CS15-319 / 15-619
Cloud Computing

Recitation 12

April 8th, 2014

Announcements

- Encounter a general bug:
  - Post on Piazza
- Encounter a grading bug:
  - Post Privately on Piazza
- Don’t ask if my answer is correct
- Don’t post code on Piazza
- Search before posting
- Post feedback on OLI

Piazza Questions

- STDOUT, STDERR redirection

  -
    ```
    ./run.sh 1> result.out 2>error.out
    ```
- Question 10
  - Some students have longer latency on Q10, this will be regarded manually.
- Security group
  - Both launch instance and HBase master node should be configured.

DynamoDB vs. HBase

- Data Model
  - Key-value vs. Column oriented Key-value
- Proprietary vs. Open source
- Cost
  - DynomoDB: Provisioned Throughput Capacity
  - HBase: Instance + EMR
- Limitations:
  - DynamoDB:
    - Item size: 64 KB
    - Query result: 1 MB

Project 3, Module 5 Reflections

- When to use DynamoDB:
  - Required throughput is determined
    - e.g. steady arrival rate
  - Easier to implement and scale
  - Enough budget
    - Charged by provisioned throughput capacity
- When to use HBase:
  - Low cost
  - Less constraints (Item size, query result)
  - Open source

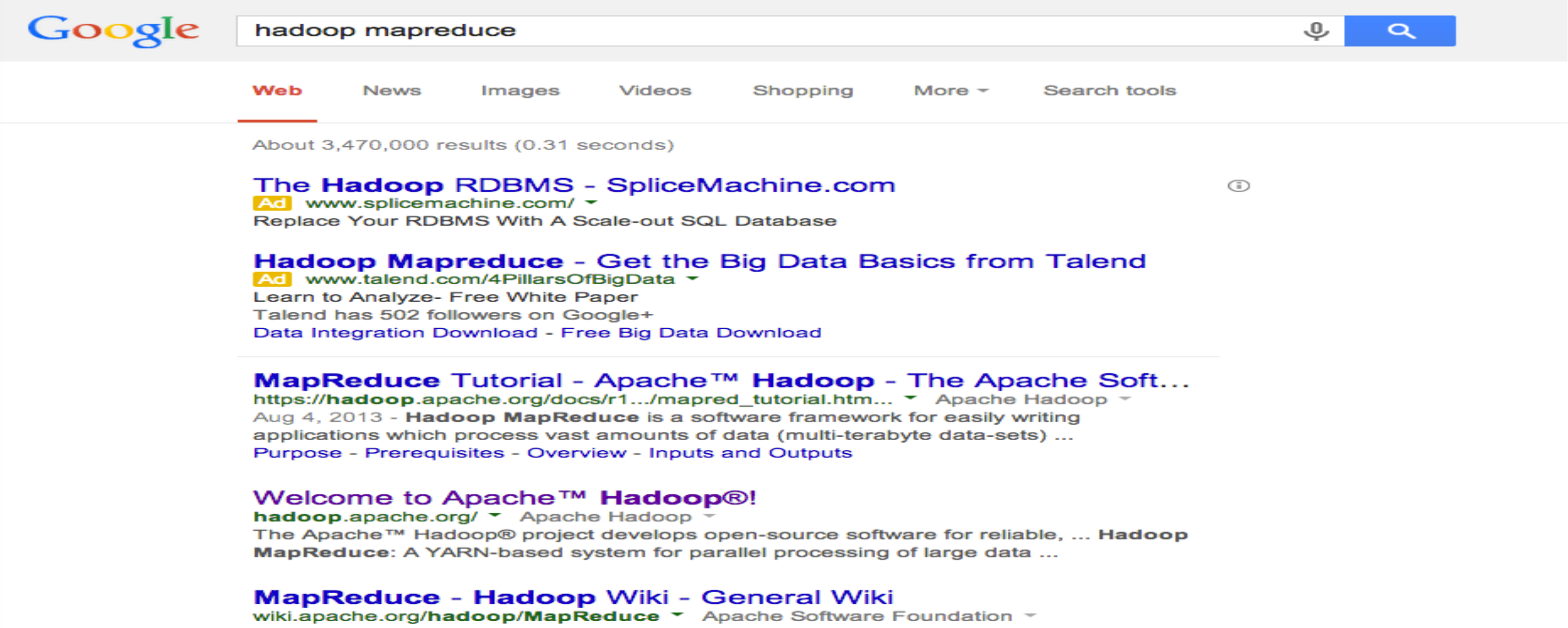
Module to Read

- UNIT 5: Distributed Programming and Analytics Engines for the Cloud
  - Module 16: Introduction to Distributed Programming for the Cloud
  - Module 17: Distributed Analytics Engines for the Cloud: MapReduce
  - Module 18: Distributed Analytics Engines for the Cloud: Pregel
  - Module 19: Distributed Analytics Engines for the Cloud: GraphLab

Project 4

- MapReduce
  - Hadoop MapReduce
- Input Text Predictor: NGram Generation
  - NGram Generation
- Input Text Predictor: Language Model and User Interface
  - Language Model Generation

Google



About 3,470,000 results (0.31 seconds)

The Hadoop RDBMS - SpliceMachine.com
Ad www.splicemachine.com/
Replace Your RDBMS With A Scale-out SQL Database

Hadoop Mapreduce - Get the Big Data Basics from Talend
Ad www.talend.com/4PillarsOfBigData
Learn to Analyze- Free White Paper
Talend has 502 followers on Google+
Data Integration Download - Free Big Data Download

MapReduce Tutorial - Apache™ Hadoop - The Apache Soft...
https://hadoop.apache.org/docs/r1.../mapred_tutorial.htm... Apache Hadoop
Aug 4, 2013 - Hadoop MapReduce is a software framework for easily writing applications which process vast amounts of data (multi-terabyte data-sets) ...
