

Hadoop: An Overview

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What Is Hadoop?

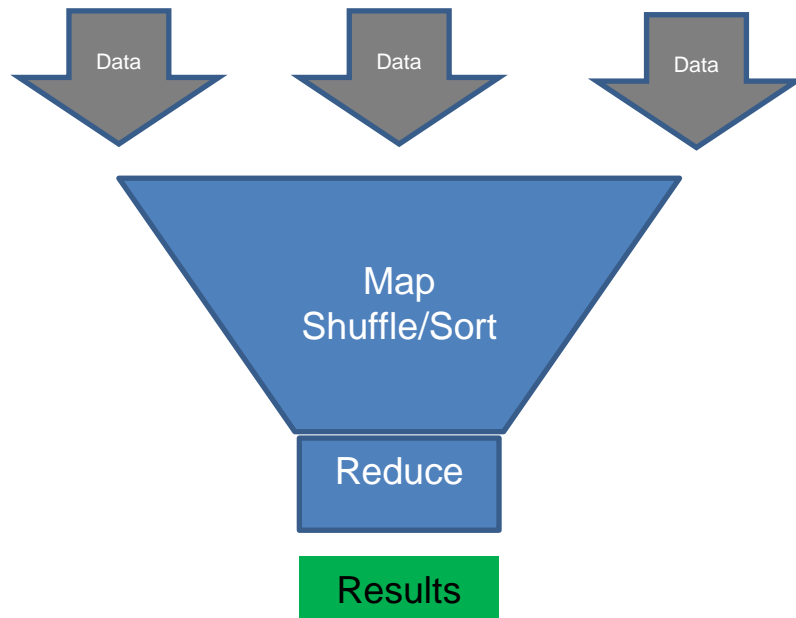
- Programming platform
- Filesystem
- Software ecosystem
- Stuffed elephant

What does Hadoop do?

- Distributes files
 - Replication
 - Closer to the CPU
- Computes
 - Map/Reduce
 - Other

MapReduce

- Map function
 - Maps k/v to intermediate k/v
- Reduce function
 - Shuffle/Sort/Reduce
 - Aggregates results of map



HDFS: Hadoop Distributed File System

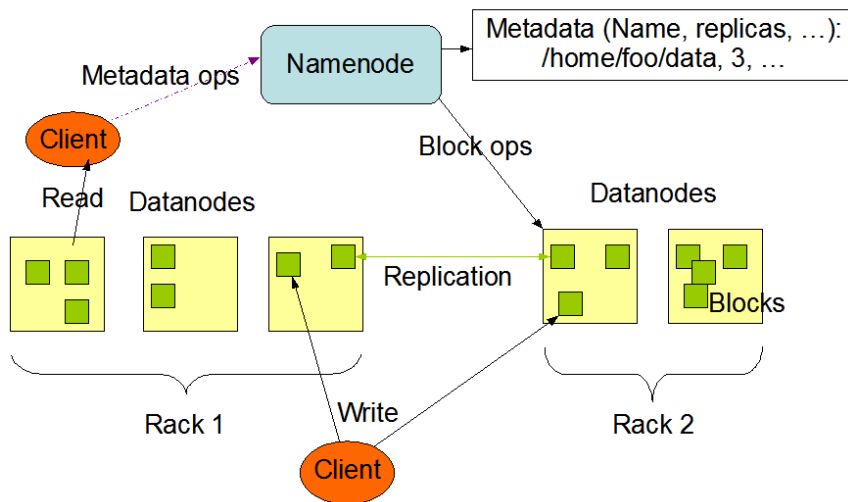
- Replication
 - Failsafe
 - Predistribution
- Write Once Read Many (WORM)
 - Streaming throughput
 - Simplified Data Coherency
 - No Random Access (contrast with RDBMS)

HDFS: Hadoop Distributed File System

- Meta filesystem
 - Requires underlying FS
 - Special access commands
 - Exports
 - NFS
 - Fuse
 - Vendor filesystems

HDFS

HDFS Architecture



Source: <https://hadoop.apache.org/docs/current/hadoop-project-dist/hadoop-hdfs/HdfsDesign.html>

