

## Rapport de :

**TP 1 : “Installation et configuration d’Apache Hadoop et exécution d’un programme MapReduce dans un cluster hadoop à nœud unique et à nœuds multiples.”**

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#### Pré-requis techniques :

- x *Oracle AM VirtualBox-6.0* :

Oracle VM VirtualBox (anciennement VirtualBox) est un logiciel libre de virtualisation publié par Oracle.

Lien de Téléchargement :



[https://download.virtualbox.org/virtualbox/6.0.12/virtualbox-6.0\\_6.0.12-133076~Ubuntu~bionic\\_amd64.ddeb](https://download.virtualbox.org/virtualbox/6.0.12/virtualbox-6.0_6.0.12-133076~Ubuntu~bionic_amd64.ddeb)

x *Ubuntu 18.04.3 :*

Ubuntu est un système d'exploitation GNU/Linux basé sur la distribution Linux Debian. Il est développé, commercialisé et maintenu pour les ordinateurs individuels (desktop), les serveurs (Server) et les objets connectés (Core) par la société Canonical.



Lien de Téléchargement de la version Ubuntu 20.04 :

<https://ubuntu.com/download/desktop/thank-you?version=20.04.1&architecture=amd64>

x *Apache Hadoop version=3.2.1 :*

est un framework libre et open source écrit en Java destiné à faciliter la création d'applications distribuées et échelonnables permettant aux applications de travailler avec des milliers de nœuds et des pétaoctets de données.



Ainsi chaque nœud est constitué de machines standard regroupées en grappe.

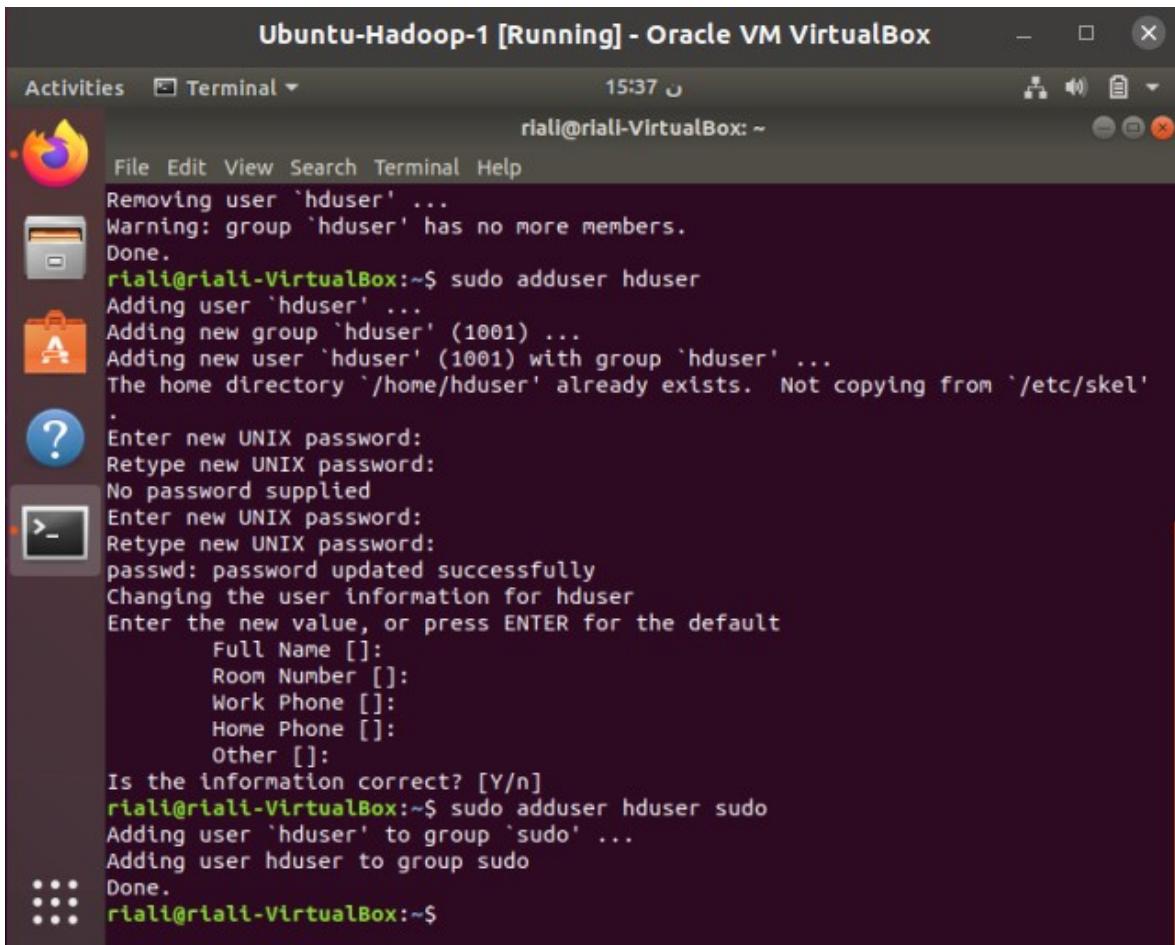
Lien de Téléchargement :

<https://downloads.apache.org/hadoop/common/hadoop-3.2.1/hadoop-3.2.1.tar.gz>

pour Java 8 : <https://github.com/sanyoushi/java-buildpack.git>

# I. Installation et configuration d'un nœud unique d'Apache Hadoop 3.2.1

## Création d'un utilisateur hduser:



```
Ubuntu-Hadoop-1 [Running] - Oracle VM VirtualBox
Activities Terminal 15:37
riali@riali-VirtualBox: ~

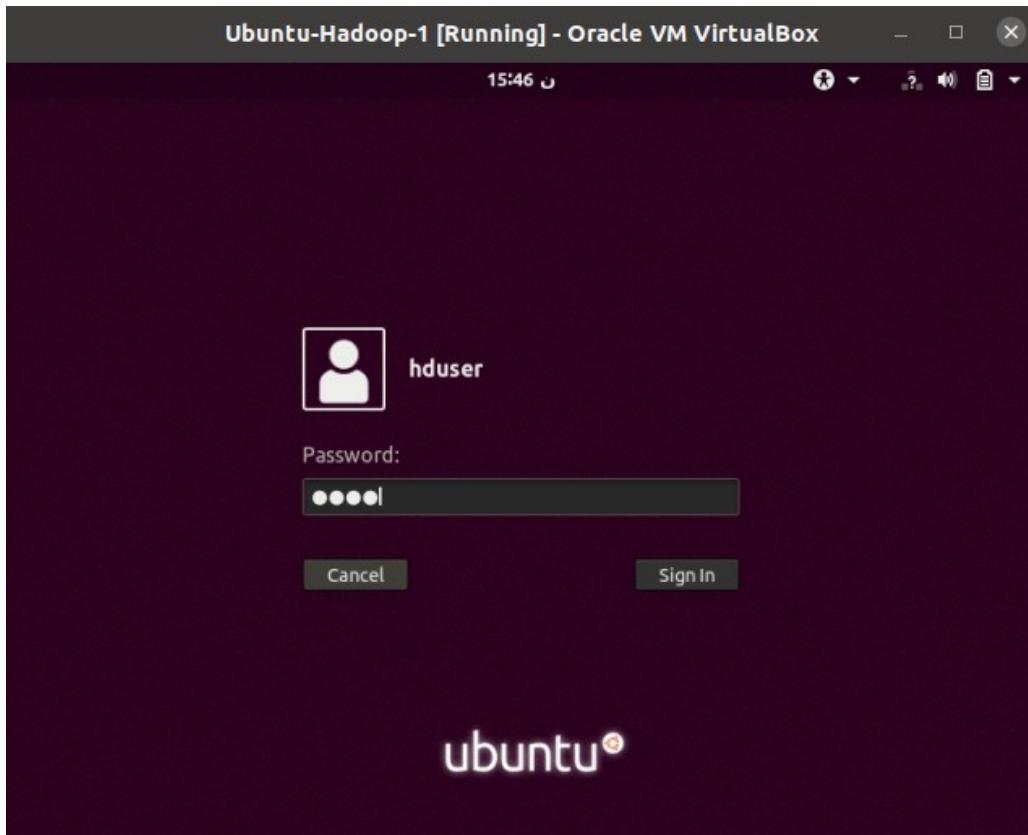
File Edit View Search Terminal Help
Removing user 'hduser' ...
Warning: group 'hduser' has no more members.
Done.
riali@riali-VirtualBox:~$ sudo adduser hduser
Adding user 'hduser' ...
Adding new group 'hduser' (1001) ...
Adding new user 'hduser' (1001) with group 'hduser' ...
The home directory '/home/hduser' already exists. Not copying from '/etc/skel'

Enter new UNIX password:
Retype new UNIX password:
No password supplied
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
Changing the user information for hduser
Enter the new value, or press ENTER for the default
    Full Name []:
    Room Number []:
    Work Phone []:
    Home Phone []:
    Other []:
Is the information correct? [Y/n]
riali@riali-VirtualBox:~$ sudo adduser hduser sudo
Adding user 'hduser' to group 'sudo' ...
Adding user hduser to group sudo
Done.
riali@riali-VirtualBox:~$
```

- Pour ajouter un nouveau “user” qu’on va l’appeler “hduser” , il faut juste appeler la commande suivante : `sudo adduser hduser`
- Ensuite on va appeler la commande : `sudo adduser hduser sudo` pour inclure le nouveau user dans le groupe sudo pour faire de lui un sudoer dont l’objectif est de lui permettre à exécuter des commandes en tant que super utilisateur .

## Mise en place de la clé ssh :

En premier lieu, il faut qu'on se connecte par l'utilisateur :  
hduser



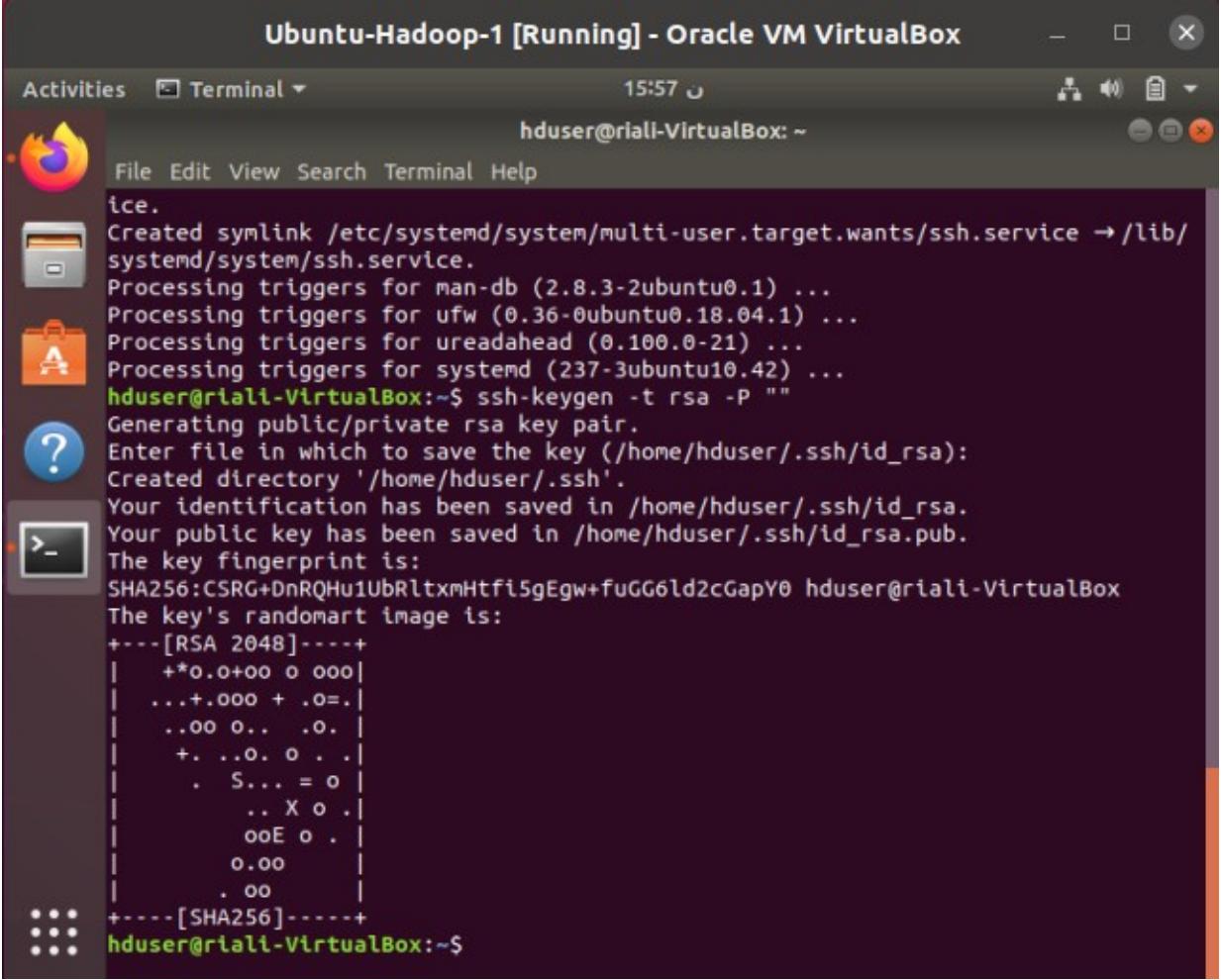
## **Installer le serveur openssh :**

**Sur Ubuntu 18.04, pour installer le serveur openssh, il ne faut qu'appeler la commande suivante : sudo apt-get install openssh-server**

## Mettre en place la clé ssh pour son propre compte :

Dans cette étape, on va comprendre pourquoi on doit se connecter par hduser, tout simplement , car il faut mettre en place une clé ssh pour celui-ci, pour qu'il puisse dans ce qui suit, se connecter aux autres machines de cluster qui vont être clonées à partir de cette machine-là, alors il faut taper ces commandes-là : **ssh-keygen -t rsa -P ""**

- **cat ~/.ssh/id\_rsa.pub >> ~/.ssh/authorized\_keys**
- **chmod 0600 ~/.ssh/authorized\_keys**



```
ice.
Created symlink /etc/systemd/system/multi-user.target.wants/ssh.service → /lib/
systemd/system/ssh.service.
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for ufw (0.36-0ubuntu0.18.04.1) ...
Processing triggers for ureadahead (0.100.0-21) ...
Processing triggers for systemd (237-3ubuntu10.42) ...
hduser@riali-VirtualBox:~$ ssh-keygen -t rsa -P ""
Generating public/private rsa key pair.
Enter file in which to save the key (/home/hduser/.ssh/id_rsa):
Created directory '/home/hduser/.ssh'.
Your identification has been saved in /home/hduser/.ssh/id_rsa.
Your public key has been saved in /home/hduser/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:CSRG+DnRQHu1UbRlxmHtfI5gEgw+fuGGold2cGapY0 hduser@riali-VirtualBox
The key's randomart image is:
+---[RSA 2048]---+
| +*o.o+oo o ooo|
| ...+.ooo + .o=.|
| ..oo o... o. .|
| +.. .o. o . .|
| . S... = o |
| ... X o .|
| ooE o .|
| o.oo |
| . oo |
+---[SHA256]---+
hduser@riali-VirtualBox:~$
```

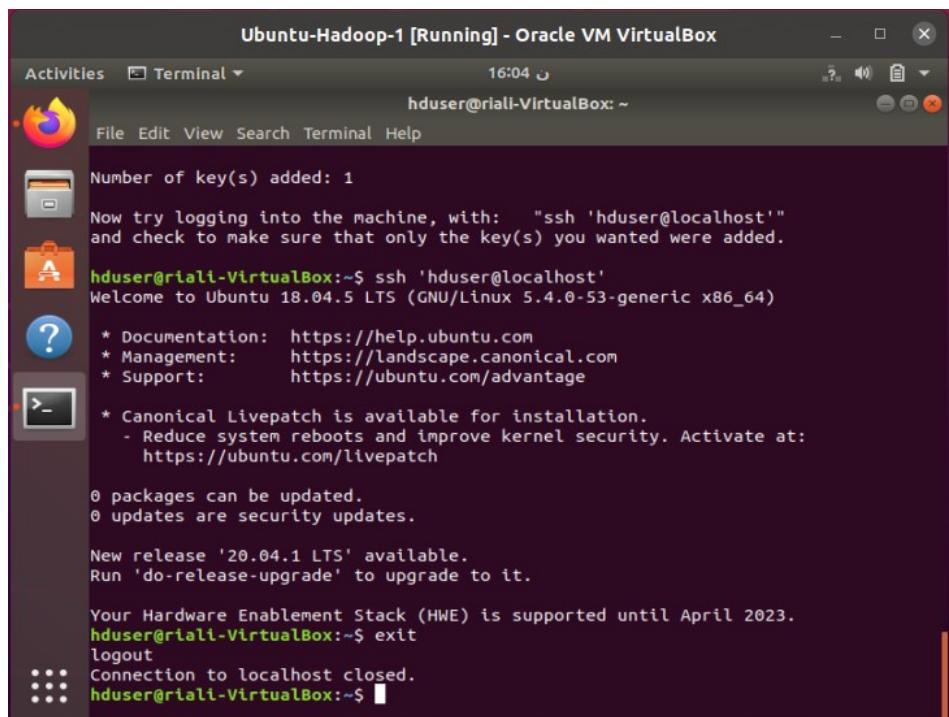
## Copier la clé publique sur le serveur localhost :