Purpose - Prerequisites - Overview - Inputs and Outputs

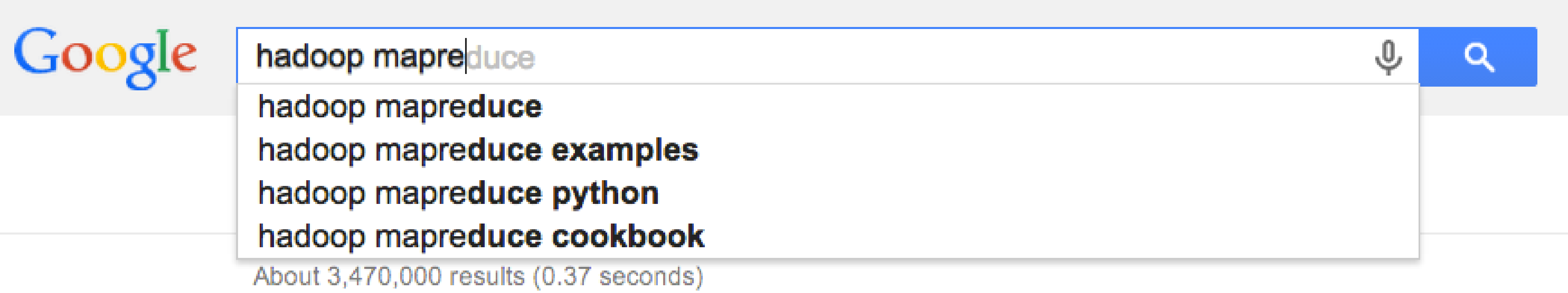
Welcome to Apache™ Hadoop®!
hadoop.apache.org/ Apache Hadoop
The Apache™ Hadoop® project develops open-source software for reliable, ... Hadoop MapReduce: A YARN-based system for parallel processing of large data ...

MapReduce - Hadoop Wiki - General Wiki
wiki.apache.org/hadoop/MapReduce Apache Software Foundation

- Inverted index
  - Word -> {doc1, doc2, ...}
- Ranking ...

Google

- Google Instant
  - Input text predictor



