Lecture 10 –Kafka

BDAT 1002

The Need for Kafka

Scenario

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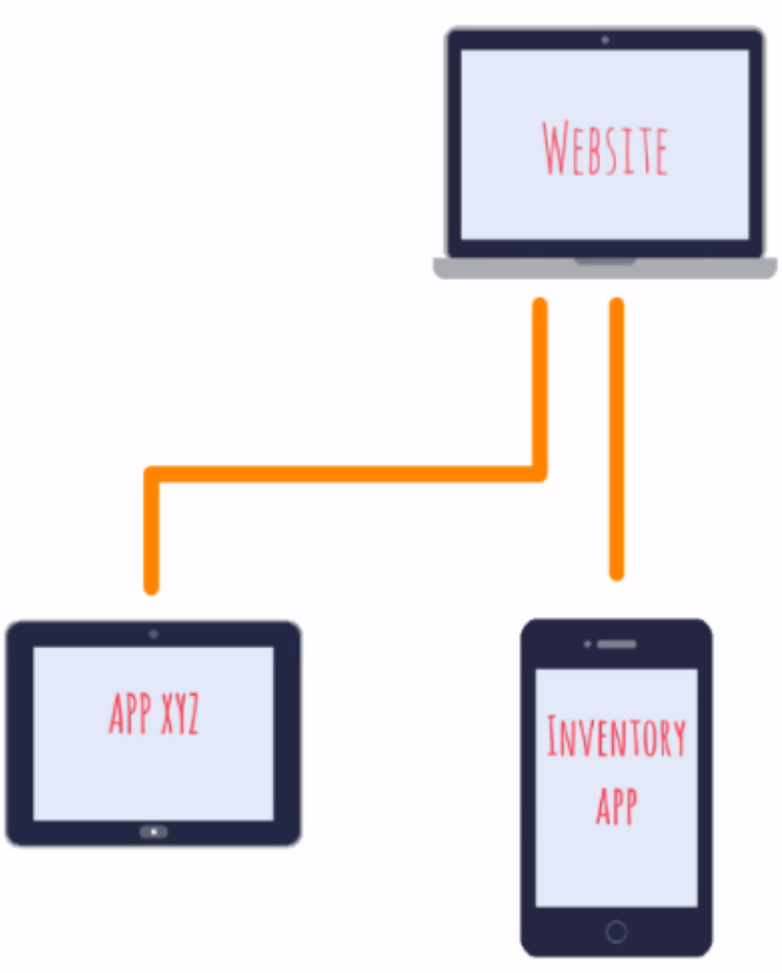
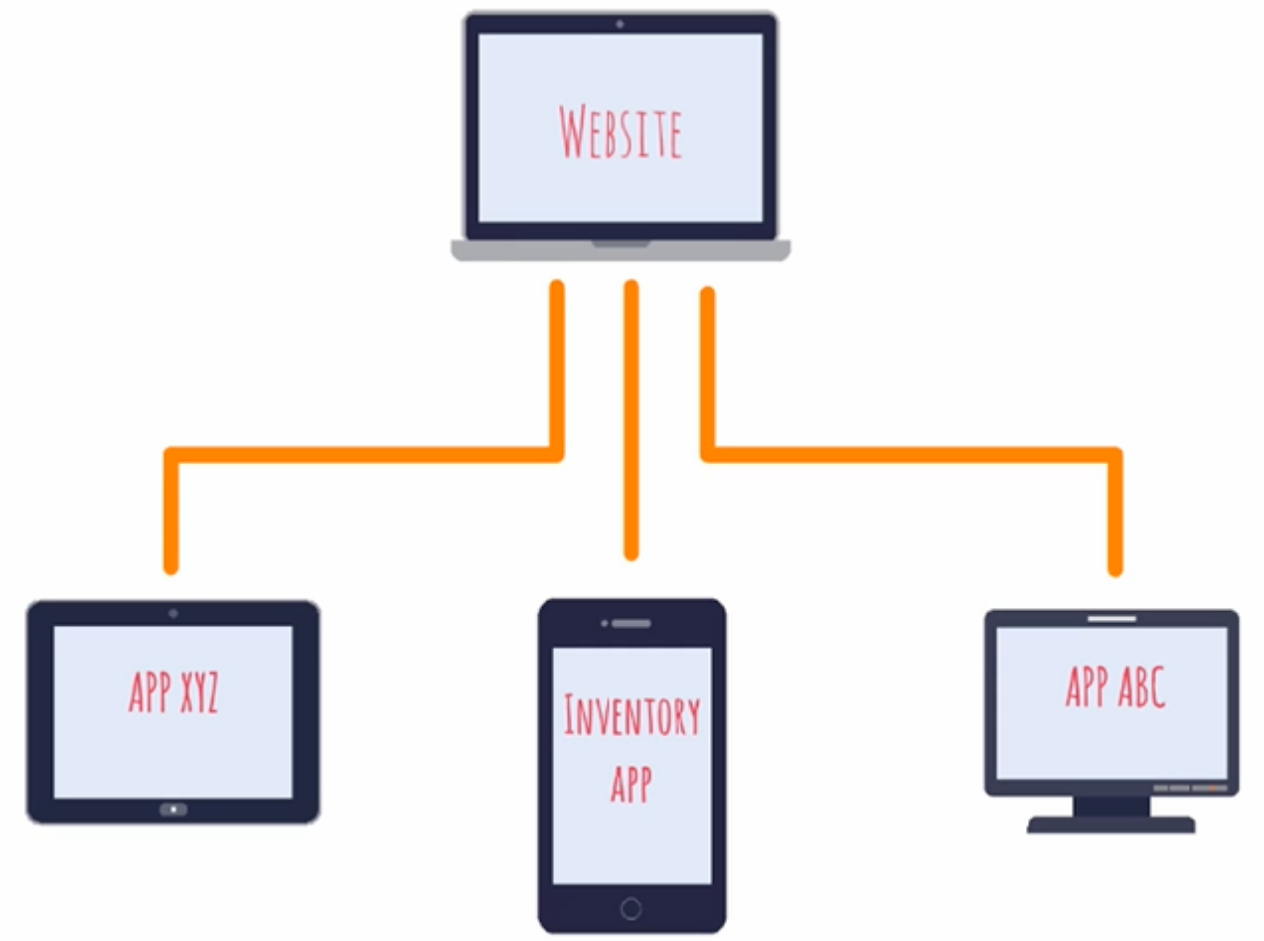


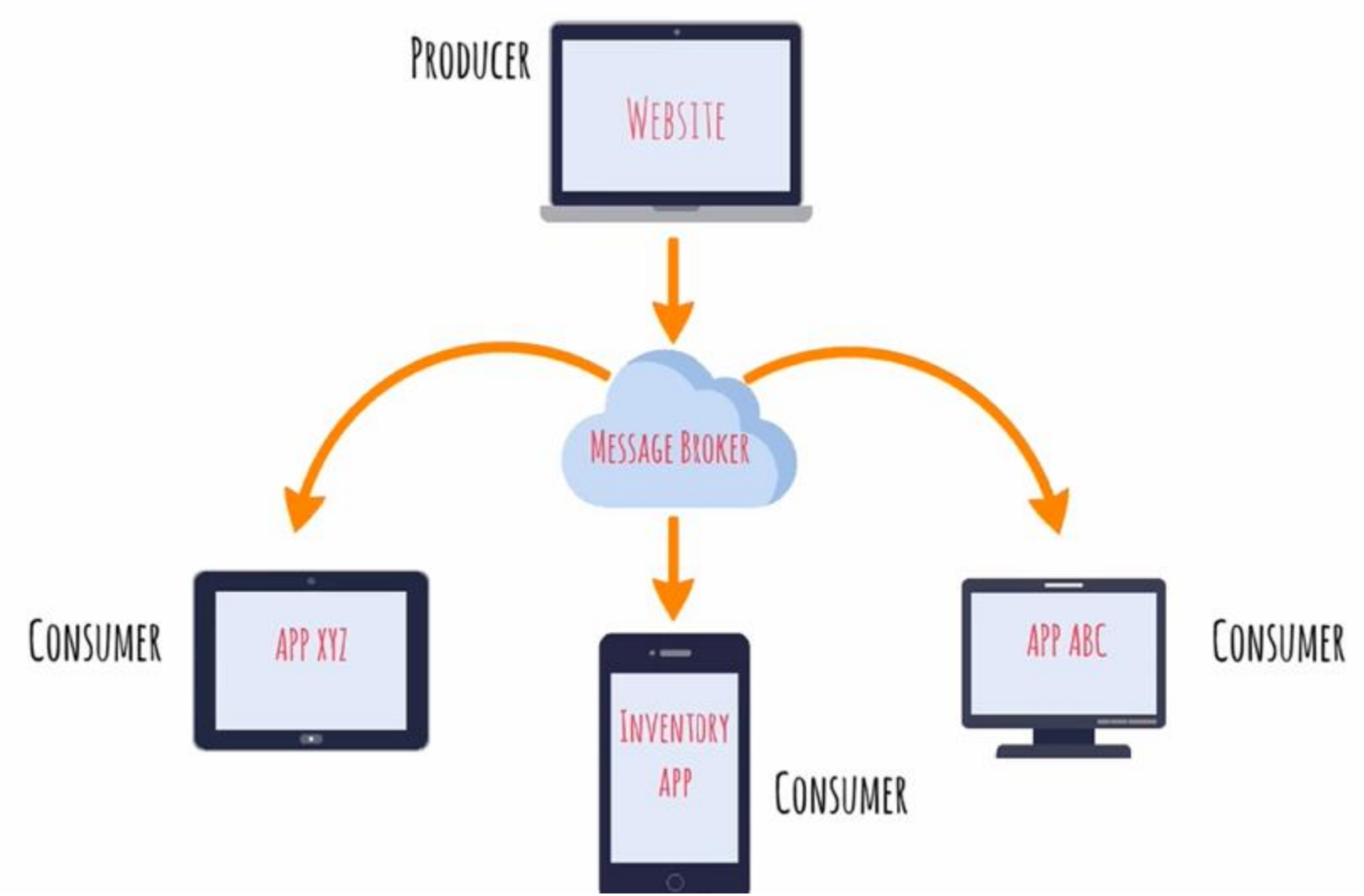
Scenario



Problems

- Two major problems
- All three applications become tightly coupled to one another
  - Changes to the website may affect the apps
  - Vice versa, if an app wants to change the way it gets information, can affect everyone else
- We have redundant code to communicate with different applications
  - Just a bit of a change for each application

