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// TUTORIAL //

How To Install Hadoop in Stand-Alone Mode on Ubuntu 20.04

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Big Data Clustering Ubuntu 20.04 Ubuntu

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Ubuntu 20.04

Introduction

Hadoop is a Java-based programming framework that supports the processing and storage of extremely large datasets on a cluster of inexpensive machines. It was the first major open source project in the big data playing field and is sponsored by the Apache Software Foundation.

Hadoop is comprised of four main layers:

- **Hadoop Common** is the collection of utilities and libraries that support other Hadoop modules.
- **HDFS**, which stands for Hadoop Distributed File System, is responsible for persisting

Hadoop clusters are relatively complex to set up, so the project includes a stand-alone mode which is suitable for learning about Hadoop, performing simple operations, and debugging.

In this tutorial, you'll install Hadoop in stand-alone mode and run one of the example MapReduce programs it includes to verify the installation.

Prerequisites

To follow this tutorial, you will need:

- **An Ubuntu 20.04 server with a non-root user with `sudo` privileges**: You can learn more about how to set up a user with these privileges in our Initial Server Setup with Ubuntu 20.04 guide.

You might also like to take a look at An Introduction to Big Data Concepts and Terminology or An Introduction to Hadoop

Once you've completed the prerequisites, log in as your `sudo` user to begin.

Step 1 – Installing Java

To get started, you'll update our package list and install OpenJDK, the default Java Development Kit on Ubuntu 20.04:

```
$ sudo apt update
$ sudo apt install default-jdk
```

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Once the installation is complete, let's check the version.

```
$ java -version
```

Copy

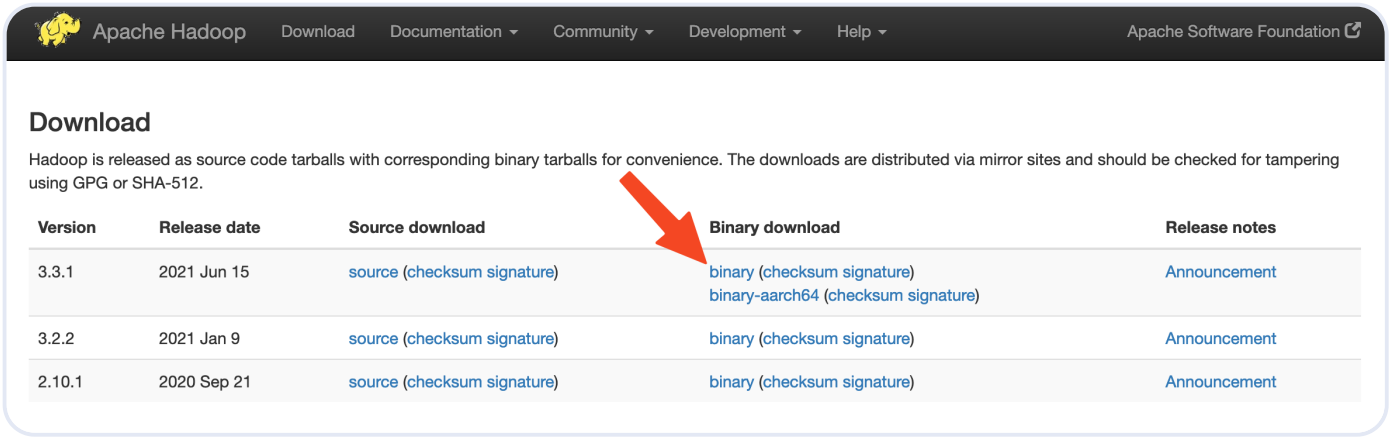
```
Output
openjdk version "11.0.13" 2021-10-19
OpenJDK Runtime Environment (build 11.0.13+8-Ubuntu-0ubuntu1.20.04)
OpenJDK 64-Bit Server VM (build 11.0.13+8-Ubuntu-0ubuntu1.20.04, mixed mode, sha
```

This output verifies that OpenJDK has been successfully installed.

