Big Data Patterns

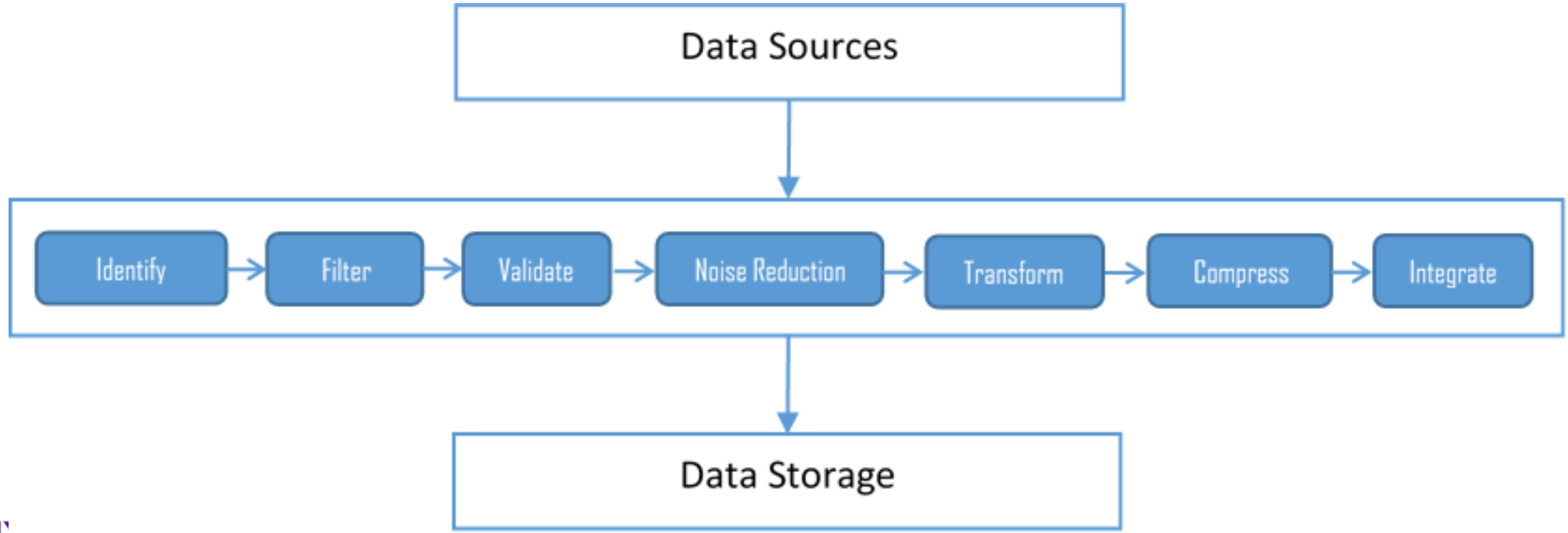
Design patterns for big data

- reduce complexity
- boost performance
- improve results for new and larger forms of data

- reference: https://www.packtpub.com/application-development/architectural-patterns

Data sources and ingestion layer

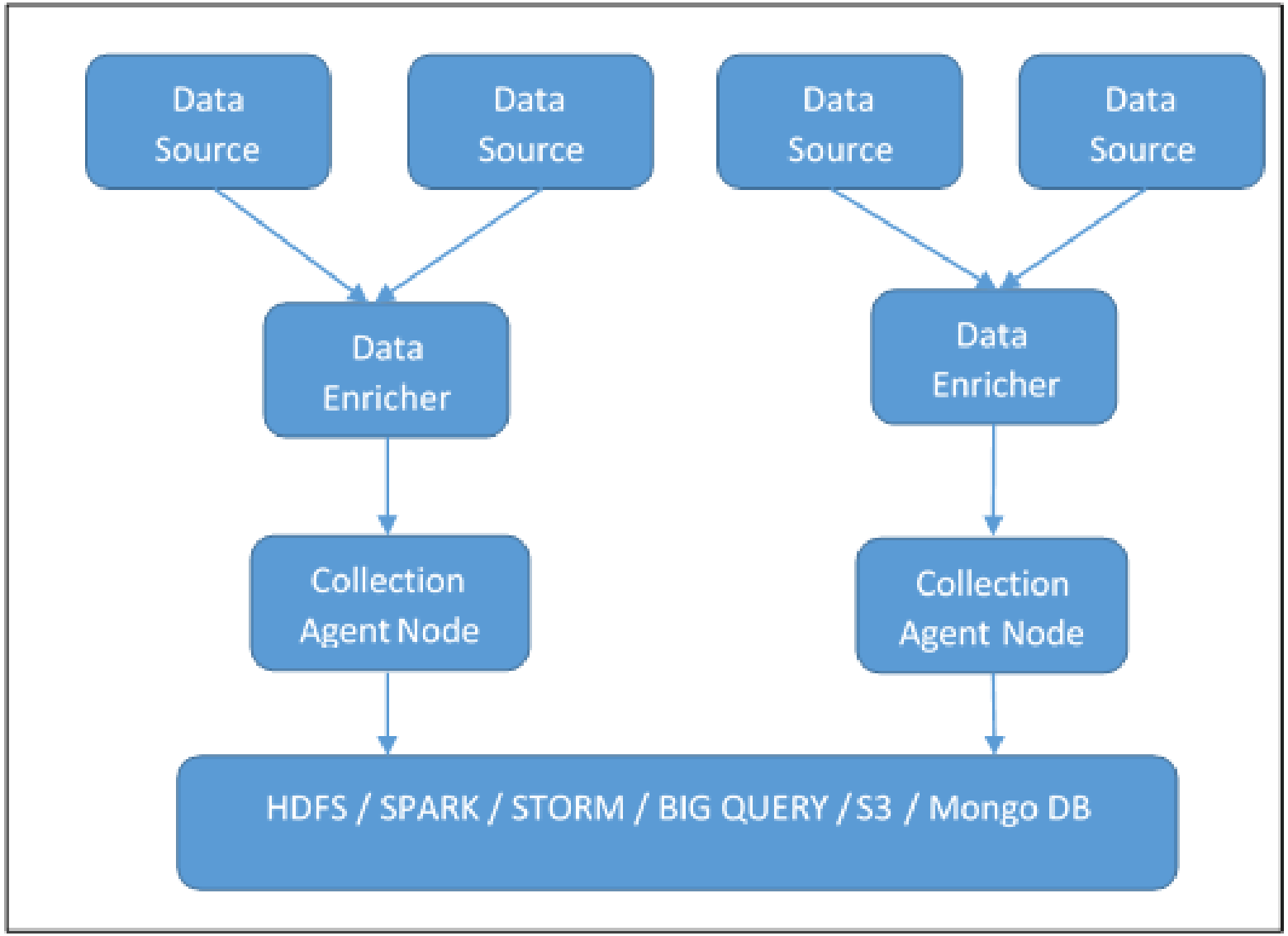
- Multiple data source load and prioritization
- Ingested data indexing and tagging
- Data validation and cleansing
- Data transformation and compression

