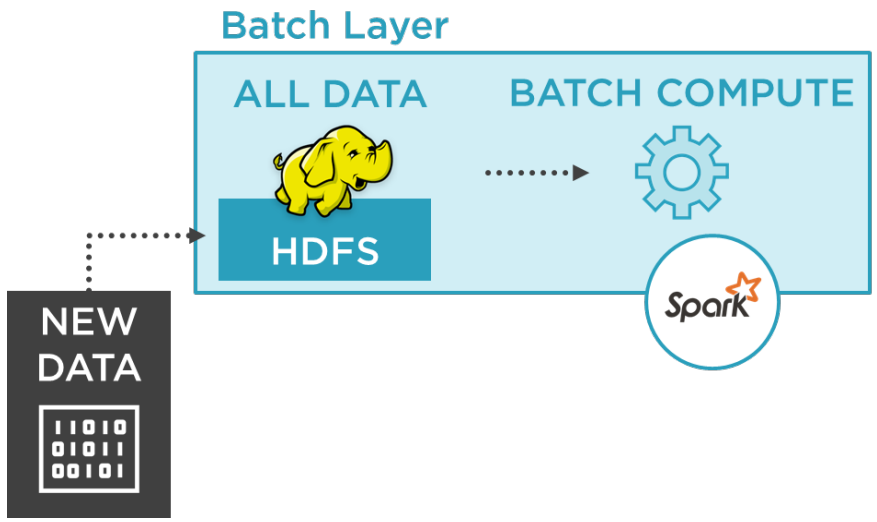
Batch Layer with Apache Spark

Ahmad Alkilani
DATA ARCHITECT

@akizl

Building the Batch Layer



Fundamentals of batch layer

Aggregations in Spark

- RDD API
- DataFrame and DataSet API
- Caching

Introduction to Spark

Spark components and scheduling

Spark is a general purpose cluster computing platform designed with components for scheduling and executing against large datasets

Batch workloads, Iterative algorithms, interactive queries, streaming applications, machine learning workloads, graph processing

Timeline of Events

2009
Mesos
Cluster Management

2010
Spark open sourced
Iterative compute

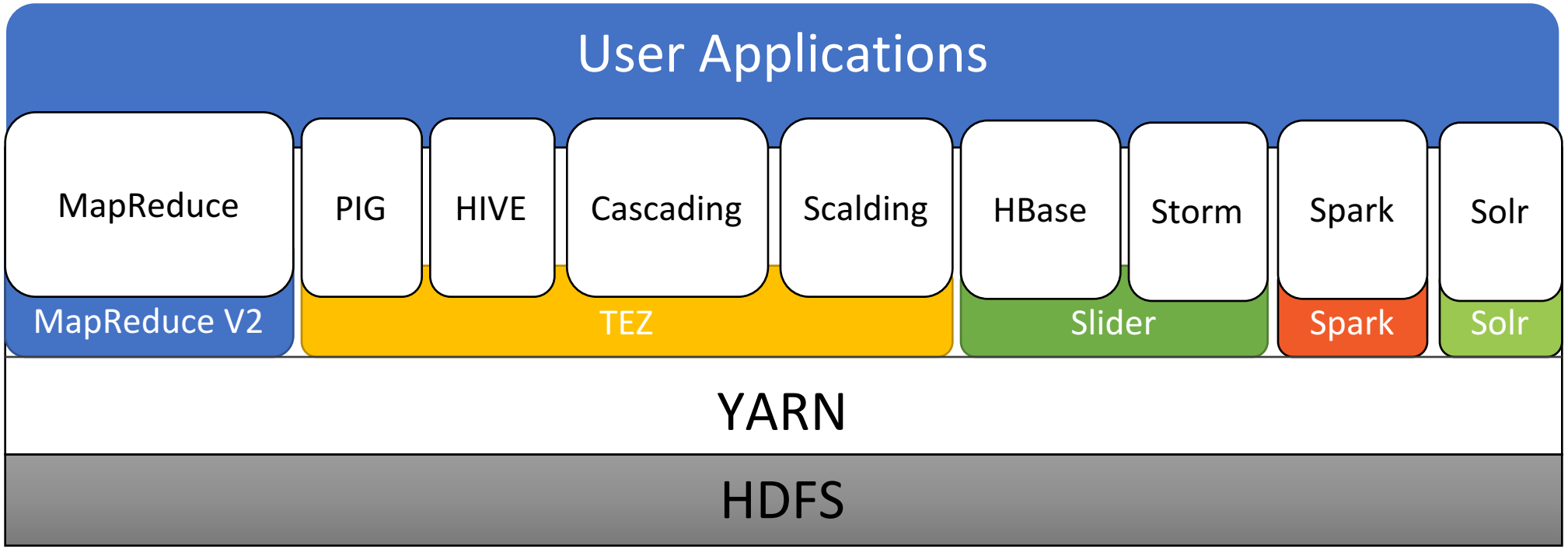
Spark 1.0
Spark SQL emerges
Spark 1.2 Data sources API

