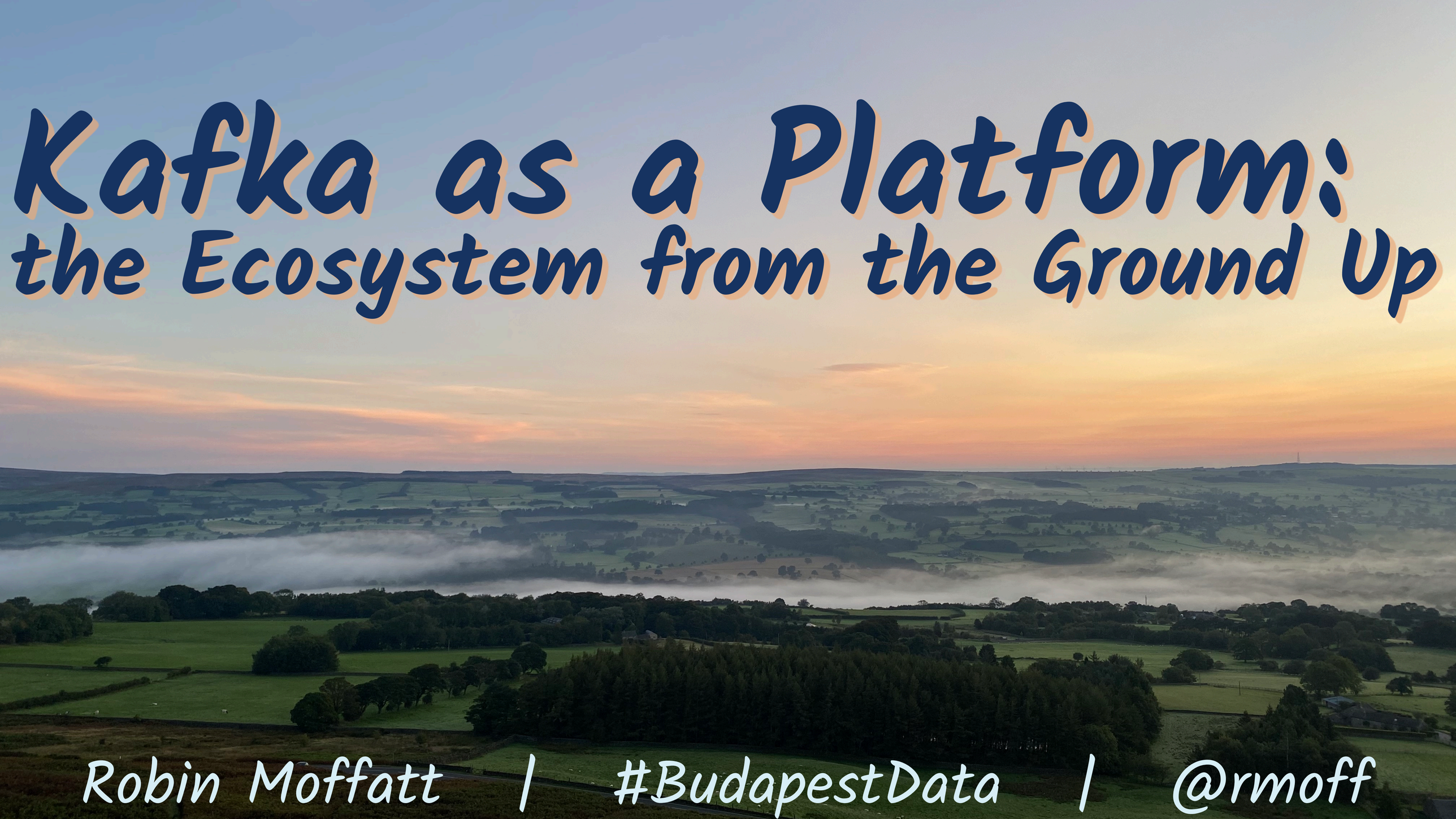
# Kafka as a Platform: the Ecosystem from the Ground Up



Robin Moffatt | #BudapestData | @rmoff

# $ whoami

- Robin Moffatt (@rmoff)
- Senior Developer Advocate at Confluent

  *(Apache Kafka, not Wikis 😉)*

- Working in data & analytics since 2001
- 🂡 Oracle ACE Director (Alumnus)


http://rmoff.dev/**talks** • http://rmoff.dev/**blog** • http://rmoff.dev/**youtube**

