ANALYTICS BIG DATA SUMMIT

Apache Spark : Fast and Easy Data Processing

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Spark

- Fast & Expressive Cluster computing engine
- Compatible with Hadoop
- Came out of Berkeley AMP Lab
- Now Apache project
- Version 1.1 just released (Sep 2014)

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Comparison With Hadoop

Hadoop	Spark
Distributed Storage + Distributed Compute	Distributed Compute Only
MapReduce framework	Generalized computation
Usually data on disk (HDFS)	On disk / in memory
Not ideal for iterative work	Great at Iterative workloads (machine learning ..etc)
Batch process	- Upto 10x faster for data on disk - Upto 100x faster for data in memory
	Compact code Java, Python, Scala supported
	Shell for ad-hoc exploration

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Spark Vs Hadoop

- Spark is ‘easier’ than Hadoop
- ‘friendlier’ for data scientists
- Interactive shell (adhoc exploration)
- API supports multiple languages
  - Java, Scala, Python
- Great for small (Gigs) to medium (100s of Gigs) data

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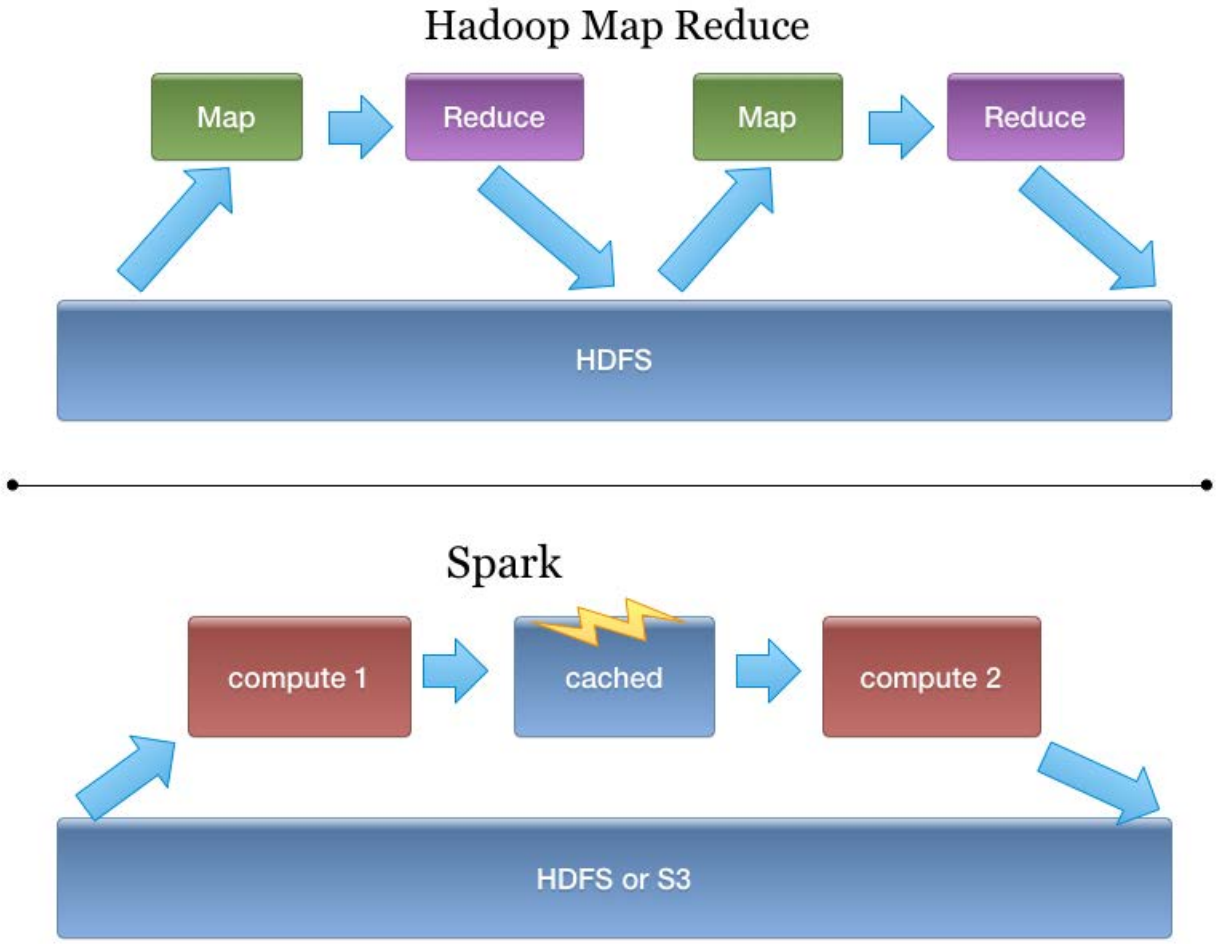
Spark Vs. Hadoop



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Is Spark Replacing Hadoop?

