SIGMOID

Reactive App using Actor model & Apache Spark

Rahul Kumar
Software Developer
@rahul_kumar_aws

APACHE: BIG_DATA EUROPE

About Sigmoid

SIGMOID

We build realtime & big data systems.

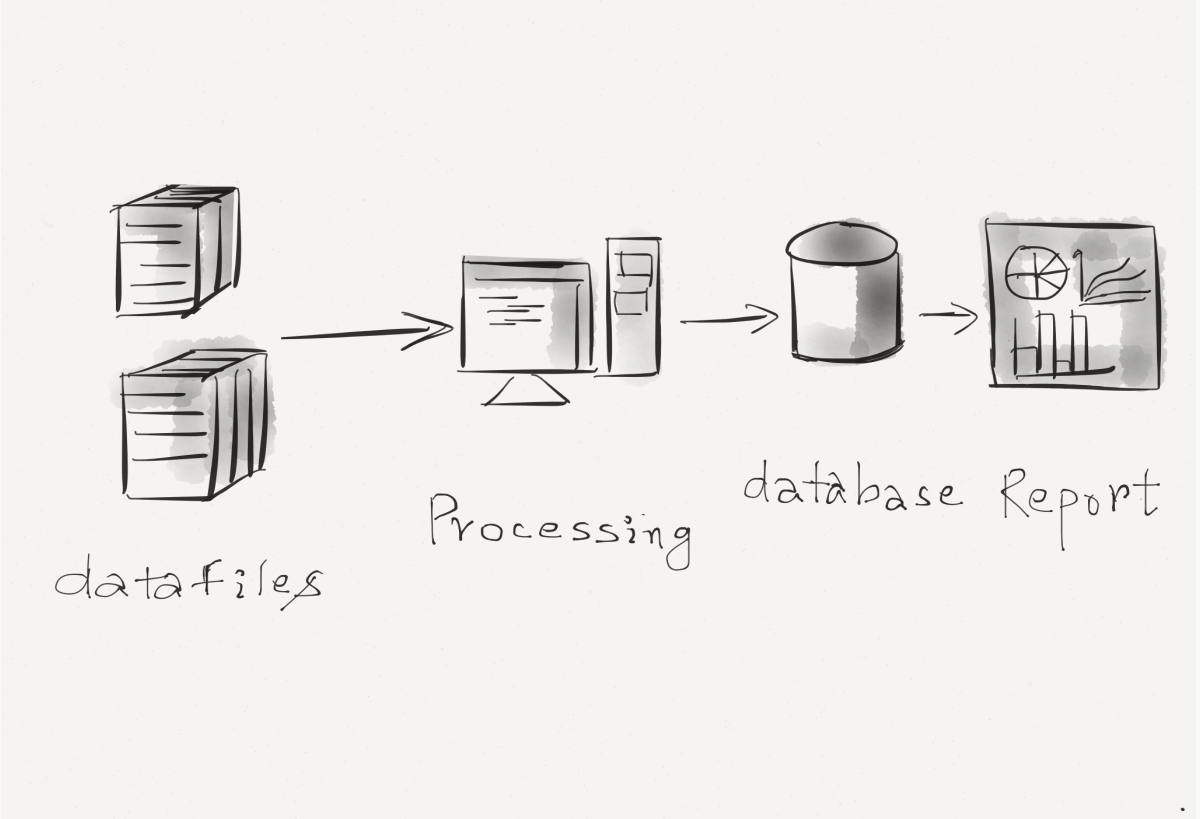
OUR CUSTOMERS

Agenda

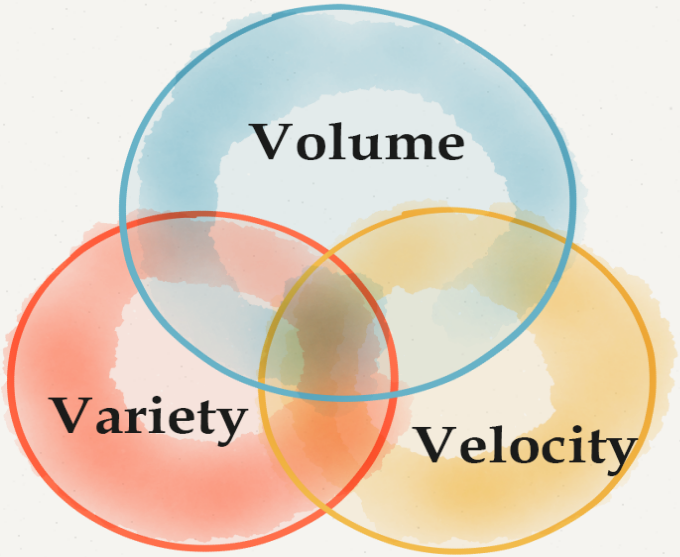
- Big Data - Intro
- Distributed Application Design
- Actor Model
- Apache Spark
- Reactive Platform
- Demo

