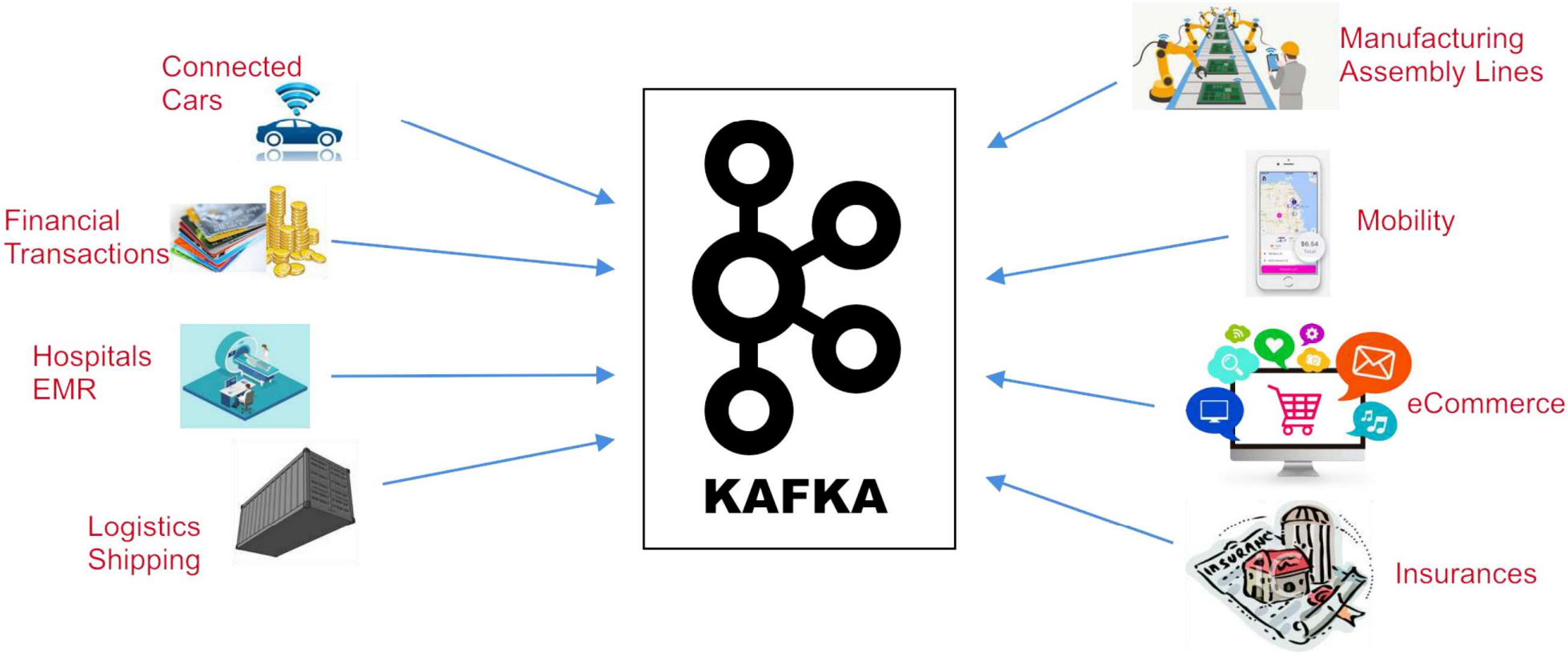
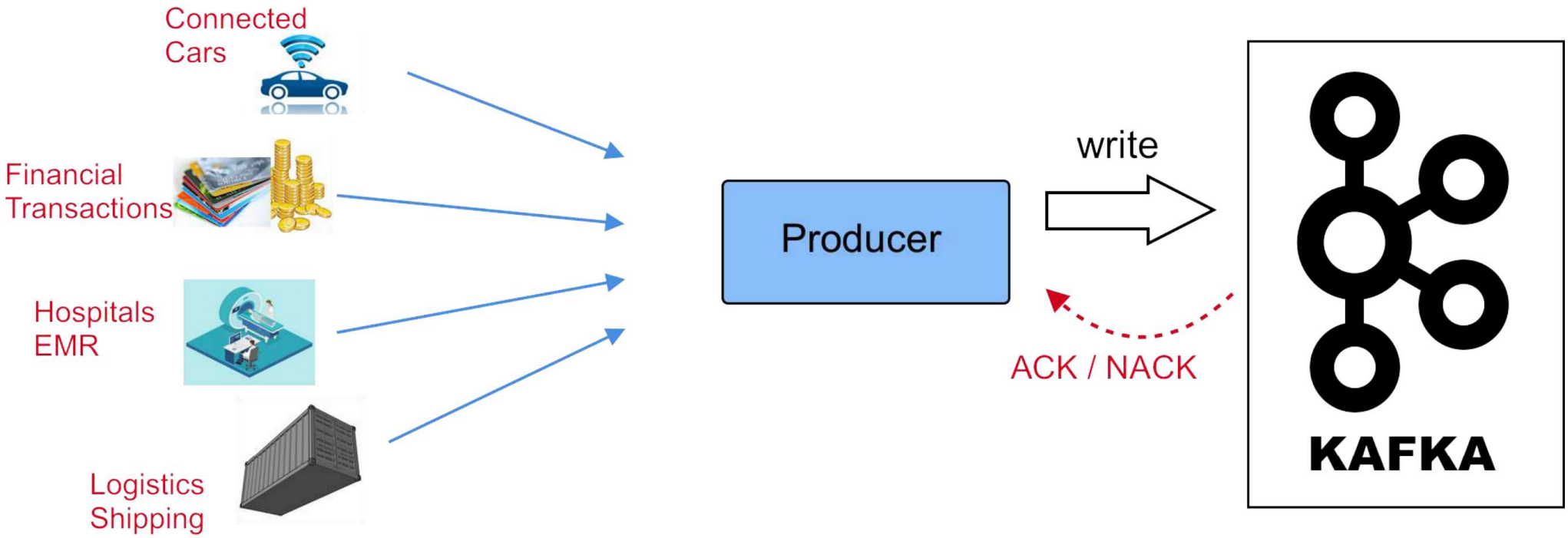
Fundamentals

