FR. CONCEICAO RODRIGUES COLLEGE OF ENGINEERING

Department of Computer Engineering
Academic Year 2025-26

Rubrics for Lab Experiments

Class : B.E. Computer **Subject Name :*BDA Lab Engineering***
Semester : VII **Subject Code :CSL702**

Practical No:	2
Title:	Hands on Hadoop HDFS
Date of Performance:	15/07/2025
Roll No:	9913
Name of the Student:	Mark Lopes

Evaluation:

Performance Indicator	Below average	Average	Good	Excellent	Marks
On time Submission (2)	Not submitted (0)	Submitted after deadline (1)	Early or on time submission(2)	---	
Test cases and output (4)	Incorrect output (1)	The expected output is verified only a for few test cases (2)	The expected output is Verified for all test cases but is not presentable (3)	Expected output is obtained for all test cases. Presentable and easy to follow (4)	
Coding efficiency (2)	The code is not structured at all (0)	The code is structured but not efficient (1)	The code is Structured and efficient. (2)	-	
Knowledge(2)	Basic concepts not clear (0)	Understood the basic concepts (1)	Could explain the concept with suitable example (1.5)	Could relate the theory with real world application(2)	
Total					

Experiment No 2

Aim: Hands on Hadoop HDFS

Objective:

The objective of this lab experiment is to provide hands-on experience with Hadoop

Distributed File System (HDFS). Students will learn how to interact with HDFS, manage

files and directories, understand replication and fault tolerance, and perform basic

administrative tasks.

Tools and Technologies:

● Hadoop: Specifically focusing on HDFS (Hadoop Distributed File System).

● Virtual or physical machines capable of running a Linux distribution (e.g., Ubuntu, CentOS).

Pre-requisites:

● Basic understanding of Linux/Unix commands.

● Familiarity with Java programming (helpful but not mandatory).

Equipment Required:

● Virtual or physical machines capable of running a Linux distribution (e.g., Ubuntu, CentOS).

● Sufficient memory and disk space to accommodate Hadoop's requirements (minimum of 4GB

RAM recommended per node).

Experiment Steps:

1. Setting Up the Environment:

o Prepare the environment by setting up virtual machines (VMs) or physical machines

with a Linux distribution (e.g., Ubuntu Server).

o Ensure that each machine has a static IP address and can communicate with each

other over the network.

2. Installing Java Development Kit (JDK):

o Hadoop requires Java, so install JDK on all machines that will be part of the Hadoop

cluster.

o Example command to install OpenJDK:

bash

Copy code

sudo apt-get update

sudo apt-get install openjdk-8-jdk

3. Downloading and Extracting Hadoop:

o Download the desired version of Hadoop from the Apache Hadoop website

(https://hadoop.apache.org/releases.html).

o Extract the downloaded Hadoop tarball to a suitable directory on each machine in

your cluster.

bash

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```
tar -xzvf hadoop-3.x.x.tar.gz -C /opt
```

4. Configuring Hadoop Environment Variables:

o Set up Hadoop environment variables in the .bashrc or .bash_profile file for each user:

bash

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```
export HADOOP_HOME=/opt/hadoop-3.x.x
export PATH=$PATH:$HADOOP_HOME/bin:$HADOOP_HOME/sbin
```

5. Configuring HDFS:

o Navigate to the Hadoop configuration directory ($HADOOP_HOME/etc/hadoop)

and edit core-site.xml and hdfs-site.xml files.

o core-site.xml:

xml

Copy code

```
&lt;configuration&gt;
&lt;property&gt;
&lt;name&gt;fs.defaultFS&lt;/name&gt;
&lt;value&gt;hdfs://namenode_host:9000&lt;/value&gt;
&lt;/property&gt;
&lt;/configuration&gt;
```

o hdfs-site.xml:

xml

Copy code

<configuration>

<property>

<name>dfs.replication</name>

<value>3</value> <!-- Adjust replication factor as needed -->

</property>

</configuration>

6. Formatting HDFS Namenode:

o Before starting HDFS, format the namenode to initialize the filesystem metadata:

bash

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hdfs namenode -format

7. Starting HDFS Services:

o Start HDFS services using the provided scripts:

bash

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start-dfs.sh

8. Interacting with HDFS:

o Use Hadoop commands (hdfs dfs) to interact with HDFS:

▪ Creating a directory in HDFS:

bash

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hdfs dfs -mkdir /user

▪ Copying files from local filesystem to HDFS:

bash

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hdfs dfs -put /local/path/to/file /hdfs/path/

▪ Listing files in a directory in HDFS:

bash

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hdfs dfs -ls /hdfs/path/

▪ Reading files from HDFS:

bash

Copy code

hdfs dfs -cat /hdfs/path/to/file

9. Understanding Replication and Fault Tolerance:

o Discuss the concept of replication factor and how it ensures fault tolerance.

o Simulate a failure scenario (e.g., shutdown a datanode) and observe how HDFS

maintains data availability.

10. Stopping HDFS Services:

o Stop HDFS services when done experimenting:

bash

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```
stop-dfs.sh
```

11. Observations and Conclusion:

o Document any issues encountered during setup and how they were resolved.

o Discuss the benefits of using HDFS for storing and managing large datasets.

o Reflect on the role of HDFS in the Hadoop ecosystem and its importance in big data

processing.

Expected Outcome:

By the end of this experiment, students should have a solid understanding of how HDFS

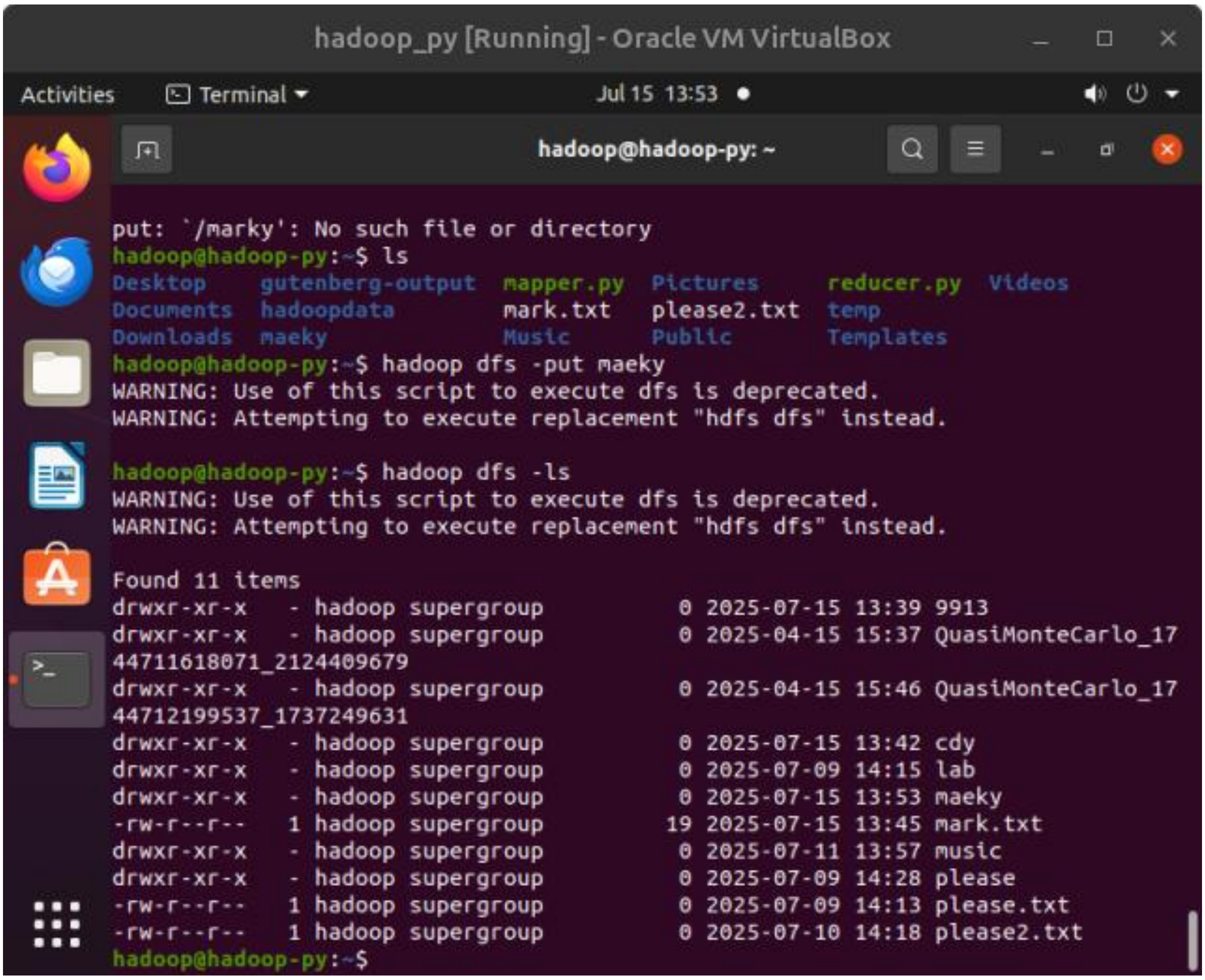
operates within a Hadoop cluster. They should be able to perform basic administrative tasks

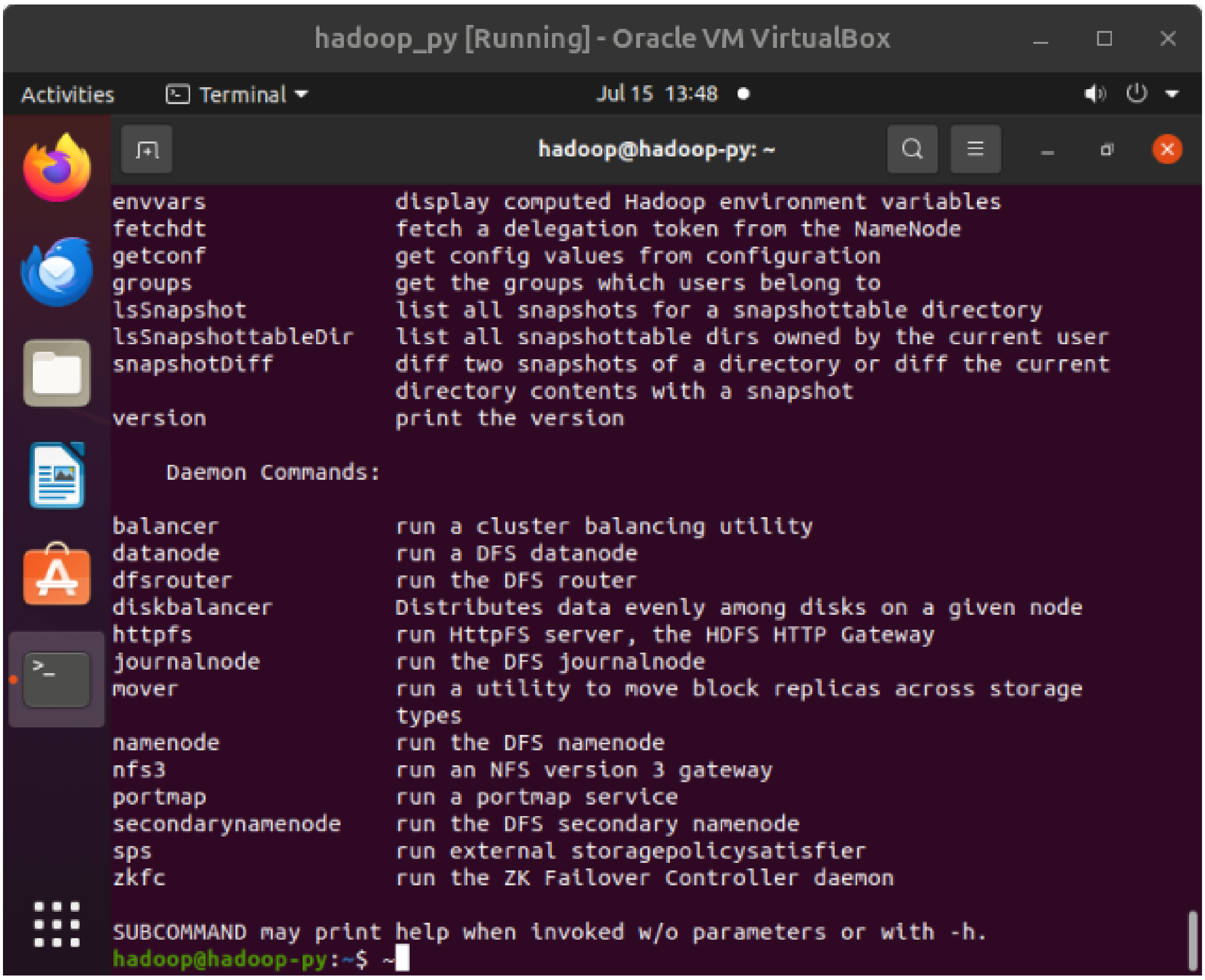
such as creating directories, copying files, and understanding replication strategies. Students

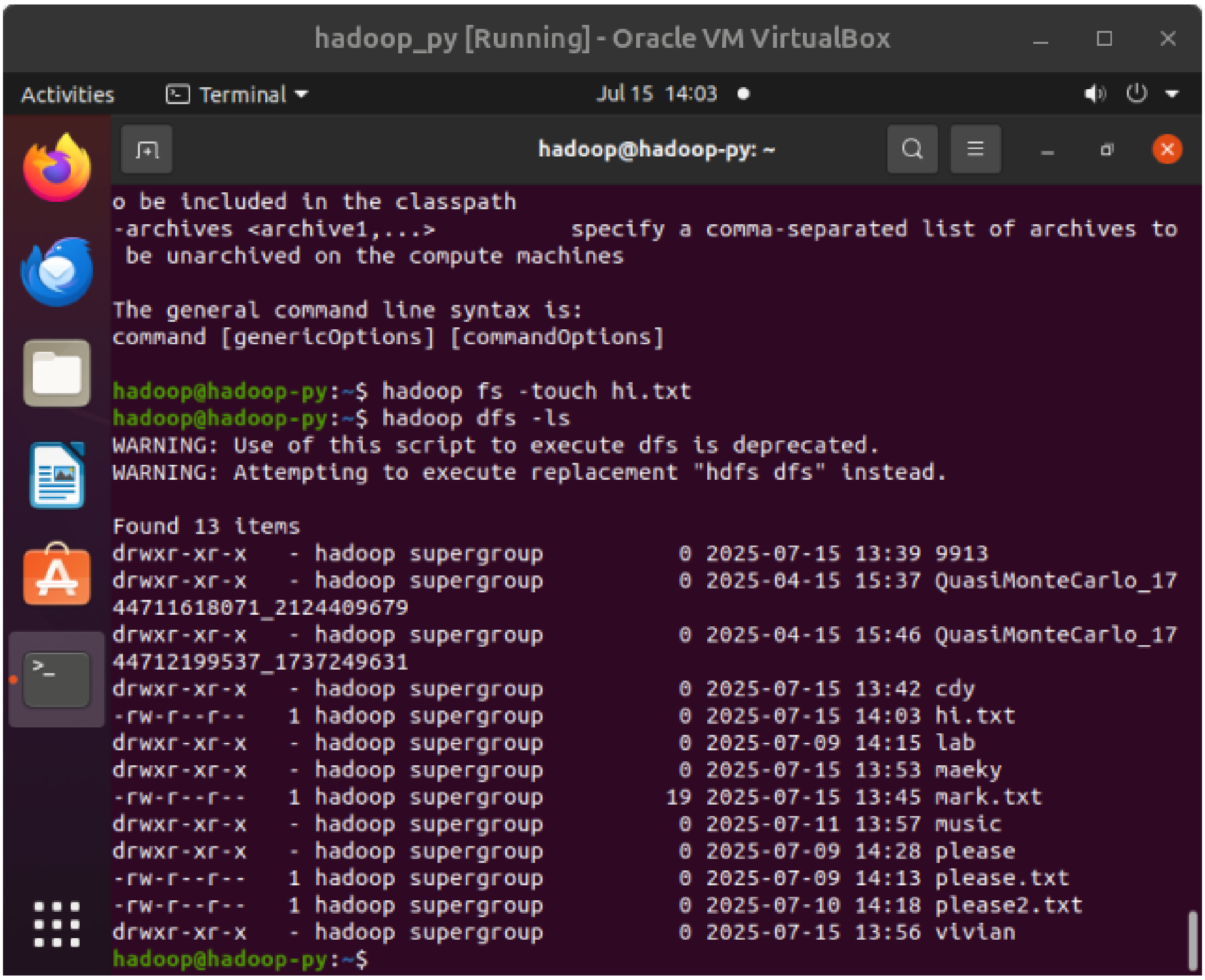
should also gain insights into HDFS's fault tolerance mechanisms and its role in supporting

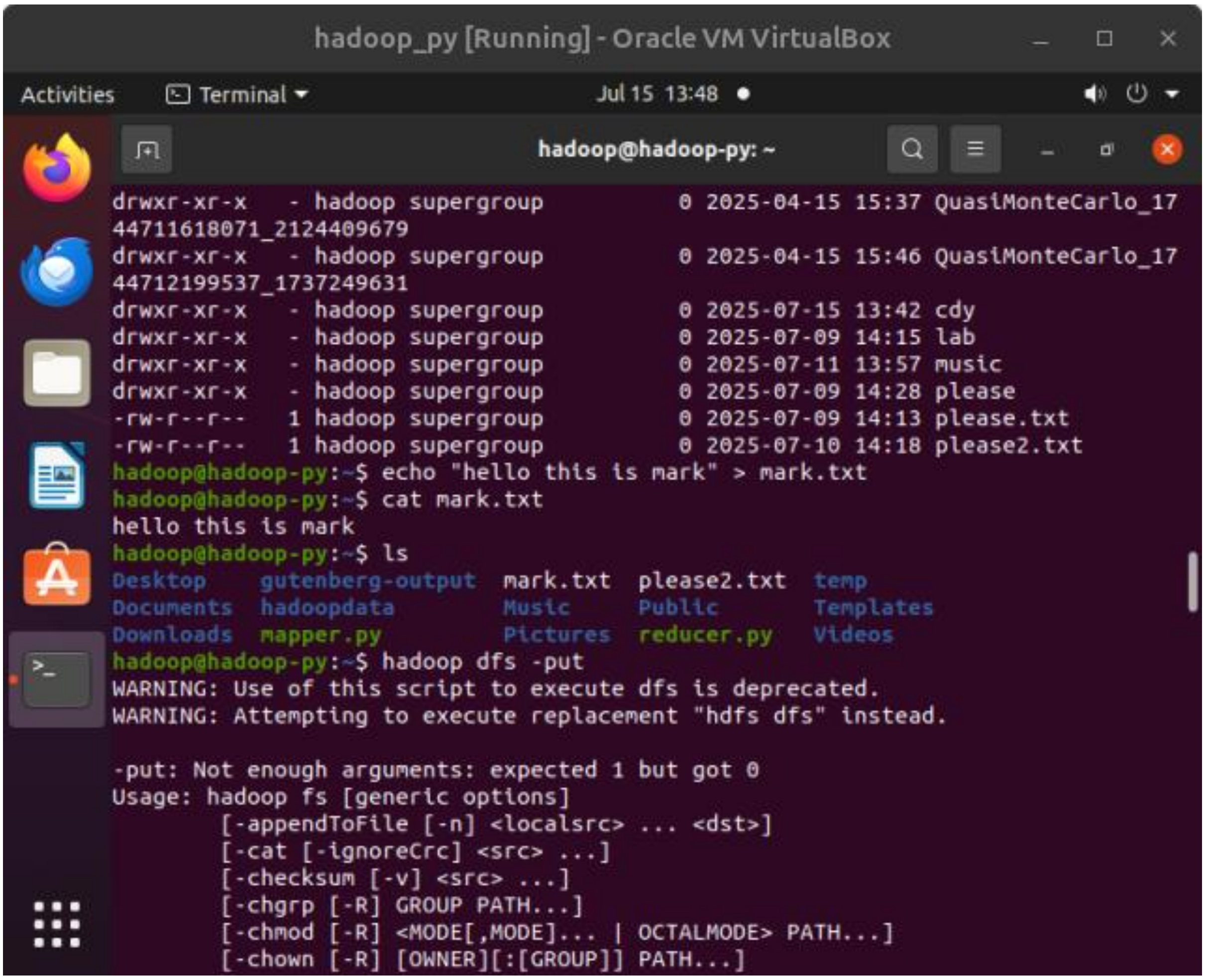
distributed data storage.

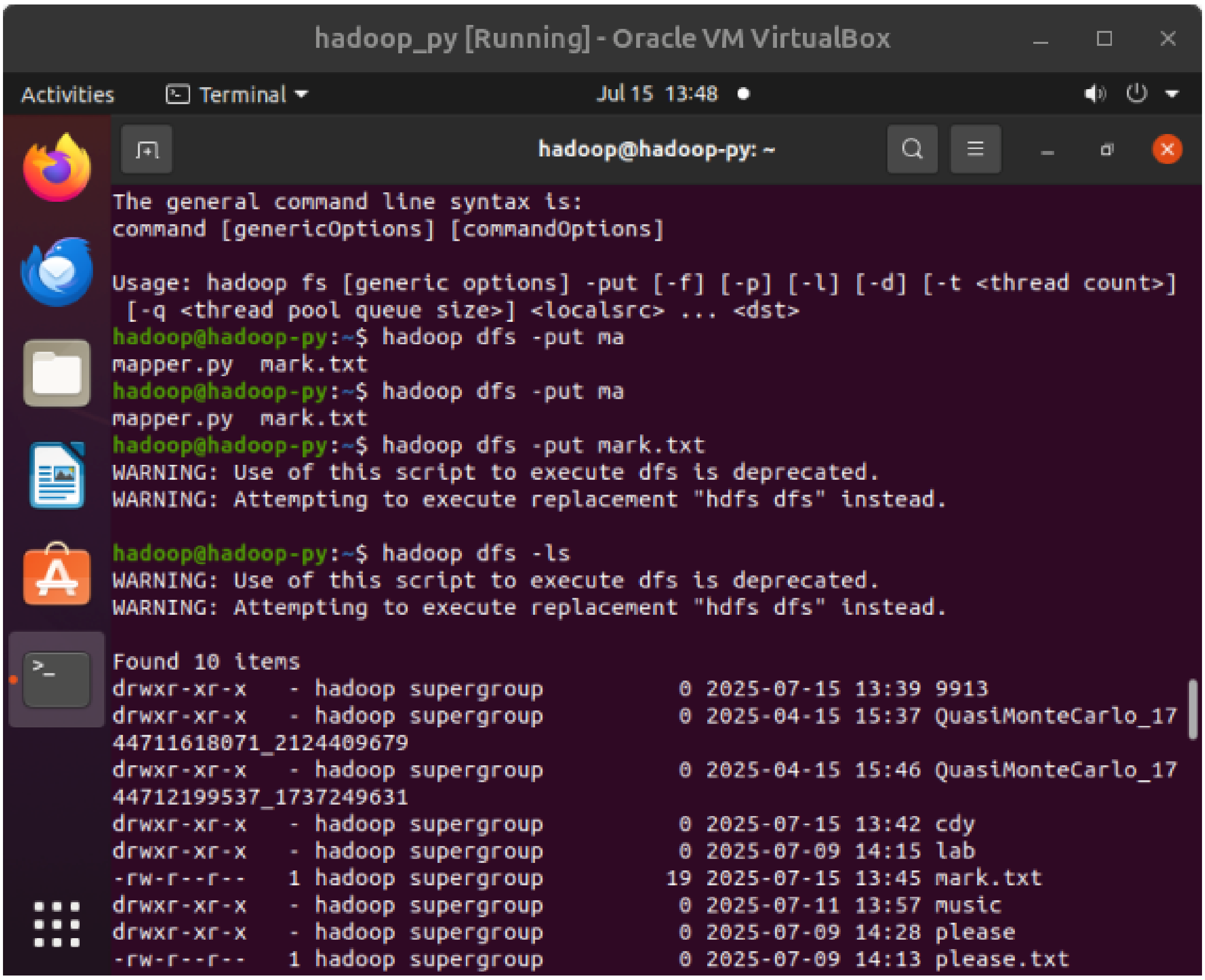
Conclusion:

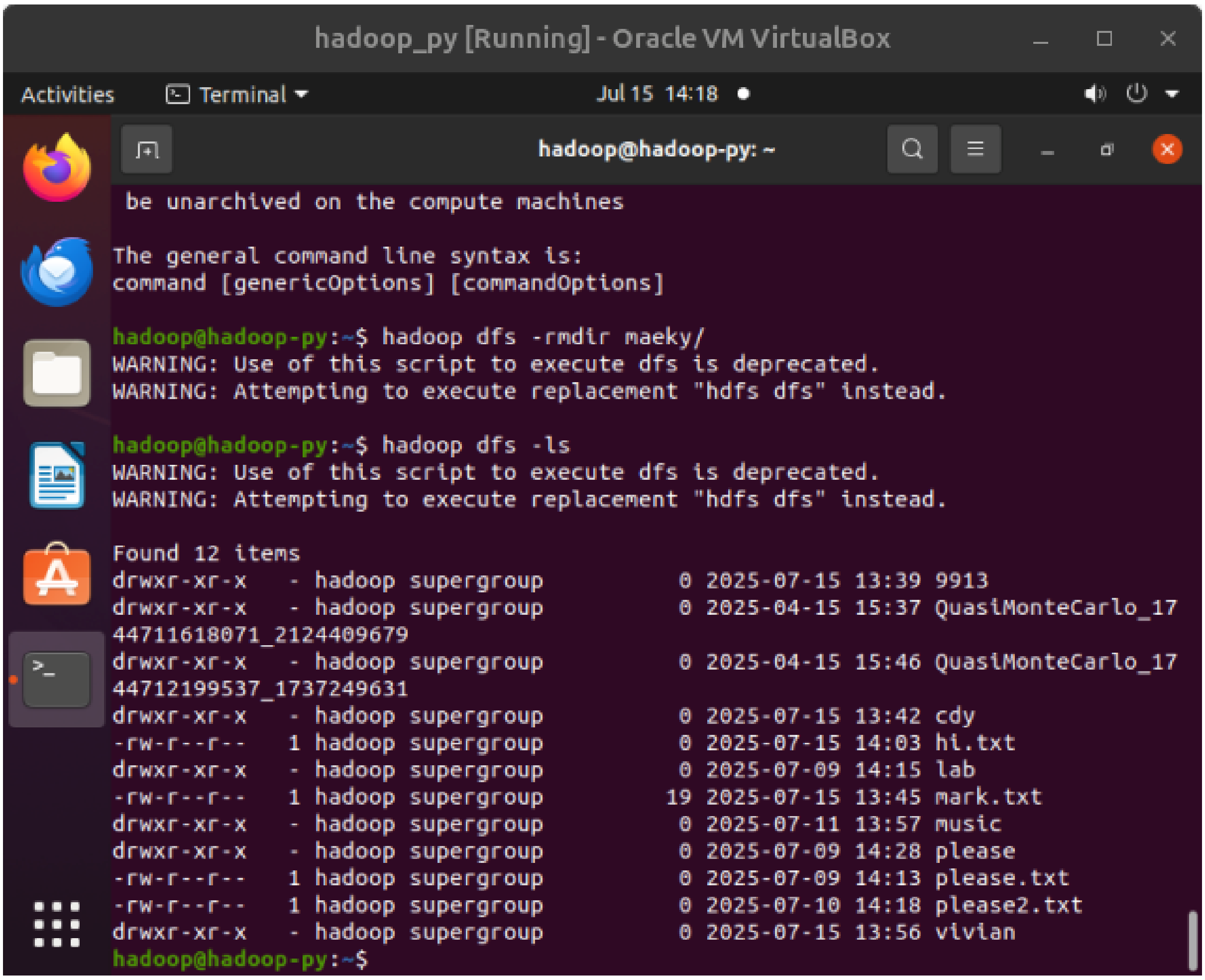

hadoop_py [Running] - Oracle VM VirtualBox
Activities
Terminal
Jul 15 13:53
hadoop@hadoop-py: ~
put: `/marky': No such file or directory
hadoop@hadoop-py:~$ ls
Desktop gutenberg-output mapper.py Pictures reducer.py Videos
Documents hadoopdata mark.txt please2.txt temp
Downloads maeky Music Public Templates
hadoop@hadoop-py:~$ hadoop dfs -put maeky
WARNING: Use of this script to execute dfs is deprecated.
WARNING: Attempting to execute replacement "hdfs dfs" instead.
hadoop@hadoop-py:~$ hadoop dfs -ls
WARNING: Use of this script to execute dfs is deprecated.
WARNING: Attempting to execute replacement "hdfs dfs" instead.
Found 11 items
drwxr-xr-x - hadoop supergroup 0 2025-07-15 13:39 9913
drwxr-xr-x - hadoop supergroup 0 2025-04-15 15:37 QuasiMonteCarlo_1744711618071_2124409679
drwxr-xr-x - hadoop supergroup 0 2025-04-15 15:46 QuasiMonteCarlo_1744712199537_1737249631
drwxr-xr-x - hadoop supergroup 0 2025-07-15 13:42 cdy
drwxr-xr-x - hadoop supergroup 0 2025-07-09 14:15 lab
drwxr-xr-x - hadoop supergroup 0 2025-07-15 13:53 maeky
-rw-r--r-- 1 hadoop supergroup 19 2025-07-15 13:45 mark.txt
drwxr-xr-x - hadoop supergroup 0 2025-07-11 13:57 music
drwxr-xr-x - hadoop supergroup 0 2025-07-09 14:28 please
-rw-r--r-- 1 hadoop supergroup 0 2025-07-09 14:13 please.txt
-rw-r--r-- 1 hadoop supergroup 0 2025-07-10 14:18 please2.txt
hadoop@hadoop-py:~$