Après la mise en place de la clé ssh pour le compte hduser, c'est le moment pour copier la clé publique sur le serveur localhost : **ssh-copy-id -i /home/hduser/.ssh/id\_rsa.pub hduser@localhost**

Enfin on va tester la connexion à localhost par la commande suivante : **ssh 'hduser@localhost'**

## Installation de JAVA 8 :

Comme on a déjà mentionné au début, Hadoop est programmé par java, alors il est impérativement d'avoir un JDK pour une bonne configuration et un bon fonctionnement de Hadoop , alors dans ce TP on a choisi d'installer le JAVA 8, D'abord on va télécharger [jdk-8u71-](#)



```
Ubuntu-Hadoop-1 [Running] - Oracle VM VirtualBox
Activities Terminal 16:04
hduser@riali-VirtualBox: ~

Number of key(s) added: 1
Now try logging into the machine, with: "ssh 'hduser@localhost'"
and check to make sure that only the key(s) you wanted were added.

hduser@riali-VirtualBox:~$ ssh 'hduser@localhost'
Welcome to Ubuntu 18.04.5 LTS (GNU/Linux 5.4.0-53-generic x86_64)

 * Documentation: https://help.ubuntu.com
 * Management: https://landscape.canonical.com
 * Support: https://ubuntu.com/advantage

 * Canonical Livepatch is available for installation.
   - Reduce system reboots and improve kernel security. Activate at:
     https://ubuntu.com/livepatch

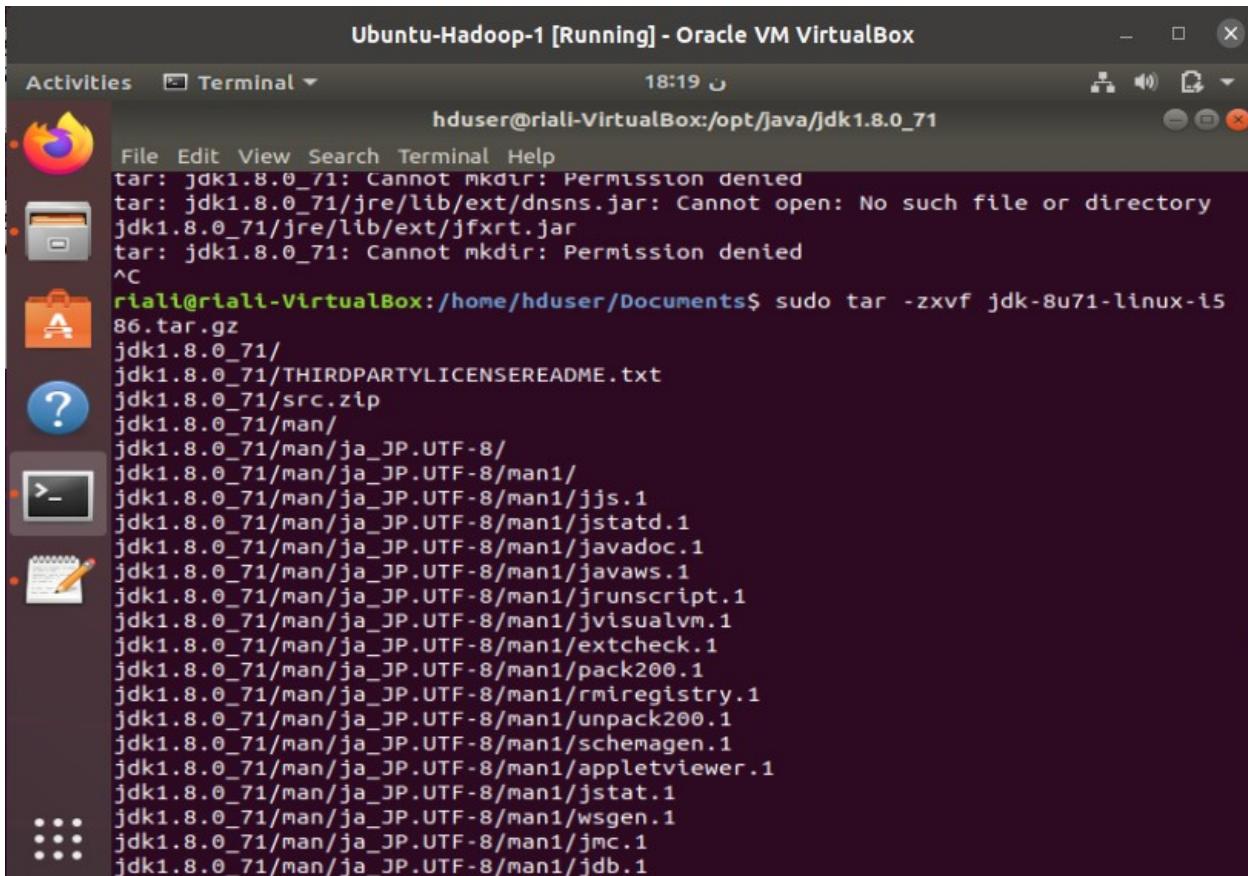
0 packages can be updated.
0 updates are security updates.

New release '20.04.1 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Your Hardware Enablement Stack (HWE) is supported until April 2023.
hduser@riali-VirtualBox:~$ exit
logout
Connection to localhost closed.
hduser@riali-VirtualBox:~$
```

[linux-x64.tar.gz](#) et après on va suite les étapes suivantes : **tar -zxvf jdk-8u71-linux-x64.tar.gz mv jdk1.8.0\_71/ /opt/java/**

**ps : on a déjà créé le rep /opt/java**



The screenshot shows a Linux desktop environment with a terminal window open. The terminal window title is "Ubuntu-Hadoop-1 [Running] - Oracle VM VirtualBox". The terminal session is running as user "hduser" and shows the following command and its output:

```
File Edit View Search Terminal Help
tar: jdk1.8.0_71: Cannot mkdir: Permission denied
tar: jdk1.8.0_71/jre/lib/ext/dnsns.jar: Cannot open: No such file or directory
jdk1.8.0_71/jre/lib/ext/jfxrt.jar
tar: jdk1.8.0_71: Cannot mkdir: Permission denied
^C
riali@riali-VirtualBox:/home/hduser/Documents$ sudo tar -zxvf jdk-8u71-linux-i5
86.tar.gz
jdk1.8.0_71/
jdk1.8.0_71/THIRDPARTYLICENSEREADME.txt
jdk1.8.0_71/src.zip
jdk1.8.0_71/man/
jdk1.8.0_71/man/ja_JP.UTF-8/
jdk1.8.0_71/man/ja_JP.UTF-8/man1/
jdk1.8.0_71/man/ja_JP.UTF-8/man1/jjs.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/jstadv.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/javadoc.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/javaws.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/jrungscript.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/jvisualvm.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/extcheck.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/pack200.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/rmiregistry.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/unpack200.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/schemagen.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/appletviewer.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/jstat.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/wsgen.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/jmc.1
jdk1.8.0_71/man/ja_JP.UTF-8/man1/jdb.1
```

Après le déplacement du répertoire `jdk1.8.0_71` vers `opt/java`, on va mettre à jour les liens par défaut de `jdk`, pour cela on va appeler les commandes suivantes dans le nouveau répertoire de `java` :

- `update-alternatives --install /usr/bin/java java /opt/java/jdk1.8.0_71/bin/java 100`
- `update-alternatives --config java`

et on va refaire la même chose pour `javac` :

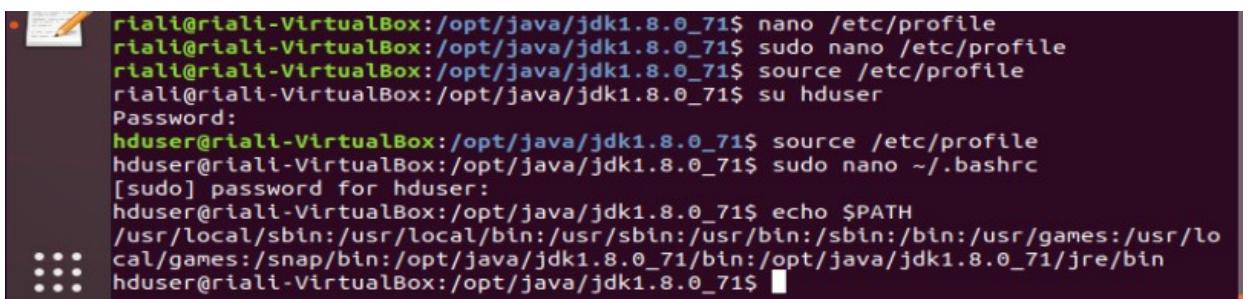
- `update-alternatives --install /usr/bin/javac javac /opt/java/jdk1.8.0_71/bin/javac 100`
- `update-alternatives --config javac`

- **sudo nano OU sudo vim OU sudo gedit /etc/profile , pour pouvoir modifier le fichier et ajouter ces trois lignes vers sa fin :**

```
export JAVA_HOME=/opt/java/jdk1.8.0_71/
export JRE_HOME=/opt/java/jdk1.8.0_71/jre
export
PATH=$PATH:/opt/java/jdk1.8.0_71/bin:/opt/java/jdk1.8.0_71/jre/
bin
```

- **refaire les mêmes opérations pour le fichier : ~/.bashrc**
- **Exécuter les 2 commandes suivantes : source /etc/profile ET source ~/.bashrc**

**ET VOILA → on observe que la variable \$PATH nous donne le vrai**



```
riali@riali-VirtualBox:/opt/java/jdk1.8.0_71$ nano /etc/profile
riali@riali-VirtualBox:/opt/java/jdk1.8.0_71$ sudo nano /etc/profile
riali@riali-VirtualBox:/opt/java/jdk1.8.0_71$ source /etc/profile
riali@riali-VirtualBox:/opt/java/jdk1.8.0_71$ su hduser
Password:
hduser@riali-VirtualBox:/opt/java/jdk1.8.0_71$ source ~/.bashrc
[sudo] password for hduser:
hduser@riali-VirtualBox:/opt/java/jdk1.8.0_71$ echo $PATH
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/usr/games:/usr/local/games:/snap/bin:/opt/java/jdk1.8.0_71/bin:/opt/java/jdk1.8.0_71/jre/bin
hduser@riali-VirtualBox:/opt/java/jdk1.8.0_71$
```

**chemin vers JAVA 8**

## Installation d'Apache Hadoop 3.2.1

On va imiter les étapes faites pour Java 8 , sauf qu'on va déplacer le répertoire vers : “/usr/local/” On aura alors :

Ubuntu-Hadoop-1 [Running] - Oracle VM VirtualBox

Activities Terminal 18:34 hduser@riali-VirtualBox: ~/Documents

```
.sql
hadoop-3.2.1/sbin/stop-dfs.cmd
hadoop-3.2.1/sbin/kms.sh
hadoop-3.2.1/sbin/yarn-daemon.sh
hadoop-3.2.1/sbin/stop-dfs.sh
hadoop-3.2.1/sbin/mr-jobhistory-daemon.sh
hadoop-3.2.1/sbin/start-yarn.sh
hadoop-3.2.1/sbin/stop-all.sh
hadoop-3.2.1/sbin/hadoop-daemons.sh
hadoop-3.2.1/sbin/stop-yarn.cmd
hadoop-3.2.1/sbin/yarn-daemons.sh
hadoop-3.2.1/sbin/start-yarn.cmd
hadoop-3.2.1/sbin/start-secure-dns.sh
hadoop-3.2.1/sbin/stop-secure-dns.sh
hadoop-3.2.1/sbin/httpfs.sh
hadoop-3.2.1/sbin/start-dfs.sh
hadoop-3.2.1/sbin/stop-balancer.sh
hadoop-3.2.1/sbin/workers.sh
hadoop-3.2.1/sbin/start-balancer.sh
hadoop-3.2.1/sbin/start-all.cmd
hadoop-3.2.1/sbin/hadoop-daemon.sh
hadoop-3.2.1/sbin/stop-yarn.sh
hadoop-3.2.1/sbin/start-all.sh
hduser@riali-VirtualBox:~/Documents$ mv hadoop-3.2.1 hadoop
hduser@riali-VirtualBox:~/Documents$ sudo mv hadoop /usr/local/hadoop/
[sudo] password for hduser:
hduser@riali-VirtualBox:~/Documents$ sudo chown -R hduser /usr/local/hadoop
hduser@riali-VirtualBox:~/Documents$
```

la ligne : “ sudo chown -R hduser /usr/local/hadoop” donne le droit à hduser d’opérer sur les fichiers et répertoires inclus dans /usr/local/hadoop de manière récursive.récurseive.

Ubuntu-Hadoop-1 [Running] - Oracle VM VirtualBox

Activities Terminal 18:32 hduser@riali-VirtualBox: ~/Documents

```
File Edit View Search Terminal Help
hadoop-3.2.1/sbin/FederationStateStore/MySQL/dropUser.sql
hadoop-3.2.1/sbin/FederationStateStore/SQLServer/
hadoop-3.2.1/sbin/FederationStateStore/SQLServer/FederationStateStoreTables.sql
hadoop-3.2.1/sbin/FederationStateStore/SQLServer/FederationStateStoreStoreProcs
.sql
hadoop-3.2.1/sbin/stop-dfs.cmd
hadoop-3.2.1/sbin/kms.sh
hadoop-3.2.1/sbin/yarn-daemon.sh
hadoop-3.2.1/sbin/stop-dfs.sh
hadoop-3.2.1/sbin/mr-jobhistory-daemon.sh
hadoop-3.2.1/sbin/start-yarn.sh
hadoop-3.2.1/sbin/stop-all.sh
hadoop-3.2.1/sbin/hadoop-daemons.sh
hadoop-3.2.1/sbin/stop-yarn.cmd
hadoop-3.2.1/sbin/yarn-daemons.sh
hadoop-3.2.1/sbin/start-yarn.cmd
hadoop-3.2.1/sbin/start-secure-dns.sh
hadoop-3.2.1/sbin/stop-secure-dns.sh
hadoop-3.2.1/sbin/httpfs.sh
hadoop-3.2.1/sbin/start-dfs.sh
hadoop-3.2.1/sbin/stop-balancer.sh
hadoop-3.2.1/sbin/workers.sh
hadoop-3.2.1/sbin/start-balancer.sh
hadoop-3.2.1/sbin/start-all.cmd
hadoop-3.2.1/sbin/hadoop-daemon.sh
hadoop-3.2.1/sbin/stop-yarn.sh
hadoop-3.2.1/sbin/start-all.sh
hduser@riali-VirtualBox:~/Documents$ tar -zxf hadoop-3.2.1.tar.gz
```

Ainsi, il faut modifier les fichiers “.bashrc” et “/etc/profile” et ajouter les chemins vers \$HADOOP\_HOME ....etc, comme il est clair dans l'image au-dessous :

Ubuntu-Hadoop-1 [Running] - Oracle VM VirtualBox

Activities Terminal 18:40 hduser@riali-VirtualBox: ~

```
File Edit View Search Terminal Help
GNU nano 2.9.3 .bashrc
export PATH=$PATH:/opt/java/jdk1.8.0_71/bin:/opt/java/jdk1.8.0_71/jre/bin

#HADOOP VARIABLES START

export JAVA_HOME=/opt/java/jdk1.8.0_71
export HADOOP_INSTALL=/usr/local/hadoop
export PATH=$PATH:$HADOOP_INSTALL/bin
export PATH=$PATH:$HADOOP_INSTALL/sbin
export HADOOP_MAPRED_HOME=$HADOOP_INSTALL
export HADOOP_COMMON_HOME=$HADOOP_INSTALL
export HADOOP_HDFS_HOME=$HADOOP_INSTALL
export YARN_HOME=$HADOOP_INSTALL
export HADOOP_COMMON_LIB_NATIVE_DIR=$HADOOP_INSTALL/lib/native
#export HADOOP_OPTS="-Djava.library.path=$HADOOP_INSTALL/lib"

#HADOOP VARIABLES END

^G Get Help      ^O Write Out     ^W Where Is      ^K Cut Text      ^J Justify
^X Exit          ^R Read File     ^\ Replace       ^U Uncut Text    ^T To Spell
```

