BDA Experiment

Aim : Implement application for counting frequency of words in a text file using MapReduce.

Objective: To implement mapreduce.

Methodology:

What is MapReduce?

MapReduce is a processing technique and a program model for distributed computing based on java. The MapReduce algorithm contains two important tasks, namely Map and Reduce. Map takes a set of data and converts it into another set of data, where individual elements are broken down into tuples (key/value pairs). Secondly, reduce task, which takes the output from a map as an input and combines those data tuples into a smaller set of tuples. As the sequence of the name MapReduce implies, the reduce task is always performed after the map job.

The major advantage of MapReduce is that it is easy to scale data processing over multiple computing nodes. Under the MapReduce model, the data processing primitives are called mappers and reducers. Decomposing a data processing application into *mappers* and *reducers* is sometimes nontrivial. But, once we write an application in the MapReduce form, scaling the application to run over hundreds, thousands, or even tens of thousands of machines in a cluster is merely a configuration change. This simple scalability is what has attracted many programmers to use the MapReduce model.

The Algorithm

Generally MapReduce paradigm is based on sending the computer to where the data resides!

MapReduce program executes in three stages, namely map stage, shuffle stage, and reduce stage.

Map stage − The map or mapper's job is to process the input data. Generally the input data is in the form of file or directory and is stored in the Hadoop file system (HDFS). The input file is passed to the mapper function line by line. The mapper processes the data and creates several small chunks of data.

Reduce stage − This stage is the combination of the Shuffle stage and the Reduce stage. The Reducer's job is to process the data that comes from the mapper. After processing, it produces a new set of output, which will be stored in the HDFS.

During a MapReduce job, Hadoop sends the Map and Reduce tasks to the appropriate servers in the cluster.

The framework manages all the details of data-passing such as issuing tasks, verifying task completion, and copying data around the cluster between the nodes.

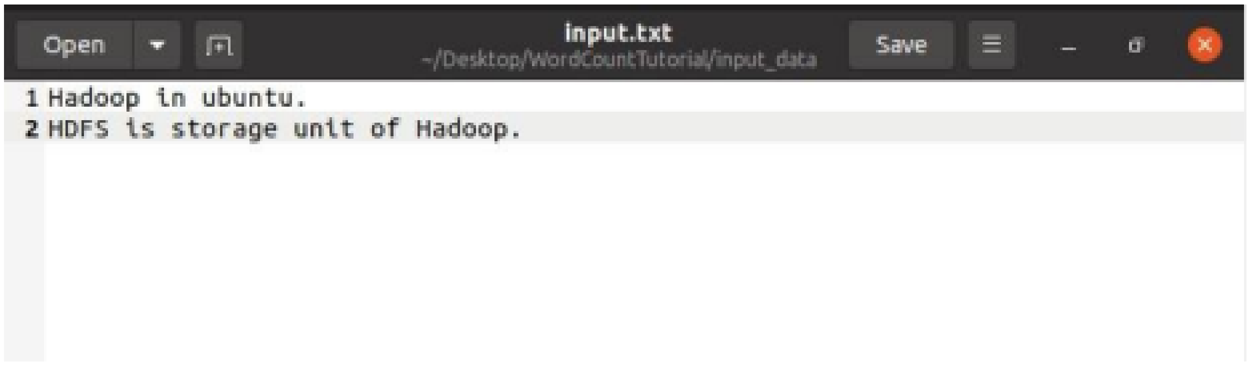
Most of the computing takes place on nodes with data on local disks that reduces the network traffic.

After completion of the given tasks, the cluster collects and reduces the data to form an appropriate result, and sends it back to the Hadoop server.

