Lab 6.5: Thread per Consumer

Welcome to the session 6 lab 5. The work for this lab is done in `~/kafka-training/lab6.5`. In this lab, you are going to implement a thread per consumer.

Please refer to the Kafka course notes for any updates or changes to this lab.

Find the latest version of this lab here.

Lab Thread per consumer

Unlike Kafka producers, Kafka consumers are not thread-safe.

All network I/O happens in a thread of the application making calls. Kafka Consumers manage buffers, and connections state that threads can't share.

The only exception thread-safe method that the consumer has is `consumer.wakeup()`. The `wakeup()` method forces the consumer to throw a `WakeupException` on any thread the consumer client is blocking. You can use this to shut down a consumer from another thread.

Consumer per thread

The easiest to implement a client application that can handle more work is to use a thread per consumer and then spin up more consumers. This approach works best because it requires no inter-thread co-ordination. You don't have to worry about in-order processing on a per-partition basis because Kafka is already sending messages by key to the partitions that you are managing so in-order processing is natural. This approach is easy to implement. Just process records in the order that you receive them.

StockPriceConsumerRunnable is Runnable

To create a consumer per thread, we will move away from our `SimpleStockPriceConsumer` and use a new class called `StockPriceConsumerRunnable` that implements Runnable. We will then use a thread pool to launch `StockPriceConsumerRunnable` instances.

~/kafka-training/lab6.5/src/main/java/com/cloudurable/kafka/consumer/StockPriceConsumerRunnable.java

Kafka Consumer: StockPriceConsumerRunnable

```
package com.cloudurable.kafka.consumer;

import com.cloudurable.kafka.model.StockPrice;
import org.apache.kafka.clients.consumer.CommitFailedException;
import org.apache.kafka.clients.consumer.Consumer;
import org.apache.kafka.clients.consumer.ConsumerRecord;
import org.apache.kafka.clients.consumer.ConsumerRecords;
import org.slf4j.Logger;
import org.slf4j.LoggerFactory;

import java.util.Collections;
import java.util.HashMap;
import java.util.Map;
import java.util.concurrent.atomic.AtomicBoolean;
```

```
import static com.cloudurable.kafka.StockAppConstants.TOPIC;

public class StockPriceConsumerRunnable implements Runnable{
    private static final Logger logger =
            LoggerFactory.getLogger(StockPriceConsumerRunnable.class);

    private final Consumer<String, StockPrice> consumer;
    private final int readCountStatusUpdate;
    private final int threadIndex;
    private final AtomicBoolean stopAll;
    private boolean running = true;


    @Override
    public void run() {
        try {
        runConsumer();
        } catch (Exception ex) {
        logger.error("Run Consumer Exited with", ex);
        }
    }

    ...

    void runConsumer() throws Exception {
        // Subscribe to the topic.
        consumer.subscribe(Collections.singletonList(TOPIC));
        final Map<String, StockPrice> lastRecordPerStock = new HashMap<>();
        try {
            int readCount = 0;
            while (isRunning()) {
                pollRecordsAndProcess(lastRecordPerStock, readCount);
            }
        } finally {
            consumer.close();
        }
    }


    private void pollRecordsAndProcess(
            final Map<String, StockPrice> currentStocks,
            final int readCount) throws Exception {

        final ConsumerRecords<String, StockPrice> consumerRecords =
                consumer.poll(100);

        if (consumerRecords.count() == 0) {
            if (stopAll.get()) this.setRunning(false);
            return;
        }
        consumerRecords.forEach(record -> currentStocks.put(record.key()
                new StockPriceRecord(record.value(), saved: true, record)));
```

```
        try {
            startTransaction();                         //Start DB Transaction

            processRecords(currentStocks, consumerRecords);
            consumer.commitSync();                      //Commit the Kafka offset
            commitTransaction();                        //Commit DB Transaction
        } catch (CommitFailedException ex) {
            logger.error("Failed to commit sync to log", ex);
            rollbackTransaction();                      //Rollback Transaction
        }


        if (readCount % readCountStatusUpdate == 0) {
            displayRecordsStatsAndStocks(currentStocks, consumerRecords);
        }
    }
...
}
```

ConsumerMain

We will also create a `ConsumerMain` class that will start up thread pool. It will create a producer per thread. Then it will submit the producers (StockPriceConsumerRunnable, which are runnable) to the `executorService` (`threadPool`).