Spark 1.3
DataFrame API
Structured data

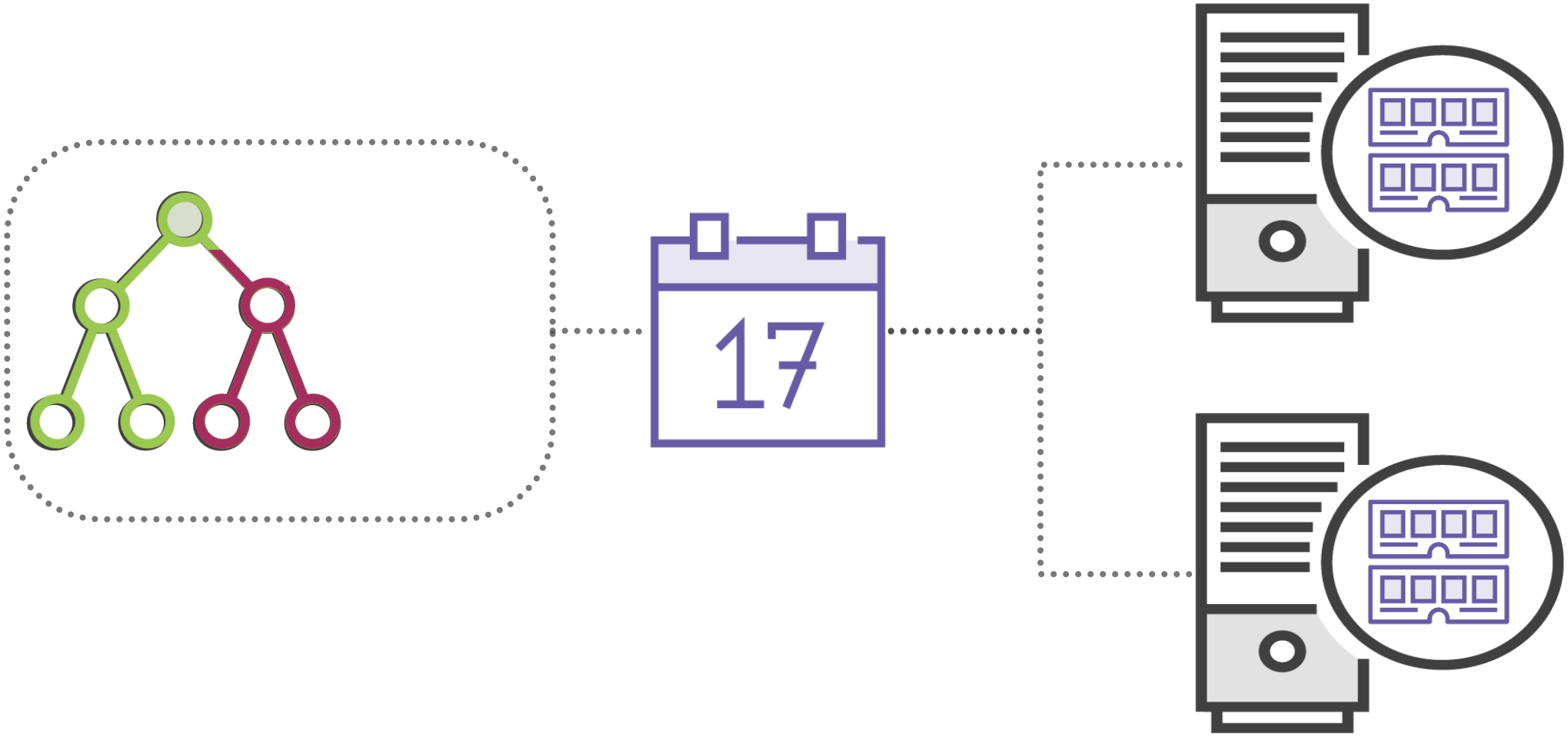
Spark 1.6
Dataset API
Superset of Dataframes

Spark 2.0
Streaming is Key!

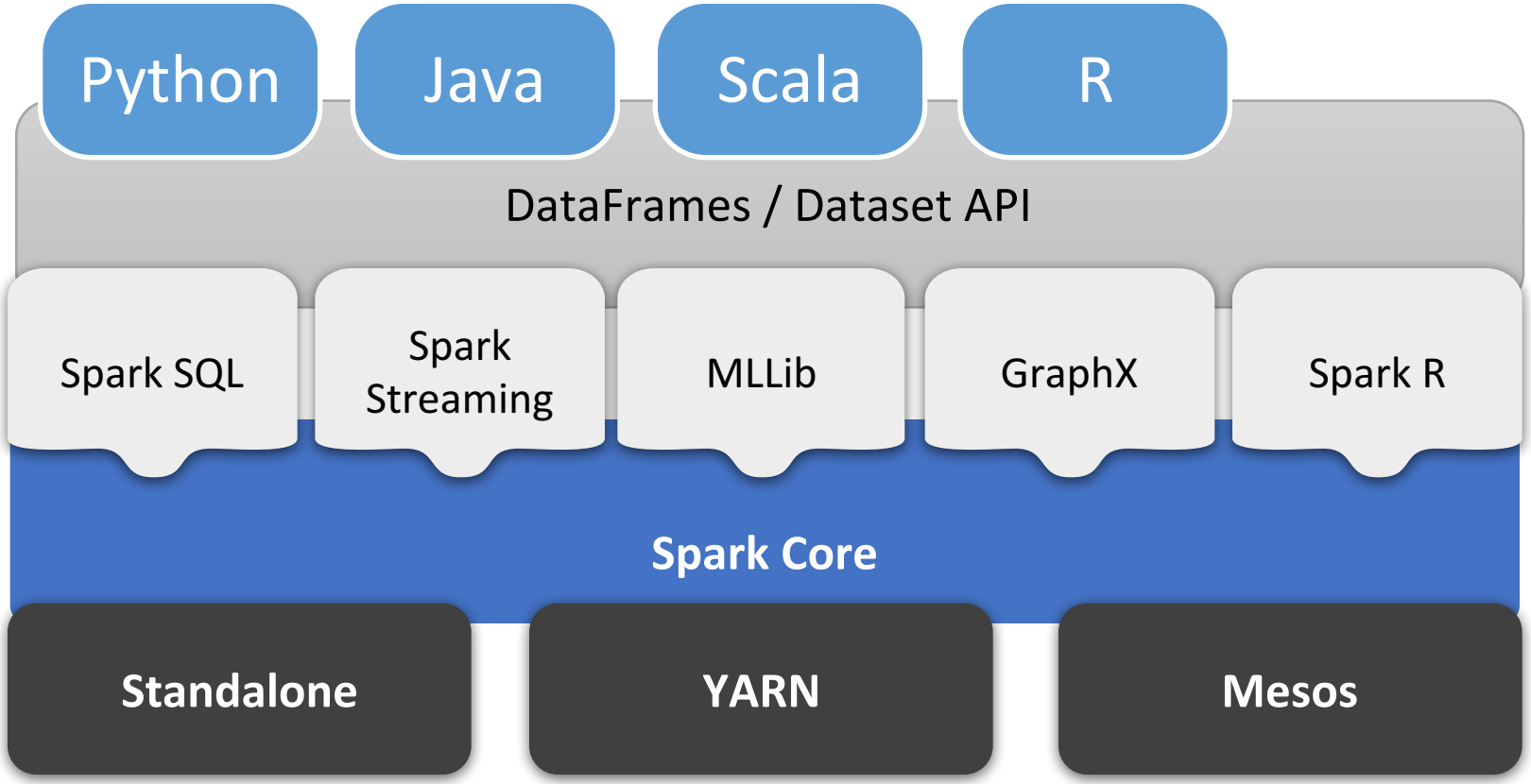
YARN


User Applications
MapReduce
PIG
HIVE
Cascading
Scalding
HBase
Storm
Spark
Solr
MapReduce V2
TEZ
Slider
Spark
Solr
YARN
HDFS

