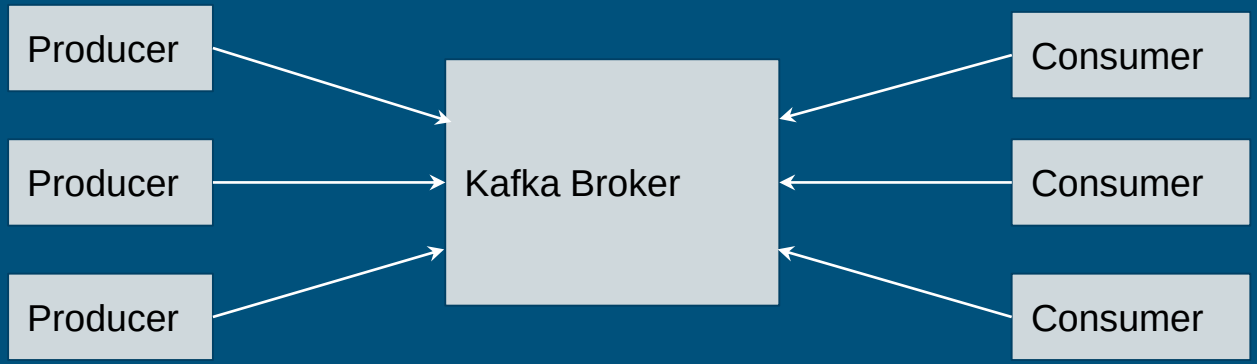
# Kafka

A distributed streaming engine

# Pub-Sub Architecture

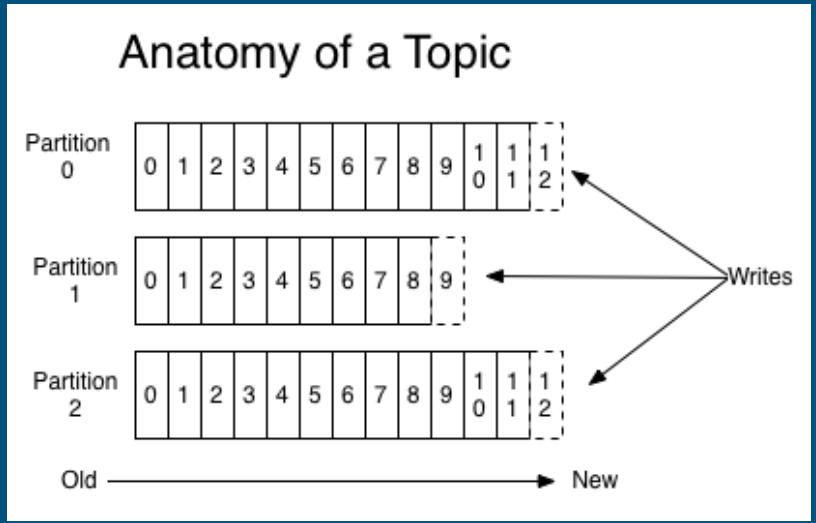


# APIs

- Producer
  - Push data into a topic
- Consumer
  - Pull data from a topic
- Streaming
  - Producer + Consumer API with inbuilt common functionalities
- Connector
  - Connect with any other system to push or pull data

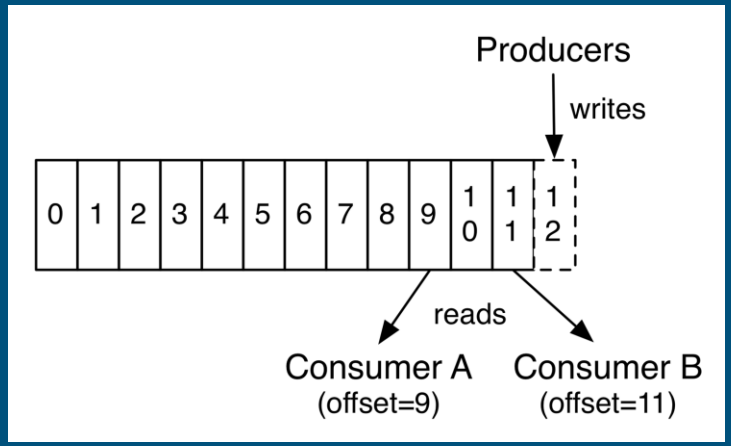
# Topic

- Abstractions over stream of records
- Or in other word, its a name tag of data stream
- Kafka maintains a partitioned log for each topic
- Each topic has multiple partitions within it



# Partition

- Structured record holder that is
  - Ordered
  - Immutable
  - Append only
- Each record has a unique sequence id
- Persists all record no matter consumed or not for a specified retention period
- Consumer can manage offset to read data from a partition
- Hence, consumer can go and join any time
- Producer has choice to push individual record to a specific partition



