Report
CS6240: Parallel Data Processing
Assignment 1
Harsh Shukla

1. Running the code:

Javac Main.class arguments.

2. Running on eclipse/IDE:

- Extract the Zip file.
- Import project(multithreading Big-data) as a maven project.
- Give the input file's path as an argument in run configurations.
- RUN.

QUESTIONS

For each of the versions of your sequential and multi-threaded program detailed in B and C, report the minimum, average and maximum running time observed over the 10 runs. (5 points)

Sequential Execution without Fibonacci(17).

Time for execution	Time(Seconds)
Minimum execution time for 10 rounds:	2.173
Average execution time for 10 rounds:	2.394
Maximum execution time for 10 rounds:	3.632

Sequential Execution with Fibonacci(17).

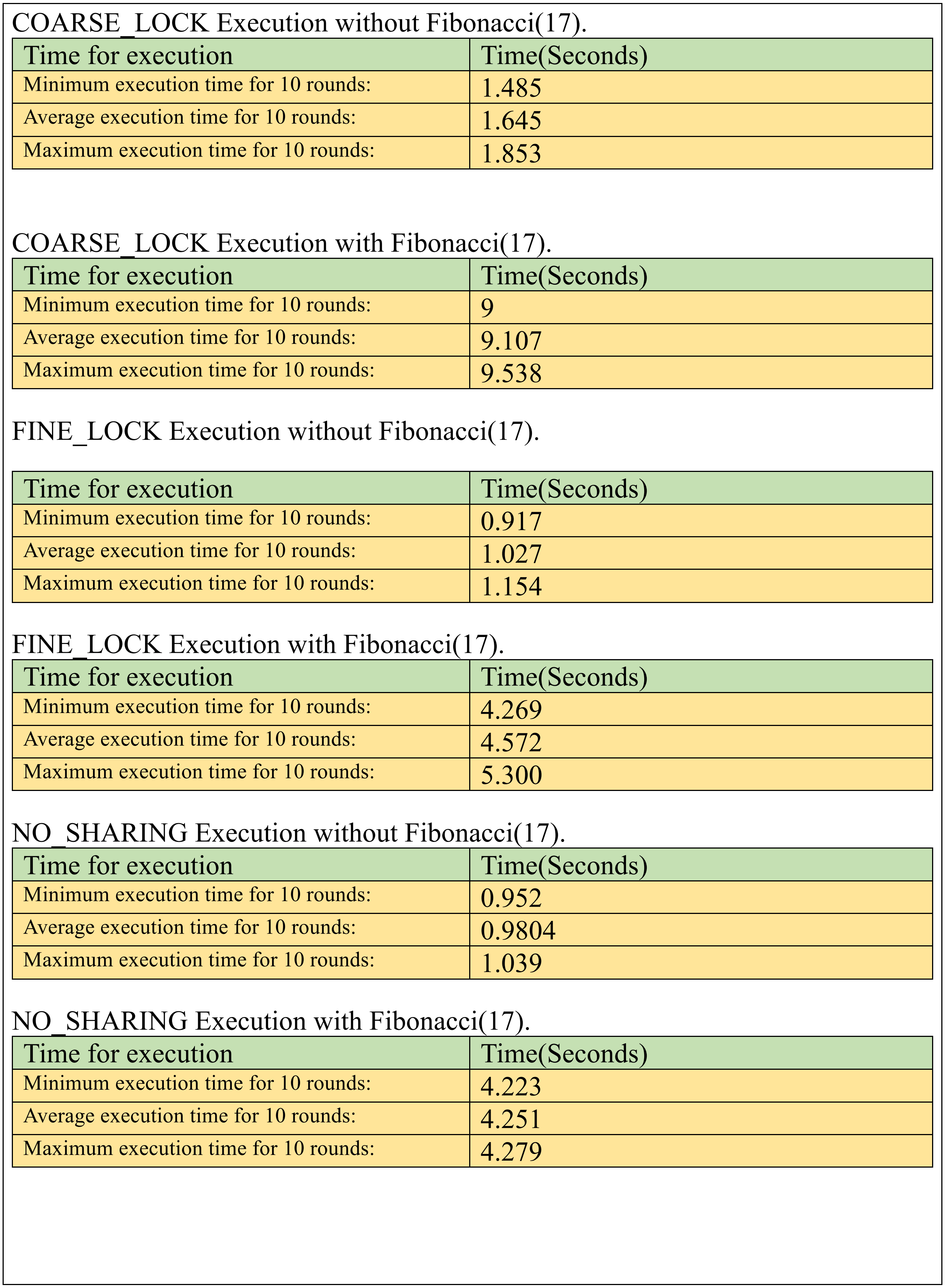
Time for execution	Time(Seconds)
Minimum execution time for 10 rounds:	10.398
Average execution time for 10 rounds:	10.688
Maximum execution time for 10 rounds:	10.925

NO_LOCK Execution without Fibonacci(17).

Time for execution	Time(Seconds)
Minimum execution time for 10 rounds:	0.748
Average execution time for 10 rounds:	0.979
Maximum execution time for 10 rounds:	1.033

NO_LOCK Execution with Fibonacci(17).

Time for execution	Time(Seconds)
Minimum execution time for 10 rounds:	2.626
Average execution time for 10 rounds:	3.206
Maximum execution time for 10 rounds:	3.865



COARSE_LOCK Execution without Fibonacci(17).

Time for execution	Time(Seconds)
Minimum execution time for 10 rounds:	1.485
Average execution time for 10 rounds:	1.645
Maximum execution time for 10 rounds:	1.853

COARSE_LOCK Execution with Fibonacci(17).

Time for execution	Time(Seconds)
Minimum execution time for 10 rounds:	9
Average execution time for 10 rounds:	9.107
Maximum execution time for 10 rounds:	9.538

FINE_LOCK Execution without Fibonacci(17).

Time for execution	Time(Seconds)
Minimum execution time for 10 rounds:	0.917
Average execution time for 10 rounds:	1.027
Maximum execution time for 10 rounds:	1.154

FINE_LOCK Execution with Fibonacci(17).

Time for execution	Time(Seconds)
Minimum execution time for 10 rounds:	4.269
Average execution time for 10 rounds:	4.572
Maximum execution time for 10 rounds:	5.300

NO_SHARING Execution without Fibonacci(17).

Time for execution	Time(Seconds)
Minimum execution time for 10 rounds:	0.952
Average execution time for 10 rounds:	0.9804
Maximum execution time for 10 rounds:	1.039

NO_SHARING Execution with Fibonacci(17).

