Hadoop Multi-Nodes Cluster Setup on Ubuntu 12.04

This configuration is referred to:

http://www.michael-noll.com/tutorials/running-hadoop-on-ubuntu-linux-multi-node-cluster/

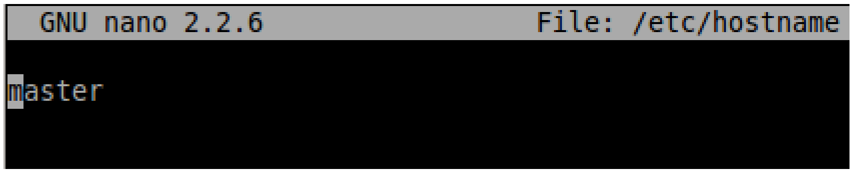
1. Prerequisites

It is assumed that all the nodes have successfully configured as single-node cluster. To see how to configure hadoop single node cluster, refer the following post:

http://www.michael-noll.com/tutorials/running-hadoop-on-ubuntu-linux-single-node-cluster/

2. Networking

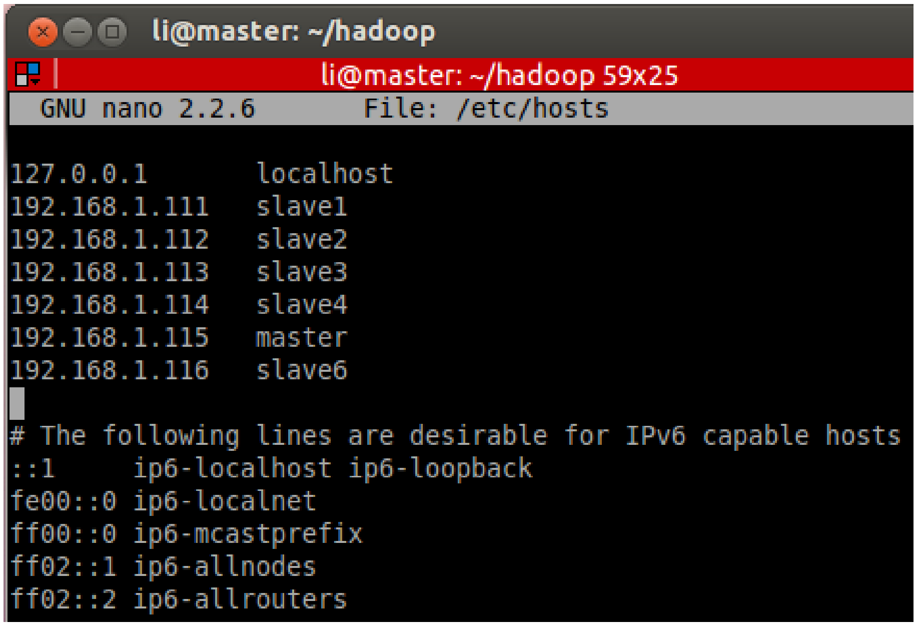
Edit machine name to master, slave1, slave2, slave3, slave4, slave6 and make sure any of them can reach others over the network



```
  GNU nano 2.2.6                      File: /etc/hostname

master
```

On master node:
change host name to master
on master node at:

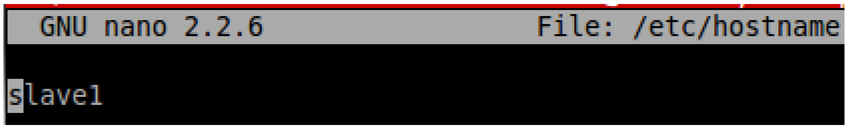
/etc/hostname



```
 GNU nano 2.2.6        File: /etc/hosts

127.0.0.1       localhost
192.168.1.111   slave1
192.168.1.112   slave2
192.168.1.113   slave3
192.168.1.114   slave4
192.168.1.115   master
192.168.1.116   slave6

# 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
```

On master node:

