

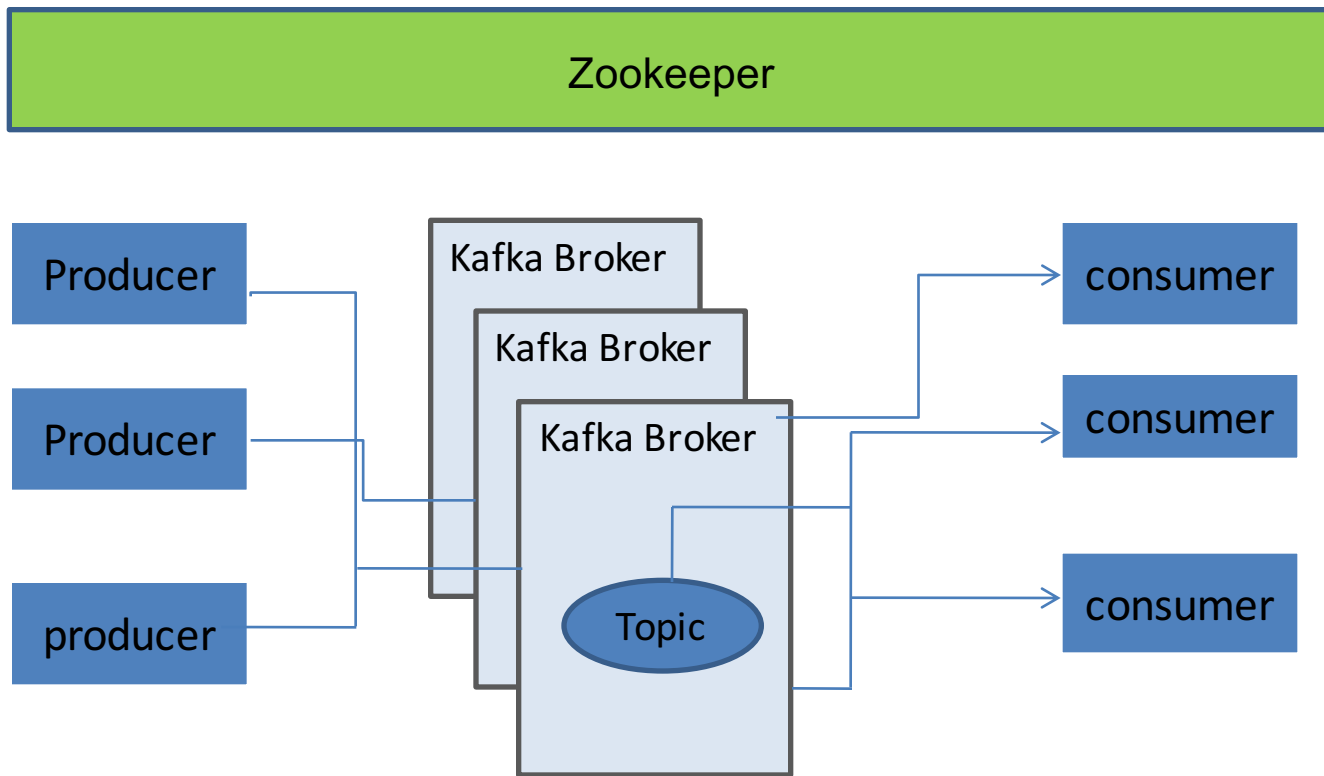
Kafka Cluster and Failover

- ❖ Kafka Cluster is made up of multiple Kafka Brokers
- ❖ Each Broker has an ID (number)
- ❖ Brokers contain topic log partitions
- ❖ Connecting to one broker bootstraps client to entire cluster
- ❖ Start with at least three brokers, cluster can have, 10, 100, 1000 brokers if needed

- ❖ Topic ***Partitions*** can be ***replicated***
 - ❖ across ***multiple nodes*** for failover
- ❖ Topic should have a replication factor greater than 1
 - ❖ (2, or 3)
- ❖ ***Failover***
 - ❖ if one Kafka Broker goes down then Kafka Broker with ISR (in-sync replica) can serve data