- Right now, Spark runs on Hadoop / YARN
  - Complimentary
- Can be seen as generic MapReduce
- Spark is really great if data fits in memory (few hundred gigs),
- People are starting to use Spark as their only compute platform
- Future ???

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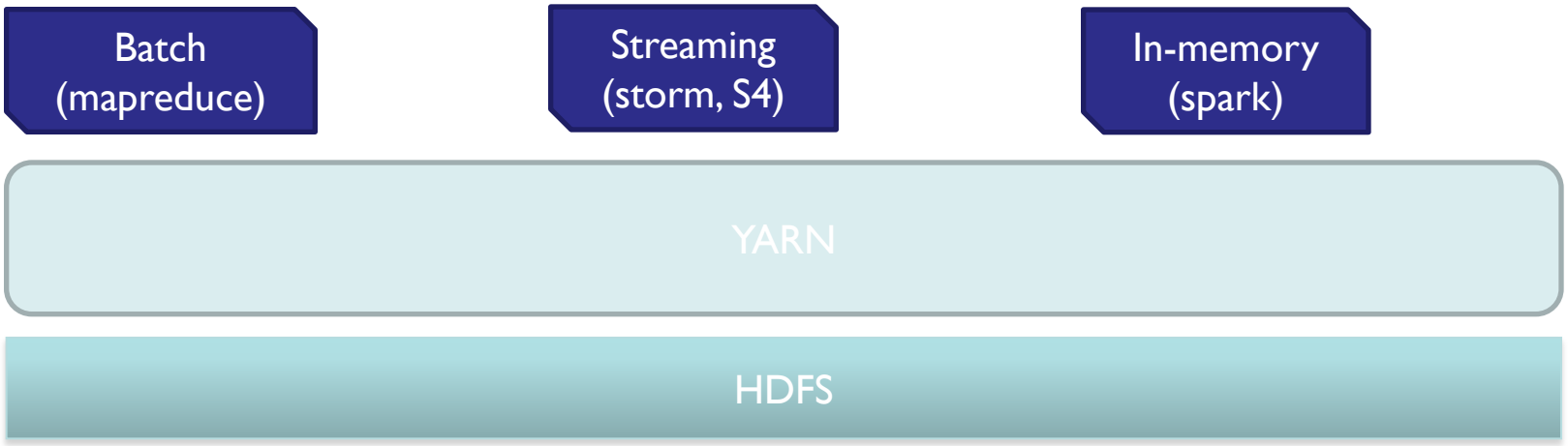
Hadoop + Yarn : Universal OS for Cluster Computing



