsumerRecord<String, String>>
partitionedRecords = records.records(partition);

                    long offset =
partitionedRecords.get(partitionedRecords.size() - 1).offset();
                    System.out.println(">>>" + offset + " - " +
partition.partition());
                    offsetsToCommit.put(partition, new
OffsetAndMetadata(offset + 1));
                }
```

```
                    boolean flag = false;

                    producer.sendOffsetsToTransaction(offsetsToCommit,
CONSUMER_GROUP_ID);

                    if (flag == true) {
                       throw new Exception();
                    }

                    producer.commitTransaction();

                }

            } catch (Exception e) {

                producer.abortTransaction();

            }


        }


}
```

Once we are ready, then we also need to call *initTransaction* to prepare the producer to use transactions:

```
producer.initTransactions();
```

This registers the producer with the broker as one that can use transactions, **identifying it by its *transactional.id* and a sequence number, or epoch**. In turn, the broker will use these to write-ahead any actions to a transaction log.
And consequently, **the broker will remove any actions from that log that belong to a producer with the same transaction id and earlier epoch,** presuming them to be from defunct transactions.

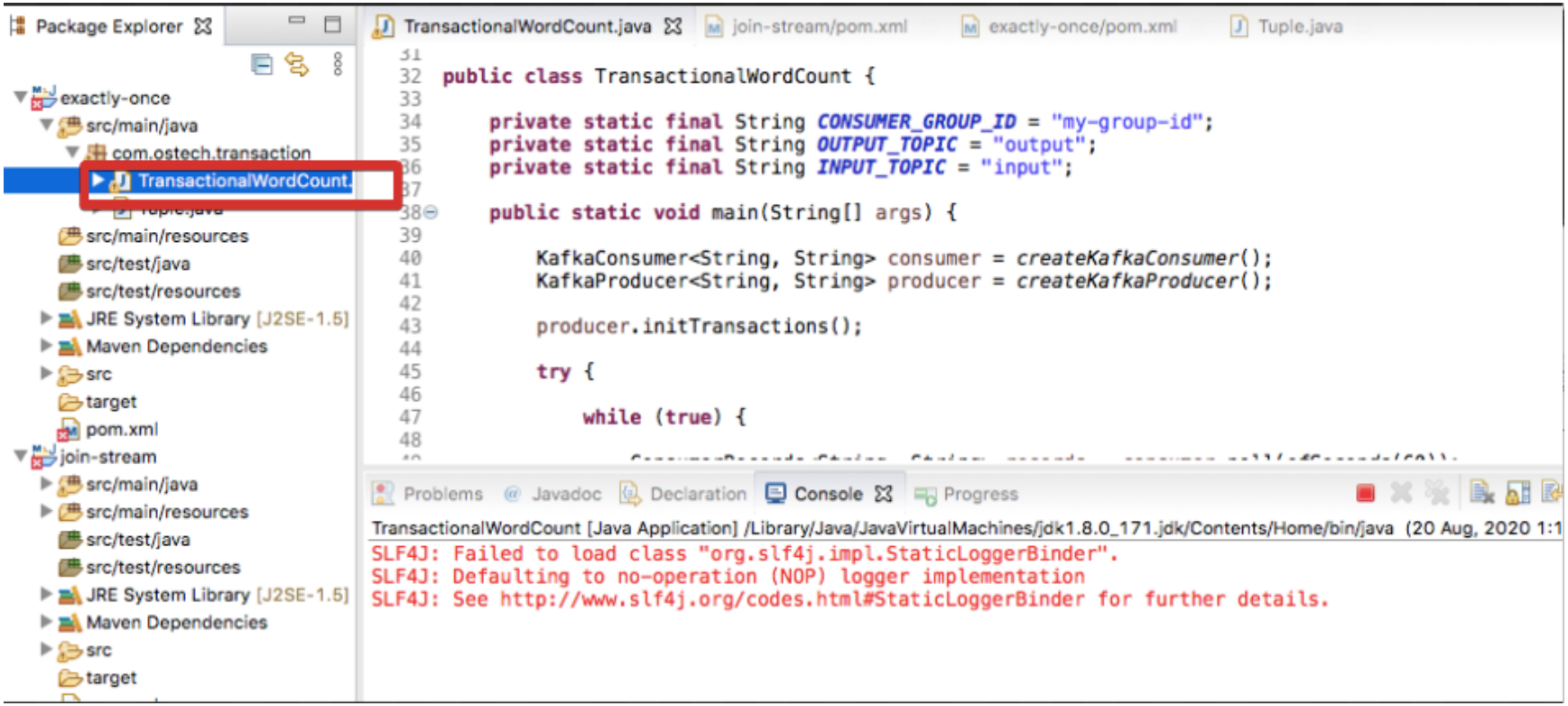
Now that we have the producer and consumer both configured to write and read transactionally, we can consume records from our input topic and count each word in each record:

Note, that there is nothing transactional about the above code. But, since we used read_committed, it means that no messages that were written to the input topic in the same transaction will be read by this consumer until they are all written.

Now, we can send the calculated word count to the **output** topic.

```
package com.ostech.transaction;

public class Tuple {

    private String key;
    private Integer value;

    private Tuple(String key, Integer value) {
        this.key = key;
        this.value = value;
    }

    public static Tuple of(String key, Integer value){
        return new Tuple(key,value);
    }

    public String getKey() {
        return key;
    }

    public Integer getValue() {
        return value;
    }
}
```

Execute the Program:



Sent some records to the **input** topic. You don't need to explicitly create the topic as auto enable in the broker and will be created when the program gets started.

Execute the following from a separate terminal:

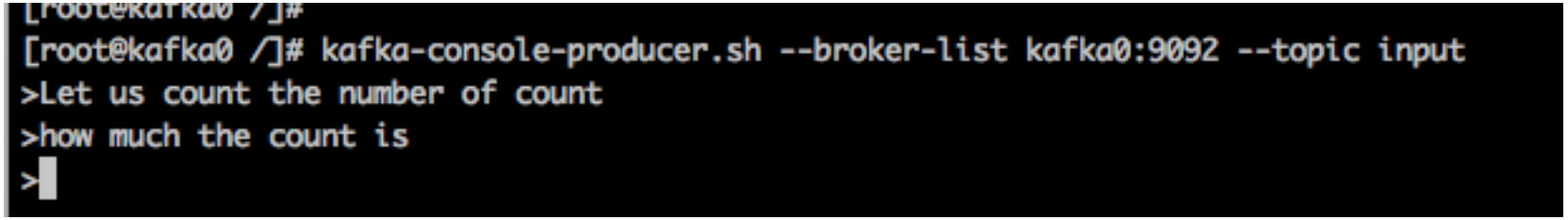
```
# kafka-console-producer.sh --broker-list kafka0:9092 --topic input
```

Enter the following sentences:

```
Let us count the number of count
how much the count is
```

Consume from the **output** topic.

```
# kafka-console-consumer.sh  --bootstrap-server kafka0:9092 --topic output --from-beginning
```



```
[root@kafka0 /]# kafka-console-consumer.sh  --bootstrap-server kafka0:9092 --topic output --from-beginning
the-1
number-1
of-1
count-2
Let-1
us-1
the-1
how-1
count-1
is-1
much-1
```

Enable the following Flag:

```
58
59                  wordCountMap.forEach((key, value) -> producer.send(new ProducerRecord<String, String>(OU
60
61                  Map<TopicPartition, OffsetAndMetadata> offsetsToCommit = new HashMap<>();
62
63                  for (TopicPartition partition : records.partitions()) {
64                      List<ConsumerRecord<String, String>> partitionedRecords = records.records(partition)
65
66                      long offset = partitionedRecords.get(partitionedRecords.size() - 1).offset();
67                      System.out.println(">>>" + offset + " - " + partition.partition());
68                      offsetsToCommit.put(partition, new OffsetAndMetadata(offset + 1));
69                  }
70
71                  boolean flag = true;
72
73                  producer.sendOffsetsToTransaction(offsetsToCommit, CONSUMER_GROUP_ID);
74
75                  if (flag == true) {
76                      throw new Exception();
77                  }
78
79                  producer.commitTransaction();
```

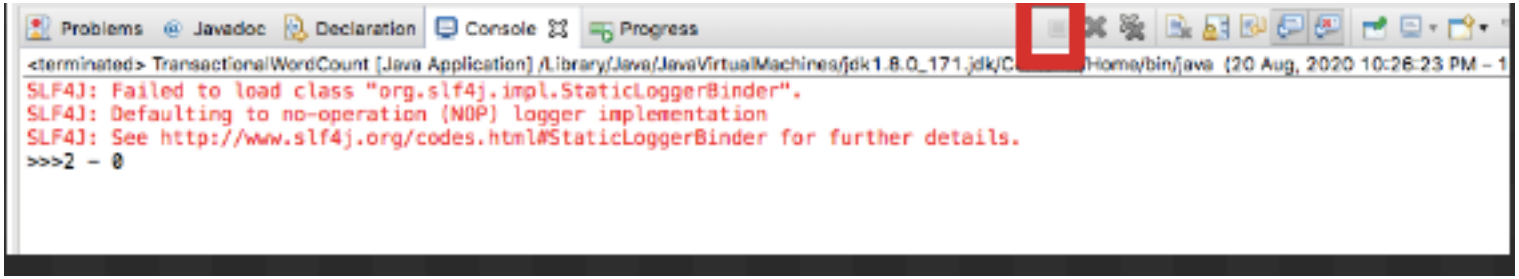
Stop the program and start it again

And type a sentence on the producer terminal:

```
(base) Henrys-MacBook-Air:~ henrypotsangbam$ kafka-console-producer --broker-list localhost:9092 --topic input
>Let us count the number of count
>transaction works
```

Verify the console on the consumer and the execution of the program.

stop the program execution:

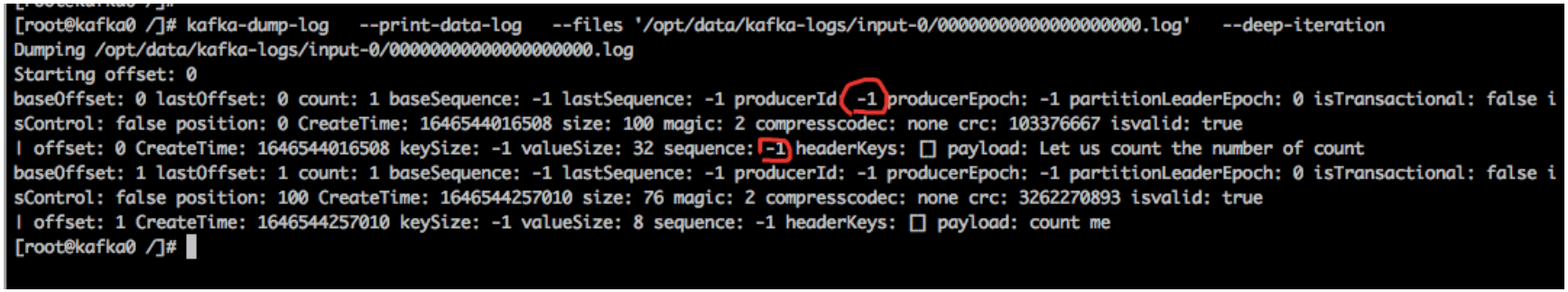


As observe because of the transaction, the messages are sent to the output topic once only.

Verify the messages:

Let us observe the messages of the Topic: **input**

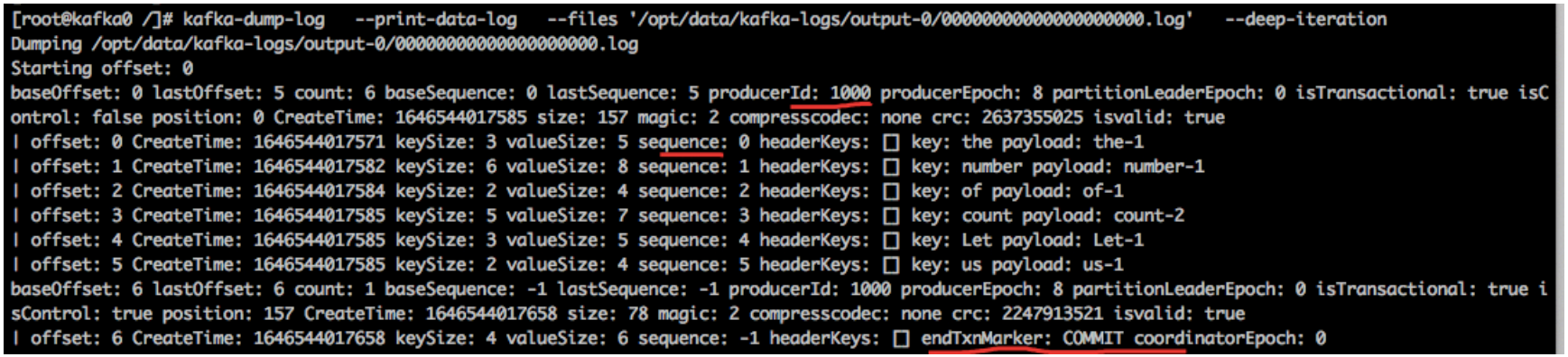
kafka-dump-log --print-data-log --files '/opt/data/kafka-logs/input-0/oooooooooooooooooo.log' --deep-iteration



Here, producerID and the sequence are assigned to -1, that is transaction is not enabled for the messages of topic, **input**.

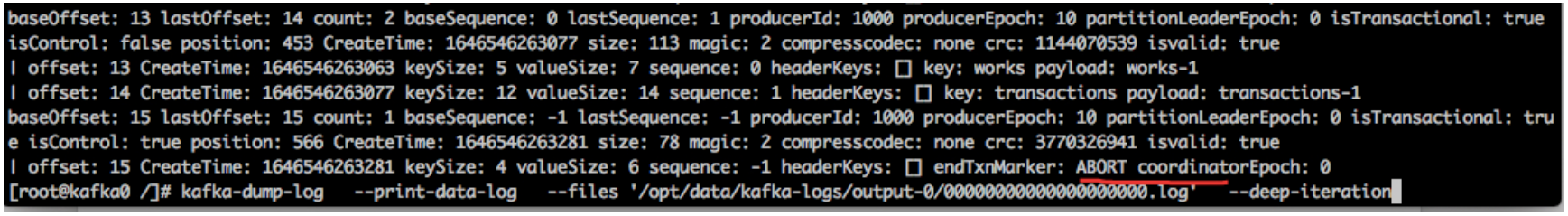
Now, Let us observe the messages of the Topic: **output**

kafka-dump-log --print-data-log --files '/opt/data/kafka-logs/output-0/00000000000000000000.log' --deep-iteration



As you have observed, the commit transaction is done at the end of the batch. There are producerID and sequence no maintain for each message under a transaction.

When you abort:
kafka-dump-log --print-data-log --files '/opt/data/kafka-logs/output-0/00000000000000000000.log' --deep-iteration


baseOffset: 13 lastOffset: 14 count: 2 baseSequence: 0 lastSequence: 1 producerId: 1000 producerEpoch: 10 partitionLeaderEpoch: 0 isTransactional: true
isControl: false position: 453 CreateTime: 1646546263077 size: 113 magic: 2 compresscodec: none crc: 1144070539 isvalid: true
| offset: 13 CreateTime: 1646546263063 keySize: 5 valueSize: 7 sequence: 0 headerKeys: [] key: works payload: works-1
| offset: 14 CreateTime: 1646546263077 keySize: 12 valueSize: 14 sequence: 1 headerKeys: [] key: transactions payload: transactions-1
baseOffset: 15 lastOffset: 15 count: 1 baseSequence: -1 lastSequence: -1 producerId: 1000 producerEpoch: 10 partitionLeaderEpoch: 0 isTransactional: tru
e isControl: true position: 566 CreateTime: 1646546263281 size: 78 magic: 2 compresscodec: none crc: 3770326941 isvalid: true
| offset: 15 CreateTime: 1646546263281 keySize: 4 valueSize: 6 sequence: -1 headerKeys: [] endTxnMarker: ABORT coordinatorEpoch: 0
[root@kafka0 /]# kafka-dump-log --print-data-log --files '/opt/data/kafka-logs/output-0/00000000000000000000.log' --deep-iteration

Let us write a consumer that consume only the committed message.

```
package com.ostech.transaction;

public class ConsumeOnlyTransactionalMessage {
}
```

Import the following:

```
import static java.util.Collections.singleton;
import static
org.apache.kafka.clients.consumer.ConsumerConfig.BOOTSTRAP_SERVERS_
CONFIG;
import static
org.apache.kafka.clients.consumer.ConsumerConfig.ENABLE_AUTO_COMMIT
_CONFIG;
import static
org.apache.kafka.clients.consumer.ConsumerConfig.GROUP_ID_CONFIG;
import static
org.apache.kafka.clients.consumer.ConsumerConfig.ISOLATION_LEVEL_CO
NFIG;
import static
org.apache.kafka.clients.consumer.ConsumerConfig.KEY_DESERIALIZER_C
LASS_CONFIG;
import static
```

```
org.apache.kafka.clients.consumer.ConsumerConfig.VALUE_DESERIALIZER
_CLASS_CONFIG;

import java.time.Duration;
import java.util.Properties;

import org.apache.kafka.clients.consumer.Consumer;
import org.apache.kafka.clients.consumer.ConsumerConfig;
import org.apache.kafka.clients.consumer.ConsumerRecords;
import org.apache.kafka.clients.consumer.KafkaConsumer;
```

Define the configuration:

```
private static final String CONSUMER_GROUP_ID = "my-group-id-tr1";
private static final String INPUT_TOPIC = "output";
```

Define the consumer configuration:

```
props.put(ISOLATION_LEVEL_CONFIG, "read_committed");
```

The above line states that only commited message will be consumed by the consumer.

```
private static KafkaConsumer<String, String> createKafkaConsumer()
{
        Properties props = new Properties();
        props.put(BOOTSTRAP_SERVERS_CONFIG, "localhost:8082");
        props.put(GROUP_ID_CONFIG, CONSUMER_GROUP_ID);
        props.put(ConsumerConfig.AUTO_OFFSET_RESET_CONFIG,
"earliest");
        props.put(ENABLE_AUTO_COMMIT_CONFIG, "false");
        props.put(ISOLATION_LEVEL_CONFIG, "read_committed");
        props.put(KEY_DESERIALIZER_CLASS_CONFIG,
"org.apache.kafka.common.serialization.StringDeserializer");
        props.put(VALUE_DESERIALIZER_CLASS_CONFIG,
"org.apache.kafka.common.serialization.StringDeserializer");

        KafkaConsumer<String, String> consumer = new
KafkaConsumer<>(props);
        consumer.subscribe(singleton(INPUT_TOPIC));
        return consumer;
    }
```

The consumer that polls for the message.

```
static void runConsumer() throws InterruptedException {
            final Consumer<String, String> consumer =
createKafkaConsumer();

            final int giveUp = 100;
            int noRecordsCount = 0;

            while (true) {
                final ConsumerRecords<String, String>
consumerRecords =
                        consumer.poll(Duration.ofMillis(1000));

                if (consumerRecords.count() == 0) {
                    noRecordsCount++;
                    if (noRecordsCount > giveUp)
                        break;
                    else
                        continue;
                }

                consumerRecords.forEach(record -> {
                    System.out.printf("Consumer Record:(%s, %s, %d,
%d)\n", record.key(), record.value(),
```

```
                                record.partition(), record.offset());
                    });

                    consumer.commitAsync();
                }
                consumer.close();
                System.out.println("DONE");
            }
```

Invoke the consume method from the main method.

```
public static void main(String[] args) throws InterruptedException
{
        // TODO Auto-generated method stub
         runConsumer();
    }
```

Execute the program:

```
groupId=my-group-id-tr2] Resetting offset for partition output-0 to offset 0.
Consumer Record:(the, the-1, 0, 0)
Consumer Record:(number, number-1, 0, 1)
Consumer Record:(of, of-1, 0, 2)
Consumer Record:(count, count-2, 0, 3)
Consumer Record:(Let, Let-1, 0, 4)
Consumer Record:(us, us-1, 0, 5)
Consumer Record:(the, the-1, 0, 7)
Consumer Record:(how, how-1, 0, 8)
Consumer Record:(count, count-1, 0, 9)
Consumer Record:(is, is-1, 0, 10)
Consumer Record:(much, much-1, 0, 11)
```

As observed above, Only the committed message get consumed.

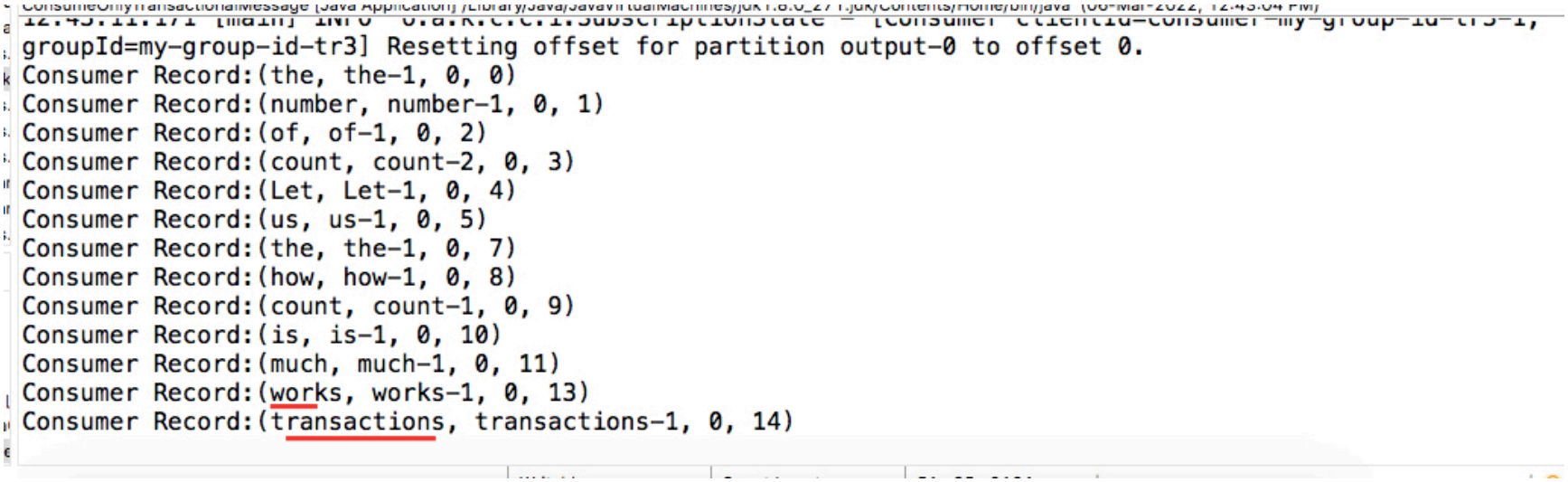
Next comment the following:

```
//  props.put(ISOLATION_LEVEL_CONFIG, "read_committed");
```

Update the consumer group ID

```
private static final String CONSUMER_GROUP_ID = "my-group-id-tr3";
```

Excute the main program:



As observed, the uncommitted records get consumed too.

---------- Lab Ends Here ----------

8. Schema registry – 90 Minutes

Create a java maven project or include the earlier project.

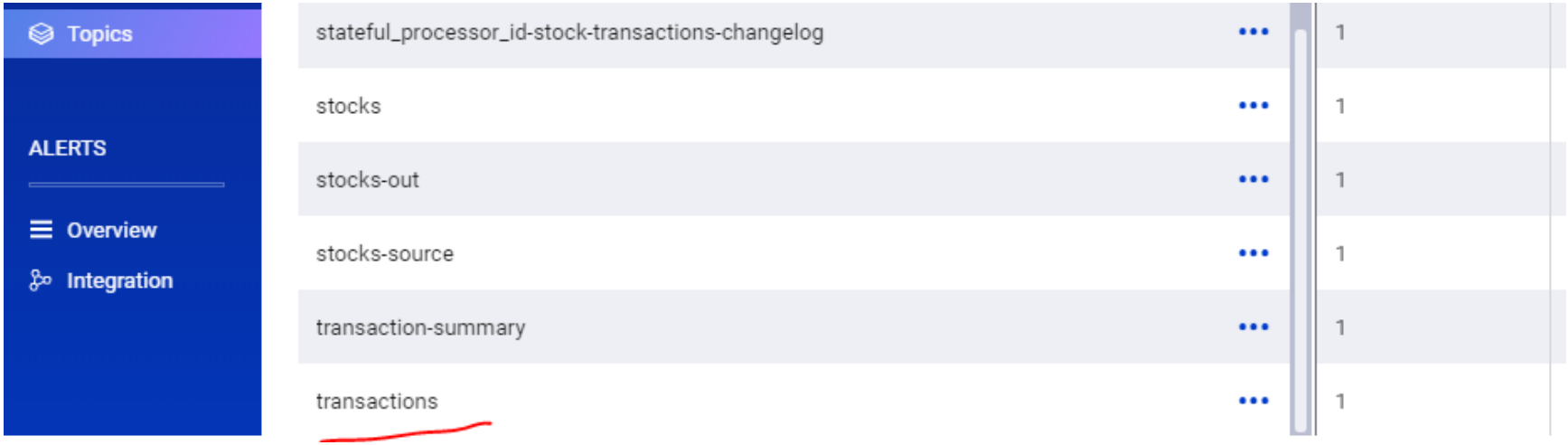
This tutorial provides a step-by-step workflow for using Confluent Schema Registry.

You will learn how to enable client applications to read and write Avro data and use Confluent Control Center, which has integrated capabilities with Schema Registry.

Create the transactions topic
For the exercises in this tutorial, you will be producing to and consuming from a topic called `transactions`. Create this topic in Control Center.

1. Navigate to the Control Center web interface at http://localhost:9021/.

Click into the cluster, select **Topics** and click **Add a topic**.
Name the topic `transactions` and click **Create with defaults**.
The new topic is displayed.



Or using CLI:
#kafka-topics.sh --create --bootstrap-server kafka0:9092 --partitions 1 --replication-factor 1 --topic transactions

Schema Definition

The first thing developers need to do is agree on a basic schema for data. Client applications form a contract:

- producers will write data in a schema
- consumers will be able to read that data

Consider the original Payment schema.

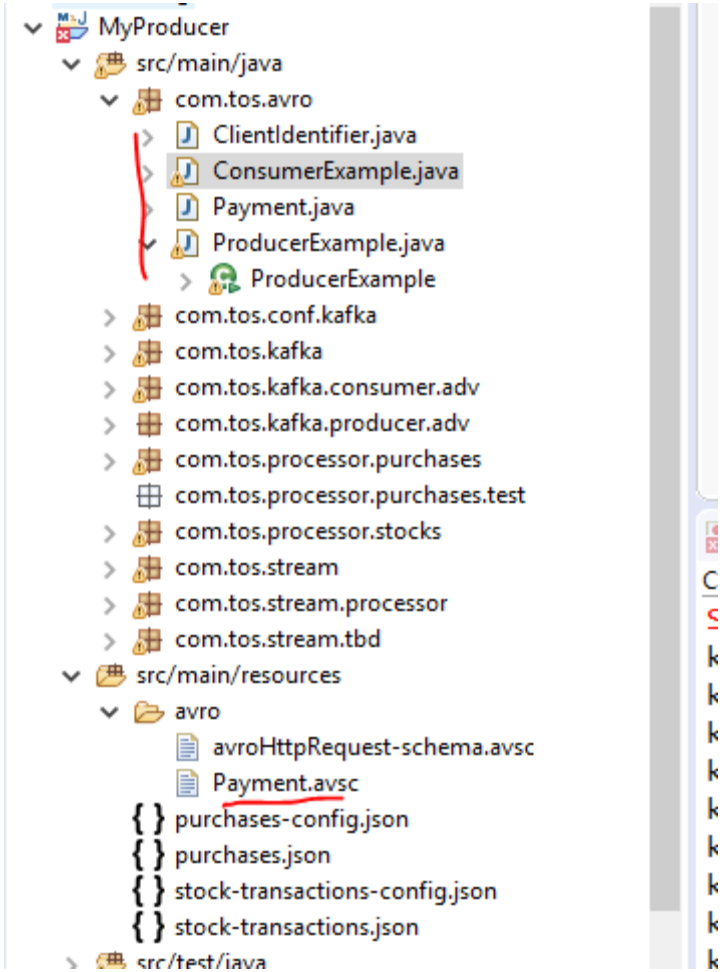
Copy the following content in src/main/resources folder with file Name:Payment.avsc