# EVENTS

# EVENTS

# EVENTS

- Notification
- State change

# Human generated events

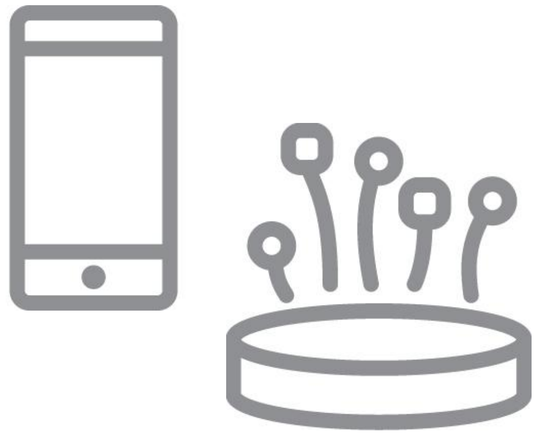
## A Sale

## A Stock movement

# Machine generated events

## Networking

## IoT



## Applications

# EVENTS

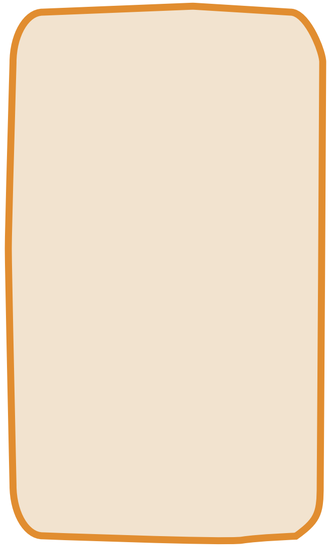
# are

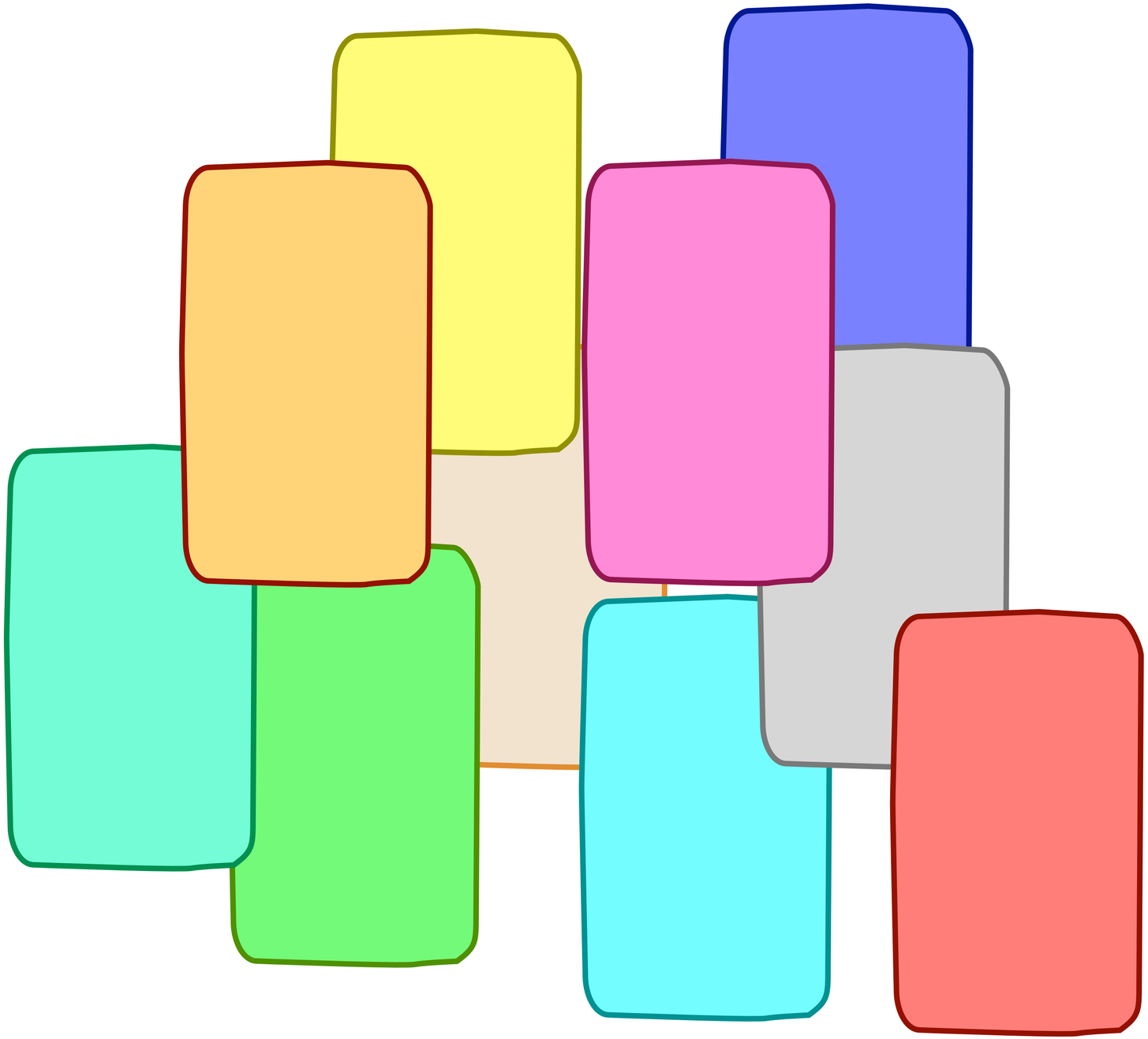
# EVERYWHERE

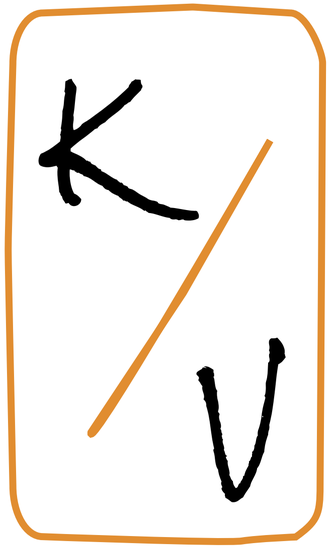
# EVENTS

are

very POWERFUL






K
V

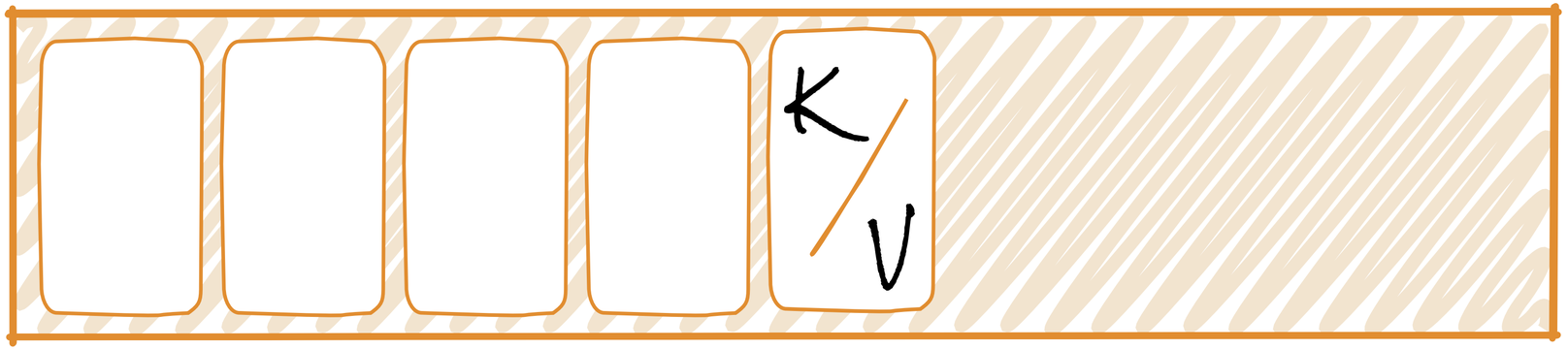
# LOG

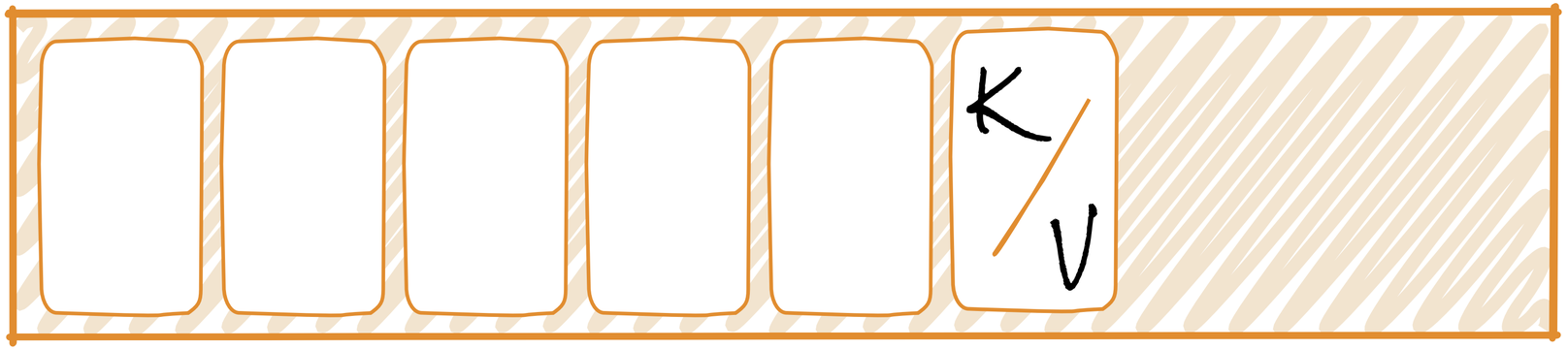

K
V

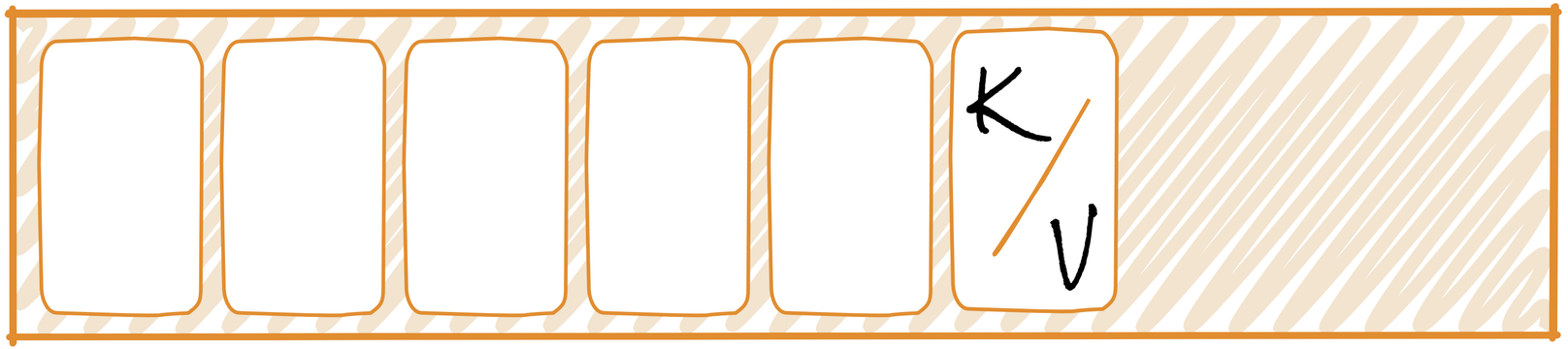

K
V


K
V

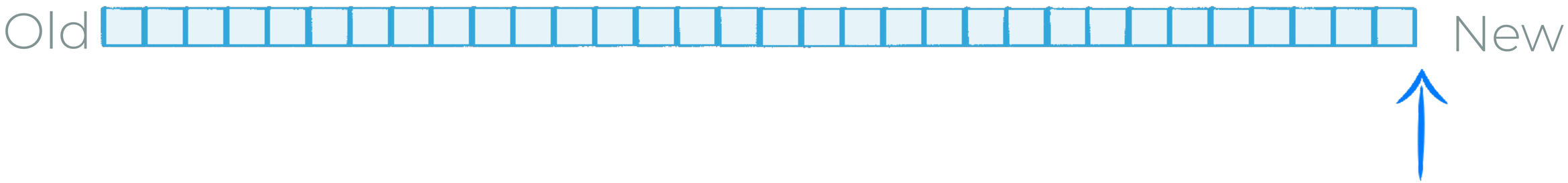

K
V


K
V


K
V


K
V

# Immutable Event Log




Events are added at the end of the log

# TOPICS

# Topics

Clicks

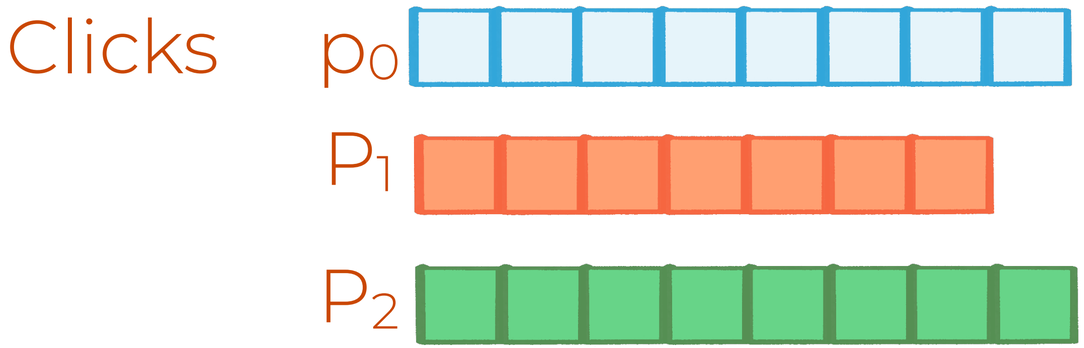
Orders

Customers

Topics are similar in concept to tables in a database

# PARTITIONS

# Partitions

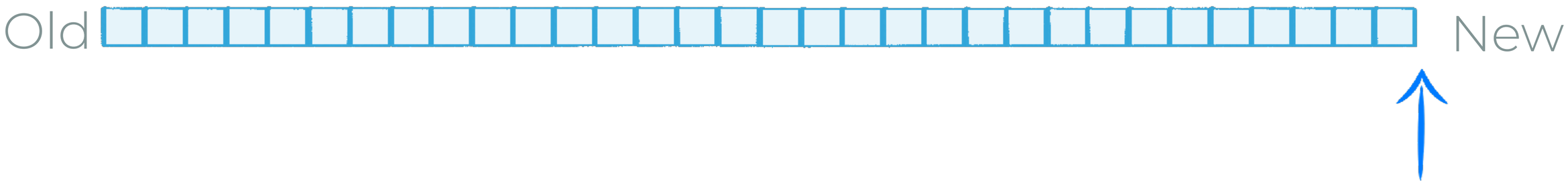



Messages are guaranteed to be strictly ordered within a partition

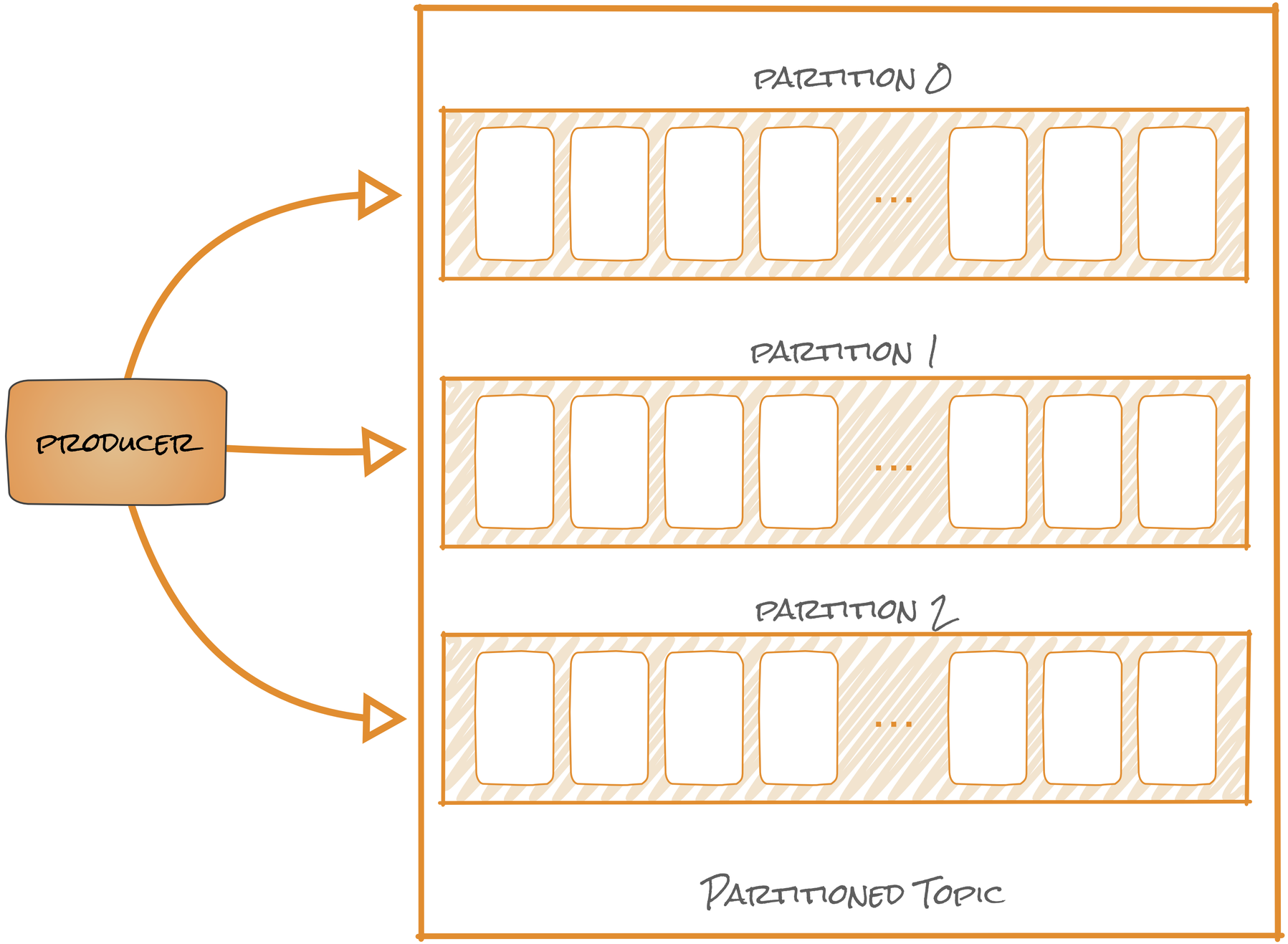
# PUB / SUB

# PUB / SUB

# Producing data



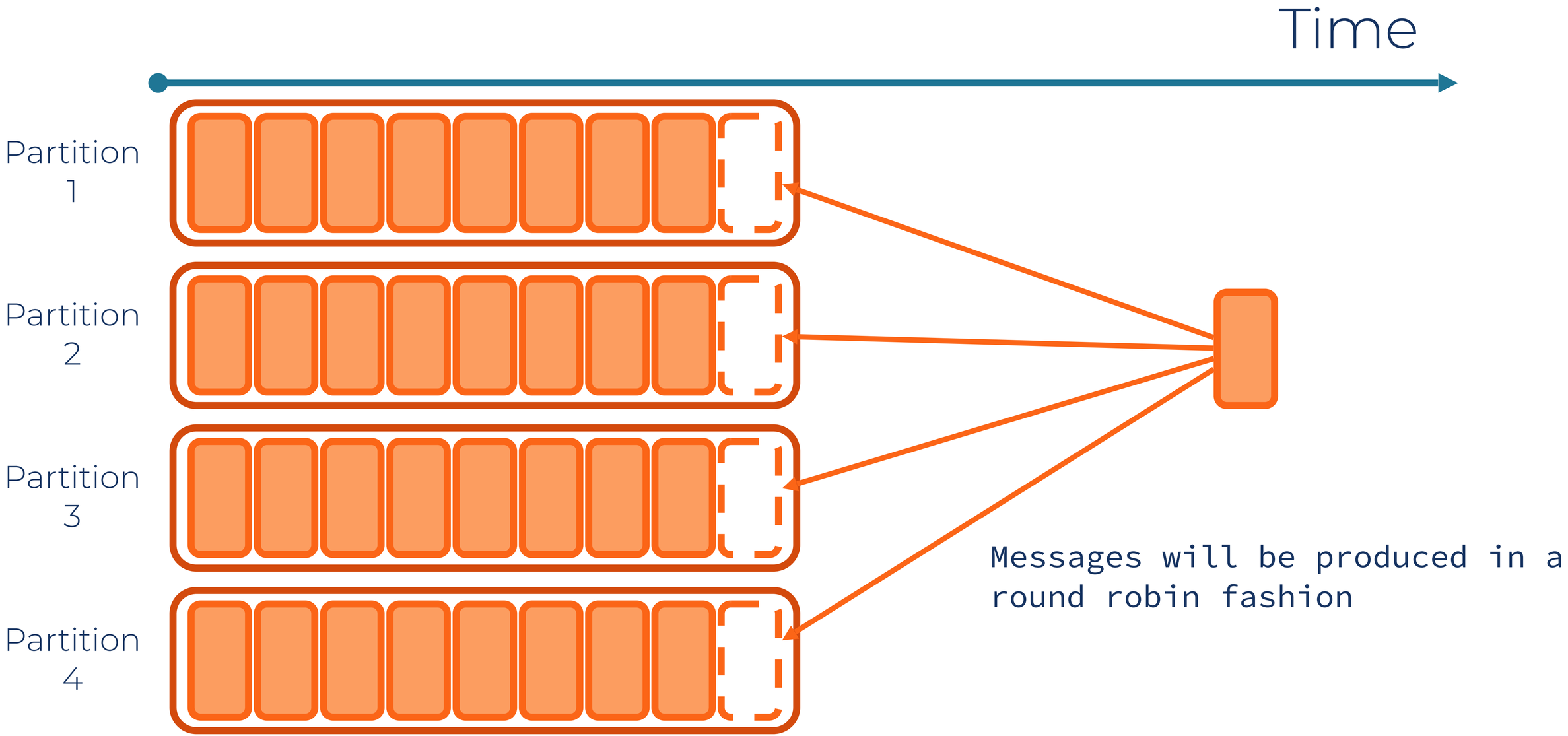

Messages are added at the end of the log


PRODUCER
PARTITION 0
PARTITION 1
PARTITION 2
PARTITIONED TOPIC

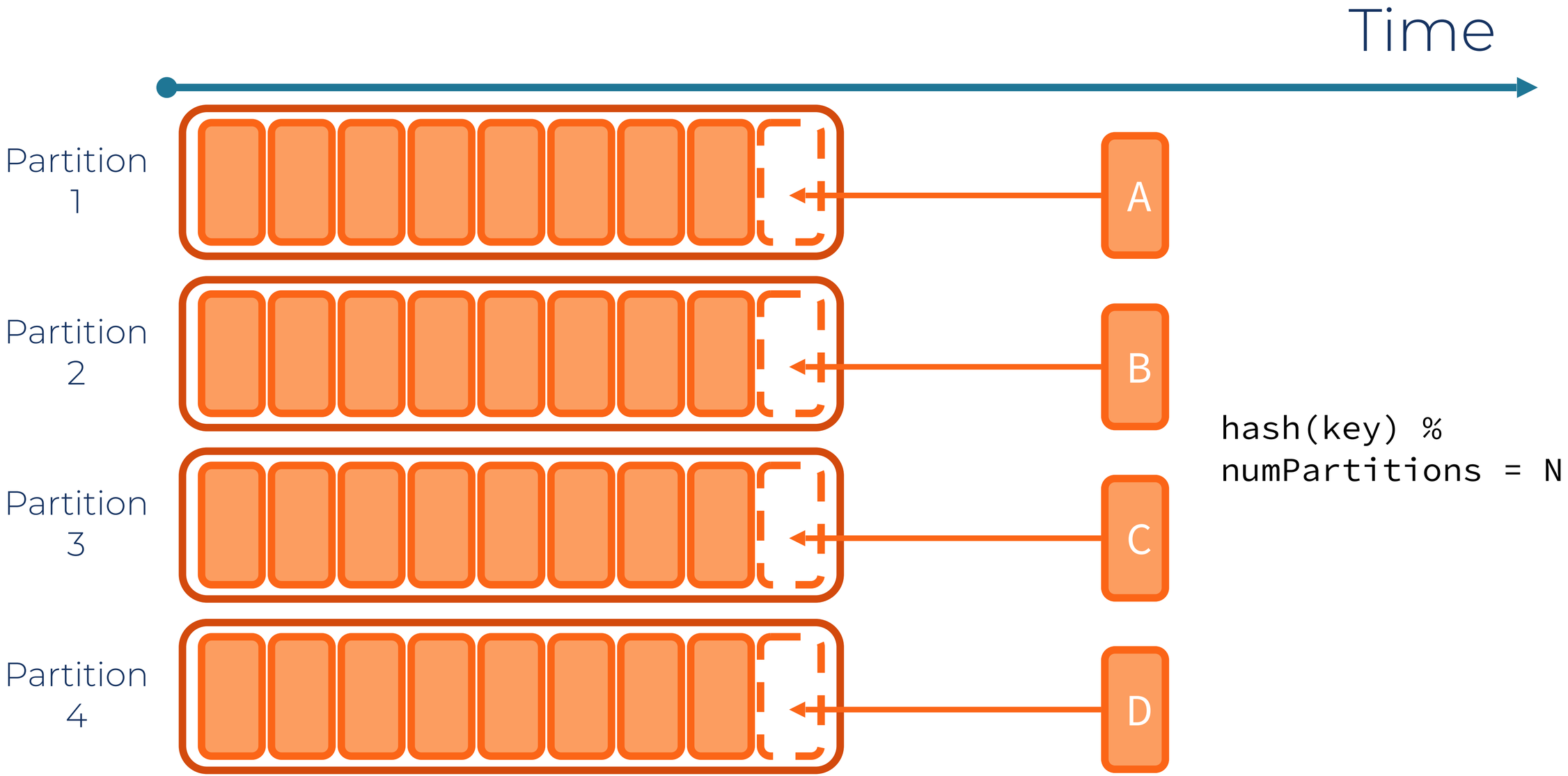
```
try (KafkaProducer<String, Payment> producer = new KafkaProducer<String, Payment>(props)) {

    for (long i = 0; i < 10; i++) {
        final String orderId = "id" + Long.toString(i);
        final Payment payment = new Payment(orderId, 1000.00d);
        final ProducerRecord<String, Payment> record =
           new ProducerRecord<String, Payment>("transactions",
                                               payment.getId().toString(),
                                               payment);
        producer.send(record);
    }
} catch (final InterruptedException e) {
    e.printStackTrace();
}
```

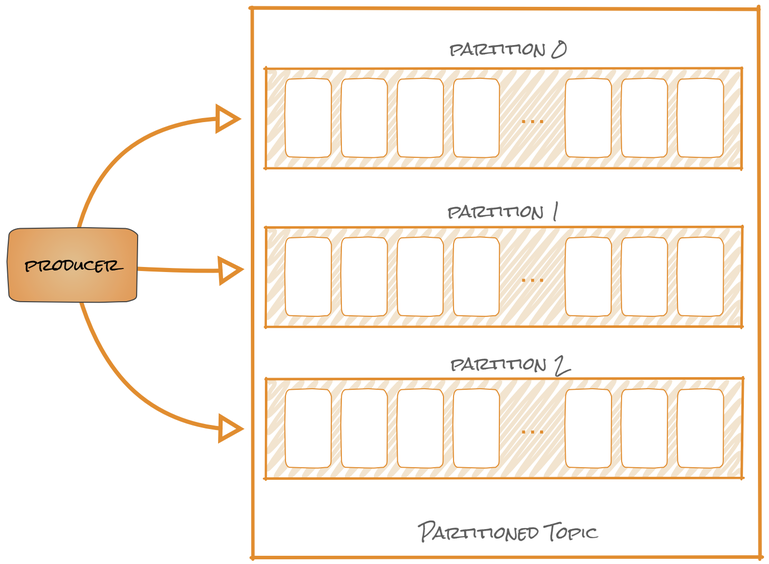
# Producing to Kafka - No Key



# Producing to Kafka - With Key



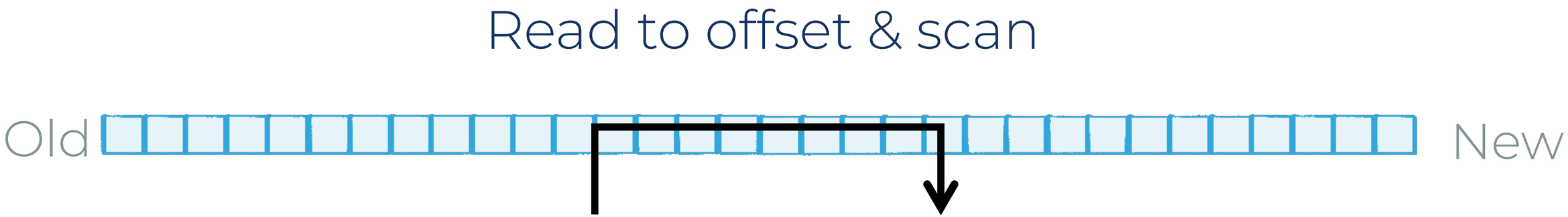
# Producers



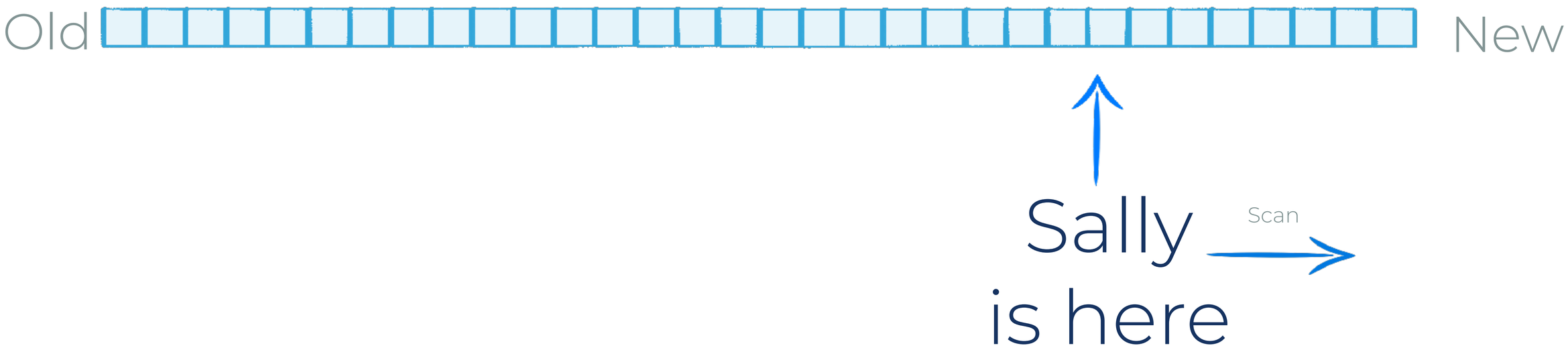

- A client application
- Puts messages into topics
- Handles partitioning, network protocol
- Java, Go, .NET, C/C++, Python
- Also every other language

# PUB / SUB

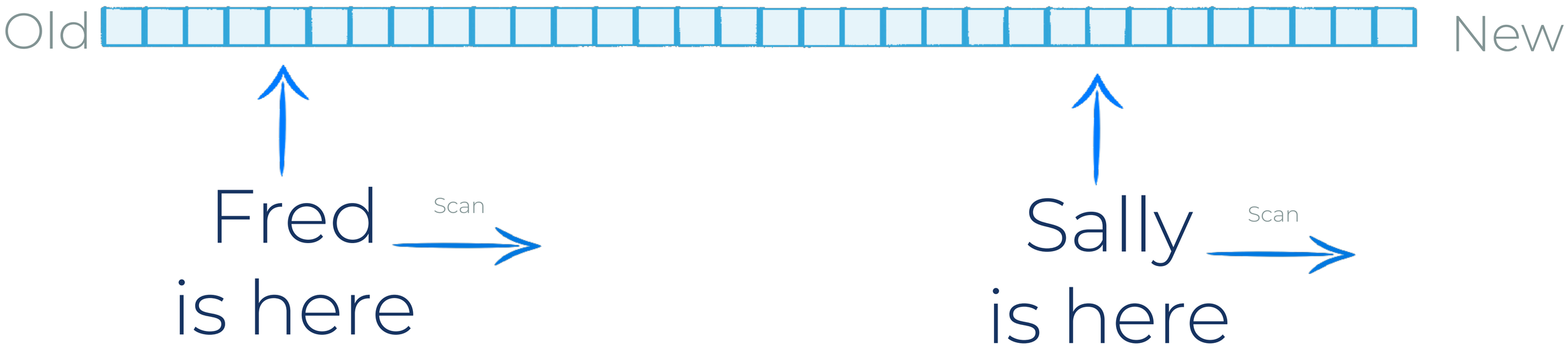
# Consuming data - access is only sequential



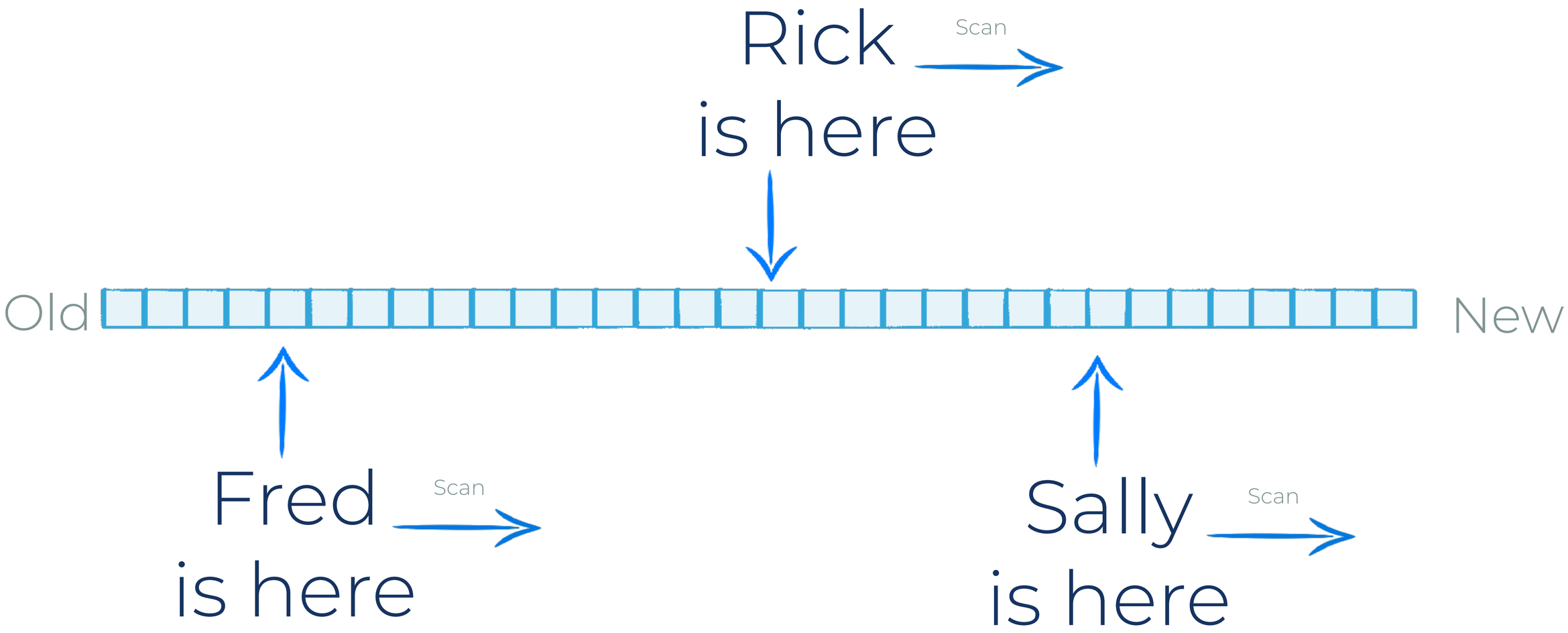
# Consumers have a position of their own



# Consumers have a position of their own

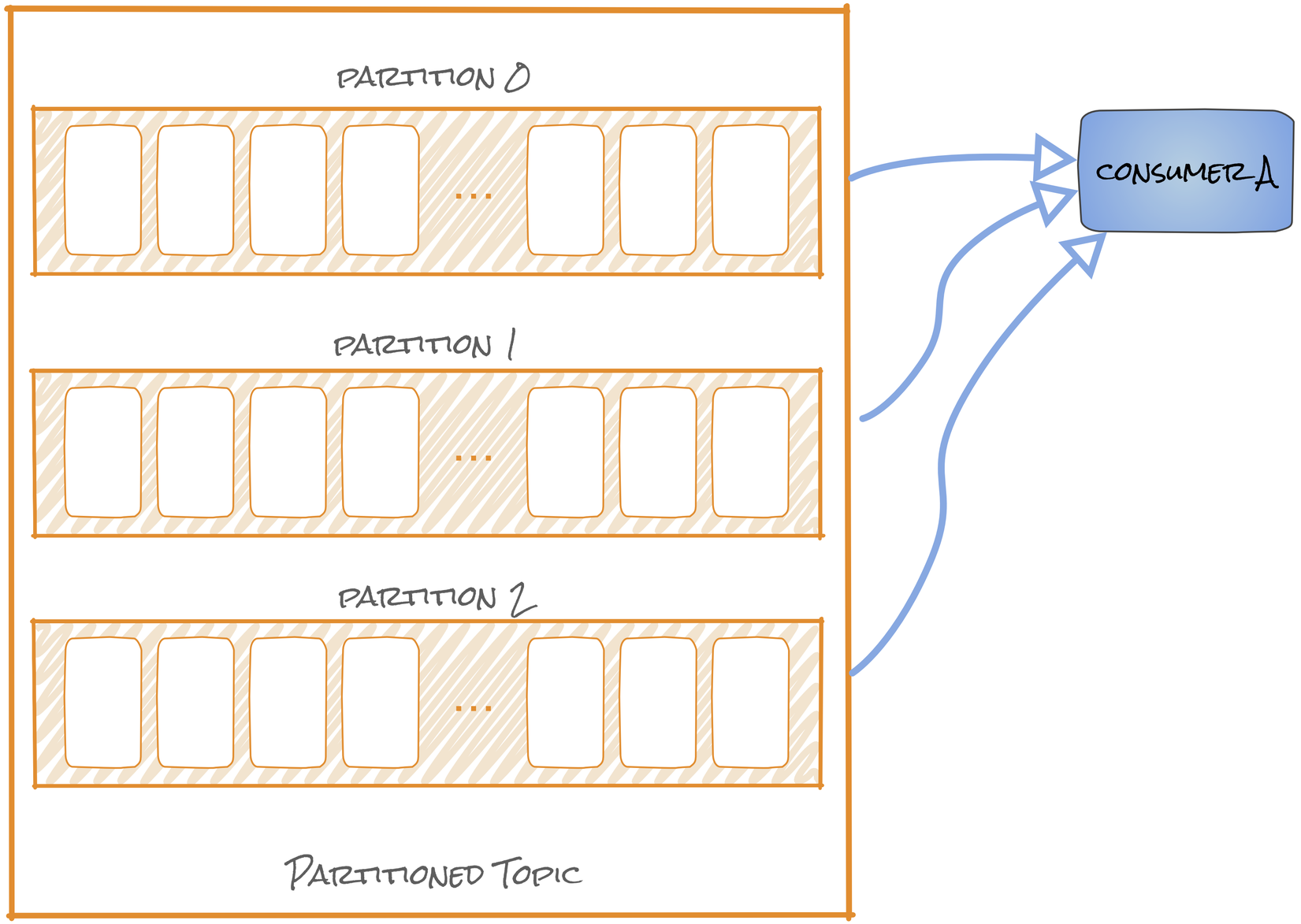


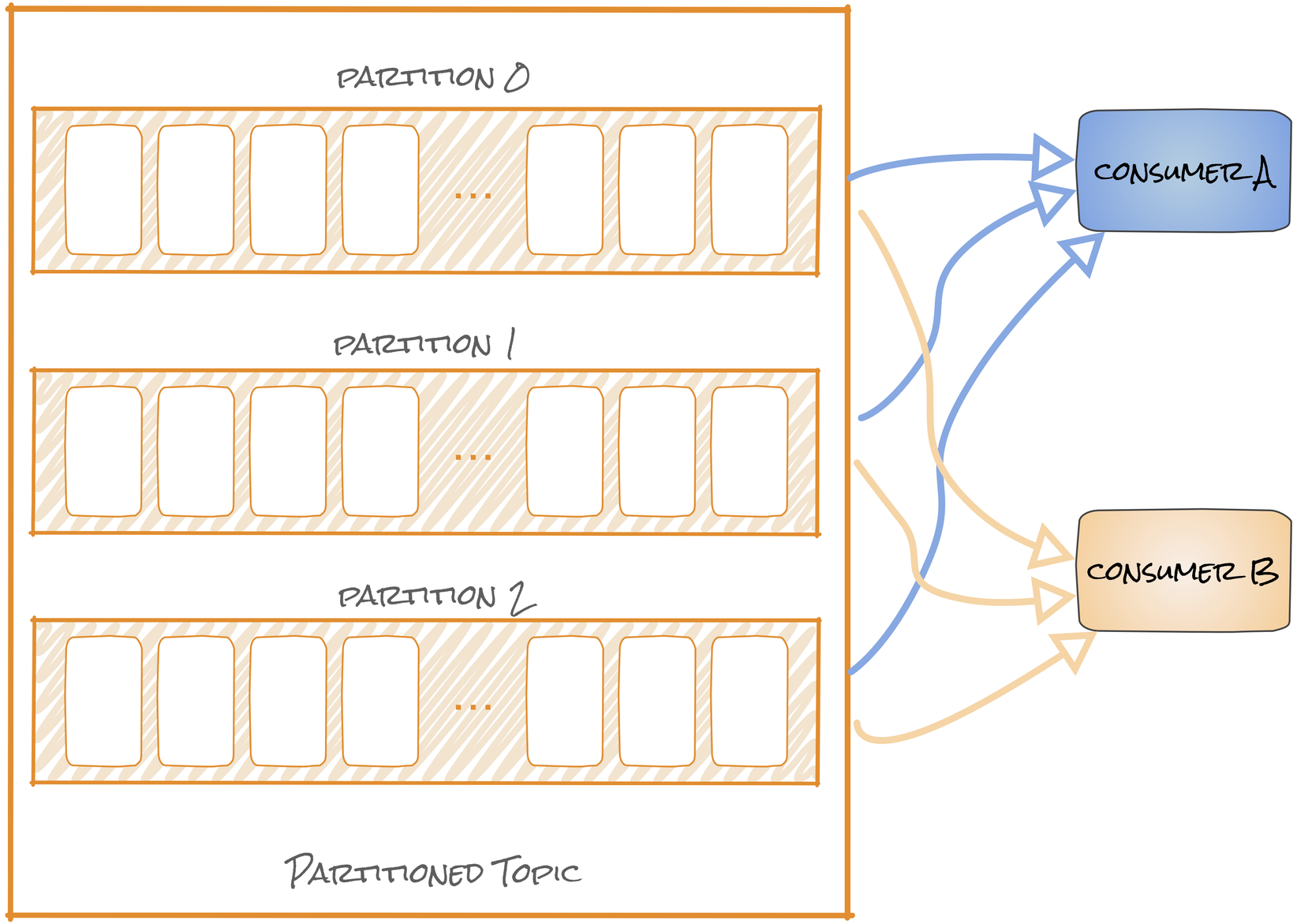
# Consumers have a position of their own



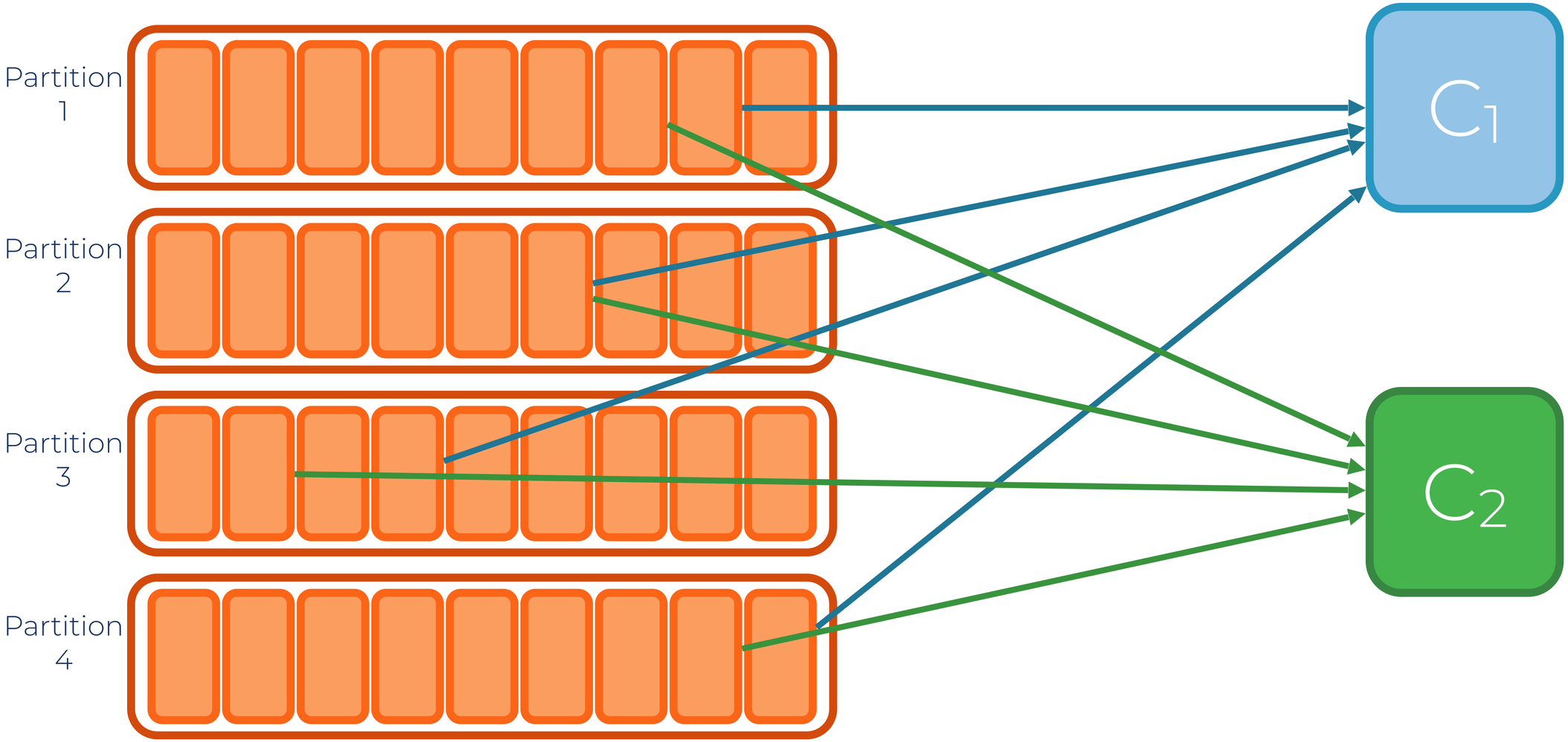
```
try (final KafkaConsumer<String, Payment> consumer = new KafkaConsumer<>(props)) {
    consumer.subscribe(Collections.singletonList(TOPIC));

    while (true) {
        ConsumerRecords<String, Payment> records = consumer.poll(100);
        for (ConsumerRecord<String, Payment> record : records) {
            String key = record.key();
            Payment value = record.value();
            System.out.printf("key = %s, value = %s%n", key, value);
        }
    }
}
```

