

# Day 7 (12-11-2025)

## Case Study: Online Retail Order Processing System with Kafka

## Step 1: Start Kafka and Zookeeper

## Start Zookeeper:

## Start Kafka Broker:

## Step 2: Create Kafka Topics

Create a topic orders with 3 partitions and replication factor 2:

```
|rac@PTPMR707 ~ % kafka-topics.sh --create --topic orders --bootstrap-server localhost:9092 --partitions 3 --replication-factor 2
Error while executing topic command : Replication factor: 2 larger than available brokers: 1.
[2025-11-13 22:58:37,005] ERROR org.apache.kafka.common.errors.InvalidReplicationFactorException: Replication factor: 2 larger than available brokers: 1.
(kafka.admin.TopicCommands)
|rac@PTPMR707 ~ % kafka-topics.sh --create --topic orders --bootstrap-server localhost:9092 --partitions 3 --replication-factor 2
Created topic orders.
rac@PTPMR707 ~ %
```

List all topics:

```
|rac@PTPMR707 ~ % kafka-topics.sh --create --topic orders --bootstrap-server localhost:9092 --partitions 3 --replication-factor 2
Error while executing topic command : Replication factor: 2 larger than available brokers: 1.
[2025-11-13 22:58:37,005] ERROR org.apache.kafka.common.errors.InvalidReplicationFactorException: Replication factor: 2 larger than available brokers: 1.
(kafka.admin.TopicCommands)
|rac@PTPMR707 ~ % kafka-topics.sh --create --topic orders --bootstrap-server localhost:9092 --partitions 3 --replication-factor 2
Created topic orders.
|rac@PTPMR707 ~ % kafka-topics.sh --list --bootstrap-server localhost:9092
    _consumer_offsets
orders
|rac@PTPMR707 ~ %
```

Describe the topic to see partitions and leader info:

```
|rac@PTPMR707 ~ % kafka-topics.sh --create --topic orders --bootstrap-server localhost:9092 --partitions 3 --replication-factor 2
Error while executing topic command : Replication factor: 2 larger than available brokers: 1.
[2025-11-13 22:58:37,005] ERROR org.apache.kafka.common.errors.InvalidReplicationFactorException: Replication factor: 2 larger than available brokers: 1.
(kafka.admin.TopicCommands)
|rac@PTPMR707 ~ % kafka-topics.sh --create --topic orders --bootstrap-server localhost:9092 --partitions 3 --replication-factor 2
Created topic orders.
|rac@PTPMR707 ~ % kafka-topics.sh --list --bootstrap-server localhost:9092
    _consumer_offsets
orders
|rac@PTPMR707 ~ % kafka-topics.sh --describe --topic orders --bootstrap-server localhost:9092
Topic: orders  TopicId: v-zle-flYfC1-z5mDAgmA PartitionCount: 3  ReplicationFactor: 2  Configs:
  Topic: orders  Partition: 0  Leader: 1  Replicas: 1,0  Isr: 1,0
  Topic: orders  Partition: 1  Leader: 0  Replicas: 0,2  Isr: 0,2
  Topic: orders  Partition: 2  Leader: 2  Replicas: 2,1  Isr: 2,1
|rac@PTPMR707 ~ %
```

## Step 3: Produce Messages

Start a Kafka Producer to send order messages:

Send a few sample messages:

```
|rac@PTPMR707 ~ % kafka-console-producer.sh --topic orders --bootstrap-server localhost:9092
>OrderID:1001,Item:Laptop,Quantity:2
>OrderID:1002,Item:Mobile,Quantity:1
>OrderID:1003,Item:Headphones,Quantity:5
>%
```