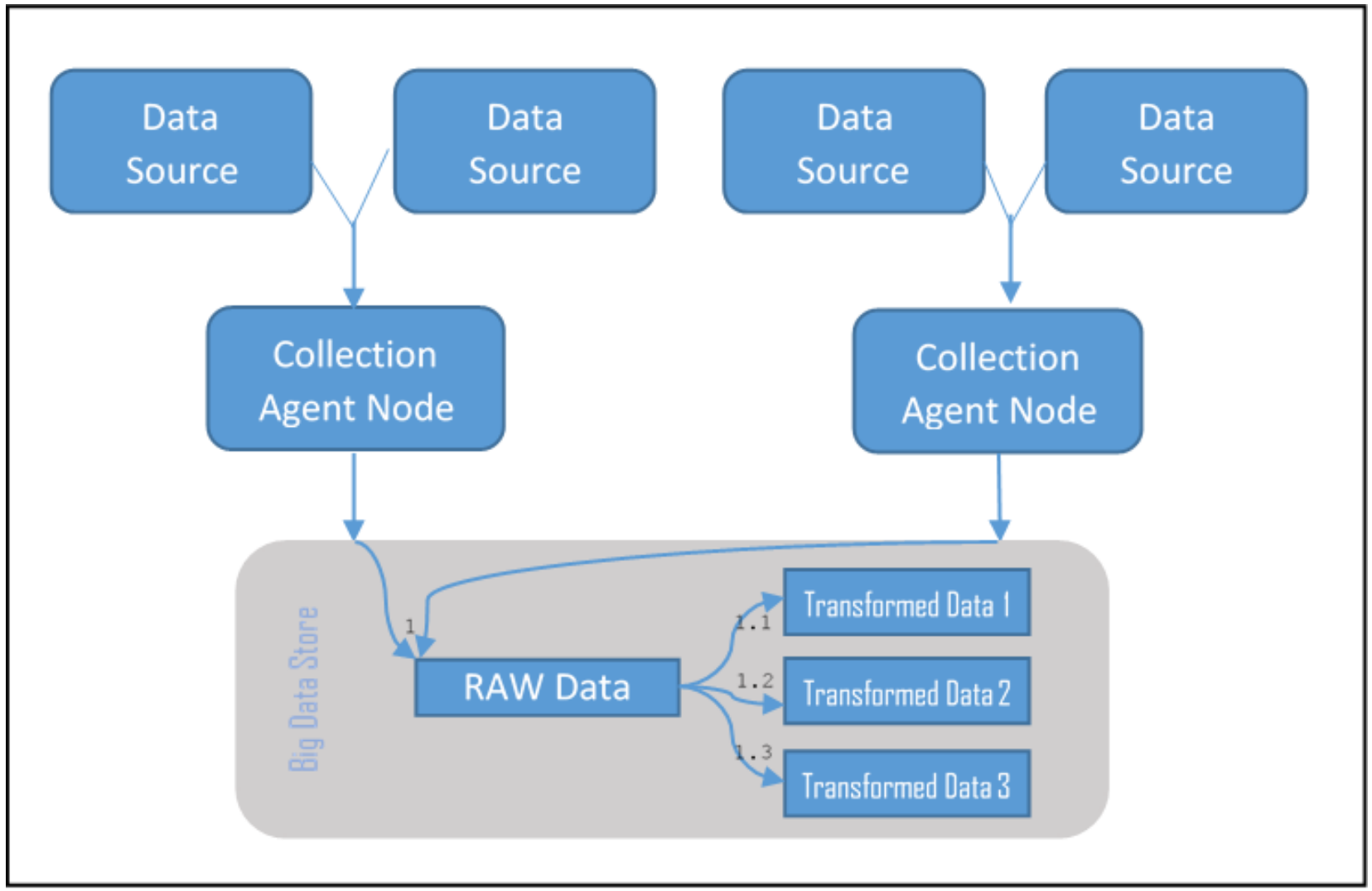


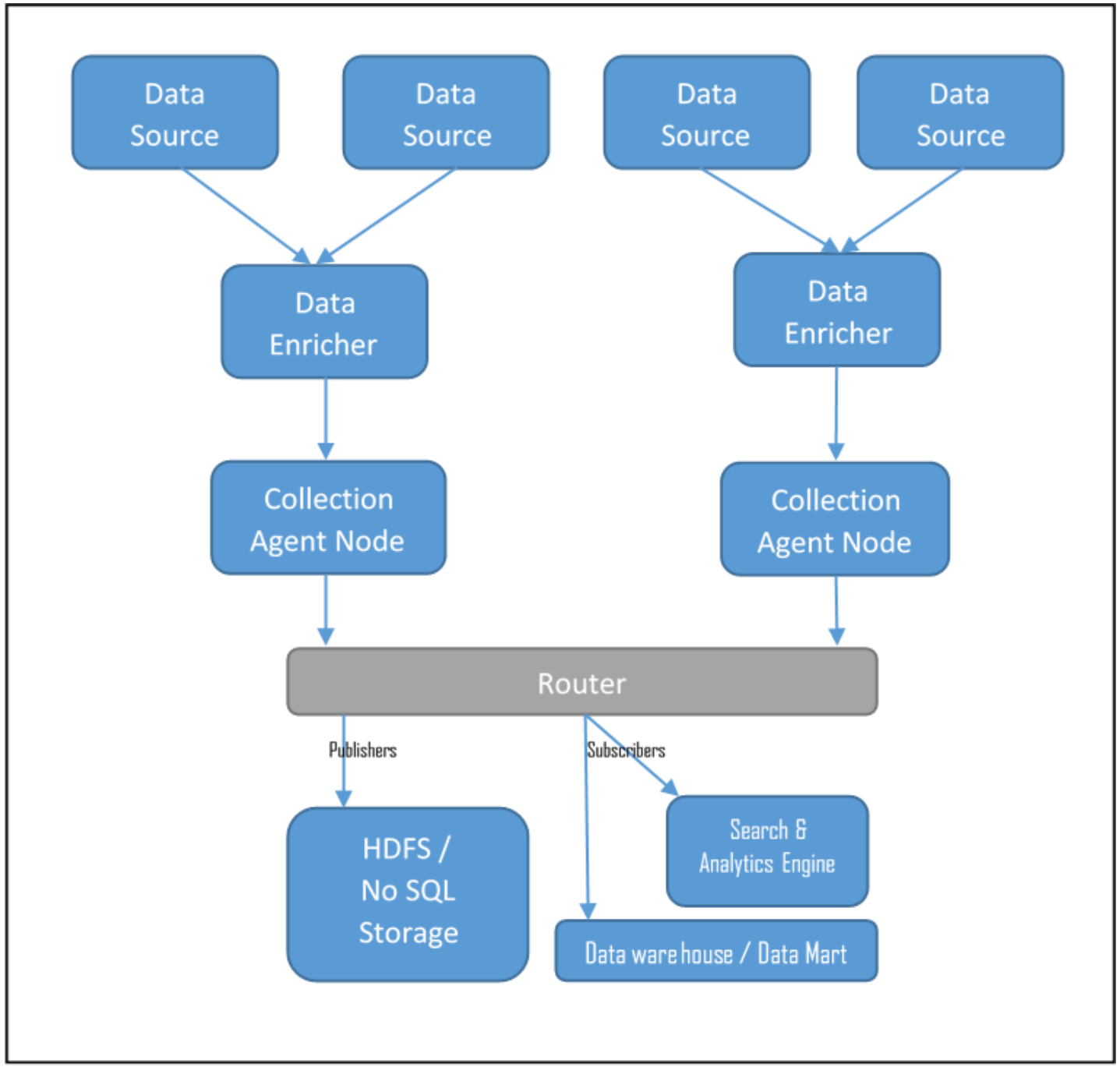
Ingestion and streaming patterns

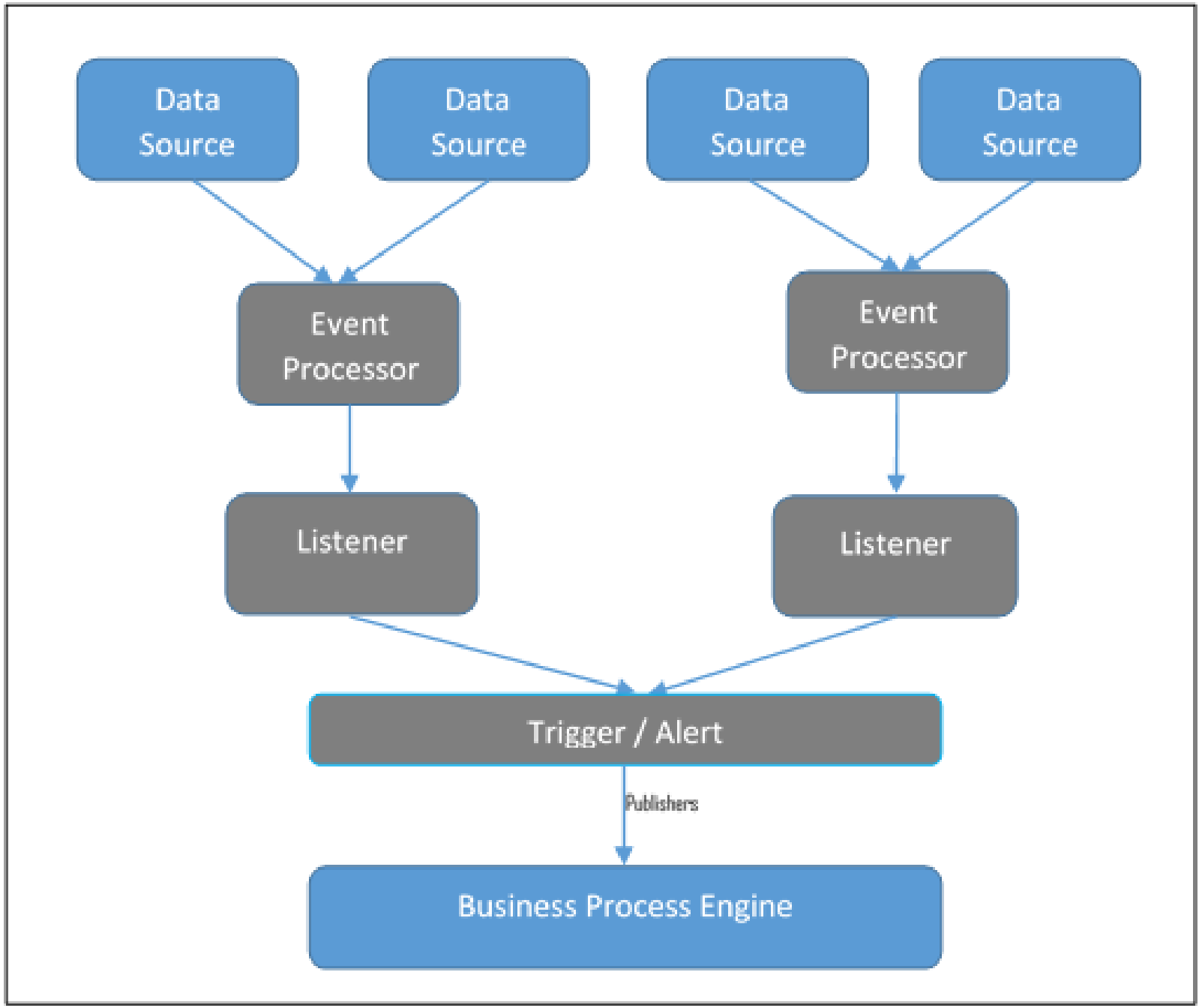
- Multisource extractor
- Multidestination
- Protocol converter
- **Just-in-time** (**JIT**) transformation
- Real-time streaming pattern