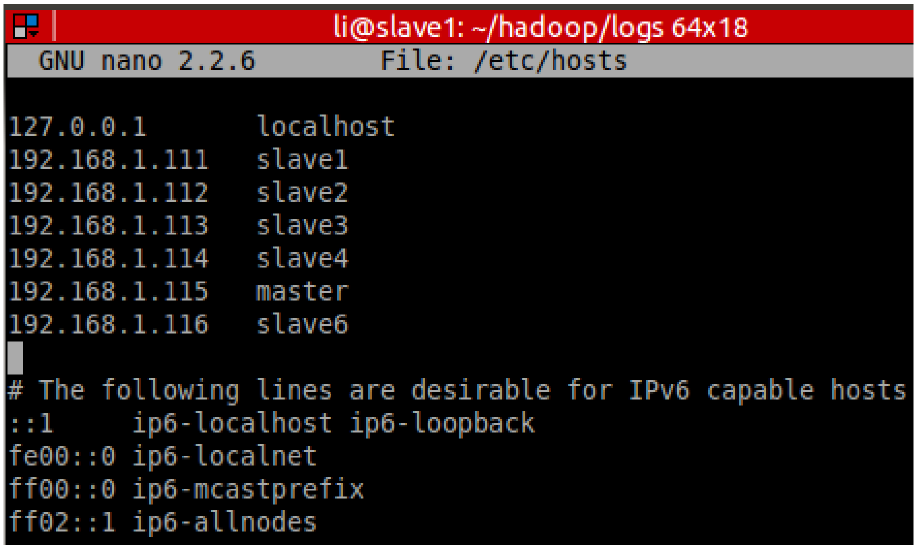
Add master and slave machine IP & name



```
  GNU nano 2.2.6                      File: /etc/hostname

slave1
```

On slave1:
change host name to slave1
on slave1 node at:

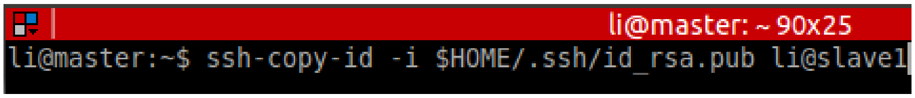
	/etc/hostname

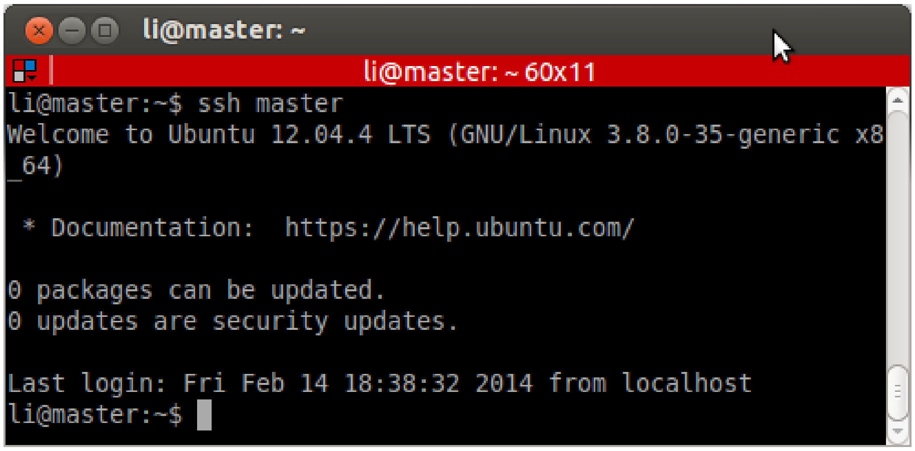

li@slave1: ~/hadoop/logs 64x18
`GNU nano 2.2.6          File: /etc/hosts`
`127.0.0.1       localhost`
`192.168.1.111   slave1`
`192.168.1.112   slave2`
`192.168.1.113   slave3`
`192.168.1.114   slave4`
`192.168.1.115   master`
`192.168.1.116   slave6`
`# The following lines are desirable for IPv6 capable hosts`
`::1     ip6-localhost ip6-loopback`
`fe00::0 ip6-localnet`
`ff00::0 ip6-mcastprefix`
`ff02::1 ip6-allnodes`
	On slave1 node:
	Add master and slave machine IP & name

Repeat the same steps for slave2, 3, 4, 6	

3. SSH Access

Enable user li on master to connect to slave1, 2, 3, 4, 6 via a password-less SSH login

 li@master: ~ 90x25 `li@master:~$ ssh-copy-id -i $HOME/.ssh/id_rsa.pub li@slave1`	On master node: add the li@master’s public SSH key (which should be in $HOME/.ssh/id_rsa.pub) to the authorized_keys file of li@slave1
li@master:~$ ssh-copy-id -i $HOME/.ssh/id_rsa.pub li@slave1 li@master:~$ ssh-copy-id -i $HOME/.ssh/id_rsa.pub li@slave2 li@master:~$ ssh-copy-id -i $HOME/.ssh/id_rsa.pub li@slave3 li@master:~$ ssh-copy-id -i $HOME/.ssh/id_rsa.pub li@slave4 li@master:~$ ssh-copy-id -i $HOME/.ssh/id_rsa.pub li@slave6	Repeat the same step to add SSH key to slave2, 3, 4, 6

