Cloud Computing Homework 3: Playing with Hadoop

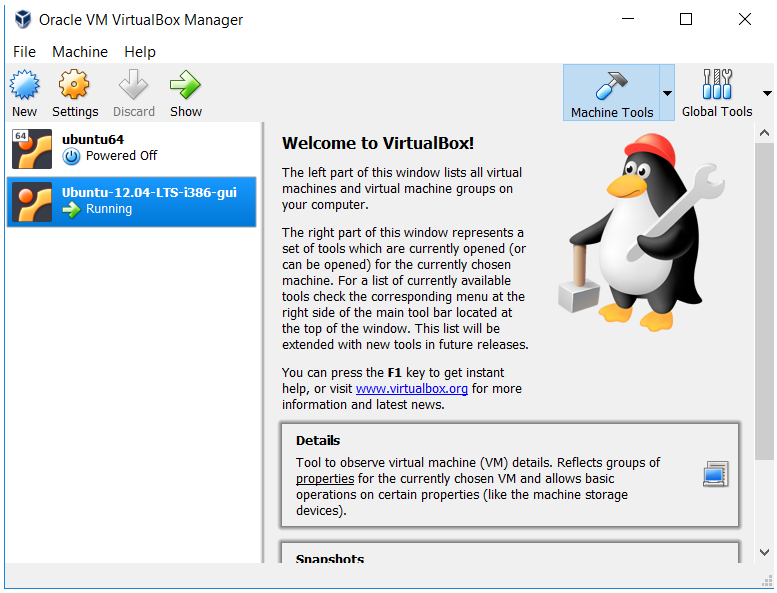
Detailed Report

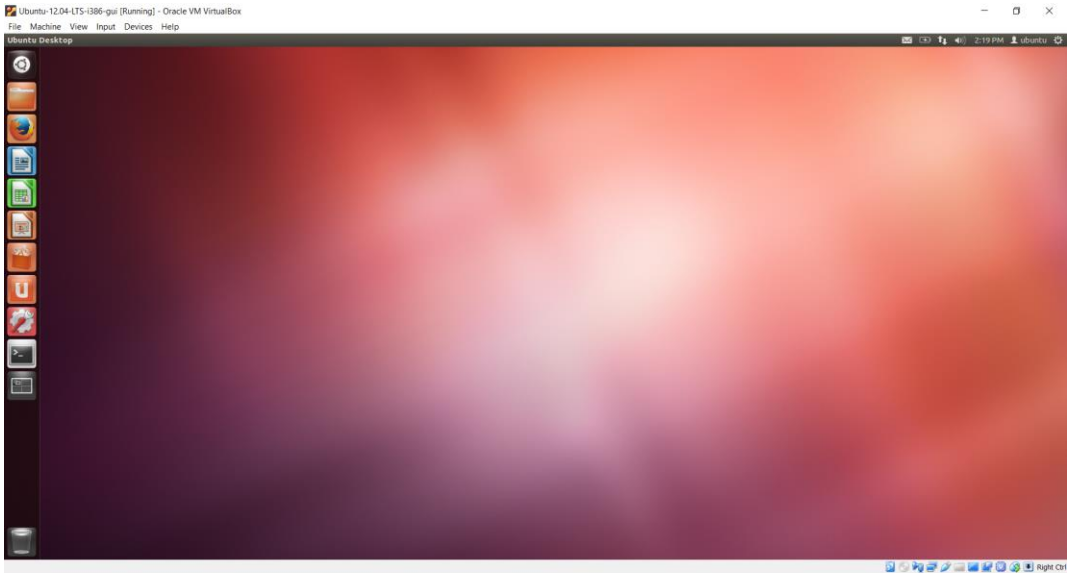
Task Specifications:

In this homework, I was asked to prepare an environment to work (Step 1), install Apache Hadoop in this environment (Step 2) and go through two coding tutorials (Steps 3 and 4). There was also a bonus task.