Time for execution	Time(Seconds)
Minimum execution time for 10 rounds:	4.223
Average execution time for 10 rounds:	4.251
Maximum execution time for 10 rounds:	4.279

Report the number of worker threads used and the speedup of the multithreaded versions based on the corresponding average running times.
(5 points)

Number of threads spawned: 4,
Speed up for following cases:

NO_LOCK: Program B: 2.44 Program C: 3.33
COARSE_LOCK: Program B:1.45 Program C:1.17
FINE_LOCK: Program B:2.33 Program C:2.33
NO_SHARING: Program B:2.44 Program C:2.51

3) Answer the following questions in a brief and concise manner: (4 points each)
Question) Which program version (SEQ, NO-LOCK, COARSE-LOCK, FINE-LOCK, NO-SHARING) would you normally expect to finish fastest and why? Do the experiments confirm your expectation? If not, try to explain the reasons.

Ans: By theory no locking must be the most optimum or the fastest one. There are multiple reasons to support this argument. **Parallelism** helps in attaining the best performance and as there are no locks maximum parallelism is achieved here.

The observations in the experiment **confirms** these. expectations.

Question) Which program version (SEQ, NO-LOCK, COARSE-LOCK, FINE-LOCK, NO-SHARING) would you normally expect to finish slowest and why? Do the experiments confirm your expectation? If not, try to explain the reasons.

Ans: Out of all the program versions sequential should be the slowest by concept. In sequential there is no parallel approach being followed and hence the multiple cores are not utilized efficiently. For all the parallel programs, we are able to achieve the optimum efficiencies because of the concept of parallelism therefore in my understanding sequential should be the slowest.

My observation from the experiment support this theory and confirms the expectations.

Question) Compare the temperature averages returned by each program version. Report if any of them is incorrect or if any of the programs crashed because of concurrent accesses.

Ans: When we have a very large input we can see the effects of parallelism. The average temperatures returned by sequential, finelock, no sharing and coarse lock are pretty consistent but no lock does show some anomaly. This happens when the number of threads are increased for concurrent access. This is because of inconsistencies in values because of no knowledge transfer of shared data structure at a given time. The threads do not know about the status as there are no locks involved.

Question) Compare the running times of SEQ and COARSE-LOCK. Try to explain why one is slower than the other. (Make sure to consider the results of both B and C—this might support or refute a possible hypothesis.)

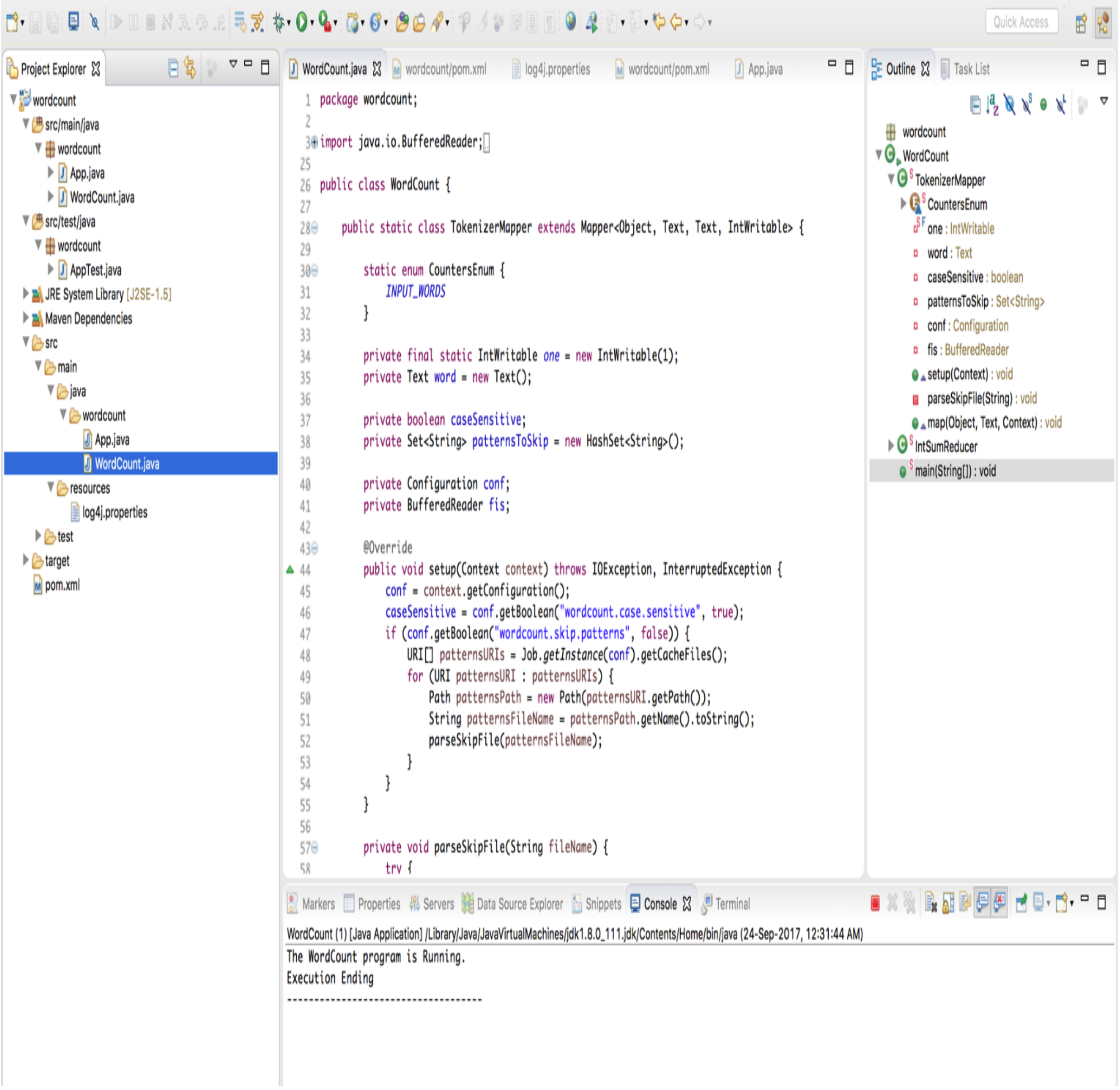
Ans: By theory as explained above the sequential run should be slower than coarse lock. This is not exactly the case when a

Sequential is generally slower than coarse lock mechanism. However, we have seen that when a delay is introduced (Fibonacci code in this case) the results are very close . On introducing the delay sequential has shown improvement over time. This could be because effects of parallelism are best observed when the input file is large and when a small code like Fibonacci is introduced this leads to small transfer of locks but for larger input with the wait for threads to be released and hence it might take more time to wait and execute the overall code.

