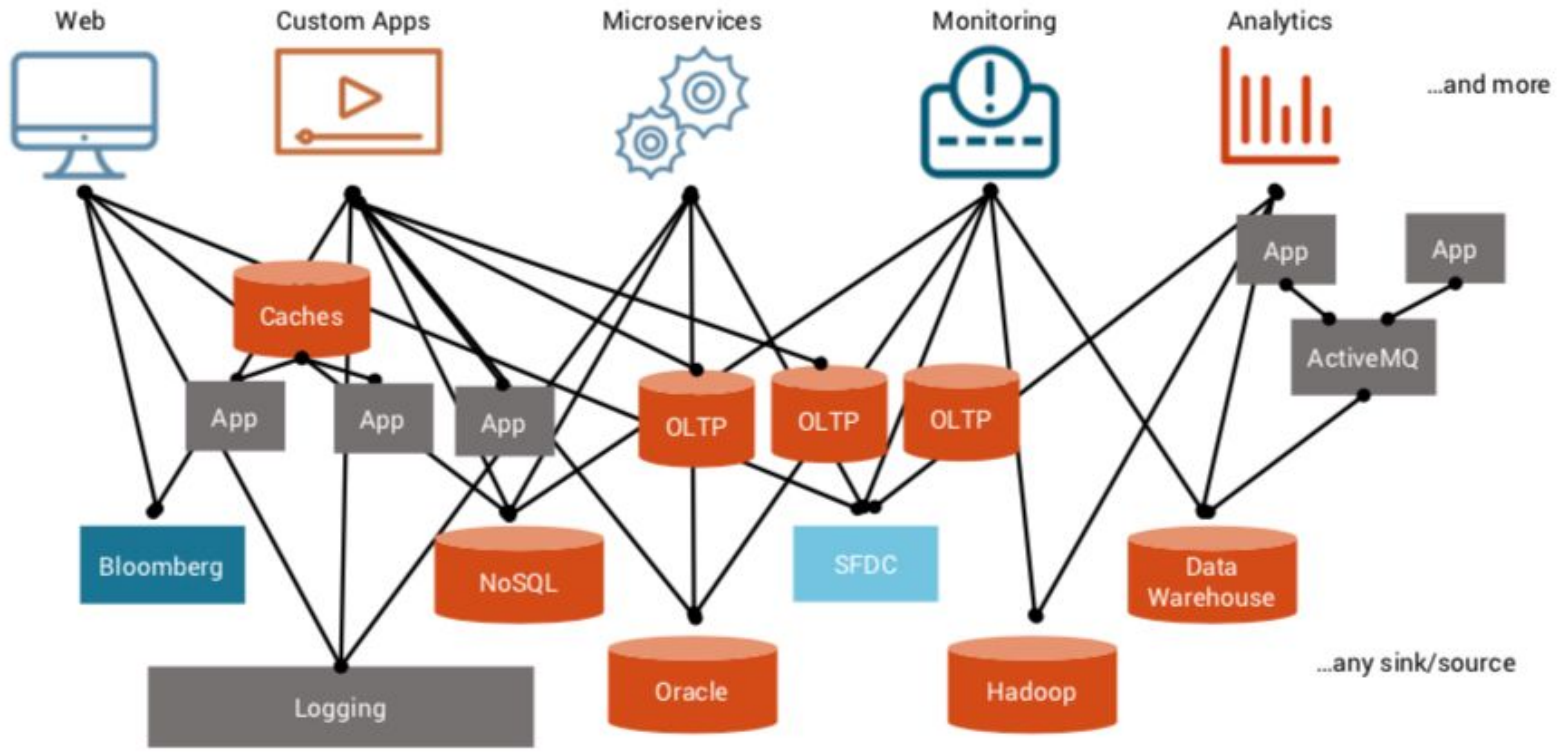
Intro to Kafka

Ankush

Index

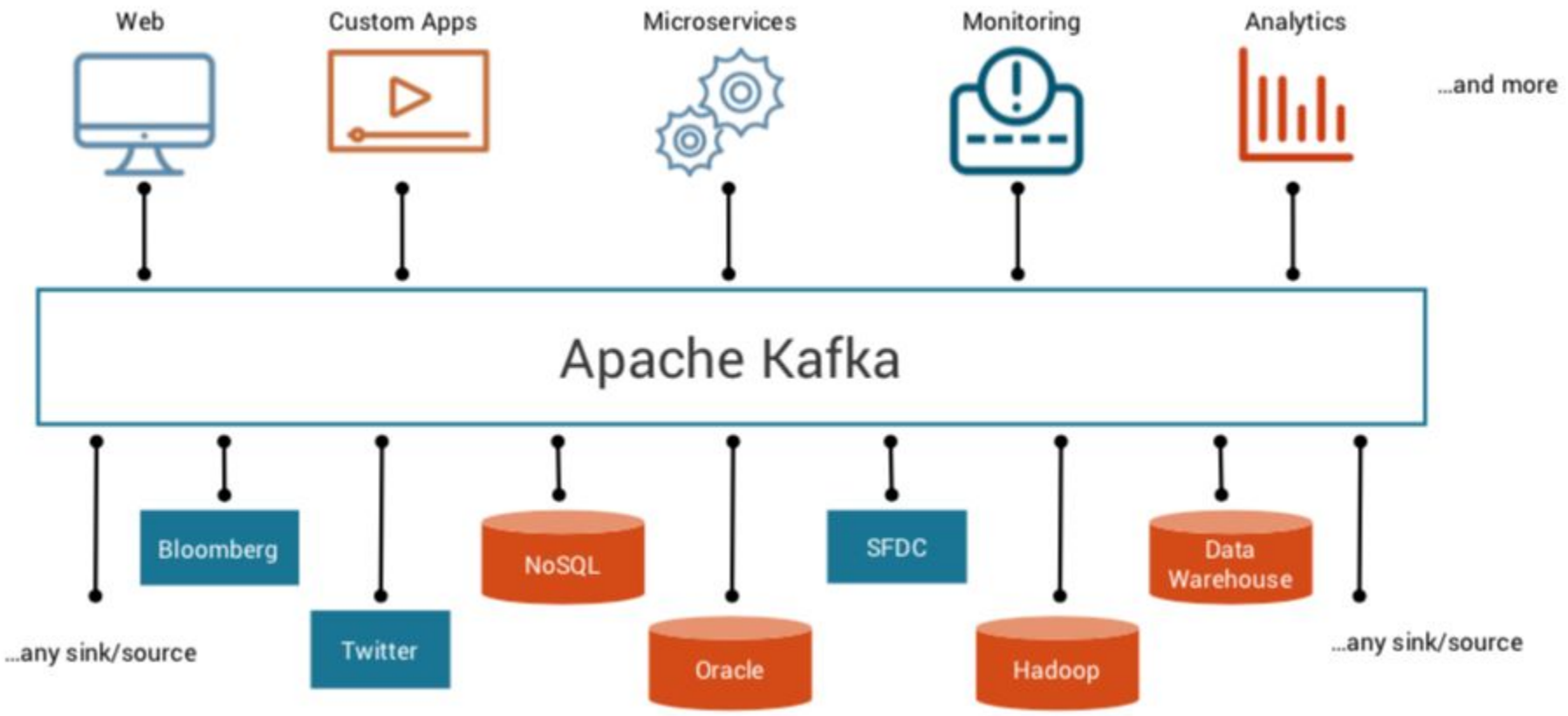
- What is kafka
- Basic components
- Avro and Schema Registry
- Kafka Connect
- Kafka Streams
- What questions to ask?

Architecture w/o kafka?



source: https://www.slideshare.net/PaoloCastagna1/introduction-to-apache-kafka-confluent-and-why-they-matter

Architecture with Kafka?



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Kafka everywhere

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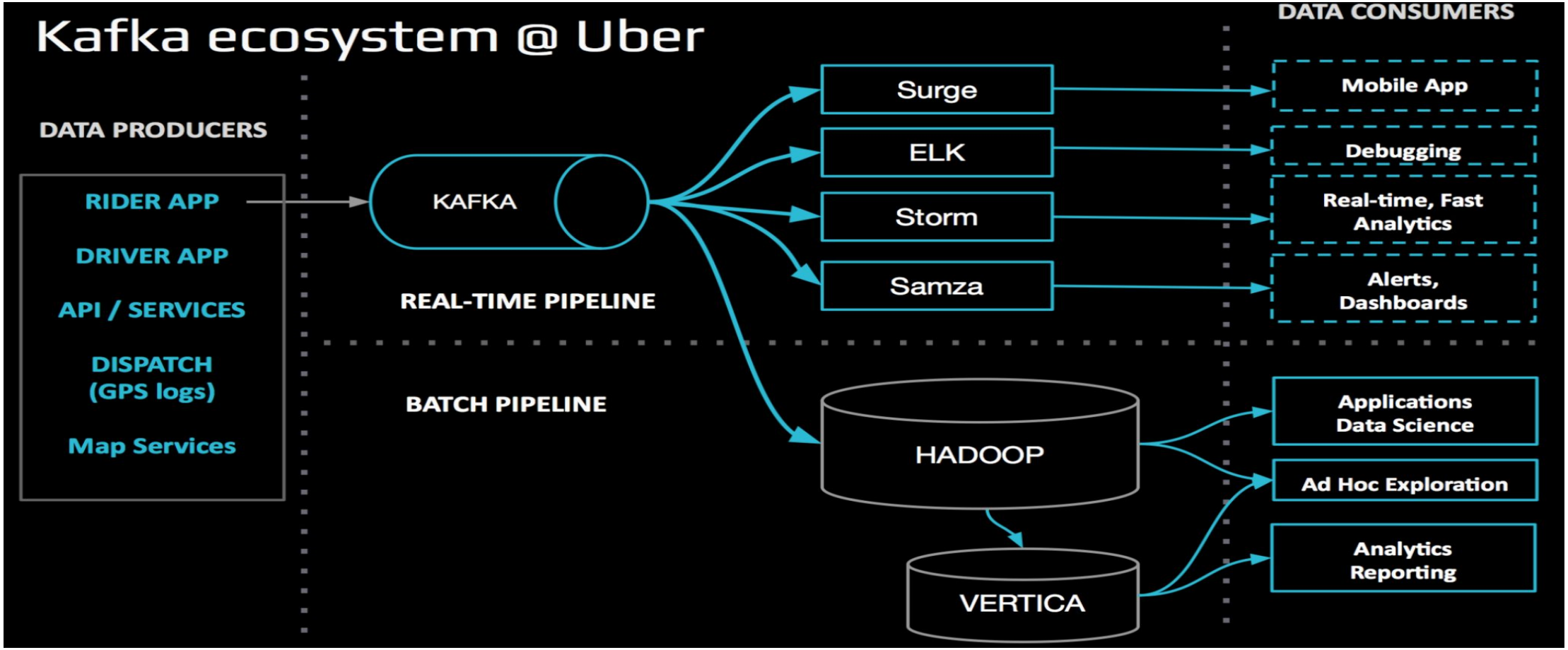
Kafka everywhere



