# PROJECT PART 1

Andres Namm

Cluster Computing

# Contents

# XEN INSTALLATION

**I had soo much fun!**

**Workshop tasks were all done using student13, student14, student1, student2 if not mentioned anything else. I did all the Project 1 individual tasks besides executing the vm-s with overlarge memory and the bonus task.**

Ubuntu contains a number of tools for creating Xen guests. The easiest one is xen-tools. This
software suite manages the downloading and installing of guest operating systems. In this guide we
are going to use xen-tools to prepare an Ubuntu para-virtualized DomU (your Dom1).

## hardware configuration

1 [Before you install xen] show the hardware configuration of the physical machine using commands: “sudo lshw–short” & “sudo xl info”; highlight the CPU model, RAM size, and # of coresin each physical machine. (2%)

| | A | B | C |
|---|---|---|---|
| 1 | | | |
| 2 | | student13 | student14 |
| 3 | IP | 10.42.0.57 | 10.42.0.60 |
| 4 | CPU model | Intel(R) Core(TM) i-5 CPU @ 3.GHz | Intel(R) Core(TM) i-5 CPU @ 3.GHz |
| 5 | Memory (RAM) | 16 GiB | 16 GiB |
| 6 | # of Cores | 4 | 4 |
| 7 | Disc Storage | 500 GiB | 500 GiB |

| | | | |
|---|---|---|---|
| 8 | IP | student1 | student2 |
| 9 | CPU model | 10.42.0.21 | 10.42.0.24 |
| 10 | Memory (RAM) | Intel(R) Core(TM)2 Duo CPU @ 2.83GHz | Intel(R) Core(TM)2 Duo CPU @ 2.83GHz |
| 11 | # of Cores | 4 GiB | 4 GiB |
| 12 | Disc Storage | 2 | 2 |
| 13 | | 250 GiB | 250 GiB |
| 14 | | | |

Interesting notes: I used the cat /proc/cpuinfo command later when had created 3 VM-s. Even when x3 was not running, dom0 had less memory. I don't understand What Im saying here anymore.

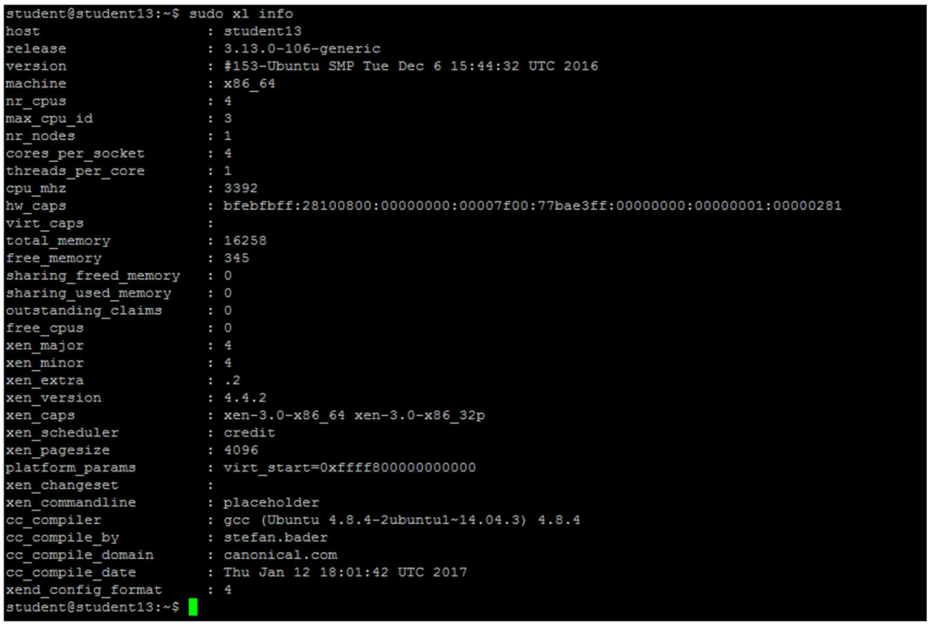
df -h harddisk info .

sudo lshw -short - http://www.binarytides.com/linux-lshw-command/

https://arstechnica.com/gadgets/2016/02/pentium-core-i5-core-i7-making-sense-of-intels-convoluted-cpu-lineup/

```
student@student13:~$ sudo lshw -short
H/W path        Device      Class       Description
====================================================
                            system      HP Compaq Elite 8300 SFF (QV996AV)
/0                          bus         3397
/0/0                        memory      64KiB BIOS
/0/4                        memory      256KiB L1 cache
/0/5                        memory      1MiB L2 cache
/0/6                        memory      6MiB L3 cache
/0/7                        memory      16GiB System Memory
/0/7/0                      memory      DIMM [empty]
/0/7/1                      memory      8GiB DIMM DDR3 Synchronous 1600 MHz (0.6
/0/7/2                      memory      DIMM [empty]
/0/7/3                      memory      8GiB DIMM DDR3 Synchronous 1600 MHz (0.6
/0/10                       processor   Intel(R) Core(TM) i5-3570 CPU @ 3.40GHz
/0/100                      bridge      Xeon E3-1200 v2/3rd Gen Core processor D
/0/100/2                    display     Xeon E3-1200 v2/3rd Gen Core processor G
/0/100/14                   bus         7 Series/C210 Series Chipset Family USB
/0/100/19       eth0        network     82579LM Gigabit Network Connection
/0/100/1a                   bus         7 Series/C210 Series Chipset Family USB
/0/100/1b                   multimedia  7 Series/C210 Series Chipset Family High
/0/100/1d                   bus         7 Series/C210 Series Chipset Family USB
/0/100/1e                   bridge      82801 PCI Bridge
/0/100/1f                   bridge      Q77 Express Chipset LPC Controller
/0/100/1f.2                 storage     7 Series/C210 Series Chipset Family 6-po
/0/100/1f.3                 bus         7 Series/C210 Series Chipset Family SMBu
/0/1            scsi0       storage
/0/1/0.0.0      /dev/sda    disk        500GB ST500DM002-1BD14
/0/1/0.0.0/1    /dev/sda1   volume      449GiB EXT4 volume
/0/1/0.0.0/2    /dev/sda2   volume      15GiB Extended partition
/0/1/0.0.0/2/5  /dev/sda5   volume      15GiB Linux swap / Solaris partition
/0/2            scsi2       storage
/0/2/0.0.0      /dev/cdrom  disk        DVD-RAM GH80N
/1              vif1.0      network     Ethernet interface
/2              vif2.0      network     Ethernet interface
student@student13:~$
```

sudo xl info http://www.binarytides.com/linux-lshw-command/ - DOM infop



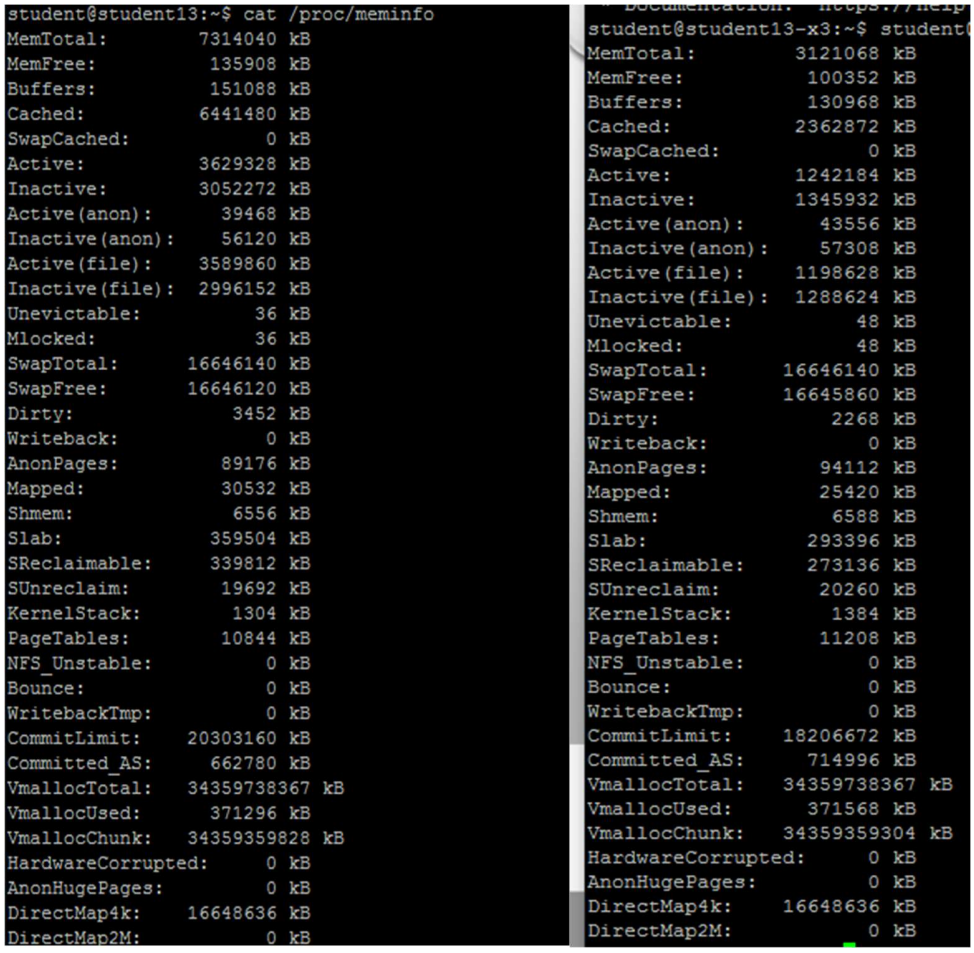
cat /proc/meminfo https://www.centos.org/docs/5/html/5.1/Deployment_Guide/s2-proc-meminfo.html

About, what different Directories stand for in the UNIX filesystem
https://en.wikipedia.org/wiki/Unix_filesystem

About proc fileSystem and virtual files
https://www.centos.org/docs/5/html/5.1/Deployment_Guide/s1-proc-virtual.html

I forgot to screenshot thi command before creating new XEN VM-s this is the output for dom0, where 8 GB of memory has already been given to the X1,X2

The left hand one is with 2 VM-s running, right hand with 3 VM-s running.



cat /proc/cpuinfo

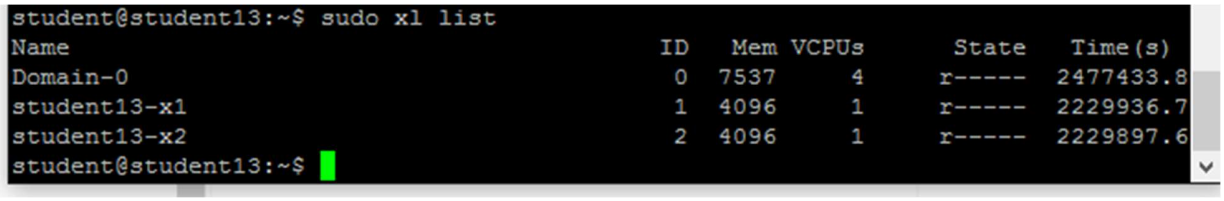
https://www.centos.org/docs/5/html/5.1/Deployment_Guide/s2-proc-cpuinfo.html

https://et.wikipedia.org/wiki/H%C3%BCper-hargt%C3%B6%C3%B6tlus – Tehnoloogia osa

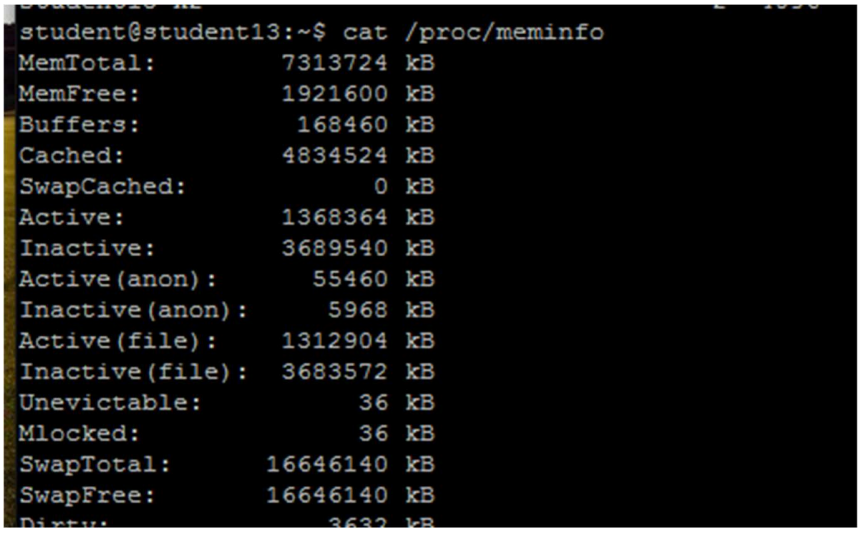
Partial output…

In addition to dom0, construction two VMs (x1 & x2)
at your machine. Show the configuration of dom0, VM1, and VM2, including vcpu, memory size, disk size, and swap space size. (

“Sudo xl list”,




“cat /proc/meminfo”,




“cat /proc/cpuinfo”, etc.) (4%) Does not change

| | dom0 | x1 | x2 |
|---|---|---|---|
| vcpu | vcpu: 4 | vcpu: 1 | vcpu:1 |
| memory | memory 7537 MB<br>7311692 kB | memory 4096 MB<br>4097820 kB | memory 4096 MB<br>4097820 kB |
| swap space | swap space<br>16646140 kB=<br>16255MB | 8 GB 8388604 kB | 8 GB 8388604 kB |
| disk size | lsblk 465 GB<br>lshw 500 GB | 50 GB | 50 GB |

Dom0 Has notified to have 4 vcpu-s according to xl list commad. At the same time it has 4 cores. How does this sharing between computers work ? What is considered as a vcpu ? definition kinda vague.

Question/ Claim, number oc VCPU-s is pretty much the number of CPU-s shown to the current VM ? That my hypothesis.

More about VCPU-s

http://whatis.techtarget.com/definition/virtual-CPU-vCPU - It is a physical processing unit that is assigned to VM . [ADDITION LATER ON]

http://www.hardwaresecrets.com/everything-you-need-to-know-about-the-intel-virtualization-technology/2/

http://serverfault.com/questions/504626/best-practice-vcpus-per-physical-core - Some recommendations about utilizing Vcpu-s

According to this article: A single physical CPU can be utilized as many vCPUs. You rarely run out of CPU resources in virtualization solutions. RAM and storage are always the limiting factors

Has my hard disk size shown for dom0 changed with the virtual disk creation ? No, checked with a 3. v.m

Check xenbridge on your machine: (brctlshow; brctlshowmacs xenbr0) (2%)

brctl show – it is bridging the connection between the virtual machines and dom0, which has control of the hardware.

```
student@student13:~$ brctl show
bridge name     bridge id               STP enabled     interfaces
virbr0          8000.000000000000       yes
xenbr0          8000.24be05109fdb       no              eth0
                                                        vif1.0
                                                        vif2.0

student@student13:~$
```

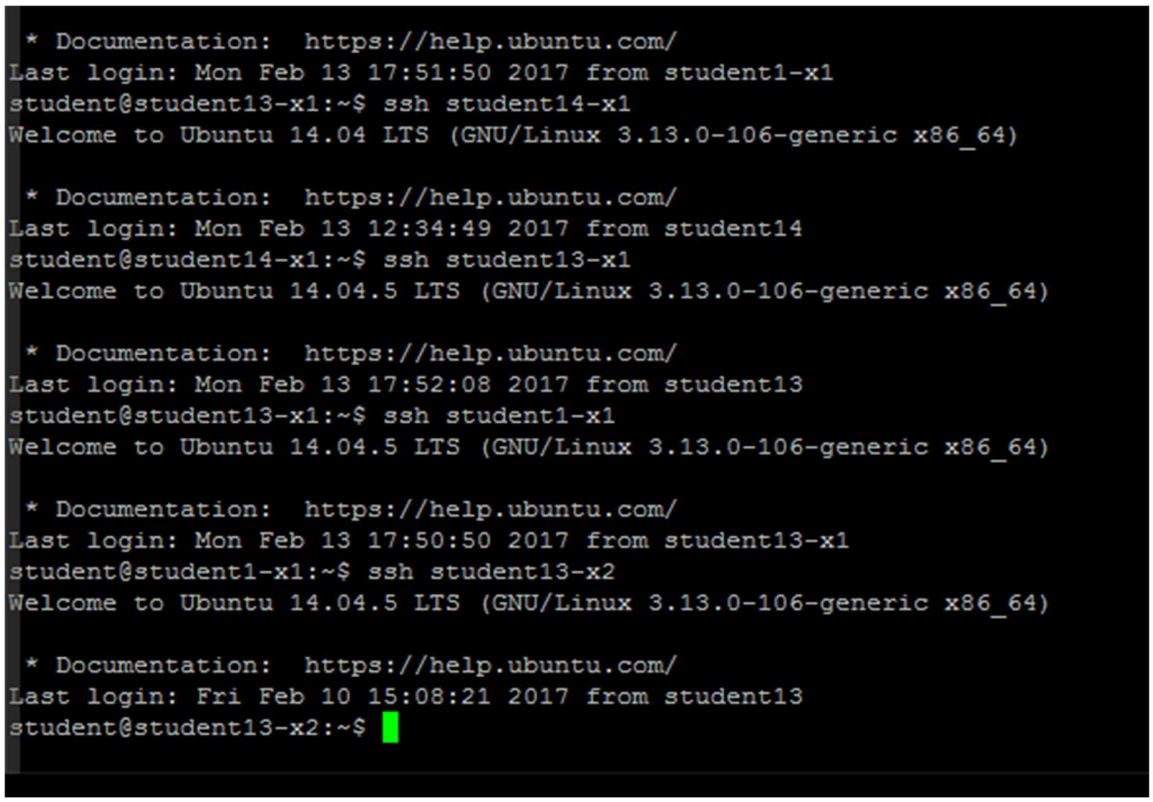
brctl showmacs xenbr0, both virtual machines seem to be on the list. Shown as non-local.