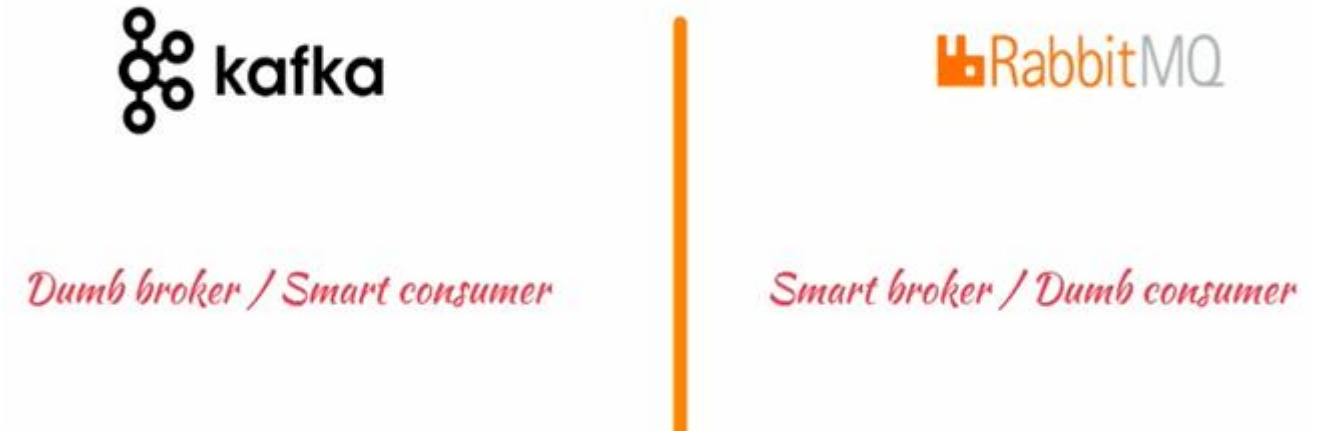
Solution: Message Broker



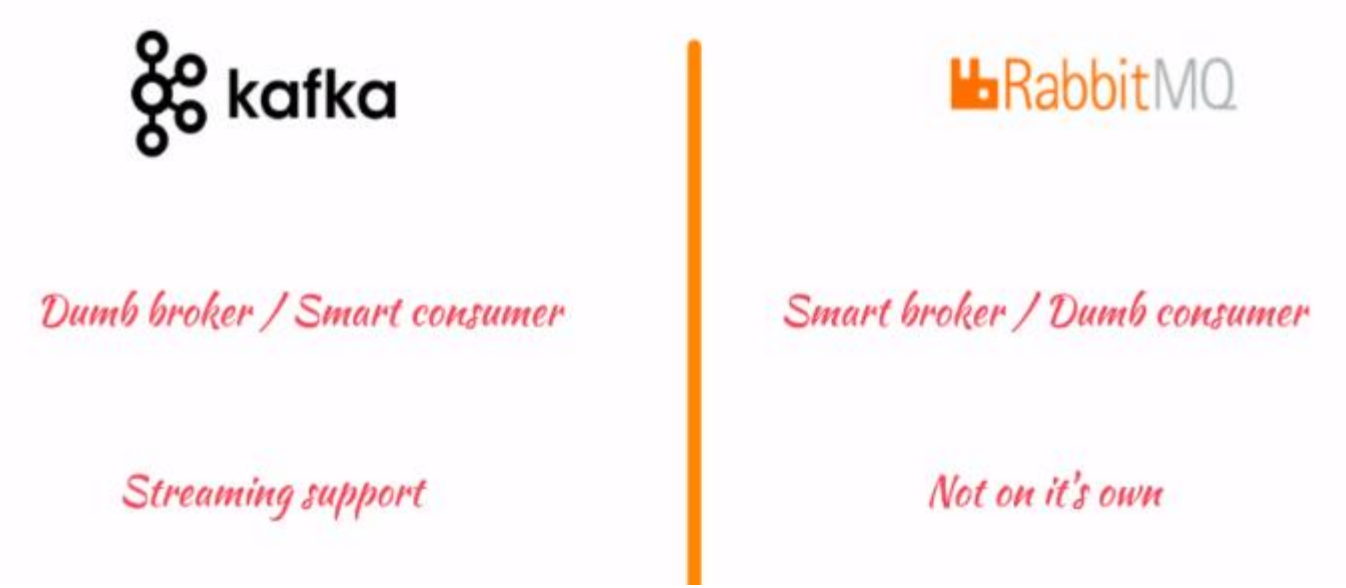
Kafka

- Kafka is open source
- Developed by LinkedIn
- Written in Scala (mostly)
- But is Kafka the first message broker ever written?

Kafka vs other MB's



Kafka vs other MB's



Kafka vs other MB's

kafka	RabbitMQ
Dumb broker / Smart consumer	Smart broker / Dumb consumer
Streaming support	Not on it's own
External tools - Zookeeper	External tools - not needed

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Supports few languages	Supports many languages
100,000 messages per second	20,000 messages per second

Kafka Concepts

Kafka Basic Process

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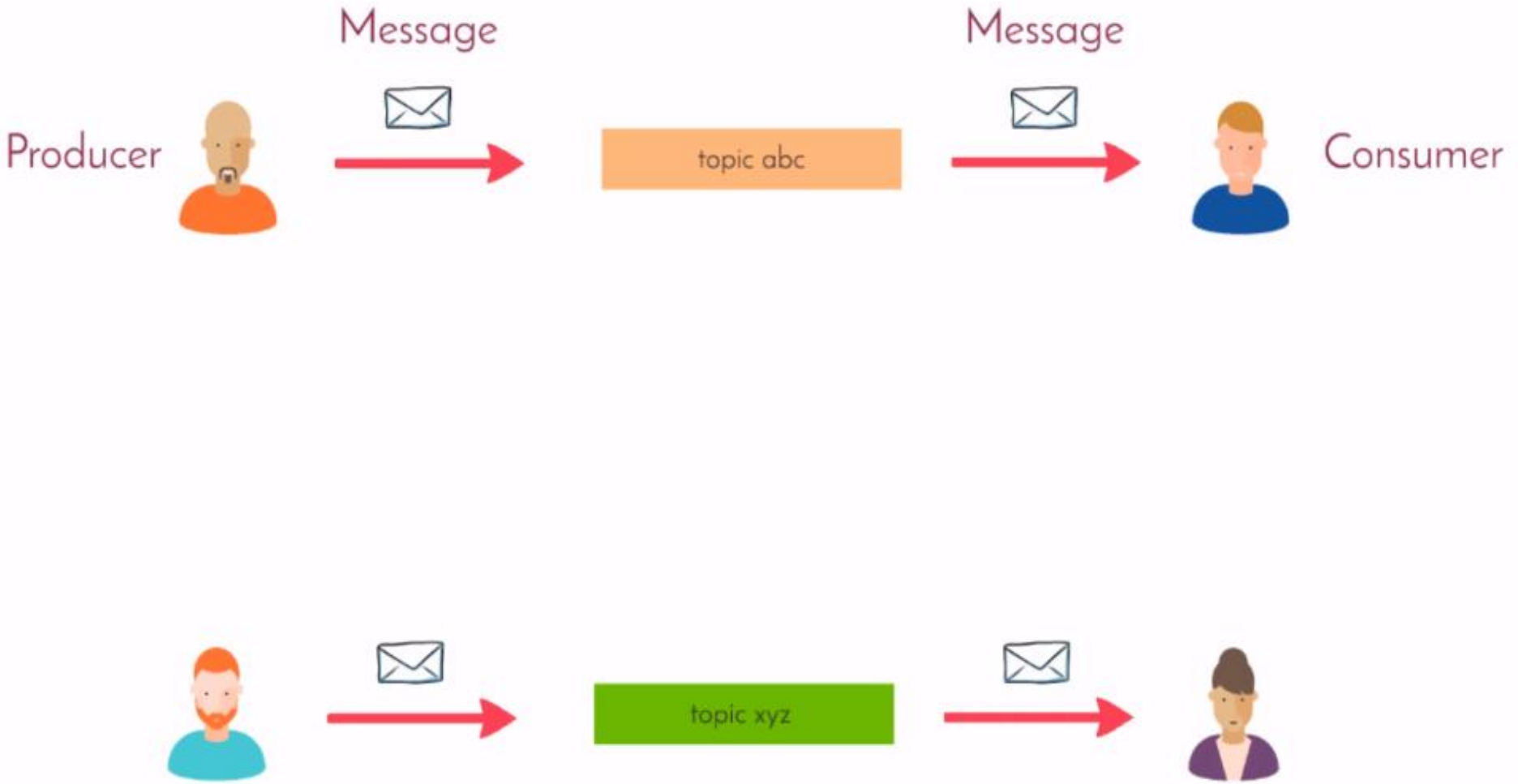

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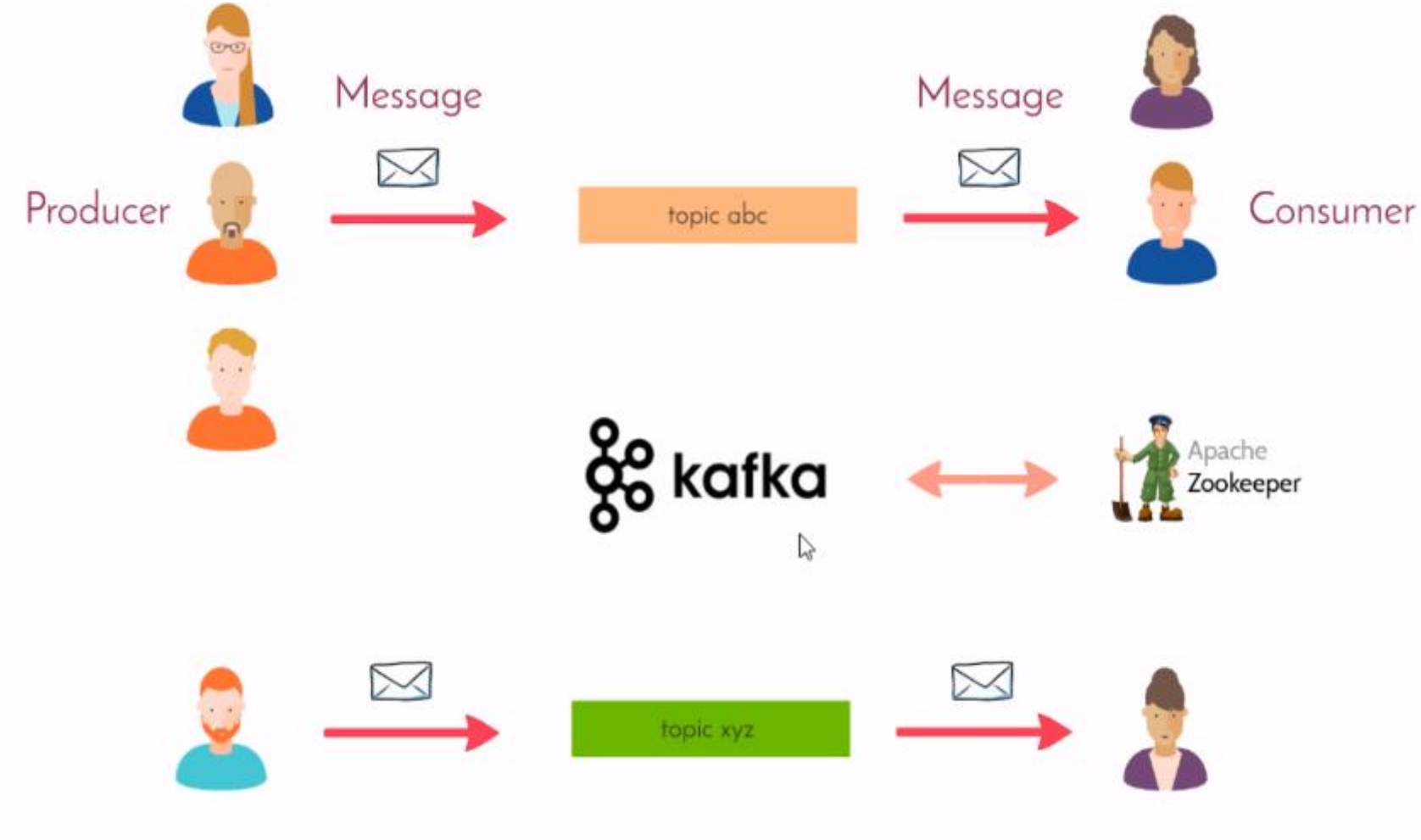


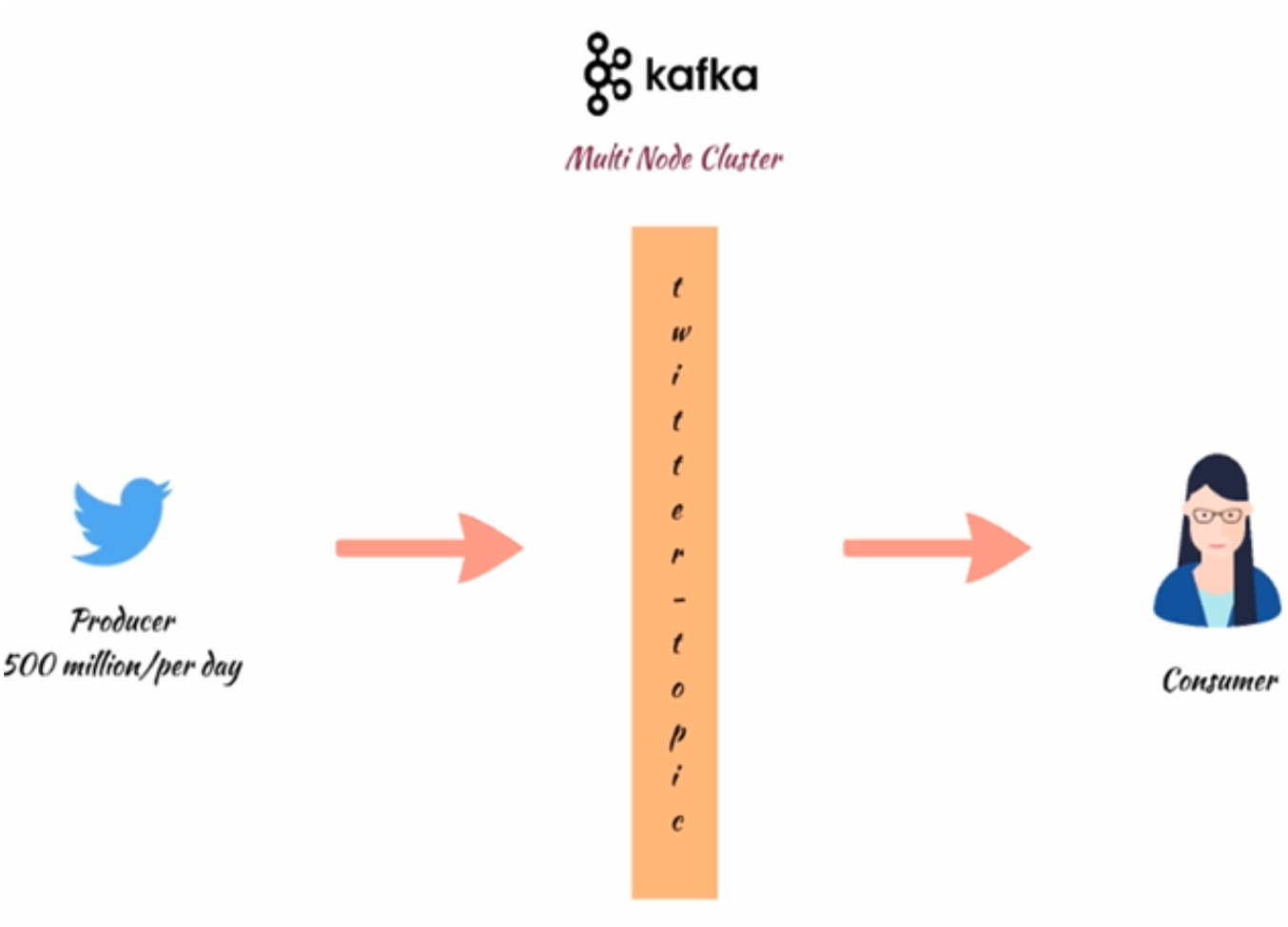
Producer, consumer, message

- A producer can be twitter producing tweets or an application or a program
  - Anything that produces a stream of message
- A consumer can be any program or application that is interested in consuming the messages produced by the producer
- A message is nothing more than a key-value pair with a time stamp
  - String, json, costum object

