Storm

The Real-Time Layer Your Big Data's Been Missing

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@danklynn

FullContact

Keeps Contact Information Current and Complete

Based in **Denver, Colorado**

Advisors to FullContact
include some of the leading pioneers in internet startups.

techstars

FullContact is
a TechStars 2011 Boulder Graduate.

CTO & Co-Founder
dan@fullcontact.com
@danklynn

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Turn Partial Contacts Into **Full** Contacts

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Your data is **old**

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Old data is **confusing**

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First, there was the spreadsheet

Next, there was SQL

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Then, there wasn't SQL

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Batch Processing

Stale Data

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Streaming Computation

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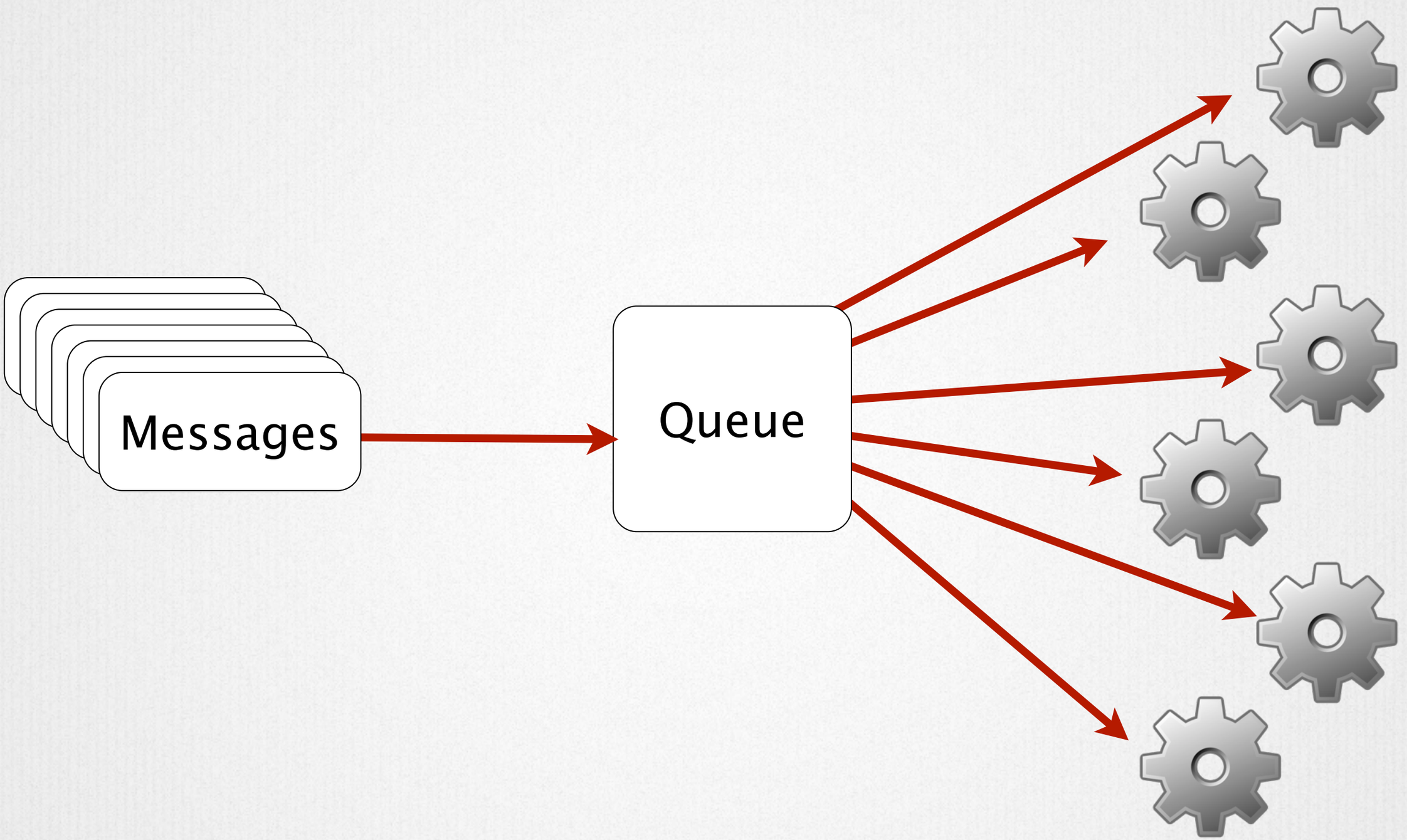
Queues / Workers

Queues / Workers



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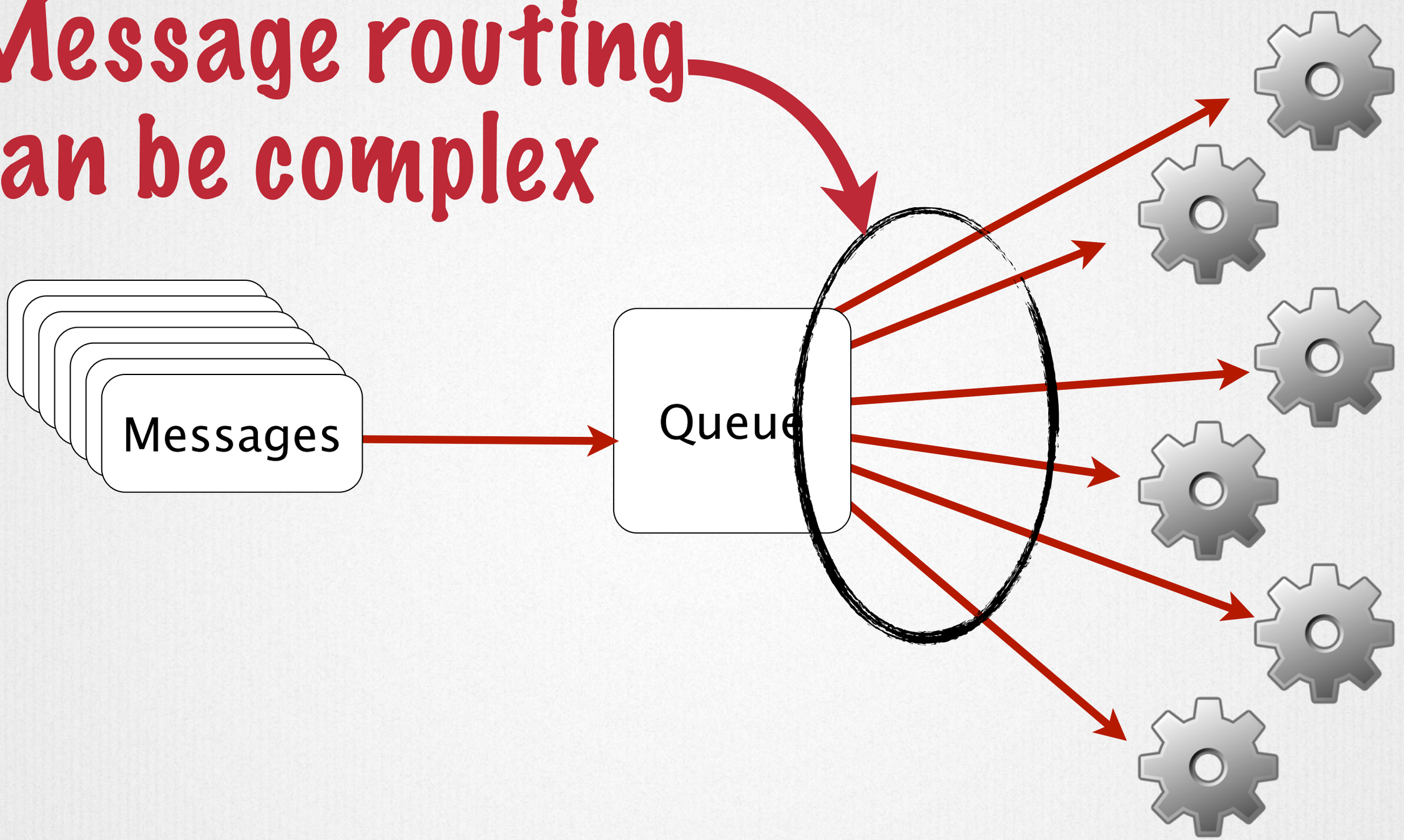
Queues / Workers

