Big Data Engineering With MapReduce and Hive

Data Science Dojo

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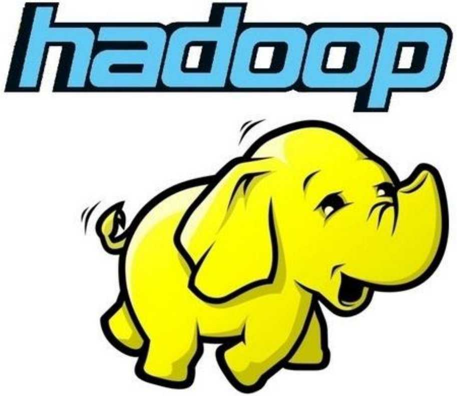
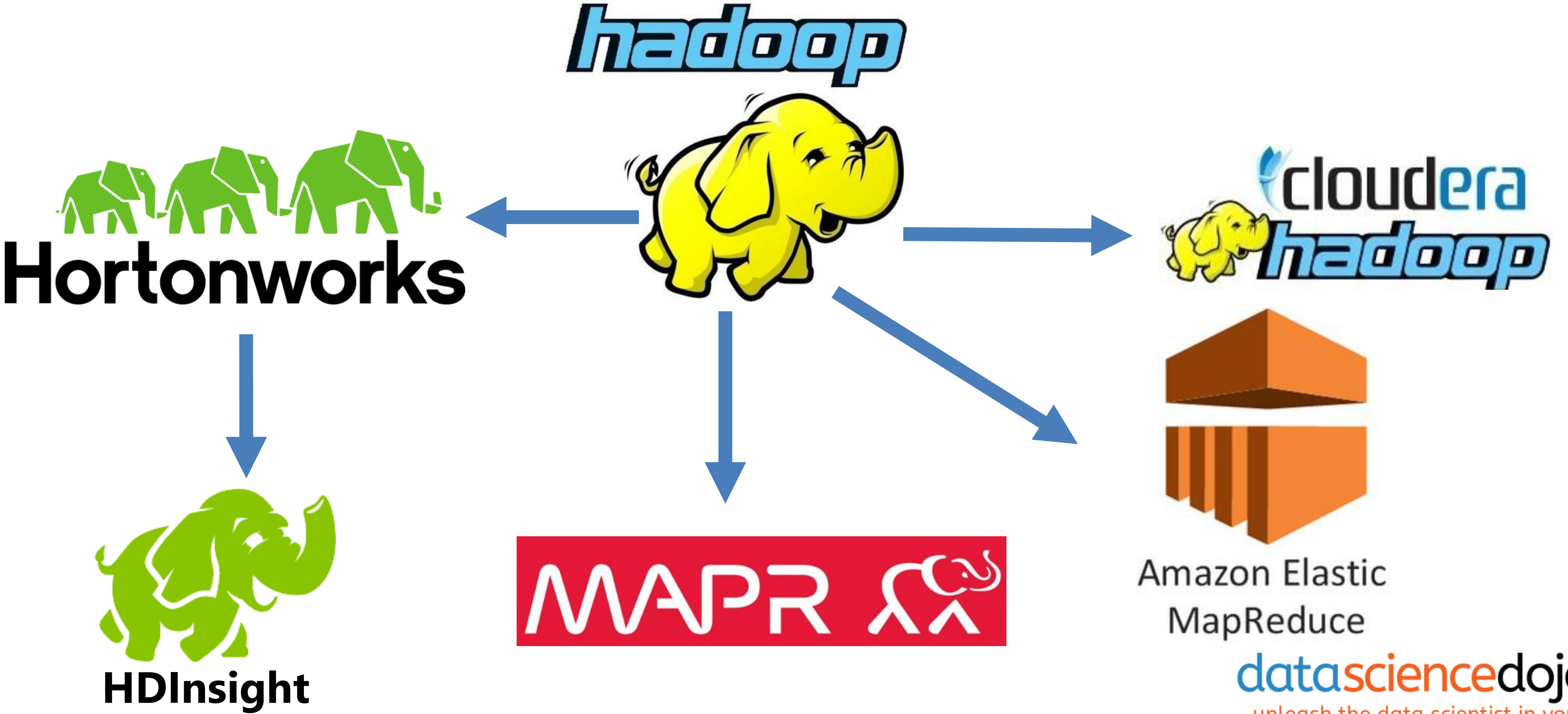
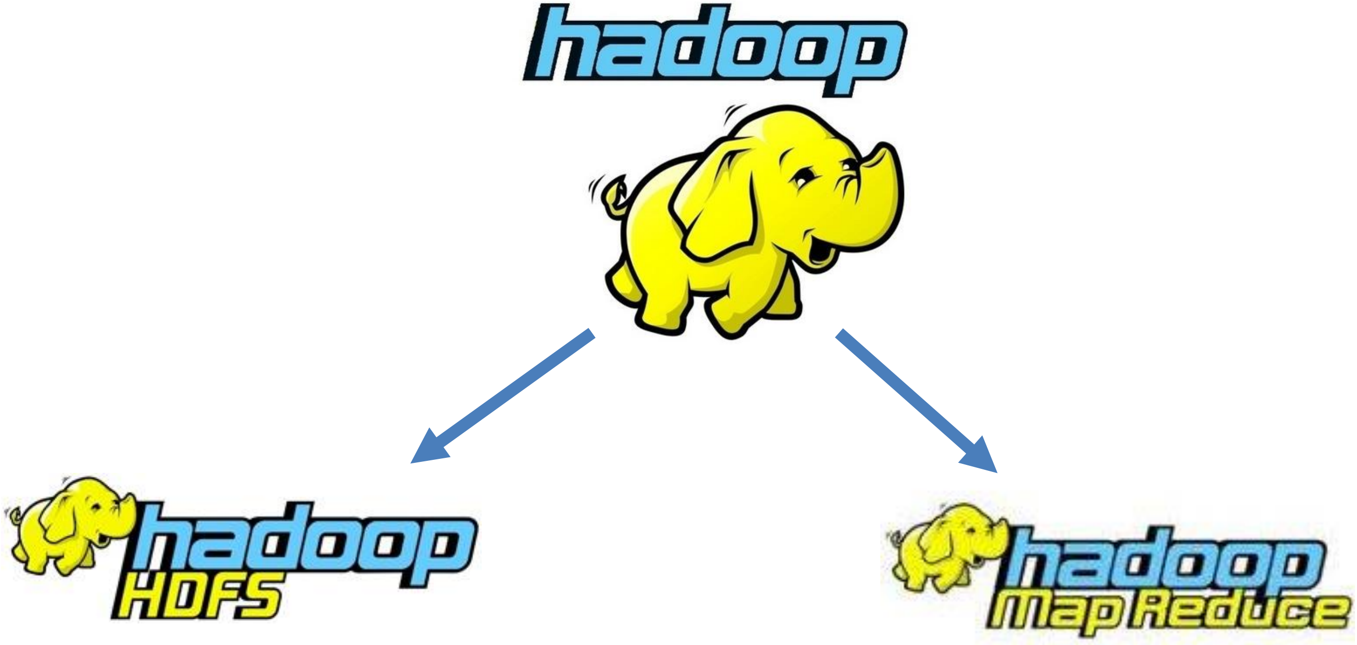
Agenda