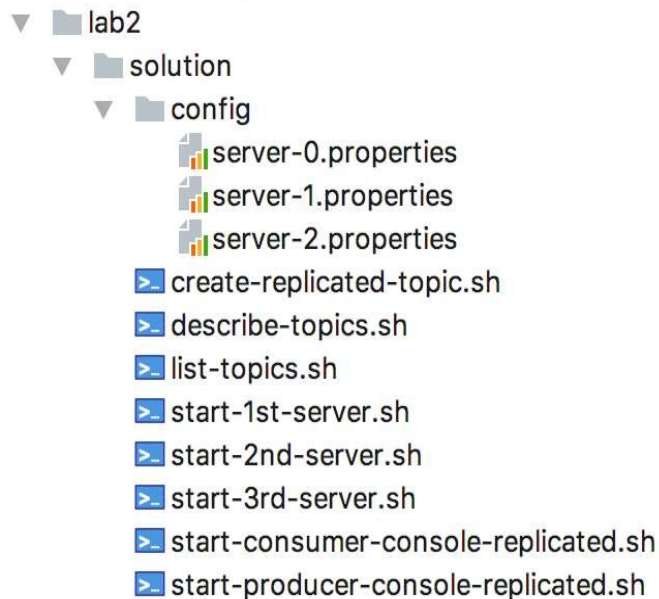
Zoo Keeper does coordination for Kafka cluster

Tos



- ❖ Replication of Kafka Topic Log partitions allows for failure of a rack or AWS availability zone
 - ❖ You need a replication factor of at least 3
- ❖ ***Kafka Replication*** is for ***Failover***
- ❖ ***Replicator/Mirror Maker*** is used for ***Disaster Recovery***
- ❖ Mirror Maker replicates a Kafka cluster to another data-centre or AWS region
 - ❖ Called mirroring since replication happens within a cluster

- ❖ Run many Kafka Brokers
- ❖ Create a replicated topic
- ❖ Demonstrate Pub / Sub
- ❖ Demonstrate load balancing consumers
- ❖ Demonstrate consumer failover
- ❖ Demonstrate broker failover



- ❖ If not already running, start up ZooKeeper
 - ❖ Shutdown Kafka from first lab
- ❖ Copy server properties for three brokers
 - ❖ Modify properties files, Change port, Change Kafka log location
- ❖ Start up many Kafka server instances
- ❖ Create Replicated Topic
- ❖ Use the replicated topic

```
~/kafka-training
$ ./run-zookeeper.sh
```

Create three new server- n.properties files

- ❖ Copy existing ***server.properties*** to ***server-0.properties***, ***server-1.properties***, ***server-2.properties***
- ❖ Change ***server-0.properties*** to use ***log.dirs***. “./logs/kafka-logs-0”
- ❖ Change ***server-1.properties*** to use ***port 9093***, ***broker id 1***, and ***log.dirs*** “./logs/kafka-logs-1”
- ❖ Change ***server-2.properties*** to use ***port 9094***, ***broker id 2***, and ***log.dirs*** “./logs/kafka-logs-2”

Modify server-x.properties

Tos

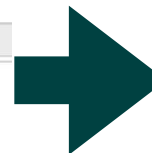
server-0.properties x	
1	<code>broker.id=0</code>
2	<code>port=9092</code>
3	<code>log.dirs=./logs/kafka-0</code>
server-1.properties x	
1	<code>broker.id=1</code>
2	<code>port=9093</code>
3	<code>log.dirs=./logs/kafka-1</code>
server-2.properties x	
1	<code>broker.id=2</code>
2	<code>port=9094</code>
3	<code>log.dirs=./logs/kafka-2</code>

- ❖ Each have different *broker.id*
- ❖ Each have different *log.dirs*
- ❖ Each had different *port*