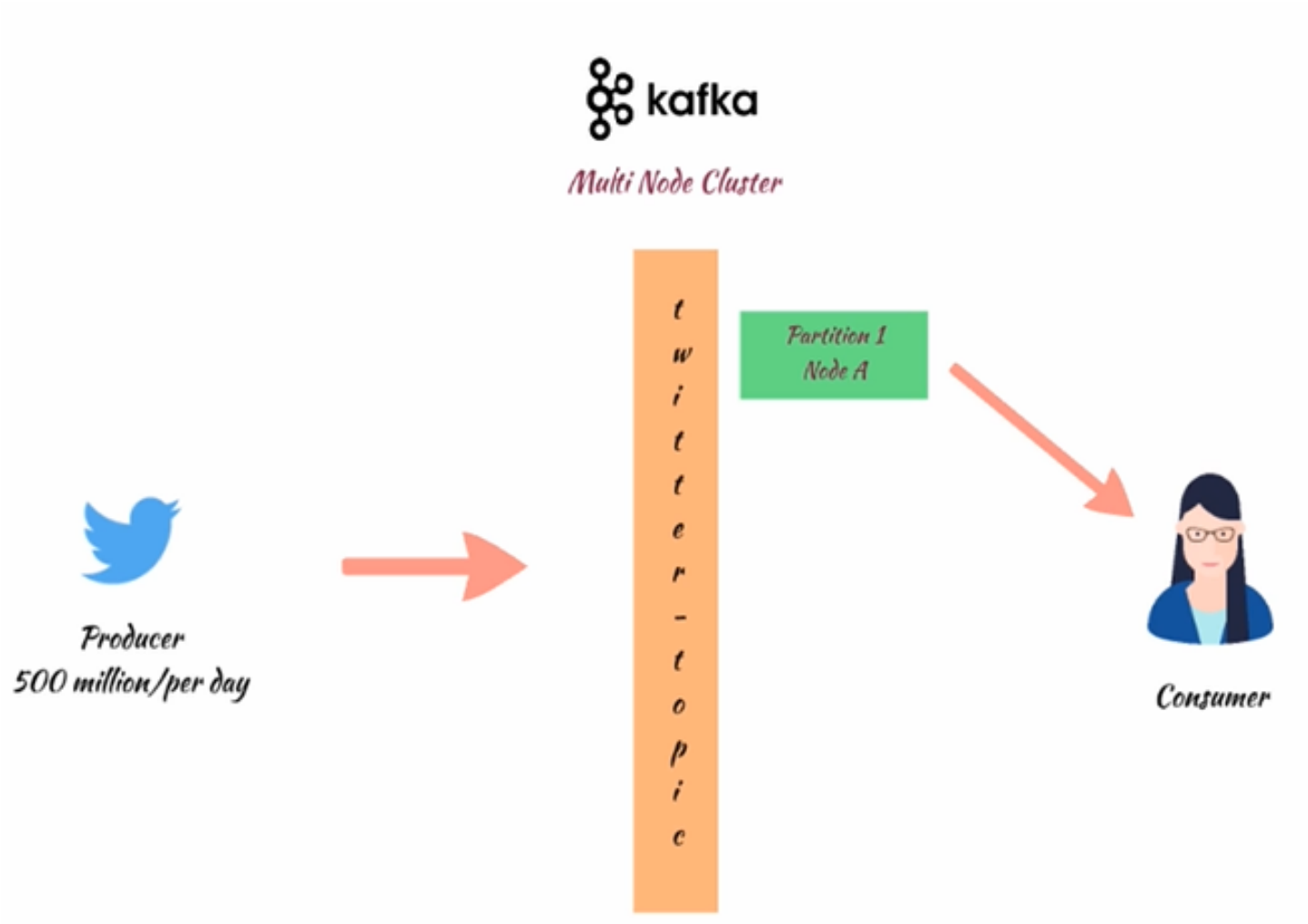
Kafka as a cluster

- Kafka is generally deployed as a cluster
  - A cluster of nodes running Kafka
  - Each node is called a broker or server
- Kafka broker is responsible for bringing the messages from the producer to the consumer ***reliably***
  - Not easy in Big Data environment
- Zookeeper helps manage the nodes
  - Which nodes are alive/dead
  - Elect leader
  - Metadata information