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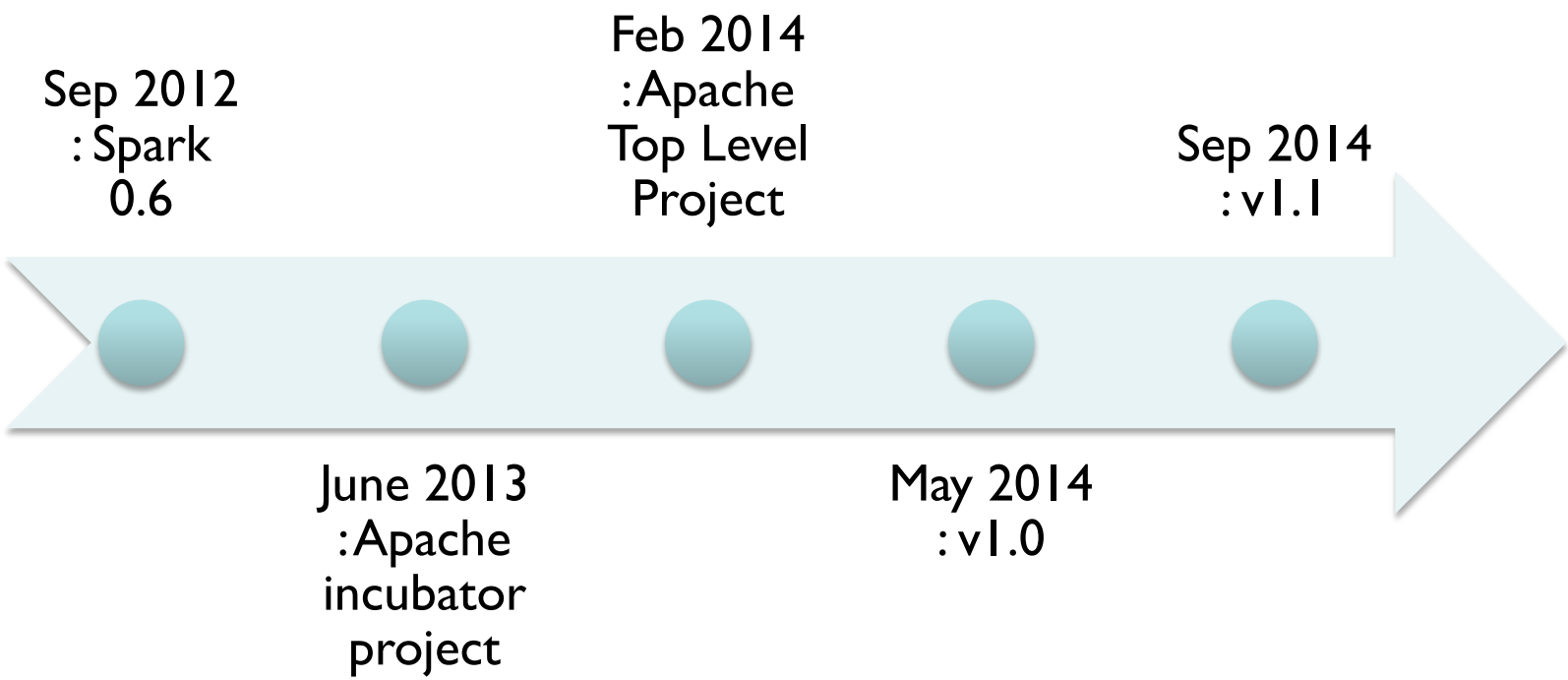
Bit of History of Spark



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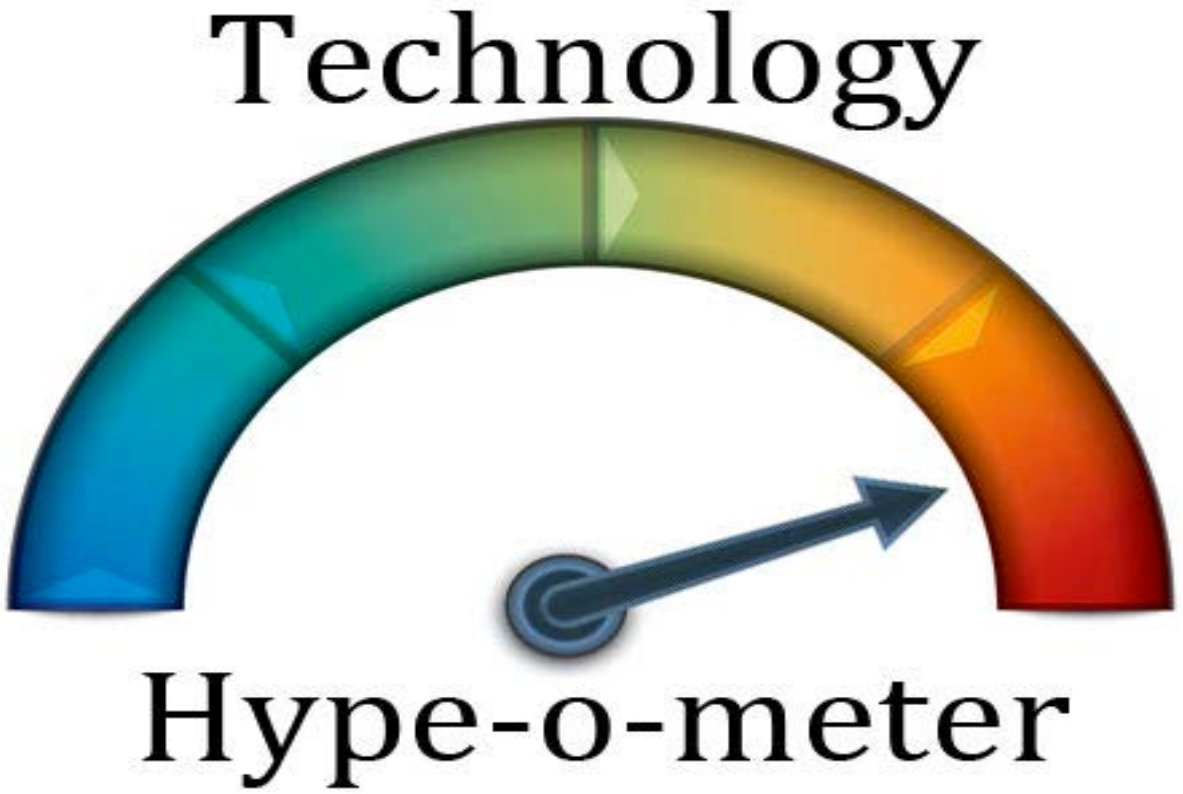
Hypo-meter ☺