hadoop mapre|duce

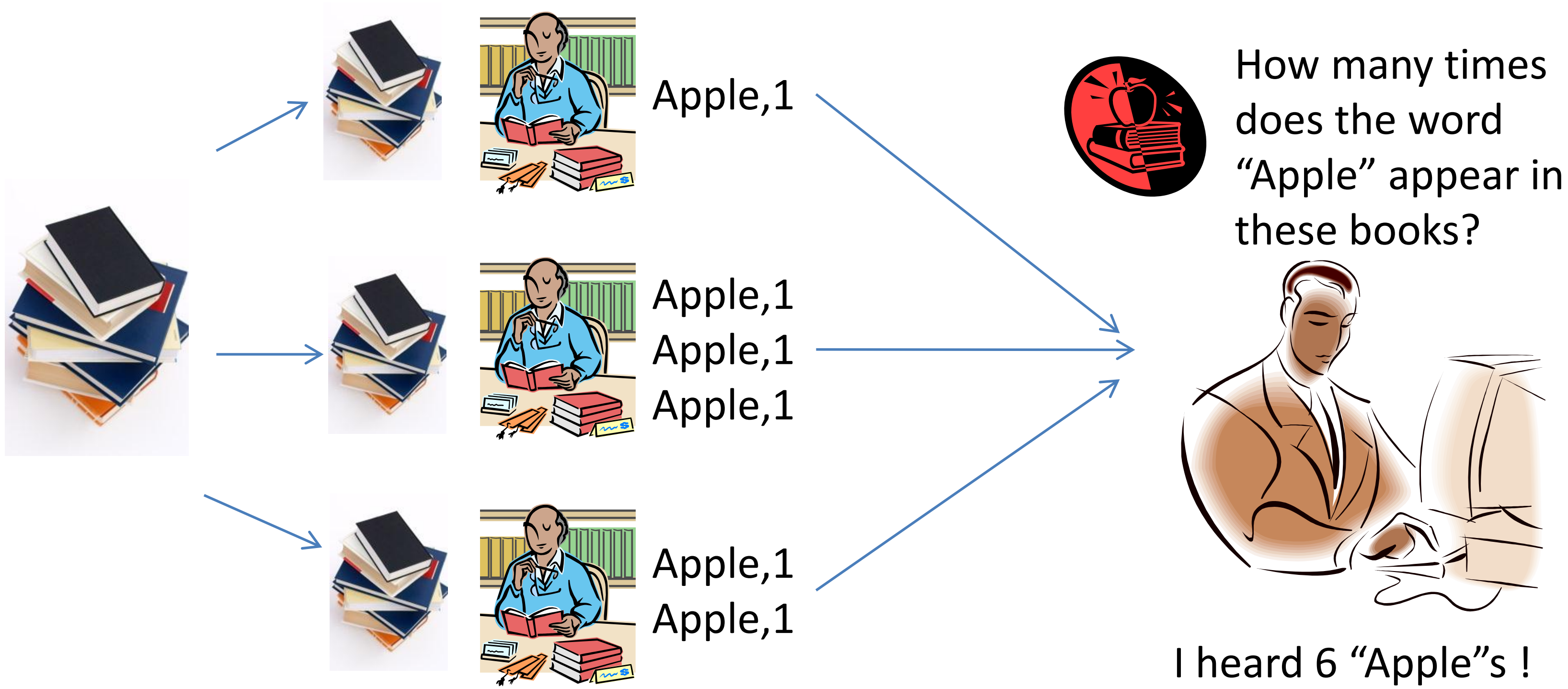
hadoop mapre**duce**
hadoop mapre**duce examples**
hadoop mapre**duce python**
hadoop mapre**duce cookbook**

About 3,470,000 results (0.37 seconds)

  - Generate a list of phrases in a text corpus with their corresponding counts
  - Rank the probability

MapReduce Reflection on Project 1

- The idea of MapReduce



Apple,1

Apple,1
Apple,1
Apple,1

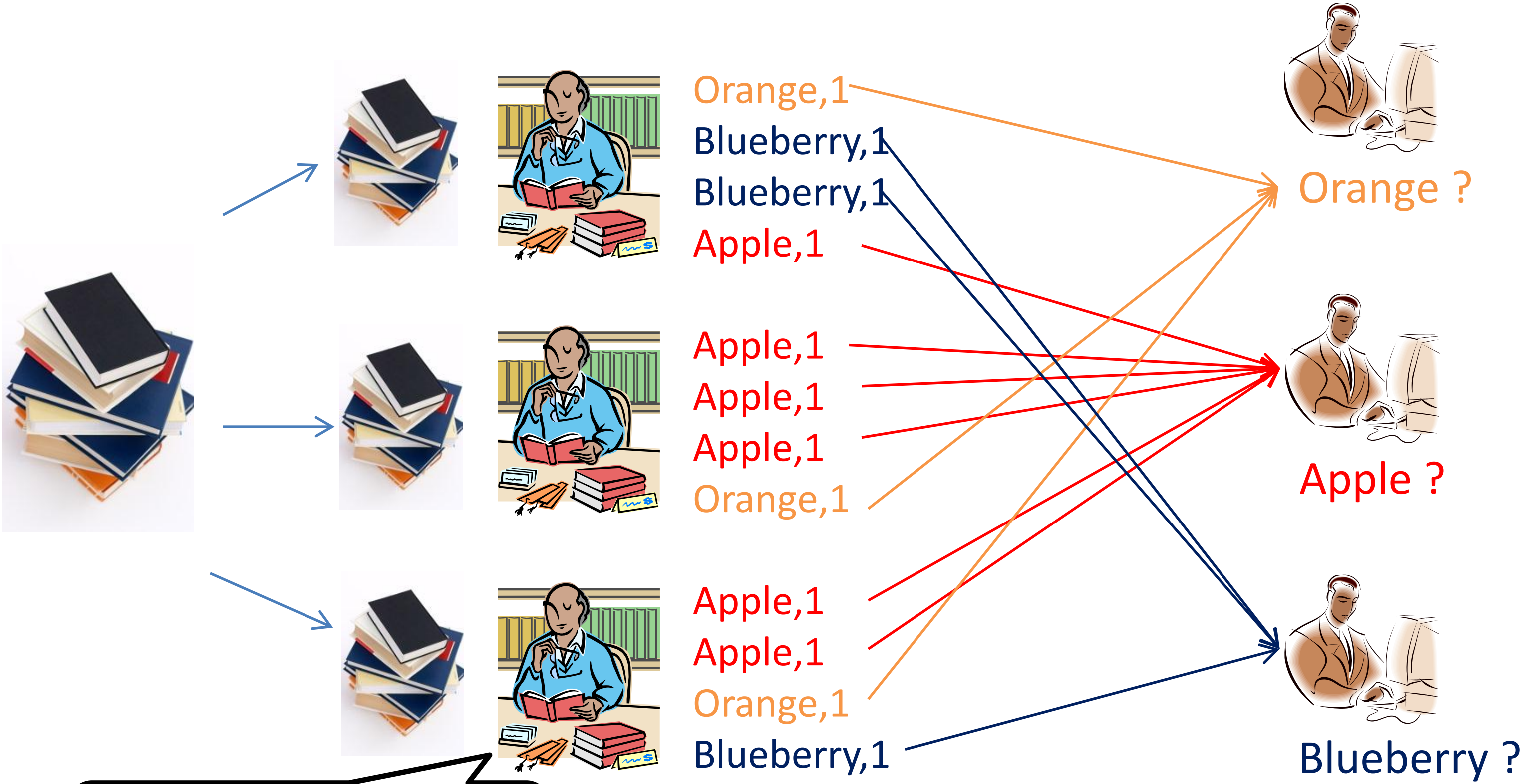
Apple,1
Apple,1

How many times does the word “Apple” appear in these books?