# Benefits of Partitions

- Allows log to scale beyond capacity of a single node
- Provides unit of parallelism

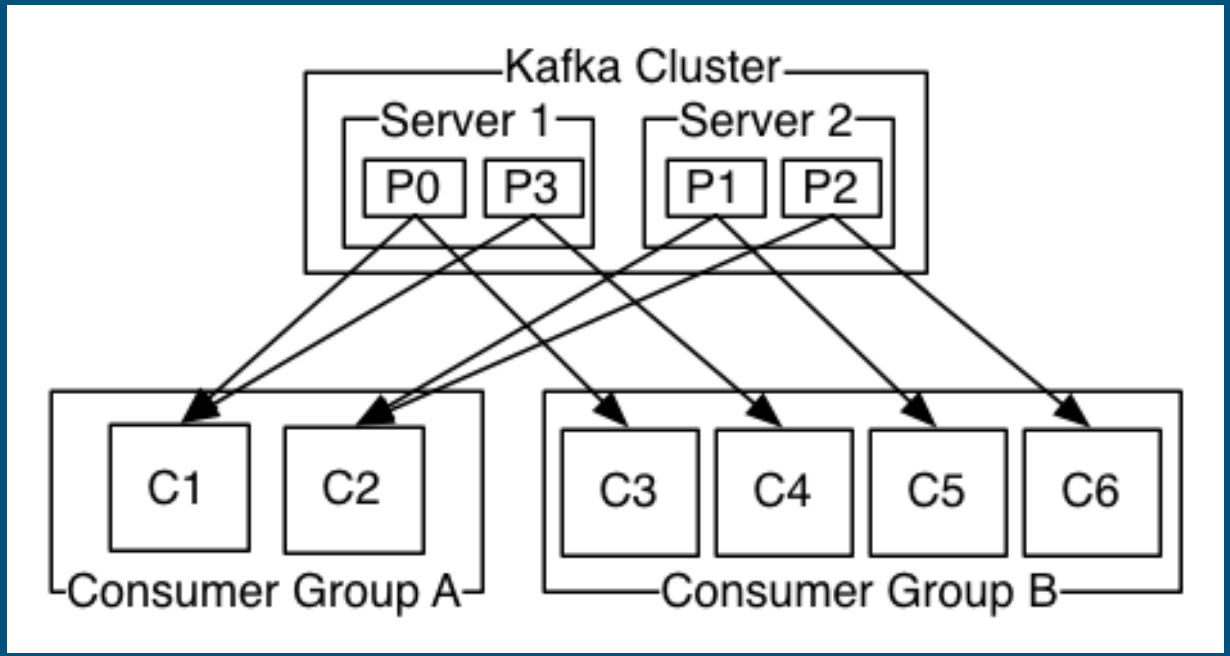
# Fault tolerance

- Each partition is replicated (configurable) across multiple nodes to achieve fault tolerance
- One server will work as Leader and rest as follower
- Leader will be entertaining all read-write requests
- Followers will just make sure to be in sync with leader
- On of the follower will push himself as leader in case existing crashes
- Hence, a topic with N replication factor can tolerate N-1 failures
- A corner question, who elect new leader?

# But what about Consumer?

- Consumers can form a group
- Kafka will deliver each message to at least of the consumer within a group
- Do we need to have all consumers in same process?
  - No, they can be in different processes or even machines
- What if all consumers are in same group
  - Kafka will do the load balancing
- And if all are in different groups
  - Simple! broadcasts each record to all of them

# Message delivery



# What if a message fails to deliver

- Various message delivery semantics
  a. Exactly once
  b. At most once
  c. At least once: This what Kafka follows

# More clarification on load balancing

- Partitions will be divided equally among #consumers in a group
  - If new consumer joins then it will grab some from existing members
  - And if one fails then kafka will distribute equally among remaining

- Wait! What about order of records then?
  - Total order will be maintained within partition but not between partitions

# Ordering in Distributed System

- FIFO Ordering
  - If m was generated before m’ then m will be delivered before m’
- Causal Ordering
  - If m has happened before m’ then m will be delivered before m’
- Total Ordering
  - No matter when m and m’ were generated, but if one **correct process** receives m before m’ then all the correct processes should receive m before m’

# Kafka is just for processing?

- Not really! It can be used for distributed storage too
- How?

# Use cases

- Messaging
- Website activity tracking
- Log aggregation
- Stream processing
- And many more...

# Reference

- https://stackoverflow.com/questions/44014975/kafka-consumer-api-vs-stream-api
- https://kafka.apache.org/intro