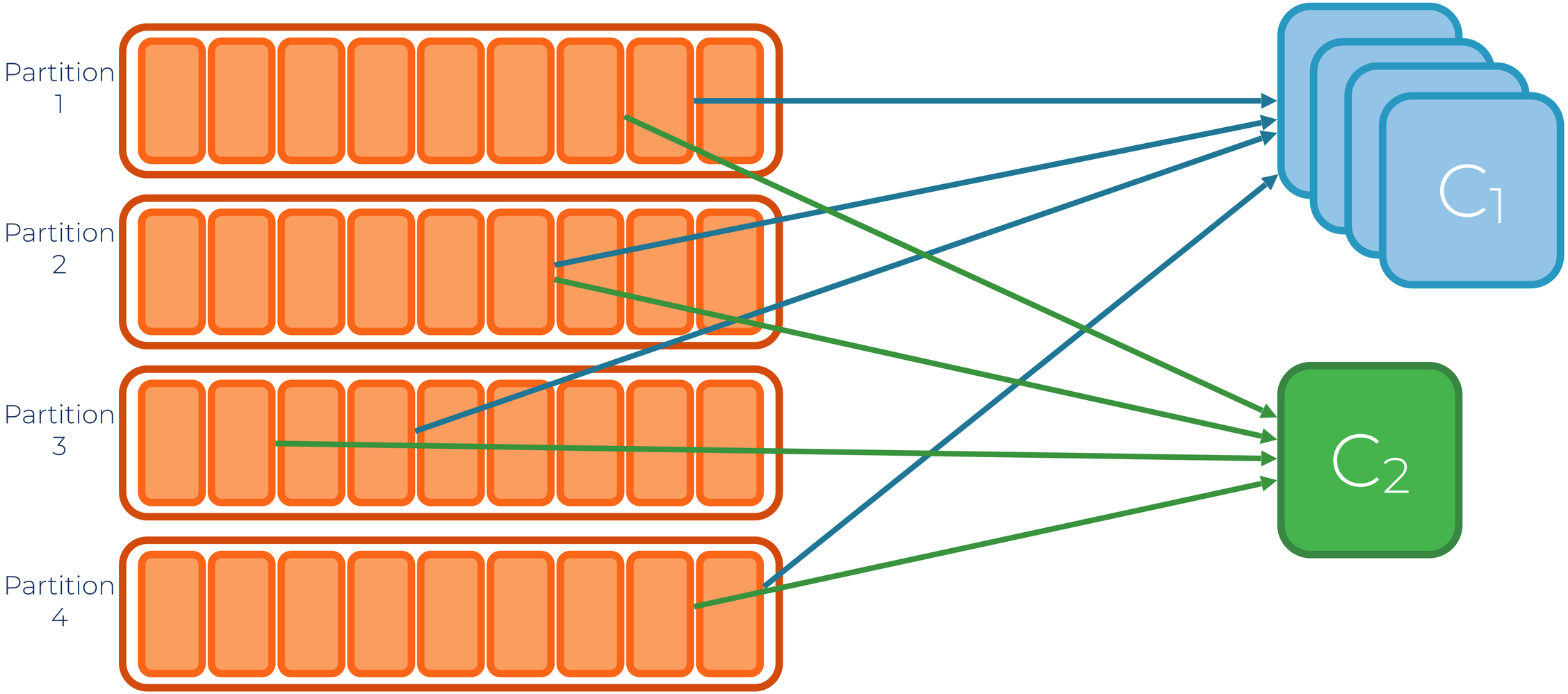

PARTITION 0
PARTITION 1
PARTITION 2
PARTITIONED TOPIC
CONSUMER A


PARTITION 0
PARTITION 1
PARTITION 2
PARTITIONED TOPIC
CONSUMER A
CONSUMER B

# Consuming From Kafka - Multiple Consumers

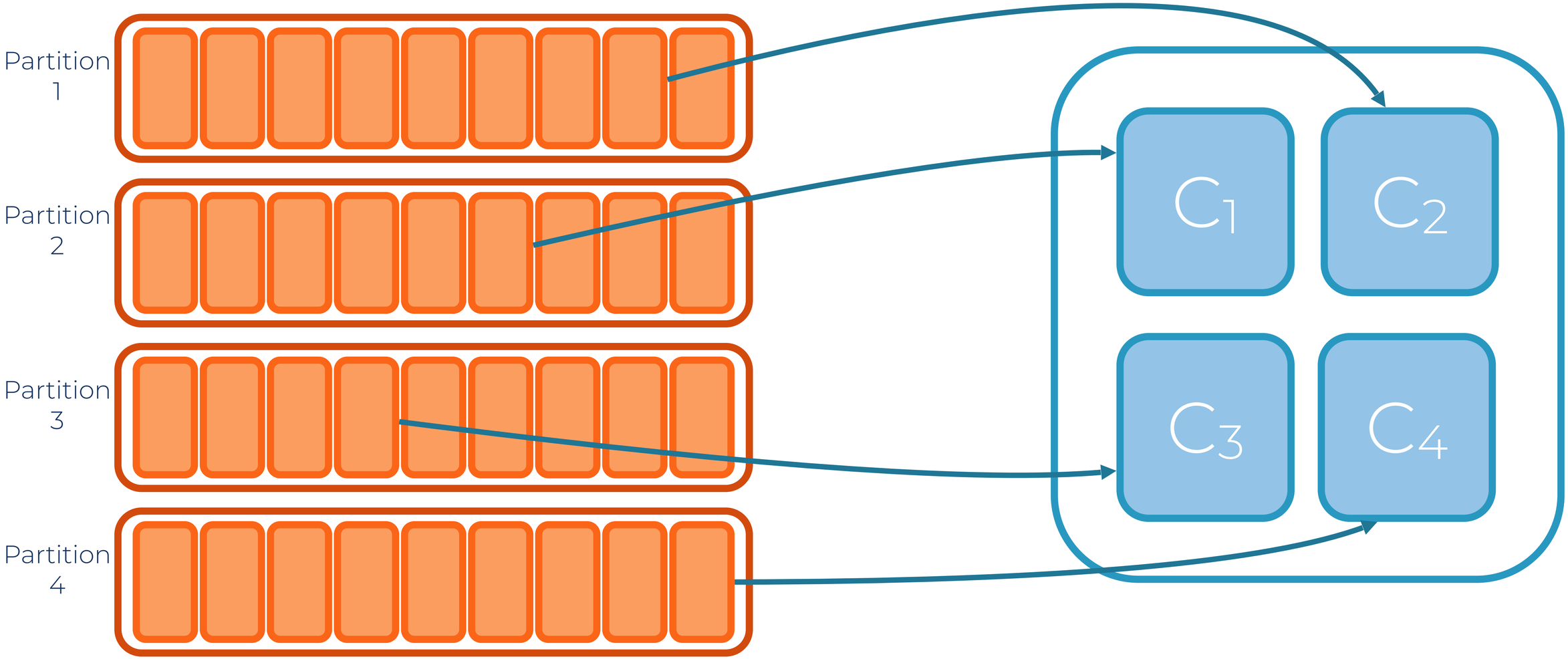


# Consuming From Kafka - Grouped Consumers

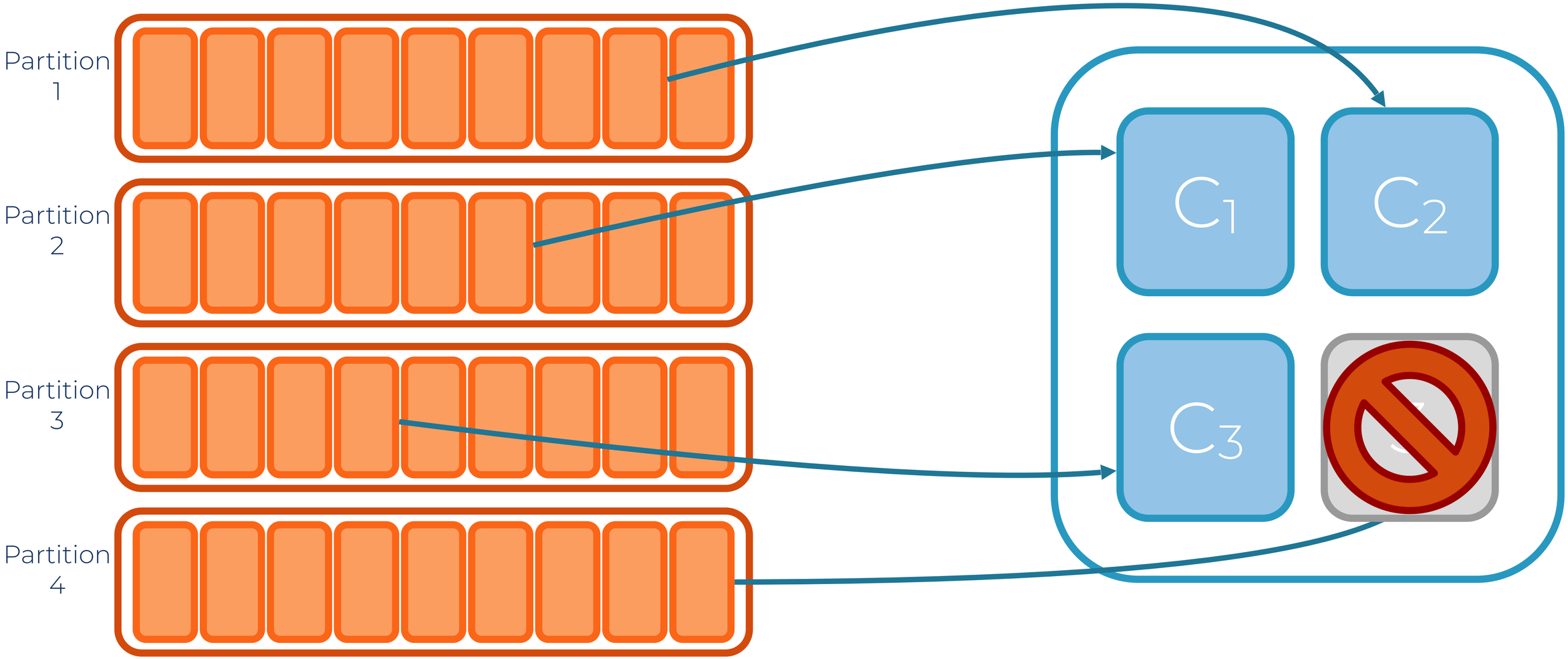



CONSUMER GROUP
COORDINATOR
CONSUMERS
CONSUMER GROUP

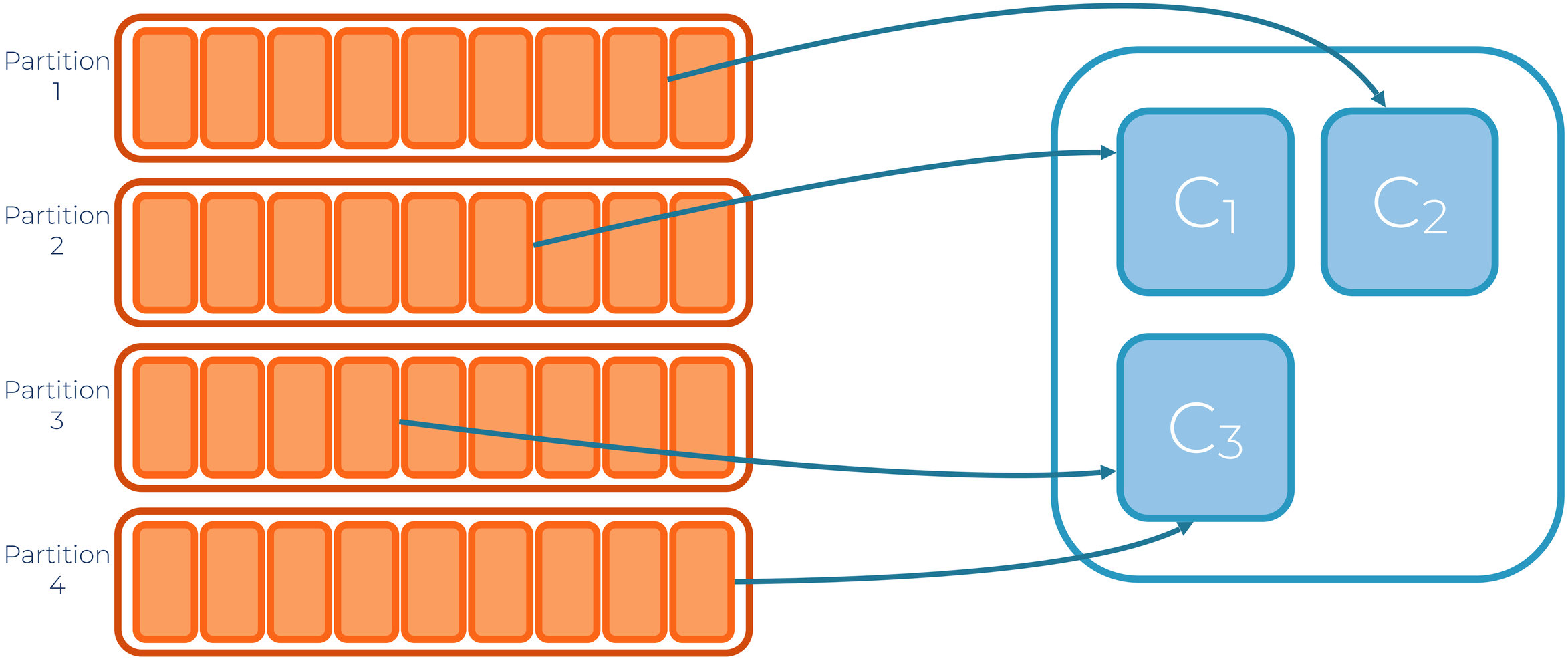
# Consuming From Kafka - Grouped Consumers



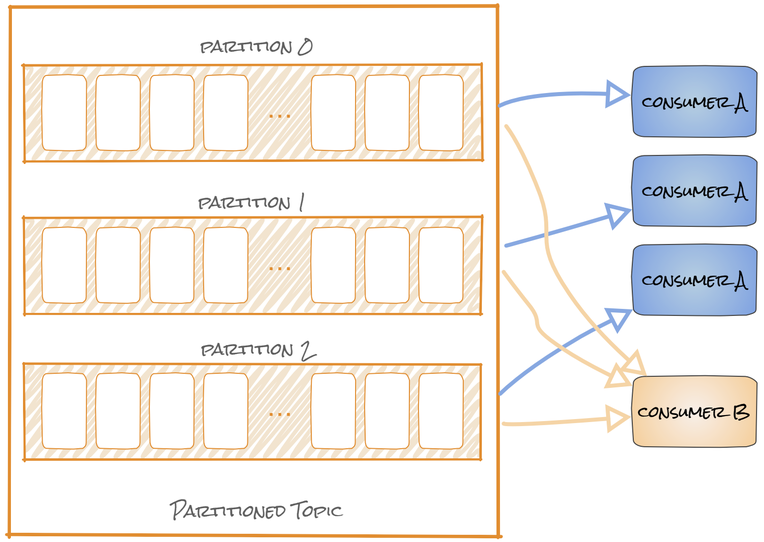
# Consuming From Kafka - Grouped Consumers



# Consuming From Kafka - Grouped Consumers



# Consumers



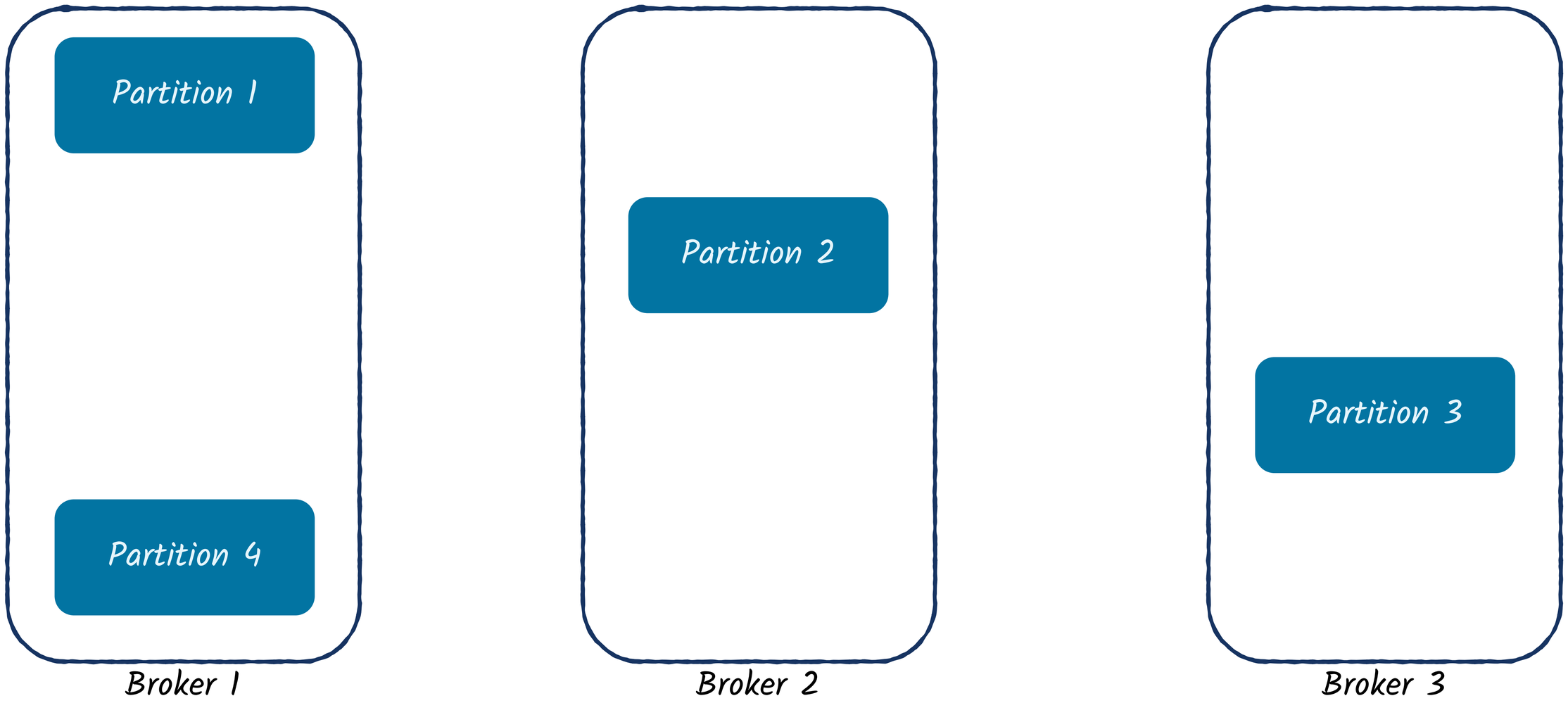

- A client application
- Reads messages from topics
- Horizontally, elastically scalable (if stateless)
- Java, Go, .NET, C/C++, Python, everything else