, on ouvre le fichier /usr/local/hadoop/etc/hadoop/hadoop-env.sh et on modifie la variable d'environnement JAVA\_HOME : export

```
Ubuntu-Hadoop-1 [Running] - Oracle VM VirtualBox
Activities Terminal 18:43 hduser@riali-VirtualBox: ~

File Edit View Search Terminal Help
-rw----- 1 hduser hduser 61 16 18:26 .bash_history
-rw-r--r-- 1 hduser hduser 220 16 15:43 .bash_logout
-rw-r--r-- 1 hduser hduser 3929 16 18:14 .bashrc
drwx----- 13 hduser hduser 4096 16 15:59 .cache
drwxr--r-- 12 hduser hduser 4096 16 18:02 .config
drwxr-xr-x 2 hduser hduser 4096 16 18:23 Desktop
drwxr-xr-x 2 hduser hduser 4096 16 18:33 Documents
drwxr-xr-x 2 hduser hduser 4096 16 17:50 Downloads
drwx----- 3 hduser hduser 4096 16 15:46 .gnupg
-rw----- 1 hduser hduser 358 16 15:46 .ICEauthority
drwx----- 3 hduser hduser 4096 16 15:46 .local
drwx----- 5 hduser hduser 4096 16 15:47 .mozilla
drwxr-xr-x 2 hduser hduser 4096 16 15:46 Music
drwxr-xr-x 2 hduser hduser 4096 16 15:46 Pictures
-rw-r--r-- 1 hduser hduser 807 16 15:43 .profile
drwxr-xr-x 2 hduser hduser 4096 16 15:46 Public
drwx----- 2 hduser hduser 4096 16 15:59 .ssh
-rw-r--r-- 1 hduser hduser 0 16 15:53 .sudo_as_admin_successful
drwxr-xr-x 2 hduser hduser 4096 16 15:46 Templates
drwxr-xr-x 2 hduser hduser 4096 16 15:46 Videos
hduser@riali-VirtualBox:~$ nano .bashrc
hduser@riali-VirtualBox:~$ sudo nano .bashrc
hduser@riali-VirtualBox:~$ sudo nano .bashrc
hduser@riali-VirtualBox:~$ source .bashrc
hduser@riali-VirtualBox:~$ sudo nano /usr/local/hadoop/etc/hadoop/hadoop-env.sh

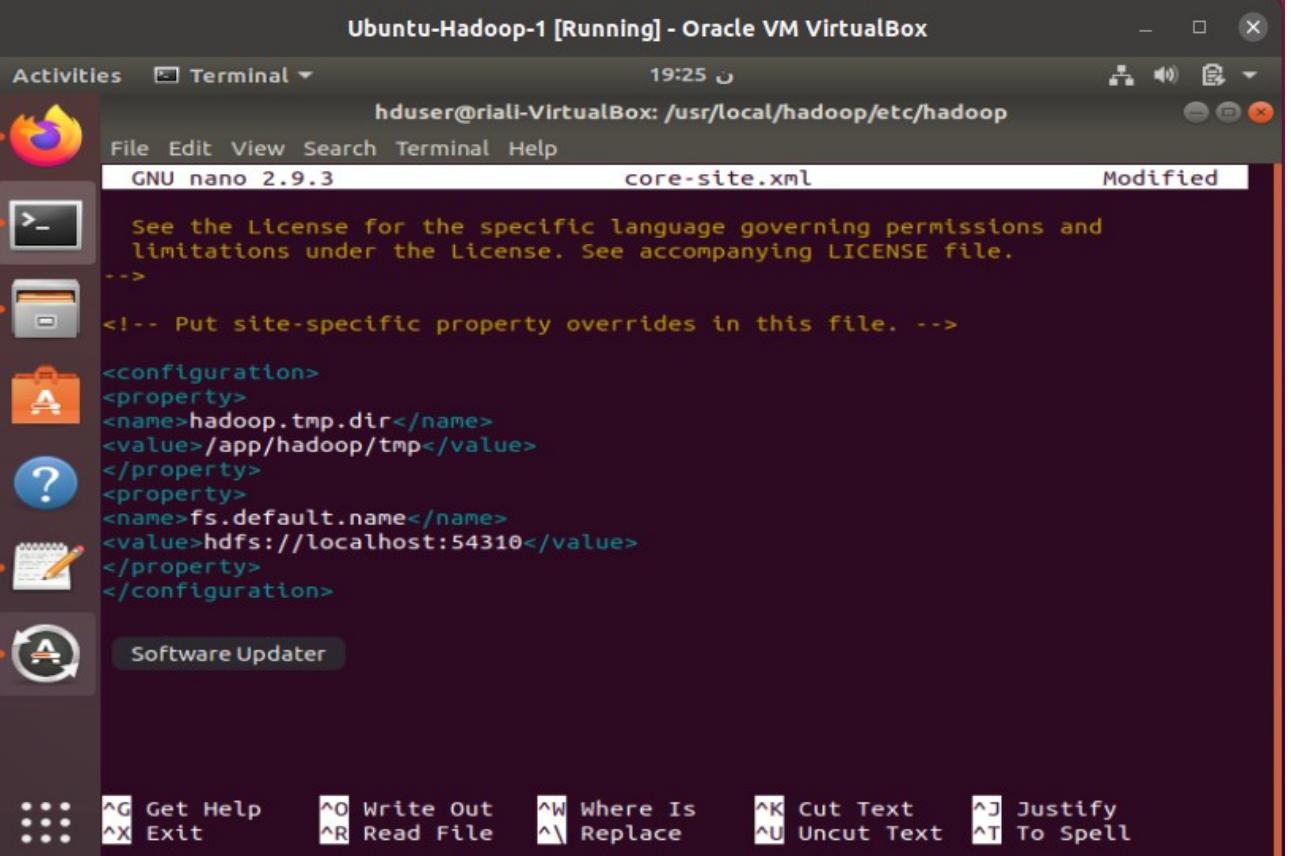
hduser@riali-VirtualBox:~$ sudo nano /usr/local/hadoop/etc/hadoop/hadoop-env.sh
```

JAVA\_HOME=/opt/java/jdk1.8.0\_71

On crée le répertoire des fichiers temporaires de hadoop :

- `sudo mkdir -p /app/hadoop/tmp`
- `sudo chown hduser /app/hadoop/tmp`

**Modification des fichiers de configuration de Hadoop :**



```
See the License for the specific language governing permissions and
limitations under the License. See accompanying LICENSE file.

-->

<!-- Put site-specific property overrides in this file. -->

<configuration>
<property>
<name>hadoop.tmp.dir</name>
<value>/app/hadoop/tmp</value>
</property>
<property>
<name>fs.default.name</name>
<value>hdfs://localhost:54310</value>
</property>
</configuration>
```

Nous allons maintenant passer au répertoire «/ usr / local / hadoop» Commençons avec “core-site.xml” :

- **hadoop.tmp.dir** : C'est une base locale pour des répertoires temporaires.
- **fs.default.name** : Le nom du système de fichiers par défaut.défaut. Un URI dont le schéma et l'autorité déterminent l'implémentation FileSystem

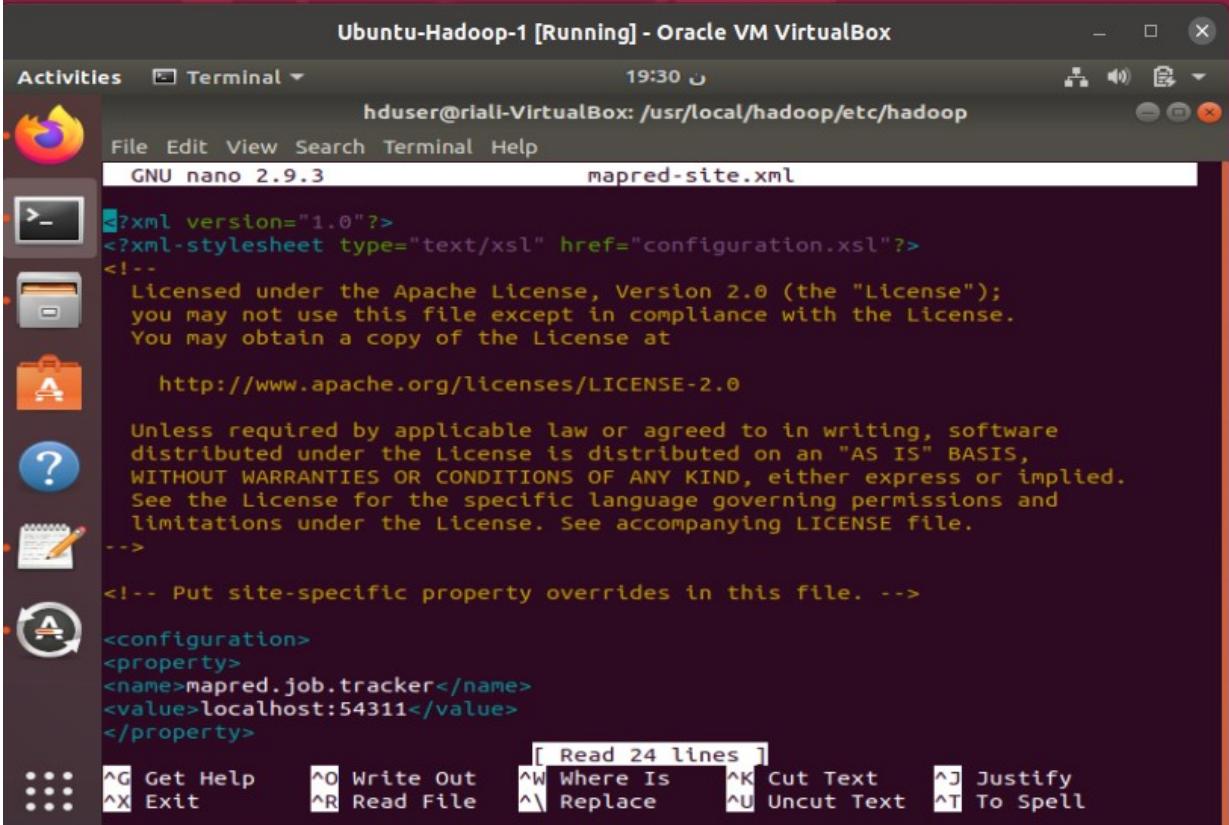
Puis on va passer au “**hdfs-site.xml**” :

- **dfs.replication** : Lorsque nous stockons les fichiers dans HDFS, la structure hadoop divise le fichier en un ensemble de blocs (64 Mo ou 128 Mo), puis ces blocs seront répliqués sur les nœuds du cluster. La configuration dfs. la

réPLICATION consiste à spécifier le nombre de réPLICATIONS requises.

- **dfs.namenode.name.dir** : Détermine où sur le système de fichiers local le nœud de nom DFS doit stocker la table de noms (fsimage). S'il s'agit d'une liste de réPERTOIRES séPARÉS par des virGULES, la table de noms est réPLiquée dans tous les réPERTOIRES, pour la redONDANCE.
- **Dfs.datanode.data.dir** : Détermine où sur le système de fichiers local un nœud de données DFS doit stocker ses blocs. S'il s'agit d'une liste de réPERTOIRES séPARÉS par des virGULES, les données seront stockées dans tous les réPERTOIRES nomMés, généRALEMENT sur DIFFéRENTS appareils. Les réPERTOIRES qui n'existent pas sont ignorés.

→ **mapred-site.xml** :



The screenshot shows a terminal window on an Ubuntu system within a VirtualBox environment. The title bar reads "Ubuntu-Hadoop-1 [Running] - Oracle VM VirtualBox". The terminal window displays the contents of the file "/usr/local/hadoop/etc/hadoop/mapred-site.xml". The file contains XML configuration for Hadoop's MapReduce framework, specifically overriding the job tracker's host and port. The terminal interface includes a menu bar with File, Edit, View, Search, Terminal, Help, and a status bar showing the time as 19:30. The bottom of the window features a command-line interface with various keyboard shortcuts for file operations like Get Help (^G), Write Out (^O), Where Is (^W), Cut Text (^K), Justify (^J), Exit (^X), Read File (^R), Replace (^L), Uncut Text (^U), and To Spell (^T).

```
<?xml version="1.0"?>
<?xml-stylesheet type="text/xsl" href="configuration.xsl"?>
<!--
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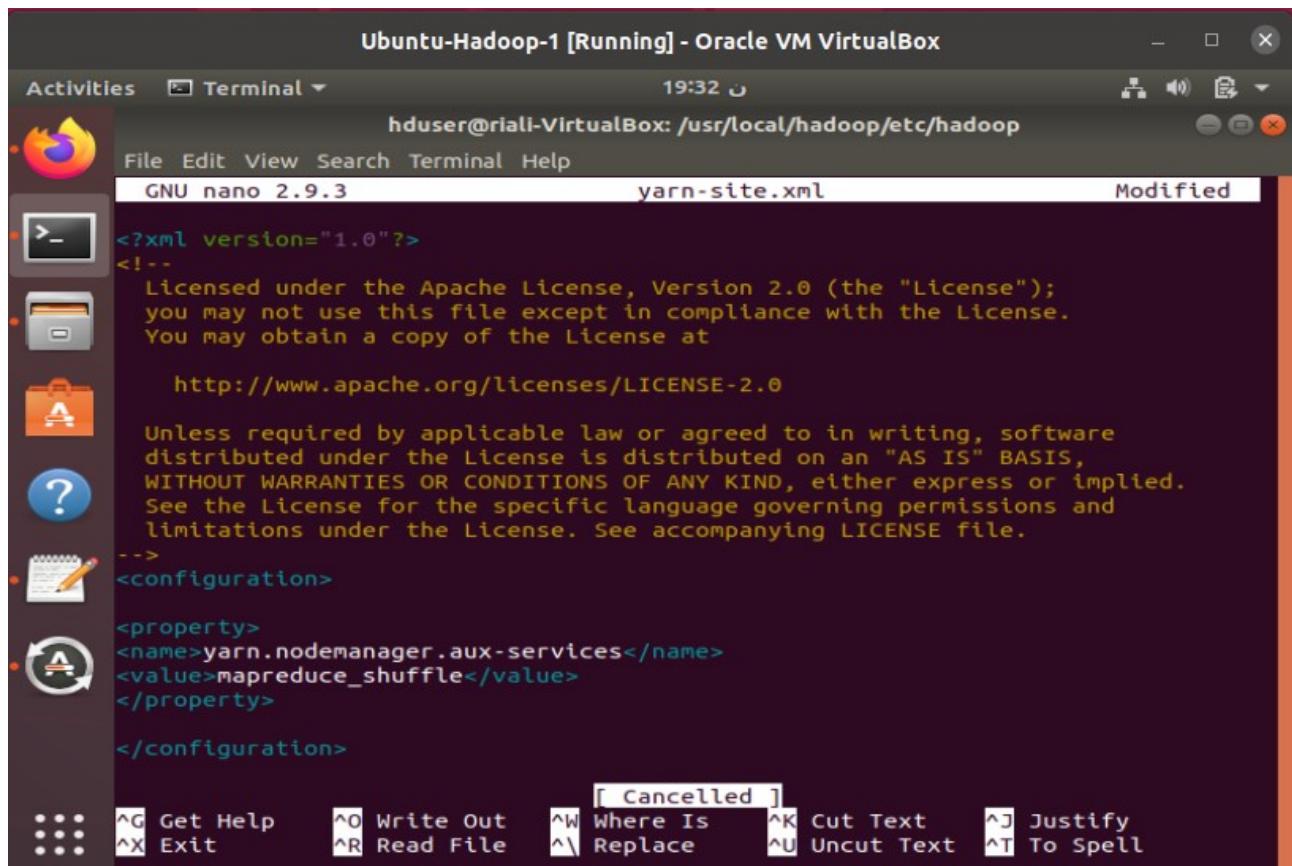
http://www.apache.org/licenses/LICENSE-2.0

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WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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limitations under the License. See accompanying LICENSE file.
-->

<configuration>
<property>
<name>mapred.job.tracker</name>
<value>localhost:54311</value>
</property>
```

- **mapred.job.tracker** : L'hôte et le port sur lesquels s'exécute le suivi des travaux MapReduce. Si « local », les travaux sont exécutés en cours de processus comme une seule carte et réduisent la tâche.

→ **yarn-site.xml** :



```

Ubuntu-Hadoop-1 [Running] - Oracle VM VirtualBox
Activities Terminal 19:32
hduser@riali-VirtualBox: /usr/local/hadoop/etc/hadoop
File Edit View Search Terminal Help
GNU nano 2.9.3          yarn-site.xml          Modified
<?xml version="1.0"?>
<!--
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    http://www.apache.org/licenses/LICENSE-2.0

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distributed under the License is distributed on an "AS IS" BASIS,
WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
See the License for the specific language governing permissions and
limitations under the License. See accompanying LICENSE file.
-->
<configuration>
<property>
<name>yarn.nodemanager.aux-services</name>
<value>mapreduce_shuffle</value>
</property>
</configuration>

```

The terminal window shows the content of the `yarn-site.xml` file in the `nano` text editor. The file contains XML configuration for YARN, specifically defining the auxiliary services provided by the nodemanager. The `mapreduce_shuffle` service is listed under the `yarn.nodemanager.aux-services` property.

