

# Python + Spark

## Lightning Fast Cluster Computing

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Data Engineer



What is **Spark**  ?

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**In-memory** cluster computing framework for large-scale  
data processing

# Some facts about Apache Spark

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- Started in 2009 by AMP Lab at UC Berkeley.
- Graduated from Apache Incubator earlier this year.
- Close to 300 contributors on Github.
- Developed using Scala, with Java and Python APIs.
- Can sit on an existing Hadoop cluster.
- Processes data up to 100x faster than Hadoop Map-Reduce in memory or up to 10x faster in disk.

# Who are using Spark?

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Alibaba

eBay Inc.

Rocketfuel

Amazon

Guavus

Shazam

Autodesk

IBM Almaden

Shopify

Baidu

NASA JPL

Stratio

Conviva

Nokia S&N

Yahoo!

Databricks

Ooyala

Yandex

Full list at: <https://cwiki.apache.org/confluence/display/SPARK/Powered+By+Spark>

Few misconceptions around Spark

# Misconception #1

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**FALSE**

# Misconception #2

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**FALSE**

# Misconception #3

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Not all Spark features are available for **Python** or **PySpark**

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**FALSE\***

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**FALSE\***

**\* Spark Streaming coming soon!**

PySpark

PySpark



# About PySpark

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- Python API for Spark using Py4j.
- Provides interactive shell for processing data from command line.
- 2x to 10x less code than standalone programs.
- Can be used from iPython shell or notebook.
- Full support for Spark SQL (previously Shark).
- Spark Streaming coming soon... (version 1.2.0)

Who can benefit from PySpark?



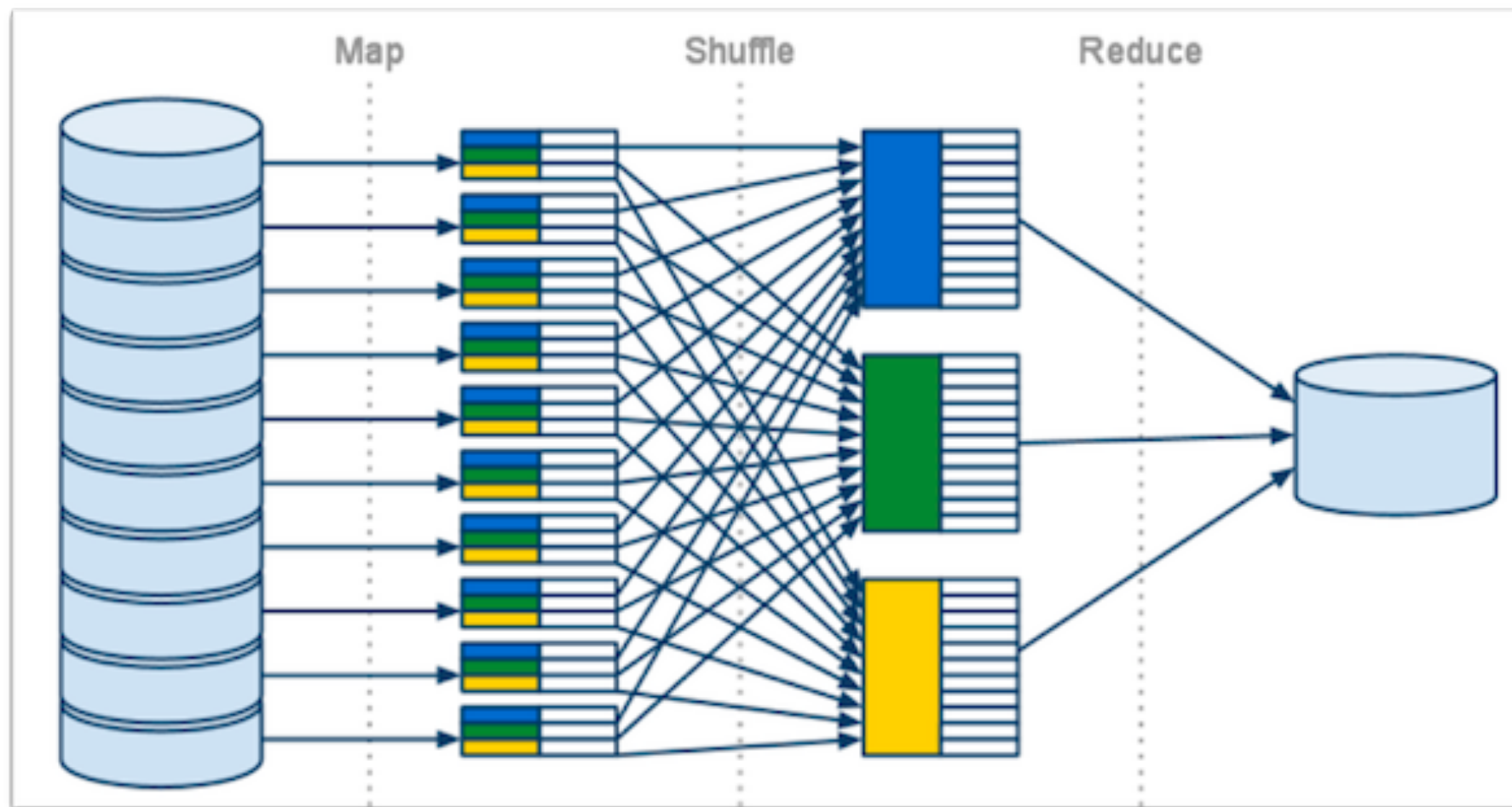
# Data Scientists

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- Rich, scalable machine learning libraries (MLlib)
  - Statistics - Correlation, sampling, hypothesis testing
  - ML - Classification, Regression, Collaborative filtering, Clustering, Dimensionality Reduction etc.
- Seamless integration of Numpy, Matplotlib and Pandas for data wrangling and visualizations.
- Advantage of in-memory processing for iterative tasks

# Spark vs. Hadoop Map-Reduce

# Hadoop Map-Reduce



- A programming paradigm for batch processing.
- Data loaded and read from disk for each iteration and finally written to disk.
- Fault tolerance achieved through data replication on data nodes.
- Each Pig/Hive query spawns a separate Map-Reduce job and reads from disk.