00:23:ae:9b:d1:3A 10.42.0.58 student13-x1

00:23:ae:9b:d1:3B 10.42.0.59 student13-x2

```
                                                        vif2.0
student@student13:~$ brctl showmacs xenbr0
port no mac addr                is local?       ageing timer
  1     00:06:52:58:34:00       no                 23.37
  1     00:11:bb:60:83:00       no                 48.63
  1     00:11:bb:60:83:06       no                  6.49
  1     00:1d:92:97:3f:f1       no                  0.58
  1     00:1d:92:97:44:fe       no                  4.17
  1     00:1d:92:97:57:96       no                  1.97
  1     00:1d:92:97:5a:7a       no                  1.57
  1     00:23:ae:9b:d0:a2       no                  3.30
  2     00:23:ae:9b:d1:3a       no                  0.22
  3     00:23:ae:9b:d1:3b       no                  0.22
  1     00:23:ae:9b:d1:48       no                225.25
  1     00:23:ae:9b:d1:a0       no                  2.18
  1     00:23:ae:9b:d1:a1       no                 10.19
  1     00:23:ae:9b:d1:b5       no                  3.78
  1     00:23:ae:9b:d1:b6       no                  4.16
  1     00:23:ae:9b:d2:05       no                  3.73
  1     00:23:ae:9b:d7:8f       no                  2.08
  1     00:23:ae:9b:db:82       no                  4.09
  1     00:23:ae:9b:db:93       no                  0.00
  1     00:23:ae:9c:04:37       no                  1.60
  1     00:23:ae:b0:9e:f9       no                  0.23
  1     00:23:ae:b0:ca:84       no                  0.00
  1     24:be:05:10:9f:db       yes                 0.00
  1     24:be:05:15:d3:7a       no                 38.41
  1     40:61:86:c4:d0:15       no                  7.31
  1     40:61:86:c7:9d:a8       no                 16.35
  1     5c:26:0a:bf:d5:bb       no                 13.25
  1     6c:62:6d:0c:1a:8e       no                  2.45
  2     fe:ff:ff:ff:ff:ff       yes                 0.00
student@student13:~$
```

SSH a VM without password from two other remote vms (e.G., Studentxx-x1 ←→ studentyy-x1, studentzz-x2). (“Ssh student@studentxx-x2”) (2%)



# GANGLIA

## 1 SSH tunneling setup and add Web UI.

Setup SSH tunneling to allow web access outside CBLG104 lab room. Show the GUI of your Ganglia (http://{IP_Address}/ganglia/). Should display CPU, memory, disk, network usage of your two VMs (x1 and x2) (2%)

### Short summary of process

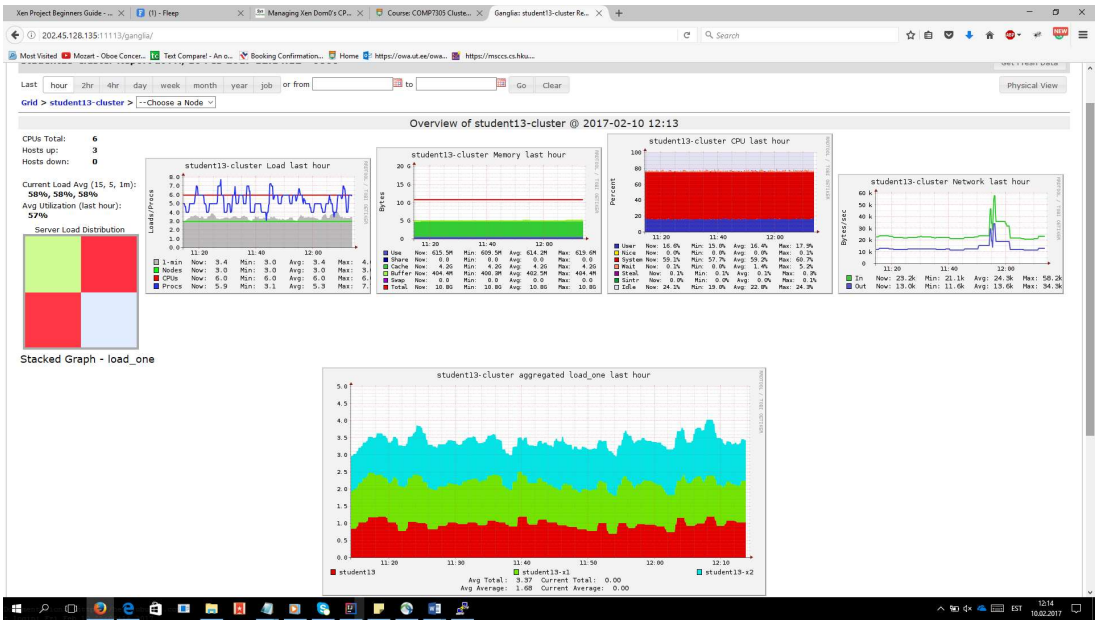
Ganglia Intro: https://www.digitalocean.com/community/tutorials/introduction-to-ganglia-on-ubuntu-14-04

Overall process here was that we configured gmetad and gmond on dom, and gmond-s on both virtualmachines. gmond is pretty much the information provider about the system and gmetad on dom0 listens/monitors this info and gives it to another tool, which then presents this information visually on apache web-server

Dom0, VM1,VM2 Accessible at Currently only dom0, because VM-s assigned to Cluster.

http://202.45.128.135:10113/ganglia

On Bottom graph we can see dom0, x1, x2 are monitored.



Physical View

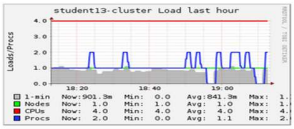
Grid > student13-cluster > --Choose a Node

Overview of student13-cluster @ 2017-02-13 19:12

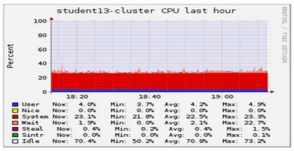
CPUs Total: **4**
Hosts up: **1**
Hosts down: **0**

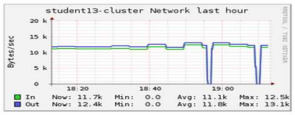
Current Load Avg (15, 5, 1m):
**22%, 22%, 21%**
Avg Utilization (last hour):
**21%**

Server Load Distribution

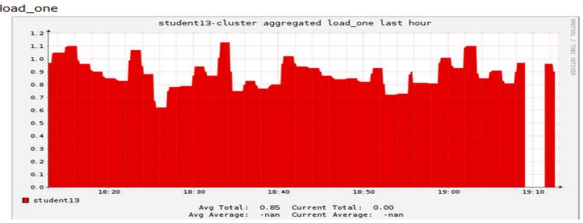







Stacked Graph - load_one

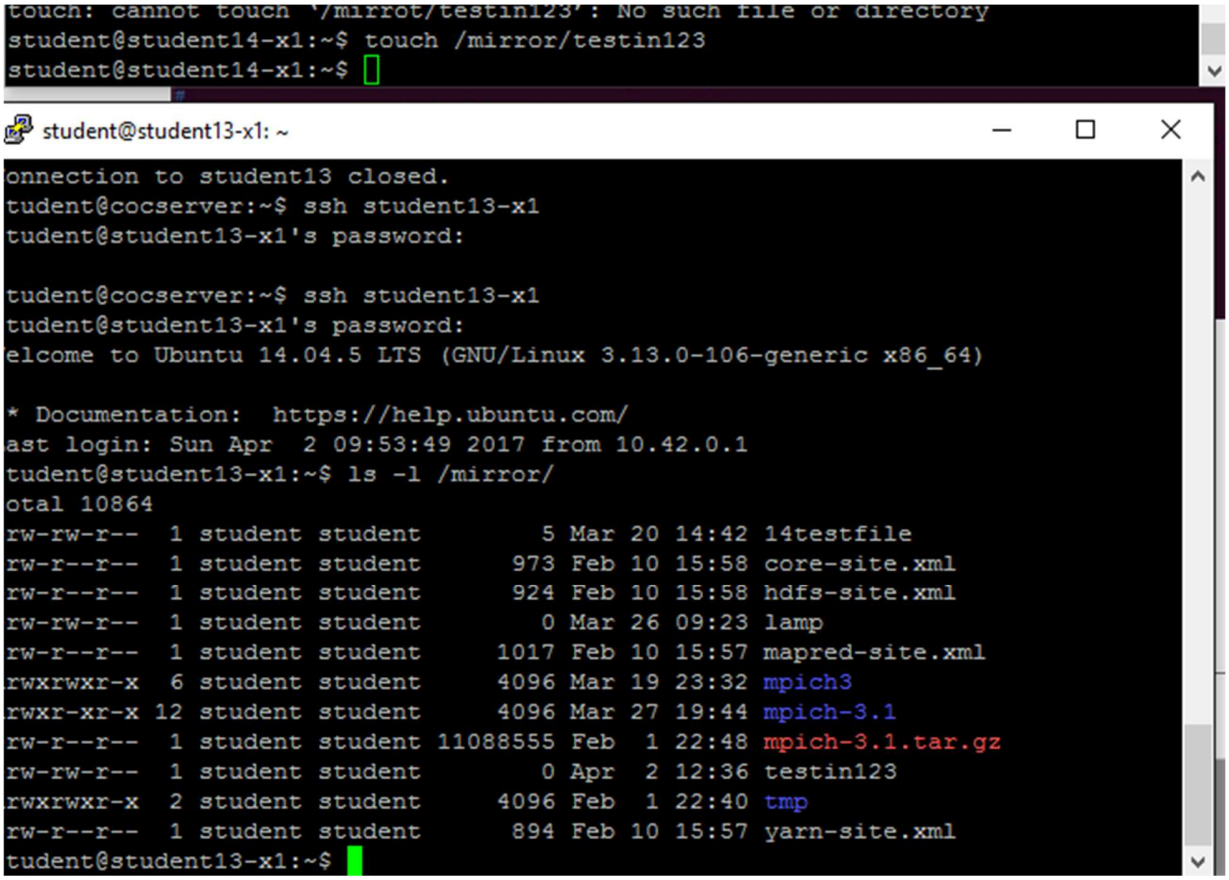


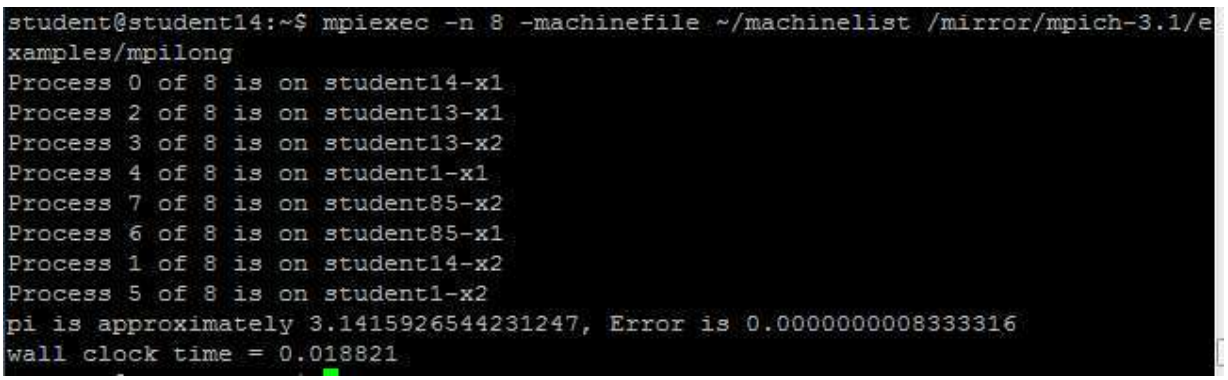
5%: NFS and MPICH

– Create new files in your NFS folder (/mirror). Show these newly created files can be viewed (“ls”) and accessed (“cat”) from a remote virtual machine (NFS client) created by your groupmate. **(2%)**

– **E**xecute the cpi MPI program on all 8 VMs to show the results. **(3%)**

[Note: you can show the execution status using Ganglia]

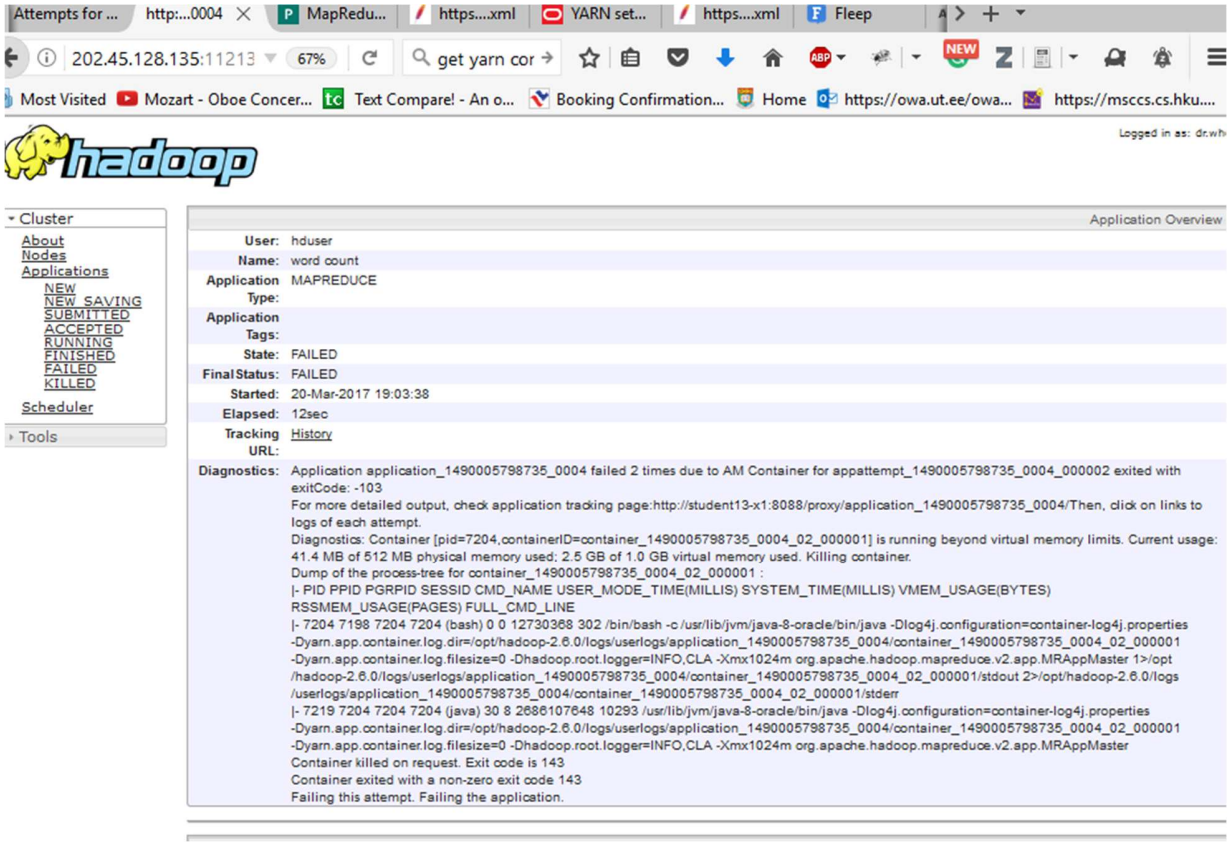


Swap space management:

**(4%)** Intentionally run a large MapReduce program that crashes because the system is “out of swap space”. Increase the swap space of your VMs to solve the problem. (Hint: (1). “swapoff” to turn off current swap space, (2). “dd” to increase current swap

space, (3). “mkswap” and “swapon” to turn on swap space; or something equivalent). [**Note**:
handle this problem after you finish most tasks in Part I ^_^]




Without swap and with 2 gb of memory for both, the map reduce crashed in different ways.

Adding swap solved the issue. This can be also solved by configurin yarn to run differently, e.g with less memory if the input tasks are possible with smalle containers

## Ganglia for Virtual Cluster Monitoring: (5%)

Used reports to monitor all together

CPU_REPORT

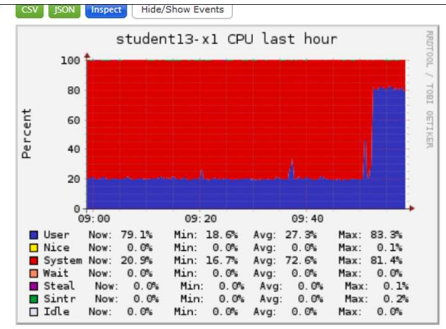
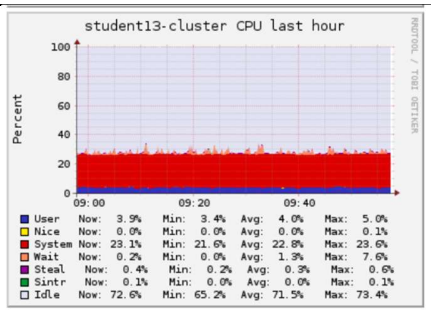
MEMORY_REPORT

Other useful commands to test and check ganglia

top
stress –cpu 3

**WordCount (word_input.txt 900MB) on the 8 VMs (no work to Dom0).**

- *For testing purposes, to see how ganglia follows cpu utilization I ran program*
  - *top*
  - *stress –cpu 3*
    - *Tested this on student13-x1- result*