I heard 6 “Apple”s !

MapReduce Reflection on Project 1

- The idea of MapReduce



Orange,1
Blueberry,1
Blueberry,1
Apple,1

Apple,1
Apple,1
Apple,1
Orange,1

Apple,1
Apple,1
Orange,1
Blueberry,1

Orange ?

Apple ?

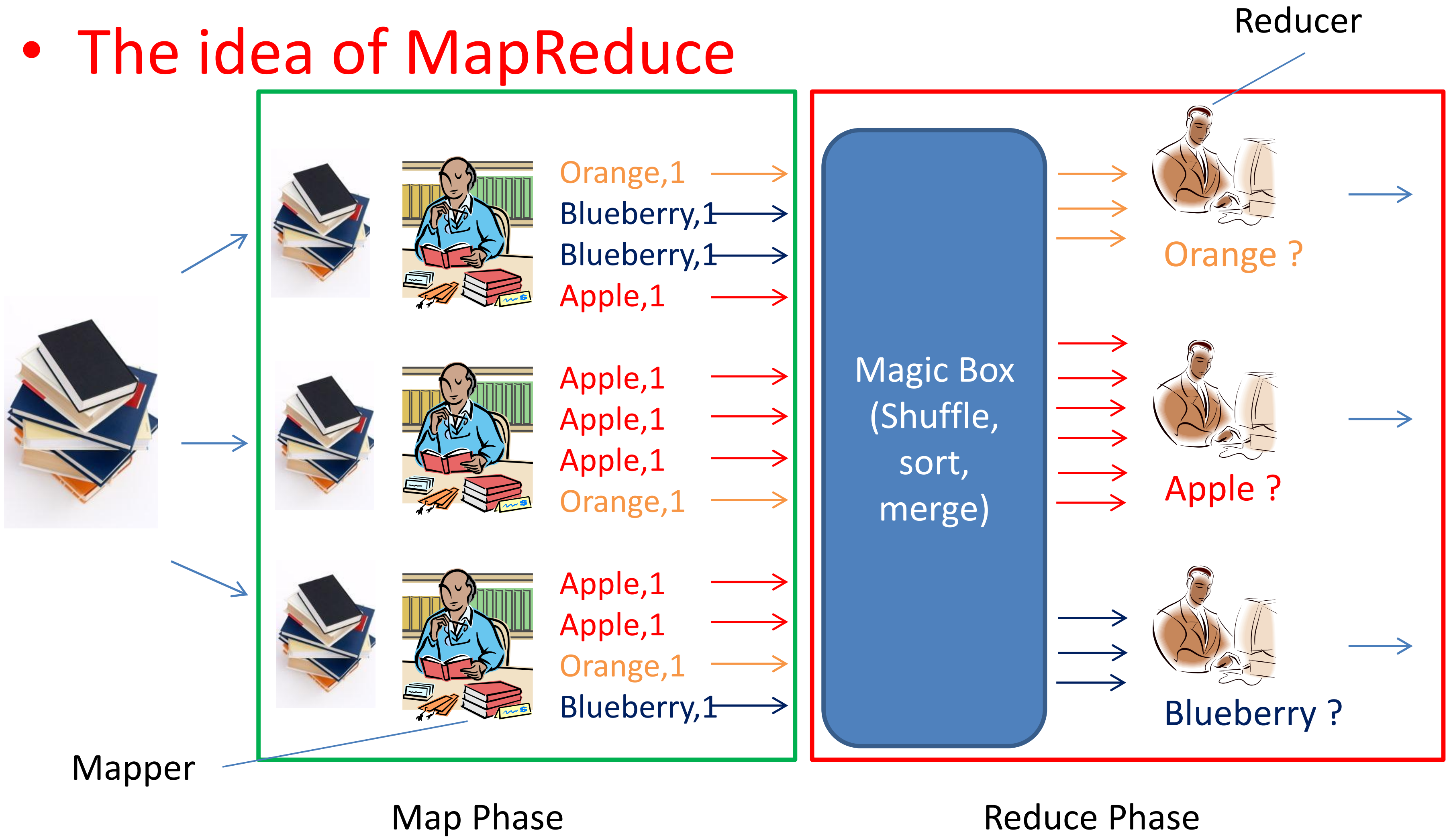
Blueberry ?

How Do I know Who is the “Apple” Man?

You Don’t!