Multisource extractor



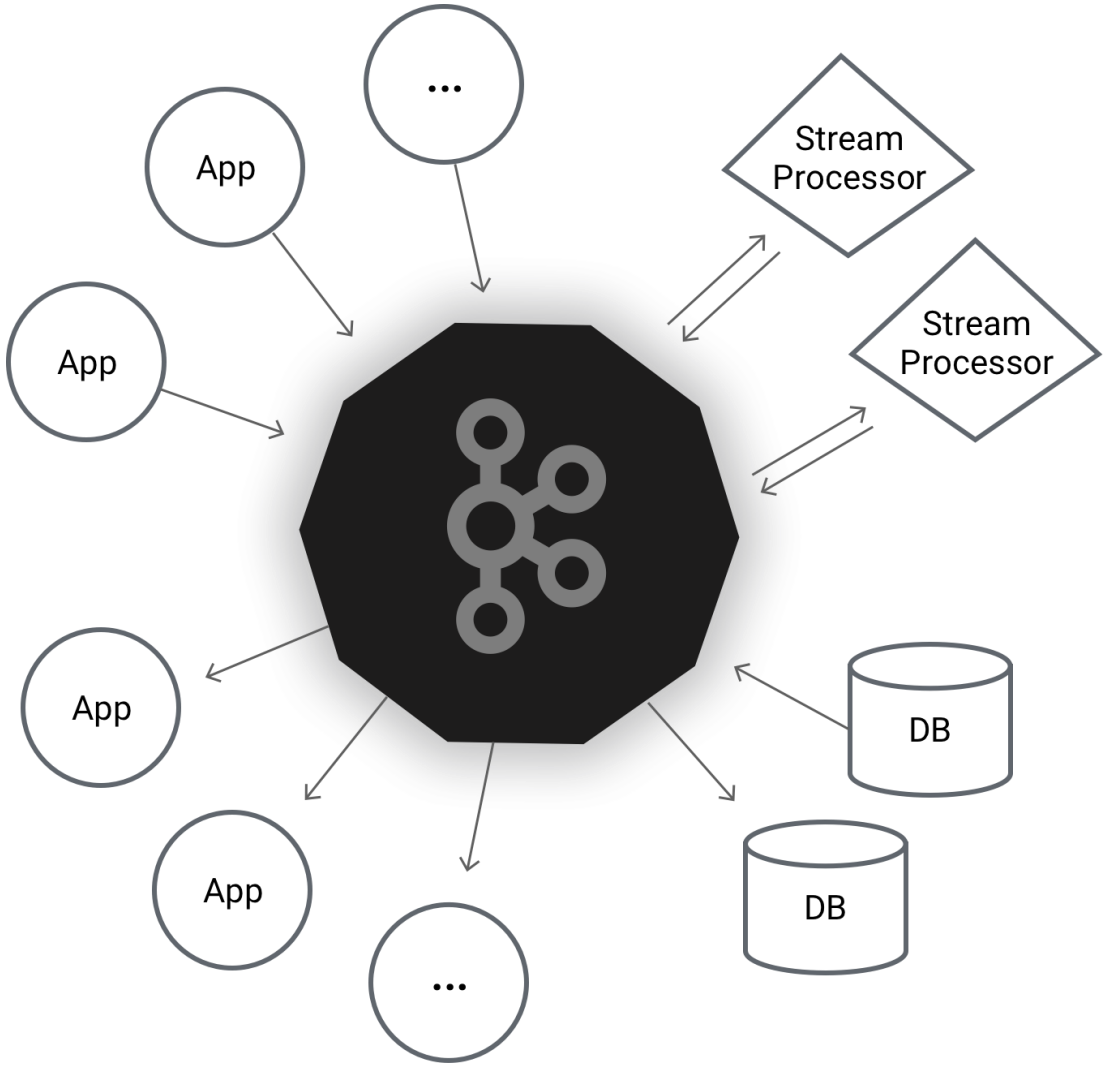

Data Source
Data Source
Data Source
Data Source
Collection Agent Node
Collection Agent Node
Big Data Store
1
RAW Data
1.1
Transformed Data 1
1.2
Transformed Data 2
1.3
Transformed Data 3


Data Source
Data Source
Data Source
Data Source
Data Enricher
Data Enricher
Collection Agent Node
Collection Agent Node
Router
Publishers
Subscribers
HDFS / No SQL Storage
Search & Analytics Engine
Data ware house / Data Mart


Data Source
Data Source
Data Source
Data Source
Event Processor
Event Processor
Listener
Listener
Trigger / Alert
Publishers
Business Process Engine

Real World Examples

https://kafka.apache.org/



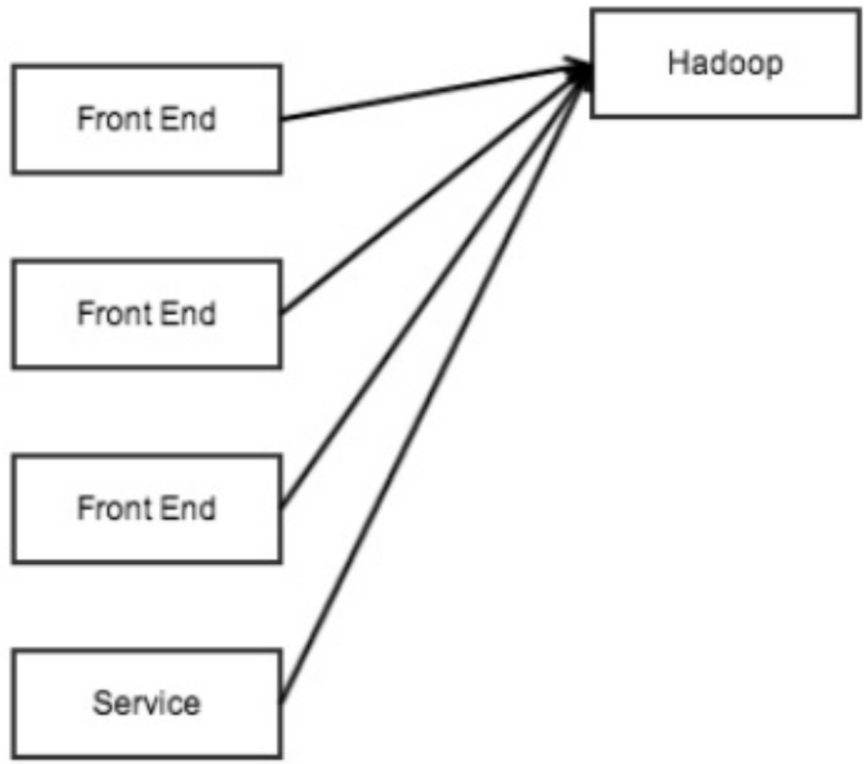
Apache Kafka

- What, Why, How of Apache Kafka
  - Producers, Brokers, Consumers, Topics and Partitions
- Get up and running - Quick Start
- Existing Integrations & Client Libraries
- Developing Producers
- Developing Consumers