| student13-x1 | student13 aka dom0 |
| --- | --- |
|  |  |

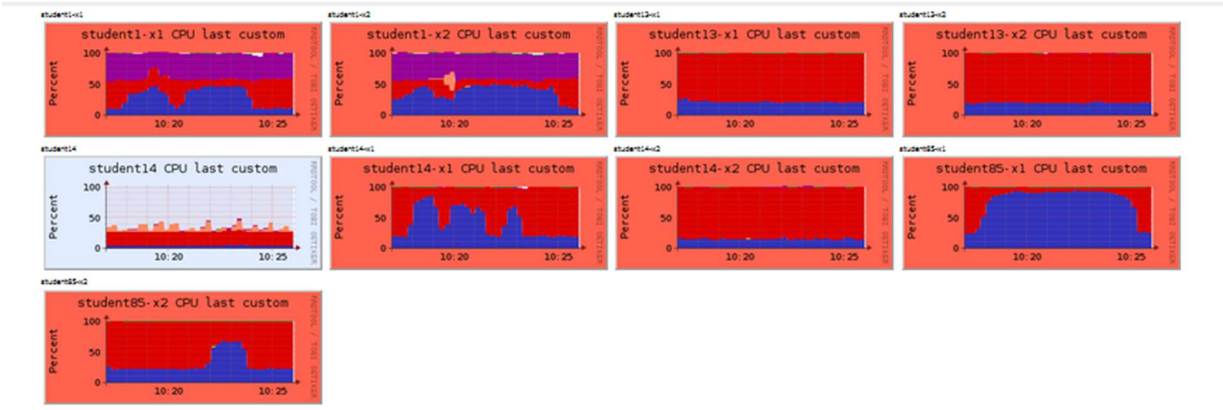




**Show the status (CPU, memory, disk, network) of the 8 VMs.**

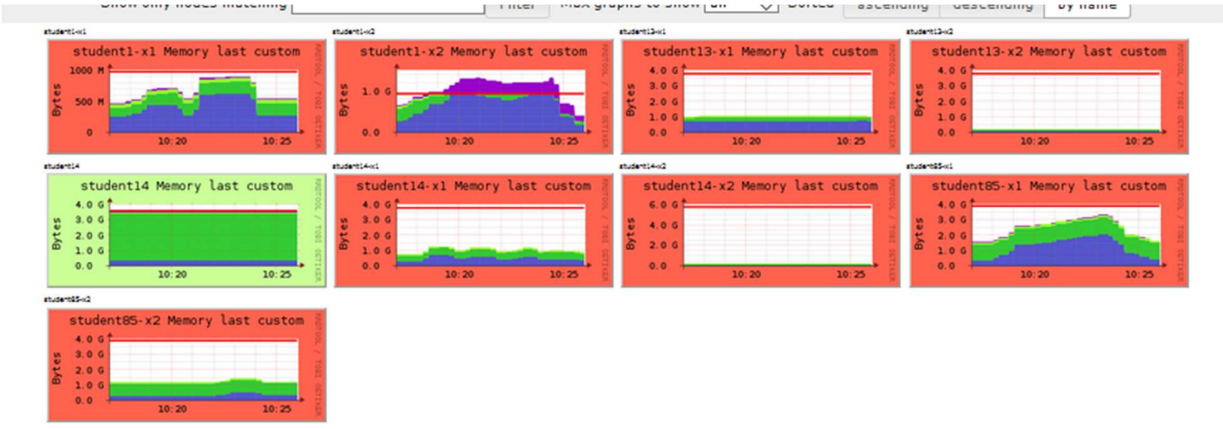
From: 10.17
To: 10.26

## CPU




(Nodes colored by 1-minute load) | Legend

## MEMORY

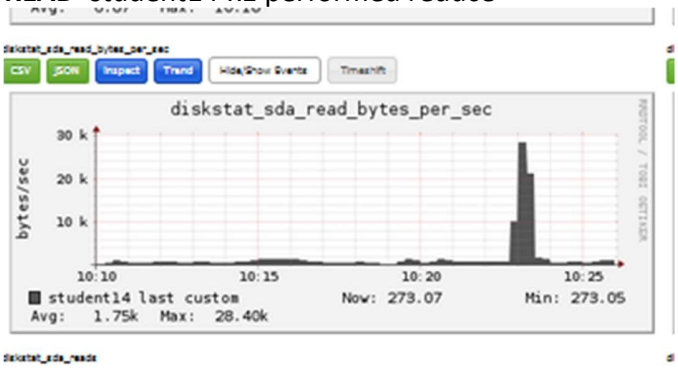



(Nodes colored by 1-minute load) | Legend

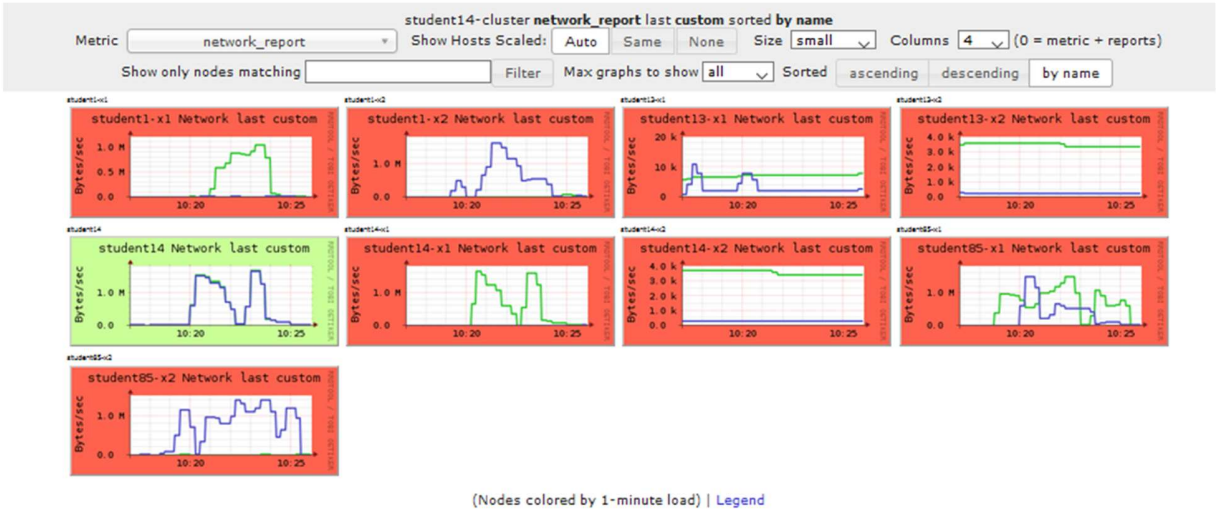
## DISK

http://eastcirclek.blogspot.hk/2015/10/monitoring-disk-throughput-using-ganglia.html
Because I had to install some python module to read every disk separately, I only followed disk load on Student 14-x1. But its easy to assume, that Disk IO was high before map operations (reading ), during sort, shuffle, merge phase (read, write) and reduce(read)

**READ** student14-x1 performed reduce



## NETWORK

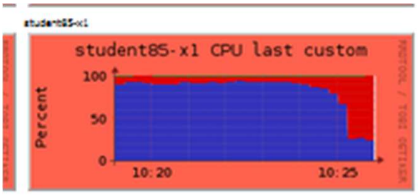



**Show which VM(s) has the highest CPU load during the Reduce phase. (3%)**

Reduce

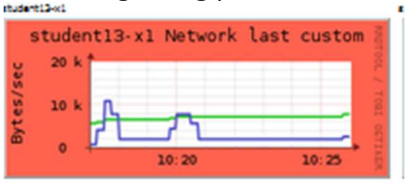
From: 10.19

To: 10.25




**Show which VM(s) involve the largest network load/traffic. Why? (2%)**

In the beginning phase it was the ResourceManager




After that it seems student85-x1 had the bigges io load. It is most likely because of misplaced datablocks.

# Hadoop

15%: Hadoop installation on a single machine with two VMs (x1 & x2): [Note: Must enable Yarn. You can choose one VM as the NameNodeand let both VMs as the DataNodes. Set the replication of the input data file to 1.]

## Definitions:

| | MASTER | SLAVE |
|---|---|---|
| HDFS | NameNode | DataNode |
| YARN | ResourceManager | NodeManager |

job – unit of work, the client wants to be performed

task – 1 map / reduce task

input- divided into input splits. 1 input split – 1 task

1 container runs 1 task

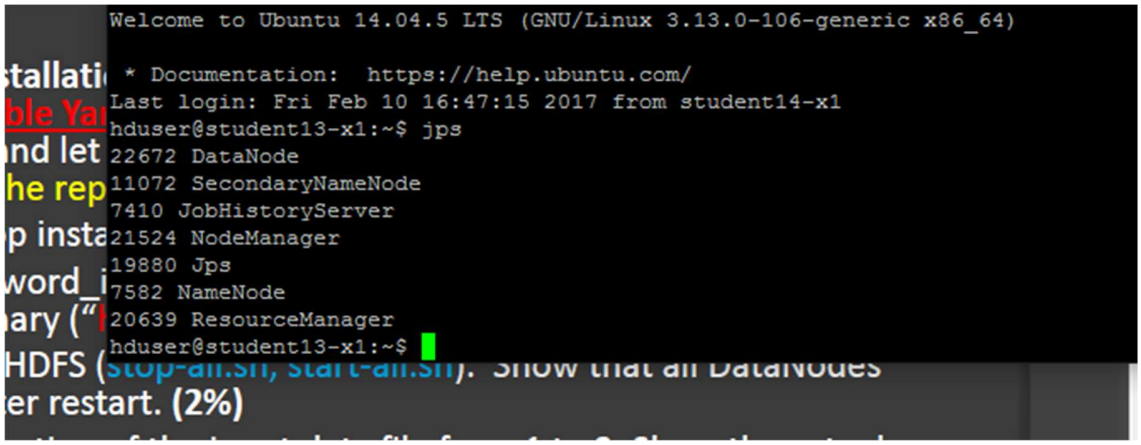
1 CONTAINER HAS 1 TASK WHICH PROCESSES 1 INPUT UNIT

The amount of containteres running concurrenly depends on memory and cvrpu settings.

There are multiple important parameters, when setting up a cluster

Verify the Hadoop installation: Do JPS on the two VMs respectively. (2%)

x1




x2

Load a file (500 MB) to HDFS and show the overall disk usage summary ("hdfs dfsadmin –report") (2%)

http://202.45.128.135:11113/dfshealth.html#tab-overview

```
hduser@student13-x1:~$ hdfs dfsadmin -report
Configured Capacity: 105420939264 (98.18 GB)
Present Capacity: 91731599360 (85.43 GB)
DFS Remaining: 89826762752 (83.66 GB)
DFS Used: 1904836608 (1.77 GB)
DFS Used%: 2.08%
Under replicated blocks: 0
Blocks with corrupt replicas: 0
Missing blocks: 0

-------------------------------------------------
Live datanodes (2):

Name: 10.42.0.59:50010 (student13-x2)
Hostname: student13-x2
Decommission Status : Normal
Configured Capacity: 52710469632 (49.09 GB)
DFS Used: 952418304 (908.30 MB)
Non DFS Used: 6270291968 (5.84 GB)
DFS Remaining: 45487759360 (42.36 GB)
DFS Used%: 1.81%
DFS Remaining%: 86.30%
Configured Cache Capacity: 0 (0 B)
Cache Used: 0 (0 B)
Cache Remaining: 0 (0 B)
Cache Used%: 100.00%
Cache Remaining%: 0.00%
Xceivers: 1
Last contact: Tue Feb 14 18:25:24 HKT 2017


Name: 10.42.0.58:50010 (student13-x1)
Hostname: student13-x1
Decommission Status : Normal
Configured Capacity: 52710469632 (49.09 GB)
DFS Used: 952418304 (908.30 MB)
Non DFS Used: 7419047936 (6.91 GB)
DFS Remaining: 44339003392 (41.29 GB)
DFS Used%: 1.81%
DFS Remaining%: 84.12%
Configured Cache Capacity: 0 (0 B)
Cache Used: 0 (0 B)
Cache Remaining: 0 (0 B)
Cache Used%: 100.00%
Cache Remaining%: 0.00%
Xceivers: 1
Last contact: Tue Feb 14 18:25:24 HKT 2017
```

# Datanode Information

## In operation

| Node | Last contact | Admin State | Capacity | Used | Non DFS Used | Remaining | Blocks | Block pool used | Failed Volumes | Version |
|---|---|---|---|---|---|---|---|---|---|---|
| student13-x2 (10.42.0.59:50010) | 0 | In Service | 49.09 GB | 907.22 MB | 5.84 GB | 42.36 GB | 15 | 907.22 MB (1.8%) | 0 | 2.6.0 |
| student13-x1 (10.42.0.58:50010) | 0 | In Service | 49.09 GB | 907.22 MB | 6.91 GB | 41.29 GB | 15 | 907.22 MB (1.8%) | 0 | 2.6.0 |

## Decomissioning

| Node | Last contact | Under replicated blocks | Blocks with no live replicas | Under Replicated Blocks In files under construction |
|---|---|---|---|---|

Hadoop, 2014.

Legacy UI

Stop and restart HDFS (stop-all.sh, start-all.sh). Verify that all DataNodesremain active after restart. (2%)

```
hduser@student13-x1:~$ start-dfs.sh
Starting namenodes on [student13-x1]
student13-x1: starting namenode, logging to /opt/hadoop-2.6.0/logs/hadoop-hduser-namenode-student13-x1.out
student13-x2: starting datanode, logging to /opt/hadoop-2.6.0/logs/hadoop-hduser-datanode-student13-x2.out
student13-x1: starting datanode, logging to /opt/hadoop-2.6.0/logs/hadoop-hduser-datanode-student13-x1.out
Starting secondary namenodes [0.0.0.0]
0.0.0.0: starting secondarynamenode, logging to /opt/hadoop-2.6.0/logs/hadoop-hduser-secondarynamenode-student13-x1.o
ut
hduser@student13-x1:~$ jps
21908 SecondaryNameNode
19991 DataNode
2681 Jps
18911 NameNode
```

Run WordCount(512 MB) on the two VMs and report the execution time.

Show the # of running containers, # of map and reduce tasks during the execution of the WordCountjob. (Note 2) (4%)

Example

This is running an already built file

hadoop jar /opt/hadoop-2.6.0/share/hadoop/mapreduce/hadoop-mapreduce-examples-2.6.0.jar wordcount / dft-single-13x1 /dft-single-13x1-output-randomString

This is running a .java file, that has not been previously built.

mkdir wordcount_classes

### Compilation

javac -cp /opt/hadoop-2.6.0/share/hadoop/mapreduce/hadoop-mapreduce-client-core-2.6.0. jar:/opt/hadoop-2.6.0/share/hadoop/common/hadoop-common2.6.0.jar :/…… -d wordcount_classes WordCount.java

-cp : classpath

-d directory

### Create jar

jar -cvfwordcount.jar -C wordcount_classes/ .

### Run the specific example

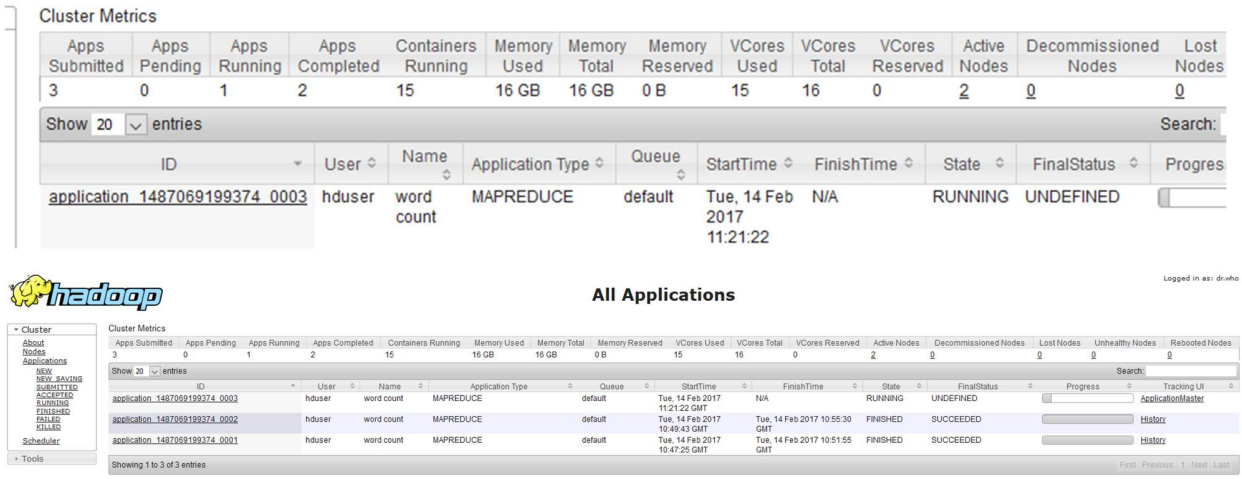
hadoop/yarn jar wordcount.jar org.myorg.WordCount/dft /dft-output-2

*hadoop and yarn command in this case same*
*http://stackoverflow.com/questions/22769129/differences-between-hadoop-jar-and-yarn-jar*

### Retrieve the result

hdfs dfs -copyToLocal /dft-output2  ~/

# Running Containers 15



Cluster Metrics

| Apps Submitted | Apps Pending | Apps Running | Apps Completed | Containers Running | Memory Used | Memory Total | Memory Reserved | VCores Used | VCores Total | VCores Reserved | Active Nodes | Decommissioned Nodes | Lost Nodes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 0 | 1 | 2 | 15 | 16 GB | 16 GB | 0 B | 15 | 16 | 0 | 2 | 0 | 0 |

Show 20 entries Search:

| ID | User | Name | Application Type | Queue | StartTime | FinishTime | State | FinalStatus | Progres |
|---|---|---|---|---|---|---|---|---|---|
| application_1487069199374_0003 | hduser | word count | MAPREDUCE | default | Tue, 14 Feb 2017 11:21:22 | N/A | RUNNING | UNDEFINED | |



All Applications

Logged in as: dr.who

Cluster

About
Nodes
Applications
NEW
NEW_SAVING
SUBMITTED
ACCEPTED
RUNNING
FINISHED
FAILED
KILLED
Scheduler

Tools

Cluster Metrics

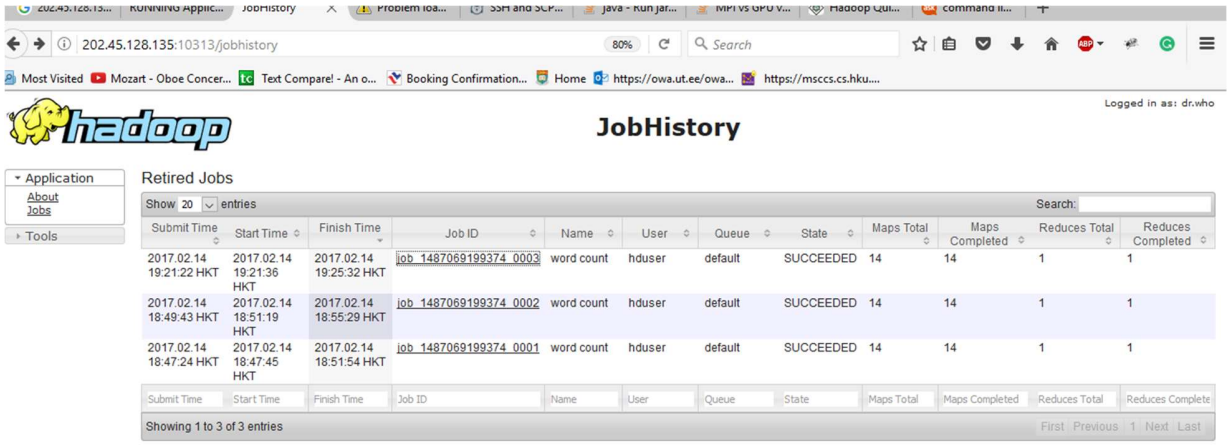
| Apps Submitted | Apps Pending | Apps Running | Apps Completed | Containers Running | Memory Used | Memory Total | Memory Reserved | VCores Used | VCores Total | VCores Reserved | Active Nodes | Decommissioned Nodes | Lost Nodes | Unhealthy Nodes | Rebooted Nodes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 0 | 1 | 2 | 15 | 16 GB | 16 GB | 0 B | 15 | 16 | 0 | 2 | 0 | 0 | 0 | 0 |

Show 20 entries Search:

| ID | User | Name | Application Type | Queue | StartTime | FinishTime | State | FinalStatus | Progress | Tracking UI |
|---|---|---|---|---|---|---|---|---|---|---|
| application_1487069199374_0003 | hduser | word count | MAPREDUCE | default | Tue, 14 Feb 2017 11:21:22 GMT | N/A | RUNNING | UNDEFINED | | ApplicationMaster |
| application_1487069199374_0002 | hduser | word count | MAPREDUCE | default | Tue, 14 Feb 2017 10:49:43 GMT | Tue, 14 Feb 2017 10:55:30 GMT | FINISHED | SUCCEEDED | | History |
| application_1487069199374_0001 | hduser | word count | MAPREDUCE | default | Tue, 14 Feb 2017 10:47:25 GMT | Tue, 14 Feb 2017 10:51:55 GMT | FINISHED | SUCCEEDED | | History |

Showing 1 to 3 of 3 entries First Previous 1 Next Last

# Maps = 14 & Reduces = 1



202.45.128.135:10313/jobhistory

Most Visited Mozart - Oboe Concer... Text Compare! - An o... Booking Confirmation... Home https://owa.ut.ee/owa... https://msccs.cs.hku....