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https://eng.uber.com/ureplicator/

Basic terms

Messages in kafka

- Kafka Message
  - Key
  - Value
  - Timestamp

Topic in Kafka

- Producer pushes messages to a topic
- Consumer consumes messages from a topic

Kafka Broker

- Kafka broker => Physical machine on which Kafka is running
- Kafka Cluster => Multiple Kafka brokers => Multiple machines working together

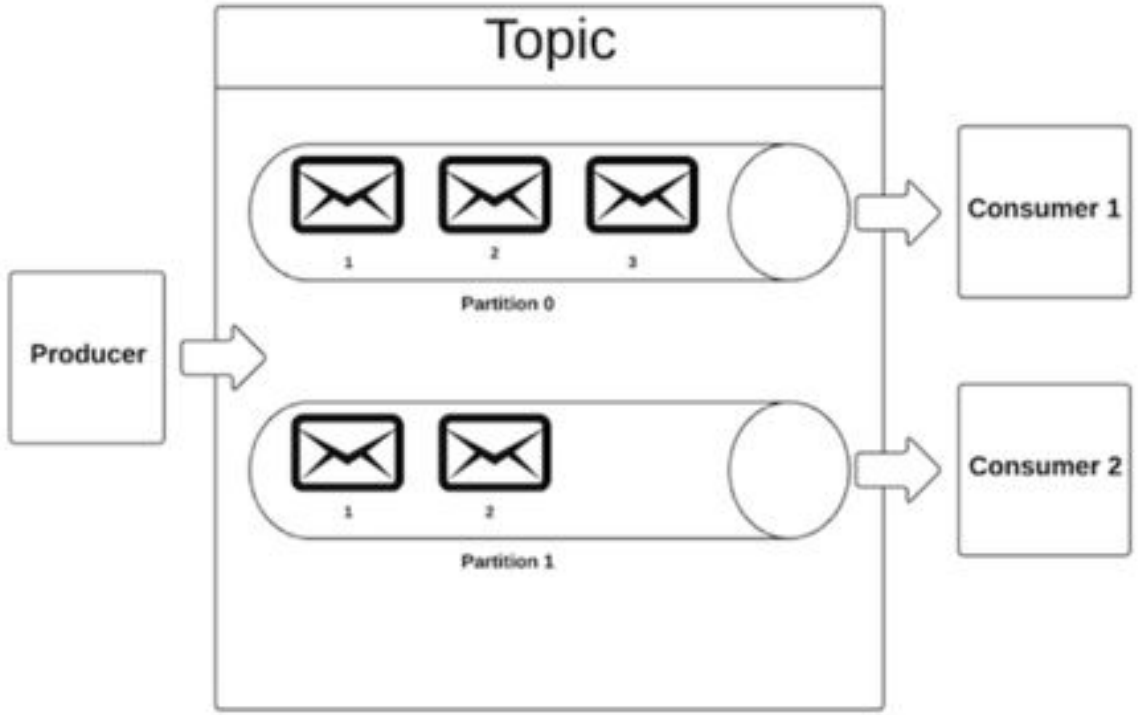
Logs

- Data segments present in your disk
- Stores messages in a order fashion
  - Assigns sequence id to each message before storing in logs

Partitioning in Kafka

Scalability

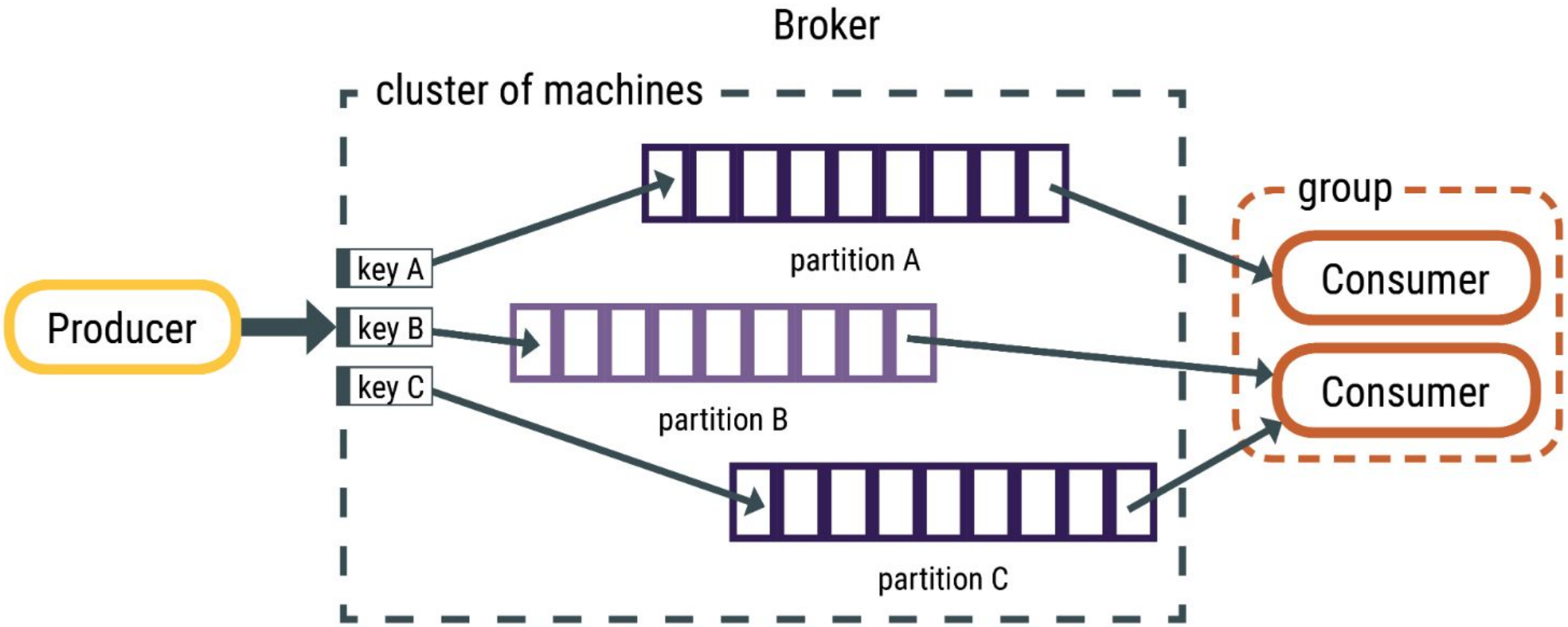
Topics and Partitions in Apache Kafka



- topic partitions are a unit of parallelism
- a partition can only be worked on by one consumer in a consumer group at a time

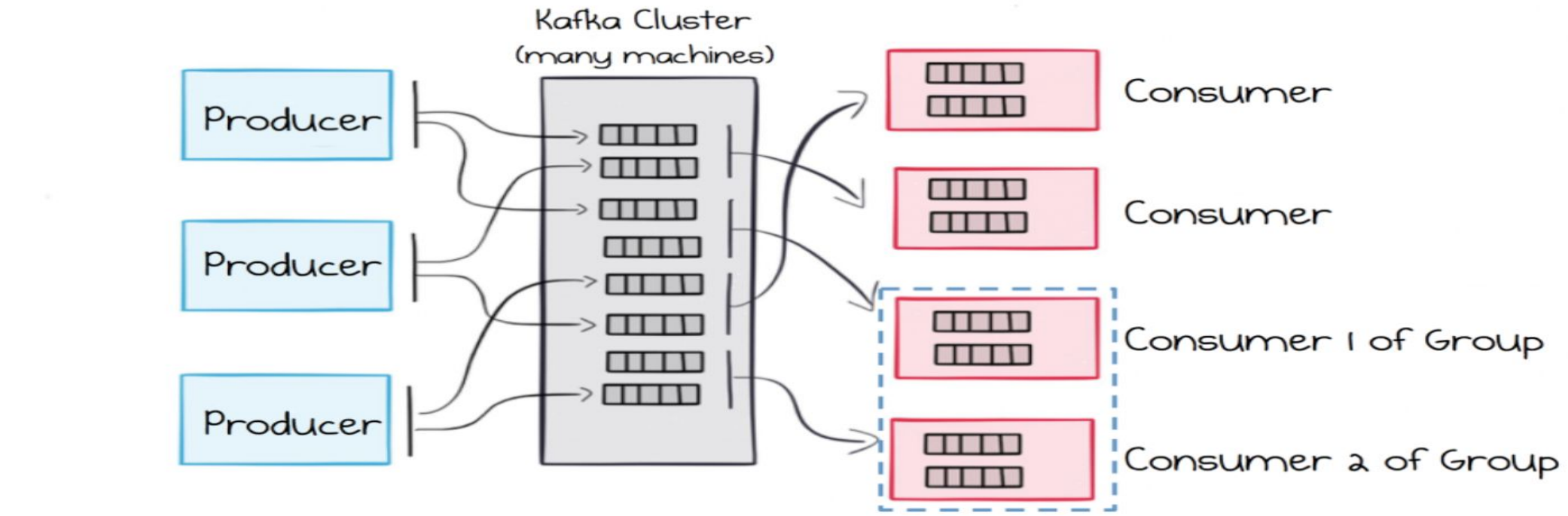
https://www.javaworld.com/article/3066873/big-data-messaging-with-kafka-part-2.html