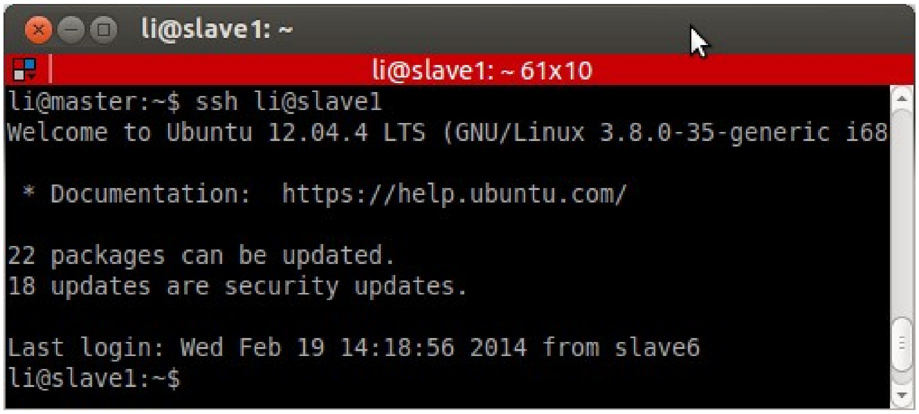


```
li@master:~$ ssh master
Welcome to Ubuntu 12.04.4 LTS (GNU/Linux 3.8.0-35-generic x8
_64)

 * Documentation:  https://help.ubuntu.com/

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

Last login: Fri Feb 14 18:38:32 2014 from localhost
li@master:~$
```

Test

on master:
connect from master to master

ssh master



```
li@master:~$ ssh li@slave1
Welcome to Ubuntu 12.04.4 LTS (GNU/Linux 3.8.0-35-generic i68

 * Documentation:  https://help.ubuntu.com/

22 packages can be updated.
18 updates are security updates.

Last login: Wed Feb 19 14:18:56 2014 from slave6
li@slave1:~$
```

Test

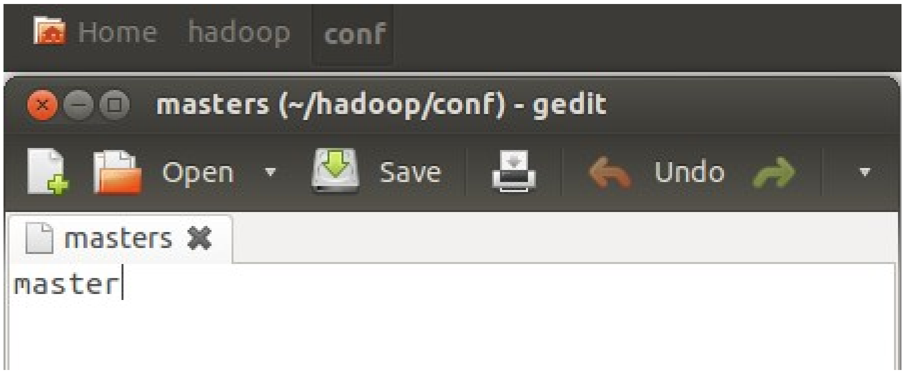
on master

connect from master to slave1

ssh li@slave1

5. Configuration - Hadoop/conf/masters(master only)

Despite its name, the conf/masters file defines on which machines Hadoop will start *secondary NameNodes* in our multi-node cluster. In our case, this is just the master machine. The primary NameNode and the JobTracker will be started on the same machine if you run bin/start-all.sh.

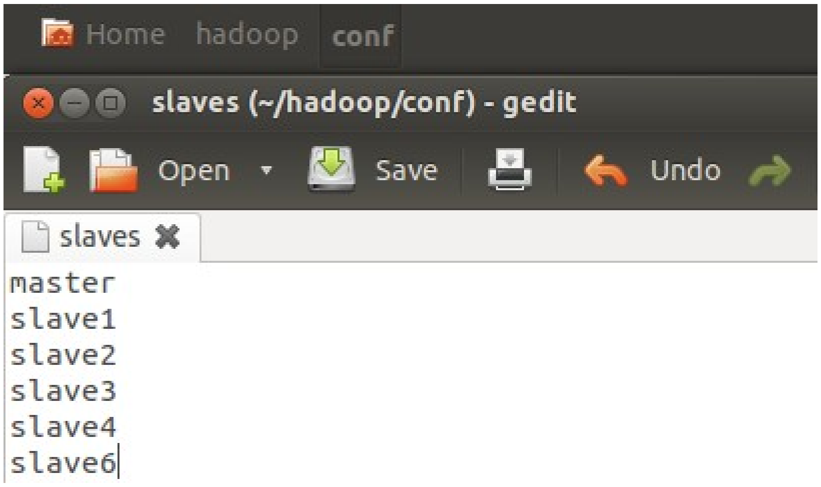


```
master
```

Edit hadoop/conf/masters:

Hadoop/conf/slaves(master only)

The conf/slaves file lists the hosts, one per line, where the Hadoop slave daemons (DataNodes and TaskTrackers) will be run. We want both the master box and the slave box to act as Hadoop slaves because we want both of them to store and process data.

