Assignment 1:

Problem Statement:

Create a multi node cluster with 6 machines. One will run Namenode, one Secondary Namenode and one Job Tracker. The other three machines will be slaves which will run Datanodes and Tasktrackers

Solution:

Okay, so we are going to set up a Multi Node Cluster today. Before we begin, let me explain the set up that we will be doing to you.

We will have 6 machines. One will run Namenode, one Secondary Namenode and one Job Tracker. The other three machines will be slaves which will run Datanodes and Tasktrackers. The entire set up can be done in three phases.

Phase-1

In phase 1 we create the cluster with proper connectivity. Use the machine that we used for the last module assignment as a base and you have to create 5 more machines from this, by cloning it. Now, if you are running VMWARE Workstation, you can simply right click and clone it. But we have only VMWARE player. So, in player, the procedure for cloning the virtual machines is described below.

First of all, find out the directory in which your VM files are stored.

Copy the entire directory and paste it in the same location.

Rename the directory accordingly

Now launch Player and click on open virtual machine

Navigate to the newly copied folder and open the .vmx file inside it

Click on it and Player will ask you whether you have copied it.

Click on "Yes, I have copied it".

That's it

An external article explaining the whole process can be found here

http://aztcs.org/meeting_notes/winhardsig/virtualmachines/vmware/Cloning_VM_in_VMwarePlayer--Windows.pdf

Now this way create 5 clones of your existing VM and power them on.

The set up assumes the following IP and Host names

192.168.10.100	namenode.mycluster.com	- NAMENODE
192.168.10.101	jt.mycluster.com	-JOB TRACKER
192.168.10.102	snn.mycluster.com	- SECONDARY NAMENODE
192.168.10.103	dn1.mycluster.com	– DATANODE 1
192.168.10.104	dn2.mycluster.com	- DATANODE 2
192.168.10.105	dn3.mycluster.com	– DATANODE 3

Since we have cloned them all of them are going to have same hostname, MAC and IP addresses. We have to change it. In order to change it perform the following steps on all the newly cloned VMs

1. Open /etc/sysconfig/network-scripts/ifcfg-eth0 with vi editor
2. Change the IP address accordingly and delete the line named Hardware Address
3. Open /etc/sysconfig/network
4. Change the hostname accordingly
5. Restart all the machines to apply changes

Also, on all machines, edit the /etc/hosts file to include the entries of all hosts. The file will look like this

127.0.0.1   localhost localhost.localdomain localhost4 localhost4.localdomain4

::1   localhost localhost.localdomain localhost6 localhost6.localdomain6

192.168.10.100 namenode.mycluster.com

192.168.10.101 jt.mycluster.com

192.168.10.102 snn.mycluster.com

192.168.10.103 dn1.mycluster.com

192.168.10.104 dn2.mycluster.com

192.168.10.105 dn3.mycluster.com

Now make sure that you can ping all the machines with IP addresses and hostnames.

Phase -2

Now we will configure Passwordless SSH

On Namenode, type ssh-keygen

Hit enter when prompted anything.

You will have the SSH keys generated.

Now go to /home/Hadoop/.ssh folder

Open id_rsa.pub file

Copy the contents of the file

Go to secondary Namenode

Go to /home/Hadoop/.ssh

Open authorized_keys file (create one if it is not already there)

Paste the contents there and save it.

Repeat this for DN1,DN2 and DN3

Now you should be able to ssh from Namenode to SNN, DN1,DN2 and DN3 without a password.

Also you have to make sure that .ssh folder has 700 permission and all the files under it has 600.

The above process has to be repeated on Job Tracker node as well.

Generate the keys on JT and add the public keys to authorized_keys file on DN1,DN2 and DN3.

Note:- The public keys of Namenode and Job Tracker has to be pasted on themselves by creating an authorized_keys file on the same machines. This is for passwordless SSH to localhost.