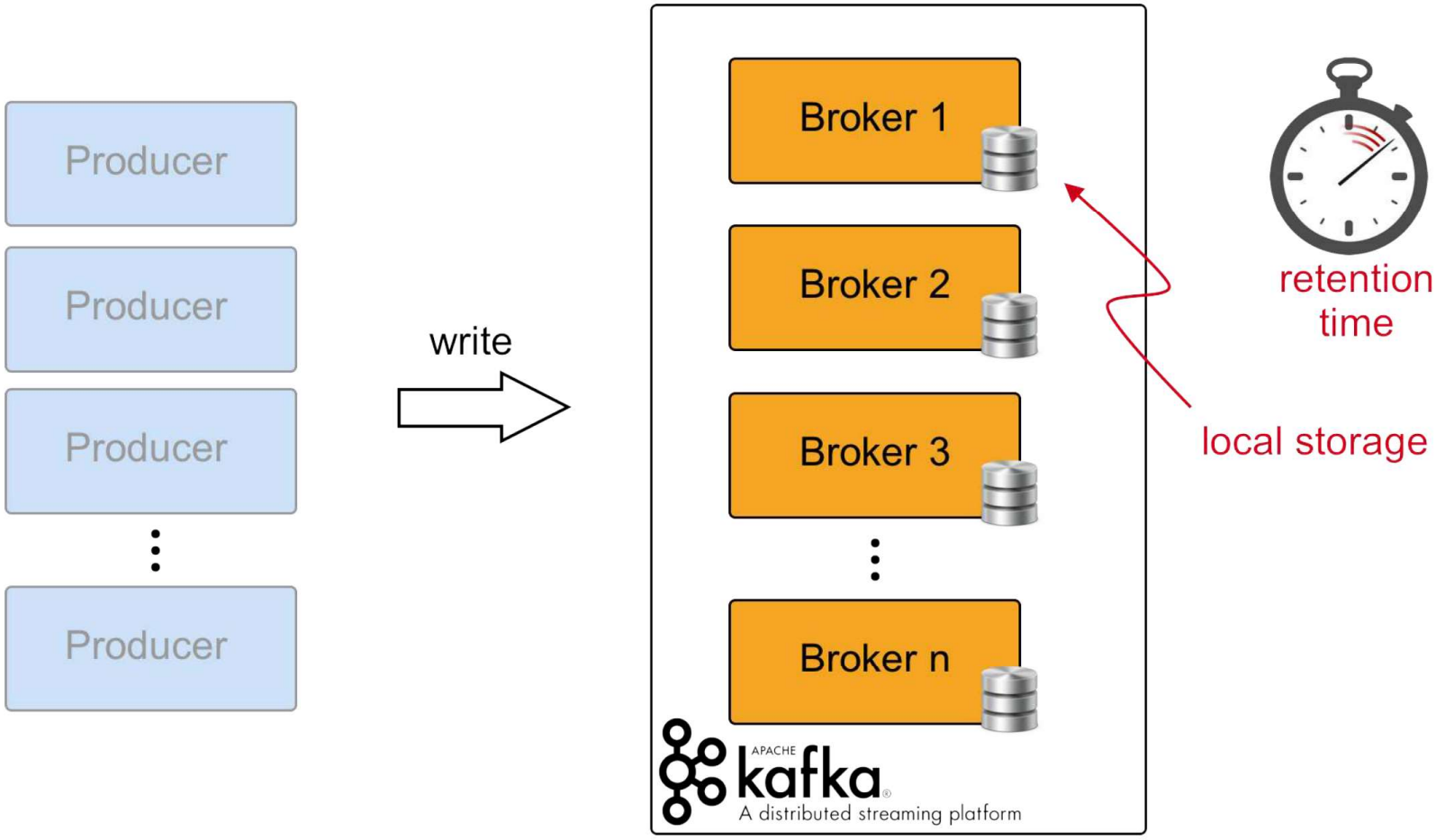
The World Produces Data



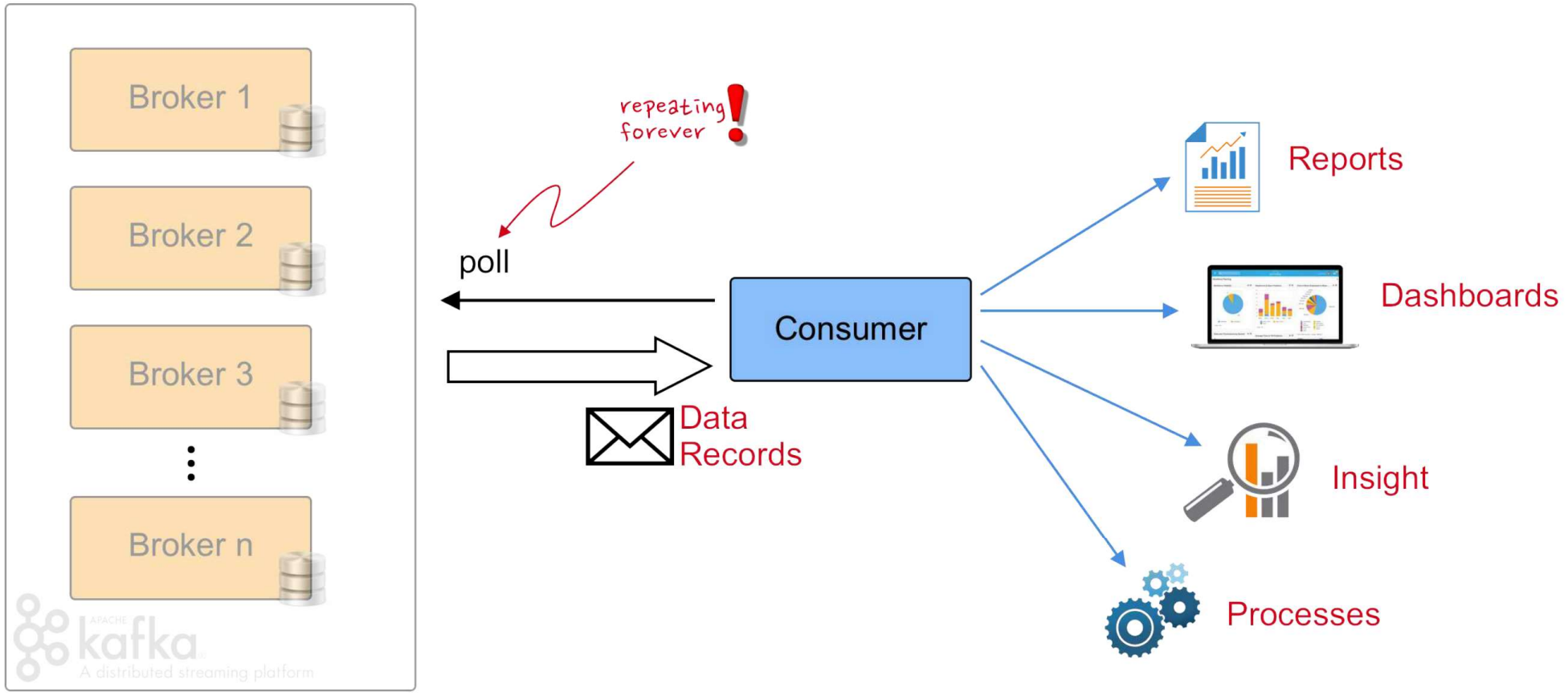
Producers


Connected
Cars
Financial
Transactions
Hospitals
EMR
Logistics
Shipping
Producer
write
ACK / NACK
KAFKA