# BROKERS

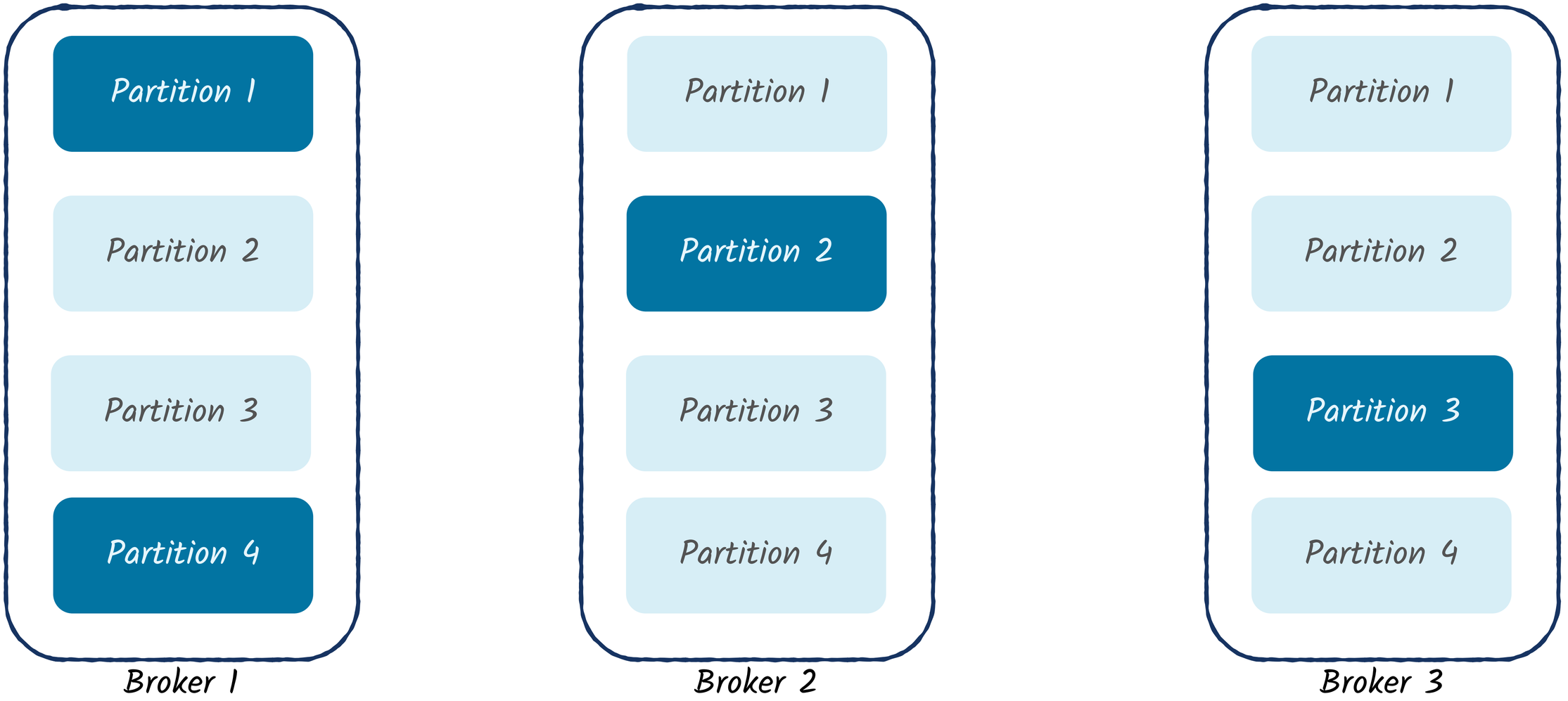
## and REPLICATION

@rmoff | #BudapestData | @confluentinc

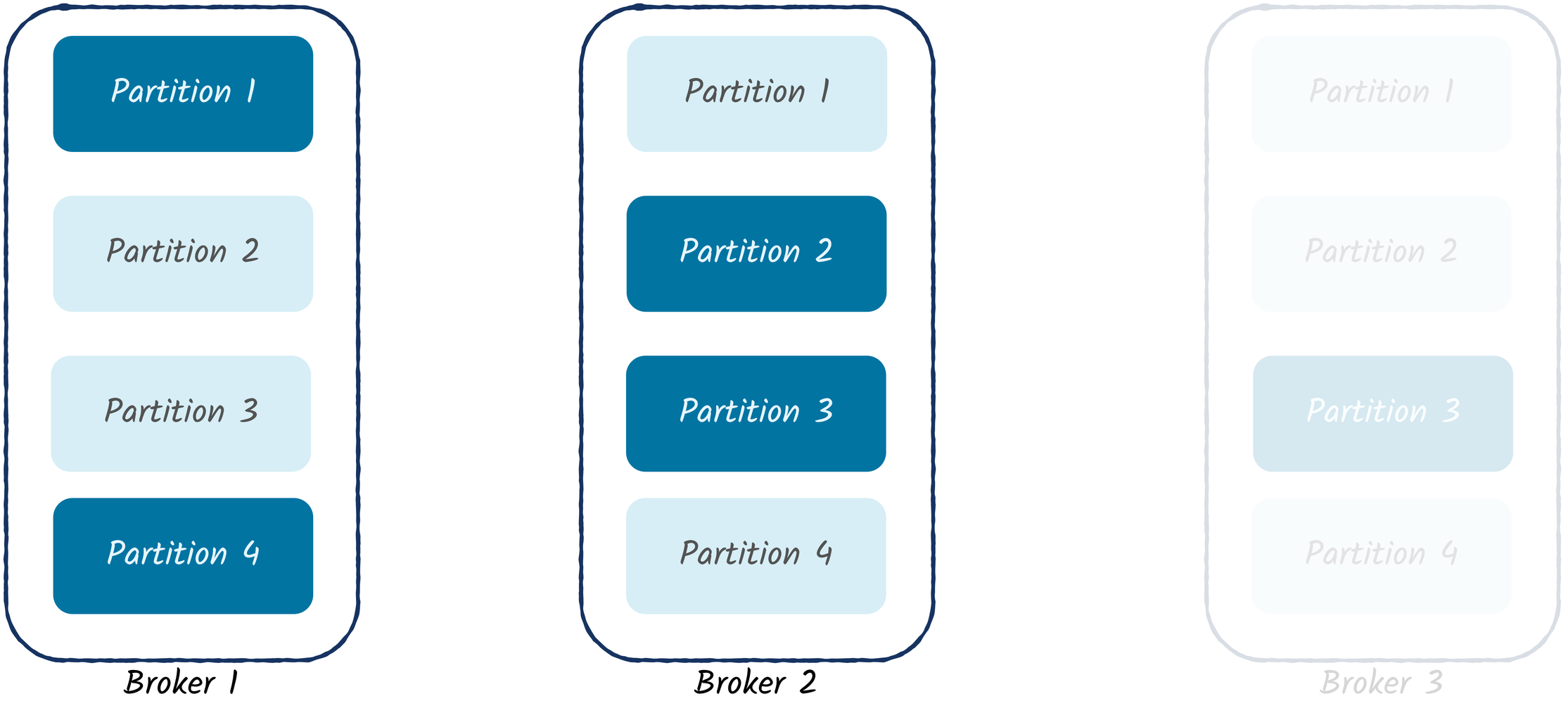
# Partition Leadership and Replication



# Partition Leadership and Replication



# Partition Leadership and Replication




CONFLUENT

# DEMO

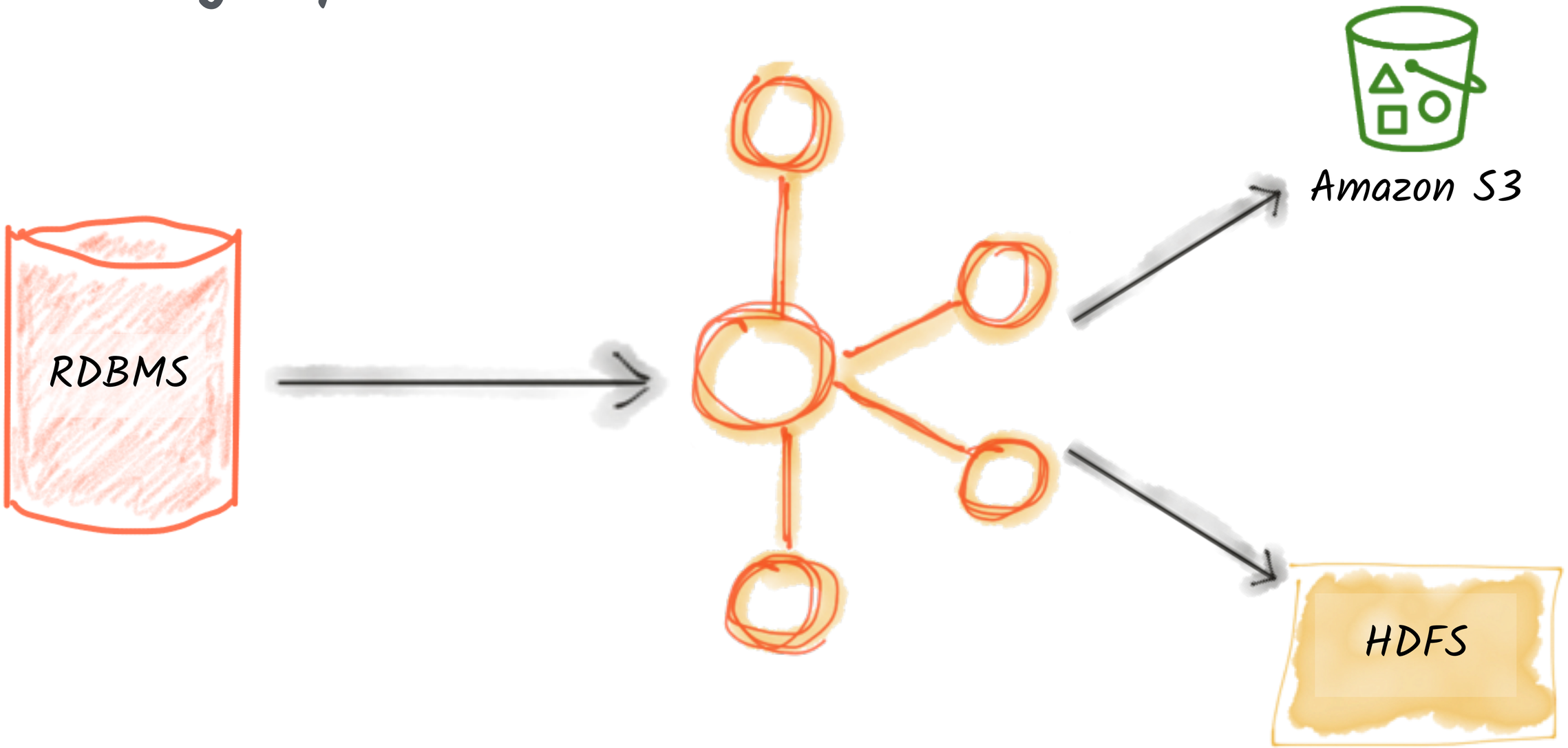
# So far, this is Pretty good

So far, this is

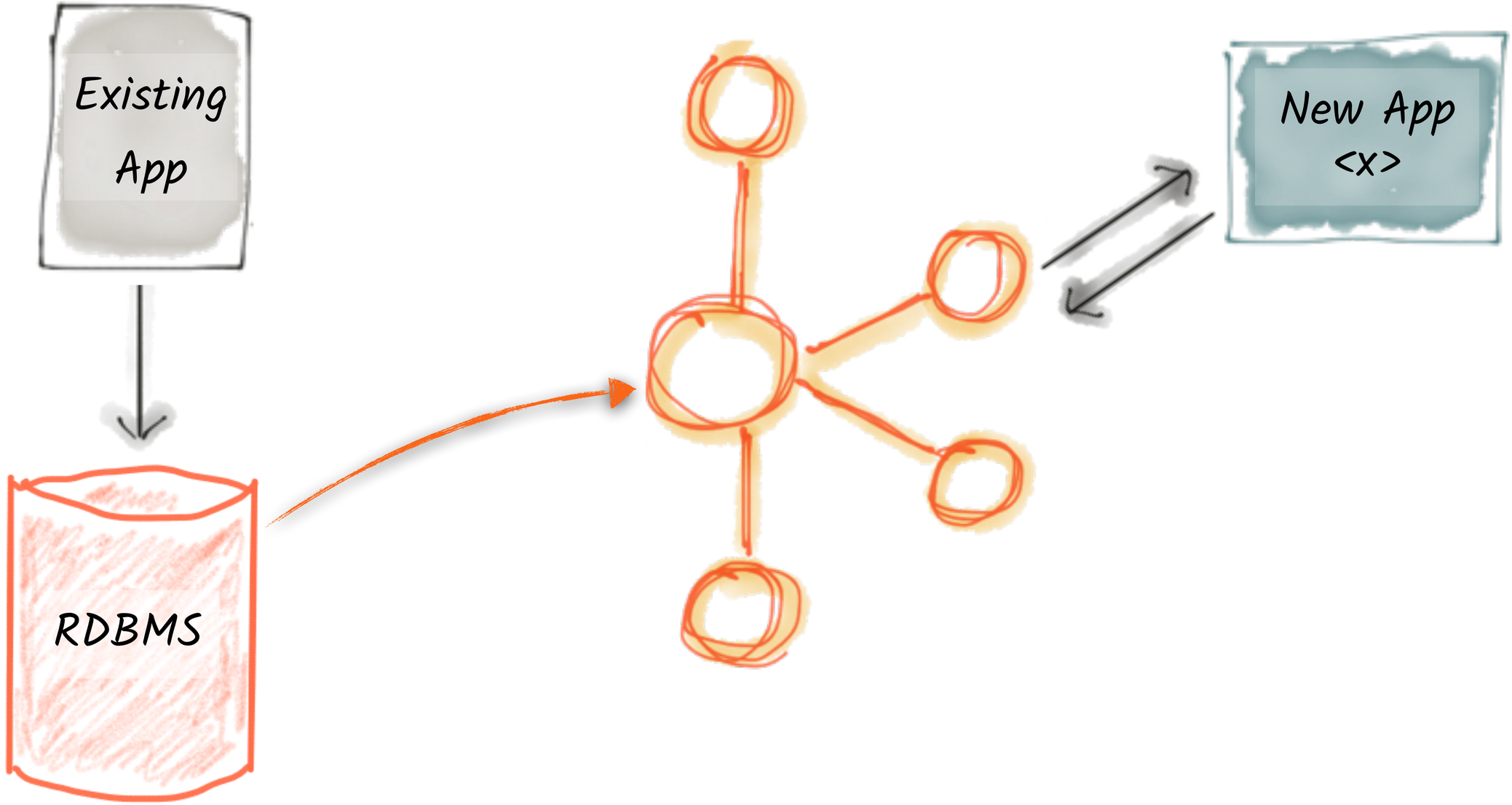
# Pretty good

but I've not finished yet...

# Streaming Pipelines

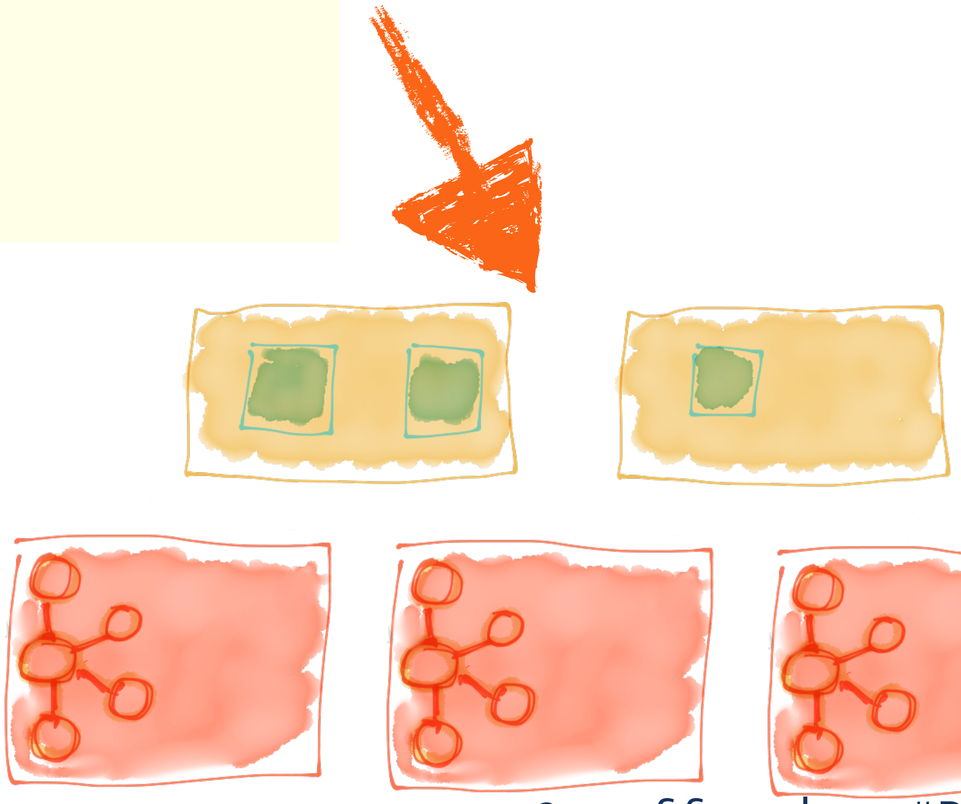


# Evolve processing from old systems to new



# Streaming Integration with Kafka Connect


Sources

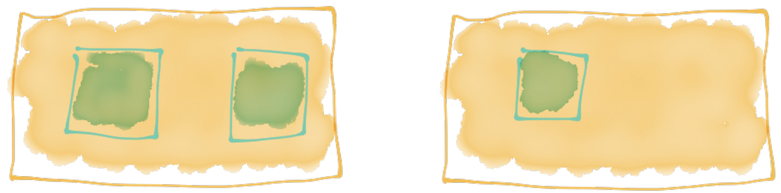


Kafka Connect

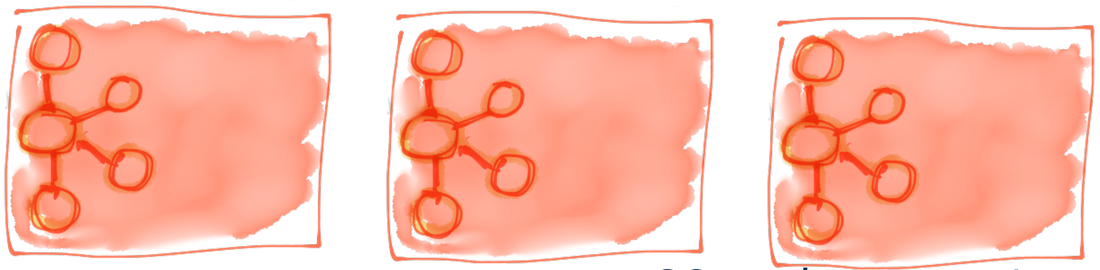
Kafka Brokers

# Streaming Integration with Kafka Connect

Sinks

Kafka Connect

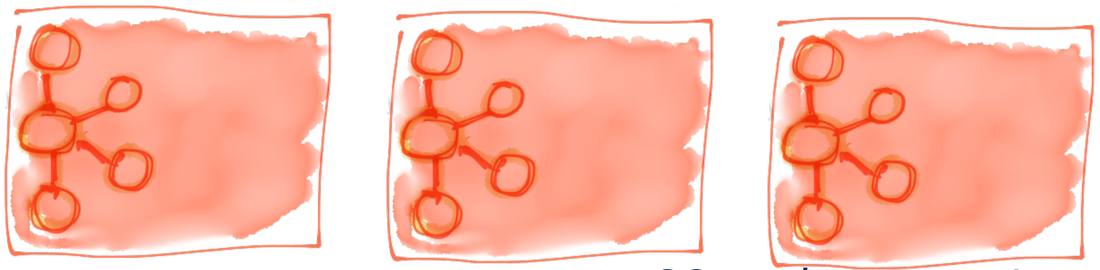


Kafka Brokers

# Streaming Integration with Kafka Connect



Kafka Connect



Kafka Brokers

# Look Ma, No Code!

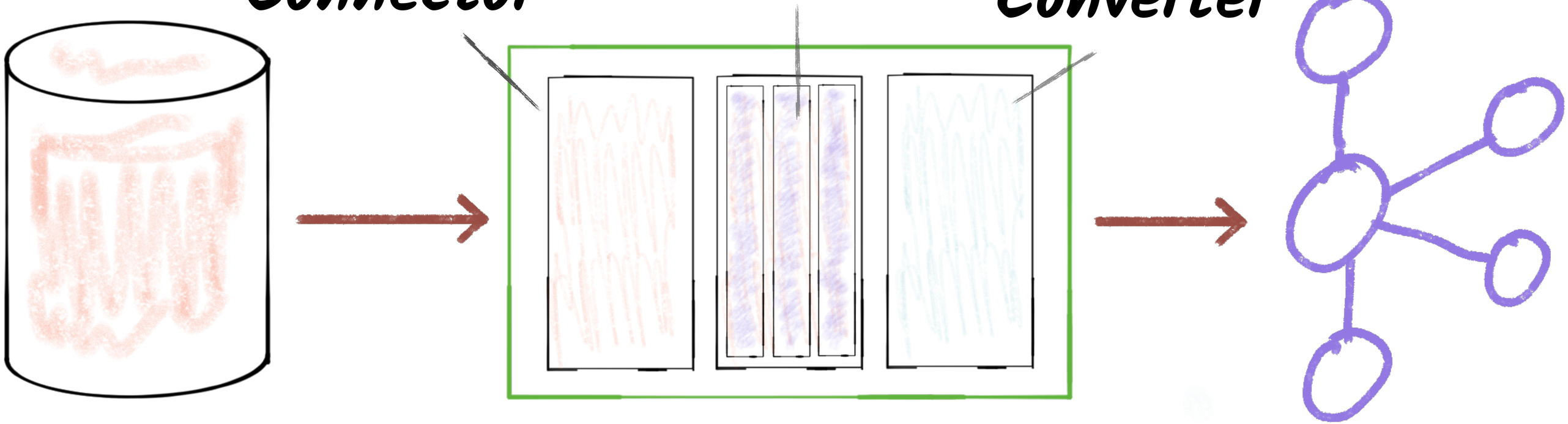
```
{
  "connector.class":
    "io.confluent.connect.jdbc.JdbcSourceConnector",
  "connection.url":
    "jdbc:mysql://asgard:3306/demo",
  "table.whitelist":
    "sales,orders,customers"
}
```

# Extensible

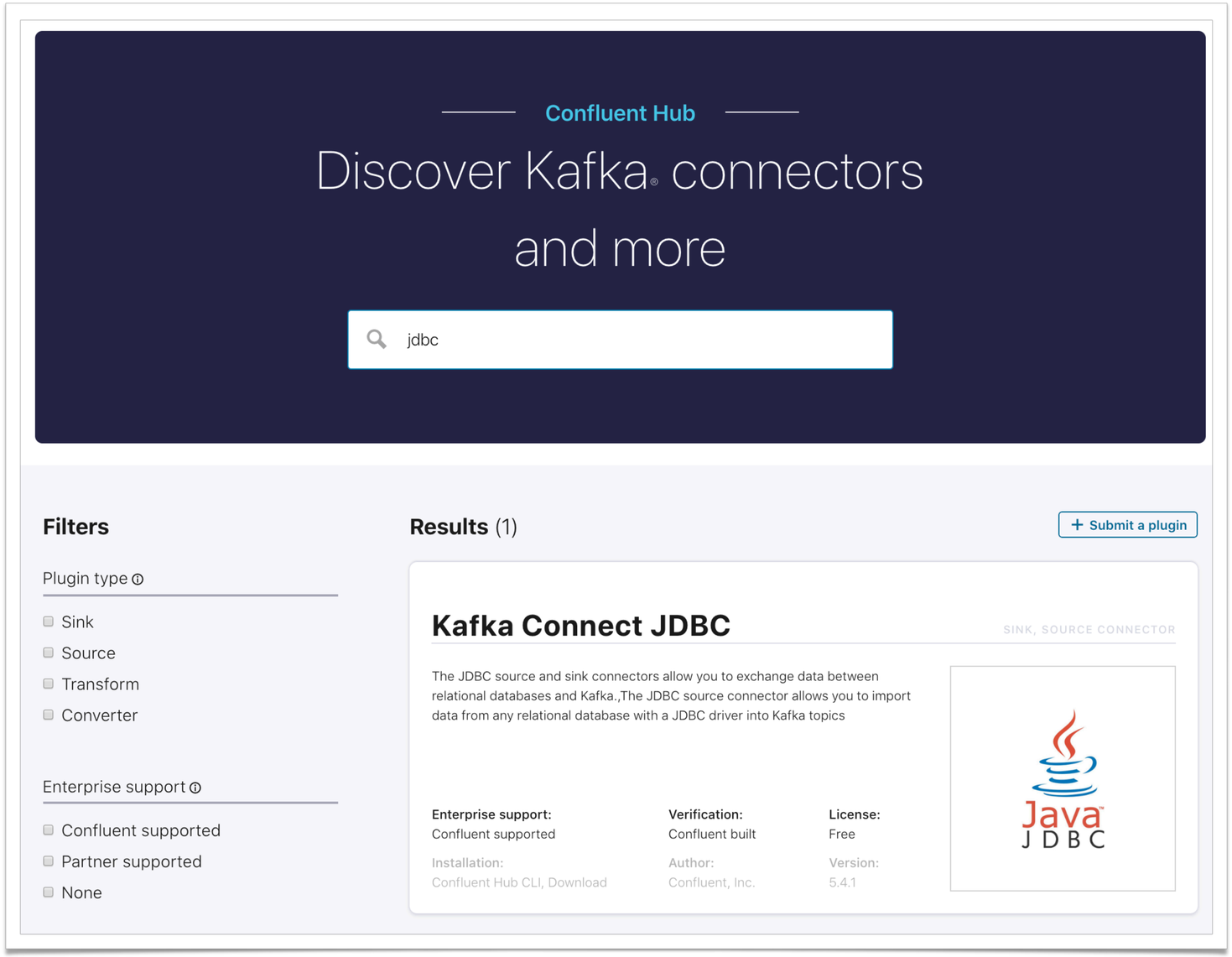
Connector

Transform(s)

