Introduction to Apache Spark

Lightening fast cluster computing

Evolution of distributed systems

- First Generation
- Second Generation
- Third Generation

First distributed systems

- Proprietary
- Custom Hardware and software
- Centralized data
- Hardware based fault recovery

Ex: Teradata, Netezza etc

Second generation

- Open source
- Commodity hardware
- Distributed data
- Software based fault recovery

Ex : Hadoop, HPCC

Why we need new generation?

- Lot has been changed from 2000
- Both hardware and software gone through changes
- Big data has become necessity now
- Let’s look at what changed over decade

State of hardware in 2000

- Disk was cheap so disk was primary source of data
- Network was costly so data locality
- RAM was very costly
- Single core machines were dominant

State of hardware now

- RAM is the king
- RAM is primary source of data and we use disk for fallback
- Network is speedier
- Multi core machines are commonplace

Software in 2000

- Object orientation was the king
- Software optimized for single core
- No open frameworks for creating
  - Distributed storage
  - Distributed processing
- SQL was the only dominant way for data analysis

Software now

- Functional programming is on rise
- Software needs to exploit multiple cores on single node
- There are good frameworks to create distributed systems
  - HDFS for storage
  - Apache Mesos/ YARN to create distributed processing
- NoSQL is real alternative now

Big Data processing needs in 2000

- Very few companies had big data issue
- Batch processing system ruled the world
- Volume was big concern compare to velocity
- Mostly used for
  - Search
  - Log analysis

Big data processing needs now

- All companies use big data
- Velocity is as much concern as volume
- Needs of real time are as much important as batch processing
- Use cases are not just limited to search

Shortcomings of Second generation

- Batch processing is primary objective
- Not designed to change depending upon use cases
- Tight coupling between API and run time
- Do not exploit new hardware capabilities
- Too much complex

Third generation distributed systems

- Handle both batch processing and real time
- Exploit RAM as much as disk
- Multiple core aware
- Do not reinvent the wheel
- They use
  - HDFS for storage
  - Apache Mesos / YARN for distribution
- Plays well with Hadoop

Apache Spark

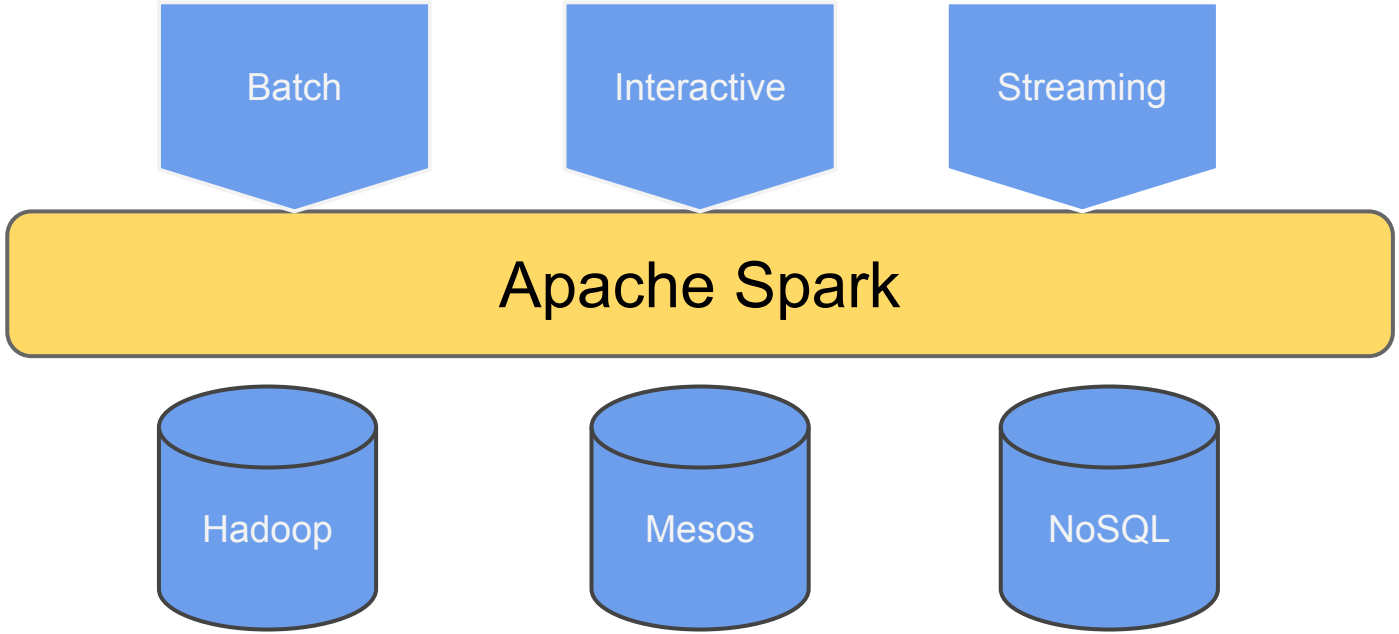
- A fast and general engine for large scale data processing
- Created by AMPLab now Databricks
- Written in Scala
- Licensed under Apache
- Lives in Github

