

## **Exp.1 Downloading and installing Hadoop, Understanding different Hadoop modes, Startup scripts, Configuration files.**

### **AIM:**

To Download and install Hadoop, Understanding different Hadoop modes, Startup scripts, Configuration files.

### **Procedure:**

#### **Step 1 : Install Java Development Kit**

The default Ubuntu repositories contain Java 8 and Java 11 both. But, Install Java 8 because hive only works on this version. Use the following command to install it.

```
$sudo apt update&&sudo apt install openjdk-8-jdk
```

#### **Step 2 : Verify the Java version**

Once installed, verify the installed version of Java with the following

command: **\$ java -version** Output:

```
naveen@ubuntu:~$ java -version
openjdk version "11.0.24" 2024-07-16
OpenJDK Runtime Environment (build 11.0.24+8-post-Ubuntu-1ubuntu322.04)
OpenJDK 64-Bit Server VM (build 11.0.24+8-post-Ubuntu-1ubuntu322.04, mixed mode,
sharing)
naveen@ubuntu:~$
```

#### **Step 3: Install SSH**

SSH (Secure Shell) installation is vital for Hadoop as it enables secure communication between nodes in the Hadoop cluster. This ensures data integrity, confidentiality, and allows for efficient distributed processing of data. **\$sudo apt install ssh** across the cluster.

#### **Step 4 : Create the hadoop user :**

All the Hadoop components will run as the user that you create for Apache Hadoop, and the user will also be used for logging in to Hadoop's web interface. Run the command to create user and set password:

```
$ sudo adduser hadoop
```

**Output:**

```

sanjay@sanjay-VirtualBox:~$ sudo adduser hadoop
Adding user 'hadoop' ...
Adding new group 'hadoop' (1001) ...
Adding new user 'hadoop' (1001) with group 'hadoop (1001)' ...
adduser: The home directory '/home/hadoop' already exists. Not copying from '/etc/skel'.
New password:
BAD PASSWORD: The password is shorter than 8 characters
Retype new password:
passwd: password updated successfully
Changing the user information for hadoop
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] y
Adding new user 'hadoop' to supplemental / extra groups 'users' ...
Adding user 'hadoop' to group 'users' ...
sanjay@sanjay-VirtualBox:~$ su - hadoop
Password:
hadoop@sanjay-VirtualBox:~$

```

### Step 5 : Switch user

Switch to the newly created hadoop user:

**\$ su - hadoop**

### Step 6 : Configure SSH

Now configure password-less SSH access for the newly created hadoop user, so didn't enter the key to save file and passphrase. Generate an SSH keypair (generate Public and Private Key Pairs)first

**\$ssh-keygen -t rsa**

```

hadoop@sanjay-VirtualBox:~$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/hadoop/.ssh/id_rsa):
Created directory '/home/hadoop/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/hadoop/.ssh/id_rsa
Your public key has been saved in /home/hadoop/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:yu8Hsie3mbQ7UifnFH6iam4kFLRRbEb9zVYGutbaYyg hadoop@sanjay-VirtualBox
The key's randomart image is:
+---[RSA 3072]----+
|      .o+o.  ..+o |
|      .o+ .  o  + |
|      .+   . o.= |
|      .   E..=o. |
|      . $   ... . |
|      .o.= o     |
|      o*.B       |
|      +o*++ o .  |
|      X@*+.+o    |
+-----[SHA256]-----+
hadoop@sanjay-VirtualBox:~$

```

### Step 7 : Set permissions :

Next, append the generated public keys from id\_rsa.pub to authorized\_keys and set proper permission:

**\$ cat ~/.ssh/id\_rsa.pub >> ~/.ssh/authorized\_keys**

**\$ chmod 640 ~/.ssh/authorized\_keys**

### Step 8 : SSH to the localhost

Next, verify the password less SSH authentication with the following command:

**\$ ssh localhost**

You will be asked to authenticate hosts by adding RSA keys to known hosts. Type yes and hit Enter to authenticate the localhost:

```
hadoop@ubuntu:/home$ ssh localhost
hadoop@localhost's password:
Welcome to Ubuntu 24.04.1 LTS (GNU/Linux 6.8.0-41-generic x86_64)

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

Expanded Security Maintenance for Applications is not enabled.

17 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

8 additional security updates can be applied with ESM Apps.
Learn more about enabling ESM Apps service at https://ubuntu.com/esm
```

### Step 9 : Switch user

Again switch to hadoop. So, First, change the user to hadoop with the following command: **\$ su-hadoop**

### Step 10 : Install hadoop

Next, download the latest version of Hadoop using the wget command:

**\$ wget <https://downloads.apache.org/hadoop/common/hadoop-3.3.6/hadoop-3.3.6.tar.gz>**

Once downloaded, extract the downloaded file:

**\$ tar -xvzf hadoop-3.3.6.tar.gz**

Next, rename the extracted directory to hadoop:

**\$ mv hadoop-3.3.6 hadoop**

```
hadoop@sanjay-VirtualBox:~$ mv hadoop-3.3.6 hadoop
hadoop@sanjay-VirtualBox:~$ ls
hadoop  hadoop-3.3.6.tar.gz
hadoop@sanjay-VirtualBox:~$
```

Next, you will need to configure Hadoop and Java Environment Variables on your system. Open the ~/.bashrc file in your favorite text editor. Use nano editor , to pasting the code we use ctrl+shift+v for saving the file ctrl+x and ctrl+y ,then hit enter:

Next, you will need to configure Hadoop and Java Environment Variables on your system.

Open the ~/.bashrc file in your favorite text editor:

**\$ nano ~/.bashrc**

Append the below lines to file.

```
export JAVA_HOME=/usr/lib/jvm/java-8-openjdk-amd64
export HADOOP_HOME=/home/hadoop/hadoop
export HADOOP_INSTALL=$HADOOP_HOME
export HADOOP_MAPRED_HOME=$HADOOP_HOME
export HADOOP_COMMON_HOME=$HADOOP_HOME
export HADOOP_HDFS_HOME=$HADOOP_HOME
export HADOOP_YARN_HOME=$HADOOP_HOME
export HADOOP_COMMON_LIB_NATIVE_DIR=$HADOOP_HOME/lib/native
export PATH=$PATH:$HADOOP_HOME/sbin:$HADOOP_HOME/bin
export HADOOP_OPTS="-Djava.library.path=$HADOOP_HOME/lib/native"
```

Save and close the file. Then, activate the environment variables with the following command:

**s\$ source ~/.bashrc**

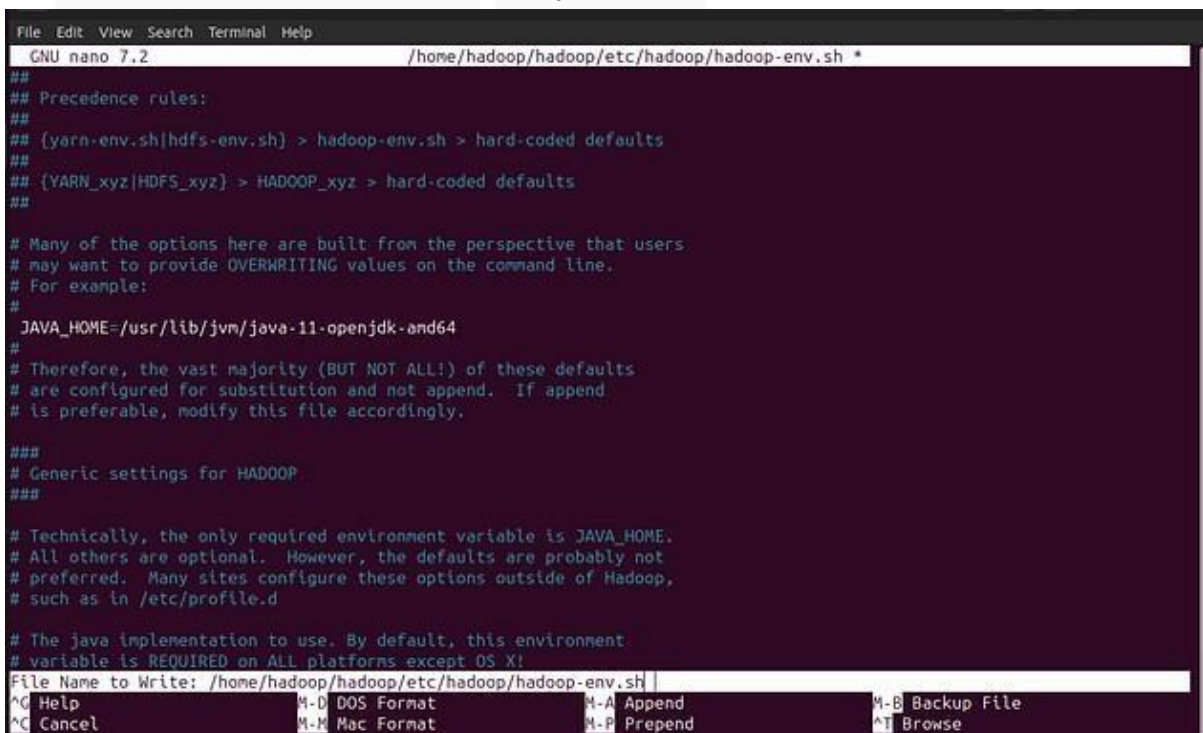
Next, open the Hadoop environment variable file:

**\$ nano**

**\$HADOOP\_HOME/etc/hadoop/hadoopenv.sh**

Search for the “export JAVA\_HOME” and configure it.

**JAVA\_HOME=/usr/lib/jvm/java-8-openjdk-**  
**amd64**



```
File Edit View Search Terminal Help
GNU nano 7.2 /home/hadoop/hadoop/etc/hadoop/hadoop-env.sh *
##
## Precedence rules:
##
## (yarn-env.sh|hdfs-env.sh) > hadoop-env.sh > hard-coded defaults
##
## {YARN_xyz|HDFS_xyz} > HADOOP_xyz > hard-coded defaults
##
# Many of the options here are built from the perspective that users
# may want to provide OVERWRITING values on the command line.
# For example:
#
# JAVA_HOME=/usr/lib/jvm/java-11-openjdk-amd64
#
# 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!
File Name to Write: /home/hadoop/hadoop/etc/hadoop/hadoop-env.sh
^C Help      M-D DOS Format  M-A Append      M-B Backup File
^C Cancel    M-M Mac Format  M-P Prepend      ^T Browse
```

Save and close the file when you are finished.

## Step 11 : Configuring Hadoop :

First, you will need to create the namenode and datanode directories inside the Hadoop user home directory. Run the following command to create both directories:

```
$ cd hadoop/
```

```
$mkdir -p ~/hadoopdata/hdfs/{namenode,datanode}
```

- Next, edit the core-site.xml file and

```
The list of available updates is more than a week old.  
To check for new updates run: sudo apt update  
Last login: Mon Aug 19 13:36:03 2024 from 127.0.0.1  
hadoop@ubuntu:~$ mkdir -p ~/hadoop/hdfs/(namenode,datanode)
```

update with your system hostname:

```
$nano $HADOOP_HOME/etc/hadoop/core-site.xml
```

Change the following name as per your system hostname:

```
<configuration>  
  <property>  
    <name>fs.defaultFS</name>  
    <value>hdfs://localhost:9000</value>  
  </property>  
</configuration>
```

Save and close the file.