Create Startup scripts for three Kafka servers

Tos

```
start-1st-server.sh x
1  #!/usr/bin/env bash
2  CONFIG=`pwd`/config
3
4  cd ~/kafka-training
5
6  ## Run Kafka
7  kafka/bin/kafka-server-start.sh \
8      "$CONFIG/server-0.properties"
9
start-2nd-server.sh x
1  #!/usr/bin/env bash
2  CONFIG=`pwd`/config
3  cd ~/kafka-training
4
5  ## Run Kafka
6  kafka/bin/kafka-server-start.sh \
7      "$CONFIG/server-1.properties"
8
start-3rd-server.sh x
1  #!/usr/bin/env bash
2  CONFIG=`pwd`/config
3  cd ~/kafka-training
4
5  ## Run Kafka
6  kafka/bin/kafka-server-start.sh \
7      "$CONFIG/server-2.properties"
8
```



```
start-2nd-server.sh x
1  #!/usr/bin/env bash
2  CONFIG=`pwd`/config
3  cd ~/kafka-training
4
5  ## Run Kafka
6  kafka/bin/kafka-server-start.sh \
7      "$CONFIG/server-1.properties"
8
9
```

❖ Passing properties files from last step

```
$ ./start-1st-server.sh  
[2017-05-15 11:18:00,168] INFO KafkaConfig values:  
    advertised.host.name = null  
    advertised.listeners = null  
    advertised.port = null
```

```
$ ./start-2nd-server.sh  
[2017-05-15 11:18:24,980] INFO KafkaConfig values:  
    advertised.host.name = null  
    advertised.listeners = null  
    advertised.port = null  
    authorizer.class.name =
```

```
~/kafka-training/lab2/solution  
[$ ./start-3rd-server.sh  
[2017-05-15 11:19:04,129] INFO KafkaConfig  
    advertised.host.name = null  
    advertised.listeners = null  
    advertised.port = null  
    authorizer.class.name =
```

Create Kafka replicated topic my-failsafe-topic

Tos

```
create-replicated-topic.sh x
1  #!/usr/bin/env bash
2
3  cd ~/kafka-training
4
5  kafka/bin/kafka-topics.sh --create \ --bootstrap-server localhost:9092
6
7      --replication-factor 3 \
8      --partitions 13 \
9      --topic my-failsafe-topic
10
```

- ❖ **Replication Factor** is set to 3
- ❖ Topic name is **my-failsafe-topic**
- ❖ **Partitions** is 13

```
$ ./create-replicated-topic.sh
Created topic "my-failsafe-topic".
```

```
start-consumer-console-replicated.sh x
1  #!/usr/bin/env bash
2  cd ~/kafka-training
3
4  kafka/bin/kafka-console-consumer.sh \
5      --bootstrap-server localhost:9094,localhost:9092 \
6      --topic my-failsafe-topic \
7      --from-beginning
8
```

- ❖ Pass list of Kafka servers to bootstrap-server
- ❖ We pass two of the three
- ❖ Only one needed, it learns about the rest

Start Kafka Producer

Tos

>_ start-producer-console-replicated.sh x

```
1  #!/usr/bin/env bash
2  cd ~/kafka-training
3
4  kafka/bin/kafka-console-producer.sh \
5  --broker-list localhost:9092,localhost:9093 \
6  --topic my-failsafe-topic
7
```

- ❖ Start producer
- ❖ Pass list of Kafka Brokers

Kafka 1 consumer and 1 producer running

Tos

```
Last login: Mon May 15 11:25:19 on ttys007
```

```
~/kafka-training/lab2/solution
```

```
[$ ./start-producer-console-replicated.sh
```

```
Hi mom
```

```
How are you?
```

```
How are things going?
```

```
Good!
```

```
[
```

```
Last login: Mon May 15 11:19:27 on ttys006
```

```
~/kafka-training/lab2/solution
```

```
[$ ls
```

```
config
```

```
start-2
```

```
create-replicated-topic.sh
```

```
start-3
```

```
list-topics.sh
```

```
start-c
```

```
start-1st-server.sh
```

```
start-p
```

```
~/kafka-training/lab2/solution
```

```
[$ ./start-consumer-console-replicated.sh
```

```
Hi mom
```

```
How are you?
```

```
How are things going?
```