Question) How does the higher computation cost in part C (additional Fibonacci computation) affect the difference between COARSE-LOCK and FINE-LOCK? Try to explain the reason.

Ans: Coarse_lock is a independent mechanism i.e. the locks are held over the entire data structure and therefore no other thread can manipulate the data structure(hash map in this case).Therefore whenever two Fibonacci calculations occur they occur separately and not in parallel leading to the delays in sequential manner. This is not the case with Fine_lock and parallel execution is actually observed as the lock is not held over our data structure but only held over the variable to be updated. Therefore fine lock would perform better here.

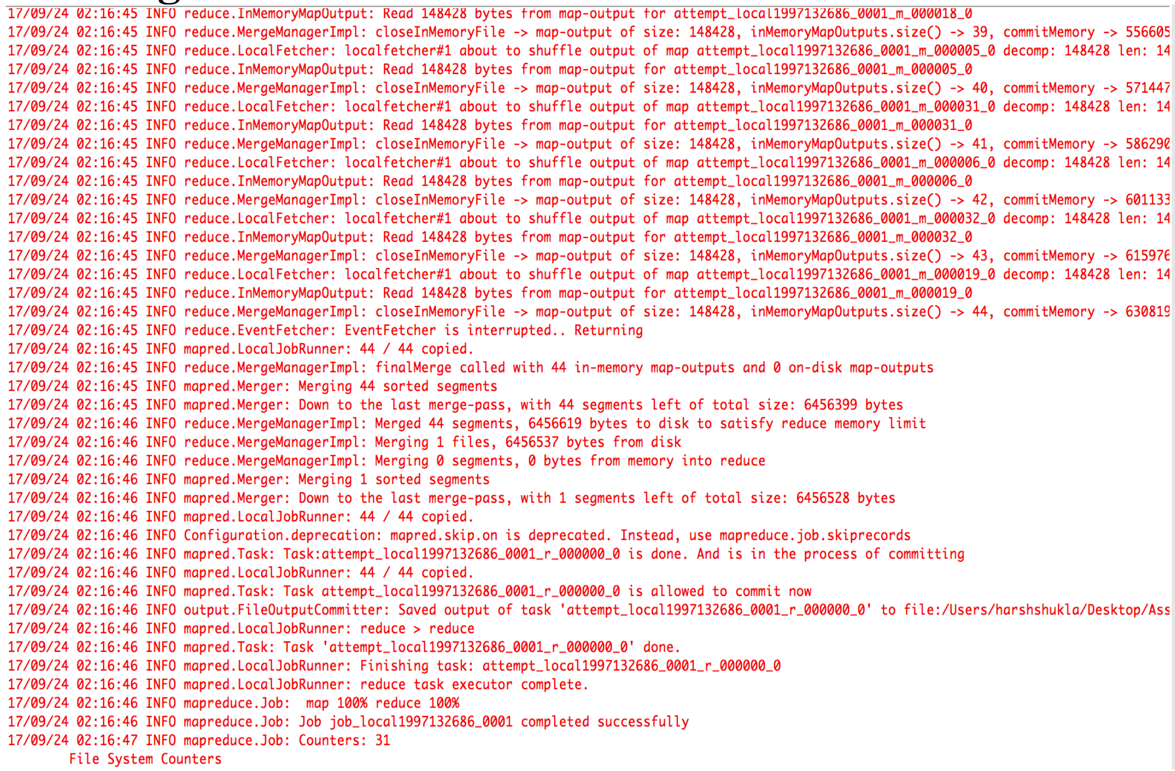
WordCount Local Execution:



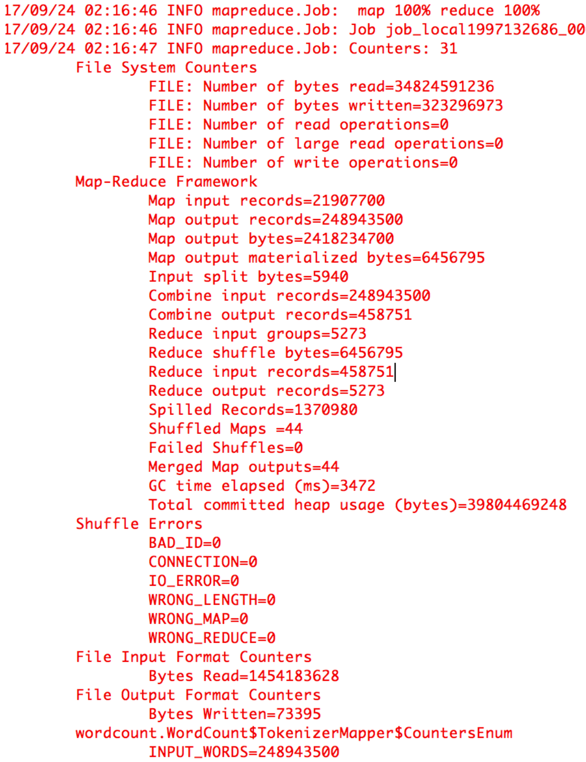
```java
package wordcount;

import java.io.BufferedReader;

public class WordCount {

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

        static enum CountersEnum {
            INPUT_WORDS
        }

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

        private boolean caseSensitive;
        private Set<String> patternsToSkip = new HashSet<String>();

        private Configuration conf;
        private BufferedReader fis;

        @Override
        public void setup(Context context) throws IOException, InterruptedException {
            conf = context.getConfiguration();
            caseSensitive = conf.getBoolean("wordcount.case.sensitive", true);
            if (conf.getBoolean("wordcount.skip.patterns", false)) {
                URI[] patternsURIs = Job.getInstance(conf).getCacheFiles();
                for (URI patternsURI : patternsURIs) {
                    Path patternsPath = new Path(patternsURI.getPath());
                    String patternsFileName = patternsPath.getName().toString();
                    parseSkipFile(patternsFileName);
                }
            }
        }

        private void parseSkipFile(String fileName) {
            try {
```

```
WordCount (1) [Java Application] /Library/Java/JavaVirtualMachines/jdk1.8.0_111.jdk/Contents/Home/bin/java (24-Sep-2017, 12:31:44 AM)
The WordCount program is Running.
Execution Ending
------------------------------------
```

IDE Logs:



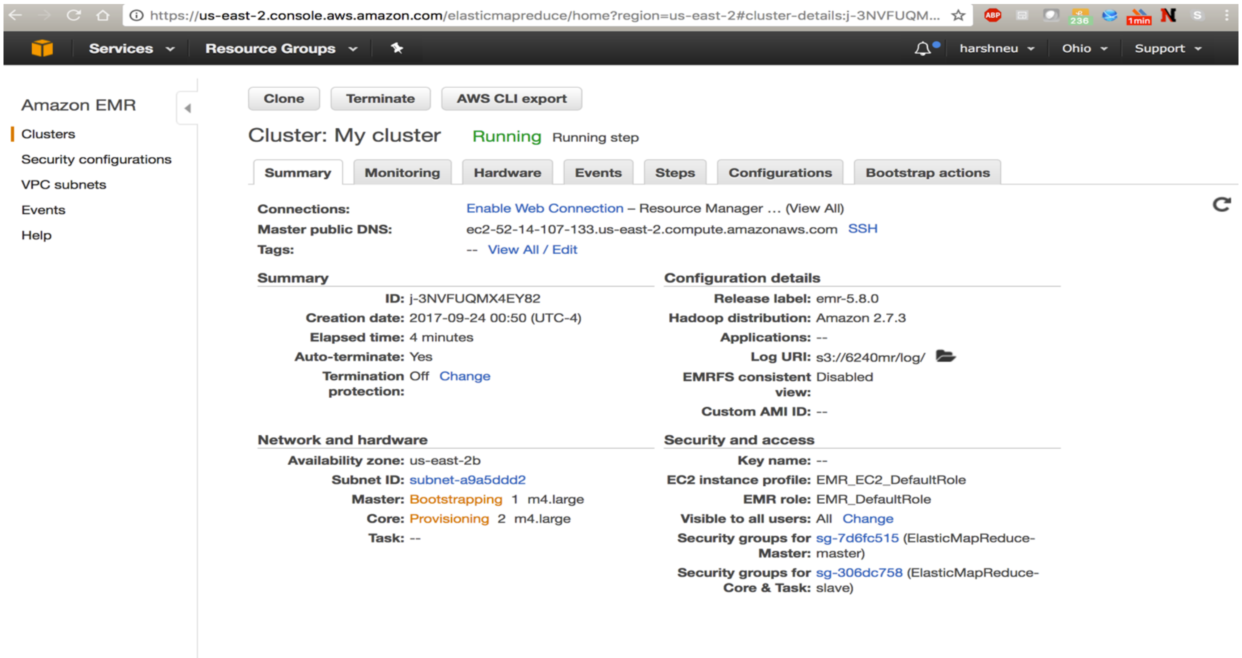
```
17/09/24 02:16:45 INFO reduce.InMemoryMapOutput: Read 148428 bytes from map-output for attempt_local1997132686_0001_m_000018_0
17/09/24 02:16:45 INFO reduce.MergeManagerImpl: closeInMemoryFile -> map-output of size: 148428, inMemoryMapOutputs.size() -> 39, commitMemory -> 556605
17/09/24 02:16:45 INFO reduce.LocalFetcher: localfetcher#1 about to shuffle output of map attempt_local1997132686_0001_m_000005_0 decomp: 148428 len: 14
17/09/24 02:16:45 INFO reduce.InMemoryMapOutput: Read 148428 bytes from map-output for attempt_local1997132686_0001_m_000005_0
17/09/24 02:16:45 INFO reduce.MergeManagerImpl: closeInMemoryFile -> map-output of size: 148428, inMemoryMapOutputs.size() -> 40, commitMemory -> 571447
17/09/24 02:16:45 INFO reduce.LocalFetcher: localfetcher#1 about to shuffle output of map attempt_local1997132686_0001_m_000031_0 decomp: 148428 len: 14
17/09/24 02:16:45 INFO reduce.InMemoryMapOutput: Read 148428 bytes from map-output for attempt_local1997132686_0001_m_000031_0
17/09/24 02:16:45 INFO reduce.MergeManagerImpl: closeInMemoryFile -> map-output of size: 148428, inMemoryMapOutputs.size() -> 41, commitMemory -> 586290
17/09/24 02:16:45 INFO reduce.LocalFetcher: localfetcher#1 about to shuffle output of map attempt_local1997132686_0001_m_000006_0 decomp: 148428 len: 14
17/09/24 02:16:45 INFO reduce.InMemoryMapOutput: Read 148428 bytes from map-output for attempt_local1997132686_0001_m_000006_0
17/09/24 02:16:45 INFO reduce.MergeManagerImpl: closeInMemoryFile -> map-output of size: 148428, inMemoryMapOutputs.size() -> 42, commitMemory -> 601133
17/09/24 02:16:45 INFO reduce.LocalFetcher: localfetcher#1 about to shuffle output of map attempt_local1997132686_0001_m_000032_0 decomp: 148428 len: 14
17/09/24 02:16:45 INFO reduce.InMemoryMapOutput: Read 148428 bytes from map-output for attempt_local1997132686_0001_m_000032_0
17/09/24 02:16:45 INFO reduce.MergeManagerImpl: closeInMemoryFile -> map-output of size: 148428, inMemoryMapOutputs.size() -> 43, commitMemory -> 615976
17/09/24 02:16:45 INFO reduce.LocalFetcher: localfetcher#1 about to shuffle output of map attempt_local1997132686_0001_m_000019_0 decomp: 148428 len: 14
17/09/24 02:16:45 INFO reduce.InMemoryMapOutput: Read 148428 bytes from map-output for attempt_local1997132686_0001_m_000019_0
17/09/24 02:16:45 INFO reduce.MergeManagerImpl: closeInMemoryFile -> map-output of size: 148428, inMemoryMapOutputs.size() -> 44, commitMemory -> 630819
17/09/24 02:16:45 INFO reduce.EventFetcher: EventFetcher is interrupted.. Returning
17/09/24 02:16:45 INFO mapred.LocalJobRunner: 44 / 44 copied.
17/09/24 02:16:45 INFO reduce.MergeManagerImpl: finalMerge called with 44 in-memory map-outputs and 0 on-disk map-outputs
17/09/24 02:16:45 INFO mapred.Merger: Merging 44 sorted segments
17/09/24 02:16:45 INFO mapred.Merger: Down to the last merge-pass, with 44 segments left of total size: 6456399 bytes
17/09/24 02:16:46 INFO reduce.MergeManagerImpl: Merged 44 segments, 6456619 bytes to disk to satisfy reduce memory limit
17/09/24 02:16:46 INFO reduce.MergeManagerImpl: Merging 1 files, 6456537 bytes from disk
17/09/24 02:16:46 INFO reduce.MergeManagerImpl: Merging 0 segments, 0 bytes from memory into reduce
17/09/24 02:16:46 INFO mapred.Merger: Merging 1 sorted segments
17/09/24 02:16:46 INFO mapred.Merger: Down to the last merge-pass, with 1 segments left of total size: 6456528 bytes
17/09/24 02:16:46 INFO mapred.LocalJobRunner: 44 / 44 copied.
17/09/24 02:16:46 INFO Configuration.deprecation: mapred.skip.on is deprecated. Instead, use mapreduce.job.skiprecords
17/09/24 02:16:46 INFO mapred.Task: Task:attempt_local1997132686_0001_r_000000_0 is done. And is in the process of committing
17/09/24 02:16:46 INFO mapred.LocalJobRunner: 44 / 44 copied.
17/09/24 02:16:46 INFO mapred.Task: Task attempt_local1997132686_0001_r_000000_0 is allowed to commit now
17/09/24 02:16:46 INFO output.FileOutputCommitter: Saved output of task 'attempt_local1997132686_0001_r_000000_0' to file:/Users/harshshukla/Desktop/Ass
17/09/24 02:16:46 INFO mapred.LocalJobRunner: reduce > reduce
17/09/24 02:16:46 INFO mapred.Task: Task 'attempt_local1997132686_0001_r_000000_0' done.
17/09/24 02:16:46 INFO mapred.LocalJobRunner: Finishing task: attempt_local1997132686_0001_r_000000_0
17/09/24 02:16:46 INFO mapred.LocalJobRunner: reduce task executor complete.
17/09/24 02:16:46 INFO mapreduce.Job:  map 100% reduce 100%
17/09/24 02:16:46 INFO mapreduce.Job: Job job_local1997132686_0001 completed successfully
17/09/24 02:16:47 INFO mapreduce.Job: Counters: 31
        File System Counters
```



```
17/09/24 02:16:46 INFO mapreduce.Job:  map 100% reduce 100%
17/09/24 02:16:46 INFO mapreduce.Job: Job job_local1997132686_0001 completed successfully
17/09/24 02:16:47 INFO mapreduce.Job: Counters: 31
        File System Counters
                FILE: Number of bytes read=34824591236
                FILE: Number of bytes written=323296973
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
        Map-Reduce Framework
                Map input records=21907700
                Map output records=248943500
                Map output bytes=2418234700
                Map output materialized bytes=6456795
                Input split bytes=5940
                Combine input records=248943500
                Combine output records=458751
                Reduce input groups=5273
                Reduce shuffle bytes=6456795
                Reduce input records=458751
                Reduce output records=5273
                Spilled Records=1370980
                Shuffled Maps =44
                Failed Shuffles=0
                Merged Map outputs=44
                GC time elapsed (ms)=3472
                Total committed heap usage (bytes)=39804469248
        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=1454183628
        File Output Format Counters
                Bytes Written=73395
        wordcount.WordCount$TokenizerMapper$CountersEnum
                INPUT_WORDS=248943500
```