Partitions in Apache Kafka



https://docs.datastax.com/en/kafka/doc/kafka/kafkaHowMessages.html

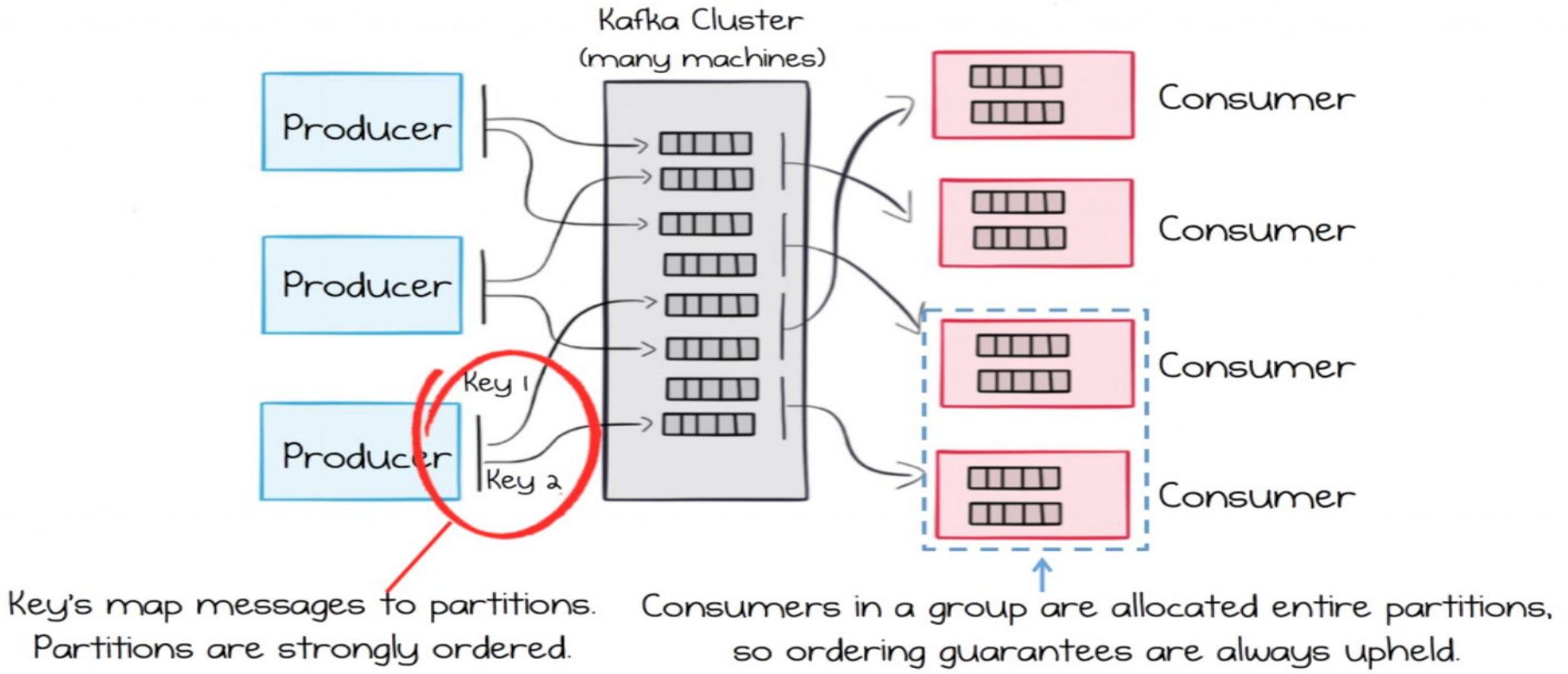
Partitions in Apache Kafka



Producers spread messages over many partitions, on many machines, where each partition is a little queue. Load balanced consumers (denoted a Consumer Group) share the partitions between them.

https://www.confluent.io/blog/apache-kafka-for-service-architectures/

Partitions in Apache Kafka



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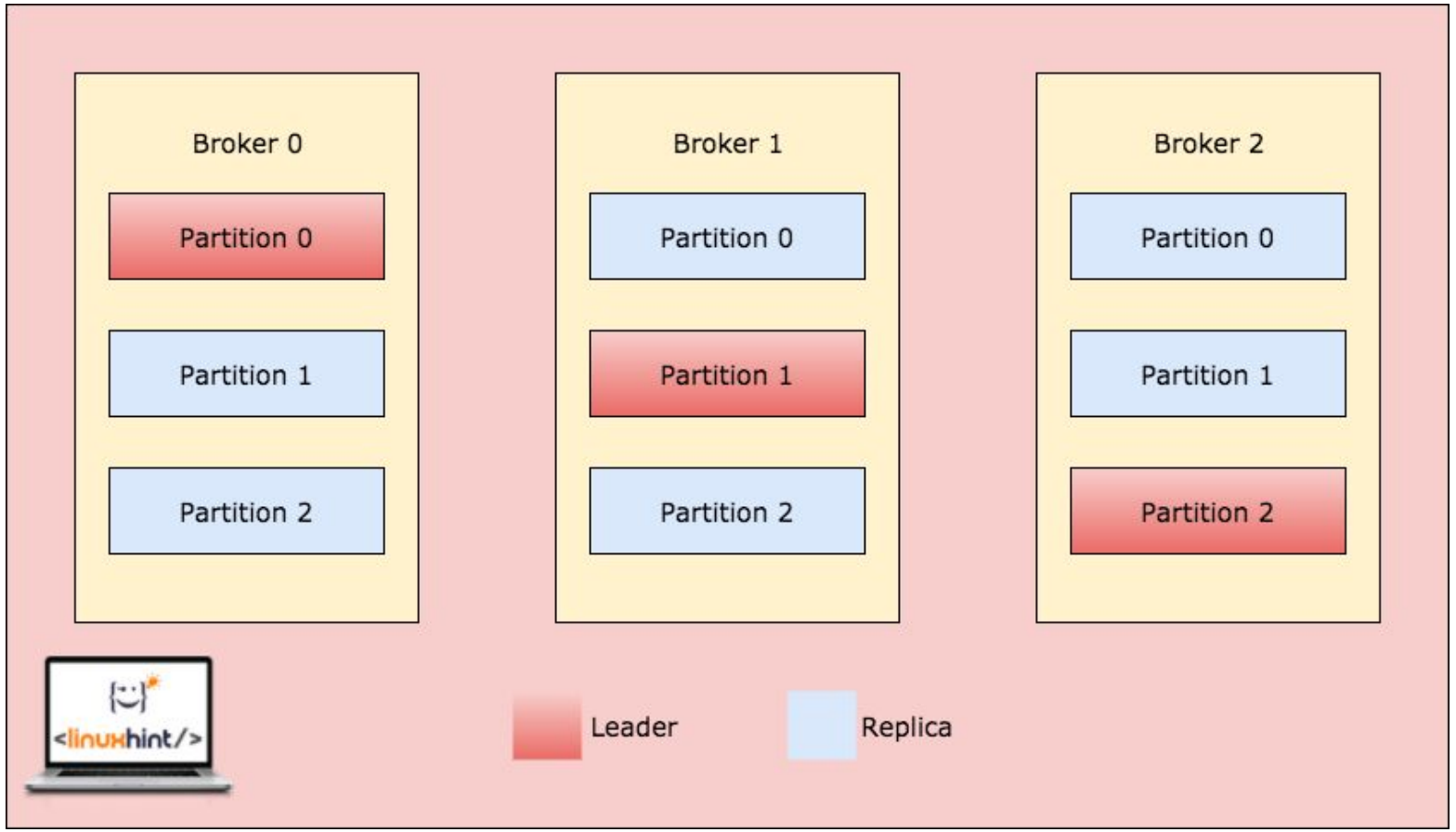
Replication in Kafka

Fault tolerance



Configuration terms

Configurations Topic

- **retention.ms** => Amount of time logs will stay before they get deleted
- **cleanup.policy**=[delete|compact], either delete the messages from topic or compact them
- **partition**, scalability count
- **replication**, number of times a partition will be replicated