- **yarn.nodemanager.aux-services** : Le nom du service auxiliaire

**Formatage du Namenode :**

Pour pouvoir lancer le service **Hadoop Distributed File System** , il faut d'abord formatter le **Namenode** par la commande suivante :

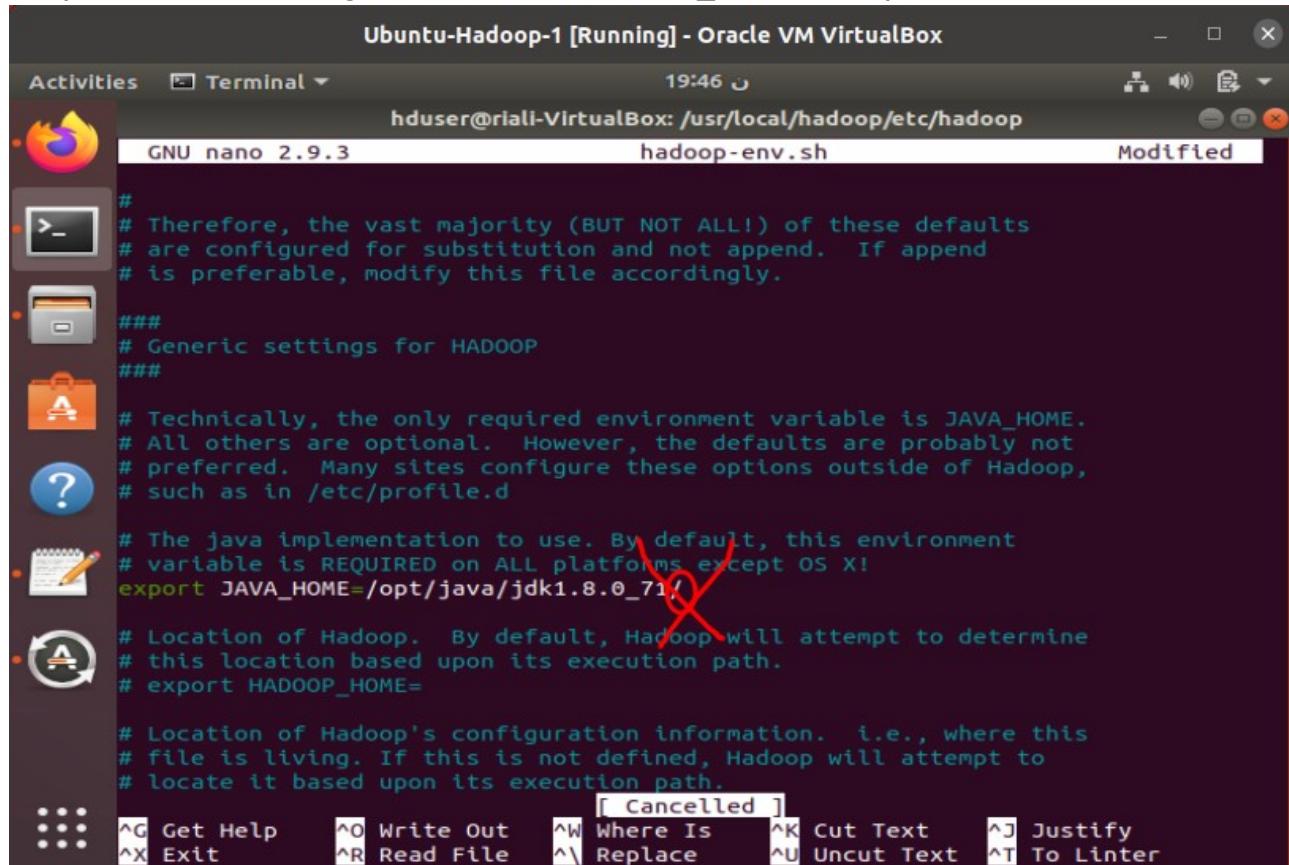
“**hdfs namenode -format**” comme il est clair au-dessous :

The screenshot shows a terminal window titled "Ubuntu-Hadoop-1 [Running] - Oracle VM VirtualBox". The terminal session is as follows:

```
hduser@riali-VirtualBox: /usr/local/hadoop/etc/hadoop
hduser@riali-VirtualBox: /usr/local/hadoop/etc/hadoop$ sudo nano mapred-site.xml
hduser@riali-VirtualBox: /usr/local/hadoop/etc/hadoop$ sudo nano mapred-site.xml
hduser@riali-VirtualBox: /usr/local/hadoop/etc/hadoop$ sudo nano yarn-site.xml
hduser@riali-VirtualBox: /usr/local/hadoop/etc/hadoop$ hdfs namenode -format
WARNING: /usr/local/hadoop/logs does not exist. Creating.
/usr/local/hadoop/libexec/hadoop-functions.sh: line 1808: /opt/java/jdk1.8.0_71
//bin/java: No such file or directory
hduser@riali-VirtualBox: /usr/local/hadoop/etc/hadoop$ hdfs namenode -format
/usr/local/hadoop/libexec/hadoop-functions.sh: line 1808: /opt/java/jdk1.8.0_71
//bin/java: No such file or directory
hduser@riali-VirtualBox: /usr/local/hadoop/etc/hadoop$ sudo nano /usr/local/hadoop/libexec/hadoop-functions.sh
hduser@riali-VirtualBox: /usr/local/hadoop/etc/hadoop$ ls
capacity-scheduler.xml          kms-log4j.properties
configuration.xsl                kms-site.xml
container-executor.cfg           log4j.properties
core-site.xml                   mapred-env.cmd
hadoop-env.cmd                  mapred-env.sh
hadoop-env.sh                   mapred-queues.xml.template
hadoop-metrics2.properties      mapred-site.xml
hadoop-policy.xml               shellprofile.d
hadoop-user-functions.sh.example ssl-client.xml.example
hdfs-site.xml                   ssl-server.xml.example
httpfs-env.sh                   user_ec_policies.xml.template
httpfs-log4j.properties         workers
httpfs-signature.secret         yarn-env.cmd
httpfs-site.xml                 yarn-env.sh
kms-acls.xml                   yarnservice-log4j.properties
kms-env.sh                      yarn-site.xml
hduser@riali-VirtualBox: /usr/local/hadoop/etc/hadoop$ sudo nano hadoop-env.sh
```

Malheureusement une erreur est survenue et voir le message d'erreur on peut bien estimer qu'il faut modifier la variable **JAVA\_HOME** dans le fichier **hadoop-env.sh** :

Après avoir changé la variable **JAVA\_HOME** on peut d'abord relancer



```
# Therefore, the vast majority (BUT NOT ALL!) of these defaults
# are configured for substitution and not append. If append
# is preferable, modify this file accordingly.

### Generic settings for HADOOP

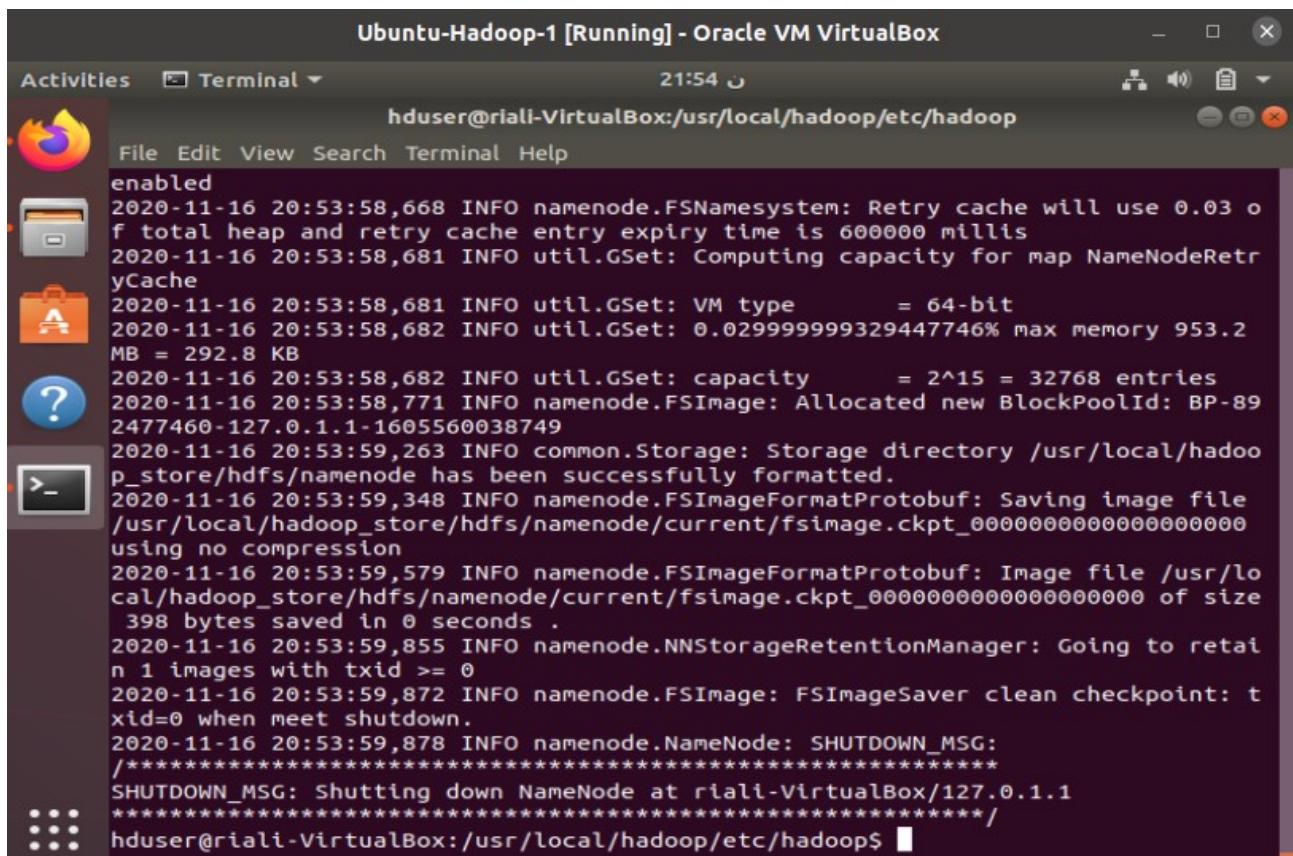
# Technically, the only required environment variable is JAVA_HOME.
# All others are optional. However, the defaults are probably not
# preferred. Many sites configure these options outside of Hadoop,
# such as in /etc/profile.d

# The java implementation to use. By default, this environment
# variable is REQUIRED on ALL platforms except OS X!
export JAVA_HOME=/opt/java/jdk1.8.0_71/

# Location of Hadoop. By default, Hadoop will attempt to determine
# this location based upon its execution path.
# export HADOOP_HOME=

# Location of Hadoop's configuration information. i.e., where this
# file is living. If this is not defined, Hadoop will attempt to
# locate it based upon its execution path.
```

notre commande du formatage du **Namenode** :



```
File Edit View Search Terminal Help
enabled
2020-11-16 20:53:58,668 INFO namenode.FSNamesystem: Retry cache will use 0.03 o
f total heap and retry cache entry expiry time is 600000 millis
2020-11-16 20:53:58,681 INFO util.GSet: Computing capacity for map NameNodeRetr
yCache
2020-11-16 20:53:58,681 INFO util.GSet: VM type      = 64-bit
2020-11-16 20:53:58,682 INFO util.GSet: 0.029999999329447746% max memory 953.2
MB = 292.8 KB
2020-11-16 20:53:58,682 INFO util.GSet: capacity      = 2^15 = 32768 entries
2020-11-16 20:53:58,771 INFO namenode.FSImage: Allocated new BlockPoolId: BP-89
2477460-127.0.1.1-1605560038749
2020-11-16 20:53:59,263 INFO common.Storage: Storage directory /usr/local/hadoo
p_store/hdfs/namenode has been successfully formatted.
2020-11-16 20:53:59,348 INFO namenode.FSImageFormatProtobuf: Saving image file
/usr/local/hadoop_store/hdfs/namenode/current/fsimage.ckpt_00000000000000000000
using no compression
2020-11-16 20:53:59,579 INFO namenode.FSImageFormatProtobuf: Image file /usr/lo
cal/hadoop_store/hdfs/namenode/current/fsimage.ckpt_00000000000000000000 of size
398 bytes saved in 0 seconds .
2020-11-16 20:53:59,855 INFO namenode.NNStorageRetentionManager: Going to retai
n 1 images with txid >= 0
2020-11-16 20:53:59,872 INFO namenode.FSImage: FSImageSaver clean checkpoint: t
xid=0 when meet shutdown.
2020-11-16 20:53:59,878 INFO namenode.NameNode: SHUTDOWN_MSG:
*****SHUTDOWN_MSG: Shutting down NameNode at riali-VirtualBox/127.0.1.1*****
*****hduser@riali-VirtualBox:/usr/local/hadoop/etc/hadoop$
```

- Ensuite, on va lancer les deux commandes suivantes :
- **start-dfs.sh** : Démarrer les démons Hadoop DFS, le namenode et les datanodes
- **start-yarn.sh** : démarre le serveur MapReduce
- **jps** : Pour s'assurer que tout fonctionne, utiliser l'outil jps pour lister les processus Java en cours d'exécution

```
hduser@riali-VirtualBox:/usr/local/hadoop/etc/hadoop$ start-dfs.sh
Starting namenodes on [localhost]
localhost: namenode is running as process 2939. Stop it first.
Starting datanodes
localhost: datanode is running as process 3101. Stop it first.
Starting secondary namenodes [riali-VirtualBox]
riali-VirtualBox: secondarynamenode is running as process 3300. Stop it first.
2020-11-16 21:57:02,379 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
hduser@riali-VirtualBox:/usr/local/hadoop/etc/hadoop$ start-yarn.sh
Starting resourcemanager
Starting nodemanagers
hduser@riali-VirtualBox:/usr/local/hadoop/etc/hadoop$ jps
3300 SecondaryNameNode
5275 Jps
2939 NameNode
4924 NodeManager
3101 DataNode
4767 ResourceManager
```

## II. Exécution d'un programme Map/Reduce dans un cluster à nœud unique :

**Accéder aux services de Hadoop via le navigateur :**

The screenshot shows a web browser window with the following details:

- URL:** localhost:8088/cluster
- Page Title:** All Applications
- Left Sidebar (Cluster):**
  - About
  - Nodes
  - Node Labels
  - Applications (highlighted)
  - NEW
  - NEW\_SAVING
  - SUBMITTED
  - ACCEPTED
  - RUNNING
  - FINISHED
  - FAILED
  - KILLED
  - Scheduler
  - Tools
- Content Area:**
  - Cluster Metrics:**

Apps Submitted	Apps Pending	Apps Running	Apps Completed	Containers Running	Memory Used
0	0	0	0	0	0 B
  - Cluster Nodes Metrics:**

Active Nodes	Decommissioning Nodes	Decommissioned Nodes	Lost Nodes
1	0	0	0
  - Scheduler Metrics:**

Scheduler Type	Scheduling Resource Type	Minimum Allocation
Capacity Scheduler	[memory-mb (unit=Mi), vcores]	<memory:1024, vCores:1>
  - Table Headers:** ID, User, Name, Application Type, Queue, Application Priority, StartTime, LaunchTime, FinishTime, State, FinalStatus, Running Containers.
  - Message:** No data available in table
  - Footer:** Showing 0 to 0 of 0 entries

localhost:9870/dfshealth.html 80% ...

## Overview 'localhost:54310' (active)

Started:	Tue Nov 17 12:00:05 +0100 2020
Version:	3.2.1, rb3cbbb467e22ea829b3808f4b7b01d07e0bf3842
Compiled:	Tue Sep 10 16:56:00 +0100 2019 by rohitsharmaks from branch-3.2.1
Cluster ID:	CID-e24b372d-e17d-4461-939f-6495884d0aba
Block Pool ID:	BP-892477460-127.0.1.1-1605560038749

## Summary

Security is off.  
Safemode is off.  
2 files and directories, 1 blocks (1 replicated blocks, 0 erasure coded block groups) = 3 total filesystem object(s).

localhost:9870/dfshealth.html 80% ...

## Datanode usage histogram

1

0 10 20 30 40 50 60 70 80 90 100

Disk usage of each DataNode (%)

## In operation

Show 25 entries Search:

Node	Http Address	Last contact	Last Block Report	Capacity	Blocks	Block pool used	Version
riali-VirtualBox:9866 (127.0.0.1:9866)	http://riali-VirtualBox:9864	0s	7m	19.56 GB	1	48 KB (0%)	3.2.1

### Exécution d'un programme Map/Reduce :

Pour exécuter le programme **Map/Reduce**, on va exécuter les commandes suivantes :

- **hdfs dfsadmin -report** : “pour tester le bon fonctionnement du service **hdfs**”

```
-----
Live datanodes (1):

Name: 127.0.0.1:9866 (localhost)
Hostname: riali-VirtualBox
Decommission Status : Normal
Configured Capacity: 21001486336 (19.56 GB)
DFS Used: 28672 (28 KB)
Non DFS Used: 9721094144 (9.05 GB)
DFS Remaining: 10189950976 (9.49 GB)
DFS Used%: 0.00%
DFS Remaining%: 48.52%
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: Mon Nov 16 23:04:40 WET 2020
Last Block Report: Mon Nov 16 23:02:13 WET 2020
Num of Blocks: 0

hduser@riali-VirtualBox:/usr/local/hadoop/etc/hadoop$
```

- **cd /home/hduser/Documents/code/** : accéder au répertoire contenant les fichiers **wordcount** et le fichier **poeme.txt**
- **mkdir -p org/hadoop/wordcount/** : créer les répertoires **org** ET **hadoop** ET **wordcount**
- **. classpath** : exécuter le fichier “classpath”
- **javac WCount\*java** : exécuter tous les fichiers {Wcount\*java}
- **mv \*.class org/hadoop/wordcount/**
- **jar -cvf wcount.jar . /home/hduser/Documents/code/org** : Générer le **.jar**

```
hduser@riali-VirtualBox:~/Documents/code$ File Edit View Search Terminal Help
symbol: class Text
location: class WCountReduce
46 errors
hduser@riali-VirtualBox:~/Documents/code$ . classpath
hduser@riali-VirtualBox:~/Documents/code$ javac WCount.java
hduser@riali-VirtualBox:~/Documents/code$ mv *.class org/hadoop/wordcount/
hduser@riali-VirtualBox:~/Documents/code$ jar -cvf wcount.jar . /home/hduser/Do
cuments/code/org
added manifest
adding: classpath(in = 305) (out= 114)(deflated 62%)
adding: org/(in = 0) (out= 0)(stored 0%)
adding: org/hadoop/(in = 0) (out= 0)(stored 0%)
adding: org/hadoop/wordcount/(in = 0) (out= 0)(stored 0%)
adding: org/hadoop/wordcount/WCountReduce.class(in = 1834) (out= 775)(deflated
57%)
adding: org/hadoop/wordcount/WCountMap.class(in = 1674) (out= 722)(deflated 56%
)
adding: org/hadoop/wordcount/WCount.class(in = 1646) (out= 859)(deflated 47%)
adding: WCountMap.java(in = 1057) (out= 565)(deflated 46%)
adding: WCount.java(in = 2005) (out= 890)(deflated 55%)
adding: WCountReduce.java(in = 1142) (out= 589)(deflated 48%)
adding: home/hduser/Documents/code/org/(in = 0) (out= 0)(stored 0%)
adding: home/hduser/Documents/code/org/hadoop/(in = 0) (out= 0)(stored 0%)
adding: home/hduser/Documents/code/org/hadoop/wordcount/(in = 0) (out= 0)(store
d 0%)
adding: home/hduser/Documents/code/org/hadoop/wordcount/WCountReduce.class(in =
1834) (out= 775)(deflated 57%)
adding: home/hduser/Documents/code/org/hadoop/wordcount/WCountMap.class(in = 16
74) (out= 722)(deflated 56%)
```