Message routing can be complex



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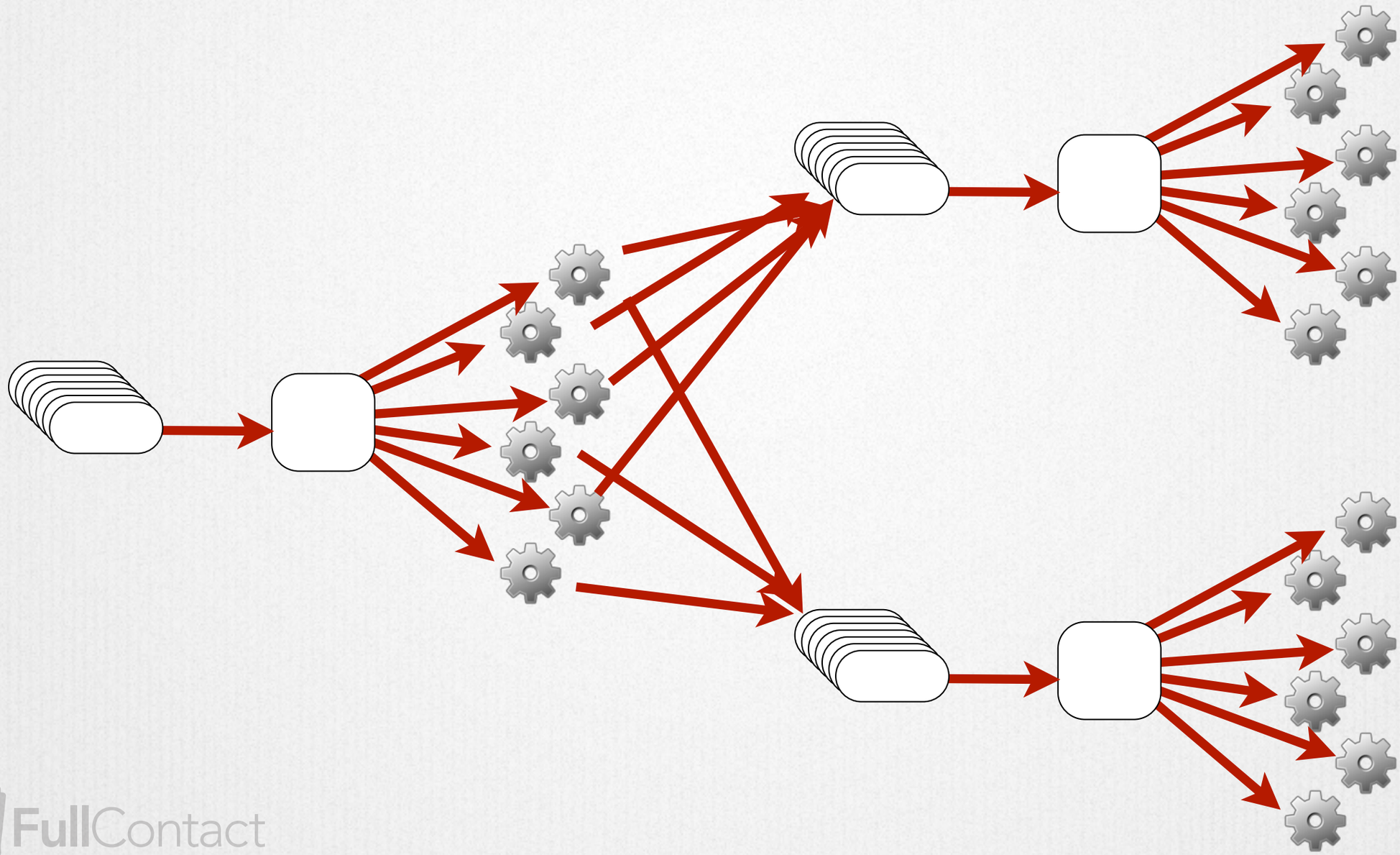
Queues / Workers



Brittle

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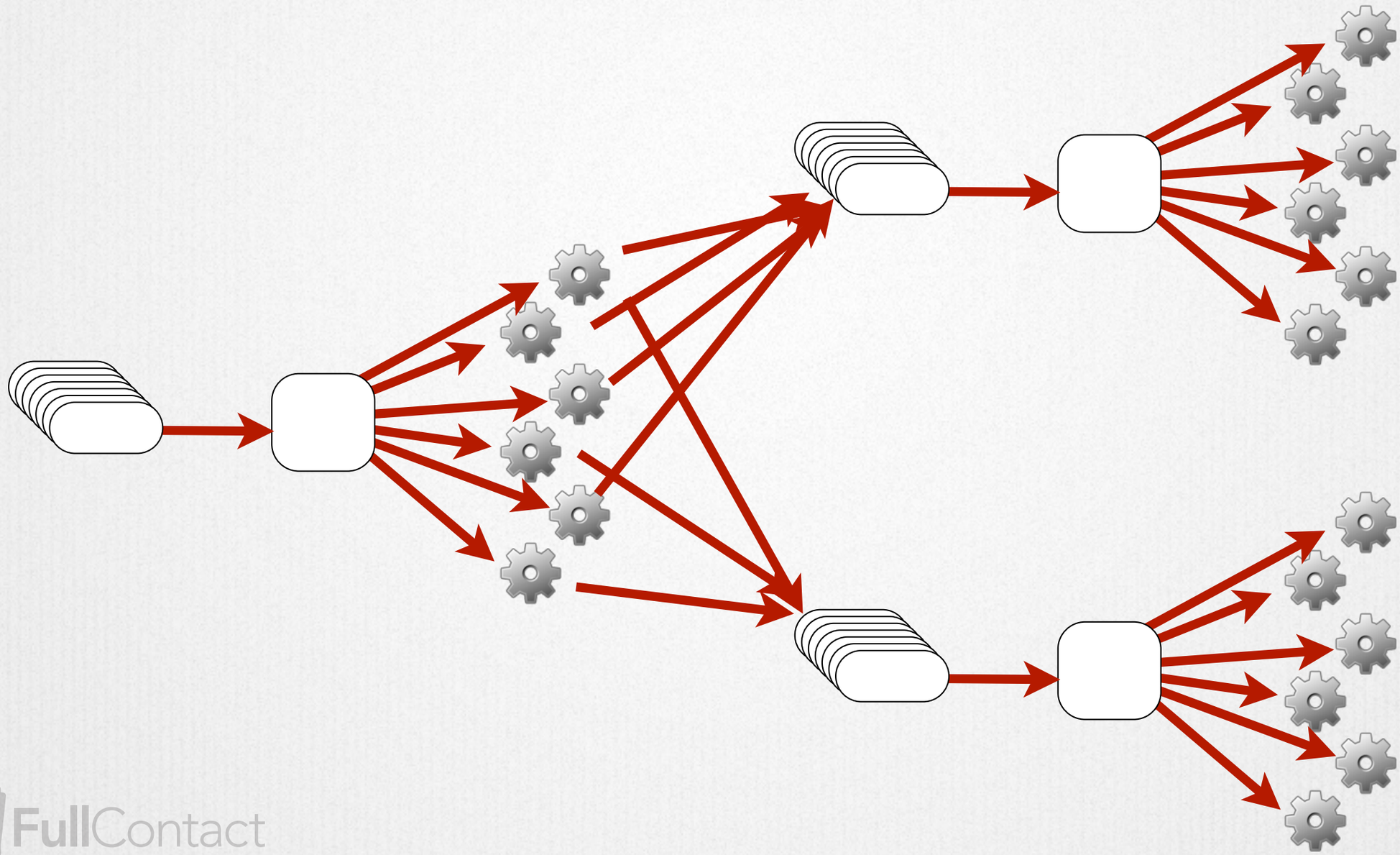
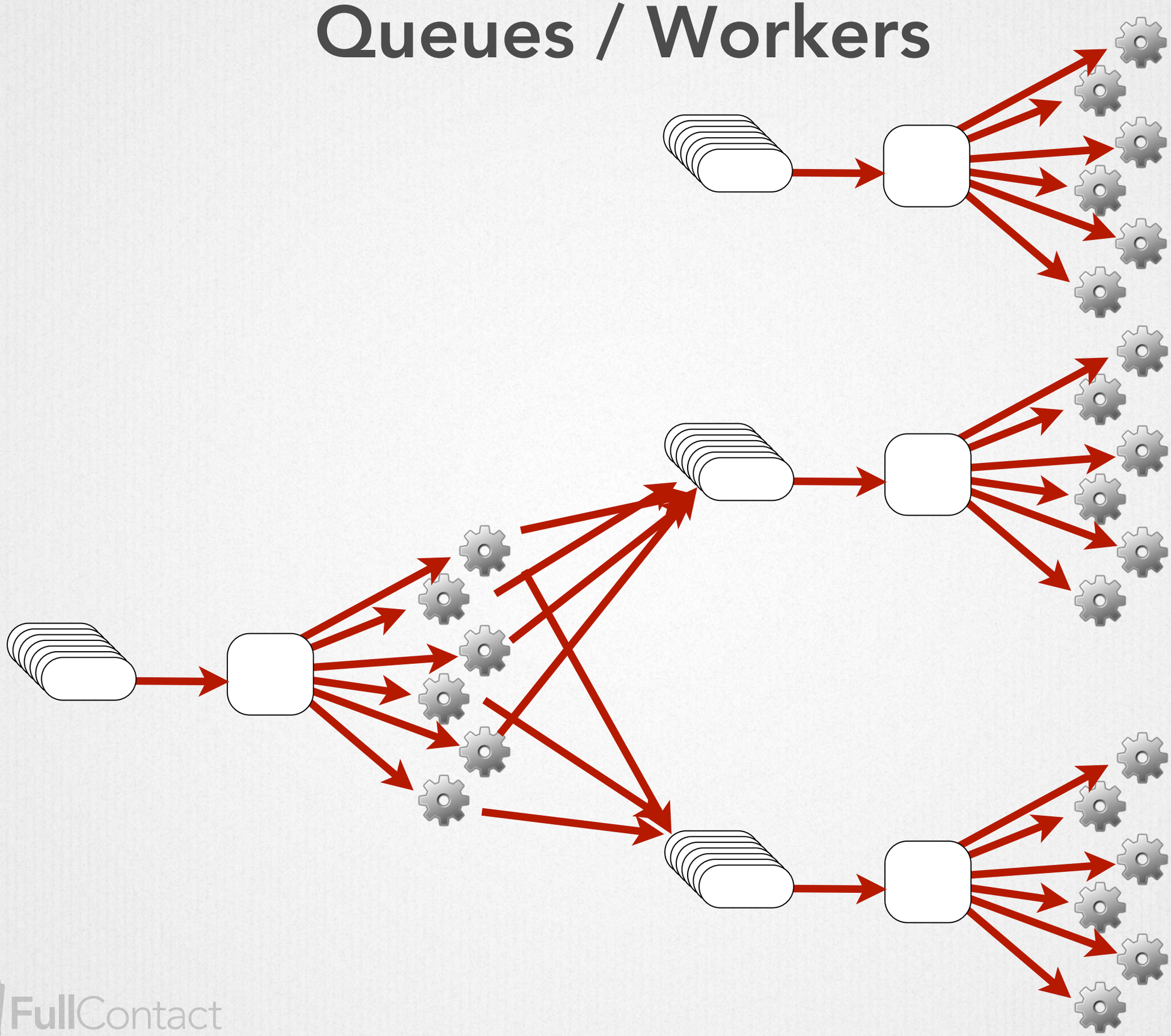
Hard to scale