Configuration Consumer

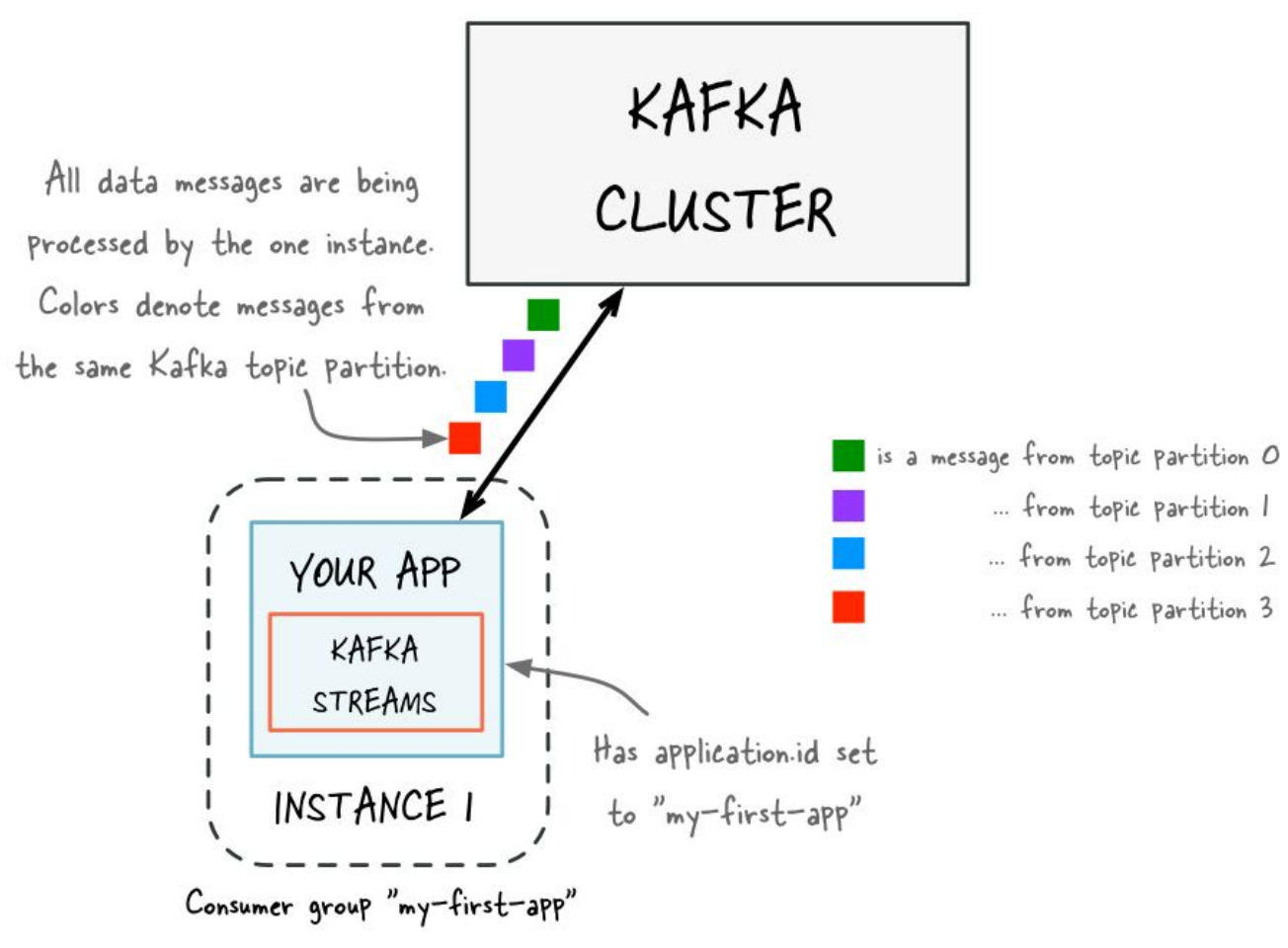
- **offset** => What has already been read by the consumer
- **consumer.group.id** => Identifier for the consumer group
- **auto.offset.reset**=[earliest|latest], when consumer connects for first time to a topic (offset does not exists for this consumer.group.id), where to start reading from. From first (earliest) message or last (latest) message

Configuration Producer

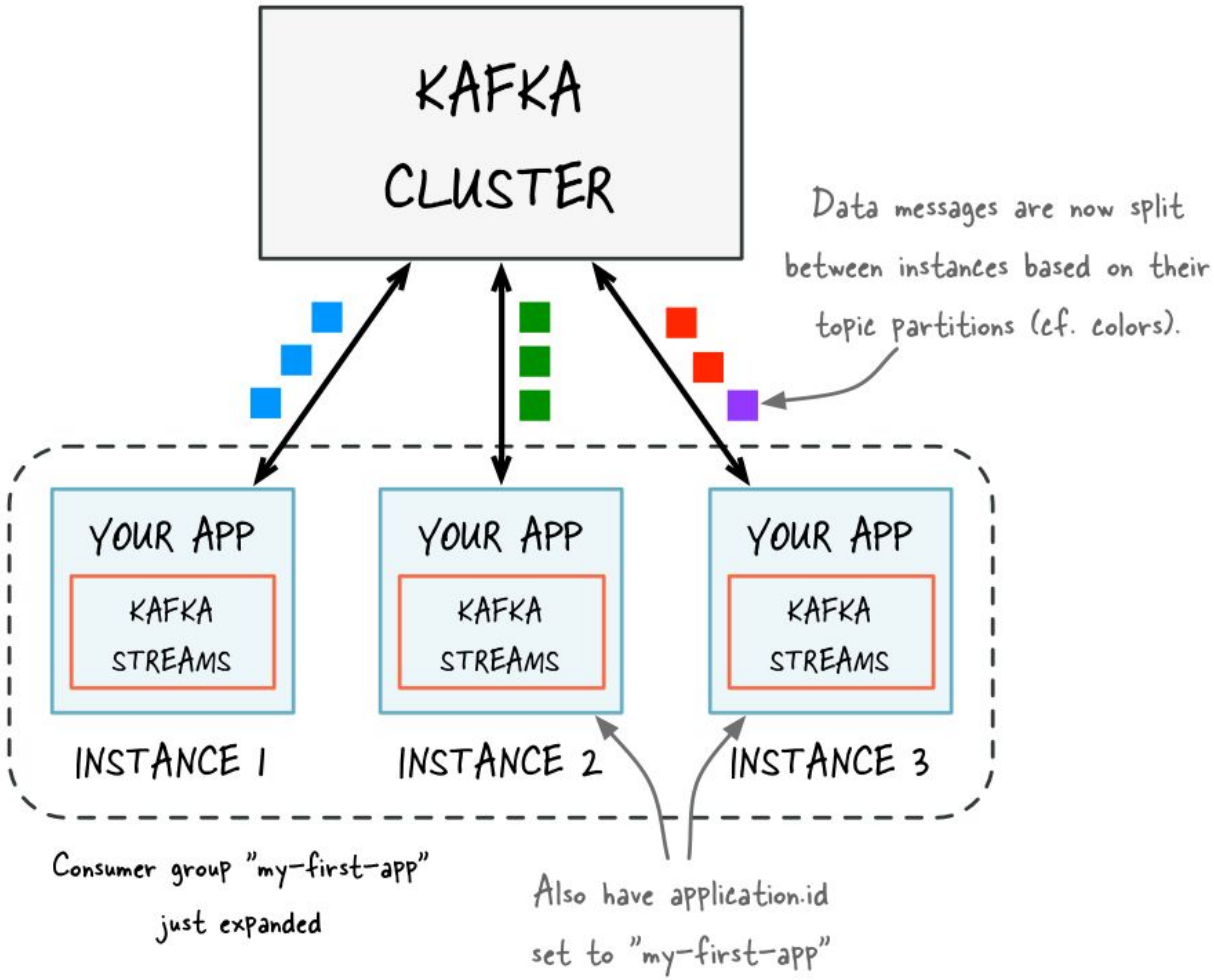
- **acks**: [0|1|all]
  - 0 => Does not wait for leader or replica broker to write the message to disk
  - 1 => Waits for leader broker to write the message to disk
  - all => Waits for leader and all replica to write the message to disk