Logged in as: dr.who

JobHistory

Application
About
Jobs

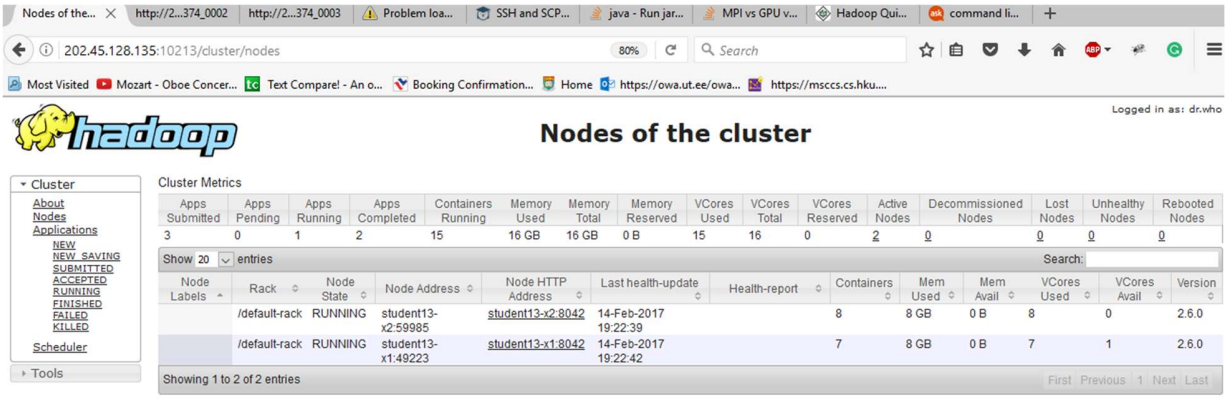
Tools

Retired Jobs

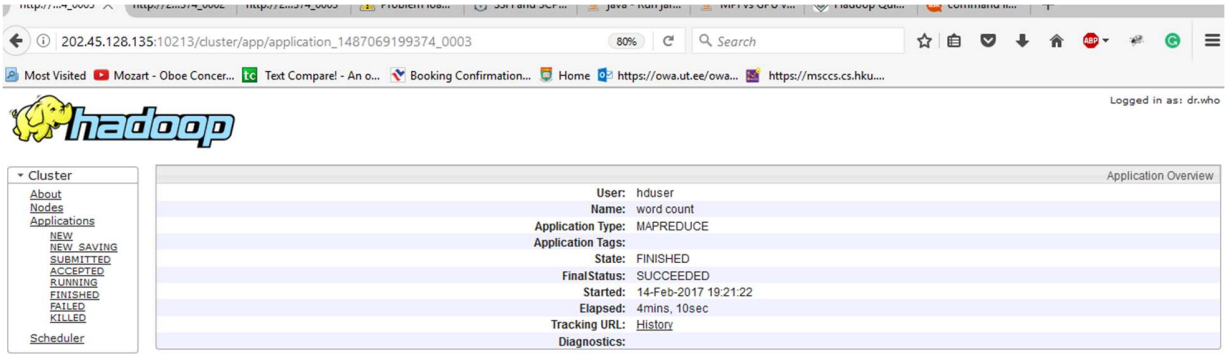
Show 20 entries Search:

| Submit Time | Start Time | Finish Time | Job ID | Name | User | Queue | State | Maps Total | Maps Completed | Reduces Total | Reduces Completed |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2017.02.14 19:21:22 HKT | 2017.02.14 19:21:36 HKT | 2017.02.14 19:25:32 HKT | job_1487069199374_0003 | word count | hduser | default | SUCCEEDED | 14 | 14 | 1 | 1 |
| 2017.02.14 18:49:43 HKT | 2017.02.14 18:51:19 HKT | 2017.02.14 18:55:29 HKT | job_1487069199374_0002 | word count | hduser | default | SUCCEEDED | 14 | 14 | 1 | 1 |
| 2017.02.14 18:47:24 HKT | 2017.02.14 18:47:45 HKT | 2017.02.14 18:51:54 HKT | job_1487069199374_0001 | word count | hduser | default | SUCCEEDED | 14 | 14 | 1 | 1 |

Showing 1 to 3 of 3 entries First Previous 1 Next Last




After Run 2. We can see, that time it took to run the program was 4 minutes. It had 15 containers running. 13 map tasks, 1 reduce task and also one AM




TeraSort(with 500 & 900 MB data) on a single machine (2%).

Show the execution time for sorting 500 MB data using 2 VMs (x1 & x2). Validate the sorted output data of TeraSort. (TeraValidate)

Generate data

```
hduser@student13-x1:/opt/hadoop-2.6.0/share/hadoop/mapreduce$ yarn jar hadoop-mapreduce-examples-2.6.0.jar teragen 50
00000 /terainput
```

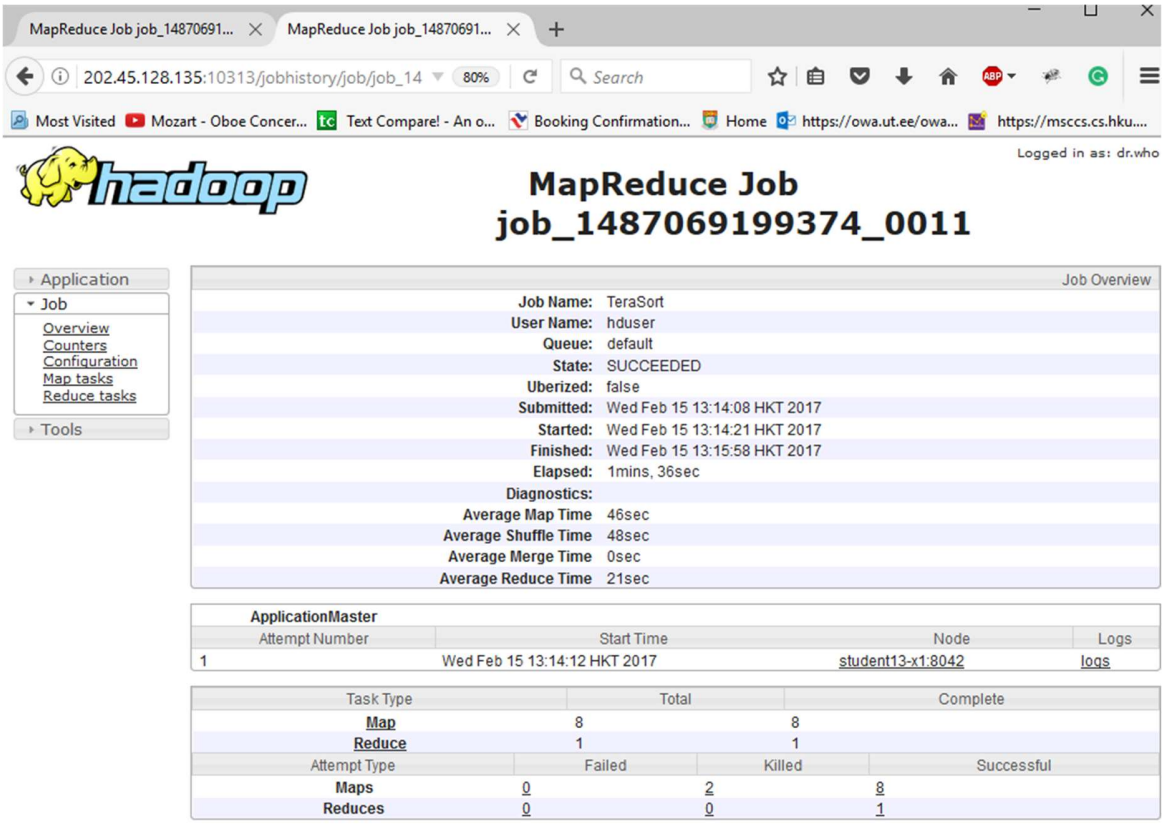
Sort

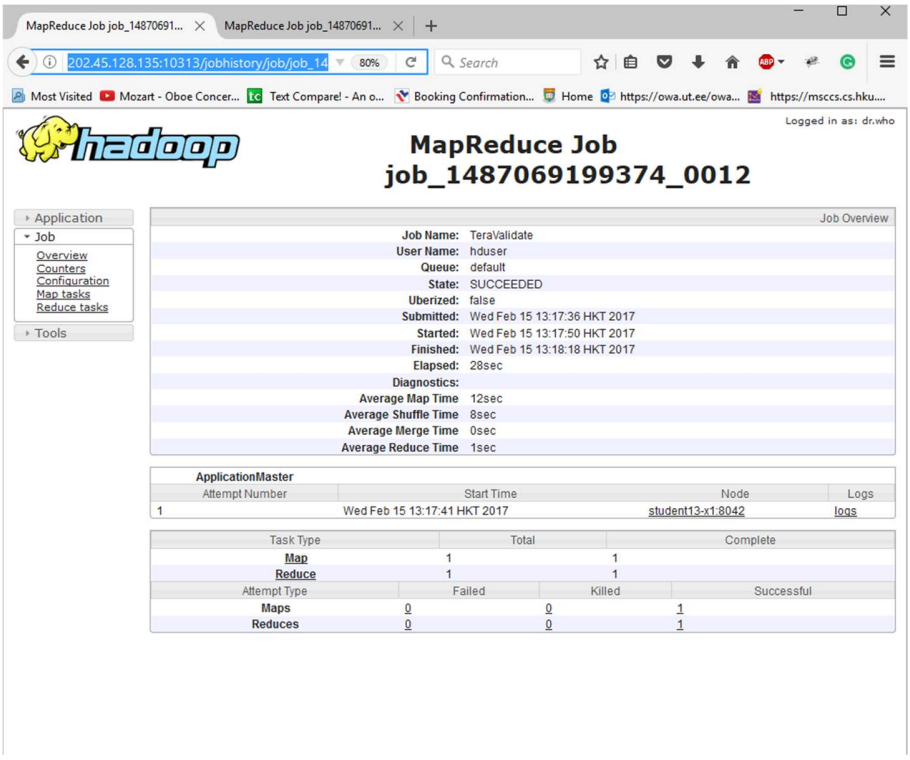
```
                Bytes Written=500000000
hduser@student13-x1:/opt/hadoop-2.6.0/share/hadoop/mapreduce$ yarn jar hadoop-mapreduce-examples-2.6.0.jar terasort /
terainput /teraoutput
17/02/15 13:13:57 INFO terasort.TeraSort: starting
```

Validate - Success

```
hduser@student13-x1:/opt/hadoop-2.6.0/share/hadoop/mapreduce$ yarn jar hadoop-mapreduce-examples-2.6.0.jar teravalida
te /teraoutput /teravalidate
17/02/15 13:17:32 INFO client.RMProxy: Connecting to ResourceManager at student13-x1/10.42.0.58:8032
```

Sort time 1 min, 36 sec

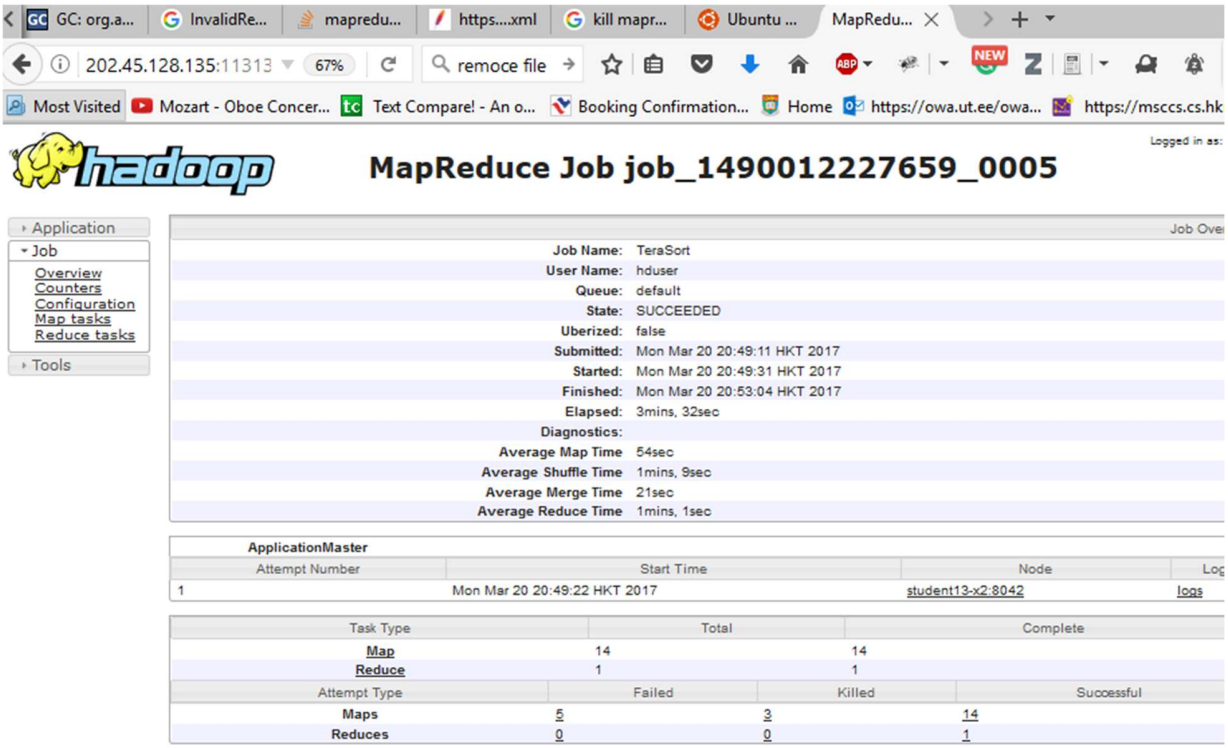

MapReduce Job job_14870691...
MapReduce Job job_14870691...
202.45.128.135:10313/jobhistory/job/job_14
80%
Search
Most Visited
Mozart - Oboe Concer...
Text Compare! - An o...
Booking Confirmation...
Home
https://owa.ut.ee/owa...
https://msccs.cs.hku....
Logged in as: dr.who
hadoop
MapReduce Job
job_1487069199374_0011
Application
Job
Overview
Counters
Configuration
Map tasks
Reduce tasks
Tools
Job Overview
Job Name: TeraSort
User Name: hduser
Queue: default
State: SUCCEEDED
Uberized: false
Submitted: Wed Feb 15 13:14:08 HKT 2017
Started: Wed Feb 15 13:14:21 HKT 2017
Finished: Wed Feb 15 13:15:58 HKT 2017
Elapsed: 1mins, 36sec
Diagnostics:
Average Map Time 46sec
Average Shuffle Time 48sec
Average Merge Time 0sec
Average Reduce Time 21sec
ApplicationMaster
Attempt Number
Start Time
Node
Logs
1
Wed Feb 15 13:14:12 HKT 2017
student13-x1:8042
logs
Task Type
Total
Complete
Map
8
8
Reduce
1
1
Attempt Type
Failed
Killed
Successful
Maps
0
2
8
Reduces
0
0
1


MapReduce Job job_14870691...
MapReduce Job job_14870691...
202.45.128.135:10313/jobhistory/job/job_14
80%
Search
Most Visited
Mozart - Oboe Concer...
Text Compare! - An o...
Booking Confirmation...
Home
https://owa.ut.ee/owa...
https://msccs.cs.hku....
Logged in as: dr.who
hadoop
MapReduce Job
job_1487069199374_0012
Application
Job
Overview
Counters
Configuration
Map tasks
Reduce tasks
Tools
Job Overview
Job Name: TeraValidate
User Name: hduser
Queue: default
State: SUCCEEDED
Uberized: false
Submitted: Wed Feb 15 13:17:36 HKT 2017
Started: Wed Feb 15 13:17:50 HKT 2017
Finished: Wed Feb 15 13:18:18 HKT 2017
Elapsed: 28sec
Diagnostics:
Average Map Time 12sec
Average Shuffle Time 8sec
Average Merge Time 0sec
Average Reduce Time 1sec
ApplicationMaster
Attempt Number
Start Time
Node
Logs
1
Wed Feb 15 13:17:41 HKT 2017
student13-x1:8042
logs
Task Type
Total
Complete
Map
1
1
Reduce
1
1
Attempt Type
Failed
Killed
Successful
Maps
0
0
1
Reduces
0
0
1

900 mb data

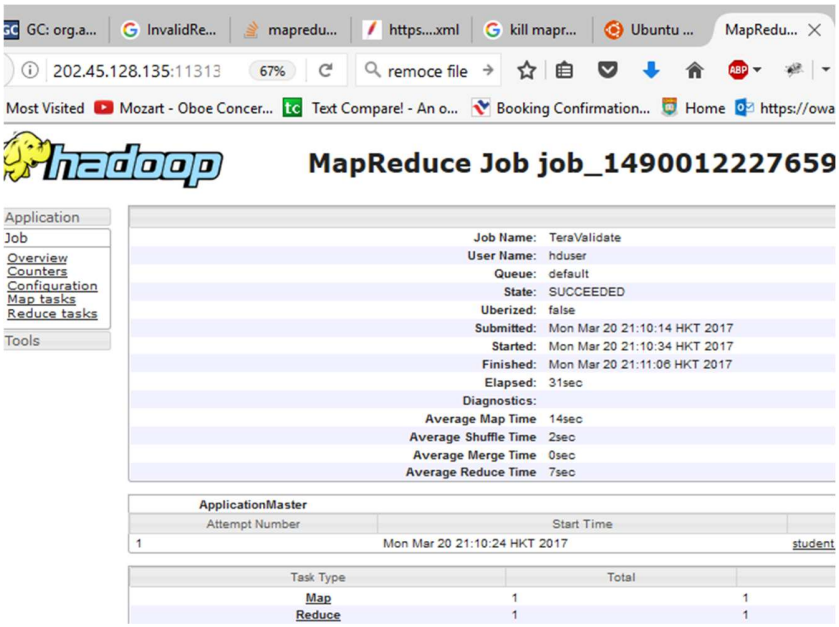
```
              Bytes Written=900000000
17/03/20 20:53:02 INFO terasort.TeraSort: done
hduser@student13-x1:~$ yarn jar /opt/hadoop-2.6.0/share/hadoop/mapreduce/hadoop-mapreduce-examples-2.6.0.jar te
/terainput900-4 teraoutput900-4
17/03/20 20:55:14 INFO terasort.TeraSort: starting
17/03/20 20:55:19 ERROR terasort.TeraSort: Input path does not exist: hdfs://student13-x1:9000/terainput900-4
hduser@student13-x1:~$ yarn jar /opt/hadoop-2.6.0/share/hadoop/mapreduce/hadoop-mapreduce-examples-2.6.0.jar te
/terainput900 teraoutput900-4
17/03/20 20:55:33 INFO terasort.TeraSort: starting
17/03/20 20:55:36 INFO input.FileInputFormat: Total input paths to process : 2
Spent 552ms computing base-splits.
Spent 7ms computing TeraScheduler splits.
Computing input splits took 573ms
Sampling 10 splits of 14
Making 1 from 100000 sampled records
Computing parititions took 2432ms
Spent 3011ms computing partitions.
17/03/20 20:55:39 INFO client.RMProxy: Connecting to ResourceManager at student13-x1/10.42.0.58:8032
17/03/20 20:55:42 INFO mapreduce.JobSubmitter: number of splits:14
17/03/20 20:55:42 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1490012227659_0006
17/03/20 20:55:43 INFO impl.YarnClientImpl: Submitted application application_1490012227659_0006
17/03/20 20:55:43 INFO mapreduce.Job: The url to track the job: http://student13-x1:8088/proxy/application_1490
59_0006/
17/03/20 20:55:43 INFO mapreduce.Job: Running job: job_1490012227659_0006
17/03/20 20:55:58 INFO mapreduce.Job: Job job_1490012227659_0006 running in uber mode : false
17/03/20 20:55:58 INFO mapreduce.Job:  map 0% reduce 0%
17/03/20 20:56:32 INFO mapreduce.Job:  map 2% reduce 0%
17/03/20 20:56:33 INFO mapreduce.Job:  map 6% reduce 0%
17/03/20 20:56:34 INFO mapreduce.Job:  map 9% reduce 0%
17/03/20 20:56:36 INFO mapreduce.Job:  map 11% reduce 0%
17/03/20 20:56:37 INFO mapreduce.Job:  map 13% reduce 0%
17/03/20 20:56:39 INFO mapreduce.Job:  map 16% reduce 0%
17/03/20 20:56:40 INFO mapreduce.Job:  map 18% reduce 0%
17/03/20 20:56:42 INFO mapreduce.Job:  map 21% reduce 0%
17/03/20 20:56:43 INFO mapreduce.Job:  map 25% reduce 0%
```

```
                BAD_ID=0
                CONNECTION=0
                IO_ERROR=0
                WRONG_LENGTH=0
                WRONG_MAP=0
                WRONG_REDUCE=0
        File Input Format Counters
                Bytes Read=900000000
        File Output Format Counters
                Bytes Written=900000000
17/03/20 20:58:47 INFO terasort.TeraSort: done
hduser@student13-x1:~$
```




Above you can find  Time to sort 900 mb

Teravalidate took 31 sec



Because Student2 did not work (hard disk failure as it turned out) I just in case reconfigured the cluster for execution with 6 vm-s to do the assignement last Saturday. I did this to avoid time clashes later on. Our group was assigned a new computer (student85) this Thursday, but I did not do all the tasks again. Only somee. In those places I have noted that. Default is 6 vm cluster.