Hadoop Implementations

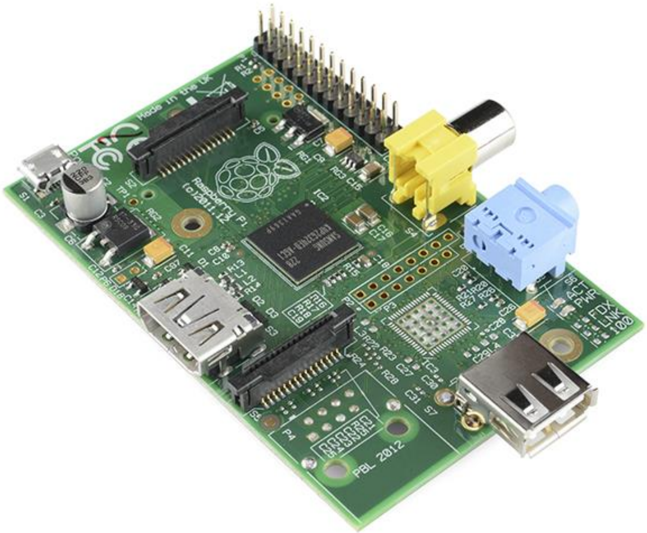


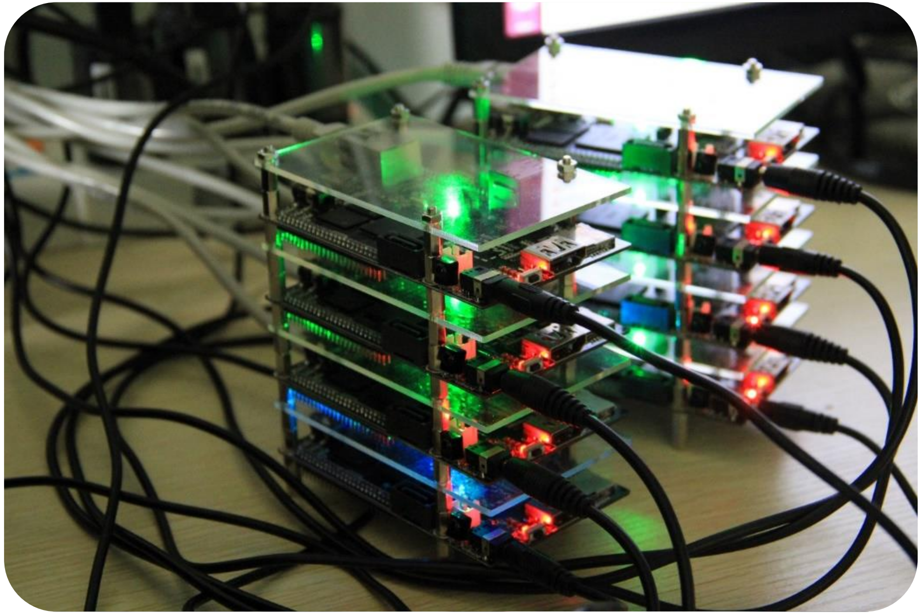
Hadoop



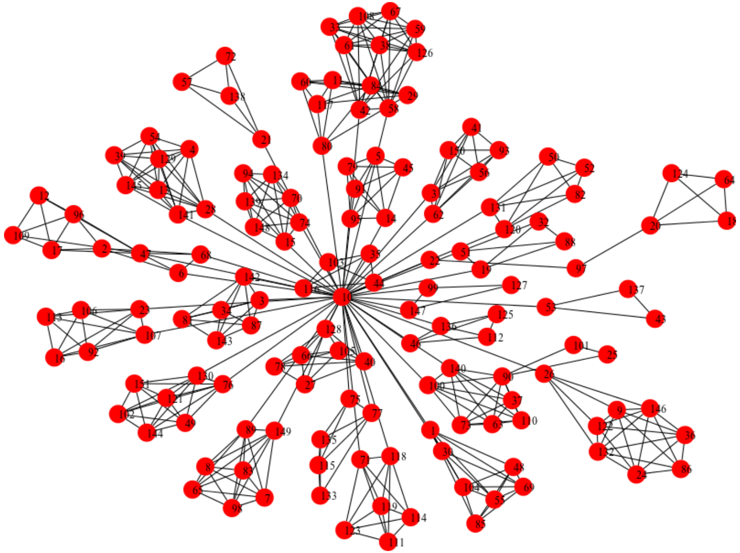
Turn Back The Clock, The Mainframe

Distributed Computing





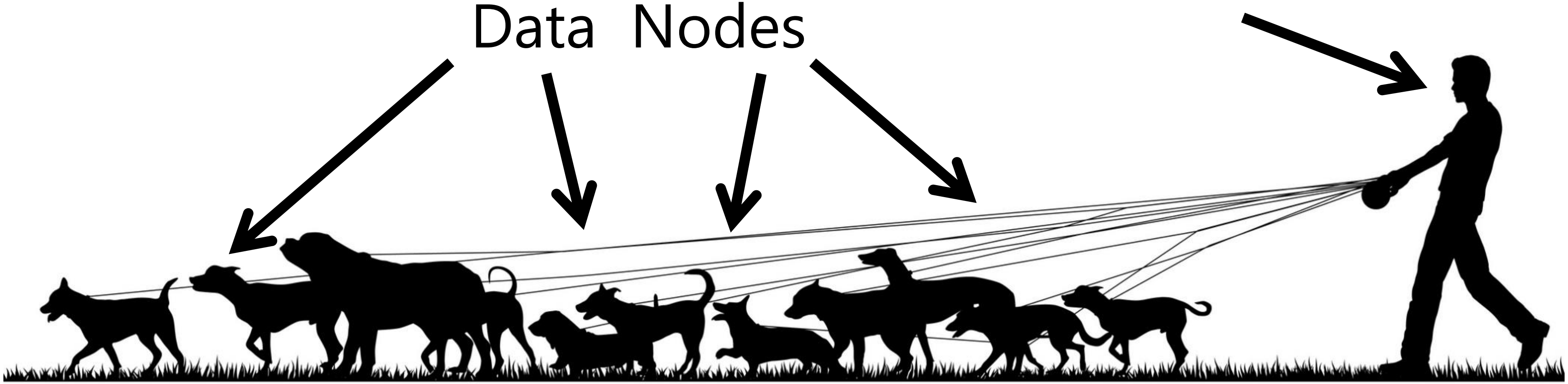
Cloud Computing



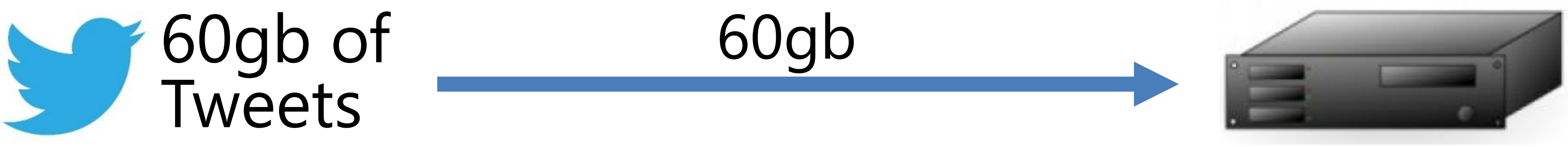
If dogs were servers…

Head Node (Named Node)