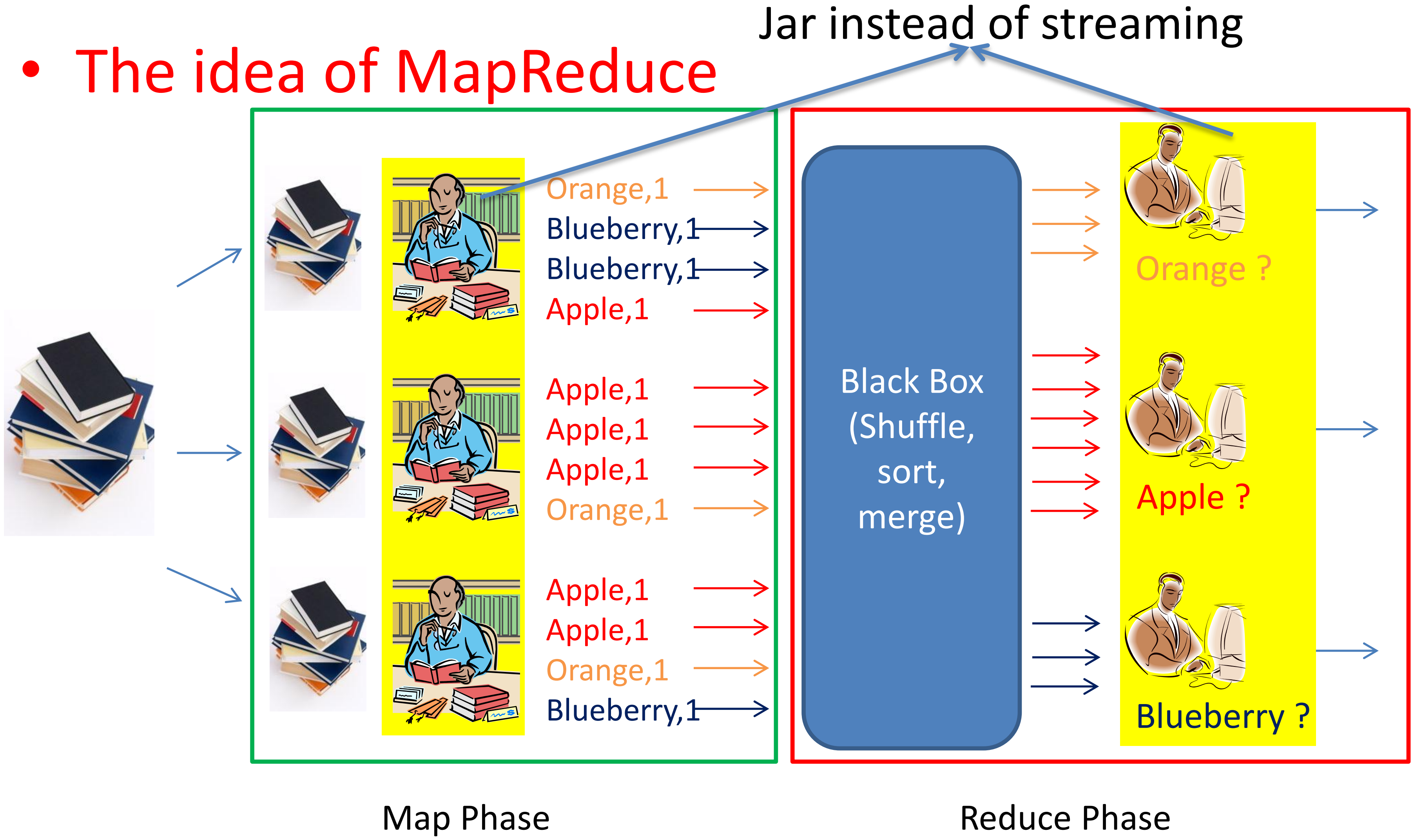
MapReduce Reflection on Project 1

- The idea of MapReduce



MapReduce This Week

- The idea of MapReduce

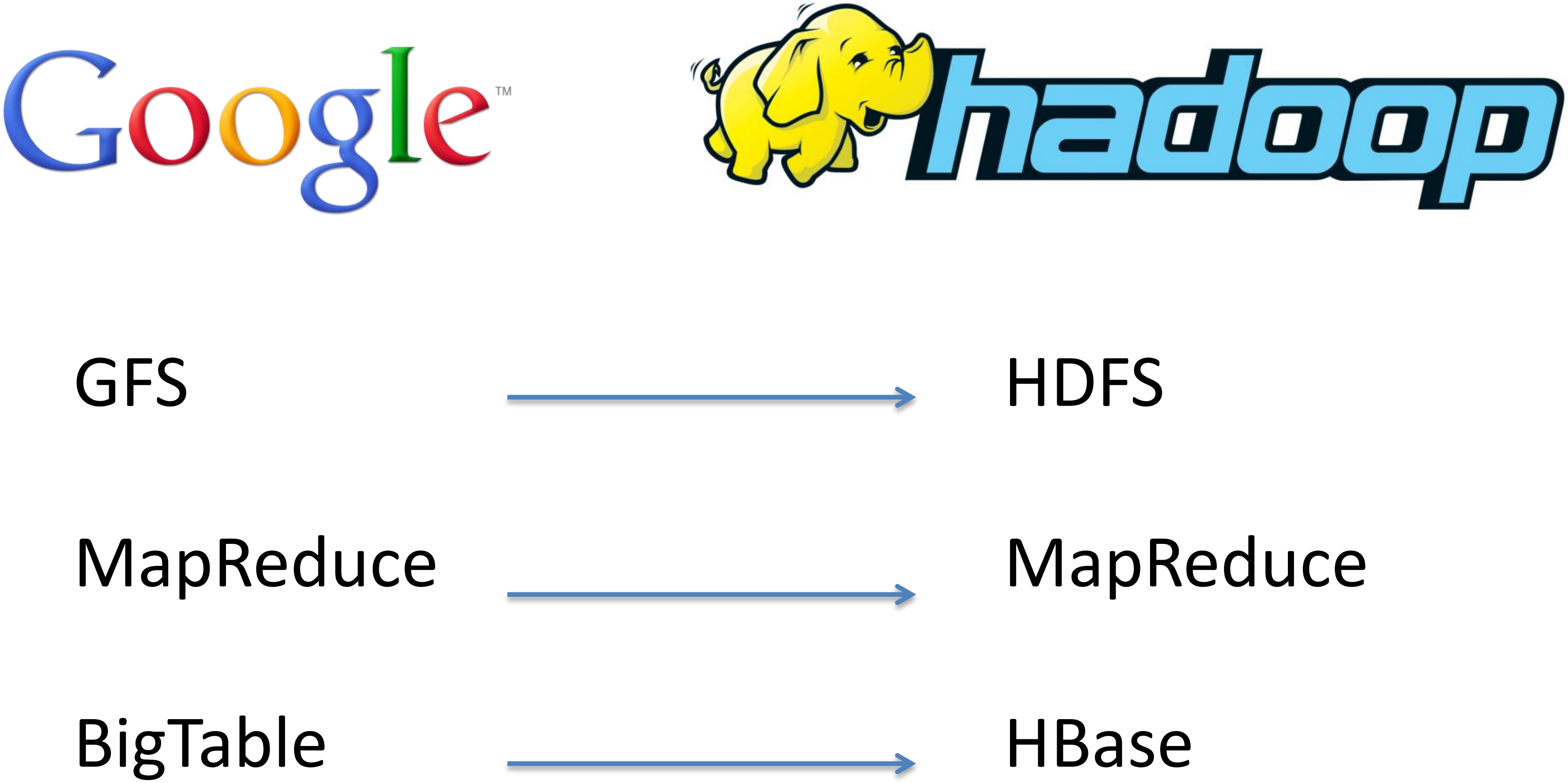


MapReduce

- Mapper
  - Input: **key-value pairs**
    - lines in files in our project
  - Output: **key-value pairs**
    - **Keys** are used in Shuffling and Merge to find the Reducer that handles the intermediate output for that specific key. (in our example, Apple, Orange and Blueberry are keys)
    - **Values** are messages sent from mapper to reducer (in our case it is always 1)
    - Mappers’ output is intermediate because reducers will receive the key-value pairs and take them as input.

MapReduce

- Reducer
  - Input: **key-value pairs**
  - Output: **key-value pairs**
    - the final result we need