## Step 4: Consume Messages and Observe Partitions

Start a Kafka Consumer with partition and offset info displayed:

```
|rac@PTPMR707 ~ % kafka-console-consumer.sh --topic orders --from-beginning --bootstrap-server localhost:9092 --property print.partition=true --property print.offset=true
Partition:1  Offset:0  OrderID:1001,Item:Laptop,Quantity:2
Partition:1  Offset:1  OrderID:1002,Item:Mobile,Quantity:1
Partition:1  Offset:2  OrderID:1003,Item:Headphones,Quantity:5
Partition:1  Offset:3  OrderID:1001,Item:Laptop,Quantity:2
Partition:1  Offset:4  OrderID:1002,Item:Mobile,Quantity:1
Partition:1  Offset:5  OrderID:1003,Item:Headphones,Quantity:5
Partition:0  Offset:0  OrderID:1001,Item:Laptop,Quantity:2
Partition:0  Offset:1  OrderID:1002,Item:Mobile,Quantity:1
Partition:0  Offset:2  OrderID:1003,Item:Headphones,Quantity:5
%
```

## Step 5: Use Consumer Groups

## Start multiple consumers in the same group to simulate load balancing:

```
~ -- zsh ...fig/zookeeper.properties ...config/server1.properties ... ...onfig/server2.properties ... ...onfig/server3.properties ... ~ -- zsh ~ -- zsh +  
[rac0PTPMRT07 ~ % kafka-console-producer.sh --topic orders --bootstrap-server localhost:9092  
>OrderID:1001,Item:Laptop,Quantity:2  
>OrderID:1002,Item:Mobile,Quantity:1  
>OrderID:1003,Item:Headphones,Quantity:5  
>^C  
[rac0PTPMRT07 ~ % kafka-console-consumer.sh --topic orders --group retailGroup --bootstrap-server localhost:9092  
  
^CProcessed a total of 0 messages  
[rac0PTPMRT07 ~ % ]
```

Produce more messages and observe partition assignment among consumers.

List consumer groups:

```
~ -- zsh ...fig/zookeeper.properties ...config/server1.properties ... ...onfig/server2.properties ... ...onfig/server3.properties ... ~ -- zsh ~ -- zsh +  
[rac0PTPMRT07 ~ % kafka-consumer-groups.sh --bootstrap-server localhost:9092 --list  
retailGroup  
console-consumer-89672  
[rac0PTPMRT07 ~ % ]
```

Describe a consumer group:

```
~ -- zsh ...fig/zookeeper.properties ...config/server1.properties ... ...onfig/server2.properties ... ...onfig/server3.properties ... ~ -- zsh ~ -- zsh +  
[rac0PTPMRT07 ~ % kafka-consumer-groups.sh --bootstrap-server localhost:9092 --list  
retailGroup  
console-consumer-89672  
[rac0PTPMRT07 ~ % kafka-consumer-groups.sh --bootstrap-server localhost:9092 --describe --group retailGroup  
  
Consumer group 'retailGroup' has no active members.  
  
GROUP TOPIC PARTITION CURRENT-OFFSET LOG-END-OFFSET LAG CONSUMER-ID HOST CLIENT-ID  
retailGroup orders 0 3 3 0 - - -  
retailGroup orders 1 6 6 0 - - -  
retailGroup orders 2 0 0 0 - - -  
[rac0PTPMRT07 ~ % ]
```

## Step 6: Explore Message Keys

Produce messages with keys to control partition assignment:

```
~ -- zsh ...fig/zookeeper.properties ...config/server1.properties ... ...onfig/server2.properties ... ~ -- zsh ~ -- zsh +...server localhost:9092  
[rac0PTPMRT07 ~ % kafka-consumer-groups.sh --bootstrap-server localhost:9092 --list  
retailGroup  
console-consumer-89672  
[rac0PTPMRT07 ~ % kafka-consumer-groups.sh --bootstrap-server localhost:9092 --describe --group retailGroup  
  
Consumer group 'retailGroup' has no active members.  
  
GROUP TOPIC PARTITION CURRENT-OFFSET LOG-END-OFFSET LAG CONSUMER-ID HOST CLIENT-ID  
retailGroup orders 0 3 3 0 - - -  
retailGroup orders 1 6 6 0 - - -  
retailGroup orders 2 0 0 0 - - -  
[rac0PTPMRT07 ~ % kafka-console-producer.sh --topic orders --property parse.key=true --property key.separator=: --bootstrap-server localhost:9092  
>1001:Laptop  
>1002:Mobile  
>1001:Mouse  
[rac0PTPMRT07 ~ % ]
```