History of Apache Spark

- Mesos, a distributed system framework as class project in UC Berkeley in 2009.
- Spark to test how mesos works
- Focused on
  - Iterative programs (ML)
  - Interactive querying
  - Unifying real time and batch processing
- Open sourced in 2010
- http://blog.madhukaraphatak.com/history-of-spark/

Why Spark?

Unified Platform for Big Data Apps



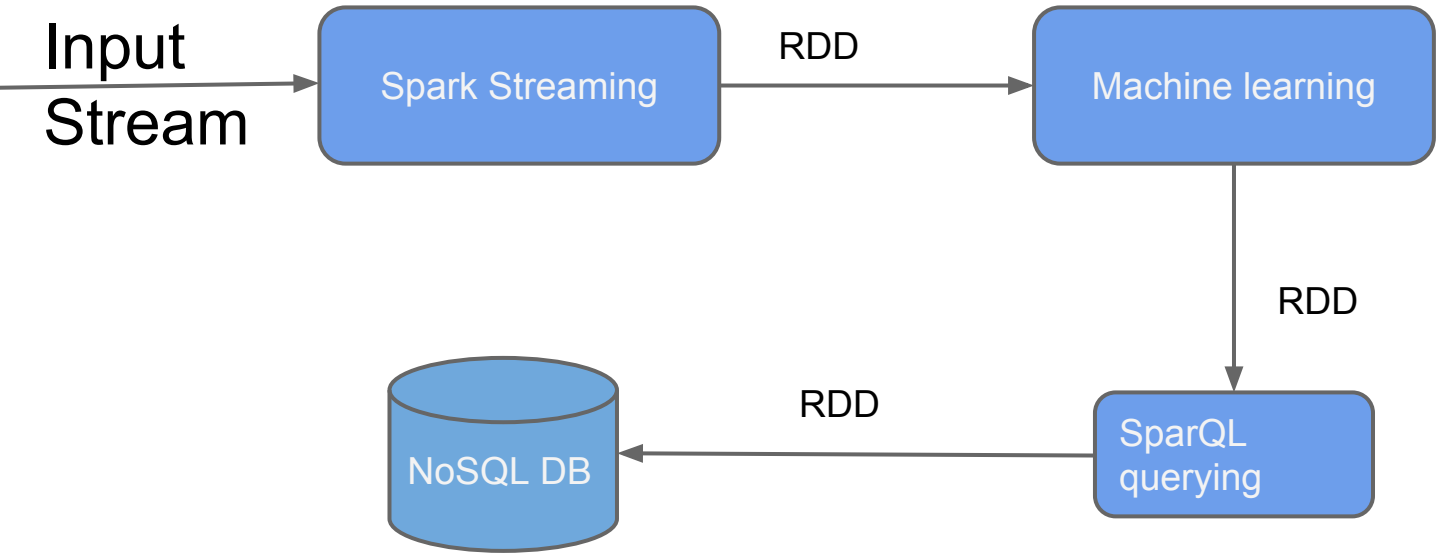
Why unification matters?

