Fundamentals of Big Data

BIG DATA FUNDAMENTALS WITH PYSPARK

Upendra Devisetty
Science Analyst, CyVerse

datacamp

What is Big Data?

- Big data is a term used to refer to the study and applications of data sets that are too complex for traditional data-processing software - **Wikipedia**

The 3 V's of Big Data

- Volume, Variety and Velocity
- **Volume**: Size of the data
- **Variety**: Different sources and formats
- **Velocity**: Speed of the data

Big Data concepts and Terminology

- **Clustered computing:** Collection of resources of multiple machines
- **Parallel computing:** Simultaneous computation on single computer
- **Distributed computing:** Collection of nodes (networked computers) that run in parallel
- **Batch processing:** Breaking the job into small pieces and running them on individual machines
- **Real-time processing:** Immediate processing of data

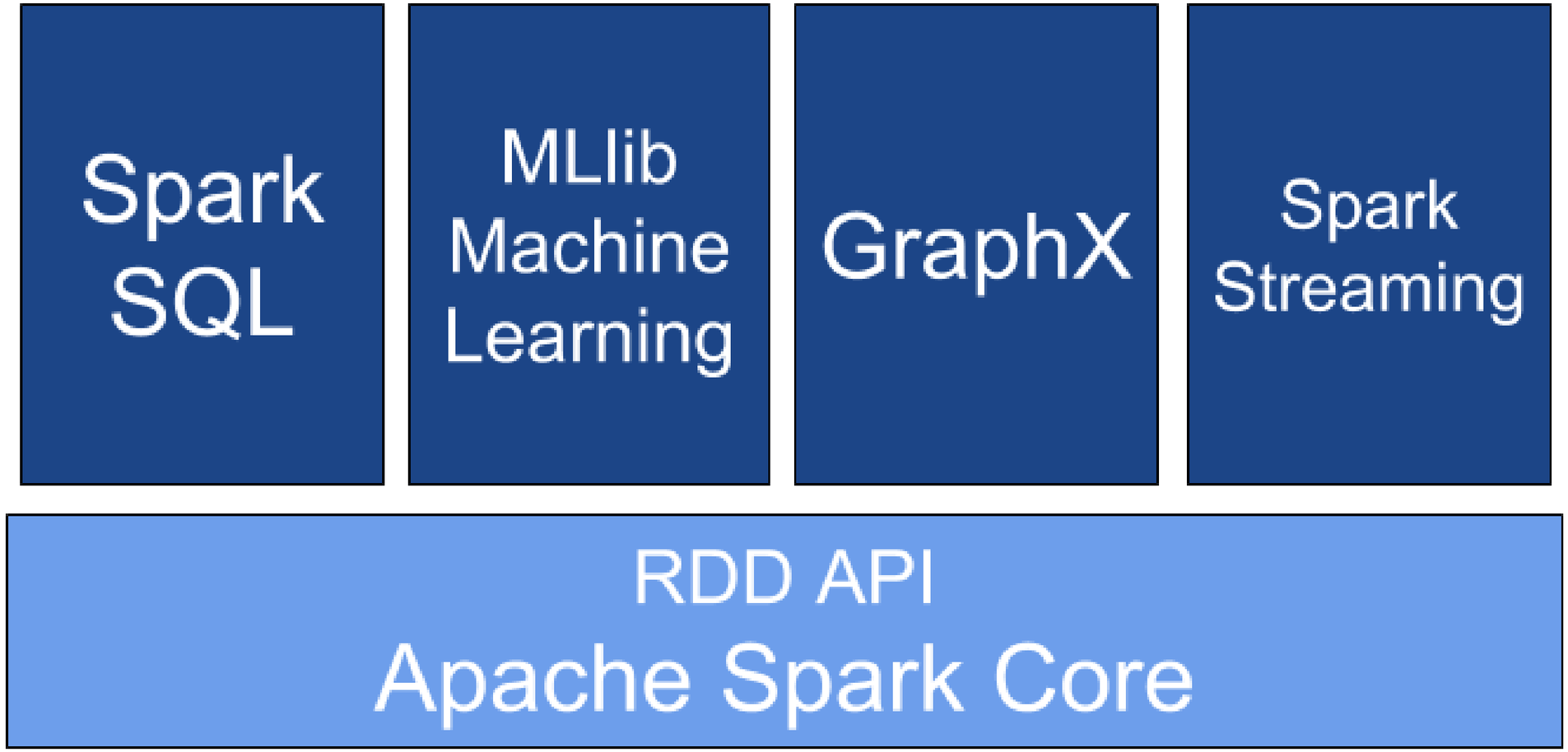
Big Data processing systems

- **Hadoop/MapReduce:** Scalable and fault tolerant framework written in Java
  - Open source
  - Batch processing
- **Apache Spark:** General purpose and lightning fast cluster computing system
  - Open source
  - Both batch and real-time data processing
- **Note:** Apache Spark is nowadays preferred over Hadoop/MapReduce