Data Nodes



HDFS & MapReduce



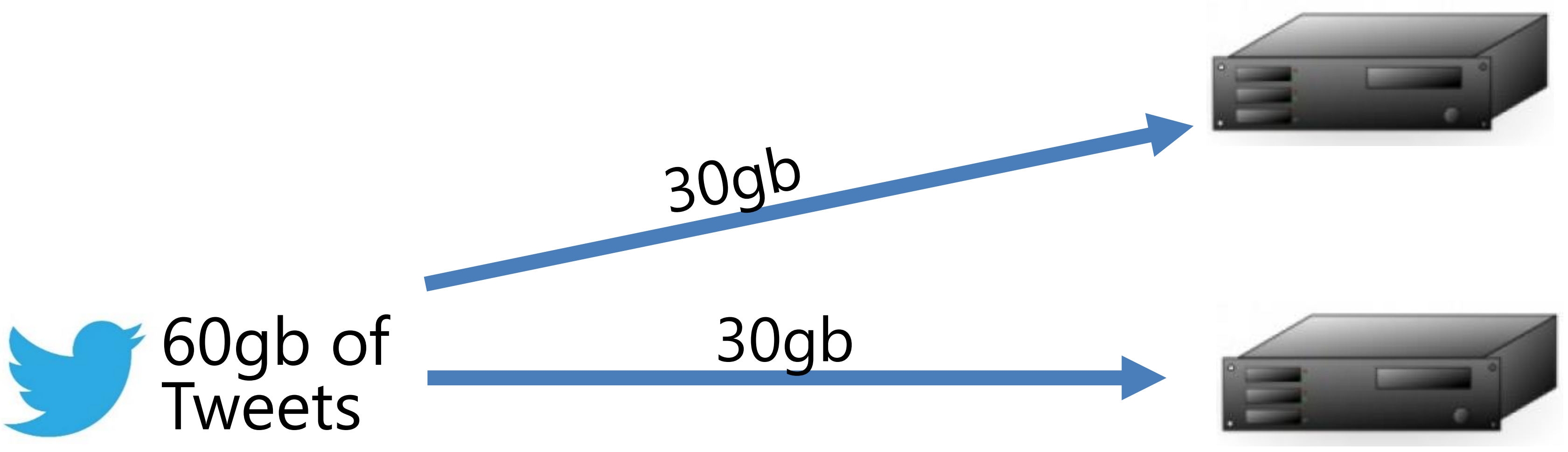
60gb of Tweets

60gb

1 Computer

Processing: 30 hours

HDFS & MapReduce



60gb of Tweets

30gb

30gb

2 Computers

Processing: 15 hours

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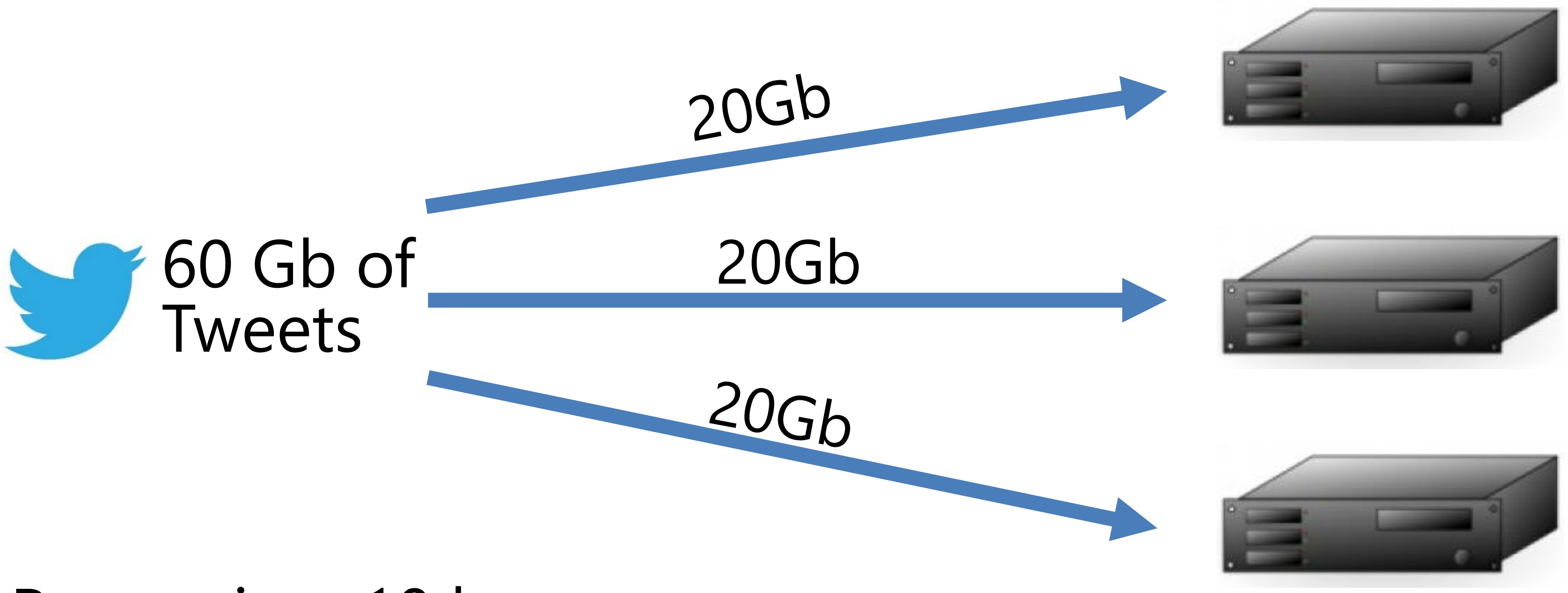
HDFS & MapReduce



Processing: 10 hours

3 Computers

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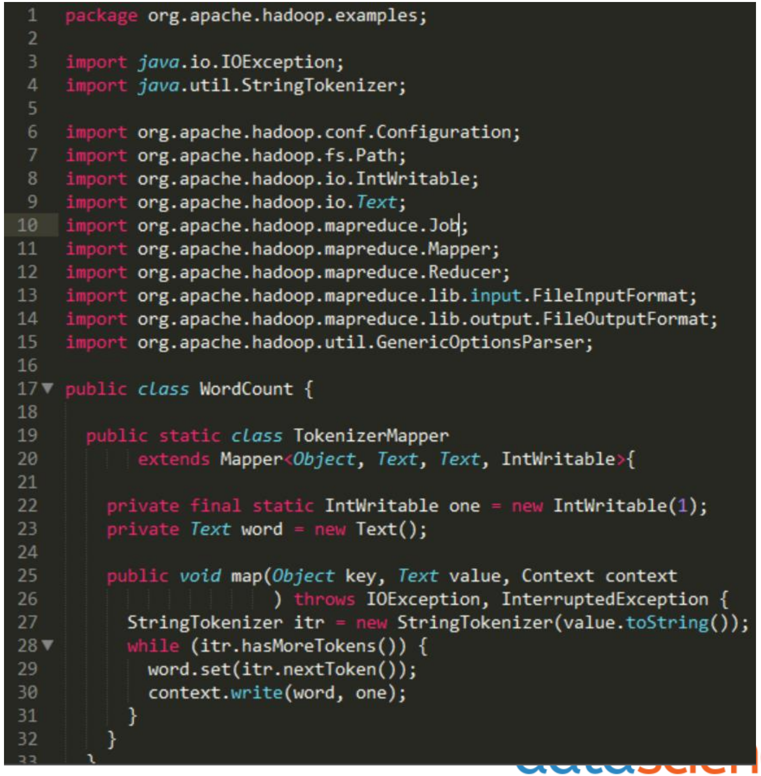
Most Cases, Linear Scaling Of Processing Power

Number of Computers	Processing Time (hours)
1	30
2	15
3	10
4	7.5
5	6
6	5
7	4.26
8	3.75
9	3.33