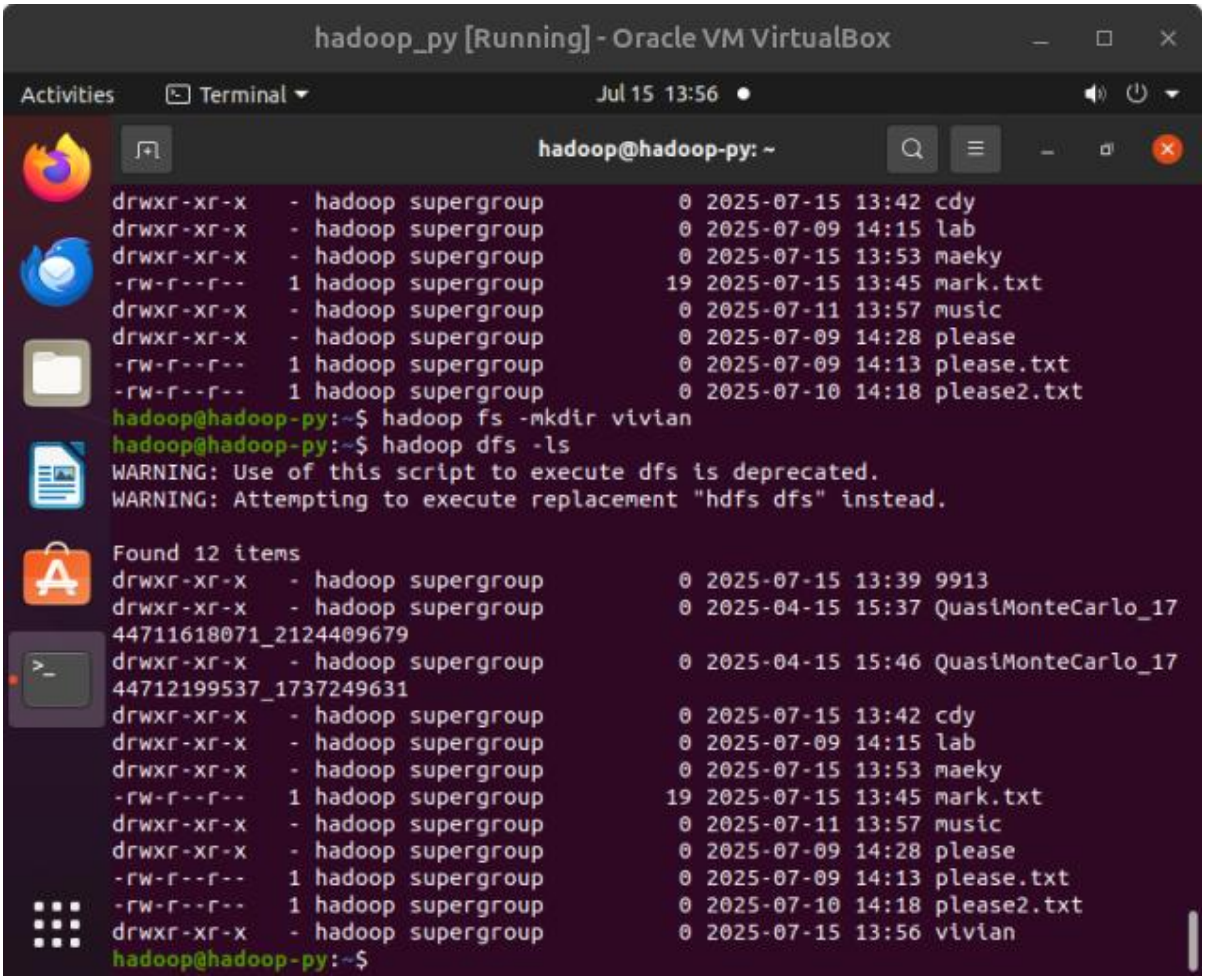

hadoop_py [Running] - Oracle VM VirtualBox
Activities
Terminal
Jul 15 13:48
hadoop@hadoop-py: ~
envvars display computed Hadoop environment variables
fetchdt fetch a delegation token from the NameNode
getconf get config values from configuration
groups get the groups which users belong to
lsSnapshot list all snapshots for a snapshottable directory
lsSnapshottableDir list all snapshottable dirs owned by the current user
snapshotDiff diff two snapshots of a directory or diff the current directory contents with a snapshot
version print the version
Daemon Commands:
balancer run a cluster balancing utility
datanode run a DFS datanode
dfsrouter run the DFS router
diskbalancer Distributes data evenly among disks on a given node
httpfs run HttpFS server, the HDFS HTTP Gateway
journalnode run the DFS journalnode
mover run a utility to move block replicas across storage types
namenode run the DFS namenode
nfs3 run an NFS version 3 gateway
portmap run a portmap service
secondarynamenode run the DFS secondary namenode
sps run external storagepolicysatisfier
zkfc run the ZK Failover Controller daemon
SUBCOMMAND may print help when invoked w/o parameters or with -h.
hadoop@hadoop-py:~$ ~

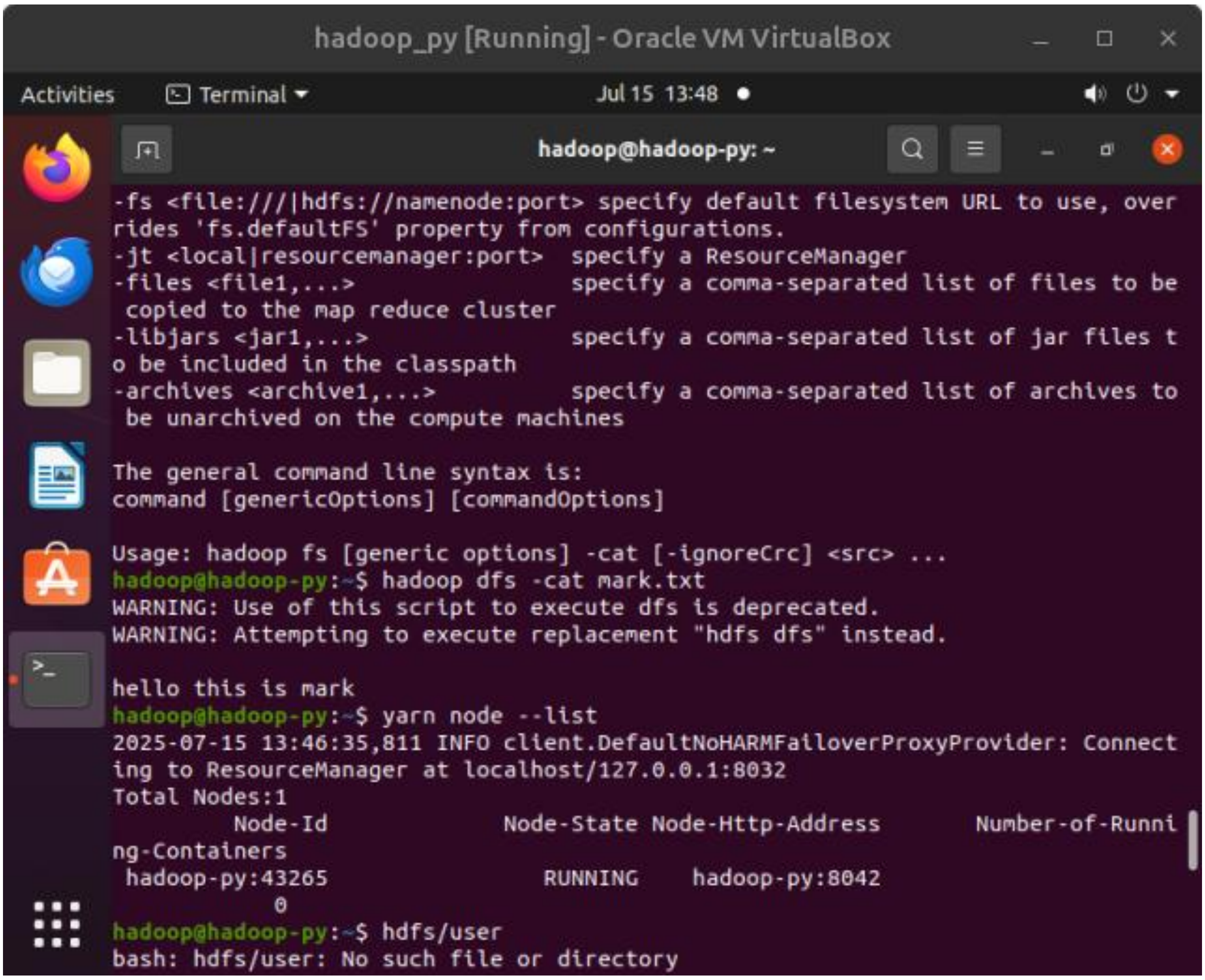

hadoop_py [Running] - Oracle VM VirtualBox
Activities
Terminal
Jul 15 14:03
hadoop@hadoop-py: ~
o be included in the classpath
-archives <archive1,...>   specify a comma-separated list of archives to
 be unarchived on the compute machines
The general command line syntax is:
command [genericOptions] [commandOptions]
hadoop@hadoop-py:~$ hadoop fs -touch hi.txt
hadoop@hadoop-py:~$ hadoop dfs -ls
WARNING: Use of this script to execute dfs is deprecated.
WARNING: Attempting to execute replacement "hdfs dfs" instead.
Found 13 items
drwxr-xr-x   - hadoop supergroup   0 2025-07-15 13:39 9913
drwxr-xr-x   - hadoop supergroup   0 2025-04-15 15:37 QuasiMonteCarlo_1744711618071_2124409679
drwxr-xr-x   - hadoop supergroup   0 2025-04-15 15:46 QuasiMonteCarlo_1744712199537_1737249631
drwxr-xr-x   - hadoop supergroup   0 2025-07-15 13:42 cdy
-rw-r--r--   1 hadoop supergroup   0 2025-07-15 14:03 hi.txt
drwxr-xr-x   - hadoop supergroup   0 2025-07-09 14:15 lab
drwxr-xr-x   - hadoop supergroup   0 2025-07-15 13:53 maeky
-rw-r--r--   1 hadoop supergroup   19 2025-07-15 13:45 mark.txt
drwxr-xr-x   - hadoop supergroup   0 2025-07-11 13:57 music
