How to Install and Configure Hadoop on Ubuntu 20.04

Hadoop is a free, open-source, and Java-based software framework used for the storage and processing of large datasets on clusters of machines. It uses HDFS to store its data and process these data using MapReduce. It is an ecosystem of Big Data tools that are primarily used for data mining and machine learning.

Apache Hadoop 3.3 comes with noticeable improvements and many bug fixes over the previous releases. It has four major components such as Hadoop Common, HDFS, YARN, and MapReduce.

This tutorial will explain you to how to install and configure Apache Hadoop on Ubuntu 20.04 LTS Linux system.

Step 1 – Installing Java

Hadoop is written in Java and supports only Java version 8. Hadoop version 3.3 and latest also support Java 11 runtime as well as Java 8.

You can install OpenJDK 11 from the default apt repositories:

```
sudo apt update

sudo apt install openjdk-11-jdk
```

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

```
java -version
```

You should get the following output:

```
openjdk version "11.0.11" 2021-04-20
OpenJDK Runtime Environment (build 11.0.11+9-Ubuntu-0ubuntu2.20.04)
OpenJDK 64-Bit Server VM (build 11.0.11+9-Ubuntu-0ubuntu2.20.04, mixed mode, sharing)
```

Step 2 – Create a Hadoop User

It is a good idea to create a separate user to run Hadoop for security reasons.

Run the following command to create a new user with name hadoop:

```
sudo adduser hadoop
```

Provide and confirm the new password as shown below:

```
Adding user `hadoop' ...
Adding new group `hadoop' (1002) ...
Adding new user `hadoop' (1002) with group `hadoop' ...
Creating home directory `/home/hadoop' ...
Copying files from `/etc/skel' ...
New password:
```

```
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
```

Step 3 – Configure SSH Key-based Authentication

Next, you will need to configure passwordless SSH authentication for the local system.

First, change the user to hadoop with the following command:

```
su - hadoop
```

Next, run the following command to generate Public and Private Key Pairs:

```
ssh-keygen -t rsa
```

You will be asked to enter the filename. Just press Enter to complete the process:

```
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:QSa2syeISwP0hD+UXxxi0j9MSOrjKDGIbkfbM3ejyIk  hadoop@ubuntu20
The key's randomart image is:
+---[RSA 3072]----+
| ..o++=.+        |
|..oo++.O         |
|. oo. B .        |
|o..+ o * .       |
|= ++o o S        |
|.++o+  o         |
|.+.+ + . o       |
|o . o * o .      |
|   E + .         |
+----[SHA256]-----+
```

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
```

Next, verify the passwordless 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:

```
The authenticity of host 'localhost (127.0.0.1)' can't be established.
ECDSA key fingerprint is SHA256:JFqDVbM3zTPhUPgD5oMJ4ClviH6tzIRZ2
GD3BdNqGMQ.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
```

Step 4 – Installing Hadoop

First, change the user to hadoop with the following command:

```
su - hadoop
```

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

```
wget  https://downloads.apache.org/hadoop/common/hadoop-3.3.0/hadoop-3.3.0.tar.
gz
```

Once downloaded, extract the downloaded file:

```
tar -xvzf hadoop-3.3.0.tar.gz
```

Next, rename the extracted directory to hadoop:

```
mv hadoop-3.3.0 hadoop
```

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. You can find JAVA_HOME location by running dirname $(dirname $(readlink -f $(which java))) command on terminal.

```
export JAVA_HOME=/usr/lib/jvm/java-11-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:

```
source ~/.bashrc
```

Next, open the Hadoop environment variable file:

```
nano $HADOOP_HOME/etc/hadoop/hadoop-env.sh
```

Again set the JAVA_HOME in hadoop environemnt.

```
export JAVA_HOME=/usr/lib/jvm/java-11-openjdk-amd64
```

Save and close the file when you are finished.

Step 5 - Configuring Hadoop

First, you will need to create the namenode and datanode directories inside Hadoop home directory:

Run the following command to create both directories:

```
mkdir -p ~/hadoopdata/hdfs/namenode
mkdir -p ~/hadoopdata/hdfs/datanode
```

Next, edit the **core-site.xml** file and update with your system hostname:

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

Change the following name as per your system hostname:

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```
<configuration>
        <property>
                <name>fs.defaultFS</name>
                <value>hdfs://hadoop.tecadmin.com: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 path as shown below:

```
<configuration>

        <property>
                <name>dfs.replication</name>
                <value>1</value>
        </property>

        <property>
```

```
            <name>dfs.name.dir</name>
            <value>file:///home/hadoop/hadoopdata/hdfs/namenode</value>
        </property>

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

Save and close the file. Then, edit the **mapred-site.xml** file:

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

Make the following changes:

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```
<configuration>
        <property>
            <name>mapreduce.framework.name</name>
            <value>yarn</value>
        </property>
</configuration>
```

Save and close the file. Then, edit the **yarn-site.xml** file:

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

Make the following changes:

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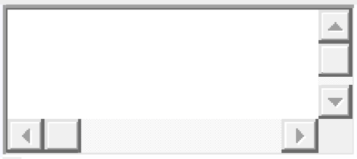

```
<configuration>
        <property>
            <name>yarn.nodemanager.aux-services</name>
            <value>mapreduce_shuffle</value>
        </property>
</configuration>
```

Save and close the file when you are finished.

Step 6 - 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
```

You should get the following output:

```
2020-11-23 10:31:51,318 INFO namenode.NNStorageRetentionManager: Going to r
etain 1 images with txid >= 0
```

```
2020-11-23 10:31:51,323 INFO namenode.FSImage: FSImageSaver clean checkpoint: txid=0 when meet shutdown.
2020-11-23 10:31:51,323 INFO namenode.NameNode: SHUTDOWN_MSG:
/************************************************************
SHUTDOWN_MSG: Shutting down NameNode at hadoop.tecadmin.net/127.0.1.1
************************************************************/
```

After formatting the Namenode, run the following command to start the hadoop cluster:

```
start-dfs.sh
```

Once the HDFS started successfully, you should get the following output:

```
Starting namenodes on [hadoop.tecadmin.com]
hadoop.tecadmin.com: Warning: Permanently added 'hadoop.tecadmin.com,fe80::200:2dff:fe3a:26ca%eth0' (ECDSA) to the list of known hosts.
Starting datanodes
Starting secondary namenodes [hadoop.tecadmin.com]
```

Next, start the YARN service as shown below:

```
start-yarn.sh
```

You should get the following output:

```
Starting resourcemanager
Starting nodemanagers
```

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

```
jps
```

You should see all the running services in the following output:

```
18194 NameNode
18822 NodeManager
17911 SecondaryNameNode
17720 DataNode
18669 ResourceManager
19151 Jps
```

Step 7 - Adjust Firewall

Hadoop is now started and listening on port 9870 and 8088. Next, you will need to allow these ports through the firewall.

Run the following command to allow Hadoop connections through the firewall:

```
firewall-cmd --permanent --add-port=9870/tcp
firewall-cmd --permanent --add-port=8088/tcp
```

Next, reload the firewalld service to apply the changes:

```
firewall-cmd --reload
```

Step 8 - Access Hadoop Namenode and Resource Manager

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

http://hadoop.tecadmin.net:9870