Queues / Workers



Queues / Workers



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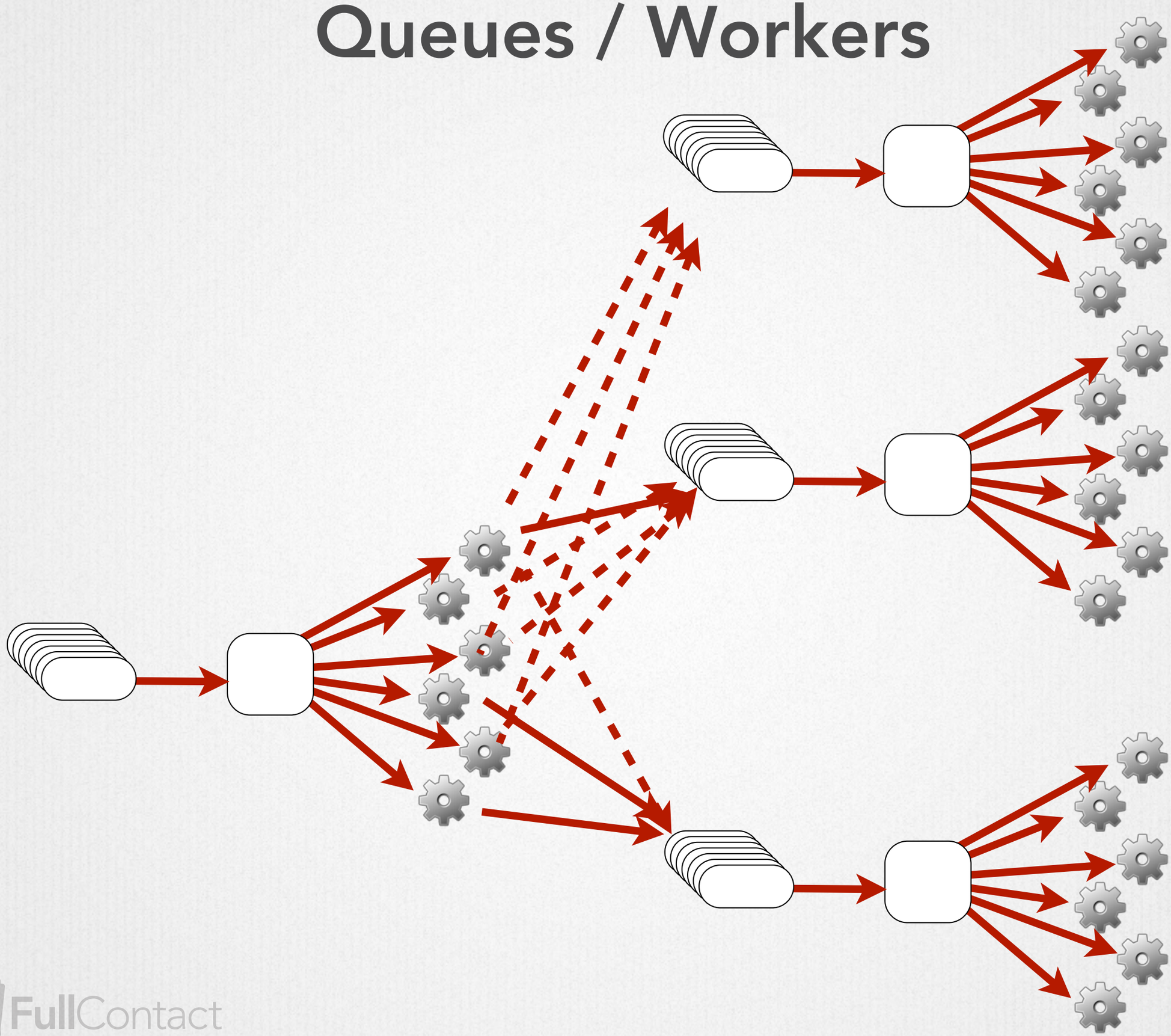
Queues / Workers