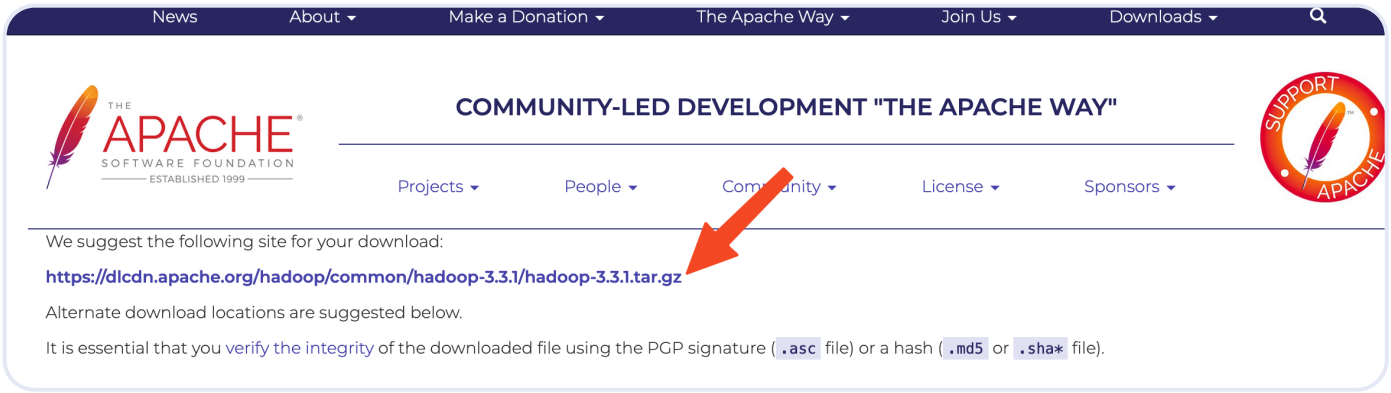
Step 2 – Installing Hadoop

With Java in place, you'll visit the Apache Hadoop Releases page to find the most recent stable release.

Navigate to **binary** for the release you'd like to install. In this guide you'll install Hadoop 3.3.1, but you can substitute the version numbers in this guide with one of your choice.



On the next page, right-click and copy the link to the release binary.



On the server, you'll use `wget` to fetch it:

```
$ wget https://dlcdn.apache.org/hadoop/common/hadoop-3.3.1/hadoop-3.3.1.tar.gz
```

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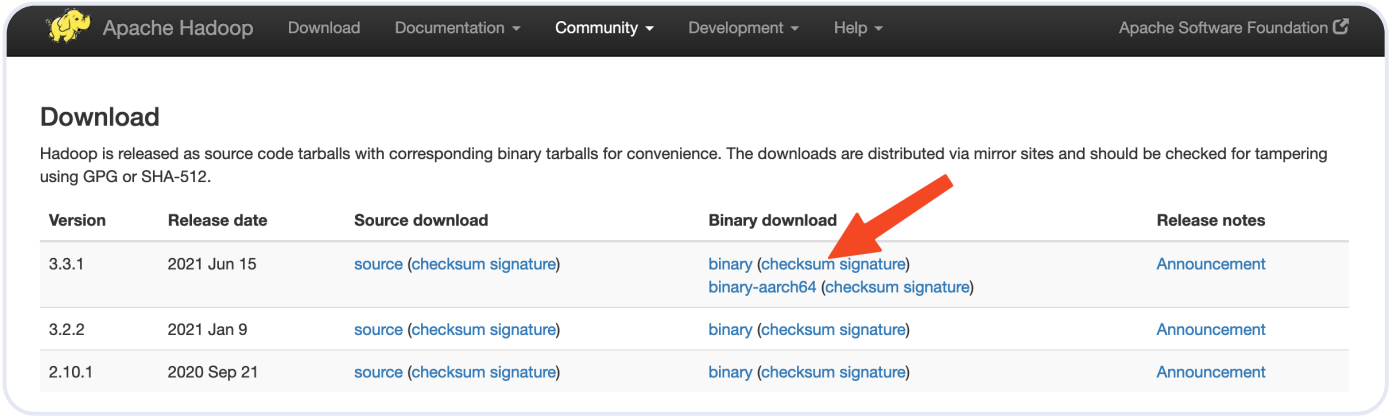
Note: The Apache website will direct you to the best mirror dynamically, so your URL may not match the URL above.

In order to make sure that the file you downloaded hasn't been altered, you'll do a quick check using SHA-512, or the Secure Hash Algorithm 512. Return to the releases page, then right-click and copy the link to the checksum file for the release binary you downloaded:



Again, you'll use `wget` on our server to download the file:

```
$ wget https://downloads.apache.org/hadoop/common/hadoop- 3.3.1 /hadoo
```
Copy 1 .

Then run the verification:

```
$ shasum -a 512 hadoop- 3.3.1 .tar.gz
```
Copy

```
Output
2fd0bf74852c797dc864f373ec82ffaa1e98706b309b30d1effa91ac399b477e1accc1ee74d4ccb
```

Compare this value with the SHA-512 value in the `.sha512` file:

```
$ cat hadoop-3.3.1.tar.gz.sha512
```
Copy

~/hadoop-3.3.1.tar.gz.sha512

```
...
SHA512 (hadoop-3.3.1.tar.gz) = 2fd0bf74852c797dc864f373ec82ffaa1e98706b309b30d1
```

```
...
```

The output of the command you ran against the file you downloaded from the mirror should match the value in the file you downloaded from apache.org.