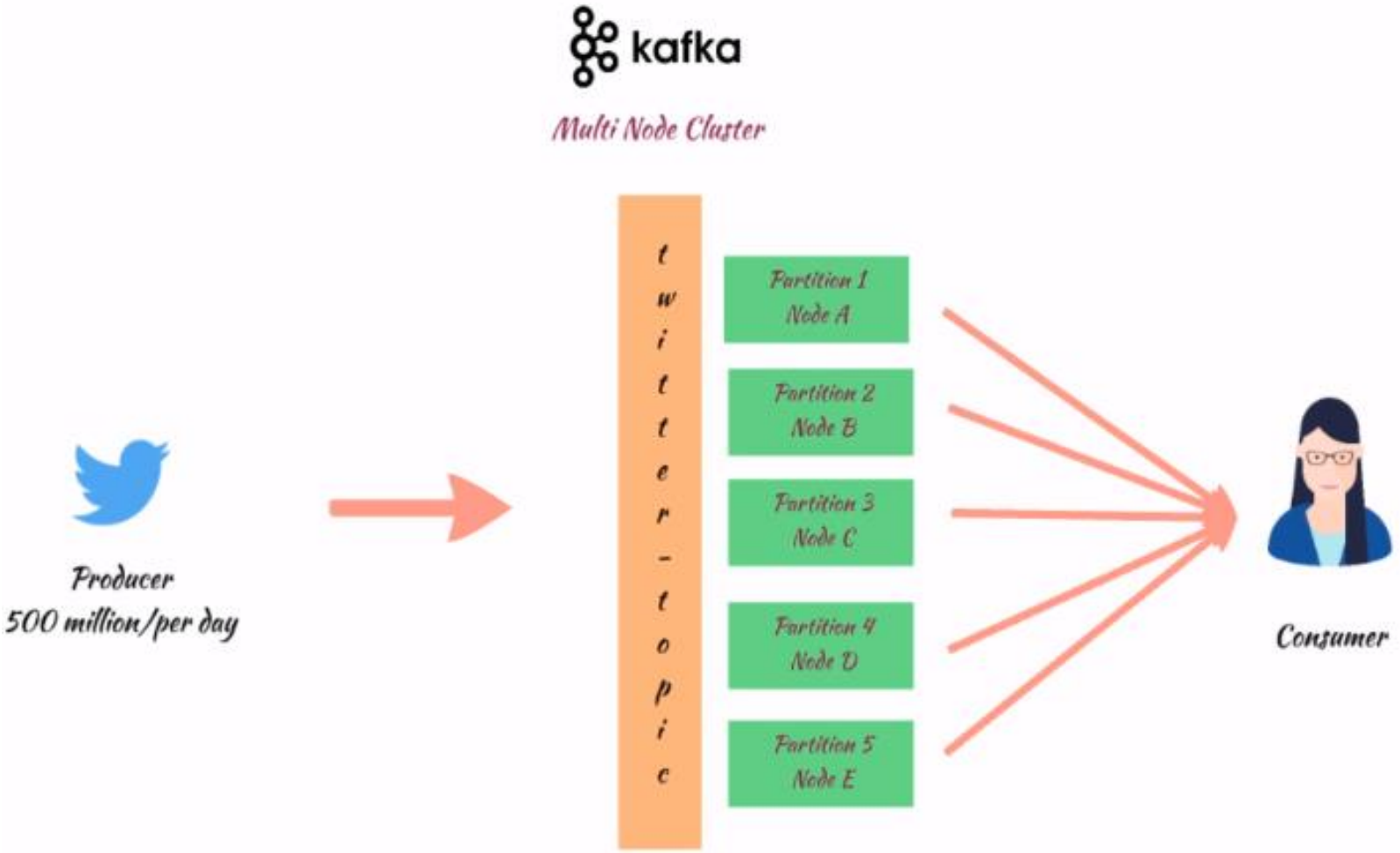
Kafka Use Case



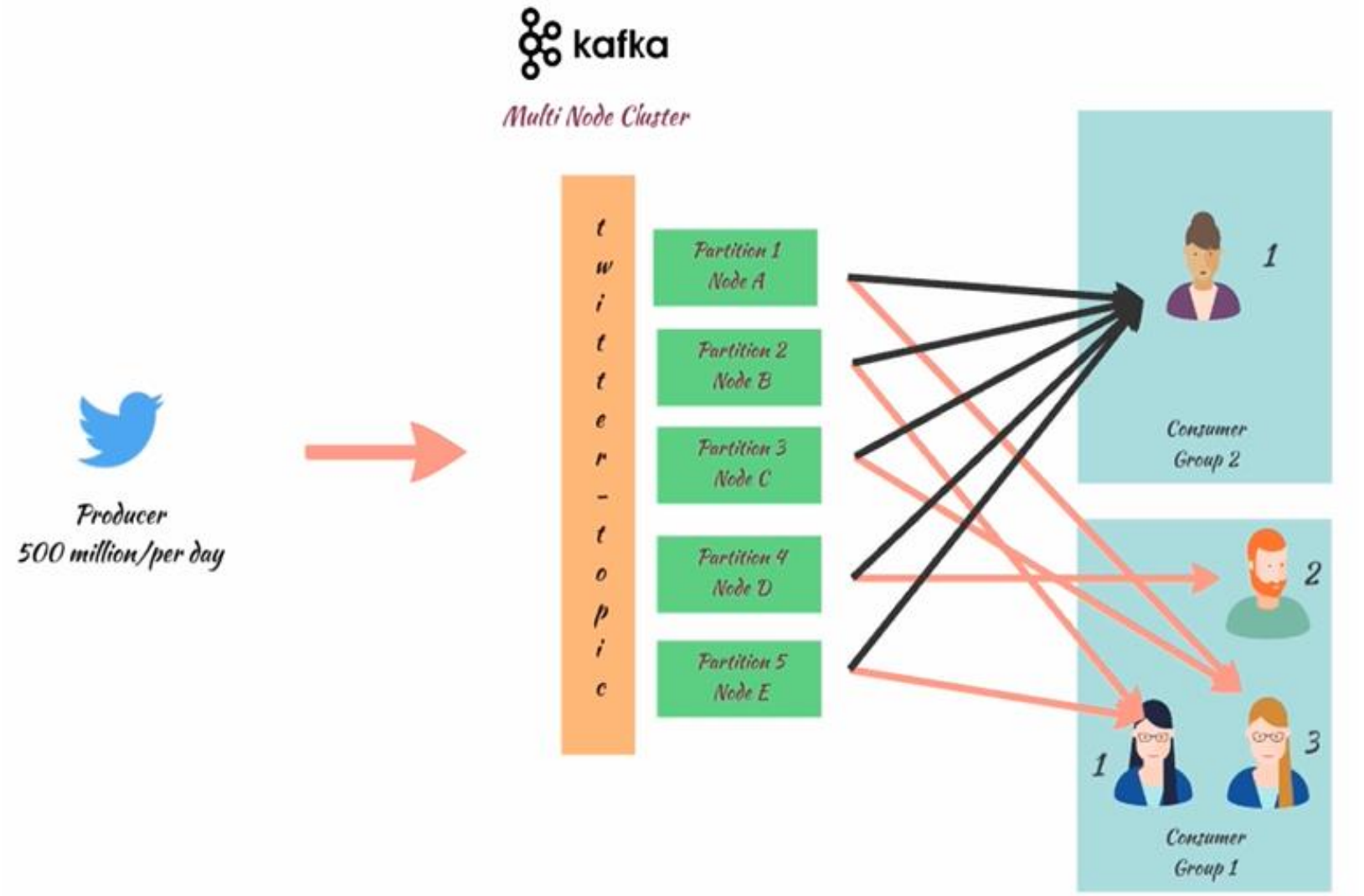
Kafka partitions



Multiple nodes



Multiple consumers

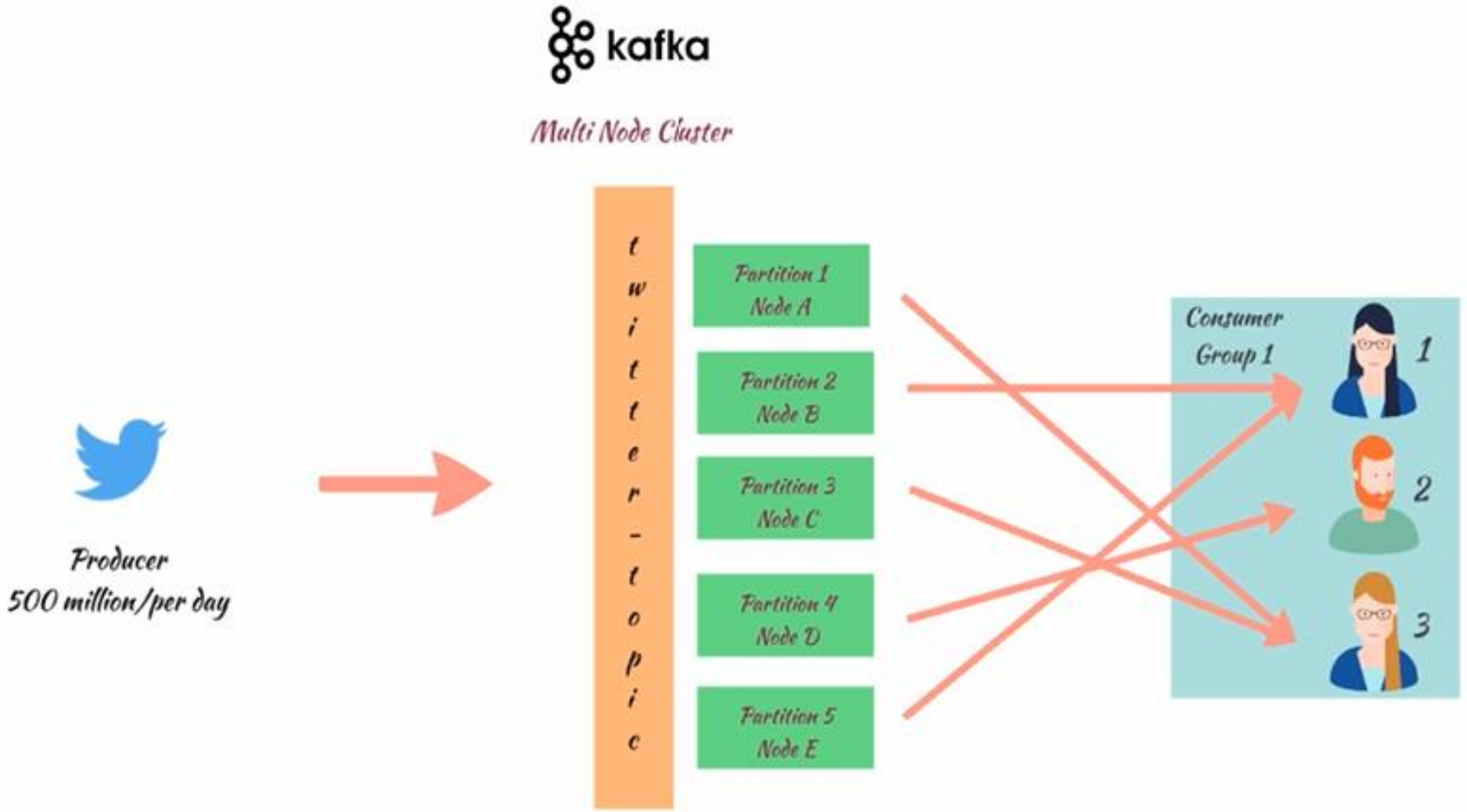


Consumer groups

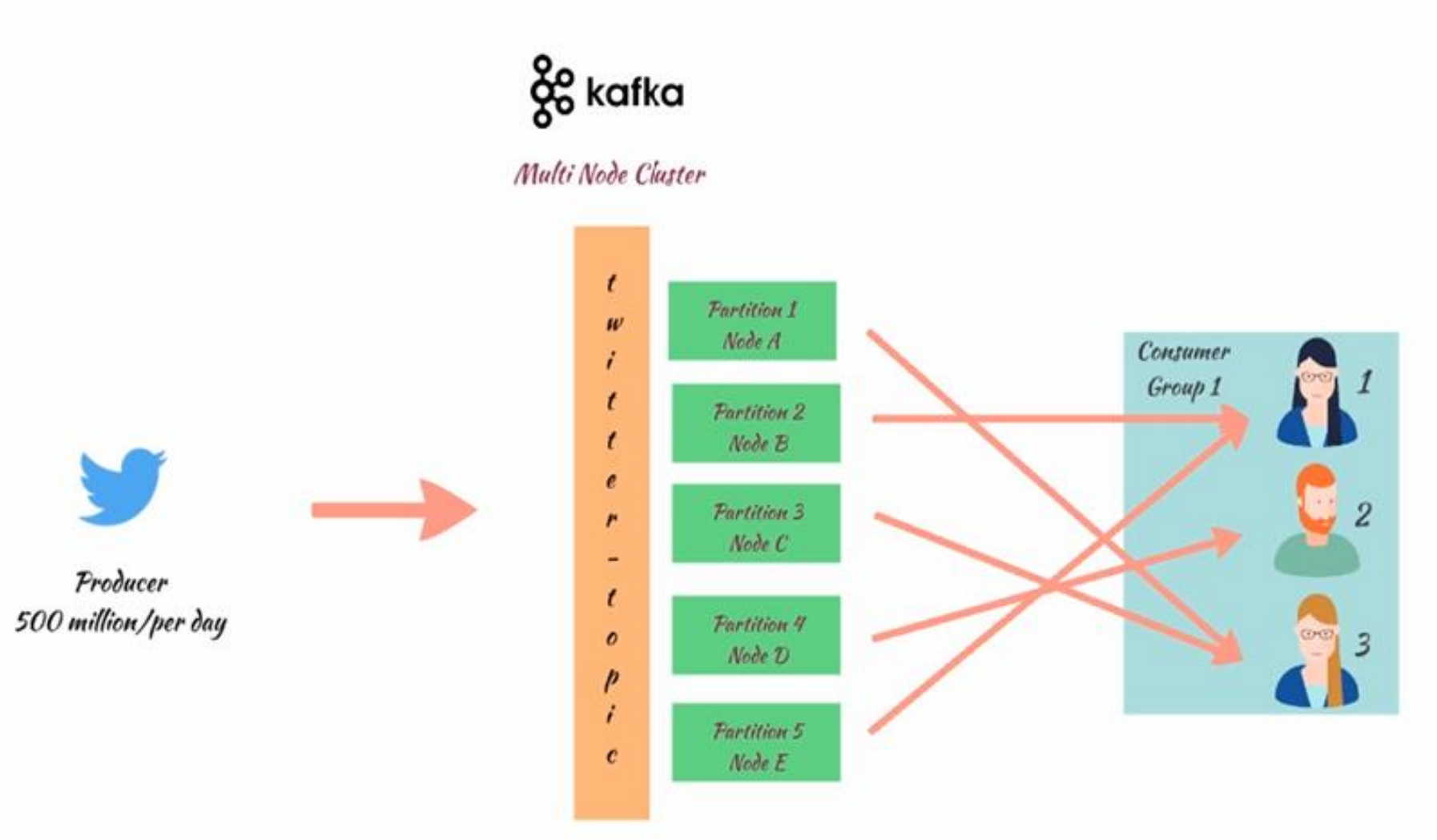
- When Kafka sees consumers from the same group, it will make sure that a single message is not sent to more than one consumer
- Every consumer is assigned to a partition
- Only one consumer can consumer from a partition
- Consumer groups are like different applications.

Reliability and Fault Tolerance in Kafka Producers and Consumers

Producer Failure



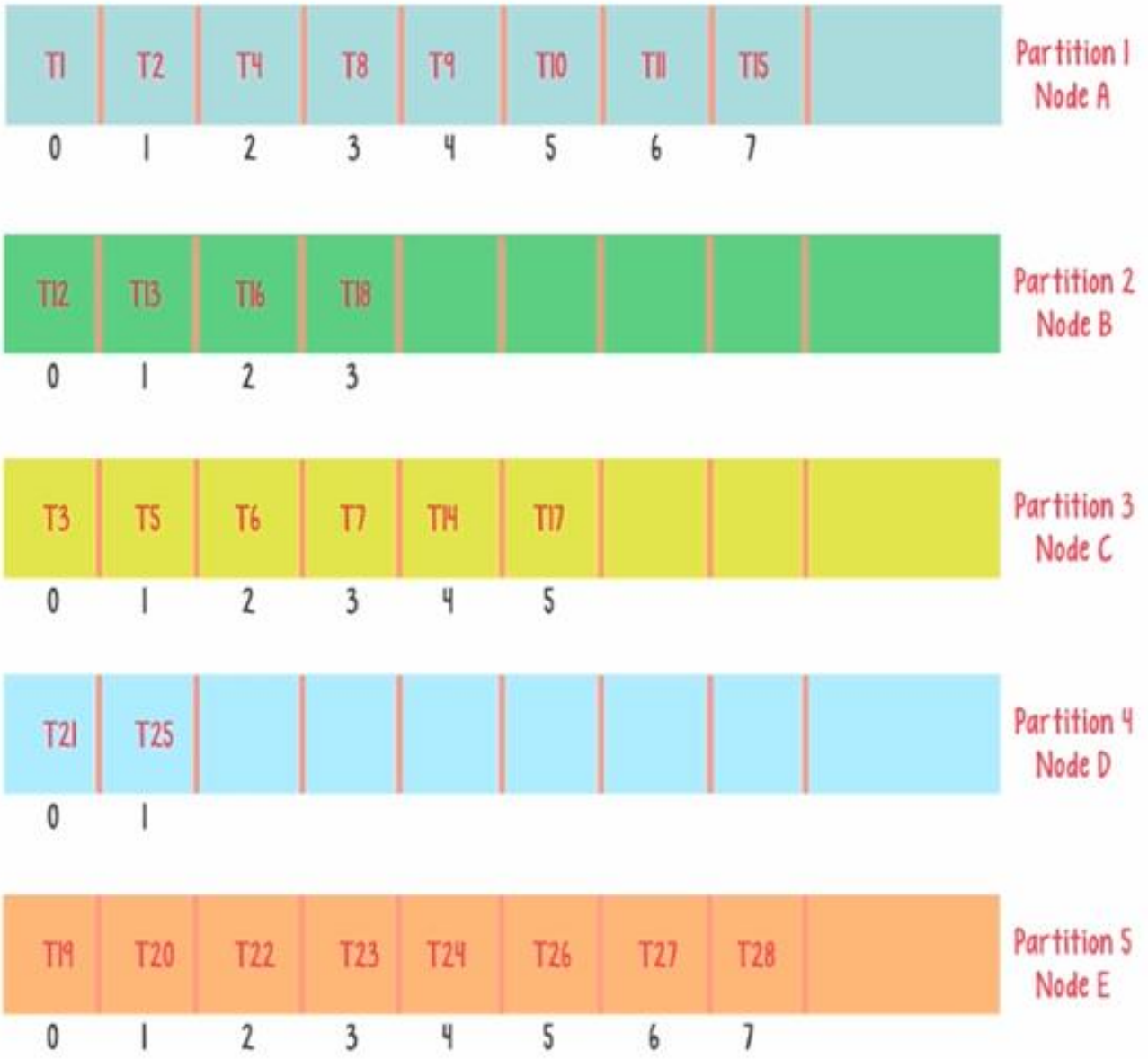
Consumer Failure



Interview Question

- Assume Consumer 1 goes down
- Does Consumer 2 start where Consumer 1 left off or start from the beginning?
  - Ideally should be from where you left off
- Follow up question:
  - How does Consumer 2 know where to start?

