Bench marking and Stress Testing on HDP Hadoop Cluster with Terasort, TestDFSIO:

In this article I would like to introduce to some of the benchmarking and testing tools that are included in the Hortonworks Hadoop Distribution. Namely, we look at the benchmarks TestDFSIO and Terasort.

Hence knowing how to run these tools will help you to shake out your cluster in terms of architecture, hardware and software, to measure its performance and also to share and compare your results with other people.

Here are the differences in executing the same teragen/terasort on HDP and Cloudera.

HDP measures on a 4 node cluster with m3.medium:
```
Total time spent by all maps in occupied slots (ms)=19716
Total time spent by all reduces in occupied slots (ms)=23438
Total time spent by all map tasks (ms)=19716
Total time spent by all reduce tasks (ms)=11719
Total vcore-seconds taken by all map tasks=19716
Total vcore-seconds taken by all reduce tasks=11719
Total megabyte-seconds taken by all map tasks=6723156
Total megabyte-seconds taken by all reduce tasks=7992358
```

CDH measures on a 5 node cluster:
```
Total time spent by all maps in occupied slots (ms)=12838
Total time spent by all reduces in occupied slots (ms)=36156
Total time spent by all map tasks (ms)=12838
Total time spent by all reduce tasks (ms)=36156
Total vcore-seconds taken by all map tasks=12838
Total vcore-seconds taken by all reduce tasks=36156
Total megabyte-seconds taken by all map tasks=13146112
Total megabyte-seconds taken by all reduce tasks=37023744
```

HDP measures on a 4 node cluster:
```
Map-Reduce Framework
Map input records=10000
Map output records=10000
Map output bytes=1020000
Map output materialized bytes=1040012
Input split bytes=296
Combine input records=0
Combine output records=0
Reduce input groups=10000
Reduce shuffle bytes=1040012
Reduce input records=10000
Reduce output records=10000
Spilled Records=20000
Shuffled Maps =2
Failed Shuffles=0
```

```
Merged Map outputs=2
GC time elapsed (ms)=753
CPU time spent (ms)=5590
Physical memory (bytes) snapshot=772042752
Virtual memory (bytes) snapshot=3504418816
Total committed heap usage (bytes)=572661760
16/05/13 01:20:18 INFO terasort.TeraSort: done
```

CDH measures on a 5 node cluster with m3.large flavor:
```
Map–Reduce Framework
Map input records=10000
Map output records=10000
Map output bytes=1020000
Map output materialized bytes=430163
Input split bytes=294
Combine input records=0
Combine output records=0
Reduce input groups=10000
Reduce shuffle bytes=430163
Reduce input records=10000
Reduce output records=10000
Spilled Records=20000
Shuffled Maps =8
Failed Shuffles=0
Merged Map outputs=8
GC time elapsed (ms)=335
CPU time spent (ms)=10870
Physical memory (bytes) snapshot=1622138880
Virtual memory (bytes) snapshot=9454505984
Total committed heap usage (bytes)=1480589312
16/05/13 01:33:43 INFO terasort.TeraSort: done
```

Prerequisites:
Running HDP (Single-Node Cluster) or
Running HDP (Multi-Node Cluster)

Overview of Benchmarks and Testing Tools on HDP:

1. Browse to the ResourceManager:

http://$resourcemanager.full.hostname:8088/

2.Create a $CLIENT_USER in all of the nodes and add it to the users groups.
    useradd client
    usermod -a -G users client

3. As the HDFS user, create a /user/client
 sudo su - hdfs

hdfs dfs -mkdir /user/client
hdfs dfs -chown client:client /user/client
hdfs dfs -chmod -R 755 /user/client

4. Run the smoke test as the $CLIENT_USER. Using Terasort, sort 10GB of data.
   su - $CLIENT_USER

Teragen on HDP:

```
/usr/hdp/current/hadoop-client/bin/hadoop jar /usr/hdp/current/hadoop-
mapreduce-client/hadoop-mapreduce-examples-*.jar teragen 10000
tmp/teragenout
```