drwxr-xr-x   - hadoop supergroup   0 2025-07-09 14:28 please
-rw-r--r--   1 hadoop supergroup   0 2025-07-09 14:13 please.txt
-rw-r--r--   1 hadoop supergroup   0 2025-07-10 14:18 please2.txt
drwxr-xr-x   - hadoop supergroup   0 2025-07-15 13:56 vivian
hadoop@hadoop-py:~$

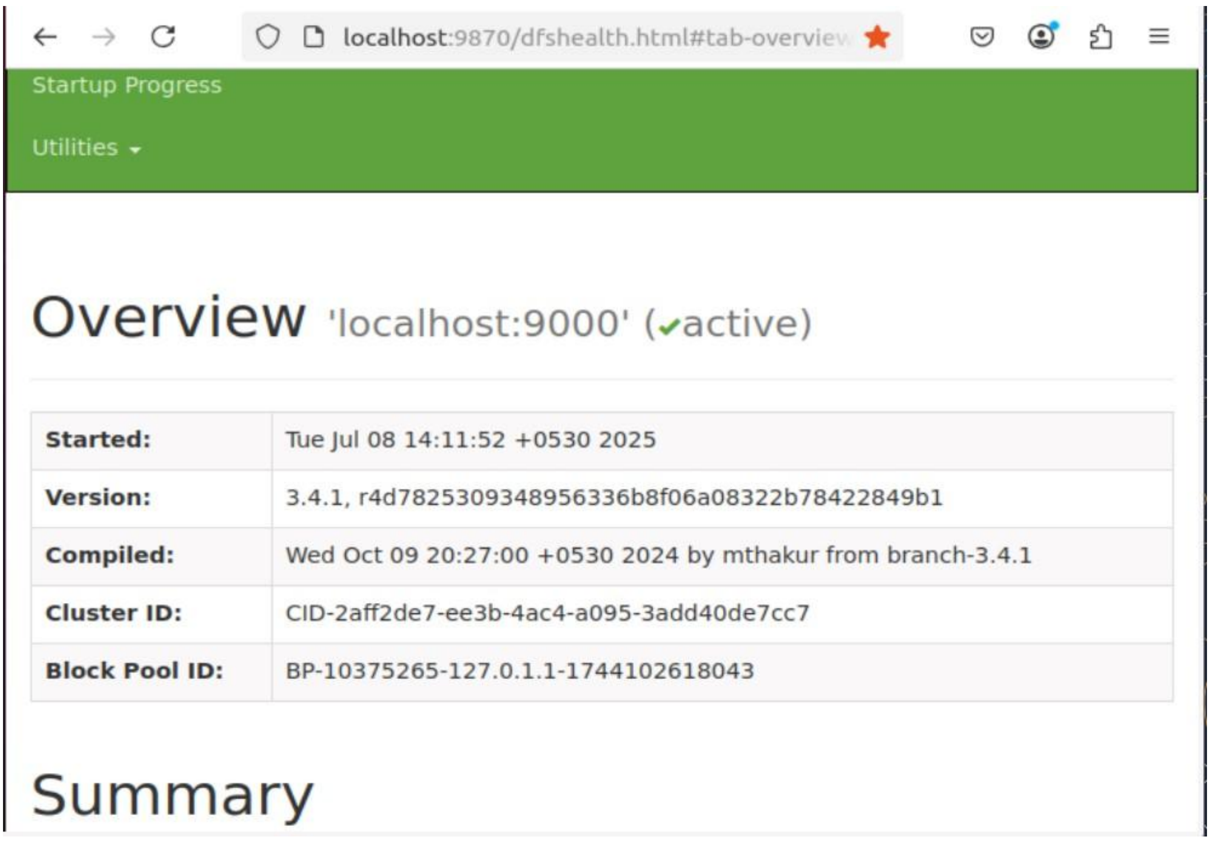

hadoop_py [Running] - Oracle VM VirtualBox
Activities
Terminal
Jul 15 13:48
hadoop@hadoop-py: ~
drwxr-xr-x - hadoop supergroup 0 2025-04-15 15:37 QuasiMonteCarlo_1744711618071_2124409679
drwxr-xr-x - hadoop supergroup 0 2025-04-15 15:46 QuasiMonteCarlo_1744712199537_1737249631
drwxr-xr-x - hadoop supergroup 0 2025-07-15 13:42 cdy
drwxr-xr-x - hadoop supergroup 0 2025-07-09 14:15 lab
drwxr-xr-x - hadoop supergroup 0 2025-07-11 13:57 music
drwxr-xr-x - hadoop supergroup 0 2025-07-09 14:28 please
-rw-r--r-- 1 hadoop supergroup 0 2025-07-09 14:13 please.txt
-rw-r--r-- 1 hadoop supergroup 0 2025-07-10 14:18 please2.txt
hadoop@hadoop-py:~$ echo "hello this is mark" > mark.txt
hadoop@hadoop-py:~$ cat mark.txt
hello this is mark
hadoop@hadoop-py:~$ ls
Desktop gutenberg-output mark.txt please2.txt temp
Documents hadoopdata Music Public Templates
Downloads mapper.py Pictures reducer.py Videos
hadoop@hadoop-py:~$ hadoop dfs -put
WARNING: Use of this script to execute dfs is deprecated.
WARNING: Attempting to execute replacement "hdfs dfs" instead.
-put: Not enough arguments: expected 1 but got 0
Usage: hadoop fs [generic options]
[-appendToFile [-n] <localsrc> ... <dst>]
[-cat [-ignoreCrc] <src> ...]
[-checksum [-v] <src> ...]
[-chgrp [-R] GROUP PATH...]
[-chmod [-R] <MODE[,MODE]... | OCTALMODE> PATH...]
[-chown [-R] [OWNER][:[GROUP]] PATH...]


hadoop_py [Running] - Oracle VM VirtualBox
Activities
Terminal
Jul 15 13:48
hadoop@hadoop-py: ~
The general command line syntax is:
command [genericOptions] [commandOptions]
Usage: hadoop fs [generic options] -put [-f] [-p] [-l] [-d] [-t <thread count>] [-q <thread pool queue size>] <localsrc> ... <dst>
hadoop@hadoop-py:~$ hadoop dfs -put ma
mapper.py mark.txt
hadoop@hadoop-py:~$ hadoop dfs -put ma
mapper.py mark.txt
hadoop@hadoop-py:~$ hadoop dfs -put mark.txt
WARNING: Use of this script to execute dfs is deprecated.
WARNING: Attempting to execute replacement "hdfs dfs" instead.
hadoop@hadoop-py:~$ hadoop dfs -ls
WARNING: Use of this script to execute dfs is deprecated.
WARNING: Attempting to execute replacement "hdfs dfs" instead.
Found 10 items