WordCount AWS execution:

Running Steps Homework file under scanner.



Cluster: My cluster Running Running step

Connections: Enable Web Connection – Resource Manager … (View All)
Master public DNS: ec2-52-14-107-133.us-east-2.compute.amazonaws.com SSH
Tags: -- View All / Edit

Summary

ID: j-3NVFUQMX4EY82
Creation date: 2017-09-24 00:50 (UTC-4)
Elapsed time: 4 minutes
Auto-terminate: Yes
Termination protection: Off Change

Configuration details

Release label: emr-5.8.0
Hadoop distribution: Amazon 2.7.3
Applications: --
Log URI: s3://6240mr/log/
EMRFS consistent view: Disabled
Custom AMI ID: --

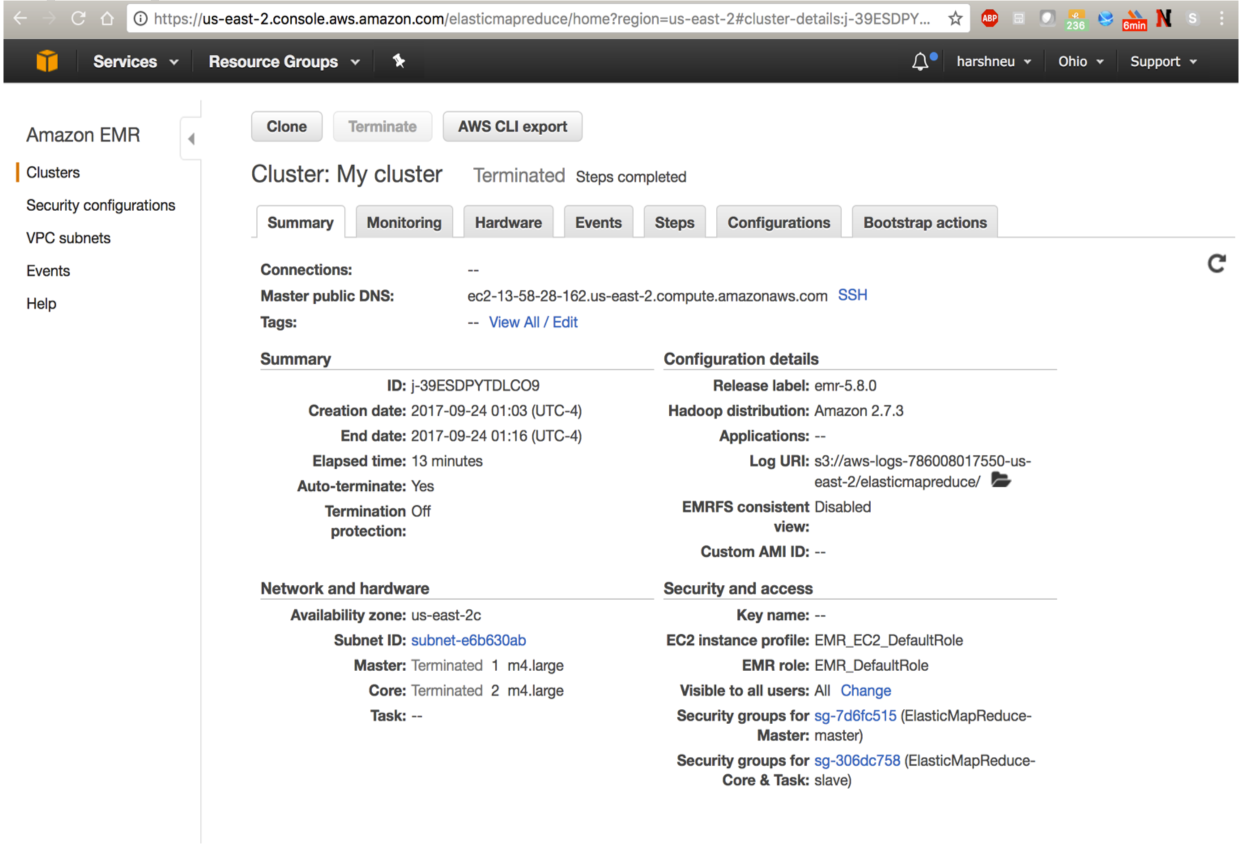
Network and hardware

Availability zone: us-east-2b
Subnet ID: subnet-a9a5ddd2
Master: Bootstrapping 1 m4.large
Core: Provisioning 2 m4.large
Task: --

Security and access

Key name: --
EC2 instance profile: EMR_EC2_DefaultRole
EMR role: EMR_DefaultRole
Visible to all users: All Change
Security groups for Master: sg-7d6fc515 (ElasticMapReduce-master)
Security groups for Core & Task: sg-306dc758 (ElasticMapReduce-slave)

Steps Completed.