How messages are stored in partitions



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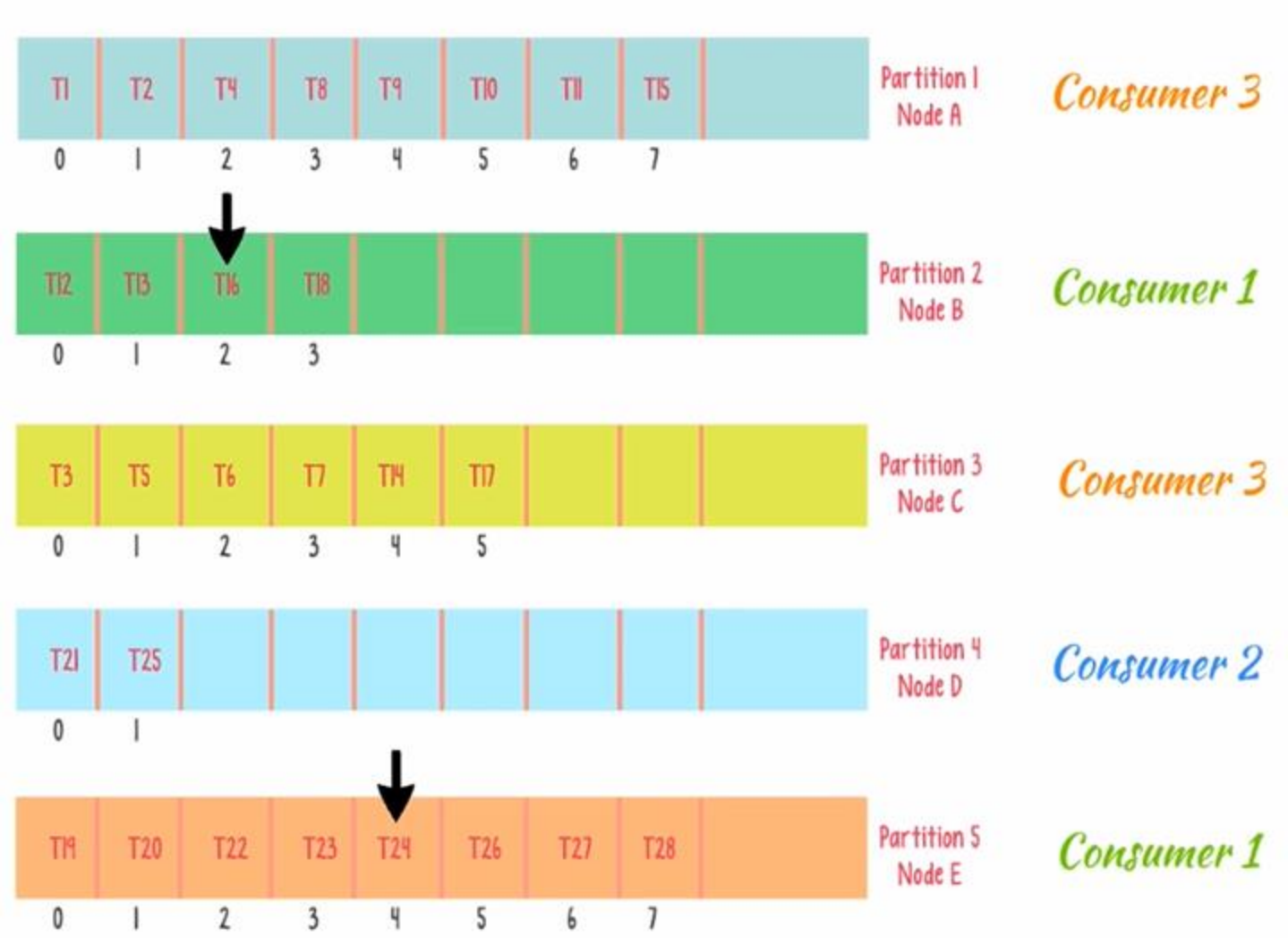

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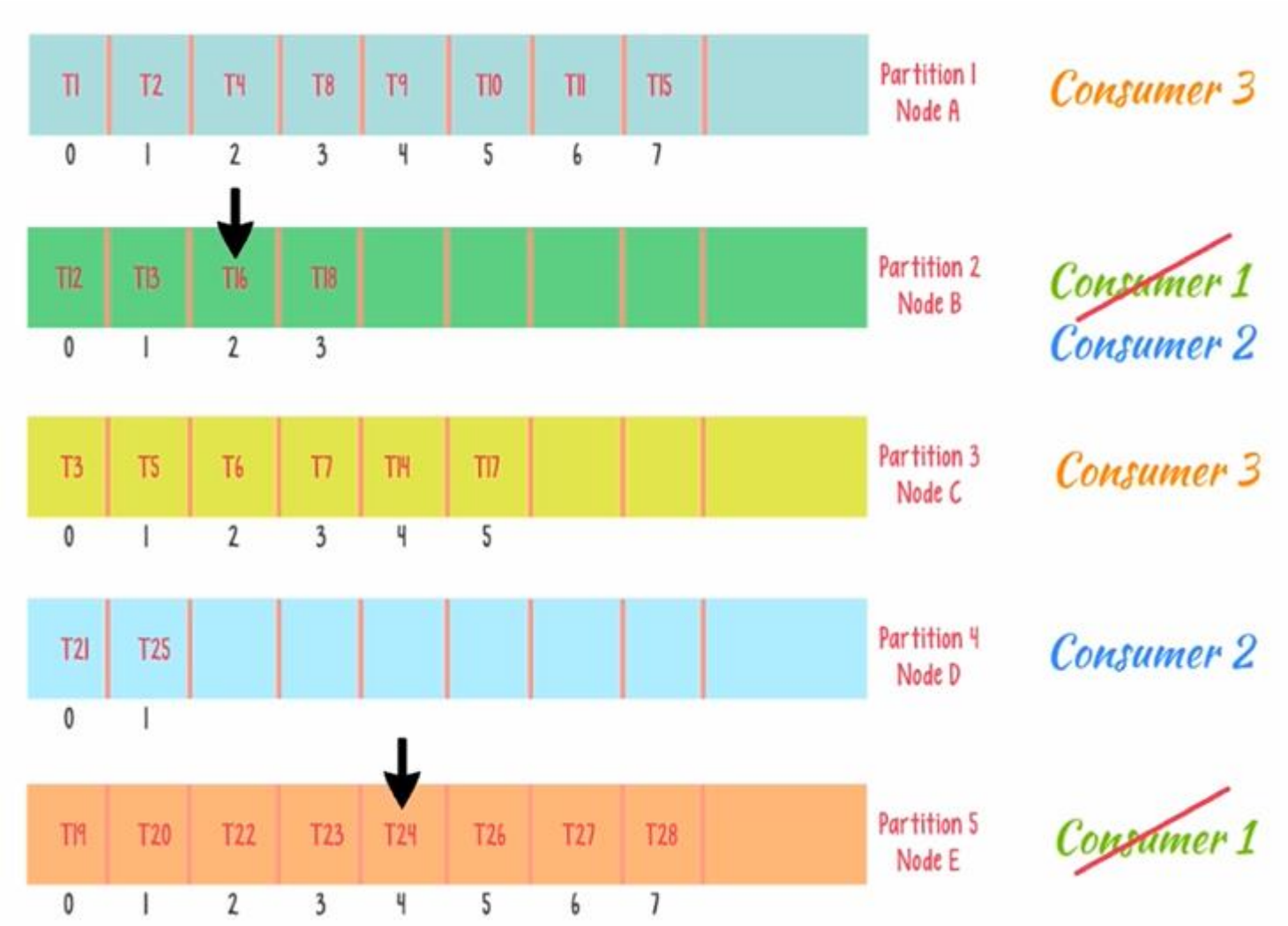
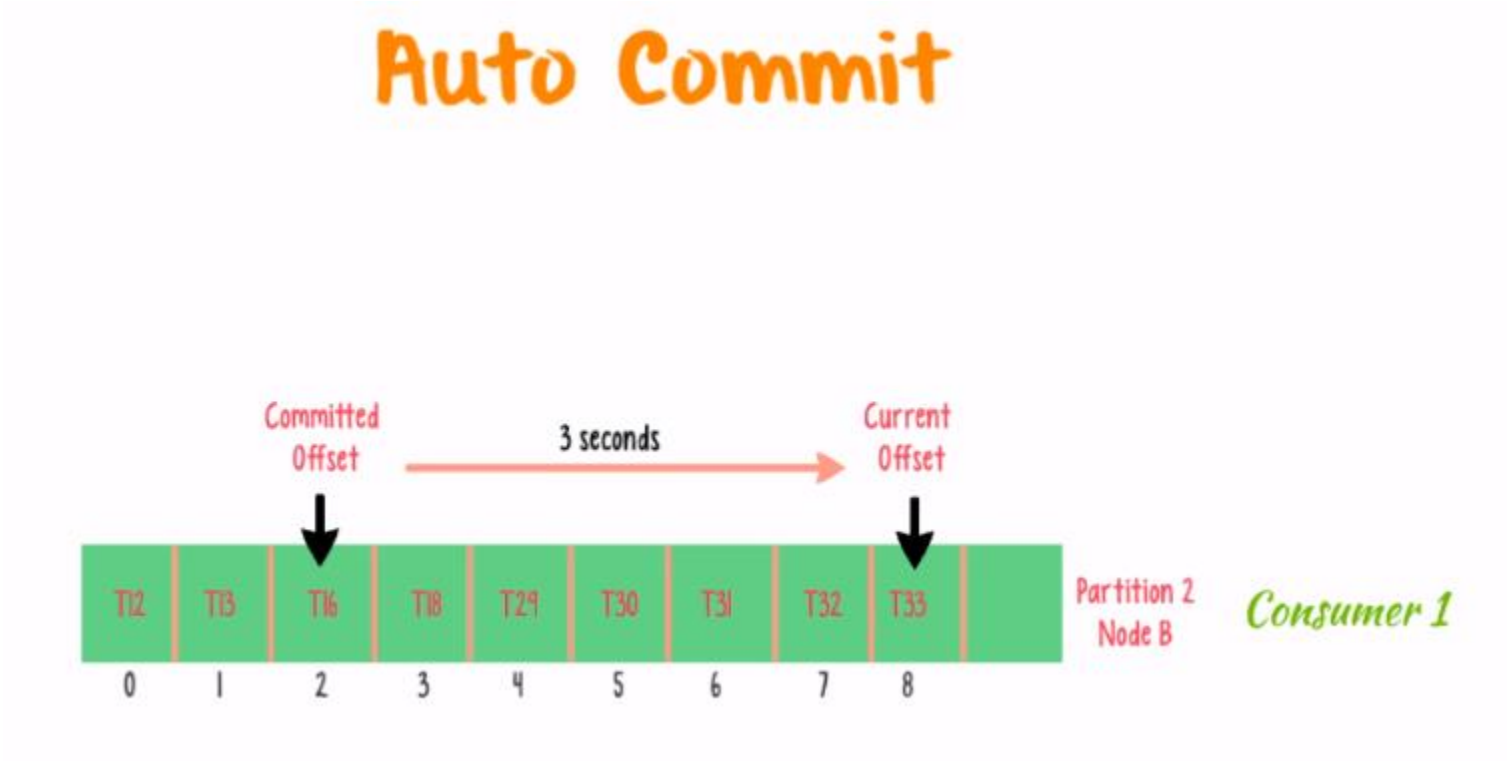


Overhead with internal topic

- Recording index every time is a huge overhead
- How to overcome this?
- Few options