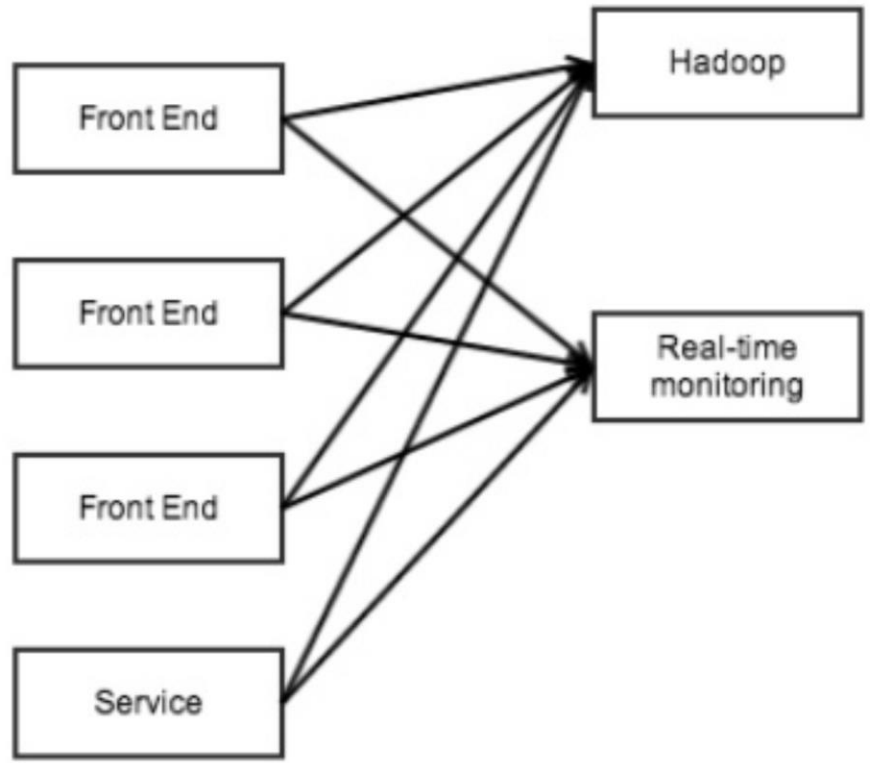
Source: Joe Stein, http://allthingshadoop.com

It often starts with just one data pipeline

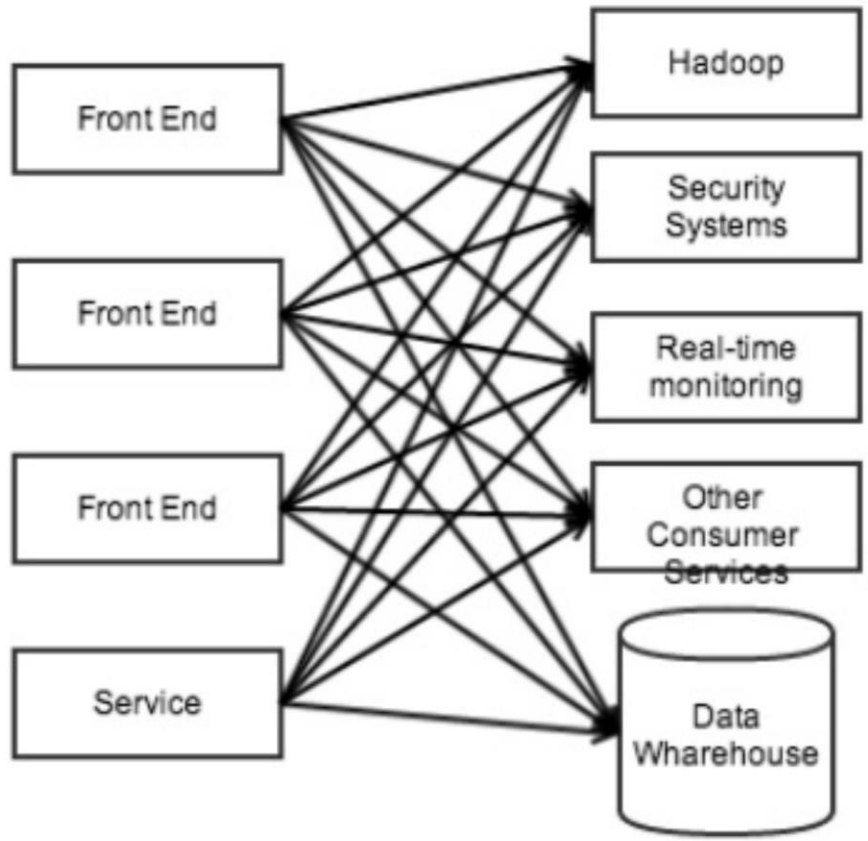
Reuse of data pipelines for new providers