~/kafka-training/lab6.5/src/main/java/com/cloudurable/kafka/consumer/ConsumerMain.java

Kafka Consumer: ConsumerMain

```
package com.cloudurable.kafka.consumer;

import com.cloudurable.kafka.StockAppConstants;
import com.cloudurable.kafka.model.StockPrice;
import org.apache.kafka.clients.consumer.Consumer;
import org.apache.kafka.clients.consumer.ConsumerConfig;
import org.apache.kafka.clients.consumer.KafkaConsumer;
import org.apache.kafka.common.serialization.StringDeserializer;
import org.slf4j.Logger;
import org.slf4j.LoggerFactory;

import java.util.Properties;
import java.util.concurrent.ExecutorService;
import java.util.concurrent.TimeUnit;
import java.util.concurrent.atomic.AtomicBoolean;
import java.util.stream.IntStream;

import static java.util.concurrent.Executors.newFixedThreadPool;

public class ConsumerMain {
    ...
    public static void main(String... args) throws Exception {
        final int threadCount = 5;
```

```
        final ExecutorService executorService = newFixedThreadPool(threadCount);
        final AtomicBoolean stopAll = new AtomicBoolean();

        IntStream.range(0, threadCount).forEach(index -> {
            final StockPriceConsumerRunnable stockPriceConsumer =
                new StockPriceConsumerRunnable(createConsumer(),
                        readCountStatusUpdate: 10, index, stopAll);
            executorService.submit(stockPriceConsumer);
        });
        ...
    }
    ...
}
```

Lab Work

ACTION - EDIT `com.cloudurable.kafka.consumer.StockPriceConsumerRunnable` and follow the instructions in the file.

ACTION - EDIT `com.cloudurable.kafka.consumer.ConsumerMain` and follow the instructions in the file.

ACTION - RUN ZooKeeper and Brokers if needed.

ACTION - RUN ConsumerMain from IDE

ACTION - RUN StockPriceKafkaProducer from IDE

ACTION - OBSERVE and then STOP consumers and producer

Expected behavior

It should run and should get messages like this:

Expected output

```
New ConsumerRecords par count 1 count 3, max offset
ticker AAA price 80.25 Thread 1
ticker CCC price 80.25 Thread 1
ticker EEE price 80.25 Thread 1
ticker DEF price 94.44 Thread 1
ticker XYZ price 94.44 Thread 1

New ConsumerRecords par count 1 count 2, max offset
ticker IBM price 61.74 Thread 2
ticker UBER price 544.94 Thread 2

New ConsumerRecords par count 1 count 3, max offset
```

```
ticker GOOG price 448.74 Thread 0
ticker ABC price 94.44 Thread 0
ticker BBB price 80.25 Thread 0
ticker DDD price 80.25 Thread 0
ticker FFF price 80.25 Thread 0
ticker SUN price 61.74 Thread 0
ticker INEL price 61.74 Thread 0
```

It should all run. Stop consumer and producer when finished.

Kafka Tutorial

This comprehensive *Kafka tutorial* covers Kafka architecture and design. The *Kafka tutorial* has example Java Kafka producers and Kafka consumers. The *Kafka tutorial* also covers Avro and Schema Registry.

Complete Kafka Tutorial: Architecture, Design, DevOps and Java Examples.

- Kafka Tutorial Part 1: What is Kafka?
- Kafka Tutorial Part 2: Kafka Architecture
- Kafka Tutorial Part 3: Kafka Topic Architecture
- Kafka Tutorial Part 4: Kafka Consumer Architecture
- Kafka Tutorial Part 5: Kafka Producer Architecture
- Kafka Tutorial Part 6: Using Kafka from the command line
- Kafka Tutorial Part 7: Kafka Broker Failover and Consumer Failover
- Kafka Tutorial Part 8: Kafka Ecosystem
- Kafka Tutorial Part 9: Kafka Low-Level Design
- Kafka Tutorial Part 10: Kafka Log Compaction Architecture
- Kafka Tutorial Part 11: Writing a Kafka Producer example in Java
- Kafka Tutorial Part 12: Writing a Kafka Consumer example in Java
- Kafka Tutorial Part 13: Writing Advanced Kafka Producer Java examples
- Kafka Tutorial 14: Writing Advanced Kafka Consumer Java examples
- Kafka Tutorial Part 15: Kafka and Avro
- Kafka Tutorial Part 16: Kafka and Schema Registry
- Kafka Tutorial