```
{"namespace": "io.tos.examples.clients.basicavro",
 "type": "record",
 "name": "Payment",
 "fields": [
     {"name": "id", "type": "string"},
     {"name": "amount", "type": "double"}
 ]
}
```

Here is a break-down of what this schema defines:

- `namespace`: a fully qualified name that avoids schema naming conflicts
- `type`: Avro data type, for example, `record`, `enum`, `union`, `array`, `map`, or `fixed`
- `name`: unique schema name in this namespace
- `fields`: one or more simple or complex data types for a `record`. The first field in this record is called *id*, and it is of type *string*. The second field in this record is called *amount*, and it is of type *double*.

`Project structure will be as shown after performing this lab.`


MyProducer
src/main/java
com.tos.avro
ClientIdentifier.java
ConsumerExample.java
Payment.java
ProducerExample.java
ProducerExample
com.tos.conf.kafka
com.tos.kafka
com.tos.kafka.consumer.adv
com.tos.kafka.producer.adv
com.tos.processor.purchases
com.tos.processor.purchases.test
com.tos.processor.stocks
com.tos.stream
com.tos.stream.processor
com.tos.stream.tbd
src/main/resources
avro
avroHttpRequest-schema.avsc
Payment.avsc
purchases-config.json
purchases.json
stock-transactions-config.json
stock-transactions.json
src/test/java

Update pom.xml

- Dependencies `org.apache.avro.avro` and `io.confluent.kafka-avro-serializer` to serialize data as Avro
- Plugin `avro-maven-plugin` to generate Java class files from the source schema

The `pom.xml` file may also include:

- Plugin `kafka-schema-registry-maven-plugin` to check compatibility of evolving schemas

Configuring Avro

Kafka applications using Avro data and Schema Registry need to specify at least two configuration parameters:

- Avro serializer or deserializer
- Properties to connect to Schema Registry

There are two basic types of Avro records that your application can use:

- a specific code-generated class, or
- a generic record

The examples in this tutorial demonstrate how to use the specific `Payment` class. Using a specific code-generated class requires you to define and compile a Java class for your schema, but it easier to work with in your code.

Java Producers

Within the application, Java producers need to configure the Avro serializer for the Apache Kafka® value (or Kafka key) and URL to Schema Registry. Then the producer can write records where the Kafka value is of `Payment` class.

Example Producer Code

When constructing the producer, configure the message value class to use the application's code-generated `Payment` class. For example:

```
// Code Begins Here
package com.tos.avro;

import java.util.Properties;
import org.apache.kafka.clients.producer.KafkaProducer;
import org.apache.kafka.clients.producer.ProducerConfig;
import org.apache.kafka.clients.producer.ProducerRecord;
import org.apache.kafka.common.errors.SerializationException;
import org.apache.kafka.common.serialization.StringSerializer;
import io.confluent.kafka.serializers.AbstractKafkaAvroSerDeConfig;
```

```
import io.confluent.kafka.serializers.KafkaAvroSerializer;
public class ProducerExample {

    private static final String TOPIC = "transactions";

    @SuppressWarnings("InfiniteLoopStatement")

    public static void main(final String[] args) {

        final Properties props = new Properties();
        props.put(ProducerConfig.BOOTSTRAP_SERVERS_CONFIG,
"192.168.139.132:9092");
        props.put(ProducerConfig.ACKS_CONFIG, "all");
        props.put(ProducerConfig.RETRIES_CONFIG, 0);
        props.put(ProducerConfig.KEY_SERIALIZER_CLASS_CONFIG,
StringSerializer.class);
        props.put(ProducerConfig.VALUE_SERIALIZER_CLASS_CONFIG,
KafkaAvroSerializer.class);

    props.put(AbstractKafkaAvroSerDeConfig.SCHEMA_REGISTRY_URL_CONFIG
, "http://localhost:8081");

        try (KafkaProducer<String, Payment> producer = new KafkaProducer<String,
Payment>(props)) {
```

```
                for (long i = 0; i < 10; i++) {
                        final String orderId = "id" + Long.toString(i);
                        final Payment payment = new Payment(orderId, 1000.00d);
                        final ProducerRecord<String, Payment> record = new
ProducerRecord<String, Payment>(TOPIC,
                                        payment.getId().toString(), payment);

                        producer.send(record);
                        Thread.sleep(1000L);
                }

                producer.flush();
                System.out.printf("Successfully produced 10 messages to a topic called
%s%n", TOPIC);

            } catch (final SerializationException e) {
                e.printStackTrace();
            } catch (final InterruptedException e) {
                e.printStackTrace();
            }

        }

}
// Code Ends Here
```

Execute Maven → Generate Sources.

It will generate Payment.java file in the same package as the main class. Its specified in the pom.xml

Pom.xml has the plugins for generating sources for avro. Ensure that avro schema file is in the below directores as specified below.

```
<plugin>
 <groupId>org.apache.avro</groupId>
 <artifactId>avro-maven-plugin</artifactId>
 <version>${avro.version}</version>
 <executions>
   <execution>
     <phase>generate-sources</phase>
     <goals>
       <goal>schema</goal>
      </goals>
      <configuration>
     <sourceDirectory>${project.basedir}/src/main/resources/</sourceDirectory>
     <includes>
       <include>Payment.avsc</include>
     </includes>
     <outputDirectory>${project.basedir}/src/main/java</outputDirectory>
   </configuration>
   </execution>
 </executions>
</plugin>
```

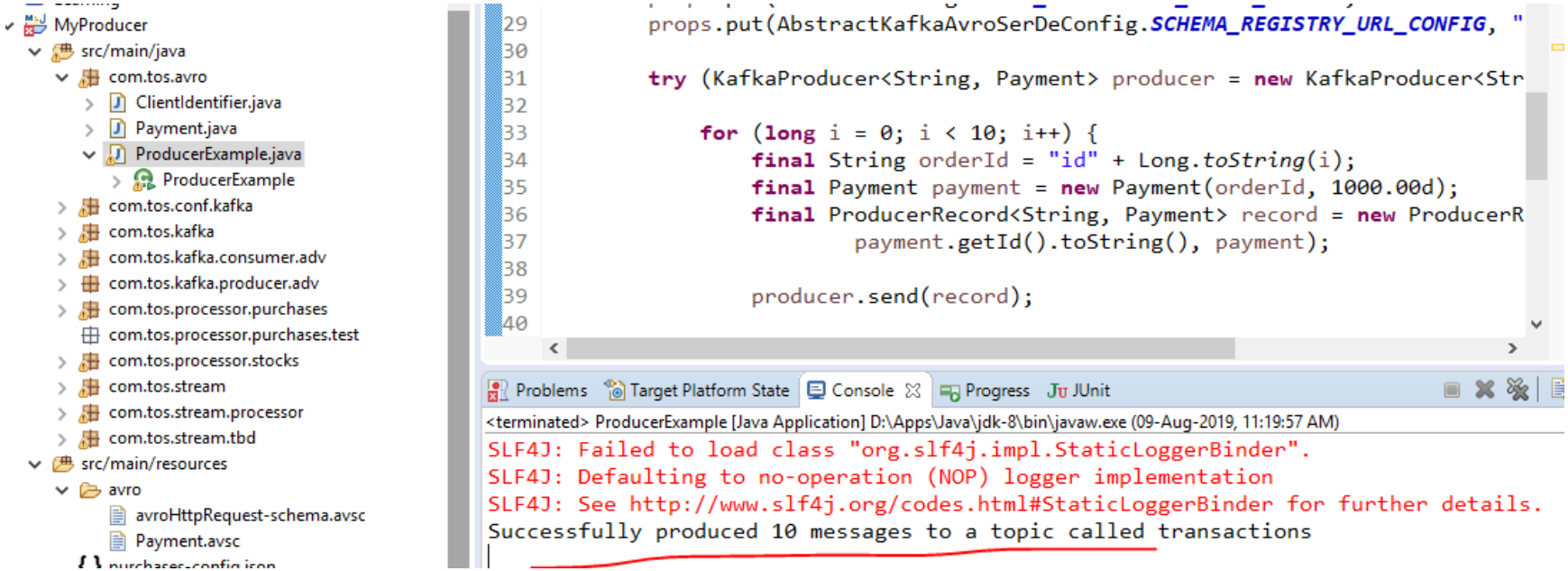
Run the Producer

1. From the Control Center navigation menu at http://localhost:9021/, make sure the cluster is selected, and click **Management -> Topics**.

   Next, click the transactions topic and go to the **Messages** tab.

   You should see no messages because no messages have been produced to this topic yet.

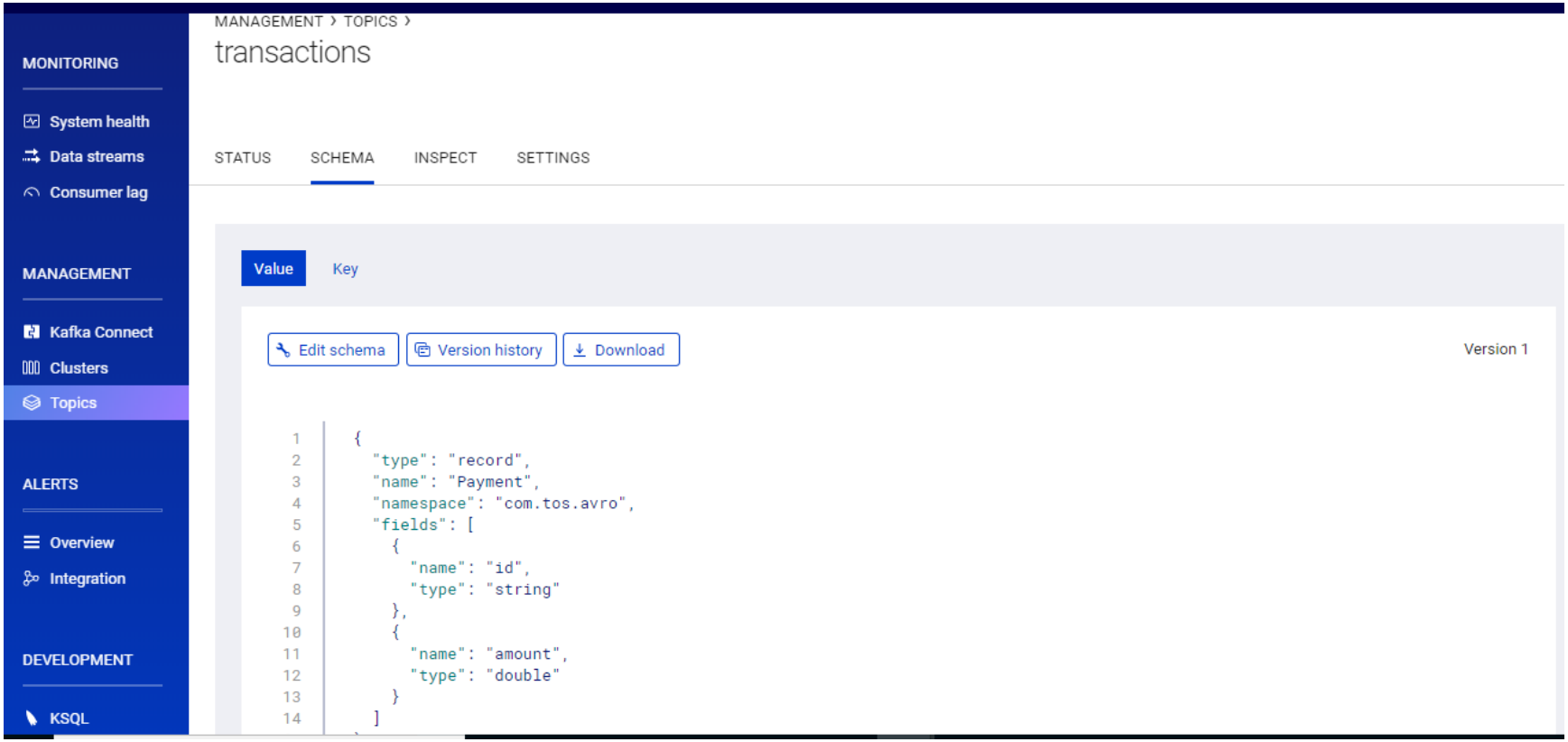
2. Run ProducerExample, which produces Avro-formatted messages to the transactions topic.



Now you should be able to see messages in Control Center by inspecting the `transactions` topic as it dynamically deserializes the newly arriving data that was serialized as Avro.

At http://localhost:9021/, click into the cluster on the left, then go to **Topics** -> `transactions` -> **Messages**.

Verify the schema too from the control Center.



Or Using CLI:

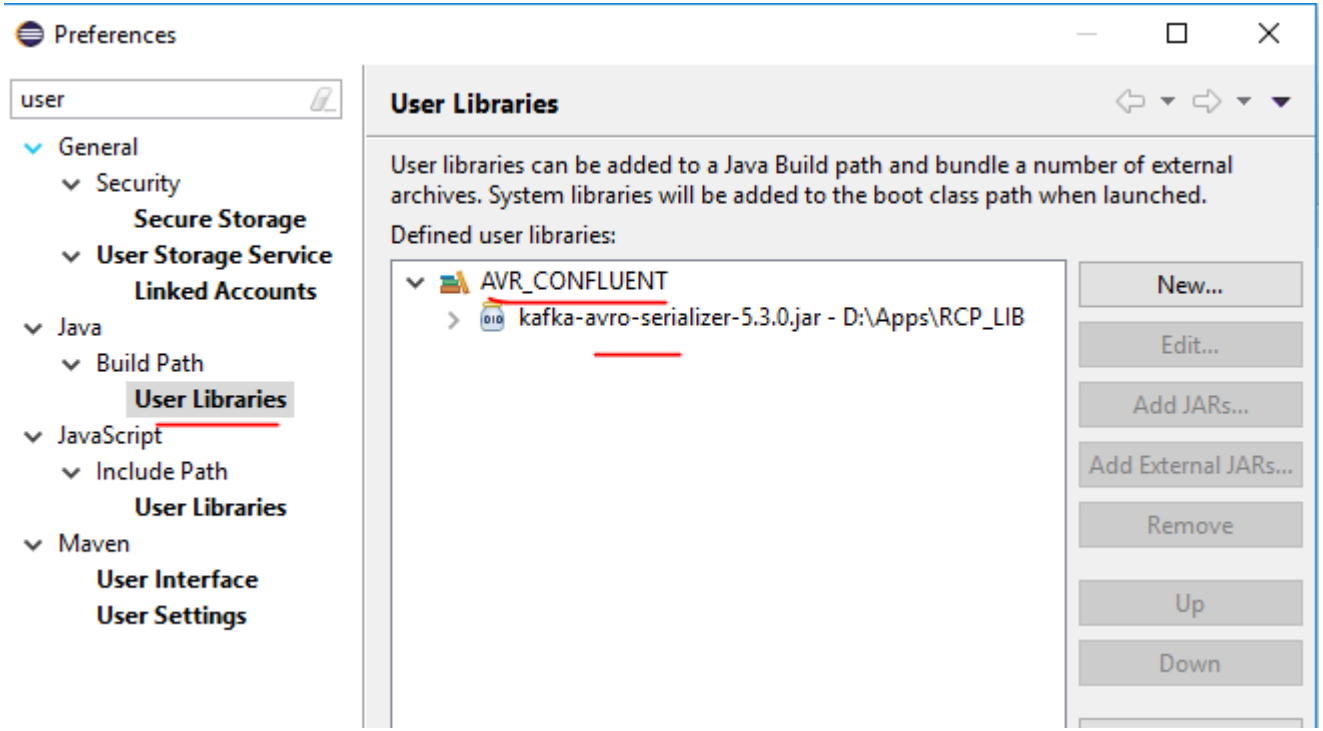
curl -X GET http://localhost:8081/subjects
curl -X GET http://localhost:8081/subjects/transactions-value/versions/latest

```
[root@kafka0 kafka-logs]# curl -X GET http://localhost:8081/subjects
["transactions-value"][root@kafka0 kafka-logs]# curl -X GET http://localhost:8081/subjects/transactions-value/ver
sions/latest
{"subject":"transactions-value","version":1,"id":1,"schema":"{\"type\":\"record\",\"name\":\"Payment\",\"namespac
e\":\"com.tos.registry\",\"fields\":[{\"name\":\"id\",\"type\":\"string\"},{\"name\":\"amount\",\"type\":\"double
\"}]}"}[root@kafka0 kafka-logs]#
```

Consumer CLI:
kafka-console-consumer.sh --bootstrap-server kafka0:9092 --topic transactions --from-beginning

```
[root@kafka0 kafka-logs]# kafka-console-consumer.sh --bootstrap-server kafka0:9092 --topic transactions --from-be
ginning
id0@@
id1@@
id2@@
id3@@
id4@@
id5@@
id6@@
id7@@
id8@@
id9@@
```

If the compilation issue is there, include the following jar in the project separately.


Preferences
user
General
Security
Secure Storage
User Storage Service
Linked Accounts
Java
Build Path
User Libraries
JavaScript
Include Path
User Libraries
Maven
User Interface
User Settings
User Libraries
User libraries can be added to a Java Build path and bundle a number of external archives. System libraries will be added to the boot class path when launched.
Defined user libraries:
AVR_CONFLUENT
kafka-avro-serializer-5.3.0.jar - D:\Apps\RCP_LIB
New...
Edit...
Add JARs...
Add External JARs...
Remove
Up
Down

Java Consumers

Within the client application, Java consumers need to configure the Avro deserializer for the Kafka value (or Kafka key) and URL to Schema Registry. Then the consumer can read records where the Kafka value is of `Payment` class.

Example Consumer Code

By default, each record is deserialized into an Avro `GenericRecord`, but in this tutorial the record should be deserialized using the application's code-generated `Payment` class. Therefore, configure the deserializer to use Avro `SpecificRecord`, i.e., `SPECIFIC_AVRO_READER_CONFIG` should be set to `true`. For example:

```
// Code Begins Here
package com.tos.avro;

import java.time.Duration;
import java.util.Collections;
import java.util.Properties;

import org.apache.kafka.clients.consumer.ConsumerConfig;
import org.apache.kafka.clients.consumer.ConsumerRecord;
import org.apache.kafka.clients.consumer.ConsumerRecords;
import org.apache.kafka.clients.consumer.KafkaConsumer;
import org.apache.kafka.common.serialization.StringDeserializer;
```

```
import io.confluent.kafka.serializers.AbstractKafkaAvroSerDeConfig;
import io.confluent.kafka.serializers.KafkaAvroDeserializer;
import io.confluent.kafka.serializers.KafkaAvroDeserializerConfig;
public class ConsumerExample {
    private static final String TOPIC = "transactions";

    @SuppressWarnings("InfiniteLoopStatement")
    public static void main(final String[] args) {
        final Properties props = new Properties();
        props.put(ConsumerConfig.BOOTSTRAP_SERVERS_CONFIG,
"localhost:8082");
        props.put(ConsumerConfig.GROUP_ID_CONFIG, "test-payments");
        props.put(ConsumerConfig.ENABLE_AUTO_COMMIT_CONFIG,
"true");
        props.put(ConsumerConfig.AUTO_COMMIT_INTERVAL_MS_CONFIG,
"1000");
        props.put(ConsumerConfig.AUTO_OFFSET_RESET_CONFIG,
"earliest");

props.put(AbstractKafkaAvroSerDeConfig.SCHEMA_REGISTRY_URL_CONFIG,
"http://localhost:8081");
        props.put(ConsumerConfig.KEY_DESERIALIZER_CLASS_CONFIG,
StringDeserializer.class);
        props.put(ConsumerConfig.VALUE_DESERIALIZER_CLASS_CONFIG,
```

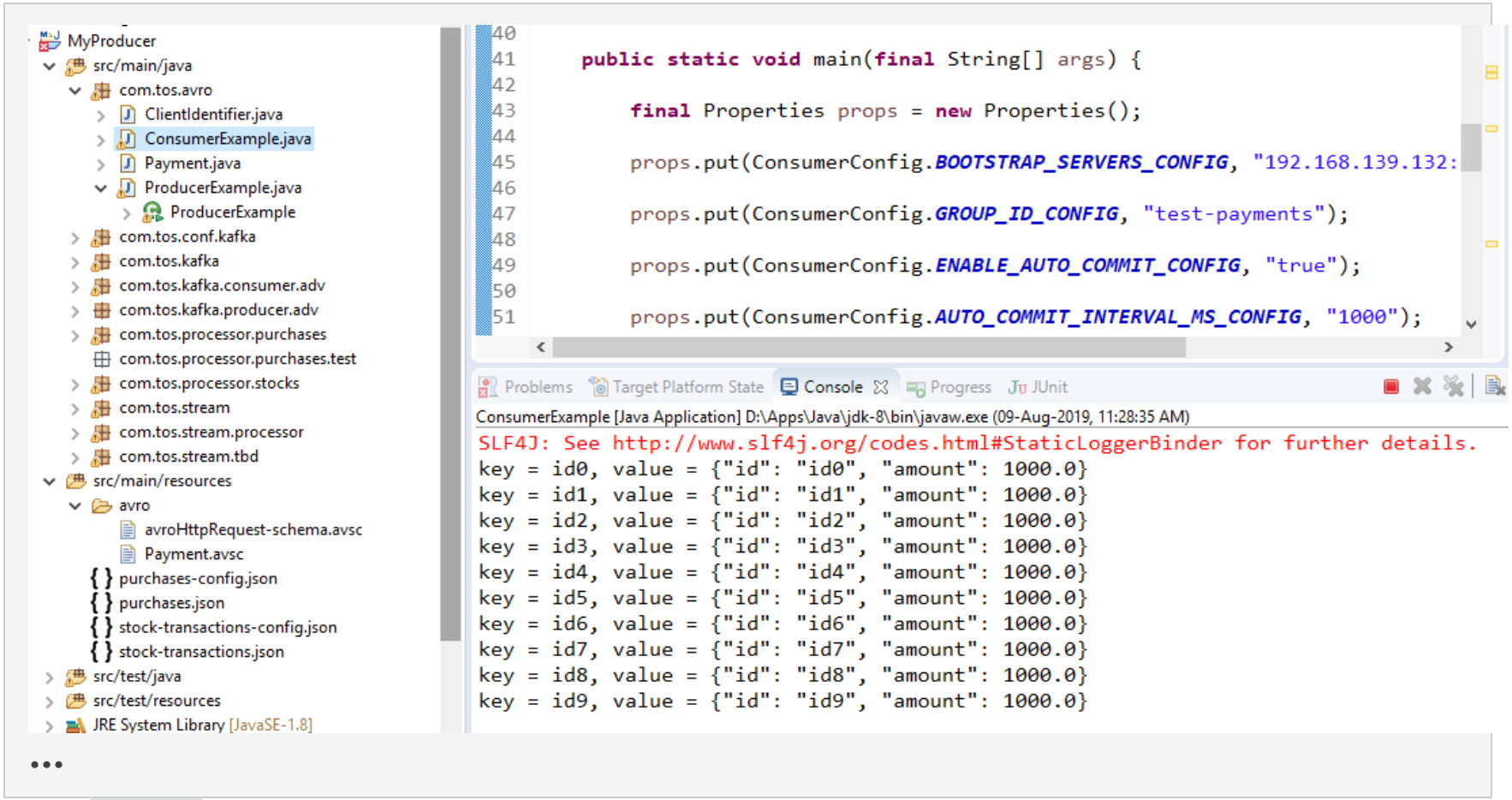
```
KafkaAvroDeserializer.class);

props.put(KafkaAvroDeserializerConfig.SPECIFIC_AVRO_READER_CONFIG,
true);

        try (final KafkaConsumer<String, Payment> consumer = new
KafkaConsumer<>(props)) {

            consumer.subscribe(Collections.singletonList(TOPIC));
            while (true) {
                final ConsumerRecords<String, Payment> records =
consumer.poll(Duration.ofMillis(100));
                for (final ConsumerRecord<String, Payment> record :
records) {
                    final String key = record.key();
                    final Payment value = record.value();
                    System.out.printf("key = %s, value = %s%n",
key, value);