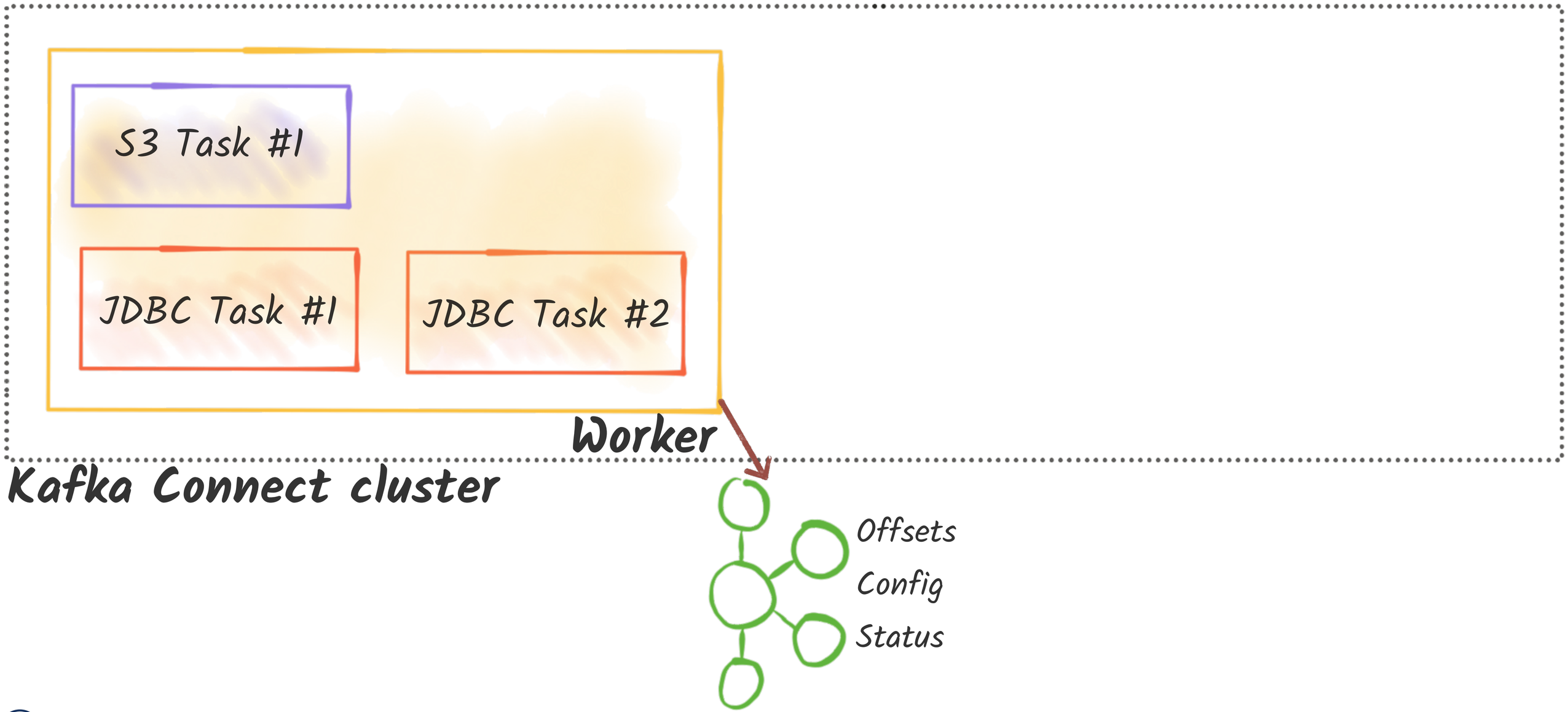
Converter



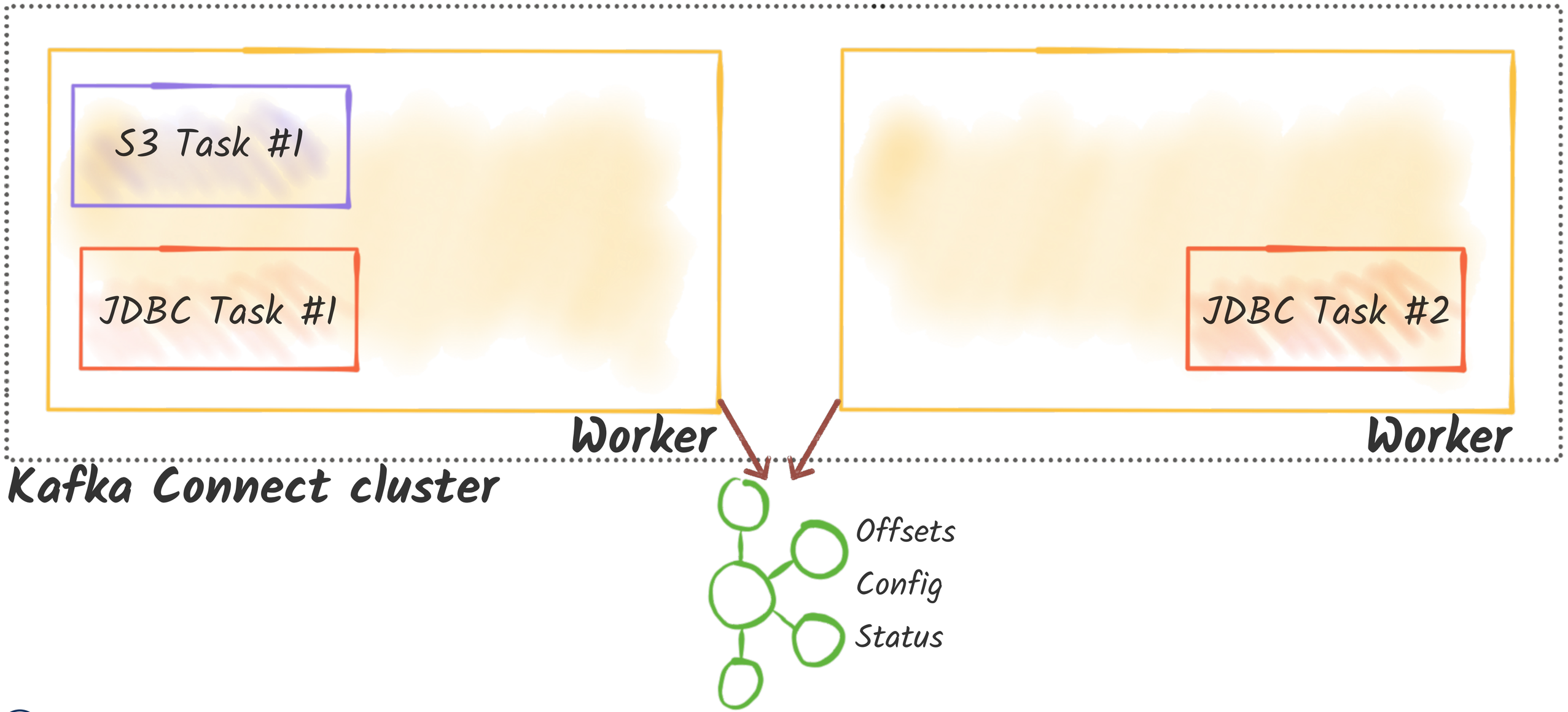
# hub.confluent.io



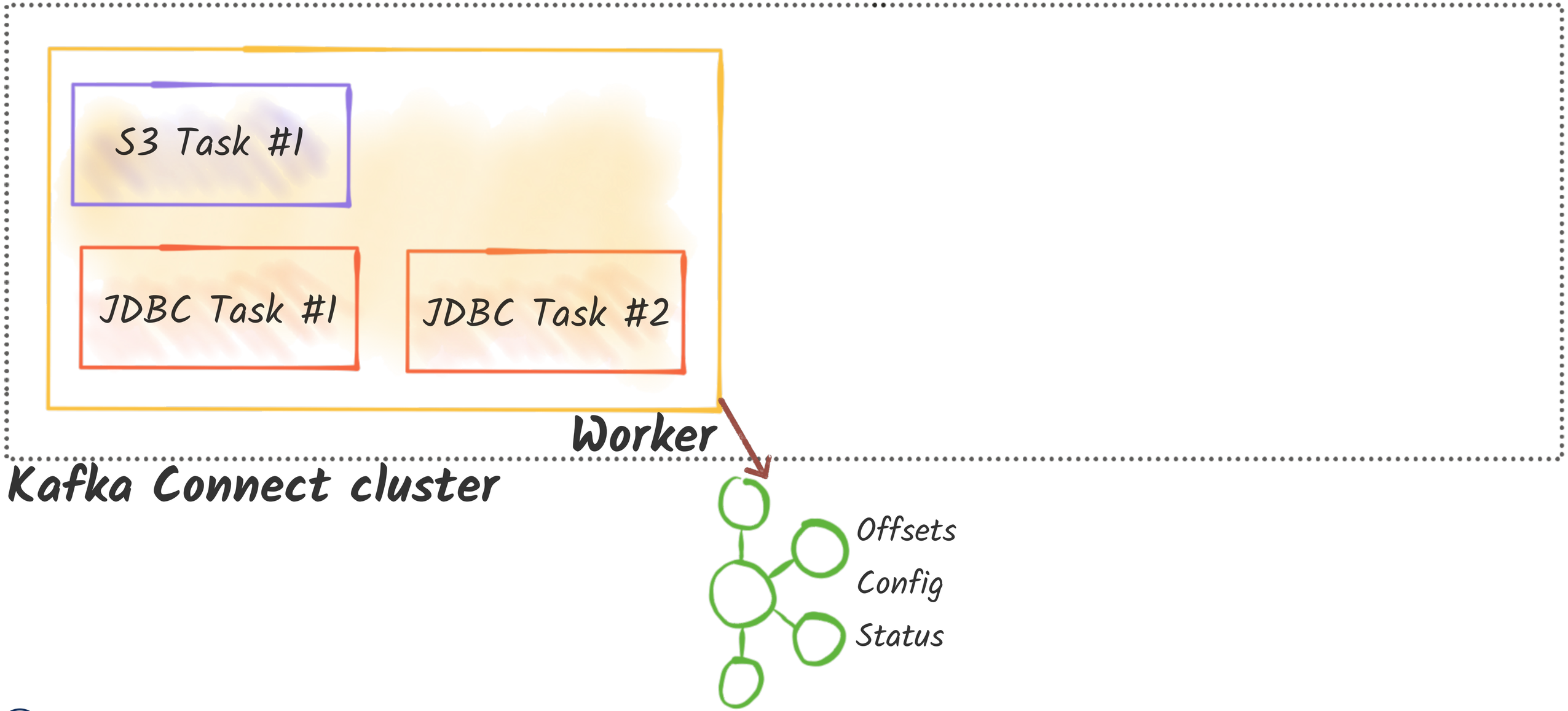
# Single Kafka Connect node



# Kafka Connect - scalable and fault-tolerant



# Automatic fault tolerance

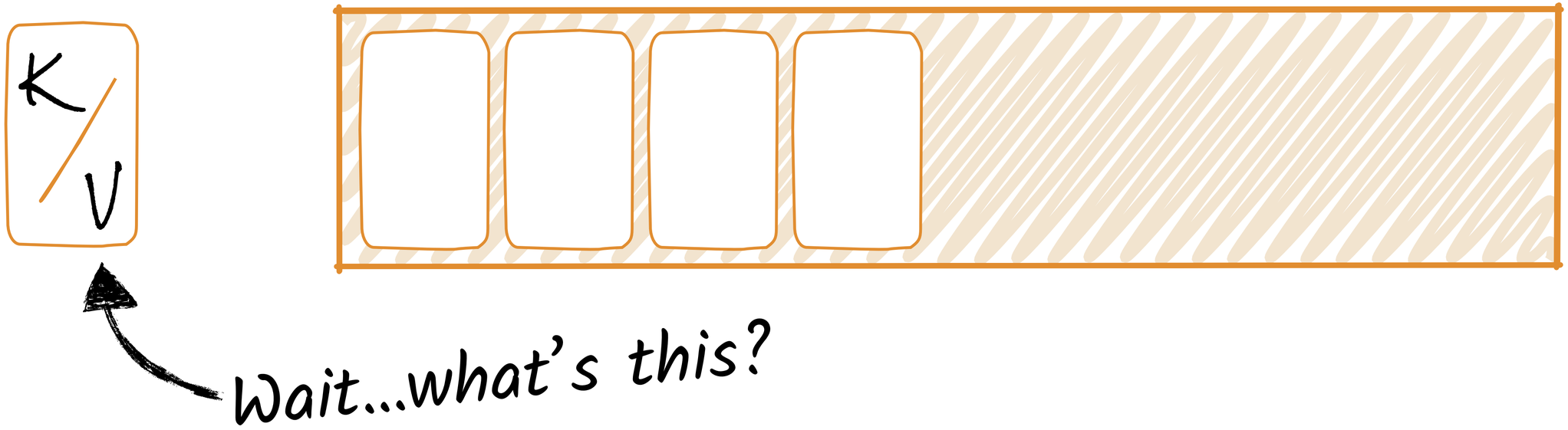



K
V


K
V


K
V

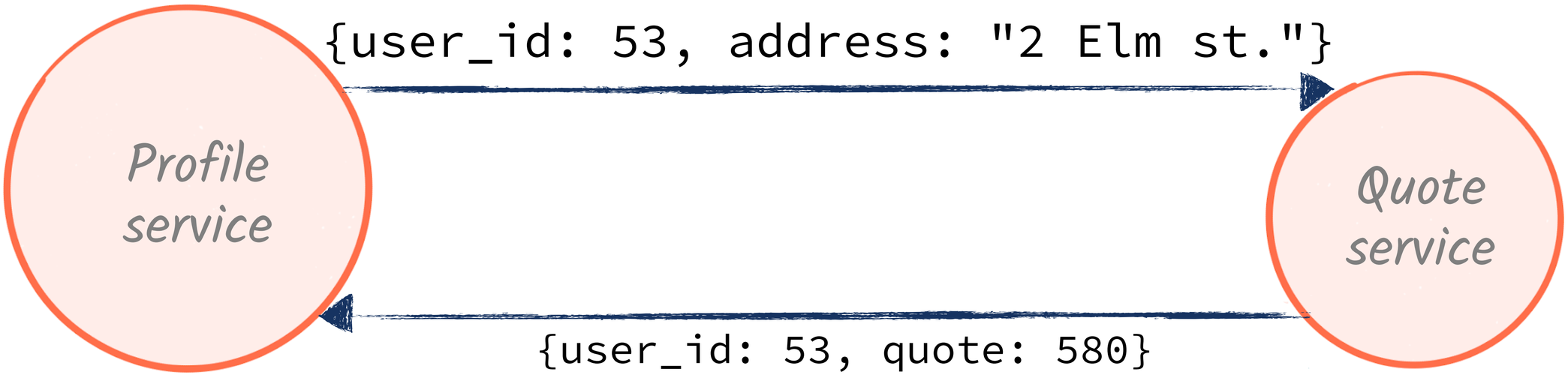

K
V


K
V
Wait...what's this?

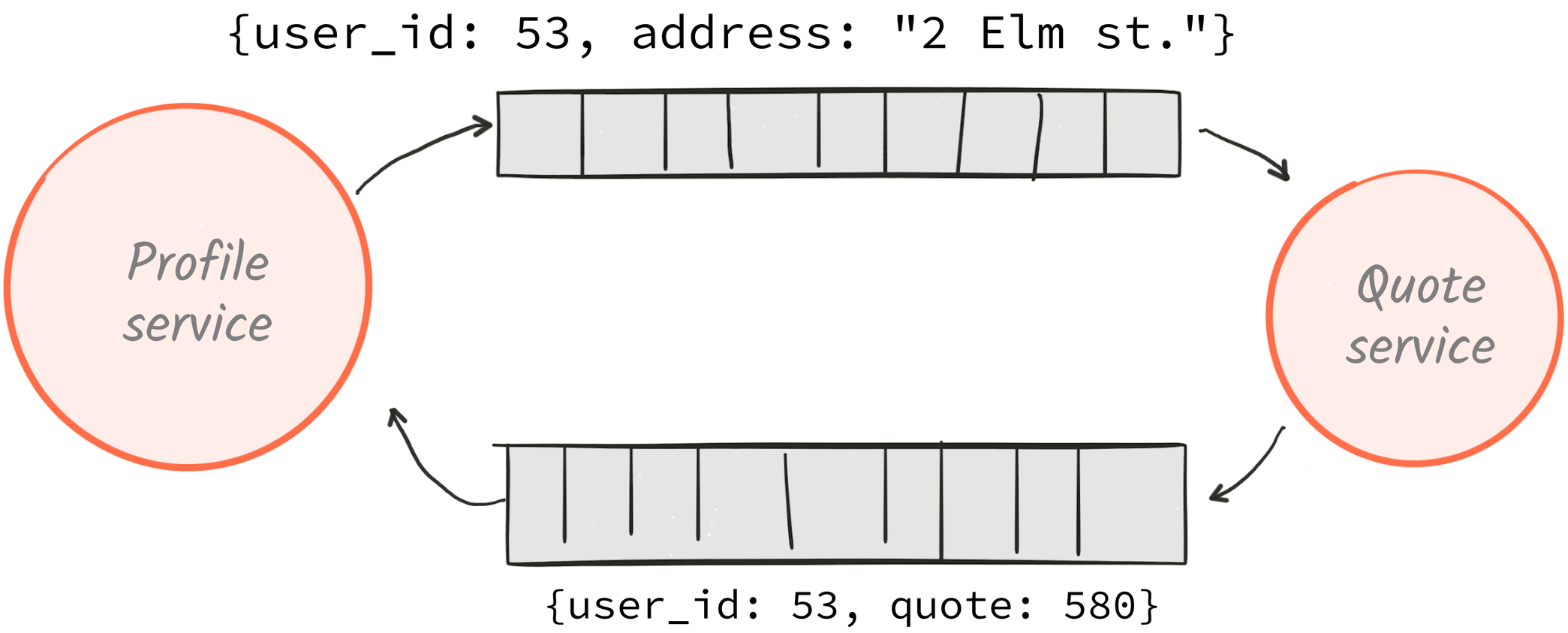
# How do you serialise your data?

Avro Protobuf JSON Schema JSON CSV

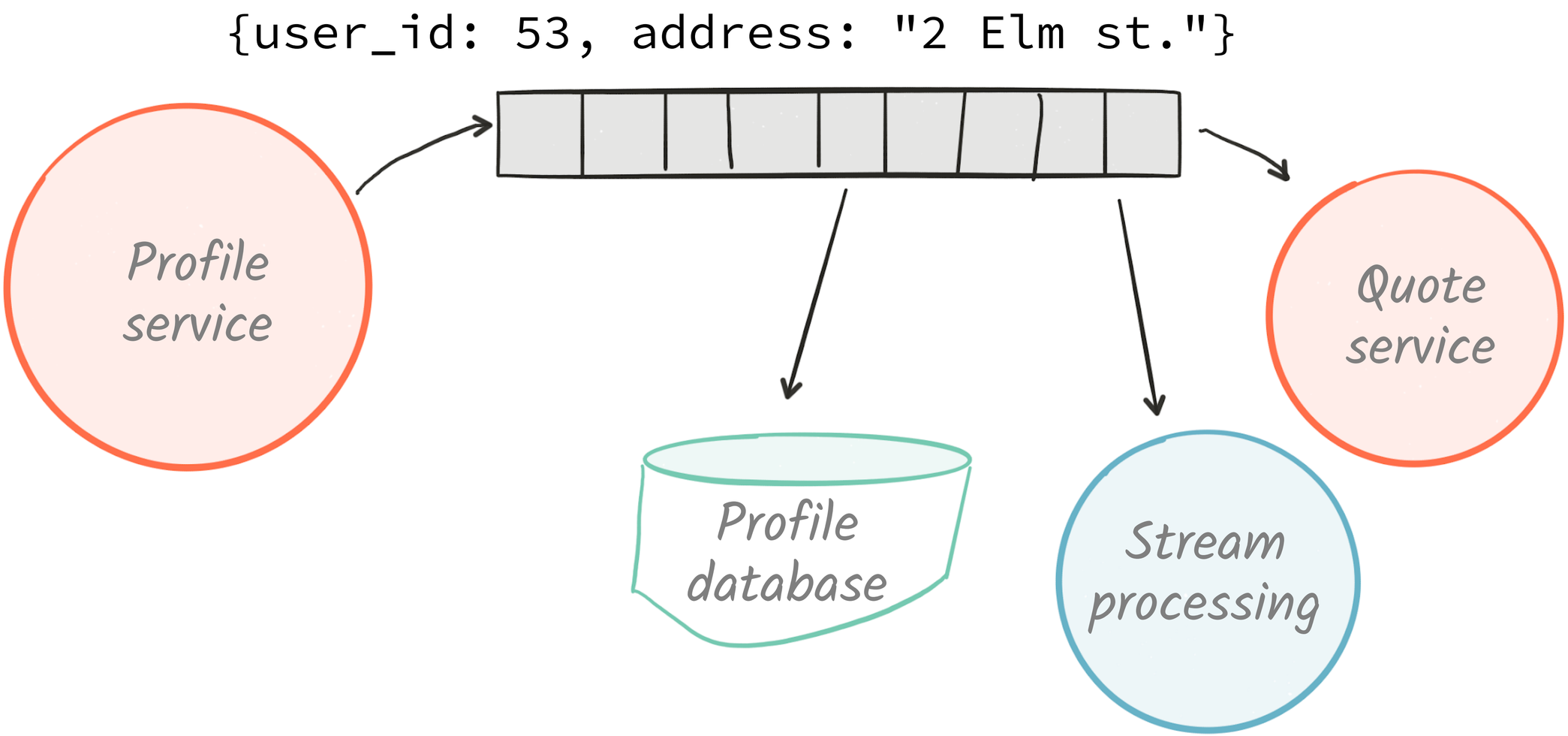
# APIs are contracts between services



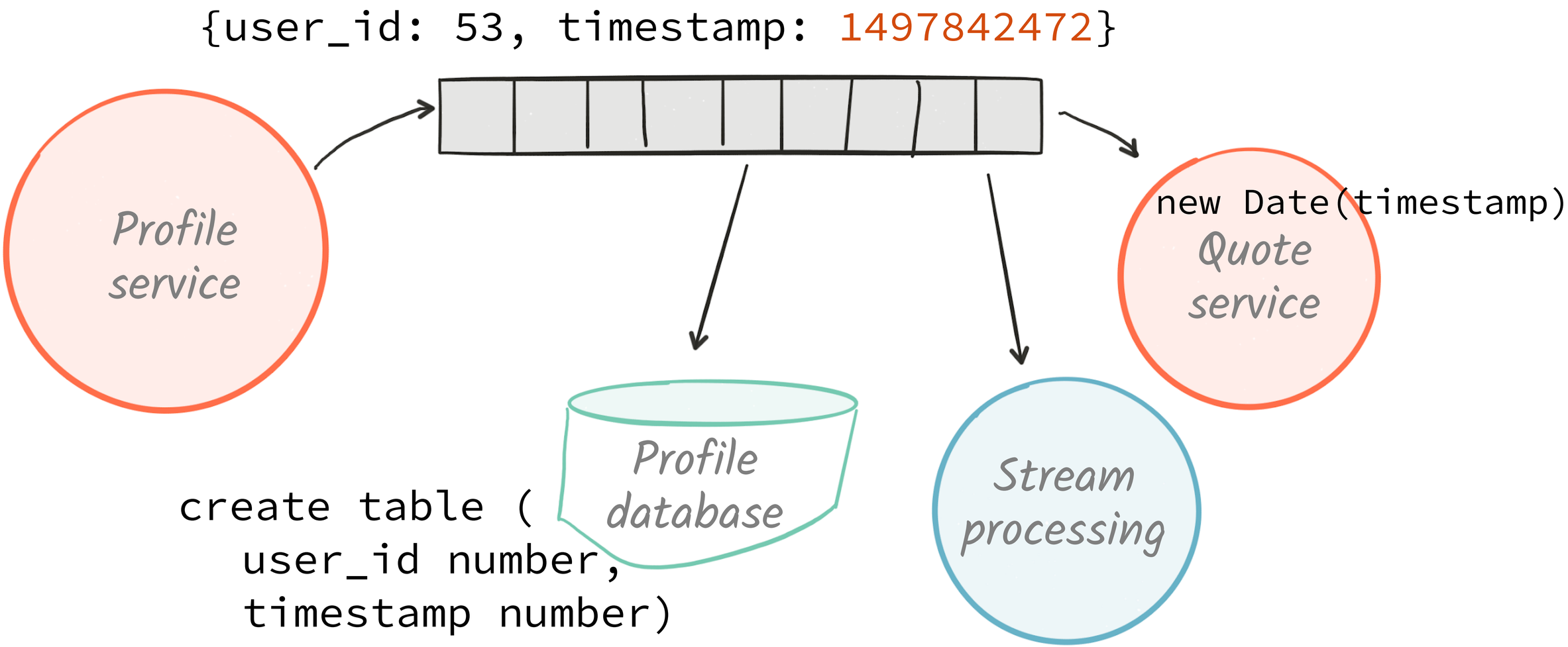
# But not all services



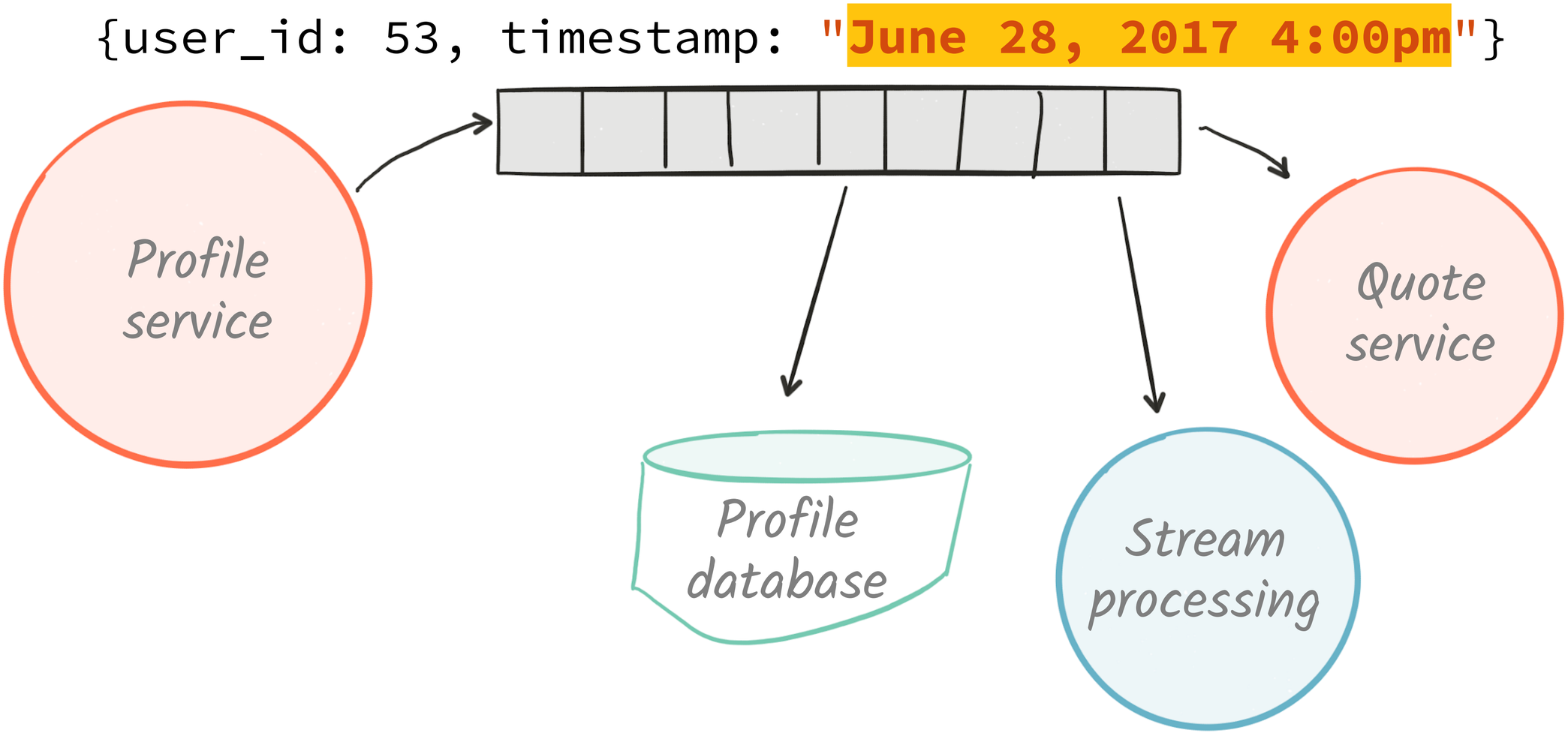
# And naturally...