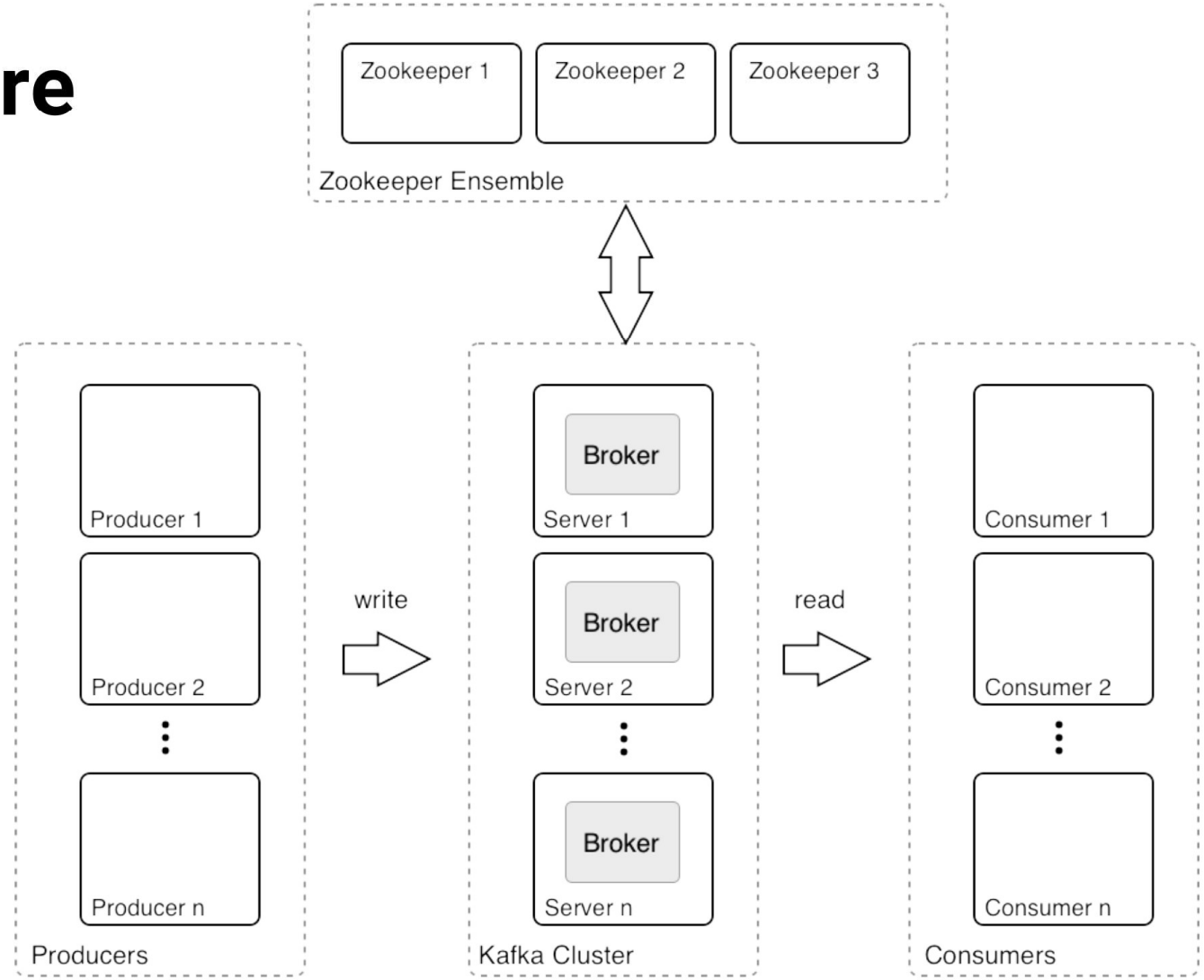
Kafka Brokers



Consumers

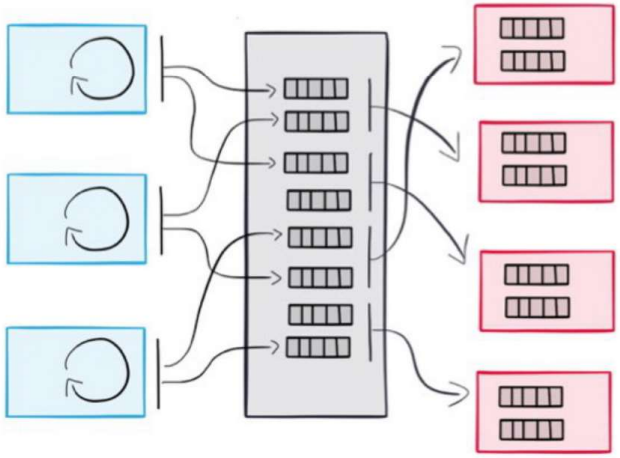

Broker 1
Broker 2
Broker 3
Broker n
APACHE kafka
A distributed streaming platform
repeating forever
poll
Consumer
Data Records
Reports
Dashboards
Insight
Processes

Architecture

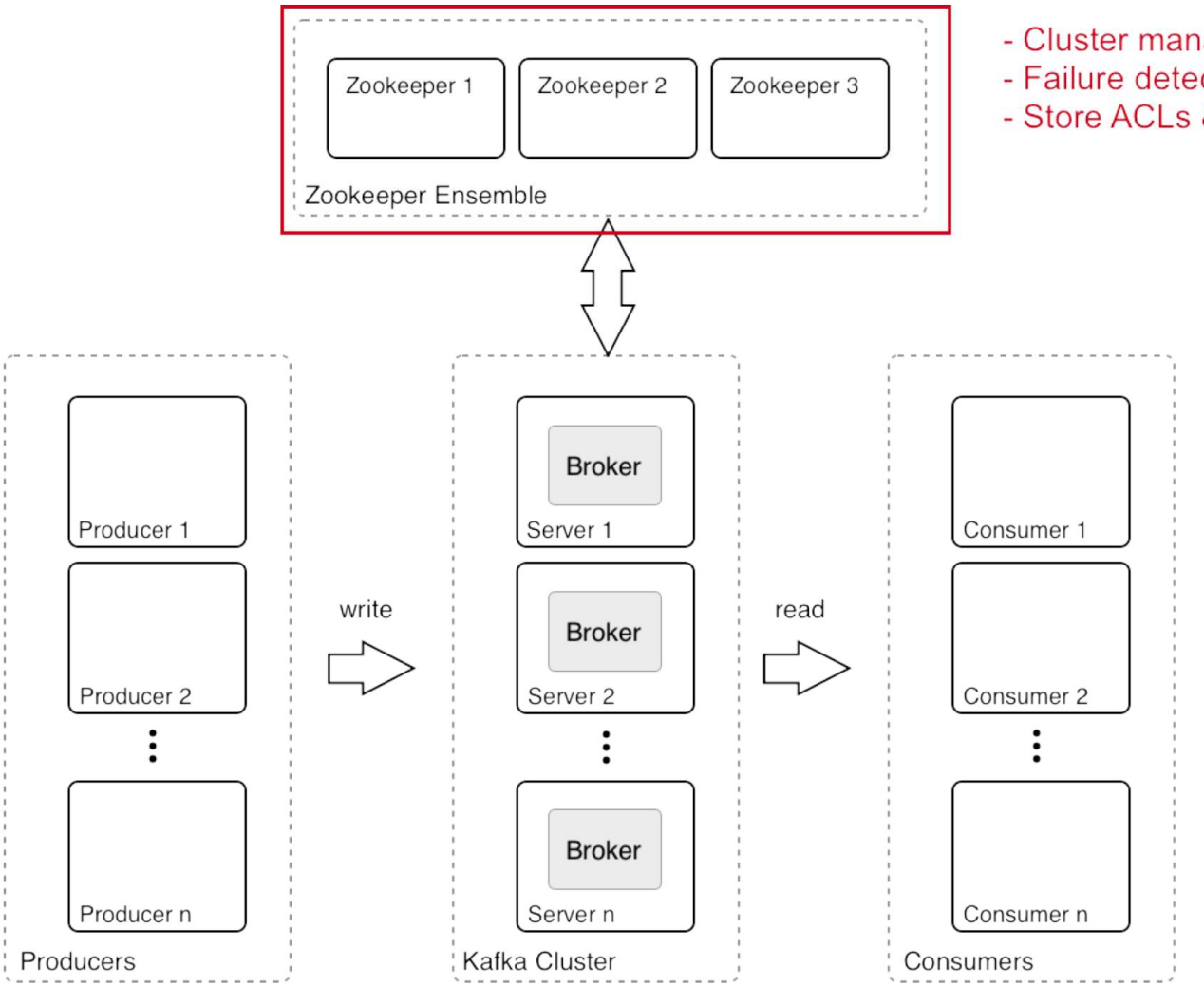


Decoupling Producers and Consumers

- Producers and Consumers are decoupled
- Slow Consumers do not affect Producers
- Add Consumers without affecting Producers
- Failure of Consumer does not affect System