                }

            }
        }
    }
}
```

// Code Ends Here

Run the Consumer

1. run `ConsumerExample` (assuming you already ran the `ProducerExample` above).

You should see:



2. Hit Ctrl-C to stop.

------ ---------- Lab Ends Here ----------

9. DSL - Transform a stream of events – 60 Minutes

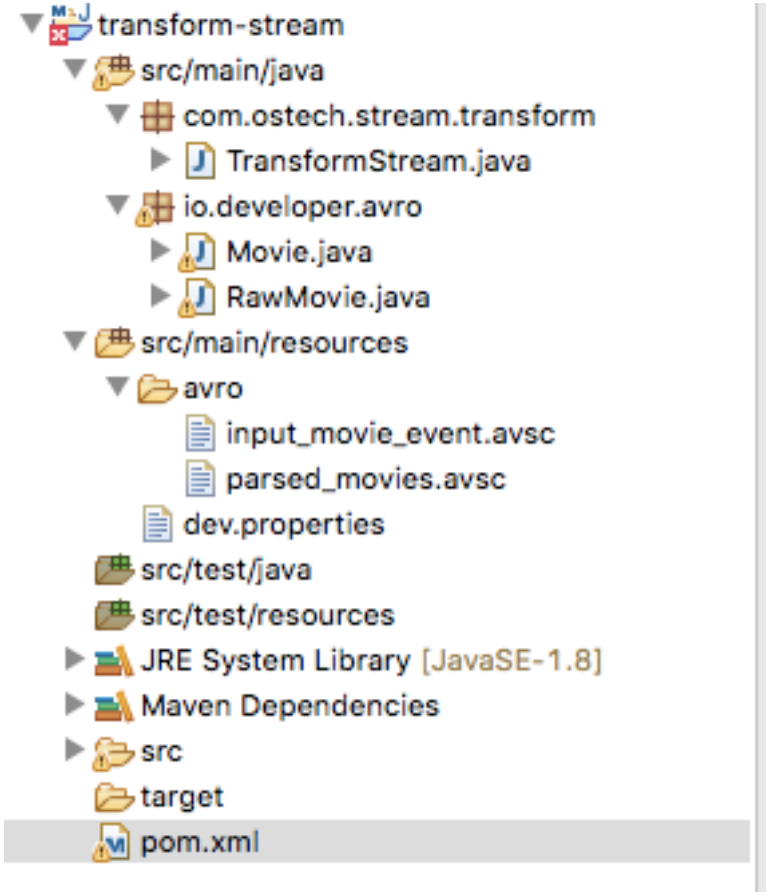
In this lab, the following topic will be implemented:

- Use Schema Registry with Avro
- Map Transformation and KeyValue Pair
- Create Topic with AdminClient API

Consider a topic with events that represent movies. Each event has a single attribute that combines its title and its release year into a string. In this tutorial, we'll write a program that creates a new topic with the title and release date turned into their own attributes.

Input : {"id":294,"title":"Die Hard::1988","genre":"action"}
Output: {"id":294,"title":"Die Hard","release_year":1988,"genre":"action"}

Create a Maven Project:
com.ostech:transform-stream
At the end you should have the project structure as shown below:


transform-stream
src/main/java
com.ostech.stream.transform
TransformStream.java
io.developer.avro
Movie.java
RawMovie.java
src/main/resources
avro
input_movie_event.avsc
parsed_movies.avsc
dev.properties
src/test/java
src/test/resources
JRE System Library [JavaSE-1.8]
Maven Dependencies
src
target
pom.xml

Update the pom.xml with the following entry.

Then create a development file at configuration src/main/resources/dev.properties:

```
application.id=transforming-app
bootstrap.servers=localhost:9092
schema.registry.url=http://localhost:8081

input.topic.name=raw-movies
input.topic.partitions=1
input.topic.replication.factor=1

output.topic.name=movies
output.topic.partitions=1
output.topic.replication.factor=1
```

Create a schema for the events
Create a directory for the schemas that represent the events in the stream:
src/main/resources/avro

Then create the following Avro schema file at `src/main/resources/avro/input_movie_event.avsc` for the raw movies:

```
{
  "namespace": "io.developer.avro",
  "type": "record",
  "name": "RawMovie",
  "fields": [
    {"name": "id", "type": "long"},
    {"name": "title", "type": "string"},
    {"name": "genre", "type": "string"}
  ]
}
```

While you're at it, create another Avro schema file at `src/main/resources/avro/parsed_movies.avsc` for the transformed movies:

```
{
  "namespace": "io.developer.avro",
  "type": "record",
  "name": "Movie",
```

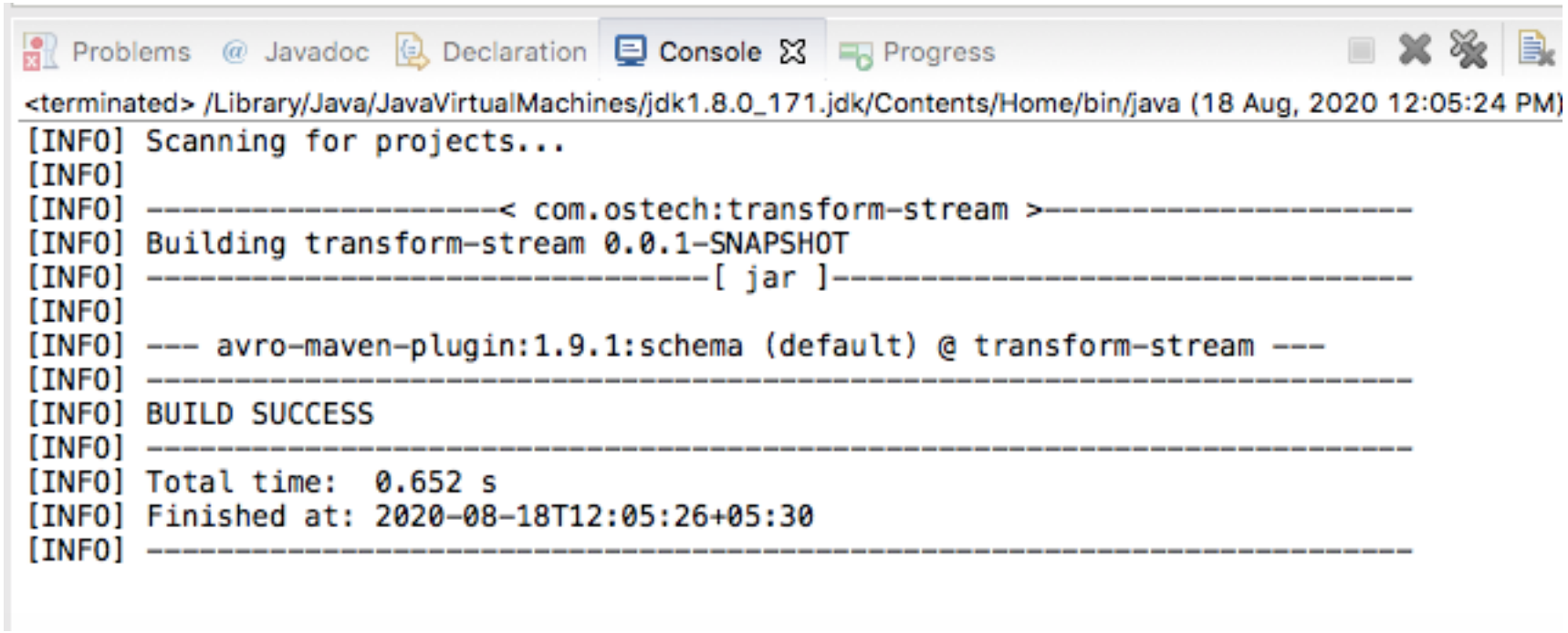
```
  "fields": [
    {"name": "id", "type": "long"},
    {"name": "title", "type": "string"},
    {"name": "release_year", "type": "int"},
    {"name": "genre", "type": "string"}
  ]
}
```

Because we will use this Avro schema in our Java code, we'll need to compile it. The Maven Avro plugin is a part of the build, so it will see your new Avro files, generate Java code for them, and compile those and all other Java sources. Run this command to get it all done:

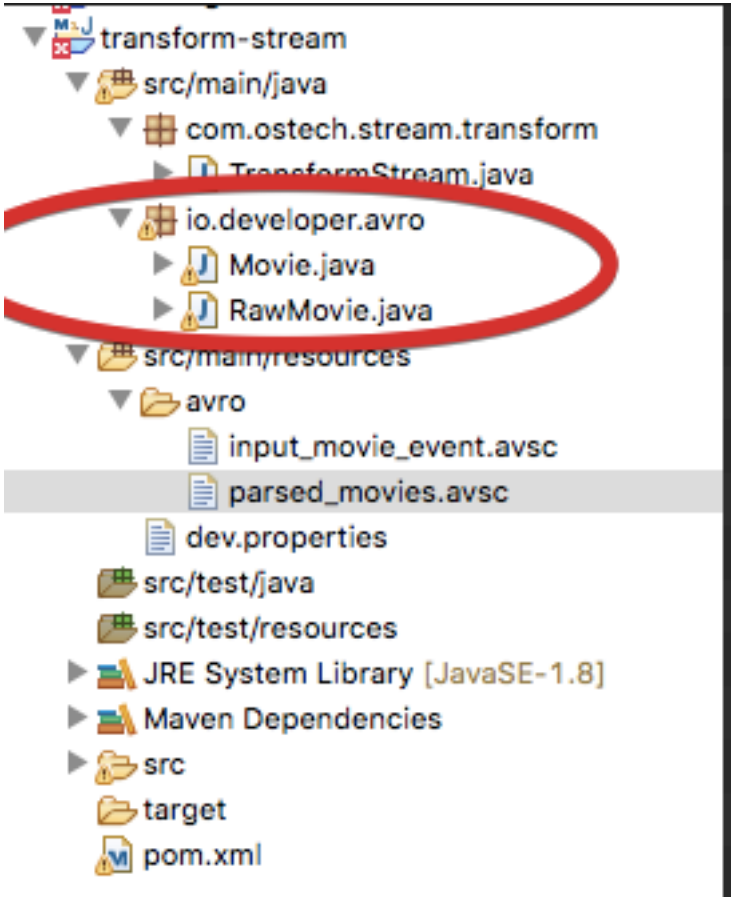
Include the above Avro Schema in the Avro-maven-plugin source directory to generate the source code.

```
97          <artifactId>avro-maven-plugin</artifactId>
98          <version>${avro.version}</version>
99          <executions>
100           <execution>
101             <phase>generate-sources</phase>
102             <goals>
103               <goal>schema</goal>
104              </goals>
105              <configuration>
106             <sourceDirectory>${project.basedir}/src/main/resources/</sourceDirectory>
107             <sourceDirectory>${project.basedir}/src/main/resources/avro</sourceDirectory>
108             <includes>
109               <include>input_movie_event.avsc</include>
110               <include>parsed_movies.avsc</include>
111               <include>Payment.avsc</include>
112             </includes>
113             <outputDirectory>${project.basedir}/src/main/java</outputDirectory>
114           </configuration>
115           </execution>
```

Maven → Generated-Sources



Ensure that generated classes don't have any compile error.


transform-stream
src/main/java
com.ostech.stream.transform
io.developer.avro
Movie.java
RawMovie.java
src/main/resources
avro
input_movie_event.avsc
parsed_movies.avsc
dev.properties
src/test/java
src/test/resources
JRE System Library [JavaSE-1.8]
Maven Dependencies
src
target
pom.xml

Create the Kafka Streams topology

Then create the following file `TransformStream.java inside` **package** com.ostech.stream.transform

```
package com.ostech.stream.transform;

import java.io.FileInputStream;
import java.io.IOException;
import java.util.ArrayList;
import java.util.HashMap;
import java.util.List;
import java.util.Map;
import java.util.Properties;
import java.util.concurrent.CountDownLatch;

import org.apache.kafka.clients.admin.AdminClient;
import org.apache.kafka.clients.admin.NewTopic;
import org.apache.kafka.common.serialization.Serdes;
import org.apache.kafka.streams.KafkaStreams;
import org.apache.kafka.streams.KeyValue;
import org.apache.kafka.streams.StreamsBuilder;
import org.apache.kafka.streams.StreamsConfig;
import org.apache.kafka.streams.Topology;
```

```
import org.apache.kafka.streams.kstream.KStream;
import org.apache.kafka.streams.kstream.Produced;

import io.confluent.kafka.serializers.AbstractKafkaAvroSerDeConfig;
import io.confluent.kafka.streams.serdes.avro.SpecificAvroSerde;
import io.developer.avro.Movie;
import io.developer.avro.RawMovie;

public class TransformStream {

    public Properties buildStreamsProperties(Properties envProps) {
        Properties props = new Properties();

        props.put(StreamsConfig.APPLICATION_ID_CONFIG,
envProps.getProperty("application.id"));
        props.put(StreamsConfig.BOOTSTRAP_SERVERS_CONFIG,
envProps.getProperty("bootstrap.servers"));
        props.put(StreamsConfig.DEFAULT_KEY_SERDE_CLASS_CONFIG,
Serdes.String().getClass());
        props.put(StreamsConfig.DEFAULT_VALUE_SERDE_CLASS_CONFIG,
SpecificAvroSerde.class);

props.put(AbstractKafkaAvroSerDeConfig.SCHEMA_REGISTRY_URL_CONFIG,
envProps.getProperty("schema.registry.url"));
```

```
        return props;
    }

    public Topology buildTopology(Properties envProps) {
        final StreamsBuilder builder = new StreamsBuilder();
        final String inputTopic =
envProps.getProperty("input.topic.name");

        KStream<String, RawMovie> rawMovies =
builder.stream(inputTopic);
        KStream<Long, Movie> movies = rawMovies.map((key, rawMovie)
->
                new KeyValue<Long, Movie>(rawMovie.getId(),
convertRawMovie(rawMovie)));

      //  movies.to("movies", Produced.with(Serdes.Long(),
movieAvroSerde(envProps)));

        movies.to("movies", Produced.with(Serdes.Long(),
movieAvroSerde(envProps)));
        return builder.build();
    }

    public static Movie convertRawMovie(RawMovie rawMovie) {
        String titleParts[] =
```

```
rawMovie.getTitle().toString().split("::");
        String title = titleParts[0];
        int releaseYear = Integer.parseInt(titleParts[1]);
        return new Movie(rawMovie.getId(), title, releaseYear,
rawMovie.getGenre());
    }

    private SpecificAvroSerde<Movie> movieAvroSerde(Properties
envProps) {
        SpecificAvroSerde<Movie> movieAvroSerde = new
SpecificAvroSerde<>();

        final HashMap<String, String> serdeConfig = new
HashMap<>();

serdeConfig.put(AbstractKafkaAvroSerDeConfig.SCHEMA_REGISTRY_URL_CO
NFIG,
                envProps.getProperty("schema.registry.url"));

        movieAvroSerde.configure(serdeConfig, false);
        return movieAvroSerde;
    }

    public void createTopics(Properties envProps) {
        Map<String, Object> config = new HashMap<>();
```

```
        config.put("bootstrap.servers",
envProps.getProperty("bootstrap.servers"));
        AdminClient client = AdminClient.create(config);

        List<NewTopic> topics = new ArrayList<>();

        topics.add(new NewTopic(
                envProps.getProperty("input.topic.name"),

Integer.parseInt(envProps.getProperty("input.topic.partitions")),

Short.parseShort(envProps.getProperty("input.topic.replication.fact
or"))));

        topics.add(new NewTopic(
                envProps.getProperty("output.topic.name"),

Integer.parseInt(envProps.getProperty("output.topic.partitions")),

Short.parseShort(envProps.getProperty("output.topic.replication.fac
tor"))));

        client.createTopics(topics);
        client.close();
    }
```

```
    public Properties loadEnvProperties(String fileName) throws
IOException {
        Properties envProps = new Properties();
        FileInputStream input = new FileInputStream(fileName);
        envProps.load(input);
        input.close();

        return envProps;
    }

    public static void main(String[] args) throws Exception {
       /* if (args.length < 1) {
            throw new IllegalArgumentException("This program takes
one argument: the path to an environment configuration file.");
        }
        */
        String propFile = "/Users/henrypotsangbam/eclipse-
workspace/LearningKafka/transform-
stream/src/main/resources/dev.properties";
        TransformStream ts = new TransformStream();
        Properties envProps = ts.loadEnvProperties(propFile);
        Properties streamProps =
ts.buildStreamsProperties(envProps);
        Topology topology = ts.buildTopology(envProps);
```

```
        ts.createTopics(envProps);

        final KafkaStreams streams = new KafkaStreams(topology,
streamProps);
        final CountDownLatch latch = new CountDownLatch(1);

        // Attach shutdown handler to catch Control-C.
        Runtime.getRuntime().addShutdownHook(new Thread("streams-
shutdown-hook") {
            @Override
            public void run() {
                streams.close();
                latch.countDown();
            }
        });

        try {
            streams.start();
            latch.await();
        } catch (Throwable e) {
            System.exit(1);
        }
        System.exit(0);
    }
```

```
}
```

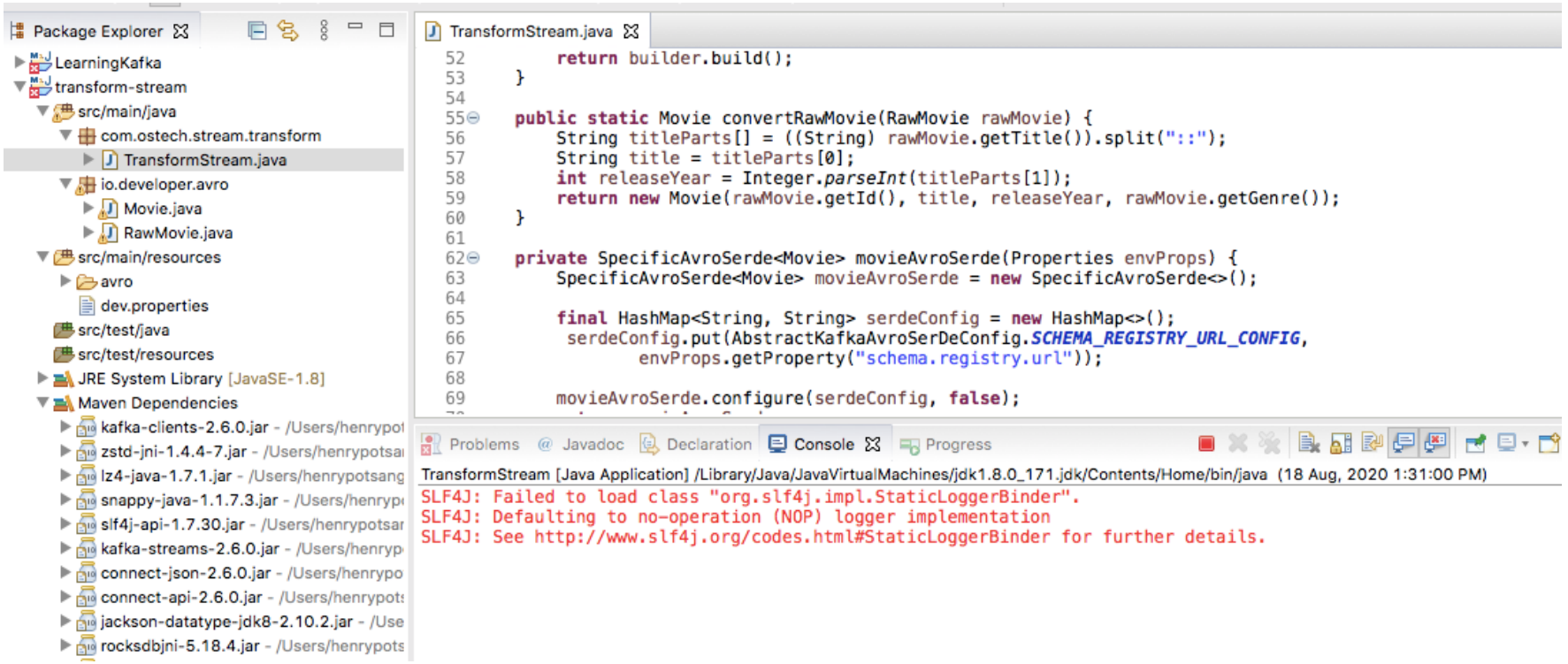
`Description :`

The first thing the method does is create an instance of `StreamsBuilder`, which is the helper object that lets us build our topology. Next we call the `stream()` method, which creates a `KStream` object (called `rawMovies` in this case) out of an underlying Kafka topic. Note the type of that stream is `Long, RawMovie`, because the topic contains the raw movie objects we want to transform. RawMovie's `title` field contains the title and the release year together, which we want to make into separate fields in a new object.
We get that transforming work done with the next line, which is a call to the `map()` method. `map()` takes each input record and creates a new stream with transformed records in it. Its parameter is a single Java Lambda that takes the input key and value and returns an instance of the `KeyValue` class with the new record in it. This does two things. First, it rekeys the incoming stream, using the `movieId` as the key. We don't absolutely need to do that to accomplish the transformation, but it's easy enough to do at the same time, and it sets a useful key on the output stream, which is generally a good idea. Second, it calls the `convertRawMovie()` method to turn the `RawMovie` value into a `Movie`. This is the essence of the transformation.
The `convertRawMovie()` method contains the sort of unpleasant string parsing that is a part of many stream processing pipelines, which we are happily able to encapsulate in a single, easily testable method. Any further stages we might build in the pipeline after this point are blissfully unaware that we ever had a string to parse in the first place.
Moreover, it's worth noting that we're calling `map()` and not `mapValues()`:

Ensure the dev.properties is refer with the correct path.

Start the kafka and the registry server

Compile and run the Kafka Streams program



Produce events to the input topic

In a new terminal, run:

Copy the avsc file in a specific folder and Execute the following.

```
#kafka-avro-console-producer --topic raw-movies --broker-list kafka0:9092 --property
value.schema="$(< input_movie_event.avsc)"
```

[
./kafka-avro-console-producer --topic raw-movies --broker-list localhost:9092 --property value.schema="$(< /software/input_movie_event.avsc)"
]
When the console producer starts, it will log some messages and hang, waiting for your input. Type in one line at a time and press enter to send it. Each line represents an event. To send all of the events below, paste the following into the prompt and press enter:

```
{"id": 294, "title": "Die Hard::1988", "genre": "action"}
{"id": 354, "title": "Tree of Life::2011", "genre": "drama"}
{"id": 782, "title": "A Walk in the Clouds::1995", "genre": "romance"}
{"id": 128, "title": "The Big Lebowski::1998", "genre": "comedy"}
```

```
(base) Henrys-MacBook-Air:transform-stream henrypotsangbam$ kafka-avro-console-producer --topic r
aw-movies --broker-list localhost:9092 --property value.schema="$(< src/main/resources/avro/input
_movie_event.avsc)"
{"id": 294, "title": "Die Hard::1988", "genre": "action"}
{"id": 354, "title": "Tree of Life::2011", "genre": "drama"}
{"id": 782, "title": "A Walk in the Clouds::1995", "genre": "romance"}
{"id": 128, "title": "The Big Lebowski::1998", "genre": "comedy"}
```

At registry log:

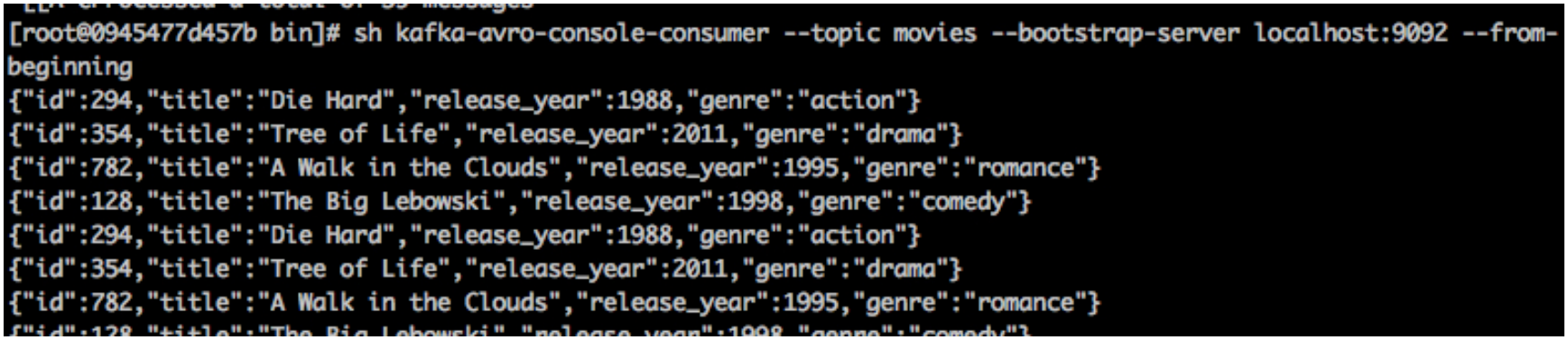
```
[2020-09-28 12:40:20,182] INFO HV000001: Hibernate Validator 6.0.17.Final (org.hibernate.validator.internal.util.Version:21)
[2020-09-28 12:40:20,768] INFO Started o.e.j.s.ServletContextHandler@4c9e38{/,null,AVAILABLE} (org.eclipse.jetty.server.handler.ContextHandl
er:825)
[2020-09-28 12:40:20,805] INFO Started o.e.j.s.ServletContextHandler@27aae97b{/ws,null,AVAILABLE} (org.eclipse.jetty.server.handler.ContextH
andler:825)
[2020-09-28 12:40:20,851] INFO Started NetworkTrafficServerConnector@186f8716{HTTP/1.1,[http/1.1]}{0.0.0.0:8081} (org.eclipse.jetty.server.A
bstractConnector:330)
[2020-09-28 12:40:20,852] INFO Started @7688ms (org.eclipse.jetty.server.Server:399)
[2020-09-28 12:40:20,853] INFO Server started, listening for requests... (io.confluent.kafka.schemaregistry.rest.SchemaRegistryMain:44)
[2020-09-28 12:41:04,660] INFO Registering new schema: subject raw-movies-value, version null, id null, type null (io.confluent.kafka.schema
registry.rest.resources.SubjectVersionsResource:249)
[2020-09-28 12:41:04,819] INFO 127.0.0.1 - - [28/Sep/2020:12:41:04 +0000] "POST /subjects/raw-movies-value/versions HTTP/1.1" 200 8  410 (io
.confluent.rest-utils.requests:62)
```

Observe the transformed movies in the output topic.

Leave your original terminal running. To consume the events produced by your Streams application you'll need another terminal open.

First, to consume the events of drama films, run the following:
This should yield the following messages:

```
#kafka-avro-console-consumer --topic movies --bootstrap-server kafka0:9092 --from-beginning
```



Open another termminal, you can consume the raw-movies as shown below:

```
# kafka-avro-console-consumer --topic raw-movies --bootstrap-server kafka0:9092 --from-beginning
```

```
(base) Henrys-MacBook-Air:~ henrypotsangbam$ kafka-avro-console-consumer --topic raw-movies --bootstrap-server localhost:9092 --from-beginning
{"id":294,"title":"Die Hard::1988","genre":"action"}
{"id":354,"title":"Tree of Life::2011","genre":"drama"}
{"id":354,"title":"Tree of Life::2011","genre":"drama"}
{"id":294,"title":"Die Hard::1988","genre":"action"}
{"id":294,"title":"Die Hard::1988","genre":"action"}
{"id":354,"title":"Tree of Life::2011","genre":"drama"}
{"id":782,"title":"A Walk in the Clouds::1995","genre":"romance"}
{"id":128,"title":"The Big Lebowski::1998","genre":"comedy"}
{"id":294,"title":"Die Hard::1988","genre":"action"}
{"id":354,"title":"Tree of Life::2011","genre":"drama"}
{"id":782,"title":"A Walk in the Clouds::1995","genre":"romance"}
{"id":128,"title":"The Big Lebowski::1998","genre":"comedy"}
```

Task:

Add: peek method to get a print after transformation:

```
44        KStream<String, RawMovie> rawMovies = builder.stream(inputTopic);
45        KStream<Long, Movie> movies = rawMovies.map((key, rawMovie) ->
46                new KeyValue<Long, Movie>(rawMovie.getId(), convertRawMovie(rawMovie)))
47                .peek((k,v) -> System.out.println("Key:  " + k + " , Movie : " + v.getTitle()));
48
49      //  movies.to("movies", Produced.with(Serdes.Long(), movieAvroSerde(envProps)));
50
```

```
Console
TransformStream (1) [Java Application] /Library/Java/JavaVirtualMachines/jdk1.8.0_271.jdk/Contents/Home/bin/java  (03-Mar-2022, 10:35:23 PM)
SLF4J: Failed to load class "org.slf4j.impl.StaticLoggerBinder".
SLF4J: Defaulting to no-operation (NOP) logger implementation
SLF4J: See http://www.slf4j.org/codes.html#StaticLoggerBinder for further details.
Key:  128 , Movie : The Big Lebowski
```

Your output should be as shown above, when you enter the following in the producer console.

{"id": 128, "title": "The Big Lebowski::1998", "genre": "comedy"}

```
[root@kafka0 code]# kafka-avro-console-producer --topic raw-movies --broker-list kafka0:9092 --property value.schema="$(<
input_movie_event.avsc)"
{"id": 294, "title": "Die Hard::1988", "genre": "action"}
{"id": 354, "title": "Tree of Life::2011", "genre": "drama"}
{"id": 782, "title": "A Walk in the Clouds::1995", "genre": "romance"}
{"id": 128, "title": "The Big Lebowski::1998", "genre": "comedy"}
{"id": 128, "title": "The Big Lebowski::1998", "genre": "comedy"}
```

---------- Lab Ends Here ----------

10. Stream Using – FMV Stateless – 45 Minutes

In this lab, following actions will be performed.

- Kstream creation from the Topic
- Perform transformation using flatMapValues function
- Perform aggregation method
- Conversion from stream to KTable.

Logic:

Stream from the input topic, streams-plaintext-input is created and perform some transformation to it and the output is written to the topic, streams-wordcount-output.

Transformation logic:

Parse the text inserted in the input topic and count the occurrence of each word.
It will be calculate the count for the complete execution.

Create a class file with the following specification.

Package: com.ostech.ktable
Class: WordCountLambdaExample.java

Update the following with the IP address of your broker.