    - Depends on what we want, our code should process the value in the key-value pairs that we got accordingly (in the word count example, we just add up all the values).



Google™

hadoop

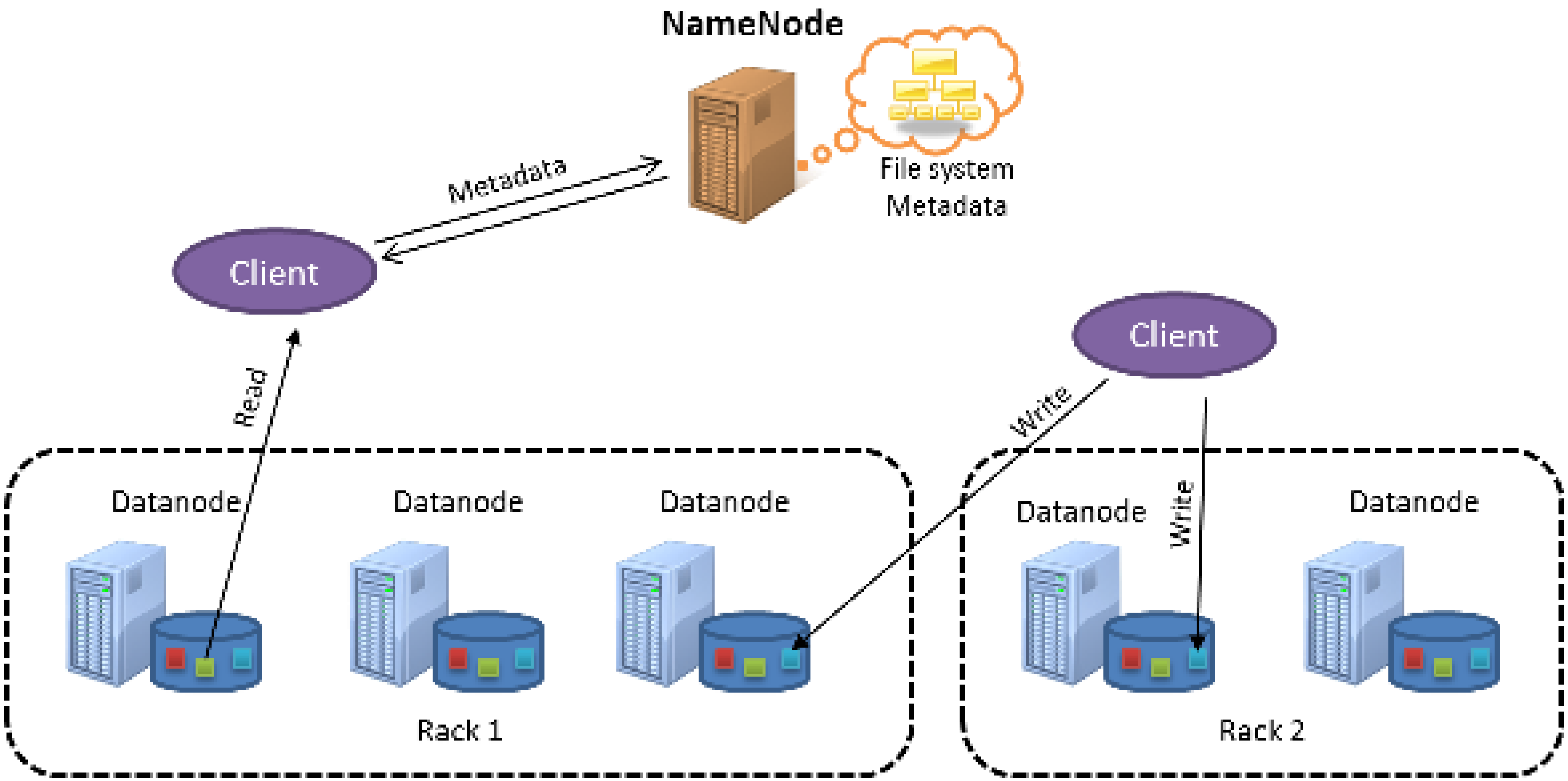
GFS → HDFS

MapReduce → MapReduce

BigTable → HBase

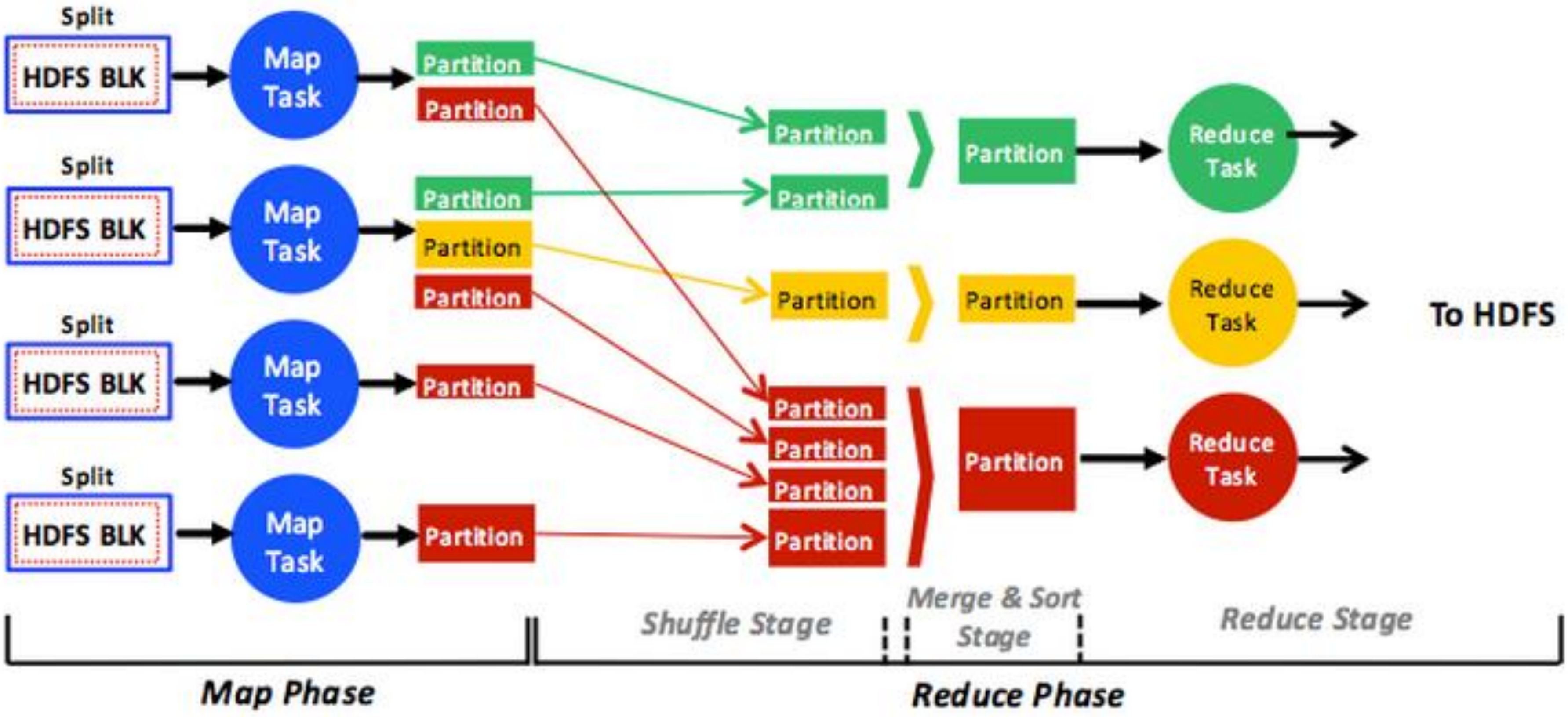
HDFS

- Hadoop Distributed File System
- Open source version of Google File System



MapReduce and HDFS

- Workflow

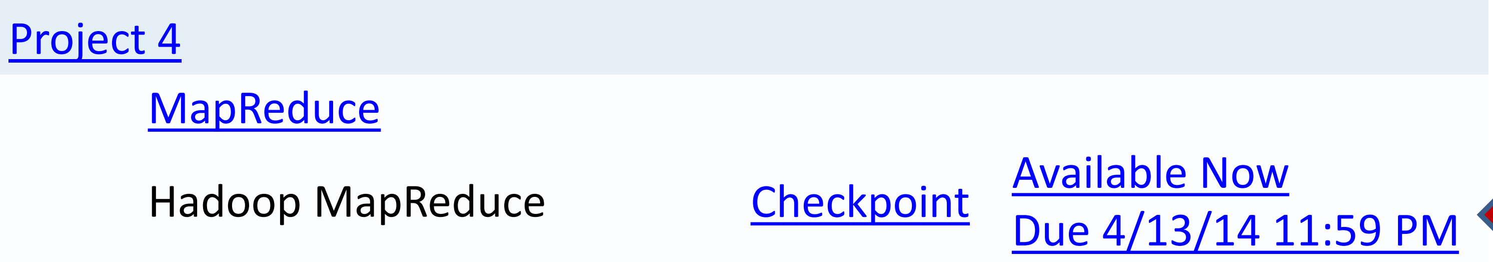


Project 4 Module 1

- Write a MapReduce program that will build an inverted index of documents
- Have to use EMR Custom Jar
  - CANNOT use EMR streaming

Upcoming Deadlines

- Project 4:

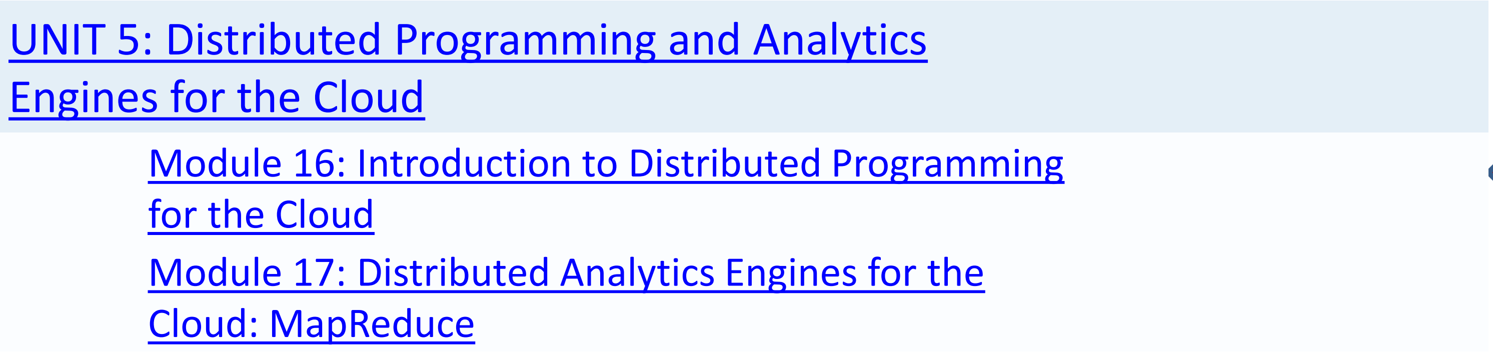


Project 4

MapReduce

Hadoop MapReduce	Checkpoint	Available Now Due 4/13/14 11:59 PM

- Unit 5:



UNIT 5: Distributed Programming and Analytics Engines for the Cloud

