

CS 378 – Big Data Programming

Lecture 22

Spark Introduction

Review

- Assignment 9 – Job Chaining
 - Solution review

Review

- Assignment 9 – Directory structure
- After session binning
 - clicker-m-0000x.avro
 - cpo-m-0000x.avro
 - other-m-0000x.avro
 - part-m-0000x.avro
 - shower-m-0000x.avro
 - submitter-m-0000x.avro
 - visitor-m-0000x.avro

Review

- After three parallel jobs (collect click subtype stats)
 - clicker-m-0000x.avro
 - **clickerStats**
 - part-m-00000.avro
 - cpo-m-0000x.avro
 - **cpoStats**
 - part-m-00000.avro
 - other-m-0000x.avro
 - part-m-0000x.avro
 - shower-m-0000x.avro
 - submitter-m-0000x.avro
 - **submitterStats**
 - part-m-00000.avro
 - visitor-m-0000x.avro

Review

- After three parallel jobs (collect click subtype stats)
 - **aggregateStats**
 - part-m-00000
 - clicker-m-0000x.avro
 - **clickerStats**
 - part-m-00000
 - cpo-m-0000x.avro
 - **cpoStats**
 - part-m-00000
 - other-m-0000x.avro
 - part-m-0000x.avro
 - shower-m-0000x.avro
 - submitter-m-0000x.avro
 - **submitterStats**
 - part-m-00000
 - visitor-m-0000x.avro

Issues with MapReduce

- One “template”: map, then reduce
- HDFS is its own file system
- In a data pipeline, each map-reduce step
 - Reads all input data from disk
 - Writes all output data to disk
 - Even if output is just an intermediate result
- Addresses failure handling with replicated data
 - Lots of disk, but can help performance

Apache Spark

- Open source project out of AMPLab at UC Berkeley
- A Spark program defines:
 - Transformations and actions on data sets
 - Data flow, or lineage graph among data sets, induced by the transformations
- Data sets in Spark are called RDDs
 - Resilient Distributed Datasets

Spark Features

- Provide domain specific libraries
 - Example: map-reduce library
 - Promotes functional programming model
- Access to multiple data (file) systems
 - Local, HDFS, Cassandra, S3, database tables, ...
- Lazy evaluation, and caching for performance
 - Reduce or eliminate disk I/O
- Support multi-stage and iterative apps

Spark RDDs

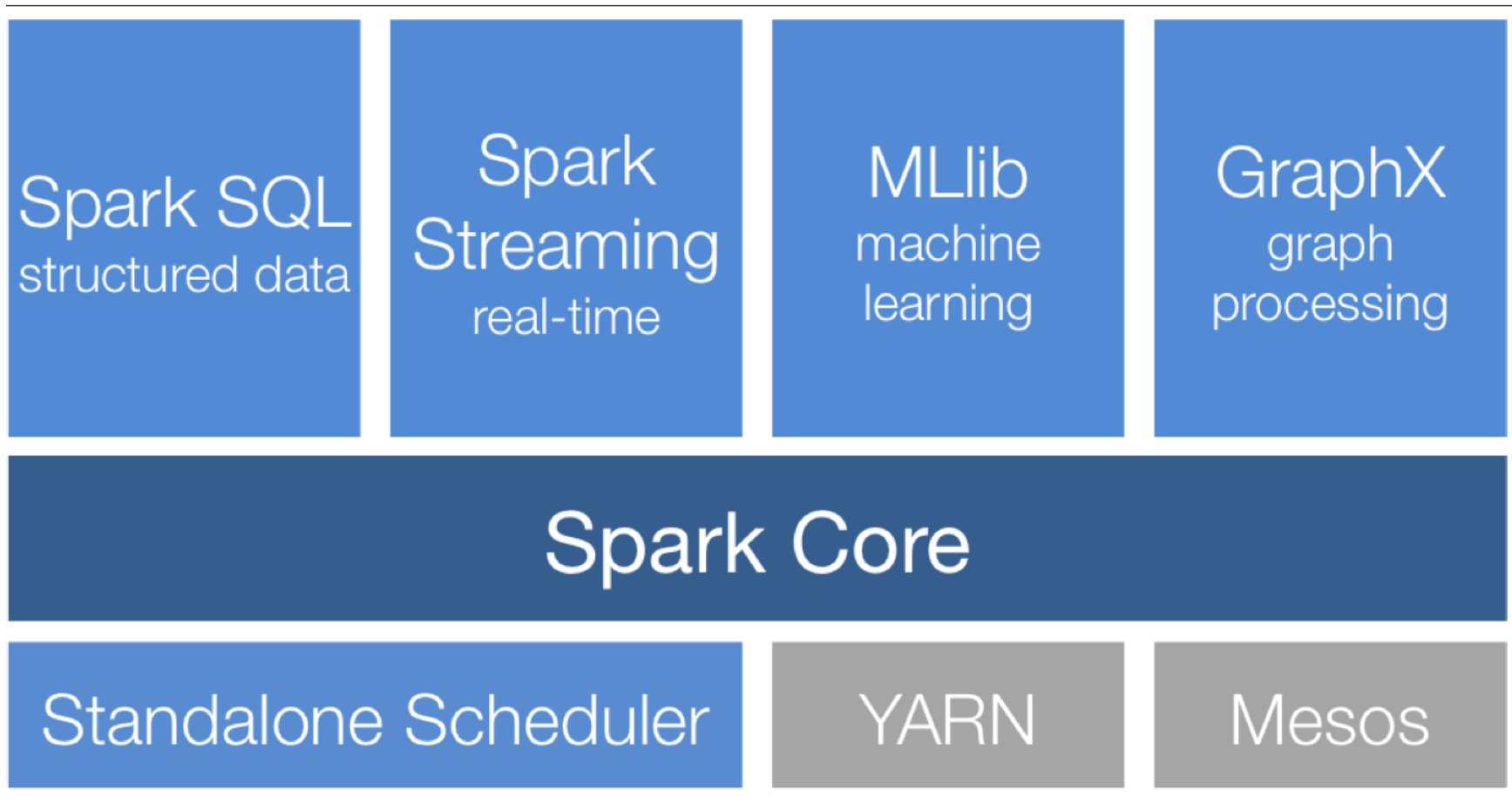
- Resilient Distributed Dataset
 - One RDD has one or more partition
 - Partitions are distributed across machines
 - Rebuilt from base data on failure (versus replication)
 - Lazy evaluation – created on demand
- RDD types offer various functions
 - map, reduce
 - groupBy, reduceByKey
 - joins (inner, leftOuterJoin, rightOuterJoin)
 - filter, sample

Spark

- Provides a higher level of abstraction for coding
 - Multi-stage map-reduce pipeline in Hadoop ...
 - Can be composed functions in Spark
- RDD support and libraries
 - Spark SQL – RDD representing relational table
 - Streaming data – D-Stream, Twitter stream
 - Graph data – GraphX
 - ...

Spark Stack

Learning Spark, Figure 1-1.



Spark Programs

- A Spark program defines:
 - RDDs
 - Input from external sources, or
 - Produced by a transformation
 - Transformations
 - Produce a new RDD from the input RDD
 - Actions
 - Compute something from the input RDD
 - Return non-RDD objects (e.g., number)
 - Write an RDD to external storage

Spark Example

- Interactive
 - Scala

- Batch
 - Java

Assignment 10

- Download Spark
- Compile Java WordCount for Spark
- Run Java WordCount using Spark