Data Management

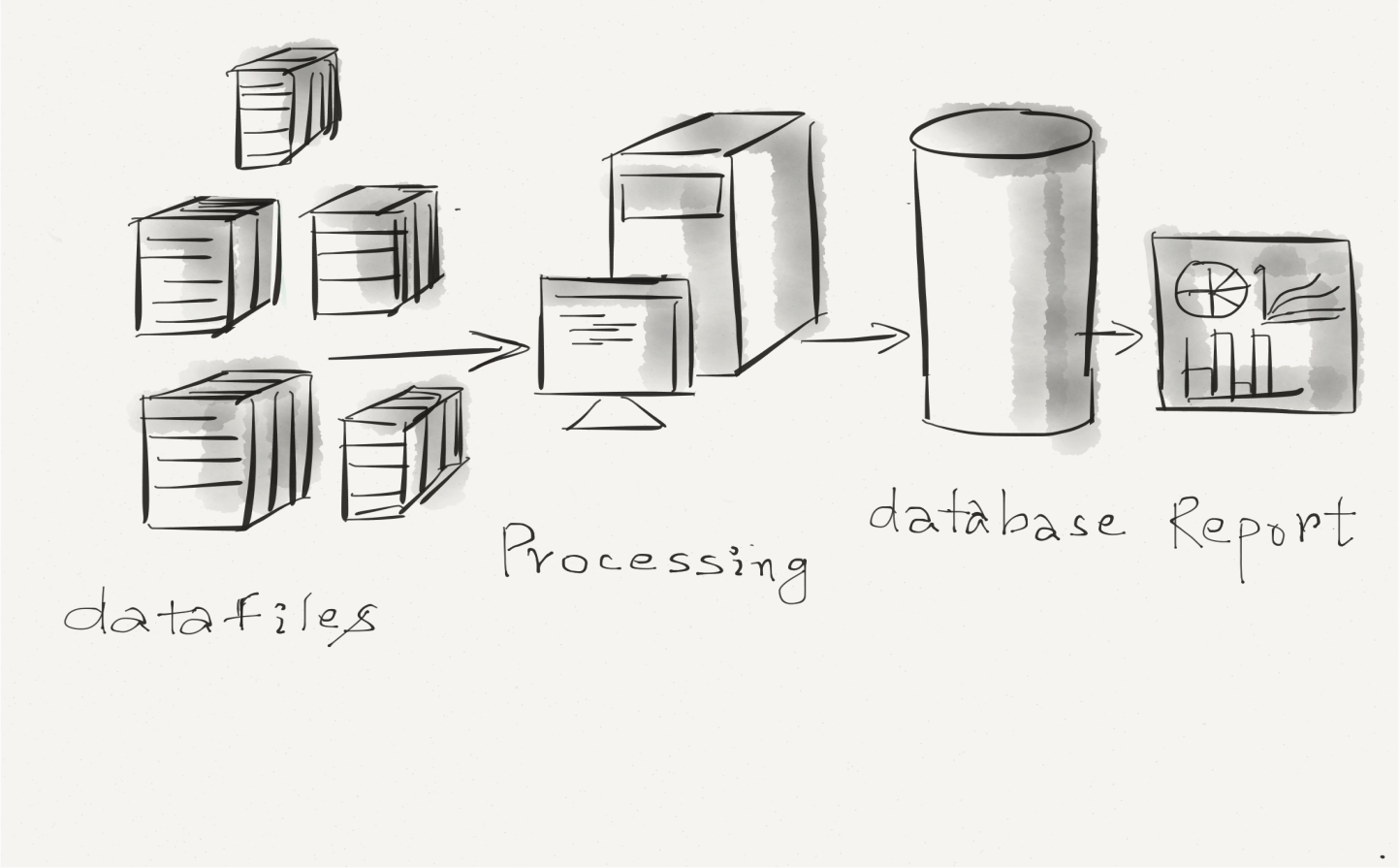
Managing data and analysing data have always greatest benefit and the greatest challenge for organization.



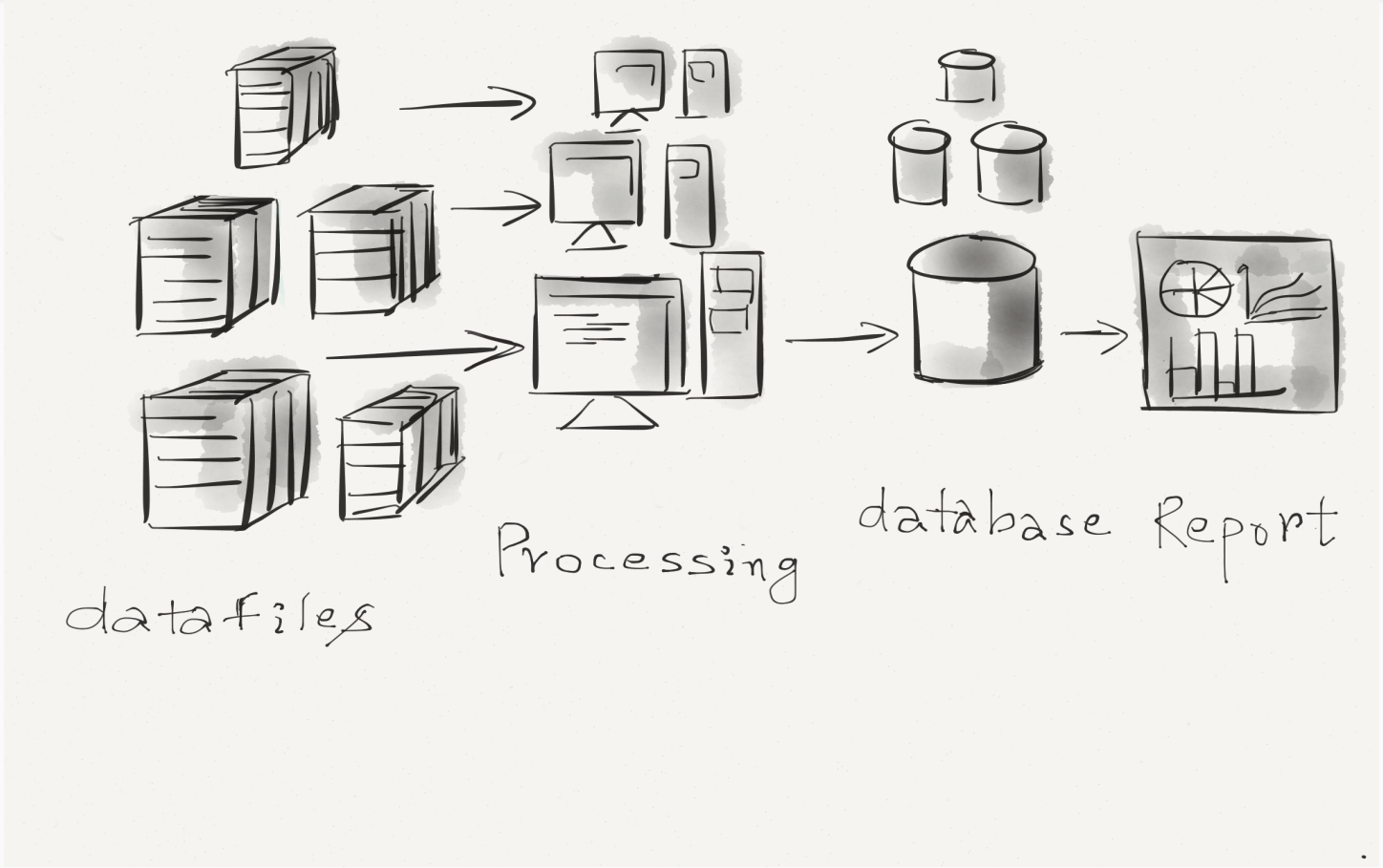
Three V’s of Big data



Scale Vertically (Scale Up)



Scale Horizontally (Scale out)



Understanding Distributed application

“ A distributed system is a software system in which components located on networked computers communicate and coordinate their actions by passing messages.”

Principles Of Distributed Application Design

- **Availability**
- **Performance**
- **Reliability**
- **Scalability**
- **Manageability**
- **Cost**

Actor Model

The fundamental idea of the actor model is to use actors as concurrent primitive that can act upon receiving messages in different ways :

- Send a finite number of messages to other actors
- spawn a finite number of new actors
- change its own internal behavior, taking effect when the next incoming message is handed.

Each actor instance is guaranteed to be run using at most one thread at a time, making concurrency much easier.

Actors can also be deployed remotely.

In Actor Model the basic unit is a message, which can be any object, but it should be serializable as well for remote actors.