Reuse of existing providers for new consumers

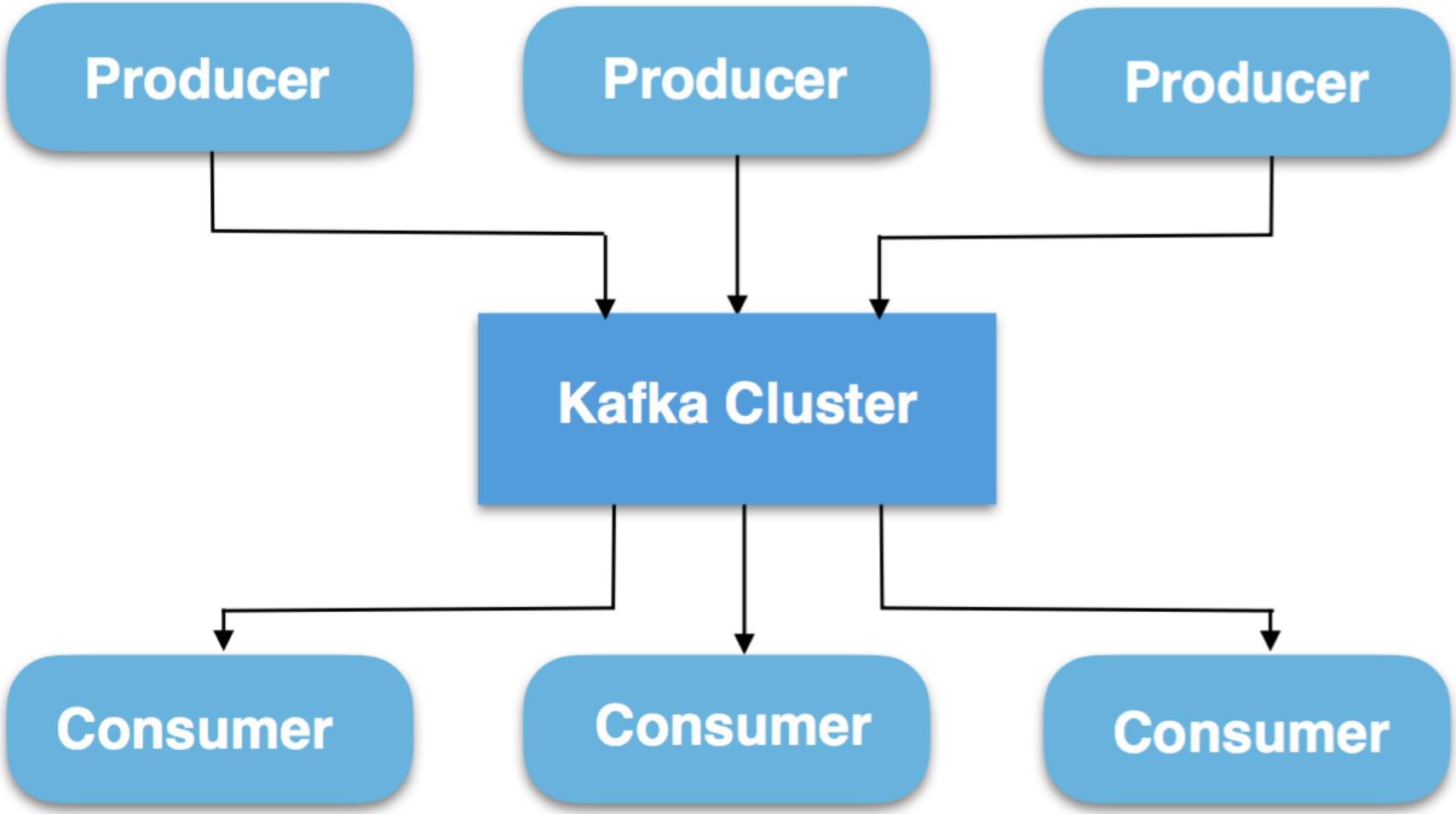


Eventually the solution becomes the problem



Apache Kafka

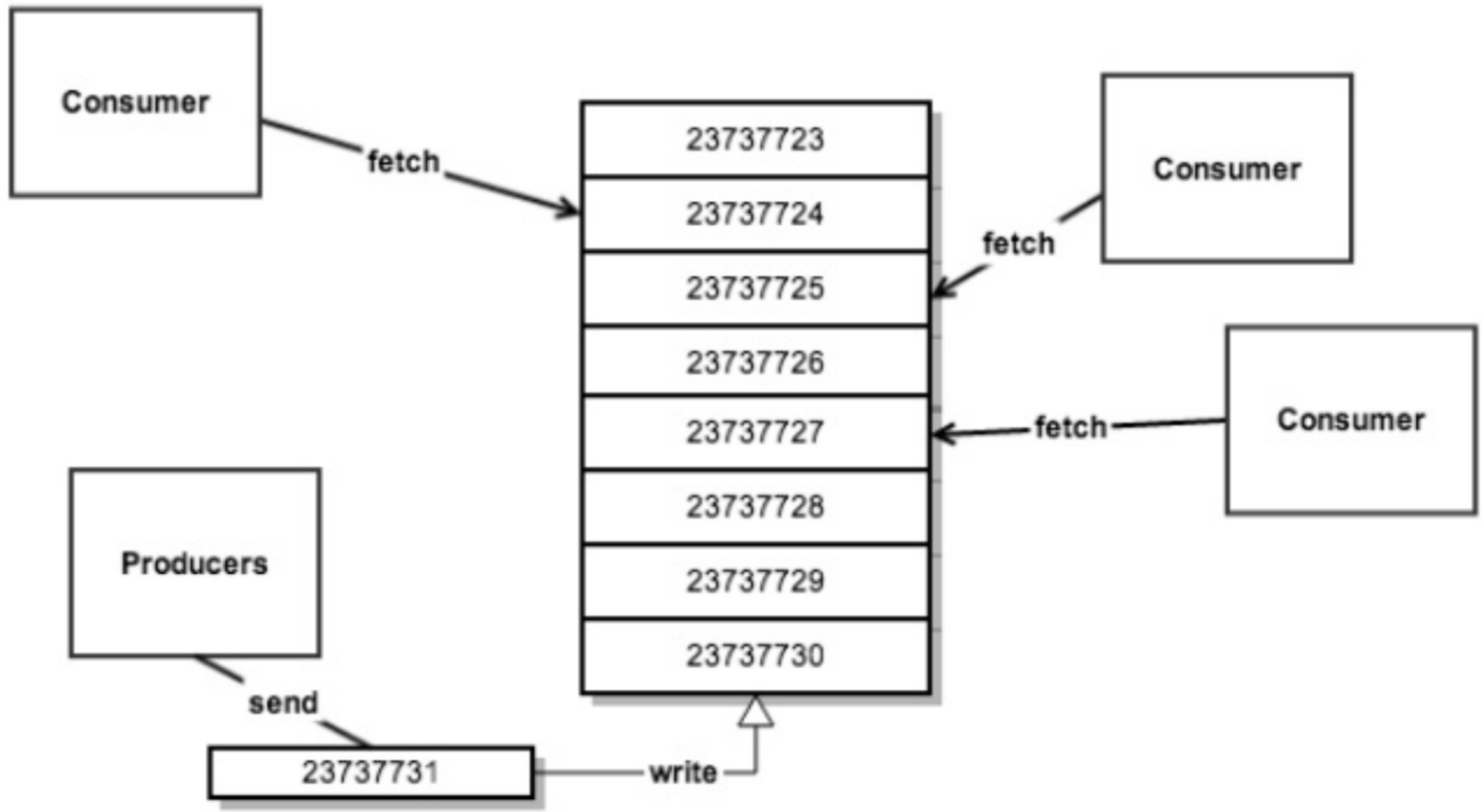
- Decouple the data pipeline
- Messaging System
  - Queues (Topics)
  - Writers (Producers)
  - Readers (Consumers)



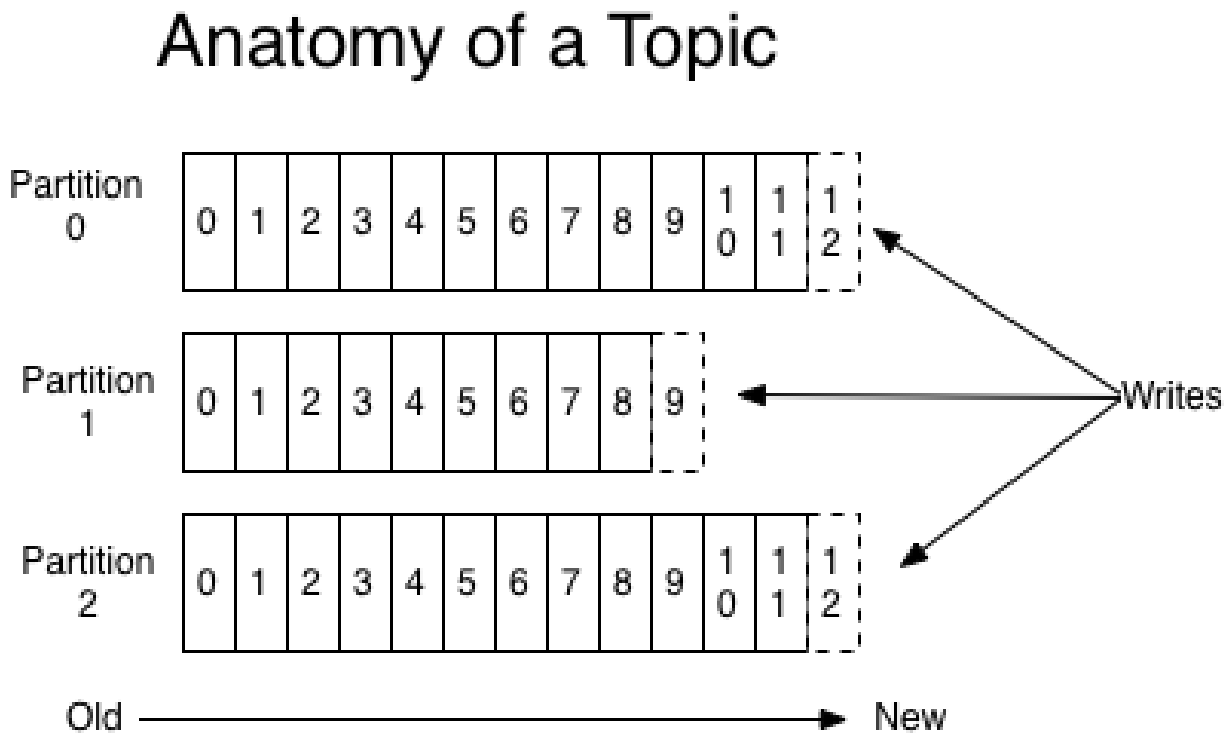
How does Kafka do this?

- Producers - ** push **
  - Batching
  - Compression
  - Sync (Ack), Async (auto batch)
  - Replication
  - Sequential writes, guaranteed ordering within each partition
- Consumers - ** pull **
  - No state held by broker
  - Consumers control reading from the stream
- Zero Copy for producers and consumers to and from the broker http://kafka.apache.org/documentation.html#maximizingefficiency
- Message stay on disk when consumed, deletes on TTL with compaction