Kafka Scaling

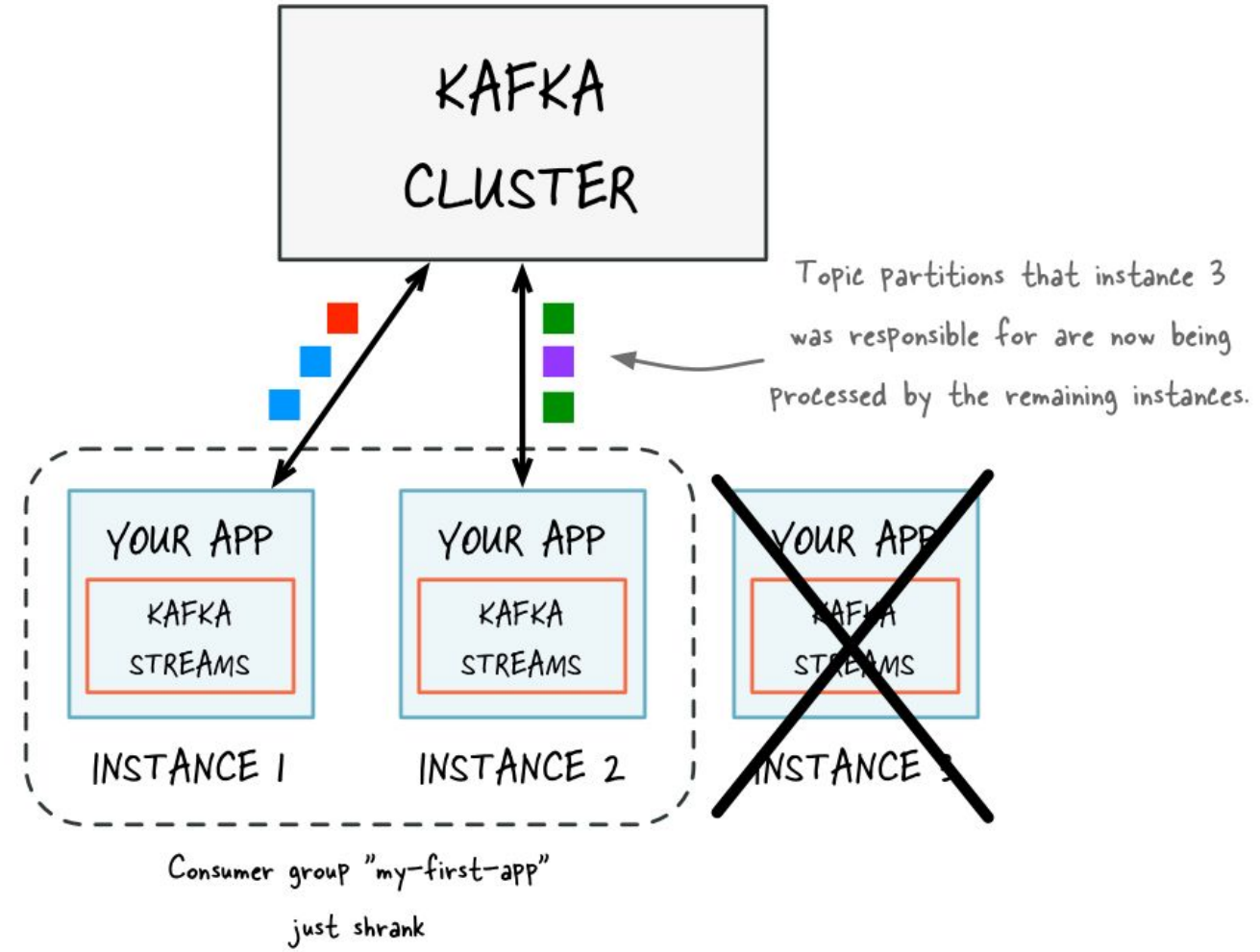
Kafka Scaling



Kafka Scaling

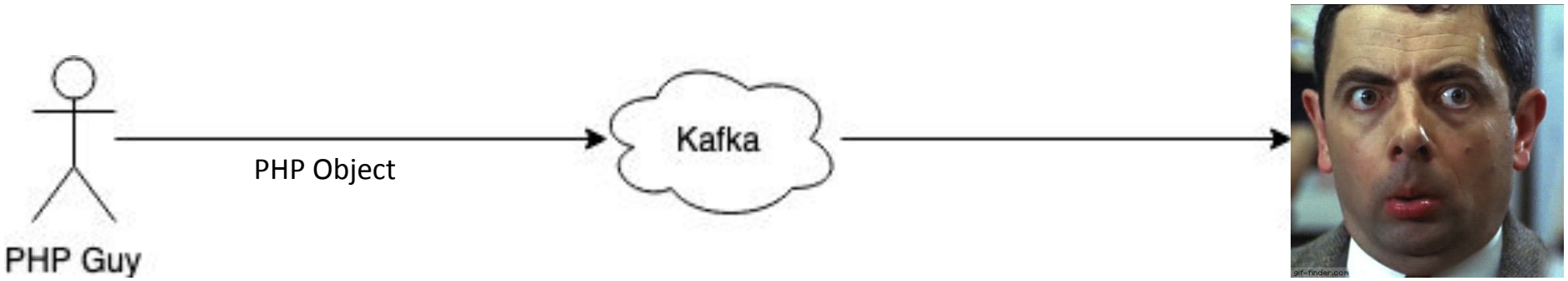


Kafka Scaling



Avro & Schema Registry

Why is schema needed?

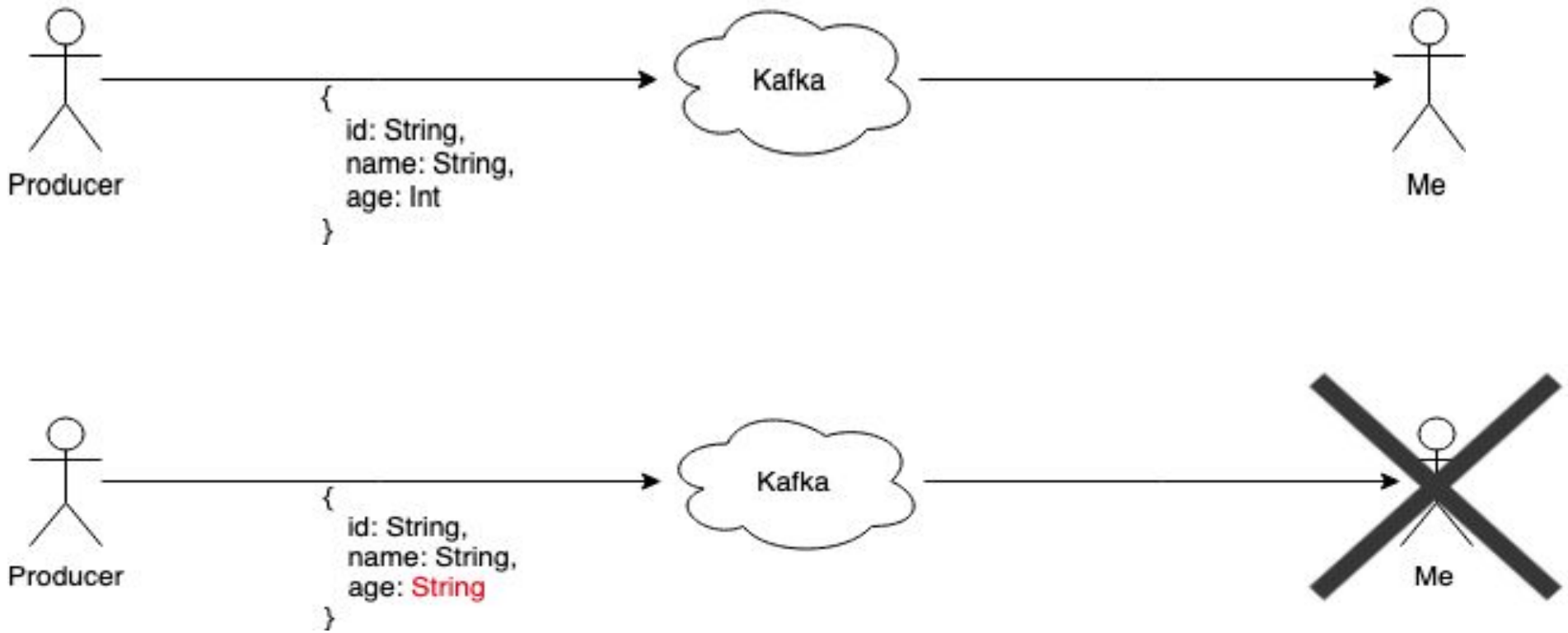


What is Avro

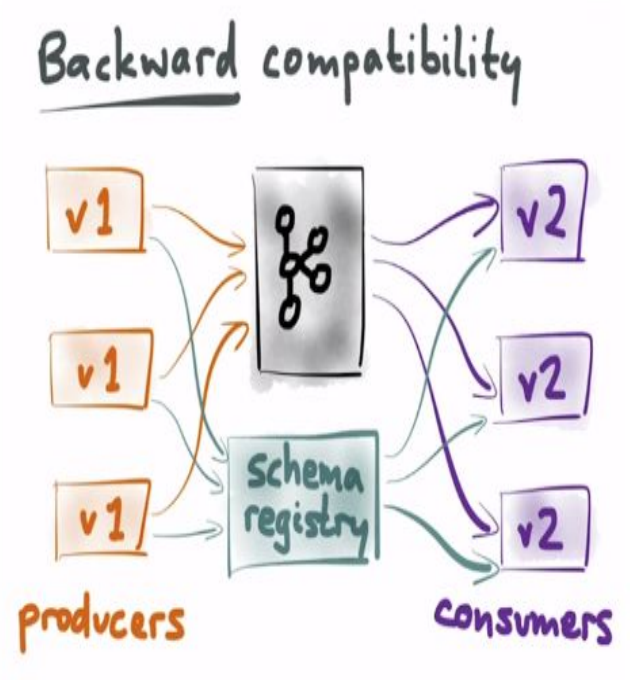
- Avro is a data serialization system
- **Schema stored separate from Record** (i.e. need schema to read record) (unlike *ProtoBuffers* or *JSON*)
- Records stored using binary encoding or JSON
- Avro advantages:
  - Smaller filesize (vs JSON)
  - Schema evolution
  - Avro clients provide automatic validation against schema

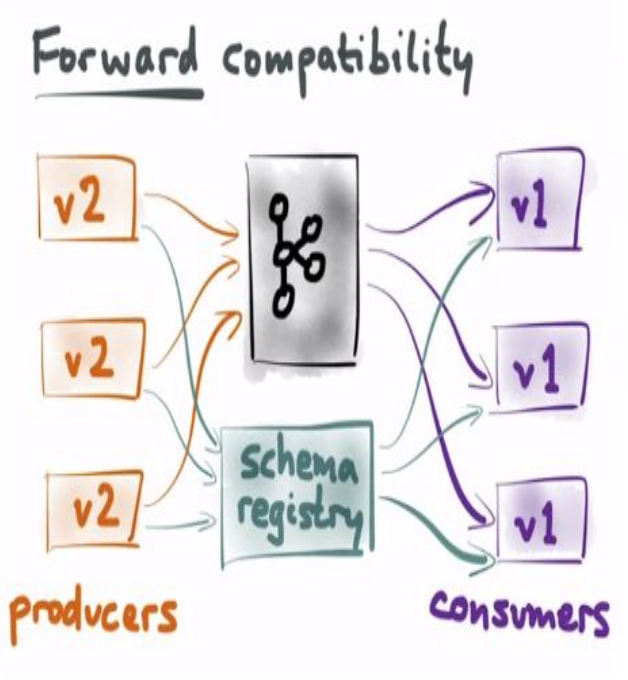
https://inakianduaga.github.io/kafka-image-processor/#/1

