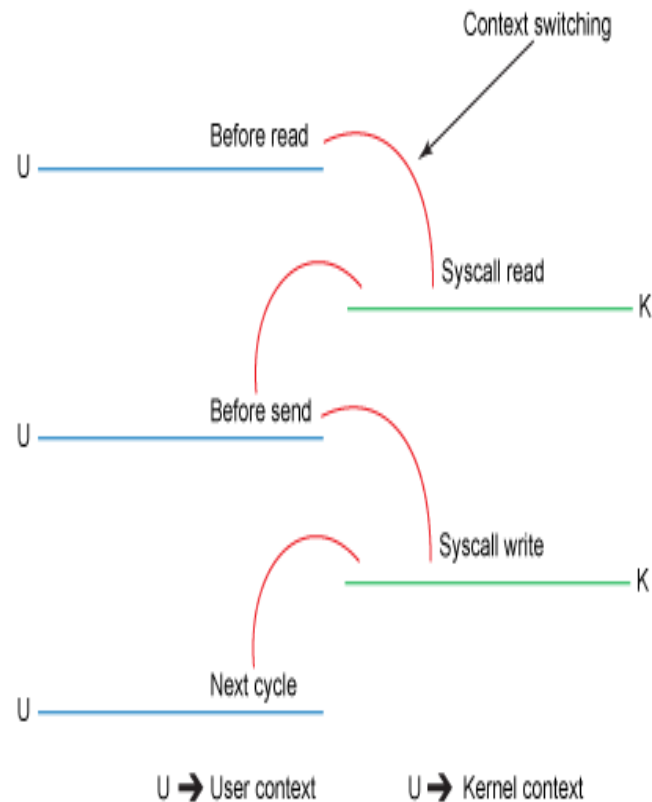
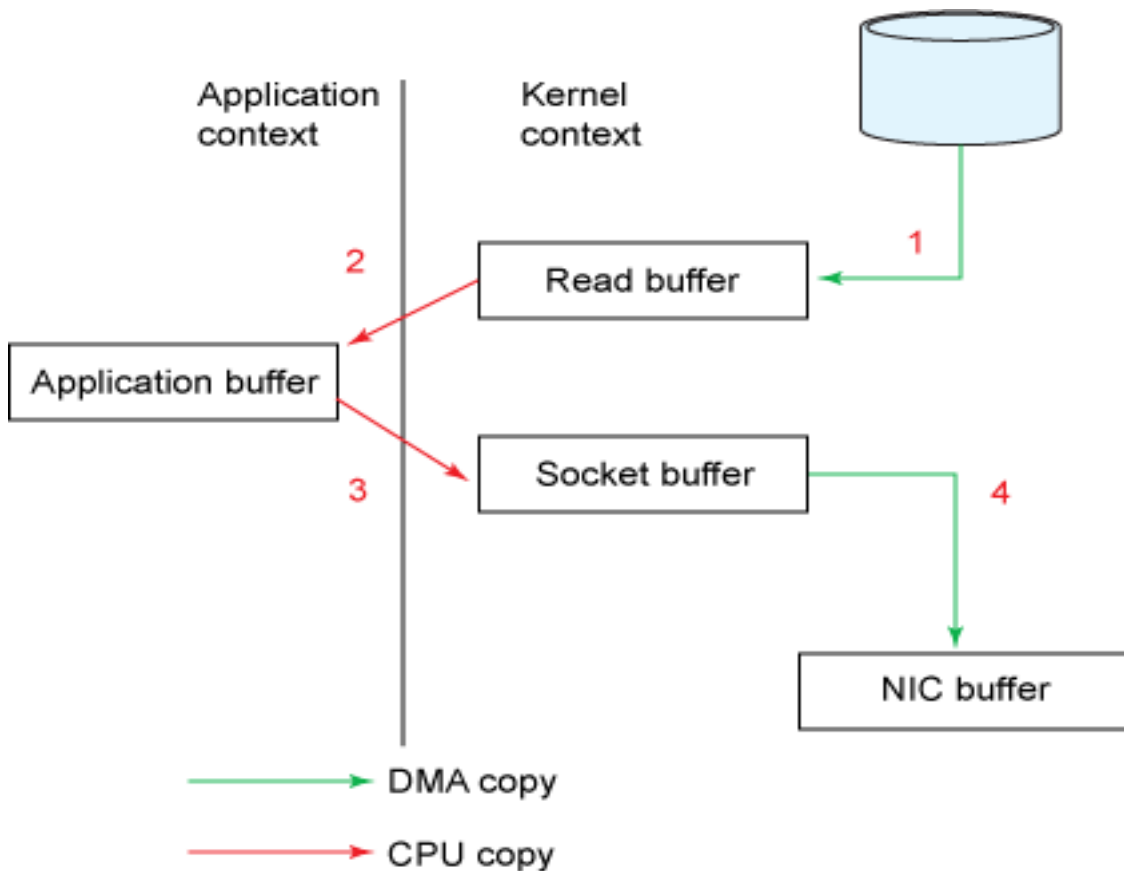