- **cd /usr/local/hadoop/** : accéder au répertoire de hadoop
- **bin/hdfs dfs -put /home/hduser/Documents/code/poeme.txt /** :  
Copier “poeme.txt” de fichiers local vers le système de fichiers de destination. Lit également l’entrée de stdin et écrit dans le système de fichiers de destination.
- **bin/hdfs dfs -ls /** : Pour un répertoire comme notre cas, il renvoie la liste de ses enfants directs comme dans Unix
- **cd /home/hduser/Documents/code/**
- **hadoop jar wcount.jar org.hadoop.wordcount.WCount /poeme.txt /results**

```

hduser@riali-VirtualBox:~/Documents/code$ cd /usr/local/hadoop/
hduser@riali-VirtualBox:/usr/local/hadoop$ bin/hdfs dfs -put /home/hduser/Documents/code/poeme.txt /
2020-11-17 11:39:54,447 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
put: `/home/hduser/Documents/code/poeme.txt': No such file or directory
hduser@riali-VirtualBox:/usr/local/hadoop$ bin/hdfs dfs -put /home/hduser/Documents/code/poeme.txt /
2020-11-17 11:40:51,377 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
put: `/poeme.txt': File exists
hduser@riali-VirtualBox:/usr/local/hadoop$ bin/hdfs dfs -ls /
2020-11-17 11:41:23,131 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Found 1 items
-rw-r--r--  1 hduser supergroup      1670 2020-11-17 00:11 /poeme.txt
hduser@riali-VirtualBox:/usr/local/hadoop$ cd /home/hduser/Documents/code/
hduser@riali-VirtualBox:~/Documents/code$ hadoop jar wcount.jar org.hadoop.wordcount.WCount /poeme.txt /results
2020-11-17 11:42:48,083 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
2020-11-17 11:42:49,654 INFO impl.MetricsConfig: Loaded properties from hadoop-metrics2.properties
2020-11-17 11:42:50,836 INFO impl.MetricsSystemImpl: Scheduled Metric snapshot period at 10 second(s).
2020-11-17 11:42:50,836 INFO impl.MetricsSystemImpl: JobTracker metrics system started
2020-11-17 11:42:52,112 INFO input.FileInputFormat: Total input files to process

```

- **hadoop fs -ls /results**
- **hadoop fs -cat /results/part-r-00000**

```

hduser@riali-VirtualBox:~/Documents/code$ hadoop fs -ls /results
2020-11-17 11:43:38,675 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
Found 2 items
-rw-r--r--  1 hduser supergroup      0 2020-11-17 11:42 /results/_SUCCESS
-rw-r--r--  1 hduser supergroup  2823 2020-11-17 11:42 /results/part-r-00000
hduser@riali-VirtualBox:~/Documents/code$ hadoop fs -cat /results/part-r-00000
2020-11-17 11:44:24,582 WARN util.NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java classes where applicable
2020-11-17 11:44:26,078 INFO sasl.SaslDataTransferClient: SASL encryption trust check: localHostTrusted = false, remoteHostTrusted = false
a          6 occurrences.
adoraient    1 occurrences.
ailes       1 occurrences.
aima        1 occurrences.
amour       1 occurrences.
au         11 occurrences.
bas         1 occurrences.
belle       1 occurrences.
bles        1 occurrences.
bras        1 occurrences.
bretagne     1 occurrences.
brula       1 occurrences.
celle        1 occurrences.
celui       20 occurrences.
cette       1 occurrences.
chancelle     1 occurrences.

```

### III. Configuration d'un cluster multi-noeuds d'Apache Hadoop .

#### Attribution statique d'adresse IP à la machine hadoopmaster :

##### **/etc/hosts**

Modifier le fichier /etc/hosts de la machine en ajoutant les lignes suivantes qui représentent les IP fixes des différentes machines du cluster :

- 192.168.0.1 hadoopmaster
- 192.168.0.2 slave1
- 192.168.0.3 slave2

```
GNU nano 2.9.3                               /etc/hosts

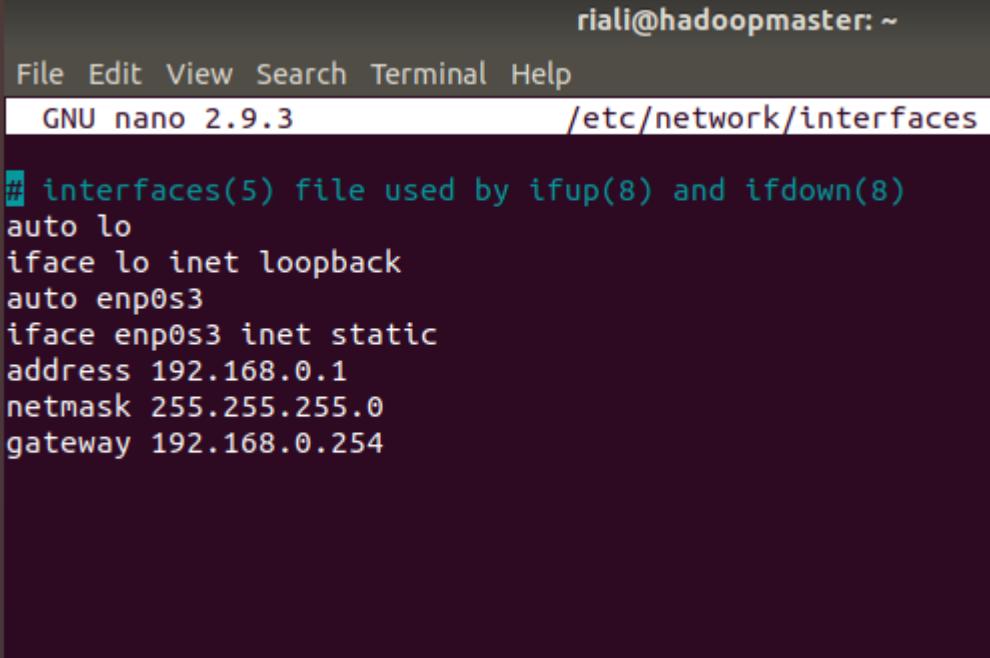
127.0.0.1      localhost
127.0.1.1      riali-VirtualBox
192.168.0.1    hadoopmaster
192.168.0.2    slave1
192.168.0.3    slave2
# The following lines are desirable for IPv6 capable hosts
::1      ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters

[ File '/etc/hosts' is unwritable ]
^G Get Help   ^O Write Out   ^W Where Is   ^K Cut Text   ^J Justify
^X Exit       ^R Read File   ^\ Replace    ^U Uncut Text  ^T To Spell
```

## **/etc/network/interfaces :**

Afin de configurer de manière permanente l'adresse IP fixe de la machine hadoopmaster, il faut ajouter les lignes suivantes dans /etc/network/interfaces :

```
auto enp0s3  
iface enp0s3 inet static  
address 192.168.0.1  
netmask 255.255.255.0  
gateway 192.168.0.254
```



The screenshot shows a terminal window titled "riali@hadoopmaster: ~". The window has a menu bar with "File", "Edit", "View", "Search", "Terminal", and "Help". Below the menu is the text "GNU nano 2.9.3" and the path "/etc/network/interfaces". The main area of the terminal displays the configuration file content:

```
# interfaces(5) file used by ifup(8) and ifdown(8)  
auto lo  
iface lo inet loopback  
auto enp0s3  
iface enp0s3 inet static  
address 192.168.0.1  
netmask 255.255.255.0  
gateway 192.168.0.254
```

Pour prendre en compte ces configurations on doit redémarrer la machine :

```
sudo reboot
```

## **etc/hostname :**

Modifier le contenu de ce fichier par : **hadoopmaster**

```
GNU nano 2.9.3          /etc/hostname
hadoopmaster

[ File '/etc/hostname' is unwritable ]

^G Get Help  ^O Write Out  ^W Where Is  ^K Cut Text  ^J Justify
^X Exit      ^R Read File  ^\ Replace   ^U Uncut Text  ^T To Spell
```

### Modification des fichiers de configuration de hadoop :

**hadoop\_master :**

Ensuite , il faut supprimer les fichiers dans **hadoop\_master** et créer de nouveau le répertoire :

**/usr/local/hadoop\_master/hdfs/namenode** exécuter les commandes suivantes :

- **cd /usr/local/hadoop\_store/**
- **sudo rm -rf \***
- **sudo mkdir -p /usr/local/hadoop\_store/hdfs/namenode**

- chown -R hduser /usr/local/hadoop\_store/

```
riali@hadoopmaster:~$ cd /usr/local/hadoop_store/
riali@hadoopmaster:/usr/local/hadoop_store$ ls
hdfs
riali@hadoopmaster:/usr/local/hadoop_store$ rm -rf *
rm: cannot remove 'hdfs/datanode': Permission denied
rm: cannot remove 'hdfs/namenode/current': Permission denied
riali@hadoopmaster:/usr/local/hadoop_store$ sudo rm -rf *
[sudo] password for riali:
riali@hadoopmaster:/usr/local/hadoop_store$ ls
riali@hadoopmaster:/usr/local/hadoop_store$ mkdir -p /usr/local/hadoop_store/hd
fs/namenode
mkdir: cannot create directory '/usr/local/hadoop_store/hdfs': Permission denie
d
riali@hadoopmaster:/usr/local/hadoop_store$ sudo mkdir -p /usr/local/hadoop_sto
re/hdfs/namenode
riali@hadoopmaster:/usr/local/hadoop_store$ ls -R
.:
hdfs
./hdfs:
namenode
./hdfs/namenode:
riali@hadoopmaster:/usr/local/hadoop_store$ █
```

**core-site.xml : [ \$ cd /usr/local/hadoop/etc/hadoop/ ]**

Modifier le fichier **core-site.xml**, en modifiant la balise  
**<configuration></configuration>** →

```
<configuration>
<property>
<name>hadoop.tmp.dir</name>
<value>/app/hadoop/tmp</value>
</property>
<property>
<name>fs.default.name</name>
<value>hdfs://hadoopmaster: 54310</value>
</property>
</configuration>
```

```

GNU nano 2.9.3           core-site.xml

See the License for the specific language governing permissions and
limitations under the License. See accompanying LICENSE file.
-->

<!-- Put site-specific property overrides in this file. -->

<configuration>
<property>
<name>hadoop.tmp.dir</name>
<value>/app/hadoop/tmp</value>
</property>
<property>
<name>fs.default.name</name>
<value>hdfs://hadoopmaster:54310</value>
</property>
</configuration>

^G Get Help   ^O Write Out   ^W Where Is   ^K Cut Text   ^J Justify
^X Exit      ^R Read File   ^\ Replace    ^U Uncut Text  ^T To Spell

```

### hdfs-site.xml :

Modifier le fichier `hdfs-site.xml`, en modifiant la balise  
`<configuration></configuration>` →

```

<configuration>
<property>
<name>dfs.replication</name>
<value>2</value>
</property>
<property>
<name>dfs.namenode.name.dir</name>
<value>file:/usr/local/hadoop_store/hdfs/namenode</value>
</property>
</configuration>

```

```

GNU nano 2.9.3           hdfs-site.xml

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limitations under the License. See accompanying LICENSE
-->

<!-- Put site-specific property overrides in this file. -->

<configuration>
<property>
<name>dfs.replication</name>
<value>2</value>
</property>
<property>
<name>dfs.namenode.name.dir</name>
<value>file:/usr/local/hadoop_store/hdfs/namenode</value>
</property>
</configuration>

```

**mapred-site.xml :**

On va manipuler ce fichier comme ceux-ci au-dessus :

**yarn-site.xml :**

**masters :**

Créer le fichier masters qui contient le hostname de la machine masters :

- **cd /usr/local/hadoop/etc/hadoop**
- **sudo nano masters**

```
GNU nano 2.9.3          /usr/local/hadoop/etc/hadoop/masters
```

```
hadoopmaster
```

**workers :**

- **cd /usr/local/hadoop/etc/hadoop**
- **sudo nano workers**

```
GNU nano 2.9.3
```

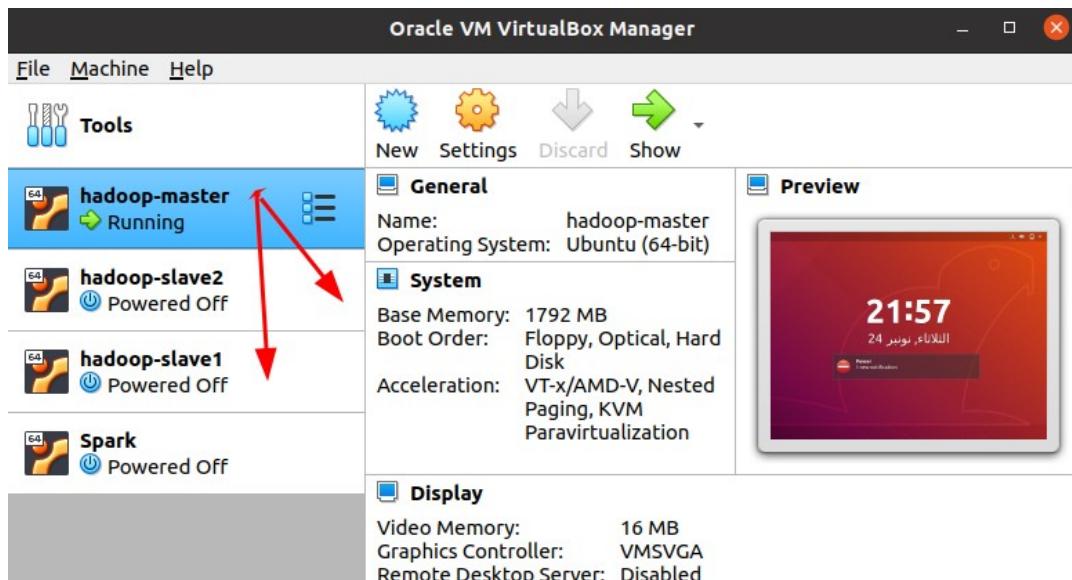
```
workers
```

```
slave1  
slave2
```

### Clonage de la machine hadoopmaster :

Nous allons cloner deux machines slave1 et slave2 à partir de la machine hadoopmaster, pour cela on va effectuer les étapes suivantes :

- Éteindre la machine hadoopmaster
- Bouton droit sur l'icône de la machine dans le gestionnaire virtualBox, puis cloner.
- Entrer le nom de la machine puis suivant.
- Choisir le type de clonage : clone intégral. [full]



### Configuration d'adresse IP fixe et de hostname :

Par modifier le fichier `/etc/hostname` pour chacune des 2 machines slaves, en définissant deux nouveaux **hostnames** qui sont : **slave1 → hadoop-slave1 ET slave2 → hadoop-slave2**, puis, on modifie les fichiers `/etc/hosts` /`/etc/network/interfaces`, pour chacune des machines afin de leurs donner des adresses IP fixes :

```
GNU nano 2.9.3                               /etc/hosts

127.0.0.1      localhost
127.0.1.1      slave1
auto enp0s3
iface enp0s3 inet static
address 192.168.0.2
netmask 255.255.255.0
gateway 192.168.0.254
# The following lines are desirable for IPv6 capable hosts
::1      ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
```

slave-2 [Running] - Oracle VM VirtualBox

Activities Terminal 13:35

File Edit View Search Terminal Help

GNU nano 2.9.3 /etc/network/interfaces Modified

```
# interfaces(5) file used by ifup(8) and ifdown(8)
auto enp0s3
iface enp0s3 inet static
address 192.168.0.3
netmask 255.255.255.0
gateway 192.168.0.254
```

Document Viewer

Get Help Write Out Where Is Cut Text Justify  
Exit Read File Replace Uncut Text To Spell

slave1 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal 14:04

File Edit View Search Terminal Help

GNU nano 2.9.3 /etc/network/interfaces

```
# interfaces(5) file used by ifup(8) and ifdown(8)
auto enp0s3
iface enp0s3 inet static
address 192.168.0.2
netmask 255.255.255.0
gateway 192.168.0.254
```

Get Help Write Out Where Is Cut Text Justify  
Exit Read File Replace Uncut Text To Spell