Limitations with MapReduce

- ~200 lines of code to do anything
- Slow
- Troubleshooting multiple computers
- Good devs are scarce
- Expensive certifications



```java
package org.apache.hadoop.examples;

import java.io.IOException;
import java.util.StringTokenizer;

import org.apache.hadoop.conf.Configuration;
import org.apache.hadoop.fs.Path;
import org.apache.hadoop.io.IntWritable;
import org.apache.hadoop.io.Text;
import org.apache.hadoop.mapreduce.Job;
import org.apache.hadoop.mapreduce.Mapper;
import org.apache.hadoop.mapreduce.Reducer;
import org.apache.hadoop.mapreduce.lib.input.FileInputFormat;
import org.apache.hadoop.mapreduce.lib.output.FileOutputFormat;
import org.apache.hadoop.util.GenericOptionsParser;

public class WordCount {

  public static class TokenizerMapper
       extends Mapper<Object, Text, Text, IntWritable>{

    private final static IntWritable one = new IntWritable(1);
    private Text word = new Text();

    public void map(Object key, Text value, Context context
                    ) throws IOException, InterruptedException {
      StringTokenizer itr = new StringTokenizer(value.toString());
      while (itr.hasMoreTokens()) {
        word.set(itr.nextToken());
        context.write(word, one);
      }
    }
```

Ambari: Cluster provisioning, management, and monitoring

Avro (Microsoft .NET Library for Avro): Data serialization for the Microsoft .NET environment

HBase: Non-relational database for very large tables

HDFS: Hadoop Distributed File System

Hive: SQL-like querying

Mahout: Machine learning

MapReduce and YARN: Distributed processing and resource management

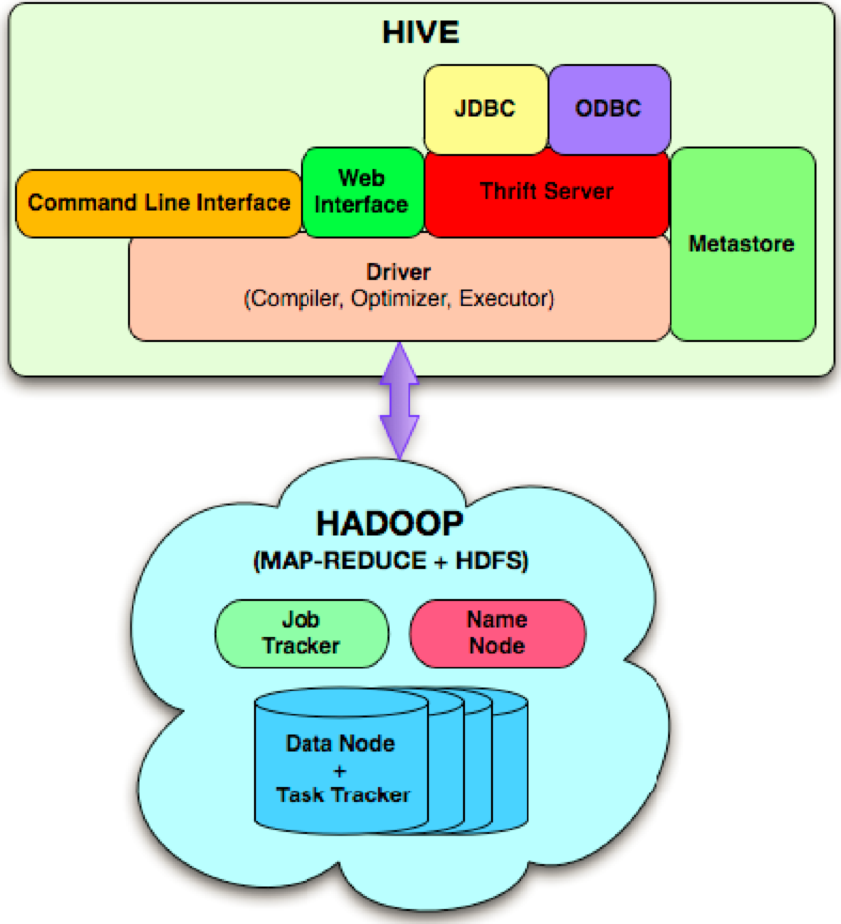
Oozie: Workflow management

Pig: Simpler scripting for MapReduce transformations

Sqoop: Data import and export

Storm: Real-time processing of fast, large data streams

Zookeeper: Coordinates processes in distributed systems


HIVE

JDBC

ODBC

Command Line Interface

Web Interface

Thrift Server

Metastore

Driver
(Compiler, Optimizer, Executor)

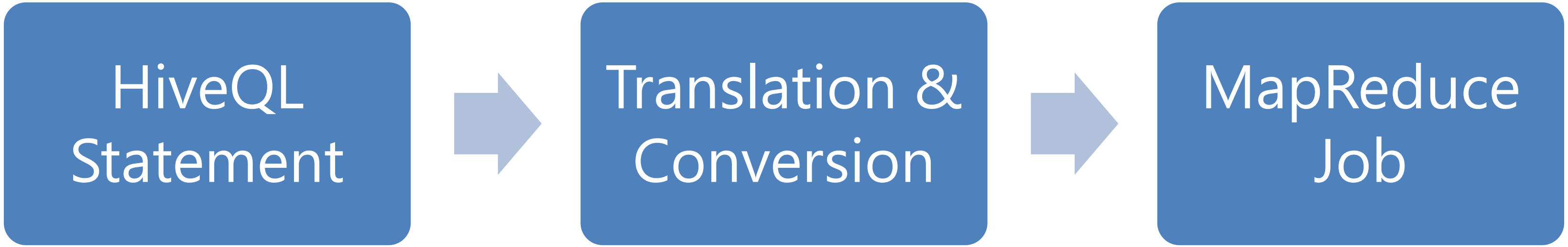
HADOOP
(MAP-REDUCE + HDFS)