– **[All the above tasks should be done on the machine assigned to you. We will verify the machine ID or IP address from your screen shots.]**

## 25%: Hadoop Installation on 8 VMs (4 machines)

[Reconfigure Xen and Hadoop to construct an 8-VM virtual cluster with ONE VM serves as the master node (ResourceManager + NameNode), and the other 7 VMs as salve nodes (NodeManager + DataNode). **You should also create a new user account for yourself. Each member should use his/her own user account for the MapReduce job submission.]**

– Show the hardware and VM configuration in one table (See a sample table at the end of this evaluation form). Indicate the role(s) of each VM in the Hadoop cluster (Master/Slave, NameNode/DataNode, ResourceManager/NodeManager). **(2%)**

| **name** | **student13** | | **student14** | | **student1** | | **student85** | |
|---|---|---|---|---|---|---|---|---|
| **ip** | **10.42.0.57** | | **10.42.0.60** | | **10.42.0.21** | | 10.42.0.237 | |
| **cpu** | Intel(R) Core(TM) i-5 CPU @ 3.GHz | | Intel(R) Core(TM) i-5 CPU @ 3.GHz | | Intel(R) Core(TM)2 Duo CPU @ 2.83GHz | | Intel(R) Core(TM) i5 CPU @ 3.33GHz | |
| **memory** | DIMM DDR3 Synchronous 1600 MHz (0.6 ns) (16G) | | DIMM DDR3 Synchronous 1600 MHz (0.6 ns) (16G) | | DIMM DDR2 Synchronous 667 MHz (1.5 ns) (4G) | | DIMM DDR3 Synchronous 1333 MHz (0.8 ns) (16G) , seems like only 4g allowed tho | |
| **Disk** | **500 GB** | | **500 GB** | | **250 GB** | | **250 GB** | |
| **Virtual Machines** | | | | | | | | |
| **Name** | **x1** | **x2** | **x1** | **x2** | **x1** | **x2** | **x1** | **x2** |
| **IP** | **10.42.0.58** | **10.42.0.59** | **10.42.0.61** | **10.42.0.62** | **10.42.01.22** | **10.42.01.23** | 10.42.1.84 | 10.42.1.85 |
| **MAC** | 00:23:ae:9b:d1:3A | 00:23:ae:9b:d1:3B | 00:23:ae:9b:d1:3D | 00:23:ae:9b:d1:3E | 00:23:ae:9b:d1:16 | 00:23:ae:9b:d1:17 | 00:23:ae:9b:d2:07 | 00:23:ae:9b:d2:08 |
| **Memory** | **4** | **4** | **4** | **4** | **1** | **1** | **1** | **4** |
| **Storage** | **50** | **50** | **50** | **50** | **50** | **50** | **50** | **50** |

For all the machines x3 vm has the same specified settings.

– **Set the default number of replication to 2** (number_of_replicas = 2). Load a large file (1 GB) to HDFS and show the overall disk usage summary ("hdfs dfsadmin –report"). **(2%)**

**8 VM cluster**
**Before adding**

```
hduser@student13-x1:/opt/hadoop-2.6.0/etc/hadoop$ hdfs dfsadmin -report
Configured Capacity: 368973287424 (343.63 GB)
Present Capacity: 293570928640 (273.41 GB)
DFS Remaining: 289984102400 (270.07 GB)
DFS Used: 3586826240 (3.34 GB)
DFS Used%: 1.22%
Under replicated blocks: 2
Blocks with corrupt replicas: 0
Missing blocks: 0

-------------------------------------------------
Live datanodes (7):

Name: 10.42.0.26:50010 (student2-x2)
Hostname: student2-x2
Decommission Status : Normal
Configured Capacity: 52710469632 (49.09 GB)
DFS Used: 746242048 (711.67 MB)
Non DFS Used: 6822391808 (6.35 GB)
DFS Remaining: 45141835776 (42.04 GB)
DFS Used%: 1.42%
DFS Remaining%: 85.64%
Configured Cache Capacity: 0 (0 B)
Cache Used: 0 (0 B)
Cache Remaining: 0 (0 B)
Cache Used%: 100.00%
Cache Remaining%: 0.00%
Xceivers: 1
Last contact: Fri Mar 24 13:12:07 HKT 2017


Name: 10.42.0.23:50010 (student1-x2)
Hostname: student1-x2
```

– Check the location of data blocks of the uploaded word_input.txt file(with 900 MB data). Show if data blocks are evenly distributed among the DataNodes. **(2%)**

In operation

| Node | Last contact | Admin State | Capacity | Used | Non DFS Used | Remaining | Blocks | Block pool used | Failed Volumes | Version |
|---|---|---|---|---|---|---|---|---|---|---|
| student13-x2 (10.42.0.59:50010) | 2 | In Service | 49.09 GB | 456.27 MB | 6.8 GB | 41.84 GB | 8 | 456.27 MB (0.91%) | 0 | 2.6.0 |
| student14-x2 (10.42.0.62:50010) | 2 | In Service | 49.09 GB | 645.78 MB | 8.34 GB | 40.12 GB | 10 | 645.78 MB (1.28%) | 0 | 2.6.0 |
| student1-x2 (10.42.0.23:50010) | 1 | In Service | 49.09 GB | 129.19 MB | 5.77 GB | 43.2 GB | 2 | 129.19 MB (0.26%) | 0 | 2.6.0 |
| student1-x1 (10.42.0.22:50010) | 2 | In Service | 49.09 GB | 327.13 MB | 26.16 GB | 22.61 GB | 6 | 327.13 MB (0.65%) | 0 | 2.6.0 |
| student14-x1 (10.42.0.61:50010) | 2 | In Service | 49.09 GB | 258.34 MB | 9.23 GB | 39.6 GB | 4 | 258.34 MB (0.51%) | 0 | 2.6.0 |

We can clearly see, that there are 30 blocks in the dfs filesystem after adding the word_input.txt file with duplication 2. 30 blocks = (block size = 64M) = 1920MB



– **Stop and restart HDFS** (stop-all.sh, start-all.sh). Show all DataNodes remain active and health after restart (jps). [**Warning**: if HDFS was not set up properly, you may find your DataNode is not starting (e.g., not shown in jps). If this happens, report how you fix the problem. **Hints:** You could first manually start a DataNode ("hadoop datanode"). In the worst case, you may need to reformat the NameNode: "hadoop namenode –format". Be careful, this command will destroy all the data on the Hadoop file system.] **(2%)**

**8VM**
Script I ran

```
# My first script


stop-yarn.sh
stop-dfs.sh
mr-jobhistory-daemon.sh stop historyserver


start-dfs.sh
start-yarn.sh
mr-jobhistory-daemon.sh start historyserver


~
~
```

8VM

Result- Everything worked

```
hduser@student13-x1:~$ \. starthadoop
stopping yarn daemons
stopping resourcemanager
student14-x1: stopping nodemanager
student14-x2: stopping nodemanager
student13-x2: stopping nodemanager
student2-x1: stopping nodemanager
student2-x2: stopping nodemanager
student1-x2: stopping nodemanager
student1-x1: stopping nodemanager
student14-x2: nodemanager did not stop gracefully after 5 seconds: killing with kill -9
student14-x1: nodemanager did not stop gracefully after 5 seconds: killing with kill -9
student13-x2: nodemanager did not stop gracefully after 5 seconds: killing with kill -9
student2-x1: nodemanager did not stop gracefully after 5 seconds: killing with kill -9
student2-x2: nodemanager did not stop gracefully after 5 seconds: killing with kill -9
student1-x2: nodemanager did not stop gracefully after 5 seconds: killing with kill -9
student1-x1: nodemanager did not stop gracefully after 5 seconds: killing with kill -9
no proxyserver to stop
Stopping namenodes on [student13-x1]
student13-x1: stopping namenode
student14-x1: stopping datanode
student14-x2: stopping datanode
student13-x2: stopping datanode
student2-x2: stopping datanode
student1-x2: stopping datanode
student2-x1: stopping datanode
student1-x1: stopping datanode
Stopping secondary namenodes [0.0.0.0]
0.0.0.0: stopping secondarynamenode
stopping historyserver
Starting namenodes on [student13-x1]
student13-x1: starting namenode, logging to /opt/hadoop-2.6.0/logs/hadoop-hduser-namenode-student13-x1.out
student13-x2: starting datanode, logging to /opt/hadoop-2.6.0/logs/hadoop-hduser-datanode-student13-x2.out
student14-x2: starting datanode, logging to /opt/hadoop-2.6.0/logs/hadoop-hduser-datanode-student14-x2.out
student14-x1: starting datanode, logging to /opt/hadoop-2.6.0/logs/hadoop-hduser-datanode-student14-x1.out
student2-x2: starting datanode, logging to /opt/hadoop-2.6.0/logs/hadoop-hduser-datanode-student2-x2.out
student1-x2: starting datanode, logging to /opt/hadoop-2.6.0/logs/hadoop-hduser-datanode-student1-x2.out
student1-x1: starting datanode, logging to /opt/hadoop-2.6.0/logs/hadoop-hduser-datanode-student1-x1.out
student2-x1: starting datanode, logging to /opt/hadoop-2.6.0/logs/hadoop-hduser-datanode-student2-x1.out
Starting secondary namenodes [0.0.0.0]
0.0.0.0: starting secondarynamenode, logging to /opt/hadoop-2.6.0/logs/hadoop-hduser-secondarynamenode-student13-
ut
starting yarn daemons
starting resourcemanager, logging to /opt/hadoop-2.6.0/logs/yarn-hduser-resourcemanager-student13-x1.out
student14-x1: starting nodemanager, logging to /opt/hadoop-2.6.0/logs/yarn-hduser-nodemanager-student14-x1.out
student14-x2: starting nodemanager, logging to /opt/hadoop-2.6.0/logs/yarn-hduser-nodemanager-student14-x2.out
student13-x2: starting nodemanager, logging to /opt/hadoop-2.6.0/logs/yarn-hduser-nodemanager-student13-x2.out
student2-x2: starting nodemanager, logging to /opt/hadoop-2.6.0/logs/yarn-hduser-nodemanager-student2-x2.out
student1-x2: starting nodemanager, logging to /opt/hadoop-2.6.0/logs/yarn-hduser-nodemanager-student1-x2.out
student2-x1: starting nodemanager, logging to /opt/hadoop-2.6.0/logs/yarn-hduser-nodemanager-student2-x1.out
student1-x1: starting nodemanager, logging to /opt/hadoop-2.6.0/logs/yarn-hduser-nodemanager-student1-x1.out
starting historyserver, logging to /opt/hadoop-2.6.0/logs/mapred-hduser-historyserver-student13-x1.out
hduser@student13-x1:~$
```

– **Run the WordCount** (900 MB data, number_of_replicas = 2) on the 8-VM virtual cluster. Show the largest number of "running" containers used during the execution. Report the total execution time, # of map, and # of Reduce. Also show which VM is running the ApplicationManager (AM). **(5%)**

Cluster Metrics

| Apps Submitted | Apps Pending | Apps Running | Apps Completed | Containers Running | Memory Used | Memory Total | Memory Reserved | VCores Used | VCores Total | VCores Reserved | Active Nodes | Decommissioned Nodes | Lost Nodes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 0 | 15 | 16 GB | 40 GB | 0 B | 15 | 40 | 0 | 5 | 2 | 0 |

Show 20 entries Search:

| ID | User | Name | Application Type | Queue | StartTime | FinishTime | State | FinalStatus | Progress |
|---|---|---|---|---|---|---|---|---|---|
| application_1490506436015_0001 | hduser13 | word count | MAPREDUCE | default | Sun, 26 Mar 2017 06:13:11 GMT | N/A | RUNNING | UNDEFINED | |

Showing 1 to 1 of 1 entries First Prev

**#maps 14**
**#reduces 1**
**AM – on student13-x2**

**ApplicationMaster**

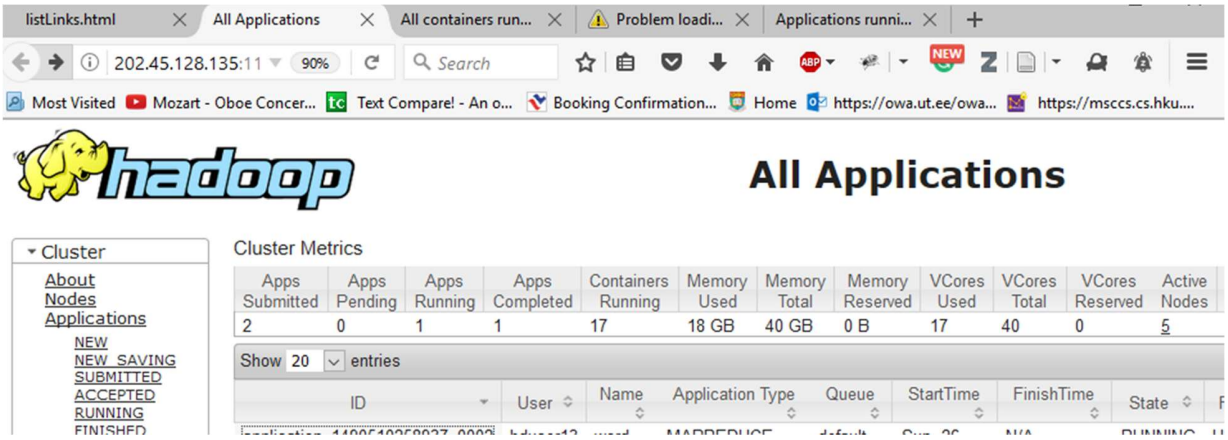
| Attempt Number | Start Time | Node | Logs |
|---|---|---|---|
| 1 | Sun Mar 26 14:13:26 HKT 2017 | student13-x2:8042 | logs |

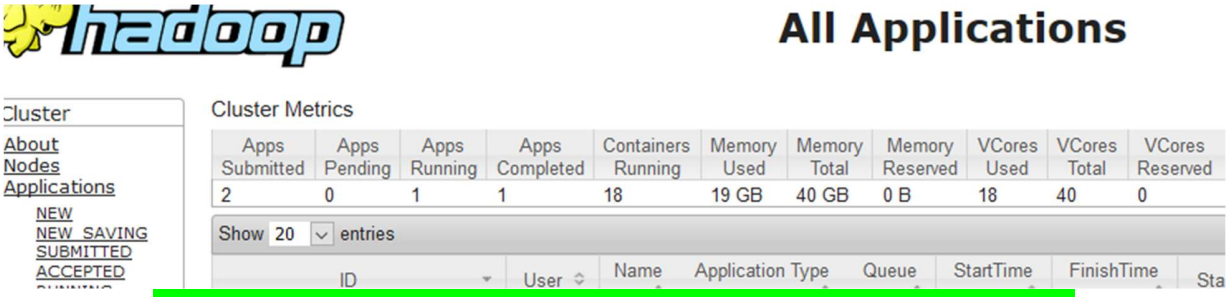
**Time 4 minutes, 26 seconds**

Job Overview

| | |
|---|---|
| **Job Name:** | word count |
| **User Name:** | hduser13 |
| **Queue:** | default |
| **State:** | SUCCEEDED |
| **Uberized:** | false |
| **Submitted:** | Sun Mar 26 14:13:11 HKT 2017 |
| **Started:** | Sun Mar 26 14:13:35 HKT 2017 |
| **Finished:** | Sun Mar 26 14:18:02 HKT 2017 |
| **Elapsed:** | 4mins, 26sec |
| **Diagnostics:** | |
| **Average Map Time** | 2mins, 57sec |
| **Average Shuffle Time** | 2mins, 21sec |
| **Average Merge Time** | 1sec |
| **Average Reduce Time** | 0sec |

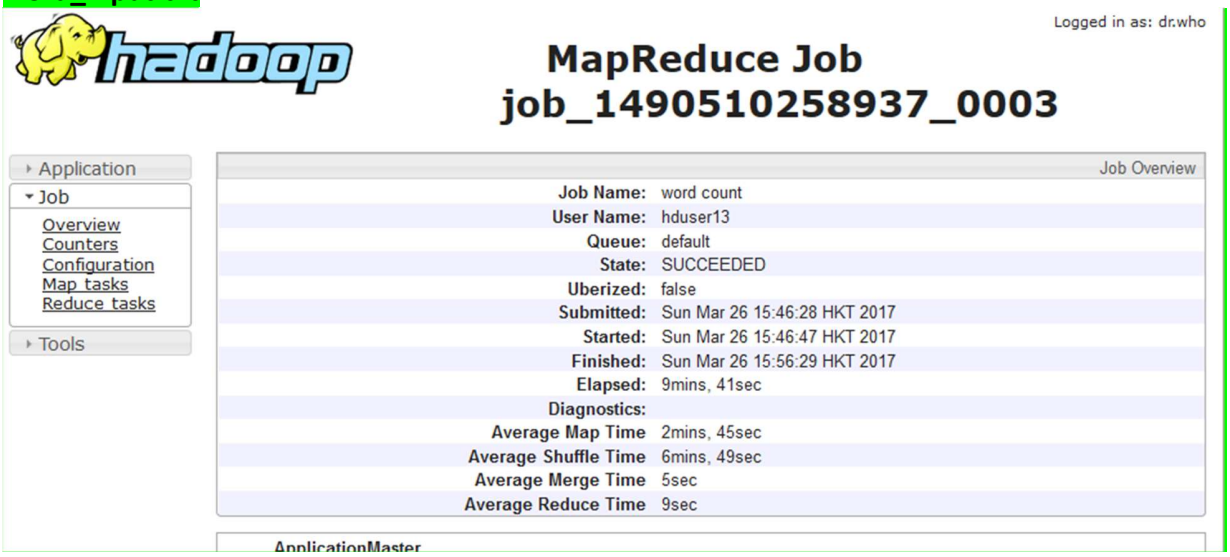
**#of maximum running containers 18**




– Increase the replication of data blocks from **2** to **3**. Run the WordCount again and compare the execution time. Is it faster if the replication is increased from 2 to 3? **(2%)**