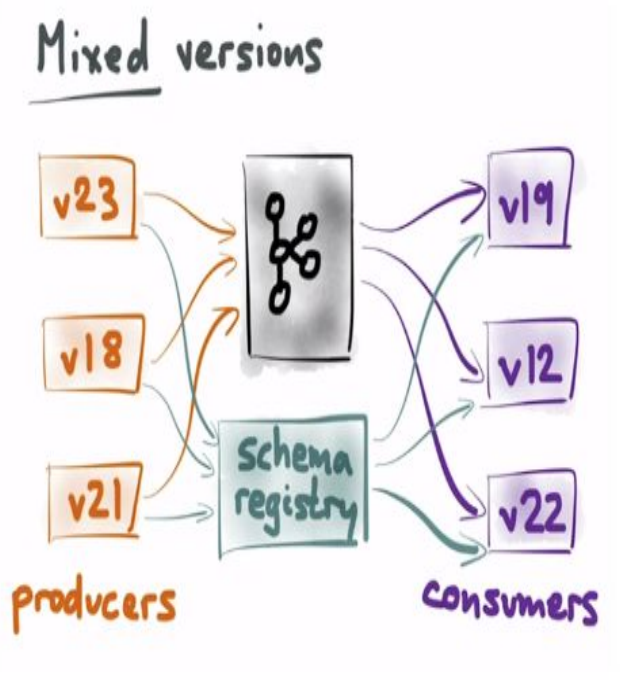
Why Schema Compatibility?



Avro schema evolution







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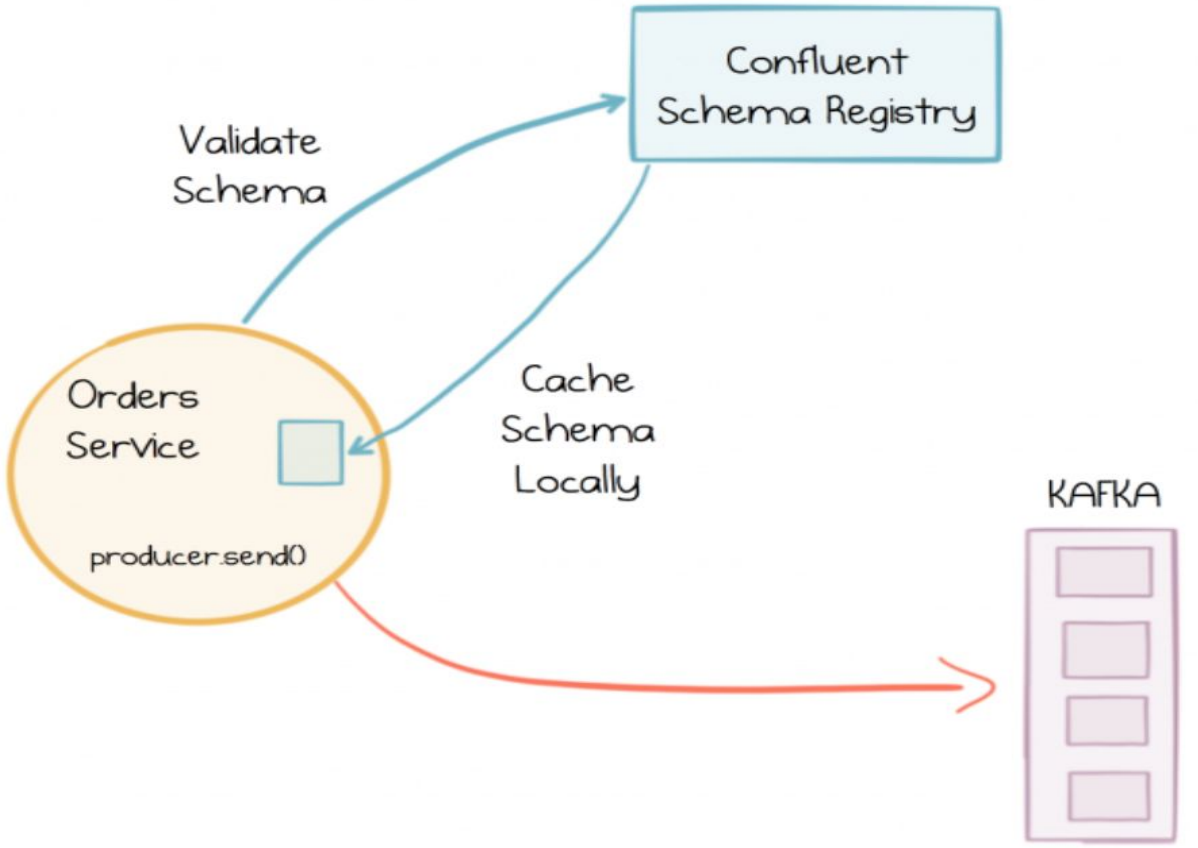
https://inakianduaga.github.io/kafka-image-processor/#/1

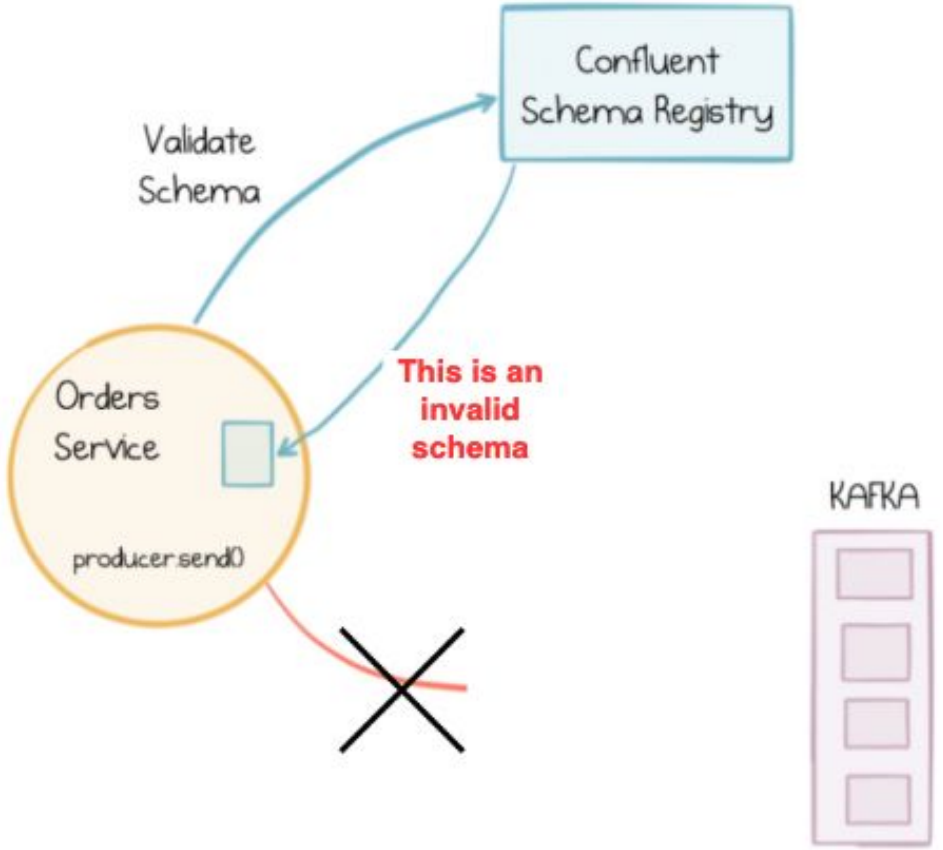
Schema Registry

The Confluent Schema Registry provides both runtime validation of schema compatibility, as well as a caching feature for Avro schemas, so they don't need to be included in the message payload.