How Kafka Uses ZooKeeper

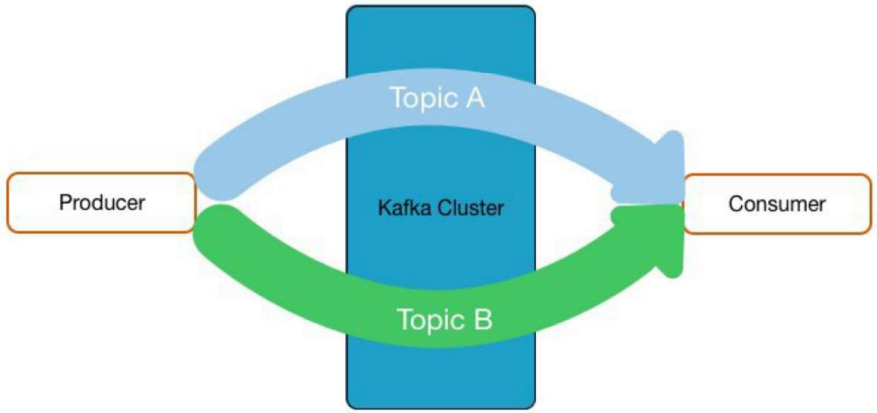


ZooKeeper Basics

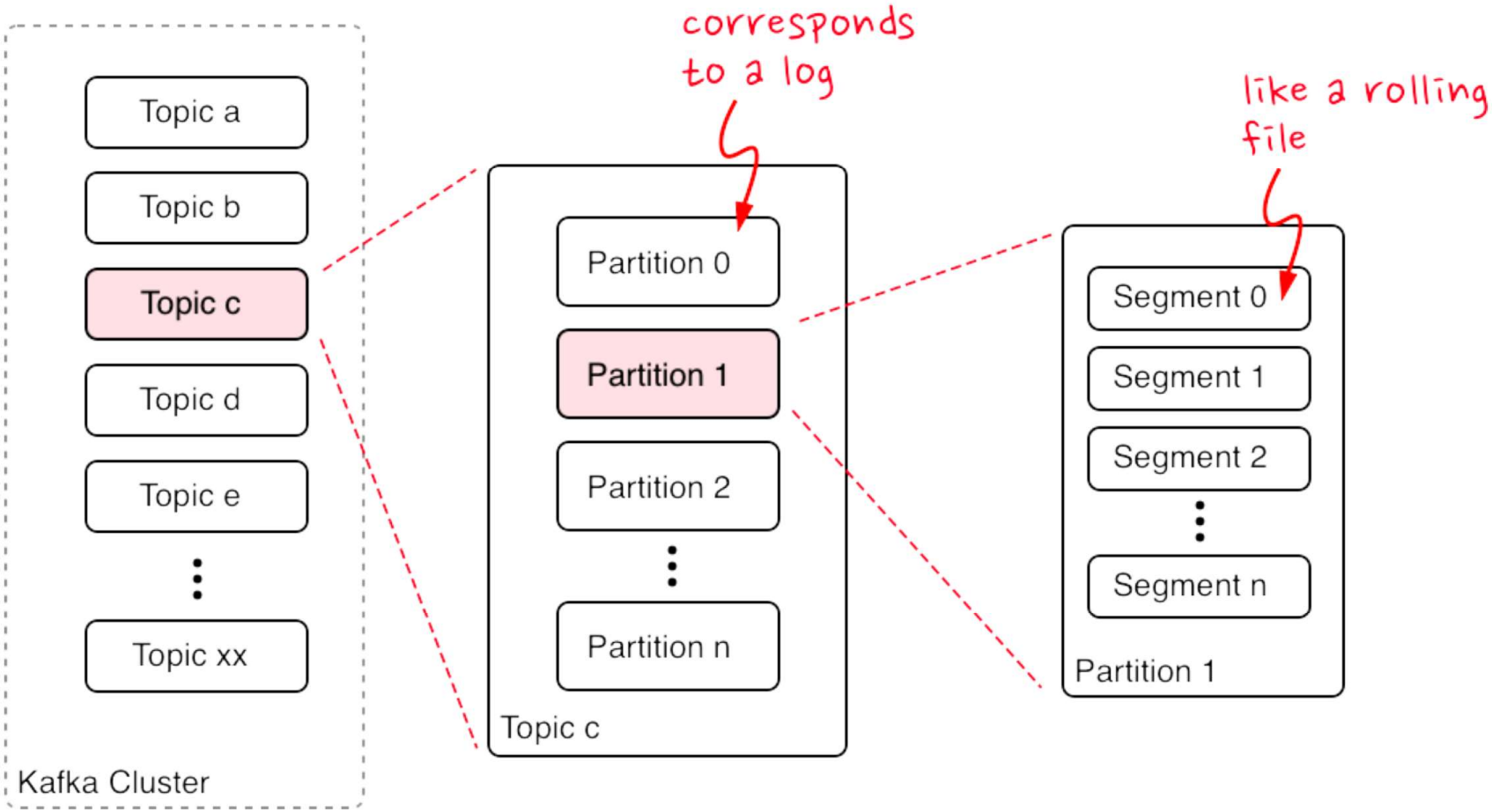
- **Open Source** Apache Project
- Distributed **Key Value Store**
- Maintains **configuration information**
- Stores **ACLs** and **Secrets**
- Enables highly reliable **distributed coordination**
- Provides **distributed synchronization**
- Three or five servers form an **ensemble**

Topics

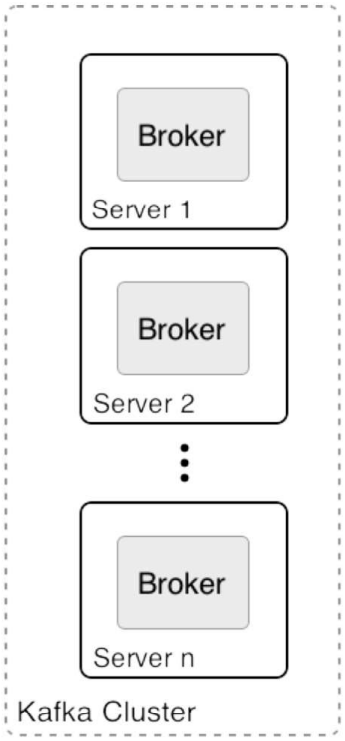
- **Topics**: Streams of “related” Messages in Kafka
  - Is a Logical Representation
  - Categorizes Messages into Groups
- Developers define Topics
- Producer ⟷ Topic: N to N Relation
- Unlimited Number of Topics