Module 16: Introduction to Distributed Programming for the Cloud

Module 17: Distributed Analytics Engines for the Cloud: MapReduce

Demo Outline

- Introduction to Hadoop & HDFS
- Code for MapReduce example
- Demo of using custom Jar

Hadoop

- Apache Hadoop
  - A framework for running applications on a large cluster of commodity hardware
  - Implements the MapReduce computational paradigm
  - Uses HDFS for data storage
  - Engineers with little knowledge of distributed computing can finish the code in a short period
- MapReduce
  - A programming model for processing large data sets using a parallel distributed algorithm

HDFS

- Paper
  - The Hadoop Distributed File System, Konstantin Shvachko, Hairong Kuang, Sanjay Radia, Robert Chansler, Yahoo!, 2010 IEEE 26th Symposium on Mass Storage Systems and Technologies (MSST)
- Purpose
  - Implemented for running Hadoop's MapReduce applications with distributed storage
  - An open-source framework which can be used by different clients with different needs

Custom Jar

- What is custom Jar
  - Customize your java MapReduce program
- Why custom Jar
  - More resources: HDFS/HBASE/S3
  - More job configuration flexibility
  - More control of how the resources are utilized

Demo

- WordCount program demo
  - Code review
  - Launch EMR Cluster
  - Compile Java code
  - Generate WordCount input
  - Run WordCount program

Recommendations

- Test for correctness with small datasets first
- DO NOT need to restart a new cluster
  - EMR will charge you one hour of usage for instances even though your EMR job failed to start
- Pay attention to your code efficiency
- Version of Hadoop
  - should match the version of your API
- Start early

Q & A

- Thanks