drwxr-xr-x - hadoop supergroup 0 2025-07-15 13:39 9913
drwxr-xr-x - hadoop supergroup 0 2025-04-15 15:37 QuasiMonteCarlo_1744711618071_2124409679
drwxr-xr-x - hadoop supergroup 0 2025-04-15 15:46 QuasiMonteCarlo_1744712199537_1737249631
drwxr-xr-x - hadoop supergroup 0 2025-07-15 13:42 cdy
drwxr-xr-x - hadoop supergroup 0 2025-07-09 14:15 lab
-rw-r--r-- 1 hadoop supergroup 19 2025-07-15 13:45 mark.txt
drwxr-xr-x - hadoop supergroup 0 2025-07-11 13:57 music
drwxr-xr-x - hadoop supergroup 0 2025-07-09 14:28 please
-rw-r--r-- 1 hadoop supergroup 0 2025-07-09 14:13 please.txt


hadoop_py [Running] - Oracle VM VirtualBox
Activities
Terminal
Jul 15 14:18
hadoop@hadoop-py: ~
be unarchived on the compute machines
The general command line syntax is:
command [genericOptions] [commandOptions]
hadoop@hadoop-py:~$ hadoop dfs -rmdir maeky/
WARNING: Use of this script to execute dfs is deprecated.
WARNING: Attempting to execute replacement "hdfs dfs" instead.
hadoop@hadoop-py:~$ hadoop dfs -ls
WARNING: Use of this script to execute dfs is deprecated.
WARNING: Attempting to execute replacement "hdfs dfs" instead.
Found 12 items
drwxr-xr-x - hadoop supergroup 0 2025-07-15 13:39 9913
drwxr-xr-x - hadoop supergroup 0 2025-04-15 15:37 QuasiMonteCarlo_1744711618071_2124409679
drwxr-xr-x - hadoop supergroup 0 2025-04-15 15:46 QuasiMonteCarlo_1744712199537_1737249631
drwxr-xr-x - hadoop supergroup 0 2025-07-15 13:42 cdy
-rw-r--r-- 1 hadoop supergroup 0 2025-07-15 14:03 hi.txt
drwxr-xr-x - hadoop supergroup 0 2025-07-09 14:15 lab
-rw-r--r-- 1 hadoop supergroup 19 2025-07-15 13:45 mark.txt
drwxr-xr-x - hadoop supergroup 0 2025-07-11 13:57 music
drwxr-xr-x - hadoop supergroup 0 2025-07-09 14:28 please
-rw-r--r-- 1 hadoop supergroup 0 2025-07-09 14:13 please.txt
-rw-r--r-- 1 hadoop supergroup 0 2025-07-10 14:18 please2.txt
drwxr-xr-x - hadoop supergroup 0 2025-07-15 13:56 vivian
hadoop@hadoop-py:~$


hadoop_py [Running] - Oracle VM VirtualBox
Activities
Terminal
Jul 15 13:56
hadoop@hadoop-py: ~
drwxr-xr-x   - hadoop supergroup   0 2025-07-15 13:42 cdy
drwxr-xr-x   - hadoop supergroup   0 2025-07-09 14:15 lab
drwxr-xr-x   - hadoop supergroup   0 2025-07-15 13:53 maeky
-rw-r--r--   1 hadoop supergroup   19 2025-07-15 13:45 mark.txt
drwxr-xr-x   - hadoop supergroup   0 2025-07-11 13:57 music
drwxr-xr-x   - hadoop supergroup   0 2025-07-09 14:28 please
-rw-r--r--   1 hadoop supergroup   0 2025-07-09 14:13 please.txt