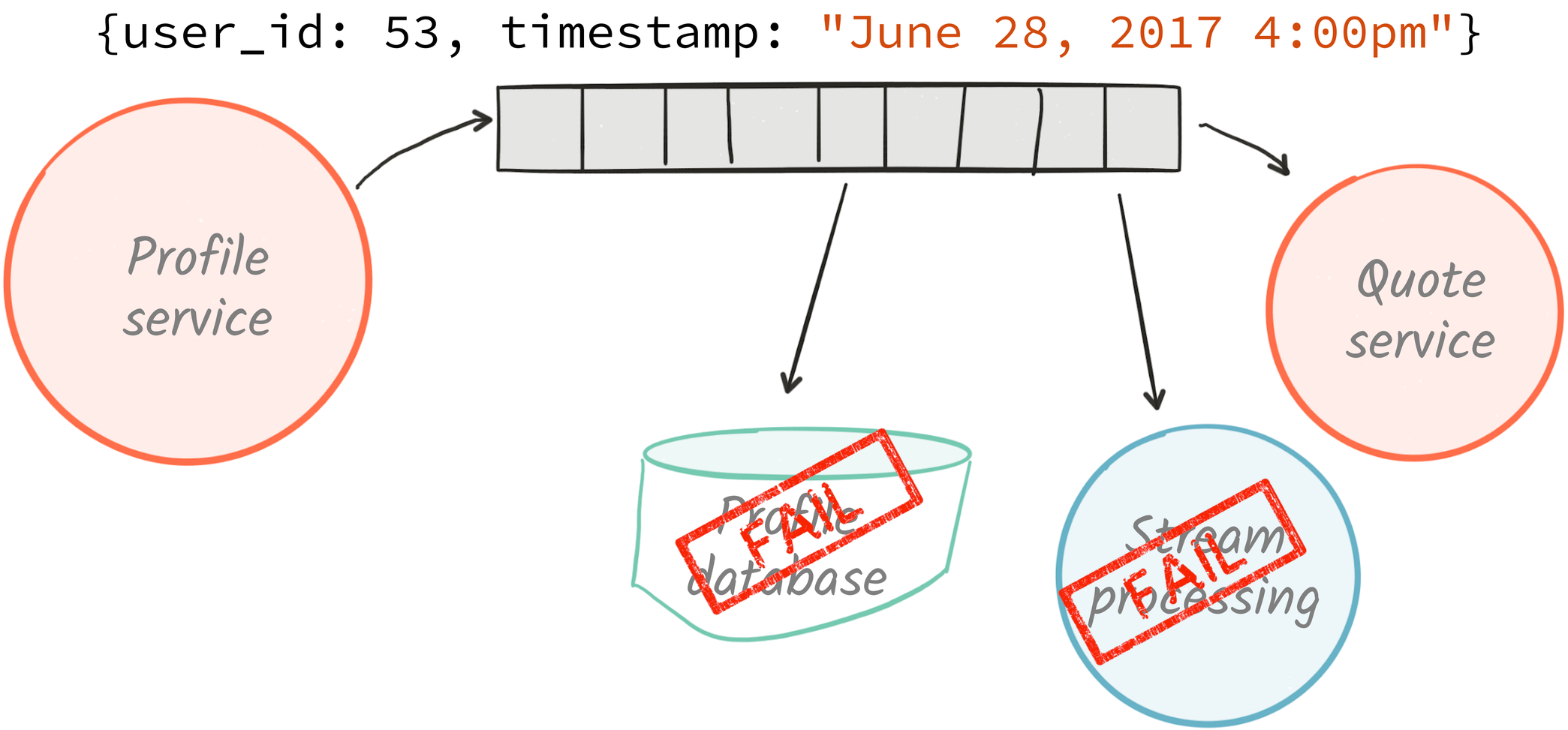
# Schemas are about how teams work together



# Things change...



# Moving fast and breaking things



# Lack of schemas - Coupling teams and services

```
2001 2001 Citrus Heights-Sunrise Blvd
Citrus_Hghts 60670001  3400293 34 SAC
Sacramento SV Sacramento Valley SAC
Sacramento County APCD SMA8 Sacramento
Metropolitan Area CA 6920 Sacramento 28 6920
13588 7400 Sunrise Blvd9561038 41 56
38.6988889 121  16 15.98999977
-121.271111  10 4284781 650345  52
```

# Serialisation & Schemas

Avro Protobuf JSON Schema JSON CSV

# Serialisation & Schemas

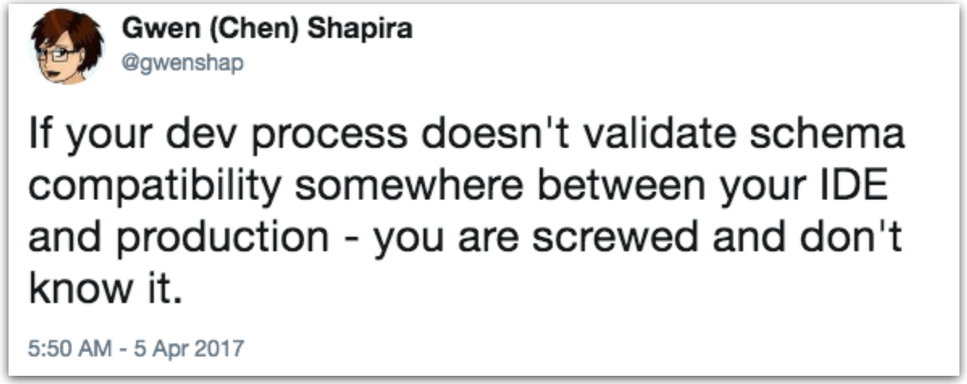
Avro 👍

Protobuf 👍

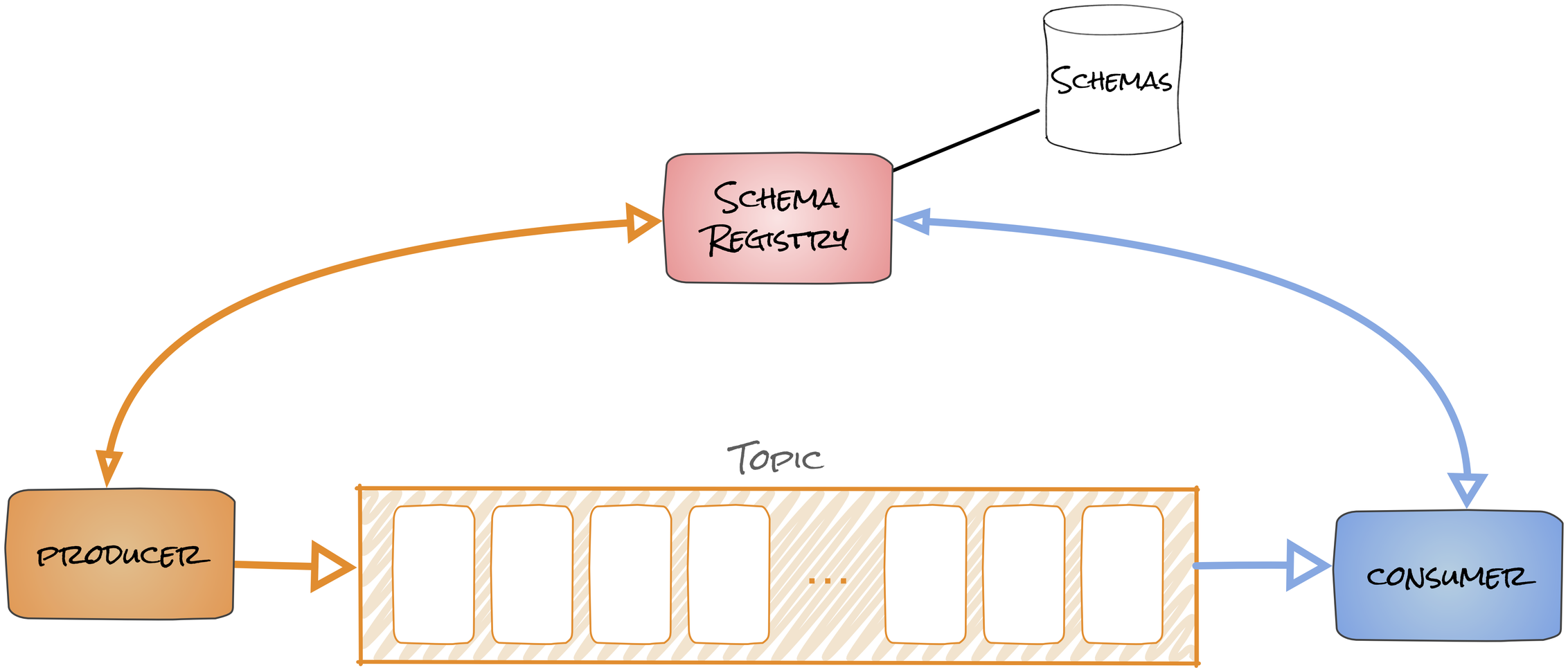
JSON Schema 👍

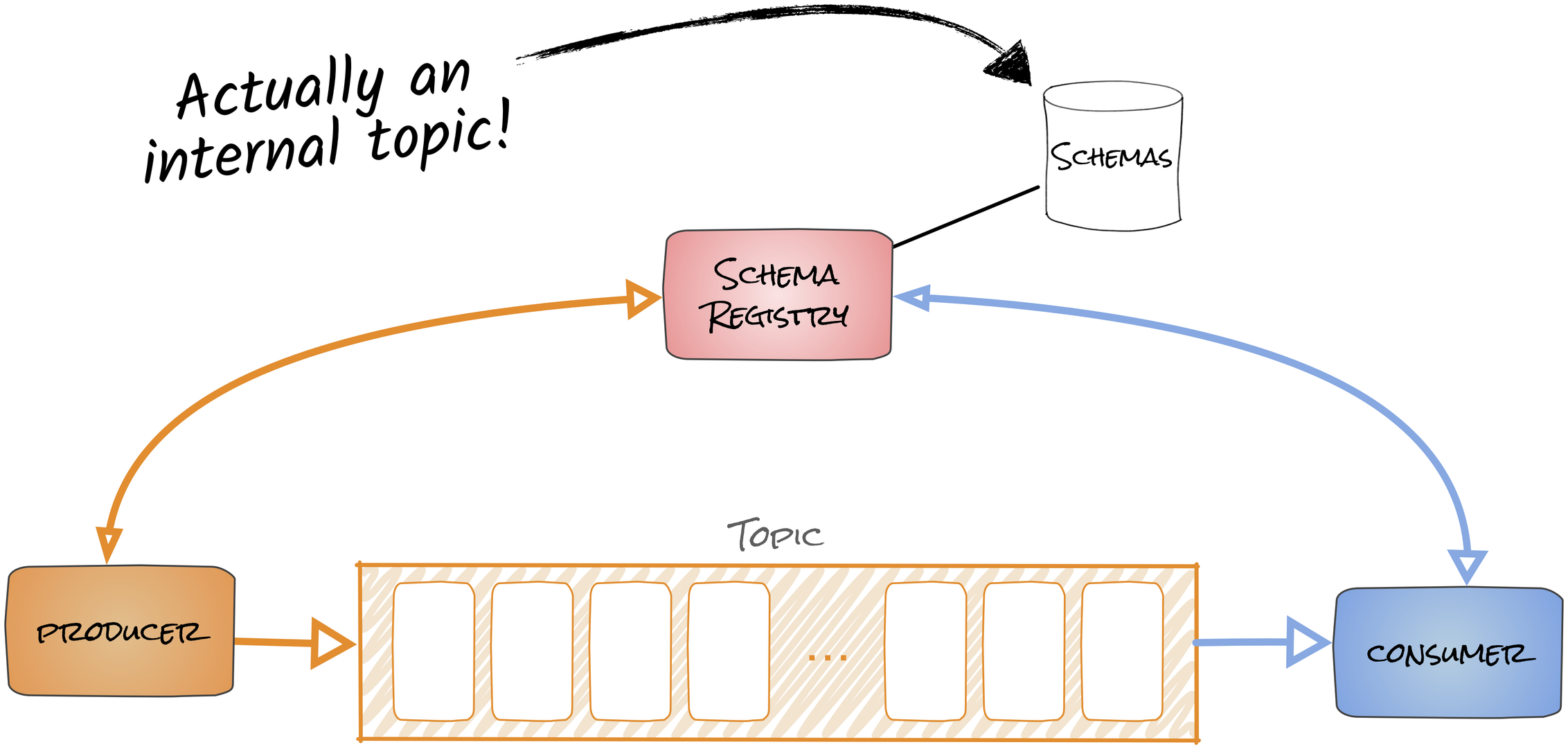
JSON 😬

CSV 



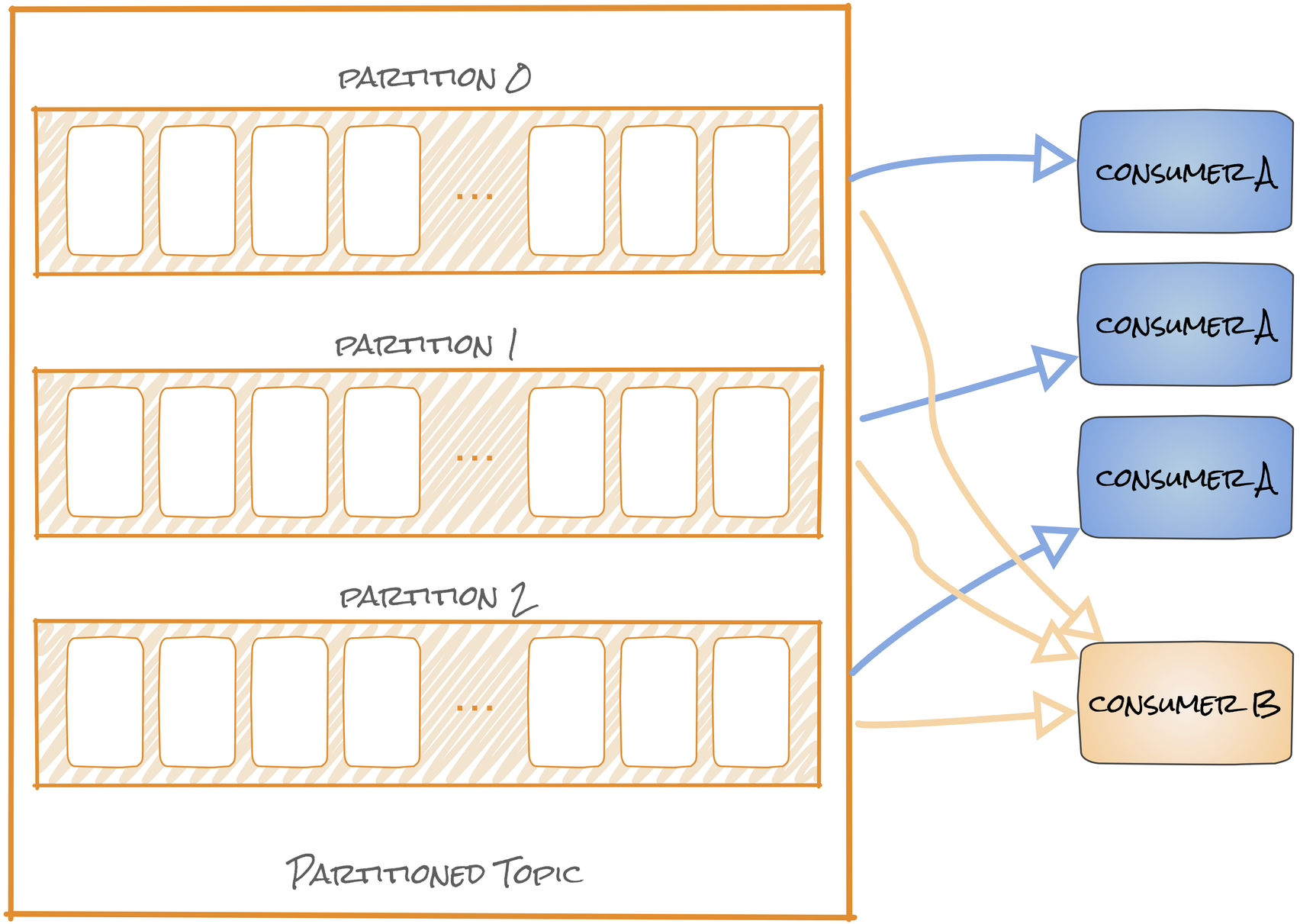

https://qconnewyork.com/system/files/presentation-slides/qcon_17_-_schemas_and_apis.pdf


SCHEMAS
SCHEMA REGISTRY
TOPIC
PRODUCER
CONSUMER


Actually an internal topic!
Schemas
Schema Registry
Topic
Producer
Consumer

# Producers contain serializers

```
props.put("key.serializer",
    "org.apache.kafka.serializers.StringSerializer");
props.put("value.serializer",
    "io.confluent.kafka.serializers.KafkaAvroSerializer");
props.put("schema.registry.url",
          "http://schema-registry:8081");
…
producer<String, LogLine> producer = new
  KafkaProducer<String, LogLine>(props);
```


PARTITION 0
PARTITION 1
PARTITION 2
PARTITIONED TOPIC
CONSUMER A
CONSUMER A
CONSUMER A
CONSUMER B

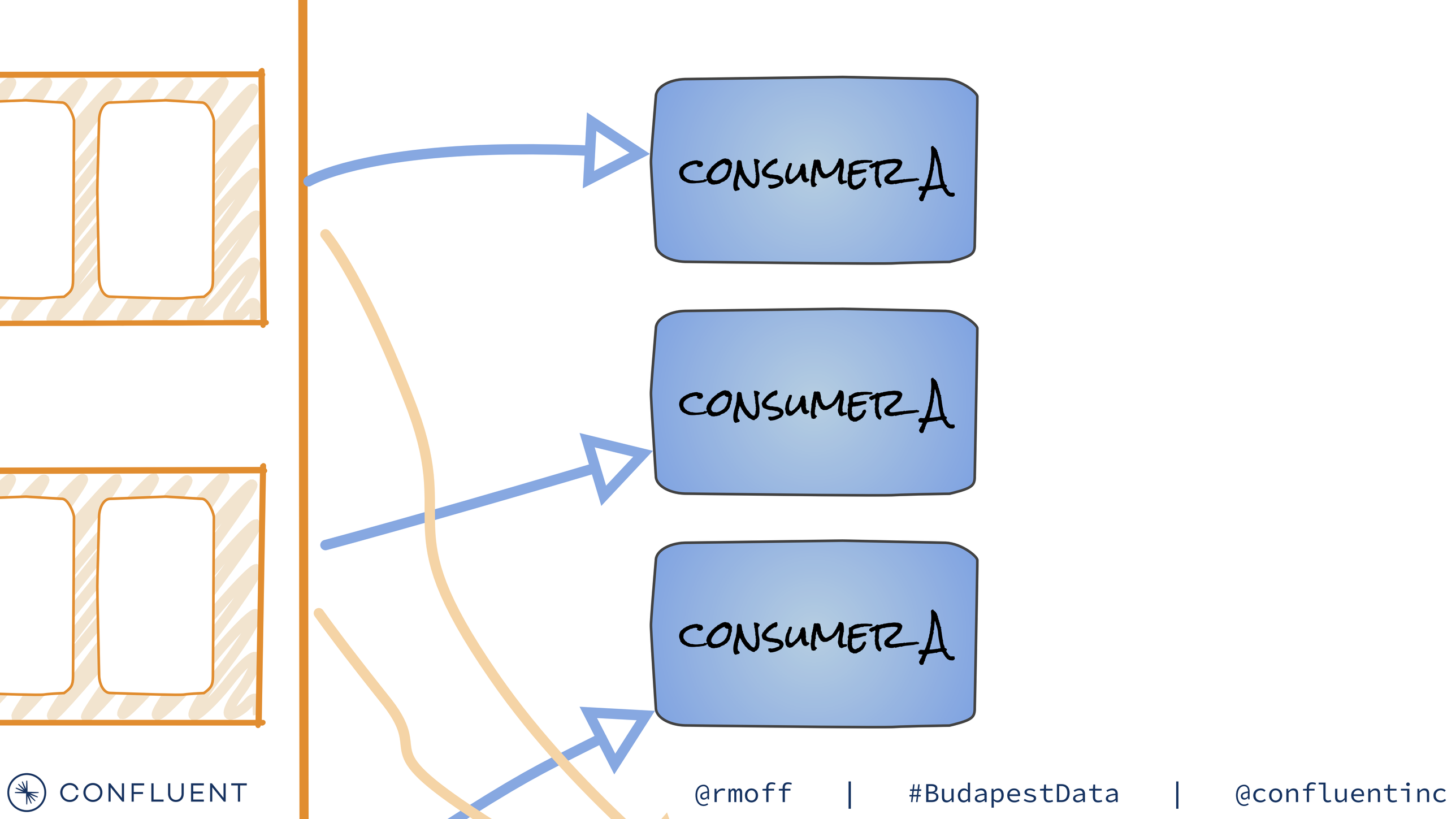
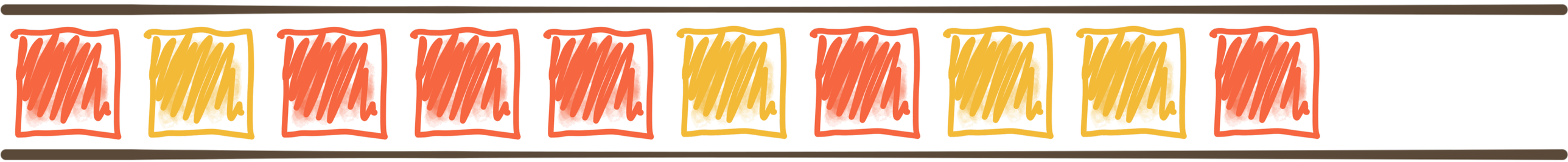

CONSUMER A
CONSUMER A
CONSUMER A

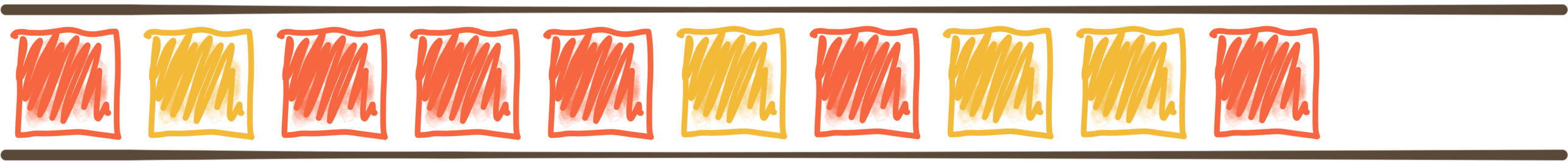

Photo by Franck V. on Unsplash

# Streams of events



Time

# Stream Processing



*Stream*: widgets

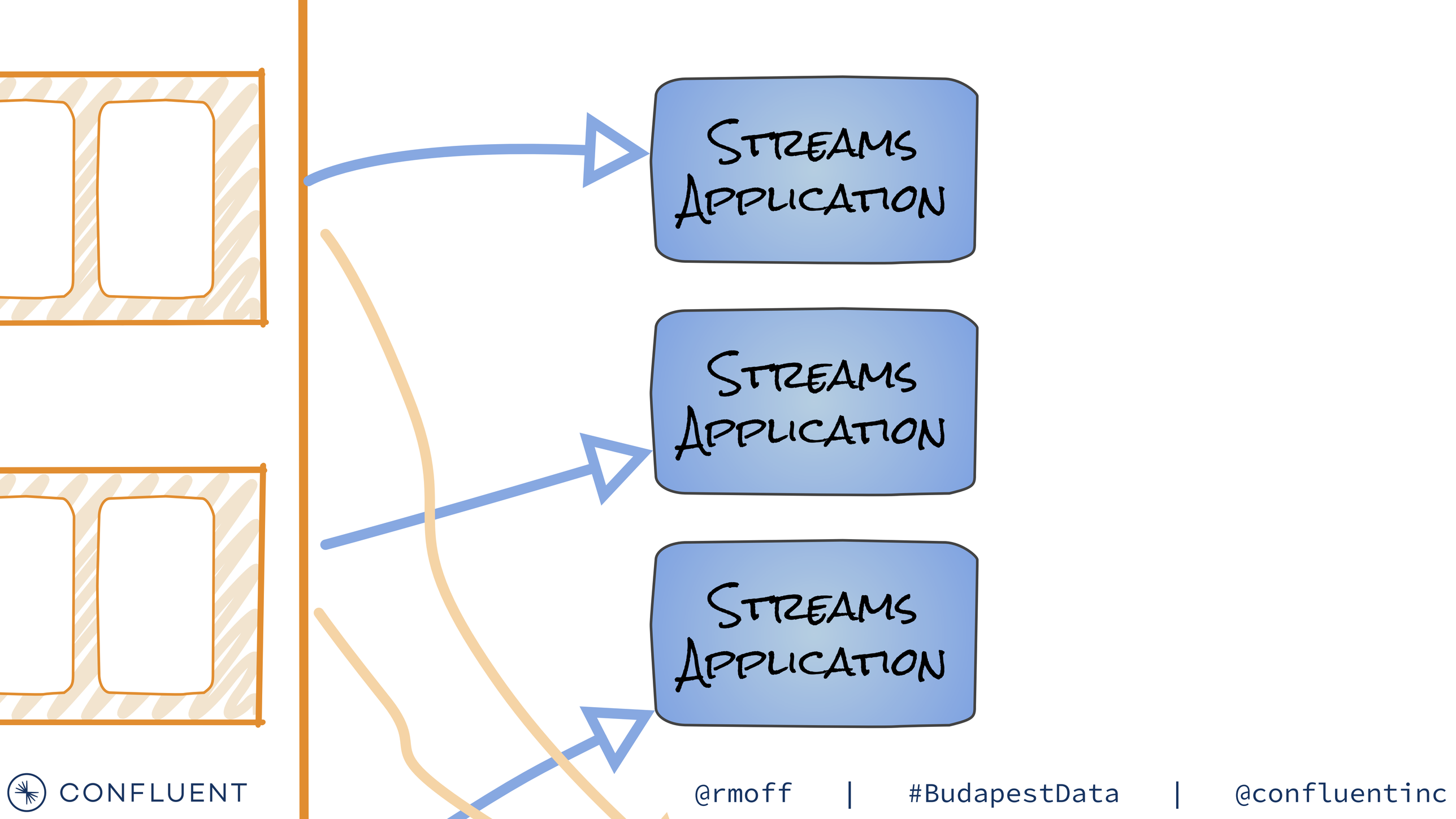
*Stream*: widgets_red

# Stream Processing with Kafka Streams

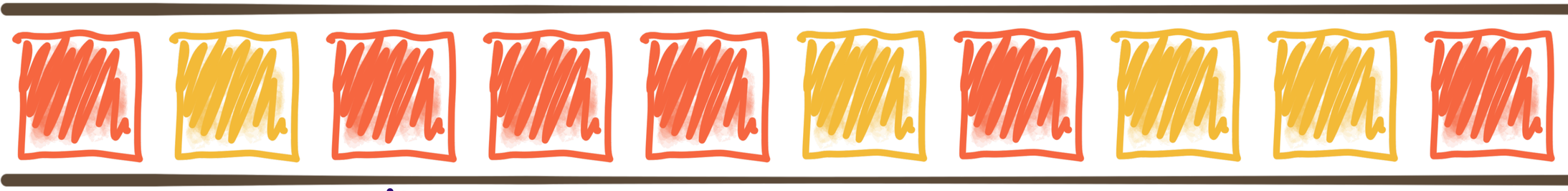
*Stream:*
widgets

```
final StreamsBuilder builder = new StreamsBuilder()
    .stream("widgets", Consumed.with(stringSerde, widgetsSerde))
    .filter( (key, widget) -> widget.getColour().equals("RED") )
    .to("widgets_red", Produced.with(stringSerde, widgetsSerde));
```

*Stream:*
widgets_red


Streams Application
Streams Application
Streams Application

# Stream Processing with ksqlDB



*Stream:*
widgets

ksqlDB

```
CREATE STREAM widgets_red AS
SELECT * FROM widgets
WHERE colour='RED';
```

*Stream:*
widgets_red


Photo by Franck V. on Unsplash

```
SELECT *
FROM WIDGETS
WHERE WEIGHT_G > 120
```