Tools Used: Hadoop, text editor, java

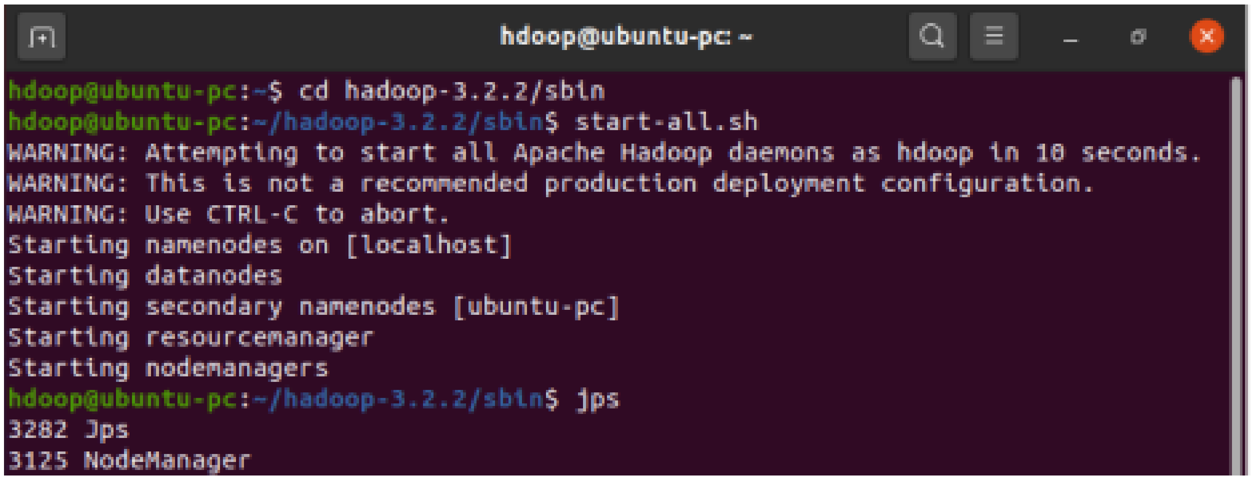
Actual Work Done:

Create a text file



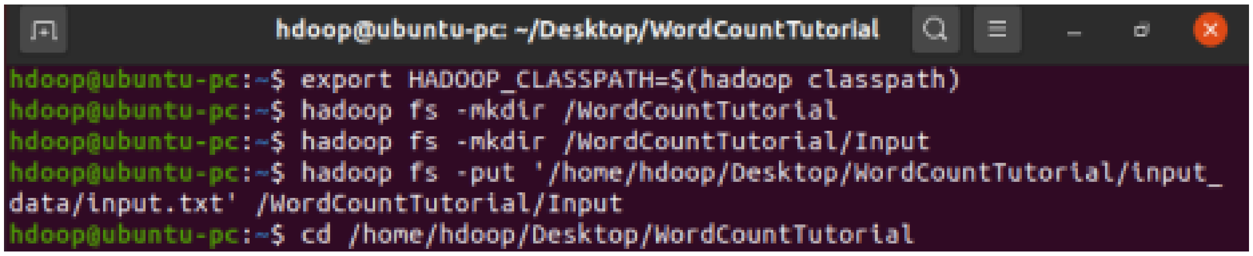
```
Hadoop in ubuntu.
HDFS is storage unit of Hadoop.
```