Start a consumer with partition info as in Step 4 and observe that messages with the same key go to the same partition:

```
~ -- zsh ...fig/zookeeper.properties ...config/server1.properties ... ...onfig/server2.properties ... ~ -- zsh ~ -- zsh +  
[rac0PTPMRT07 ~ % kafka-topics.sh --describe --topic orders --bootstrap-server localhost:9092  
Topic: orders TopicId: v-zle-flRFcJ-c5oDfAgAA PartitionCount: 3 ReplicationFactor: 2 Configs:  
  Topic: orders Partition: 0 Leader: 1 Replicas: 1,0 Isr: 1,0  
  Topic: orders Partition: 1 Leader: 0 Replicas: 0,2 Isr: 0,2  
  Topic: orders Partition: 2 Leader: 2 Replicas: 2,1 Isr: 2,1  
[rac0PTPMRT07 ~ % kafka-console-consumer --topic orders --from-beginning --bootstrap-server localhost:9092 --property print.partition=true --property print.offset=true  
Partition:0 Offset:0 OrderID:1001,Item:Laptop,Quantity:2  
Partition:1 Offset:1 OrderID:1002,Item:Mobile,Quantity:1  
Partition:1 Offset:2 OrderID:1003,Item:Headphones,Quantity:  
Partition:1 Offset:3 OrderID:1001,Item:Laptop,Quantity:2  
Partition:1 Offset:4 OrderID:1002,Item:Mobile,Quantity:1  
Partition:1 Offset:5 OrderID:1003,Item:Headphones,Quantity:5  
Partition:0 Offset:0 OrderID:1001,Item:Laptop,Quantity:2  
Partition:0 Offset:1 OrderID:1002,Item:Mobile,Quantity:1  
Partition:0 Offset:2 OrderID:1003,Item:Headphones,Quantity:5  
Partition:0 Offset:3 Laptop  
Partition:0 Offset:4 Mobile  
Partition:0 Offset:5 Mouse  
[rac0PTPMRT07 ~ % ]
```

## Step 7: Explore Replication Factor

Describe topic orders to see leader and replicas:

## Stop a broker and observe that messages are still available due to replication.

```
[>*^C
rac@PTPMR707 ~ % kafka-console-consumer.sh --topic orders --group retailGroup --bootstrap-server localhost:9092

^CProcessed a total of 0 messages
[rac@PTPMR707 ~ % kafka-topics.sh --describe --topic orders --bootstrap-server localhost:9092
Topic: orders  TopicId: v-zle-flRfcJ-c5uDfAgAA PartitionCount: 3  ReplicationFactor: 2  Configs:
  Topic: orders  Partition: 0  Leader: 1  Replicas: 1,0  Isr: 1,0
  Topic: orders  Partition: 1  Leader: 0  Replicas: 0,2  Isr: 0,2
  Topic: orders  Partition: 2  Leader: 2  Replicas: 2,1  Isr: 2,1
[rac@PTPMR707 ~ % kafka-console-consumer.sh --topic orders --from-beginning --bootstrap-server localhost:9092 --property print.partition=true --property print.offset=true
Partition:0  Offset:0  OrderId:1091,Item:Laptop,Quantity:2
Partition:1  Offset:1  OrderId:1092,Item:Mobile,Quantity:1
Partition:2  Offset:2  OrderId:1093,Item:Headphones,Quantity:2
Partition:0  Offset:3  OrderId:1091,Item:Laptop,Quantity:2
Partition:0  Offset:4  OrderId:1092,Item:Mobile,Quantity:1
Partition:0  Offset:5  OrderId:1093,Item:Headphones,Quantity:5
Partition:0  Offset:6  OrderId:1091,Item:Laptop,Quantity:2
Partition:0  Offset:7  OrderId:1092,Item:Mobile,Quantity:1
Partition:0  Offset:8  OrderId:1093,Item:Headphones,Quantity:5
Partition:0  Offset:9  Laptop
Partition:0  Offset:10  Mobile
Partition:0  Offset:11  Mouse
[2025-11-13 23:06:14,845] WARN [Consumer clientId=console-consumer, groupId=console-consumer-2100] Connection to node 2 (localhost/127.0.0.1:9094) could not be established. Broker may not be available.
(org.apache.kafka.clients.NetworkClient)
[2025-11-13 23:06:15,007] WARN [Consumer clientId=console-consumer, groupId=console-consumer-2100] Connection to node 2 (localhost/127.0.0.1:9094) could not be established. Broker may not be available.
(org.apache.kafka.clients.NetworkClient)
^CProcessed a total of 12 messages
[rac@PTPMR707 ~ % kafka-console-consumer.sh --topic orders --from-beginning --bootstrap-server localhost:9092 --property print.partition=true --property print.offset=true
Partition:0  Offset:0  OrderId:1091,Item:Laptop,Quantity:2
Partition:1  Offset:1  OrderId:1092,Item:Mobile,Quantity:1
Partition:2  Offset:2  OrderId:1093,Item:Headphones,Quantity:5
Partition:0  Offset:3  Laptop
Partition:0  Offset:4  Mobile
Partition:0  Offset:5  Mouse
Partition:1  Offset:6  OrderId:1091,Item:Laptop,Quantity:2
Partition:1  Offset:7  OrderId:1092,Item:Mobile,Quantity:1
Partition:1  Offset:8  OrderId:1093,Item:Headphones,Quantity:5
Partition:1  Offset:9  OrderId:1091,Item:Laptop,Quantity:2
Partition:1  Offset:10  OrderId:1092,Item:Mobile,Quantity:1
Partition:1  Offset:11  OrderId:1093,Item:Headphones,Quantity:5
^CProcessed a total of 12 messages
[rac@PTPMR707 ~ % kafka-topics.sh --describe --topic orders --bootstrap-server localhost:9092
Topic: orders  TopicId: v-zle-flRfcJ-c5uDfAgAA PartitionCount: 3  ReplicationFactor: 2  Configs:
  Topic: orders  Partition: 0  Leader: 1  Replicas: 1,0  Isr: 1,0
  Topic: orders  Partition: 1  Leader: 0  Replicas: 0,2  Isr: 0,2
  Topic: orders  Partition: 2  Leader: 1  Replicas: 2,1  Isr: 1
[rac@PTPMR707 ~ % kafka-topics.sh --delete --topic orders --bootstrap-server localhost:9092
rac@PTPMR707 ~ ]
```

## Step 8: Cleanup

### Delete the topic:

```
Partition:0  Offset:5  Mouse
Partition:1  Offset:0  OrderId:1091,Item:Laptop,Quantity:2
Partition:1  Offset:1  OrderId:1092,Item:Mobile,Quantity:1
Partition:1  Offset:2  OrderId:1093,Item:Headphones,Quantity:5
Partition:1  Offset:3  OrderId:1091,Item:Laptop,Quantity:2
Partition:1  Offset:4  OrderId:1092,Item:Mobile,Quantity:1
Partition:1  Offset:5  OrderId:1093,Item:Headphones,Quantity:5
^CProcessed a total of 12 messages
[rac@PTPMR707 ~ % kafka-topics.sh --describe --topic orders --bootstrap-server localhost:9092
Topic: orders  TopicId: v-zle-flRfcJ-c5uDfAgAA PartitionCount: 3  ReplicationFactor: 2  Configs:
  Topic: orders  Partition: 0  Leader: 1  Replicas: 1,0  Isr: 1,0
  Topic: orders  Partition: 1  Leader: 0  Replicas: 0,2  Isr: 0,2
  Topic: orders  Partition: 2  Leader: 1  Replicas: 2,1  Isr: 1
[rac@PTPMR707 ~ % kafka-topics.sh --delete --topic orders --bootstrap-server localhost:9092
rac@PTPMR707 ~ ]
```