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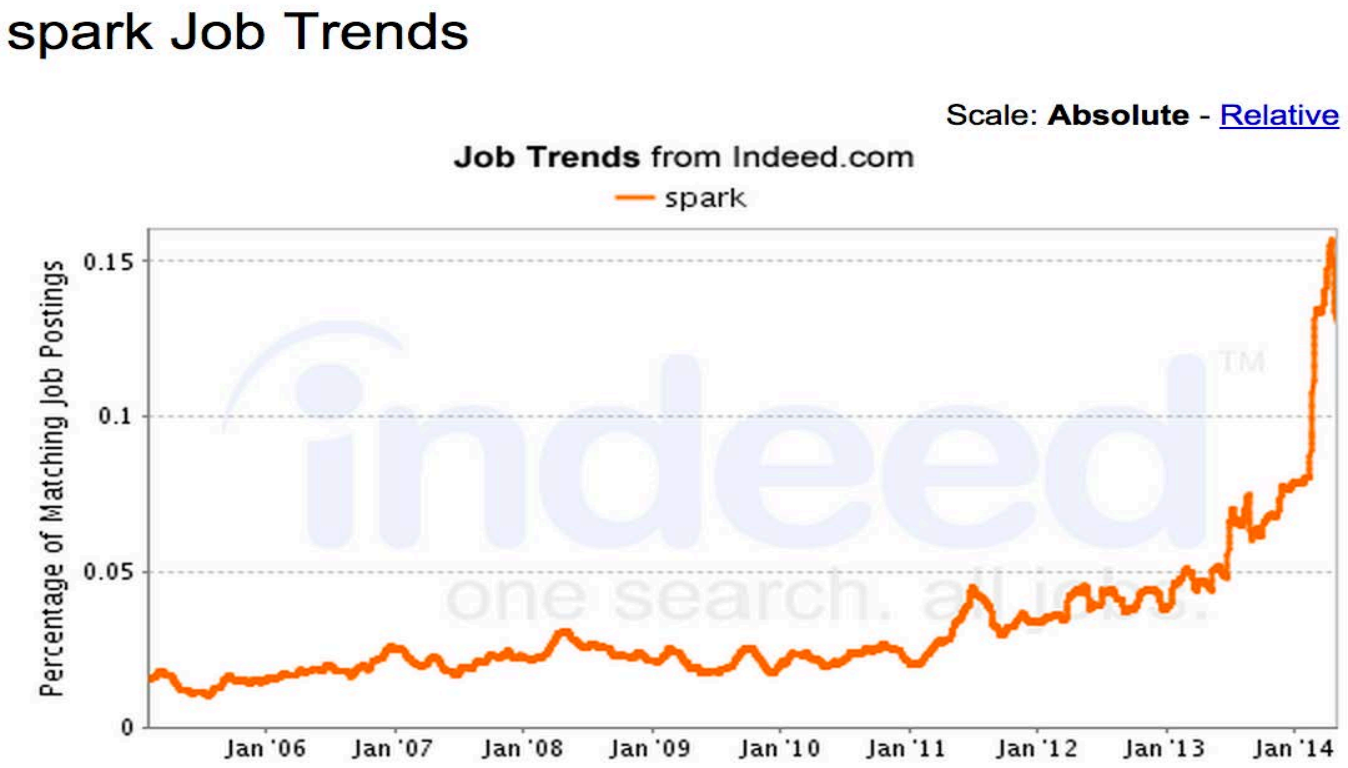
Spark Job Trends