```
final String bootstrapServers =  "kafka0:8082";
```

// Update with the following code in the class file.

Import the following packages and classes:

```
import java.util.Arrays;
import java.util.Properties;
import java.util.concurrent.CountDownLatch;
import java.util.regex.Pattern;

import org.apache.kafka.clients.consumer.ConsumerConfig;
import org.apache.kafka.common.serialization.Serdes;
import org.apache.kafka.streams.KafkaStreams;
import org.apache.kafka.streams.StreamsBuilder;
import org.apache.kafka.streams.StreamsConfig;
import org.apache.kafka.streams.kstream.KStream;
import org.apache.kafka.streams.kstream.KTable;
import org.apache.kafka.streams.kstream.Produced;
```

Define the Input and output topic.

```
public class WordCountLambdaExample {
    final static String inputTopic =  "streams-plaintext-input";
     final static String outputTopic =  "streams-wordcount-output";

    public static void main(String args[]) {

    }}
```

Define the config properties: The state of the aggregration will be stored in directory specified by `StreamsConfig.STATE_DIR_CONFIG.`

```
private static Properties config() {
        Properties props = new Properties();
        props.put(StreamsConfig.APPLICATION_ID_CONFIG, "streams-
temperature");
        props.put(StreamsConfig.BOOTSTRAP_SERVERS_CONFIG,
"localhost:8082");
        props.put(StreamsConfig.STATE_DIR_CONFIG, "//tmp//WC");
        props.put(StreamsConfig.DEFAULT_KEY_SERDE_CLASS_CONFIG,
Serdes.String().getClass());
        props.put(StreamsConfig.DEFAULT_VALUE_SERDE_CLASS_CONFIG,
Serdes.String().getClass());
        props.put(ConsumerConfig.AUTO_OFFSET_RESET_CONFIG,
"earliest");
        props.put(StreamsConfig.CACHE_MAX_BYTES_BUFFERING_CONFIG,
0);
        return props;

    }
```

Transformation logic define below:

a) Read the stream from input topic.
b) Convert each word of a sentences into array of words like (“kafka”,”again”).
c) Group the list by word i.e “kafka”
d) Finally count the occurrence of the word using count aggregration.

```
public static void countWordByUsingFMValues() {

        Properties props = config();
        StreamsBuilder builder = new StreamsBuilder();

        // Update with the following code in createWordCountStream
method body.
        final KStream<String, String> textLines =
builder.stream(inputTopic);

        final Pattern pattern = Pattern.compile("\\W+",
Pattern.UNICODE_CHARACTER_CLASS);

        final KTable<String, Long> wordCounts = textLines
                .flatMapValues(value ->
Arrays.asList(pattern.split(value.toLowerCase())))
                .groupBy((keyIgnored, word) -> word).count();
```

```
        // Write the `KTable<String, Long>` to the output topic.
        wordCounts.toStream().to(outputTopic,
Produced.with(Serdes.String(), Serdes.Long()));
        // Update till Here

        final KafkaStreams streams = new
KafkaStreams(builder.build(), props);
        final CountDownLatch latch = new CountDownLatch(1);
        // attach shutdown handler to catch control-c
        Runtime.getRuntime().addShutdownHook(new Thread("streams-
temperature-shutdown-hook") {
            @Override
            public void run() {
                streams.close();
                latch.countDown();
            }
        });

        try {
            streams.start();
            latch.await();
        } catch (Throwable e) {
            System.exit(1);
        }
```

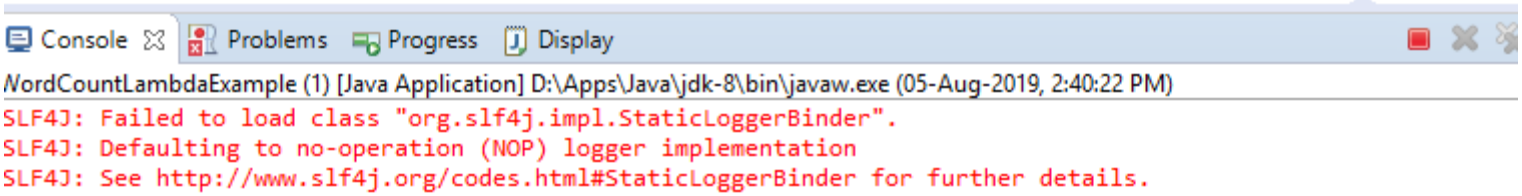
```
        System.exit(0);

    }
```

Executing the Application:

Create the input and output topics used by this example. Execute the Kafka topic command from the bin folder of kafka installation folder.

```
# sh kafka-topics.sh --create --topic streams-plaintext-input \
            --bootstrap-server kafka0:9092 --partitions 1 --replication-factor 1
# sh kafka-topics.sh --create --topic streams-wordcount-output \
            --bootstrap-server kafka0:9092  --partitions 1 --replication-factor 1
```

Start this example application either in your IDE or in the command line.



Start the console producer. You can then enter input data by writing some line of text, followed by ENTER:

* #
* # hello kafka streams<ENTER>

* # all streams lead to kafka<ENTER>
* # join kafka summit<ENTER>
* #
* # Every line you enter will become the value of a single Kafka message.

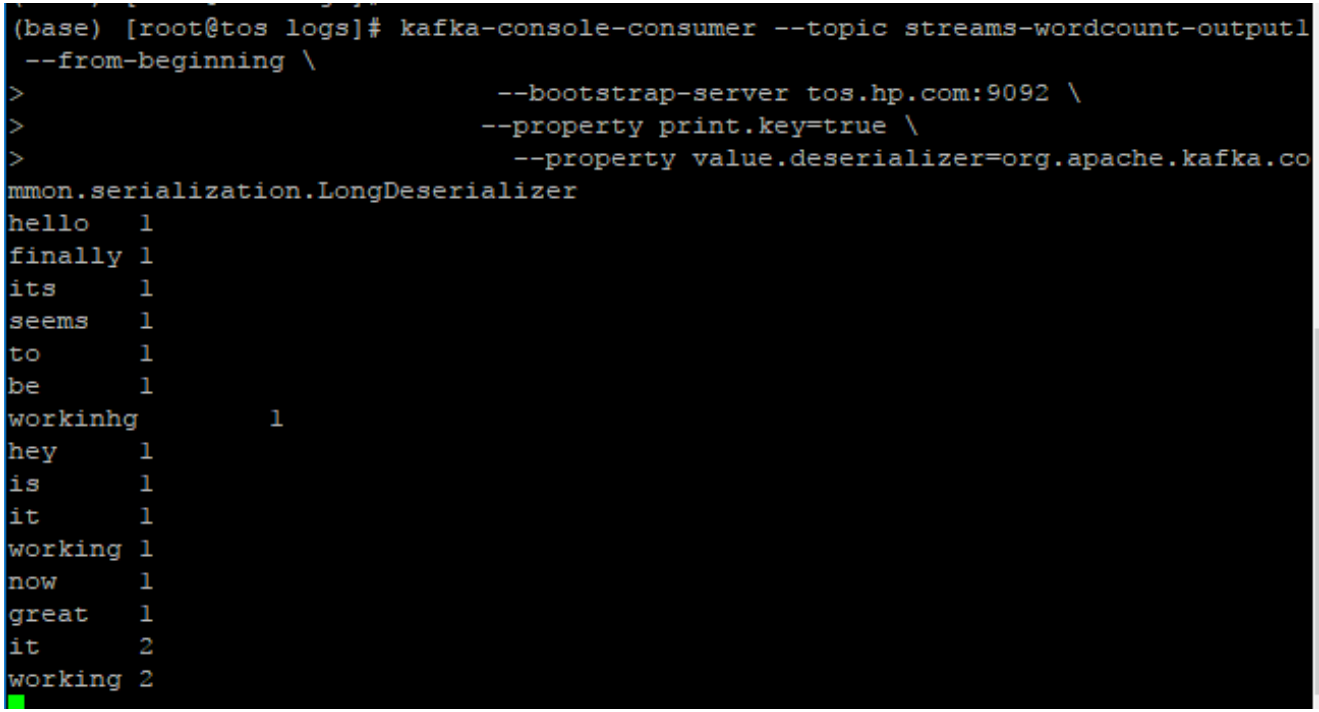
sh kafka-console-producer.sh --broker-list kafka0:9092 --topic streams-plaintext-input

```
(base) [root@tos ~]# kafka-console-producer --broker-list tos.hp.com:9092 --topi
c streams-plaintext-input1
>Hello
>finally its seems to be workinhg
>Hey
>is it working now
>Great It working
>
```

Inspect the resulting data in the output topic. * You should see output data similar to below. Please note that the exact output * sequence will depend on how fast you type the above sentences. If you type them
* slowly, you are likely to get each count update, e.g., kafka 1, kafka 2, kafka 3.
* If you type them quickly, you are likely to get fewer count updates, e.g., just kafka 3.
* This is because the commit interval is set to 10 seconds. Anything typed within
* that interval will be compacted in memory.

```
# sh kafka-console-consumer.sh  --topic streams-wordcount-output --from-beginning \
                    --bootstrap-server kafka0:9092 \
                   --property print.key=true \
```

--property
value.deserializer=org.apache.kafka.common.serialization.LongDeserializer



Once you're done with your experiments, you can stop this example via {@code Ctrl-C}.

---------- Lab Ends Here ----------

11. DSL: stateful transformations – reduce – 45 Minutes

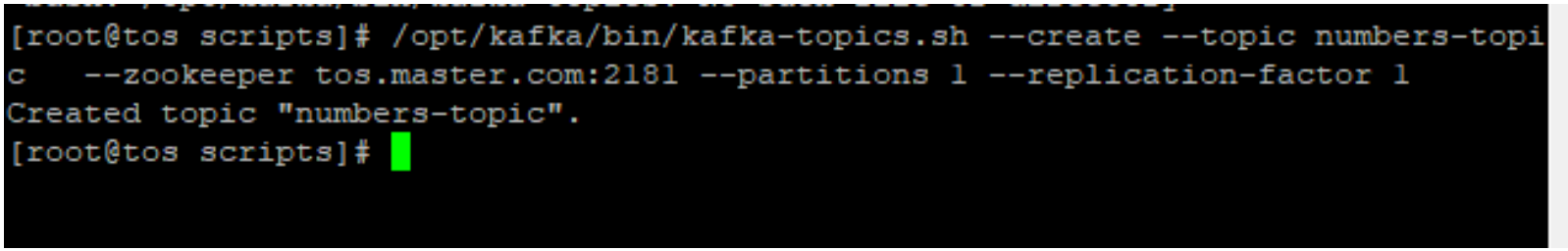
Demonstrate the following APIs:

- Ktable
- Filter
- selectKey
- Aggregration: GroupBy & reduce

Demonstrates how to use `reduce` to sum numbers.

Note: Use Full path with .sh extension for Kafka broker else the commands are for confluent kafka. Replace the hostname accordingly.

#kafka-topics.sh --create --topic numbers-topic --bootstrap-server kafka0:9092 --partitions 1 --replication-factor 1



#kafka-topics.sh --create --topic sum-of-odd-numbers-topic --bootstrap-server kafka0:9092 --partitions 1 --replication-factor 1

```
[root@tos scripts]# /opt/kafka/bin/kafka-topics.sh --create --topic sum-of-odd-n
umbers-topic  --zookeeper tos.master.com:2181 --partitions 1 --replication-facto
r 1
Created topic "sum-of-odd-numbers-topic".
[root@tos scripts]#
```

On Confluent Kafka Only:

```
zookeeper is [UP]
(base) [root@tos apps]# kafka-topics --create --topic numbers-topic   --zookeepe
r tos.hp.com:2181 --partitions 1 --replication-factor 1
Created topic numbers-topic.
(base) [root@tos apps]# kafka-topics --create --topic sum-of-odd-numbers-topic
--zookeeper tos.hp.com:2181 --partitions 1 --replication-factor 1
Created topic sum-of-odd-numbers-topic.
```

We will create two java classes in this lab. You can use the transform-stream maven project in this lab.

Create a java class, SumLambdaExample and replace the code which is provided below. It Perform the transformation.

// Code Begins Here.

```
package com.tos.stream.dsl;

import java.util.Properties;

import org.apache.kafka.clients.consumer.ConsumerConfig;
import org.apache.kafka.common.serialization.Serdes;
import org.apache.kafka.streams.KafkaStreams;
import org.apache.kafka.streams.StreamsBuilder;
import org.apache.kafka.streams.StreamsConfig;
import org.apache.kafka.streams.Topology;
import org.apache.kafka.streams.kstream.KStream;
import org.apache.kafka.streams.kstream.KTable;

public class SumLambdaExample {

	static final String SUM_OF_ODD_NUMBERS_TOPIC = "sum-of-odd-numbers-
topic";
	static final String NUMBERS_TOPIC = "numbers-topic";
```

```
      public static void main(final String[] args) {
        final String bootstrapServers = args.length > 0 ? args[0] :
"kafka0:8082";
        final Properties streamsConfiguration = new Properties();
        streamsConfiguration.put(StreamsConfig.APPLICATION_ID_CONFIG,
"sum-lambda-example");
        streamsConfiguration.put(StreamsConfig.CLIENT_ID_CONFIG, "sum-
lambda-example-client");
        streamsConfiguration.put(StreamsConfig.BOOTSTRAP_SERVERS_CONFIG,
bootstrapServers);

streamsConfiguration.put(StreamsConfig.DEFAULT_KEY_SERDE_CLASS_CONFIG,
Serdes.Integer().getClass().getName());

streamsConfiguration.put(StreamsConfig.DEFAULT_VALUE_SERDE_CLASS_CONFIG,
Serdes.Integer().getClass().getName());
        streamsConfiguration.put(ConsumerConfig.AUTO_OFFSET_RESET_CONFIG,
"earliest");
        streamsConfiguration.put(StreamsConfig.STATE_DIR_CONFIG,
"\\tmp\\kafka-streams");
        // Records should be flushed every 10 seconds. This is less than
the default
        // in order to keep this example interactive.
```

```
        streamsConfiguration.put(StreamsConfig.COMMIT_INTERVAL_MS_CONFIG,
10 * 1000);

        final Topology topology = getTopology();
        final KafkaStreams streams = new KafkaStreams(topology,
streamsConfiguration);
        // Always (and unconditionally) clean local state prior to
starting the processing topology.
        // We opt for this unconditional call here because this will make
it easier for you to play around with the example
        // when resetting the application for doing a re-run (via the
Application Reset Tool,
        // http://docs.confluent.io/current/streams/developer-
guide.html#application-reset-tool).
        //
        // The drawback of cleaning up local state prior is that your app
must rebuilt its local state from scratch, which
        // will take time and will require reading all the state-relevant
data from the Kafka cluster over the network.
        streams.cleanUp();
        streams.start();

        // Add shutdown hook to respond to SIGTERM and gracefully close
Kafka Streams
```

```
        Runtime.getRuntime().addShutdownHook(new Thread(streams::close));
      }

      static Topology getTopology() {
        final StreamsBuilder builder = new StreamsBuilder();
        // We assume the input topic contains records where the values
are Integers.
        // We don't really care about the keys of the input records;  for
simplicity, we assume them
        // to be Integers, too, because we will re-key the stream later
on, and the new key will be
        // of type Integer.
        final KStream<Integer, Integer> input =
builder.stream(NUMBERS_TOPIC);

        final KTable<Integer, Integer> sumOfOddNumbers = input
          // We are only interested in odd numbers.
          .filter((k, v) -> v % 2 != 0)
          // We want to compute the total sum across ALL numbers, so we
must re-key all records to the
          // same key.  This re-keying is required because in Kafka
Streams a data record is always a
          // key-value pair, and KStream aggregations such as `reduce`
operate on a per-key basis.
```

```
          // The actual new key (here: `1`) we pick here doesn't matter
as long it is the same across
          // all records.
          .selectKey((k, v) -> 1)
          // no need to specify explicit serdes because the resulting key
and value types match our default serde settings
          .groupByKey()
          // Add the numbers to compute the sum.
          .reduce((v1, v2) -> v1 + v2);

        sumOfOddNumbers.toStream().to(SUM_OF_ODD_NUMBERS_TOPIC);

        return builder.build();
      }

    }
// Code Ends Here.
```

Create another class file: SumLambdaExampleDriver.
It will Produce message for the input topic and consume the transform message from the Output topic.

// Code Begins Here.

```
package com.tos.stream.dsl;

import java.time.Duration;
import java.util.ArrayList;
import java.util.Collections;
import java.util.List;
import java.util.Properties;
import java.util.stream.IntStream;

import org.apache.kafka.clients.consumer.ConsumerConfig;
import org.apache.kafka.clients.consumer.ConsumerRecord;
import org.apache.kafka.clients.consumer.ConsumerRecords;
import org.apache.kafka.clients.consumer.KafkaConsumer;
import org.apache.kafka.clients.producer.KafkaProducer;
import org.apache.kafka.clients.producer.ProducerConfig;
import org.apache.kafka.clients.producer.ProducerRecord;
import org.apache.kafka.common.serialization.IntegerDeserializer;
import org.apache.kafka.common.serialization.IntegerSerializer;

public class SumLambdaExampleDriver {
```

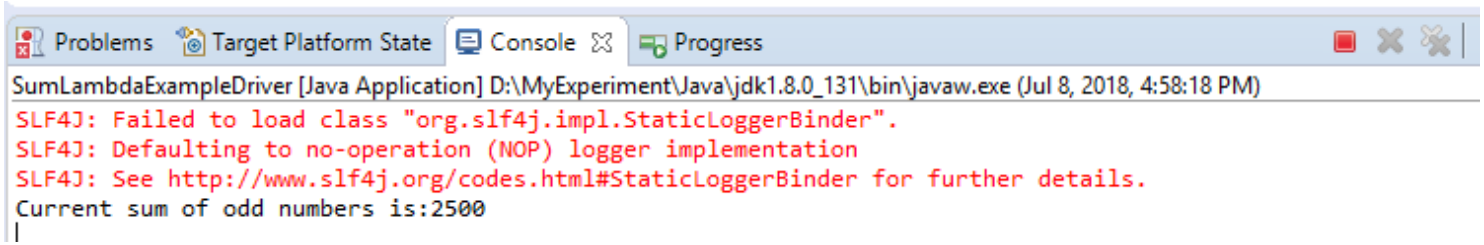
```
    public static void main(final String[] args) {
      final String bootstrapServers = args.length > 0 ? args[0] :
"kafka0:8082";
      produceInput(bootstrapServers);
      consumeOutput(bootstrapServers);
    }

    private static void consumeOutput(final String bootstrapServers) {
      final Properties properties = new Properties();
      properties.put(ConsumerConfig.BOOTSTRAP_SERVERS_CONFIG,
bootstrapServers);
      properties.put(ConsumerConfig.KEY_DESERIALIZER_CLASS_CONFIG,
IntegerDeserializer.class);
      properties.put(ConsumerConfig.VALUE_DESERIALIZER_CLASS_CONFIG,
IntegerDeserializer.class);
      properties.put(ConsumerConfig.GROUP_ID_CONFIG, "sum-lambda-
example-consumer");
      properties.put(ConsumerConfig.AUTO_OFFSET_RESET_CONFIG,
"earliest");
      final KafkaConsumer<Integer, Integer> consumer = new
KafkaConsumer<>(properties);
```

```
consumer.subscribe(Collections.singleton(SumLambdaExample.SUM_OF_ODD_NUMB
ERS_TOPIC));
        while (true) {
          final ConsumerRecords<Integer, Integer> records =
                  consumer.poll(Duration.ofMillis(Long.MAX_VALUE));

          for (final ConsumerRecord<Integer, Integer> record : records) {
            System.out.println("Current sum of odd numbers is:" +
record.value());
          }
        }
      }

      private static void produceInput(final String bootstrapServers) {
        final Properties props = new Properties();
        props.put(ProducerConfig.BOOTSTRAP_SERVERS_CONFIG,
bootstrapServers);
        props.put(ProducerConfig.KEY_SERIALIZER_CLASS_CONFIG,
IntegerSerializer.class);
        props.put(ProducerConfig.VALUE_SERIALIZER_CLASS_CONFIG,
IntegerSerializer.class);
```

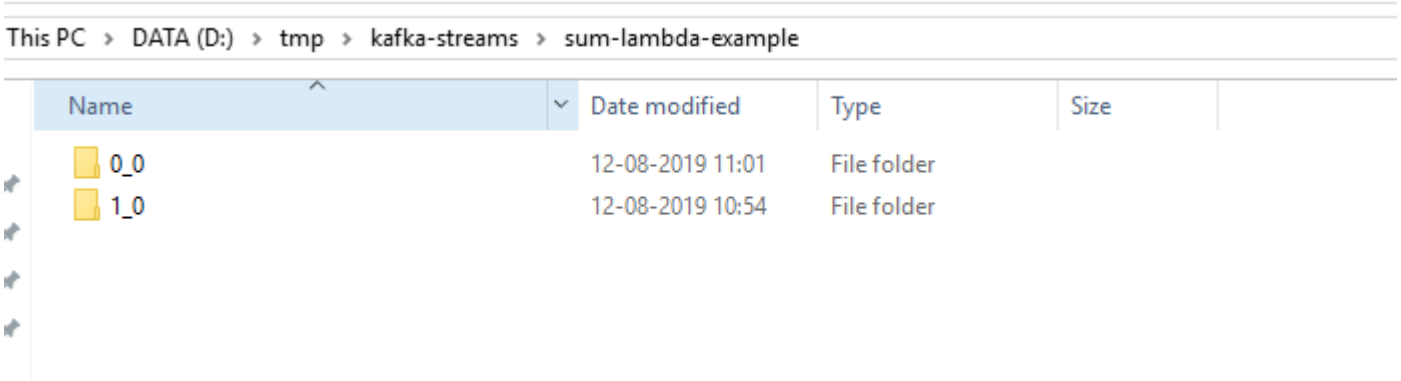
```
        final KafkaProducer<Integer, Integer> producer = new
KafkaProducer<>(props);

        List noList = new ArrayList();
        IntStream.range(0, 100)
                .mapToObj(val -> new
ProducerRecord<>(SumLambdaExample.NUMBERS_TOPIC, val, val))
                .forEach(producer::send);

        producer.flush();
      }


    }
// Code Ends Here.
```

Execute the following sequentially.

SumLambdaExample → It will listen to the input topic and perform the transformation and insert the output to the destination topic.
SumLambdaExampleDriver → It will generate message and sent messages to the i/p topic and consume from the o/p topic and display to the console.



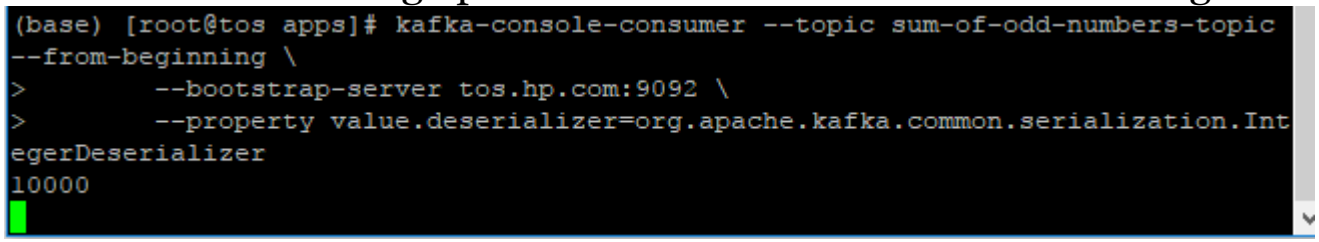
If you get error while running subsequently. Clear the following folder manually.



This is where the message is store for state full calculation of the message .i.e sum.

Inspect the resulting data in the output topics,

```
#kafka-console-consumer --topic sum-of-odd-numbers-topic --from-beginning \
      --bootstrap-server localhost:8082 \
      --property
value.deserializer=org.apache.kafka.common.serialization.IntegerDeserializer
```



--------- Labs End Here ----------

12. Running your first Kafka Streams Application: WordCount – 60 minutes

This lab will demonstrate how to run a streaming application coded using stream api library.

Create a java class – WordCountApplication.java

Import the following packages and classes.

```
import org.apache.kafka.clients.consumer.ConsumerConfig;
import org.apache.kafka.common.serialization.Serdes;
import org.apache.kafka.streams.KafkaStreams;
import org.apache.kafka.streams.StreamsBuilder;
import org.apache.kafka.streams.StreamsConfig;
import org.apache.kafka.streams.kstream.KStream;
import org.apache.kafka.streams.kstream.KTable;
import org.apache.kafka.streams.kstream.Produced;

import java.io.FileInputStream;
import java.io.IOException;
```

```
import java.util.Arrays;
import java.util.Locale;
import java.util.Properties;
import java.util.concurrent.CountDownLatch;
```

It configures the parameter required to connect to the kafka broker.