Job Tracker

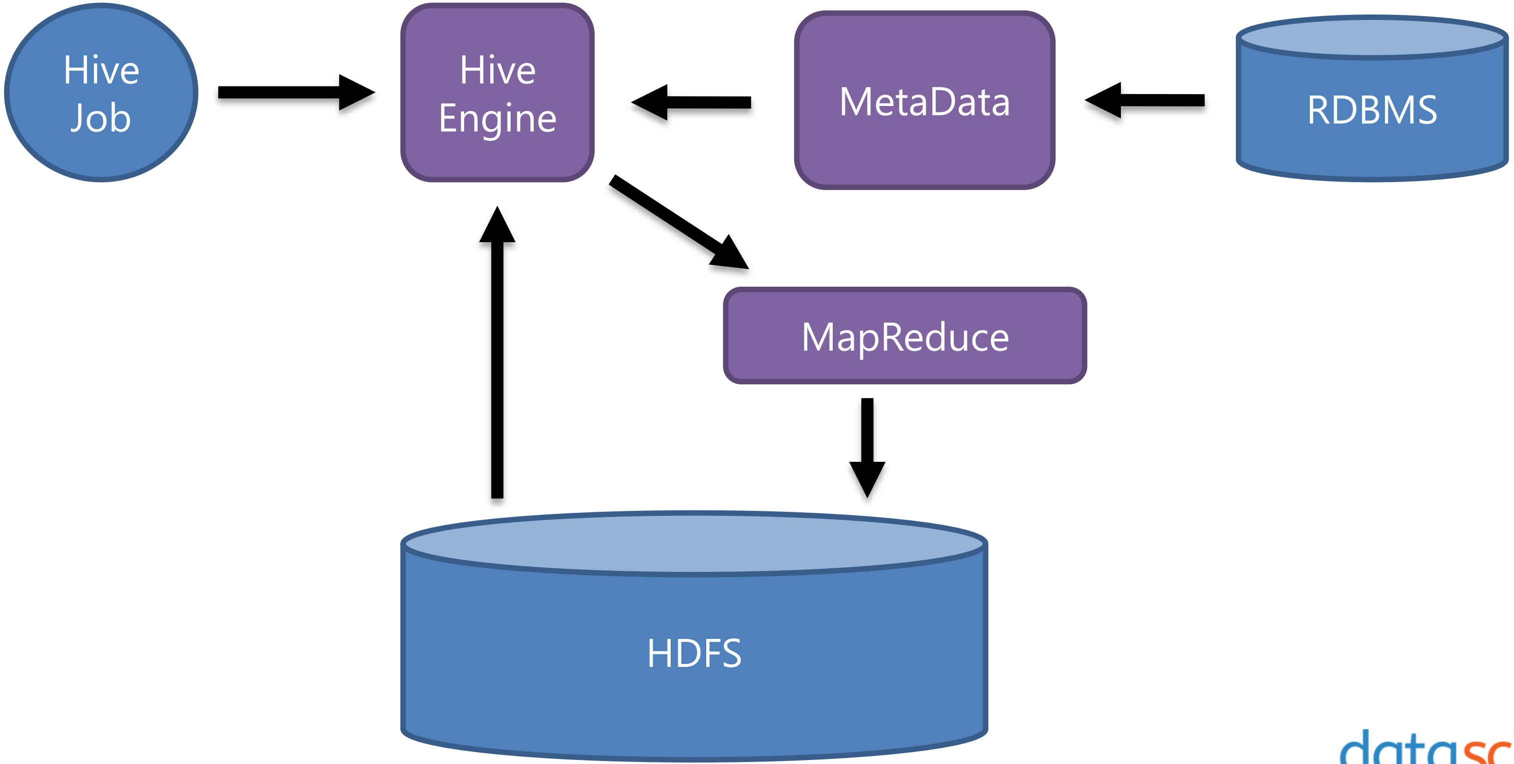
Name Node

Data Node
+
Task Tracker

Hive Jobs



Hive Architecture



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Data File = Unstructured Data

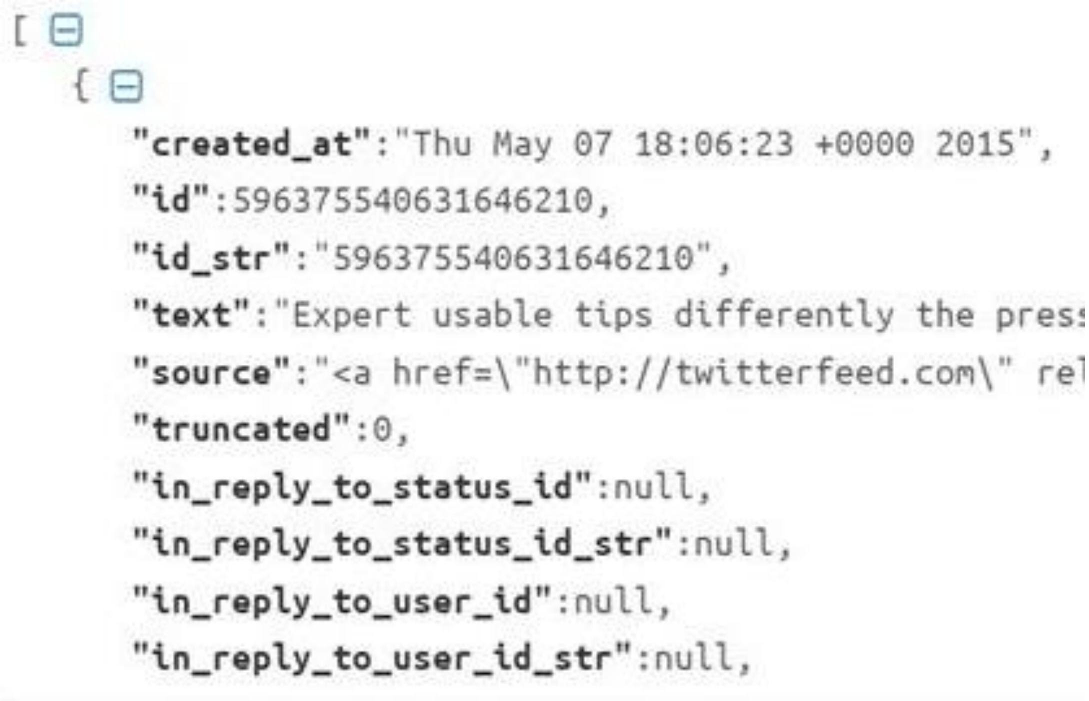
Data File + Metadata File/DB = Structured Data

Semi Structured Data

Self Describing

Flat Files

- XML
- JSON
- CSV
- TSV



```
[ ⊟
  { ⊟
    "created_at":"Thu May 07 18:06:23 +0000 2015",
    "id":596375540631646210,
    "id_str":"596375540631646210",
    "text":"Expert usable tips differently the pres
    "source":"<a href=\"http://twitterfeed.com\" re
    "truncated":0,
    "in_reply_to_status_id":null,
    "in_reply_to_status_id_str":null,
    "in_reply_to_user_id":null,
    "in_reply_to_user_id_str":null,
```

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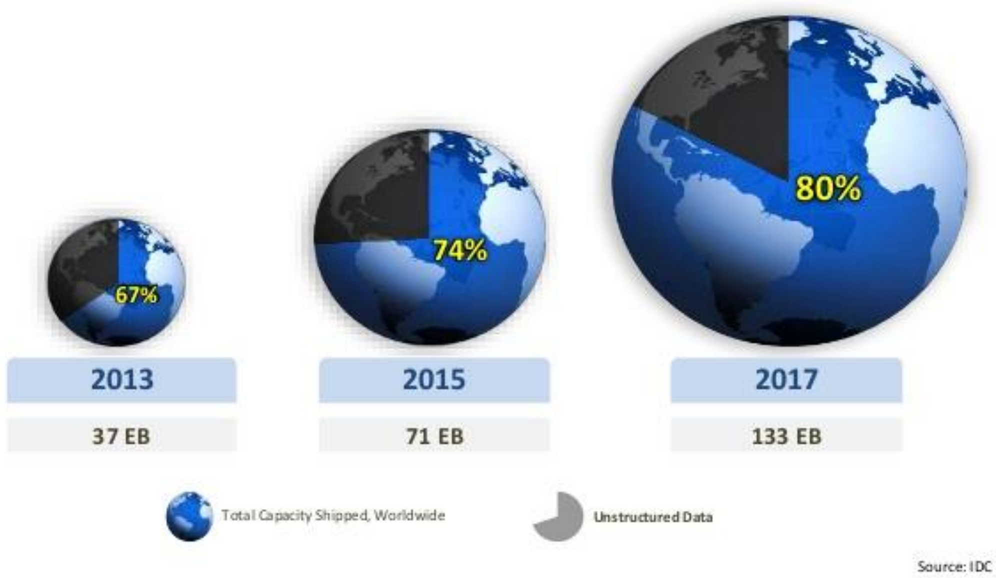
Why Hive?