Now that you've verified that the file wasn't corrupted or changed, you can extract it:

```
$ tar -xzvf hadoop- 3.3.1 .tar.gz
```

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Use the `tar` command with the `-x` flag to extract, `-z` to uncompress, `-v` for verbose output, and `-f` to specify that you're extracting from a file.

Finally, you'll move the extracted files into `/usr/local`, the appropriate place for locally installed software:

```
$ sudo mv hadoop- 3.3.1  /usr/local/hadoop
```

Copy

With the software in place, you're ready to configure its environment.

Step 3 – Configuring Hadoop's Java Home

Hadoop requires that you set the path to Java, either as an environment variable or in the Hadoop configuration file.

The path to Java, `/usr/bin/java` is a symlink to `/etc/alternatives/java`, which is in turn a symlink to default Java binary. You will use `readlink` with the `-f` flag to follow every symlink in every part of the path, recursively. Then, you'll use `sed` to trim `bin/java` from the output to give us the correct value for `JAVA_HOME`.

To find the default Java path

```
$ readlink -f /usr/bin/java | sed "s:bin/java::"
```

Copy

```
Output
```

```
/usr/lib/jvm/java-11-openjdk-amd64/
```

You can copy this output to set Hadoop's Java home to this specific version, which ensures that if the default Java changes, this value will not. Alternatively, you can use the `readlink` command dynamically in the file so that Hadoop will automatically use whatever Java version is set as the system default.

To begin, open `hadoop-env.sh`:

```
$ sudo nano /usr/local/hadoop/etc/hadoop/hadoop-env.sh
```
Copy

Then, modify the file by choosing one of the following options:

Option 1: Set a Static Value

/usr/local/hadoop/etc/hadoop/hadoop-env.sh

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

Option 2: Use Readlink to Set the Value Dynamically

/usr/local/hadoop/etc/hadoop/hadoop-env.sh

```
. . .
# export JAVA_HOME=
export JAVA_HOME=$(readlink -f /usr/bin/java | sed "s:bin/java::")
. . .
```

If you have trouble finding these lines, use `CTRL+W` to quickly search through the text. Once you're done, exit with `CTRL+X` and save your file.

> **Note:** With respect to Hadoop, the value of `JAVA_HOME` in `hadoop-env.sh` overrides any values that are set in the environment by `/etc/profile` or in a user's profile.

Step 4 – Running Hadoop

Now you should be able to run Hadoop:

```
$ /usr/local/hadoop/bin/hadoop
```

Copy

```
Output
Usage: hadoop [OPTIONS] SUBCOMMAND [SUBCOMMAND OPTIONS]
 or    hadoop [OPTIONS] CLASSNAME [CLASSNAME OPTIONS]
  where CLASSNAME is a user-provided Java class

  OPTIONS is none or any of:

--config dir                     Hadoop config directory
--debug                          turn on shell script debug mode
--help                           usage information
buildpaths                       attempt to add class files from build tree
hostnames list[,of,host,names]   hosts to use in slave mode
hosts filename                   list of hosts to use in slave mode
loglevel level                   set the log4j level for this command
workers                          turn on worker mode

  SUBCOMMAND is one of:
. . .
```

This output means you've successfully configured Hadoop to run in stand-alone mode.

You'll ensure that Hadoop is functioning properly by running the example MapReduce program it ships with. To do so, create a directory called `input` in our home directory and copy Hadoop's configuration files into it to use those files as our data.

```
$ mkdir ~/input
$ cp /usr/local/hadoop/etc/hadoop/*.xml ~/input
```

Copy

Next, you can use the following command to run the MapReduce `hadoop-mapreduce-examples` program, a Java archive with several options:

```
$ /usr/local/hadoop/bin/hadoop jar /usr/local/hadoop/share/hadoop/mapr
```
Copy 'hac

This invokes the `grep` program, one of the many examples included in `hadoop-mapreduce-examples`, followed by the input directory, `input` and the output directory `grep_example`. The MapReduce grep program will count the matches of a literal word or regular expression. Finally, the regular expression `allowed[.]*` is given to find occurrences of the word `allowed` within or at the end of a declarative sentence. The expression is case-sensitive, so you wouldn't find the word if it were capitalized at the beginning of a sentence.