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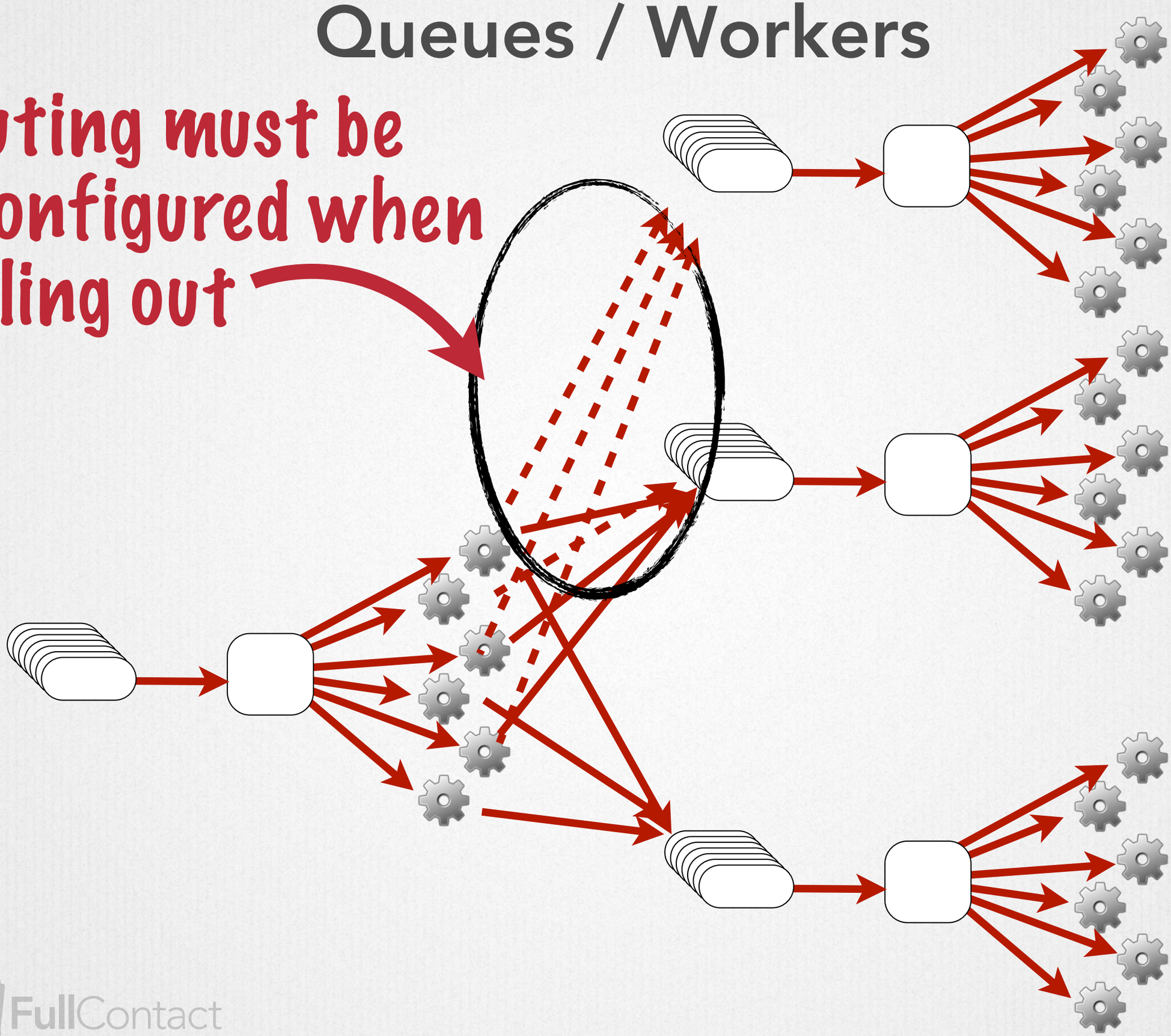
Queues / Workers

Routing must be reconfigured when scaling out



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Distributed and fault-tolerant real-time computation

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Distributed and fault-tolerant real-time computation

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Distributed and fault-tolerant real-time computation

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Distributed and fault-tolerant real-time computation

Key Concepts

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Tuples

Ordered list of elements

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Tuples

Ordered list of elements

```
("search-01384", "e:dan@fullcontact.com")
```

Streams

Unbounded sequence of tuples

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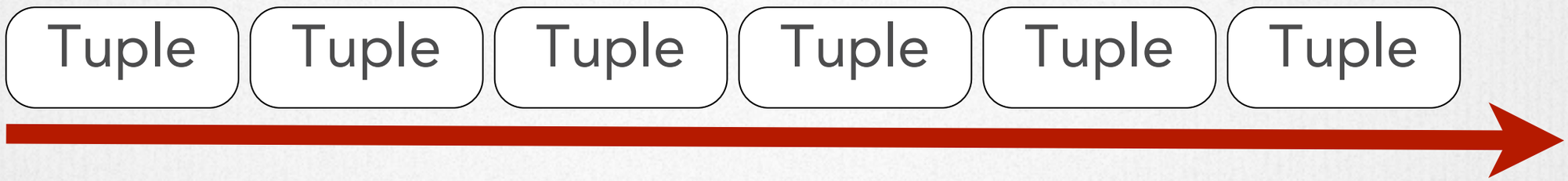
Streams

Unbounded sequence of tuples



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Spouts

Source of streams

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Spouts

Source of streams

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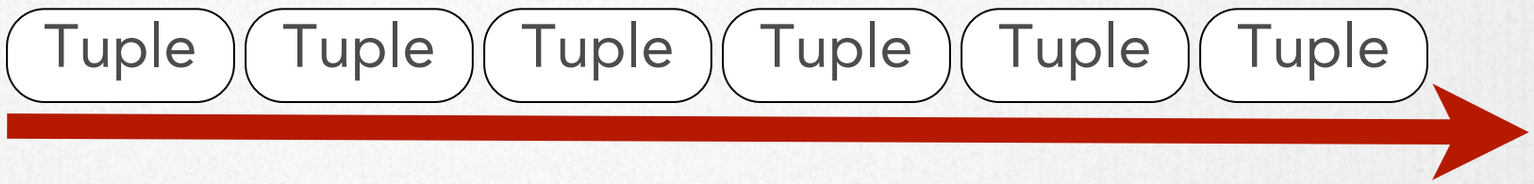
Spouts

Source of streams



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Spouts can talk with

some images from http://commons.wikimedia.org

Spouts can talk with

- Queues

some images from http://commons.wikimedia.org

Spouts can talk with

- Queues
- Web logs

some images from http://commons.wikimedia.org

Spouts can talk with

- Queues
- Web logs
- API calls

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Spouts can talk with

- Queues
- Web logs
- API calls
- Event data

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Bolts

Process tuples and create new streams

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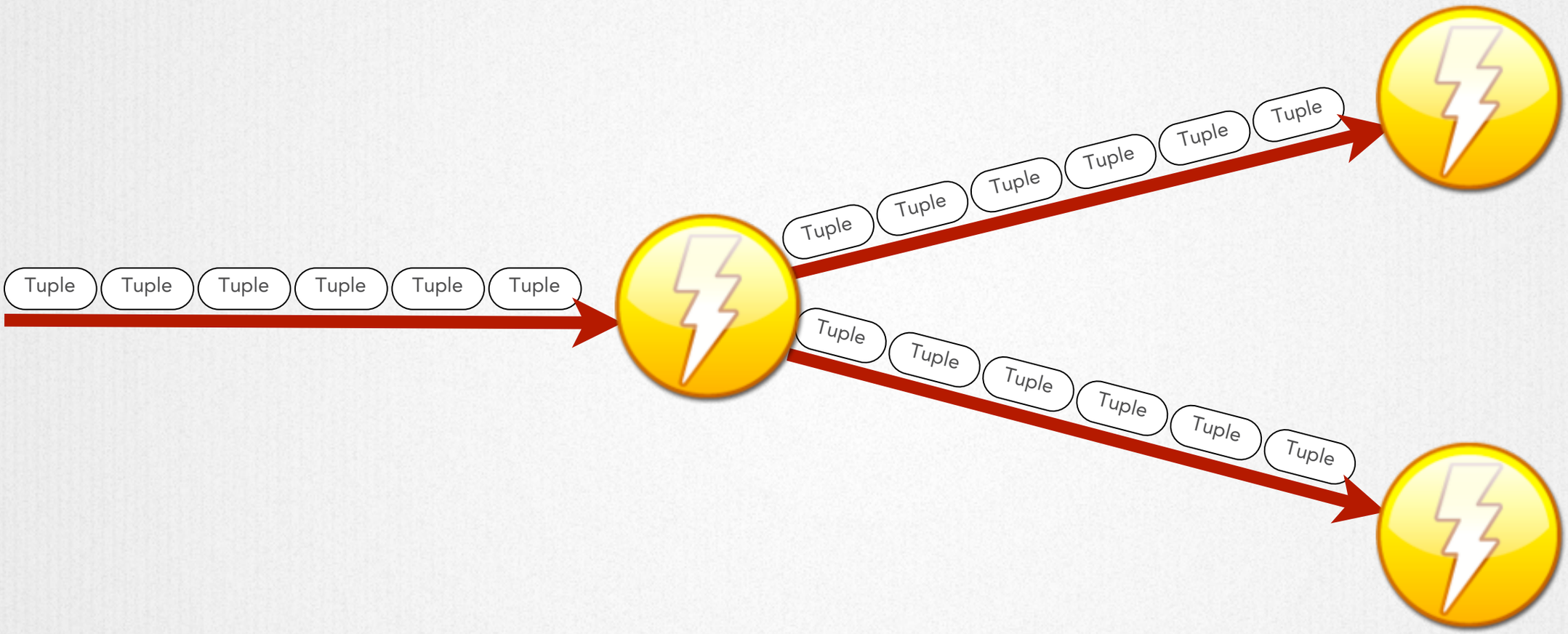
Bolts



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Bolts

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Bolts

- Apply functions / transforms

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some images from http://commons.wikimedia.org

Bolts

- Apply functions / transforms
- Filter

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Bolts

- Apply functions / transforms
- Filter
- Aggregation

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Bolts

- Apply functions / transforms
- Filter
- Aggregation
- Streaming joins

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Bolts

- Apply functions / transforms
- Filter
- Aggregation
- Streaming joins
- Access DBs, APIs, etc...