Phase -3

Now we begin the Hadoop set up. Since we already have the Hadoop configuration afiles and Java on all the machines, it is just a matter of changing them to create the cluster. I will explain the configuration of each machine one by one

NAMENODE

The core-site.xml file will remain the same. No changes

Hdfs-site.xml – Remove the property dfs.data.dir and change the replication factor to 3

Empty the mapred-site.xml file

In masters file, add 192.168.10.102

In slaves file, add

dn1.mycluster.com

dn2.mycluster.com

dn3.mycluster.com

Go to /home/Hadoop/hadoopstore

Delete all the folders

Create a folder named nn

JOBTRACKER

The core-site.xml file will remain the same. No changes

Empty the hdfs-site.xml file

Remove everything from mapred-site.xml and add the following property

<property>

    <name>mapred.job.tracker</name>

    <value>jt.mycluster.com:8021</value>

</property>

In slaves file, add

dn1.mycluster.com

dn2.mycluster.com

dn3.mycluster.com

delete all the folders from /home/Hadoop/hadoopstore

SECONDARYNAMENODE

The core-site.xml file will remain the same. No changes

Remove everything from hdfs-site.xml and add the following

<property>

    <name>fs.checkpoint.dir</name>

    <value>/home/hadoop/hadoopstore/snn</value>

    </property>

<property>

 <name>dfs.http.address</name>

 <value>namenode.mycluster.com:50070</value>

<description>Enter your NameNode hostname for http access.</description>

</property>

Mapred-site.xml, masters and slaves directories will remain empty

Go to hadoopstore directory, empty everything and create a folder named snn

DATANODE-1

The core-site.xml file will remain the same. No changes

Empty everything from hdfs-site.xml and add the following

<property>

    <name>dfs.data.dir</name>

    <value>/home/hadoop/hadoopstore/dn/</value>

    <final>true</final>

</property>

<property>

    <name>dfs.replication</name>

    <value>3</value>

</property>

<property>

    <name>dfs.block.size</name>

    <value>67108864</value>

</property>

Empty everything from mapred-site.xml and add the following

<property>

    <name>mapred.job.tracker</name>

    <value>jt.mycluster.com:8021</value>

</property>

Go to hadoopstore directory and delete all the folders

Create a new directory by the name dn and set the permissions to 755

Repeat the same steps for DN2 and DN3

Now go to Namenode and format it

[hadoop@namenode ~]$ hadoop namenode -format

15/07/22 01:41:11 INFO namenode.NameNode: STARTUP_MSG:

/**

STARTUP_MSG: Starting NameNode

STARTUP_MSG: host = namenode.mycluster.com/192.168.10.100

STARTUP_MSG: args = [-format]

STARTUP_MSG: version = 1.2.1

STARTUP_MSG: build = https://svn.apache.org/repos/asf/hadoop/common/branches/branch-1.2 -r 1503152; compiled by 'mattf' on Mon Jul 22 15:23:09 PDT 2013

STARTUP_MSG: java = 1.8.0_45

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Re-format filesystem in /home/hadoop/hadoopstore/nn ? (Y or N) Y

15/07/22 01:41:14 INFO util.GSet: Computing capacity for map BlocksMap

15/07/22 01:41:14 INFO util.GSet: VM type   = 64-bit

15/07/22 01:41:14 INFO util.GSet: 2.0% max memory = 1013645312

15/07/22 01:41:14 INFO util.GSet: capacity   = 2^21 = 2097152 entries

15/07/22 01:41:14 INFO util.GSet: recommended=2097152, actual=2097152

15/07/22 01:41:14 INFO namenode.FSNamesystem: fsOwner=hadoop

15/07/22 01:41:14 INFO namenode.FSNamesystem: supergroup=supergroup

15/07/22 01:41:14 INFO namenode.FSNamesystem: isPermissionEnabled=true

15/07/22 01:41:14 INFO namenode.FSNamesystem: dfs.block.invalidate.limit=100

15/07/22 01:41:14 INFO namenode.FSNamesystem: isAccessTokenEnabled=false accessKeyUpdateInterval=0 min(s), accessTokenLifetime=0 min(s)

15/07/22 01:41:14 INFO namenode.FSEditLog: dfs.namenode.edits.toleration.length = 0

15/07/22 01:41:14 INFO namenode.NameNode: Caching file names occuring more than 10 times

15/07/22 01:41:15 INFO common.Storage: Image file /home/hadoop/hadoopstore/nn/current/fsimage of size 112 bytes saved in 0 seconds.