```
public static final String INPUT_TOPIC = "streams-plaintext-input";
    public static final String OUTPUT_TOPIC = "streams-wordcount-
output";

    static Properties getStreamsConfig(final String[] args) throws
IOException {
        final Properties props = new Properties();
        if (args != null && args.length > 0) {
            try (final FileInputStream fis = new
FileInputStream(args[0])) {
                props.load(fis);
            }
            if (args.length > 1) {
                System.out.println("Warning: Some command line
arguments were ignored. This demo only accepts an optional
```

```
configuration file.");
                }
        }
        props.putIfAbsent(StreamsConfig.APPLICATION_ID_CONFIG,
"streams-wordcount");
        props.putIfAbsent(StreamsConfig.BOOTSTRAP_SERVERS_CONFIG,
"localhost:8082");

props.putIfAbsent(StreamsConfig.CACHE_MAX_BYTES_BUFFERING_CONFIG,
0);

props.putIfAbsent(StreamsConfig.DEFAULT_KEY_SERDE_CLASS_CONFIG,
Serdes.String().getClass().getName());

props.putIfAbsent(StreamsConfig.DEFAULT_VALUE_SERDE_CLASS_CONFIG,
Serdes.String().getClass().getName());

props.putIfAbsent(ConsumerConfig.AUTO_OFFSET_RESET_CONFIG,
"earliest");
        return props;
    }
```

Next code creates an instance of stream and perform the transformation.

```
static void createWordCountStream(final StreamsBuilder builder) {
        final KStream<String, String> source =
builder.stream(INPUT_TOPIC);

        final KTable<String, Long> counts = source.peek( (k,v) ->
System.out.println("Value" + v))
            .flatMapValues(value ->
Arrays.asList(value.toLowerCase(Locale.getDefault()).split("\\W+"))
)
            .groupBy((key, value) -> value)
            .count();

        // need to override value serde to Long type
        counts.toStream().to(OUTPUT_TOPIC,
Produced.with(Serdes.String(), Serdes.Long()));
    }
```

It implements the WordCount algorithm, which computes a word occurrence histogram from the input text. However, unlike other WordCount examples you might have seen before that operate on bounded data, the WordCount demo application behaves slightly differently because it is designed to operate on an **infinite, unbounded stream** of data. Similar to the bounded variant, it is a stateful algorithm that tracks and updates the counts of words. However, since it must assume potentially unbounded input data, it will

periodically output its current state and results while continuing to process more data because it cannot know when it has processed "all" the input data.

Update the following code in the main method().

```
final Properties props = getStreamsConfig(args);

        final StreamsBuilder builder = new StreamsBuilder();
        createWordCountStream(builder);
        final KafkaStreams streams = new
KafkaStreams(builder.build(), props);
        final CountDownLatch latch = new CountDownLatch(1);

        // attach shutdown handler to catch control-c
        Runtime.getRuntime().addShutdownHook(new Thread("streams-
wordcount-shutdown-hook") {
            @Override
            public void run() {
                streams.close();
                latch.countDown();
            }
        });

        try {
```

```
            streams.start();
            latch.await();
        } catch (final Throwable e) {
            System.exit(1);
        }
        System.exit(0);
```

At the end, you should have the following code structure:

```
public class WordCountDemo {

    public static final String INPUT_TOPIC = "streams-plaintext-input";
    public static final String OUTPUT_TOPIC = "streams-wordcount-output";

    static Properties getStreamsConfig(final String[] args) throws IOException {
        final Properties props = new Properties();
        if (args != null && args.length > 0) {
            try (final FileInputStream fis = new FileInputStream(args[0])) {
                props.load(fis);
            }
            if (args.length > 1) {
                System.out.println("Warning: Some command line arguments were ignored. This demo only accep
            }
        }
        props.putIfAbsent(StreamsConfig.APPLICATION_ID_CONFIG, "streams-wordcount");
        props.putIfAbsent(StreamsConfig.BOOTSTRAP_SERVERS_CONFIG, "localhost:8082");
        props.putIfAbsent(StreamsConfig.CACHE_MAX_BYTES_BUFFERING_CONFIG, 0);
        props.putIfAbsent(StreamsConfig.DEFAULT_KEY_SERDE_CLASS_CONFIG,
                Serdes.String().getClass().getName());
        props.putIfAbsent(StreamsConfig.DEFAULT_VALUE_SERDE_CLASS_CONFIG,
                Serdes.String().getClass().getName());

        // setting offset reset to earliest so that we can re-run the demo code with the same pre-loaded da
        // Note: To re-run the demo, you need to use the offset reset tool:
        // https://cwiki.apache.org/confluence/display/KAFKA/Kafka+Streams+Application+Reset+Tool
        props.putIfAbsent(ConsumerConfig.AUTO_OFFSET_RESET_CONFIG, "earliest");
        return props;
```

```
static void createWordCountStream(final StreamsBuilder builder) {
    final KStream<String, String> source = builder.stream(INPUT_TOPIC);

    final KTable<String, Long> counts = source.peek( (k,v) -> System.out.println("Value" + v))
        .flatMapValues(value -> Arrays.asList(value.toLowerCase(Locale.getDefault()).split("\\W+")))
        .groupBy((key, value) -> value)
        .count();

    // need to override value serde to Long type
    counts.toStream().to(OUTPUT_TOPIC, Produced.with(Serdes.String(), Serdes.Long()));
}

public static void main(final String[] args) throws IOException {
    final Properties props = getStreamsConfig(args);

    final StreamsBuilder builder = new StreamsBuilder();
    createWordCountStream(builder);
    final KafkaStreams streams = new KafkaStreams(builder.build(), props);
    final CountDownLatch latch = new CountDownLatch(1);

    // attach shutdown handler to catch control-c
    Runtime.getRuntime().addShutdownHook(new Thread("streams-wordcount-shutdown-hook") {
        @Override
        public void run() {
            streams.close();
            latch.countDown();
        }
```

```
        try {
            streams.start();
            latch.await();
        } catch (final Throwable e) {
            System.exit(1);
        }
        System.exit(0);
    }
```

Prepare input topic and start Kafka producer

Next, we create the input topic named streams-plaintext-input and the output topic named streams-wordcount-output:

```
# /opt/kafka/bin/kafka-topics.sh --create \
  --bootstrap-server localhost:9092 \
  --replication-factor 1 \
  --partitions 1 \
  --topic streams-plaintext-input
```

Note: we create the output topic with compaction enabled because the output stream is a changelog stream.

```
# /opt/kafka/bin/kafka-topics.sh --create \
   --bootstrap-server localhost:9092 \
   --replication-factor 1 \
   --partitions 1 \
   --topic streams-wordcount-output \
   --config cleanup.policy=compact
```

The created topic can be described with the same kafka-topics tool:
#/opt/kafka/bin/kafka-topics.sh --bootstrap-server localhost:9092 --describe

```
        Topic: my-failsafe-topic        Partition: 12   Leader: 0       Replicas: 2,0,1 Isr: 0
Topic: streams-plaintext-input  TopicId: hG4VK81QRROfD7I4Jp9TdQ PartitionCount: 1       ReplicationFactor: 1       Configs: segment.bytes=1073741824
        Topic: streams-plaintext-input  Partition: 0    Leader: 0       Replicas: 0     Isr: 0
Topic: test     TopicId: Kp4hHo8fTR-YAlyg-MgPuQ PartitionCount: 1       ReplicationFactor: 1    Configs: segment.bytes=1073741824
        Topic: test     Partition: 0    Leader: 0       Replicas: 0     Isr: 0
Topic: my-kafka-topic   TopicId: sgEalbYqSkq1wC-aTNtNpQ PartitionCount: 13      ReplicationFactor: 3       Configs: segment.bytes=1073741824
        Topic: my-kafka-topic   Partition: 0    Leader: 0       Replicas: 0,1,2 Isr: 0
        Topic: my-kafka-topic   Partition: 1    Leader: 0       Replicas: 1,2,0 Isr: 0
```

Start the Wordcount Application.

The demo application will read from the input topic **streams-plaintext-input**, perform the computations of the WordCount algorithm on each of the read messages, and continuously write its current results to the output topic **streams-wordcount-output**. Hence there won't be any STDOUT output except log entries as the results are written back into in Kafka.

Now we can start the console producer in a separate terminal to write some input data to this topic:

```
#/opt/kafka/bin/kafka-console-producer.sh --bootstrap-server
localhost:9092 --topic streams-plaintext-input
```

and inspect the output of the WordCount demo application by reading from its output topic with the console consumer in a separate terminal:

```
> /opt/kafka/bin/kafka-console-consumer.sh --bootstrap-server
localhost:9092 \
    --topic streams-wordcount-output \
    --from-beginning \
    --formatter kafka.tools.DefaultMessageFormatter \
    --property print.key=true \
    --property print.value=true \
    --property
key.deserializer=org.apache.kafka.common.serialization.StringDeserializer
\
    --property
value.deserializer=org.apache.kafka.common.serialization.LongDeserializer
```

Process some data

Now let's write some message with the console producer into the input topic **streams-plaintext-input** by entering a single line of text and then hit <RETURN>. This will send a new message to the input topic, where the message key is null and the message value is the

string encoded text line that you just entered (in practice, input data for applications will typically be streaming continuously into Kafka, rather than being manually entered):

```
all streams lead to kafka
```

```
[root@kafka0 /]#
[root@kafka0 /]# /opt/kafka/bin/kafka-console-producer.sh --bootstrap-server localhost:9092 --topic streams-plaintext-input
>all streams lead to kafka
>
```

This message will be processed by the Wordcount application and the following output data will be written to the **streams-wordcount-output** topic and printed by the console consumer:

```
[root@kafka0 /]# /opt/kafka/bin/kafka-console-consumer.sh --bootstrap-server localhost:9092 \
>     --topic streams-wordcount-output \
>     --from-beginning \
>     --formatter kafka.tools.DefaultMessageFormatter \
>     --property print.key=true \
>     --property print.value=true \
>     --property key.deserializer=org.apache.kafka.common.serialization.StringDeserializer \
>     --property value.deserializer=org.apache.kafka.common.serialization.LongDeserializer

all     1
streams 1
lead    1
to      1
kafka   1
```

Here, the first column is the Kafka message key in java.lang.String format and represents a word that is being counted, and the second column is the message value in java.lang.Longformat, representing the word's latest count.

Now let's continue writing one more message with the console producer into the input topic **streams-plaintext-input**. Enter the text line "hello kafka streams" and hit <RETURN>. Your terminal should look as follows:

```
[root@kafka0 /]# /opt/kafka/bin/kafka-console-producer.sh --bootstrap-server localhost:9092 --topic streams-plaintext-input
>all streams lead to kafka
>hello kafka streams
>
```

In your other terminal in which the console consumer is running, you will observe that the WordCount application wrote new output data:

Here the last printed lines kafka 2 and streams 2 indicate updates to the keys kafka and streams whose counts have been incremented from 1 to 2. Whenever you write further input messages to the input topic, you will observe new messages being added to the streams-wordcount-output topic, representing the most recent word counts as computed by the WordCount application. Let's enter one final input text line "join kafka

training" and hit <RETURN> in the console producer to the input topic streams-plaintext-input before we wrap up this quickstart:

```
[root@kafka0 /]# /opt/kafka/bin/kafka-console-producer.sh --bootstrap-server localhost:9092 --topic streams-plaintext-input
>all streams lead to kafka
>hello kafka streams
>join kafka training
>
```

The streams-wordcount-output topic will subsequently show the corresponding updated word counts (see last three lines):

```
[root@kafka0 /]# /opt/kafka/bin/kafka-console-consumer.sh --bootstrap-server localhost:9092 \
>     --topic streams-wordcount-output \
>     --from-beginning \
>     --formatter kafka.tools.DefaultMessageFormatter \
>     --property print.key=true \
>     --property print.value=true \
>     --property key.deserializer=org.apache.kafka.common.serialization.StringDeserializer \
>     --property value.deserializer=org.apache.kafka.common.serialization.LongDeserializer

all     1
streams 1
lead    1
to      1
kafka   1
hello   1
kafka   2
streams 2
join    1
kafka   3
training        1
```

As one can see, outputs of the Wordcount application is actually a continuous stream of updates, where each output record (i.e. each line in the original output above) is an updated count of a single word, aka record key such as "kafka". For multiple records with the same key, each later record is an update of the previous one.

You can now stop the console consumer, the console producer, the Wordcount application, the Kafka broker and the ZooKeeper server in order via **Ctrl-C**

https://kafka.apache.org/31/documentation/streams/quickstart

----------Lab Ends Here ----------

13. Stream – DSL and Windows – 45 Minutes

The following features will be demonstrated:

- Window - Tumbling
- Reduce and Filter

Demonstrates, using the high-level KStream DSL, how to implement an IoT demo application which ingests temperature value processing the maximum value in the latest TEMPERATURE_WINDOW_SIZE seconds (which * is 5 seconds) sending a new message if it exceeds the TEMPERATURE_THRESHOLD (which is 20)

In this example, the input stream reads from a topic named "iot-temperature", where the values of messages represent temperature values; using a TEMPERATURE_WINDOW_SIZE seconds "tumbling" window, the maximum value is processed and sent to a topic named "iot-temperature-max" if it exceeds the TEMPERATURE_THRESHOLD.

You can use any of the Project you have created earlier.

Create a java class TemperatureDemo.java in package: `com.ostech.windows`.

Type the following logic in the class file.

```java
package com.ostech.windows;

import java.time.Duration;
import java.util.Properties;
import java.util.concurrent.CountDownLatch;

import org.apache.kafka.clients.consumer.ConsumerConfig;
import org.apache.kafka.common.serialization.Serde;
import org.apache.kafka.common.serialization.Serdes;
import org.apache.kafka.streams.KafkaStreams;
import org.apache.kafka.streams.StreamsBuilder;
import org.apache.kafka.streams.StreamsConfig;
import org.apache.kafka.streams.kstream.KStream;
import org.apache.kafka.streams.kstream.Produced;
import org.apache.kafka.streams.kstream.TimeWindows;
import org.apache.kafka.streams.kstream.Windowed;
import org.apache.kafka.streams.kstream.WindowedSerdes;
public class TemperatureDemo {

    // threshold used for filtering max temperature values
    private static final int TEMPERATURE_THRESHOLD = 20;
    // window size within which the filtering is applied
    private static final int TEMPERATURE_WINDOW_SIZE = 5;

    public static void main(String[] args) {
```

```
        Properties props = new Properties();
        props.put(StreamsConfig.APPLICATION_ID_CONFIG, "streams-
temperature");
        props.put(StreamsConfig.BOOTSTRAP_SERVERS_CONFIG,
"localhost:8082");
        props.put(StreamsConfig.DEFAULT_KEY_SERDE_CLASS_CONFIG,
Serdes.String().getClass());
        props.put(StreamsConfig.DEFAULT_VALUE_SERDE_CLASS_CONFIG,
Serdes.String().getClass());

        props.put(ConsumerConfig.AUTO_OFFSET_RESET_CONFIG,
"earliest");
        props.put(StreamsConfig.CACHE_MAX_BYTES_BUFFERING_CONFIG,
0);

        StreamsBuilder builder = new StreamsBuilder();

        KStream<String,String> source = builder.stream("iot-
temperature");
     //  source.to("iot-temperature-max");
   // Define the Tumbling Windows:
        TimeWindows tumblingWindow =

    TimeWindows.ofSizeWithNoGrace(Duration.ofSeconds(TEMPERATURE_WI
```

```
NDOW_SIZE));
        final KStream<Windowed<String>, String> max = source
                // temperature values are sent without a key
(null), so in order
                // to group and reduce them, a key is needed
("temp" has been chosen)
                .selectKey((key, value) -> {
                  //System.out.print(">>>" + value);
                  return "temp";

                })
                .groupByKey()
                .windowedBy(tumblingWindow)
                .reduce((value1, value2) -> {
                    if (Integer.parseInt((String)value1) >
Integer.parseInt((String)value2)) {
                        return value1;
                    } else {
                        return value2;
                    }
                })
                .toStream()
                .filter((key, value) ->
Integer.parseInt((String)(value)) > TEMPERATURE_THRESHOLD);
```

```
        final Serde<Windowed<String>> windowedSerde  =
WindowedSerdes.timeWindowedSerdeFrom(String.class);

        // need to override key serde to Windowed type
        max.to("iot-temperature-max", Produced.with(windowedSerde,
Serdes.String()));

        final KafkaStreams streams = new
KafkaStreams(builder.build(), props);
        final CountDownLatch latch = new CountDownLatch(1);

        // attach shutdown handler to catch control-c
        Runtime.getRuntime().addShutdownHook(new Thread("streams-
temperature-shutdown-hook") {
            @Override
            public void run() {
                streams.close();
                latch.countDown();
            }
        });

        try {
            streams.start();
            latch.await();
```

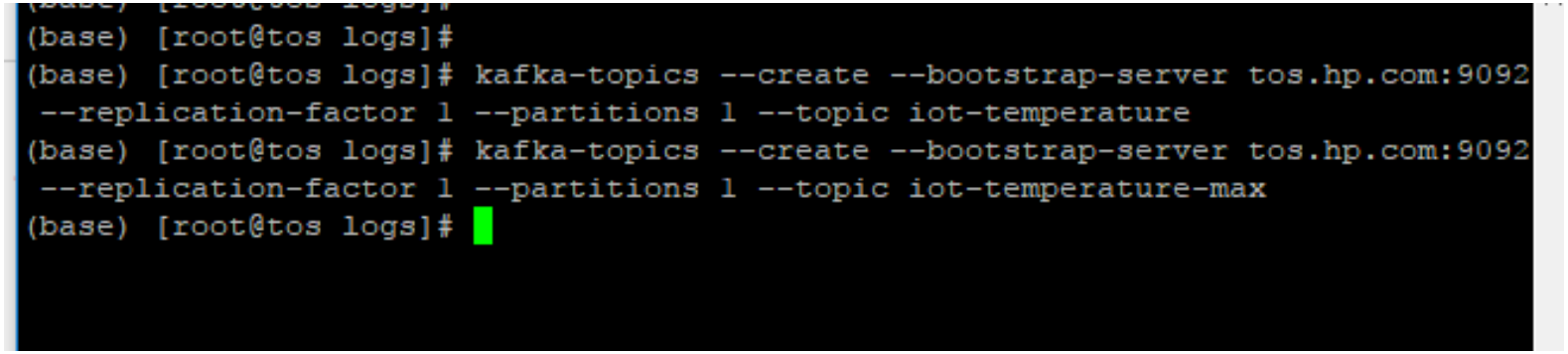
```
            } catch (Throwable e) {
                System.exit(1);
            }
            System.exit(0);
        }
}
```

Execution:
Before running this example, you must create the input topic for temperature values in Using the following command:

#kafka-topics.sh --create --bootstrap-server localhost:9092 --replication-factor 1 --partitions 1 --topic iot-temperature

And at same time create the output topic for filtered values:

#kafka-topics.sh --create --bootstrap-server localhost:9092 --replication-factor 1 --partitions 1 --topic iot-temperature-max



After that, a console consumer can be started in order to read filtered values from the "iot-temperature-max" topic:

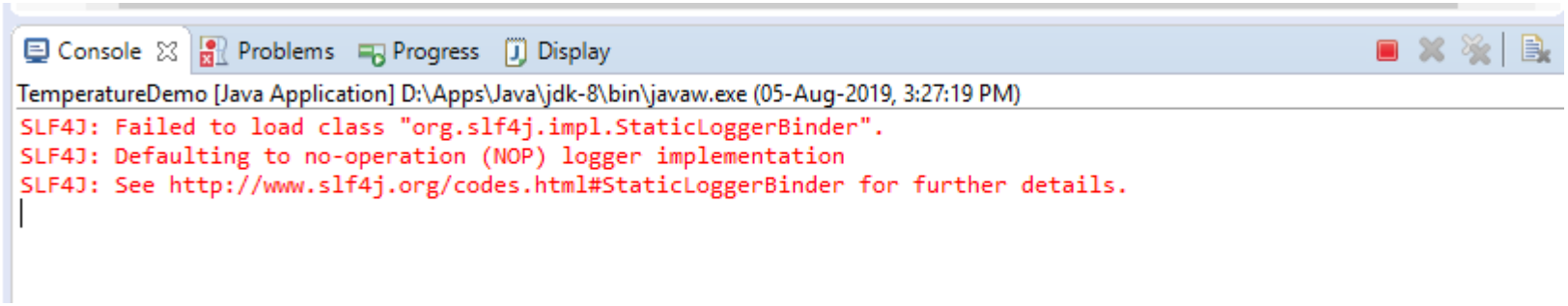
#kafka-console-consumer.sh --bootstrap-server localhost:9092 --topic iot-temperature-max --from-beginning

On the other side, a console producer can be used for sending temperature values (which needs to be integers) to "iot-temperature" typing them on the console :

#kafka-console-producer.sh --broker-list localhost:9092 --topic iot-temperature
> 10
> 15
> 22

```
-bash: kafka-console-producer.sh: command not found
(base) [root@tos ~]# kafka-console-producer --broker-list tos.hp.com:9092 --topi
c iot-temperature
>10
>15
>22
>35
```

Execute the java program.



You will observe the max temperature in the Consumer console.

```
(base) [root@tos logs]#  kafka-console-consumer --bootstrap-server tos.hp.com:90
92 --topic iot-temperature-max --from-beginning
22
35
```

---------- Lab Ends Here ----------

14. DSL - join a stream and a table together – 90 Minutes

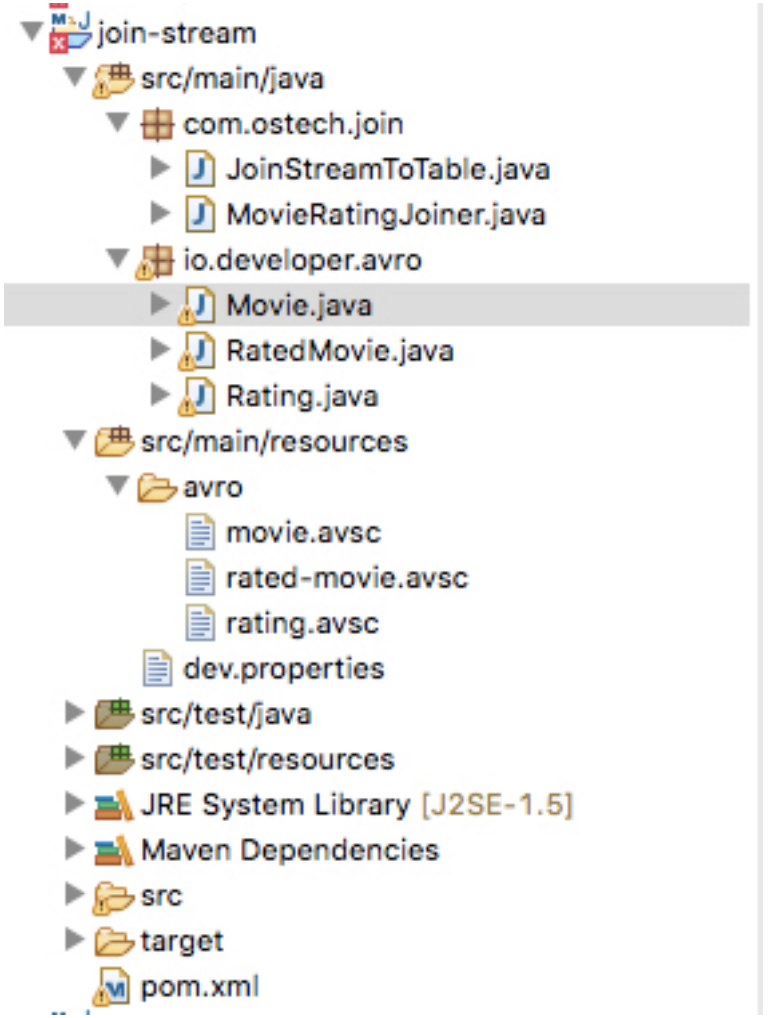
The following features will be demonstrated:
- Joining two streams.
- The ValueJoiner interface in the Streams API to combine two stream.

Scenario:
Suppose you have a set of movies that have been released and a stream of ratings from movie-goers about how entertaining they are.
In this tutorial, we'll write a program that joins each rating with content about the movie.

Input stream : Movies and Ratings
Join stream : Rating against each movie.

Initialize a maven project
com.ostech:join-stream

Update the pom.xml.
At the end, your project structure should be as shown below:



Create a development file at src/main/resources/devj.properties

```
application.id=joining-app
bootstrap.servers=localhost:9092
schema.registry.url=http://localhost:8081

movie.topic.name=movies
movie.topic.partitions=1
movie.topic.replication.factor=1

rekeyed.movie.topic.name=rekeyed-movies
rekeyed.movie.topic.partitions=1
rekeyed.movie.topic.replication.factor=1

rating.topic.name=ratings
rating.topic.partitions=1
rating.topic.replication.factor=1

rated.movies.topic.name=rated-movies
rated.movies.topic.partitions=1
rated.movies.topic.replication.factor=1
```

Create a schema for the events

This tutorial uses three streams: one called movies that holds movie reference data, one called ratings that holds a stream of inbound movie ratings, and one called rated-movies that holds the result of the join between ratings and movies. Let's create schemas for all three.
Create a directory for the schemas that represent the events in the stream:

Src/java/main/resources/avro

Then create the following Avro schema file at `src/main/resources/avro/movie.avsc` for the movies lookup table:

```
{
  "namespace": "io.developer.avro",
  "type": "record",
  "name": "Movie",
  "fields": [
    {"name": "id", "type": "long"},
    {"name": "title", "type": "string"},
    {"name": "release_year", "type": "int"}
  ]
}
```

Next, create another Avro schema file at `src/main/resources/avro/rating.avsc` for the stream of ratings:

```
{
  "namespace": "io.developer.avro",
  "type": "record",
  "name": "Rating",
  "fields": [
    {"name": "id", "type": "long"},
    {"name": "rating", "type": "double"}
  ]
}
```

And finally, create another Avro schema file at `src/main/resources/avro/rated-movie.avsc` for the result of the join:

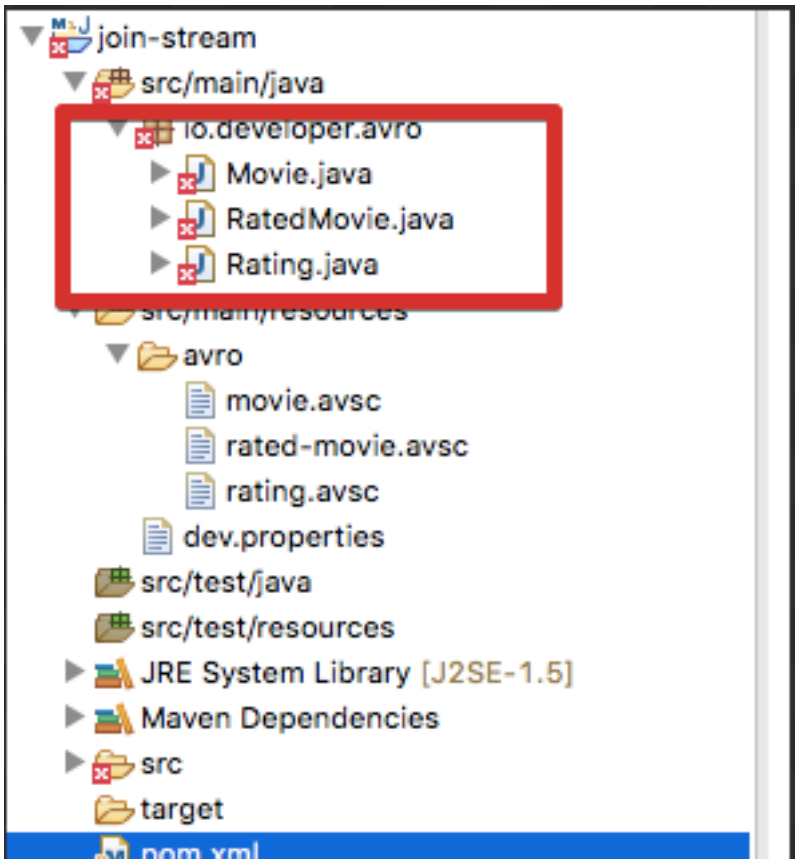
```
{
  "namespace": "io.developer.avro",
  "type": "record",
  "name": "RatedMovie",
  "fields": [
    {"name": "id", "type": "long"},
    {"name": "title", "type": "string"},
    {"name": "release_year", "type": "int"},
    {"name": "rating", "type": "double"}
  ]
}
```

Because we will use this Avro schema in our Java code, we'll need to compile it. The Gradle Maven plugin is a part of the build, so it will see your new Avro files, generate Java code for them, and compile those and all other Java sources. Run this command to get it all done:

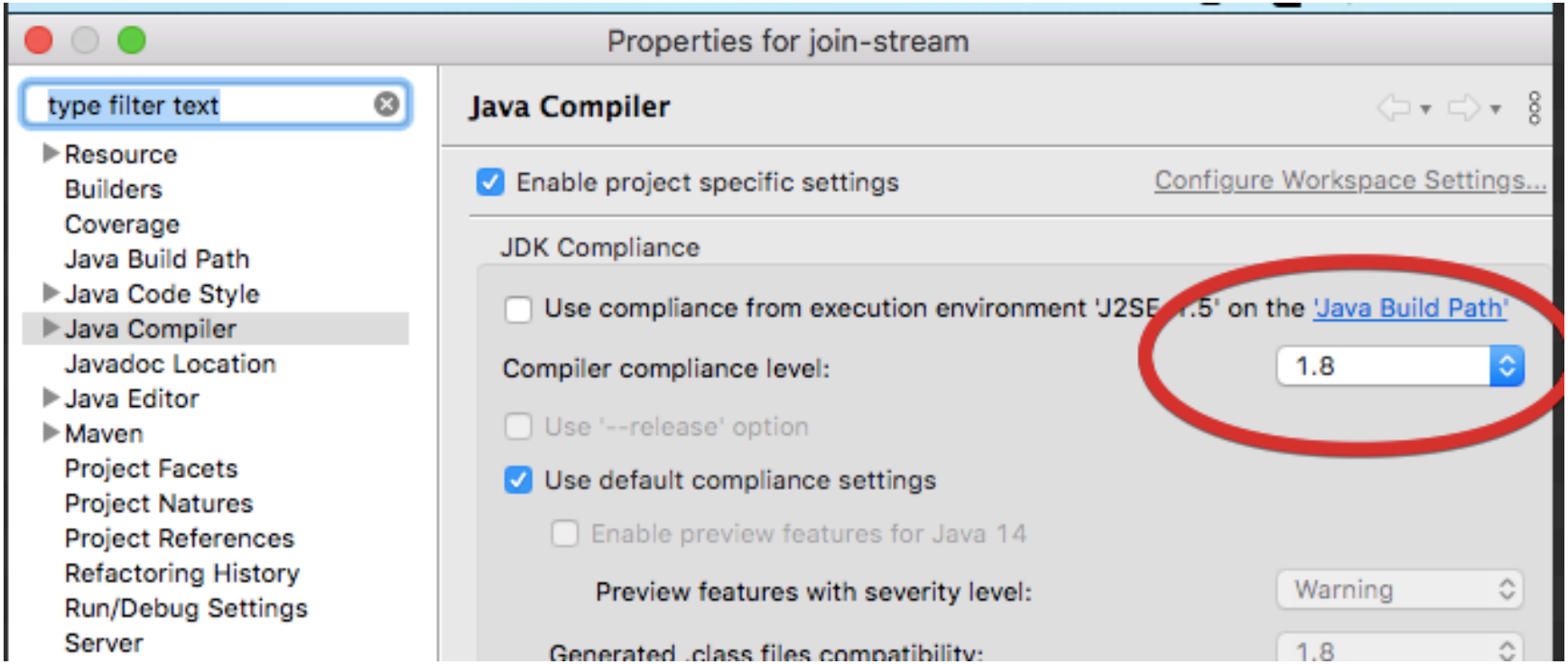
Ensure to include in the pom.xml (avsc paths)

```
105            <configuration>
106           <sourceDirectory>${project.basedir}/src/main/resources/</sourceDirectory>
107           <sourceDirectory>${project.basedir}/src/main/resources/avro</sourceDirectory>
108           <includes>
109             <include>input_movie_event.avsc</include>
110             <include>parsed_movies.avsc</include>
111             <include>Payment.avsc</include>
112             <include>*.avsc</include>
113           </includes>
114           <outputDirectory>${project.basedir}/src/main/java</outputDirectory>
115         </configuration>
116         </execution>
117       </executions>
```

mvn generated-sources



If you observe any compile error like above, ensure to convert the project into java 1.8 compiler compatible. (project name → Properties)


Properties for join-stream
type filter text
Resource
Builders
Coverage
Java Build Path
Java Code Style
Java Compiler
Javadoc Location
Java Editor
Maven
Project Facets
Project Natures
Project References
Refactoring History
Run/Debug Settings
Server
Java Compiler
Enable project specific settings
Configure Workspace Settings...
JDK Compliance
Use compliance from execution environment 'J2SE
.5' on the 'Java Build Path'
Compiler compliance level:
1.8
Use '--release' option
Use default compliance settings
Enable preview features for Java 14
Preview features with severity level:
Warning
Generated .class files compatibility:
1.8

Create the Kafka Streams topology.(Package Name/ Java Class)

com.ostech.join.stream/JoinStreamToTable.java

```
package com.ostech.join.stream;
```

Import the following packages and classes

```
import java.io.FileInputStream;
import java.io.IOException;
import java.util.ArrayList;
import java.util.HashMap;
import java.util.List;
import java.util.Map;
import java.util.Properties;
import java.util.concurrent.CountDownLatch;

import org.apache.kafka.clients.admin.AdminClient;
import org.apache.kafka.clients.admin.NewTopic;
import org.apache.kafka.common.serialization.Serdes;
import org.apache.kafka.streams.KafkaStreams;
import org.apache.kafka.streams.KeyValue;
import org.apache.kafka.streams.StreamsBuilder;
import org.apache.kafka.streams.StreamsConfig;
```

```
import org.apache.kafka.streams.Topology;
import org.apache.kafka.streams.kstream.KStream;
import org.apache.kafka.streams.kstream.KTable;
import org.apache.kafka.streams.kstream.Produced;

import io.confluent.kafka.serializers.AbstractKafkaAvroSerDeConfig;
import io.confluent.kafka.streams.serdes.avro.SpecificAvroSerde;
import io.developer.avro.Movie;
import io.developer.avro.RatedMovie;
import io.developer.avro.Rating;

public class JoinStreamToTable {

}
```

Define the method that initialize the properties for the Stream.

```
    /*
    *  Initialize the properties
    */
   public Properties buildStreamsProperties(Properties envProps) {
       Properties props = new Properties();

       props.put(StreamsConfig.APPLICATION_ID_CONFIG,
envProps.getProperty("application.id"));
       props.put(StreamsConfig.BOOTSTRAP_SERVERS_CONFIG,
```

```
envProps.getProperty("bootstrap.servers"));
        props.put(StreamsConfig.DEFAULT_KEY_SERDE_CLASS_CONFIG,
Serdes.String().getClass());
        props.put(StreamsConfig.DEFAULT_VALUE_SERDE_CLASS_CONFIG,
SpecificAvroSerde.class);

    props.put(AbstractKafkaAvroSerDeConfig.SCHEMA_REGISTRY_URL_CONF
IG, envProps.getProperty("schema.registry.url"));

        return props;
    }
```

Define the Stream Topology.

```
    public Topology buildTopology(Properties envProps) {
        final StreamsBuilder builder = new StreamsBuilder();
        final String movieTopic =
envProps.getProperty("movie.topic.name");
        final String rekeyedMovieTopic =
envProps.getProperty("rekeyed.movie.topic.name");
        final String ratingTopic =
envProps.getProperty("rating.topic.name");
        final String ratedMoviesTopic =
envProps.getProperty("rated.movies.topic.name");
```

```
        final MovieRatingJoiner joiner = new MovieRatingJoiner();

        KStream<String, Movie> movieStream = builder.<String,
Movie>stream(movieTopic)
                .map((key, movie) -> new
KeyValue<>(Long.valueOf(movie.getId()).toString(), movie));

        movieStream.to(rekeyedMovieTopic);

        KTable<String, Movie> movies =
builder.table(rekeyedMovieTopic);

        KStream<String, Rating> ratings = builder.<String,
Rating>stream(ratingTopic)
                .map((key, rating) -> new
KeyValue<>(Long.valueOf(rating.getId()).toString(), rating));

        KStream<String, RatedMovie> ratedMovie =
ratings.join(movies, joiner);

        // System.out.println(">>>"+ ratedMovie);
        ratedMovie.to(ratedMoviesTopic,
Produced.with(Serdes.String(), ratedMovieAvroSerde(envProps)));

        return builder.build();
```

```
    }
```

Initialize the AVRO schema for Rated Movie that Join Stream.

```
    private SpecificAvroSerde<RatedMovie>
ratedMovieAvroSerde(Properties envProps) {
        SpecificAvroSerde<RatedMovie> movieAvroSerde = new
SpecificAvroSerde<>();

        final HashMap<String, String> serdeConfig = new
HashMap<>();

    serdeConfig.put(AbstractKafkaAvroSerDeConfig.SCHEMA_REGISTRY_UR
L_CONFIG,
                envProps.getProperty("schema.registry.url"));

        movieAvroSerde.configure(serdeConfig, false);
        return movieAvroSerde;
    }
```

Method to create the required topics:

```
    public void createTopics(Properties envProps) {
        Map<String, Object> config = new HashMap<>();
        config.put("bootstrap.servers",
envProps.getProperty("bootstrap.servers"));
        AdminClient client = AdminClient.create(config);

        List<NewTopic> topics = new ArrayList<>();

        topics.add(new
NewTopic(envProps.getProperty("movie.topic.name"),

    Integer.parseInt(envProps.getProperty("movie.topic.partitions")
),

    Short.parseShort(envProps.getProperty("movie.topic.replication.
factor"))));

        topics.add(new
NewTopic(envProps.getProperty("rekeyed.movie.topic.name"),

    Integer.parseInt(envProps.getProperty("rekeyed.movie.topic.part
itions")),
```

```
    Short.parseShort(envProps.getProperty("rekeyed.movie.topic.repl
ication.factor"))));

        topics.add(new
NewTopic(envProps.getProperty("rating.topic.name"),

    Integer.parseInt(envProps.getProperty("rating.topic.partitions"
)),

    Short.parseShort(envProps.getProperty("rating.topic.replication
.factor"))));

        topics.add(new
NewTopic(envProps.getProperty("rated.movies.topic.name"),

    Integer.parseInt(envProps.getProperty("rated.movies.topic.parti
tions")),

    Short.parseShort(envProps.getProperty("rated.movies.topic.repli
cation.factor"))));

        client.createTopics(topics);
        client.close();
    }
```

Method to load the properties file.

```
    public Properties loadEnvProperties(String fileName) throws
IOException {
        Properties envProps = new Properties();
        FileInputStream input = new FileInputStream(fileName);
        envProps.load(input);
        input.close();

        return envProps;
    }
```

Main Method, that invoke the Stream Thread.

```
    public static void main(String[] args) throws Exception {

        String propFile = "/Users/henrypotsangbam/eclipse-
workspace/LearningKafka/join-
stream/src/main/resources/dev.properties";

        JoinStreamToTable ts = new JoinStreamToTable();
        Properties envProps = ts.loadEnvProperties(propFile);
        Properties streamProps =
ts.buildStreamsProperties(envProps);
        Topology topology = ts.buildTopology(envProps);
```

```
        ts.createTopics(envProps);

        final KafkaStreams streams = new KafkaStreams(topology,
streamProps);
        final CountDownLatch latch = new CountDownLatch(1);

        // Attach shutdown handler to catch Control-C.
        Runtime.getRuntime().addShutdownHook(new Thread("streams-
shutdown-hook1") {

            @Override
            public void run() {
                streams.close();
                latch.countDown();
            }
        });

        try {
            streams.start();
            latch.await();
        } catch (Throwable e) {
            System.exit(1);
        }
```

```
            System.exit(0);

        }
}
```

The first thing the method does is create an instance of StreamsBuilder, which is the helper object that lets us build our topology. With our builder in hand, there are three things we need to do.

First, we call the stream() method to create a KStream<String, Movie> object. The problem is that we can't make any assumptions about the key of this stream, so we have to repartition it explicitly. We use the map() method for that, creating a new KeyValue instance for each record, using the movie ID as the new key.

The movies start their life in a stream, but fundamentally, movies are entities that belong in a table. To turn them into a table, we first emit the rekeyed stream to a Kafka topic using the to() method. We can then use the builder.table() method to create a KTable<String,Movie>. We have successfully turned a topic full of movie entities into a scalable, key-addressable table of Movie objects. With that, we're ready to move on to ratings.

Creating the KStream<String,Rating> of ratings looks just like our first step with the movies: we create a stream from the topic, then repartition it with the map() method. Note that we must choose the same key—movie ID—for our join to work.

With the ratings stream and the movie table in hand, all that remains is to join them using the join() method. It's a wonderfully simply one-liner, but we have concealed a bit of complexity in the form of the MovieRatingJoiner class.

Implement a ValueJoiner class

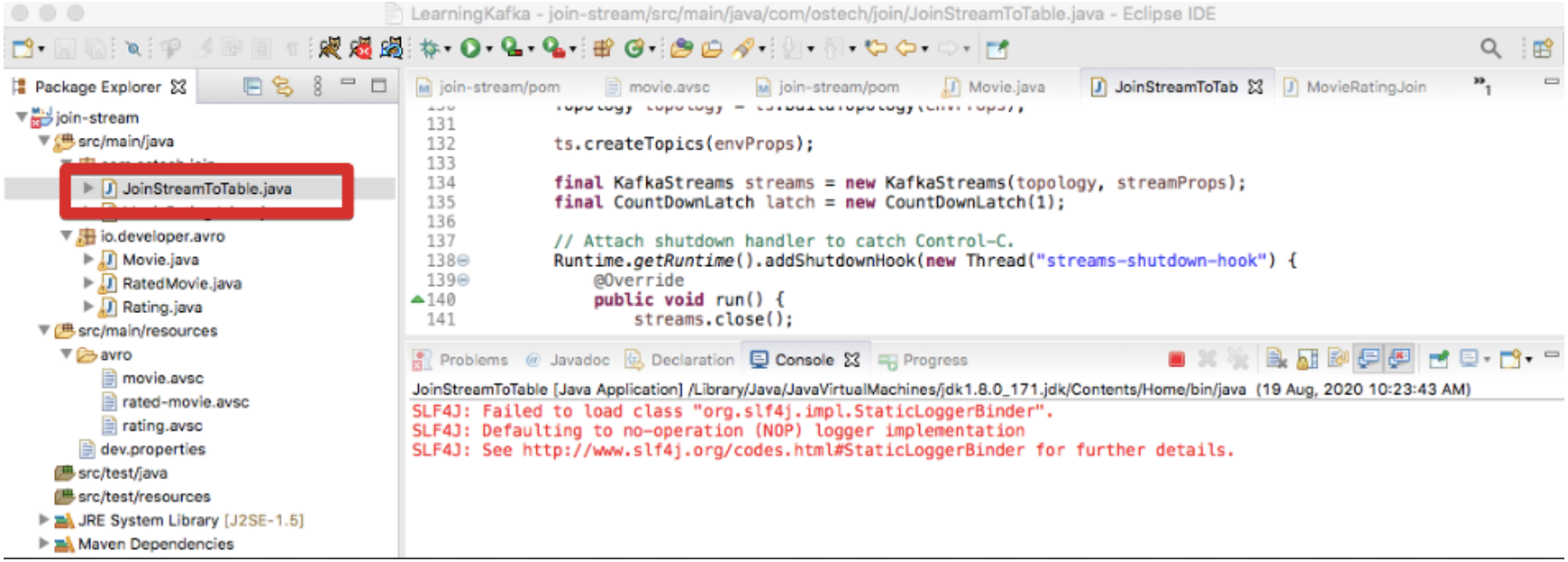
For the ValueJoiner class, create the following file MovieRatingJoiner.java

```
package com.ostech.join.stream;

import org.apache.kafka.streams.kstream.ValueJoiner;

import io.developer.avro.Movie;
import io.developer.avro.RatedMovie;
import io.developer.avro.Rating;

public class MovieRatingJoiner implements ValueJoiner<Rating,
Movie, RatedMovie> {
    public RatedMovie apply(Rating rating, Movie movie) {
        return RatedMovie.newBuilder()
                .setId(movie.getId())
                .setTitle(movie.getTitle())
                .setReleaseYear(movie.getReleaseYear())
                .setRating(rating.getRating())
                .build();
    }
}
```

When you join two tables in a relational database, by default you get a new table containing all of the columns of the left table plus all of the columns of the right table. When you join a stream and a table, you get a new stream, but you must be explicit about the value of that stream—the combination between the value in the stream and the assocaited value in the table. The ValueJoiner interface in the Streams API does this work. The single apply() method takes the stream and table values as parameters, and returns the value of the joined stream as output. (Their keys are not a part of the equation, because they are equal by definition and do not change in the result.) As you can see here, this is just a matter of creating a RatedMovie object and populating it with the relevant fields of the input movie and rating.

You can do this in a Java Lambda in the call to the join() method where you're building the stream topology, but the joining logic may become complex, and breaking it off into its own trivially testable class is a good move.

Compile and run the Kafka Streams program



Load in some movie reference data

Start your zookeeper, kafka broker and Registry server for this.

Create a movie.avsc schema file in /opt/code folder with the following content.

```
{
  "namespace": "io.developer.avro",
  "type": "record",
  "name": "Movie",
  "fields": [
    {"name": "id", "type": "long"},
    {"name": "title", "type": "string"},
    {"name": "release_year", "type": "int"}
  ]
}
```

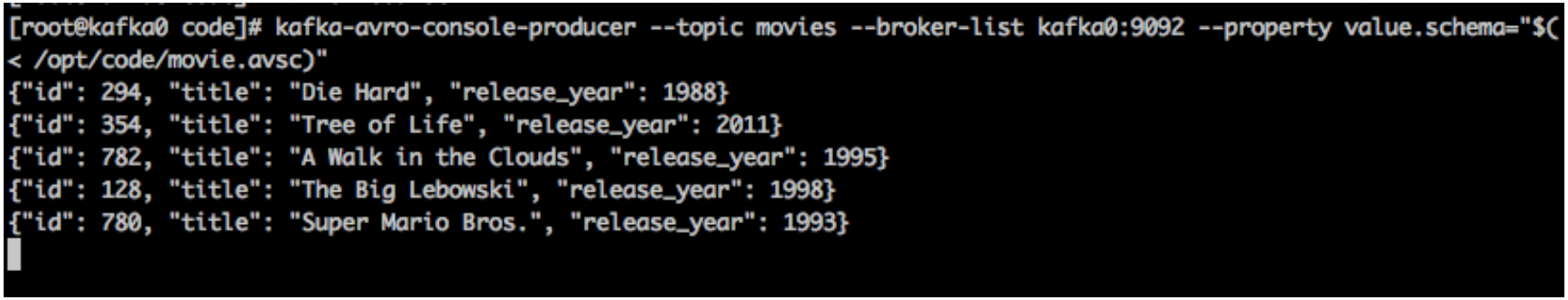
In a new terminal (Use confluent bin folder), run:

```
# sh kafka-avro-console-producer --topic movies --broker-list kafka0:9092 --property
value.schema="$(< /opt/code/movie.avsc)"
```

When the console producer starts, it will log some messages and hang, waiting for your input. Copy and paste one line at a time and press enter to send it. Note that these lines

contain hard tabs between the key and the value, so retyping them without the tab will not work.
Each line represents a movie we will be able to rate. To send all of the events below, paste the following into the prompt and press enter:

```
{"id": 294, "title": "Die Hard", "release_year": 1988}
{"id": 354, "title": "Tree of Life", "release_year": 2011}
{"id": 782, "title": "A Walk in the Clouds", "release_year": 1995}
{"id": 128, "title": "The Big Lebowski", "release_year": 1998}
{"id": 780, "title": "Super Mario Bros.", "release_year": 1993}
```



Get ready to observe the rated movies in the output topic

Before you start producing ratings, it's a good idea to set up the consumer on the output topic. This way, as soon as you produce ratings (and they're joined to movies), you'll see the results right away. Run this to get ready to consume the rated movies:

```
# sh kafka-avro-console-consumer --topic rated-movies --bootstrap-server localhost:9092 --from-beginning
```

```
Last login: Wed Aug 19 10:48:49 on ttys001
(base) Henrys-MacBook-Air:~ henrypotsangbam$ kafka-avro-console-consumer --topic
 rated-movies --bootstrap-server localhost:9092 --from-beginning
```

You won't see any results until the next step.

Produce some ratings to the input topic

Run the following in a new terminal window. This process is the most fun if you can see this and the previous terminal (which is consuming the rated movies) at the same time. If your terminal program lets you do horizontal split panes, try it that way:

Create a rating.avsc schema file in /opt/code folder.

```
{
  "namespace": "io.developer.avro",
  "type": "record",
  "name": "Rating",
  "fields": [
    {"name": "id", "type": "long"},
    {"name": "rating", "type": "double"}
  ]
}
```

```
#sh kafka-avro-console-producer --topic ratings --broker-list kafka0:9092 --property value.schema="$(<
/opt/code/rating.avsc)"
```

When the producer starts up, copy and paste these lines into the terminal. Try doing them one at a time, observing the results in the consumer terminal:

```
{"id": 294, "rating": 8.2}
{"id": 294, "rating": 8.5}
{"id": 354, "rating": 9.9}
{"id": 354, "rating": 9.7}
{"id": 782, "rating": 7.8}
{"id": 782, "rating": 7.7}
{"id": 128, "rating": 8.7}
{"id": 128, "rating": 8.4}
{"id": 780, "rating": 2.1}
```

Speaking of that consumer terminal, these are the results you should see there if you paste in all the movies and ratings as shown in this tutorial:

```
{"id":294,"title":"Die Hard","release_year":1988,"rating":8.2}
{"id":294,"title":"Die Hard","release_year":1988,"rating":8.5}
{"id":354,"title":"Tree of Life","release_year":2011,"rating":9.9}
{"id":354,"title":"Tree of Life","release_year":2011,"rating":9.7}
{"id":782,"title":"A Walk in the Clouds","release_year":1995,"rating":7.8}
{"id":782,"title":"A Walk in the Clouds","release_year":1995,"rating":7.7}
{"id":128,"title":"The Big Lebowski","release_year":1998,"rating":8.7}
{"id":128,"title":"The Big Lebowski","release_year":1998,"rating":8.4}
{"id":780,"title":"Super Mario Bros.","release_year":1993,"rating":2.1}
```

---------- Lab Ends Here ----------

16. Processor API integration – 60 Minutes

The following example shows how to leverage Processor API, via the `KStream#process()` method, a custom `Processor` that sends an email notification whenever a Rating count reaches a predefined threshold.

First, we need to implement a custom stream processor, `PopularPersonEmailAlert`, that implements the `Processor` interface:
Add the processor class. It sends email when, the Rating is more than 6.

```
package com.ostech.custom.processor;

import org.apache.kafka.streams.processor.api.Processor;
import org.apache.kafka.streams.processor.api.Record;

//A processor that sends an alert message about a popular person to
a configurable email address
public class PopularPersonEmailAlert implements Processor<String,
Long, Void, Void>  {
     private final String emailAddress;

      public PopularPersonEmailAlert(String emailAddress) {
        this.emailAddress = emailAddress;
      }
```

```
    @Override
    public void process(Record<String, Long> record) {

        System.out.println(" Sending email to : " + emailAddress
                           + "\n : Name : " + record.key() + " Total
Rating is : " + record.value());

    }

}
```

Then we can leverage the `PopularPageEmailAlert` processor in the DSL via `KStream#process`.

Define a class.