**i assume, here is also meant that, if i increase the # or datablocks I also upload a new file word_input.txt**



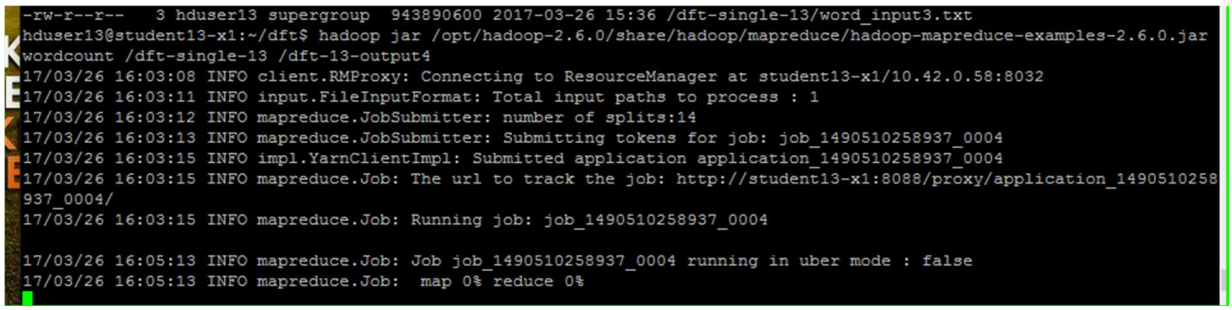
**Suprisingly It is slower, although the higher replication should allow quicekr access to elements.**

– VM Migration: Run a long job (e.g., WordCount) and migrate one "active" VM during the middle of execution from one machine to another machine. Show the whole job can complete without error (i.e., WordCount result is still correct). Command to be used: `sudo xl migrate <Domain-to-be-migrated> <new host>`. **(5%) [Note: after the migration, there should be 3 VMs running at the destination node.]**

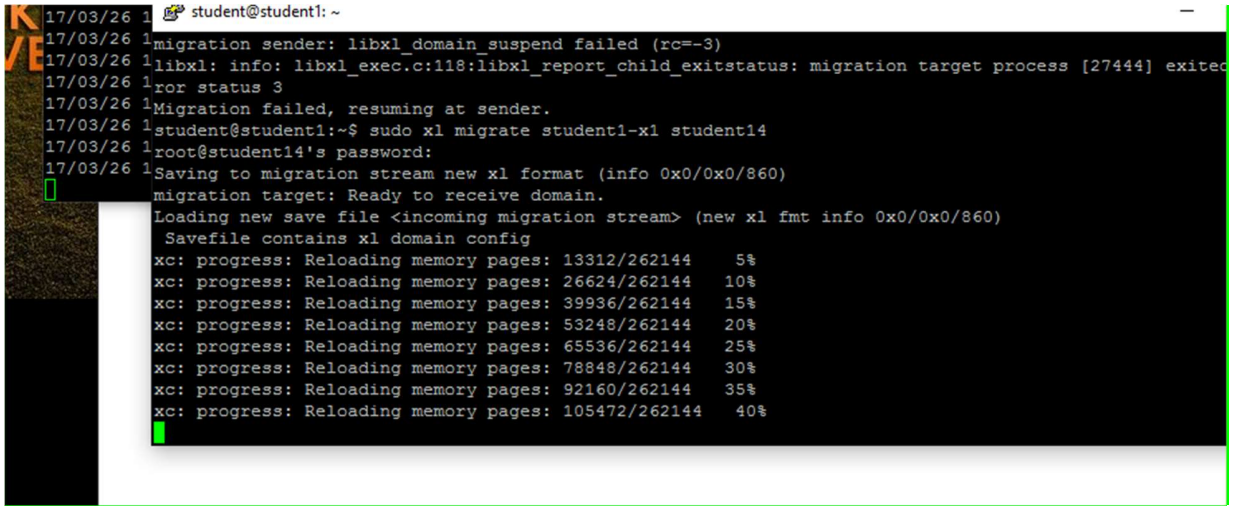
I migrated from student1 to student14. To make vm migration possible I had to use NFS as a shared filesystem. E.g. add student1-x1 folder to export in student 1 exports file. Then I had to mount that folder in student 14.

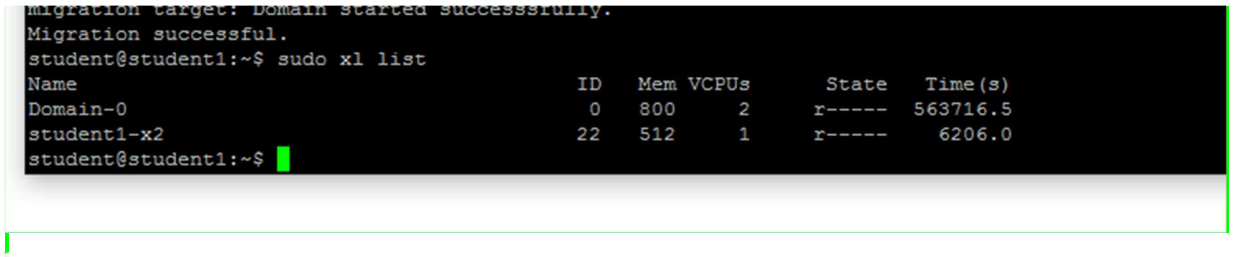
To make that possible I followed mainly this tutorial :
https://www.centos.org/docs/5/html/5.2/Virtualization/sect-Virtualization-Virtualization_live_migration-An_example_of_a_configuration_for_live_migration.html
Also the ganglia tutorial part where mounting is specified
Also last years project about Ecommerce Business helper Accessible On Reports

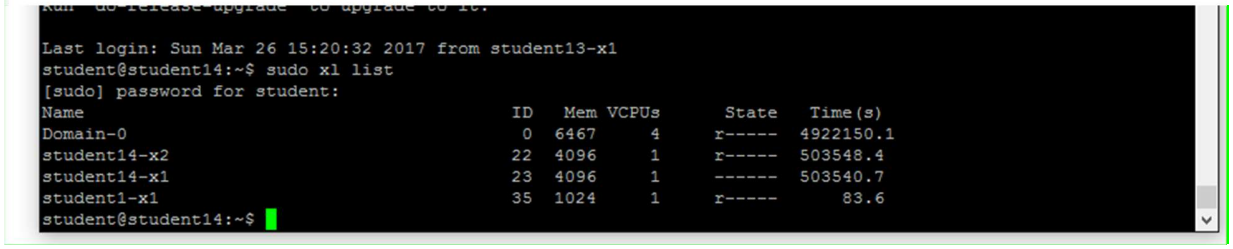
**Starting the job**



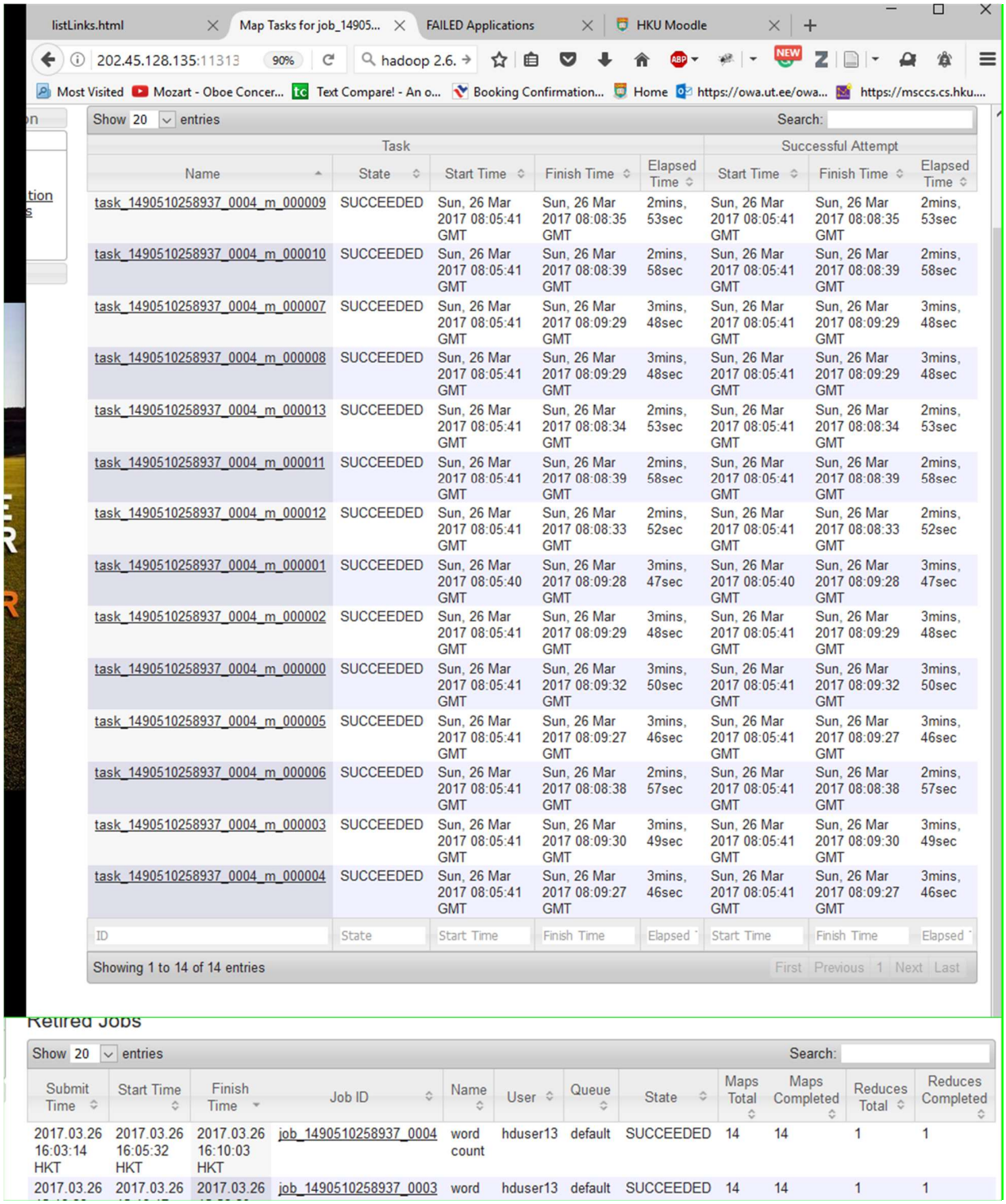

**MIGRATION sudo xl migrate**



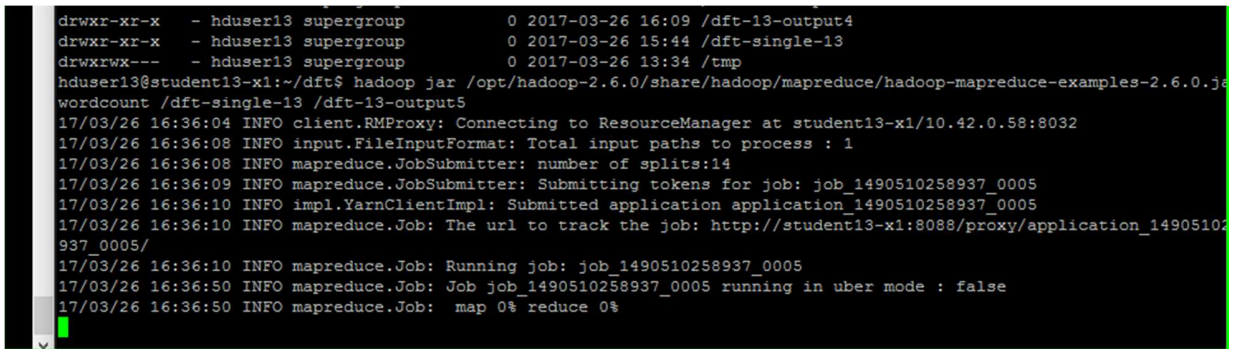




**Result of JOB**

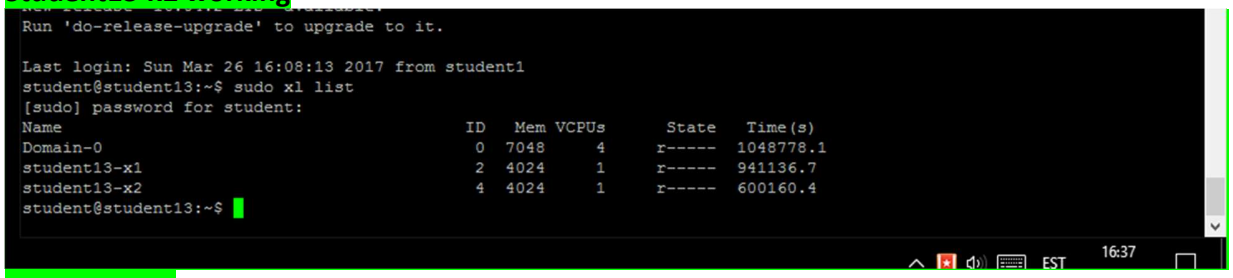

listLinks.html
Map Tasks for job_14905...
FAILED Applications
HKU Moodle
202.45.128.135:11313
90%
hadoop 2.6.
Most Visited
Mozart - Oboe Concer...
Text Compare! - An o...
Booking Confirmation...
Home
https://owa.ut.ee/owa...
https://msccs.cs.hku....
Show 20 entries
Search:
Task
Successful Attempt
Name
State
Start Time
Finish Time
Elapsed Time
Start Time
Finish Time
Elapsed Time
task_1490510258937_0004_m_000009 SUCCEEDED Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:08:35 GMT 2mins, 53sec Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:08:35 GMT 2mins, 53sec
task_1490510258937_0004_m_000010 SUCCEEDED Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:08:39 GMT 2mins, 58sec Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:08:39 GMT 2mins, 58sec
task_1490510258937_0004_m_000007 SUCCEEDED Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:09:29 GMT 3mins, 48sec Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:09:29 GMT 3mins, 48sec
task_1490510258937_0004_m_000008 SUCCEEDED Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:09:29 GMT 3mins, 48sec Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:09:29 GMT 3mins, 48sec
task_1490510258937_0004_m_000013 SUCCEEDED Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:08:34 GMT 2mins, 53sec Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:08:34 GMT 2mins, 53sec
task_1490510258937_0004_m_000011 SUCCEEDED Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:08:39 GMT 2mins, 58sec Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:08:39 GMT 2mins, 58sec
task_1490510258937_0004_m_000012 SUCCEEDED Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:08:33 GMT 2mins, 52sec Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:08:33 GMT 2mins, 52sec
task_1490510258937_0004_m_000001 SUCCEEDED Sun, 26 Mar 2017 08:05:40 GMT Sun, 26 Mar 2017 08:09:28 GMT 3mins, 47sec Sun, 26 Mar 2017 08:05:40 GMT Sun, 26 Mar 2017 08:09:28 GMT 3mins, 47sec
task_1490510258937_0004_m_000002 SUCCEEDED Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:09:29 GMT 3mins, 48sec Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:09:29 GMT 3mins, 48sec
task_1490510258937_0004_m_000000 SUCCEEDED Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:09:32 GMT 3mins, 50sec Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:09:32 GMT 3mins, 50sec
task_1490510258937_0004_m_000005 SUCCEEDED Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:09:27 GMT 3mins, 46sec Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:09:27 GMT 3mins, 46sec
task_1490510258937_0004_m_000006 SUCCEEDED Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:08:38 GMT 2mins, 57sec Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:08:38 GMT 2mins, 57sec
task_1490510258937_0004_m_000003 SUCCEEDED Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:09:30 GMT 3mins, 49sec Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:09:30 GMT 3mins, 49sec
task_1490510258937_0004_m_000004 SUCCEEDED Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:09:27 GMT 3mins, 46sec Sun, 26 Mar 2017 08:05:41 GMT Sun, 26 Mar 2017 08:09:27 GMT 3mins, 46sec
ID
State
Start Time
Finish Time
Elapsed
Start Time
Finish Time
Elapsed
Showing 1 to 14 of 14 entries
First
Previous
1
Next
Last
Retired Jobs
Show 20 entries
Search:
Submit Time
Start Time
Finish Time
Job ID
Name
User
Queue
State
Maps Total
Maps Completed
Reduces Total
Reduces Completed
2017.03.26 16:03:14 HKT 2017.03.26 16:05:32 HKT 2017.03.26 16:10:03 HKT job_1490510258937_0004 word count hduser13 default SUCCEEDED 14 14 1 1
2017.03.26 2017.03.26 2017.03.26 job_1490510258937_0003 word hduser13 default SUCCEEDED 14 14 1 1

– Fault Tolerance: Run a long job (e.g., WordCount) on the 8-VM cluster and shutdown one V M in the middle of execution ("xm shutdown"). Show the job can still complete with correct results using only 7 VMs. **(5%)**