Overhead with internal topic



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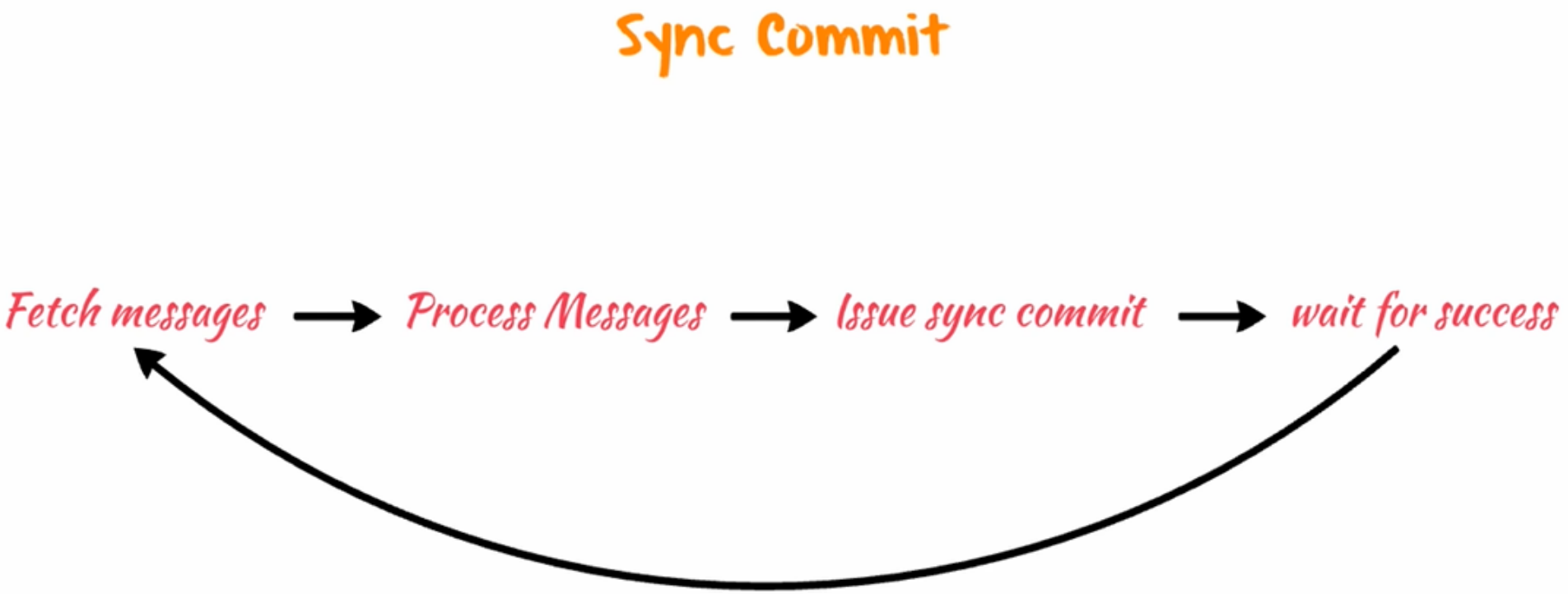
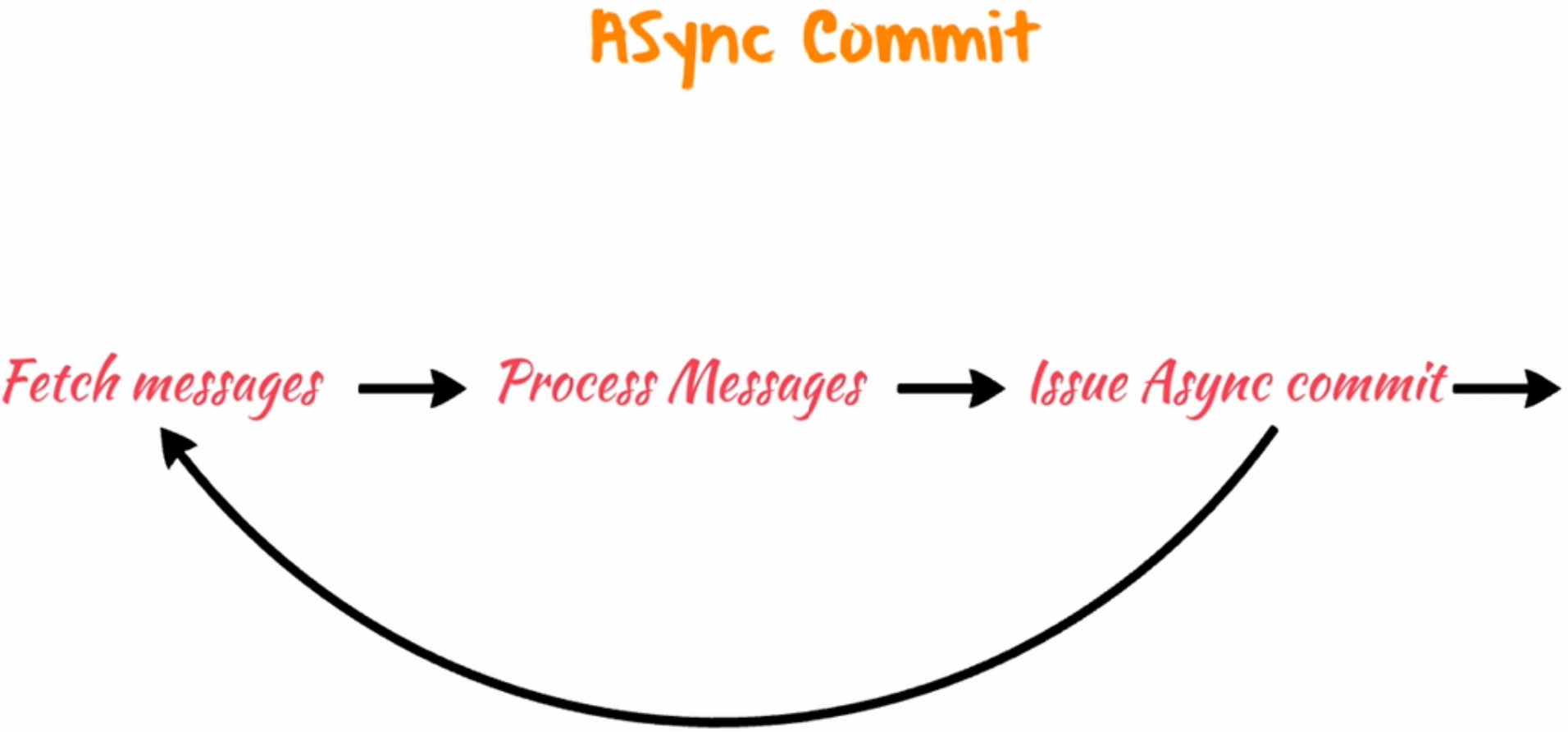


Overhead with internal topic

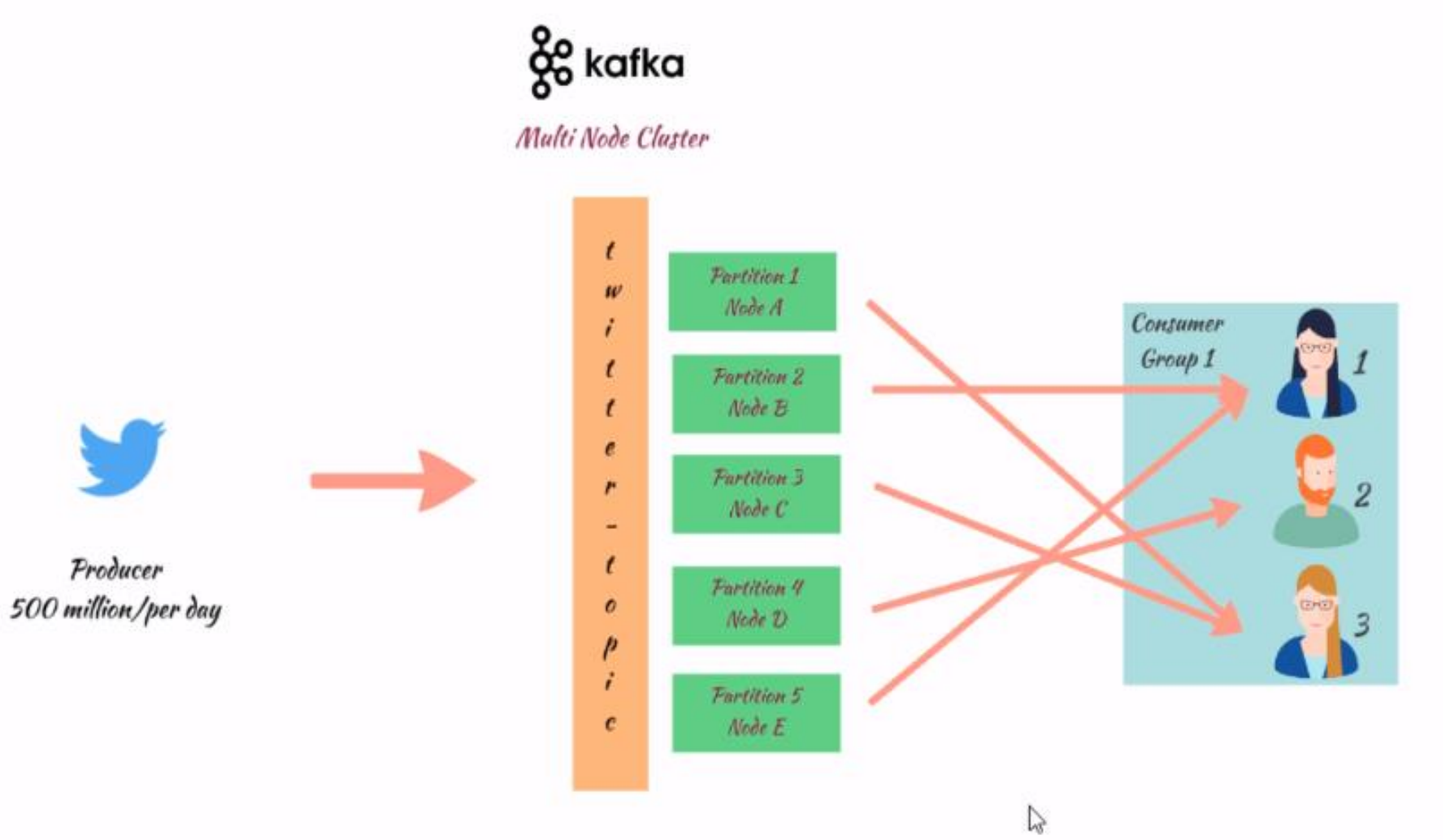


Overhead with internal topic

- Commit option you choose depends on your use case
- If you care less about duplication of data and velocity of data is light, you can go auto-commit
- If you care about data being unique and also have light velocity, use synchronous commit
- Somewhere in between choose asynchronous commit

Reliability and Fault Tolerance in Kafka Brokers

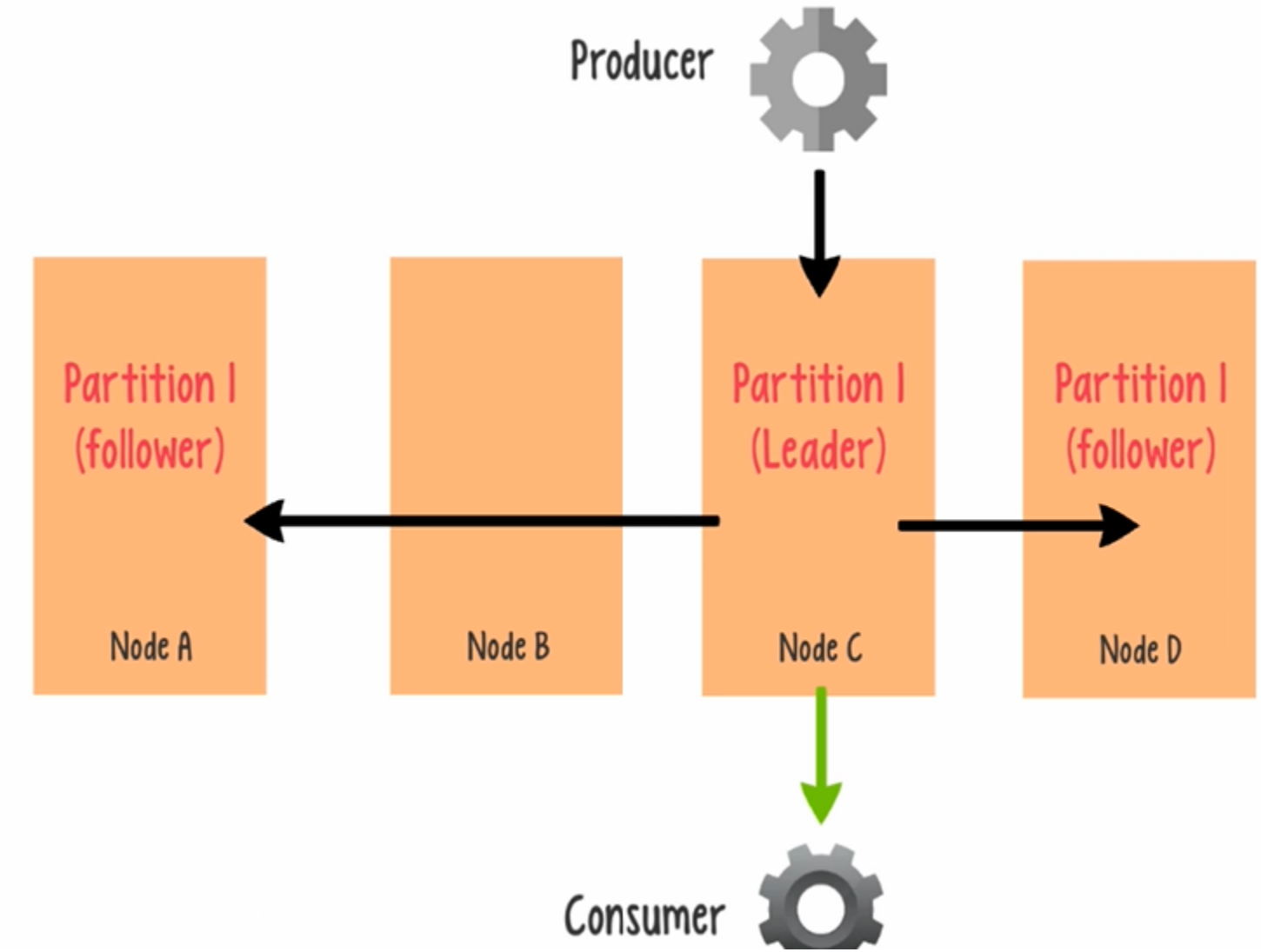
Fault tolerance in Kafka



Fault tolerance Kafka Nodes

- To tolerate failure we need repetition
- Very similar to Hadoop HDFS
  - Replication factor usually 3
  - But there is a big problem in this case
- How do we keep the replicas in sync
  - Data is constantly changing as new messages come in