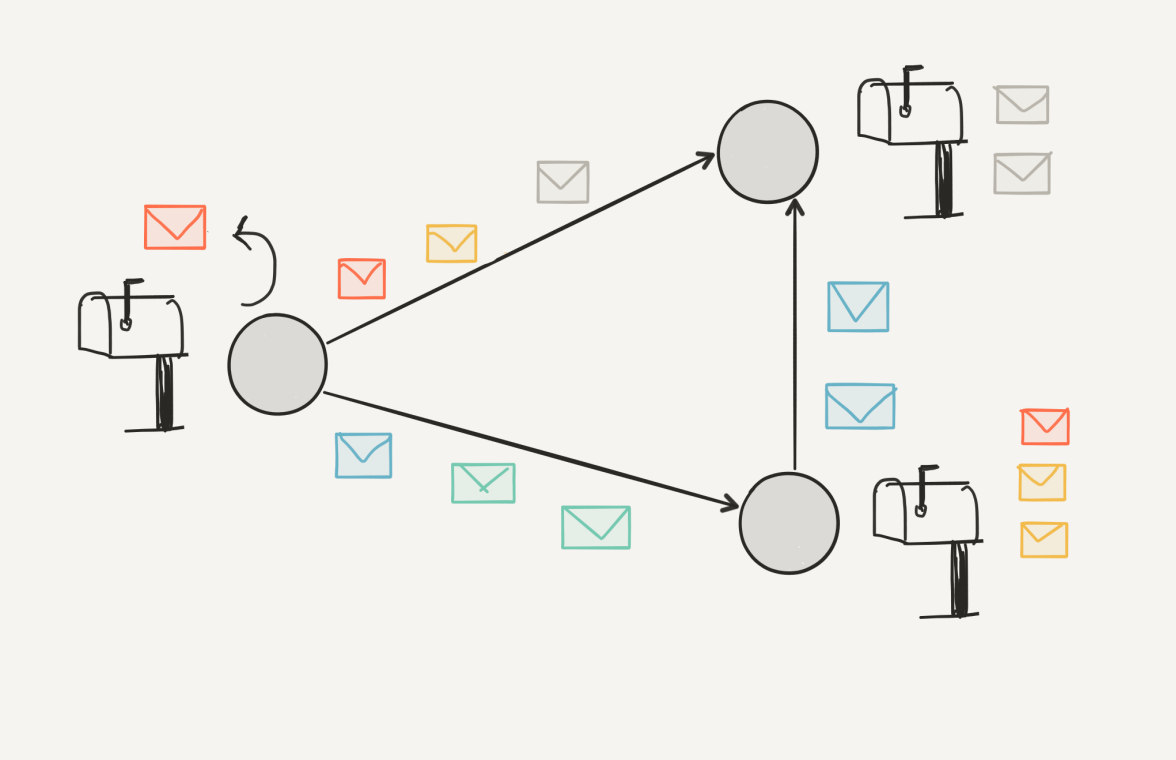
Actors

For communication actor uses asynchronous message passing.

Each actor have there own mailbox and can be addressed.

Each actor can have no or more than one address.

Actor can send message to them self.



Akka : Actor based Concurrency

Akka is a toolkit and runtime for building highly concurrent, distributed, and resilient message-driven applications on the JVM.

- Simple Concurrency & Distribution
- High Performance
- Resilient by design
- Elastic & Decentralized

Akka Modules

akka-actor – Classic Actors, Typed Actors, IO Actor etc.

akka-agent – Agents, integrated with Scala STM

akka-camel – Apache Camel integration

akka-cluster – Cluster membership management, elastic routers.

akka-kernel – Akka microkernel for running a bare-bones mini application server

akka-osgi – base bundle for using Akka in OSGi containers, containing the akka-actor classes

akka-osgi-aries – Aries blueprint for provisioning actor systems

akka-remote – Remote Actors

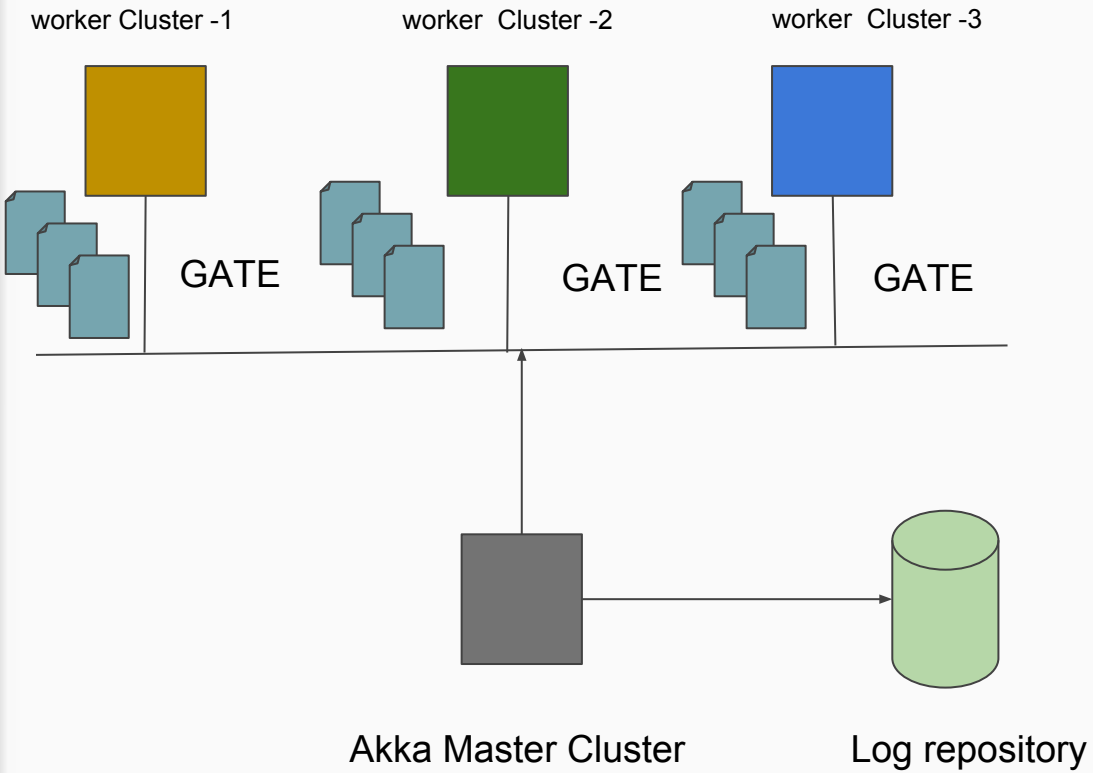
akka-slf4j – SLF4J Logger (event bus listener)