Spark Fundamentals



Spark Components



Spark RDD

Fundamental abstraction and building block. RDD represents a Resilient Distributed Dataset

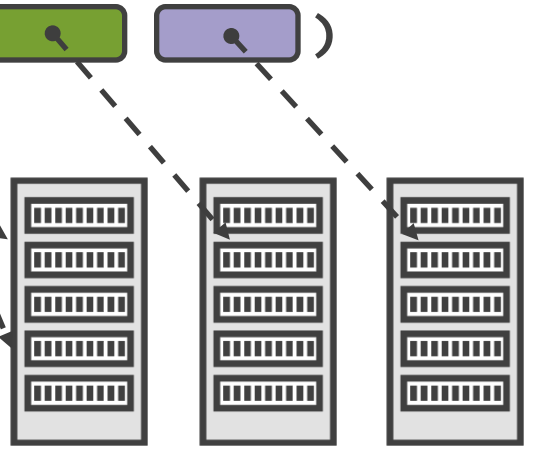
Spark RDD

val scalaCollection : Array[ ] = ( )

scalaCollection.map(item => turnOrange(item))

val sparkRDD : RDD [ ] = ( )

sparkRDD.map(item => turnOrange(item))



Generates execution DAG

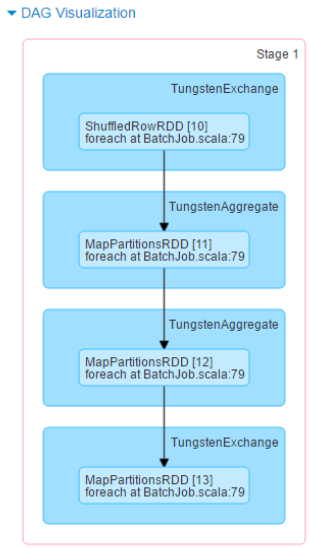
Optimizes DAG execution

Cache datasets

Resiliency by lineage

Spark modules

- Core
- Streaming
- Spark SQL
- MLLib
- Spark R



Spark Components & Scheduling

Spark's Relationship to Hadoop

HDFS

Read/Write

Native integration with Hadoop APIs and various file formats

Hive

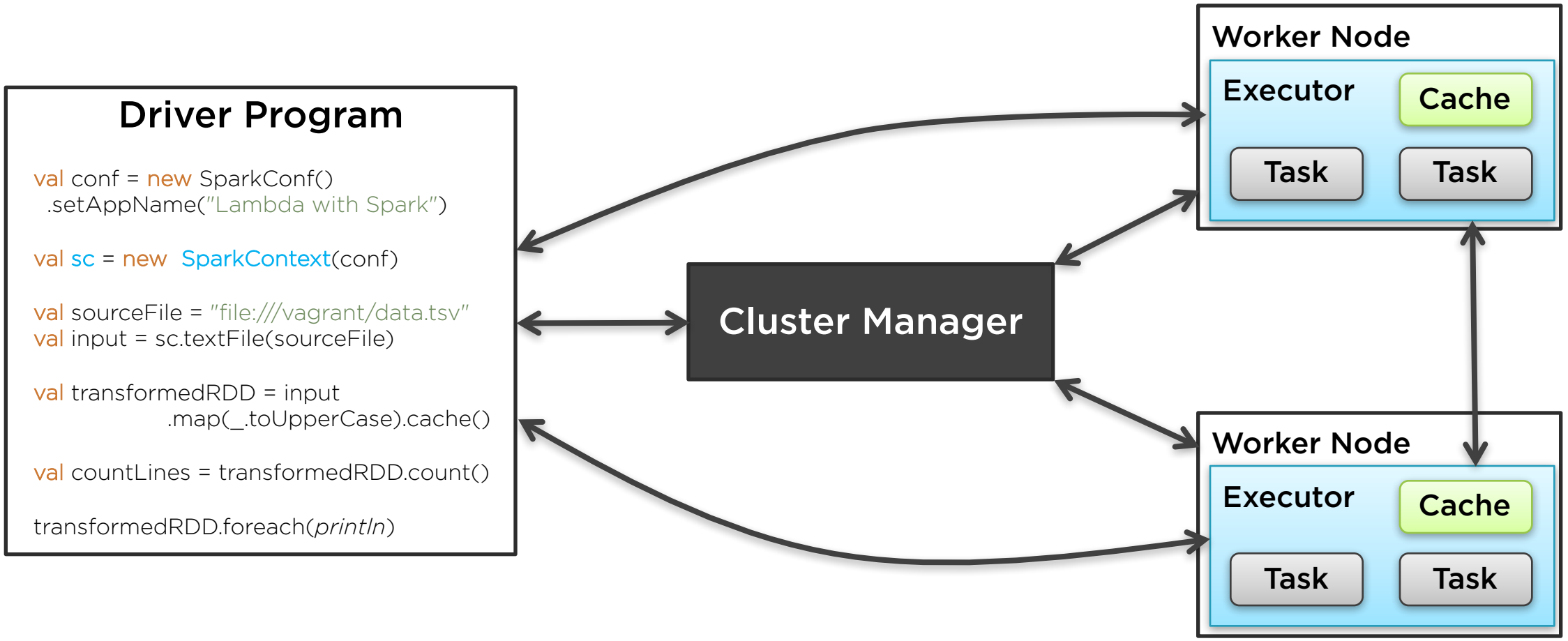
Tight integration with Hive and Hive's metastore. Spark's HiveContext uses HiveQL