```
package com.ostech.custom.processor;

import java.util.Properties;
import java.util.concurrent.CountDownLatch;

import org.apache.kafka.clients.consumer.ConsumerConfig;
import org.apache.kafka.common.serialization.Serdes;
import org.apache.kafka.streams.KafkaStreams;
```

```
import org.apache.kafka.streams.KeyValue;
import org.apache.kafka.streams.StreamsBuilder;
import org.apache.kafka.streams.StreamsConfig;
import org.apache.kafka.streams.Topology;
import org.apache.kafka.streams.kstream.Grouped;
import org.apache.kafka.streams.kstream.KStream;
import org.apache.kafka.streams.kstream.KTable;
import org.apache.kafka.streams.kstream.Produced;

public class AnalyzeRating {

    public static void main(String[] args) throws Exception {
            Properties envProps = buildStreamsProperties();
            Topology topology = buildTopology(envProps);

            final KafkaStreams streams = new KafkaStreams(topology,
envProps);
            final CountDownLatch latch = new CountDownLatch(1);

            // Attach shutdown handler to catch Control-C.
            Runtime.getRuntime().addShutdownHook(new
Thread("streams-shutdown-hook") {
                @Override
                public void run() {
                    streams.close();
```

```
                    latch.countDown();
                }
            });

            try {
                streams.start();
                latch.await();
            } catch (Throwable e) {
                System.exit(1);
            }
            System.exit(0);
        }

    /*
     * Initialize the properites required to connect to the Topic
     */
    public static Properties buildStreamsProperties() {
            Properties props = new Properties();
            props.put(StreamsConfig.APPLICATION_ID_CONFIG,
"AnalzeRatingApp23");

props.put(StreamsConfig.BOOTSTRAP_SERVERS_CONFIG,"localhost:8082");

props.putIfAbsent(ConsumerConfig.AUTO_OFFSET_RESET_CONFIG,
"earliest");
```

```
            props.put(StreamsConfig.DEFAULT_KEY_SERDE_CLASS_CONFIG,
Serdes.String().getClass());

props.put(StreamsConfig.DEFAULT_VALUE_SERDE_CLASS_CONFIG,
Serdes.String().getClass());
            props.put(StreamsConfig.COMMIT_INTERVAL_MS_CONFIG, 10 *
1000);
         // For illustrative purposes we disable record caches.

props.put(StreamsConfig.CACHE_MAX_BYTES_BUFFERING_CONFIG, 0);
            // Use a temporary directory for storing state, which
will be automatically removed after the test.
            props.put(StreamsConfig.STATE_DIR_CONFIG, "/tmp/art");
            return props;
        }

     /*
      *  Read the rating stream , sum all the rating for each
person and save into another topic
      */
        public static Topology buildTopology(Properties envProps) {
            final StreamsBuilder builder = new StreamsBuilder();
            final String inputTopic = "myratings";

            KStream<String, String> ratings =
```

```
builder.stream(inputTopic);
            // Input - ("Henry",1) -> Name , Ratings
           KTable<String,Long> myRatings = ratings.filter( (k,v) ->
v !=null && v.trim().length() > 1)
                    .map((key, rate) ->{
                    String rats[] = rate.trim().split(",");
                     return new KeyValue<String,
Long>(rats[0].trim(),Long.valueOf(rats[1].trim()));
            })
             //.peek((k,v) -> System.out.println( k + " Ratings : "
+ v))

.groupByKey(Grouped.with(Serdes.String(),Serdes.Long()))
             .reduce((v1,v2) -> v1+ v2);



         // myRatings.toStream().peek((k,v) -> System.out.println(
k + " Ratings1 : " + v));
           myRatings.toStream().to("mycompratings",
Produced.with(Serdes.String(), Serdes.Long() ));
            return builder.build();
        }
```

```
}
```

The program will consume messages from the topic: myratings and will transform the message into Person and Rating then finally aggregrate Rating for each person.

Create topics - Input & OutPut :

#kafka-topics.sh --create --topic myratings --partitions 2 --bootstrap-server kafka0:9092
#kafka-topics.sh --create --topic mycompratings --partitions 2 --bootstrap-server kafka0:9092

Send input using producer console.
#kafka-console-producer.sh --bootstrap-server kafka0:9092 --topic myratings

Enter some messages in the form (Name, Rating)
#Ram,2
#Shyam,3
#John,3
#Ram,2
#Ram,1

Execute:
The main program, `AnalyzeRating.java`

Consume message using console.

```
# kafka-console-consumer.sh --bootstrap-server kafka0:9092 \
   --topic mycompratings \
   --from-beginning  \
--property print.key=true --property print.value=true \
--property key.deserializer=org.apache.kafka.common.serialization.StringDeserializer \
   --property value.deserializer=org.apache.kafka.common.serialization.LongDeserializer
```

Example output:

```
[root@kafka0 code]# kafka-console-producer.sh --bootstrap-server kafka0:9092 --topic myratings
>Ram,2
>Shyam,3
>John,3
>Ram,2
>Ram,1
>
```

Consumer console:

```
[root@kafka0 /]# kafka-console-consumer.sh --bootstrap-server kafka0:9092 \
>     --topic mycompratings \
>     --from-beginning  \
> --property print.key=true --property print.value=true \
> --property key.deserializer=org.apache.kafka.common.serialization.StringDeserializer \
>     --property value.deserializer=org.apache.kafka.common.serialization.LongDeserializer
Ram     2
Ram     4
Ram     5
Shyam   3
John    3
```

Now let us configure the Processor API. First stop the main program execution.

Add the following line in the Main Program.

```
myRatings.toStream()
                    .filter((k,v)-> v.intValue() > 6)
                    .process(()-> new
PopularPersonEmailAlert("kstream@apache.com"));;
```

```
76              })
77               //.peek((k,v) -> System.out.println( k + " Ratings : " + v))
78               .groupByKey(Grouped.with(Serdes.String(),Serdes.Long()))
79               .reduce((v1,v2) -> v1+ v2);
80
81              myRatings.toStream()
82                     .filter((k,v)-> v.intValue() > 6)
83                     .process(()-> new PopularPersonEmailAlert("kstream@apache.com"));;
84
85
86            // myRatings.toStream().peek((k,v) -> System.out.println( k + " Ratings1 : " +
87             myRatings.toStream().to("mycompratings", Produced.with(Serdes.String(), Serd
88              return builder.build();
89        }
90
91
```

Execute the Main program after enabling the Processor in the stream.

On the producer console – CLI: Send more messages related to Ram. So, that total rating for Ram is more than 6.

On the consumer console:

```
[root@kafka0 /]# kafka-console-consumer.sh --bootstrap-server kafka0:9092 \
>     --topic mycompratings \
>     --from-beginning  \
> --property print.key=true --property print.value=true \
> --property key.deserializer=org.apache.kafka.common.serialization.StringDeserializer \
>     --property value.deserializer=org.apache.kafka.common.serialization.LongDeserializer
Ram     2
Ram     4
Ram     5
Shyam   3
John    3
Ram     7
Shyam   4
```

You will observe the following in the main program console.

Congrats, you have successfully integrated the Processor API in the Kafka Stream DSL.

---------- Lab Ends Here ----------

17. Kafka - UDAF

In this lab we will learn how to to write UDAF and consume in KSQL. UDAFs can be used for computing aggregates against multiple rows of data.
It depends on: KSQL - Kafka Aggregation

This UDAF may seem complicated at first, but it's really just performing some basic math and adding the computations to a Map object. Returning a Map is one method for returning multiple values from a KSQL function. Using the example above for your own UDAF, take note of the following methods:

- initialize: used to specify the initial value of your aggregation
- aggregate: performs the actual aggregation by looking at the current row's value (i.e., the currentValue argument), as well as the current aggregation value (i.e., aggregateValue argument), and generates a new aggregate
- merge: describes how to merge two aggregations into one (e.g., when using session windows)

<!---------------------- POM Begins Here-->

```
<project xmlns="http://maven.apache.org/POM/4.0.0"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
http://maven.apache.org/xsd/maven-4.0.0.xsd">
    <modelVersion>4.0.0</modelVersion>
```

```
    <groupId>com.tos.kafka</groupId>
    <artifactId>MyProducer</artifactId>
    <version>0.0.1</version>
    <properties>
        <maven.compiler.target>1.8</maven.compiler.target>
        <maven.compiler.source>1.8</maven.compiler.source>
        <avro.version>1.8.2</avro.version>
        <confluent.version>5.3.0</confluent.version>
    </properties>
    <dependencies>
        <dependency>
            <groupId>org.apache.kafka</groupId>
            <artifactId>kafka-streams</artifactId>
            <version>2.3.0</version>
        </dependency>
        <dependency>
            <groupId>org.apache.kafka</groupId>
            <artifactId>kafka-clients</artifactId>
            <version>2.3.0</version>
        </dependency>
        <!-- Optionally include Kafka Streams DSL for Scala for Scala
2.12 -->
        <dependency>
            <groupId>org.apache.kafka</groupId>
```

```
            <artifactId>kafka-streams-scala_2.12</artifactId>
            <version>2.3.0</version>
        </dependency>
        <dependency>
            <groupId>io.advantageous.boon</groupId>
            <artifactId>boon-json</artifactId>
            <version>0.6.6</version>
        </dependency>
         <!-- KSQL dependency is needed to write your own UDF -->
        <dependency>
            <groupId>io.confluent.ksql</groupId>
            <artifactId>ksql-udf</artifactId>
            <version>${confluent.version}</version>
        </dependency>

        <dependency>
            <groupId>org.slf4j</groupId>
            <artifactId>slf4j-ext</artifactId>
            <version>1.7.13</version>
        </dependency>
        <!-- https://mvnrepository.com/artifact/com.google.code.gson/gson
-->
        <dependency>
            <groupId>com.google.code.gson</groupId>
```

```
        <artifactId>gson</artifactId>
        <version>2.8.5</version>
    </dependency>
    <dependency>
        <groupId>com.fasterxml.jackson.core</groupId>
        <artifactId>jackson-core</artifactId>
        <version>2.7.1</version>
    </dependency>

    <dependency>
        <groupId>com.fasterxml.jackson.core</groupId>
        <artifactId>jackson-databind</artifactId>
        <version>2.7.1</version>
    </dependency>
    <dependency>
        <groupId>org.apache.kafka</groupId>
        <artifactId>kafka-streams-test-utils</artifactId>
        <version>2.3.0</version>
        <scope>test</scope>
    </dependency>
    <!-- Test dependencies -->
    <dependency>
        <groupId>junit</groupId>
        <artifactId>junit</artifactId>
```

```
        <version>4.12</version>
        <scope>test</scope>
    </dependency>
    <dependency>
        <groupId>org.assertj</groupId>
        <artifactId>assertj-core</artifactId>
        <version>3.3.0</version>
        <scope>test</scope>
    </dependency>
    <dependency>
        <groupId>org.apache.avro</groupId>
        <artifactId>avro</artifactId>
        <version>${avro.version}</version>
    </dependency>
    <dependency>
        <groupId>org.apache.avro</groupId>
        <artifactId>avro-compiler</artifactId>
        <version>1.8.2</version>
    </dependency>
    <dependency>
        <groupId>org.apache.avro</groupId>
        <artifactId>avro-maven-plugin</artifactId>
        <version>1.8.2</version>
    </dependency>
```

```
        <dependency>
            <groupId>io.confluent</groupId>
            <artifactId>kafka-avro-serializer</artifactId>
            <version>${confluent.version}</version>
        </dependency>
        <!-- https://mvnrepository.com/artifact/org.apache.kafka/kafka-
streams-test-utils -->
        <dependency>
            <groupId>org.apache.kafka</groupId>
            <artifactId>kafka-streams-test-utils</artifactId>
            <version>2.3.0</version>
            <scope>test</scope>
        </dependency>



    </dependencies>

    <!-- <repositories> <repository> <id>confluent</id>
<name>Confluent</name>
        <url>http://maven.icm.edu.pl/artifactory/repo/</url>
</repository> </repositories> -->
    <build>
        <plugins>
```

```
                <plugin>
                    <groupId>org.apache.maven.plugins</groupId>
                    <artifactId>maven-compiler-plugin</artifactId>
                    <version>3.6.1</version>
                    <configuration>
                        <source>1.8</source>
                        <target>1.8</target>
                    </configuration>
                </plugin>
                <plugin>
                    <artifactId>maven-assembly-plugin</artifactId>
                    <configuration>
                        <archive>
                            <manifest>

    <mainClass>fully.qualified.MainClass</mainClass>
                            </manifest>
                        </archive>
                        <descriptorRefs>
                            <descriptorRef>jar-with-
dependencies</descriptorRef>
                        </descriptorRefs>
                    </configuration>
                    <executions>
```

```
                    <execution>
                        <id>make-assembly</id> <!-- this is used for
inheritance merges -->
                        <phase>package</phase> <!-- bind to the packaging
phase -->
                        <goals>
                            <goal>single</goal>
                        </goals>
                    </execution>
                </executions>
            </plugin>
            <plugin>
                <groupId>org.apache.avro</groupId>
                <artifactId>avro-maven-plugin</artifactId>
                <version>${avro.version}</version>
                <executions>
                    <execution>
                        <id>schemas</id>
                        <phase>generate-sources</phase>
                        <goals>
                            <goal>schema</goal>
                            <goal>protocol</goal>
                            <goal>idl-protocol</goal>
                        </goals>
```

```
                        <configuration>

    <sourceDirectory>${project.basedir}/src/main/resources/avro/</sourceD
irectory>

    <outputDirectory>${project.basedir}/src/main/java/</outputDirectory>
                        </configuration>
                    </execution>
                </executions>
            </plugin>
        </plugins>
    </build>
</project>
```

<!------------------------- POM Ends Here --->

<!------------------------- UDAF Begins Here--->

```
package com.tos.kafka.udf;

import java.util.HashMap;
import java.util.Map;

import io.confluent.ksql.function.udaf.Udaf;
import io.confluent.ksql.function.udaf.UdafDescription;
import io.confluent.ksql.function.udaf.UdafFactory;
```

```
/**
 * In this example, we implement a UDAF for computing some summary
statistics
 * for a stream of doubles.
 * </pre>
 */
@UdafDescription(name = "summary_stats_big", description = "Example UDAF
that computes some summary stats for a stream of BigInt", version =
"1.0", author = "Henry P")
public final class SummaryStatsUdaf {

    private SummaryStatsUdaf() {
    }

    @UdafFactory(description = "compute summary stats for BigInt")
    // Can be used with stream aggregations. The input of our aggregation
will be
    // doubles,
    // and the output will be a map
    public static Udaf<Long, Map<String, Long>> createUdaf() {

        return new Udaf<Long, Map<String, Long>>() {
```

```
            /**
             * Specify an initial value for our aggregation
             *
             * @return the initial state of the aggregate.
             */
            @Override
            public Map<String, Long> initialize() {
                final Map<String, Long> stats = new HashMap<>();
                stats.put("mean", Long.valueOf(0));
                stats.put("sample_size", Long.valueOf(0));
                stats.put("sum", Long.valueOf(0));
                return stats;
            }

            /**
             * Perform the aggregation whenever a new record appears in
our stream.
             *
             * @param newValue
             *            the new value to add to the {@code
aggregateValue}.
             * @param aggregateValue
             *            the current aggregate.
             * @return the new aggregate value.
```

```
             */
            @Override
            public Map<String, Long> aggregate(final Long newValue, final
Map<String, Long> aggregateValue) {
                final Long sampleSize = Long.valueOf(1) +
(aggregateValue.getOrDefault
                                                    ("sample_size",
Long.valueOf(0)));

                final Long sum = newValue +
(aggregateValue.getOrDefault("sum", Long.valueOf(0)));

                // calculate the new aggregate
                aggregateValue.put("mean", sum / (sampleSize));
                aggregateValue.put("sample_size", sampleSize);
                aggregateValue.put("sum", sum);
                return aggregateValue;
            }

            /**
             * Called to merge two aggregates together.
             *
             * @param aggOne
             *            the first aggregate
```

```
             * @param aggTwo
             *            the second aggregate
             * @return the merged result
             */
            @Override
            public Map<String, Long> merge(final Map<String, Long>
aggOne, final Map<String, Long> aggTwo) {
                final Long sampleSize =
aggOne.getOrDefault("sample_size", Long.valueOf(0)) + (
                        aggTwo.getOrDefault("sample_size",
Long.valueOf(0)));
                final Long sum = aggOne.getOrDefault("sum",
Long.valueOf(0)) +
                                (aggTwo.getOrDefault("sum",
Long.valueOf(0)));
                // calculate the new aggregate
                final Map<String, Long> newAggregate = new HashMap<>();
                newAggregate.put("mean", sum / (sampleSize));
                newAggregate.put("sample_size", sampleSize);
                newAggregate.put("sum", sum);
                return newAggregate;
            }
        };
    }
```

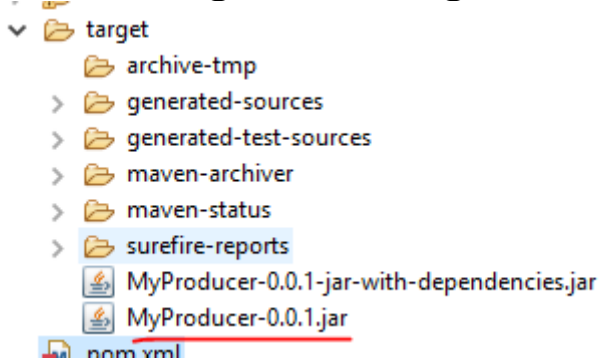
}

<!---------- UDAF Ends Here ----------->

Once the UDAF logic is ready, then it's time to deploy your KSQL functions to a KSQL server. To begin, build the project by running the following command in the project root directory:

Maven → Run As →Maven Install

The following file will be generated and need to be deployed in the kafka cluster.



Now, simply copy this JAR file to the KSQL extension directory (see the ksql.extension.dir property in the ksql-server.properties file) and restart your KSQL server so that it can pick up the new JAR containing your custom KSQL function. If the entry is not there; configure it by entering the following line in the ksql-server.properties file.

ksql.extension.dir=/apps/confluent/etc/ksql/ext

```
root@tos:/apps/confluent/etc/ksql
# this file except in compliance with the License.  You may obtain a copy of the
# License at
#
# http://www.confluent.io/confluent-community-license
#
# Unless required by applicable law or agreed to in writing, software
# distributed under the License is distributed on an "AS IS" BASIS, WITHOUT
# WARRANTIES OF ANY KIND, either express or implied.  See the License for the
# specific language governing permissions and limitations under the License.
#

ksql.extension.dir=/apps/confluent/etc/ksql/ext
#------ Endpoint config -------

### HTTP  ###
# The URL the KSQL server will listen on:
listeners=http://tos.hp.com:8088
```

Create the folder structure and grant the access.

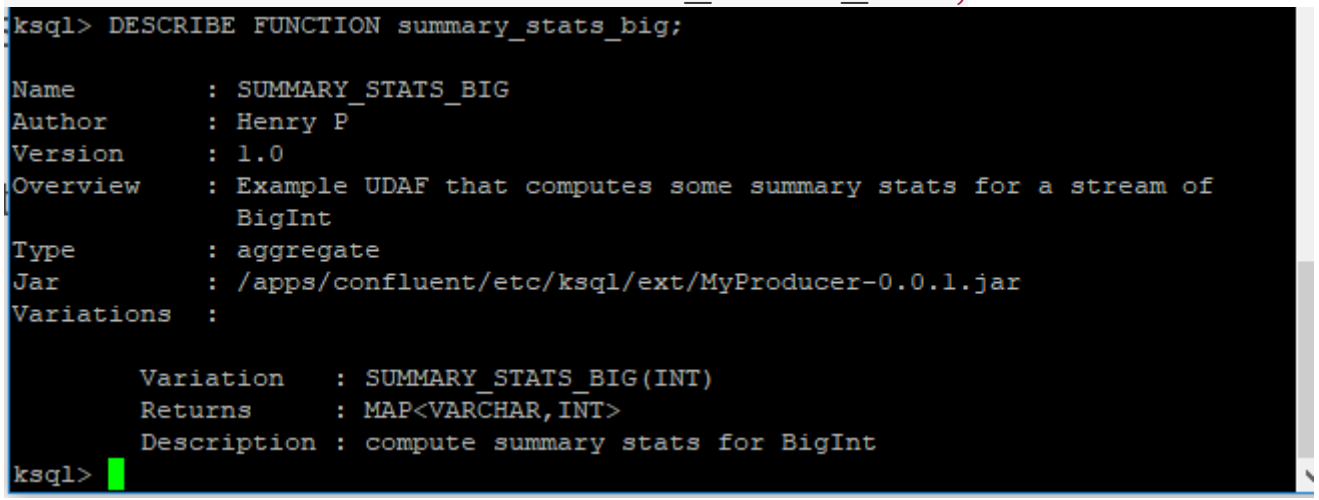
```
(base) [root@tos ksql]# pwd
/apps/confluent/etc/ksql
(base) [root@tos ksql]# mkdir ext
(base) [root@tos ksql]# chmod 777 ext
(base) [root@tos ksql]#
```

Hints[mkdir ext , chmod 777 ext]

Copy the jar.

```
(base) [root@tos ksql]# cd ext
(base) [root@tos ext]# ls
(base) [root@tos ext]# cp /mnt/hgfs/Software/data/MyProducer-0.0.1.jar .
(base) [root@tos ext]# ls -lt
total 76
-rwxr-xr-x. 1 root root 74652 Aug 22 11:03 MyProducer-0.0.1.jar
(base) [root@tos ext]#
```

Restart the confluent
Once KSQL has finished restarting and has connected to a running Apache Kafka® cluster, you can verify that the new functions exist by running the DESCRIBE FUNCTION command from the CLI:
DESCRIBE FUNCTION SUMMARY_STATS_BIG ;



Let us generate data for using this UDAF in our query.
Use the following avro schema to generate the data.
Create impressions.avro file in /apps folder and execute the following command from that folder only.
<!----------Schema File : impressions.avro Begins---------->
{
"namespace": "streams",
"name": "impressions",
"type": "record",

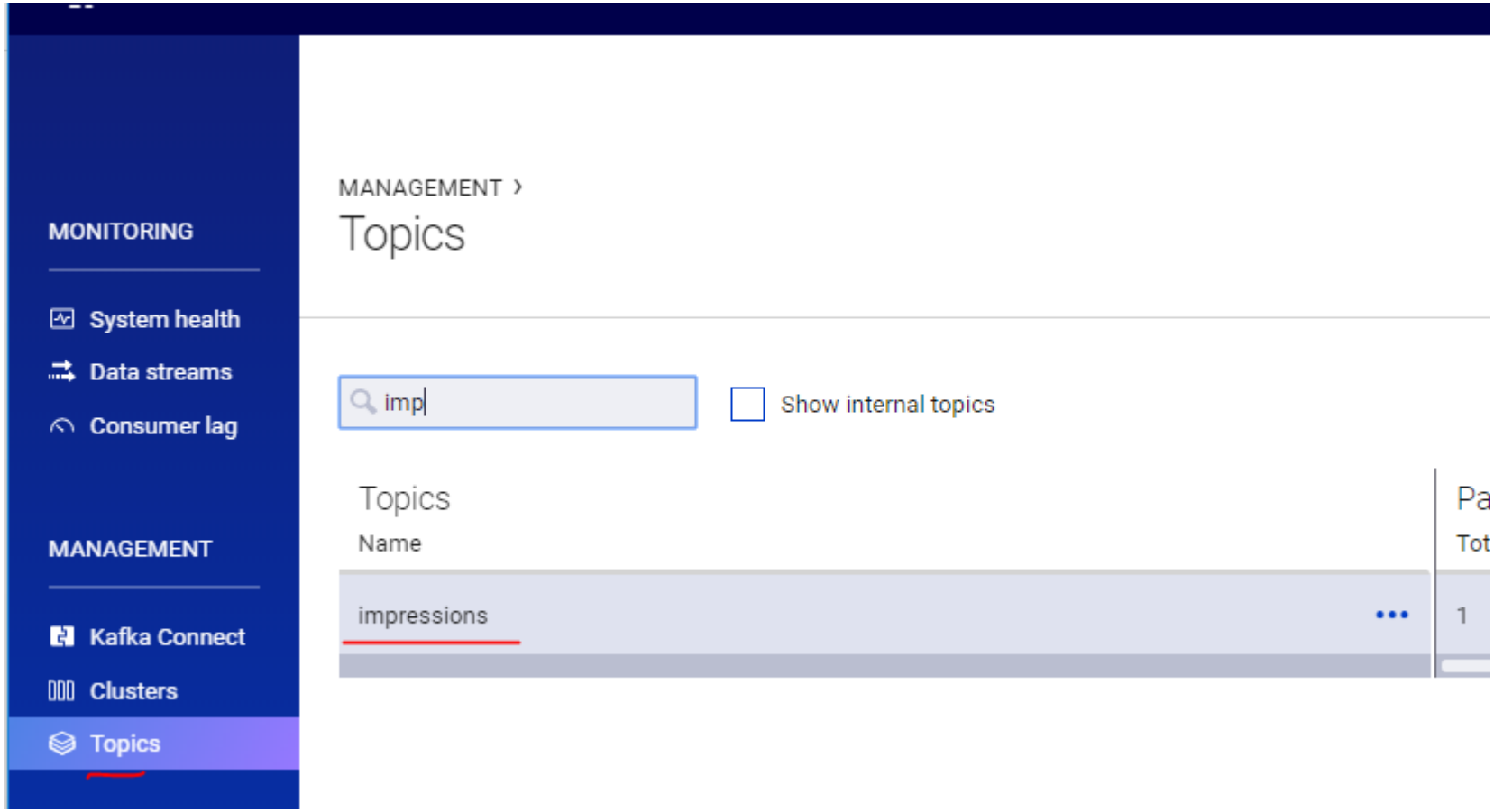
```
"fields": [
      {"name": "impresssiontime", "type": {
         "type": "long",
         "format_as_time" : "unix_long",
         "arg.properties": {
           "iteration": { "start": 1, "step": 10}
         }
      }},
      {"name": "impressionid", "type": {
         "type": "string",
         "arg.properties": {
            "regex": "impression_[1-9][0-9][0-9]"
         }
      }},
      {"name": "userid", "type": {
         "type": "string",
         "arg.properties": {
            "regex": "user_[1-9][0-9]?"
         }
      }},
      {"name": "adid", "type": {
         "type": "string",
         "arg.properties": {
            "regex": "ad_[1-9][0-9]?"
         }
```

```
            }},
            {"name": "impresssionscore", "type": {
               "type": "long",
               "arg.properties": {
                 "iteration": { "start": 1, "step": 2}
               }
            }}
      ]
}
<!-------------------- Schema File : impressions.avro  Ends ------------------------------>
```

#cd /apps
ksql-datagen schema=impressions.avro format=avro topic=impressions key=impressionid
When you have a custom schema registered, you can generate test data that's made up of random values that satisfy the schema requirements. In the `impressions` schema, advertisement identifiers are two-digit random numbers between 10 and 99, as specified by the regular expression `ad_[1-9][0-9]`. It has impresssionscore which is the score of impression for the advertisement. We will calculate stats on this column using the UDAF we have define earlier.
After a few startup messages, your output should resemble:

```
impression_162 --> ([ 1566555549459 | 'impression_162' | 'user_81' | 'ad_38' | 575 ]) ts:156655
5549459
impression_712 --> ([ 1566555549895 | 'impression_712' | 'user_33' | 'ad_26' | 577 ]) ts:156655
5549895
impression_279 --> ([ 1566555549920 | 'impression_279' | 'user_91' | 'ad_92' | 579 ]) ts:156655
5549920
impression_306 --> ([ 1566555550302 | 'impression_306' | 'user_34' | 'ad_78' | 581 ]) ts:156655
5550303
impression_522 --> ([ 1566555550475 | 'impression_522' | 'user_40' | 'ad_96' | 583 ]) ts:156655
5550476
impression_733 --> ([ 1566555550636 | 'impression_733' | 'user_80' | 'ad_31' | 585 ]) ts:156655
5550637
impression_318 --> ([ 1566555551108 | 'impression_318' | 'user_91' | 'ad_17' | 587 ]) ts:156655
5551109
impression_632 --> ([ 1566555551319 | 'impression_632' | 'user_25' | 'ad_80' | 589 ]) ts:156655
5551319
impression_959 --> ([ 1566555551366 | 'impression_959' | 'user_28' | 'ad_65' | 591 ]) ts:156655
5551366
```

By now, you should have a topic by the name, impressions as shown below.



Consume the Test Data Stream

In the KSQL CLI or in Control Center, register the impressions stream:

```
CREATE STREAM impressions (viewtime BIGINT, key VARCHAR, userid VARCHAR, adid
VARCHAR , impresssionscore BIGINT) WITH (KAFKA_TOPIC='impressions',
VALUE_FORMAT='avro');
```

You can query the stream now.

select * from impressions;