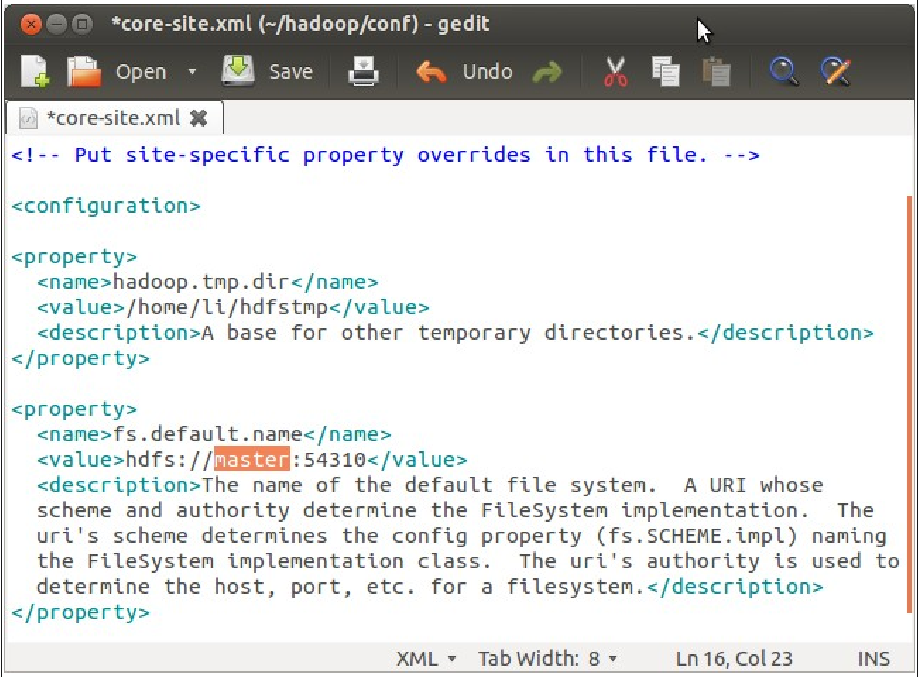


```
master
slave1
slave2
slave3
slave4
slave6
```

Edit hadoop/conf/slaves:

conf/*-site.xml (all machines)

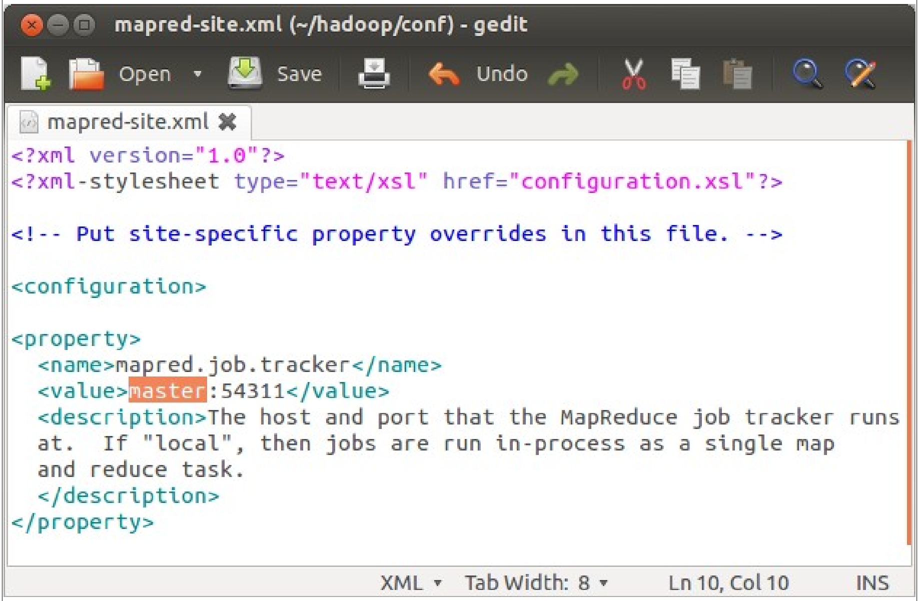
First, we have to change the fs.default.name parameter (in conf/core-site.xml), which specifies the NameNode (the HDFS master) host and port. In our case, this is the master machine.