- SQL spoken here (HiveQL)
- ODBC driver
- BI Integration
- Supports only Structured Data

Limitations

80%

of organized data is unstructured



Structured vs. Unstructured Data Growth

Source: IDC

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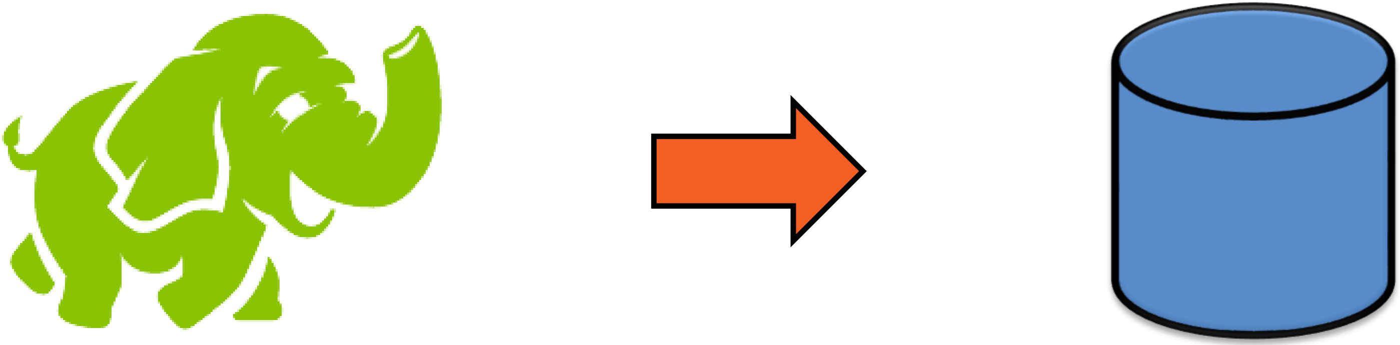
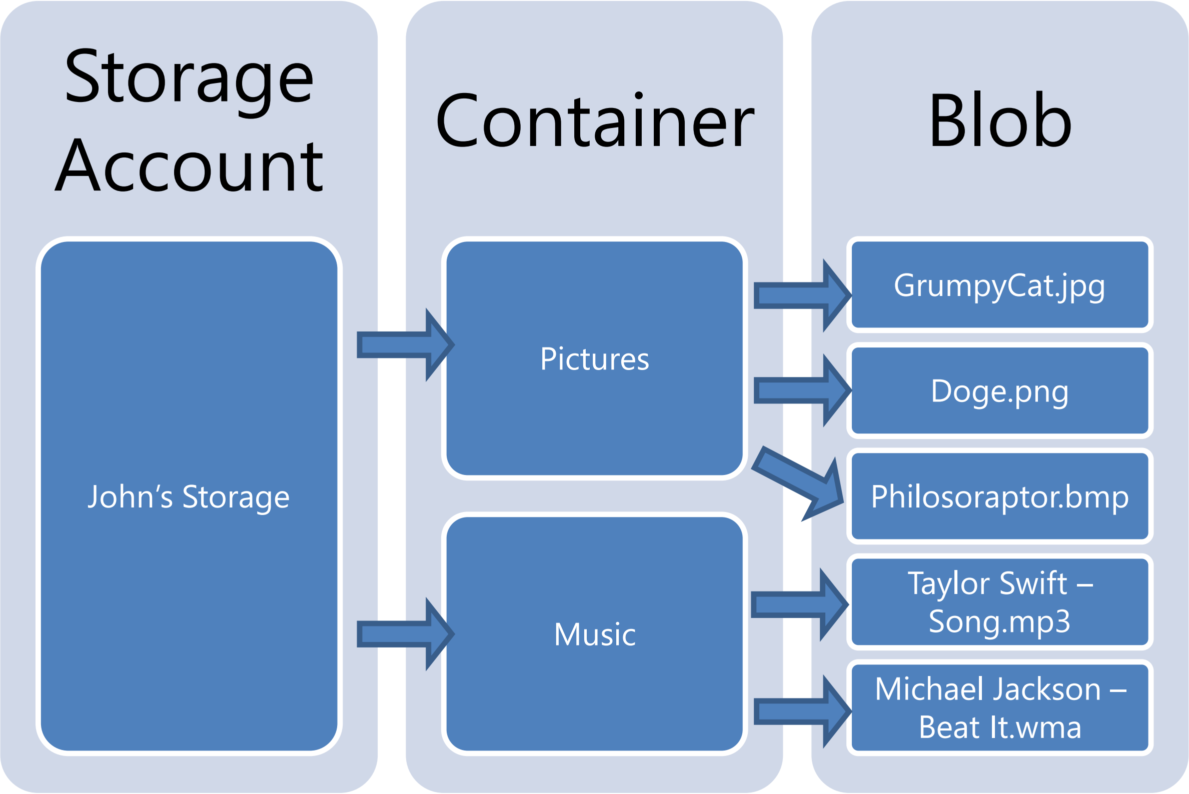
Azure Blob Storage



HDInsight

Blob Storage

Azure Blob Storage



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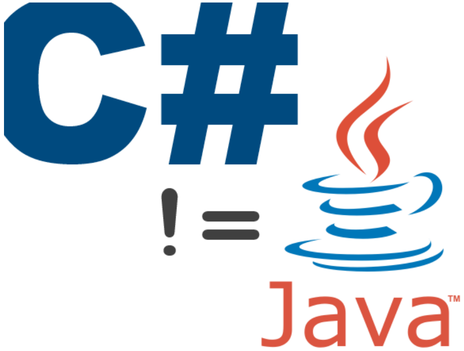
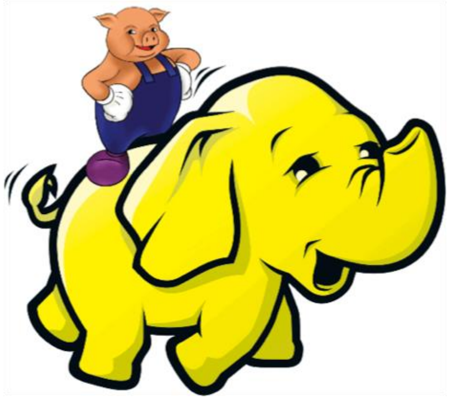
When to Use Each