Then, edit the hdfs-site.xml file:

```
$nano $HADOOP_HOME/etc/hadoop/hdfs-site.xml
```

- Change the NameNode and DataNode directory paths as shown below:

```
<configuration>  
  <property>  
    <name>dfs.replication</name>  
    <value>1</value>  
  </property>  
  
  <property>  
    <name>dfs.namenode.name.dir</name>  
    <value>file:///home/hadoop/hadoopdata/hdfs/namenode</value>  
  </property>  
  
  <property>  
    <name>dfs.datanode.data.dir</name>  
    <value>file:///home/hadoop/hadoopdata/hdfs/datanode</value>  
  </property>  
</configuration>
```



- Then, edit the mapred-site.xml file:  
**\$nano \$HADOOP\_HOME/etc/hadoop/mapred-site.xml**

- Make the following changes:

```
<configuration>
  <property>
    <name>yarn.app.mapreduce.am.env</name>
    <value>HADOOP_MAPRED_HOME=$HADOOP_HOME/home/hadoop/hadoop/bin/hadoop</value>
  </property>
  <property>
    <name>mapreduce.map.env</name>
    <value>HADOOP_MAPRED_HOME=$HADOOP_HOME/home/hadoop/hadoop/bin/hadoop</value>
  </property>
  <property>
    <name>mapreduce.reduce.env</name>
    <value>HADOOP_MAPRED_HOME=$HADOOP_HOME/home/hadoop/hadoop/bin/hadoop</value>
  </property>
</configuration>
```

- Then, edit the yarn-site.xml file:  
**\$nano \$HADOOP\_HOME/etc/hadoop/yarn-site.xml**
- Make the following changes:

```
<configuration>
  <property>
    <name>yarn.nodemanager.aux-services</name>
    <value>mapreduce_shuffle</value>
  </property>
</configuration>
```

Save the file and close it .

## Step 12 – Start Hadoop Cluster

Before starting the Hadoop cluster. You will need to format the Namenode as a hadoop user.

Run the following command to format the Hadoop Namenode:

```
$hdfs namenode -format
```

Once the namenode directory is successfully formatted with hdfs file system, you will see the message “Storage directory /home/hadoop/hadoopdata/hdfs/namenode has been successfully formatted “

Then start the Hadoop cluster with the following command.

```
$ start-all.sh
```

```
hadoop@ubuntu:~$ start-all.sh
WARNING: Attempting to start all Apache Hadoop daemons as hadoop in 10 seconds.
WARNING: This is not a recommended production deployment configuration.
WARNING: Use CTRL-C to abort.
Starting namenodes on [localhost]
Starting datanodes
Starting secondary namenodes [ubuntu]
SLF4J: Failed to load class "org.slf4j.impl.StaticLoggerBinder".
SLF4J: Defaulting to no-operation (NOP) logger implementation
SLF4J: See http://www.slf4j.org/codes.html#StaticLoggerBinder for further details.
Starting resourcemanager
Starting nodemanagers
```

You can now check the status of all Hadoop services using the jps command:

**\$ jps**

```
hadoop@ubuntu:~$ jps
4624 ResourceManager
5077 Jps
4745 NodeManager
4427 SecondaryNameNode
4204 DataNode
4079 NameNode
```

### Step 13 – Access Hadoop Namenode and Resource Manager

- First we need to know our ipaddress, In Ubuntu we need to install net-tools to run ifconfig command,

If you installing net-tools for the first time switch to default user:

**\$sudo apt install net-tools**

- Then run ifconfig command to know our ip address: **ifconfig**

```
hadoop@sanjay-VirtualBox:~/hadoop$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.6 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 2401:4900:1c28:46c4:f76c:b206:abe3:2d45 prefixlen 64 scopeid 0x0<global>
    inet6 2401:4900:1c28:46c4:ed13:53f4:5c05:50c6 prefixlen 64 scopeid 0x0<global>
    inet6 fe80::112b:300a:9242:51f3 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:83:31:35 txqueuelen 1000 (Ethernet)
    RX packets 645228 bytes 934388358 (934.3 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 93618 bytes 8998032 (8.9 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 3331 bytes 491873 (491.8 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 3331 bytes 491873 (491.8 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

hadoop@sanjay-VirtualBox:~/hadoop$
```

Here my ip address is 192.168.1.6.