Step 1: Preparing a Linux Environment to Work

Time Specifications: 10 min
Issues: No Issues Found
Snapshots:





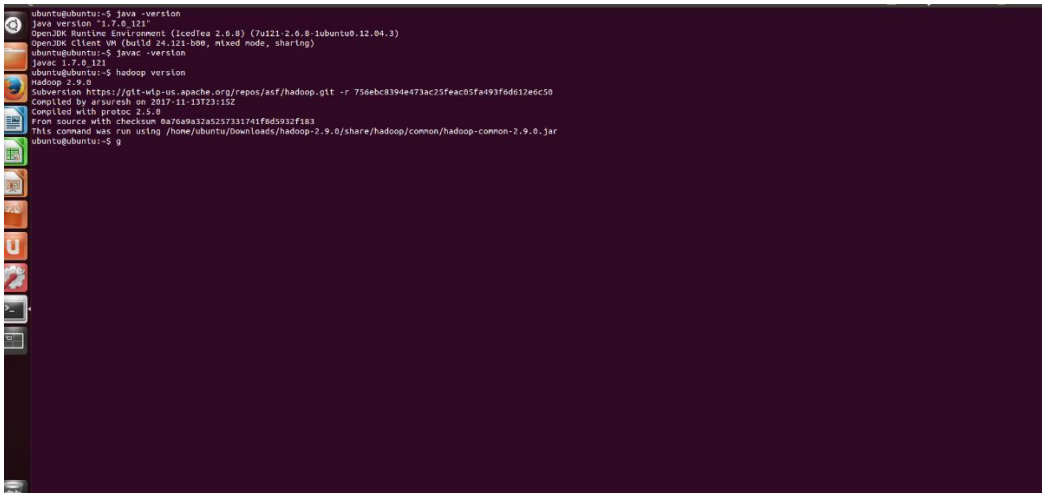
Step 2: Install Hadoop

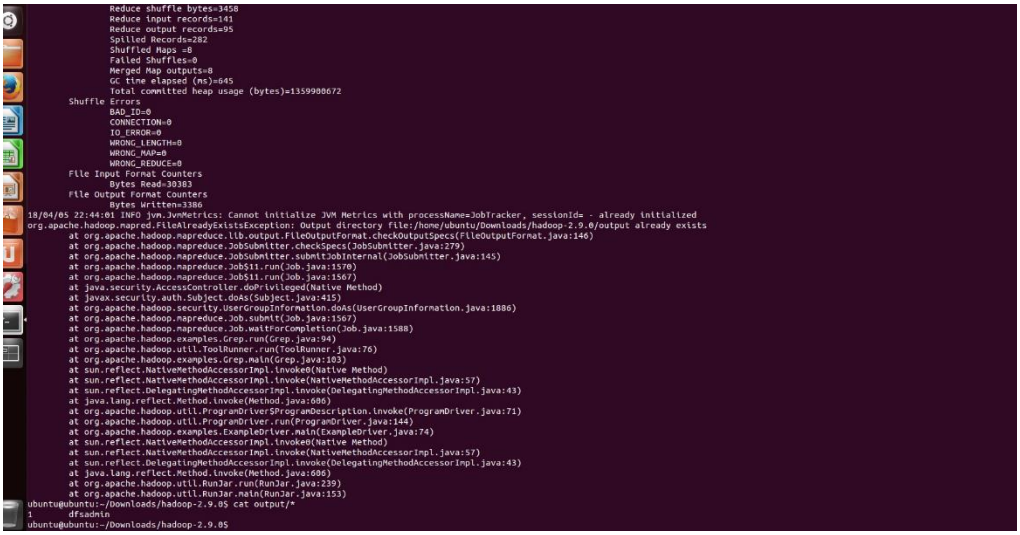
Time Specifications: 40 Mins

Issues: Some Issues Found.

- The instructions given for the Standalone Installation of Hadoop were not helpful.
- Using Hadoop 2.9.0 with Java 1.6 threw version compatibility mismatch error. The Java Version had to be upgraded to 1.7.0_121.
- Many Java and Hadoop environment variables had to be changed later.
- For eg. Following variables had to be added in ~/.bashrc file.
  1) export JAVA_HOME=/usr/lib/jvm/java-7-openjdk-i386
  2) export PATH=$PATH:$JAVA_HOME/bin
  3) export HADOOP_HOME=/home/ubuntu/Downloads/hadoop-2.9.0
  4) export PATH=$PATH:$HADOOP_HOME/bin
- The New Java Version had to be set as default.