**Ps : Pour prendre en compte les modifications, il faut redémarrer les deux machines slave1 et slave2: \$ sudo reboot**

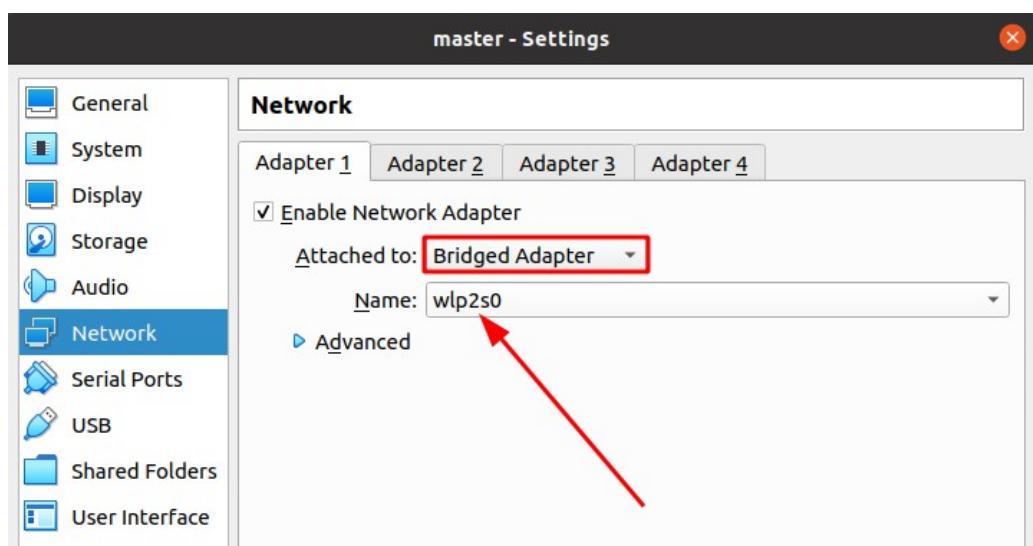
**Dans la machine slave1 et slave2, supprimer les fichiers du répertoire de stockage de données créer par l'installation**

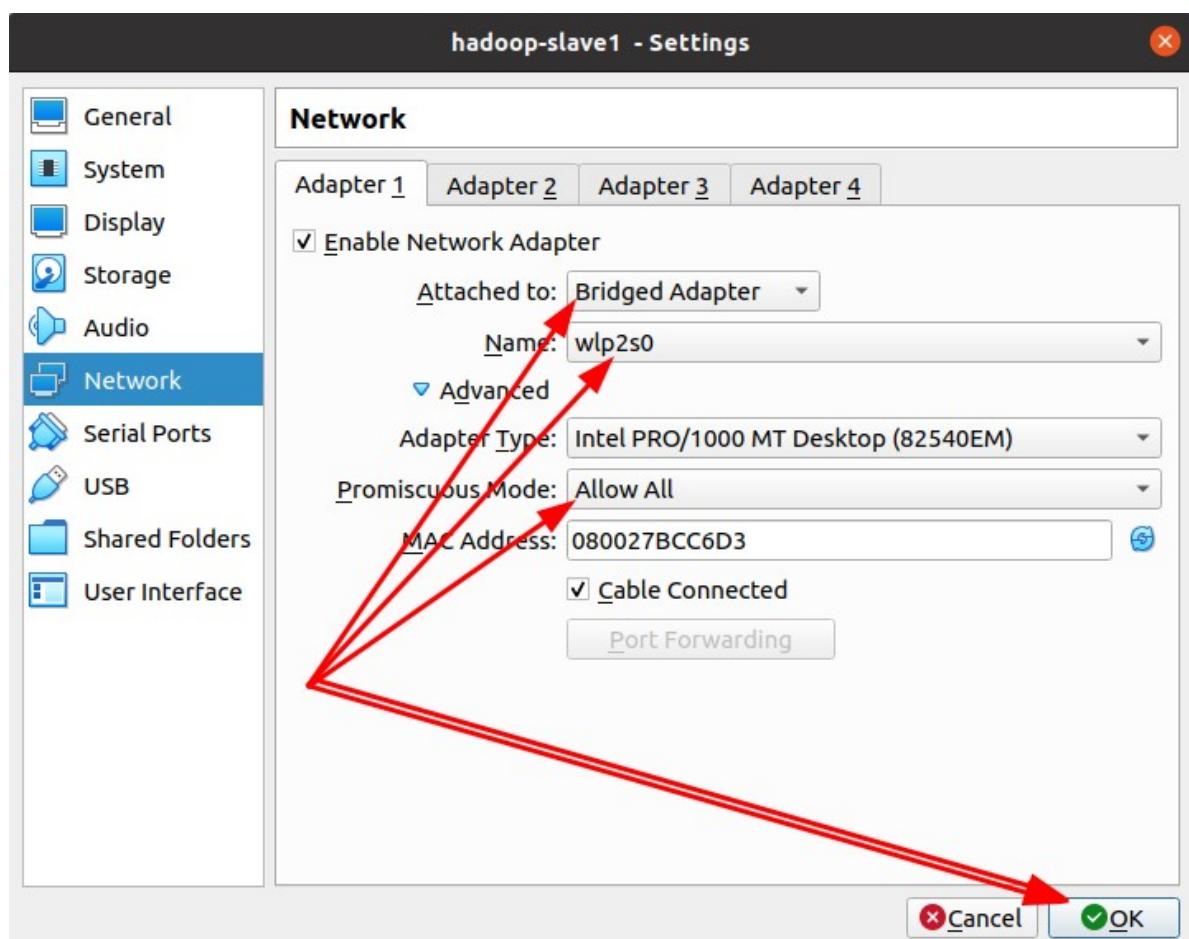
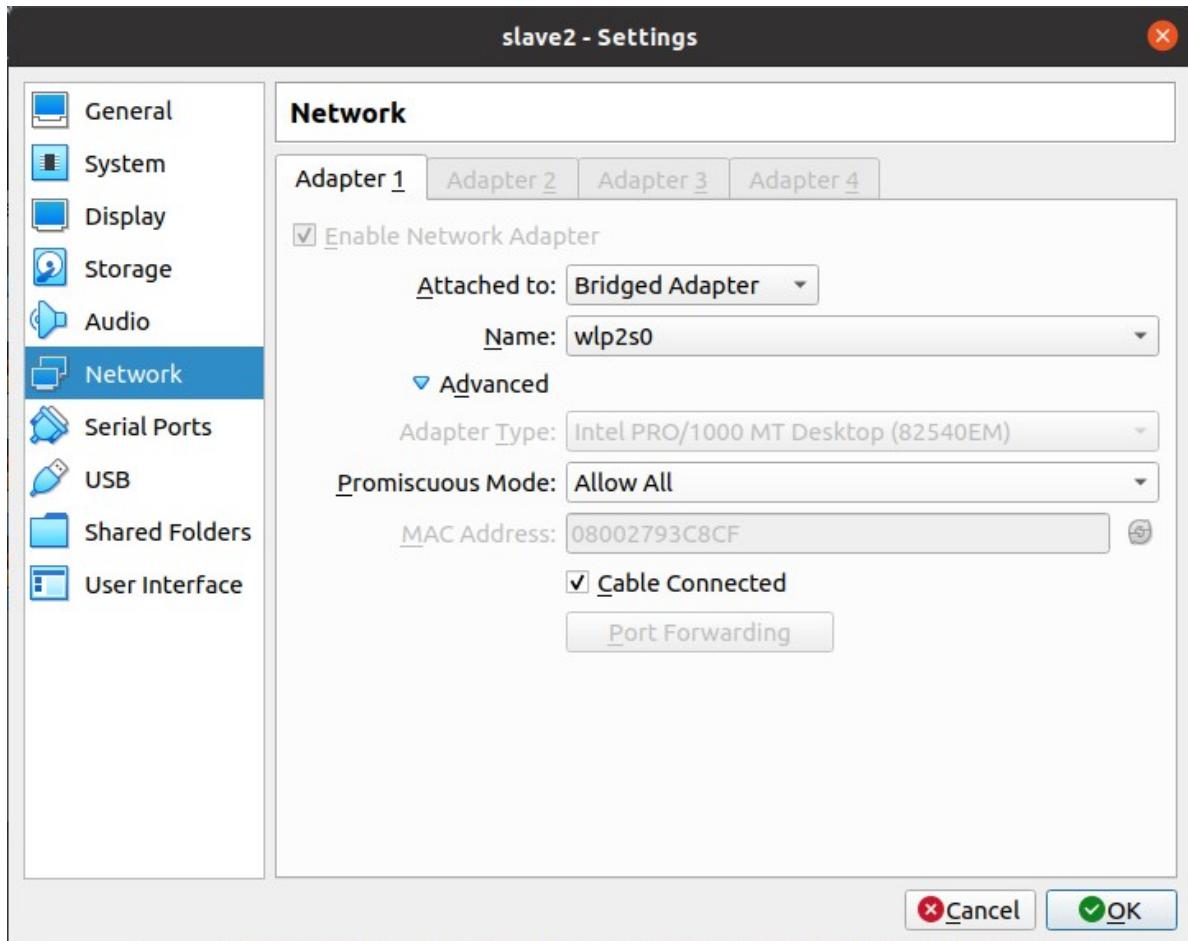
**single node de Hadoop :**

```
riali@slave2: /usr/local/hadoop_store
File Edit View Search Terminal Help
riali@slave2:~$ cd
riali@slave2:~$ cd /usr/local/hadoop_store/
riali@slave2:/usr/local/hadoop_store$ rm -rf *
rm: cannot remove 'hdfs/namenode': Permission denied
riali@slave2:/usr/local/hadoop_store$ sudo rm -rf *
[sudo] password for riali:
riali@slave2:/usr/local/hadoop_store$ mkdir -p /usr/local/hadoop_store/hdfs/datanode
mkdir: cannot create directory '/usr/local/hadoop_store/hdfs': Permission denied
riali@slave2:/usr/local/hadoop_store$ sudo mkdir -p /usr/local/hadoop_store/hdfs/datanode
chown: changing ownership of '/usr/local/hadoop_store/hdfs/datanode': Operation not permitted
riali@slave2:/usr/local/hadoop_store$ sudo chown -R hduser /usr/local/hadoop_store/hdfs/datanode
riali@slave2:/usr/local/hadoop_store$ chown -R hduser /usr/local/hadoop_store/hdfs/datanode
riali@slave2:/usr/local/hadoop_store$ █
```

**Connexion entre les machines du cluster :**

**établir un réseau ponté entre les machines virtuelles :**





On va tester la connexion entre les machines du cluster en effectuant des pings entre les différentes machines.

Dans notre cas tout va bien !!!

The image shows three terminal windows side-by-side, each displaying the output of a ping command between hosts in a Hadoop cluster. The hosts are labeled as follows:

- hadoopmaster**: The first host, with IP 192.168.0.1.
- slave1**: The second host, with IP 192.168.0.2.
- slave2**: The third host, with IP 192.168.0.3.

**Terminal 1 (hadoopmaster):**

```
hduser@hadoopmaster:~$ ping 192.168.0.1
PING 192.168.0.1 (192.168.0.1) 56(84) bytes of data.
64 bytes from 192.168.0.1: icmp_seq=1 ttl=64 time=0.047 ms
64 bytes from 192.168.0.1: icmp_seq=2 ttl=64 time=0.063 ms
^C
--- 192.168.0.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 0.047/0.055/0.063/0.008 ms
hduser@hadoopmaster:~$ ping 192.168.0.2
PING 192.168.0.2 (192.168.0.2) 56(84) bytes of data.
64 bytes from 192.168.0.2: icmp_seq=1 ttl=64 time=0.722 ms
64 bytes from 192.168.0.2: icmp_seq=2 ttl=64 time=0.480 ms
64 bytes from 192.168.0.2: icmp_seq=3 ttl=64 time=0.312 ms
^C
--- 192.168.0.2 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2043ms
rtt min/avg/max/mdev = 0.312/0.504/0.722/0.170 ms
hduser@hadoopmaster:~$ ping 192.168.0.3
PING 192.168.0.3 (192.168.0.3) 56(84) bytes of data.
64 bytes from 192.168.0.3: icmp_seq=1 ttl=64 time=0.979 ms
64 bytes from 192.168.0.3: icmp_seq=2 ttl=64 time=1.00 ms
64 bytes from 192.168.0.3: icmp_seq=3 ttl=64 time=0.930 ms
^C
--- 192.168.0.3 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 0.930/0.969/1.000/0.046 ms
hduser@hadoopmaster:~$
```

**Terminal 2 (slave2):**

```
riali@slave2:~$ ping 192.168.0.1
PING 192.168.0.1 (192.168.0.1) 56(84) bytes of data.
64 bytes from 192.168.0.1: icmp_seq=1 ttl=64 time=0.979 ms
64 bytes from 192.168.0.1: icmp_seq=2 ttl=64 time=1.00 ms
64 bytes from 192.168.0.1: icmp_seq=3 ttl=64 time=0.930 ms
^C
--- 192.168.0.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 0.930/0.969/1.000/0.046 ms
riali@slave2:~$ ping 192.168.0.2
PING 192.168.0.2 (192.168.0.2) 56(84) bytes of data.
64 bytes from 192.168.0.2: icmp_seq=1 ttl=64 time=1.80 ms
64 bytes from 192.168.0.2: icmp_seq=2 ttl=64 time=1.04 ms
64 bytes from 192.168.0.2: icmp_seq=3 ttl=64 time=0.907 ms
^C
--- 192.168.0.2 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 0.907/1.249/1.801/0.395 ms
riali@slave2:~$ ping 192.168.0.3
PING 192.168.0.3 (192.168.0.3) 56(84) bytes of data.
64 bytes from 192.168.0.3: icmp_seq=1 ttl=64 time=0.043 ms
64 bytes from 192.168.0.3: icmp_seq=2 ttl=64 time=0.069 ms
64 bytes from 192.168.0.3: icmp_seq=3 ttl=64 time=0.060 ms
^C
--- 192.168.0.3 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2041ms
rtt min/avg/max/mdev = 0.043/0.057/0.069/0.012 ms
riali@slave2:~$
```

**Terminal 3 (slave1):**

```
hduser@slave1:~$ ping 192.168.0.1
PING 192.168.0.1 (192.168.0.1) 56(84) bytes of data.
64 bytes from 192.168.0.1: icmp_seq=1 ttl=64 time=0.048 ms
64 bytes from 192.168.0.1: icmp_seq=2 ttl=64 time=0.060 ms
64 bytes from 192.168.0.1: icmp_seq=3 ttl=64 time=0.066 ms
^C
--- 192.168.0.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 0.831/0.988/1.097/0.116 ms
hduser@slave1:~$ ping 192.168.0.2
PING 192.168.0.2 (192.168.0.2) 56(84) bytes of data.
64 bytes from 192.168.0.2: icmp_seq=1 ttl=64 time=0.048 ms
64 bytes from 192.168.0.2: icmp_seq=2 ttl=64 time=0.060 ms
64 bytes from 192.168.0.2: icmp_seq=3 ttl=64 time=0.066 ms
^C
--- 192.168.0.2 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2034ms
rtt min/avg/max/mdev = 0.048/0.058/0.066/0.007 ms
hduser@slave1:~$ ping 192.168.0.3
PING 192.168.0.3 (192.168.0.3) 56(84) bytes of data.
64 bytes from 192.168.0.3: icmp_seq=1 ttl=64 time=0.727 ms
64 bytes from 192.168.0.3: icmp_seq=2 ttl=64 time=1.15 ms
64 bytes from 192.168.0.3: icmp_seq=3 ttl=64 time=1.09 ms
^C
--- 192.168.0.3 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 0.727/0.990/1.153/0.191 ms
hduser@slave1:~$
```

On va copier la clé ssh pour configurer un accès ssh sans mot de passe entre les machines du cluster.