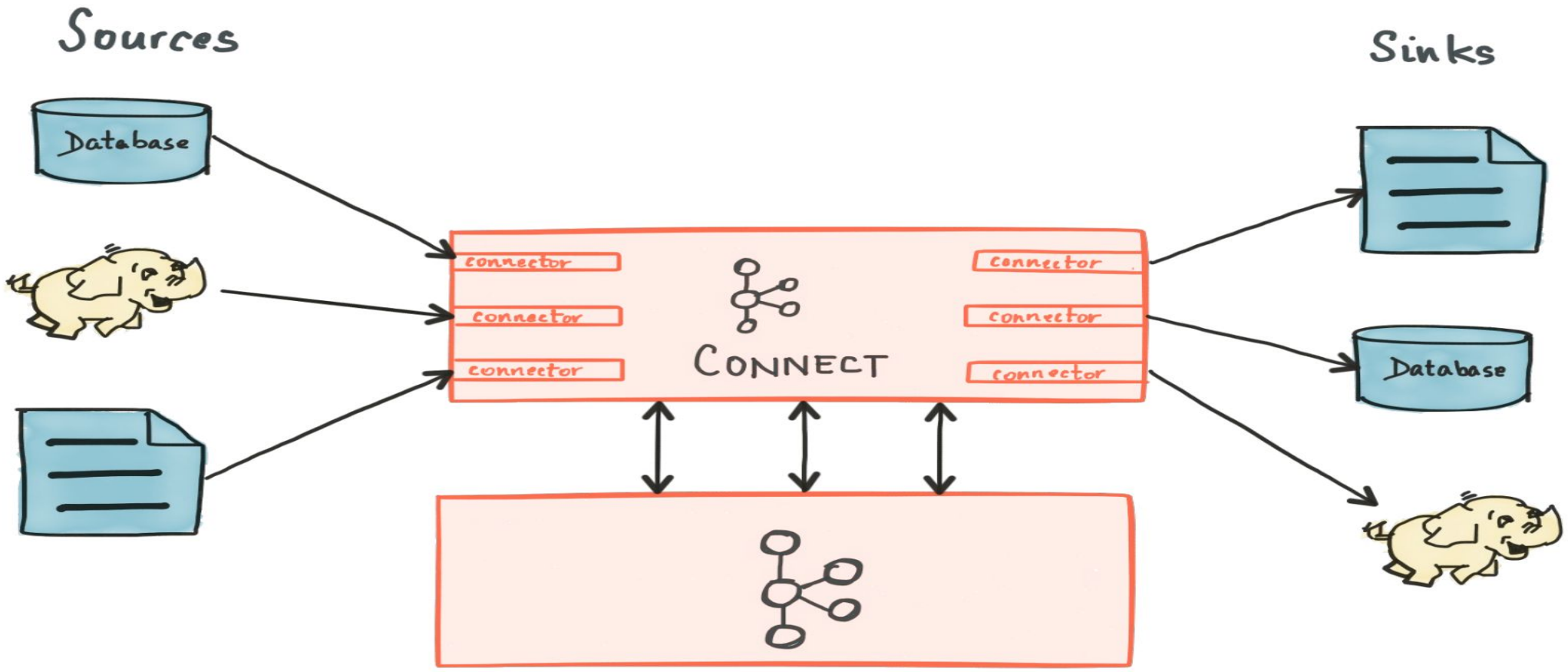
https://www.confluent.io/blog/apache-kafka-for-service-architectures/

Schema Registry



Kafka Connect

Sources and Sinks - Connectors



Available - Kafka Connect

https://www.confluent.io/hub/

Alternatives:

- Alpakka
- Custom Kafka Connect
- ...

```
curl -X POST http://localhost:8083/connectors -H "Content-Type: application/json" -d '
{
                    "name": "google_history_trip_connector",
                     "config": {
                     "connector.class": "io.confluent.connect.jdbc.JdbcSinkConnector",
                     "tasks.max": "1",
                     "topics": "google_history_trip",
                     "connection.url": "jdbc:mysql://localhost/kafka_offload",
                     "auto.create": "true",
                     "connection.user": "root",
                     "connection.password": "*******",
                     "key.converter": "io.confluent.connect.avro.AvroConverter",
                     "value.converter":"io.confluent.connect.avro.AvroConverter",
                     "value.converter.schema.registry.url": "http://localhost:8081",
                     "key.converter.schema.registry.url": "http://localhost:8081",
                     "key.converter.schemas.enable":"true",
                     "value.converter.schemas.enable":"true"
```

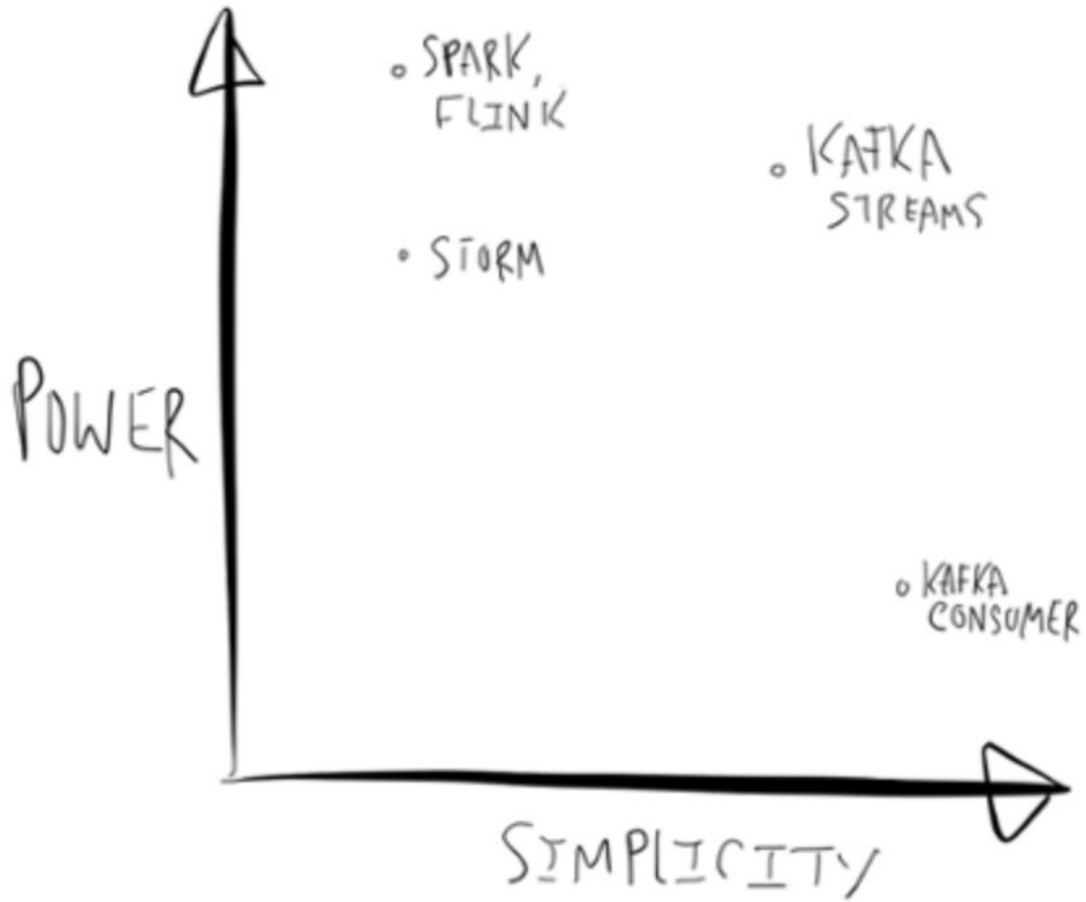
Kafka Stream

Kafka stream

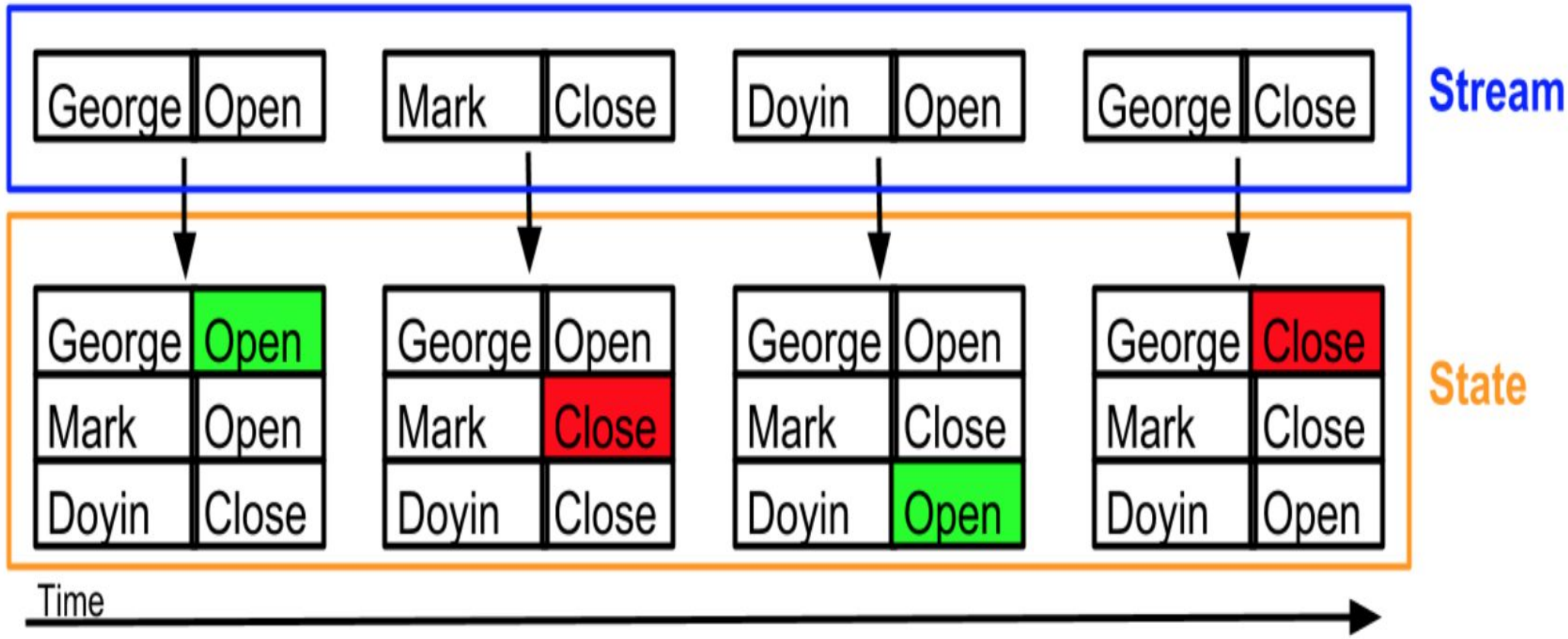
- Client library for building stream application
- Data from Kafka to Kafka
- Stream application
  - Fault tolerant
  - Scalable
- Event processing with milliseconds latency
- Provides a convenient DSL