Start the hadoop cluster

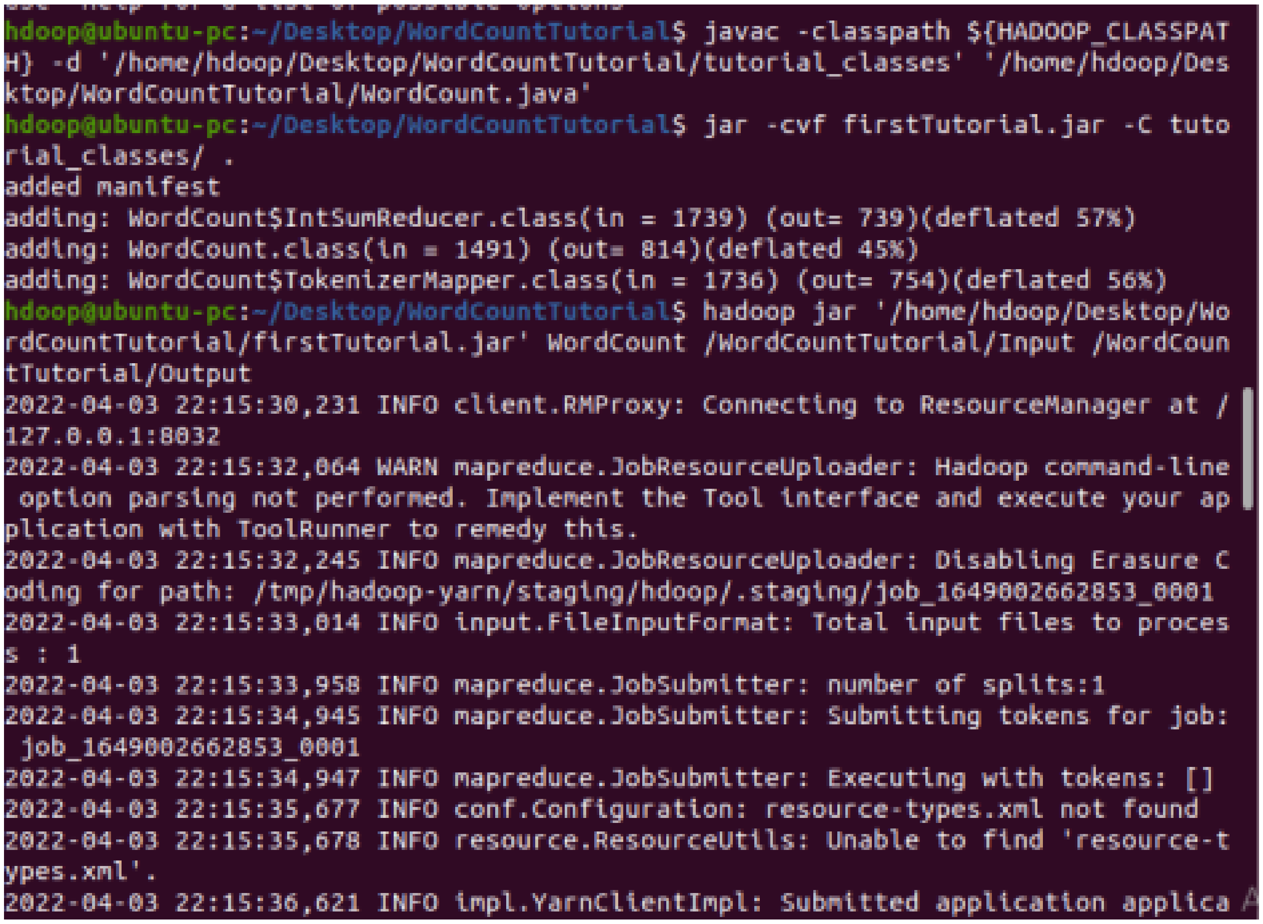


```
hdoop@ubuntu-pc:~$ cd hadoop-3.2.2/sbin
hdoop@ubuntu-pc:~/hadoop-3.2.2/sbin$ start-all.sh
WARNING: Attempting to start all Apache Hadoop daemons as hdoop in 10 seconds.
WARNING: This is not a recommended production deployment configuration.
WARNING: Use CTRL-C to abort.
Starting namenodes on [localhost]
Starting datanodes
Starting secondary namenodes [ubuntu-pc]
Starting resourcemanager
Starting nodemanagers
hdoop@ubuntu-pc:~/hadoop-3.2.2/sbin$ jps
3282 Jps
3125 NodeManager
```

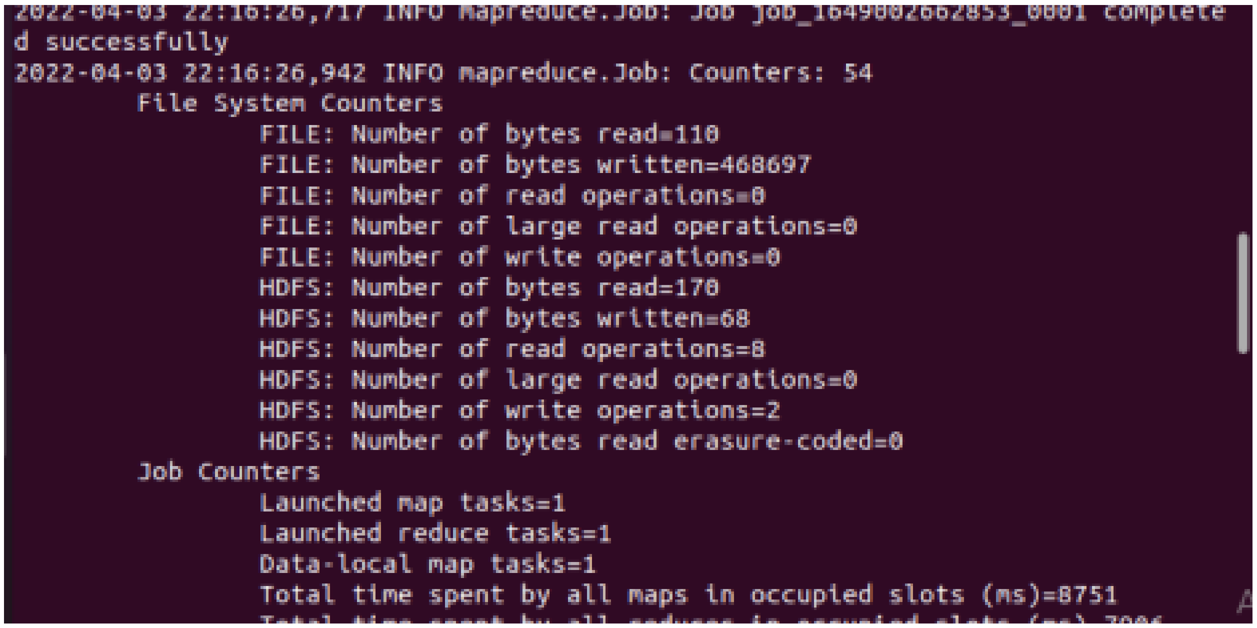
Set the classpath, make the necessary directories and make a jar file



```
hdoop@ubuntu-pc:~$ export HADOOP_CLASSPATH=$(hadoop classpath)
hdoop@ubuntu-pc:~$ hadoop fs -mkdir /WordCountTutorial
hdoop@ubuntu-pc:~$ hadoop fs -mkdir /WordCountTutorial/Input
hdoop@ubuntu-pc:~$ hadoop fs -put '/home/hdoop/Desktop/WordCountTutorial/input_
data/input.txt' /WordCountTutorial/Input
hdoop@ubuntu-pc:~$ cd /home/hdoop/Desktop/WordCountTutorial
```