VS

VS



C#
Java
MapReduce

Hive

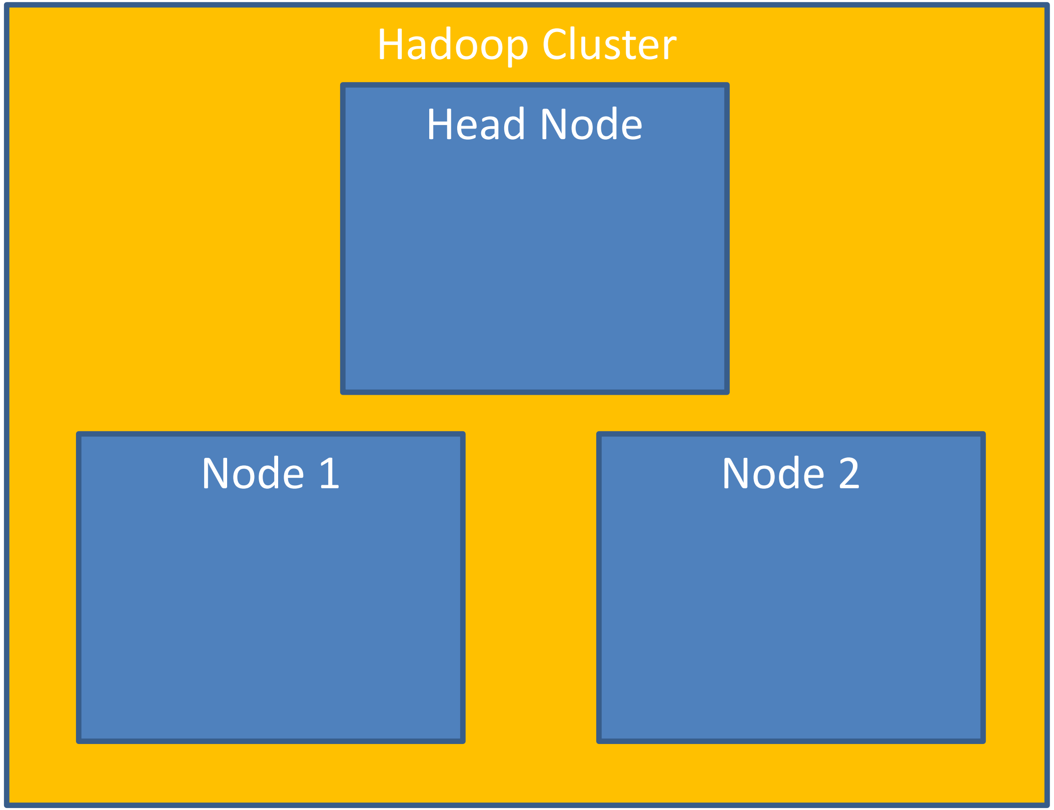
Pig

MapReduce, via Playing Cards

Let’s count the number of spades, clubs, hearts, and diamonds in a stack of cards, the way map reduce would.

- Each card represents a row of data
- Each suite represents an attribute of the data

Using a 2 Data Node Cluster



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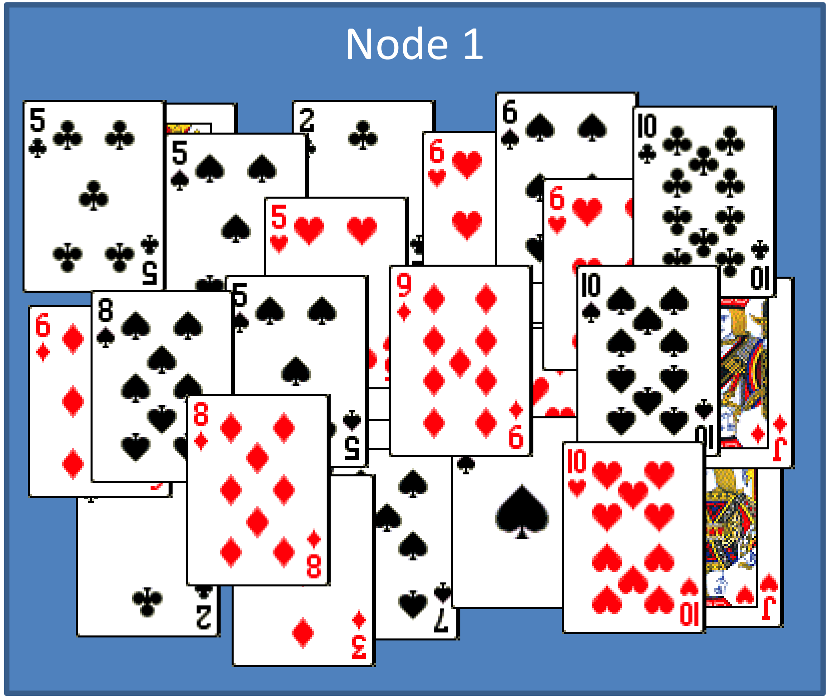
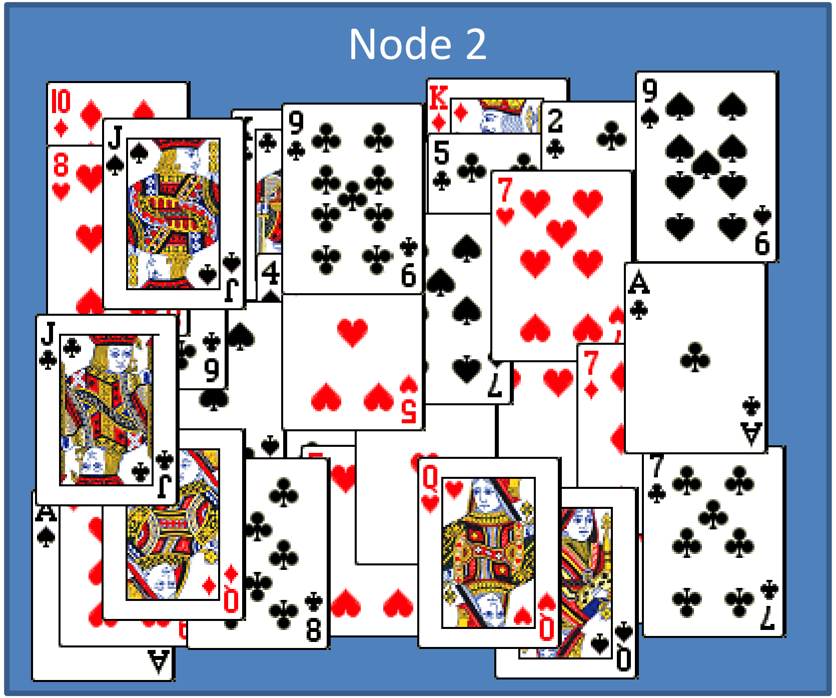
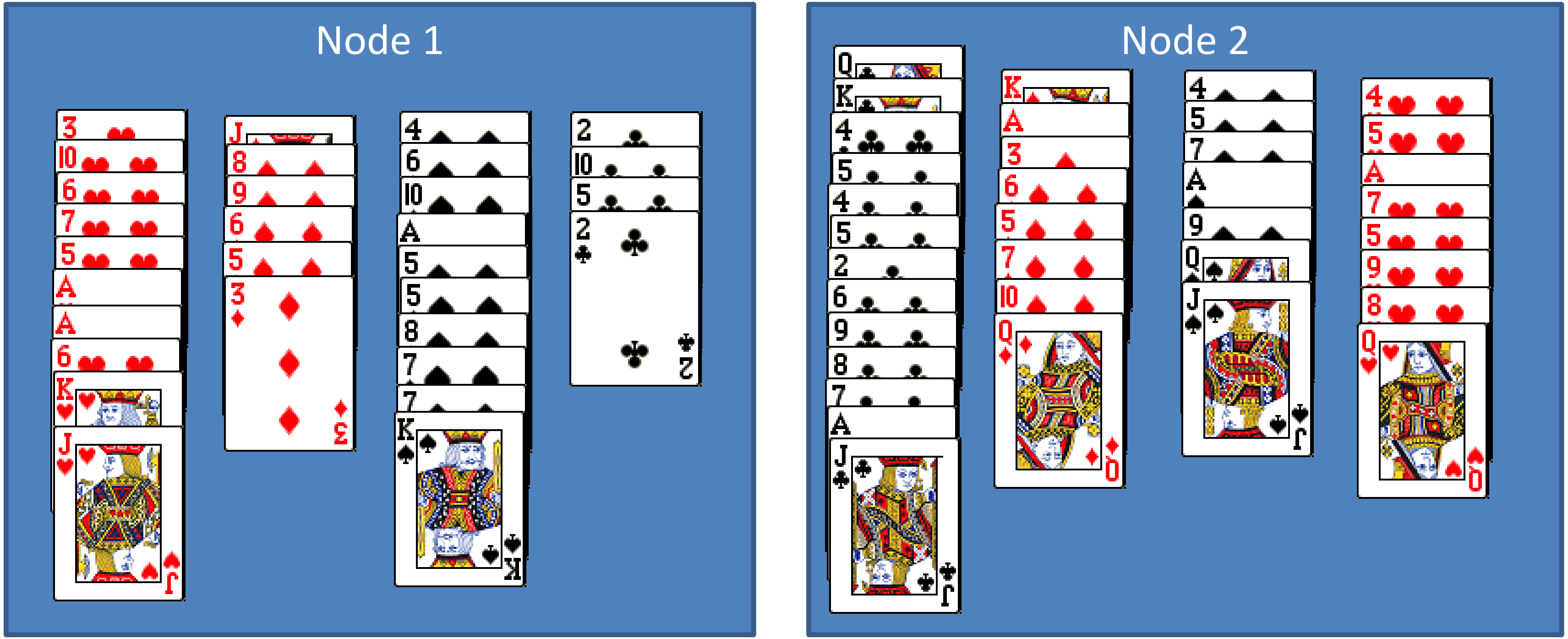
Mapping: Each Node’s HDFS