YARN

Cluster Manager

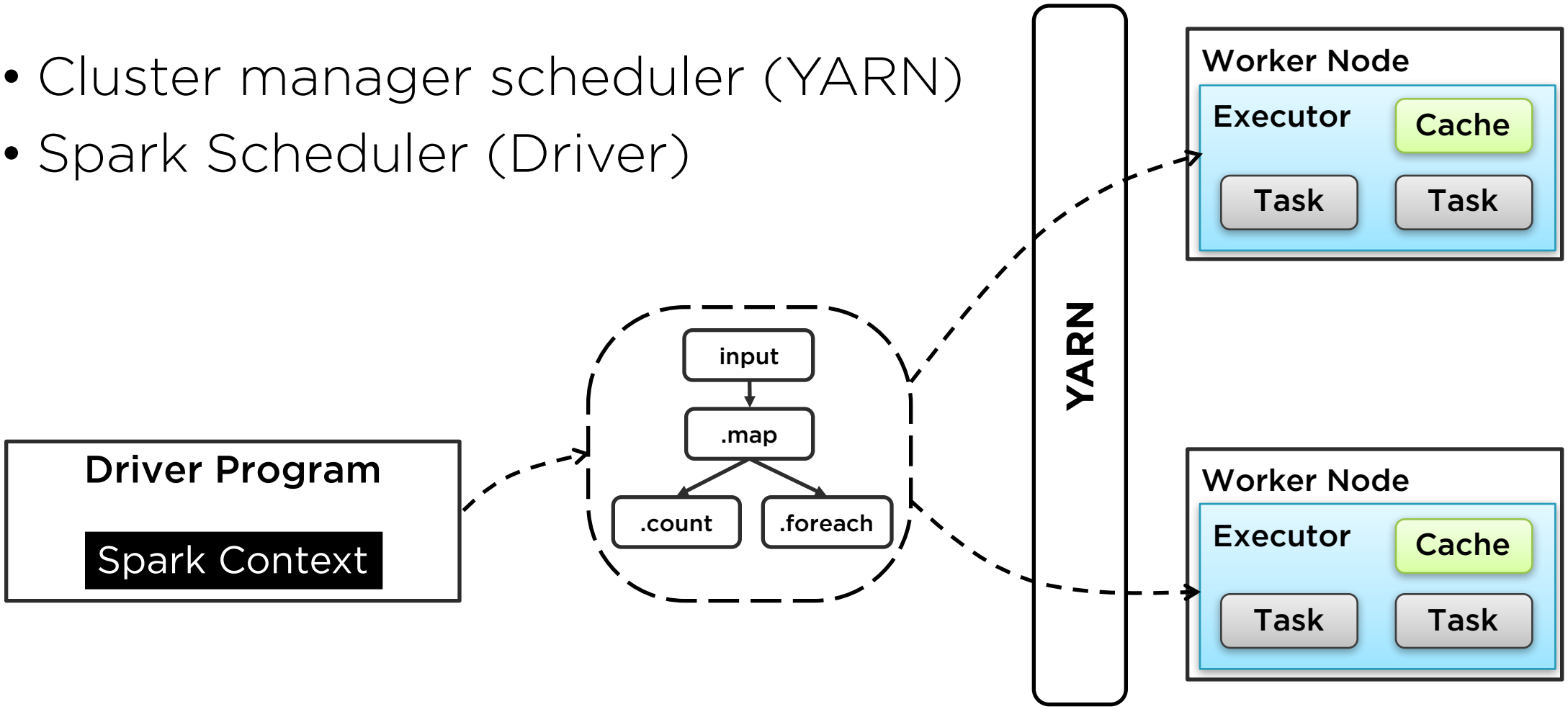
Uses YARN/Hadoop as a cluster manager to schedule the execution of Spark Executors

Spark Execution Components



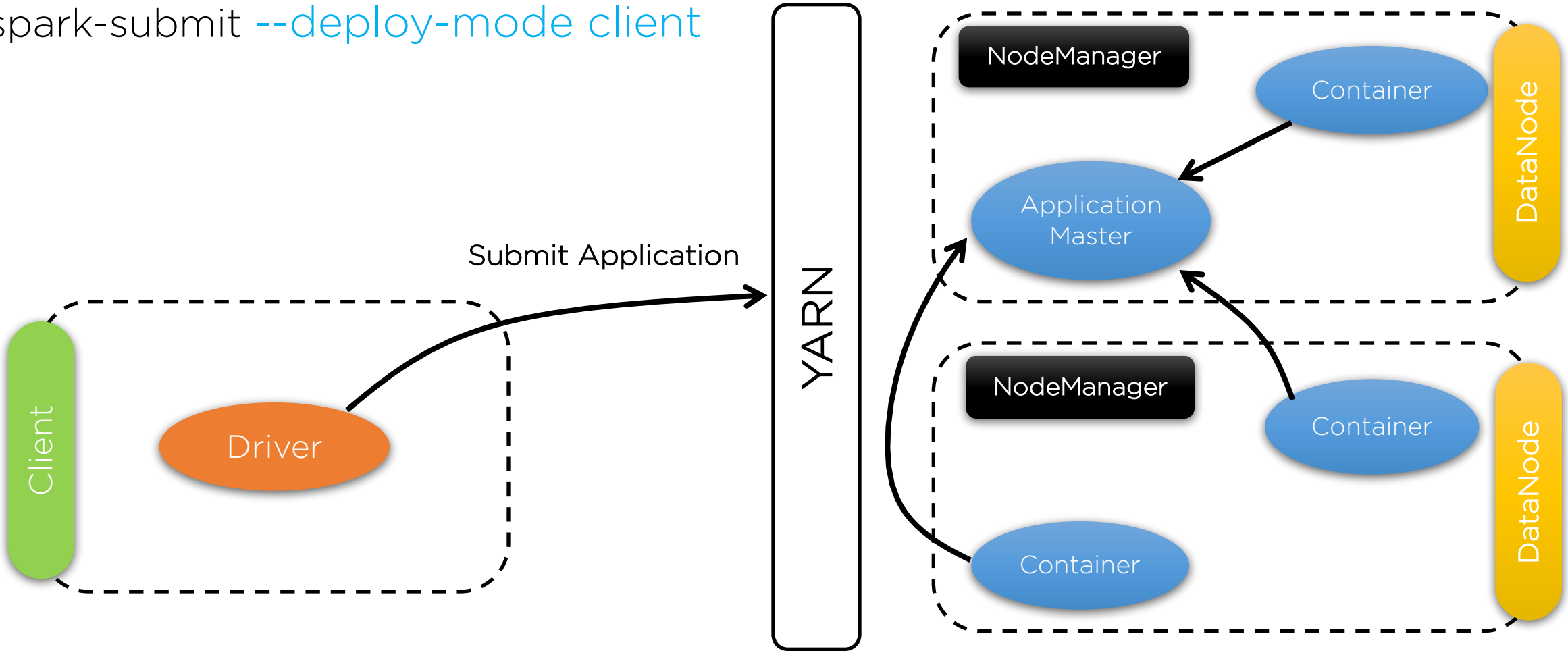
Scheduling

- Cluster manager scheduler (YARN)
- Spark Scheduler (Driver)