Terasort on HDP:

/usr/hdp/current/hadoop-client/bin/hadoop jar /usr/hdp/current/hadoop-mapreduce-client/hadoop-mapreduce-examples-*.jar terasort tmp/teragenout tmp/terasortout

Teravalidate on HDP:

```
/usr/hdp/current/hadoop-client/bin/hadoop jar /usr/hdp/current/hadoop-
mapreduce-client/hadoop-mapreduce-examples.jar teravalidate
tmp/terasortout tmp/teravalidate
```

```
drwxr-xr-x   - hdfs hdfs        0 2016-05-17 11:52 /user/hdfs/tmp/teravalidate
[hdfs@sujitha01 tmp]$ hadoop fs -ls /user/hdfs/tmp/teravalidate
Found 2 items
-rw-r--r--   3 hdfs hdfs        0 2016-05-17 11:52 /user/hdfs/tmp/teravalidate/_SUCCESS
-rw-r--r--   3 hdfs hdfs       22 2016-05-17 11:52 /user/hdfs/tmp/teravalidate/part-r-00000
[hdfs@sujitha01 tmp]$ hadoop fs -cat /user/hdfs/tmp/teravalidate/part-r-00000
checksum        139abefd74b2
[hdfs@sujitha01 tmp]$ hadoop fs -ls /user/hdfs/tmp/
```

TESTDFSIO on HDP:
```
/usr/hdp/current/hadoop-client/bin/hadoop jar /usr/hdp/current/hadoop-
mapreduce-client/hadoop-mapreduce-client-jobclient-tests.jar TestDFSIO
-write -nrFiles 10 -fileSize 40

/usr/hdp/current/hadoop-client/bin/hadoop jar /usr/hdp/current/hadoop-
mapreduce-client/hadoop-mapreduce-client-jobclient-tests.jar TestDFSIO
-read -nrFiles 10 -fileSize 40

baseDir = /benchmarks/TestDFSIO
```


Bench marking and Stress Testing on Cloudera Hadoop Cluster with Terasort/terasort/teravalidate, TestDFSIO:

hadoop jar /opt/cloudera/parcels/CDH−5.7.0−
1.cdh5.7.0.p0.45/jars/hadoop−examples.jar teragen 10000
/user/cdhuser/teragenout

hadoop jar /opt/cloudera/parcels/CDH−5.7.0−
1.cdh5.7.0.p0.45/jars/hadoop−examples.jar terasort
/user/cdhuser/teragenout /user/cdhuser/terasortout