# What is different in Spark?

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- Data is cached in RAM from disk for iterative processing.
- If data is too large for memory, rest is spilled into disk.
- Interactive processing of datasets without having to reload in the memory.
- Dataset is represented as RDD (Resilient Distributed Dataset) when loaded into Spark Context.
- Fault tolerance achieved through RDD and lineage graphs.

RDD (Resilient Distributed Dataset)

# What is RDD?

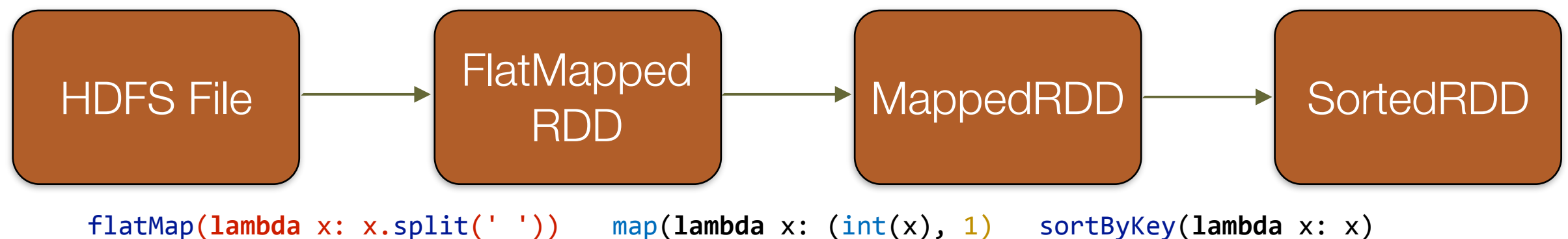
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- A read-only collection of objects, partitioned across a set of machines.
- RDDs can be re-built if a partition is lost through **lineage**: an RDD has information about how it was derived from other RDDs to be reconstructed.
- RDDs can be cached and reused in multiple Map-Reduce like parallel operations.
- RDDs are lazy and ephemeral.

# RDD Lineage

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```
lines = sc.textFile("hdfs://...")
sortedCount = lines.flatMap(lambda x: x.split(' ')) \
                    .map(lambda x: (int(x), 1)) \
                    .sortByKey(lambda x: x)
```



# RDD Operations

## **Transformations**

map, filter, flatmap, sort

## **Actions**

reduce, count, collect, save



# Map

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Returns a new RDD by applying a function to each element of this RDD

```
from pyspark.context import SparkContext

sc = SparkContext('local[2]', 'map_example')

rdd = sc.parallelize(["banana", "apple",
"watermelon"])
sorted(rdd.map(lambda x: (x, len(x))).collect())

[('apple', 5), ('banana', 6), ('watermelon',
10)]
```

# FlatMap

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Return a new RDD by first applying a function to all elements of this RDD, and then flattening the results.

```
from pyspark.context import SparkContext
```

```
sc = SparkContext('local[2]', 'flatmap_example')
```

```
rdd = sc.parallelize(["this is you", "you are here",  
"how do you feel about this"])
```

```
sorted(rdd.flatMap(lambda x: x.split()).collect())
```

```
['about', 'are', 'do', 'feel', 'here', 'how', 'is',  
'this', 'this', 'you', 'you', 'you']
```

# Filter

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Returns a new RDD containing only the elements that satisfy a predicate.

```
from pyspark.context import SparkContext

sc = SparkContext('local[2]', 'filter_example')

rdd = sc.parallelize([1, 2, 3, 4, 5])
rdd.filter(lambda x: x % 2 == 0).collect()

[2, 4]
```

# Reduce

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Reduces the elements of this RDD using the specified commutative and associative binary operator. Currently reduces partitions locally.

```
from operator import add
from pyspark.context import SparkContext

sc = SparkContext('local[2]', 'reduce_example')

num_list = [num for num in xrange(1000000)]
sc.parallelize(num_list).reduce(add)

499999500000
```

# Count

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Return the number of elements in this RDD.

```
from pyspark.context import SparkContext  
  
sc = SparkContext('local[2]', 'count_example')  
  
file = sc.textFile("hdfs://...")  
file.flatMap(lambda line: line.split()).count()
```

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# SaveAsTextFile

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Save this RDD as a text file, using string representations of elements.

```
from pyspark.context import SparkContext

sc = SparkContext('local[2]', 'filter_example')

file = sc.textFile("hdfs://...")

file.flatMap(lambda line: line.split())
      .saveAsTextFile("output_dir")
```

# Live Demo

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- Word count to compute top 5 words by frequency
- Processing a HTTP log to find number of errors in a day
- Logistic Regression
- Processing JSON using Spark SQL

# Contribute to Spark

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Submit a Pull Request on Github

[github.com/apache/spark](https://github.com/apache/spark)

Report a bug or suggestions on Apache Spark JIRA

[issues.apache.org/jira/browse/SPARK](https://issues.apache.org/jira/browse/SPARK)

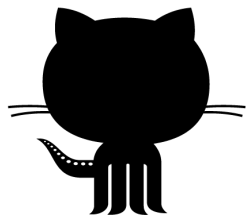
Join the Apache Spark mailing list

[spark.apache.org/mailling-lists.html](https://spark.apache.org/mailling-lists.html)



# Contact Me

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