REAL WORLD

AKKA STREAM

About Me

知乎
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罗辑　*Search Tech Lead*

Fall in love with scala since 2014

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Agenda

- Reactive Streams
- Akka Stream
- Akka Stream in Action
- Demo!

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What is a stream?

1. Ephemeral flow of data

2. Possibly unbounded in size

3. Focused on describing transformation

4. Can be formed into processing networks

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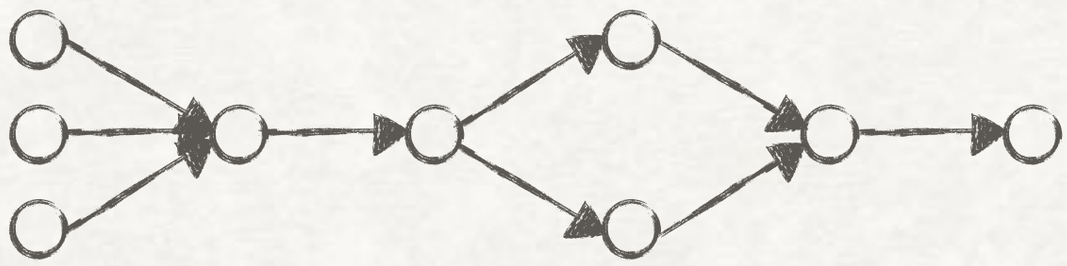

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Reactive Streams

“

Reactive Streams is an initiative to provide a standard for asynchronous stream processing with non-blocking back pressure.

http://www.reactive-streams.org

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”

Reactive Streams API

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```
trait Publisher[T] {
  def subscribe(sub: Subscriber[T]): Unit
}