akka-testkit – Toolkit for testing Actor systems

akka-zeromq – ZeroMQ integration

Akka Use case - 1

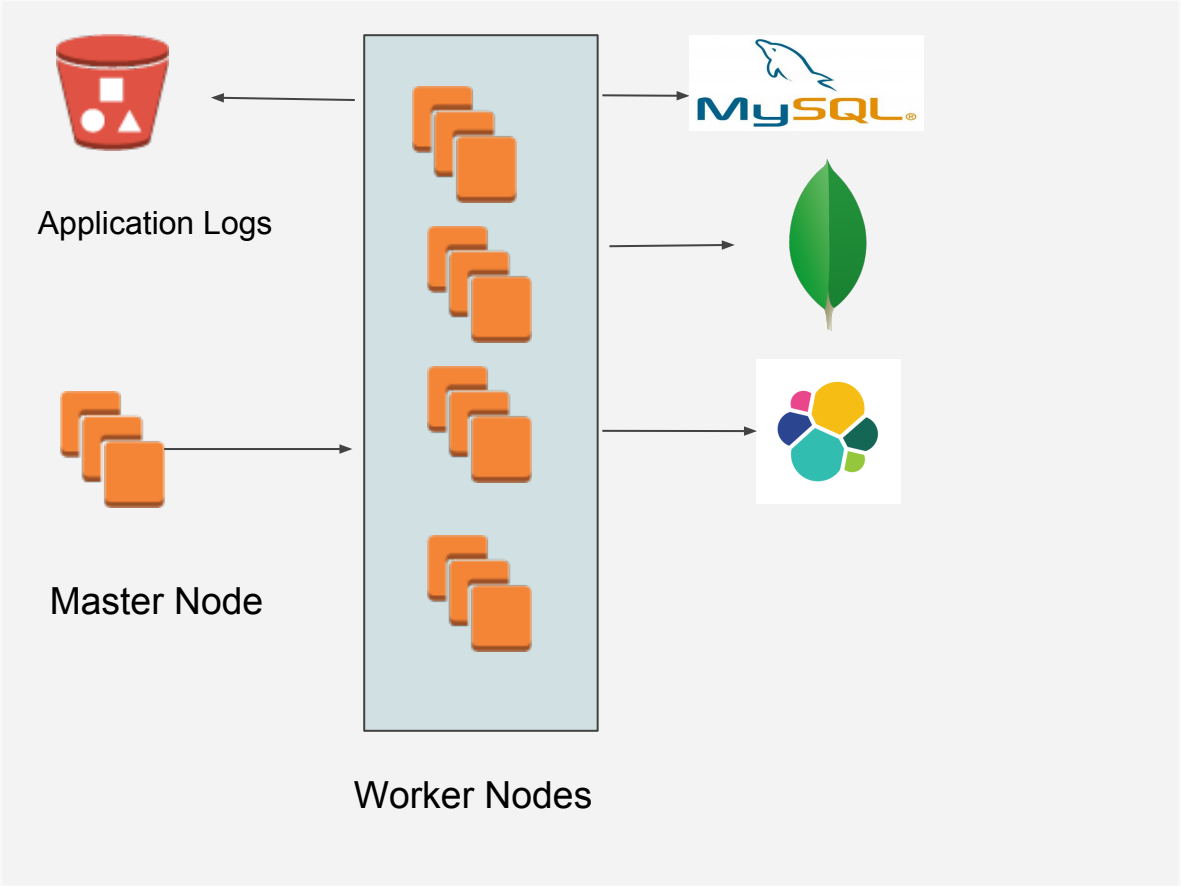
Fully fault-tolerance Text extraction system.



GATE : General architecture for Text processing

Akka Use case - 2

Real time Application Stats



Project and libraries build upon Akka

Apache Spark

Apache Spark is a fast and general execution engine for large-scale data processing.

- originally developed in the AMPLab at University of California, Berkeley
- Organize computation as concurrent tasks
- schedules tasks to multiple nodes
- Handle fault-tolerance, load balancing
- Developed on Actor Model

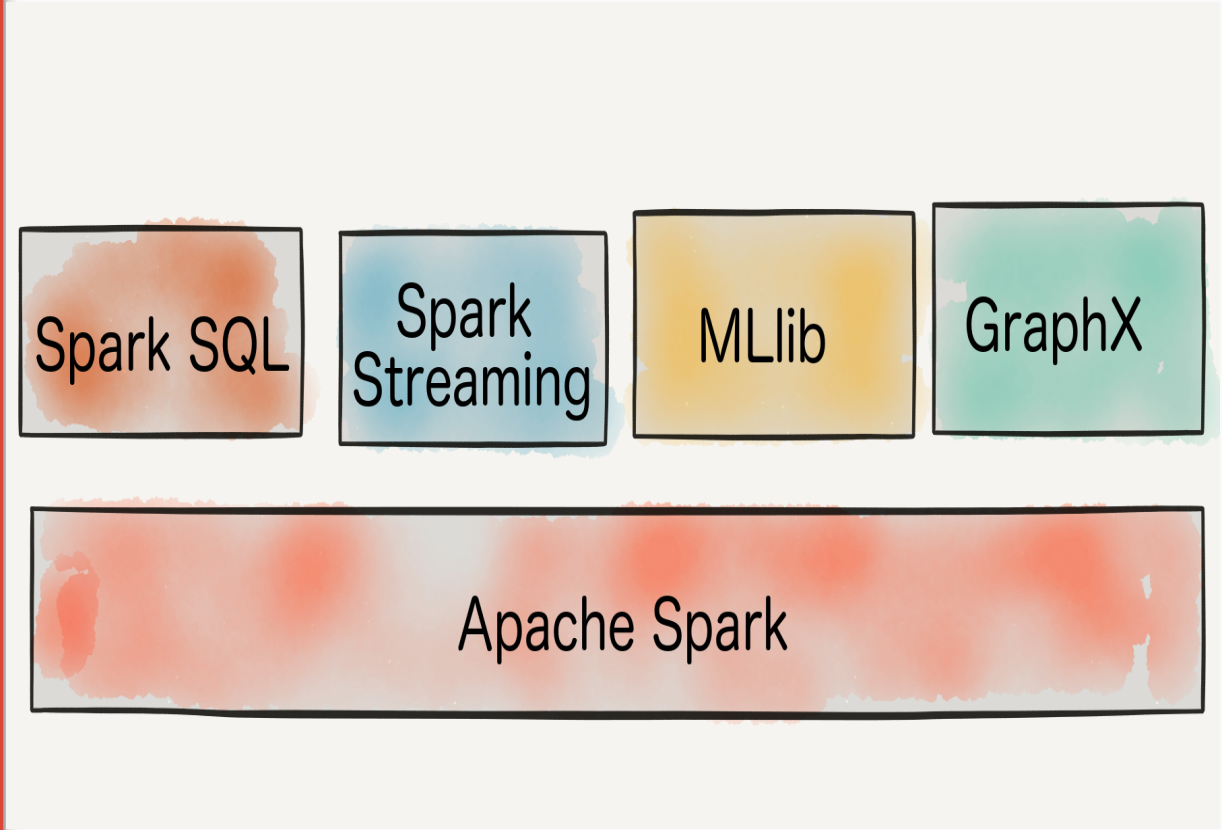
Apache Spark

Speed

Ease of Use

Generality

Run Everywhere



Cluster Support

We can run Spark using its **standalone cluster** mode, on **EC2**, on **Hadoop YARN**, or on **Apache Mesos**.