15/07/22 01:41:15 INFO namenode.FSEditLog: closing edit log: position=4, editlog=/home/hadoop/hadoopstore/nn/current/edits

15/07/22 01:41:15 INFO namenode.FSEditLog: close success: truncate to 4, editlog=/home/hadoop/hadoopstore/nn/current/edits

15/07/22 01:41:15 INFO common.Storage: Storage directory /home/hadoop/hadoopstore/nn has been successfully formatted.

15/07/22 01:41:16 INFO namenode.NameNode: SHUTDOWN_MSG:

/**

SHUTDOWN_MSG: Shutting down NameNode at namenode.mycluster.com/192.168.10.100

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Start DFS on Namenode

[hadoop@namenode ~]$ start-dfs.sh

starting namenode, logging to /home/hadoop/hadoop-1.2.1/libexec/../logs/hadoop-hadoop-namenode-namenode.mycluster.com.out

dn1.mycluster.com: starting datanode, logging to /home/hadoop/hadoop-1.2.1/libexec/../logs/hadoop-hadoop-datanode-dn1.mycluster.com.out

dn3.mycluster.com: starting datanode, logging to /home/hadoop/hadoop-1.2.1/libexec/../logs/hadoop-hadoop-datanode-dn3.mycluster.com.out

dn2.mycluster.com: starting datanode, logging to /home/hadoop/hadoop-1.2.1/libexec/../logs/hadoop-hadoop-datanode-dn2.mycluster.com.out

192.168.10.102: starting secondarynamenode, logging to /home/hadoop/hadoop-1.2.1/libexec/../logs/hadoop-hadoop-secondarynamenode-snn.mycluster.com.out

Check whether the daemon has come up

[hadoop@namenode ~]$ jps

2739 NameNode

2878 Jps

Go to Job Tracker and start Mapred

[hadoop@jt hadoopstore]$ start-mapred.sh

starting jobtracker, logging to /home/hadoop/hadoop-1.2.1/libexec/../logs/hadoop-hadoop-jobtracker-jt.mycluster.com.out

dn1.mycluster.com: starting tasktracker, logging to /home/hadoop/hadoop-1.2.1/libexec/../logs/hadoop-hadoop-tasktracker-dn1.mycluster.com.out

dn2.mycluster.com: starting tasktracker, logging to /home/hadoop/hadoop-1.2.1/libexec/../logs/hadoop-hadoop-tasktracker-dn2.mycluster.com.out

dn3.mycluster.com: starting tasktracker, logging to /home/hadoop/hadoop-1.2.1/libexec/../logs/hadoop-hadoop-tasktracker-dn3.mycluster.com.out

Check the result

[hadoop@jt hadoopstore]$ jps

2507 Jps

2382 JobTracker

Check the results on other nodes as follows

[hadoop@snn hadoopstore]$ jps

2916 Jps

2857 SecondaryNameNode

[hadoop@dn1 hadoopstore]$ jps

2601 Jps

2412 DataNode

2494 TaskTracker

[hadoop@dn2 hadoopstore]$ jps

2549 Jps

2425 DataNode

2507 TaskTracker

[hadoop@dn3 hadoopstore]$ jps

2400 DataNode

2593 Jps

2482 TaskTracker

The cluster has been fully configured and up and running ! Now do not delete anything and save the states of these machines. We have to do a lot of things !