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

<configuration>

<property>
  <name>hadoop.tmp.dir</name>
  <value>/home/li/hdfstmp</value>
  <description>A base for other temporary directories.</description>
</property>

<property>
  <name>fs.default.name</name>
  <value>hdfs://master:54310</value>
  <description>The name of the default file system.  A URI whose
  scheme and authority determine the FileSystem implementation.  The
  uri's scheme determines the config property (fs.SCHEME.impl) naming
  the FileSystem implementation class.  The uri's authority is used to
  determine the host, port, etc. for a filesystem.</description>
</property>
```

Edit hadoop/conf/core-site.xml

Second, we have to change the mapred.job.tracker parameter (in conf/mapred-site.xml), which specifies the JobTracker (MapReduce master) host and port. Again, this is the master inour case.

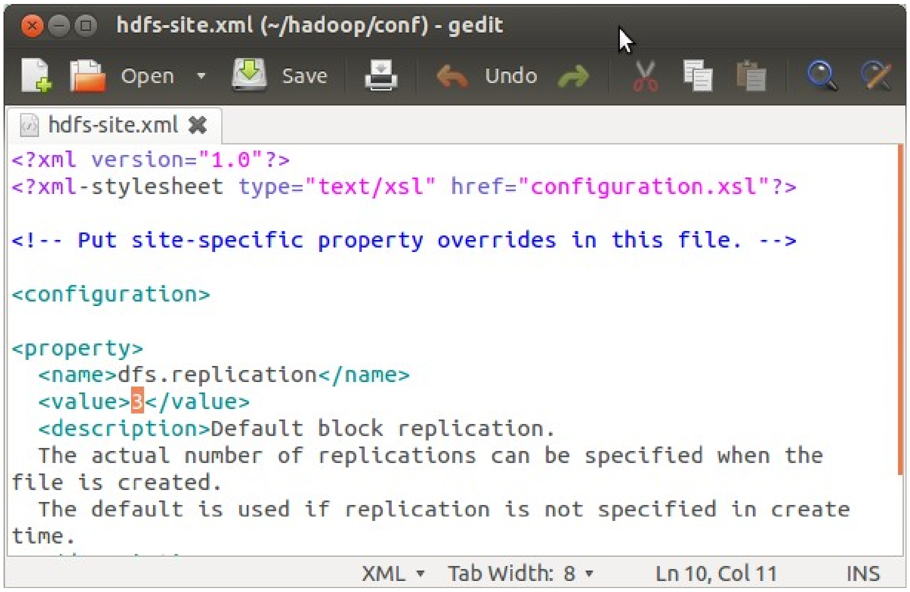


```
<?xml version="1.0"?>
<?xml-stylesheet type="text/xsl" href="configuration.xsl"?>

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

<configuration>

<property>
  <name>mapred.job.tracker</name>
  <value>master:54311</value>
  <description>The host and port that the MapReduce job tracker runs
  at.  If "local", then jobs are run in-process as a single map
  and reduce task.
  </description>
</property>
```

Edit hadoop/conf/mapred-site.xml

Third, we change the dfs.replication parameter (in conf/hdfs-site.xml) which specifies the default block replication. It defines how many machines a single file should be replicated to before it becomes available. If you set this to a value higher than the number of available slave nodes (more precisely, the number of DataNodes), you will start seeing a lot of “(Zero targets found, forbidden1.size=1)” type errors in the log files.

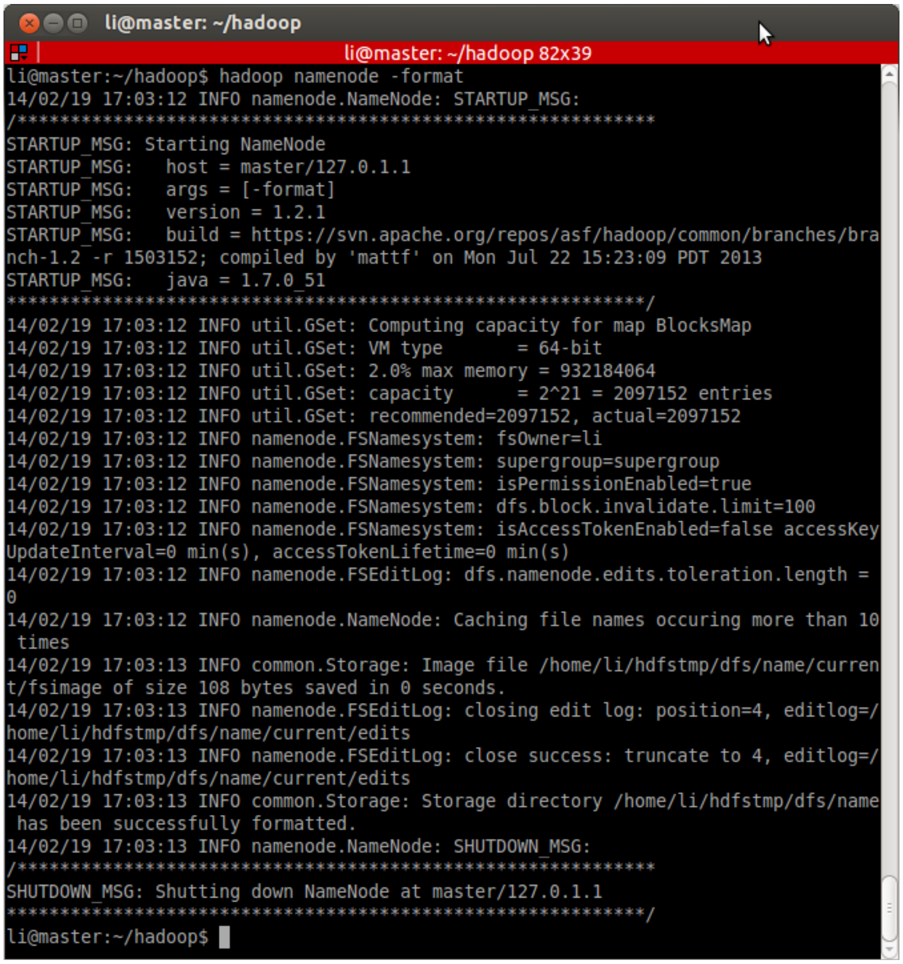
The default value of dfs.replication is 3.