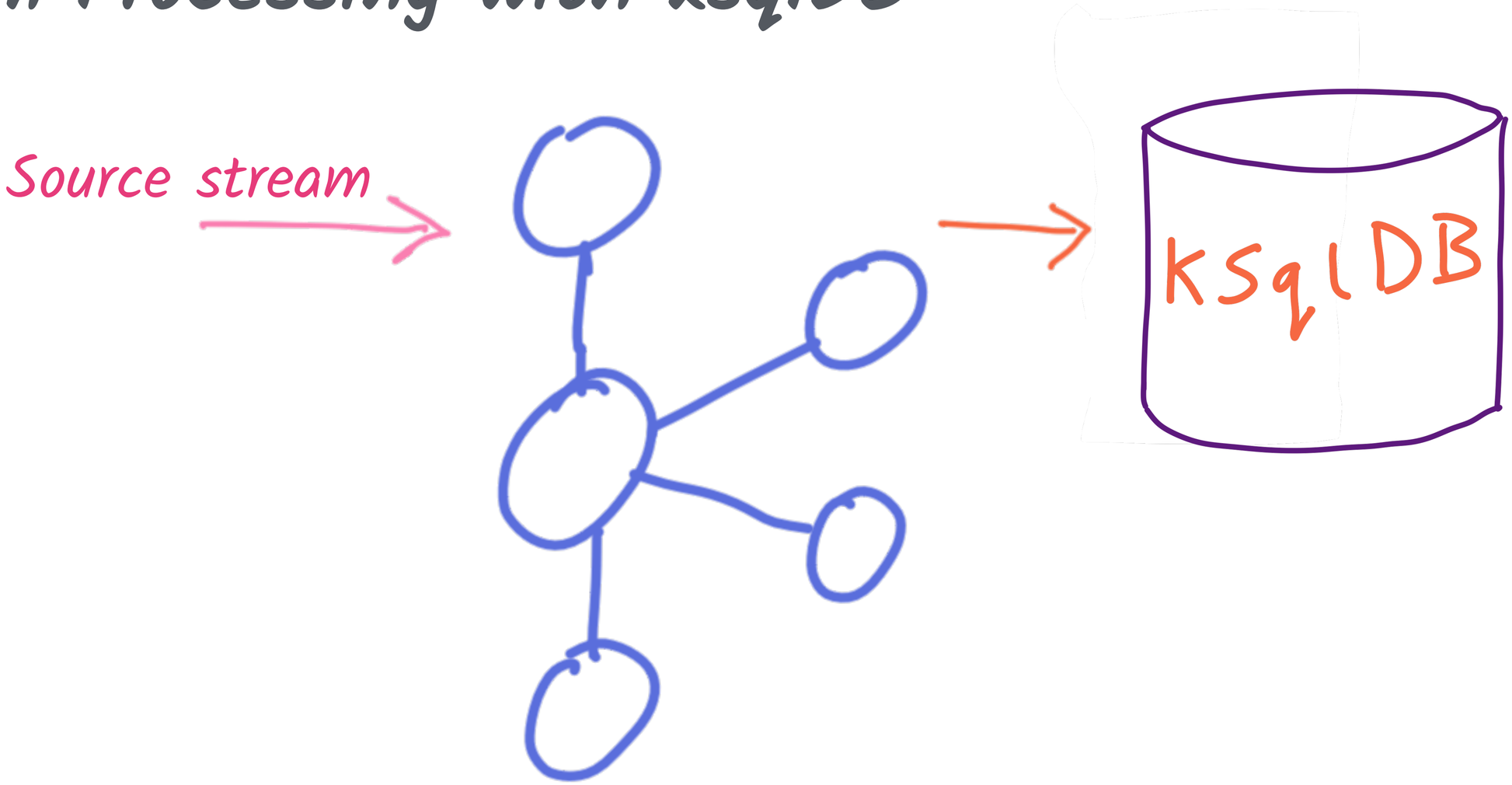
```
SELECT COUNT(*)
FROM WIDGETS
GROUP BY PRODUCTION_LINE
```

```
SELECT AVG(TEMP_CELCIUS) AS TEMP
FROM WIDGETS
GROUP BY SENSOR_ID
HAVING TEMP>20
```

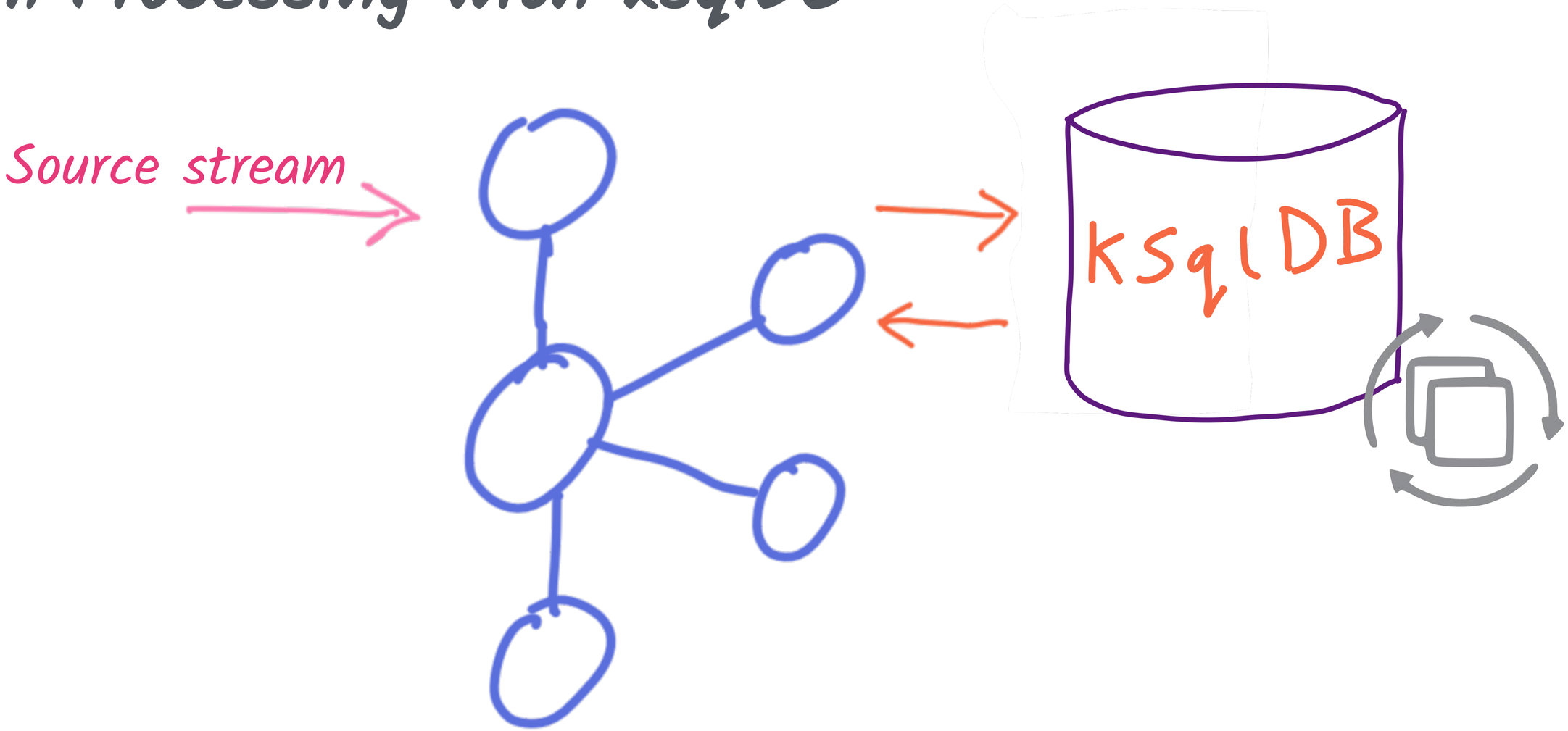
*Object store, data warehouse, RDBMS*

```
CREATE SINK CONNECTOR dw WITH (
'connector.class' = 'S3Connector',
'topics' = 'widgets'
…);
```

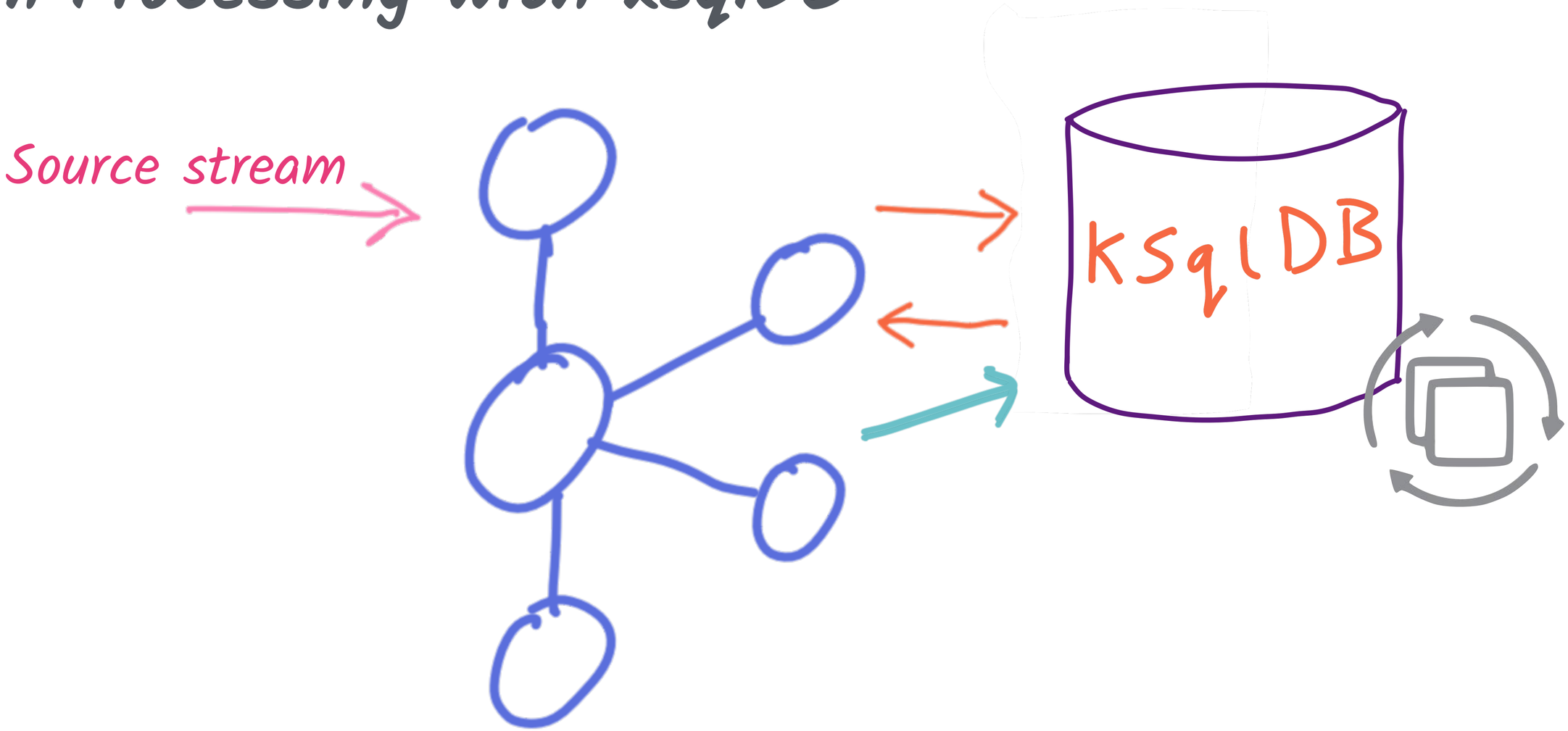
# Stream Processing with ksqlDB



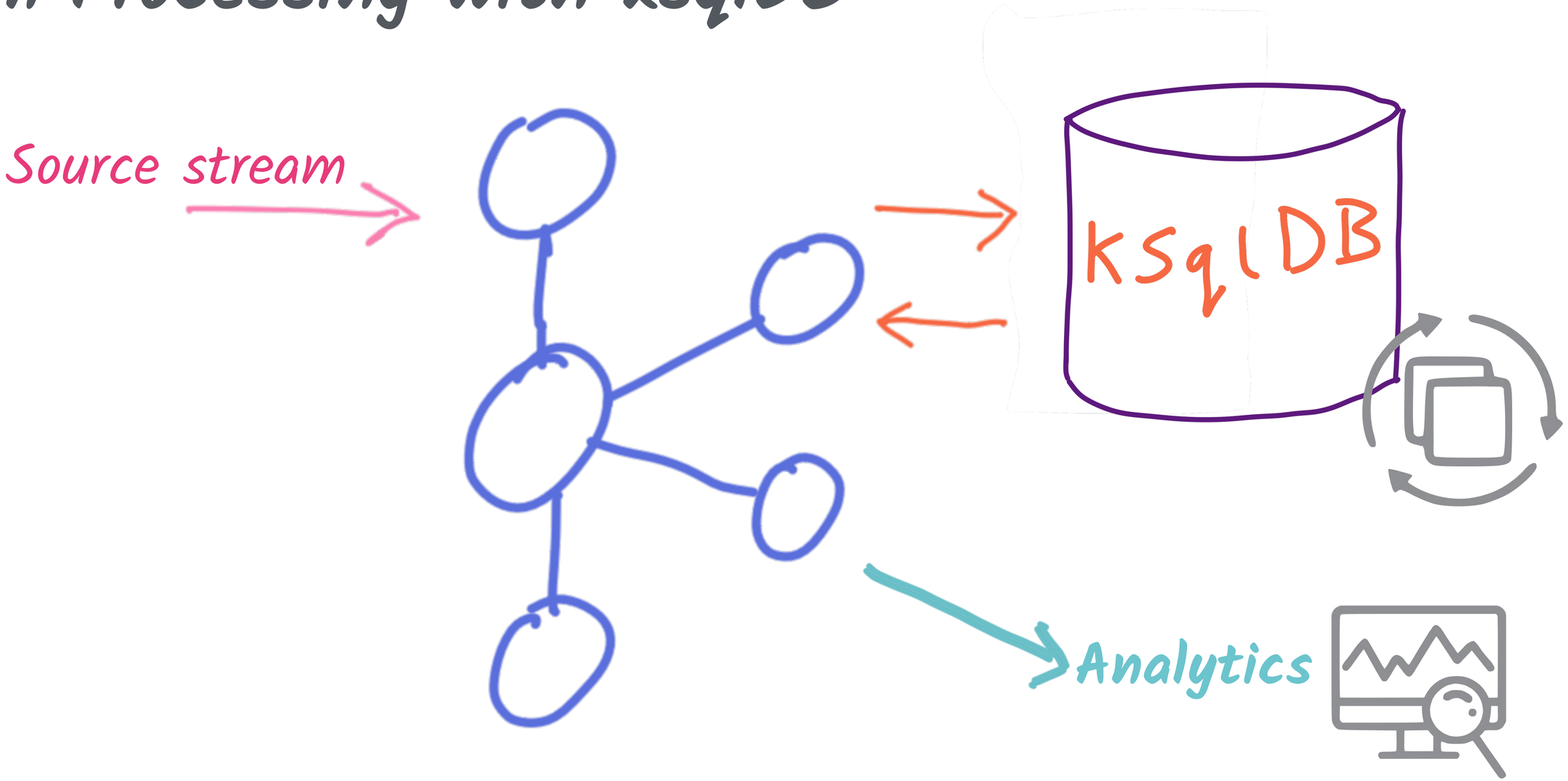
# Stream Processing with ksqlDB



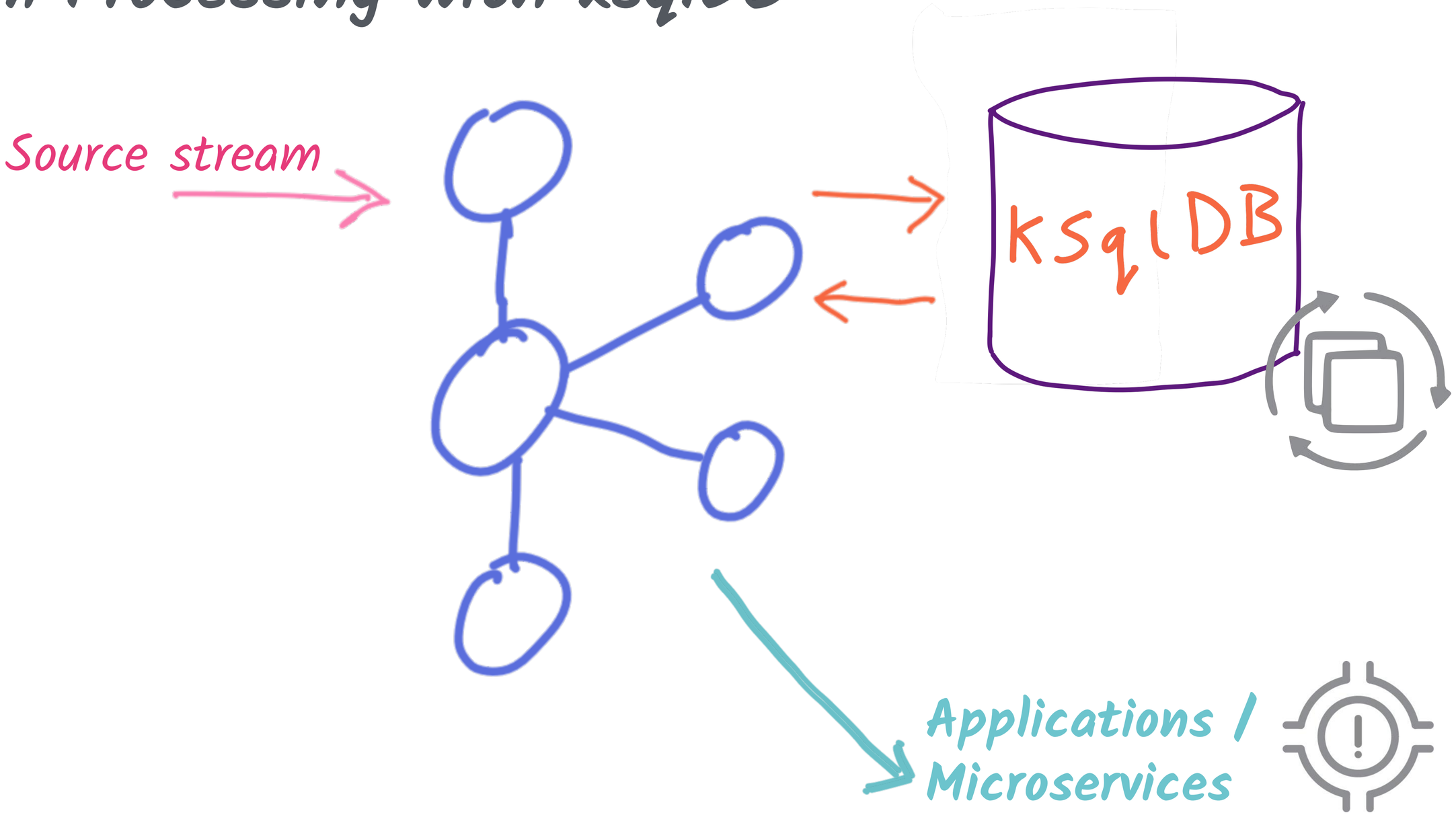
# Stream Processing with ksqlDB



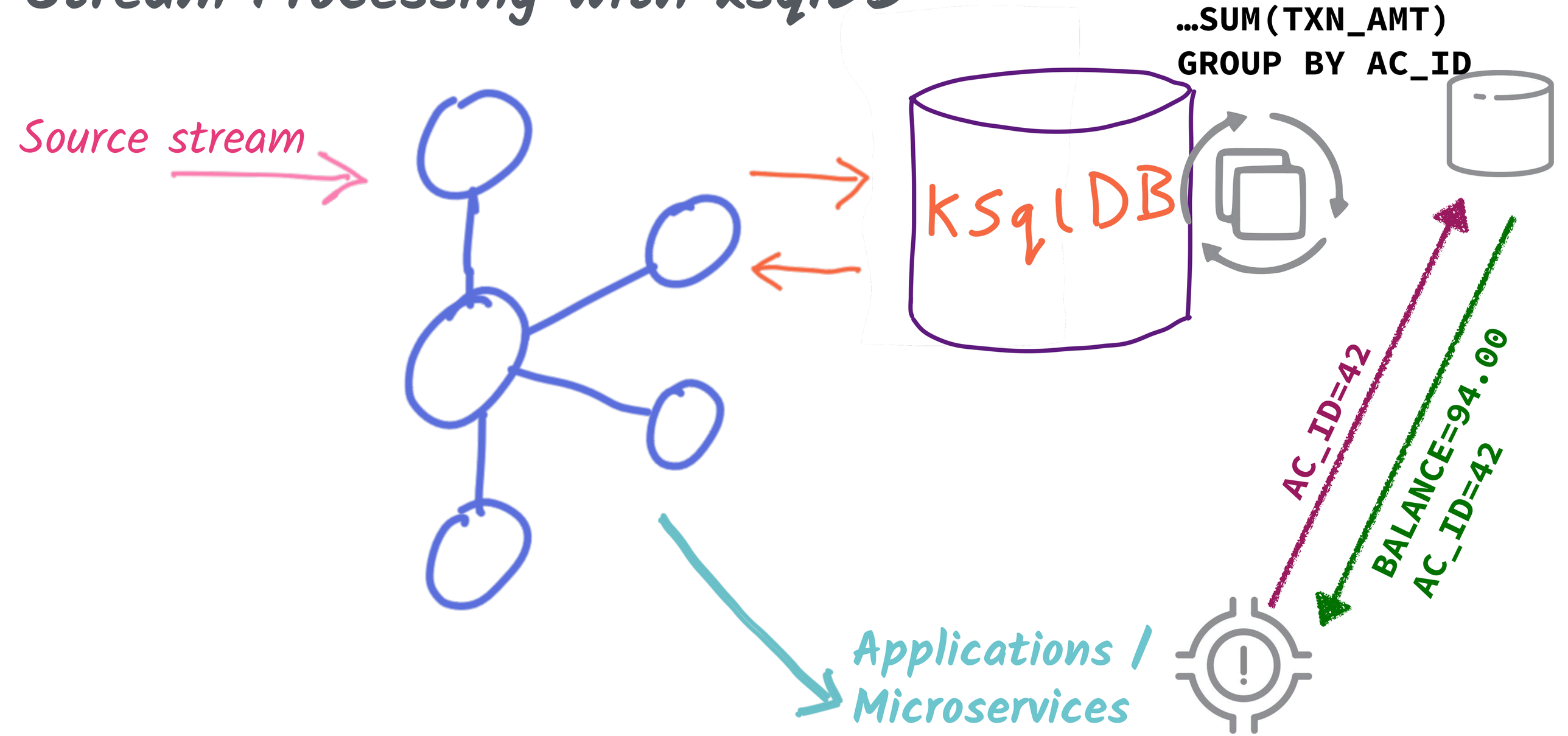
# Stream Processing with ksqlDB



# Stream Processing with ksqlDB



# Stream Processing with ksqlDB



CONFLUENT

# ksqlDB

# or

# Kafka Streams?

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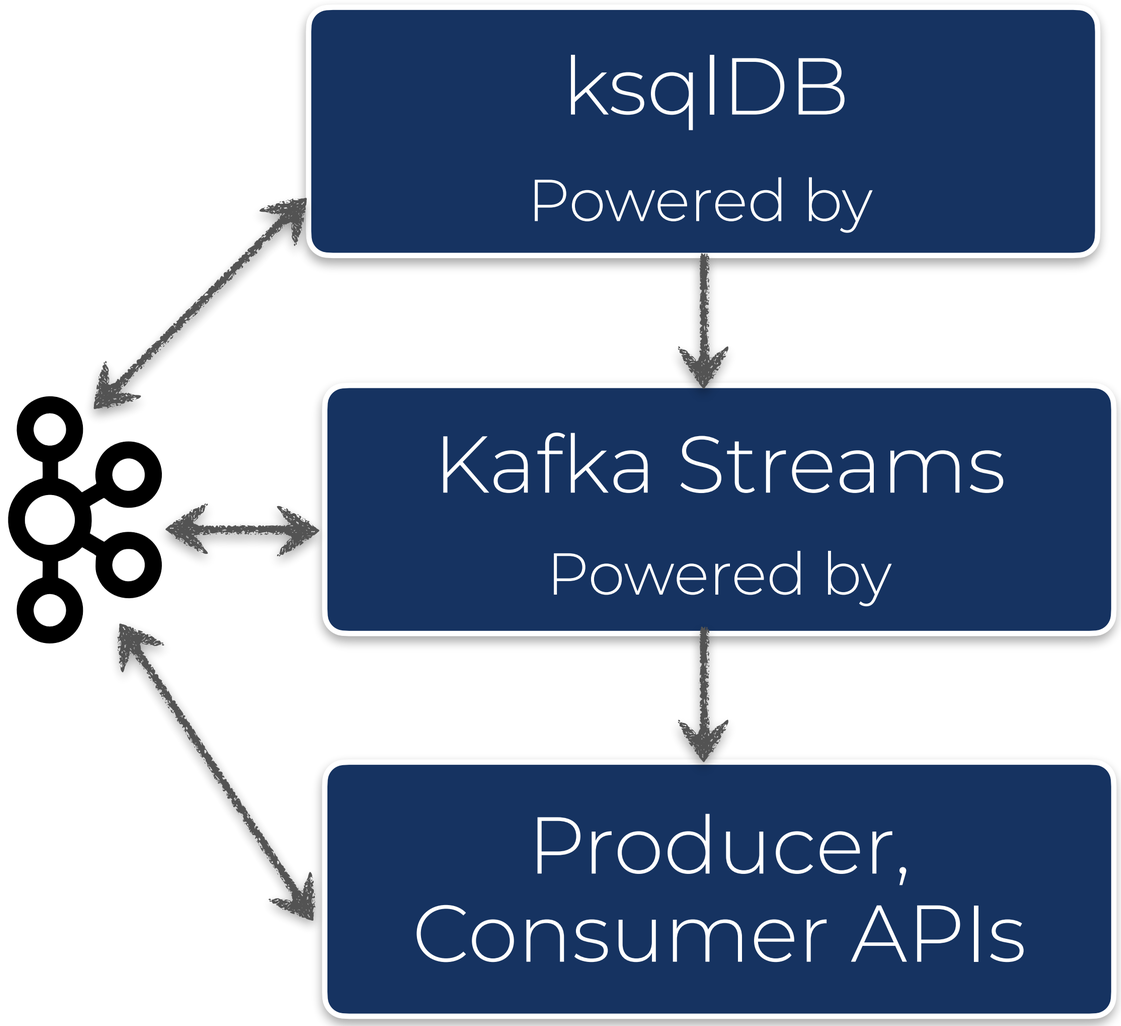
# Standing on the Shoulders of Streaming Giants