Snapshots:



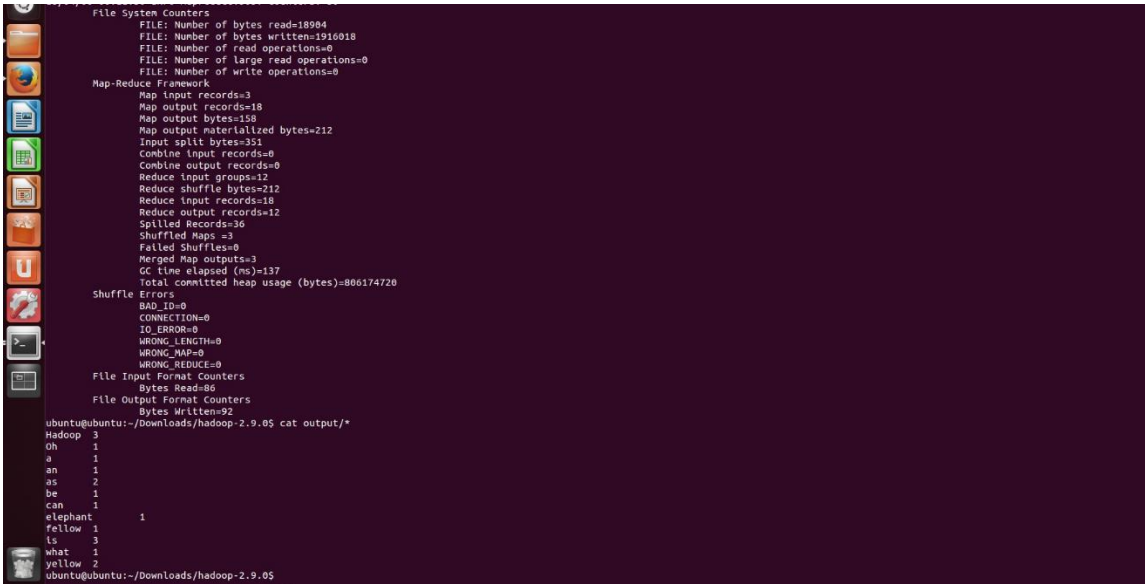


Step 3: Go through a Simple Hadoop Application

Time Specifications: 1 Hour 20 mins
Issues: Some Issues Found.

- The commands given in the HW3 Document Tutorial to run a Hadoop Application was using a Cloudera Quickstart VM.
- I did not use the commands as it wasn't necessary because I already had a VM installed and the Hadoop environment up and running. I used the same commands to run a Standalone Hadoop Application as in the previous example and obtained the results.
- I faced a lot of compilation issues of javac. I had to use "javac -cp $(hadoop classpath) WordCount.java -d build -Xlint" for compilation.

Snapshots:



Step 4: Go through a Simple Hadoop Application using Pig

Time Specifications: 1 Hour 40 mins
Issues: Many Issues Found.

- Used Apache Pig version 0.17.0
- Following Environment Variables had to be added to the ~/.bashrc file:
  export PIG_HOME="/home/ubuntu/Downloads/pig-0.17.0"
  export PIG_CONF_DIR="/home/ubuntu/Downloads/hadoop-2.9.0/etc/hadoop"
  export PIG_CLASSPATH="$PIG_CONF_DIR"
  export PATH="$PIG_HOME/bin:$PATH"
  export HADOOP_CONF_DIR="/home/ubuntu/Downloads/hadoop-2.9.0/etc/hadoop"
- On Execution of Pig Local, I received error that 'JAR does not exist or is not a normal file'. This was solved by deleting two jar files present in the directory and running 'ant jar' in the root directory of Pig.
- For Execution of Pig MapReduce, PIG_CONF_DIR and HADOOP_CONF_DIR had to be reconfigured to the location of the cluster config directory, i.e. "/hadoop-2.9.0/etc/hadoop/".