Kafka Topics Architecture

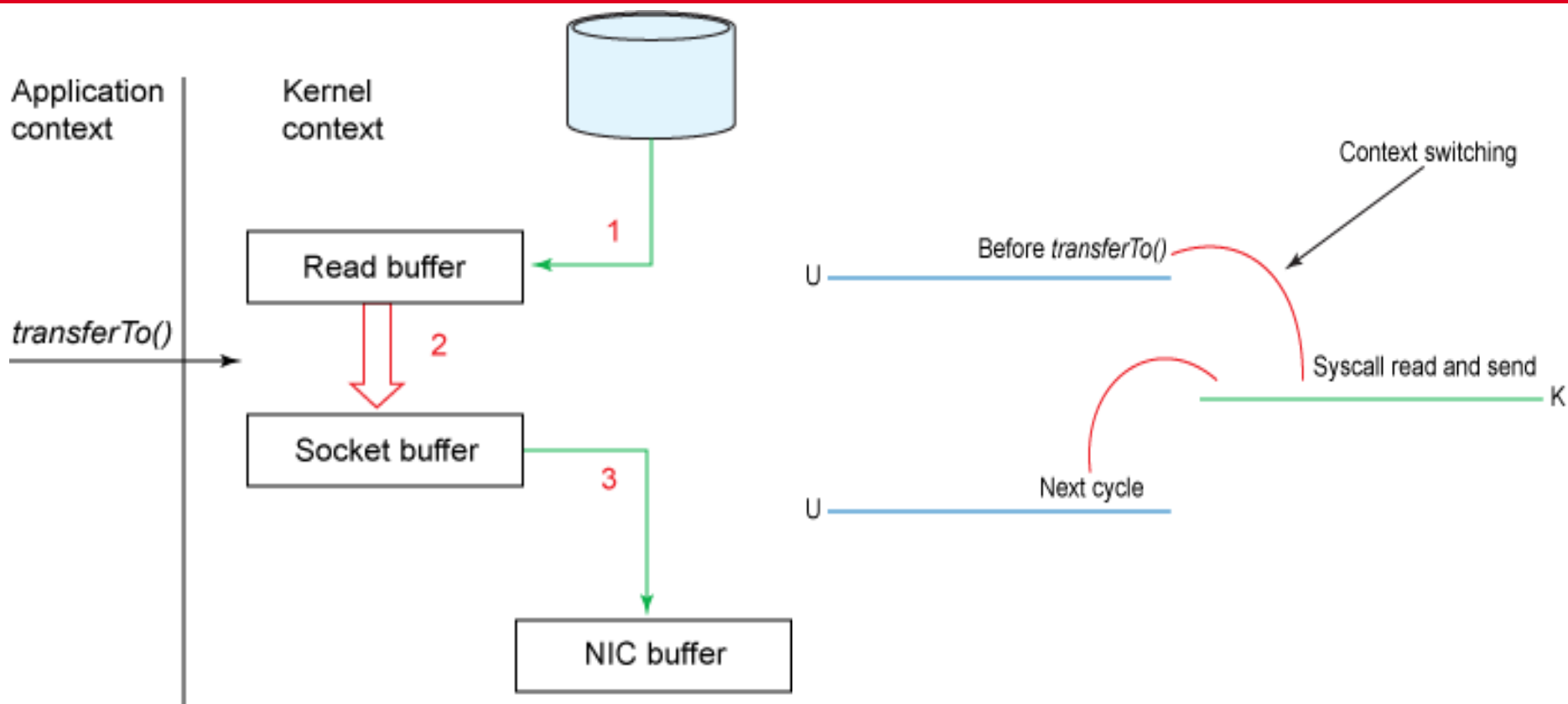
No Zero Copy

Tos



Zero Copy

Tos

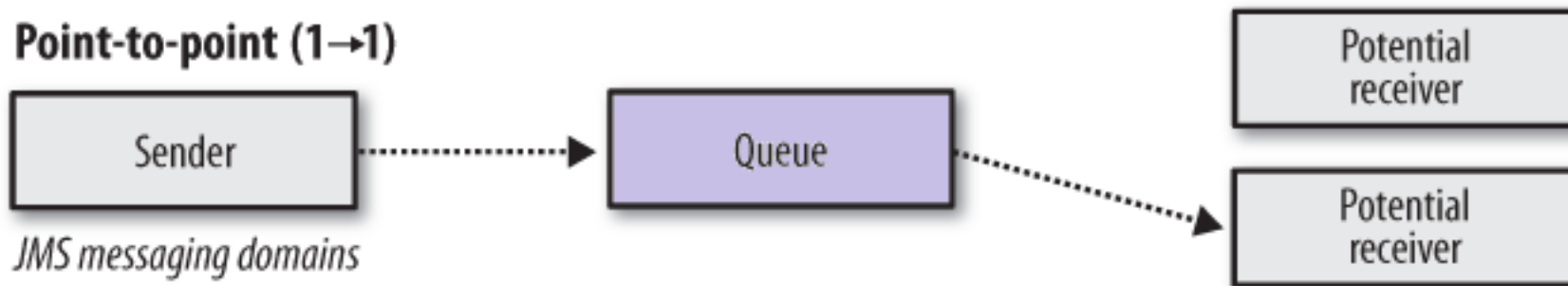


Kafka versus MOM

Publish-and-subscribe (1→Many)



Point-to-point (1→1)



JMS messaging domains

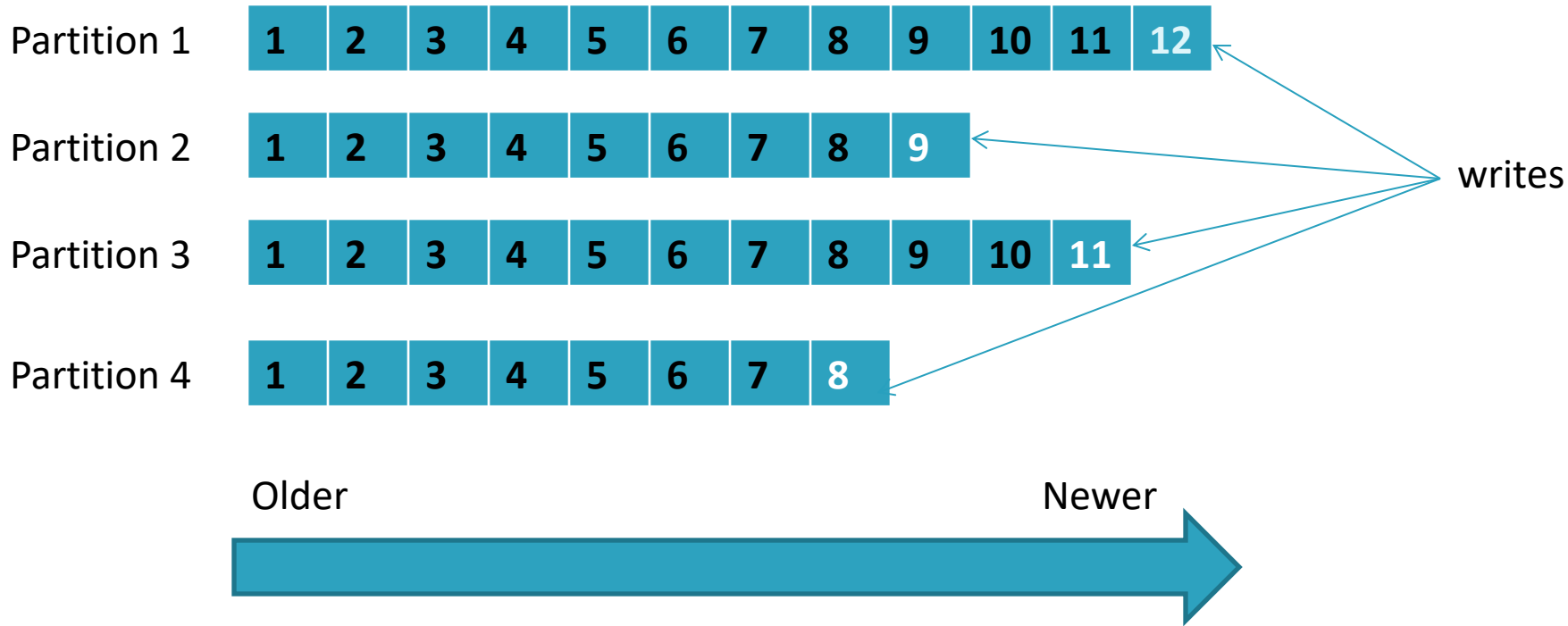
- ❖ Is Kafka a Queue or a Pub/Sub/Topic?
 - ❖ Yes
- ❖ Kafka is like a Queue per consumer group
 - ❖ Kafka is a queue system per consumer in consumer group so load balancing like JMS, RabbitMQ queue
- ❖ Kafka is like Topics in JMS, RabbitMQ, MOM
 - ❖ Topic/pub/sub by offering Consumer Groups which act like subscriptions
 - ❖ Broadcast to multiple consumer groups
- ❖ MOM = JMS, ActiveMQ, RabbitMQ, IBM MQ Series, Tibco, etc.