```
1566555480855 | impression_410 | null | null | user_74 | ad_22 | 1
1566555480926 | impression_631 | null | null | user_50 | ad_10 | 3
1566555481142 | impression_705 | null | null | user_31 | ad_12 | 5
1566555481574 | impression_365 | null | null | user_91 | ad_72 | 7
1566555481894 | impression_610 | null | null | user_91 | ad_14 | 9
1566555481970 | impression_526 | null | null | user_45 | ad_88 | 11
1566555482437 | impression_663 | null | null | user_15 | ad_24 | 13
1566555482725 | impression_939 | null | null | user_26 | ad_95 | 15
1566555482856 | impression_654 | null | null | user_39 | ad_73 | 17
```

At this point, invoking our UDF/UDAF is simply a matter of adding it to our KSQL query:

```
SELECT userid , summary_stats_big ( impresssionscore )
FROM impressions   GROUP BY userid;
```

```
user_64 | {sample_size=1, mean=1223, sum=1223}
user_12 | {sample_size=1, mean=1225, sum=1225}
user_14 | {sample_size=1, mean=1227, sum=1227}
user_60 | {sample_size=1, mean=1229, sum=1229}
user_99 | {sample_size=1, mean=1231, sum=1231}
user_23 | {sample_size=1, mean=1233, sum=1233}
user_18 | {sample_size=1, mean=1237, sum=1237}
user_57 | {sample_size=2, mean=1237, sum=2474}
user_29 | {sample_size=1, mean=1241, sum=1241}
user_96 | {sample_size=1, mean=1243, sum=1243}
user_47 | {sample_size=1, mean=1245, sum=1245}
user_15 | {sample_size=1, mean=1247, sum=1247}
user_96 | {sample_size=2, mean=1246, sum=2492}
user_19 | {sample_size=1, mean=1251, sum=1251}
user_24 | {sample_size=1, mean=1253, sum=1253}
```

As you can observe for each userid it returns a stats calculated using the UDAF we have define earlier.

---------- Lab Ends Here ----------

18. KSQL Rest API – TBR

Here's an example request that returns the results from the `LIST STREAMS` command:

```
curl -X "POST" "http://localhost:8088/ksql" \
     -H "Content-Type: application/vnd.ksql.v1+json; charset=utf-8" \
     -d $'{
  "ksql": "LIST STREAMS;",
  "streamsProperties": {}
}'
```

Here's an example request that retrieves streaming data from `TEST_STREAM`:

```
curl -X "POST" "http://localhost:8088/query" \
     -H "Content-Type: application/vnd.ksql.v1+json; charset=utf-8" \
     -d $'{
  "ksql": "SELECT * FROM users_ws;",
  "streamsProperties": {}
}'
```

Example request

```
POST /ksql HTTP/1.1
Accept: application/vnd.ksql.v1+json
Content-Type: application/vnd.ksql.v1+json

{
  "ksql": "CREATE STREAM pageviews_home AS SELECT * FROM pageviews_original WHERE pageid='home'; CREATE STREAM pageviews_al
ice AS SELECT * FROM pageviews_original WHERE userid='alice';",
  "streamsProperties": {
    "ksql.streams.auto.offset.reset": "earliest"
  }
}
```

Copy

Example response

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ksql.v1+json

[
  {
    "statementText":"CREATE STREAM pageviews_home AS SELECT * FROM pageviews_original WHERE pageid='home';",
    "commandId":"stream/PAGEVIEWS_HOME/create",
    "commandStatus": {
      "status":"SUCCESS",
      "message":"Stream created and running"
    },
    "commandSequenceNumber":10
  },
  {
    "statementText":"CREATE STREAM pageviews_alice AS SELECT * FROM pageviews_original WHERE userid='alice';",
    "commandId":"stream/PAGEVIEWS_ALICE/create",
    "commandStatus": {
      "status":"SUCCESS",
      "message":"Stream created and running"
    },
    "commandSequenceNumber":11
  }
]
```

Copy

Example request

```
POST /query HTTP/1.1
Accept: application/vnd.ksql.v1+json
Content-Type: application/vnd.ksql.v1+json

{
  "ksql": "SELECT * FROM pageviews;",
  "streamsProperties": {
    "ksql.streams.auto.offset.reset": "earliest"
  }
```

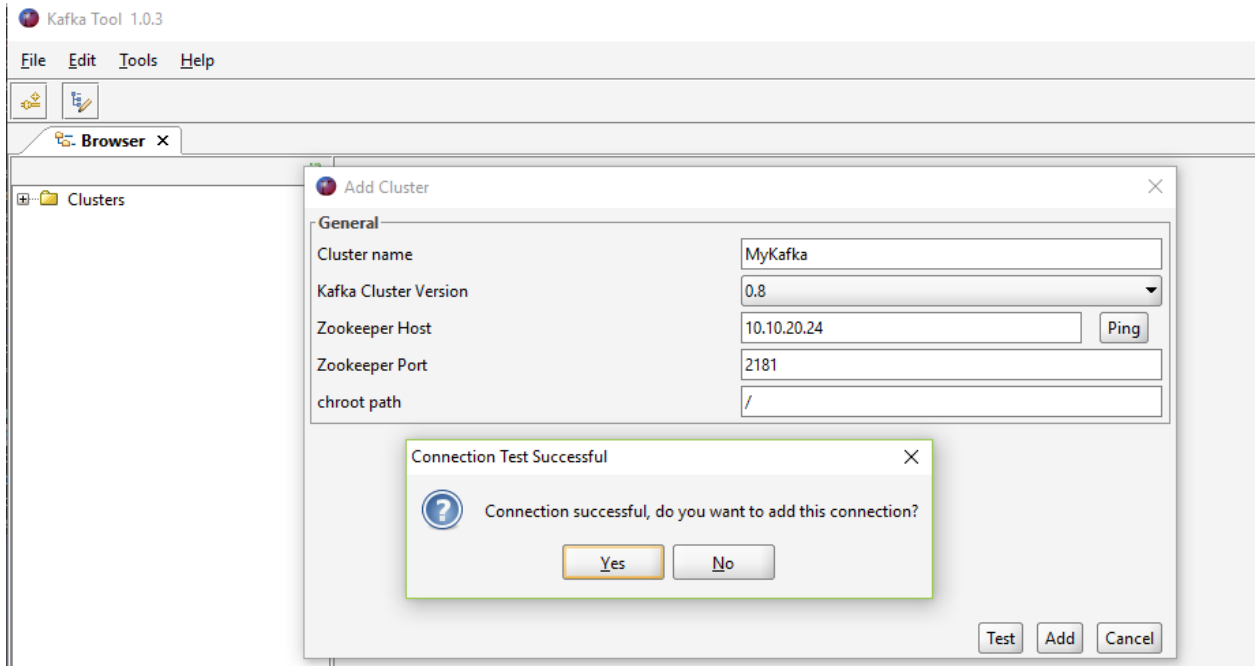
```
}
```

Copy

Example response

```
HTTP/1.1 200 OK
Content-Type: application/vnd.ksql.v1+json
Transfer-Encoding: chunked

...
{"row":{"columns":[1524760769983,"1",1524760769747,"alice","home"]},"errorMessage":null}
...
```

19. Kafkatools



20. Errors

1. LEADER_NOT_AVAILABLE

{test=LEADER_NOT_AVAILABLE} (org.apache.kafka.clients.NetworkClient)

```
[2018-05-15 23:46:40,132] WARN [Producer clientId=console-producer] Error while
fetching metadata with correlation id 14 : {test=LEADER_NOT_AVAILABLE} (org.apac
he.kafka.clients.NetworkClient)
[2018-05-15 23:46:40,266] WARN [Producer clientId=console-producer] Error while
fetching metadata with correlation id 15 : {test=LEADER_NOT_AVAILABLE} (org.apac
he.kafka.clients.NetworkClient)
^C[2018-05-15 23:46:40,394] WARN [Producer clientId=console-producer] Error whil
e fetching metadata with correlation id 16 : {test=LEADER_NOT_AVAILABLE} (org.ap
ache.kafka.clients.NetworkClient)
[root@tos opt]#  {test=LEADER_NOT_AVAILABLE} (org.apache.kafka.clients.NetworkCl
ient)
bash: syntax error near unexpected token `org.apache.kafka.clients.NetworkClient
```

Solutions: /opt/kafka/config/server.properties

Update the following information.

```
# it uses the value for "listeners" if configured.  Otherwise, it will use the v
alue
# returned from java.net.InetAddress.getCanonicalHostName().
advertised.listeners=PLAINTEXT://localhost:9092
```

java.util.concurrent.ExecutionException:

org.apache.kafka.common.errors.TimeoutException: Expiring 1 record(s) for my-kafka-topic-6: 30037 ms has passed since batch creation plus linger time

at org.apache.kafka.clients.producer.internals.FutureRecordMetadata.valueOrError(FutureRecordMetadata.java:94)

at org.apache.kafka.clients.producer.internals.FutureRecordMetadata.get(FutureRecordMetadata.java:64)
at org.apache.kafka.clients.producer.internals.FutureRecordMetadata.get(FutureRecordMetadata.java:29)
at com.tos.kafka.MyKafkaProducer.runProducer(MyKafkaProducer.java:97)
at com.tos.kafka.MyKafkaProducer.main(MyKafkaProducer.java:18)
Caused by: org.apache.kafka.common.errors.TimeoutException: Expiring 1 record(s) for my-kafka-topic-6: 30037 ms has passed since batch creation plus linger time.

Solution:

Update the following in all the server properties: /opt/kafka/config/server.properties

```
#    listeners = PLAINTEXT://your.host.name:9092
listeners=PLAINTEXT://tos.master.com:9093

# Hostname and port the broker will advertise to producers and consumers. If not
 set,
# it uses the value for "listeners" if configured.  Otherwise, it will use the v
alue
# returned from java.net.InetAddress.getCanonicalHostName().
advertised.listeners=PLAINTEXT://tos.master.com:9093

# Maps listener names to security protocols, the default is for them to be the s
ame. See the config documentation for more details
#listener.security.protocol.map=PLAINTEXT:PLAINTEXT,SSL:SSL,SASL_PLAINTEXT:SASL_
PLAINTEXT,SASL_SSL:SASL_SSL
```

Its should be updated with your hostname and restart the broker

Changes in the following file, if the hostname is to be changed.

//kafka/ Server.properties and control center

/apps/confluent/etc/confluent-control-center/control-center-dev.properties

/apps/confluent/etc/ksql/ksql-server.properties
/tmp/confluent.8A2Ii7O4/connect/connect.properties

Update localhost to resolve to the ip in /etc/hosts.

In case the hostname doesn't started, updated with ip address and restart the broker.

21. Annexure Code:

2. DumplogSegment

/opt/kafka/bin/kafka-run-class.sh kafka.tools.DumpLogSegments --deep-iteration --print-data-log --files \
/tmp/kafka-logs/my-kafka-connect-0/oooooooooooooooooo.log | head -n 4

```
[root@tos test-topic-0]# more 00000000000000000000.log
[root@tos test-topic-0]# cd ../
[root@tos kafka-logs]# cd my-kafka-connect-0/
[root@tos my-kafka-connect-0]# ls
00000000000000000000.index      00000000000000000011.snapshot
00000000000000000000.log        leader-epoch-checkpoint
00000000000000000000.timeindex
[root@tos my-kafka-connect-0]# more *log
\▒▒▒▒▒▒▒▒afka Connector.--More--(53%)

[root@tos my-kafka-connect-0]# pwd
/tmp/kafka-logs/my-kafka-connect-0
[root@tos my-kafka-connect-0]# /opt/kafka/bin/kafka-run-class.sh kafka.tools.Dum
pLogSegments --deep-iteration --print-data-log --files \
> /tmp/kafka-logs/my-kafka-connect-0/00000000000000000000.log | head -n 4
Dumping /tmp/kafka-logs/my-kafka-connect-0/00000000000000000000.log
Starting offset: 0
offset: 0 position: 0 CreateTime: 1530552634675 isvalid: true keysize: -1 values
ize: 31 magic: 2 compresscodec: NONE producerId: -1 producerEpoch: -1 sequence:
-1 isTransactional: false headerKeys: [] payload: This Message is from Test File
.
offset: 1 position: 0 CreateTime: 1530552634677 isvalid: true keysize: -1 values
ize: 43 magic: 2 compresscodec: NONE producerId: -1 producerEpoch: -1 sequence:
-1 isTransactional: false headerKeys: [] payload: It will be consumed by the Kaf
ka Connector.
[root@tos my-kafka-connect-0]#
```

3. Data Generator – JSON

Streaming Json Data Generator

Downloading the generator

You can always find the most recent release over on github where you can download the bundle file that contains the runnable application and example configurations. Head there now and download a release to get started!

Configuration

The generator runs a Simulation which you get to define. The Simulation can specify one or many Workflows that will be run as part of your Simulation. The Workflows then generates Events and these Events are then sent somewhere. You will also need to define Producers that are used to send the Events generated by your Workflows to some destination. These destinations could be a log file, or something more complicated like a Kafka Queue.

You define the configuration for the json-data-generator using two configuration files. The first is a Simulation Config. The Simulation Config defines the Workflows that should be run and different Producers that events should be sent to. The second is a Workflow configuration (of which you can have multiple). The Workflow defines the frequency of Events and Steps that the Workflow uses to generate the Events. It is the Workflow that defines the format and content of your Events as well.

For our example, we are going to pretend that we have a programmable Jackie Chan robot. We can command Jackie Chan though a programmable interface that happens to take json

as an input via a Kafka queue and you can command him to perform different fighting moves in different martial arts styles. A Jackie Chan command might look like this:

```
{
 "timestamp":"2015-05-20T22:05:44.789Z",
 "style":"DRUNKEN_BOXING",
 "action":"PUNCH",
 "weapon":"CHAIR",
 "target":"ARMS",
 "strength":8.3433
}
```

view rawexampleJackieChanCommand.json hosted with by GitHub

Now, we want to have some fun with our awesome Jackie Chan robot, so we are going to make him do random moves using our json-data-generator! First we need to define a Simulation Config and then a Workflow that Jackie will use.

SIMULATION CONFIG

Let's take a look at our example Simulation Config:

```
{
   "workflows": [{
        "workflowName": "jackieChan",
        "workflowFilename": "jackieChanWorkflow.json"
     }],
```

```
    "producers": [{
      "type": "kafka",
      "broker.server": "192.168.59.103",
      "broker.port": 9092,
      "topic": "jackieChanCommand",
      "flatten": false,
      "sync": false


    }]
  }
```

view rawjackieChanSimConfig.json hosted with by **GitHub**

As you can see, there are two main parts to the Simulation Config. The Workflows name and list the workflow configurations you want to use. The Producers are where the Generator will send the events to. At the time of writing this, we have three supported Producers:

- A Logger that sends events to log files
- A Kafka Producer that will send events to your specified Kafka Broker
- A Tranquility Producer that will send events to a Druid cluster.

You can find the full configuration options for each on the github page. We used a Kafka producer because that is how you command our Jackie Chan robot.

WORKFLOW CONFIG

The Simulation Config above specifies that it will use a Workflow called jackieChanWorkflow.json. This is where the meat of your configuration would live. Let's take a look at the example Workflow config and see how we are going to control Jackie Chan:

```
{
   "eventFrequency": 400,
   "varyEventFrequency": true,
   "repeatWorkflow": true,
   "timeBetweenRepeat": 1500,
   "varyRepeatFrequency": true,
   "steps": [{
        "config": [{
            "timestamp": "now()",
            "style": "random('KUNG_FU','WUSHU','DRUNKEN_BOXING')",
            "action": "random('KICK','PUNCH','BLOCK','JUMP')",
            "weapon": "random('BROAD_SWORD','STAFF','CHAIR','ROPE')",
            "target": "random('HEAD','BODY','LEGS','ARMS')",
            "strength": "double(1.0,10.0)"
          }
        ],
        "duration": 0
    }]
}
```

view rawjackieChanWorkflow.json hosted with by **GitHub**

The Workflow defines many things that are all defined on the github page, but here is a summary:

- At the top are the properties that define how often events should be generated and if / when this workflow should be repeated. So this is like saying we want Jackie Chan to do a martial arts move every 400 milliseconds (he's FAST!), then take a break for 1.5 seconds, and do another one.
- Next, are the Steps that this Workflow defines. Each Step has a config and a duration. The duration specifies how long to run this step. The config is where it gets interesting!

WORKFLOW STEP CONFIG

The Step Config is your specific definition of a json event. This can be any kind of json object you want. In our example, we want to generate a Jackie Chan command message that will be sent to his control unit via Kafka. So we define the command message in our config, and since we want this to be fun, we are going to randomly generate what kind of style, move, weapon, and target he will use.

You'll notice that the values for each of the object properties look a bit funny. These are special Functions that we have created that allow us to generate values for each of the properties. For instance, the "random('KICK','PUNCH','BLOCK','JUMP')" function will randomly choose one of the values and output it as the value of the "action" property in the command message. The "now()" function will output the current date in an ISO8601 date formatted string. The "double(1.0,10.0)" will generate a random double between 1 and 10

to determine the strength of the action that Jackie Chan will perform. If we wanted to, we could make Jackie Chan perform combo moves by defining a number of Steps that will be executed in order.

There are many more Functions available in the generator with everything from random string generation, counters, random number generation, dates, and even support for randomly generating arrays of data. We also support the ability to reference other randomly generated values. For more info, please check out the full documentation on the github page.

Once we have defined the Workflow, we can run it using the json-data-generator. To do this, do the following:

1. If you have not already, go ahead and download the most recent release of the json-data-generator.
2. Unpack the file you downloaded to a directory.

   (tar -xvf json-data-generator-1.4.0-bin.tar -C /apps)

3. Copy your custom configs into the conf directory
4. Then run the generator like so:
    1. java -jar json-data-generator-1.4.0.jar jackieChanSimConfig.json

You will see logging in your console showing the events as they are being generated. The jackieChanSimConfig.json generates events like these:

{"timestamp":"2015-05-20T22:21:18.036Z","style":"WUSHU","action":"BLOCK","weapon":"CHAIR","target":"BODY","strength":4.7912}
{"timestamp":"2015-05-20T22:21:19.247Z","style":"DRUNKEN_BOXING","action":"PUNCH","weapon":"BROAD_SWORD","target":"ARMS","strength":3.0248}
{"timestamp":"2015-05-20T22:21:20.947Z","style":"DRUNKEN_BOXING","action":"BLOCK","weapon":"ROPE","target":"HEAD","strength":6.7571}
{"timestamp":"2015-05-20T22:21:22.715Z","style":"WUSHU","action":"KICK","weapon":"BROAD_SWORD","target":"ARMS","strength":9.2062}
{"timestamp":"2015-05-20T22:21:23.852Z","style":"KUNG_FU","action":"PUNCH","weapon":"BROAD_SWORD","target":"HEAD","strength":4.6202}
{"timestamp":"2015-05-20T22:21:25.195Z","style":"KUNG_FU","action":"JUMP","weapon":"ROPE","target":"ARMS","strength":7.5303}
{"timestamp":"2015-05-20T22:21:26.492Z","style":"DRUNKEN_BOXING","action":"PUNCH","weapon":"STAFF","target":"HEAD","strength":1.1247}
{"timestamp":"2015-05-20T22:21:28.042Z","style":"WUSHU","action":"BLOCK","weapon":"STAFF","target":"ARMS","strength":5.5976}
{"timestamp":"2015-05-

20T22:21:29.422Z","style":"KUNG_FU","action":"BLOCK","weapon":"ROPE","target":"ARMS","strength":2.152}
{"timestamp":"2015-05-20T22:21:30.782Z","style":"DRUNKEN_BOXING","action":"BLOCK","weapon":"STAFF","target":"ARMS","strength":6.2686}
{"timestamp":"2015-05-20T22:21:32.128Z","style":"KUNG_FU","action":"KICK","weapon":"BROAD_SWORD","target":"BODY","strength":2.3534}

view rawjackieChanCommands.json hosted with by **GitHub**

If you specified to repeat your Workflow, then the generator will continue to output events and send them to your Producer simulating a real world client, or in our case, continue to make Jackie Chan show off his awesome skills. If you also had a Chuck Norris robot, you could add another Workflow config to your Simulation and have the two robots fight it out! Just another example of how you can use the generator to simulate real world situations.

22. Pom.xml (Standalone)

```
<project xmlns="http://maven.apache.org/POM/4.0.0"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
http://maven.apache.org/xsd/maven-4.0.0.xsd">
    <modelVersion>4.0.0</modelVersion>
    <groupId>com.hp.tos</groupId>
    <artifactId>LearningKafka</artifactId>
    <version>0.0.1-SNAPSHOT</version>
    <description>All About Kafka</description>
    <properties>
        <algebird.version>0.13.4</algebird.version>
        <avro.version>1.8.2</avro.version>
        <avro.version>1.8.2</avro.version>
        <confluent.version>5.3.0</confluent.version>
        <kafka.version>3.0.0</kafka.version>
        <kafka.scala.version>2.11</kafka.scala.version>
    </properties>
    <repositories>
        <repository>
            <id>confluent</id>
            <url>https://packages.confluent.io/maven/</url>
        </repository>
    </repositories>
```

```
<pluginRepositories>
    <pluginRepository>
        <id>confluent</id>
        <url>https://packages.confluent.io/maven/</url>
    </pluginRepository>
</pluginRepositories>
<dependencies>
    <dependency>
        <groupId>io.confluent</groupId>
        <artifactId>kafka-streams-avro-serde</artifactId>
        <version>${confluent.version}</version>
    </dependency>
    <dependency>
        <groupId>io.confluent</groupId>
        <artifactId>kafka-avro-serializer</artifactId>
        <version>${confluent.version}</version>
    </dependency>
    <dependency>
        <groupId>io.confluent</groupId>
        <artifactId>kafka-schema-registry-client</artifactId>
        <version>${confluent.version}</version>
    </dependency>
    <dependency>
        <groupId>org.apache.kafka</groupId>
        <artifactId>kafka-clients</artifactId>
```

```
        <version>${kafka.version}</version>
    </dependency>
    <dependency>
        <groupId>org.apache.kafka</groupId>
        <artifactId>kafka-streams</artifactId>
        <version>${kafka.version}</version>
    </dependency>

    <dependency>
        <groupId>org.apache.kafka</groupId>
        <artifactId>kafka-streams-test-utils</artifactId>
        <version>${kafka.version}</version>
        <scope>test</scope>
    </dependency>
    <dependency>
        <groupId>org.apache.avro</groupId>
        <artifactId>avro</artifactId>
        <version>${avro.version}</version>
    </dependency>
    <dependency>
        <groupId>org.apache.avro</groupId>
        <artifactId>avro-maven-plugin</artifactId>
        <version>${avro.version}</version>
    </dependency>
    <dependency>
```

```
            <groupId>org.apache.avro</groupId>
            <artifactId>avro-compiler</artifactId>
            <version>${avro.version}</version>
        </dependency>
      <dependency>
        <groupId>com.google.code.gson</groupId>
        <artifactId>gson</artifactId>
        <version>2.6.2</version>
    </dependency>

     </dependencies>

     <build>
     <plugins>
         <plugin>
         <artifactId>maven-compiler-plugin</artifactId>
         <configuration>
             <source>1.8</source>
             <target>1.8</target>
         </configuration>
     </plugin>
        <plugin>
         <groupId>org.apache.avro</groupId>
         <artifactId>avro-maven-plugin</artifactId>
         <version>${avro.version}</version>
```

```
          <executions>
            <execution>
              <phase>generate-sources</phase>
              <goals>
                <goal>schema</goal>
               </goals>
               <configuration>

<sourceDirectory>${project.basedir}/src/main/resources/</sourceDire
ctory>

<sourceDirectory>${project.basedir}/src/main/resources/avro</source
Directory>
              <includes>
                <include>input_movie_event.avsc</include>
                <include>parsed_movies.avsc</include>
                <include>Payment.avsc</include>
                <include>*.avsc</include>
              </includes>

<outputDirectory>${project.basedir}/src/main/java</outputDirectory>
            </configuration>
            </execution>
          </executions>
        </plugin>
```

```
        </plugins>
        </build>

    </project>
```

23. pom.xml (Spring boot)

```
<project xmlns="http://maven.apache.org/POM/4.0.0"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
https://maven.apache.org/xsd/maven-4.0.0.xsd">
    <modelVersion>4.0.0</modelVersion>
    <groupId>com.tos</groupId>
    <artifactId>SpringKafka</artifactId>
    <version>0.0.1-SNAPSHOT</version>
    <properties>
        <!-- Keep versions as properties to allow easy modification
-->
        <java.version>8</java.version>
        <avro.version>1.10.0</avro.version>
        <gson.version>2.9.0</gson.version>
        <!-- Maven properties for compilation -->
        <project.build.sourceEncoding>UTF-
8</project.build.sourceEncoding>
        <project.reporting.outputEncoding>UTF-8
        </project.reporting.outputEncoding>

    <checkstyle.suppressions.location>checkstyle/suppressions.xml
        </checkstyle.suppressions.location>
        <confluent.version>5.3.0</confluent.version>
    </properties>
```

```
    <parent>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-parent</artifactId>
        <version>2.4.0</version>
        <relativePath />
    </parent>
    <dependencies>
        <dependency>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot-starter-web</artifactId>
        </dependency>
        <dependency>
            <groupId>org.springframework.kafka</groupId>
            <artifactId>spring-kafka</artifactId>
        </dependency>
        <!--
https://mvnrepository.com/artifact/com.google.code.gson/gson -->
        <dependency>
            <groupId>com.google.code.gson</groupId>
            <artifactId>gson</artifactId>
        </dependency>
     <dependency>
            <groupId>org.apache.kafka</groupId>
            <artifactId>kafka-streams</artifactId>
```

```
        </dependency>
        <dependency>
            <groupId>org.apache.kafka</groupId>
            <artifactId>kafka-streams-scala_2.13</artifactId>
        </dependency>
<dependency>
    <groupId>org.javatuples</groupId>
    <artifactId>javatuples</artifactId>
    <version>1.2</version>
</dependency>
    </dependencies>
    <build>
        <plugins>
            <plugin>
                <groupId>org.springframework.boot</groupId>
                <artifactId>spring-boot-maven-plugin</artifactId>
            </plugin>
        </plugins>
    </build>
</project>
```

4. Resources

https://developer.ibm.com/hadoop/2017/04/10/kafka-security-mechanism-saslplain/
https://sharebigdata.wordpress.com/2018/01/21/implementing-sasl-plain/
https://developer.ibm.com/code/howtos/kafka-authn-authz
https://github.com/confluentinc/kafka-streams-examples/tree/4.1.x/
https://github.com/spring-cloud/spring-cloud-stream-samples/blob/master/kafka-streams-samples/kafka-streams-table-join/src/main/java/kafka/streams/table/join/KafkaStreamsTableJoin.java
https://docs.confluent.io/current/ksql/docs/tutorials/examples.html#ksql-examples