- Good for developers : One platform to learn
- Good for users : Take apps every where
- Good for distributors : More apps

Unification brings one abstraction

- All different processing systems in spark share same abstraction called RDD
- RDD is Resilient Distributed Dataset
- As they share same abstraction you can mix and match different kind of processing in same application

Spam detection



Boxes indicate different API calls not different processes

Runs everywhere

- You can spark on top any distributed system
- It can run on
  - Hadoop 1.x
  - Hadoop 2.x
  - Apache Mesos
  - It’s own cluster
- It’s just a user space library

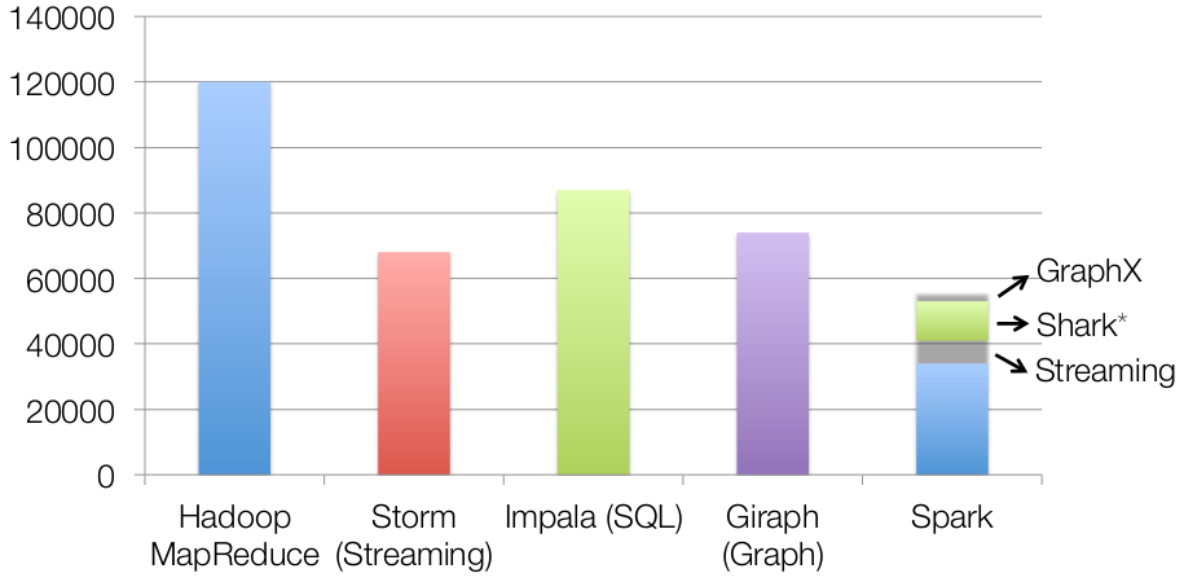
Small and Simple

- Apache Spark is highly modular
- The original version contained only 1600 lines of scala code
- Apache Spark API is extremely simple compared Java API of M/R
- API is concise and consistent

Ecosystem

Hadoop	Spark
Hive	SparkSQL
Apache Mahout	MLLib
Impala	SparkSQL
Apache Giraph	Graphax
Apache Storm	Spark streaming

Code Size



non-test, non-example source lines

* also calls into Hive

Source : http://spark-summit.org/wp-content/uploads/2013/10/Zaharia-spark-summit-2013-matei.pdf

In-memory aka Speed

- In Spark, you can cache hdfs data in main memory of worker nodes
- Spark analysis can be executed directly on in memory data
- Shuffling also can be done from in memory
- Fault tolerant

Integration with Hadoop

- No separate storage layer
- Integrates well with HDFS
- Can run on Hadoop 1.0 and Hadoop 2.0 YARN
- Excellent integration with ecosystem projects like Apache Hive, HBase etc

Multi language API

- Written in Scala but API is not limited to it
- Offers API in
  - Scala
  - Java
  - Python
- You can also do SQL using SparkSQL

Who are using Spark