Mapping: Node Sorting



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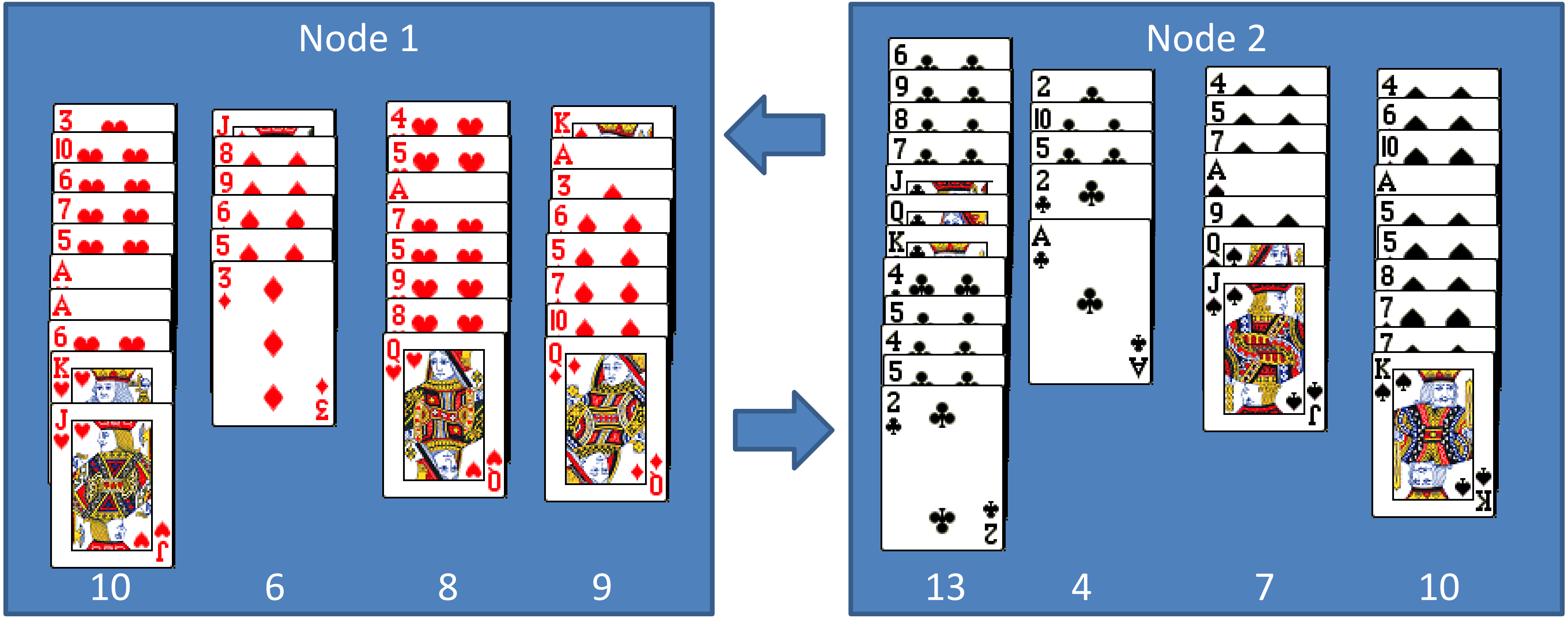
Mapping: Node Shuffle, Data Transfer



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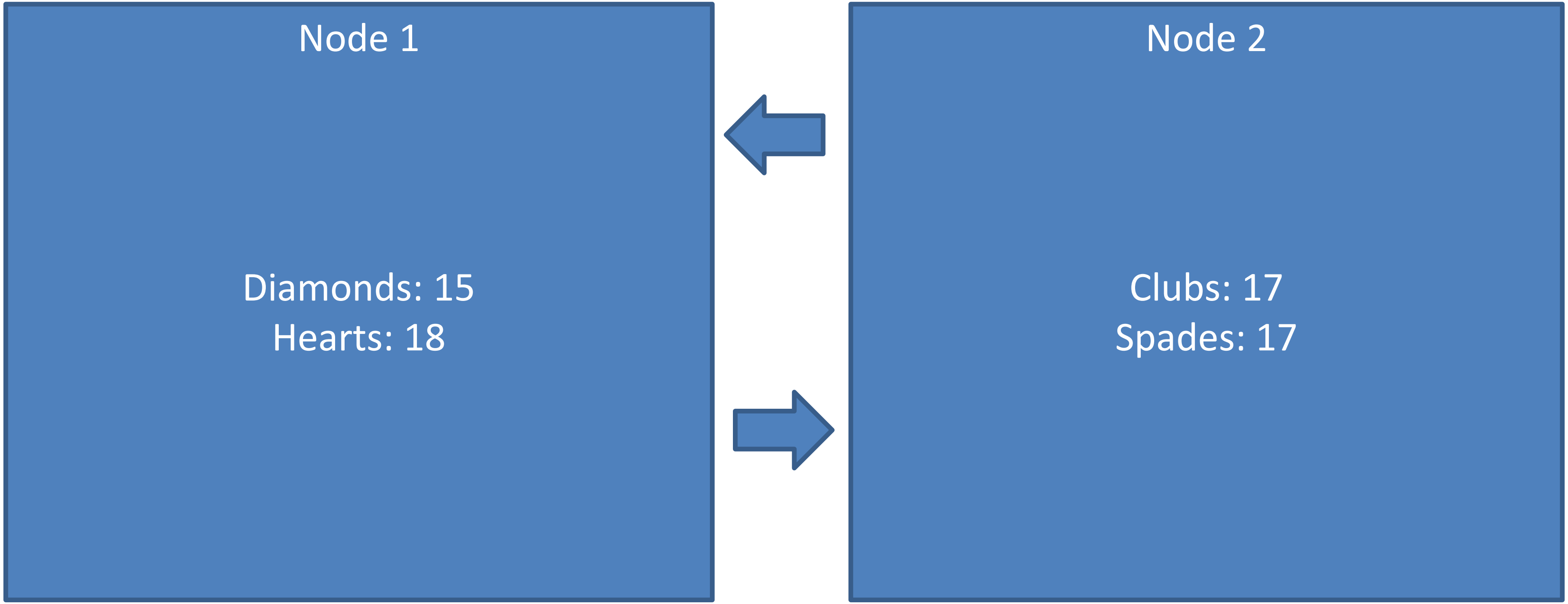
Mapping: Node Shuffle, Data Transfer



Node 1

Diamonds: 15
Hearts: 18

Node 2

Clubs: 17
Spades: 17

QUESTIONS