Snapshots:

```
ubuntu@ubuntu:~$ pig -h

Apache Pig version 0.17.0 (r1797386)
compiled Jun 02 2017, 15:41:58

USAGE: Pig [options] [-] : Run interactively in grunt shell.
       Pig [options] -e[xecute] cmd [cmd ...] : Run cmd(s).
       Pig [options] [-f[ile]] file : Run cmds found in file.
  options include:
    -4, -log4jconf - Log4j configuration file, overrides log conf
    -b, -brief - Brief logging (no timestamps)
    -c, -check - Syntax check
    -d, -debug - Debug level, INFO is default
    -e, -execute - Commands to execute (within quotes)
    -f, -file - Path to the script to execute
    -g, -embedded - ScriptEngine classname or keyword for the ScriptEngine
    -h, -help - Display this message. You can specify topic to get help for that
 topic.
        properties is the only topic currently supported: -h properties.
    -i, -version - Display version information
    -l, -logfile - Path to client side log file; default is current working dire
ctory.
    -m, -param_file - Path to the parameter file
    -p, -param - Key value pair of the form param=val
    -r, -dryrun - Produces script with substituted parameters. Script is not exe
cuted.
    -t, -optimizer_off - Turn optimizations off. The following values are suppor
ted:
            ConstantCalculator - Calculate constants at compile time
            SplitFilter - Split filter conditions
            PushUpFilter - Filter as early as possible
            MergeFilter - Merge filter conditions
            PushDownForeachFlatten - Join or explode as late as possible
            LimitOptimizer - Limit as early as possible
            ColumnMapKeyPrune - Remove unused data
            AddForEach - Add ForEach to remove unneeded columns
            MergeForEach - Merge adjacent ForEach
            GroupByConstParallelSetter - Force parallel 1 for "group all" statem
ent
            PartitionFilterOptimizer - Pushdown partition filter conditions to l
oader implementing LoadMetaData
            PredicatePushdownOptimizer - Pushdown filter predicates to loader in
plementing LoadPredicatePushDown
            All - Disable all optimizations
        All optimizations listed here are enabled by default. Optimization value
s are case insensitive.
    -v, -verbose - Print all error messages to screen
    -w, -warning - Turn warning logging on; also turns warning aggregation off
    -x, -exectype - Set execution mode: local|mapreduce|tez, default is mapreduc
e.
    -F, -stop-on-failure - Aborts execution on the first failed job; default is
```

Local Mode Snapshot:

```
ubuntu@ubuntu:~/Downloads/pigtmp$ cat script1-local-results.txt/*
07      new     2.4494897427831788      2       1.1428571428571426
08      pictures        2.04939015319192        3       1.4999999999999998
08      computer        2.4494897427831788      2       1.1428571428571426
08      s       2.545584412271571       3       1.3636363636363635
10      free    2.2657896674010605      4       1.923076923076923
10      to      2.6457513110645903      2       1.125
10      pics    2.794002794004192       3       1.3076923076923075
10      school  2.828427124746189       2       1.1111111111111114
11      pictures        2.04939015319192        3       1.4999999999999998
11      in      2.1572774865200244      3       1.4285714285714284
13      the     3.1309398305840723      6       1.9375
14      music   2.1105794120443453      4       1.6666666666666667
14      city    2.2360679774997902      2       1.1666666666666665
14      university      2.412090756622109       3       1.4000000000000001
15      adult   2.8284271247461903      2       1.1111111111111112
17      chat    2.9104275004359965      3       1.2857142857142854
19      in      2.1572774865200244      3       1.4285714285714284
19      car     2.23606797749979        3       1.3333333333333333
ubuntu@ubuntu:~/Downloads/pigtmp$
```