trait Subscription {
  def request(n: Int): Unit
  def cancel(): Unit
}

trait Subscriber[T] {
  def onSubscribe(s: Subscription): Unit
  def onNext(e: T): Unit
  def onError(t: Throwable): Unit
  def onComplete(): Unit
}
```

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Reactive Streams Implementations

rxjava @Netflix

reactor @SpringSource

vert.x @RedHat

akka-stream @Lightbend(Typesafe)

“

Reactive Streams is an initiative to provide a standard for asynchronous stream processing with non-blocking **back pressure**.

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Problem?

Reactive Streams

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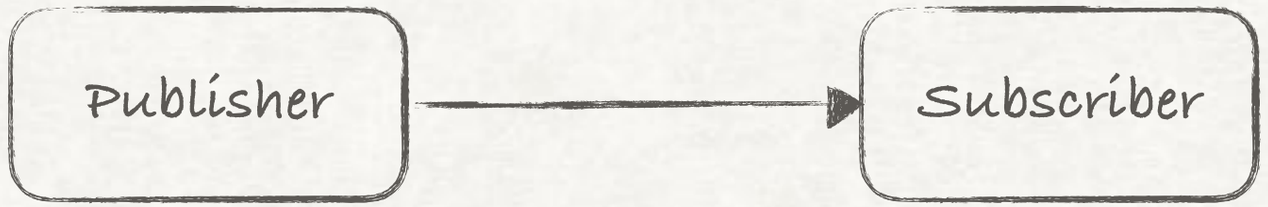

Reactive Streams

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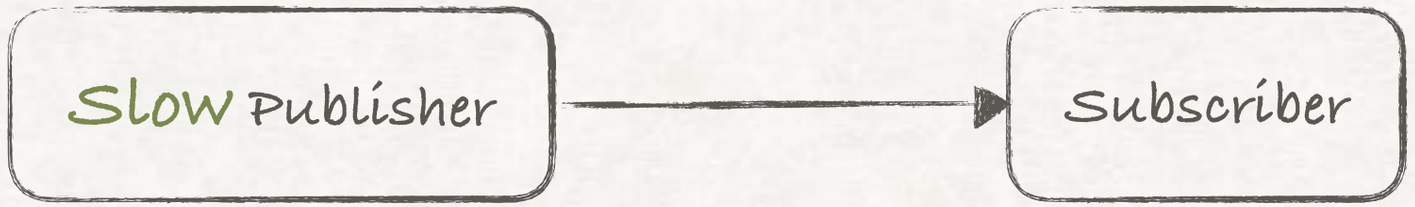

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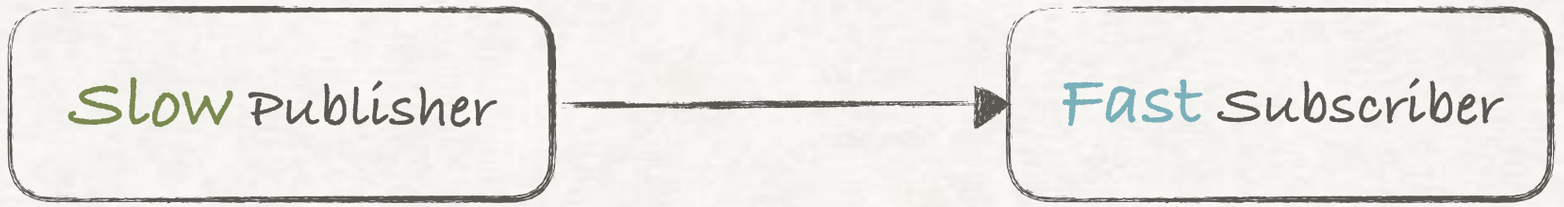

Reactive Streams

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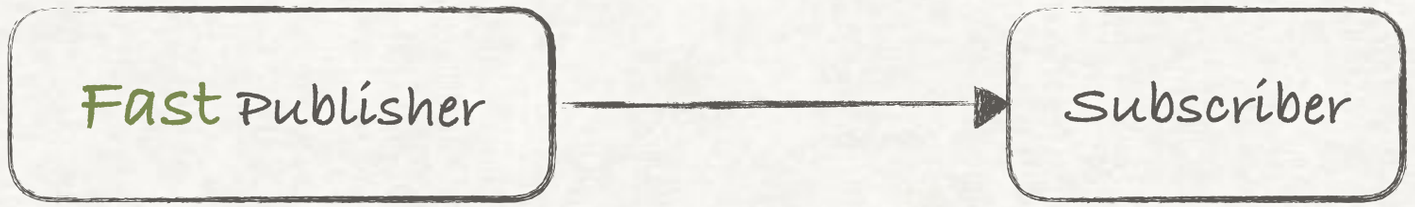

Reactive Streams