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Topologies

A directed graph of Spouts and Bolts

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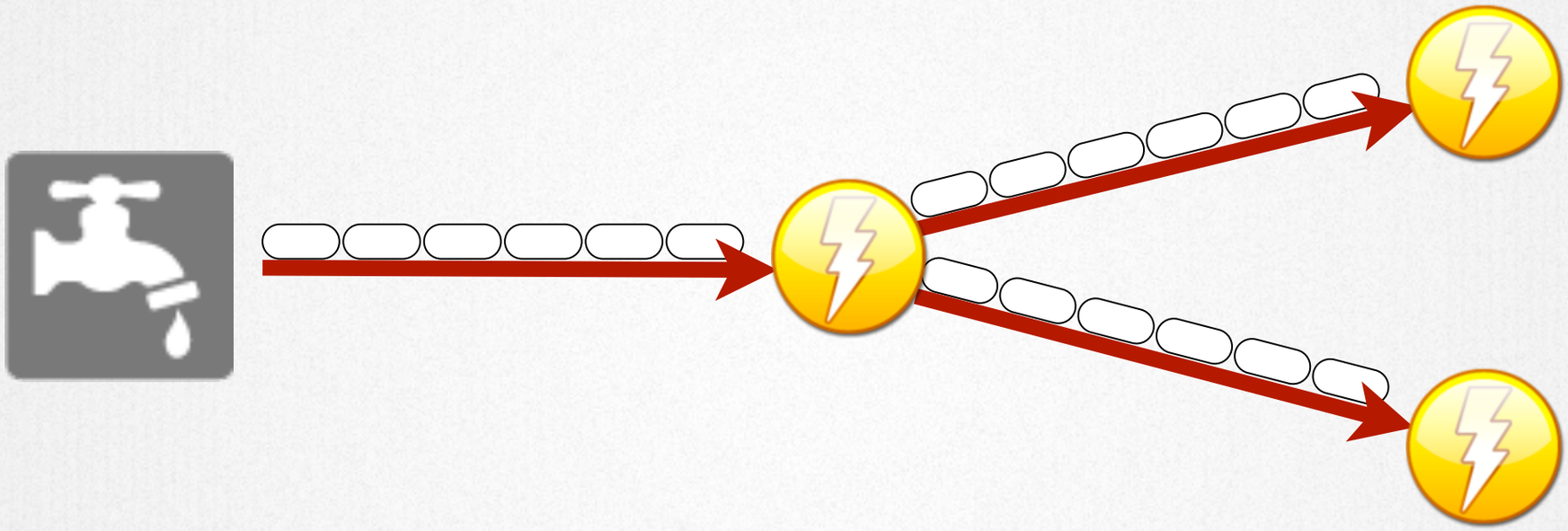
This is a Topology



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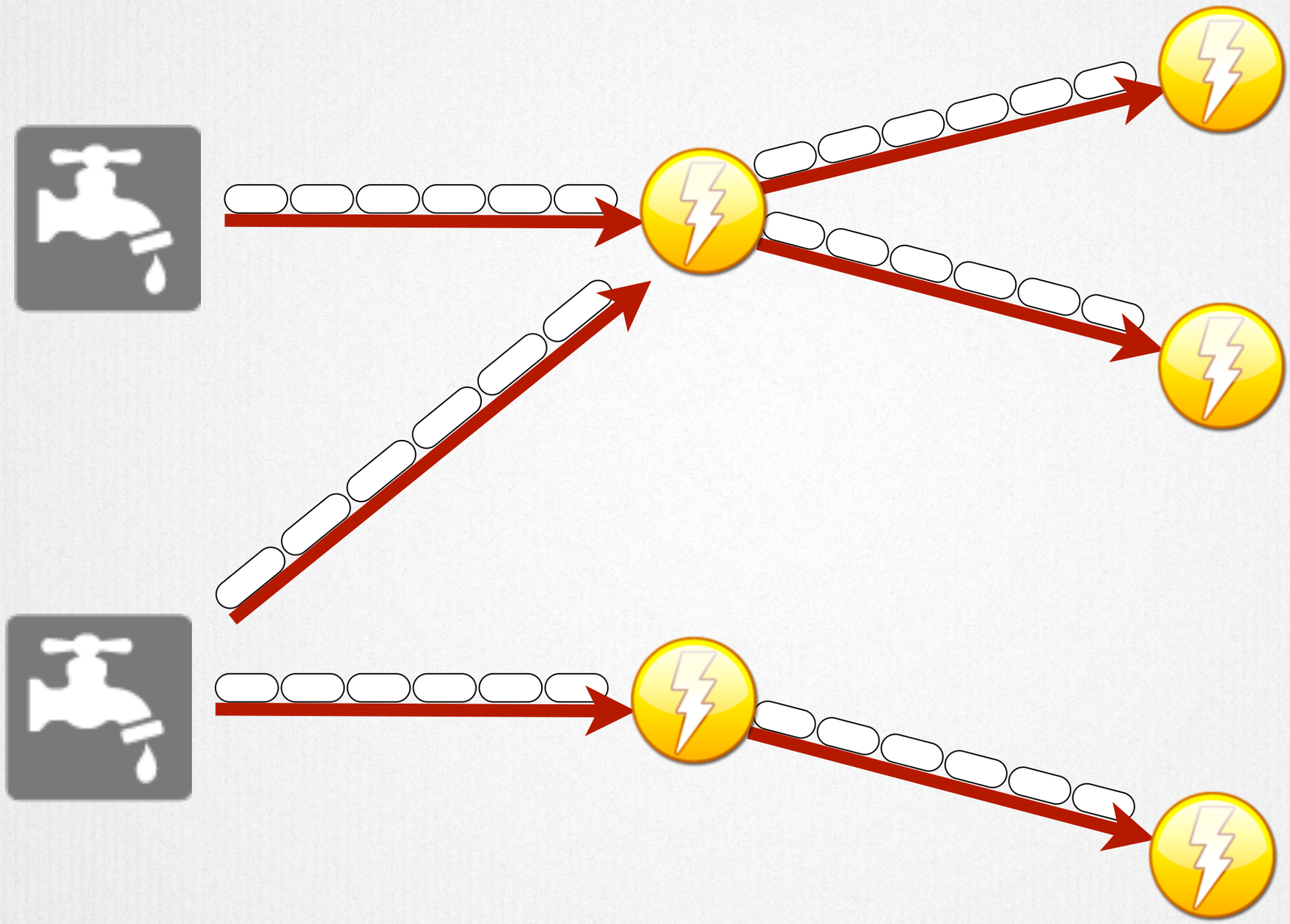
This is also a topology