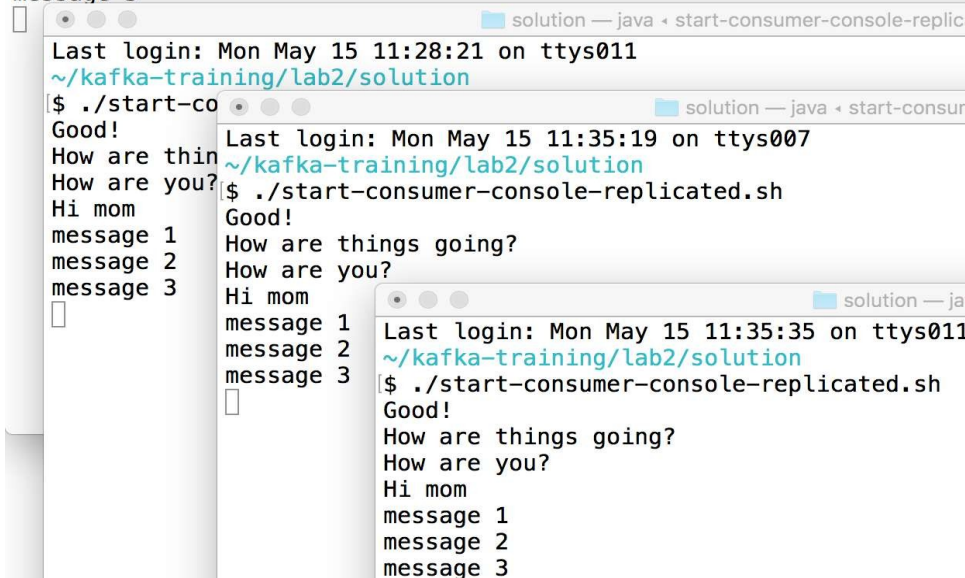
```
Good!
```

```
[
```

Start a second and third consumer

```
$ ./start-producer-console-replicated.sh
```

```
Hi mom  
How are you?  
How are things going?  
Good!  
message 1  
message 2  
message 3
```



The image shows three overlapping terminal windows. The top window is the producer, which has sent three messages. The middle window is a consumer that has just logged in and is ready to receive messages. The bottom window is another consumer that has also logged in and is ready to receive messages. The producer's output is visible in all three windows, showing the messages being sent.

```
solution — java start-consumer-console-replic  
Last login: Mon May 15 11:28:21 on ttys011  
~/kafka-training/lab2/solution  
$ ./start-co  
Good!  
How are thin  
How are you?  
Hi mom  
message 1  
message 2  
message 3
```

```
solution — java start-consum  
Last login: Mon May 15 11:35:19 on ttys007  
~/kafka-training/lab2/solution  
$ ./start-consumer-console-replicated.sh  
Good!  
How are things going?  
How are you?  
Hi mom  
message 1  
message 2  
message 3
```

```
solution — ja  
Last login: Mon May 15 11:35:35 on ttys011  
~/kafka-training/lab2/solution  
$ ./start-consumer-console-replicated.sh  
Good!  
How are things going?  
How are you?  
Hi mom  
message 1  
message 2  
message 3
```

- ❖ Acts like pub/sub
- ❖ Each consumer in its own group
- ❖ Message goes to each
- ❖ How do we load share?

Running consumers in same group

Tos

> start-consumer-console-replicated.sh x

```
1  #!/usr/bin/env bash
```

```
2  cd ~/kafka-training
```

```
3  
4  kafka/bin/kafka-console-consumer.sh \  
5      --bootstrap-server localhost:9094,localhost:9092 \  
6      --topic my-failsafe-topic \  
7      --consumer-property group.id=mygroup  
8      --from-beginning
```