Features of Apache Spark framework

- Distributed cluster computing framework
- Efficient in-memory computations for large data sets
- Lightning fast data processing framework
- Provides support for Java, Scala, Python, R and SQL

Apache Spark Components



Spark modes of deployment

- **Local mode:** Single machine such as your laptop
  - Local model convenient for testing, debugging and demonstration
- **Cluster mode:** Set of pre-defined machines
  - Good for production
- Workflow: Local -> clusters
- No code change necessary

Coming up next - PySpark

BIG DATA FUNDAMENTALS WITH PYSPARK

PySpark: Spark with Python

BIG DATA FUNDAMENTALS WITH PYSPARK

Upendra Devisetty
Science Analyst, CyVerse

datacamp

Overview of PySpark

- Apache Spark is written in Scala
- To support Python with Spark, Apache Spark Community released PySpark
- Similar computation speed and power as Scala
- PySpark APIs are similar to Pandas and Scikit-learn

What is Spark shell?

- Interactive environment for running Spark jobs
- Helpful for fast interactive prototyping
- Spark shells allow interacting with data on disk or in memory
- Three different Spark shells:
  - Spark-shell for Scala
  - PySpark-shell for Python
  - SparkR for R

PySpark shell

- PySpark shell is the Python-based command line tool
- PySpark shell allows data scientists interface with Spark data structures
- PySpark shell support connecting to a cluster

Understanding SparkContext

- SparkContext is an entry point into the world of Spark
- An entry point is a way of connecting to Spark cluster
- An entry point is like a key to the house
- PySpark has a default SparkContext called `sc`

[1] https://www.datacamp.com/cheat-sheet/pyspark-cheat-sheet-spark-in-python

Inspecting SparkContext

- **Version:** To retrieve SparkContext version

```
sc.version
```

```
2.3.1
```

- **Python Version:** To retrieve Python version of SparkContext

```
sc.pythonVer
```

```
3.6
```

- **Master:** URL of the cluster or local string to run in local mode of SparkContext

```
sc.master
```

```
local[*]
```

[1] https://www.datacamp.com/cheat-sheet/pyspark-cheat-sheet-spark-in-python

Loading data in PySpark

- SparkContext's `parallelize()` method

```
rdd = sc.parallelize([1,2,3,4,5])
```

- SparkContext's `textFile()` method

```
rdd2 = sc.textFile("test.txt")
```

[1] https://www.datacamp.com/cheat-sheet/pyspark-cheat-sheet-spark-in-python

Let's practice

BIG DATA FUNDAMENTALS WITH PYSPARK

Use of Lambda function in python - filter()

BIG DATA FUNDAMENTALS WITH PYSPARK

Upendra Devisetty
Science Analyst, CyVerse

datacamp

What are anonymous functions in Python?

- Lambda functions are anonymous functions in Python
- Very powerful and used in Python. Quite efficient with `map()` and `filter()`
- Lambda functions create functions to be called later similar to `def`
- It returns the functions without any name (i.e anonymous)
- Inline a function definition or to defer execution of a code

Lambda function syntax

- The general form of lambda functions is

```
lambda arguments: expression
```

- Example of lambda function

```
double = lambda x: x * 2
print(double(3))
```

```
6
```

Difference between def vs lambda functions

- Python code to illustrate cube of a number

```
def cube(x):
     return x ** 3
g = lambda x: x ** 3
print(g(10))
print(cube(10))
```

```
1000
1000
```

- No return statement for lambda
- Can put lambda function anywhere

Use of Lambda function in Python - map()

- map() applies a function to all items in the input list
- General syntax of map()

```
map(function, list)
```

- Example of map()

```
items = [1, 2, 3, 4]
list(map(lambda x: x + 2 , items))
```

```
[3, 4, 5, 6]
```

Use of Lambda function in python - filter()

- filter() function takes a function and a list and returns a new list for which the function evaluates as true
- General syntax of filter()

```
filter(function, list)
```

- Example of filter()

```
items = [1, 2, 3, 4]
list(filter(lambda x: (x%2 != 0), items))
```

```
[1, 3]
```

Let's practice

BIG DATA FUNDAMENTALS WITH PYSPARK