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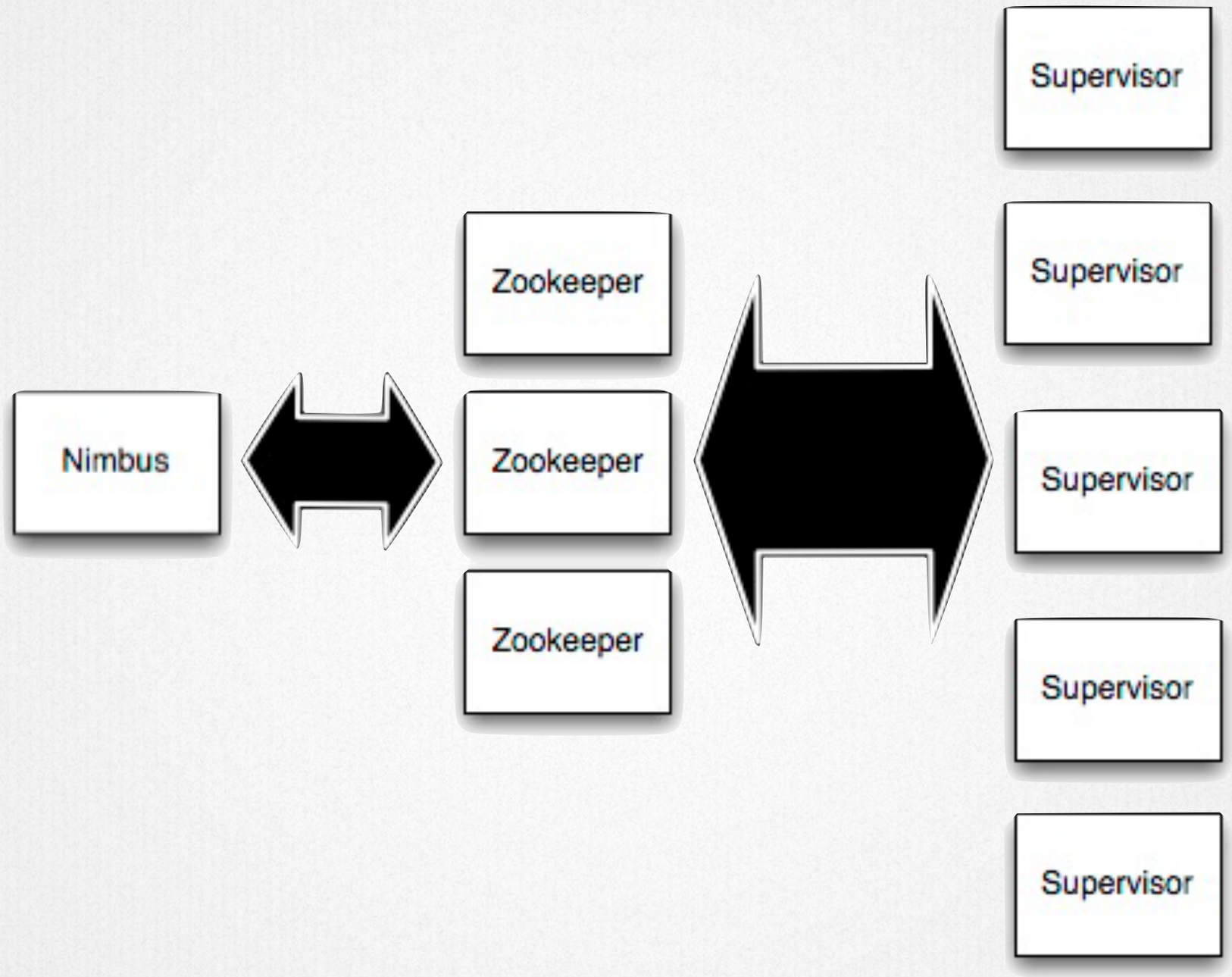
Tasks

Processes which execute Streams or Bolts

Running a Topology

```
$ storm jar my-code.jar com.example.MyTopology arg1 arg2
```

Storm Cluster



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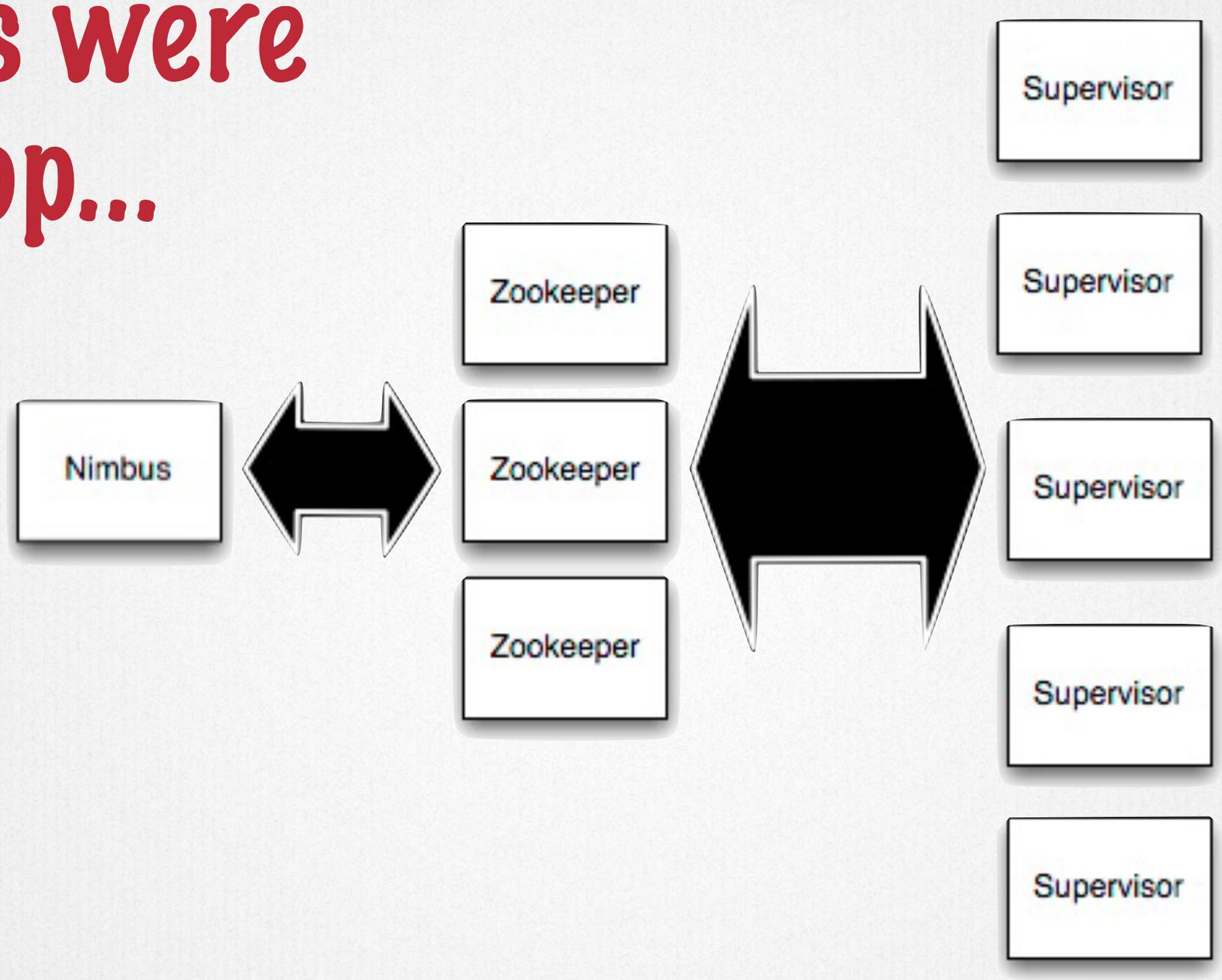
Storm Cluster

If this were Hadoop...



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Storm Cluster

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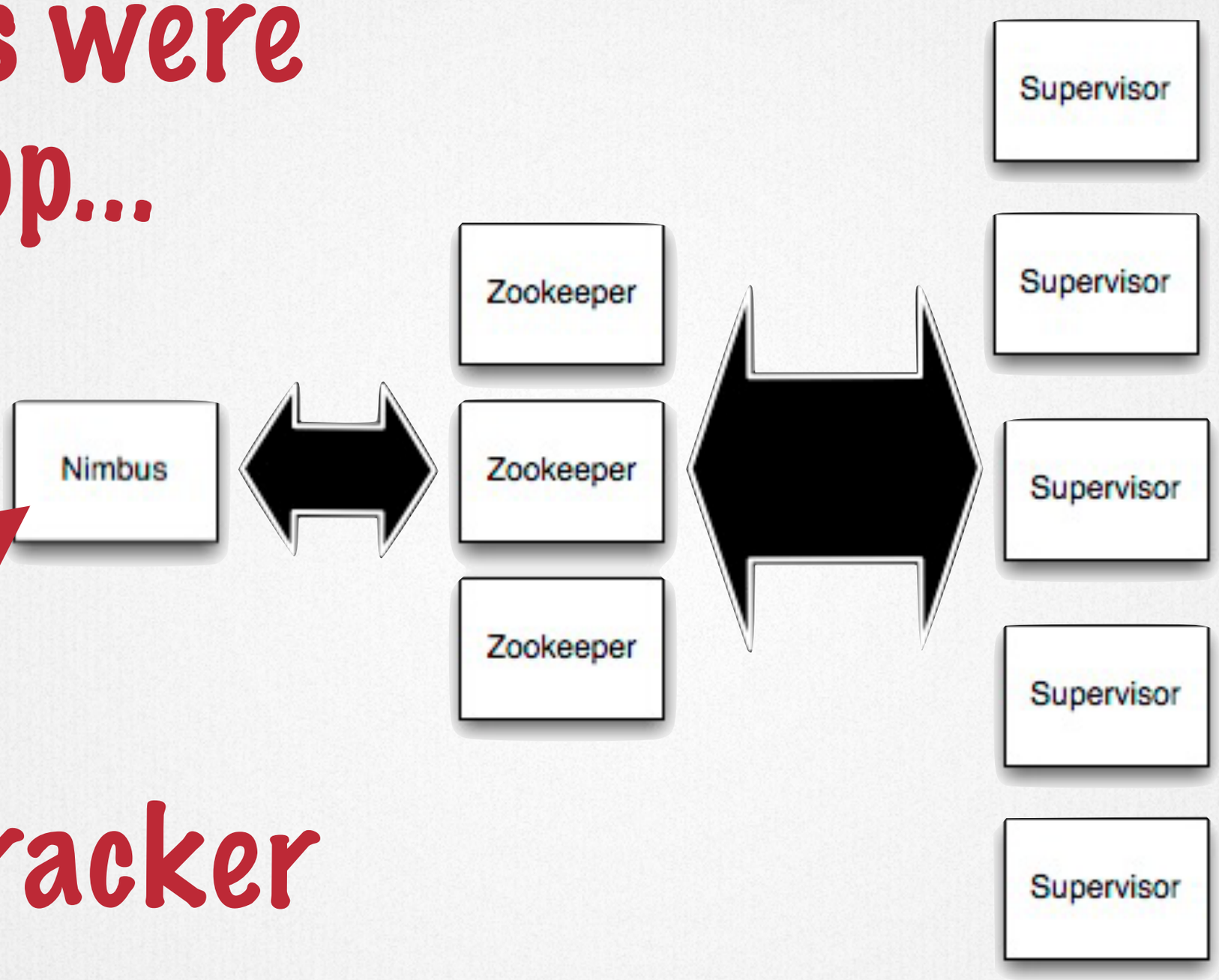