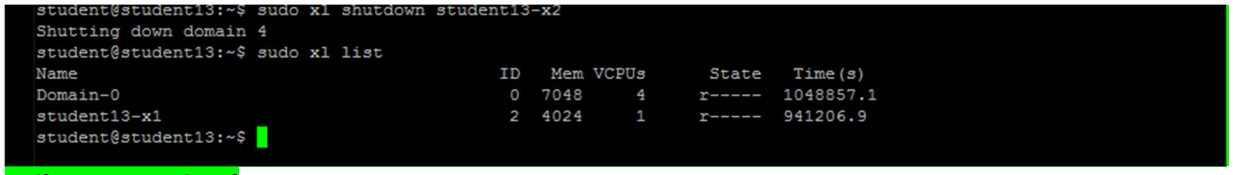
Start the job



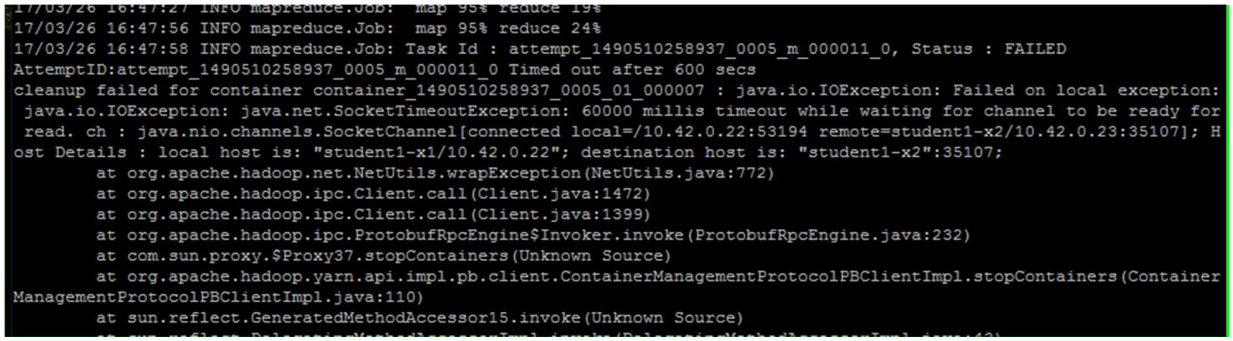

**Student13-x2 working**

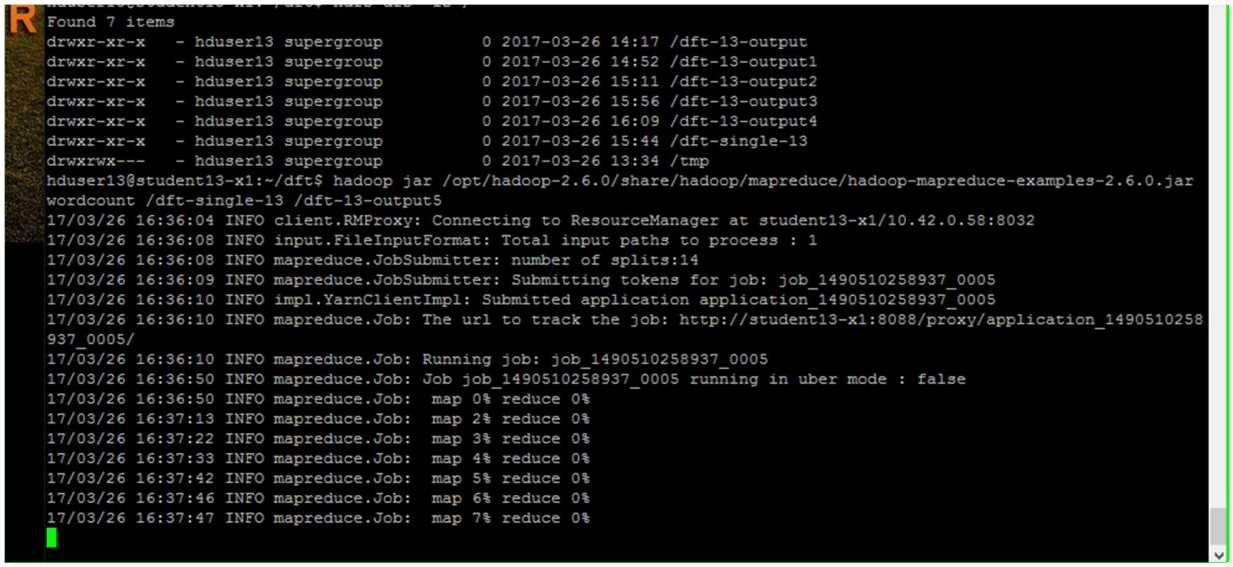


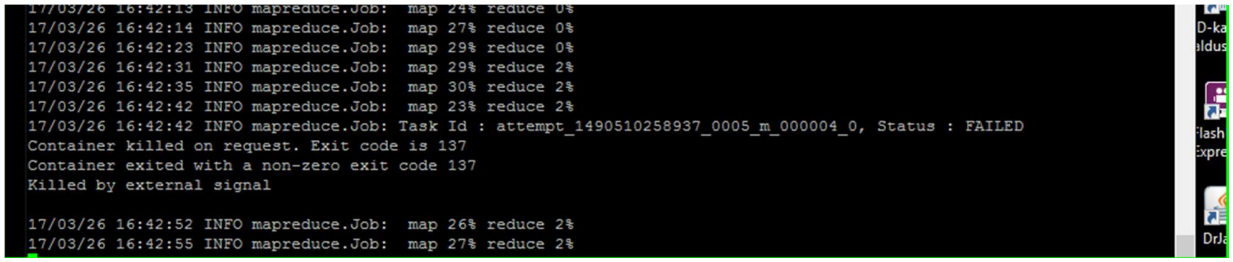

**Not anymore**




**Failures I received**






**We can see studen13-x2 is running 0 containers**

| Apps Submitted | Apps Pending | Apps Running | Apps Completed | Containers Running | Memory Used | Memory Total | Memory Reserved | VCores Used | VCores Total | VCores Reserved | Active Nodes | Decommissioned Nodes | Lost Nodes | Unh... Nc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 4 | 17 | 18 GB | 40 GB | 0 B | 17 | 40 | 0 | 5 | 2 | 0 | 0 |

how 20 entries Search:

| Node abels | Rack | Node State | Node Address | Node HTTP Address | Last health-update | Health-report | Containers | Mem Used | Mem Avail | VCores Used | V A |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | /default-rack | RUNNING | student1-x1:42006 | student1-x1:8042 | 26-Mar-2017 16:40:26 | | 5 | 6 GB | 2 GB | 5 | 3 |
| | /default-rack | RUNNING | student13-x2:45198 | student13-x2:8042 | 26-Mar-2017 16:37:47 | | 0 | 0 B | 8 GB | 0 | 8 |
| | /default-rack | RUNNING | student14-x2:51548 | student14-x2:8042 | 26-Mar-2017 16:39:51 | | 1 | 1 GB | 7 GB | 1 | 7 |
| | /default-rack | RUNNING | student14-x1:39573 | student14-x1:8042 | 26-Mar-2017 16:39:51 | | 3 | 3 GB | 5 GB | 3 | 5 |
| | /default-rack | RUNNING | student1-x2:35107 | student1-x2:8042 | 26-Mar-2017 16:41:03 | | 8 | 8 GB | 0 B | 8 | 0 |

howing 1 to 5 of 5 entries First Previous

```
17/03/26 16:49:22 INFO mapreduce.Job:  map 93% reduce 29%
17/03/26 16:49:49 INFO mapreduce.Job:  map 94% reduce 29%
17/03/26 16:49:59 INFO mapreduce.Job:  map 95% reduce 29%
17/03/26 16:50:02 INFO mapreduce.Job:  map 96% reduce 29%
17/03/26 16:50:10 INFO mapreduce.Job:  map 97% reduce 29%
17/03/26 16:50:20 INFO mapreduce.Job:  map 98% reduce 29%
17/03/26 16:50:23 INFO mapreduce.Job:  map 100% reduce 29%
17/03/26 16:50:25 INFO mapreduce.Job:  map 100% reduce 31%
17/03/26 16:51:03 INFO mapreduce.Job:  map 93% reduce 31%
17/03/26 16:51:18 INFO mapreduce.Job:  map 94% reduce 31%
17/03/26 16:51:26 INFO mapreduce.Job:  map 95% reduce 31%
17/03/26 16:51:29 INFO mapreduce.Job:  map 96% reduce 31%
17/03/26 16:51:39 INFO mapreduce.Job:  map 97% reduce 31%
17/03/26 16:51:48 INFO mapreduce.Job:  map 98% reduce 31%
17/03/26 16:51:57 INFO mapreduce.Job:  map 100% reduce 31%
17/03/26 16:52:00 INFO mapreduce.Job:  map 100% reduce 64%
17/03/26 16:52:02 INFO mapreduce.Job:  map 100% reduce 100%
```

## Still success

```
7/03/26 16:54:51 INFO mapreduce.Job: Counters: 53
        File System Counters
                FILE: Number of bytes read=50770292
                FILE: Number of bytes written=62513190
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=943945514
                HDFS: Number of bytes written=644076
                HDFS: Number of read operations=45
                HDFS: Number of large read operations=0
                HDFS: Number of write operations=2
        Job Counters
                Failed map tasks=5
                Killed map tasks=13
                Launched map tasks=32
                Launched reduce tasks=1
                Other local map tasks=4
                Data-local map tasks=24
                Rack-local map tasks=4
                Total time spent by all maps in occupied slots (ms)=9926994
                Total time spent by all reduces in occupied slots (ms)=951502
                Total time spent by all map tasks (ms)=9926994
                Total time spent by all reduce tasks (ms)=951502
                Total vcore-seconds taken by all map tasks=9926994
                Total vcore-seconds taken by all reduce tasks=951502
                Total megabyte-seconds taken by all map tasks=1985398800
                Total megabyte-seconds taken by all reduce tasks=285450600
        Map-Reduce Framework
                Map input records=19833000
                Map output records=160785600
                Map output bytes=1561130397
                Map output materialized bytes=10154074
                Input split bytes=1666
                Combine input records=163591536
                Combine output records=3507420
                Reduce input groups=50106
                Reduce shuffle bytes=10154074
                Reduce input records=701484
                Reduce output records=50106
                Spilled Records=4208904
                Shuffled Maps =14
                Failed Shuffles=5
                Merged Map outputs=14
                GC time elapsed (ms)=34941
                CPU time spent (ms)=350310
                Physical memory (bytes) snapshot=3075588096
                Virtual memory (bytes) snapshot=28203290624
                Total committed heap usage (bytes)=2228527104
        Shuffle Errors
                BAD_ID=0
                CONNECTION=0
                IO_ERROR=5
                WRONG_LENGTH=0
                WRONG_MAP=0
                WRONG_REDUCE=0
        File Input Format Counters
                Bytes Read=943943848
        File Output Format Counters
                Bytes Written=644076
duser13@student13-x1:~/dft$
```

## 20%: TeraSort (with 1000 MB data) on the 8-VM virtual cluster

– Show the best execution time using 8 VMs at the 4 machines assigned to your group. For fair comparison, the total number of VMs should be fixed at **8**, 2 per machine; with one master node and 7 slave nodes. Dom0 should not be used to run any MapReduce task. The sorted results must be validated.] **(Note 3)**

- Show the configurations of Dom0, x1, and x2 that achieved the best results for the 4GB or 16 GB machine respectively. **(2%)**
- Show the configuration of Hadoop (yarn-site.xml and mapredsite. xml) or the configuration options you specified in the "hadoop jar -D" command that achieved the best results. (Note: You are allowed to change the default Block size.) **(2%) (Note 4)**
- Show the (largest) # of running containers, # of map and reduce tasks during the execution of the TeraSort job. Check if the # of running containers is changing during the execution. **(2%)**
- Increase/decrease mapreduce.task.io.sort. mb (default 100 MB) and/or mapreduce.reduce.shuffle. parallelcopies (default=5) and



see if the performance gets improved? **(4%)**

– Write a short summary explaining your optimization strategy with evidences from your observations (e.g., CPU utilization at each VM at different phases, network traffic during shuffle phase, memory utilization, etc.) – Ganglia may help! **(10%)**

– **[Note: We will compare the best execution time submitted by all students to give marks on this part. Fastest: 18-20; Good: 14-17; Slow: < 14]**

## DISCUSSION BEFORE EXECUTION

**yarn**

yarn.nodemanager.resource.memory-mb Default 8192 *Amount of physical memory, in MB, that can be allocated for containers*

- Leave room for the Operating system
- Leave room for datanode -> very little
- Leave room for Nodemanager

yarn.app.mapreduce.am.resource.mb default = 1536 *The amount of memory the MR AppMaster needs*

- Our application master definitely does not need so much memory as specified in the default– its not a big job at all . In original settigns: mapreduce.reduce.memory.mb is 1024 => 1.5 * map could be a good size for this.

**mapreduce**

mapreduce.map.memory.mb

- This is pretty hard. I think just try wiht big and small. Do a hill climb search 😀 I guess it also depends on the datablock size. My intuition says bigger is good in the sense of reading bigger. This setting Should be multiplication of 64 or 128 I also think this setting is very much related with hdfs block size setting specified down below. Continue reading in hdfs part

mapreduce.reduce.memory.mb

- 1.5 * map I would guess
-

mapreduce.map.cpu.vcores

mapreduce.reduce.cpu.vcores

I think these are good if they are 1. Sorting is Cpu Intensive.

1. https://www.scribd.com/document/23046928/Hadoop-Performance-Tuning
2. http://www.idryman.org/blog/2014/03/05/hadoop-performance-tuning-best-practices/

mapred.compress.map.output -> change it to true -> less to write to memory

**hdfs**

dfs.block.size -> affects the number of maps needed to be done. In my eyes bigger is better. This is also recommended by the article (1) REASON being „in smaller cluster task creation is also a considerable .overhead“ <= **larger blocksize, larger maps, larger reduces**

## TRIAL 1

**Student1, Student2, Student13, Student14**

**RESULT 1.38**

**Max # Containers running the same time: 9**

**Number of maps: 8**

**Number of reduces:7**

*I avoided using student2, because of its memory limits. It slowed down the execution with 128 mb blocksize. I rather tried to use less large size containers, because there were only 8 few tasks. I avoided using 64 mb with so few machines because of the task overhead being very big.*

**VM SPECIFICATIONS**

**Student 13**

Yarn has a gigabyte of space to spare

dom0 3 gb

student13-x1 4 gb

student13-x2 8 gb

**Student 14**

Yarn has actually less memory than needed 7096

dom0 4 gb

student13-x1 6.5 gb

student13-x2 6.5 gb

**Student 1**

dom0 0.8 gb

student13-x1 1.5 gb

student13-x2 1 gb

**MAPRED**

mapreduce.map.memory.mb 1500

mapreduce.reduce.memory.mb 2000

mapreduce.task.io.sort.factor 100

mapreduce.map.output.compress false

mapreduce.job.reduces 7

mapreduce.task.io.sort.mb 450

mapreduce.reduce.shuffle.parallelcopes 8

mapreduce.map.java.opts -Xmx800

mapreduce.reduce.java.opts -Xmx1000m

**HDFS**

dfs.replication 7

dfs.blocksize 128

**YARN**

yarn.scheduler.minimum-allocation-mb

yarn.scheduler.maximum-allocation-mb

yarn.scheduler.minimum-allocation-mb

yarn.scheduler.maximum-allocation-vcores

These are for every separate container.

yarn.nodemanager.resource.memory-mb Amount of physical memory, in MB, that can be allocated for containers

mapreduce.reduce.java.opts - it seems the default is not specifid, on some places its also 1024 -> maybe specify this the same as map

mapreduce.map.java.opts -- it seems the default is not specifiEd, on some places its also 1024 -> maybe specify this the same as reduce

Logged in as: dr.who

# MapReduce Job job_1490880455212_0002

- Application
- Job
  - Overview
  - Counters
  - Configuration
  - Map tasks
  - Reduce tasks
- Tools

| Job Overview | |
|---|---|
| **Job Name:** | TeraSort |
| **User Name:** | hduser13 |
| **Queue:** | default |
| **State:** | SUCCEEDED |
| **Uberized:** | false |
| **Submitted:** | Thu Mar 30 21:31:29 HKT 2017 |
| **Started:** | Thu Mar 30 21:31:35 HKT 2017 |
| **Finished:** | Thu Mar 30 21:33:13 HKT 2017 |
| **Elapsed:** | 1mins, 38sec |
| **Diagnostics:** | |
| **Average Map Time** | 38sec |
| **Average Shuffle Time** | 49sec |
| **Average Merge Time** | 5sec |
| **Average Reduce Time** | 6sec |

**ApplicationMaster**

| Attempt Number | Start Time | Node | Logs |
|---|---|---|---|
| 1 | Thu Mar 30 21:31:17 HKT 2017 | student85-x1:8042 | logs |

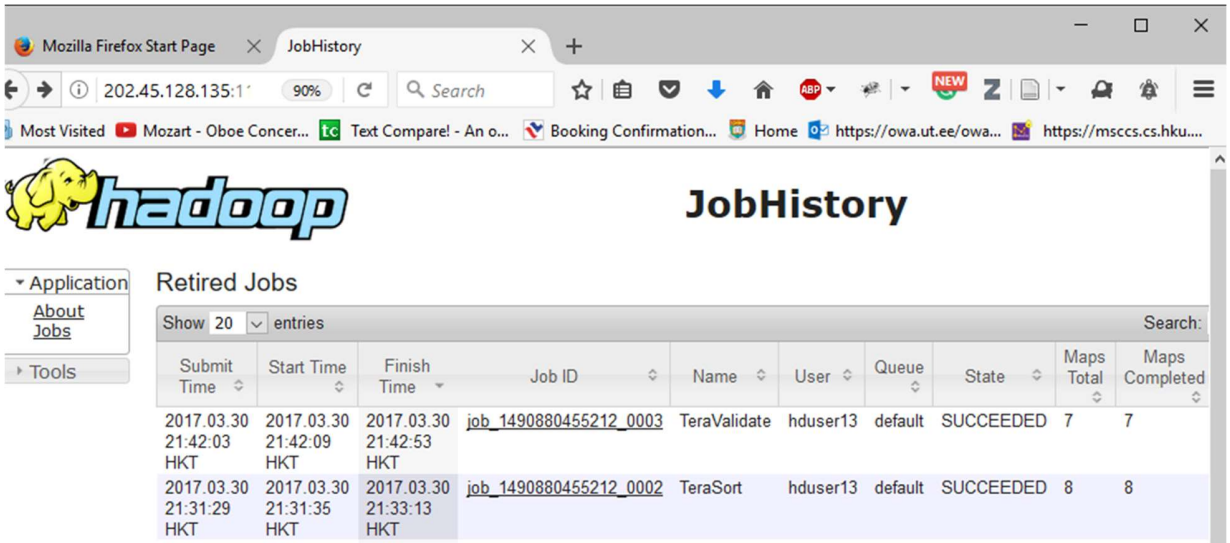
| Task Type | Total | Complete |
|---|---|---|
| **Map** | 8 | 8 |
| **Reduce** | 7 | 7 |

| Attempt Type | Failed | Killed | Successful |
|---|---|---|---|
| **Maps** | 0 | 1 | 8 |
| **Reduces** | 0 | 0 | 7 |

```
7/03/30 21:33:35 INFO mapreduce.Job: Counters: 51
        File System Counters
                FILE: Number of bytes read=1040000570
                FILE: Number of bytes written=2081607690
                FILE: Number of read operations=0
                FILE: Number of large read operations=0
                FILE: Number of write operations=0
                HDFS: Number of bytes read=1000000896
                HDFS: Number of bytes written=1000000000
                HDFS: Number of read operations=45
                HDFS: Number of large read operations=0
                HDFS: Number of write operations=14
        Job Counters
                Killed map tasks=1
                Launched map tasks=9
                Launched reduce tasks=7
                Data-local map tasks=8
                Rack-local map tasks=1
                Total time spent by all maps in occupied slots (ms)=689098
                Total time spent by all reduces in occupied slots (ms)=862074
                Total time spent by all map tasks (ms)=344549
                Total time spent by all reduce tasks (ms)=431037
                Total vcore-seconds taken by all map tasks=344549
                Total vcore-seconds taken by all reduce tasks=431037
                Total megabyte-seconds taken by all map tasks=516823500
                Total megabyte-seconds taken by all reduce tasks=862074000
        Map-Reduce Framework
                Map input records=10000000
                Map output records=10000000
                Map output bytes=1020000000
                Map output materialized bytes=1040000336
                Input split bytes=896
                Combine input records=0
                Combine output records=0
                Reduce input groups=10000000
                Reduce shuffle bytes=1040000336
                Reduce input records=10000000
                Reduce output records=10000000
                Spilled Records=20000000
                Shuffled Maps =56
                Failed Shuffles=0
                Merged Map outputs=56
                GC time elapsed (ms)=9667
                CPU time spent (ms)=106660
                Physical memory (bytes) snapshot=6871793664
                Virtual memory (bytes) snapshot=39148986368
                Total committed heap usage (bytes)=6457741312
        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=1000000000
        File Output Format Counters
                Bytes Written=1000000000
7/03/30 21:33:35 INFO terasort.TeraSort: done
duser13@student13-x1:~$
```

```
                Bytes Read=1000000000
        File Output Format Counters
                Bytes Written=1000000000
17/03/30 21:30:51 INFO terasort.TeraSort: done
hduser13@student13-x1:~$ yarn jar /opt/hadoop-2.6.0/share/hadoop/mapreduce/hadoop-mapreduce-examples-2.6.0.jar teraso
rt /terainput /teraoutputAndres
17/03/30 21:31:13 INFO terasort.TeraSort: starting
17/03/30 21:31:17 INFO input.FileInputFormat: Total input paths to process : 2
Spent 503ms computing base-splits.
Spent 6ms computing TeraScheduler splits.
Computing input splits took 512ms
Sampling 8 splits of 8
Making 7 from 100000 sampled records
Computing parititions took 3743ms
Spent 4260ms computing partitions.
17/03/30 21:31:21 INFO client.RMProxy: Connecting to ResourceManager at student13-x1/10.42.0.58:8032
17/03/30 21:31:26 INFO mapreduce.JobSubmitter: number of splits:8
17/03/30 21:31:28 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1490880455212_0002
17/03/30 21:31:29 INFO impl.YarnClientImpl: Submitted application application_1490880455212_0002
17/03/30 21:31:29 INFO mapreduce.Job: The url to track the job: http://student13-x1:8088/proxy/application_1490880455
212_0002/
17/03/30 21:31:29 INFO mapreduce.Job: Running job: job_1490880455212_0002
17/03/30 21:31:56 INFO mapreduce.Job: Job job_1490880455212_0002 running in uber mode : false
17/03/30 21:31:56 INFO mapreduce.Job:  map 0% reduce 0%
17/03/30 21:32:14 INFO mapreduce.Job:  map 8% reduce 0%
17/03/30 21:32:17 INFO mapreduce.Job:  map 25% reduce 0%
17/03/30 21:32:18 INFO mapreduce.Job:  map 29% reduce 0%
17/03/30 21:32:19 INFO mapreduce.Job:  map 36% reduce 0%
17/03/30 21:32:20 INFO mapreduce.Job:  map 42% reduce 0%
```