Cluster: My cluster Terminated Steps completed

Connections: --
Master public DNS: ec2-13-58-28-162.us-east-2.compute.amazonaws.com SSH
Tags: -- View All / Edit

Summary

ID: j-39ESDPYTDLCO9
Creation date: 2017-09-24 01:03 (UTC-4)
End date: 2017-09-24 01:16 (UTC-4)
Elapsed time: 13 minutes
Auto-terminate: Yes
Termination protection: Off

Configuration details

Release label: emr-5.8.0
Hadoop distribution: Amazon 2.7.3
Applications: --
Log URI: s3://aws-logs-786008017550-us-east-2/elasticmapreduce/
EMRFS consistent view: Disabled
Custom AMI ID: --

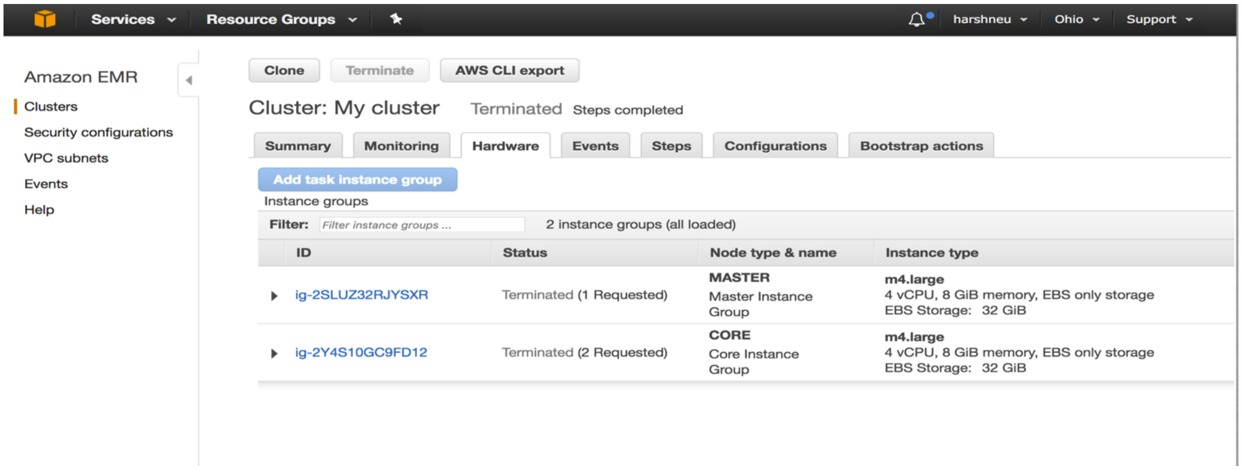
Network and hardware

Availability zone: us-east-2c
Subnet ID: subnet-e6b630ab
Master: Terminated 1 m4.large
Core: Terminated 2 m4.large
Task: --

Security and access

Key name: --
EC2 instance profile: EMR_EC2_DefaultRole
EMR role: EMR_DefaultRole
Visible to all users: All Change
Security groups for Master: sg-7d6fc515 (ElasticMapReduce-master)
Security groups for Core & Task: sg-306dc758 (ElasticMapReduce-slave)

Cluster Details:



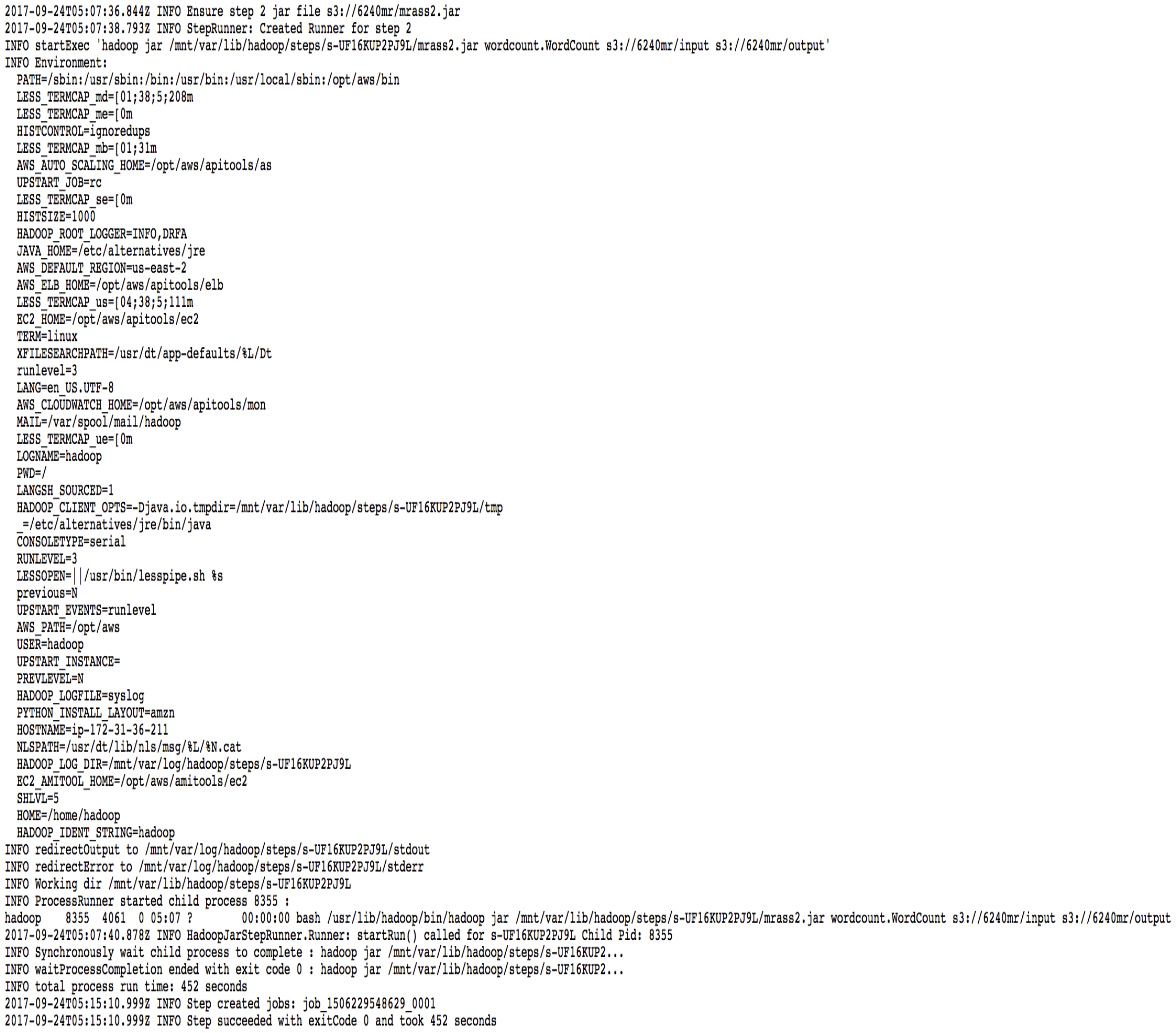
Cluster: My cluster Terminated Steps completed