```
<?xml version="1.0"?>
<?xml-stylesheet type="text/xsl" href="configuration.xsl"?>

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

<configuration>

<property>
  <name>dfs.replication</name>
  <value>3</value>
  <description>Default block replication.
  The actual number of replications can be specified when the
file is created.
  The default is used if replication is not specified in create
time.
```

Edit hadoop/conf/hdfs-site.xml

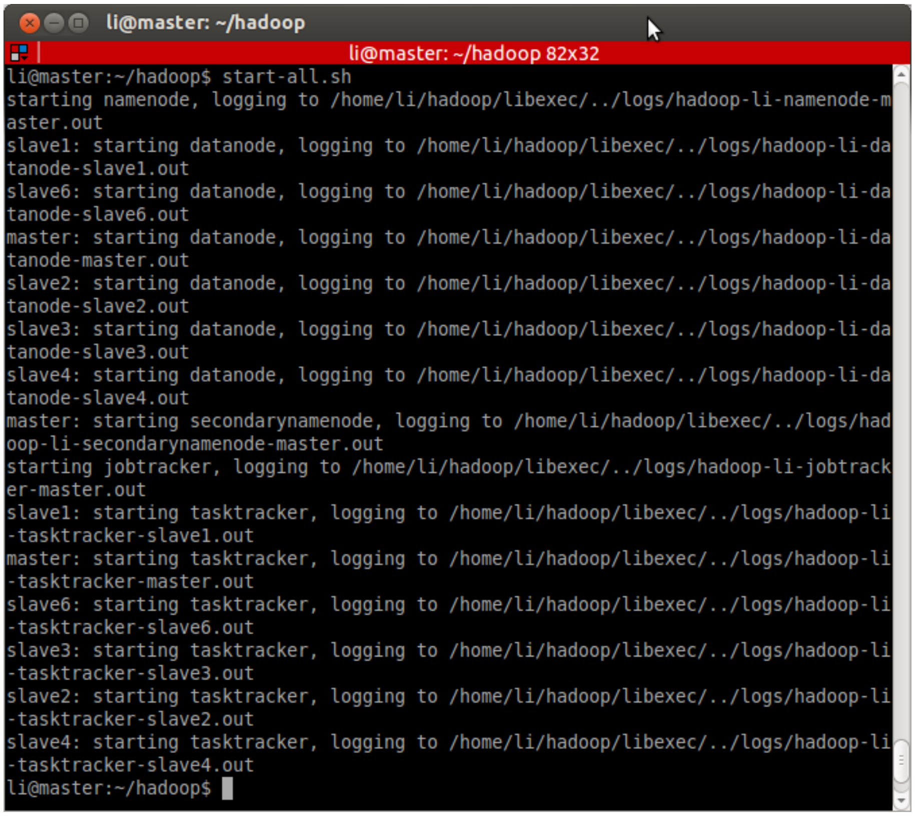
6. Formatting the HDFS filesystem via the NameNode