Node Failure Recovery



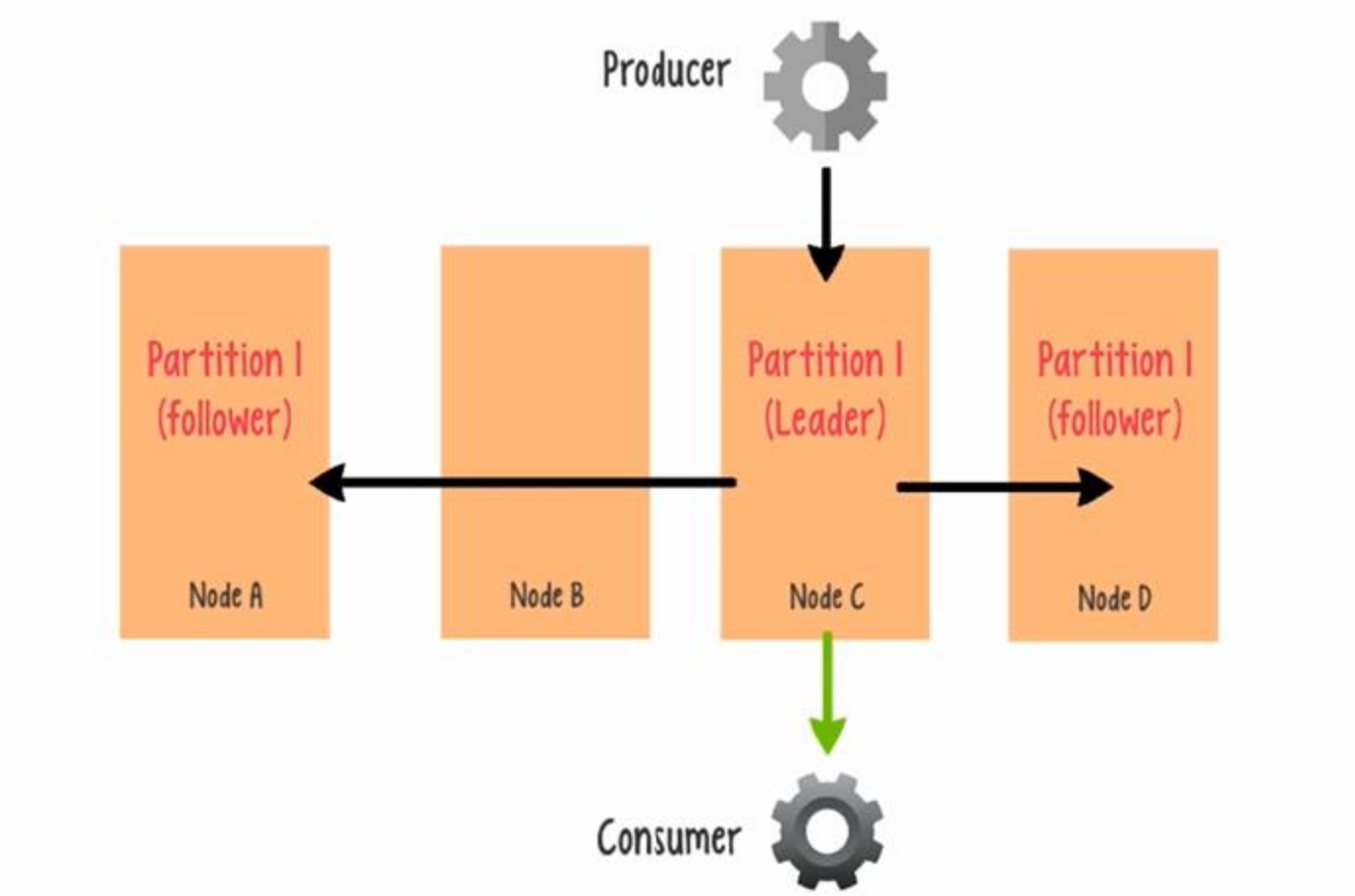
Fault tolerance Kafka Nodes

- Leader
  - Gets data from producer
  - Persists it in disk
- Follower
  - Gets data from leader
- Replicas that are in sync with the leader are called in-sync replicas (ISR's)

Fault tolerance Kafka Nodes

- It is hard for the replicas to be in-sync with the leader
  - Especially when you have high volume
- The leader gets the message first
  - So replicas can never be in-sync in real time
- So how do we achieve fault tolerance?

Fault tolerance Kafka Nodes



A message is available for a consumer to read from a partition only after the message is written or in other words committed to the in-sync replicas

Fault tolerance Kafka Nodes

replica.lag.time.max.ms = 10 sec

Stuck follower =

Follower did not issue a fetch request to the leader in the past 10 seconds

Slow follower =

Latest message in the follower replica is older than 10 seconds compared to the leader

Concept in detail

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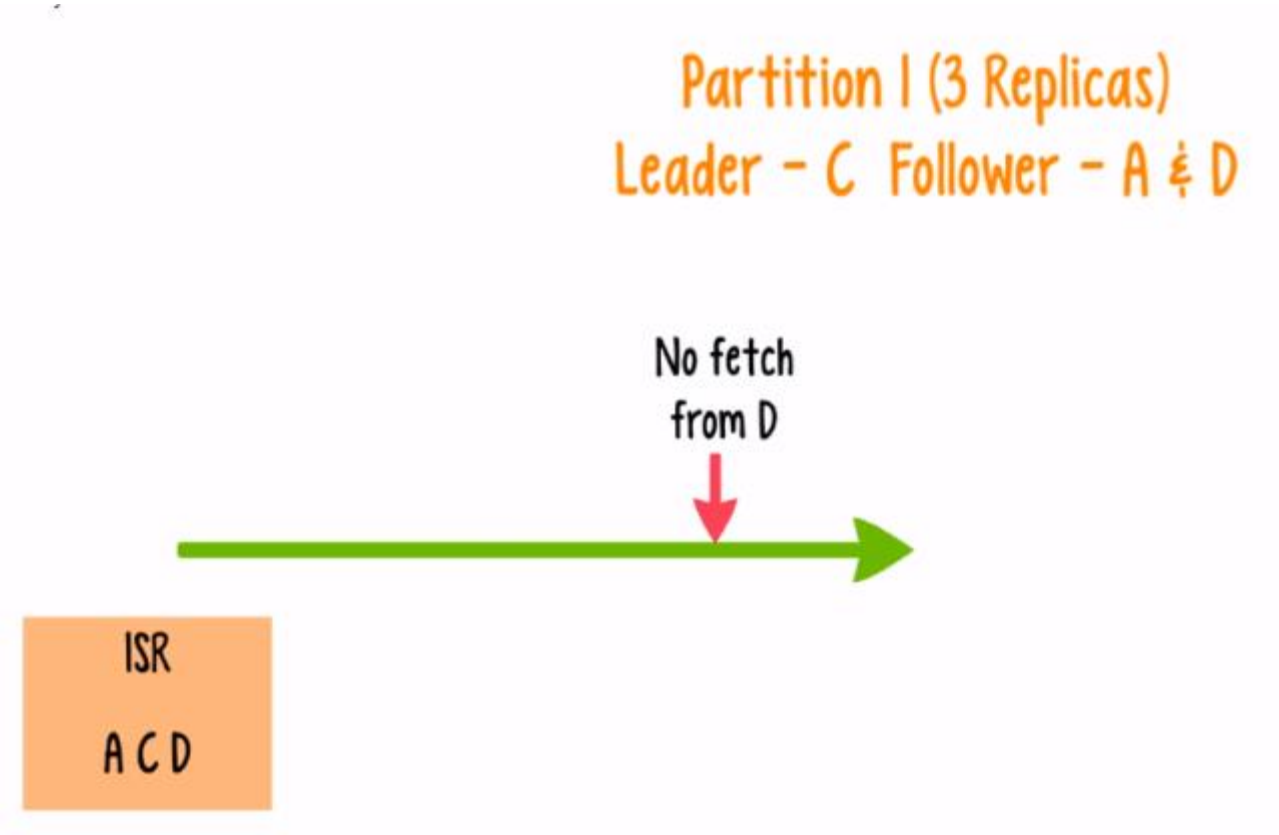

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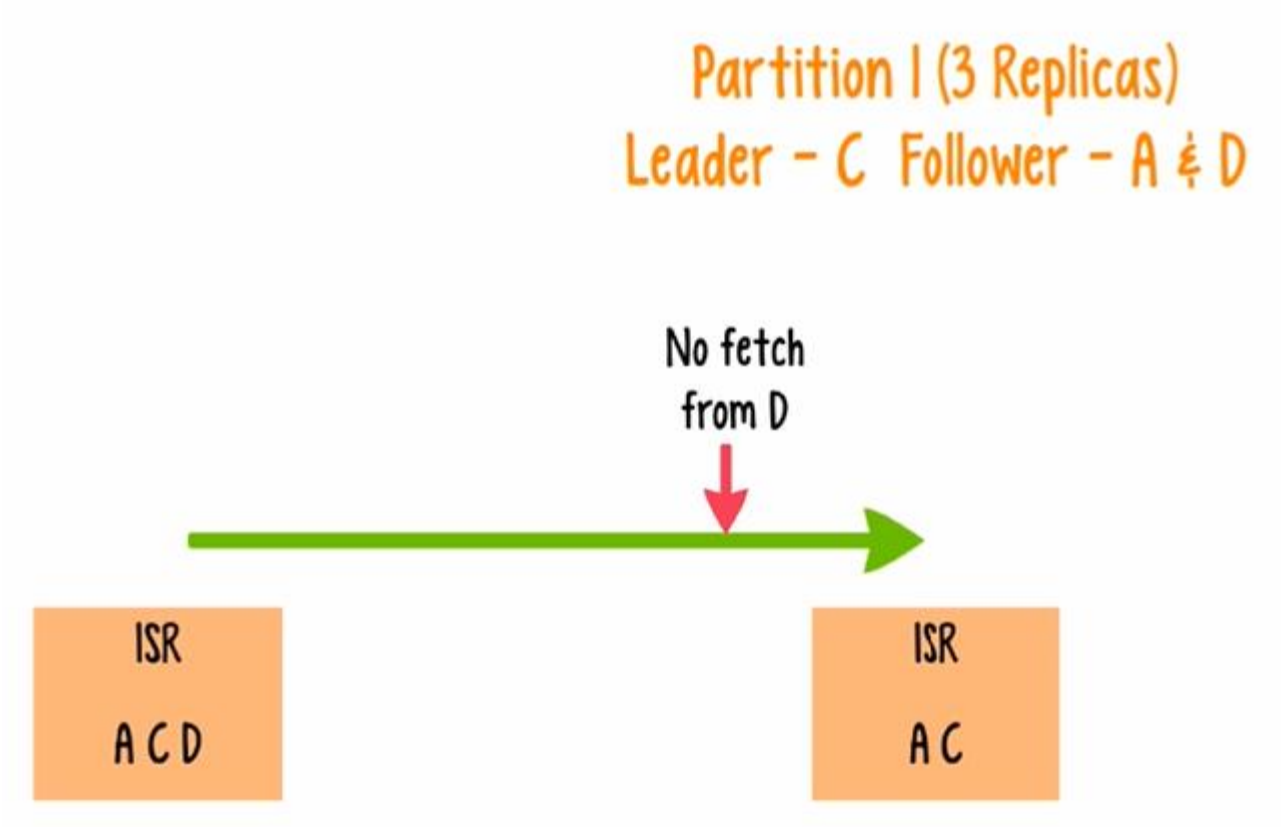