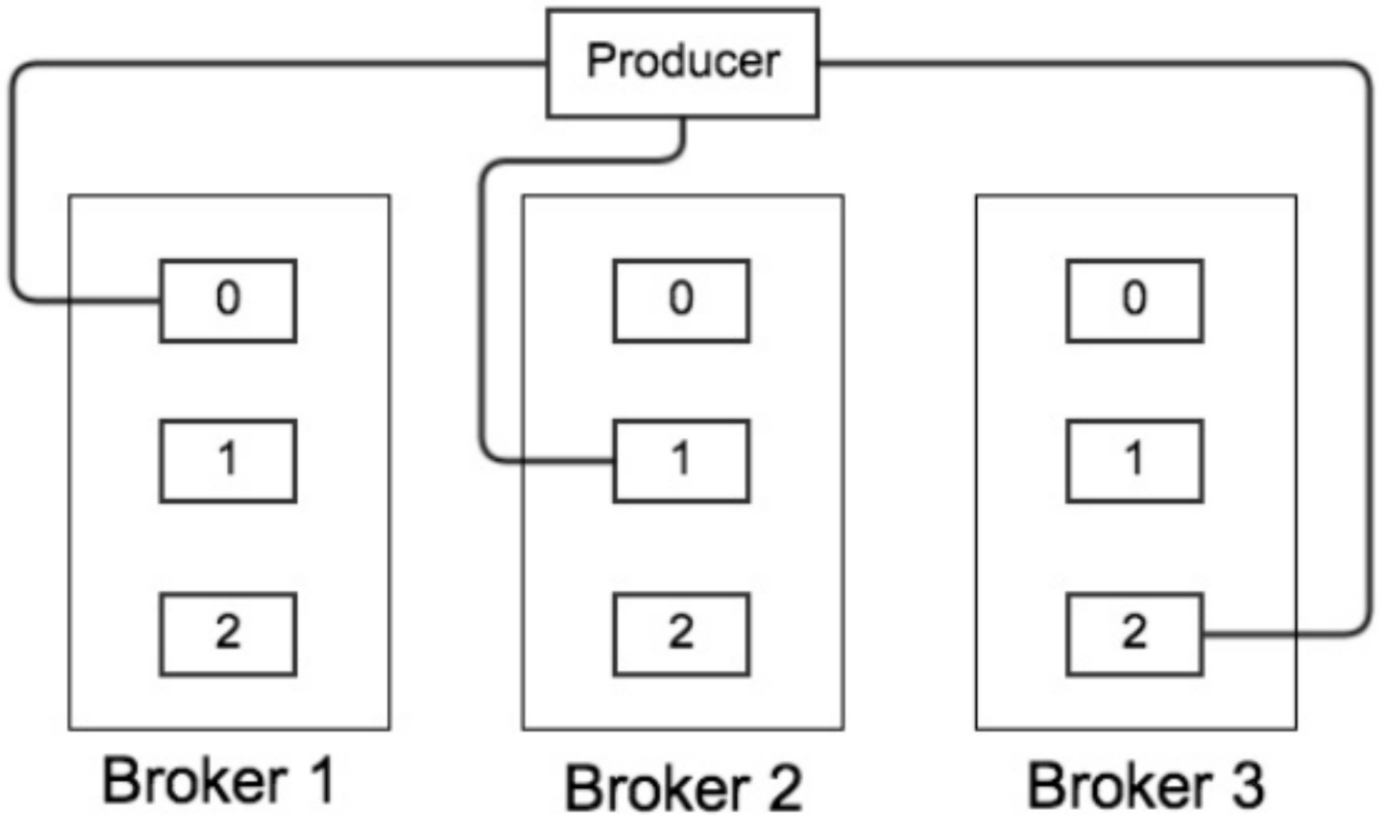
A high-throughput distributed messaging system rethought as a distributed commit log.



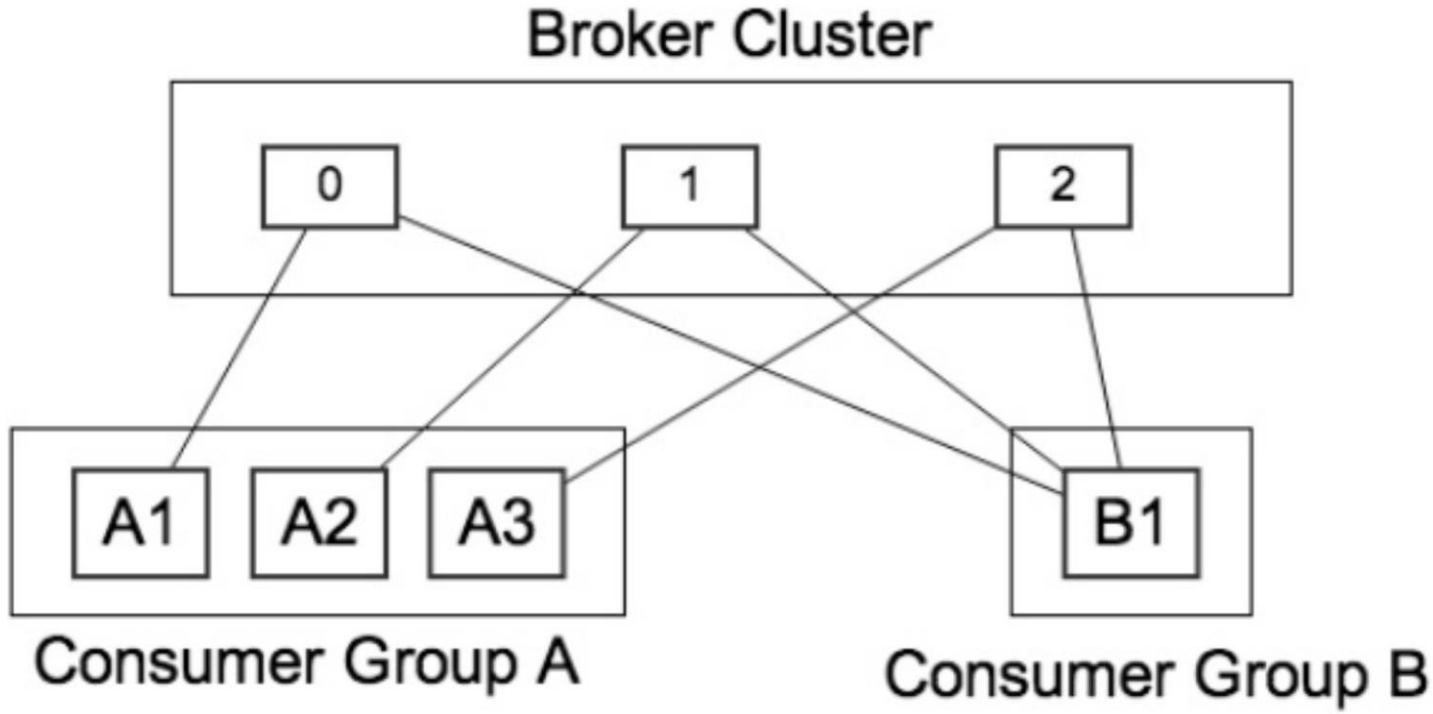
Apache Kafka



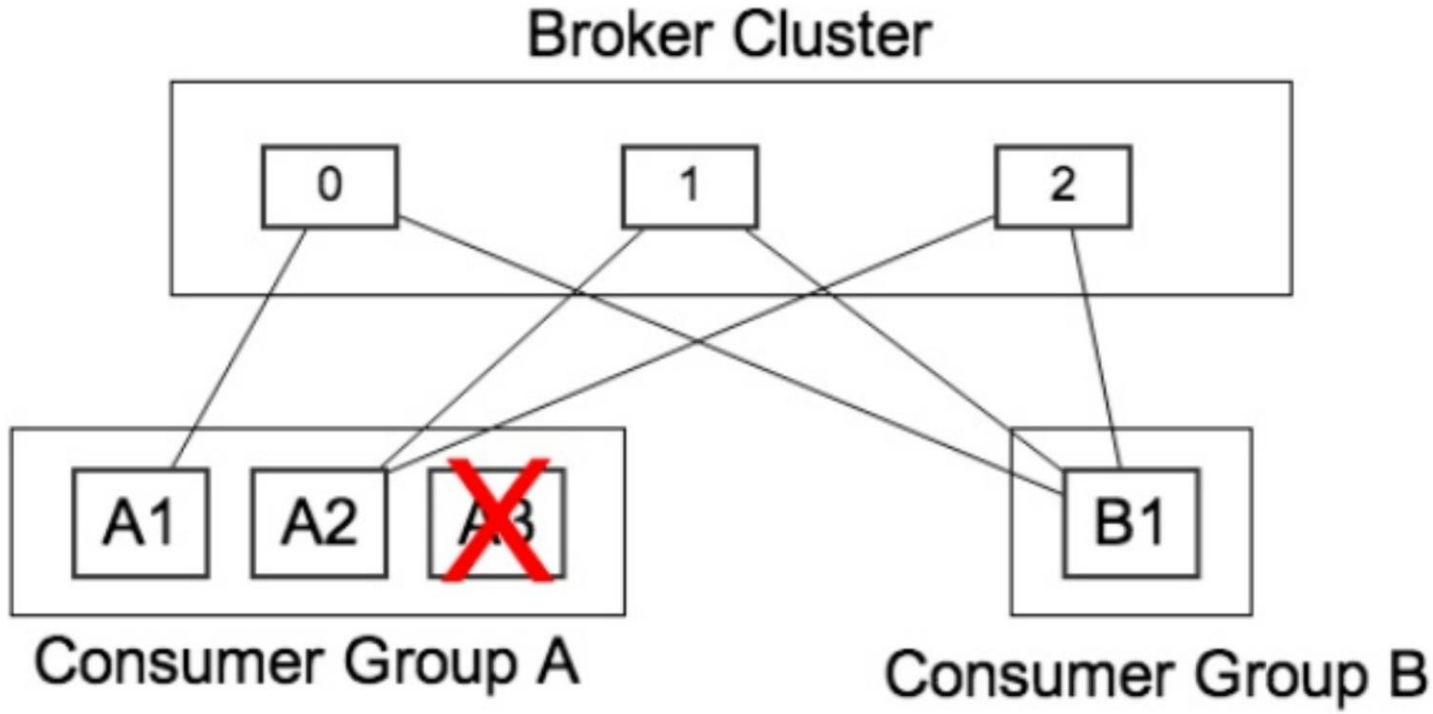
Brokers load balance producers by partition