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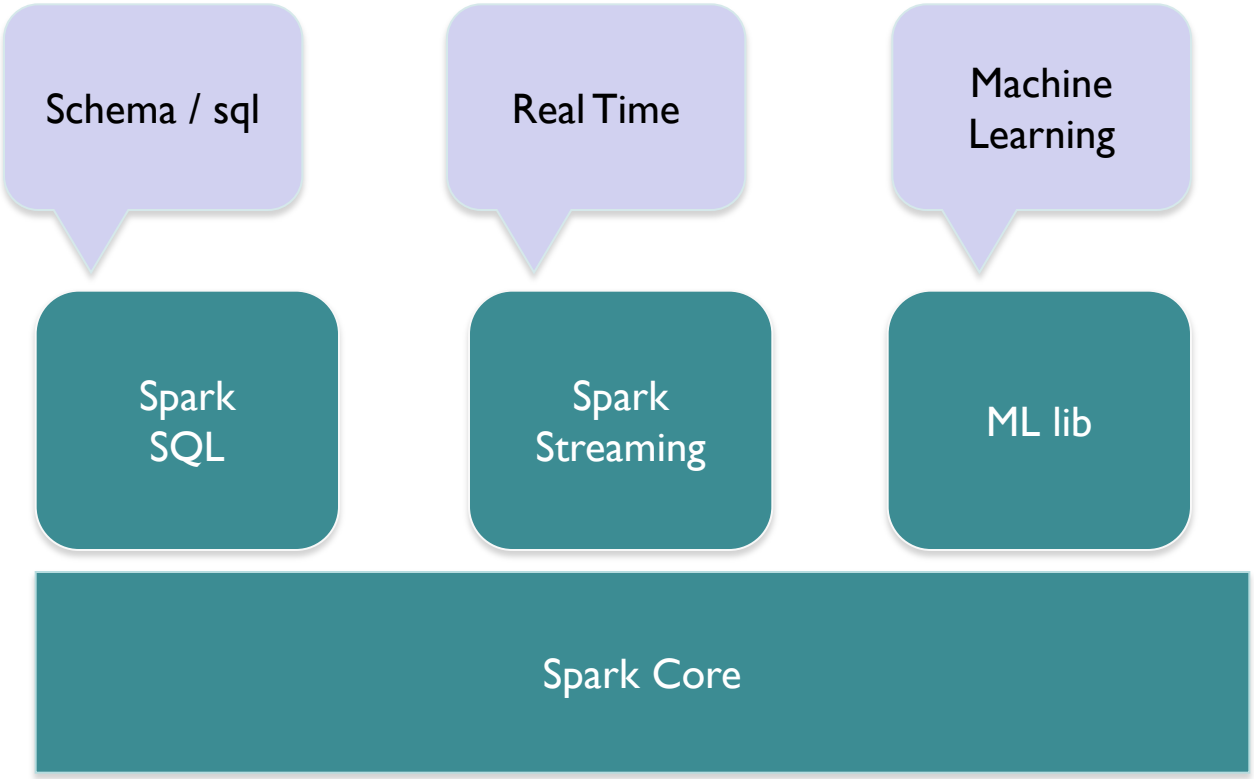
Spark Eco-System



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Spark Core

- Distributed compute engine
- Sort / shuffle algorithms
- In case of node failures -> re-computes missing pieces

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Spark Streaming

- Process data streams in **real time**
- Stock ticks / click streams …etc

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Machine Learning (ML Lib)

- Out of the box ML capabilities !
- Lots of common algorithms are supported
- Classification / Regressions
  - Linear models (linear R, logistic regression, SVM)
  - Decision trees
- Collaborative filtering (recommendations)
- K-Means clustering
- …
- More to come