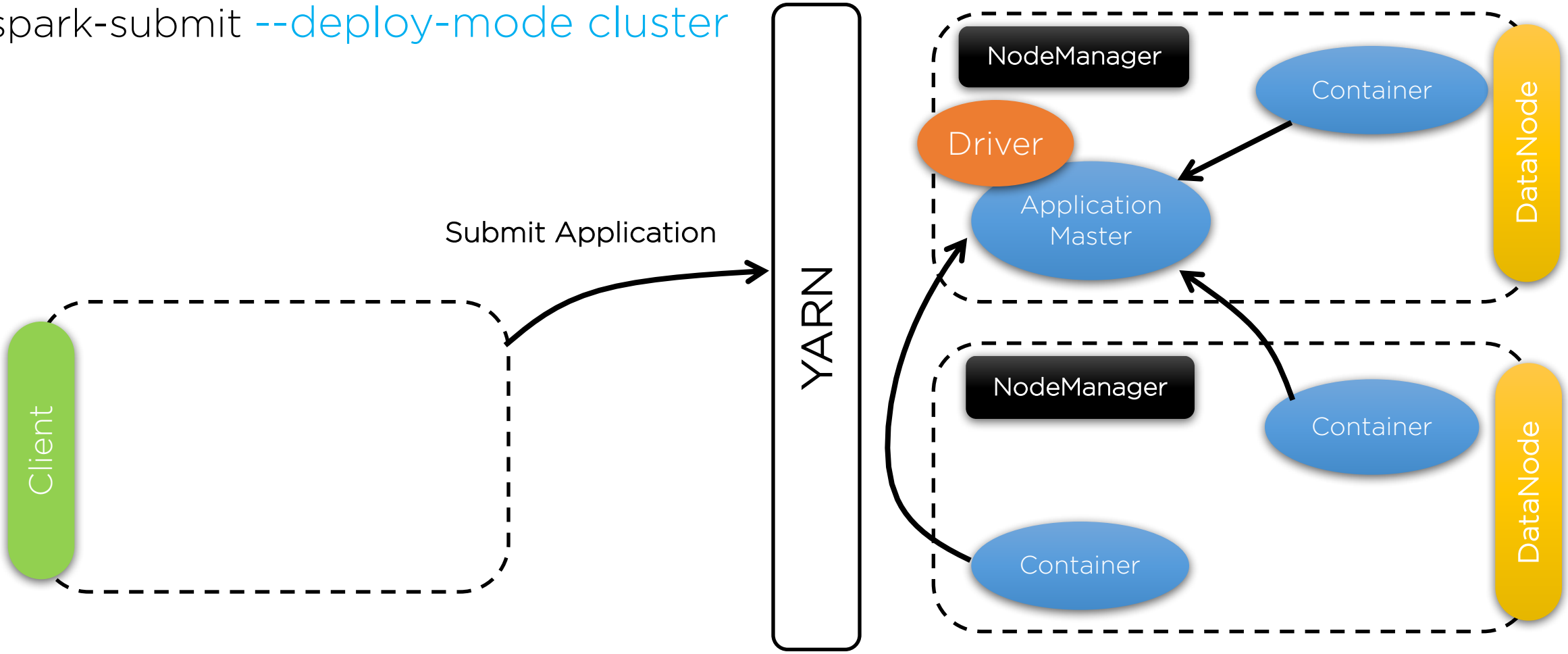
Spark Scheduling - Client

./spark-submit --deploy-mode client



Spark Scheduling - Cluster

./spark-submit --deploy-mode cluster



Client vs. Cluster Mode

Client mode

Driver managed by client host

Availability dependent on client

Interactive (Spark Shell/REPL)