- To access the Namenode, open your web browser and visit the URL <http://yourserverip:9870>.
- You should see the following screen:

<http://192.168.1.6:9870>

The screenshot shows the Hadoop Overview page. The browser address bar displays <http://192.168.1.6:9870/dfshealth.html#tab-overview>. The page has a green navigation bar with tabs: Hadoop, Overview, Datanodes, Datanode Volume Failures, Snapshot, Startup Progress, and Utilities. The main content area is titled "Overview 'localhost:9000' (active)". Below the title is a table with the following information:

Started:	Sun Sep 10 13:08:22 +0530 2023
Version:	3.3.6, r1be78238728da9266a4f88195058f08fd012bf9c
Compiled:	Sun Jun 18 13:52:00 +0530 2023 by ubuntu from (HEAD detached at release-3.3.6-RC1)
Cluster ID:	CID-dc5a1253-b0cd-4686-a807-fd0dd4c5a9a
Block Pool ID:	BP-1272319295-127.0.1.1-1694331447796

Below the table is a "Summary" section. It contains the following text:

Security is off.  
Safemode is off.  
1 files and directories, 0 blocks (0 replicated blocks, 0 erasure coded block groups) = 1 total filesystem object(s).  
Heap Memory used 69.85 MB of 107 MB Heap Memory. Max Heap Memory is 748 MB.  
Non Heap Memory used 51.89 MB of 55.44 MB Committed Non Heap Memory. Max Non Heap Memory is <unbounded>.

At the bottom, there is a table with two columns: "Configured Capacity:" and "24.44 GB".

To access Resource Manage, open your web browser and visit the URL

<http://yourserverip:8088>. You should see the following screen: <http://192.168.16:8088>

The screenshot shows the Hadoop Resource Manager interface. The browser address bar displays <http://192.168.1.6:8088/cluster>. The page features the Hadoop logo on the left. A sidebar on the left contains a "Cluster" menu with options: About, Nodes, Node Labels, Applications, NEW, NEW SAVING, SUBMITTED, ACCEPTED, RUNNING, FINISHED, FAILED, KILLED, and Scheduler. Below the sidebar is a "Tools" button. The main content area is titled "Cluster Metrics" and contains several tables:

Apps Submitted	Apps Pending	Apps Running	Apps Completed	Containers Running
0	0	0	0	0

Below this is the "Cluster Nodes Metrics" table:

Active Nodes	Decommissioning Nodes	Decommissioned Nodes
1	0	0

Next is the "Scheduler Metrics" table:

Scheduler Type	Scheduling Resource Type	Min
Capacity Scheduler	[memory-mb (unit=Mi), vcores]	<memory:1024, vCore:

Below the scheduler metrics is a table with columns: ID, User, Name, Application Type, Application Tags, Queue, Application Priority, StartTime, LaunchTime, and FinishTime. The table is currently empty, showing "Showing 0 to 0 of 0 entries".

## Step 14 – Verify the Hadoop Cluster

At this point, the Hadoop cluster is installed and configured. Next, we will create some directories in the HDFS filesystem to test the Hadoop.

Let's create some directories in the HDFS filesystem using the following command:

```
$ hdfsdfs -mkdir /test1
$ hdfsdfs -mkdir /logs
```

Next, run the following command to list the above directory:



```
$ hdfs dfs -ls /
```

You should get the following output:

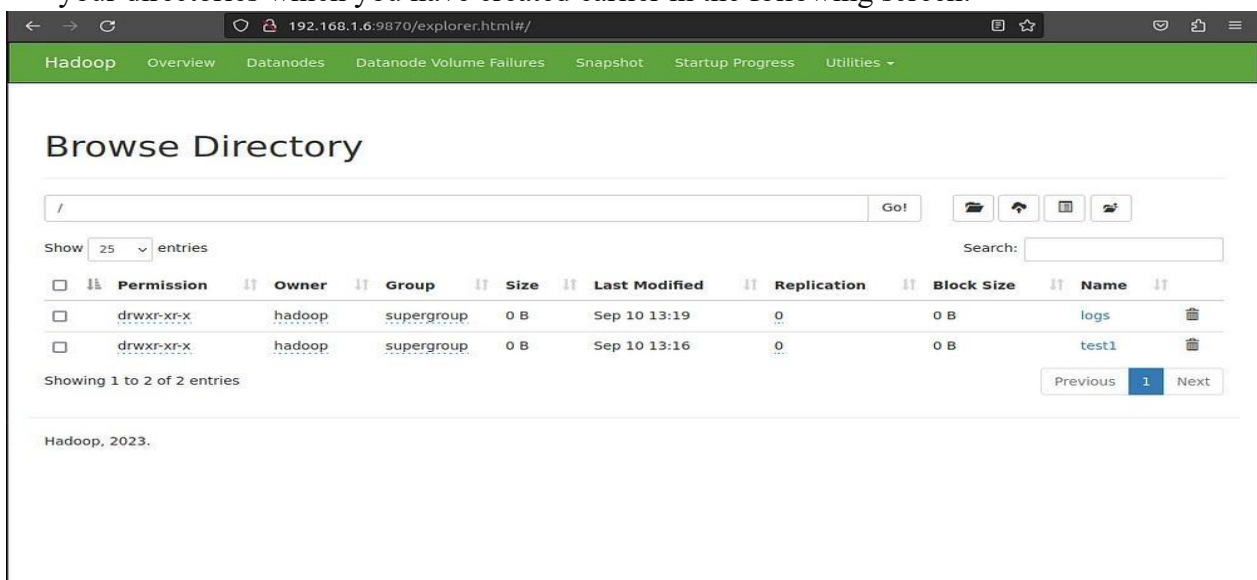
```
hadoop@sanjay-VirtualBox:~/hadoop$ hdfs dfs -ls /
Found 2 items
drwxr-xr-x  - hadoop supergroup          0 2023-09-10 13:16 /logs
drwxr-xr-x  - hadoop supergroup          0 2023-09-10 13:16 /test1
hadoop@sanjay-VirtualBox:~/hadoop$
```

Also, put some files to hadoop file system. For the example, putting log files from host machine to hadoop file system.

```
$ hdfs dfs -put /var/log/* /logs/
```

You can also verify the above files and directory in the Hadoop Namenode web interface.

Go to the web interface, click on the Utilities => Browse the file system. You should see your directories which you have created earlier in the following screen:



The screenshot shows the Hadoop Namenode web interface. The top navigation bar includes links for Overview, Datanodes, Datanode Volume Failures, Snapshot, Startup Progress, and Utilities. The main content area is titled 'Browse Directory' and shows a file explorer view. A search bar is present, and a table lists the contents of the directory. The table has columns for Permission, Owner, Group, Size, Last Modified, Replication, Block Size, and Name. Two entries are listed: 'logs' and 'test1', both owned by 'hadoop' and 'supergroup'. The page also shows a 'Showing 1 to 2 of 2 entries' message and navigation buttons for Previous, 1, and Next.

Permission	Owner	Group	Size	Last Modified	Replication	Block Size	Name
drwxr-xr-x	hadoop	supergroup	0 B	Sep 10 13:19	0	0 B	logs
drwxr-xr-x	hadoop	supergroup	0 B	Sep 10 13:16	0	0 B	test1

## Step 15 – Stop Hadoop Cluster

To stop the Hadoop all services, run the following command:

```
$ stop-all.sh
```

```
hadoop@ubuntu:~/hadoop$ stop-all.sh
WARNING: Stopping all Apache Hadoop daemons as hadoop in 10 seconds.
WARNING: Use CTRL-C to abort.
Stopping namenodes on [localhost]
Stopping datanodes
Stopping secondary namenodes [ubuntu]
SLF4J: Failed to load class "org.slf4j.impl.StaticLoggerBinder".
SLF4J: Defaulting to no-operation (NOP) logger implementation
SLF4J: See http://www.slf4j.org/codes.html#StaticLoggerBinder for further details.
Stopping nodemanagers
Stopping resourcemanager
```

**Result:**

The step-by-step installation and configuration of Hadoop on Ubuntu linux system have been successfully completed.