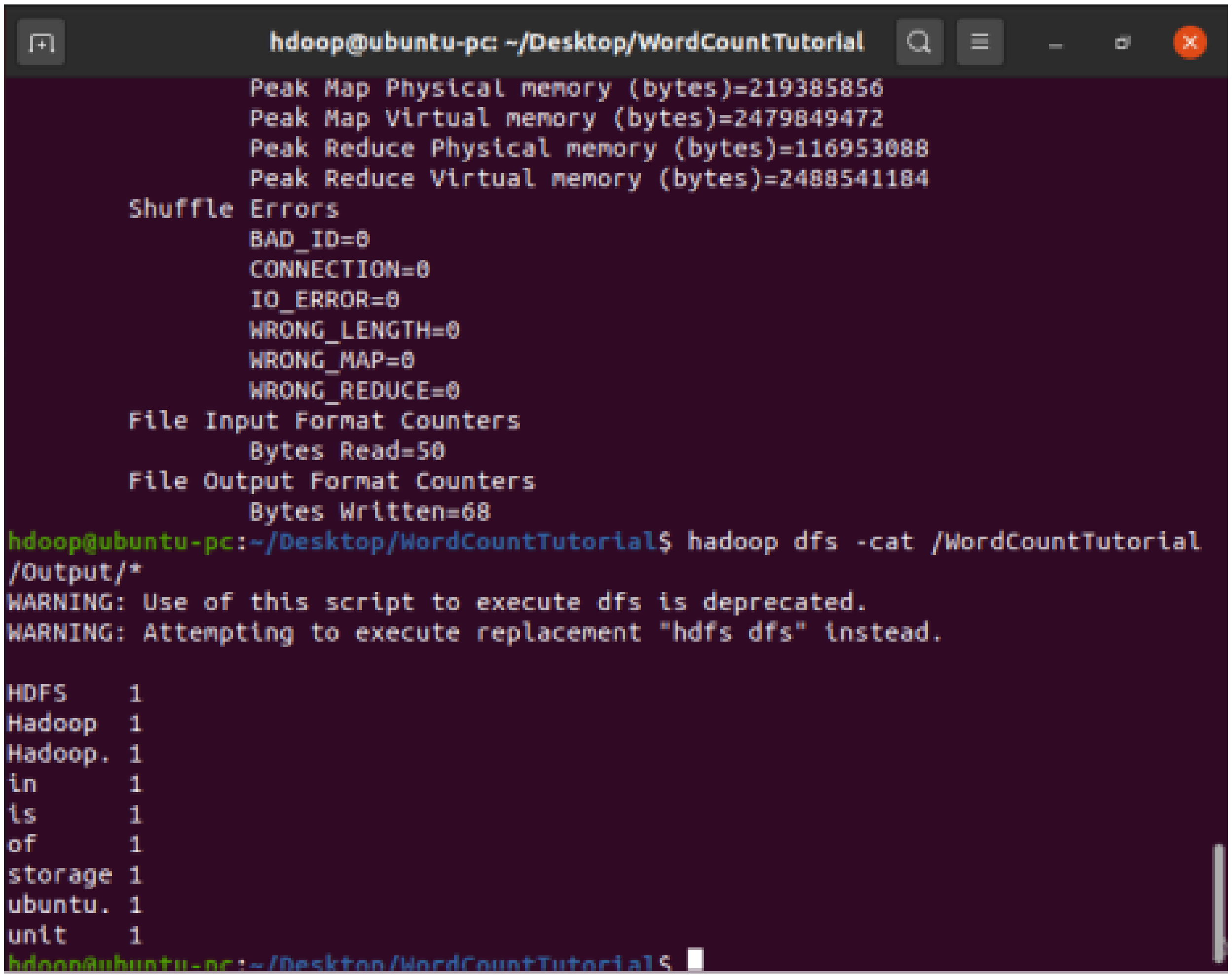


```
hdoop@ubuntu-pc:~/Desktop/WordCountTutorial$ javac -classpath ${HADOOP_CLASSPAT
H} -d '/home/hdoop/Desktop/WordCountTutorial/tutorial_classes' '/home/hdoop/Des
ktop/WordCountTutorial/WordCount.java'
hdoop@ubuntu-pc:~/Desktop/WordCountTutorial$ jar -cvf firstTutorial.jar -C tuto
rial_classes/ .
added manifest
adding: WordCount$IntSumReducer.class(in = 1739) (out= 739)(deflated 57%)
adding: WordCount.class(in = 1491) (out= 814)(deflated 45%)
adding: WordCount$TokenizerMapper.class(in = 1736) (out= 754)(deflated 56%)
hdoop@ubuntu-pc:~/Desktop/WordCountTutorial$ hadoop jar '/home/hdoop/Desktop/Wo
rdCountTutorial/firstTutorial.jar' WordCount /WordCountTutorial/Input /WordCoun
tTutorial/Output
2022-04-03 22:15:30,231 INFO client.RMProxy: Connecting to ResourceManager at /
127.0.0.1:8032
2022-04-03 22:15:32,064 WARN mapreduce.JobResourceUploader: Hadoop command-line
 option parsing not performed. Implement the Tool interface and execute your ap
plication with ToolRunner to remedy this.
2022-04-03 22:15:32,245 INFO mapreduce.JobResourceUploader: Disabling Erasure C
oding for path: /tmp/hadoop-yarn/staging/hdoop/.staging/job_1649002662853_0001
2022-04-03 22:15:33,014 INFO input.FileInputFormat: Total input files to proces
s : 1
2022-04-03 22:15:33,958 INFO mapreduce.JobSubmitter: number of splits:1
2022-04-03 22:15:34,945 INFO mapreduce.JobSubmitter: Submitting tokens for job:
 job_1649002662853_0001
2022-04-03 22:15:34,947 INFO mapreduce.JobSubmitter: Executing with tokens: []
2022-04-03 22:15:35,677 INFO conf.Configuration: resource-types.xml not found
2022-04-03 22:15:35,678 INFO resource.ResourceUtils: Unable to find 'resource-t
ypes.xml'.
2022-04-03 22:15:36,621 INFO impl.YarnClientImpl: Submitted application applica
```



```
2022-04-03 22:16:26,717 INFO mapreduce.Job: Job job_1649002662853_0001 complete