-rw-r--r--   1 hadoop supergroup   0 2025-07-10 14:18 please2.txt
hadoop@hadoop-py:~$ hadoop fs -mkdir vivian
hadoop@hadoop-py:~$ hadoop dfs -ls
WARNING: Use of this script to execute dfs is deprecated.
WARNING: Attempting to execute replacement "hdfs dfs" instead.
Found 12 items
drwxr-xr-x   - hadoop supergroup   0 2025-07-15 13:39 9913
drwxr-xr-x   - hadoop supergroup   0 2025-04-15 15:37 QuasiMonteCarlo_1744711618071_2124409679
drwxr-xr-x   - hadoop supergroup   0 2025-04-15 15:46 QuasiMonteCarlo_1744712199537_1737249631
drwxr-xr-x   - hadoop supergroup   0 2025-07-15 13:42 cdy
drwxr-xr-x   - hadoop supergroup   0 2025-07-09 14:15 lab
drwxr-xr-x   - hadoop supergroup   0 2025-07-15 13:53 maeky
-rw-r--r--   1 hadoop supergroup   19 2025-07-15 13:45 mark.txt
drwxr-xr-x   - hadoop supergroup   0 2025-07-11 13:57 music
drwxr-xr-x   - hadoop supergroup   0 2025-07-09 14:28 please
-rw-r--r--   1 hadoop supergroup   0 2025-07-09 14:13 please.txt
-rw-r--r--   1 hadoop supergroup   0 2025-07-10 14:18 please2.txt
drwxr-xr-x   - hadoop supergroup   0 2025-07-15 13:56 vivian
hadoop@hadoop-py:~$


hadoop_py [Running] - Oracle VM VirtualBox
Activities
Terminal
Jul 15 13:48
hadoop@hadoop-py: ~
-fs <file:///|hdfs://namenode:port> specify default filesystem URL to use, overrides 'fs.defaultFS' property from configurations.
-jt <local|resourcemanager:port> specify a ResourceManager
-files <file1,...> specify a comma-separated list of files to be copied to the map reduce cluster
-libjars <jar1,...> specify a comma-separated list of jar files to be included in the classpath
-archives <archive1,...> specify a comma-separated list of archives to be unarchived on the compute machines
The general command line syntax is:
command [genericOptions] [commandOptions]
Usage: hadoop fs [generic options] -cat [-ignoreCrc] <src> ...
hadoop@hadoop-py:~$ hadoop dfs -cat mark.txt
WARNING: Use of this script to execute dfs is deprecated.
WARNING: Attempting to execute replacement "hdfs dfs" instead.
hello this is mark
hadoop@hadoop-py:~$ yarn node --list
2025-07-15 13:46:35,811 INFO client.DefaultNoHARMFailoverProxyProvider: Connecting to ResourceManager at localhost/127.0.0.1:8032
Total Nodes:1
Node-Id Node-State Node-Http-Address Number-of-Running-Containers
hadoop-py:43265 RUNNING hadoop-py:8042 0
hadoop@hadoop-py:~$ hdfs/user
bash: hdfs/user: No such file or directory


localhost:9870/dfshealth.html#tab-overview
