



# Kafka



A distributed streaming engine



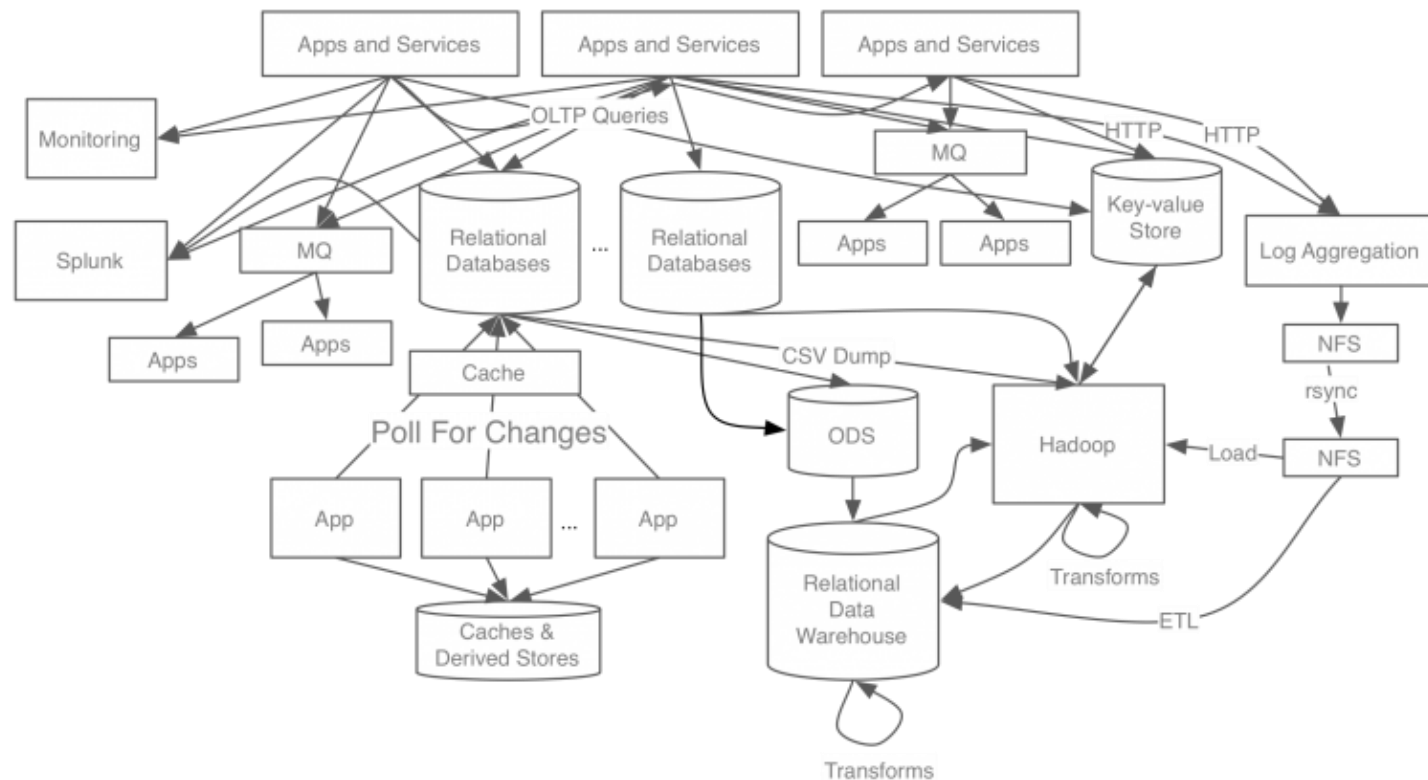
# What is Apache Kafka

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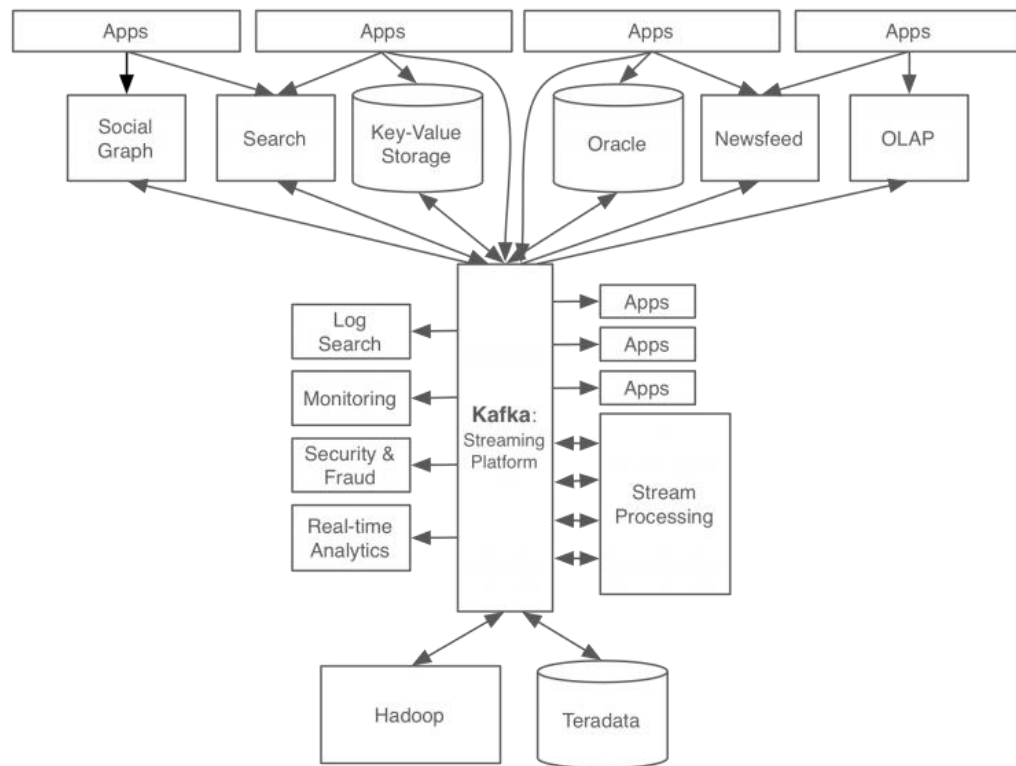
A distributed system designed to be