Modify start consumer script



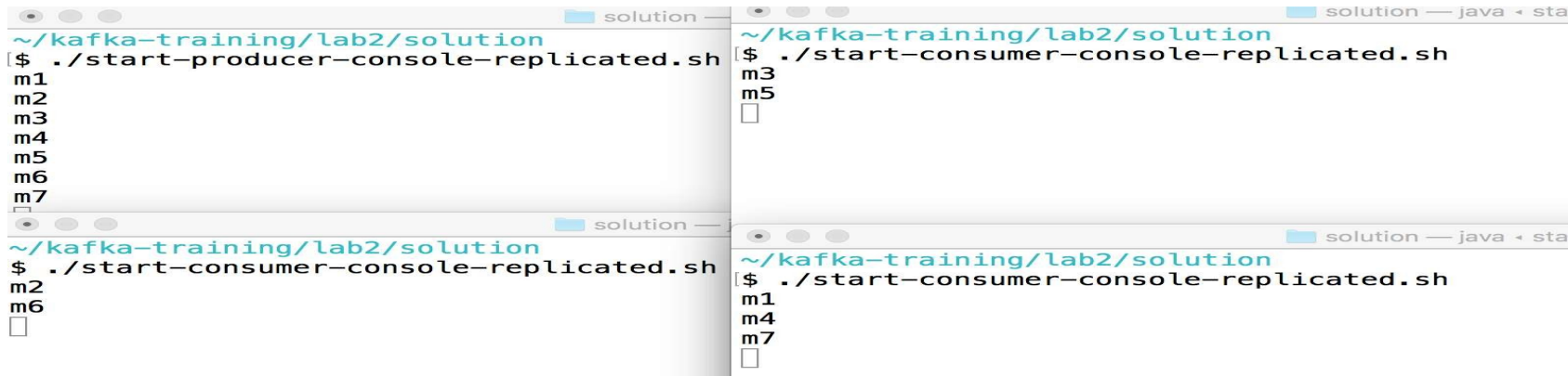
Add the consumers to a group called mygroup



Now they will share load

Start up three consumers again

Tos



The image displays four terminal windows arranged in a 2x2 grid, all showing the directory `~/kafka-training/lab2/solution`. The top-left window shows the execution of `./start-producer-console-replicated.sh`, which outputs a list of seven messages: `m1`, `m2`, `m3`, `m4`, `m5`, `m6`, and `m7`. The top-right window shows the execution of `./start-consumer-console-replicated.sh`, which outputs `m3` and `m5`, followed by a blank line. The bottom-left window shows the execution of `./start-consumer-console-replicated.sh`, which outputs `m2` and `m6`, followed by a blank line. The bottom-right window shows the execution of `./start-consumer-console-replicated.sh`, which outputs `m1`, `m4`, and `m7`, followed by a blank line. This demonstrates that the three consumers have collectively received all seven messages produced.

```
~/kafka-training/lab2/solution
[$ ./start-producer-console-replicated.sh
m1
m2
m3
m4
m5
m6
m7

~/kafka-training/lab2/solution
[$ ./start-consumer-console-replicated.sh
m3
m5
[]

~/kafka-training/lab2/solution
$ ./start-consumer-console-replicated.sh
m2
m6
[]

~/kafka-training/lab2/solution
[$ ./start-consumer-console-replicated.sh
m1
m4
m7
[]
```

- ❖ Start up producer and three consumers
- ❖ Send 7 messages
- ❖ Notice how messages are spread among 3 consumers

Consumer Failover

Tos

```

solution — java ◀ start-pi
~/kafka-training/lab2/solution
$ ./start-producer-console-replicated.sh
m1
m2
m3
m4
m5
m6
m10
m12
m13
m3
m5
m8
m9
m11
m14
m14

```

- ❖ Kill one consumer
- ❖ Send seven more messages
- ❖ Load is spread to remaining consumers
- ❖ Failover WORK!

Create Kafka Describe Topic

Tos

```
describe-topics.sh x
1  #!/usr/bin/env bash
2
3  cd ~/kafka-training
4
5  # List existing topics
6  kafka/bin/kafka-topics.sh --describe \
7    --topic my-failsafe-topic \
8    --bootstrap-server localhost:9092
9
```