```
li@master:~/hadoop$ hadoop namenode -format
14/02/19 17:03:12 INFO namenode.NameNode: STARTUP_MSG:
/************************************************************
STARTUP_MSG: Starting NameNode
STARTUP_MSG:   host = master/127.0.1.1
STARTUP_MSG:   args = [-format]
STARTUP_MSG:   version = 1.2.1
STARTUP_MSG:   build = https://svn.apache.org/repos/asf/hadoop/common/branches/bra
nch-1.2 -r 1503152; compiled by 'mattf' on Mon Jul 22 15:23:09 PDT 2013
STARTUP_MSG:   java = 1.7.0_51
************************************************************/
14/02/19 17:03:12 INFO util.GSet: Computing capacity for map BlocksMap
14/02/19 17:03:12 INFO util.GSet: VM type       = 64-bit
14/02/19 17:03:12 INFO util.GSet: 2.0% max memory = 932184064
14/02/19 17:03:12 INFO util.GSet: capacity      = 2^21 = 2097152 entries
14/02/19 17:03:12 INFO util.GSet: recommended=2097152, actual=2097152
14/02/19 17:03:12 INFO namenode.FSNamesystem: fsOwner=li
14/02/19 17:03:12 INFO namenode.FSNamesystem: supergroup=supergroup
14/02/19 17:03:12 INFO namenode.FSNamesystem: isPermissionEnabled=true
14/02/19 17:03:12 INFO namenode.FSNamesystem: dfs.block.invalidate.limit=100
14/02/19 17:03:12 INFO namenode.FSNamesystem: isAccessTokenEnabled=false accessKey
UpdateInterval=0 min(s), accessTokenLifetime=0 min(s)
14/02/19 17:03:12 INFO namenode.FSEditLog: dfs.namenode.edits.toleration.length =
0
14/02/19 17:03:12 INFO namenode.NameNode: Caching file names occuring more than 10
 times
14/02/19 17:03:13 INFO common.Storage: Image file /home/li/hdfstmp/dfs/name/curren
t/fsimage of size 108 bytes saved in 0 seconds.
14/02/19 17:03:13 INFO namenode.FSEditLog: closing edit log: position=4, editlog=/
home/li/hdfstmp/dfs/name/current/edits
14/02/19 17:03:13 INFO namenode.FSEditLog: close success: truncate to 4, editlog=/
home/li/hdfstmp/dfs/name/current/edits
14/02/19 17:03:13 INFO common.Storage: Storage directory /home/li/hdfstmp/dfs/name
 has been successfully formatted.
14/02/19 17:03:13 INFO namenode.NameNode: SHUTDOWN_MSG:
/************************************************************
SHUTDOWN_MSG: Shutting down NameNode at master/127.0.1.1
************************************************************/
li@master:~/hadoop$
```

hadoop namenode -format

7. Starting Check and stop the multi-node cluster

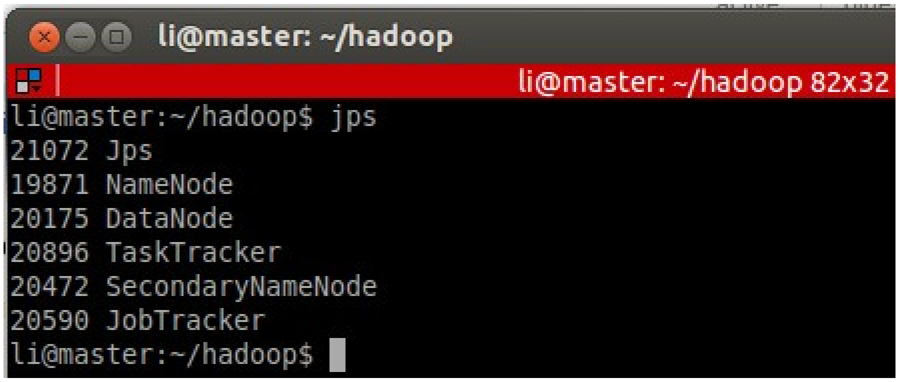