Startup Progress
Utilities
Overview 'localhost:9000' (active)
Started: Tue Jul 08 14:11:52 +0530 2025
Version: 3.4.1, r4d7825309348956336b8f06a08322b78422849b1
Compiled: Wed Oct 09 20:27:00 +0530 2024 by mthakur from branch-3.4.1
Cluster ID: CID-2aff2de7-ee3b-4ac4-a095-3add40de7cc7
Block Pool ID: BP-10375265-127.0.1.1-1744102618043
Summary

Configured Capacity:	19.02 GB
Configured Remote Capacity:	0 B
DFS Used:	10.64 MB (0.05%)
Non DFS Used:	13.06 GB
DFS Remaining:	4.96 GB (26.09%)
Block Pool Used:	10.64 MB (0.05%)
DataNodes usages% (Min/Median/Max/stdDev):	0.05% / 0.05% / 0.05% / 0.00%
Live Nodes	1 (Decommissioned: 0, In Maintenance: 0)
Dead Nodes	0 (Decommissioned: 0, In Maintenance: 0)
Decommissioning Nodes	0
Entering Maintenance Nodes	0

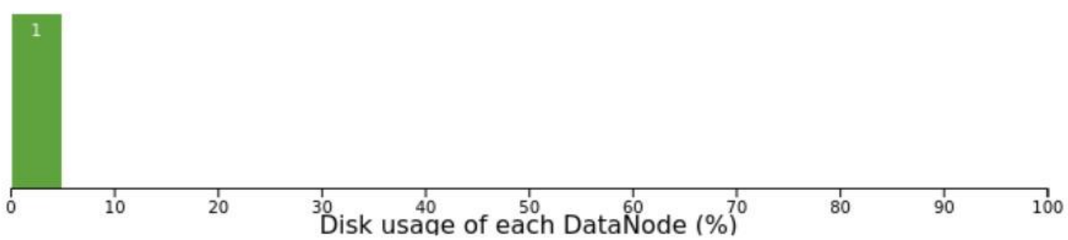
localhost:9870/dfshealth.html#tab-datanod

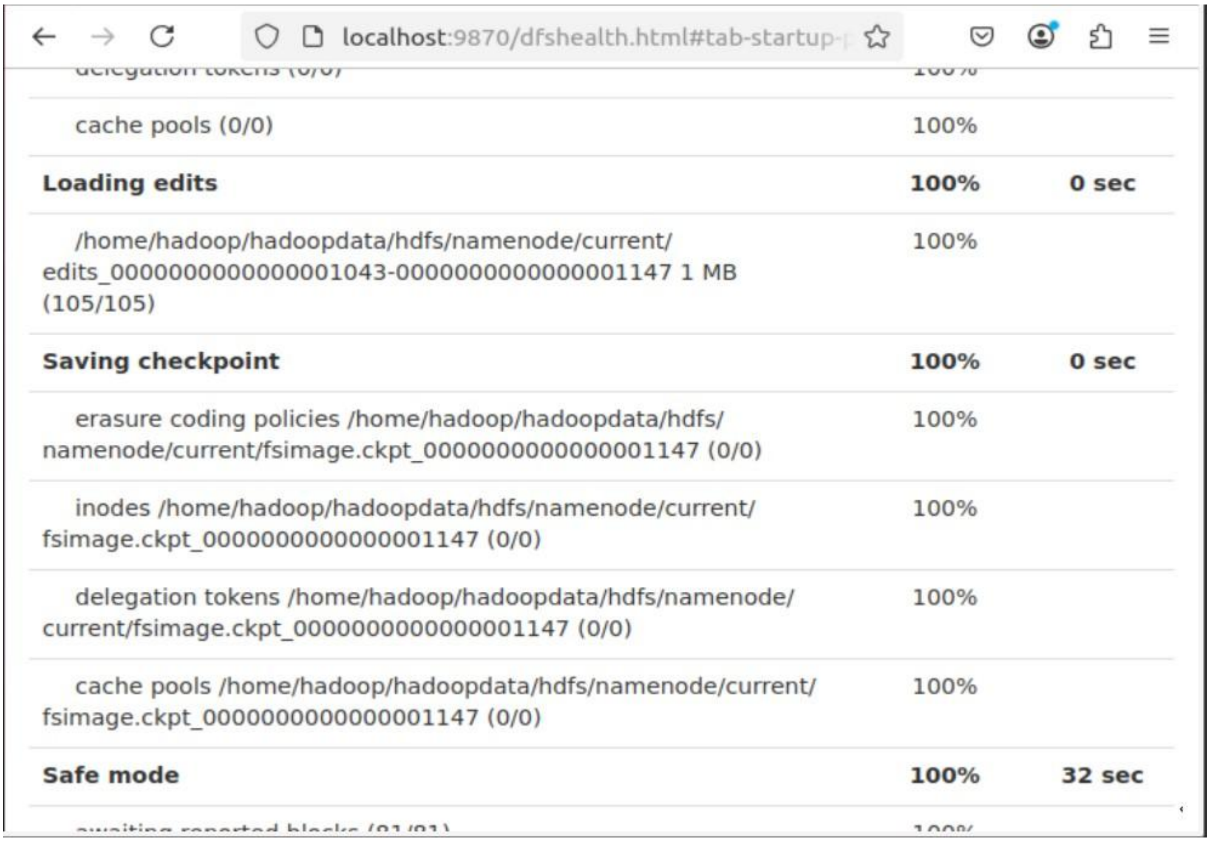
Datanode Information

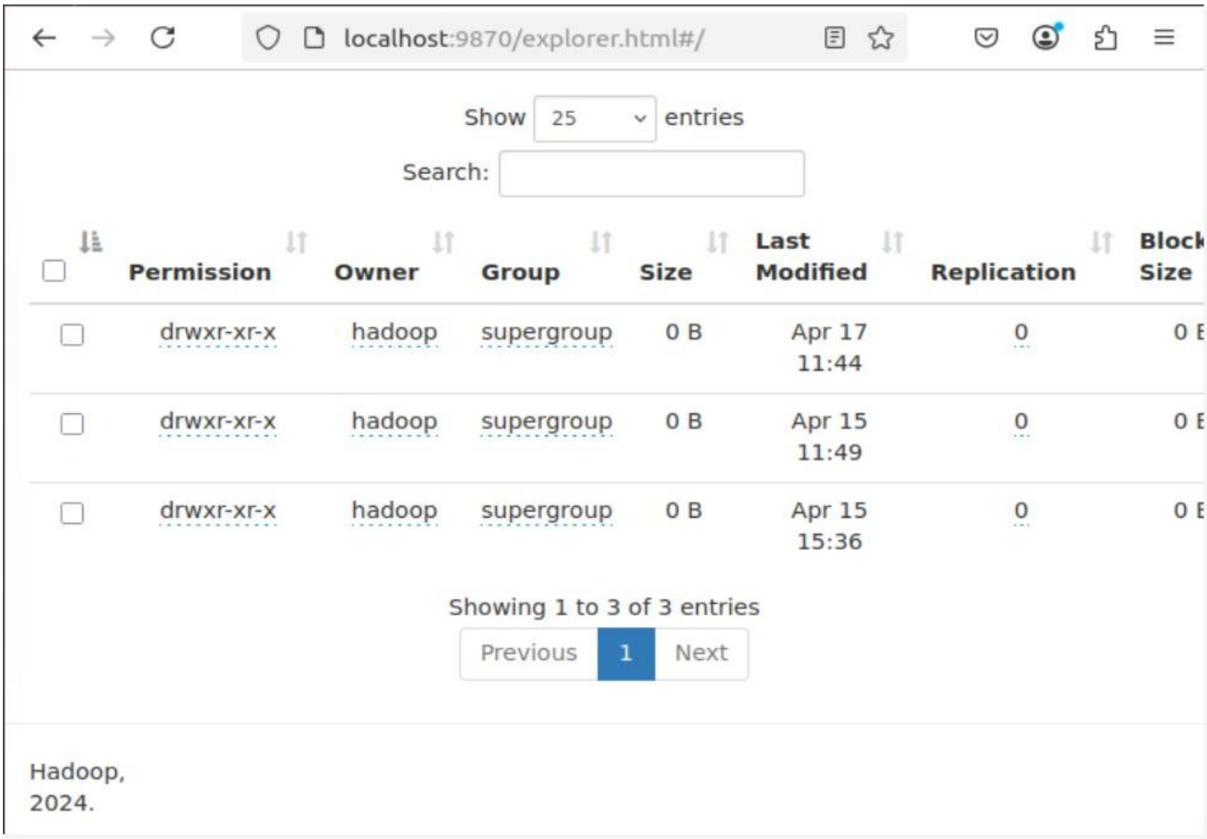
In service Down Decommissioning Decommissioned Decommissioned & dead

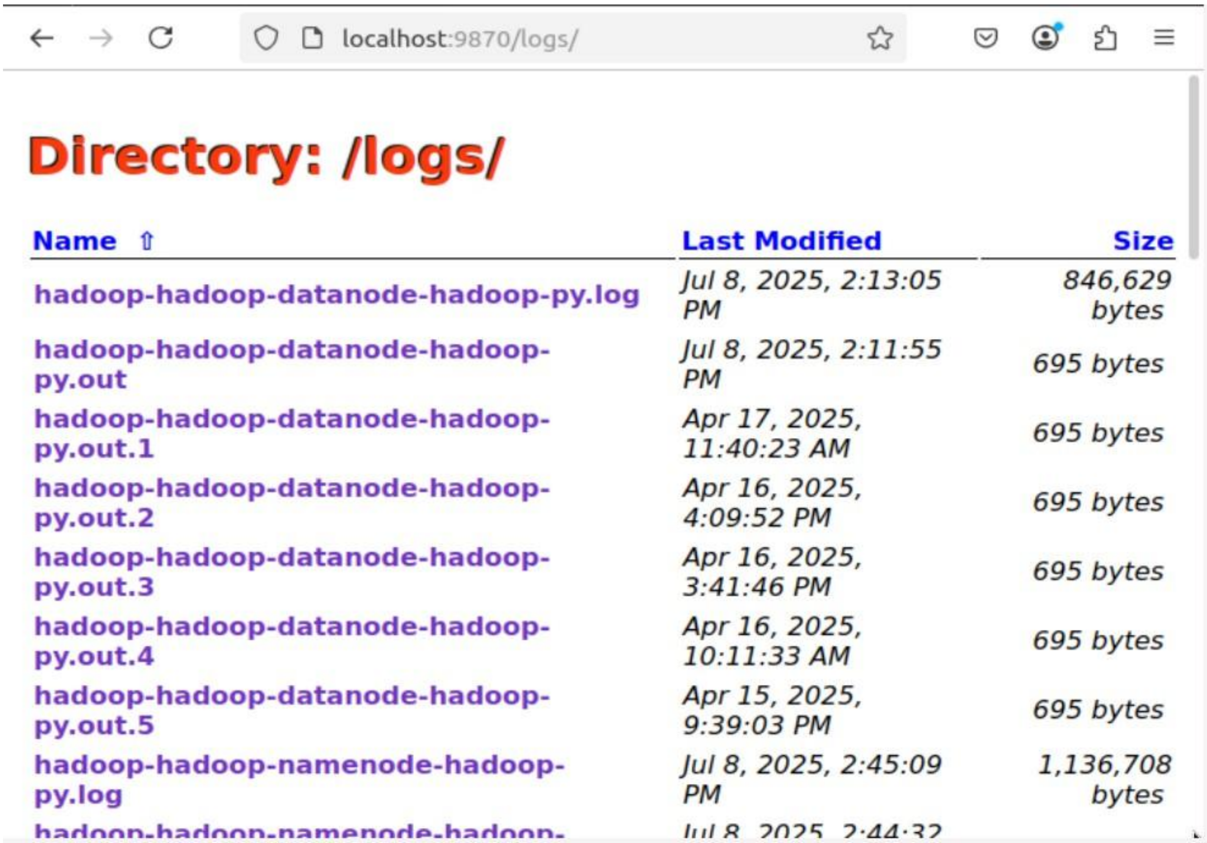
Entering Maintenance In Maintenance In Maintenance & dead

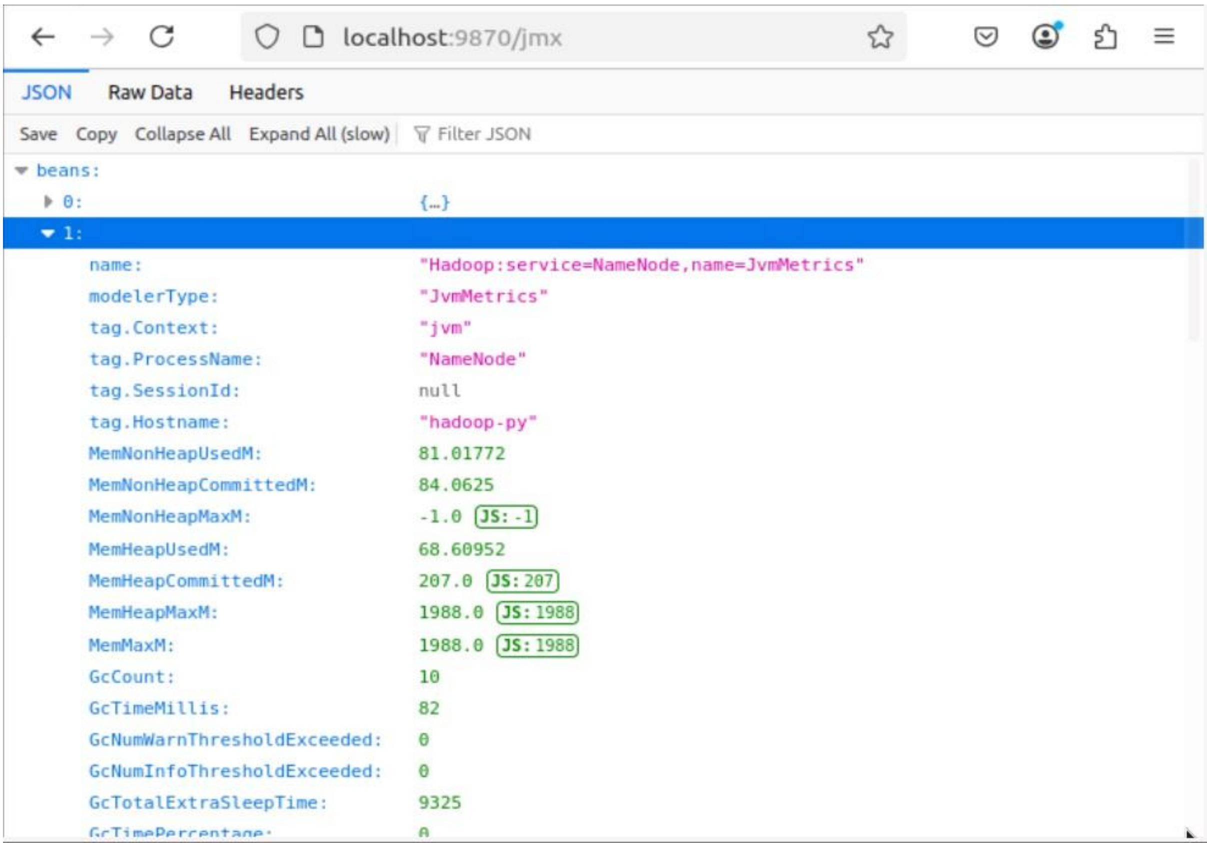
Datanode usage histogram




localhost:9870/dfshealth.html#tab-startup-
cache pools (0/0) 100%
Loading edits 100% 0 sec
/home/hadoop/hadoopdata/hdfs/namenode/current/edits_0000000000000001043-0000000000000001147 1 MB (105/105) 100%
Saving checkpoint 100% 0 sec
erasure coding policies /home/hadoop/hadoopdata/hdfs/namenode/current/fsimage.ckpt_0000000000000001147 (0/0) 100%
inodes /home/hadoop/hadoopdata/hdfs/namenode/current/fsimage.ckpt_0000000000000001147 (0/0) 100%
delegation tokens /home/hadoop/hadoopdata/hdfs/namenode/current/fsimage.ckpt_0000000000000001147 (0/0) 100%
cache pools /home/hadoop/hadoopdata/hdfs/namenode/current/fsimage.ckpt_0000000000000001147 (0/0) 100%
Safe mode 100% 32 sec


localhost:9870/explorer.html#/
Show 25 entries
Search:
Permission Owner Group Size Last Modified Replication Block Size
drwxr-xr-x hadoop supergroup 0 B Apr 17 11:44 0
drwxr-xr-x hadoop supergroup 0 B Apr 15 11:49 0
drwxr-xr-x hadoop supergroup 0 B Apr 15 15:36 0
Showing 1 to 3 of 3 entries
Previous 1 Next
Hadoop, 2024.


localhost:9870/logs/
Directory: /logs/
Name ⇧
Last Modified
Size
hadoop-hadoop-datanode-hadoop-py.log
Jul 8, 2025, 2:13:05 PM
846,629 bytes
hadoop-hadoop-datanode-hadoop-py.out
Jul 8, 2025, 2:11:55 PM
695 bytes