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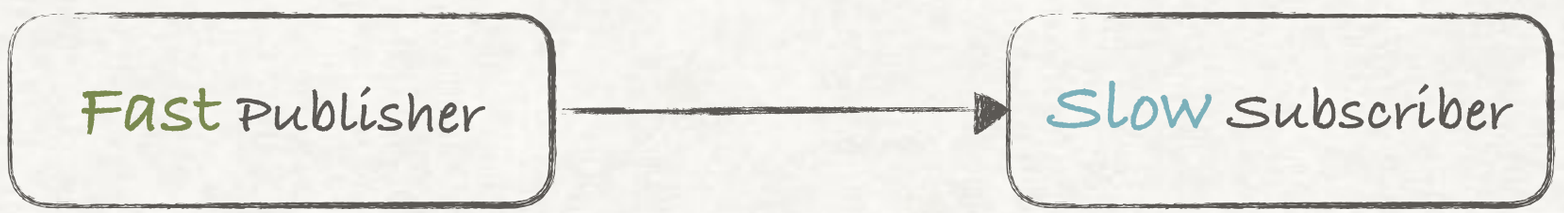
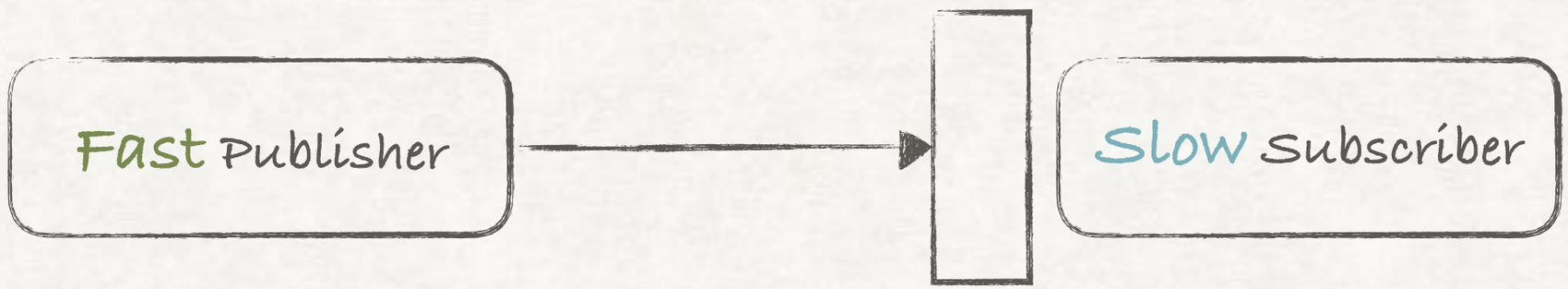


Use bounded buffer



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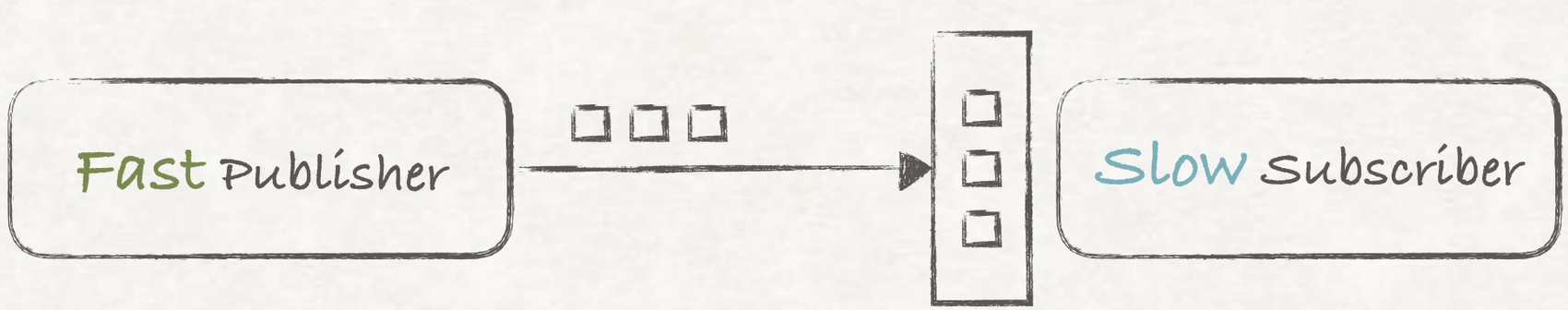
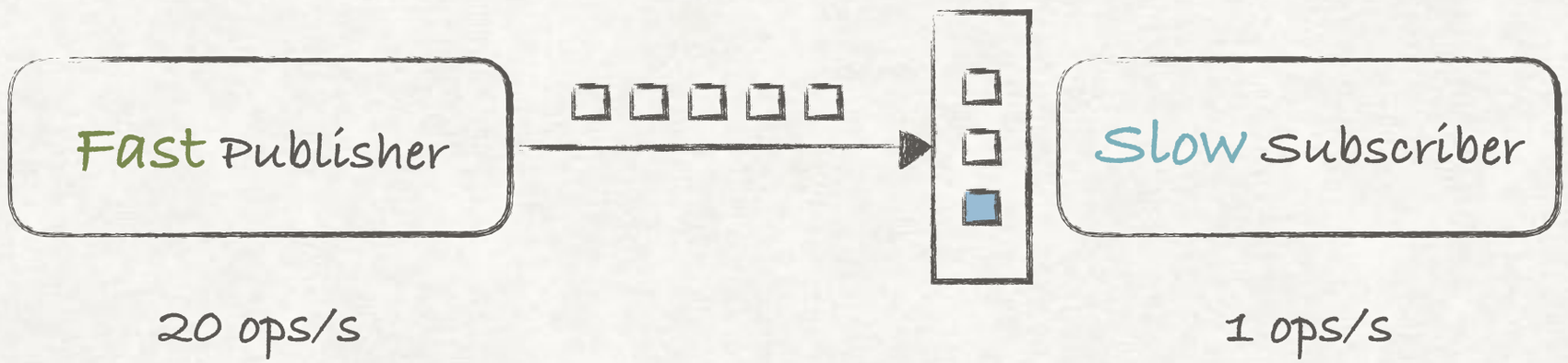
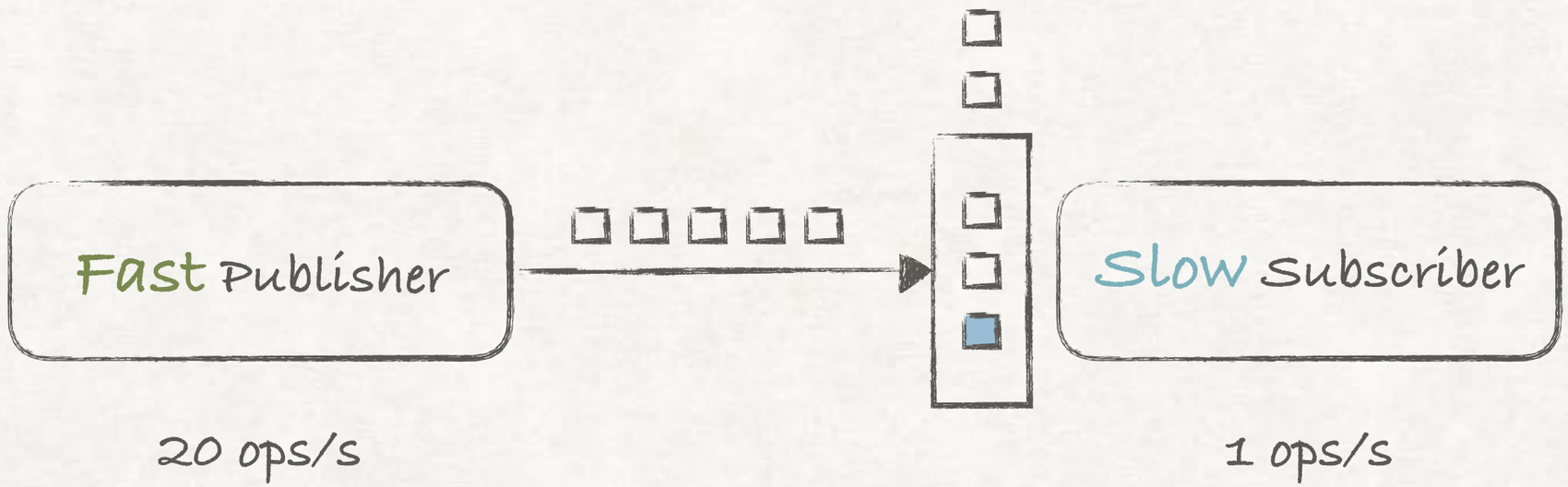


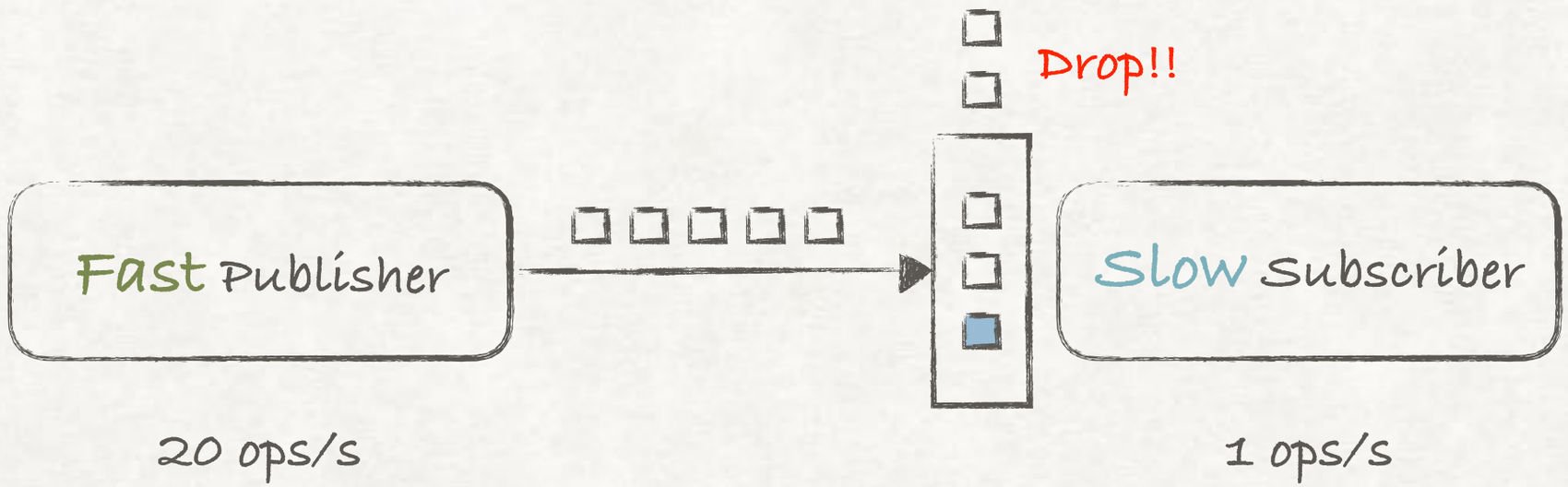
Use bounded buffer



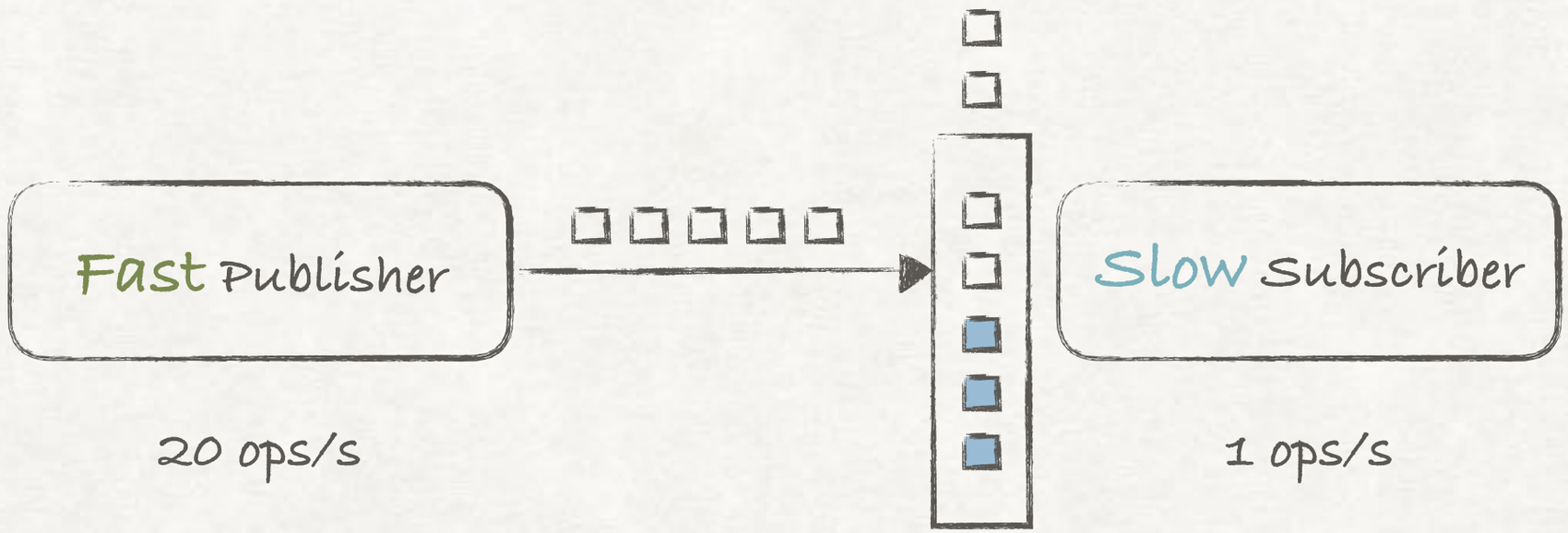
Use bounded buffer



Use bounded buffer



Increase buffer size until memory exhausted…



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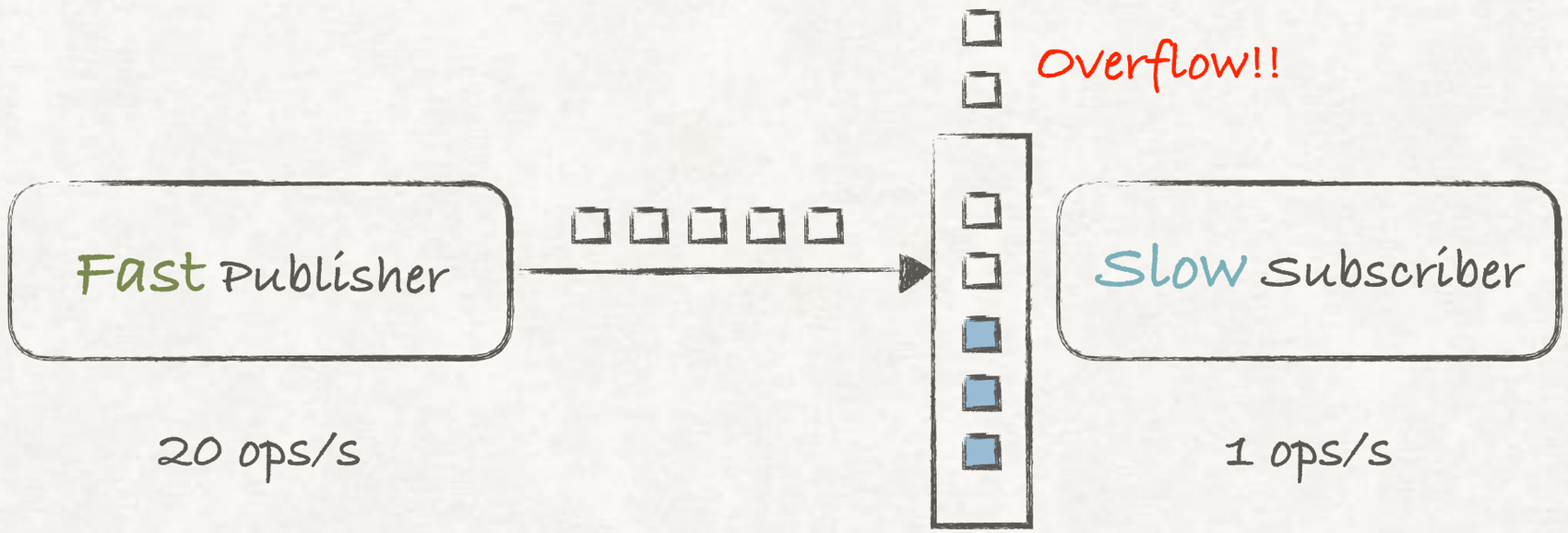

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What is back pressure?

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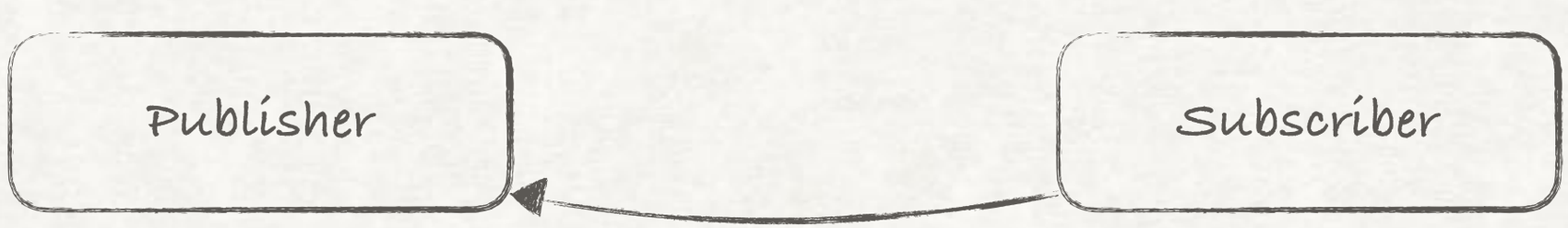
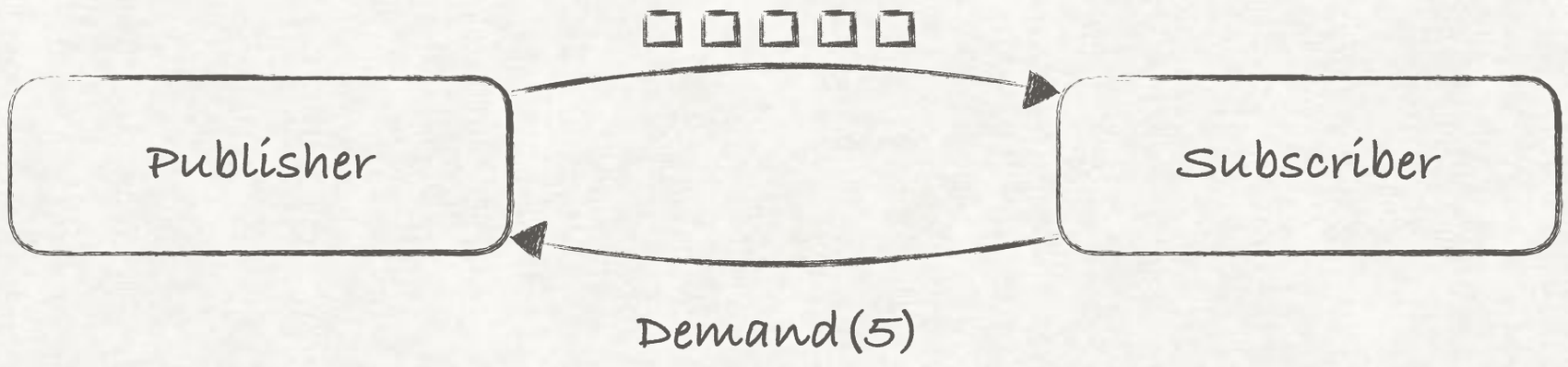
Back pressure = Dynamic push/pull

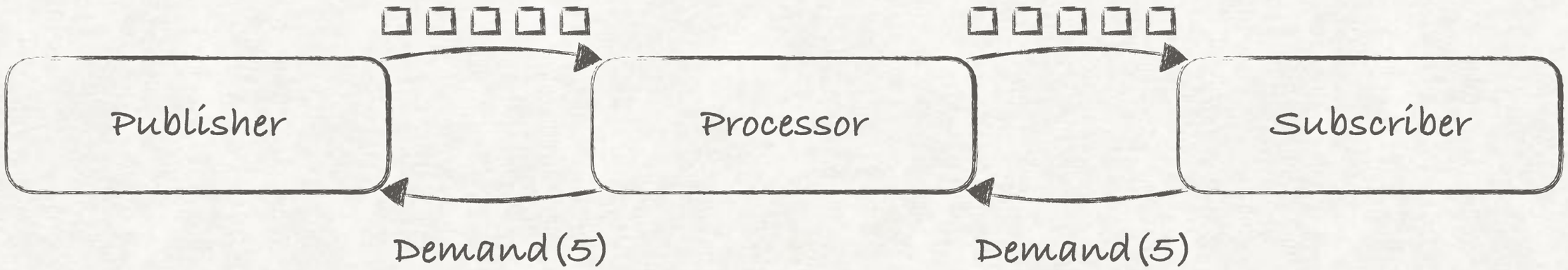
Subscriber demands 5 elements



Publisher sends at-most 5 elements.



Back pressure is **contagious**



Back pressure is **contagious**

Subscriber is slow ~> **Processor** must slow down ~> **Publisher** must slow down

Publisher back pressure strategies

Publisher back pressure strategies

1. Not generate elements, if it is able to **control** their production rate

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2. Try **buffering** the elements in a bounded manner until more demand is signaled

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3. **Drop** elements until more demand is signaled

Publisher back pressure strategies

1. Not generate elements, if it is able to **control** their production rate

2. Try **buffering** the elements in a bounded manner until more demand is signaled

3. **Drop** elements until more demand is signaled

4. **Tear down** the stream if unable to apply any of the above strategies

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Akka Stream

Akka Stream in 20 seconds

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```
implicit val system = ActorSystem()
implicit val mat = ActorMaterializer()

Source(1 to 5).map(_.toString).runForeach(println)
```