- ❖ By design, Kafka is better suited for scale than traditional MOM systems due to partition topic log
 - ❖ Load divided among Consumers for read by partition
 - ❖ Handles parallel consumers better than traditional MOM
- ❖ Also by moving location (partition offset) in log to client/consumer side of equation instead of the broker, less tracking required by Broker and more flexible consumers
- ❖ Kafka written with mechanical sympathy, modern hardware, cloud in mind
 - ❖ Disks are faster
 - ❖ Servers have tons of system memory
 - ❖ Easier to spin up servers for scale out

- ❖ **Records** have a **key (optional)**, **value** and **timestamp**; **Immutable**
- ❖ **Topic** a stream of records (“/orders”, “/user-signups”), feed name
 - ❖ **Log** topic storage on disk
 - ❖ **Partition** / Segments (parts of Topic Log)

Kafka Topic Partitions Layout

Tos



- ❖ Kafka **Topic** is a stream of records
- ❖ **Topics** stored in log
- ❖ **Log** broken up into **partitions** and **segments**
- ❖ **Topic** is a category or stream name or feed
- ❖ Topics are pub/sub
 - ❖ Can have zero or many subscribers - consumer groups
- ❖ **Topics** are broken up and spread by partitions for speed and size

- ❖ **Topics** are broken up into **partitions**
- ❖ **Partitions** decided usually by key of record
 - ❖ Key of record determines which partition
- ❖ **Partitions** are used to scale Kafka across many servers
 - ❖ Record sent to correct partition by key
- ❖ **Partitions** are used to facilitate parallel consumers
 - ❖ Records are consumed in parallel up to the number of partitions
- ❖ Order guaranteed per partition
- ❖ Partitions can be **replicated** to multiple brokers

- ❖ **Order** is maintained only in a single **partition**
 - ❖ **Partition** is ordered, immutable sequence of records that is continually appended to—a structured commit **log**
- ❖ **Records** in partitions are assigned **sequential id** number called the **offset**
- ❖ **Offset** identifies each record within the partition
- ❖ **Topic Partitions** allow Kafka log to scale beyond a size that will fit on a single server
 - ❖ Topic partition must fit on servers that host it
 - ❖ topic can span many partitions hosted on many servers

- ❖ Topic Partitions are unit of ***parallelism***
partition can only be used by one consumer in group at a time
- ❖ Consumers can run in their own process or their own thread
- ❖ If a consumer stops, Kafka spreads partitions across remaining consumer in group
- ❖ #of Consumers you can run per Consumer Group limited by #of Partitions
- ❖ Consumers getting assigned partition aids in efficient message consumption tracking

- ❖ How can Kafka scale if multiple producers and consumers read/write to same Kafka Topic log?
- ❖ Writes fast: Sequential writes to file system are **fast** (700 MB or more a second)
- ❖ Scales writes and reads by **sharding**:
 - ❖ Topic logs into **Partitions** (parts of a Topic log)
 - ❖ Topics logs can be split into multiple Partitions **different machines/different disks**
 - ❖ Multiple Producers can write to different Partitions of the same Topic
 - ❖ Multiple Consumers Groups can read from different partitions

Kafka Replication to Partition 0

Record is considered “committed”.
When all ISRs for partition wrote to
their log.