When the task completes, it provides a summary of what has been processed and errors it has encountered, but this doesn't contain the actual results.

```
Output
 . . .
   File System Counters
        FILE: Number of bytes read=1200956
        FILE: Number of bytes written=3656025
        FILE: Number of read operations=0
        FILE: Number of large read operations=0
        FILE: Number of write operations=0
    Map-Reduce Framework
        Map input records=2
        Map output records=2
        Map output bytes=33
        Map output materialized bytes=43
        Input split bytes=114
        Combine input records=0
        Combine output records=0
        Reduce input groups=2
        Reduce shuffle bytes=43
        Reduce input records=2
        Reduce output records=2
        Spilled Records=4
        Shuffled Maps =1
        Failed Shuffles=0
        Merged Map outputs=1
        GC time elapsed (ms)=41
        Total committed heap usage (bytes)=403800064
    Shuffle Errors
```

```
        BAD_ID=0
        CONNECTION=0
        IO_ERROR=0
        WRONG_LENGTH=0
        WRONG_MAP=0
        WRONG_REDUCE=0
    File Input Format Counters
        Bytes Read=147
    File Output Format Counters
        Bytes Written=34
```

Note: If the output directory already exists, the program will fail, and rather than seeing the summary, the output will look something like:

```
Output
 . . .
     at java.base/java.lang.reflect.Method.invoke(Method.java:564)
    at org.apache.hadoop.util.RunJar.run(RunJar.java:244)
    at org.apache.hadoop.util.RunJar.main(RunJar.java:158)
```

Results are stored in the output directory and can be checked by running `cat` on the output directory:

```
$ cat ~/grep_example/*
```

Copy

```
Output
22    allowed.
1    allowed
```

The MapReduce task found 19 occurrences of the word `allowed` followed by a period and one occurrence where it was not. Running the example program has verified that our stand-alone installation is working properly and that non-privileged users on the system can run Hadoop for exploration or debugging.

Conclusion

In this tutorial, you've installed Hadoop in stand-alone mode and verified it by running an example program it provided. To learn how to write your own MapReduce programs, you might want to visit Apache Hadoop's MapReduce tutorial which walks through the code behind the example. When you're ready to set up a cluster, see the Apache Foundation Hadoop Cluster Setup guide.

If you're interested in deploying a full cluster instead of just a stand-alone, see How To Spin Up a Hadoop Cluster with DigitalOcean Droplets.

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When i execute $ hadoop version

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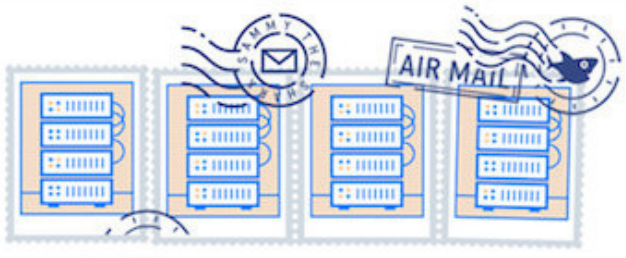

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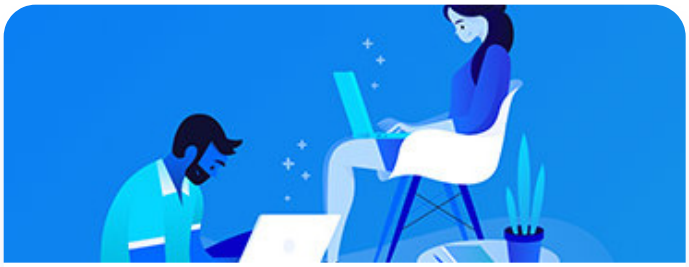

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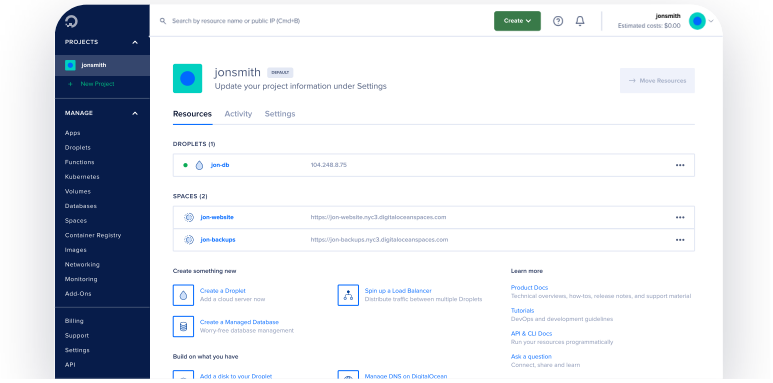

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