hadoop jar /opt/cloudera/parcels/CDH−5.7.0−
1.cdh5.7.0.p0.45/jars/hadoop−examples.jar teravalidate
/user/cdhuser/terasortout /user/cdhuser/teravalidate


```
[hdfs@sujithac01 jars]$ time hadoop jar hadoop-examples.jar teragen 100 /user/cdhuser/terasort-input
16/05/11 14:23:58 INFO client.RMProxy: Connecting to ResourceManager ot sujithac02.cloud.hortonworks.com/172.24.64.54:8032
16/05/11 14:23:59 INFO terasort.TeraGen: Generating 100 using 2
16/05/11 14:23:59 INFO mapreduce.JobSubmitter: number of splits:2
16/05/11 14:24:00 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1462923836644_0003
16/05/11 14:24:00 INFO impl.YarnClientImpl: submitted application application_1462923836644_0003
16/05/11 14:24:00 INFO mapreduce.Job: The url to track the job: http://sujithac02.cloud.hortonworks.com:8088/proxy/application_1462923836644_0003/
16/05/11 14:24:00 INFO mapreduce.Job: Running job: job_1462923836644_0003
```

```
:6/05/13 01:29:45 INFO mapreduce.Job: Job job_1463126249715_0001 completed successfully
:6/05/13 01:29:46 INFO mapreduce.Job: Counters: 31
        File System Counters
                FILE: Number of bytes read=0
                FILE: Number of bytes written=234512
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=164
                HDFS: Number of bytes written=1000000
                HDFS: Number of read operations=8
                HDFS: Number of large read operations=0
                HDFS: Number of write operations=4
        Job Counters
                Launched map tasks=2
                Other local map tasks=2
                Total time spent by all maps in occupied slots (ms)=15287
                Total time spent by all reduces in occupied slots (ms)=0
                Total time spent by all map tasks (ms)=15287
                Total vcore-seconds taken by all map tasks=15287
                Total megabyte-seconds taken by all map tasks=15653888
        Map-Reduce Framework
                Map input records=10000
                Map output records=10000
                Input split bytes=164
                Spilled Records=0
                Failed Shuffles=0
                Merged Map outputs=0
                GC time elapsed (ms)=102
                CPU time spent (ms)=1960
                Physical memory (bytes) snapshot=349241344
                Virtual memory (bytes) snapshot=3120852992
                Total committed heap usage (bytes)=355467264
        org.apache.hadoop.examples.terasort.TeraGen$Counters
                CHECKSUM=21555350172850
        File Input Format Counters
                Bytes Read=0
        File Output Format Counters
                Bytes Written=1000000
```

```
16/05/13 01:31:33 INFO mapreduce.Job: map 100% reduce 50%
16/05/13 01:32:35 INFO mapreduce.Job: map 100% reduce 75%
16/05/13 01:33:41 INFO mapreduce.Job: map 100% reduce 100%
16/05/13 01:33:42 INFO mapreduce.Job: Job job_1463126249715_0002 completed successfully
16/05/13 01:33:43 INFO mapreduce.Job: Counters: 50
        File System Counters
                FILE: Number of bytes read=432356
                FILE: Number of bytes written=1374421
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=1000294
                HDFS: Number of bytes written=1000000
                HDFS: Number of read operations=16
                HDFS: Number of large read operations=0
                HDFS: Number of write operations=0
        Job Counters
                Launched map tasks=2
                Launched reduce tasks=1
                Data-local map tasks=1
                Rack-local map tasks=1
                Total time spent by all maps in occupied slots (ms)=12838
                Total time spent by all reduces in occupied slots (ms)=36156
                Total time spent by all map tasks (ms)=12838
                Total time spent by all reduce tasks (ms)=36156
                Total vcore-seconds taken by all map tasks=12838
                Total vcore-seconds taken by all reduce tasks=36156
                Total megabyte-seconds taken by all map tasks=13146112
                Total megabyte-seconds taken by all reduce tasks=37023744
        Map-Reduce Framework
                Map input records=10000
                Map output records=10000
                Map output bytes=1020000
                Map output materialized bytes=430163
                Input split bytes=294
                Combine input records=0
                Combine output records=0
                Reduce input groups=10000
                Reduce shuffle bytes=430163
                Reduce input records=10000
                Reduce output records=10000
                Spilled Records=20000
                Shuffled Maps =8
                Failed Shuffles=0
                Merged Map outputs=8
                GC time elapsed (ms)=1878
                CPU time spent (ms)=10870
                Physical memory (bytes) snapshot=1622130088
                Virtual memory (bytes) snapshot=9454505904
                Total committed heap usage (bytes)=1488908312
        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=1000000
        File Output Format Counters
                Bytes Written=1000000
16/05/13 01:33:43 INFO terasort.TeraSort: done
```

```
[hdfs@ssankucdh01 ~]$ hadoop jar /opt/cloudera/parcels/CDH-5.7.0-1.cdh5.7.0.p0.45/jars/hadoop-examples.jar teravalidate /user/cdhuser/terasortout
16/05/17 12:07:29 INFO client.RMProxy: Connecting to ResourceManager at ssankucdh01.cloud.hortonworks.com/172.24.64.161:8032
16/05/17 12:07:31 INFO input.FileInputFormat: Total input paths to process : 4
Spent 39ms computing base-splits.
Spent 0ms computing TeraScheduler splits.
16/05/17 12:07:33 INFO mapreduce.JobSubmitter: number of splits:4
16/05/17 12:07:33 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1463126249715_0005
16/05/17 12:07:34 INFO impl.YarnClientImpl: Submitted application application_1463126249715_0005
16/05/17 12:07:34 INFO mapreduce.Job: The url to track the job: http://ssankucdh01.cloud.hortonworks.com:8088/proxy/application_1463126249715_000
16/05/17 12:07:34 INFO mapreduce.Job: Running job: job_1463126249715_0005
16/05/17 12:07:43 INFO mapreduce.Job: Job job_1463126249715_0005 running in uber mode : false
16/05/17 12:07:43 INFO mapreduce.Job:  map 0% reduce 0%
16/05/17 12:07:51 INFO mapreduce.Job:  map 50% reduce 0%
16/05/17 12:07:53 INFO mapreduce.Job:  map 75% reduce 0%
16/05/17 12:07:58 INFO mapreduce.Job:  map 100% reduce 0%
16/05/17 12:08:06 INFO mapreduce.Job:  map 100% reduce 100%
16/05/17 12:08:08 INFO mapreduce.Job: Job job_1463126249715_0005 completed successfully
16/05/17 12:08:09 INFO mapreduce.Job: Counters: 49
        File System Counters
                FILE: Number of bytes read=247
                FILE: Number of bytes written=580939
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=1000592
                HDFS: Number of bytes written=22
                HDFS: Number of read operations=15
```



```
Found 2 items
-rw-r--r--   3 hdfs supergroup          0 2016-05-17 12:08 /user/cdhuser/teravalidate/_SUCCESS
-rw-r--r--   3 hdfs supergroup         22 2016-05-17 12:08 /user/cdhuser/teravalidate/part-r-000
[hdfs@ssankucdh01 ~]$ hadoop fs -cat /user/cdhuser/teravalidate/part-r-00000
checksum        139abefd74b2
[hdfs@ssankucdh01 ~]$
```