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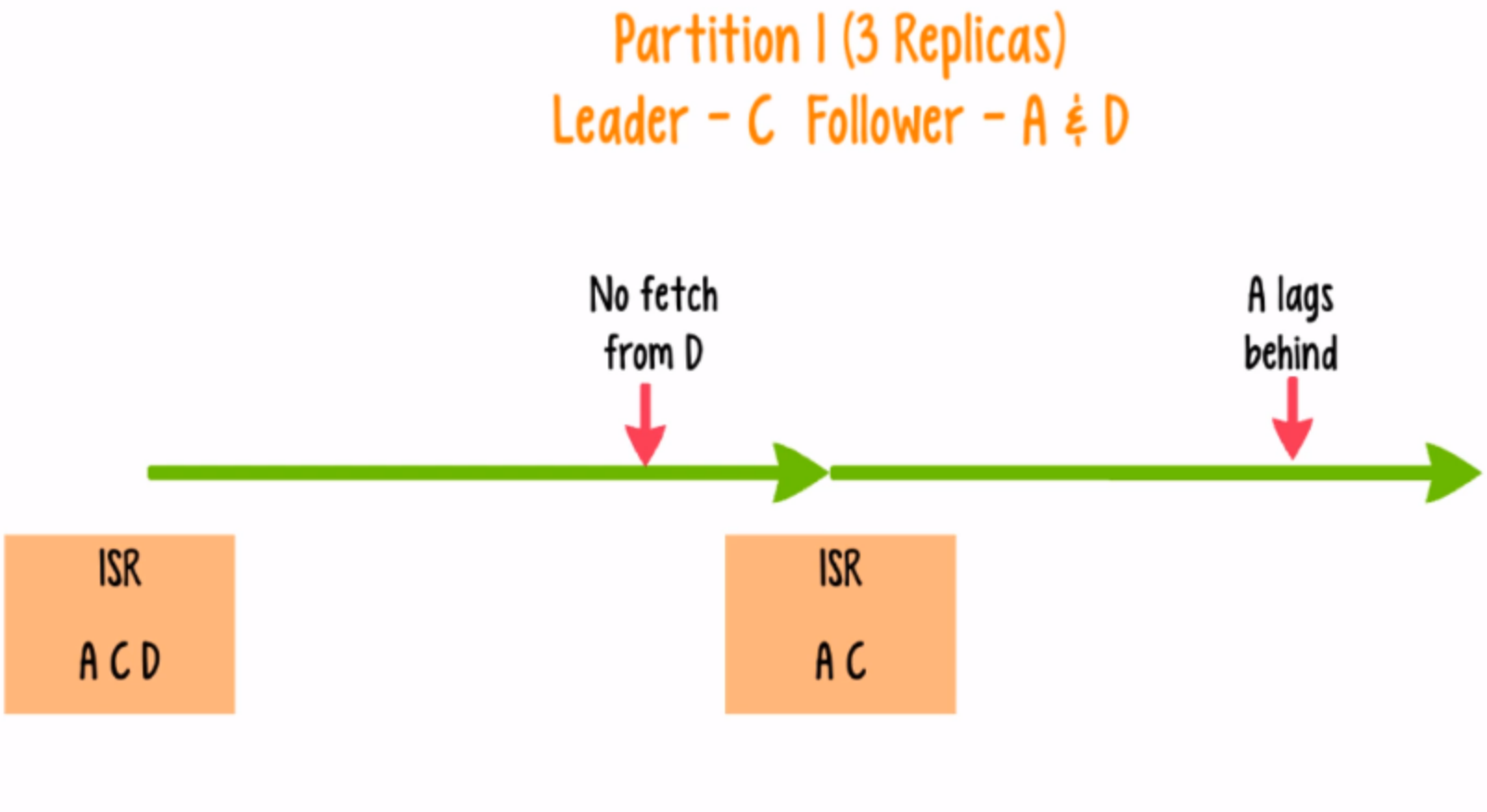

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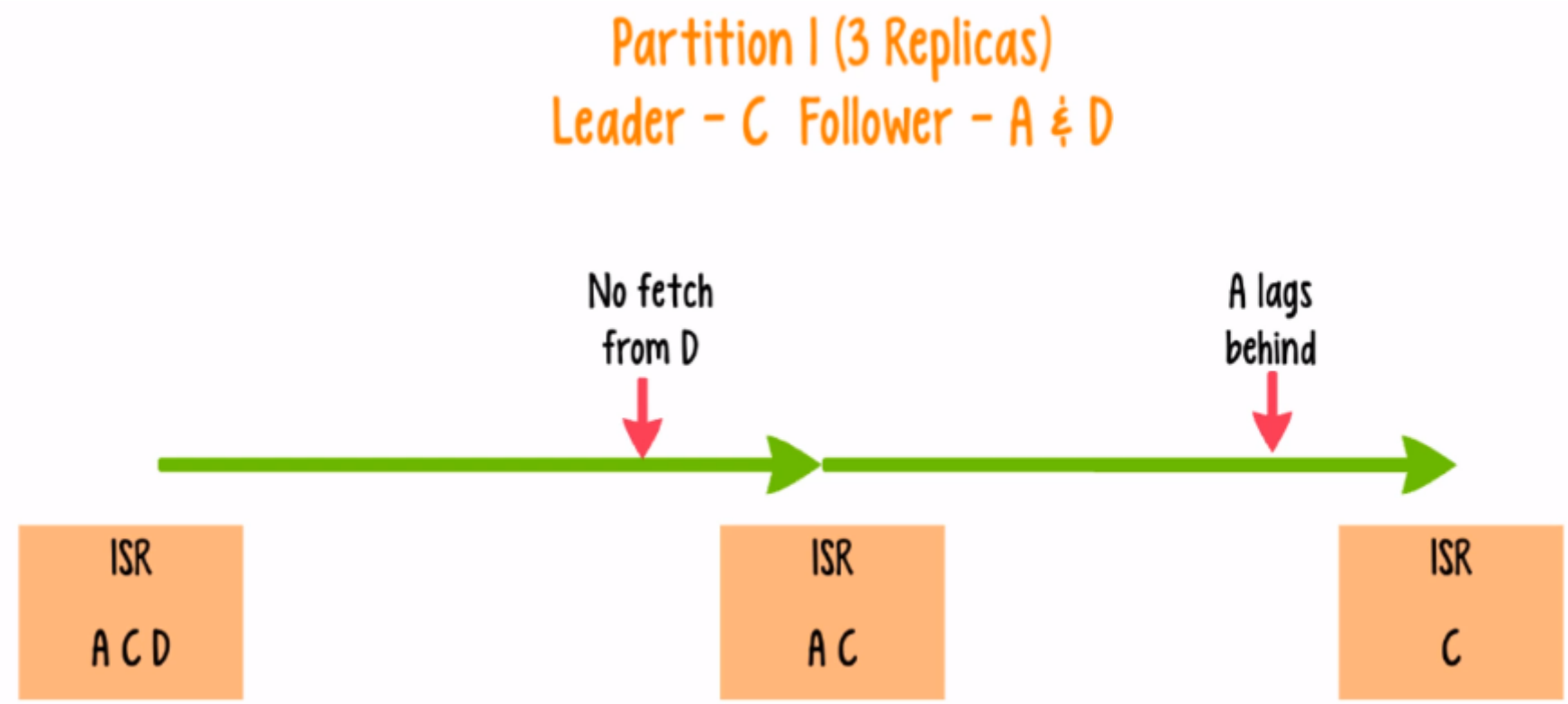


If Data Loss is acceptable

unclean.leader.election.enable

If Data Loss is Unacceptable

min.insync.replicas

Fault tolerance Kafka Nodes

- Set value to greater than 1
- Example for 2 → if the ISR is 1, producer gets an exception and Kafka will stop taking messages
  - Give administrators chance to see what's wrong
- Usually we have a few nodes going in and out of ISR lists for short periods of time
- Setting value to 2 is a good option

Kafka Installations

Kafka Instruction Details

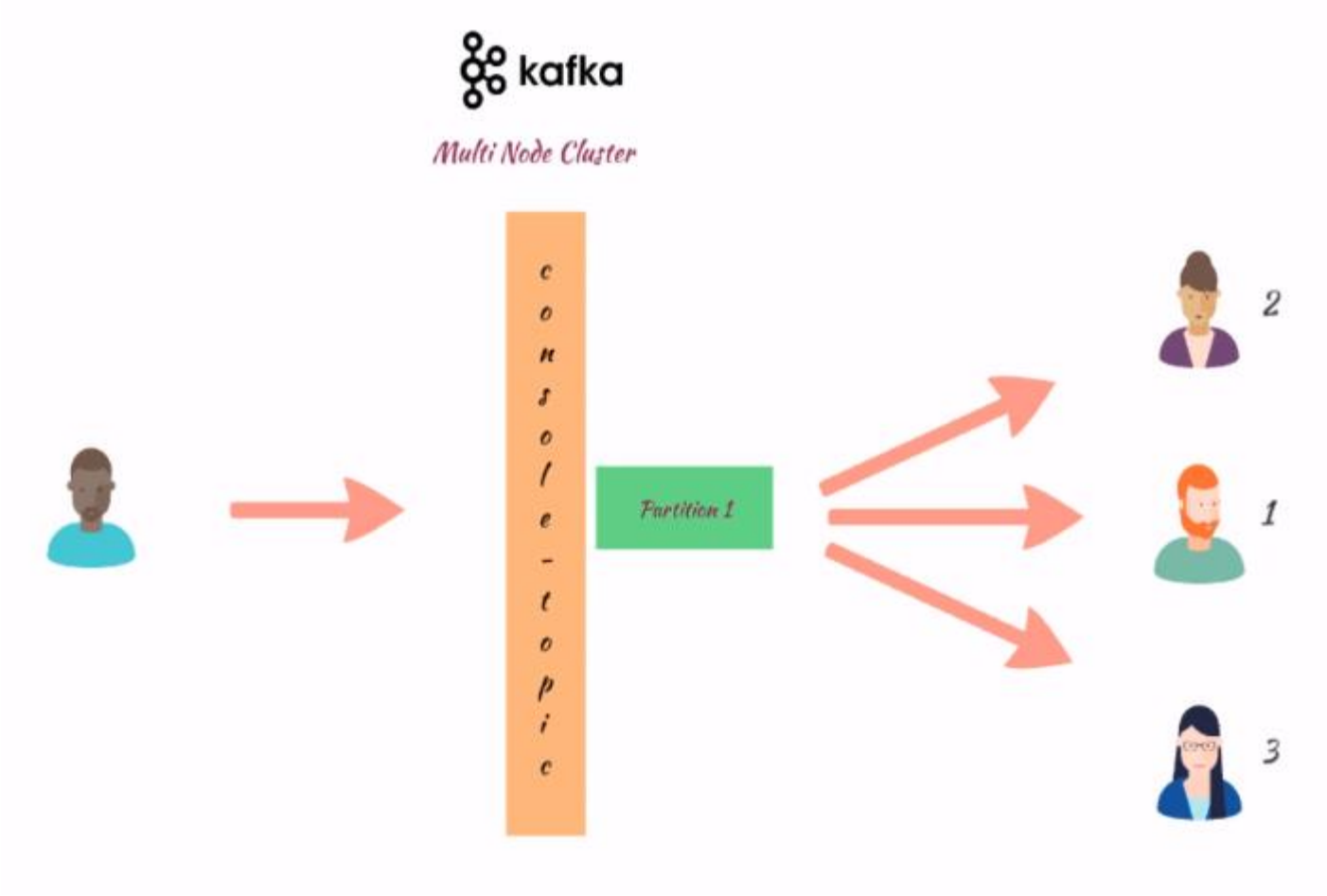
- We need to install and configure both Kafka and Zookeeper
- We will use a pre-configured version of Kafka from a company called Confluent
  - Similar to Cloudera
  - Started by engineers in LinkedIn

Kafka Experimentation

Kafka Instruction Details

- We will try to demonstrate all of the concepts in this lecture using Kafka and Zookeeper installation

Three consumers



Three consumers