**Only committed record are readable
from consumer**

Client producer

1. Write record

Leader : Red

Follower : Blue

Kafka broker 0

Partition 0

Partition 1

Partition 2

Partition 3

Partition 4

2.Replicate
record

Kafka broker 1

Partition 0

Partition 1

Partition 2

Partition 3

Partition 4

2.Replicate
record

Kafka broker 2

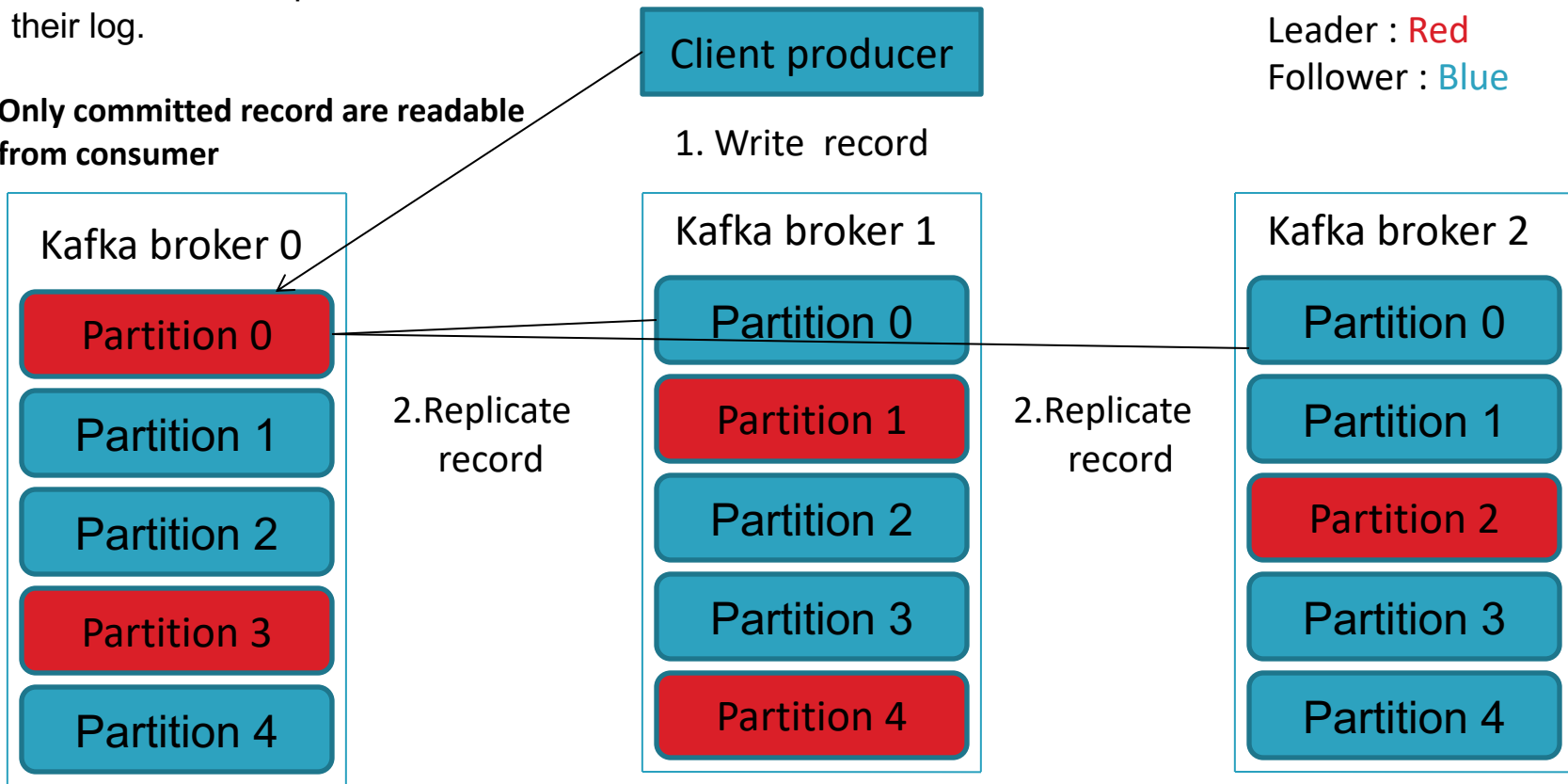
Partition 0

Partition 1

Partition 2

Partition 3

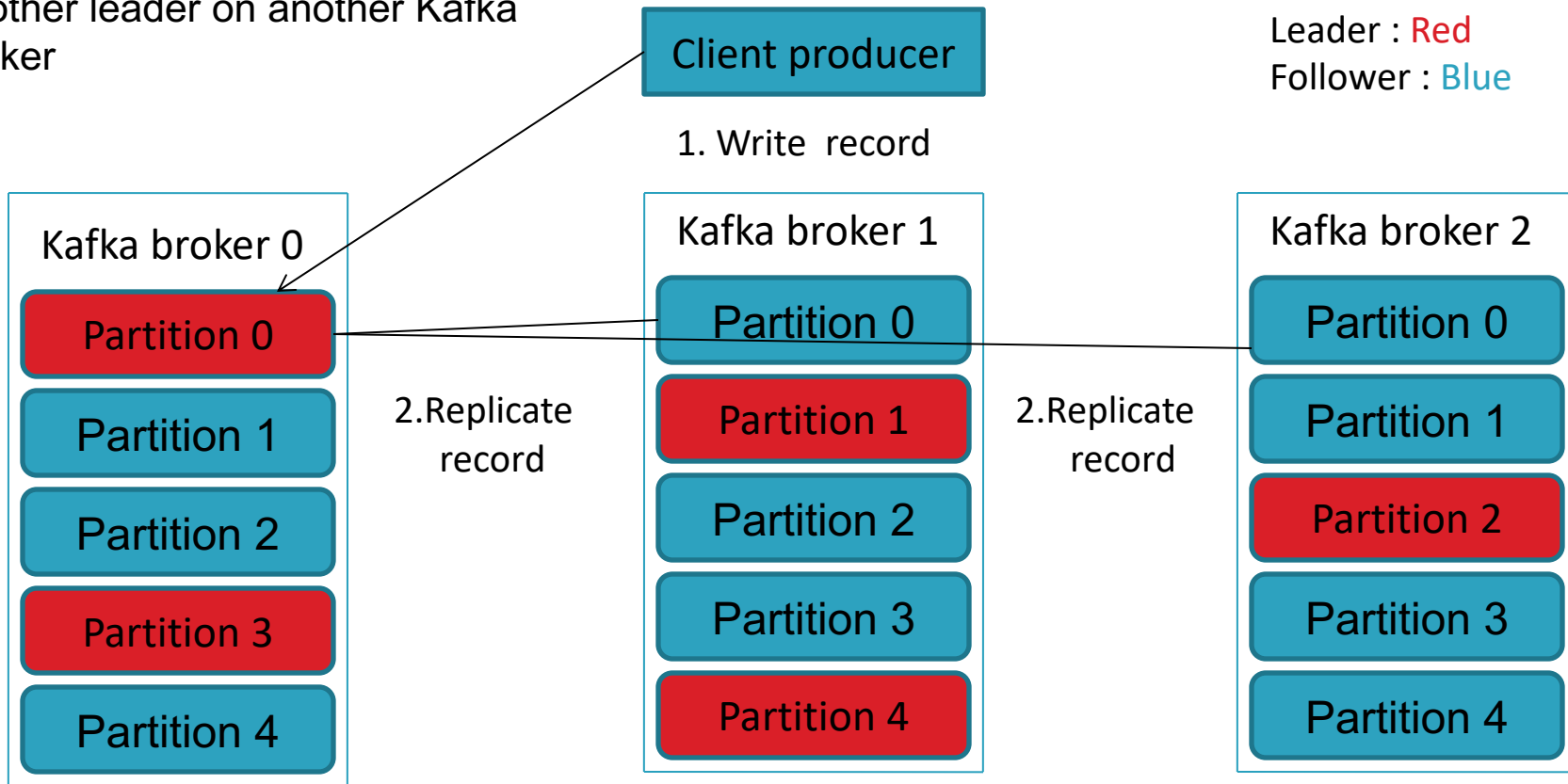
Partition 4



Kafka Replication to Partition 1

Tos

Another partition can be owned by another leader on another Kafka broker



- ❖ Each partition has **leader server** and zero or more **follower servers**
 - ❖ **Leader** handles all read and write requests for partition
 - ❖ **Followers** replicate leader, and take over if leader dies
 - ❖ Used for parallel consumer handling within a group
- ❖ Partitions of log are distributed over the servers in the Kafka cluster with each server handling data and requests for a share of partitions
- ❖ Each partition can be replicated across a configurable number of Kafka servers - Used for fault tolerance