- ❖ `--describe` will show list partitions, ISRs, and partition leadership

Use Describe Topics

```
$ ./describe-topics.sh
Topic:my-failsafe-topic PartitionCount:13 ReplicationFactor:3 Configs:
Topic: my-failsafe-topic Partition: 0 Leader: 2 Replicas: 2,0,1 Isr: 2,0,1
Topic: my-failsafe-topic Partition: 1 Leader: 0 Replicas: 0,1,2 Isr: 0,1,2
Topic: my-failsafe-topic Partition: 2 Leader: 1 Replicas: 1,2,0 Isr: 1,2,0
Topic: my-failsafe-topic Partition: 3 Leader: 2 Replicas: 2,1,0 Isr: 2,1,0
Topic: my-failsafe-topic Partition: 4 Leader: 0 Replicas: 0,2,1 Isr: 0,2,1
Topic: my-failsafe-topic Partition: 5 Leader: 1 Replicas: 1,0,2 Isr: 1,0,2
Topic: my-failsafe-topic Partition: 6 Leader: 2 Replicas: 2,0,1 Isr: 2,0,1
Topic: my-failsafe-topic Partition: 7 Leader: 0 Replicas: 0,1,2 Isr: 0,1,2
Topic: my-failsafe-topic Partition: 8 Leader: 1 Replicas: 1,2,0 Isr: 1,2,0
Topic: my-failsafe-topic Partition: 9 Leader: 2 Replicas: 2,1,0 Isr: 2,1,0
Topic: my-failsafe-topic Partition: 10 Leader: 0 Replicas: 0,2,1 Isr: 0,2,1
Topic: my-failsafe-topic Partition: 11 Leader: 1 Replicas: 1,0,2 Isr: 1,0,2
Topic: my-failsafe-topic Partition: 12 Leader: 2 Replicas: 2,0,1 Isr: 2,0,1
```

- ❖ Lists which broker owns (leader of) which partition
- ❖ Lists Replicas and ISR (replicas that are up to date)
- ❖ Notice there are 13 topics

Test Broker Failover: Kill 1st server

Tos

Kill the first server

```
~/kafka-training/lab2/solution
```

```
$ kill `ps aux | grep java | grep server-0.properties | tr -s " " | cut -d " " -f2`
```

use Kafka topic describe to see that a new leader was elected!

```
$ ./describe-topics.sh
```

```
Topic:my-failsafe-topic PartitionCount:13 ReplicationFactor:3 Configs:
Topic: my-failsafe-topic Partition: 0 Leader: 2 Replicas: 2,0,1 Isr: 2,1
Topic: my-failsafe-topic Partition: 1 Leader: 1 Replicas: 0,1,2 Isr: 1,2
Topic: my-failsafe-topic Partition: 2 Leader: 1 Replicas: 1,2,0 Isr: 1,2
Topic: my-failsafe-topic Partition: 3 Leader: 2 Replicas: 2,1,0 Isr: 2,1
Topic: my-failsafe-topic Partition: 4 Leader: 2 Replicas: 0,2,1 Isr: 2,1
Topic: my-failsafe-topic Partition: 5 Leader: 1 Replicas: 1,0,2 Isr: 1,2
Topic: my-failsafe-topic Partition: 6 Leader: 2 Replicas: 2,0,1 Isr: 2,1
Topic: my-failsafe-topic Partition: 7 Leader: 1 Replicas: 0,1,2 Isr: 1,2
Topic: my-failsafe-topic Partition: 8 Leader: 1 Replicas: 1,2,0 Isr: 1,2
Topic: my-failsafe-topic Partition: 9 Leader: 2 Replicas: 2,1,0 Isr: 2,1
Topic: my-failsafe-topic Partition: 10 Leader: 2 Replicas: 0,2,1 Isr: 2,1
Topic: my-failsafe-topic Partition: 11 Leader: 1 Replicas: 1,0,2 Isr: 1,2
Topic: my-failsafe-topic Partition: 12 Leader: 2 Replicas: 2,0,1 Isr: 2,1
```

Show Broker Failover Worked

Tos

```
~/kafka-training/lab2/solution
$ ./start-producer-console-replicated.sh
m1
m2
m3
m4
m5
m6
m10
m12
m13
m9
[2017-05-15 12:00:58,462] WARN Auto-commit
ta='', my-failsafe-topic-3=OffsetAndMetad
ffset=1, metadata='', my-failsafe-topic-1
etAndMetadata{offset=1, metadata=''}, my-f
fe-topic-5=OffsetAndMetadata{offset=2, met
triable exception. You should retry commit
Coordinator)
m16
[ ]
```

- ❖ Send two more messages from the producer
- ❖ Notice that the consumer gets the messages
- ❖ Broker Failover WORKS

- ❖ Why did the three consumers not load share the messages at first?
- ❖ How did we demonstrate failover for consumers?
- ❖ How did we demonstrate failover for producers?
- ❖ What tool and option did we use to show ownership of partitions and the ISRs?

Lab : Kafka cluster