HDFS: Daemons

- Namenode
 - Metadata server
- Datanode
 - Holds blocks
 - Compute node

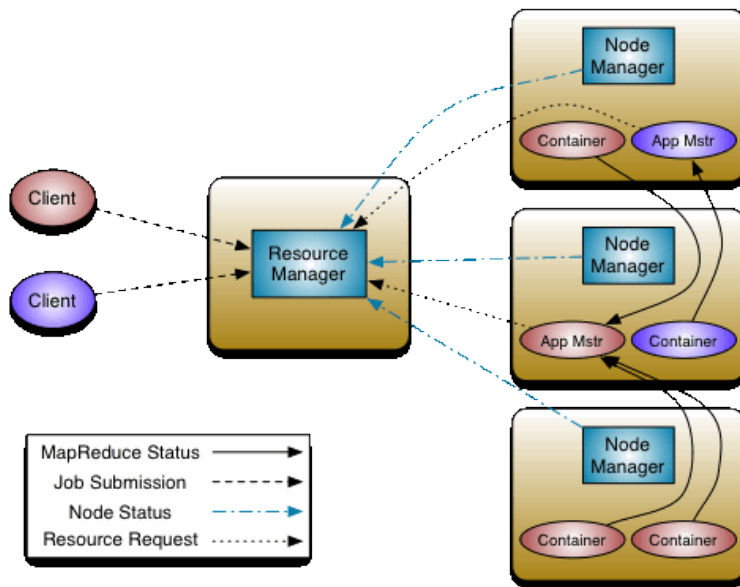
YARN: Yet Another Resource Negotiator

- Programming interface (replaces MapReduce)
- Include MapReduce API (compatible with 1.x)
- Assigns resources for applications

YARN: Daemons

- ResourceManager
 - Applications Manager
 - Scheduler (pluggable)
- NodeManager
 - Worker Node
 - Containers (tasks from ApplicationManager)

YARN



Source: <https://hadoop.apache.org/docs/current/hadoop-yarn/hadoop-yarn-site/YARN.html>

Using Hadoop

- Load data to hdfs
 - Fs commands
- Write a program
 - Java
 - Hadoop Streaming
- Submit a job

Fs Commands

- “FTP-style” commands
 - `hdfs dfs -put /local/path/myfile /user/$USER/`
 - `hdfs dfs -cat /user/$USER/myfile # | more`
 - `hdfs dfs -ls`
 - `hdfs dfs -get /user/$USER/myfile`

Moving Files

```
#on bridges:
hdfs dfs -put /home/training/hadoop/datasets /

# if you don't have permissions for / (eg. shared cluster)
# you can put it in your home directory
# (making sure to adjust paths in examples):
hdfs dfs -put /home/training/hadoop/datasets
```

Writing a MapReduce Program

- Hadoop Streaming
 - Mapper and reducer scripts read/write stdin/stdout
 - whole line is key, value is null (unless there's a tab)
 - Use builtin utilities (wc, grep, cat)
 - Write in any language (python)
- Java (compile/jar/run)

Simple MapReduce Job (HadoopStreaming)

- cat as mapper
- wc as reducer

```
hadoop jar \  
$HADOOP_HOME/share/hadoop/tools/lib/hadoop-streaming*.jar \  
-input /datasets/plays/ -output streaming-out \  
-mapper '/bin/cat' -reducer '/usr/bin/wc -l'
```


Python MapReduce (HadoopStreaming)

```
hadoop jar  
$HADOOP_HOME/share/hadoop/tools/lib/hadoop-streaming*.jar \  
-file ~training/hadoop/mapper.py -mapper mapper.py \  
-file ~training/hadoop/reducer.py -reducer reducer.py \  
-input /datasets/plays/ -output pyout
```

MapReduce Java: Compile, Jar, Run

```
cp /home/training/hadoop/*.java ./
hadoop com.sun.tools.javac.Main WordCount.java
jar cf wc.jar WordCount*.class
hadoop jar wc.jar WordCount /datasets/compleat.txt output
```

Getting Output

```
hdfs dfs -cat /user/$USER/streaming-out/part-00000 | more
```

```
hdfs dfs -get /user/$USER/streaming-out/part-00000
```

Questions?

- Thanks!