MapReduce Mode Snapshots:

```
Success!

Job Stats (time in seconds):
JobId   Maps    Reduces MaxMapTime      MinMapTime      AvgMapTime      MedianMapTime   MaxReduceTime   MinReduceTime   AvgReduceTime   MedianReducetime        Alias   Feature Outputs
job_local1173619579_0004        1       1       n/a     n/a     n/a     n/a     n/a     n/a     n/a     ordered_uniq_frequency  SAMPLER
job_local1787381488_0003        1       1       n/a     n/a     n/a     n/a     n/a     n/a     n/a     filtered_uniq_frequency,uniq_frequency1,uniq_frequency2,uniq_frequency3 GROUP_BY
job_local197899259_0002 2       1       n/a     n/a     n/a     n/a     n/a     n/a     n/a     n/a     hour_frequency1,hour_frequency2 GROUP_BY,COMBINER
job_local586710044_0001 1       1       n/a     n/a     n/a     n/a     n/a     n/a     n/a     n/a     clean1,clean2,houred,ngramed1,raw       DISTINCT
job_local891554643_0005 1       1       n/a     n/a     n/a     n/a     n/a     n/a     n/a     n/a     ordered_uniq_frequency  ORDER_BY        file:///home/ubuntu/Downloads/pigtmp/script1-hadoop-results,

Input(s):
Successfully read 944954 records from: "file:///home/ubuntu/Downloads/pigtmp/excite.log.bz2"

Output(s):
Successfully stored 13530 records in: "file:///home/ubuntu/Downloads/pigtmp/script1-hadoop-results"

Counters:
Total records written : 13530
Total bytes written : 0
Spillable Memory Manager spill count : 0
Total bags proactively spilled: 0
Total records proactively spilled: 0

Job DAG:
job_local586710044_0001 ->      job_local197899259_0002,
job_local197899259_0002 ->      job_local1787381488_0003,
job_local1787381488_0003        ->      job_local1173619579_0004,
job_local1173619579_0004        ->      job_local891554643_0005,
job_local891554643_0005
```

```
    lady diana      2.359033838334352       4       2.052631578947368
    video game      2.3750000000000004      4       1.7647058823529413
    falcon  2.3804761428476167      4       2.0
    sci fi  2.393172105652398       3       1.4999999999999996
    clearing house  2.4128907562622109      3       1.4000000000000001
    hell    2.440118418760475       4       1.6500000000000006
    g spot  2.4410577393003097      4       1.7333333333333332
    complications   2.4494897427831783      2       1.1428571428571428
    uefa cup        2.4494897427831783      2       1.1428571428571428
    cemeteries      2.4494897427831783      2       1.1428571428571428
    black hole      2.4494897427831783      2       1.1428571428571428
    shauna o        2.4494897427831783      2       1.1428571428571428
    warez sitez     2.4494897427831783      2       1.1428571428571428
    gay cum 2.4494897427831783      2       1.1428571428571428
    palsy   2.4494897427831788      2       1.1428571428571426
    asian myst      2.4810842175291756      4       1.8125
    rhonda  2.52357307257618        3       1.4285714285714282
    cock sucking    2.571583846243569       4       1.7058823529411766
    xing    2.618614682831909       3       1.4
    south east      2.6457513110645903      2       1.125
    57      2.6457513110645903      2       1.125
    nake    2.6457513110645903      2       1.125
    mpeg3   2.6457513110645903      2       1.125
    aust    2.6457513110645903      2       1.125
    cyberpunk       2.6457513110645903      2       1.125
    soaked  2.654953952106303       3       1.3
    foto    2.691946385511004       3       1.3571428571428568
    shauna  2.7714348384599967      4       1.625
    bosch   2.794002794004191       3       1.3076923076923077
    hottest 2.7950849718747373      3       1.3333333333333333
    alamak  2.81858908754796        9       2.782608695652174
    red hot 2.82842712474619        2       1.1111111111111112
    orgasmic        2.82842712474619        3       1.2222222222222223
    jerk off        2.82842712474619        2       1.1111111111111112
    bubbles 2.82842712474619        2       1.1111111111111112
    ping    2.82842712474619        5       1.8888888888888893
    highway patrol  2.82842712474619        2       1.1111111111111112
    brothels        2.82842712474619        2       1.1111111111111112
    chilton 2.82842712474619        3       1.2222222222222223
    live video      2.82842712474619        2       1.1111111111111112
    jenni cam       3.0     2       1.0999999999999999
    cheryl bachman  3.162277660168379       2       1.090909090909091
    wallpapers      3.2888995827048717      6       1.9333333333333331
    agp     3.316624790355399       2       1.0833333333333335
    bachman 3.4641016151377557      2       1.0769230769230766
    jerk    3.6055512754639896      2       1.0714285714285712
    kimberley       3.6055512754639896      2       1.0714285714285712
tu@ubuntu:~/Downloads/pigtmp$
```