Job Tracker

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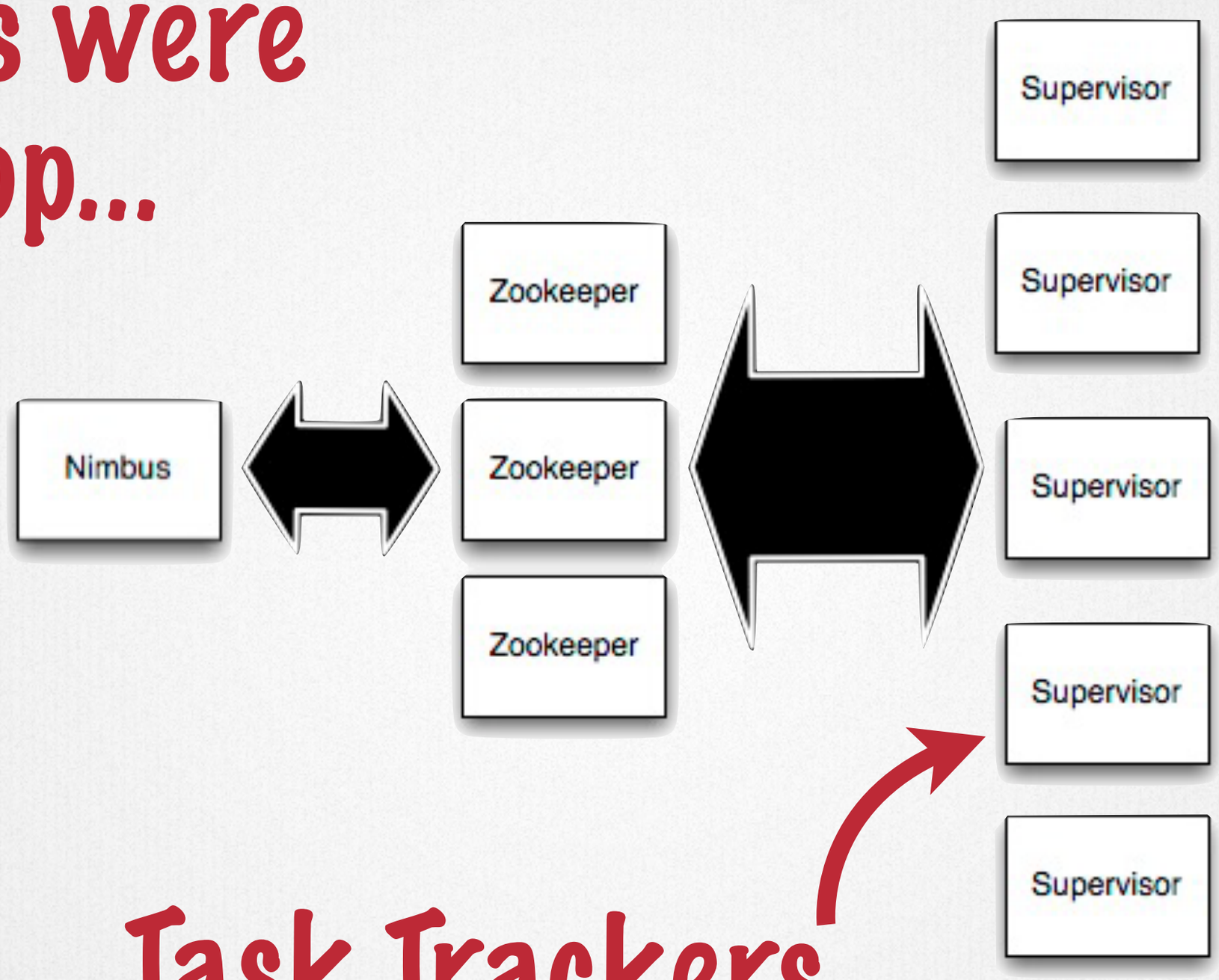
If this were Hadoop...



Task Trackers

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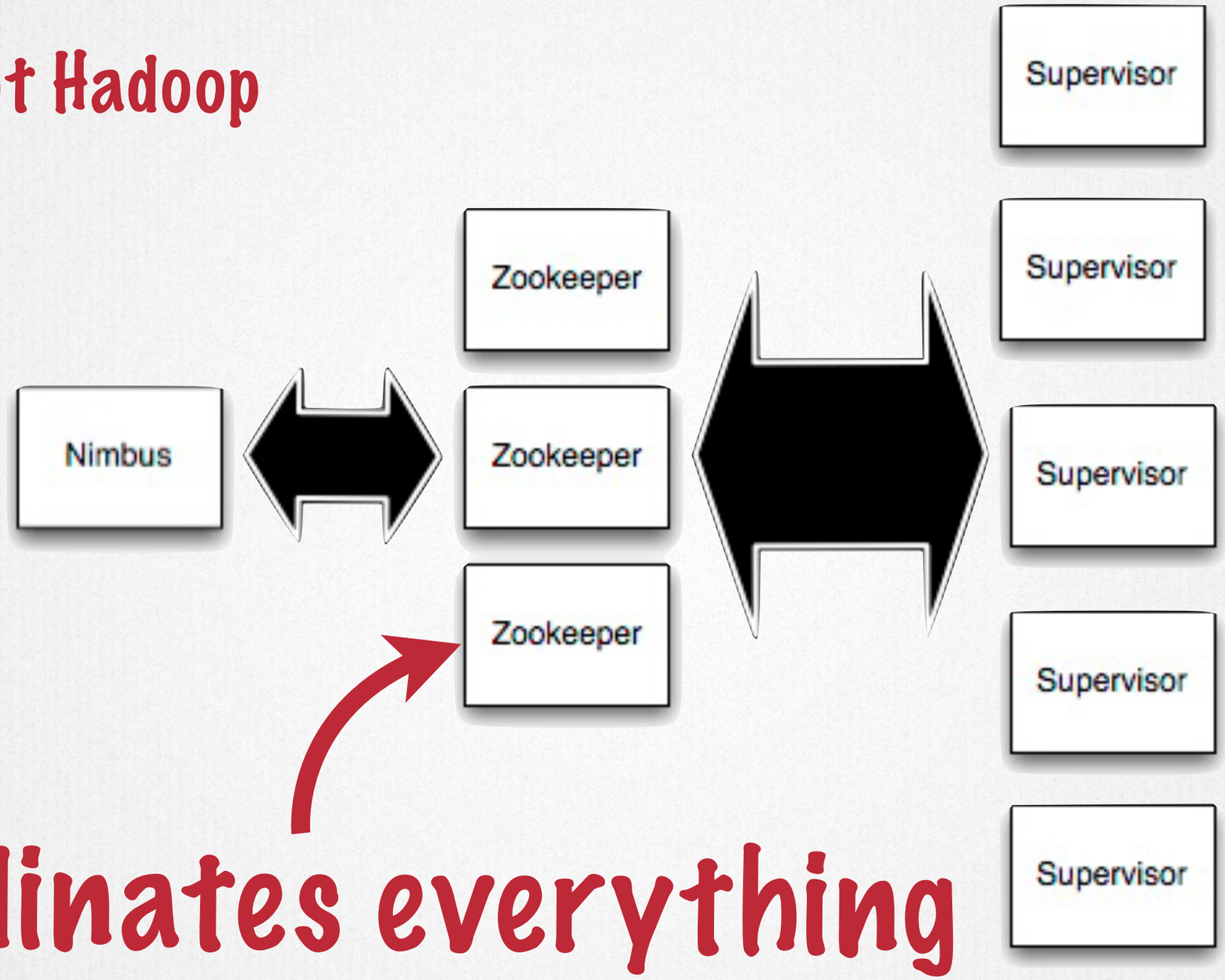
Storm Cluster