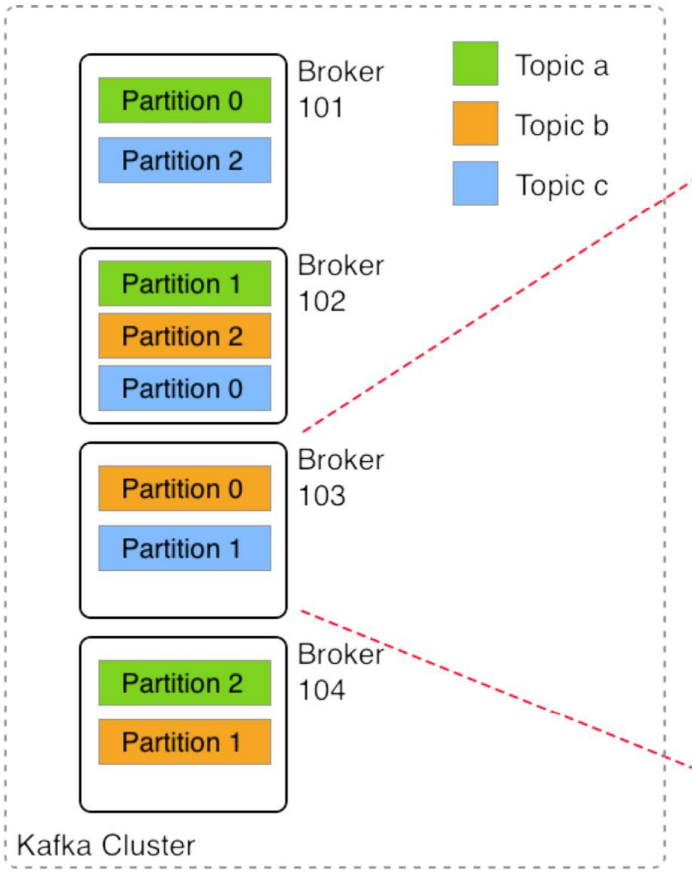
Topics, Partitions, and Segments



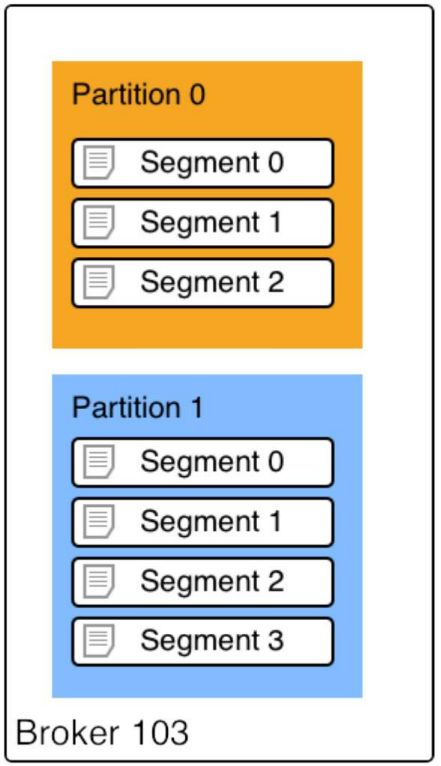
Topics, Partitions, and Segments



Scalability

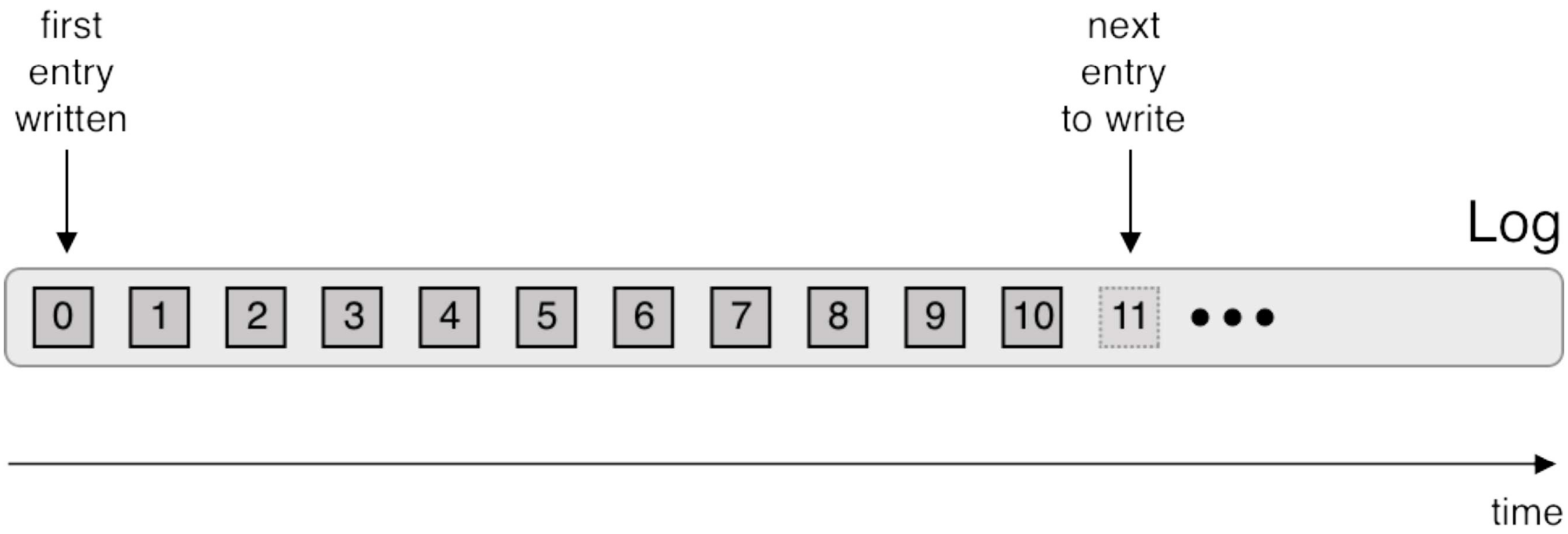


Parallelization

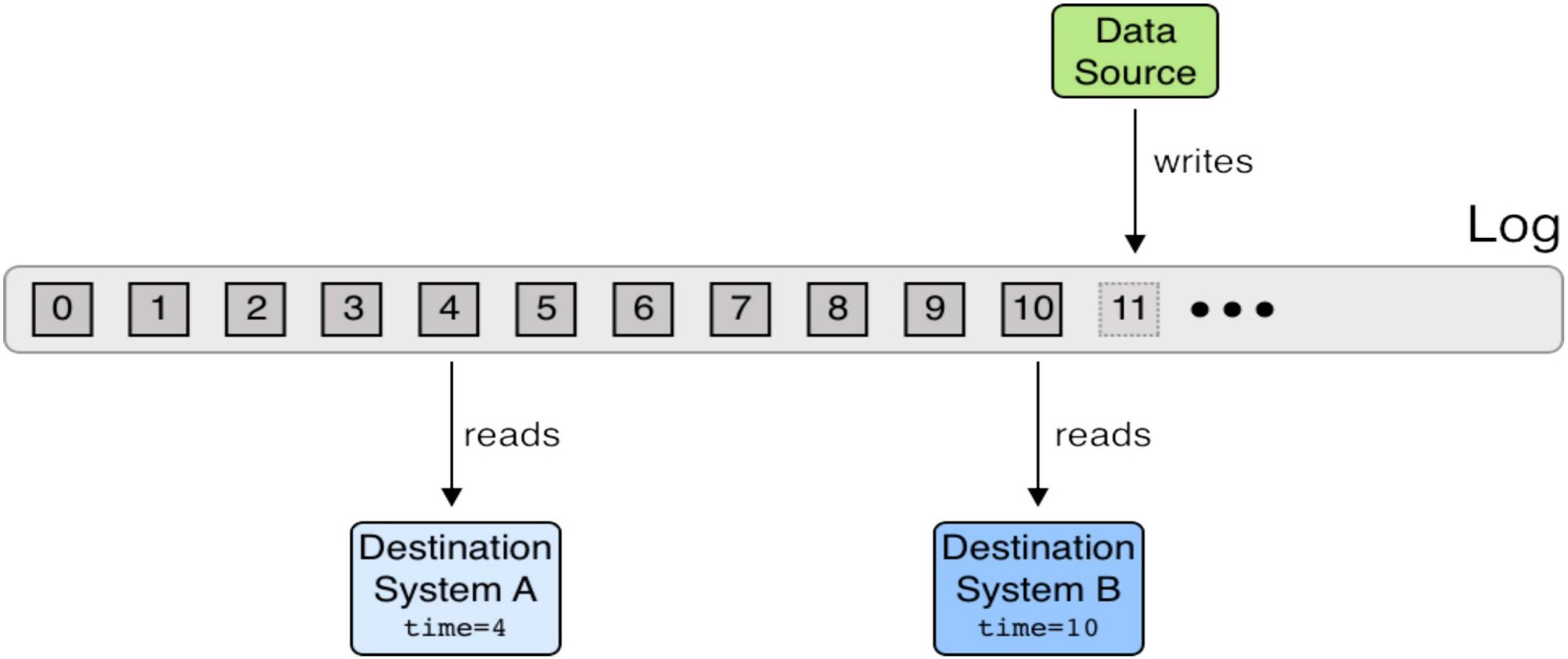


Rolling Files

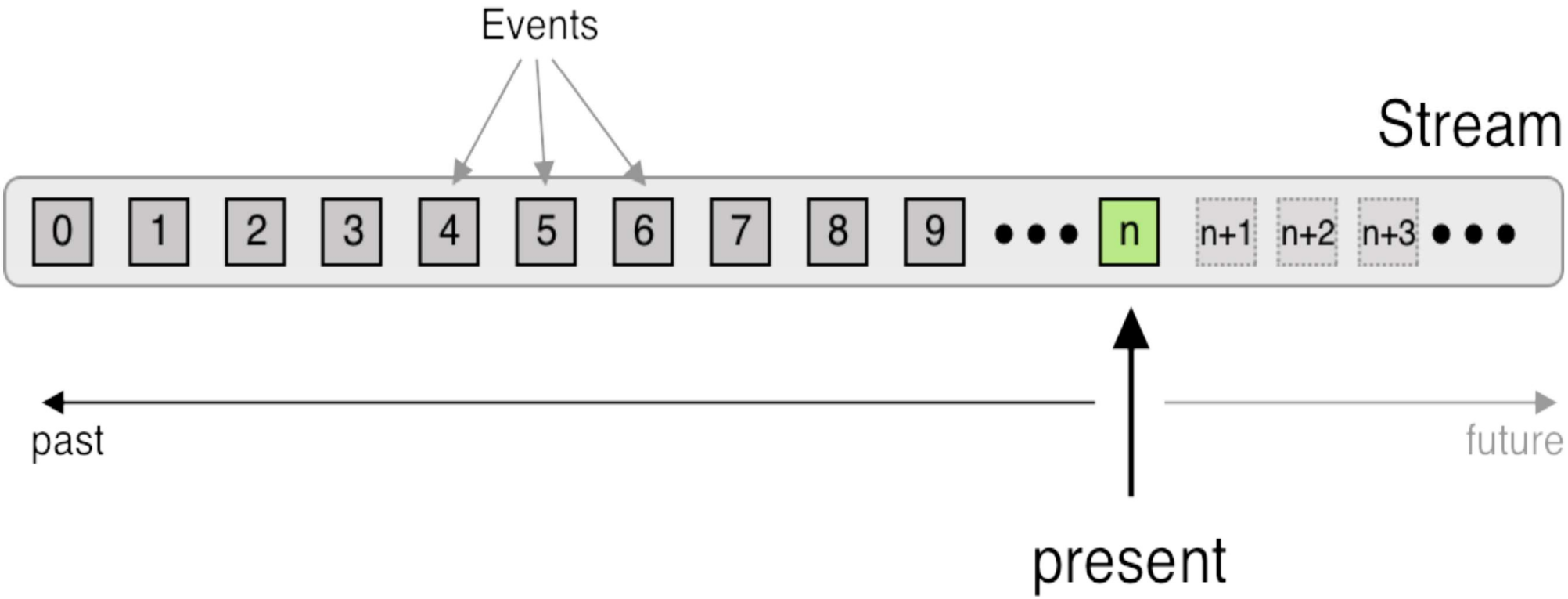
The Log


first
entry
written
next
entry
to write
Log
0
1
2
3
4
5
6
7
8
9
10
11
time

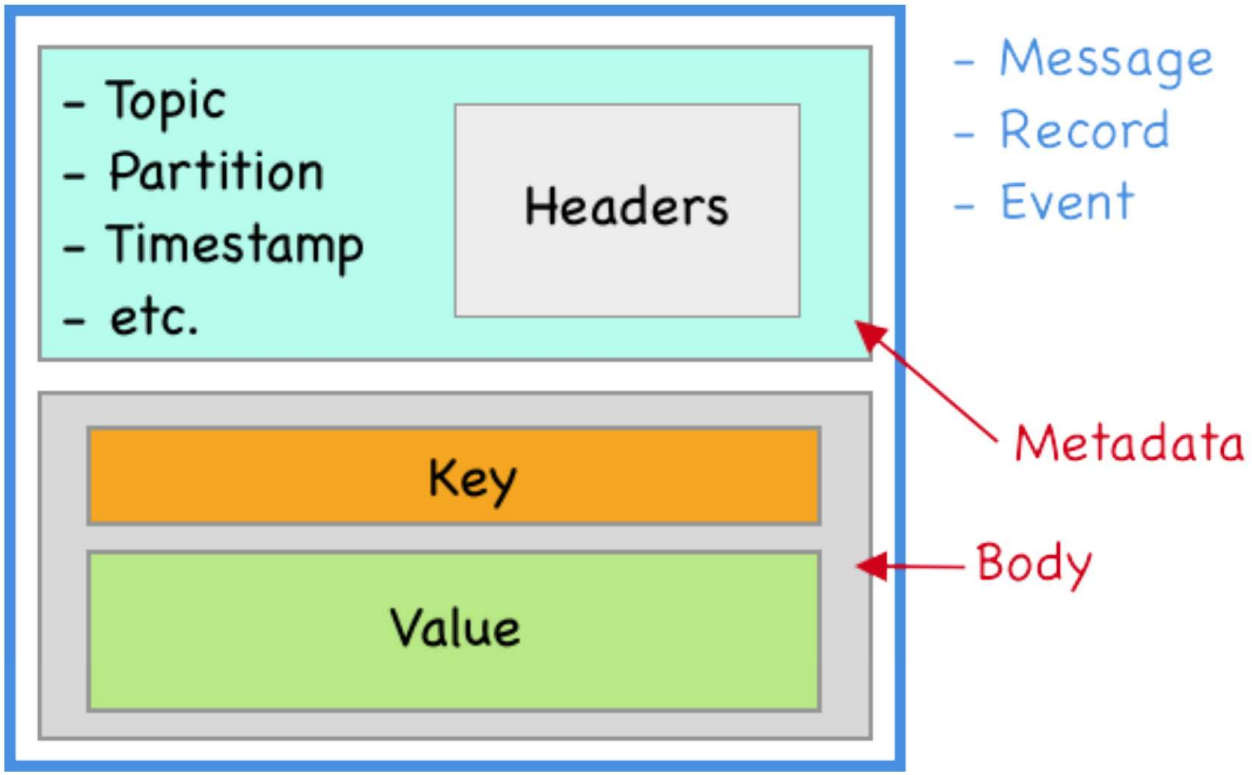
Log Structured Data Flow