Akka Stream in 20 seconds

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```scala
implicit val system = ActorSystem()
implicit val mat = ActorMaterializer()

val source = Source(1 to 5)

val flow = Flow[Int].map(_.toString)

val sink = Sink.foreach[String](println)

val runnable = source.via(flow).to(sink)

runnable.run()
```

Akka Stream in 20 seconds

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Source *(Publisher)*

A processing stage with exactly **one output**, emitting data elements whenever downstream processing stages are ready to receive them.

Sink *(Subscriber)*

A processing stage with exactly **one input**, requesting and accepting data elements possibly slowing down the upstream producer of elements.

Flow *(Processor)*

A processing stage which has exactly **one input and output**, which connects its up- and downstreams by transforming the data elements flowing through it.

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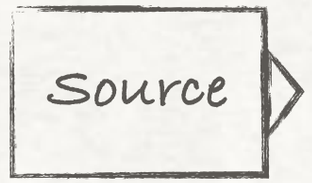

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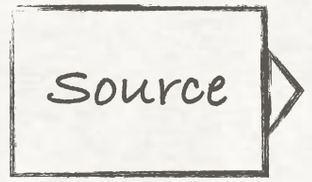

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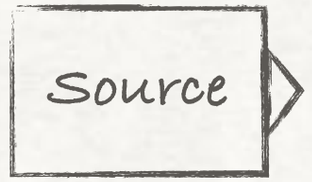

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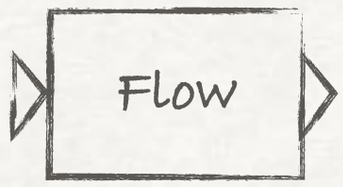
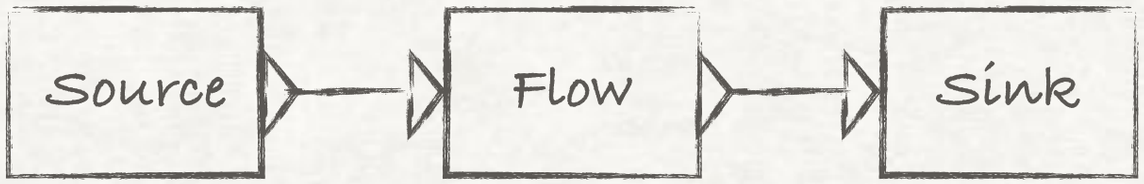
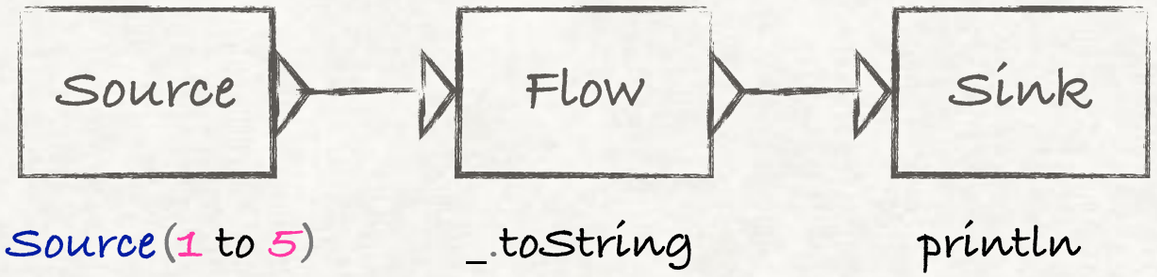
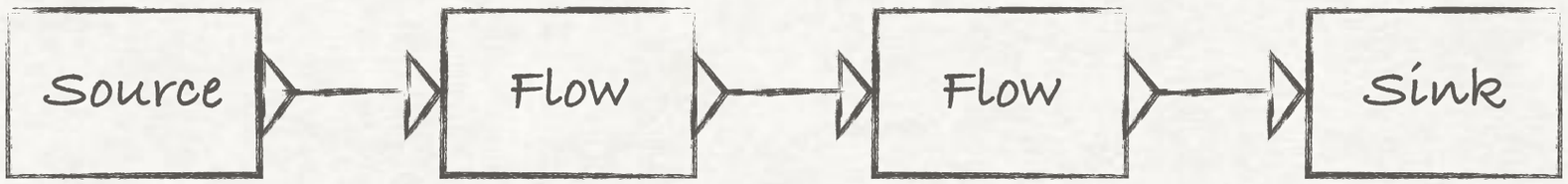




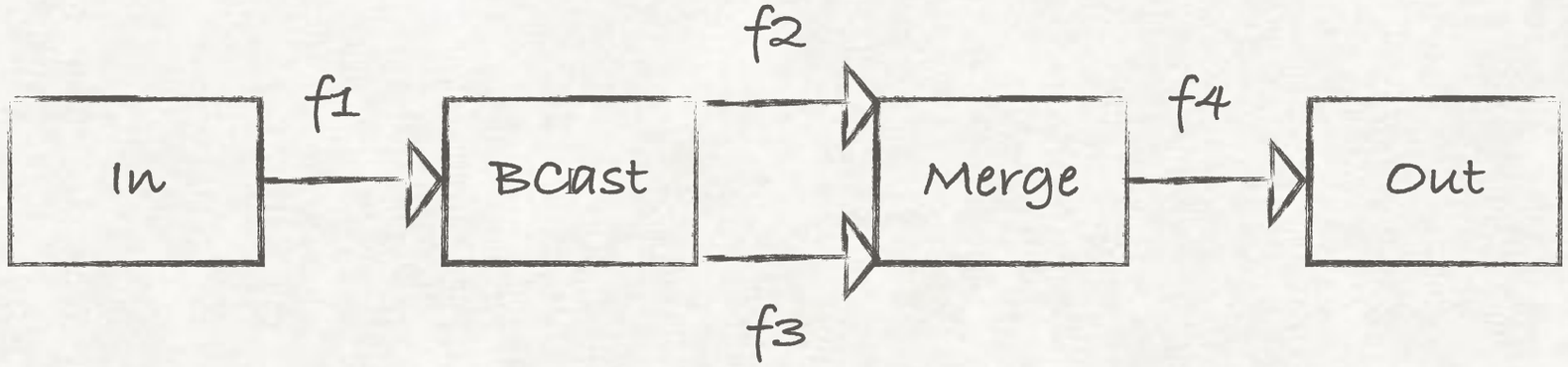


Source(1 to 5)　　_.toString　　println

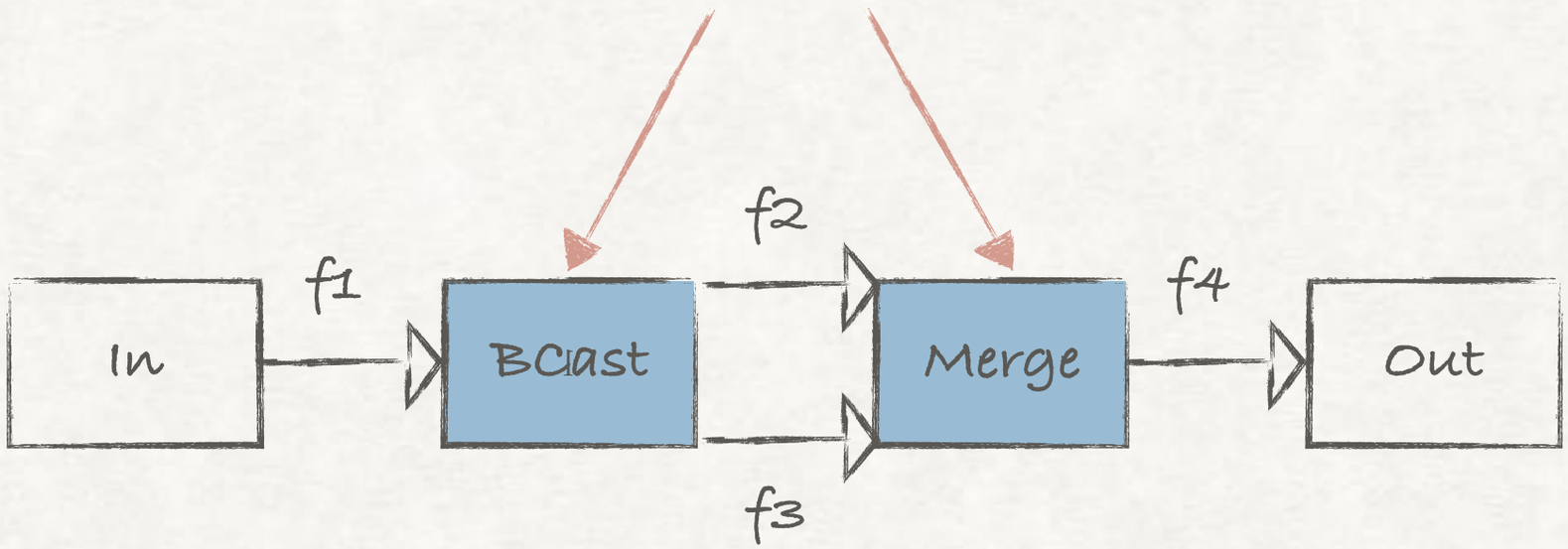
Linear Flow

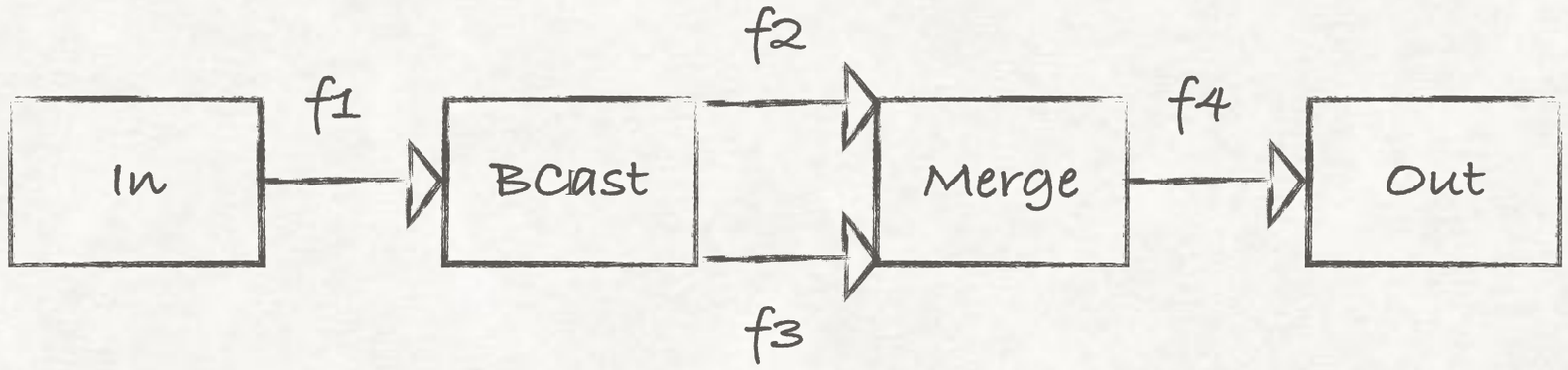


Graph Flow



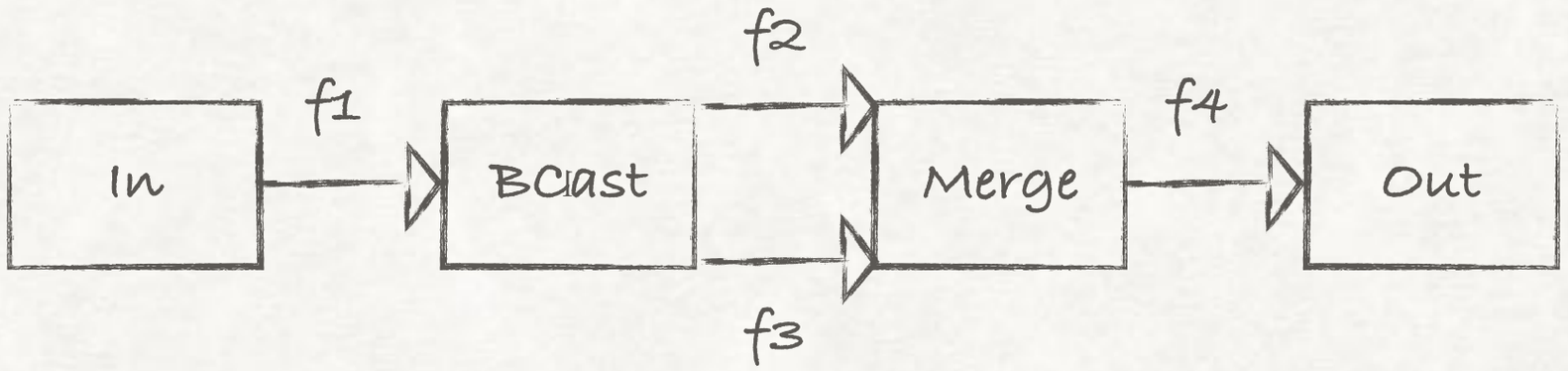
Fan-out & Fan-in






```
val f1 = Flow[Input].map(_.toIntermediate)
val f2 = Flow[Intermediate].map(_.enrich)
val f3 = Flow[Intermediate].mapFuture(_.enrichAsync)
val f4 = Flow[Enrich].filter(_.isImportant)

val in = SubscriberSource[Input]
val out = PublisherSink[Enrich]
```




```
val graph = Flow.fromGraph(GraphDSL.create() { implicit b =>
  val bcast = b.add(Broadcast[Intermediate](2))
  val merge = b.add(Merge[Enrich](2))

  in ~> f1 ~> bcast ~> f2 ~> merge
              bcast ~> f3 ~> merge ~> f4 ~> out

  FlowShape(bcast.in, merge.out)
})