Cluster mode

Driver managed by cluster manager

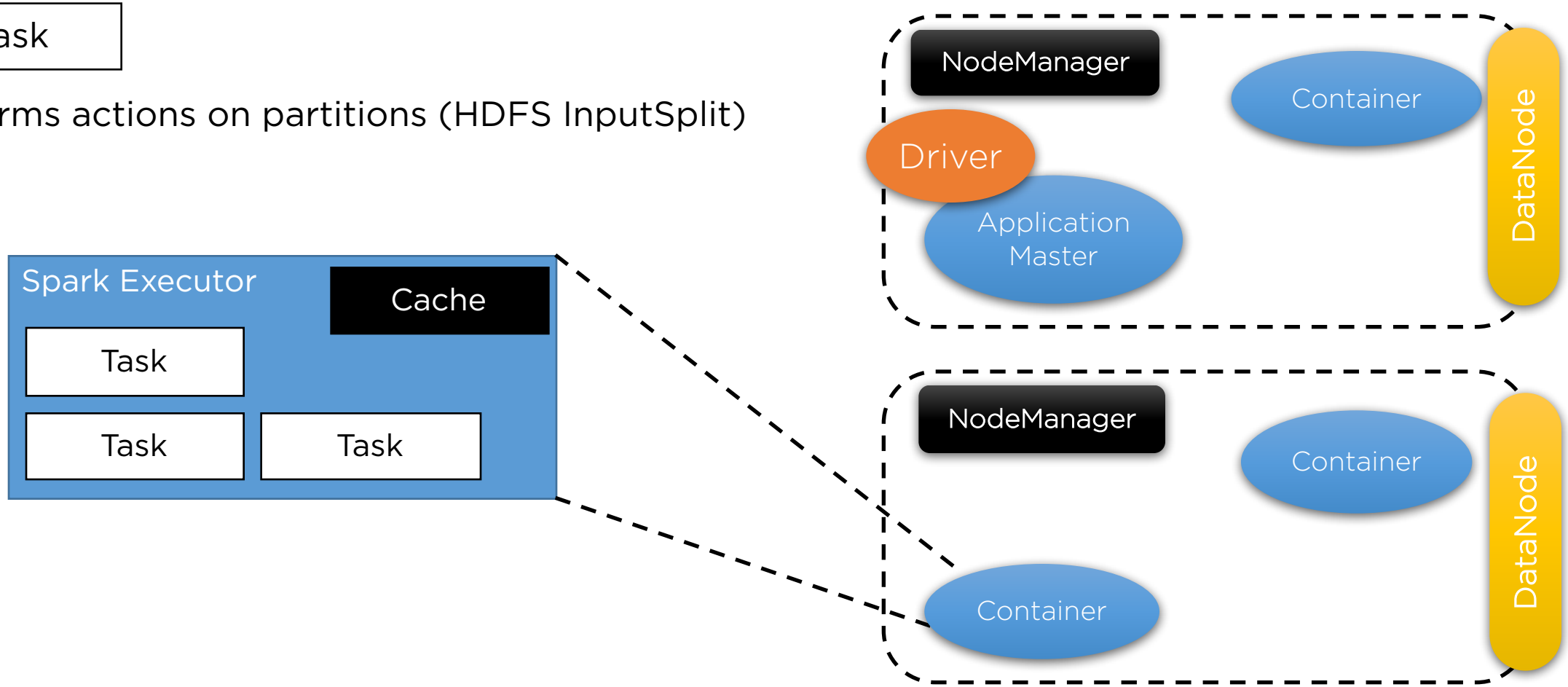
Better availability guarantees

Non-interactive

Inside the Container

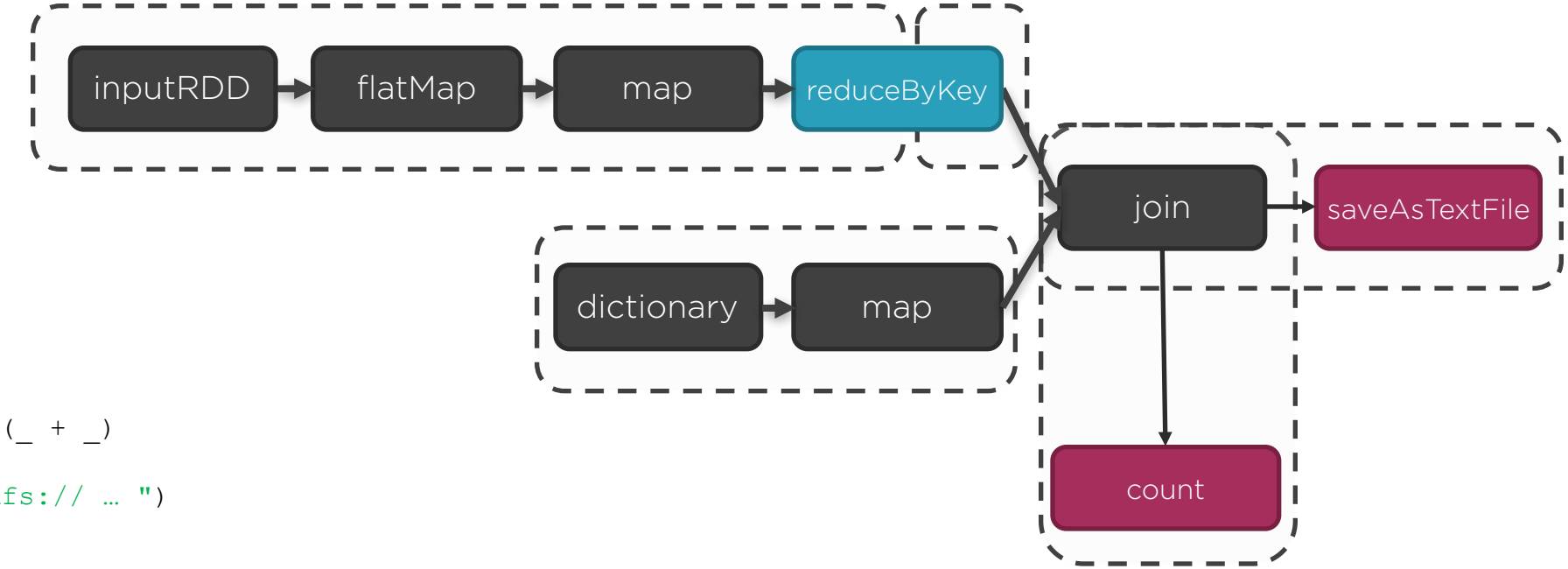
Task

Performs actions on partitions (HDFS InputSplit)



Actions and Transformations

```
val inputRDD = sc
          .textFile("hdfs://…")

val wordsRDD = inputRDD
  .flatMap(_.split(" "))
  .map(word => (word, 1))

val wordCountsRDD = wordsRDD
                    .reduceByKey(_ + _)

val dictionary = sc.textFile("hdfs:// … ")
    .map { s =>
      val split = s.split(",")
      (split(0), split(1))
    }

val joined = wordCountsRDD.join(dictionary)

joined.cache()

joined.saveAsTextFile("hdfs:// … ")
joined.count()
```