RDD Introduction

Resilient Distributed Datasets (RDDs), a distributed memory abstraction that lets programmers perform in-memory computations on large clusters in a fault-tolerant manner.

RDD shard the data over a cluster, like a virtualized, distributed collection.

Users create **RDDs** in two ways: by **loading an external dataset**, or by **distributing a collection of objects** such as List, Map etc.

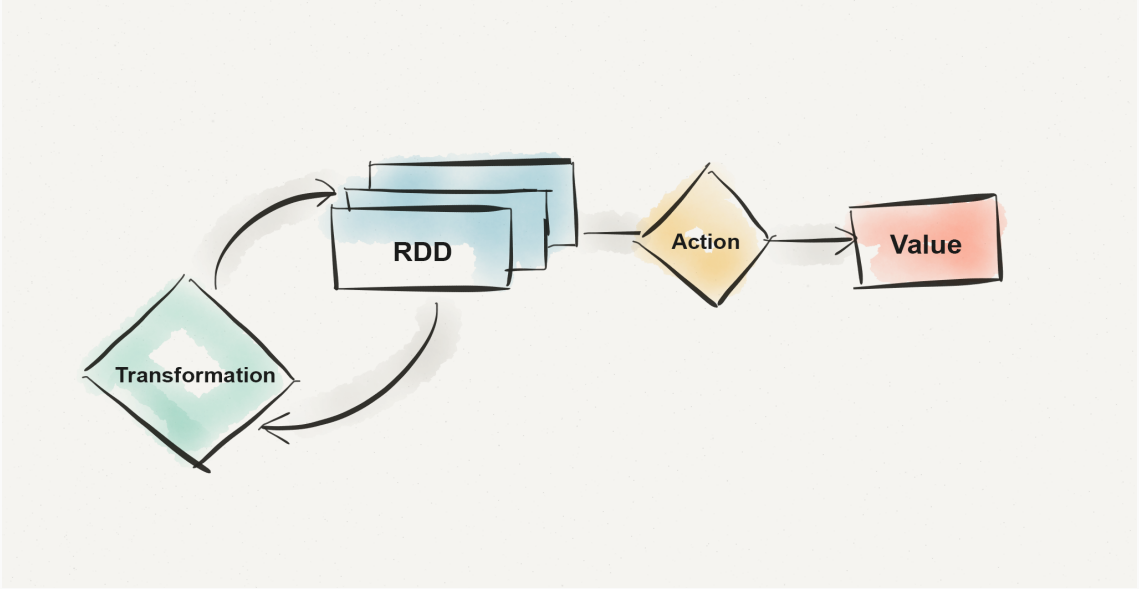
RDD Operations

Two Kind of Operations

- Transformation
- Action

Spark computes RDD only in a lazy fashion.

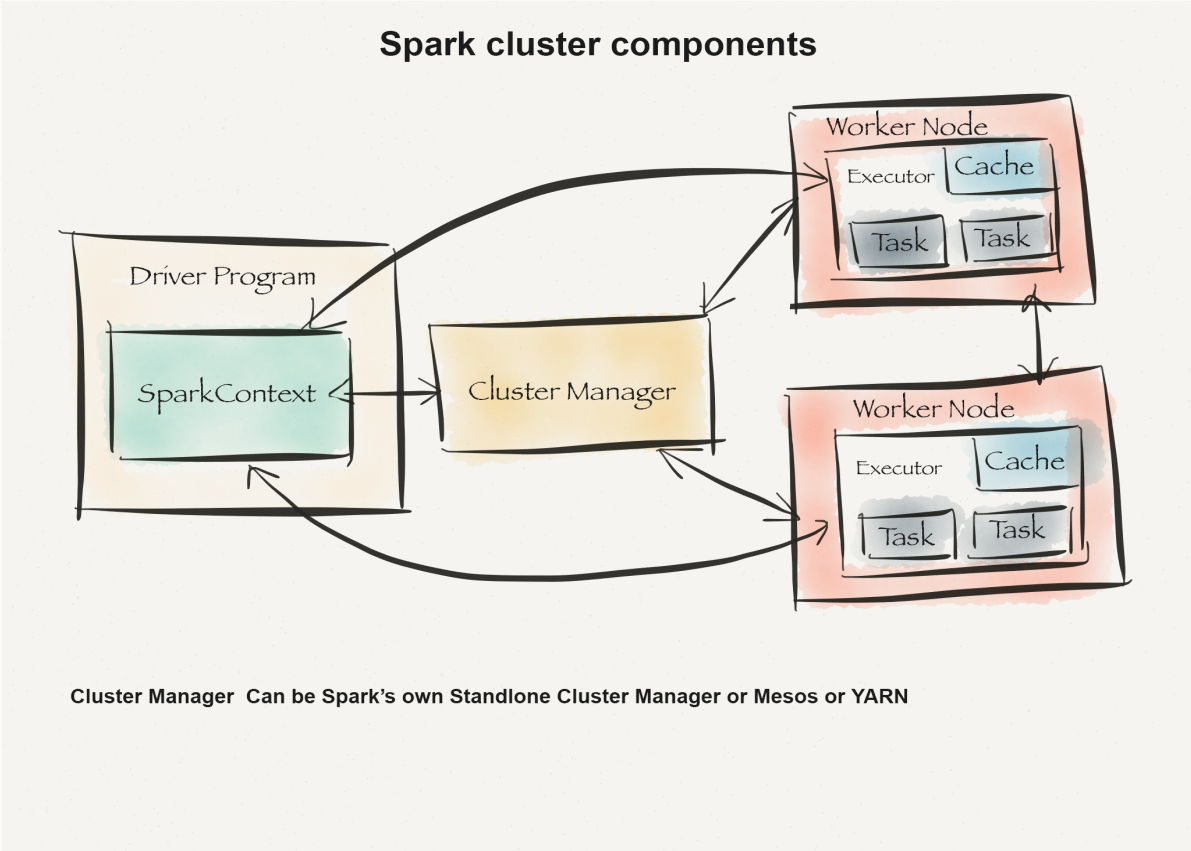
Only computation start when an Action call on RDD.



```
scala> val lineRDD = sc.textFile("sherlockholmes.txt")

lineRDD: org.apache.spark.rdd.RDD[String] = MapPartitionsRDD[3] at textFile at
<console>:21

scala> val lowercaseRDD = lineRDD.map(line=> line.toLowerCase)

lowercaseRDD: org.apache.spark.rdd.RDD[String] = MapPartitionsRDD[5] at map at
<console>:22

scala> lowercaseRDD.count()

res2: Long = 13052
```

```
import org.apache.spark.SparkContext
import org.apache.spark.SparkContext._
object SparkWordCount {

     def main(args: Array[String]): Unit = {

       val sc = new SparkContext("local","SparkWordCount")

       val wordsCounted = sc.textFile(args(0)).map(line=> line.toLowerCase)
                                    .flatMap(line => line.split("""\W+"""))
                                    .groupBy(word => word)
                                    .map{ case(word, group) => (word, group.size)}

       wordsCounted.saveAsTextFile(args(1))
       sc.stop()
     }
}
```