- ❖ One node/partition's replicas is chosen as **leader**
- ❖ Leader handles all reads and writes of Records for partition
- ❖ Writes to partition are **replicated** to **followers** (node/partition pair)
- ❖ An **follower** that is **in-sync** is called an **ISR (in-sync replica)**
- ❖ If a partition leader fails, one ISR is chosen as new leader

- ❖ Run Zoo Keeper start up script
- ❖ Run Kafka Server/Broker start up script
- ❖ Create Kafka Topic from command line

Run ZooKeeper

> run-zookeeper.sh x

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

2 **cd ~/kafka-training**

3

4 **kafka/bin/zookeeper-server-start.sh **
5 **kafka/config/zookeeper.properties**

6

\$./run-zookeeper.sh

[2017-05-13 13:34:52,489] INFO Reading configuration from: kafka/config/zookeeper.properties (org.apache.zookeeper.server.quorum.QuorumPeerConfig)

[2017-05-13 13:34:52,491] INFO autopurge.snapRetainCount set to 3 (org.apache.zookeeper.server.DataDirCleanupManager)

[2017-05-13 13:34:52,491] INFO autopurge.purgeInterval set to 0 (org.apache.zookeeper.server.DataDirCleanupManager)

[2017-05-13 13:34:52,491] INFO Purge task is not scheduled. (org.apache.zookeeper.server.DataDirCleanupManager)

[2017-05-13 13:34:52,491] WARN Either no config or no quorum defined in config, running in standalone mode (org.apache.zookeeper.server.quorum.QuorumPeerMain)

[2017-05-13 13:34:52,504] INFO Reading configuration from: kafka/config/zookeeper.properties (org.apache.zookeeper.server.quorum.QuorumPeerConfig)

[2017-05-13 13:34:52,504] INFO Starting server (org.apache.zookeeper.server.ZooKeeperServerMain)

[2017-05-13 13:34:57,609] INFO Server environment:zookeeper.version=3.4.9-1757313, built on 08/23/2016 06:50 GMT (org.apache.zookeeper.server.ZooKeeperServer)

[2017-05-13 13:34:57,609] INFO Server environment:host.name=10.0.0.115 (org.apache.zookeeper.server.ZooKeeperServer)

Run Kafka Server

Tos

run-kafka.sh x

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

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

```
3
```

```
4  kafka/bin/kafka-server-start.sh \
```

```
5  kafka/config/server.properties
```

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

```
[2017-05-13 13:47:01,497] INFO KafkaConfig values:
```

```
advertised.host.name = null
```

```
advertised.listeners = null
```

```
advertised.port = null
```

```
authorizer.class.name =
```

```
auto.create.topics.enable = true
```

```
auto.leader.rebalance.enable = true
```

```
background.threads = 10
```

```
broker.id = 0
```

```
broker.id.generation.enable = true
```

```
broker.rack = null
```

```
compression.type = producer
```

```
connections.max.idle.ms = 600000
```

```
controlled.shutdown.enable = true
```

```
controlled.shutdown.max.retries = 3
```

```
controlled.shutdown.retry.backoff.ms = 5000
```

```
controller.socket.timeout.ms = 30000
```

Create Kafka Topic

```
#!/opt/kafka/bin/kafka-topics.sh --create --bootstrap-server localhost:9020 \  
--replication-factor 1 --partitions 12 --topic my-topic
```

```
[$ ./create-topic.sh  
Created topic "my-topic".
```

List Topics

```
#/opt/kafka/bin/kafka-topics.sh --list --bootstrap-server localhost:9020
```

```
~/kafka-training/lab1/solution  
[$ ./list-topics.sh  
__consumer_offsets  
__schemas  
my-example-topic  
my-example-topic2  
my-topic  
new-employees
```

Lab - Basic Kafka Operations - CLI (Topic) – 30 Mins