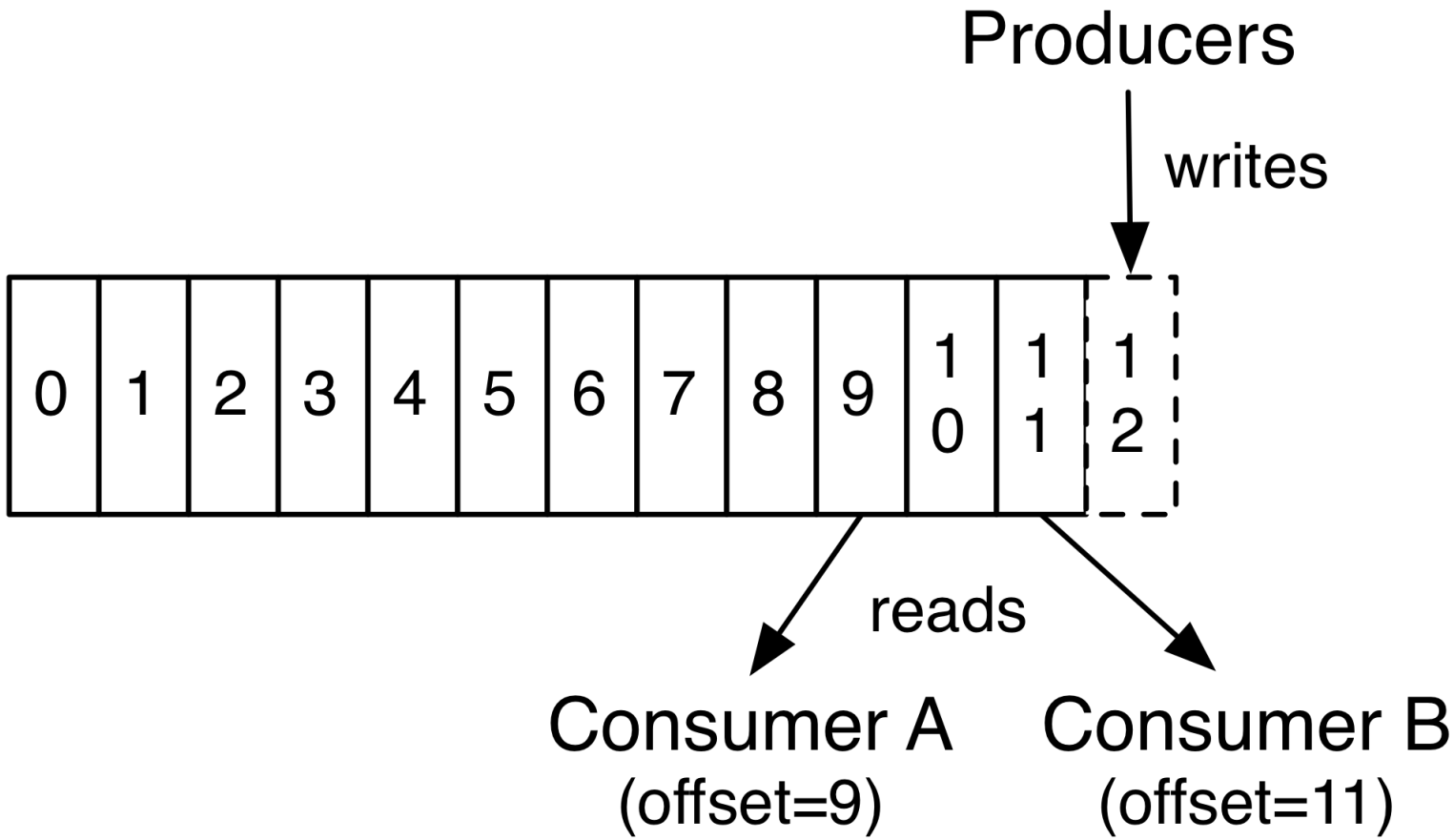
Consumer group provide isolation to topics and partitions