Kafka stream

- Kafka stream in short
  - Millisecond delay
  - Balance the processing load as new instances of your app are added or existing ones crash
  - Maintain local state for tables
  - Recover from failures

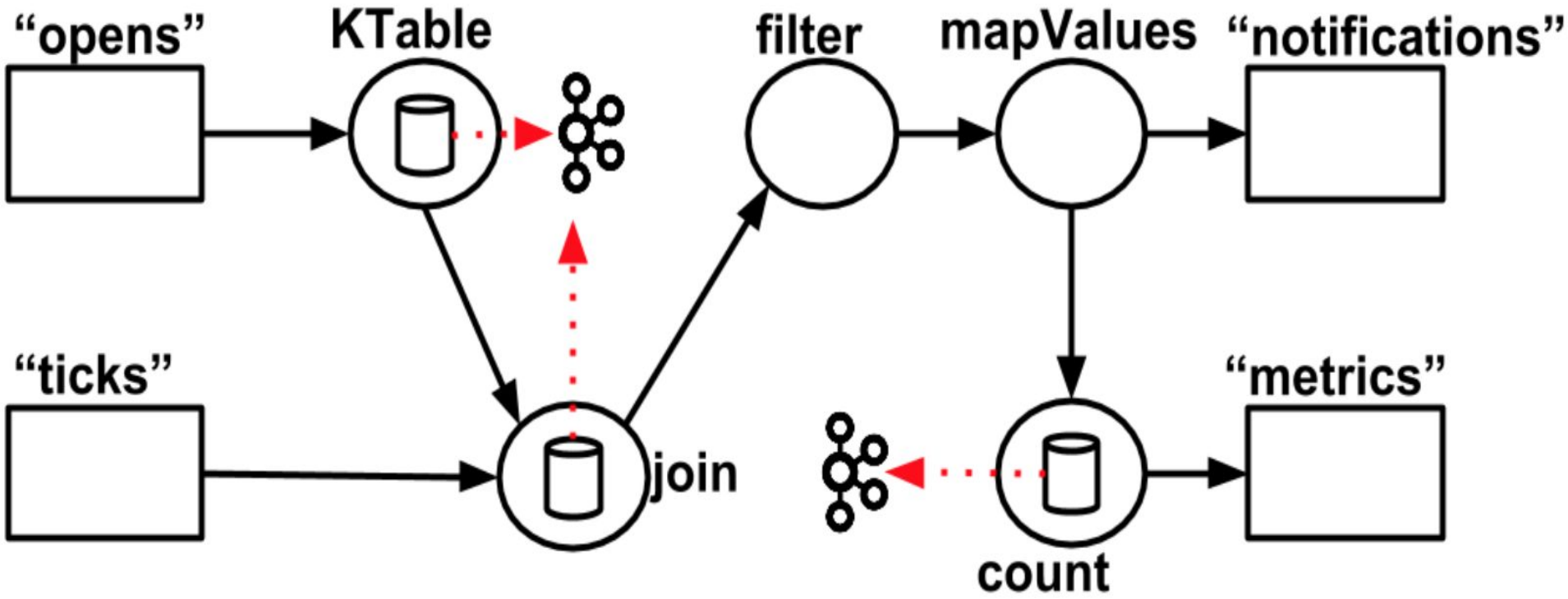


Kafka streams vs State



https://timothyrenner.github.io/engineering/2016/08/11/kafka-streams-not-looking-at-facebook.html

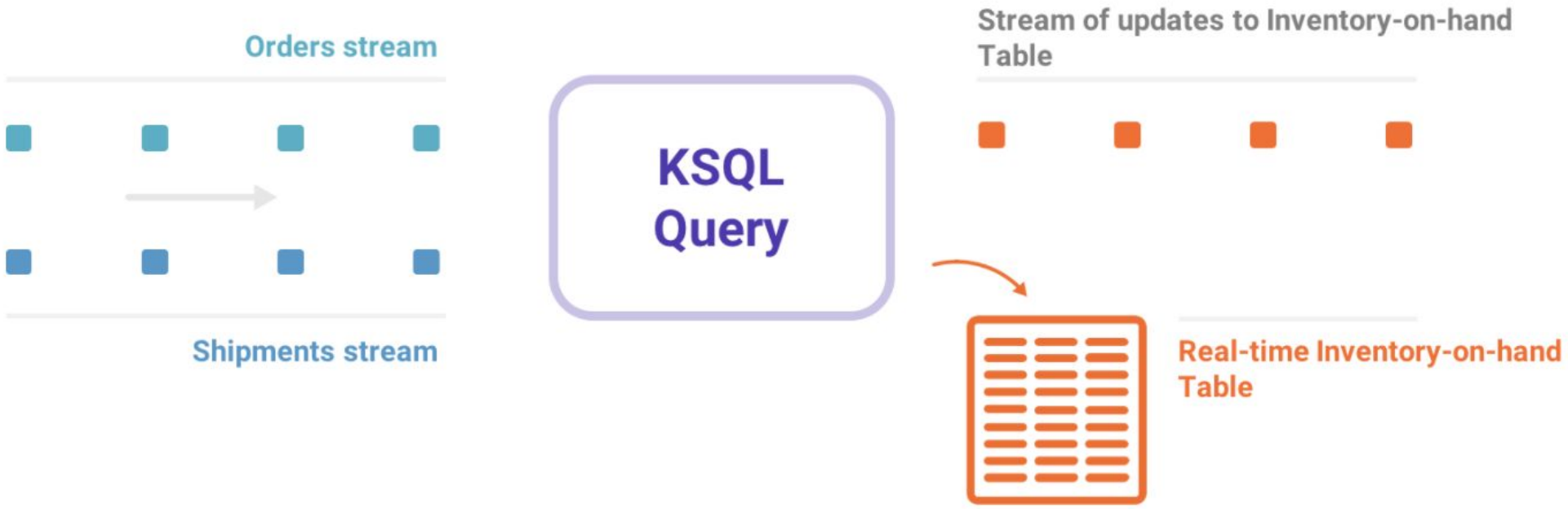
Kafka streams topology



Kafka stream features

- Aggregates: count, groupby
- Stateful processing (Stored internally in Kafka topic)
- Joins
  - KStream with KStream
  - KStream with KTable
  - KTable with KTable
- Windows
  - Time based
  - Session based

KSQL



What questions to ask?

What questions to ask?

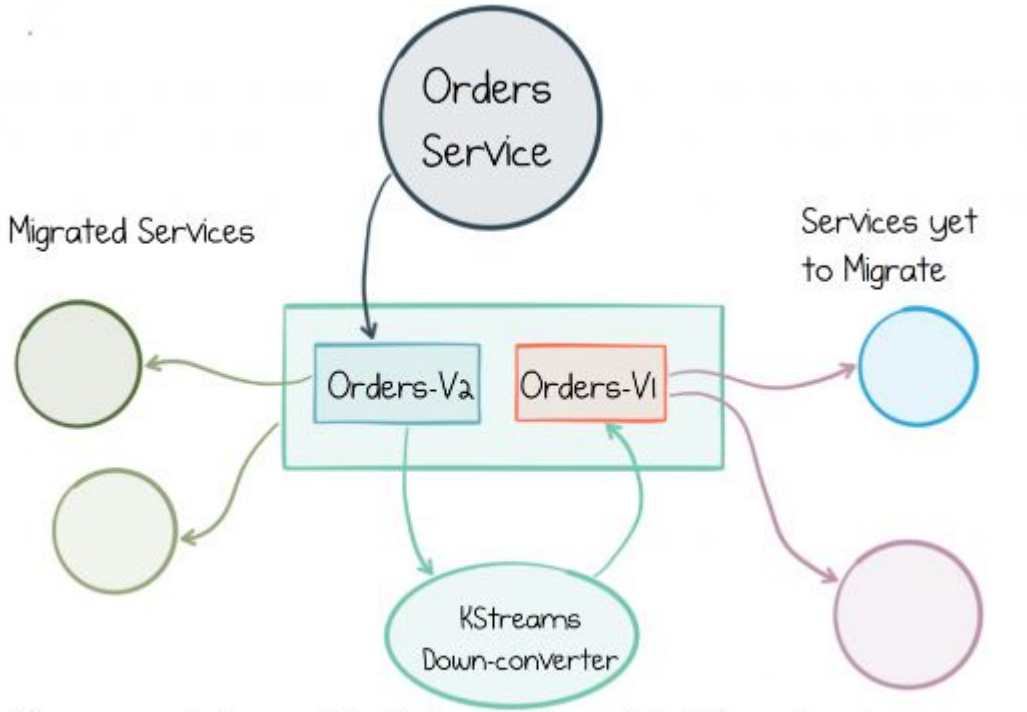
- **Replication factor**?
  - >= 3, for Kafka Brokers (>=3)
- **Retention time?**
  - <= 1 month, think wisely if you would like to have more
- **Partition size?**
  - >=5 & <=20 (normal cases), depends on your size of incoming data, consumer throughput
  - Kafka can handle high partition size, but has extra cost
- **Is key needed?**
  - Yes, same key to same partition
  - Prevent skew - if key is random enough
  - Scalability
  - Worst case: null, never a constant

What questions to ask?

- **Topic name structure?**
  - tr-<TEAM_NAME>-<CONTENT>-<EXTENSION>
- **Consumer group-id?**
  - tr-<TEAM_NAME>-<CONTENT>-<ACTION>-<EXTENSION>

Questions?

What if Schema cannot be compatible?



The same data coexists in two topics, with different schemas, so there is a window during which services can upgrade.

https://www.confluent.io/blog/apache-kafka-for-service-architectures/