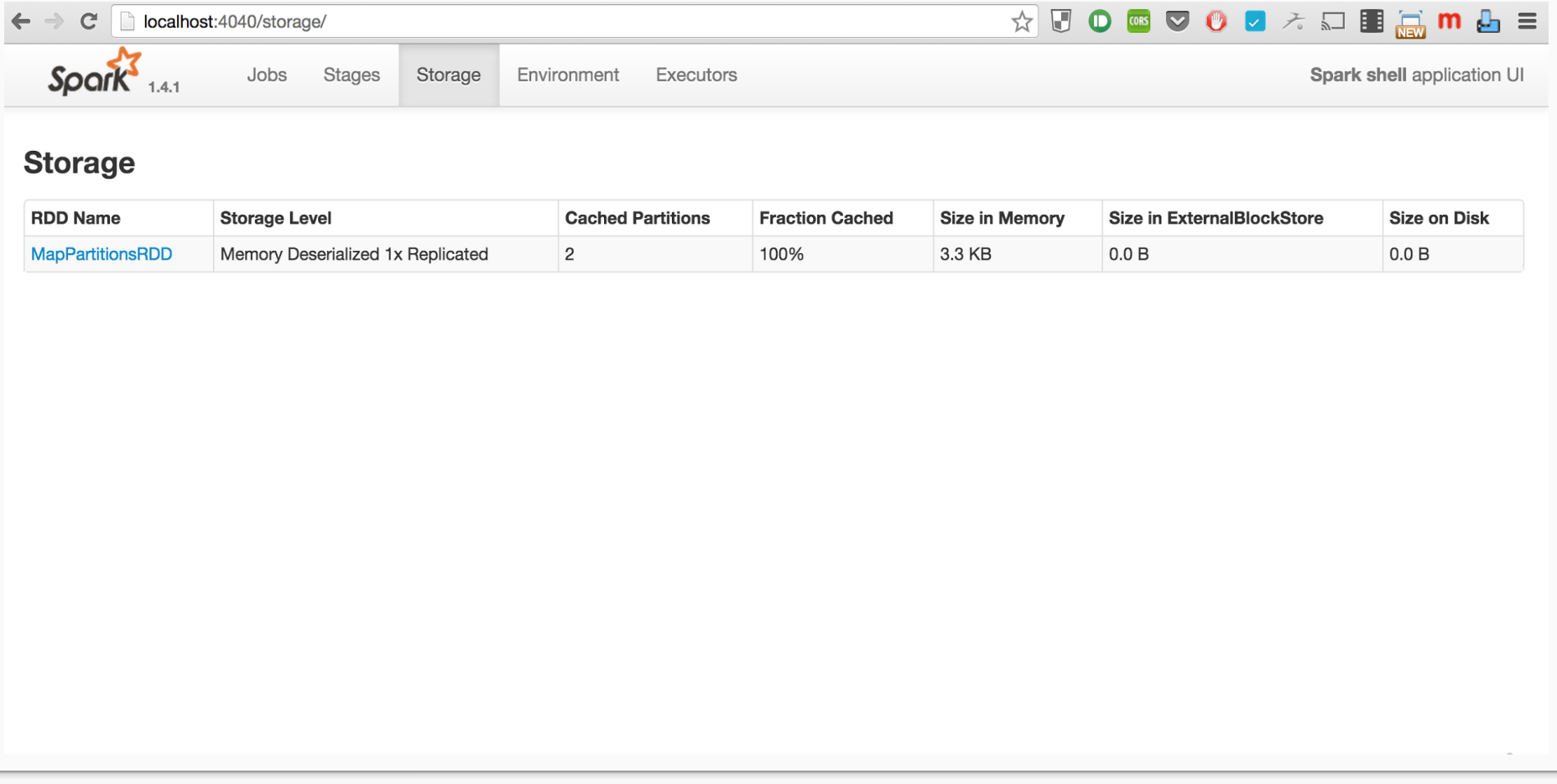
Spark Cluster



Spark Cache

pulling data sets into a cluster-wide in-memory

```
scala> val textFile = sc.textFile("README.md")

textFile: org.apache.spark.rdd.RDD[String] = MapPartitionsRDD[12]
at textFile at <console>:21

scala> val linesWithSpark = textFile.filter(line => line.
contains("Spark"))

linesWithSpark: org.apache.spark.rdd.RDD[String] =
MapPartitionsRDD[13] at filter at <console>:23

scala> linesWithSpark.cache()

res11: linesWithSpark.type = MapPartitionsRDD[13] at filter at
<console>:23

scala> linesWithSpark.count()

res12: Long = 19
```