- ssh-copy-id -i /home/hduser/.ssh/id\_rsa.pub [hduser@slave1](#)
- ssh-copy-id -i /home/hduser/.ssh/id\_rsa.pub [hduser@slave2](#)

```
hduser@hadoopmaster: ~
File Edit View Search Terminal Help
h/id_rsa.pub"
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter
out any that are already installed

/usr/bin/ssh-copy-id: ERROR: ssh: Could not resolve hostname slave3: Name or se
rvice not known

hduser@hadoopmaster:~$ ssh-copy-id -f -i /home/hduser/.ssh/id_rsa.pub hduser@sl
ave1
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/hduser/.ss
h/id_rsa.pub"

Number of key(s) added: 1 slave1

Now try logging into the machine, with: "ssh 'hduser@slave1'"
and check to make sure that only the key(s) you wanted were added.

hduser@hadoopmaster:~$ ssh-copy-id -f -i /home/hduser/.ssh/id_rsa.pub hduser@sl
ave2
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/hduser/.ss
h/id_rsa.pub"

Number of key(s) added: 1 slave2

Now try logging into the machine, with: "ssh 'hduser@slave2'"
and check to make sure that only the key(s) you wanted were added.

hduser@hadoopmaster:~$
```

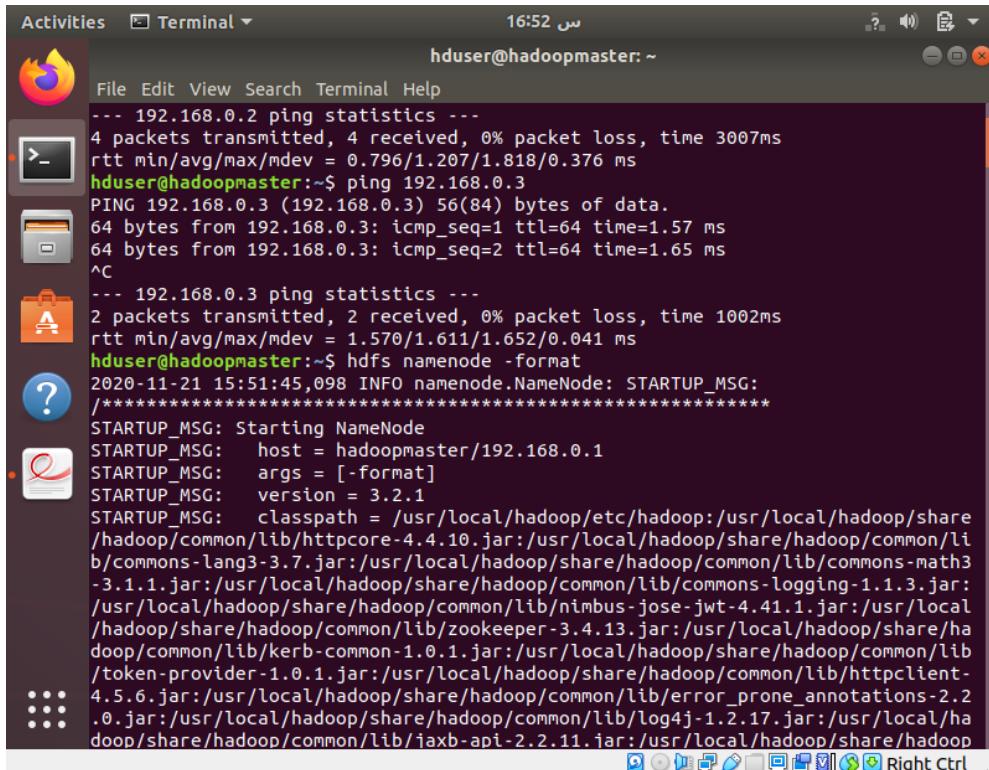
Ainsi, il faut modifier le fichier **hdfs-site.xml** de la machine virtuelle **slave1** et **slave2** comme suit :

```
hduser@slave2: /usr/local/hadoop/etc/hadoop
File Edit View Search Terminal Help
GNU nano 2.9.3 hdfs-site.xml
See the License for the specific language governing permissions and
limitations under the License. See accompanying LICENSE file.
-->
<!-- Put site-specific property overrides in this file. -->
<configuration>
<property>
<name>dfs.replication</name>
<value>2</value>
</property>
<property>
<name>dfs.datanode.data.dir</name>
<value>file:/usr/local/hadoop_store/hdfs/datanode</value>
</property>
</configuration>
```

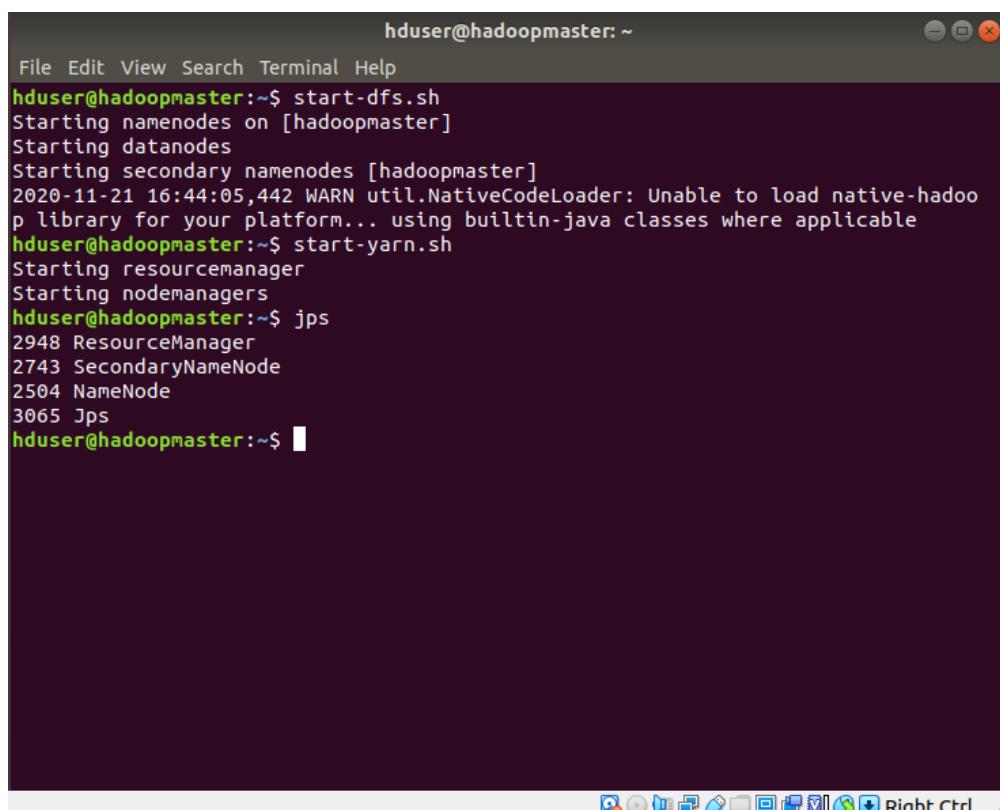
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify  
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell

## Formater le namenode dans hadoopmaster :

On va suivre les mêmes étapes et les commandes pour un unique nœud :



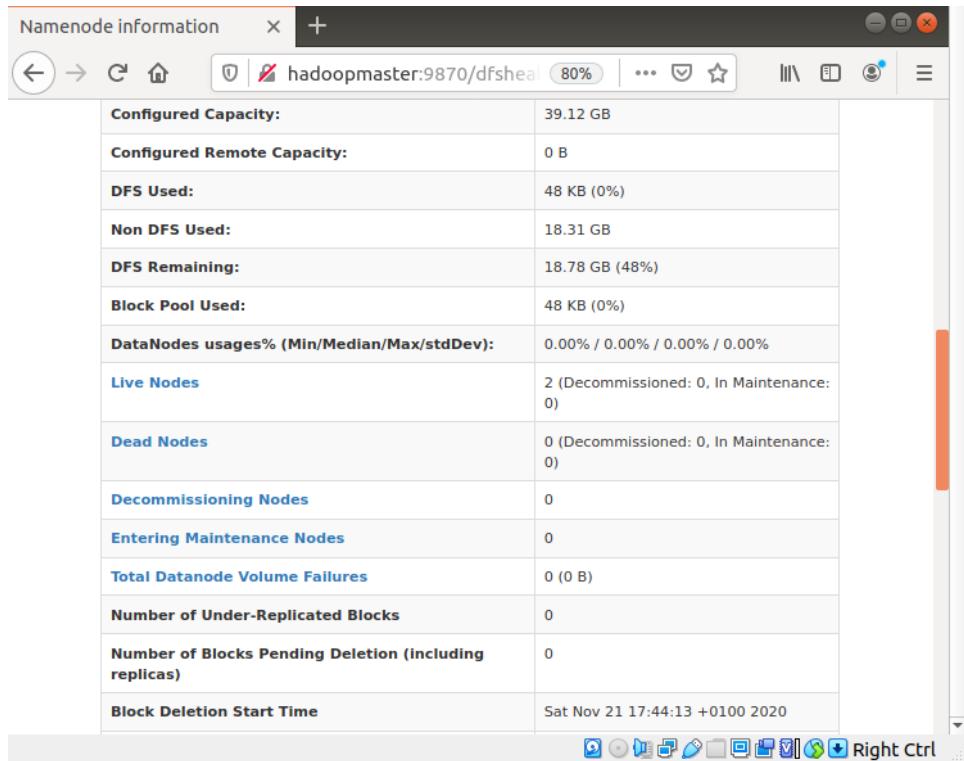
```
Activities Terminal 16:52
hduser@hadoopmaster: ~
File Edit View Search Terminal Help
--- 192.168.0.2 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3007ms
rtt min/avg/max/mdev = 0.796/1.207/1.818/0.376 ms
hduser@hadoopmaster:~$ ping 192.168.0.3
PING 192.168.0.3 (192.168.0.3) 56(84) bytes of data.
64 bytes from 192.168.0.3: icmp_seq=1 ttl=64 time=1.57 ms
64 bytes from 192.168.0.3: icmp_seq=2 ttl=64 time=1.65 ms
^C
--- 192.168.0.3 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 1.570/1.611/1.652/0.041 ms
hduser@hadoopmaster:~$ hdfs namenode -format
2020-11-21 15:51:45,098 INFO namenode.NameNode: STARTUP_MSG:
/*****
STARTUP_MSG: Starting NameNode
STARTUP_MSG: host = hadoopmaster/192.168.0.1
STARTUP_MSG: args = [-format]
STARTUP_MSG: version = 3.2.1
STARTUP_MSG: classpath = /usr/local/hadoop/etc/hadoop:/usr/local/hadoop/share
/hadoop/common/lib/httpcore-4.4.10.jar:/usr/local/hadoop/share/hadoop/common/li
b/commons-lang3-3.7.jar:/usr/local/hadoop/share/hadoop/common/lib/commons-math3
-3.1.1.jar:/usr/local/hadoop/share/hadoop/common/lib/commons-logging-1.1.3.jar:
/usr/local/hadoop/share/hadoop/common/lib/nimbus-jose-jwt-4.41.1.jar:/usr/local
/hadoop/share/hadoop/common/lib/zookeeper-3.4.13.jar:/usr/local/hadoop/share/ha
dooop/common/lib/kerb-common-1.0.1.jar:/usr/local/hadoop/share/hadoop/common/lib
/token-provider-1.0.1.jar:/usr/local/hadoop/share/hadoop/common/lib/httpclient-
4.5.6.jar:/usr/local/hadoop/share/hadoop/common/lib/error_prone_annotations-2.2
.0.jar:/usr/local/hadoop/share/hadoop/common/lib/log4j-1.2.17.jar:/usr/local/ha
dooop/share/hadoop/common/lib/iaxb-api-2.2.11.jar:/usr/local/hadoop/share/hadoop
*****
```



```
hduser@hadoopmaster: ~
File Edit View Search Terminal Help
hduser@hadoopmaster:~$ start-dfs.sh
Starting namenodes on [hadoopmaster]
Starting datanodes
Starting secondary namenodes [hadoopmaster]
2020-11-21 16:44:05,442 WARN util.NativeCodeLoader: Unable to load native-hadoo
p library for your platform... using builtin-java classes where applicable
hduser@hadoopmaster:~$ start-yarn.sh
Starting resourcemanager
Starting nodemanagers
hduser@hadoopmaster:~$ jps
2948 ResourceManager
2743 SecondaryNameNode
2504 NameNode
3065 Jps
hduser@hadoopmaster:~$
```

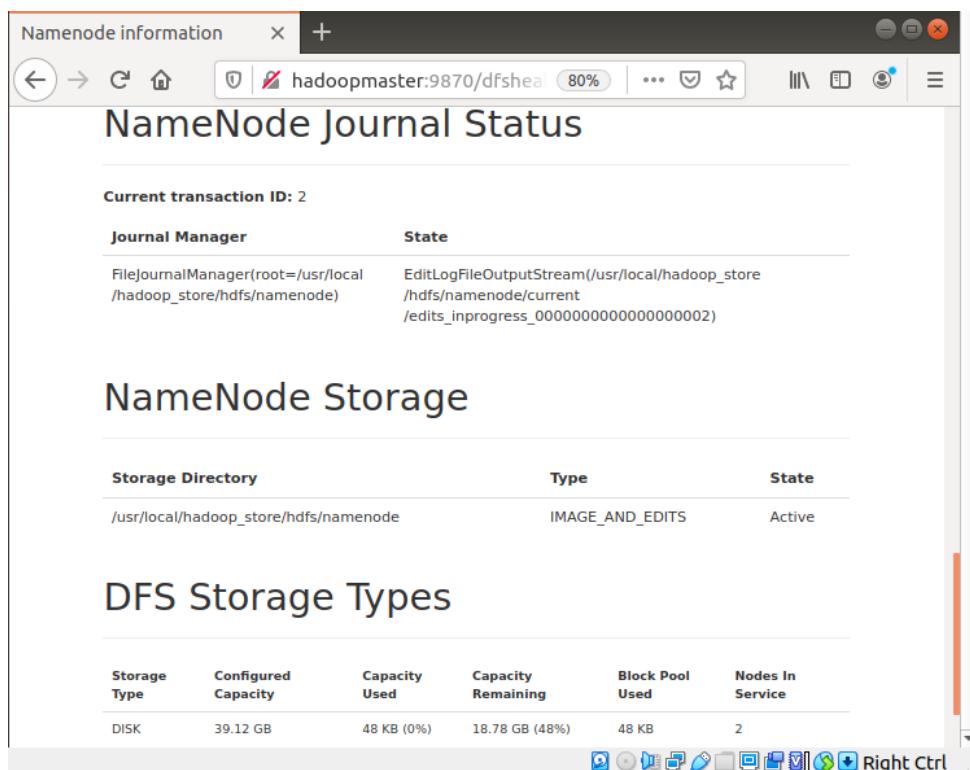
**Accéder aux services de Hadoop via le navigateur :**

<http://hadoopmaster:9870/>



Namenode information

Configured Capacity:	39.12 GB
Configured Remote Capacity:	0 B
DFS Used:	48 KB (0%)
Non DFS Used:	18.31 GB
DFS Remaining:	18.78 GB (48%)
Block Pool Used:	48 KB (0%)
DataNodes usages% (Min/Median/Max/stdDev):	0.00% / 0.00% / 0.00% / 0.00%
Live Nodes	2 (Decommissioned: 0, In Maintenance: 0)
Dead Nodes	0 (Decommissioned: 0, In Maintenance: 0)
Decommissioning Nodes	0
Entering Maintenance Nodes	0
Total Datanode Volume Failures	0 (0 B)
Number of Under-Replicated Blocks	0
Number of Blocks Pending Deletion (including replicas)	0
Block Deletion Start Time	Sat Nov 21 17:44:13 +0100 2020



## NameNode Journal Status

Current transaction ID: 2

Journal Manager	State
FileJournalManager(root=/usr/local/hadoop_store/hdfs/namenode)	EditLogFileOutputStream(/usr/local/hadoop_store/hdfs/namenode/current/edits_inprogress_00000000000000000002)

## NameNode Storage

Storage Directory	Type	State
/usr/local/hadoop_store/hdfs/namenode	IMAGE_AND_EDITS	Active

## DFS Storage Types

Storage Type	Configured Capacity	Capacity Used	Capacity Remaining	Block Pool Used	Nodes In Service
DISK	39.12 GB	48 KB (0%)	18.78 GB (48%)	48 KB	2

Namenode information +

( ) G H D X 80% ... V P M E C ☰

**Hadoop**

Overview Datanodes Datanode Volume Failures Snapshot Startup Progress

Utilities ▾

## Overview 'hadoopmaster:54310' (active)

<b>Started:</b>	Sat Nov 21 17:44:13 +0100 2020
<b>Version:</b>	3.2.1, rb3cbbb467e22ea829b3808f4b7b01d07e0bf3842
<b>Compiled:</b>	Tue Sep 10 16:56:00 +0100 2019 by rohithsharmaks from branch-3.2.1
<b>Cluster ID:</b>	CID-0a047010-973c-476b-875d-c9f33dbd56ed
<b>Block Pool ID:</b>	BP-1797888766-192.168.0.1-1605973909198

## Summary

Security is off.