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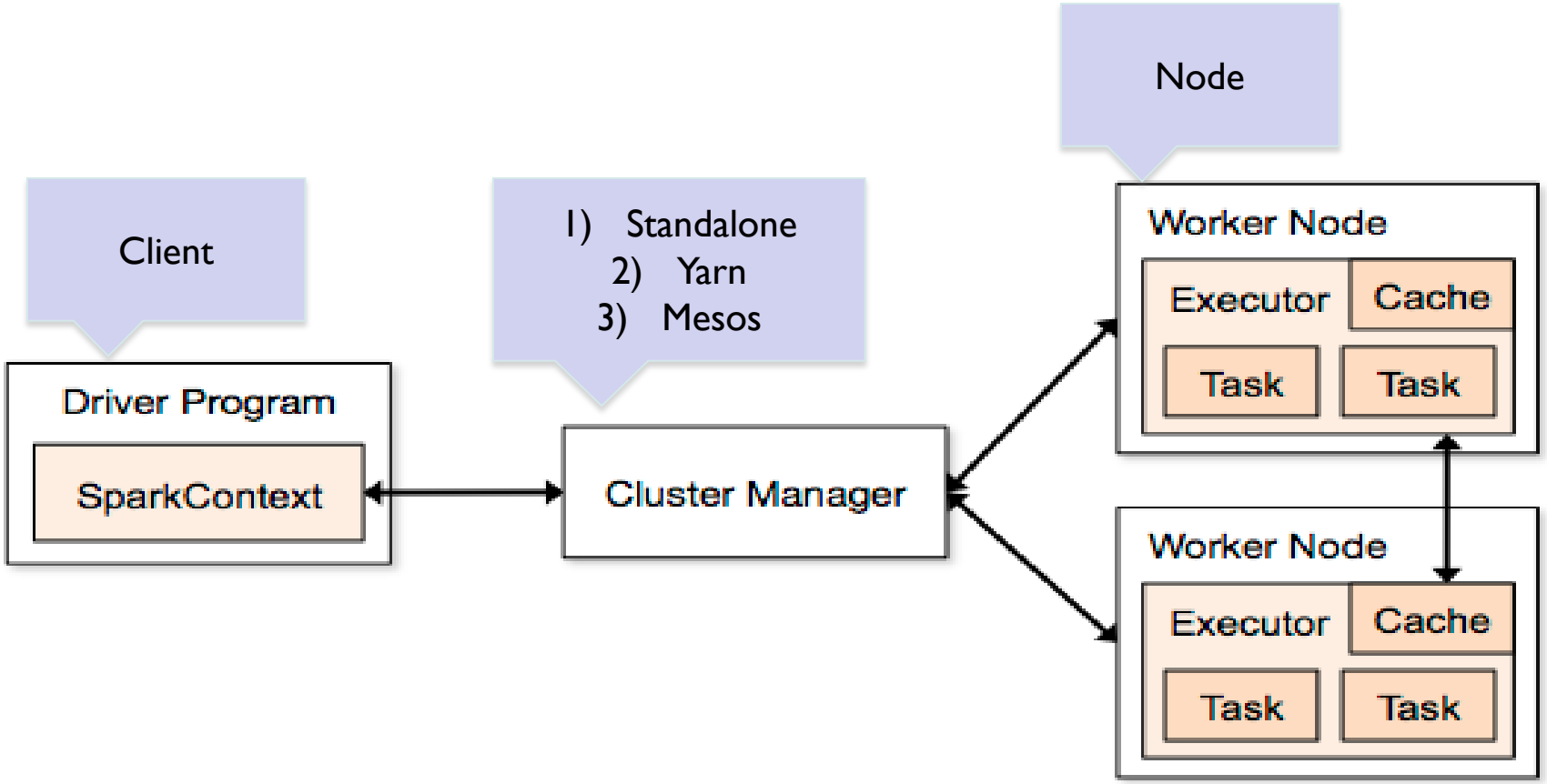
Spark Architecture



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Spark Architecture

- Multiple ‘applications’ can run at the same time
- Driver (or ‘main’) launches an application
- Each application gets its own ‘executor’
  - Isolated (runs in different JVMs)
  - Also means data can not be shared across applications
- Cluster Managers:
  - multiple cluster managers are supported
  - 1) Standalone : simple to setup
  - 2) YARN : on top of Hadoop
  - 3) Mesos : General cluster manager (AMP lab)

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Spark Data Model : RDD

- Resilient Distributed Dataset (RDD)
- Can live in
  - Memory (best case scenario)
  - Or on disk (FS, HDFS, S3 …etc)
- Each RDD is split into multiple partitions
- Partitions may live on different nodes
- Partitions can be computed in parallel on different nodes

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RDD : Loading

- Use Spark context to load RDDs from disk / external storage

```
val sc = new SparkContext(...)

val f = sc.textFile("/data/input1.txt")  // single file
sc.textFile("/data/")  // load all files under dir
sc.textFile("/data/*.log")  // wild card matching
```

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RDD Operations

- Two kinds of operations on RDDs
  - 1) Transformations
    - Create a new RDD from existing ones (e.g. Map)
  - 2) Actions
    - E.g. Returns the results to clients (e.g. Reduce)
- Transformations are **lazy**.. Actions force transformations