```
li@master:~/hadoop$ start-all.sh
starting namenode, logging to /home/li/hadoop/libexec/../logs/hadoop-li-namenode-m
aster.out
slave1: starting datanode, logging to /home/li/hadoop/libexec/../logs/hadoop-li-da
tanode-slave1.out
slave6: starting datanode, logging to /home/li/hadoop/libexec/../logs/hadoop-li-da
tanode-slave6.out
master: starting datanode, logging to /home/li/hadoop/libexec/../logs/hadoop-li-da
tanode-master.out
slave2: starting datanode, logging to /home/li/hadoop/libexec/../logs/hadoop-li-da
tanode-slave2.out
slave3: starting datanode, logging to /home/li/hadoop/libexec/../logs/hadoop-li-da
tanode-slave3.out
slave4: starting datanode, logging to /home/li/hadoop/libexec/../logs/hadoop-li-da
tanode-slave4.out
master: starting secondarynamenode, logging to /home/li/hadoop/libexec/../logs/had
oop-li-secondarynamenode-master.out
starting jobtracker, logging to /home/li/hadoop/libexec/../logs/hadoop-li-jobtrack
er-master.out
slave1: starting tasktracker, logging to /home/li/hadoop/libexec/../logs/hadoop-li
-tasktracker-slave1.out
master: starting tasktracker, logging to /home/li/hadoop/libexec/../logs/hadoop-li
-tasktracker-master.out
slave6: starting tasktracker, logging to /home/li/hadoop/libexec/../logs/hadoop-li
-tasktracker-slave6.out
slave3: starting tasktracker, logging to /home/li/hadoop/libexec/../logs/hadoop-li
-tasktracker-slave3.out
slave2: starting tasktracker, logging to /home/li/hadoop/libexec/../logs/hadoop-li
-tasktracker-slave2.out
slave4: starting tasktracker, logging to /home/li/hadoop/libexec/../logs/hadoop-li
-tasktracker-slave4.out
li@master:~/hadoop$
```

To start the cluster:

on master:

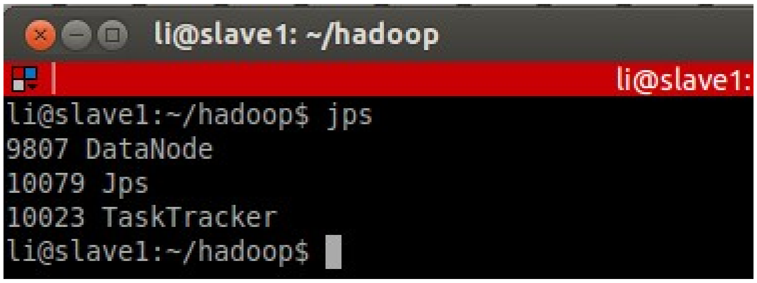
start-all.sh



```
li@master:~/hadoop$ jps
21072 Jps
19871 NameNode
20175 DataNode
20896 TaskTracker
20472 SecondaryNameNode
20590 JobTracker
li@master:~/hadoop$
```

Check running java processes on master:

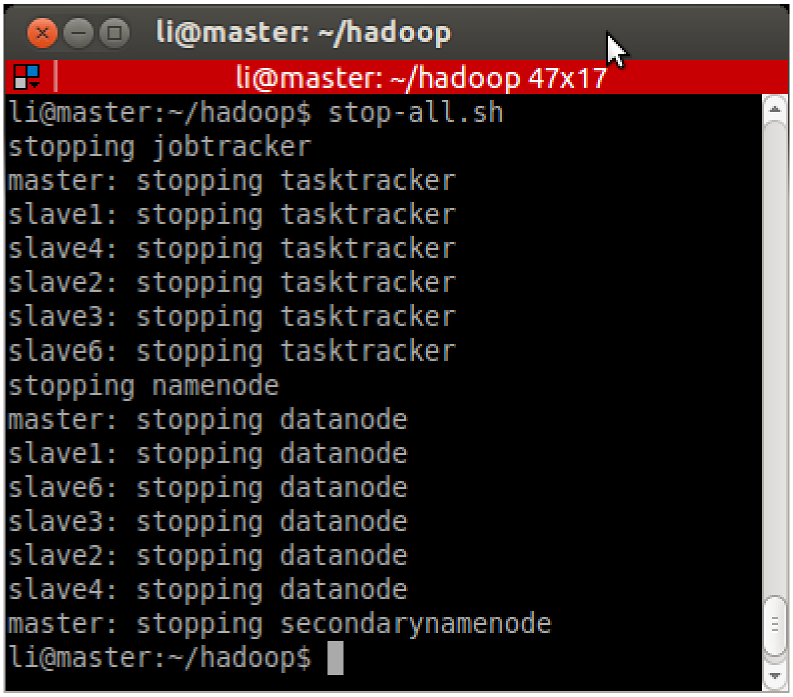
jps



```
li@slave1:~/hadoop$ jps
9807 DataNode
10079 Jps
10023 TaskTracker
li@slave1:~/hadoop$
```

Check running java processes on slave1:

jps



```
li@master:~/hadoop$ stop-all.sh
stopping jobtracker
master: stopping tasktracker
slave1: stopping tasktracker
slave4: stopping tasktracker
slave2: stopping tasktracker
slave3: stopping tasktracker
slave6: stopping tasktracker
stopping namenode
master: stopping datanode
slave1: stopping datanode
slave6: stopping datanode
slave3: stopping datanode
slave2: stopping datanode
slave4: stopping datanode
master: stopping secondarynamenode
li@master:~/hadoop$
```

Stop cluster

on master:

stop-all.sh

8. Troubleshooting

1) If datanode does not run on master after start the cluster, delete the hdfstmp folder and create a new empty hdfstmp folder then run

hadoop namenode -format

2) If you got connection refused error like

ERROR security.UserGroupInformation: PriviledgedActionException as:li cause:java.net.ConnectException: Call to master/192.168.1.115:54311 failed on connection exception: java.net.ConnectException: Connection refused

Try let the namenode leave safemode:

```
bin/hadoop dfsadmin -safemode leave
```