The Stream



Data Elements

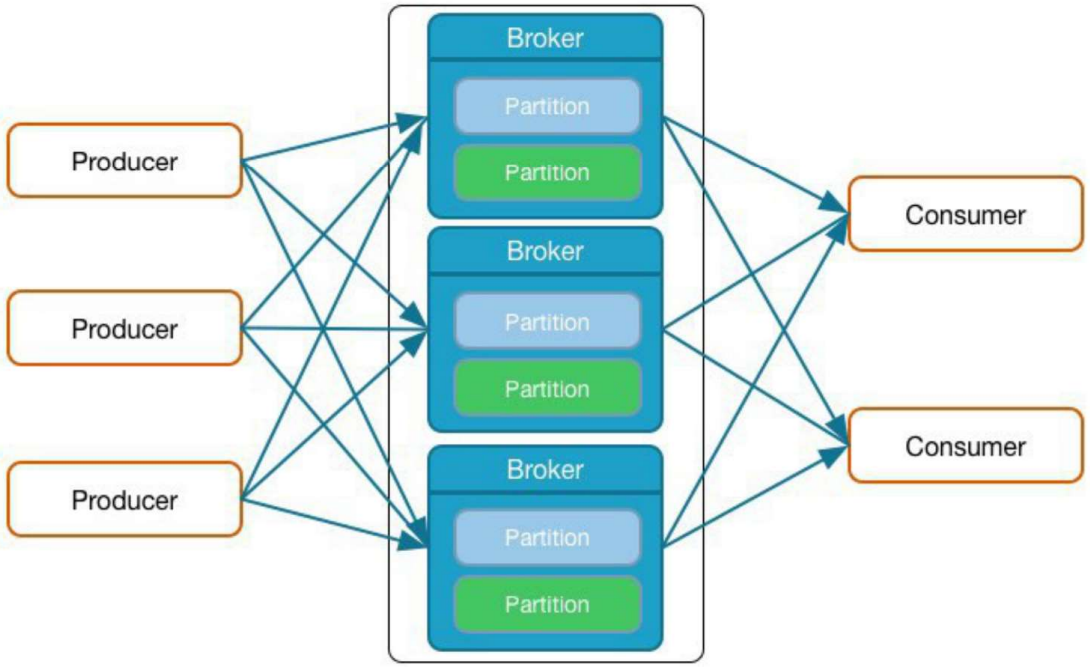


Brokers Manage Partitions

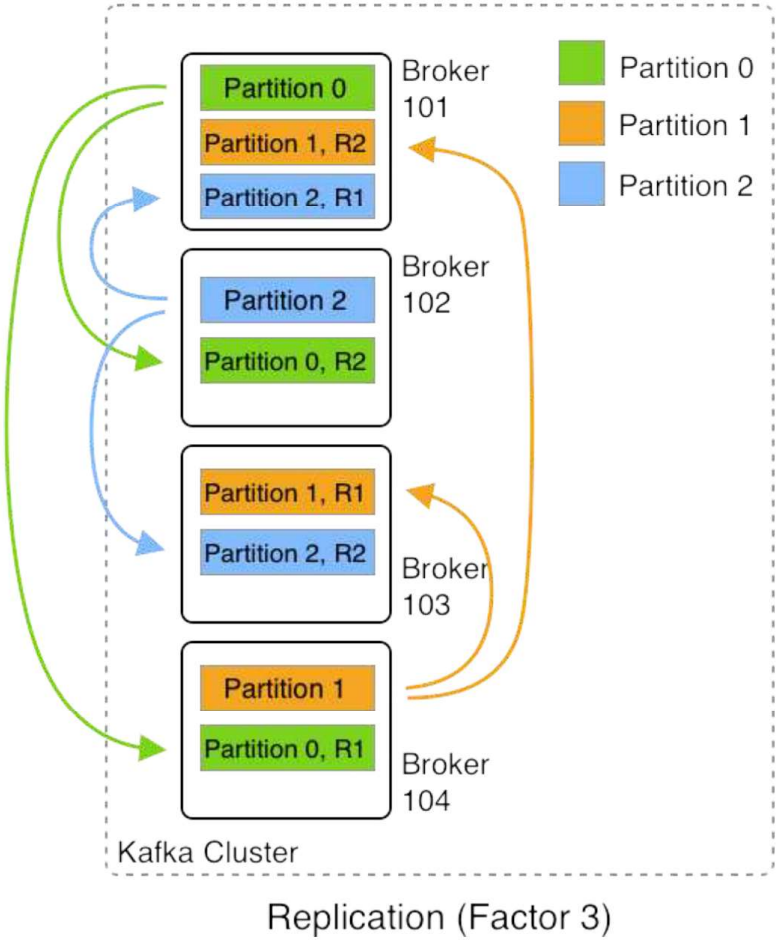
- Messages of Topic spread across Partitions
- Partitions spread across Brokers
- Each Broker handles many Partitions
- Each Partition stored on Broker’s disk
- Partition: 1..n log files
- Each message in Log identified by *Offset*
- Configurable Retention Policy

Broker Basics

- Producer sends Messages to Brokers