Instance groups

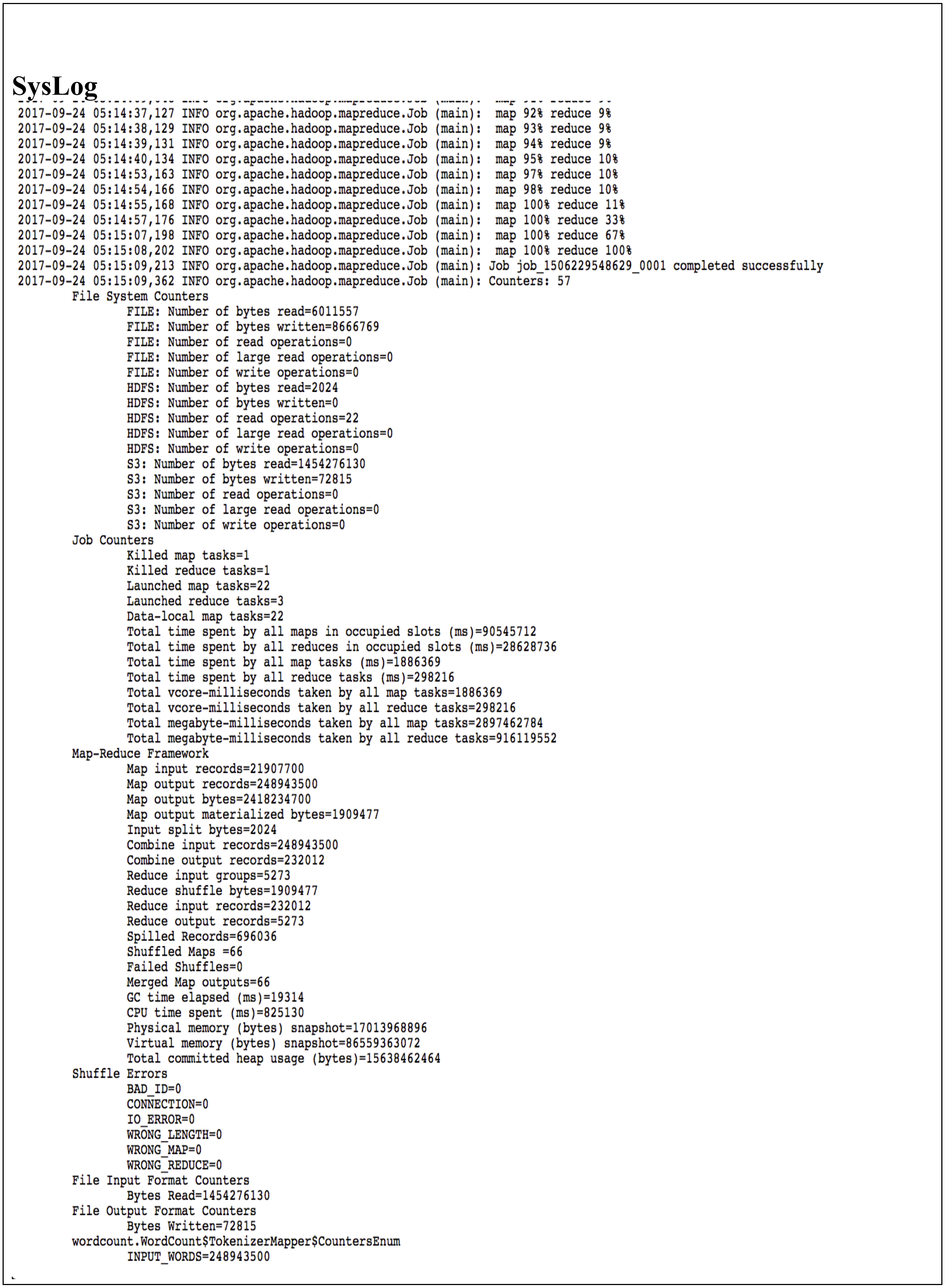
Filter: 2 instance groups (all loaded)

ID	Status	Node type & name	Instance type
ig-2SLUZ32RJYSXR	Terminated (1 Requested)	MASTER Master Instance Group	m4.large 4 vCPU, 8 GiB memory, EBS only storage EBS Storage: 32 GiB
ig-2Y4S10GC9FD12	Terminated (2 Requested)	CORE Core Instance Group	m4.large 4 vCPU, 8 GiB memory, EBS only storage EBS Storage: 32 GiB