Bonus Task:

Task Specifications:

In the Bonus Task, I was asked to write a short description on using Hadoop to build an application for analyzing tweet feeds using the Twitter API. The application had to retrieve the tweets for the last hours and the associated attributes for users, places and entities (URLs, hashtags, user mentions) and then process the retrieved information to identify:

- most popular hashtags in the 50 largest cities in the world.
- most popular words in tweets that include a URL for a popular newspaper, magazine or TV show
- most popular video

Time Specifications: 40 mins

The files obtained from the Twitter APIs contains user, location and actual tweet information and these fields are tab separated. The tweets are generally obtained in JSON format.

1. To get most popular hashtags in the 50 largest cities of the world:

    i) The tweets obtained for last hours along with the location information can be put in HDFS. Then PIG JSONLoader can be used to load data of the 50 largest cities in the world into PIG.
    ii) Now the Hashtags need to be extracted from the tweets. Also, we need to have an attribute of the location(city) along with the hashtag from the tweet.
    iii) Now Map can be used to count the number of hashtags and then probably a local reduce to get local frequency of a hashtag.
    iv) Lastly, GroupBy and Sort commands (In Descending Order) can be used to display the count of the hashtags with respect to the location.

2. To get most popular words that include a URL for a popular newspaper, magazine or TV show:

    i) The tweets obtained for last hours can be put in HDFS. Then PIG JSONLoader can be used to load only that data into PIG which includes URL entities.
    ii) Now a text file with the list of the URLs of a popular newspaper, magazine or TV show can be used to filter in the tweets based on the URLs of that list. In this manner we keep only the tweets of the popular newspaper, magazine or TV show which are in the list.
    iii) Now all the proper words can be extracted from the filtered tweets.
    iv) Now, just as in the WordCount Example given in the Homework, we can map reduce to count the number of occurrences of the words extracted from the above tweets and then sort them in descending order to get the most popular words.

3. To get the most popular video:

    i) The tweets obtained for last hours can be put in HDFS. Then PIG JSONLoader can be used to load only that data into PIG which has a video id/attribute attached to it.
    ii) Now, the hashtags/user mentions/URLs/ratings describing the videos can be extracted from the tweets to be used for map-reduce processing along with the video ids/attributes in the tweet.
    iii) The most frequent hashtags/user mentions/URLs/ratings can be found in the set of video ids/attributes formed.
    iv) The video that has the most hashtags/user mentions/URLs/ratings from the output must be the most popular video.

Time Taken to Formulate/Consolidate the Report: 1 Hour

REFERENCES:

- https://askubuntu.com/questions/761127/how-do-i-install-openjdk-7-on-ubuntu-16-04-or-higher
- https://stackoverflow.com/questions/16263556/installing-java-7-on-ubuntu
- https://hadoop.apache.org/docs/current/hadoop-project-dist/hadoop-common/SingleCluster.html#Standalone_Operation
- https://www.cloudera.com/documentation/other/tutorial/CDH5/topics/ht_wordcount1.html
- https://stackoverflow.com/questions/8396856/classpath-issue-in-hadoop-java
- http://pig.apache.org/docs/r0.10.0/start.html#tutorial
- https://pig.apache.org/docs/r0.17.0/start.html
- https://developer.twitter.com/en/docs
- https://acadgild.com/blog/determining-popular-hashtags-in-twitter-using-pig/
- http://blog.cloudera.com/blog/2012/09/analyzing-twitter-data-with-hadoop/
- http://blog.enablecloud.com/2013/02/find-popular-hash-tags-in-twitter-using.html
- https://www.linkedin.com/pulse/100-most-used-english-words-using-hadoop-carlos-iglesias-fern%C3%A1ndez
- https://www.packtpub.com/mapt/video/big_data_and_business_intelligence/9781787125568/11436/11448/example--most-popular-movie