Ease of use

Flexibility

```
CREATE STREAM,
CREATE TABLE, SELECT, JOIN,
GROUP BY, SUM, …
```

ksqlDB UDFs

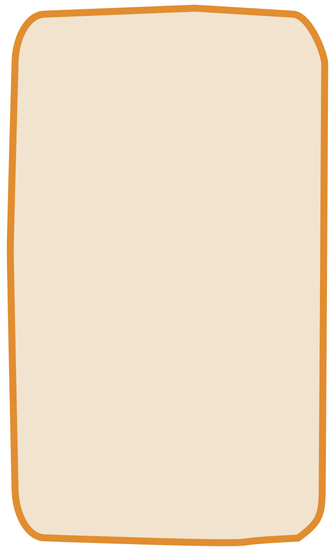
```
KStream<>, KTable<>, filter(), map(),
flatMap(), join(), aggregate(),
transform(), …
```

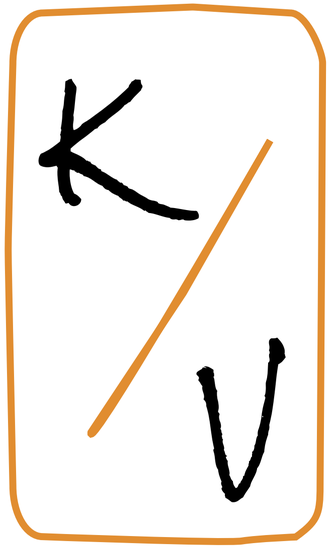
```
subscribe(), poll(), send(),
flush(), beginTransaction(), …
```

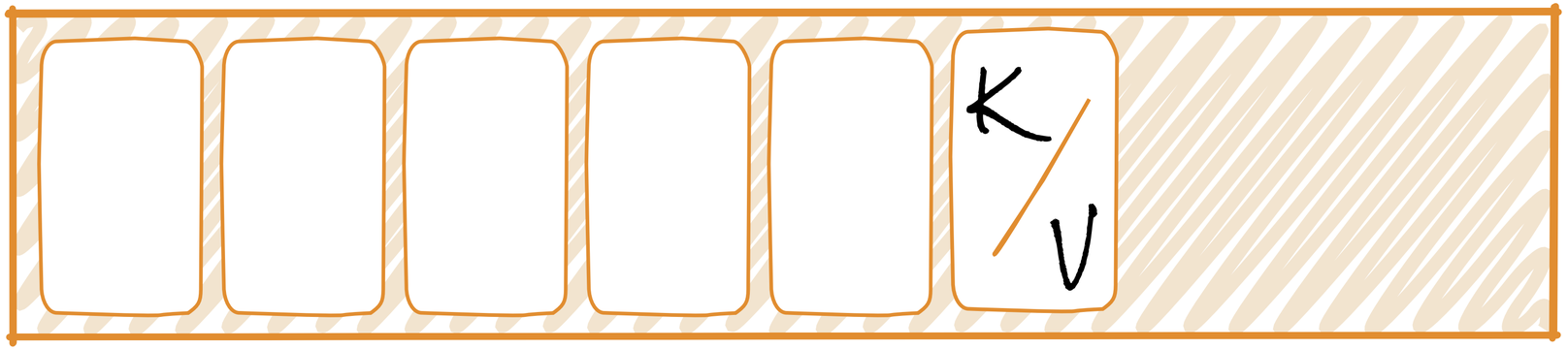

CONFLUENT

# DEMO

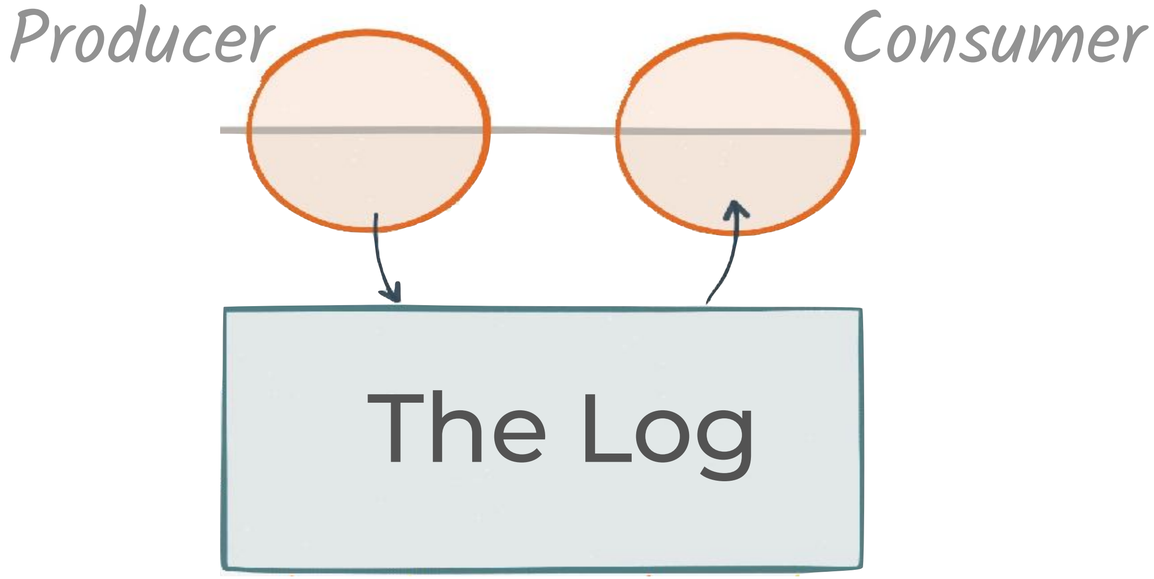
# Summary

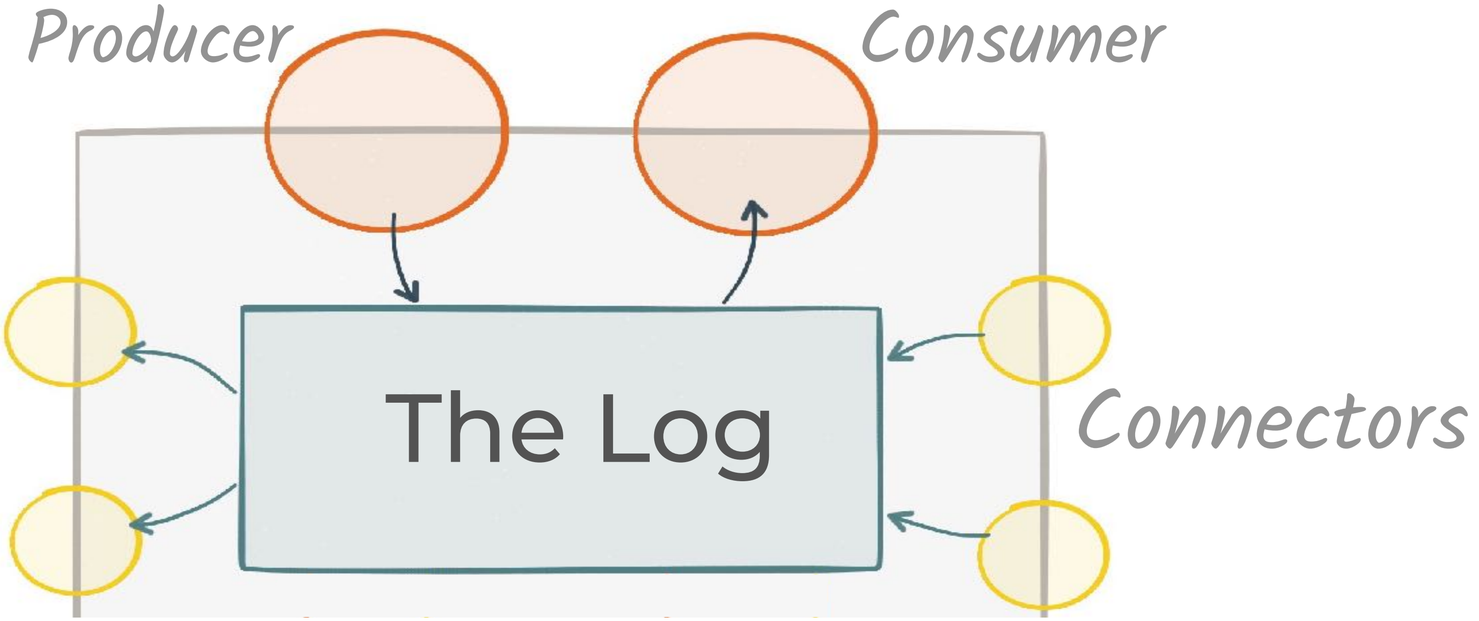


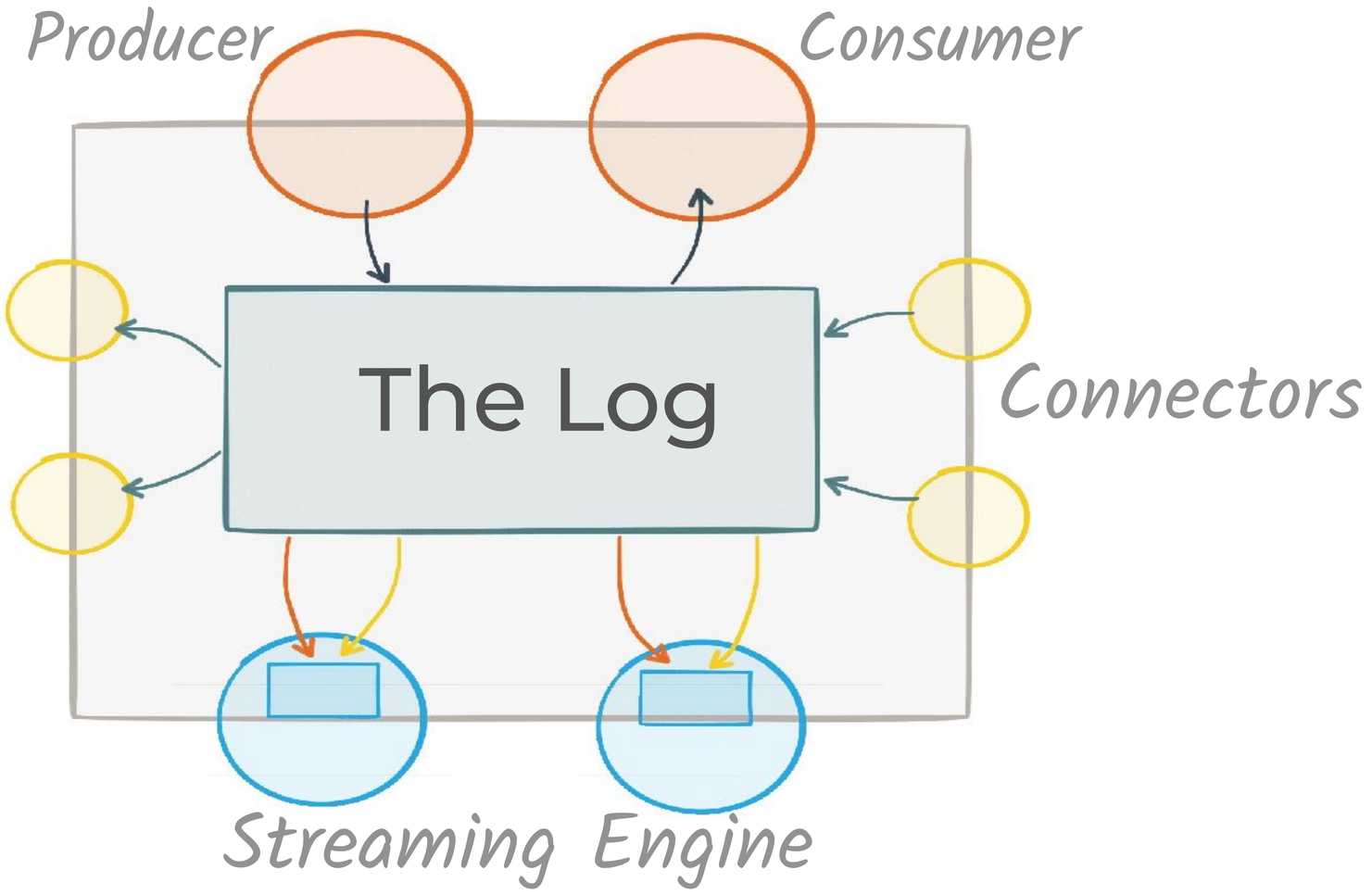

K
V


K
V

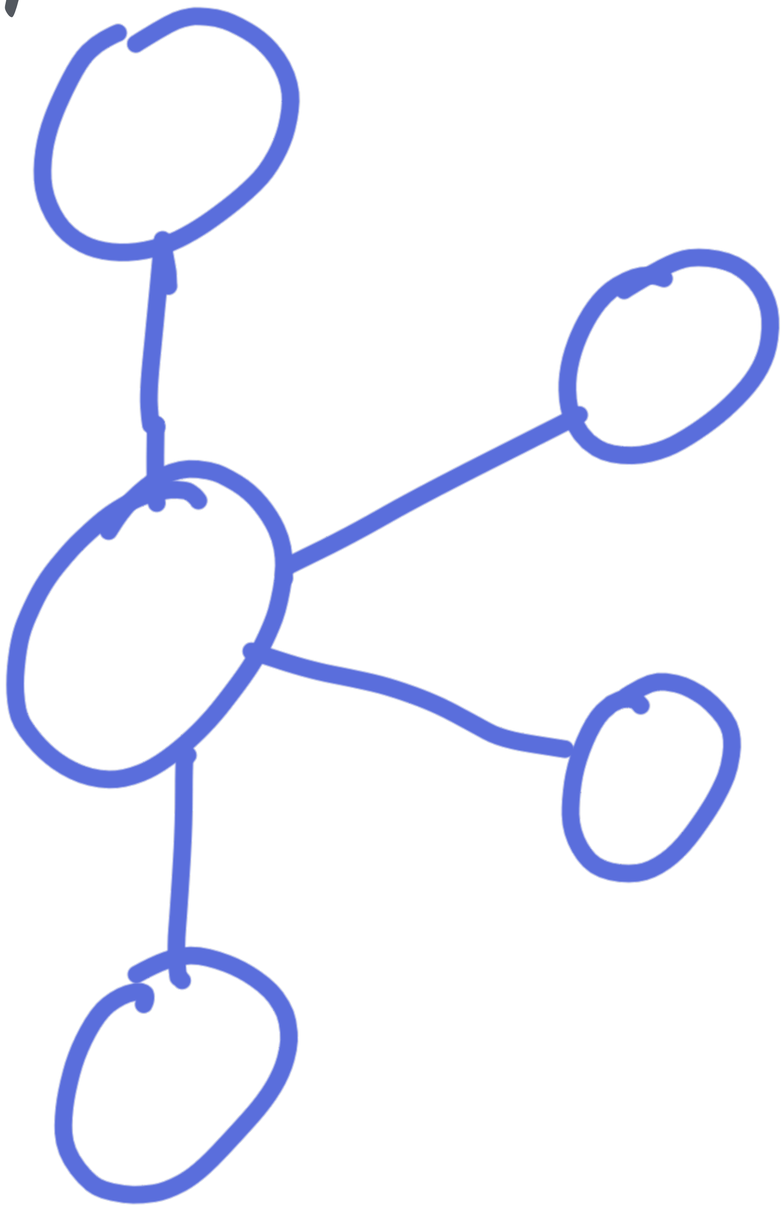
The Log

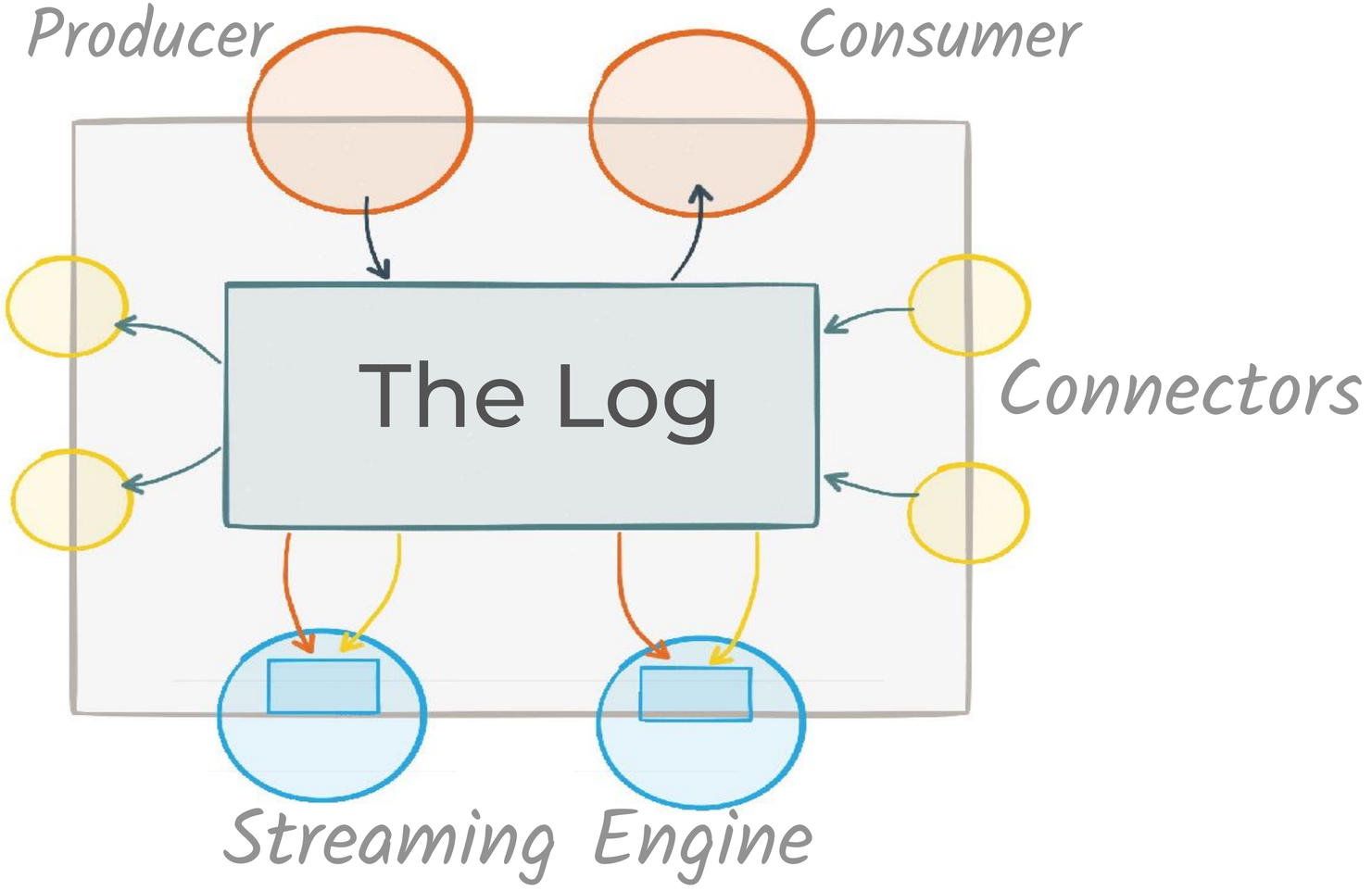

Producer
Consumer
The Log


Producer
Consumer
The Log
Connectors


Producer
Consumer
The Log
Connectors
Streaming Engine

# Apache Kafka





# EVENTS

# are

# EVERYWHERE

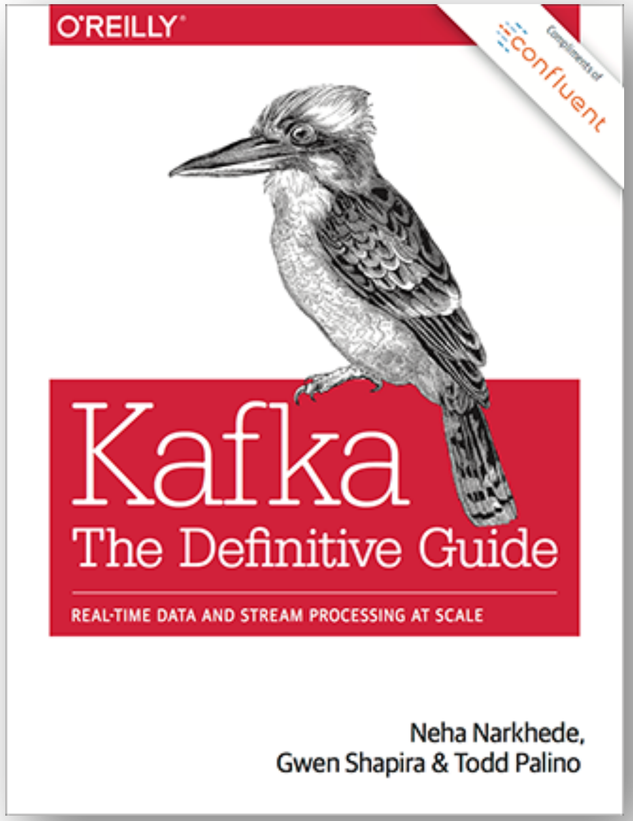
# EVENTS

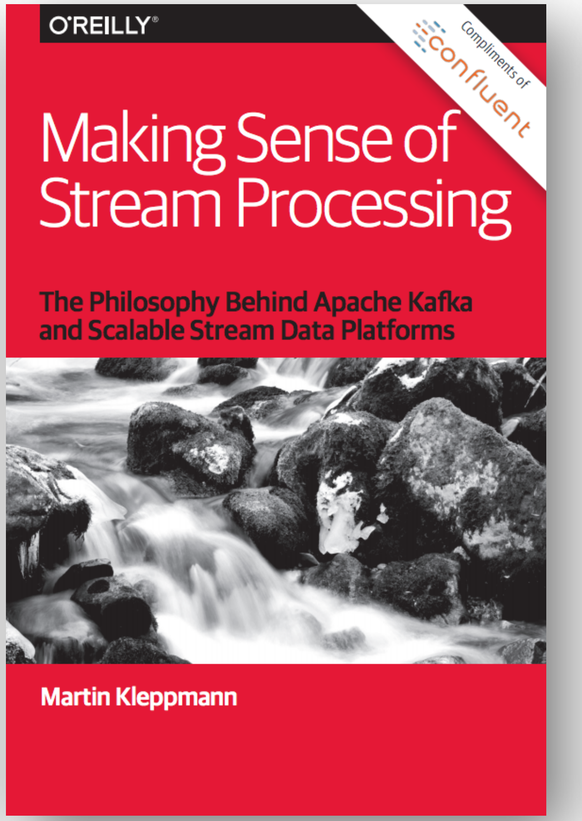
are

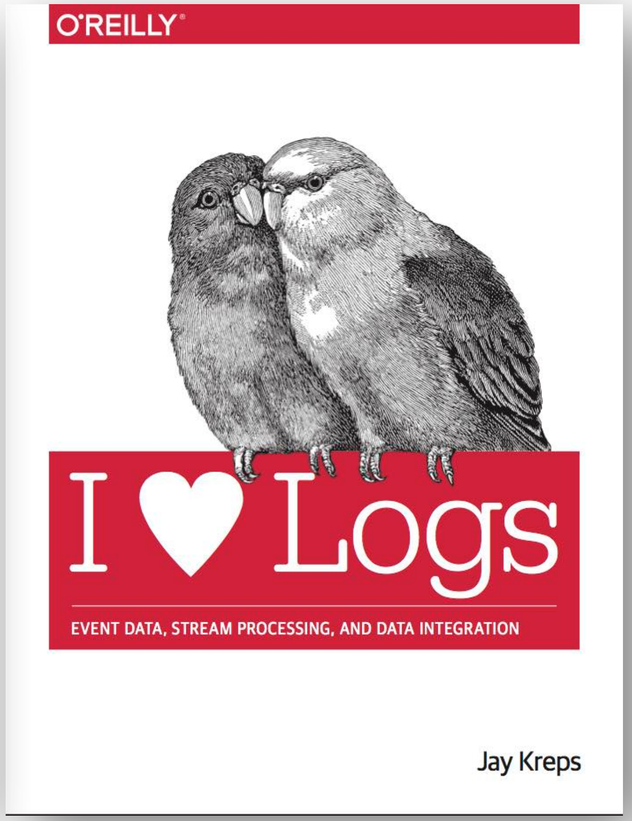
very POWERFUL

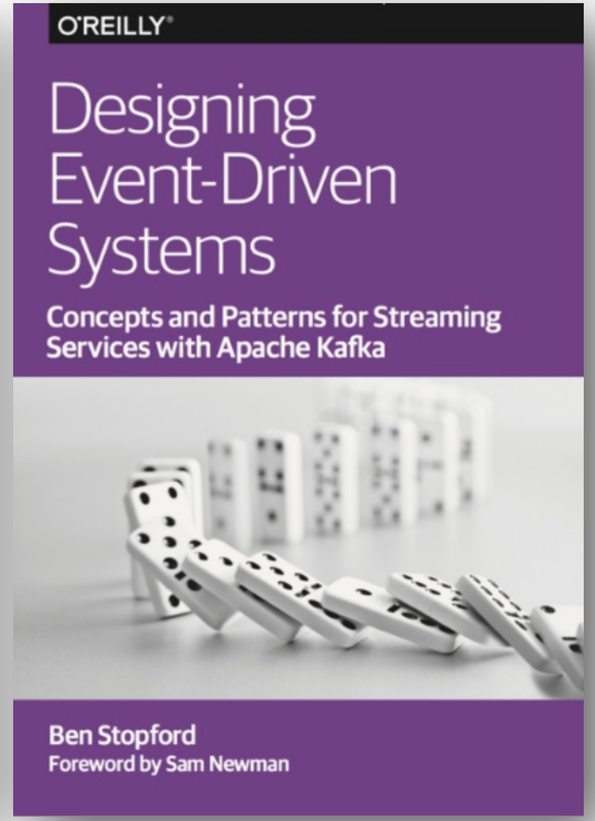
# Free Books!

**https://rmoff.dev/budapestdata**



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