Consumer rebalance themselves for partitions



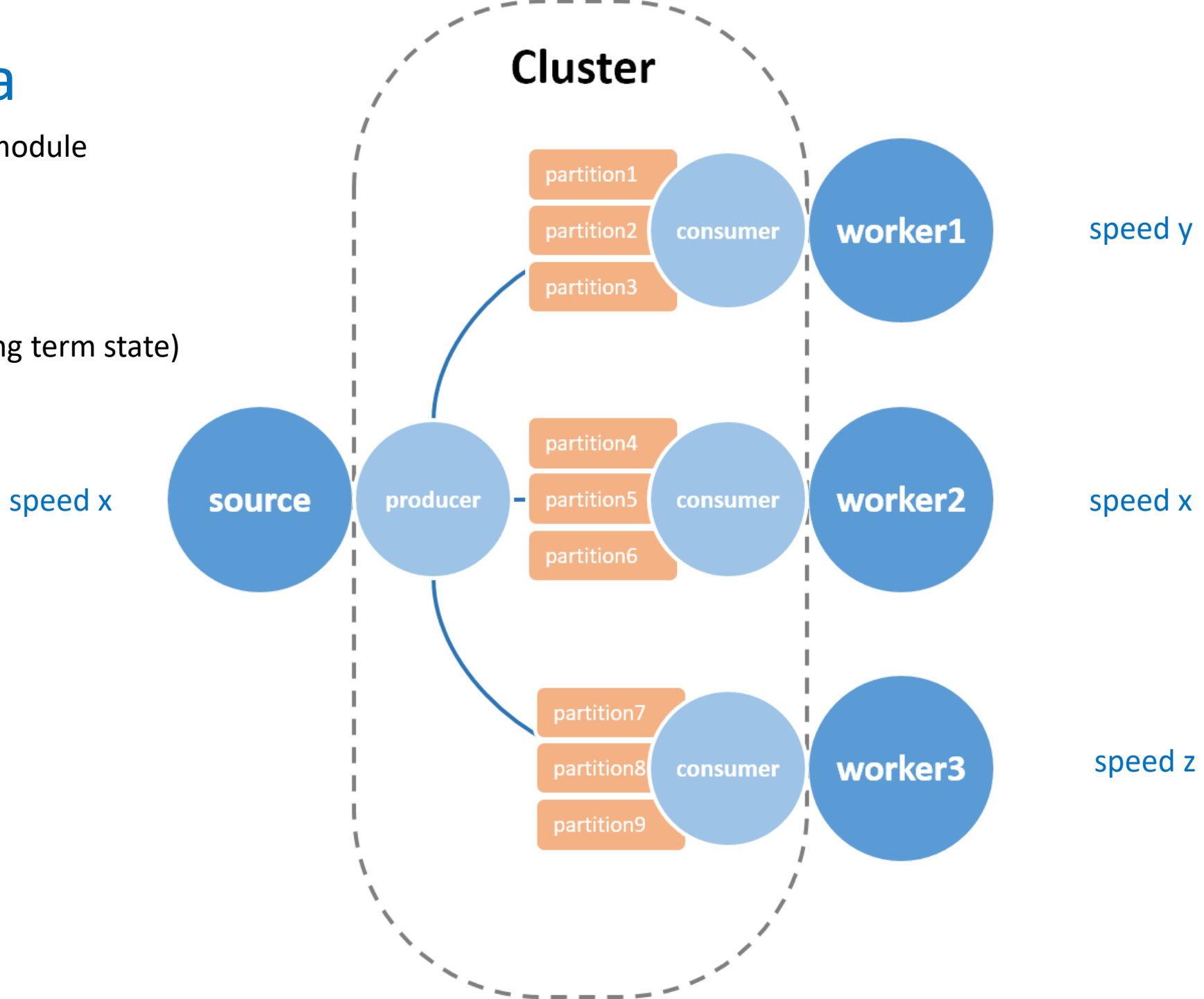
Apache Kafka



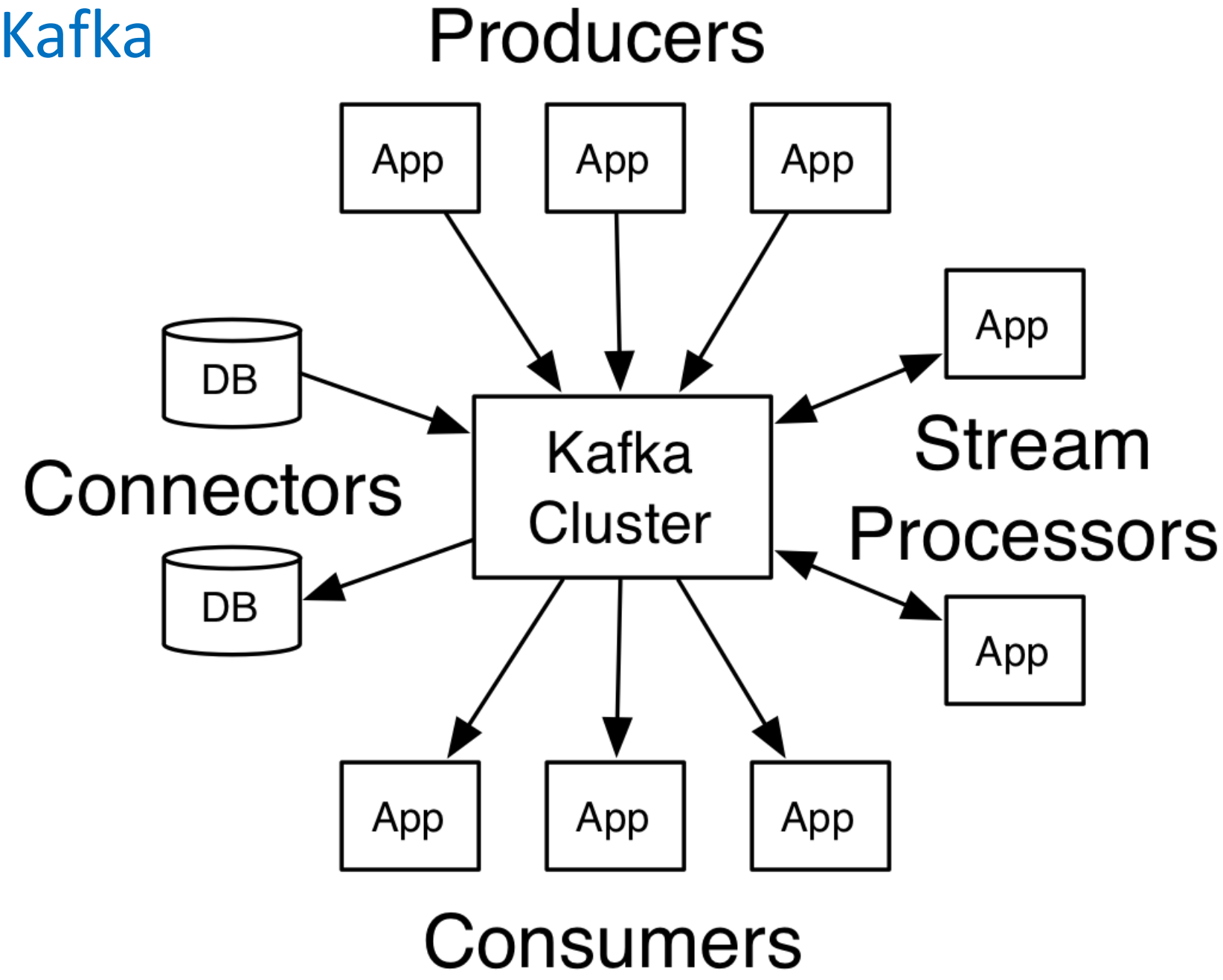
Apache Kafka

- Decoupling - remove module dependencies
- Asynchronous

x <= y,z in most cases (long term state)



Apache Kafka



Existing Integrations

https://cwiki.apache.org/confluence/display/KAFKA/Ecosystem

- log4j Appender
- Apache Storm
- Apache Camel
- Apache Samza
- Apache Hadoop
- Apache Flume
- Camus
- AWS S3
- Rieman
- Sematext
- Dropwizard
- LogStash
- Fluent

Client Libraries

Community Clients https://cwiki.apache.org/confluence/display/KAFKA/Clients

- Python - Pure Python implementation with full protocol support. Consumer and Producer implementations included, GZIP and Snappy compression supported.
- C - High performance C library with full protocol support
- C++ - Native C++ library with protocol support for Metadata, Produce, Fetch, and Offset.
- Go (aka golang) Pure Go implementation with full protocol support. Consumer and Producer implementations included, GZIP and Snappy compression supported.
- Ruby - Pure Ruby, Consumer and Producer implementations included, GZIP and Snappy compression supported. Ruby 1.9.3 and up (CI runs MRI 2.
- Clojure - Clojure DSL for the Kafka API
- JavaScript (NodeJS) - NodeJS client in a pure JavaScript implementation

Wire Protocol Developers Guide
https://cwiki.apache.org/confluence/display/KAFKA/A+Guide+To+The+Kafka+Protocol

Developing Producers

https://github.com/stealthly/scala-kafka/blob/master/src/test/scala/KafkaSpec.scala

```
val producer = new KafkaProducer(“test-topic”,"192.168.86.10:9092")
producer.send(“hello distributed commit log”)
```

Producers

https://github.com/stealthly/scala-kafka/blob/master/src/main/scala/KafkaProducer.scala

```
case class KafkaProducer(
  topic: String,
  brokerList: String,
  /** brokerList - This is for bootstrapping and the producer will only use it for getting metadata (topics, partitions and replicas). The socket connections for sending the actual data will be established based on the broker information returned in the metadata. The format is host1:port1,host2:port2, and the list can be a subset of brokers or a VIP pointing to a  subset of brokers.
  */
```

Producer

```
clientId: String = UUID.randomUUID().toString,
  /** clientId - The client id is a user-specified string sent in each request to help trace calls. It should logically identify  the application making the request. */
  synchronously: Boolean = true,
  /** synchronously - This parameter specifies whether the messages are sent asynchronously in a background thread. Valid values are false for asynchronous send and true for synchronous send. By setting the producer to async we allow batching together of requests (which is great for throughput) but open the possibility of a failure of the client machine dropping unsent data.*/
```

Producer

compress: Boolean = true,

/** compress -This parameter allows you to specify the compression codec for all data generated by this producer. When set to true gzip is used. To override and use snappy you need to implement that as the default codec for compression using SnappyCompressionCodec.codec instead of DefaultCompressionCodec.codec below. */

batchSize: Integer = 200,

/** batchSize -The number of messages to send in one batch when using async mode. The producer will wait until either this number of messages are ready to send or queue.buffer.max.ms is reached.*/

Producer

messageSendMaxRetries: Integer = 3,

/** messageSendMaxRetries - This property will cause the producer to automatically retry a failed send request. This property specifies the number of retries when such failures occur. Note that setting a non-zero value here can lead to duplicates in the case of network errors that cause a message to be sent but the acknowledgement to be lost.*/

Producer

requestRequiredAcks: Integer = -1

/** requestRequiredAcks

0) which means that the producer never waits for an acknowledgement from the broker (the same behavior as 0.7). This option provides the lowest latency but the weakest durability guarantees (some data will be lost when a server fails).

1) which means that the producer gets an acknowledgement after the leader replica has received the data. This option provides better durability as the client waits until the server acknowledges the request as successful (only messages that were written to the now-dead leader but not yet replicated will be lost).

-1) which means that the producer gets an acknowledgement after all in-sync replicas have received the data. This option provides the best durability, we guarantee that no messages will be lost as long as at least one in sync replica remains.*/

High Level Consumer

https://github.com/stealthly/scala-kafka/blob/master/src/main/scala/KafkaConsumer.scala

```
class KafkaConsumer(
  topic: String,
  /** topic - The high-level API hides the details of brokers from the consumer and allows consuming off the cluster of machines without concern for the underlying topology. It also maintains the state of what has been consumed. The high-level API also provides the ability to subscribe to topics that match a filter expression (i.e., either a whitelist or a blacklist regular expression).*/
```

High Level Consumer

groupId: String,

/** groupId - A string that uniquely identifies the group of consumer processes to which this consumer belongs. By setting the same group id multiple processes indicate that they are all part of the same consumer group.*/

zookeeperConnect: String,

/** zookeeperConnect - Specifies the zookeeper connection string in the form hostname:port where host and port are the host and port of a zookeeper server. To allow connecting through other zookeeper nodes when that zookeeper machine is down you can also specify multiple hosts in the form hostname1: port1,hostname2:port2,hostname3:port3. The server may also have a zookeeper chroot path as part of it's zookeeper connection string which puts its data under some path in the global zookeeper namespace. */

Simple Consumer

https://cwiki.apache.org/confluence/display/KAFKA/0.8.0+SimpleConsumer+Example

https://github.com/apache/kafka/blob/0.8/core/src/main/scala/kafka/tools/SimpleConsumerShell.scala

```
val fetchRequest = fetchRequestBuilder
                .addFetch(topic, partitionId, offset, fetchSize)
                .build()
```

Apache Kafka

Tutorial – Docker based

https://docs.confluent.io/current/quickstart/ce-docker-quickstart.html