in.via(graph).runWith(out)
```

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Akka Stream in Action

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Indexer Architecture

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Binlog listener

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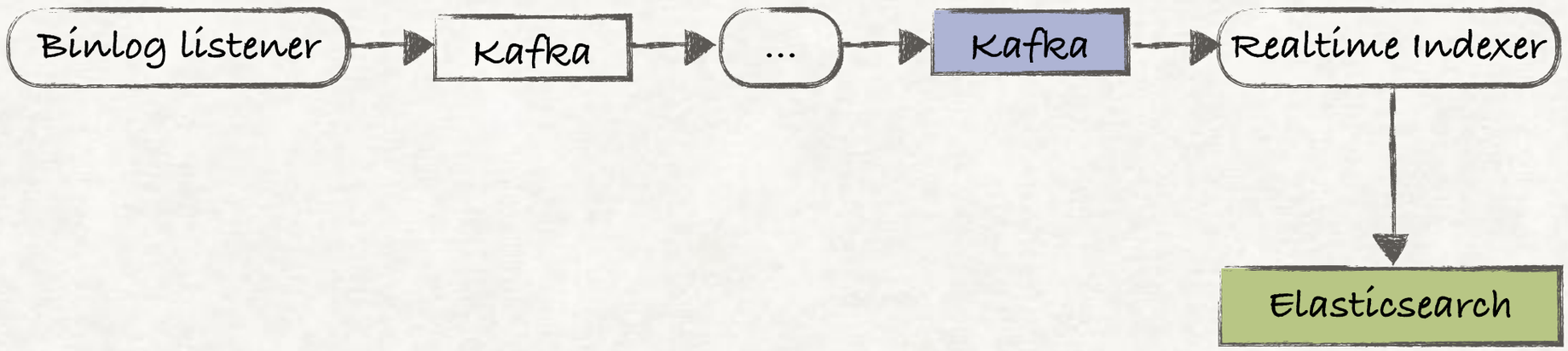

Indexer Architecture

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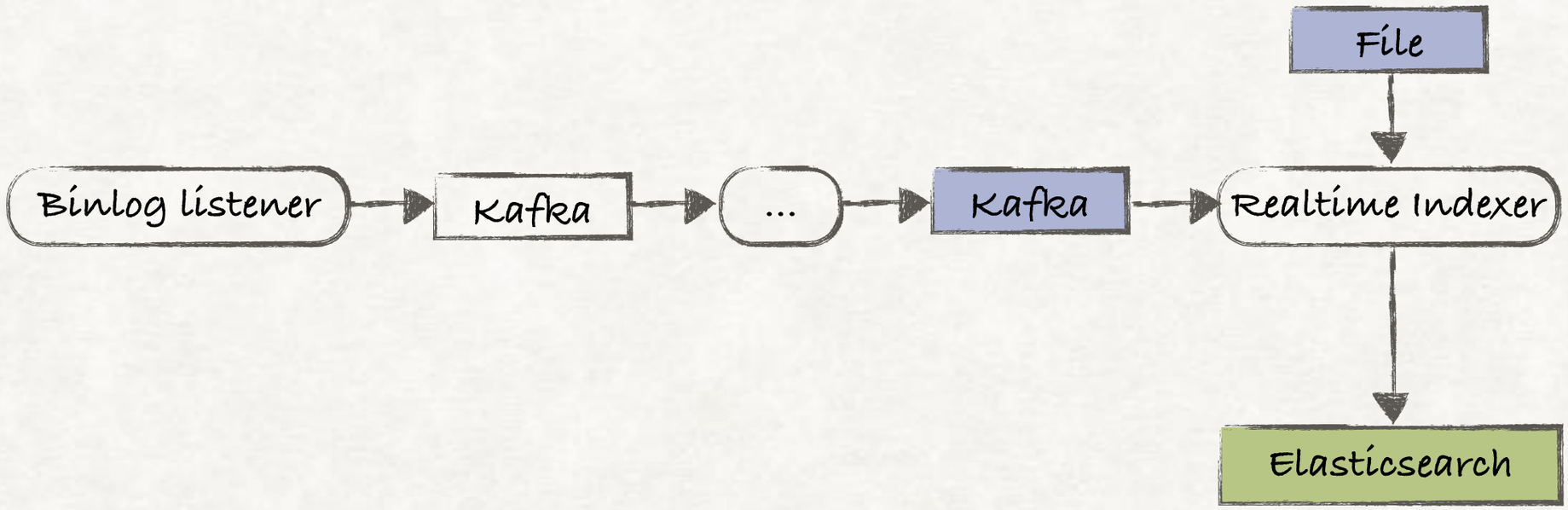

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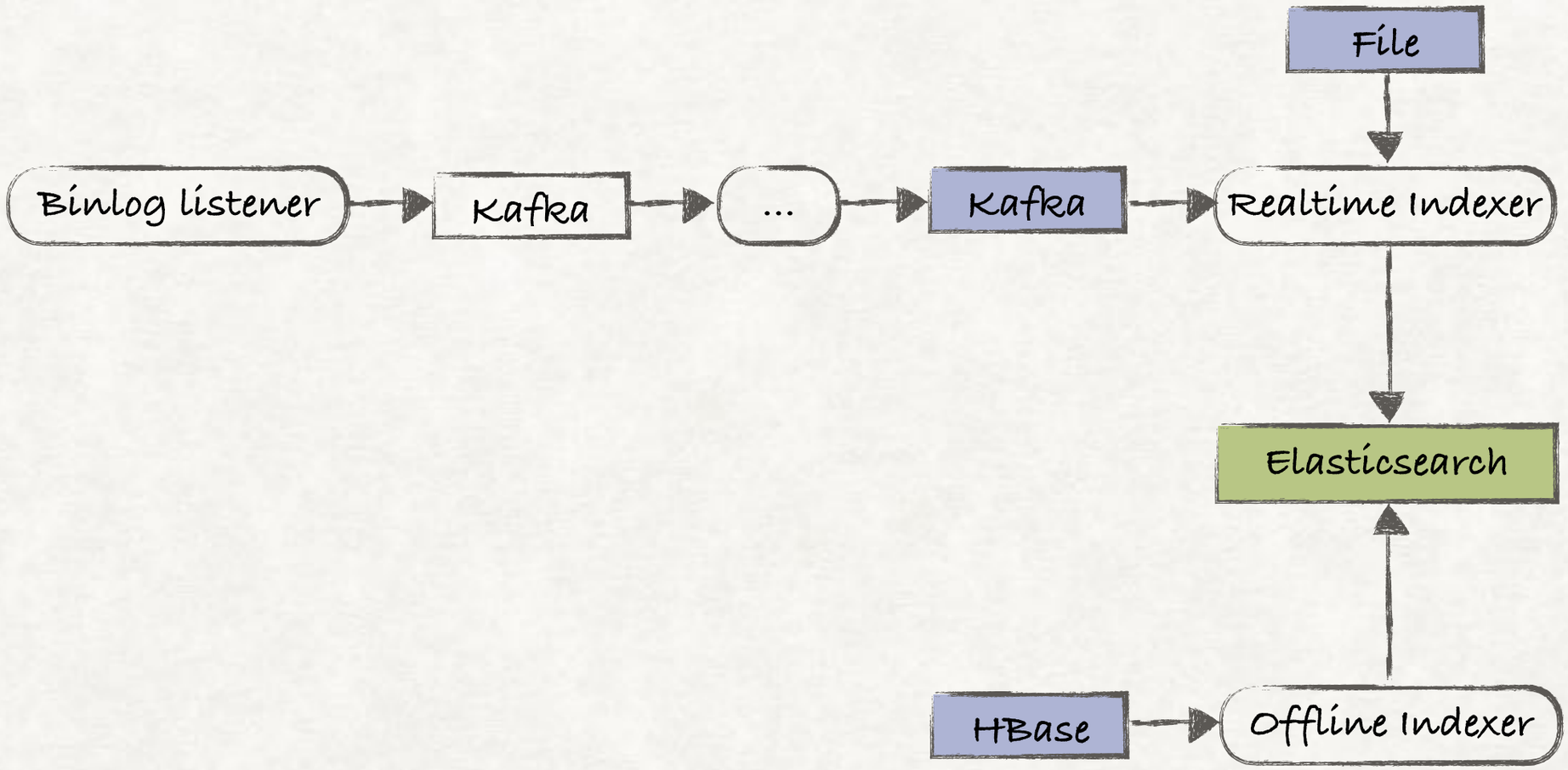

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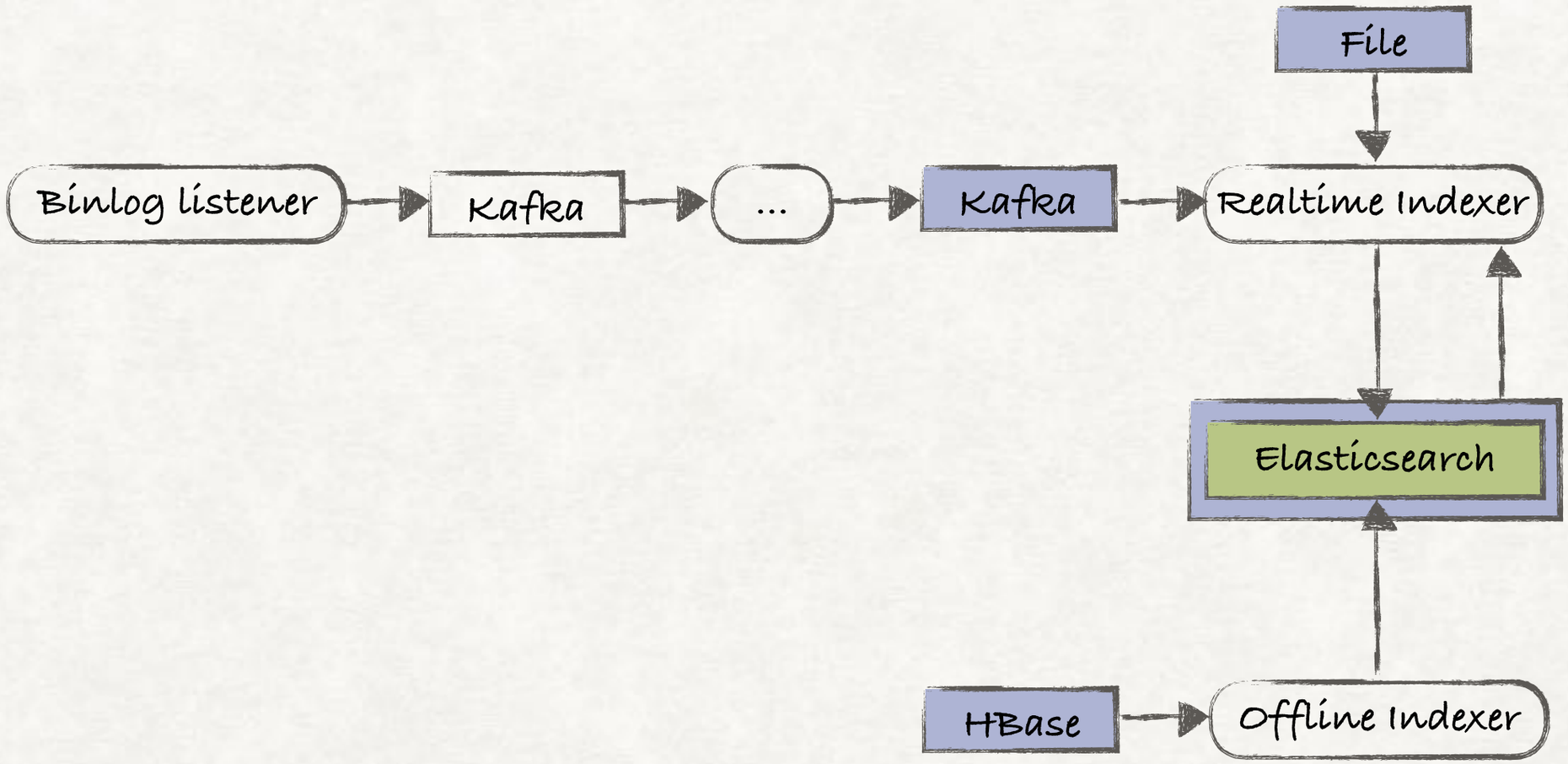

Indexer Architecture

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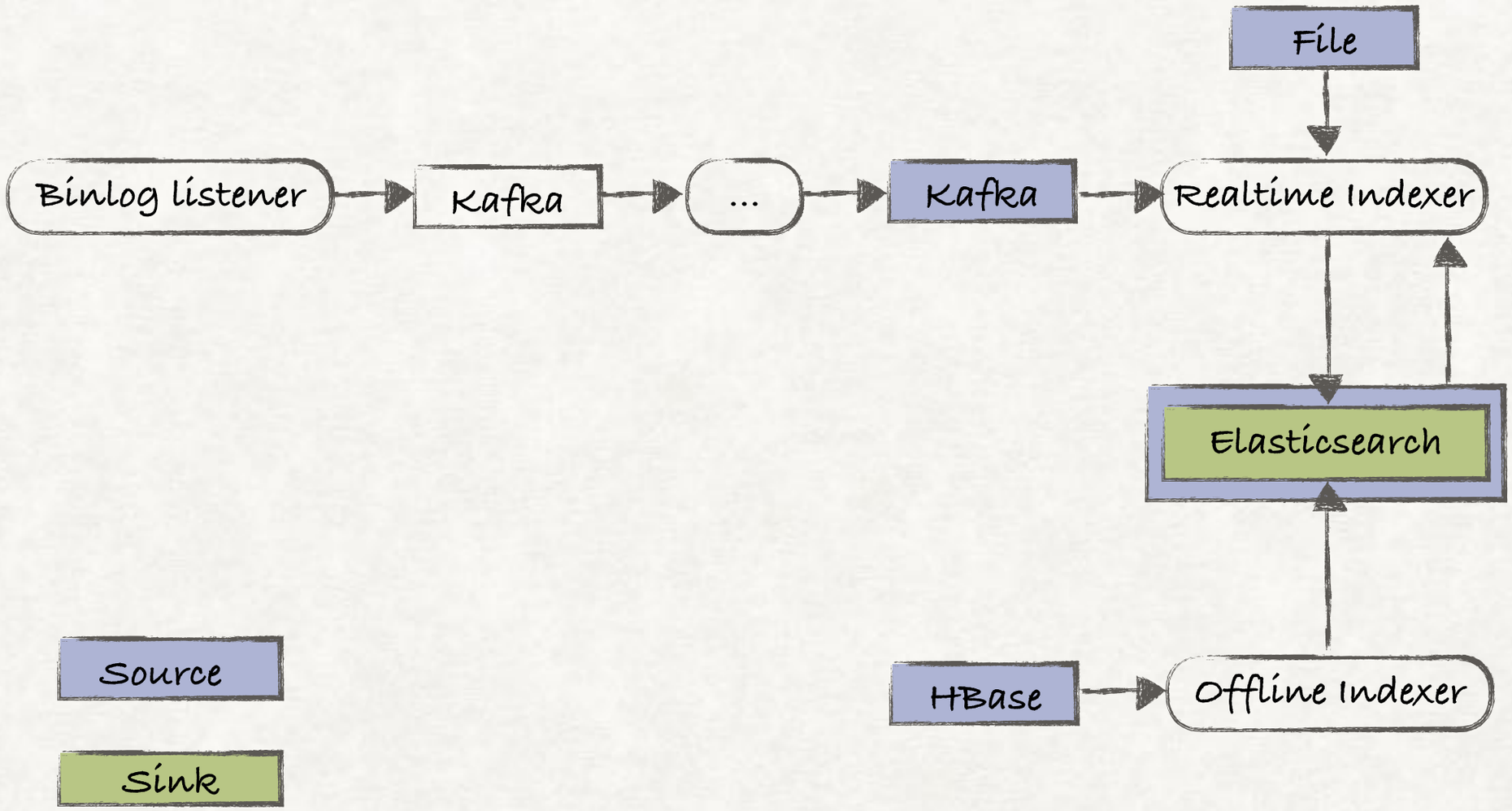

Index Sources

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```
def fromLocalFile(path: String ...): Source[SegmentedDoc, _] = {
  val fileDelimiter: Flow[ByteString, ByteString, NotUsed] =
    Framing.delimiter(
        ByteString(System.lineSeparator),
        MAX_FRAME_LENGTH_IN_BYTES,
        true)
  val jsonParserFlow: Flow[ByteString, SegmentedDoc, NotUsed] = ...

  FileIO.fromPath(Paths.get(path))
    .via(fileDelimiter)
    .via(jsonParserFlow)
}
```