- Brokers receive and store Messages
- A Kafka Cluster can have many Brokers
- Each Broker manages multiple Partitions



Broker Replication



Producer Basics

- Producers write Data as Messages
- Can be written in any language
  - Native: Java, C/C++, Python, Go,, .NET, JMS
  - More Languages by Community
  - REST Server for any unsupported Language
- Command Line Producer Tool

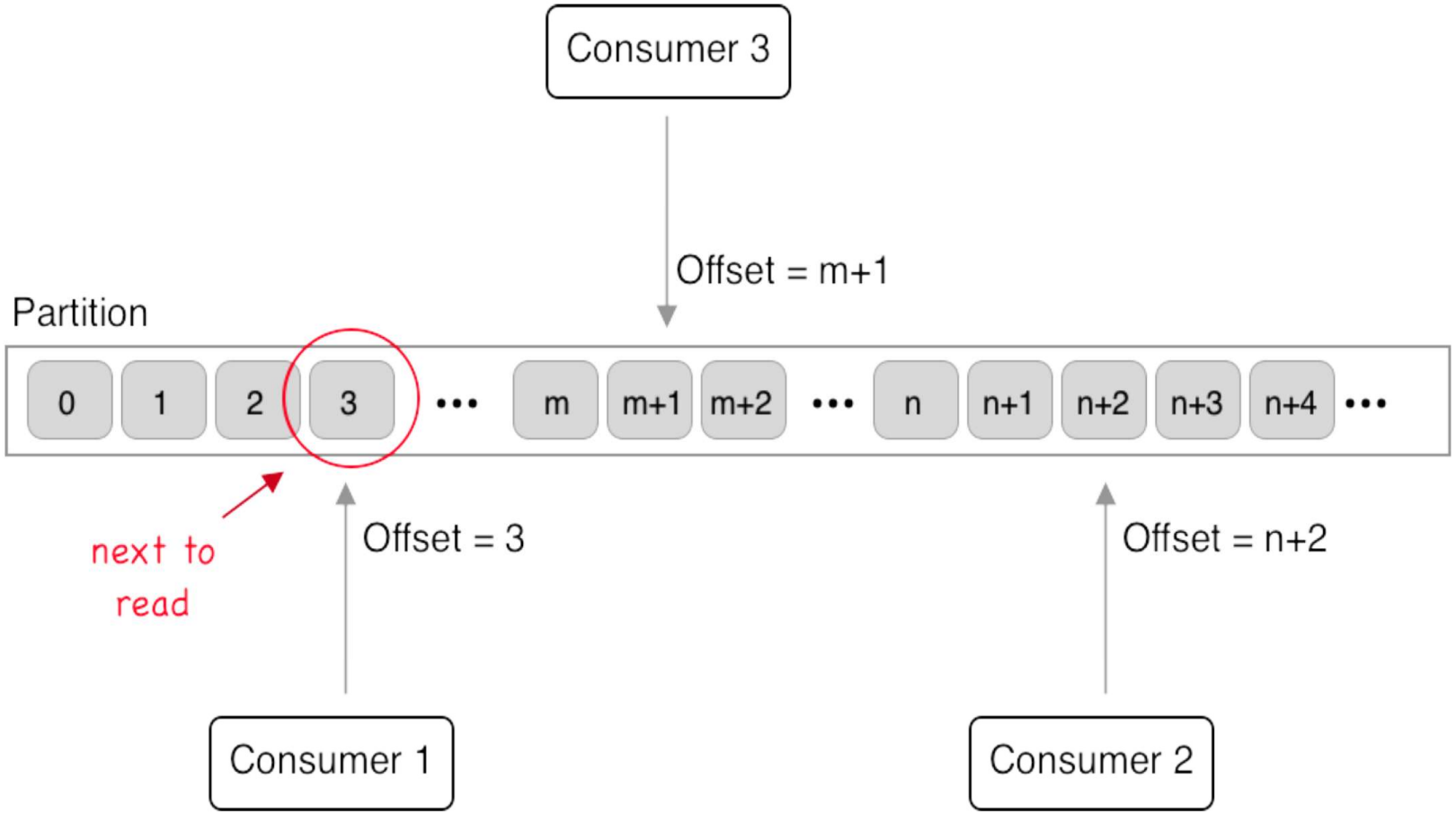
Load Balancing and Semantic Partitioning