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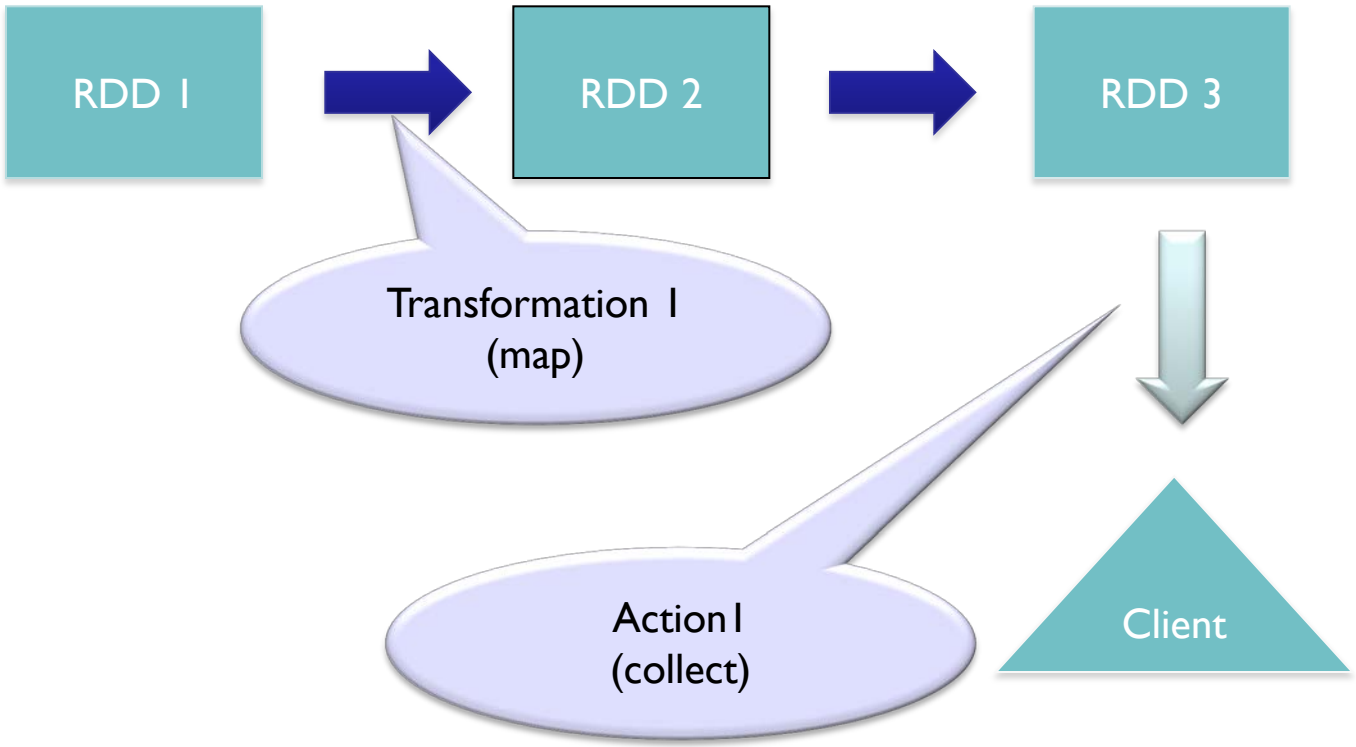
Transformations / Actions



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RDD Transformations

Transformation	Description	Example
filter	Filters through each record (aka grep)	f.filter(line => line.contains("ERROR"))
union	Merges two RDDs	rdd1.union(rdd2)
…see docs …		

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RDD Actions

Action	Description	Example
count()	Counts all records in an rdd	f.count()
first()	Extract the first record	f.first ()
take(n)	Take first N lines	f.take(10)
collect()	Gathers all records for RDD. All data has to fit in memory of ONE machine (don't use for big data sets)	f.collect()
…. See documentation ..		