Index Sources

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def fromLocalFile(path: String ...): Source[SegmentedDoc, _] = {
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  FileIO.fromPath(Paths.get(path))
    .via(fileDelimiter)
    .via(jsonParserFlow)
}

def fromHbase(...): Source[SegmentedDoc, _] = {
  val hbasePublisher = new HbasePublisher(props)
  val pbParserFlow: Flow[Array[Byte], SegmentedDoc, NotUsed] = ...

  Source.fromPublisher(hbasePublisher)
    .map(_.bytes)
    .via(pbParserFlow)
}
```

Index Sources

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def fromLocalFile(path: String ...): Source[SegmentedDoc, _] = {
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  FileIO.fromPath(Paths.get(path))
    .via(fileDelimiter)
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  val pbParserFlow: Flow[Array[Byte], SegmentedDoc, NotUsed] = ...

  Source.fromPublisher(hbasePublisher)
    .map(_.bytes)
    .via(pbParserFlow)
}

def fromKafka(...): Source[SegmentedDoc, _]  = {
  val pbParserFlow: Flow[Array[Byte], SegmentedDoc, NotUsed] = ...

  Consumer.committableSource(consumerSettings, Subscriptions.topics(topic))
    .map(_.record.value)
    .via(pbParserFlow)
}
```

Index Sources

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```
def fromLocalFile(path: String ...): Source[SegmentedDoc, _] = {
  val fileDelimiter: Flow[ByteString, ByteString, NotUsed] =
    Framing.delimiter(
        ByteString(System.lineSeparator),
        MAX_FRAME_LENGTH_IN_BYTES,
        true)
  val jsonParserFlow: Flow[ByteString, SegmentedDoc, NotUsed] = ...