Controller Text:



```
2017-09-24T05:07:36.844Z INFO Ensure step 2 jar file s3://6240mr/mrass2.jar
2017-09-24T05:07:38.793Z INFO StepRunner: Created Runner for step 2
INFO startExec 'hadoop jar /mnt/var/lib/hadoop/steps/s-UF16KUP2PJ9L/mrass2.jar wordcount.WordCount s3://6240mr/input s3://6240mr/output'
INFO Environment:
  PATH=/sbin:/usr/sbin:/bin:/usr/bin:/usr/local/sbin:/opt/aws/bin
  LESS_TERMCAP_md=[01;38;5;208m
  LESS_TERMCAP_me=[0m
  HISTCONTROL=ignoredups
  LESS_TERMCAP_mb=[01;31m
  AWS_AUTO_SCALING_HOME=/opt/aws/apitools/as
  UPSTART_JOB=rc
  LESS_TERMCAP_se=[0m
  HISTSIZE=1000
  HADOOP_ROOT_LOGGER=INFO,DRFA
  JAVA_HOME=/etc/alternatives/jre
  AWS_DEFAULT_REGION=us-east-2
  AWS_ELB_HOME=/opt/aws/apitools/elb
  LESS_TERMCAP_us=[04;38;5;111m
  EC2_HOME=/opt/aws/apitools/ec2
  TERM=linux
  XFILESEARCHPATH=/usr/dt/app-defaults/%L/Dt
  runlevel=3
  LANG=en_US.UTF-8
  AWS_CLOUDWATCH_HOME=/opt/aws/apitools/mon
  MAIL=/var/spool/mail/hadoop
  LESS_TERMCAP_ue=[0m
  LOGNAME=hadoop
  PWD=/
  LANGSH_SOURCED=1
  HADOOP_CLIENT_OPTS=-Djava.io.tmpdir=/mnt/var/lib/hadoop/steps/s-UF16KUP2PJ9L/tmp
  _=/etc/alternatives/jre/bin/java
  CONSOLETYPE=serial
  RUNLEVEL=3
  LESSOPEN=||/usr/bin/lesspipe.sh %s
  previous=N
  UPSTART_EVENTS=runlevel
  AWS_PATH=/opt/aws
  USER=hadoop
  UPSTART_INSTANCE=
  PREVLEVEL=N
  HADOOP_LOGFILE=syslog
  PYTHON_INSTALL_LAYOUT=amzn
  HOSTNAME=ip-172-31-36-211
  NLSPATH=/usr/dt/lib/nls/msg/%L/%N.cat
  HADOOP_LOG_DIR=/mnt/var/log/hadoop/steps/s-UF16KUP2PJ9L
  EC2_AMITOOL_HOME=/opt/aws/amitools/ec2
  SHLVL=5
  HOME=/home/hadoop
  HADOOP_IDENT_STRING=hadoop
INFO redirectOutput to /mnt/var/log/hadoop/steps/s-UF16KUP2PJ9L/stdout
INFO redirectError to /mnt/var/log/hadoop/steps/s-UF16KUP2PJ9L/stderr
INFO Working dir /mnt/var/lib/hadoop/steps/s-UF16KUP2PJ9L
INFO ProcessRunner started child process 8355 :
hadoop    8355  4061  0 05:07 ?        00:00:00 bash /usr/lib/hadoop/bin/hadoop jar /mnt/var/lib/hadoop/steps/s-UF16KUP2PJ9L/mrass2.jar wordcount.WordCount s3://6240mr/input s3://6240mr/output
2017-09-24T05:07:40.878Z INFO HadoopJarStepRunner.Runner: startRun() called for s-UF16KUP2PJ9L Child Pid: 8355
INFO Synchronously wait child process to complete : hadoop jar /mnt/var/lib/hadoop/steps/s-UF16KUP2...
INFO waitProcessCompletion ended with exit code 0 : hadoop jar /mnt/var/lib/hadoop/steps/s-UF16KUP2...
INFO total process run time: 452 seconds
2017-09-24T05:15:10.999Z INFO Step created jobs: job_1506229548629_0001
2017-09-24T05:15:10.999Z INFO Step succeeded with exitCode 0 and took 452 seconds
```



SysLog

```
2017-09-24 05:14:37,127 INFO org.apache.hadoop.mapreduce.Job (main):  map 92% reduce 9%
2017-09-24 05:14:38,129 INFO org.apache.hadoop.mapreduce.Job (main):  map 93% reduce 9%
2017-09-24 05:14:39,131 INFO org.apache.hadoop.mapreduce.Job (main):  map 94% reduce 9%
2017-09-24 05:14:40,134 INFO org.apache.hadoop.mapreduce.Job (main):  map 95% reduce 10%
2017-09-24 05:14:53,163 INFO org.apache.hadoop.mapreduce.Job (main):  map 97% reduce 10%
2017-09-24 05:14:54,166 INFO org.apache.hadoop.mapreduce.Job (main):  map 98% reduce 10%
2017-09-24 05:14:55,168 INFO org.apache.hadoop.mapreduce.Job (main):  map 100% reduce 11%
2017-09-24 05:14:57,176 INFO org.apache.hadoop.mapreduce.Job (main):  map 100% reduce 33%
2017-09-24 05:15:07,198 INFO org.apache.hadoop.mapreduce.Job (main):  map 100% reduce 67%
2017-09-24 05:15:08,202 INFO org.apache.hadoop.mapreduce.Job (main):  map 100% reduce 100%
2017-09-24 05:15:09,213 INFO org.apache.hadoop.mapreduce.Job (main): Job job_1506229548629_0001 completed successfully
2017-09-24 05:15:09,362 INFO org.apache.hadoop.mapreduce.Job (main): Counters: 57
	File System Counters
		FILE: Number of bytes read=6011557
		FILE: Number of bytes written=8666769
		FILE: Number of read operations=0
		FILE: Number of large read operations=0
		FILE: Number of write operations=0
		HDFS: Number of bytes read=2024
		HDFS: Number of bytes written=0
		HDFS: Number of read operations=22
		HDFS: Number of large read operations=0
		HDFS: Number of write operations=0
		S3: Number of bytes read=1454276130
		S3: Number of bytes written=72815
		S3: Number of read operations=0
		S3: Number of large read operations=0
		S3: Number of write operations=0
	Job Counters
		Killed map tasks=1
		Killed reduce tasks=1
		Launched map tasks=22
		Launched reduce tasks=3
		Data-local map tasks=22
		Total time spent by all maps in occupied slots (ms)=90545712
		Total time spent by all reduces in occupied slots (ms)=28628736
		Total time spent by all map tasks (ms)=1886369
		Total time spent by all reduce tasks (ms)=298216
		Total vcore-milliseconds taken by all map tasks=1886369
		Total vcore-milliseconds taken by all reduce tasks=298216
		Total megabyte-milliseconds taken by all map tasks=2897462784
		Total megabyte-milliseconds taken by all reduce tasks=916119552
	Map-Reduce Framework
		Map input records=21907700
		Map output records=248943500
		Map output bytes=2418234700
		Map output materialized bytes=1909477
		Input split bytes=2024
		Combine input records=248943500
		Combine output records=232012
		Reduce input groups=5273
		Reduce shuffle bytes=1909477
		Reduce input records=232012
		Reduce output records=5273
		Spilled Records=696036
		Shuffled Maps =66
		Failed Shuffles=0
		Merged Map outputs=66
		GC time elapsed (ms)=19314
		CPU time spent (ms)=825130
		Physical memory (bytes) snapshot=17013968896
		Virtual memory (bytes) snapshot=86559363072
		Total committed heap usage (bytes)=15638462464
	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=1454276130
	File Output Format Counters
		Bytes Written=72815
	wordcount.WordCount$TokenizerMapper$CountersEnum
		INPUT_WORDS=248943500
```