Max Number containers running at the same time = 9




```
sudo: dfs: command not found
hduser13@student13-x1:~$ hdfs  dfs -ls /teravalidateAndres
Found 2 items
-rw-r--r--   7 hduser13 supergroup          0 2017-03-30 21:43 /teravalidateAndres/_SUCCESS
-rw-r--r--   7 hduser13 supergroup         24 2017-03-30 21:43 /teravalidateAndres/part-r-00000
hduser13@student13-x1:~$
```

```
Computing parititions took 3743ms
Spent 4260ms computing partitions.
17/03/30 21:31:21 INFO client.RMProxy: Connecting to ResourceManager at student13-x1/10.42.0.58:8032
17/03/30 21:31:26 INFO mapreduce.JobSubmitter: number of splits:8
17/03/30 21:31:28 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1490880455212_0002
17/03/30 21:31:29 INFO impl.YarnClientImpl: Submitted application application_1490880455212_0002
17/03/30 21:31:29 INFO mapreduce.Job: The url to track the job: http://student13-x1:8088/proxy/application_1490880455
212_0002/
17/03/30 21:31:29 INFO mapreduce.Job: Running job: job_1490880455212_0002
17/03/30 21:31:56 INFO mapreduce.Job: Job job_1490880455212_0002 running in uber mode : false
17/03/30 21:31:56 INFO mapreduce.Job:  map 0% reduce 0%
17/03/30 21:32:14 INFO mapreduce.Job:  map 8% reduce 0%
17/03/30 21:32:17 INFO mapreduce.Job:  map 25% reduce 0%
17/03/30 21:32:18 INFO mapreduce.Job:  map 29% reduce 0%
17/03/30 21:32:19 INFO mapreduce.Job:  map 36% reduce 0%
17/03/30 21:32:20 INFO mapreduce.Job:  map 42% reduce 0%
17/03/30 21:32:22 INFO mapreduce.Job:  map 48% reduce 0%
17/03/30 21:32:23 INFO mapreduce.Job:  map 65% reduce 0%
17/03/30 21:32:26 INFO mapreduce.Job:  map 71% reduce 0%
17/03/30 21:32:30 INFO mapreduce.Job:  map 79% reduce 0%
17/03/30 21:32:39 INFO mapreduce.Job:  map 79% reduce 1%
17/03/30 21:32:40 INFO mapreduce.Job:  map 79% reduce 4%
17/03/30 21:32:41 INFO mapreduce.Job:  map 88% reduce 4%
17/03/30 21:32:42 INFO mapreduce.Job:  map 88% reduce 5%
17/03/30 21:32:43 INFO mapreduce.Job:  map 88% reduce 6%
17/03/30 21:32:45 INFO mapreduce.Job:  map 92% reduce 7%
17/03/30 21:32:46 INFO mapreduce.Job:  map 92% reduce 8%
17/03/30 21:32:49 INFO mapreduce.Job:  map 92% reduce 13%
17/03/30 21:32:50 INFO mapreduce.Job:  map 96% reduce 13%
17/03/30 21:32:52 INFO mapreduce.Job:  map 96% reduce 15%
17/03/30 21:32:54 INFO mapreduce.Job:  map 96% reduce 18%
17/03/30 21:32:55 INFO mapreduce.Job:  map 100% reduce 21%
17/03/30 21:32:57 INFO mapreduce.Job:  map 100% reduce 24%
17/03/30 21:32:59 INFO mapreduce.Job:  map 100% reduce 29%
17/03/30 21:33:01 INFO mapreduce.Job:  map 100% reduce 34%
17/03/30 21:33:02 INFO mapreduce.Job:  map 100% reduce 45%
17/03/30 21:33:03 INFO mapreduce.Job:  map 100% reduce 46%
17/03/30 21:33:04 INFO mapreduce.Job:  map 100% reduce 49%
17/03/30 21:33:05 INFO mapreduce.Job:  map 100% reduce 56%
17/03/30 21:33:07 INFO mapreduce.Job:  map 100% reduce 63%
17/03/30 21:33:08 INFO mapreduce.Job:  map 100% reduce 75%
17/03/30 21:33:10 INFO mapreduce.Job:  map 100% reduce 76%
17/03/30 21:33:11 INFO mapreduce.Job:  map 100% reduce 78%
17/03/30 21:33:13 INFO mapreduce.Job:  map 100% reduce 80%
17/03/30 21:33:14 INFO mapreduce.Job:  map 100% reduce 83%
17/03/30 21:33:16 INFO mapreduce.Job:  map 100% reduce 87%
17/03/30 21:33:17 INFO mapreduce.Job:  map 100% reduce 89%
17/03/30 21:33:19 INFO mapreduce.Job:  map 100% reduce 91%
17/03/30 21:33:21 INFO mapreduce.Job:  map 100% reduce 92%
17/03/30 21:33:22 INFO mapreduce.Job:  map 100% reduce 93%
17/03/30 21:33:23 INFO mapreduce.Job:  map 100% reduce 94%
17/03/30 21:33:24 INFO mapreduce.Job:  map 100% reduce 95%
17/03/30 21:33:26 INFO mapreduce.Job:  map 100% reduce 96%
17/03/30 21:33:27 INFO mapreduce.Job:  map 100% reduce 97%
17/03/30 21:33:29 INFO mapreduce.Job:  map 100% reduce 98%
17/03/30 21:33:30 INFO mapreduce.Job:  map 100% reduce 99%
```

## TRIAL 2

**Student1, Student85, Student13, Student14**

**BEST RESULT 1.32**

**# CONTAINTERS CONCURRENTLY RUNNIGN 20**

*Although the HW improved a lot, the results did not. Its a shame. But I did not have too much time to test out new hardware. A the same time, Parallelism increased significantly. I used almost all the available memory , which is a possible cause for not getting even better result. Maximum number of running containers was 14.*

**VM**

a. Student13
    i. Domain 2
    ii. x1 3
    iii. x2 11
b. Student14
    i. Domain 2
    ii. x1 7
    iii. x2 7
c. Student1
    i. Domain 1
    ii. x1 3
d. Student85
    i. Domain 2
    ii. x1 7
    iii. x2

**MAPRED**

mapreduce.map.memory.mb 1500

mapreduce.reduce.memory.mb 2000

mapreduce.task.io.sort.factor 100

mapreduce.map.output.compress false

mapreduce.job.reduces 12

mapreduce.task.io.sort.mb 450

mapreduce.reduce.shuffle.parallelcopes 8

mapreduce.map.java.opts -Xmx800

mapreduce.reduce.java.opts -Xmx1000m

**HDFS**

dfs.replication 3

dfs.blocksize 128

**YARN**

yarn.scheduler.minimum-allocation-mb

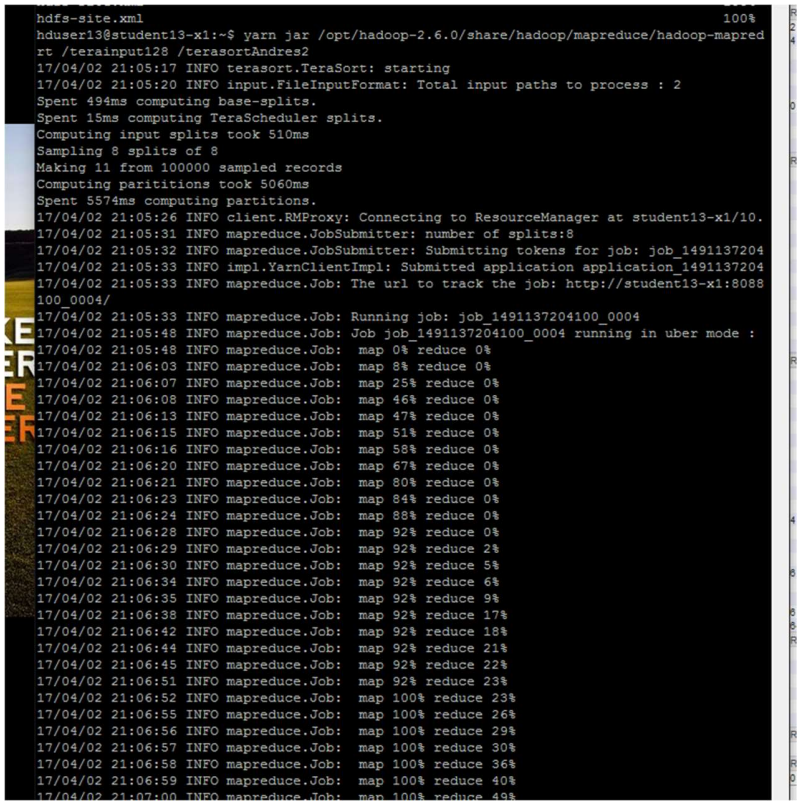
yarn.scheduler.maximum-allocation-mb

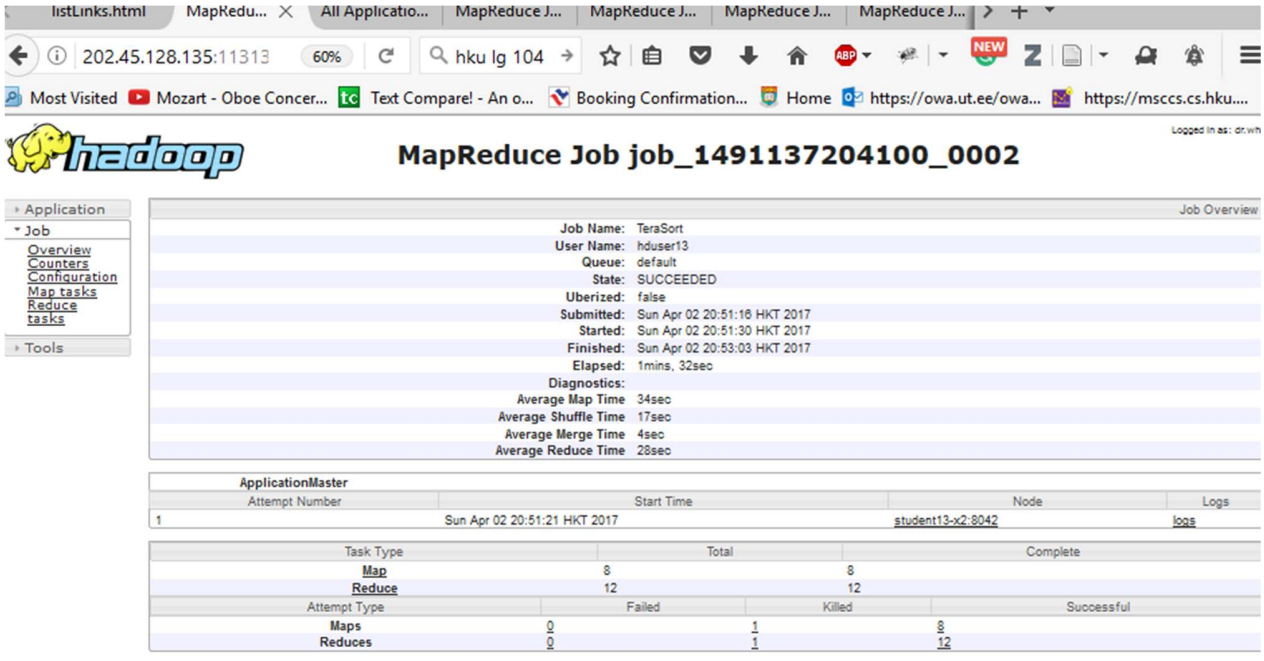
yarn.scheduler.minimum-allocation-mb

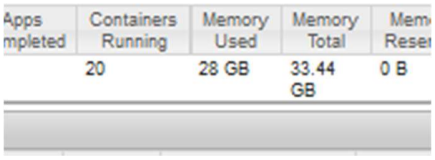
yarn.scheduler.maximum-allocation-vcores

<u>These are for every separate container.</u>

yarn.nodemanager.resource.memory-mb Amount of physical memory, in MB, that can be allocated for containers


hdfs-site.xml 100%
hduser13@student13-x1:~$ yarn jar /opt/hadoop-2.6.0/share/hadoop/mapreduce/hadoop-mapred
rt /terainput128 /terasortAndres2
17/04/02 21:05:17 INFO terasort.TeraSort: starting
17/04/02 21:05:20 INFO input.FileInputFormat: Total input paths to process : 2
Spent 494ms computing base-splits.
Spent 15ms computing TeraScheduler splits.
Computing input splits took 510ms
Sampling 8 splits of 8
Making 11 from 100000 sampled records
Computing parititions took 5060ms
Spent 5574ms computing partitions.
17/04/02 21:05:26 INFO client.RMProxy: Connecting to ResourceManager at student13-x1/10.
17/04/02 21:05:31 INFO mapreduce.JobSubmitter: number of splits:8
17/04/02 21:05:32 INFO mapreduce.JobSubmitter: Submitting tokens for job: job_1491137204
17/04/02 21:05:33 INFO impl.YarnClientImpl: Submitted application application_1491137204
17/04/02 21:05:33 INFO mapreduce.Job: The url to track the job: http://student13-x1:8088
100_0004/
17/04/02 21:05:33 INFO mapreduce.Job: Running job: job_1491137204100_0004
17/04/02 21:05:48 INFO mapreduce.Job: Job job_1491137204100_0004 running in uber mode :
17/04/02 21:05:48 INFO mapreduce.Job: map 0% reduce 0%
17/04/02 21:06:03 INFO mapreduce.Job: map 8% reduce 0%
17/04/02 21:06:07 INFO mapreduce.Job: map 25% reduce 0%
17/04/02 21:06:08 INFO mapreduce.Job: map 46% reduce 0%
17/04/02 21:06:13 INFO mapreduce.Job: map 47% reduce 0%
17/04/02 21:06:15 INFO mapreduce.Job: map 51% reduce 0%
17/04/02 21:06:16 INFO mapreduce.Job: map 58% reduce 0%
17/04/02 21:06:20 INFO mapreduce.Job: map 67% reduce 0%
17/04/02 21:06:21 INFO mapreduce.Job: map 80% reduce 0%
17/04/02 21:06:23 INFO mapreduce.Job: map 84% reduce 0%
17/04/02 21:06:24 INFO mapreduce.Job: map 88% reduce 0%
17/04/02 21:06:28 INFO mapreduce.Job: map 92% reduce 0%
17/04/02 21:06:29 INFO mapreduce.Job: map 92% reduce 2%
17/04/02 21:06:30 INFO mapreduce.Job: map 92% reduce 5%
17/04/02 21:06:34 INFO mapreduce.Job: map 92% reduce 6%
17/04/02 21:06:35 INFO mapreduce.Job: map 92% reduce 9%
17/04/02 21:06:38 INFO mapreduce.Job: map 92% reduce 17%
17/04/02 21:06:42 INFO mapreduce.Job: map 92% reduce 18%
17/04/02 21:06:44 INFO mapreduce.Job: map 92% reduce 21%
17/04/02 21:06:45 INFO mapreduce.Job: map 92% reduce 22%
17/04/02 21:06:51 INFO mapreduce.Job: map 92% reduce 23%
17/04/02 21:06:52 INFO mapreduce.Job: map 100% reduce 23%
17/04/02 21:06:55 INFO mapreduce.Job: map 100% reduce 26%
17/04/02 21:06:56 INFO mapreduce.Job: map 100% reduce 29%
17/04/02 21:06:57 INFO mapreduce.Job: map 100% reduce 30%
17/04/02 21:06:58 INFO mapreduce.Job: map 100% reduce 36%
17/04/02 21:06:59 INFO mapreduce.Job: map 100% reduce 40%


listLinks.html
MapRedu...
All Applicatio...
MapReduce J...
202.45.128.135:11313
60%
hku lg 104
Most Visited
Mozart - Oboe Concer...
Text Compare! - An o...
Booking Confirmation...
Home
https://owa.ut.ee/owa...
https://msccs.cs.hku....
Logged in as: dr.wh
hadoop
MapReduce Job job_1491137204100_0002
Application
Job
Overview
Counters
Configuration
Map tasks
Reduce tasks
Tools
Job Overview
Job Name: TeraSort
User Name: hduser13
Queue: default
State: SUCCEEDED
Uberized: false
Submitted: Sun Apr 02 20:51:16 HKT 2017
Started: Sun Apr 02 20:51:30 HKT 2017
Finished: Sun Apr 02 20:53:03 HKT 2017
Elapsed: 1mins, 32sec
Diagnostics:
Average Map Time 34sec
Average Shuffle Time 17sec
Average Merge Time 4sec
Average Reduce Time 28sec
ApplicationMaster
Attempt Number
Start Time
Node
Logs
1
Sun Apr 02 20:51:21 HKT 2017
student13-x2:8042
logs
Task Type
Total
Complete
Map
8
8
Reduce
12
12
Attempt Type
Failed
Killed
Successful
Maps
0
1
8
Reduces
0
1
12



| Apps mpleted | Containers Running | Memory Used | Memory Total | Mem Reser |
|---|---|---|---|---|
| | 20 | 28 GB | 33.44 GB | 0 B |

Some useful commands

```
hdfs fsck /tmp/test.txt -files -blocks – CHECK blocksize of a file
```