hadoop-hadoop-datanode-hadoop-py.out.1
Apr 17, 2025, 11:40:23 AM
695 bytes
hadoop-hadoop-datanode-hadoop-py.out.2
Apr 16, 2025, 4:09:52 PM
695 bytes
hadoop-hadoop-datanode-hadoop-py.out.3
Apr 16, 2025, 3:41:46 PM
695 bytes
hadoop-hadoop-datanode-hadoop-py.out.4
Apr 16, 2025, 10:11:33 AM
695 bytes
hadoop-hadoop-datanode-hadoop-py.out.5
Apr 15, 2025, 9:39:03 PM
695 bytes
hadoop-hadoop-namenode-hadoop-py.log
Jul 8, 2025, 2:45:09 PM
1,136,708 bytes


localhost:9870/jmx
JSON
Raw Data
Headers
Save
Copy
Collapse All
Expand All (slow)
Filter JSON
beans:
0: {…}
1:
name: "Hadoop:service=NameNode,name=JvmMetrics"
modelerType: "JvmMetrics"
tag.Context: "jvm"
tag.ProcessName: "NameNode"
tag.SessionId: null
tag.Hostname: "hadoop-py"
MemNonHeapUsedM: 81.01772
MemNonHeapCommittedM: 84.0625
MemNonHeapMaxM: -1.0 JS: -1
MemHeapUsedM: 68.60952
MemHeapCommittedM: 207.0 JS: 207
MemHeapMaxM: 1988.0 JS: 1988
MemMaxM: 1988.0 JS: 1988
GcCount: 10
GcTimeMillis: 82
GcNumWarnThresholdExceeded: 0
GcNumInfoThresholdExceeded: 0
GcTotalExtraSleepTime: 9325

Postlab:-

1. What are the main components of a Hadoop application?

HDFS (Hadoop Distributed File System):
Stores large files across multiple machines with fault tolerance using replication.

YARN (Yet Another Resource Negotiator):
Manages cluster resources and job scheduling.

MapReduce:
A programming model used for distributed data processing (map = split, reduce = aggregate).

Hadoop Common:
Provides essential Java libraries and utilities used by other modules.

2. Difference between NameNode, Backup Node, and Checkpoint Node:

Component	Function	Real-Time Sync	Failure Recovery Role
NameNode	Manages file system metadata like file names, directories, and block locations.	Yes	Acts as the master; essential for HDFS operation.
Backup Node	Maintains an in-memory, up-to-date copy of metadata from the NameNode.	Yes	Can immediately take over if NameNode fails.
Checkpoint Node	Periodically downloads and merges fsimage and edits, then sends a new fsimage to NameNode.	No	Reduces NameNode startup time, not used for failover.

3. Explain the use of cat, du, du -s:

- cat (concatenate):

  Used to view the contents of files in the terminal. Example: cat file.txt

- du (disk usage):

  Shows the space used by files and directories. Example: du myfolder/

- du -s (summary):

  Displays the total size of a folder, instead of listing all subdirectories. Example: du -s myfolder/