d successfully
2022-04-03 22:16:26,942 INFO mapreduce.Job: Counters: 54
        File System Counters
                FILE: Number of bytes read=110
                FILE: Number of bytes written=468697
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=170
                HDFS: Number of bytes written=68
                HDFS: Number of read operations=8
                HDFS: Number of large read operations=0
                HDFS: Number of write operations=2
                HDFS: Number of bytes read erasure-coded=0
        Job Counters
                Launched map tasks=1
                Launched reduce tasks=1
                Data-local map tasks=1
                Total time spent by all maps in occupied slots (ms)=8751
```

Get the output



```
hdoop@ubuntu-pc: ~/Desktop/WordCountTutorial
                Peak Map Physical memory (bytes)=219385856
                Peak Map Virtual memory (bytes)=2479849472
                Peak Reduce Physical memory (bytes)=116953088
                Peak Reduce Virtual memory (bytes)=2488541184
        Shuffle Errors
                BAD_ID=0
                CONNECTION=0
                IO_ERROR=0
                WRONG_LENGTH=0
                WRONG_MAP=0
                WRONG_REDUCE=0
        File Input Format Counters
                Bytes Read=50
        File Output Format Counters
                Bytes Written=68
hdoop@ubuntu-pc:~/Desktop/WordCountTutorial$ hadoop dfs -cat /WordCountTutorial
/Output/*
WARNING: Use of this script to execute dfs is deprecated.
WARNING: Attempting to execute replacement "hdfs dfs" instead.

HDFS    1
Hadoop  1
Hadoop. 1
in      1
is      1
of      1
storage 1
ubuntu. 1
unit    1
hdoop@ubuntu-pc:~/Desktop/WordCountTutorial$
```

Conclusion/Outcome :Thus I have carried out Mapreduce for word count successfully.