Right Ctrl

### Datanode usage histogram

Disk usage of each DataNode (%)

### In operation

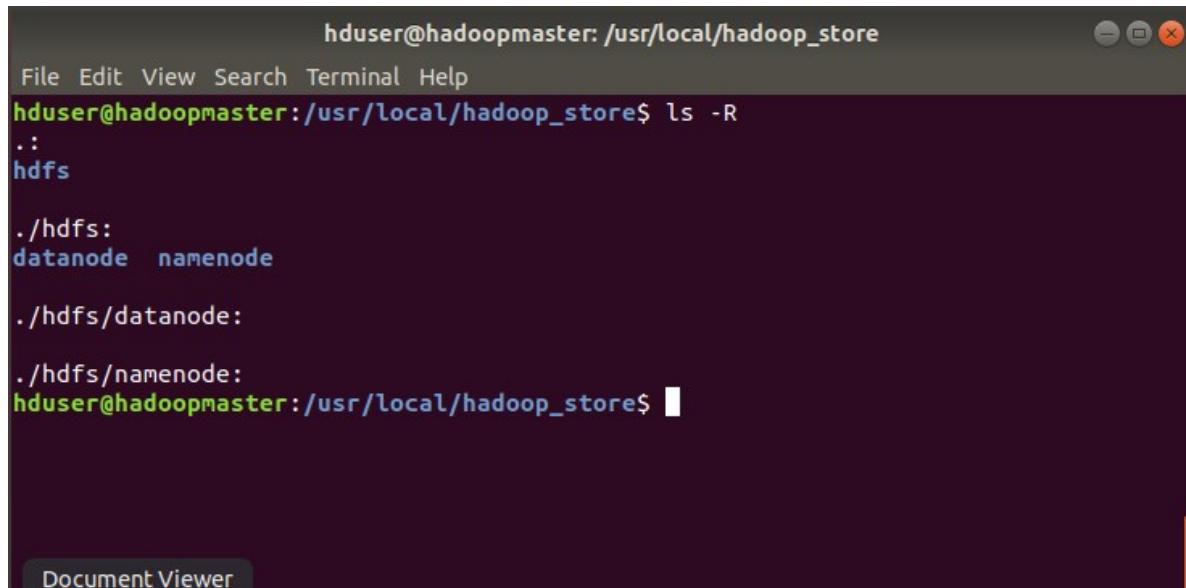
Show  entries Search:

Node	Http Address	Last contact	Last Block Report	Capacity	Blocks	Block pool used	Version
slave1:9866 (192.168.0.2:9866)	http://slave1:9864	0s	9m	19.56 GB	0	24 KB (0%)	3.2.1
slave2:9866 (192.168.0.3:9866)	http://slave2:9864	0s	9m	19.56 GB	0	28 KB (0%)	3.2.1

Showing 1 to 2 of 2 entries Previous 1 Next

Right Ctrl

## IV. Exécution d'un programme Map/Reduce dans un cluster multi-noeuds :



A screenshot of a terminal window titled "hduser@hadoopmaster: /usr/local/hadoop\_store". The window shows the command "ls -R" being run, listing the contents of the HDFS directory structure. The output includes entries for ".:", "hdfs", "./hdfs:", "datanode", "namenode", and "./hdfs/datanode:". The terminal window has a dark background and light-colored text. The title bar and some window controls are visible at the top.

```
hduser@hadoopmaster: /usr/local/hadoop_store
File Edit View Search Terminal Help
hduser@hadoopmaster:/usr/local/hadoop_store$ ls -R
.:
hdfs

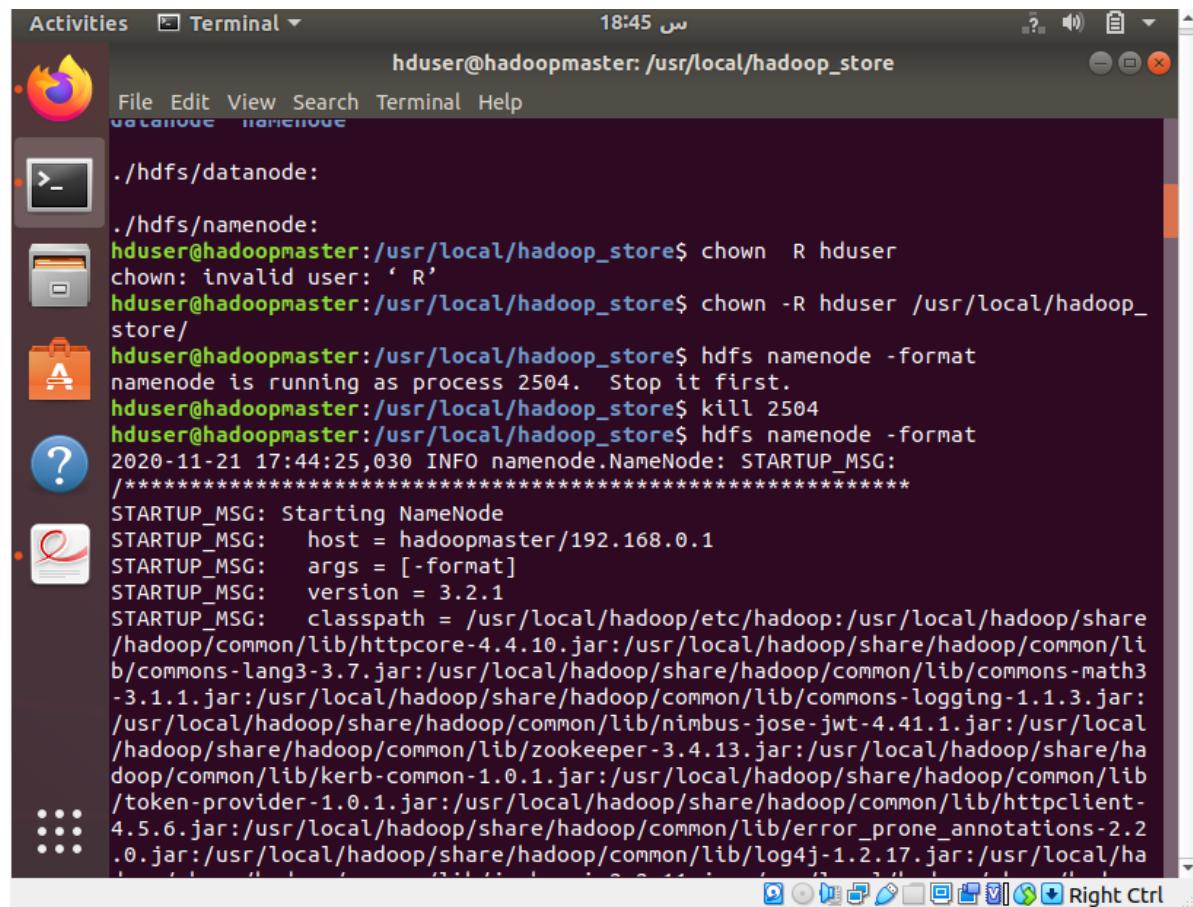
./hdfs:
datanode  namenode

./hdfs/datanode:
hduser@hadoopmaster:/usr/local/hadoop_store$
```

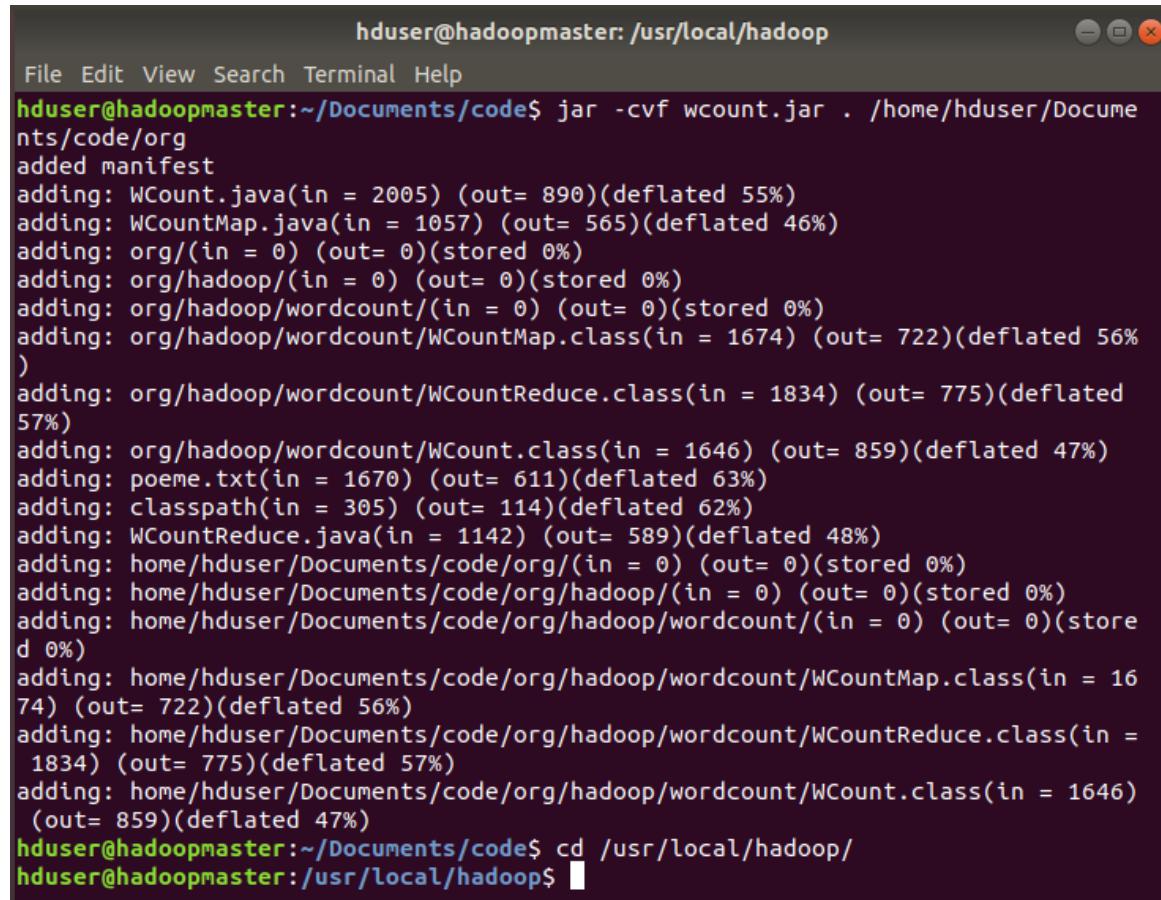
Lancer la commande : « **hdfs dfsadmin -report** » pour vérifier le bon fonctionnement de tous les nœuds du cluster ou bien accéder aux services de Hadoop via le navigateur comme c'est le cas ici :

<b>Configured Capacity:</b>	39.12 GB
<b>Configured Remote Capacity:</b>	0 B
<b>DFS Used:</b>	48 KB (0%)
<b>Non DFS Used:</b>	18.31 GB
<b>DFS Remaining:</b>	18.78 GB (48%)
<b>Block Pool Used:</b>	48 KB (0%)
<b>DataNodes usages% (Min/Median/Max/stdDev):</b>	0.00% / 0.00% / 0.00% / 0.00%
<b>Live Nodes</b>	2 (Decommissioned: 0, In Maintenance: 0)
<b>Dead Nodes</b>	0 (Decommissioned: 0, In Maintenance: 0)
<b>Decommissioning Nodes</b>	0
<b>Entering Maintenance Nodes</b>	0
<b>Total Datanode Volume Failures</b>	0 (0 B)
<b>Number of Under-Replicated Blocks</b>	0

et on va suivre les mêmes étapes citées pour l'exécution d'un programme Map/Reduce pour un seul nœud :



```
Activities Terminal 18:45 ↵
hduser@hadoopmaster: /usr/local/hadoop_store
File Edit View Search Terminal Help
datanode namenode
./hdfs/datanode:
./hdfs/namenode:
hduser@hadoopmaster: /usr/local/hadoop_store$ chown -R hduser
chown: invalid user: 'R'
hduser@hadoopmaster: /usr/local/hadoop_store$ chown -R hduser /usr/local/hadoop_
store/
hduser@hadoopmaster: /usr/local/hadoop_store$ hdfs namenode -format
namenode is running as process 2504. Stop it first.
hduser@hadoopmaster: /usr/local/hadoop_store$ kill 2504
hduser@hadoopmaster: /usr/local/hadoop_store$ hdfs namenode -format
2020-11-21 17:44:25,030 INFO namenode.NameNode: STARTUP_MSG:
*****
STARTUP_MSG: Starting NameNode
STARTUP_MSG: host = hadoopmaster/192.168.0.1
STARTUP_MSG: args = [-format]
STARTUP_MSG: version = 3.2.1
STARTUP_MSG: classpath = /usr/local/hadoop/etc/hadoop:/usr/local/hadoop/share
/hadoop/common/lib/httpcore-4.4.10.jar:/usr/local/hadoop/share/hadoop/common/li
b/commons-lang3-3.7.jar:/usr/local/hadoop/share/hadoop/common/lib/commons-math3
-3.1.1.jar:/usr/local/hadoop/share/hadoop/common/lib/commons-logging-1.1.3.jar:
/usr/local/hadoop/share/hadoop/common/lib/nimbus-jose-jwt-4.41.1.jar:/usr/local
/hadoop/share/hadoop/common/lib/zookeeper-3.4.13.jar:/usr/local/hadoop/share/ha
doop/common/lib/kerb-common-1.0.1.jar:/usr/local/hadoop/share/hadoop/common/lib
/token-provider-1.0.1.jar:/usr/local/hadoop/share/hadoop/common/lib/httpclient-
4.5.6.jar:/usr/local/hadoop/share/hadoop/common/lib/error_prone_annotations-2.2
.jar:/usr/local/hadoop/share/hadoop/common/lib/log4j-1.2.17.jar:/usr/local/ha
doo...
```



```
hduser@hadoopmaster: /usr/local/hadoop
File Edit View Search Terminal Help
hduser@hadoopmaster: ~/Documents/code$ jar -cvf wcount.jar . /home/hduser/Docume
nts/code/org
added manifest
adding: WCount.java(in = 2005) (out= 890)(deflated 55%)
adding: WCountMap.java(in = 1057) (out= 565)(deflated 46%)
adding: org/(in = 0) (out= 0)(stored 0%)
adding: org/hadoop/(in = 0) (out= 0)(stored 0%)
adding: org/hadoop/wordcount/(in = 0) (out= 0)(stored 0%)
adding: org/hadoop/wordcount/WCountMap.class(in = 1674) (out= 722)(deflated 56%
)
adding: org/hadoop/wordcount/WCountReduce.class(in = 1834) (out= 775)(deflated
57%)
adding: org/hadoop/wordcount/WCount.class(in = 1646) (out= 859)(deflated 47%)
adding: poeme.txt(in = 1670) (out= 611)(deflated 63%)
adding: classpath(in = 305) (out= 114)(deflated 62%)
adding: WCountReduce.java(in = 1142) (out= 589)(deflated 48%)
adding: home/hduser/Documents/code/org/(in = 0) (out= 0)(stored 0%)
adding: home/hduser/Documents/code/org/hadoop/(in = 0) (out= 0)(stored 0%)
adding: home/hduser/Documents/code/org/hadoop/wordcount/(in = 0) (out= 0)(store
d 0%)
adding: home/hduser/Documents/code/org/hadoop/wordcount/WCountMap.class(in = 16
74) (out= 722)(deflated 56%)
adding: home/hduser/Documents/code/org/hadoop/wordcount/WCountReduce.class(in =
1834) (out= 775)(deflated 57%)
adding: home/hduser/Documents/code/org/hadoop/wordcount/WCount.class(in = 1646)
(out= 859)(deflated 47%)
hduser@hadoopmaster: ~/Documents/code$ cd /usr/local/hadoop/
hduser@hadoopmaster: /usr/local/hadoop$
```

```
adding: org/hadoop/(in = 0) (out= 0)(stored 0%)
adding: org/hadoop/wordcount/(in = 0) (out= 0)(stored 0%)
adding: org/hadoop/wordcount/WCountMap.class(in = 1674) (out= 722)(deflated 56%)
)
adding: org/hadoop/wordcount/WCountReduce.class(in = 1834) (out= 775)(deflated 57%)
adding: org/hadoop/wordcount/WCount.class(in = 1646) (out= 859)(deflated 47%)
adding: poeme.txt(in = 1670) (out= 611)(deflated 63%)
adding: classpath(in = 305) (out= 114)(deflated 62%)
adding: WCountReduce.java(in = 1142) (out= 589)(deflated 48%)
adding: home/hduser/Documents/code/org/(in = 0) (out= 0)(stored 0%)
adding: home/hduser/Documents/code/org/hadoop/(in = 0) (out= 0)(stored 0%)
adding: home/hduser/Documents/code/org/hadoop/wordcount/(in = 0) (out= 0)(store
d 0%)
adding: home/hduser/Documents/code/org/hadoop/wordcount/WCountMap.class(in = 16
74) (out= 722)(deflated 56%)
adding: home/hduser/Documents/code/org/hadoop/wordcount/WCountReduce.class(in =
1834) (out= 775)(deflated 57%)
adding: home/hduser/Documents/code/org/hadoop/wordcount/WCount.class(in = 1646)
(out= 859)(deflated 47%)
hduser@hadoopmaster:~/Documents/code$ cd /usr/local/hadoop/
hduser@hadoopmaster:/usr/local/hadoop$ bin/dfs -put /home/hduser/Documents
/code/poeme.txt /
2020-11-22 23:02:23,397 WARN util.NativeCodeLoader: Unable to load native-hadoo
p library for your platform... using builtin-java classes where applicable
2020-11-22 23:02:28,235 INFO sasl.SaslDataTransferClient: SASL encryption trust
check: localHostTrusted = false, remoteHostTrusted = false
hduser@hadoopmaster:/usr/local/hadoop$ █
```

```
hduser@hadoopmaster:/usr/local/hadoop$ bin/dfs dfs -ls /
2020-11-22 23:03:42,261 WARN util.NativeCodeLoader: Unable to load native-hadoo
p library for your platform... using builtin-java classes where applicable
Found 1 items
-rw-r--r--  2 hduser supergroup      1670 2020-11-22 23:02 /poeme.txt
hduser@hadoopmaster:/usr/local/hadoop$ █
```

```
2020-11-22 23:05:08,880 INFO mapred.LocalJobRunner: Finishing task: attempt_loc
al1315506290_0001_r_000000_0
2020-11-22 23:05:08,880 INFO mapred.LocalJobRunner: reduce task executor comple
te.
2020-11-22 23:05:09,770 INFO mapreduce.Job:  map 100% reduce 100%
2020-11-22 23:05:09,773 INFO mapreduce.Job: Job job_local1315506290_0001 comple
ted successfully
```

```
hduser@hadoopmaster: ~/Documents/code
File Edit View Search Terminal Help
sang    1 occurrences.
sanglots    1 occurrences.
sappelle    1 occurrences.
se    1 occurrences.
sentinelle    1 occurrences.
ses    1 occurrences.
seul    1 occurrences.
soldats  1 occurrences.
songe    1 occurrences.
sont    2 occurrences.
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tombe    1 occurrences.
tous    3 occurrences.
trepas    1 occurrences.
triste    1 occurrences.
trompa    1 occurrences.
un    4 occurrences.
verra    1 occurrences.
vie    1 occurrences.
vient    1 occurrences.
violoncelle  1 occurrences.
vive    1 occurrences.
vivra    1 occurrences.
hduser@hadoopmaster:~/Documents/code$
```

**FIN**