- Fault tolerant
- High throughput
- Horizontally scalable

# Motivation

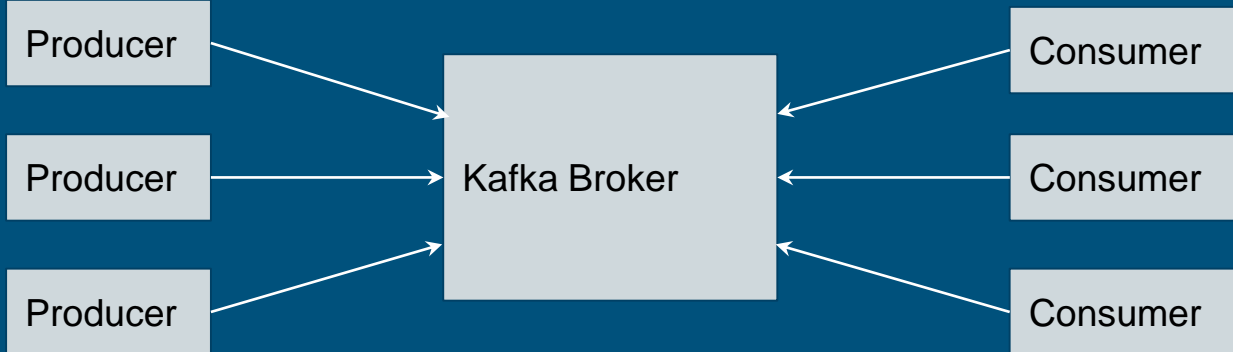


# Motivation



# Pub-Sub Architecture

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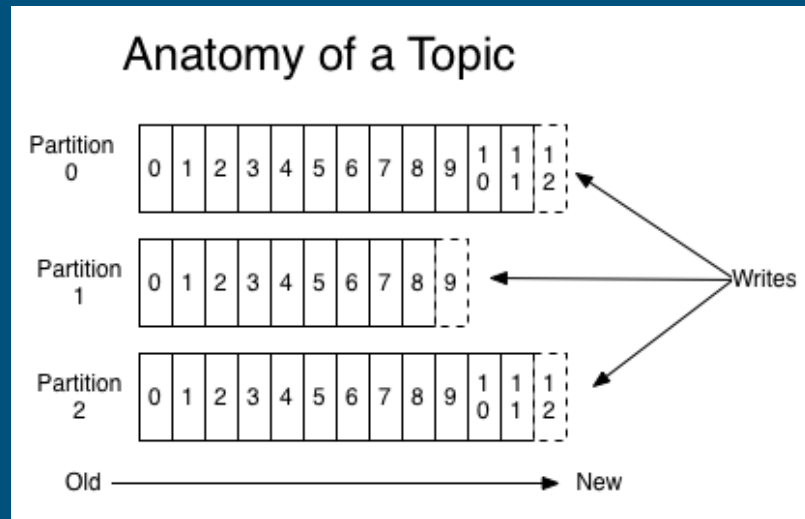
# APIs

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- **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

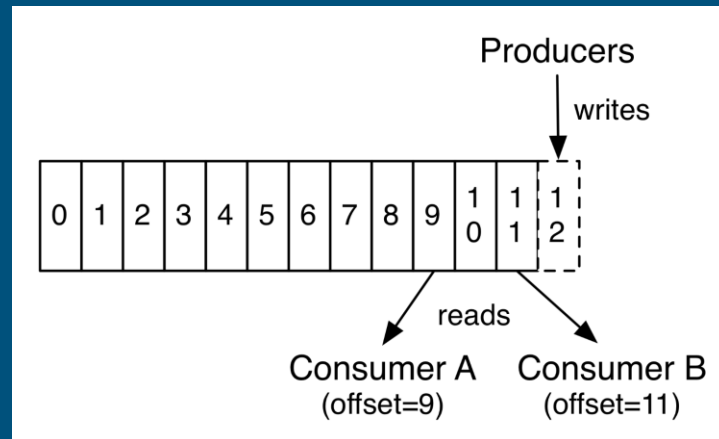
# Topic

- 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

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

# Fault tolerance

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

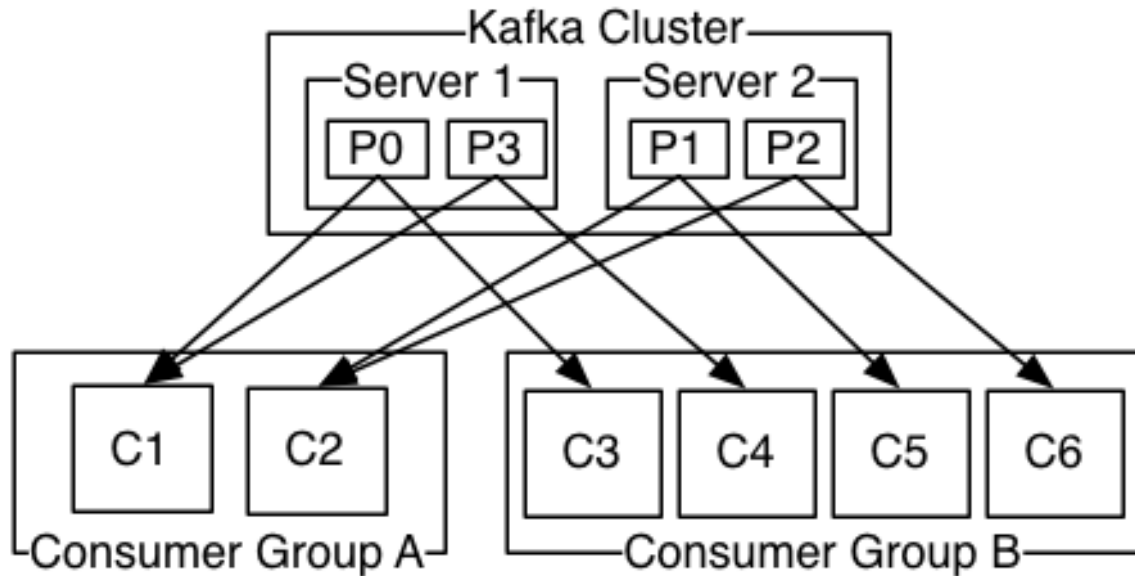
# But what about Consumer?

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- Consumers can form a group
- Kafka will deliver each message to at least one 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

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# What if a message fails to deliver

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

# More clarification on load balancing

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- 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

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- FIFO Ordering
  - If event  $m$  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?

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



# Use cases

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

# Reference

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