Demo

Demo

Log Producer – Clickstream Dataset

Typesafe Config - HOCON

- Layers of overrides
- Easier deployments

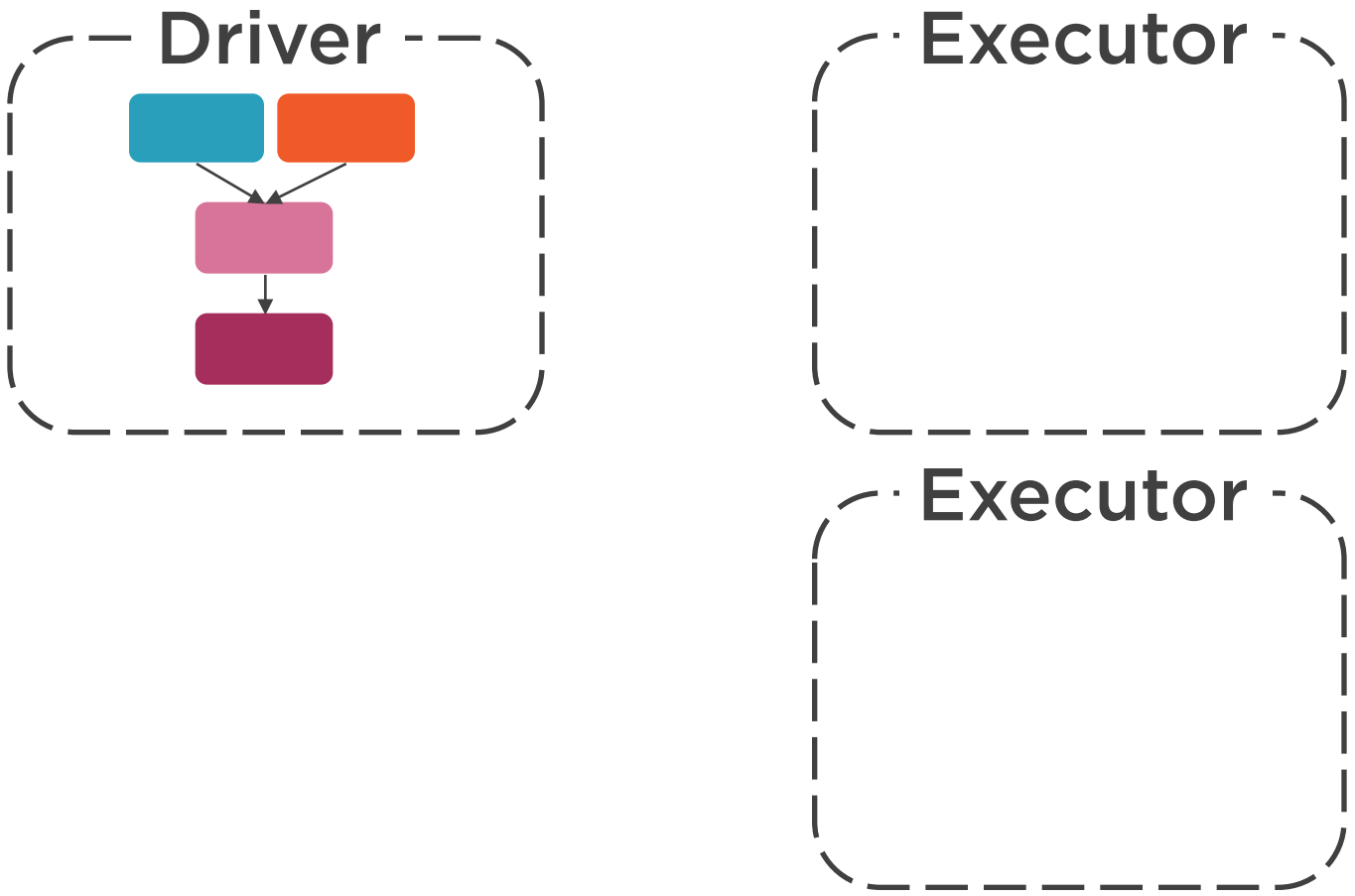
Stages of Log Producer

- Single file output
- Multiple files simulating stream
- Output to Kafka
- Kafka in Avro format