But it's not Hadoop



Coordinates everything

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Example:

Streaming Word Count

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Streaming Word Count

```
TopologyBuilder builder = new TopologyBuilder();

builder.setSpout("sentences", new RandomSentenceSpout(), 5);
builder.setBolt("split", new SplitSentence(), 8)
        .shuffleGrouping("sentences");
builder.setBolt("count", new WordCount(), 12)
        .fieldsGrouping("split", new Fields("word"));
```

Streaming Word Count

```
TopologyBuilder builder = new TopologyBuilder();

builder.setSpout("sentences", new RandomSentenceSpout(), 5);
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        .fieldsGrouping("split", new Fields("word"));
```

Streaming Word Count

```
public static class SplitSentence extends ShellBolt implements IRichBolt {

    public SplitSentence() {
        super("python", "splitsentence.py");
    }

    @Override
    public void declareOutputFields(OutputFieldsDeclarer declarer) {
        declarer.declare(new Fields("word"));
    }

    @Override
    public Map<String, Object> getComponentConfiguration() {
        return null;
    }
}
```

SplitSentence.java

Streaming Word Count

```java
public static class SplitSentence extends ShellBolt implements IRichBolt {

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    }

    @Override
    public void declareOutputFields(OutputFieldsDeclarer declarer) {
        declarer.declare(new Fields("word"));
    }

    @Over
    publi
        r
    }
}
```

SplitSentence.java

```python
import storm

class SplitSentenceBolt(storm.BasicBolt):
    def process(self, tup):
        words = tup.values[0].split(" ")
        for word in words:
            storm.emit([word])
```

splitsentence.py

Streaming Word Count

```
public static class SplitSentence extends ShellBolt implements IRichBolt {

    public SplitSentence() {
        super("python", "splitsentence.py");
    }

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SplitSentence.java

Streaming Word Count

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        .shuffleGrouping("sentences");
builder.setBolt("count", new WordCount(), 12)
        .fieldsGrouping("split", new Fields("word"));
```

java

Streaming Word Count

```
public static class WordCount extends BaseBasicBolt {
    Map<String, Integer> counts = new HashMap<String, Integer>();

    @Override
    public void execute(Tuple tuple, BasicOutputCollector collector) {
        String word = tuple.getString(0);
        Integer count = counts.get(word);
        if(count==null) count = 0;
        count++;
        counts.put(word, count);
        collector.emit(new Values(word, count));
    }

    @Override
    public void declareOutputFields(OutputFieldsDeclarer declarer) {
        declarer.declare(new Fields("word", "count"));
    }
}
```

WordCount.java

Streaming Word Count

```java
TopologyBuilder builder = new TopologyBuilder();

builder.setSpout("sentences", new RandomSentenceSpout(), 5);
builder.setBolt("split", new SplitSentence(), 8)
        .shuffleGrouping("sentences");
builder.setBolt("count", new WordCount(), 12)
        .fieldsGrouping("split", new Fields("word"));
```

java

Groupings control how tuples are routed

Shuffle grouping

Tuples are randomly distributed across all of the tasks running the bolt

Fields grouping

Groups tuples by specific named fields and routes them to the same task

Analogous to Hadoop's partitioning behavior

Fields grouping

Groups tuples by specific named fields and routes them to the same task

Distributed RPC

Before Distributed RPC,
time-sensitive queries relied on a
pre-computed index

What if you didn’t need an index?

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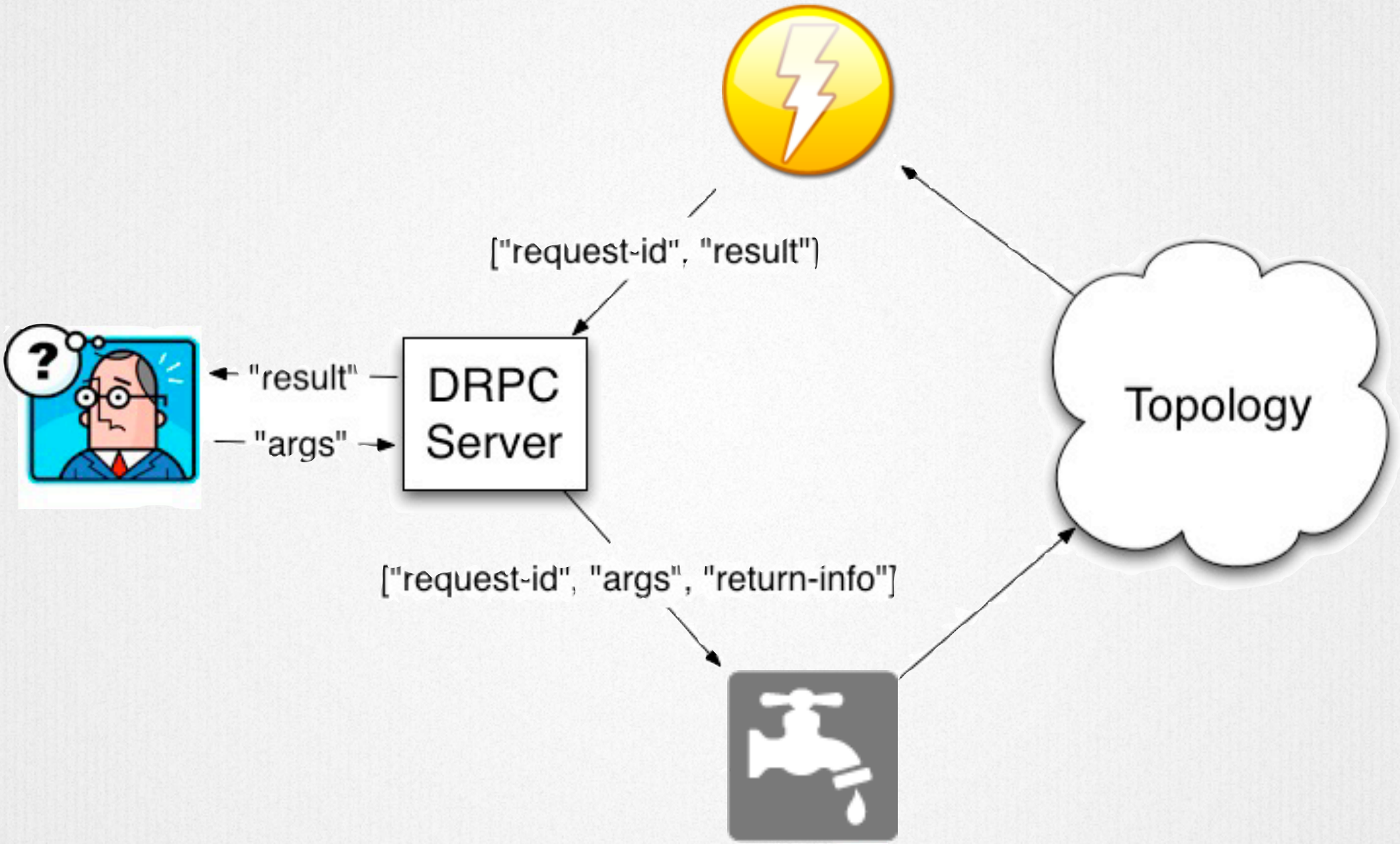
Distributed RPC



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Try it out!

Huge thanks to Nathan Marz - @nathanmarz

http://github.com/nathanmarz/storm

https://github.com/nathanmarz/storm-starter

@stormprocessor

Questions?

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