Spark Cache Web UI

Spark SQL

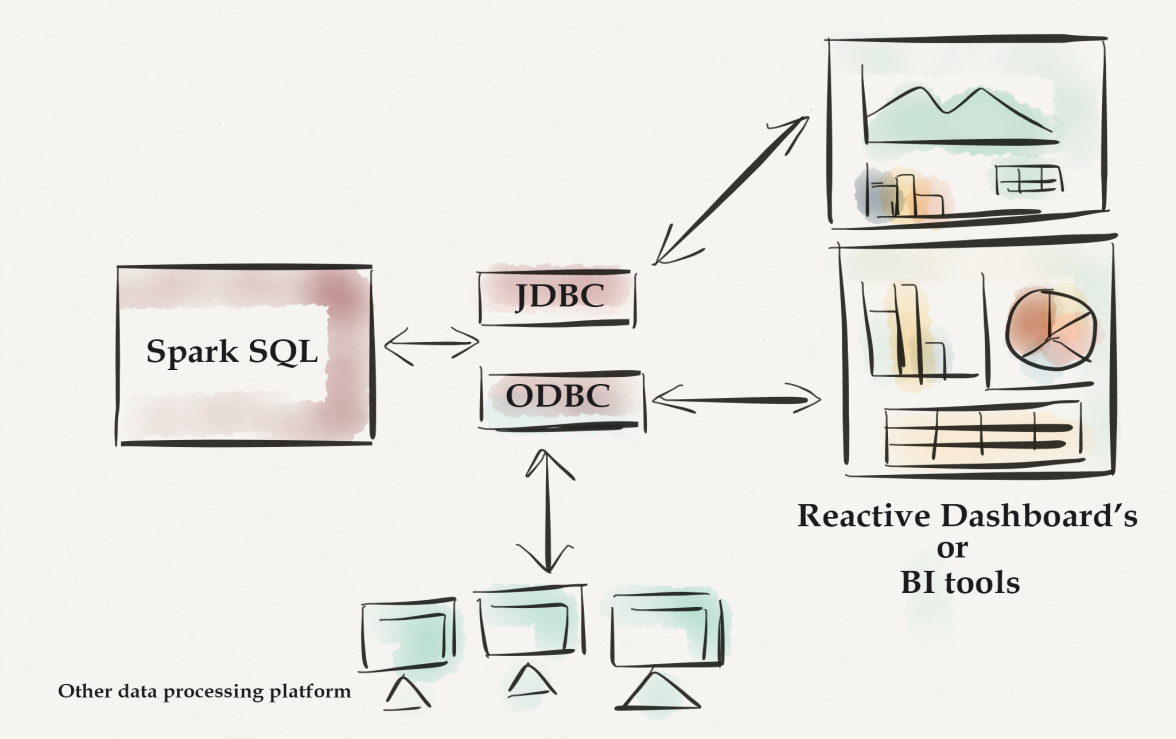
Mix SQL queries with Spark programs

Uniform Data Access, Connect to any data source

DataFrames and SQL provide a common way to access a variety of data sources,
including Hive,
Avro,
Parquet,
ORC,
JSON,
and JDBC.

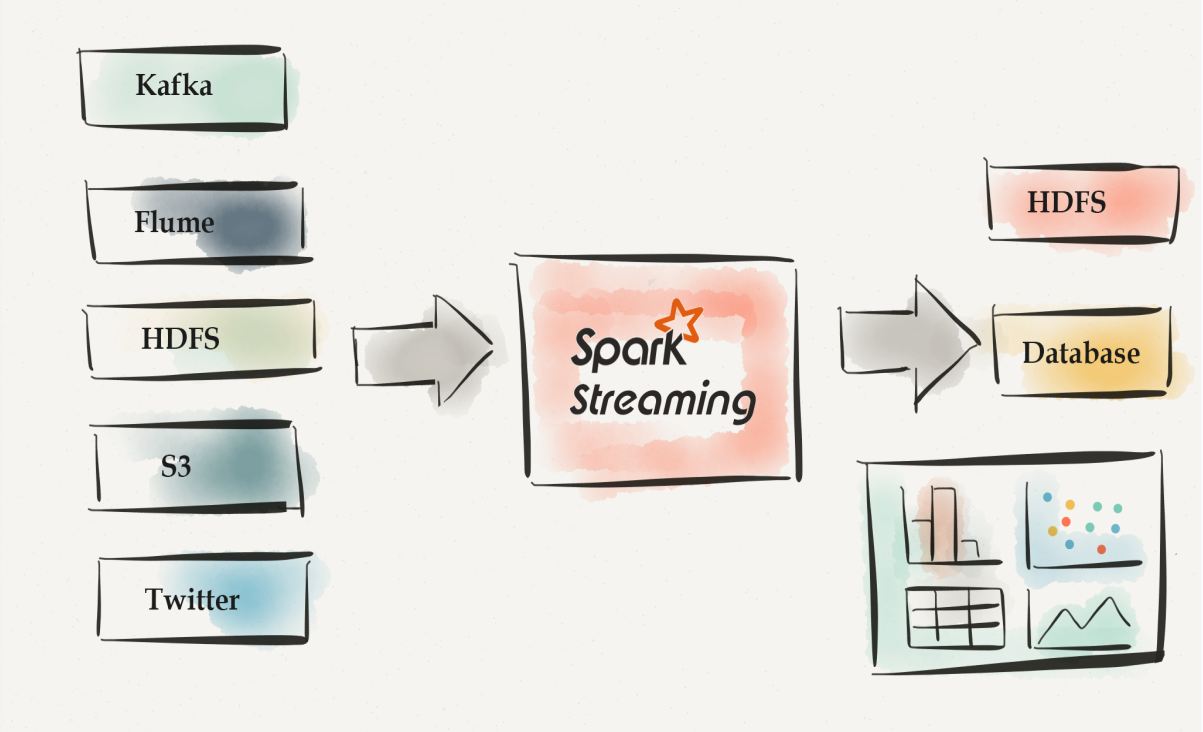
Hive Compatibility Run unmodified Hive queries on existing data.

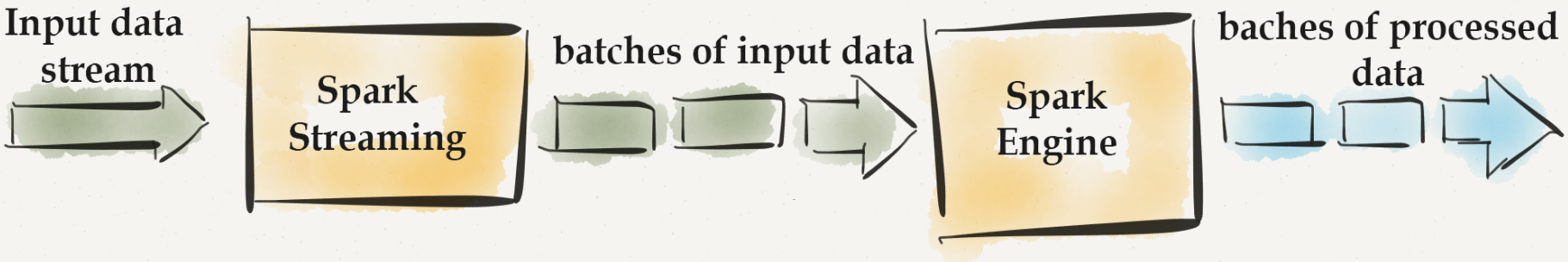
Connect through JDBC or ODBC.



Spark Streaming

Spark Streaming is an extension of the core Spark API that enables scalable, high-throughput, fault-tolerant stream processing of live data streams.