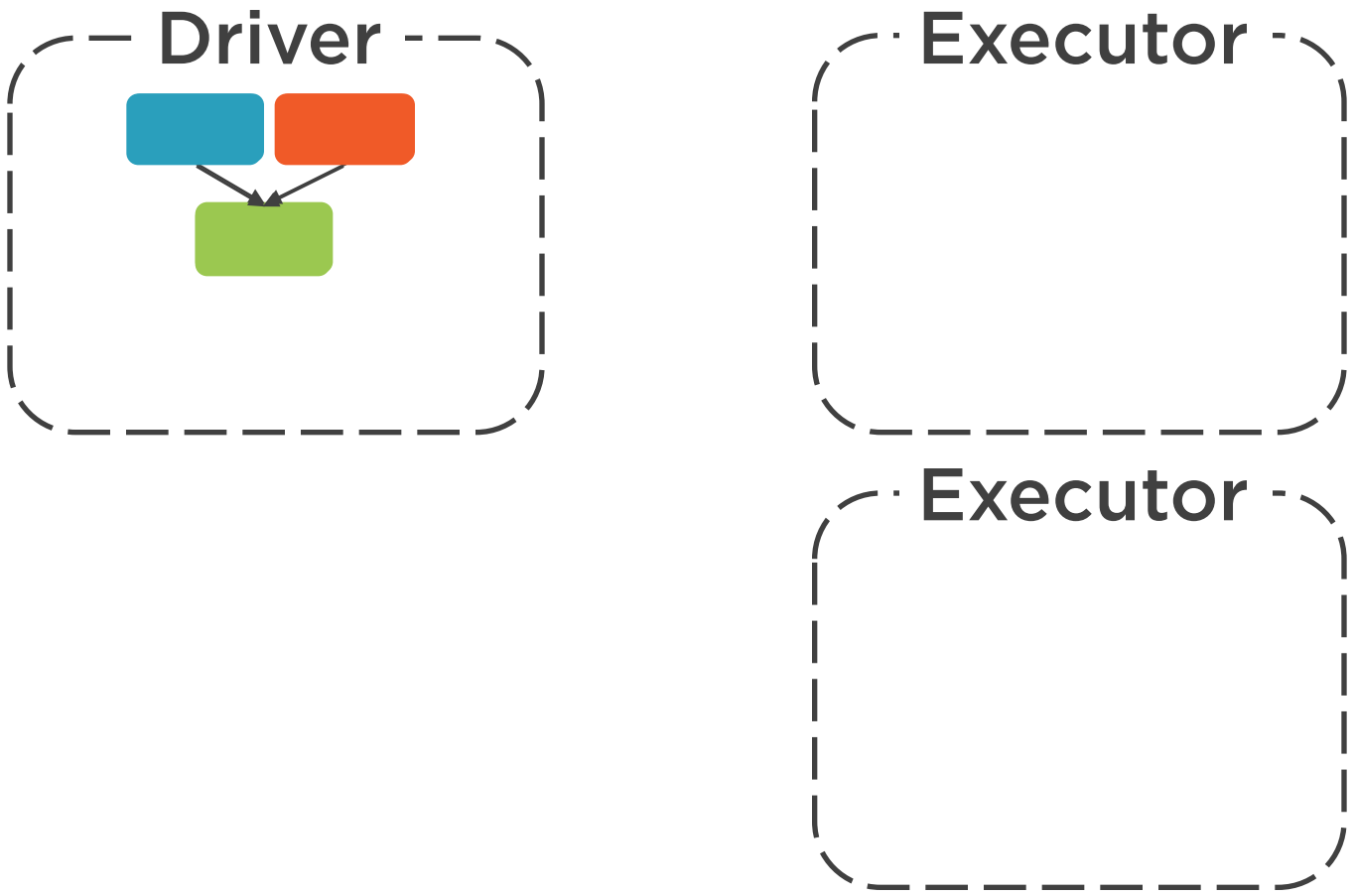
Log Producer

adjustedTimestamp	referrer	action	prevPage	visitor	page	product
1464253347272	Facebook	add_to_cart		Visitor-548011	Page-6	Chemin Du Soleil,Chardonnay
1464253347272	Other	page_view		Visitor-18032	Page-6	Purell,Advanced Hand Sanitizer -travel size
1464253347272	Twitter	page_view		Visitor-69498	Page-1	David's Tea,Chocolate Chili Chai Black Tea
1464253347272	Google	page_view		Visitor-697731	Page-3	Barilla,Rotini
1464253347272	Twitter	page_view		Visitor-992221	Page-0	Alessi,Garlic Breadsticks
1464253347272	Bing	page_view		Visitor-289265	Page-3	Garnier Fructis Style,Pure Clean Finishing Paste
1464253479272	Facebook	page_view		Visitor-313453	Page-0	Glass Plus,Glass Cleaner
1464253479272	Yahoo	page_view		Visitor-740395	Page-14	Clover Stornetta,Vitamin D Milk
1464253479272	Facebook	page_view		Visitor-576247	Page-9	Andersen's,Creamy Soup Split Pea
1464253479272	Other	purchase		Visitor-957650	Page-8	Dust Destroyer,Compressed-Gas Duster
1464253479272	Facebook	page_view		Visitor-141141	Page-11	Nestle,Leche Condensada
1464254239592	Google	page_view		Visitor-387911	Page-3	Caliber,Security Envelopes
1464254239592	Twitter	page_view		Visitor-410847	Page-12	Glad,Odor Shield Tall Kitchen Drawstring Bags
1464254239592	Yahoo	page_view		Visitor-684141	Page-2	Knorr,Salsa Lista Pizza
1464254239592	Google	page_view		Visitor-930963	Page-0	Gatorade,Fierce Grape
1464254239592	Twitter	page_view		Visitor-547631	Page-3	Tovolo,King Cube Tray

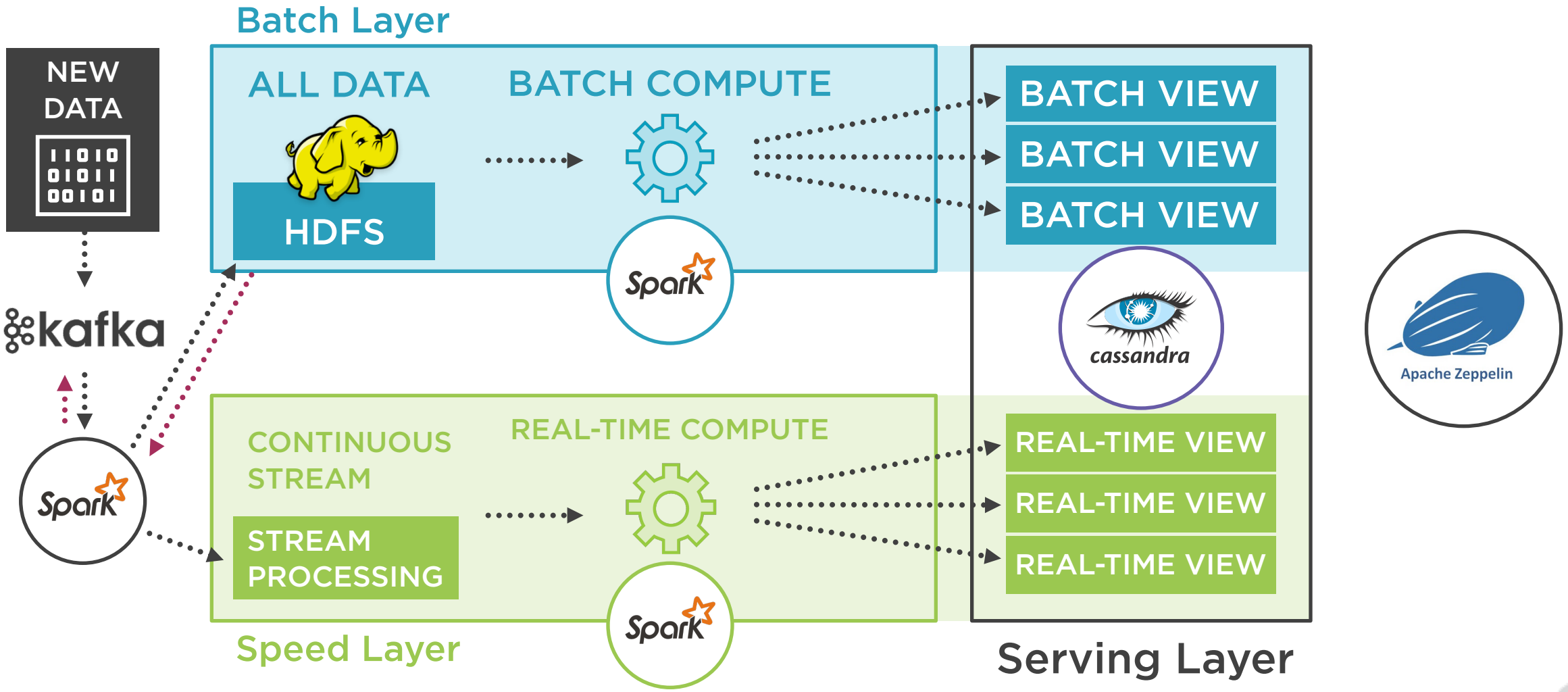
Spark Laziness



Spark Laziness



Summary


Batch Layer
NEW DATA
kafka
ALL DATA
BATCH COMPUTE
HDFS
Spark
BATCH VIEW
BATCH VIEW
BATCH VIEW
cassandra
Apache Zeppelin
Spark
CONTINUOUS STREAM
REAL-TIME COMPUTE
STREAM PROCESSING
Spark
REAL-TIME VIEW
REAL-TIME VIEW
REAL-TIME VIEW
Speed Layer
Serving Layer