- Producers use a Partitioning Strategy to assign each message to a Partition
- Two Purposes:
  - Load Balancing
  - Semantic Partitioning
- Partitioning Strategy specified by Producer
  - Default Strategy: `hash(key) % number_of_partitions`
  - No Key → Round-Robin
- Custom Partitioner possible

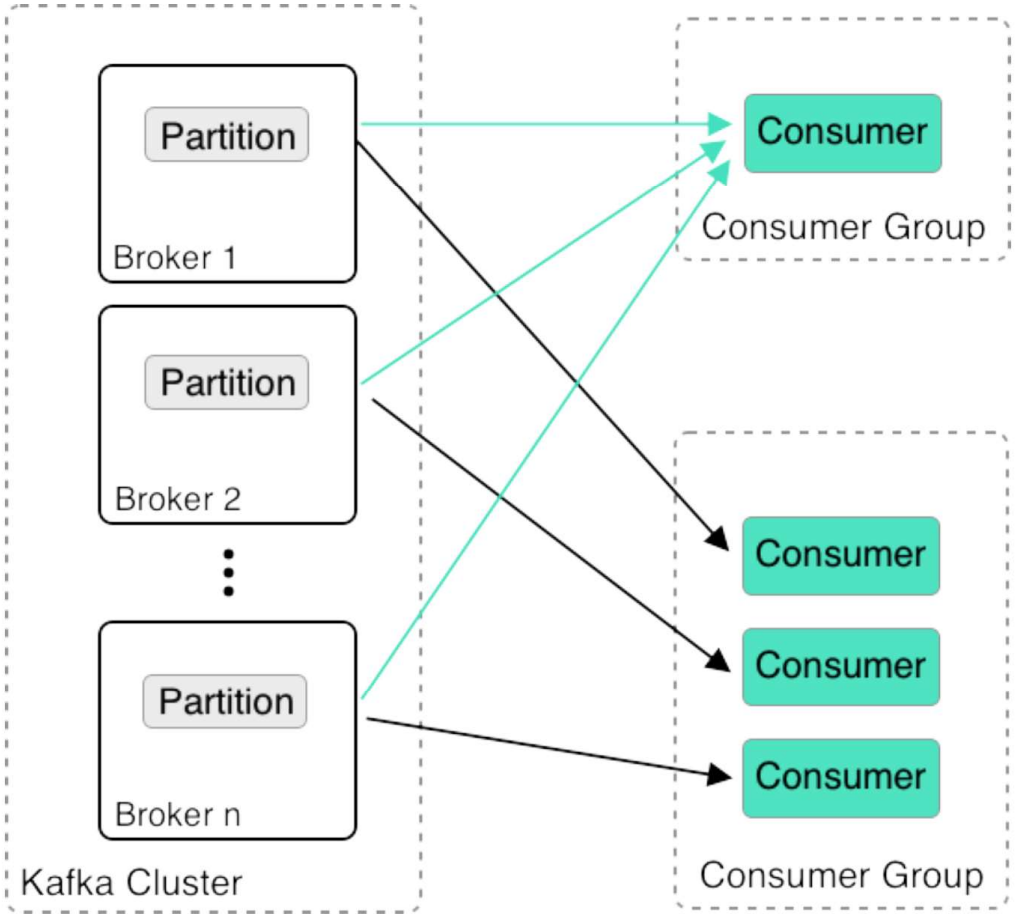
Consumer Basics

- Consumers **pull** messages from 1..n topics
- New inflowing messages are automatically retrieved
- Consumer offset
  - Keeps track of the last message read
  - Is stored in special topic
- CLI tools exist to read from cluster

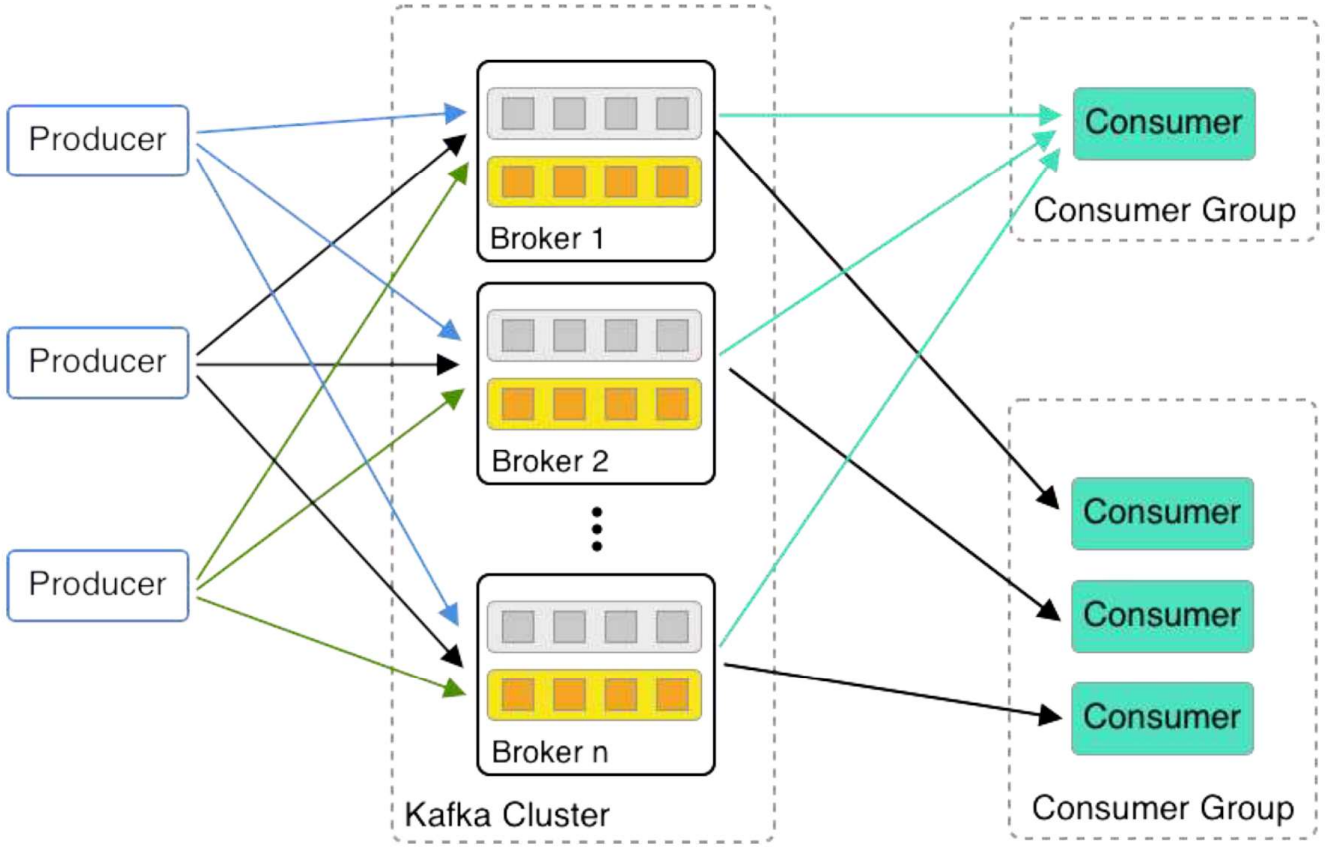
Consumer Offset



Distributed Consumption



Scalable Data Pipeline



Q&A

Questions:

- Why do we need an odd number of ZooKeeper nodes?
- How many Kafka brokers can a cluster maximally have?
- How many Kafka brokers do you minimally need for high availability?
- What is the criteria that two or more consumers form a consumer group?