TestDFSIO on cloudera: write

```
hadoop jar /opt/cloudera/parcels/CDH-5.7.0-
1.cdh5.7.0.p0.45/jars/hadoop-mapreduce-client-jobclient-2.6.0-
cdh5.7.0-tests.jar TestDFSIO -write -nrFiles 10 -fileSize 40
```



```
                    Bytes Written=78
16/05/17 15:09:48 INFO fs.TestDFSIO: ----- TestDFSIO ----- : write
16/05/17 15:09:48 INFO fs.TestDFSIO:            Date & time: Tue May 17 15:09:48 PDT 2016
16/05/17 15:09:48 INFO fs.TestDFSIO:        Number of files: 10
16/05/17 15:09:48 INFO fs.TestDFSIO: Total MBytes processed: 400.0
16/05/17 15:09:48 INFO fs.TestDFSIO:      Throughput mb/sec: 11.576083810846791
16/05/17 15:09:48 INFO fs.TestDFSIO: Average IO rate mb/sec: 35.46977996826172
16/05/17 15:09:48 INFO fs.TestDFSIO:  IO rate std deviation: 25.08206855713185
16/05/17 15:09:48 INFO fs.TestDFSIO:     Test exec time sec: 79.861
16/05/17 15:09:48 INFO fs.TestDFSIO:
```

TestDFSIO on cloudera: read

```
hadoop jar /opt/cloudera/parcels/CDH-5.7.0-
1.cdh5.7.0.p0.45/jars/hadoop-mapreduce-client-jobclient-2.6.0-
cdh5.7.0-tests.jar TestDFSIO -read -nrFiles 10 -fileSize 40
```


Reference: http://www.michael-noll.com/blog/2011/04/09/benchmarking-and-stress-testing-an-hadoop-cluster-with-terasort-testdfsio-nnbench-mrbench/