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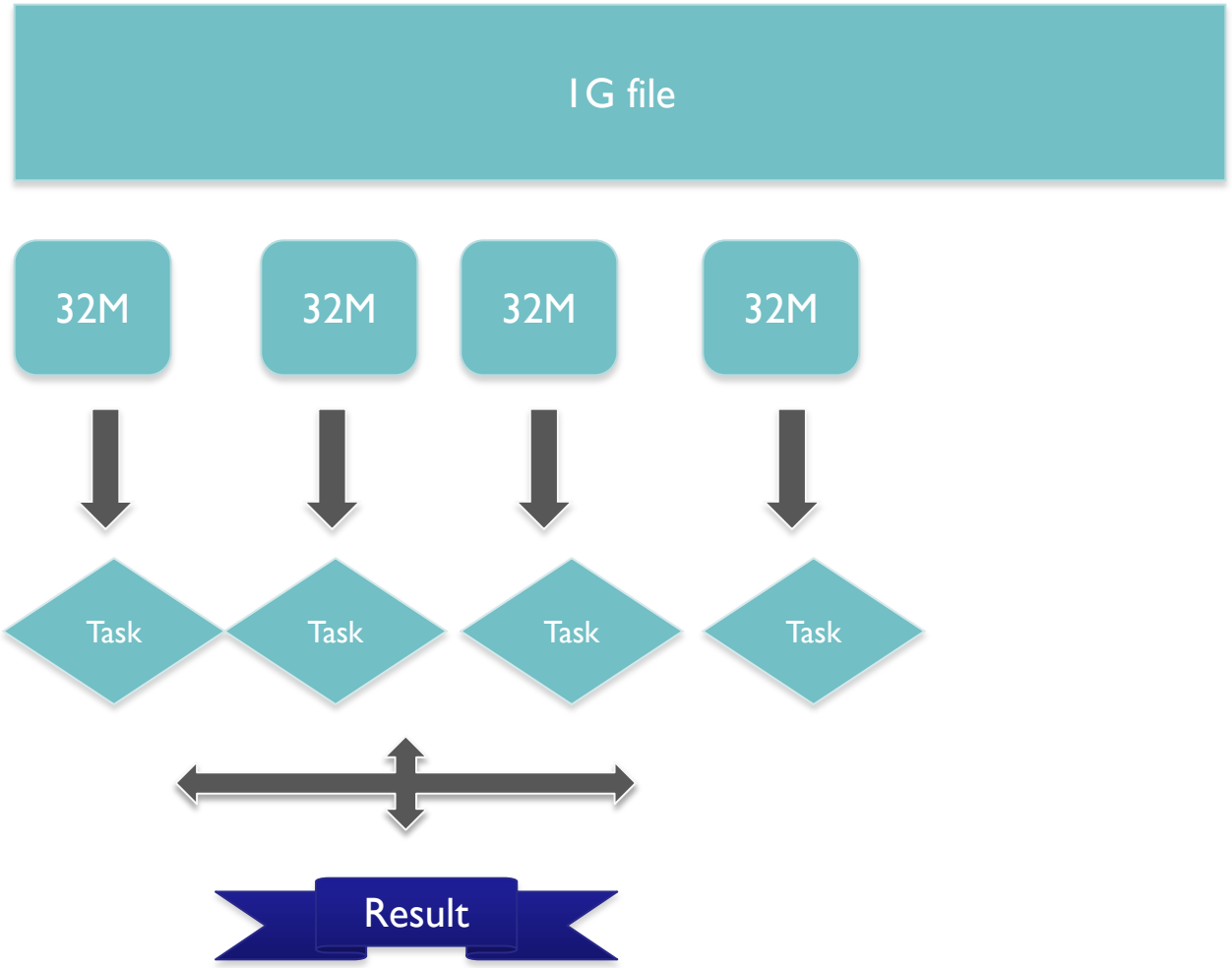
Partitions Explained



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RDD : Saving

- saveAsTextFile () and saveAsSequenceFile()

f.saveAsTextFile("/output/directory") // a directory

- Output usually is a directory
  - RDDs will be saved as multiple files in the dir
  - Each partition → one output file

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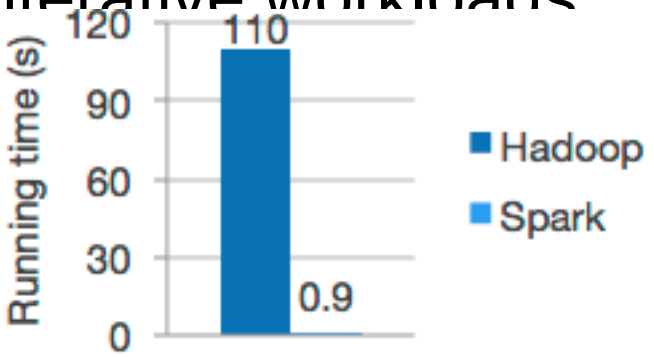
Caching of RDDs

- RDDs can be loaded from disk and computed
  - Hadoop mapreduce model
- Also RDDs can be cached in memory
- Subsequent operations are much faster

f.persist() // on disk or memory

f.cache() // memory only

- In memory RDDs are great for iterative workloads
  - Machine learning algorithms



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Demo Time !

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Demo : Spark-shell

- Invoke spark shell
- Load a data set
- Do basic operations (count / filter)

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Demo: RDD Caching

- From Spark shell
- Load an RDD
- Demonstrate the difference between cached and non-cached

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Demo : Map Reduce

- Quick Word count

```
val input = sc.textFile("…")
    val counts = input.flatMap(
                    line => line.split(" ")).
                    map(word => (word, 1)).
                    reduceByKey(_+_)
```

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Thanks !

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Credits

- http://spark.apache.org/
- http://www.strategictechplanning.com

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