  FileIO.fromPath(Paths.get(path))
    .via(fileDelimiter)
    .via(jsonParserFlow)
}

def fromHbase(...): Source[SegmentedDoc, _] = {
  val hbasePublisher = new HbasePublisher(props)
  val pbParserFlow: Flow[Array[Byte], SegmentedDoc, NotUsed] = ...

  Source.fromPublisher(hbasePublisher)
    .map(_.bytes)
    .via(pbParserFlow)
}

def fromKafka(...): Source[SegmentedDoc, _]  = {
  val pbParserFlow: Flow[Array[Byte], SegmentedDoc, NotUsed] = ...

  Consumer.committableSource(consumerSettings, Subscriptions.topics(topic))
    .map(_.record.value)
    .via(pbParserFlow)
}
```

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```
def fromLocalFile(path: String ...): Source[SegmentedDoc, _] = {
  val fileDelimiter: Flow[ByteString, ByteString, NotUsed] =
    Framing.delimiter(
        ByteString(System.lineSeparator),
        MAX_FRAME_LENGTH_IN_BYTES,
        true)
  val jsonParserFlow: Flow[ByteString, SegmentedDoc, NotUsed] = ...

  FileIO.fromPath(Paths.get(path))
    .via(fileDelimiter)
    .via(balancer(jsonParserFlow, workNum))
}

def fromHbase(...): Source[SegmentedDoc, _] = {
  val hbasePublisher = new HbasePublisher(props)
  val pbParserFlow: Flow[Array[Byte], SegmentedDoc, NotUsed] = ...

  Source.fromPublisher(hbasePublisher)
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}

def fromKafka(...): Source[SegmentedDoc, _]  = {
  val pbParserFlow: Flow[Array[Byte], SegmentedDoc, NotUsed] = ...

  Consumer.committableSource(consumerSettings, Subscriptions.topics(topic))
    .map(_.record.value)
    .via(balancer(pbParserFlow, workNum))
}
```

Concurrent flow

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```scala
def balancer[In, Out](
  worker: Flow[In, Out, Any],
  workerCount: Int
): Flow[In, Out, NotUsed] = {
  Flow.fromGraph(GraphDSL.create() { implicit b =>
    val balancer = b.add(Balance[In](workerCount))
    val merger = b.add(Merge[Out](workerCount))

    (1 to workerCount).foreach { _ =>
      balancer ~> worker.async ~> merge
    }

    FlowShape(balancer.in, merger.out)
  })
}
```

Concurrent flow

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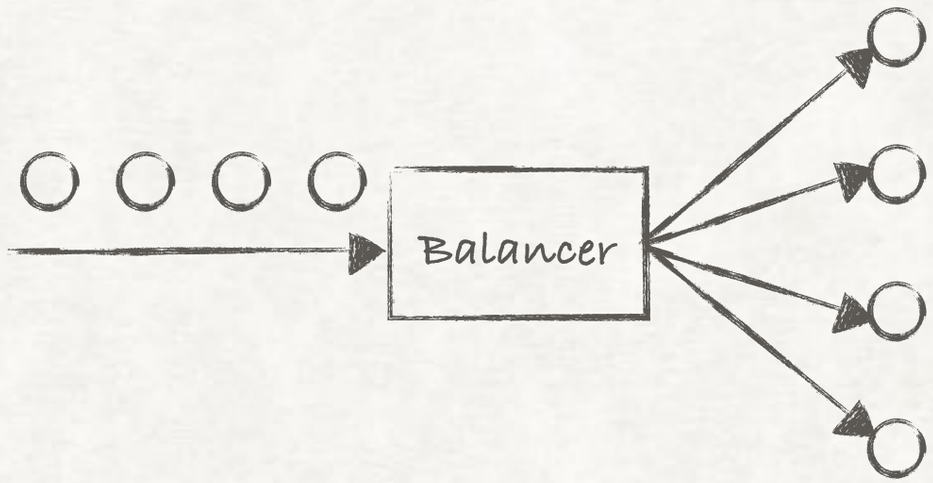

Concurrent flow

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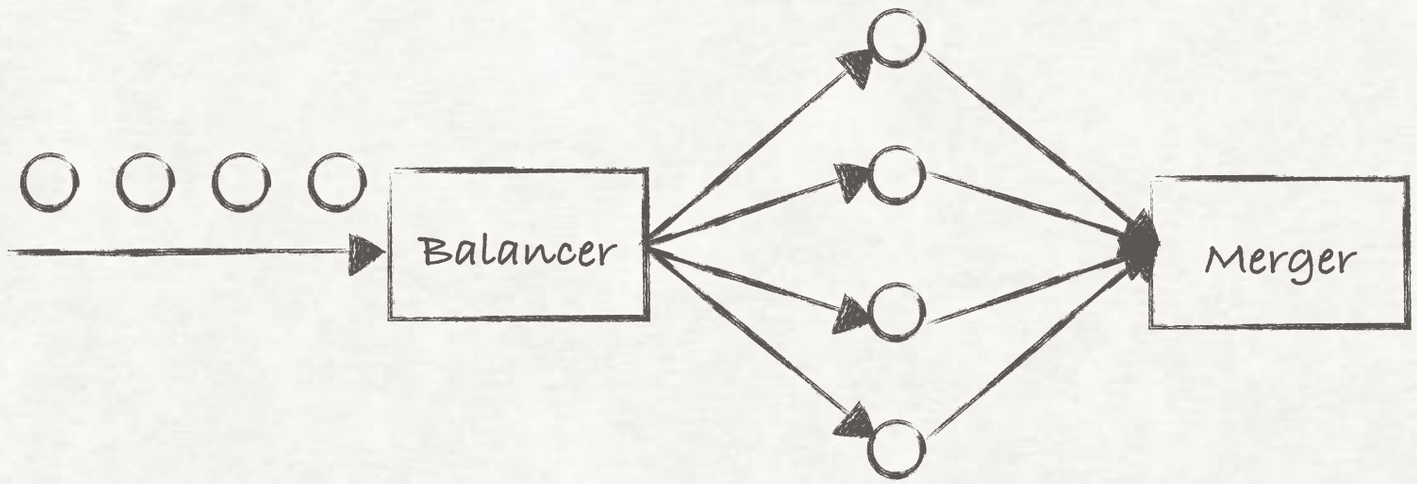

Concurrent flow

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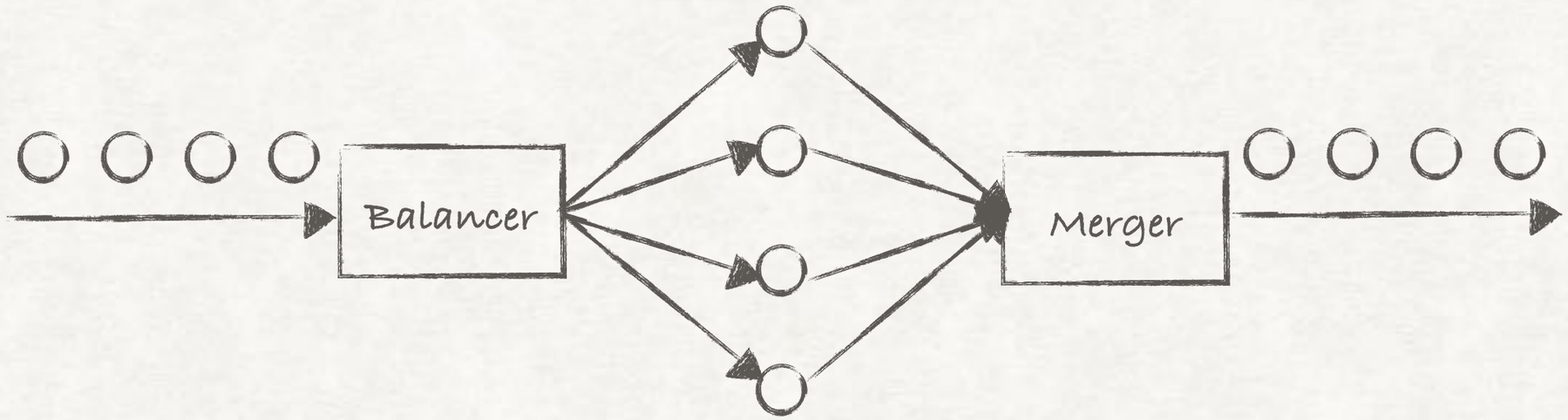

Subscriber (a.k.a Sink)

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```
val source: Source[SegmentedDoc, NotUsed] = IndexSources.create(...)

val subscriber: Subscriber[SegmentedDoc] = ESClient.createSubscriber(...)

source
  .via(balancer(..., workerNum))
  .runWith(Sink.fromSubscriber(subscriber))
```

Demo

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Thanks!