Input data stream
Spark Streaming
batches of input data
Spark Engine
baches of processed data

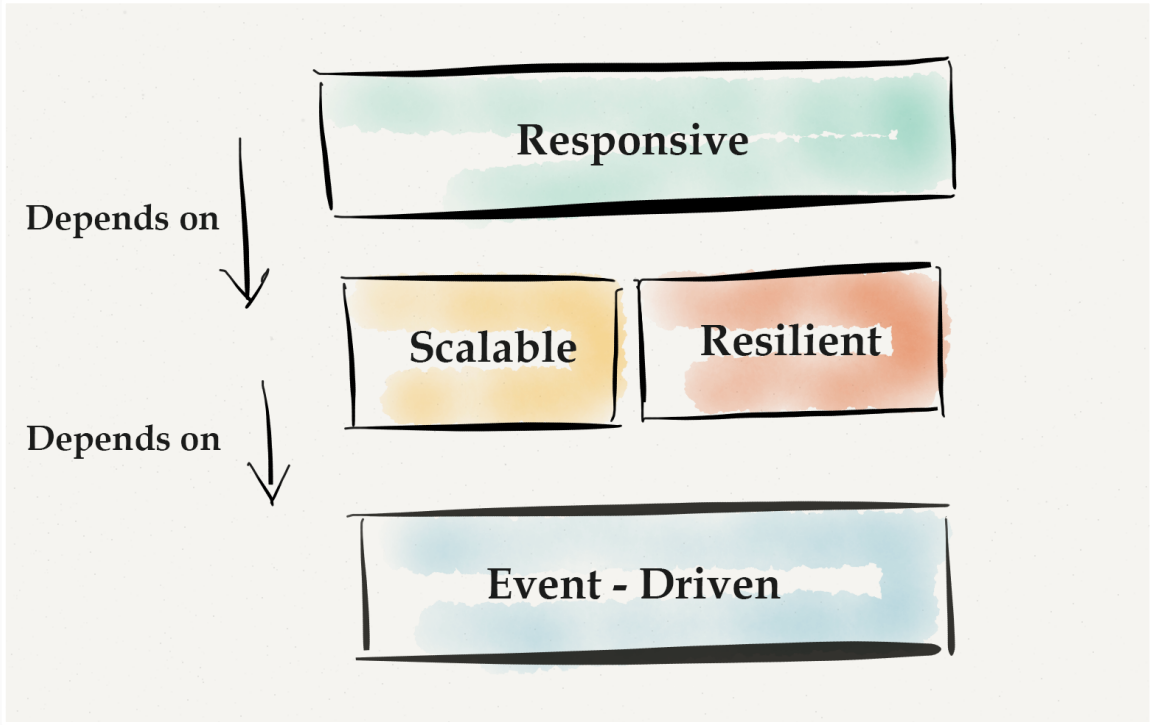
Reactive Application

Responsive

Resilient

Elastic

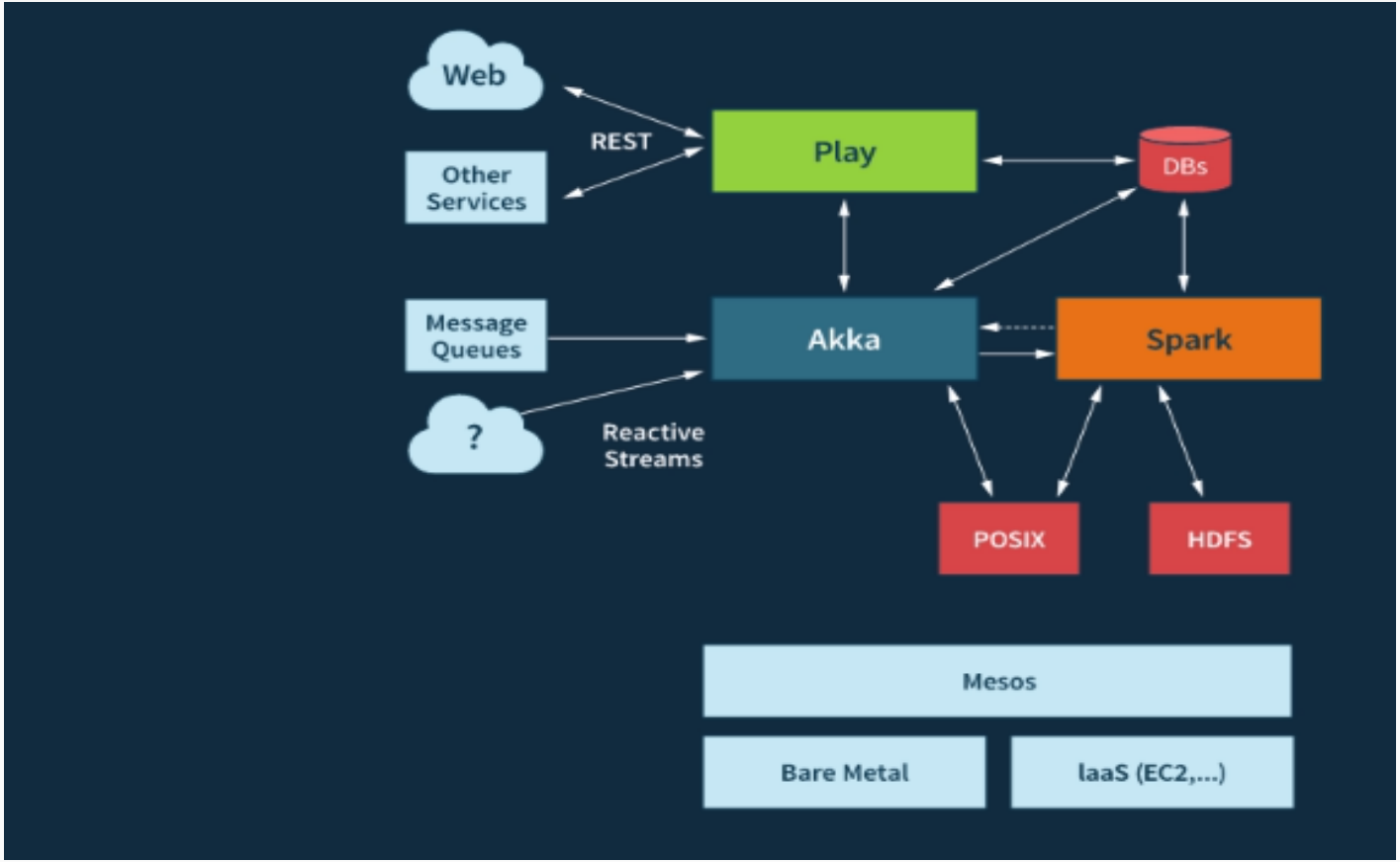
Message Driven



http://www.reactivemanifesto.org

Typesafe Reactive Platform

Typesafe Reactive Platform



- taken from Typesafe's web site

Demo

Reference

https://www.cs.berkeley.edu/~matei/papers/2012/nsdi_spark.pdf
http://spark.apache.org/docs/latest/quick-start.html
Learning Spark Lightning-Fast Big Data Analysis
By Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia
https://www.playframework.com/documentation/2.4.x/Home
http://doc.akka.io/docs/akka/2.3.12/scala.html

Thank You