Hadoop实验环境搭建

# 实验平台

主机：Fedora 19 x86\_64

虚拟机：Ubuntu 13.10 x86\_64

JAVA 1.7.0\_55

Hadoop 1.2.1

主机IP：192.168.56.1 NameNode, JobTracker

slave1：192.168.56.101 DataNode, TaskTracker

slave2：192.168.56.102 DataNode, TaskTracker

slave3：192.168.56.103 DataNode, TaskTracker

# 主机上的准备

## 修改Hosts

vi /etc/hosts

192.168.56.1 master

192.168.56.101 slave1

192.168.56.102 slave2

192.168.56.103 slave3

修改hostname为master：

# /etc/hostname

master

## 安装JAVA

从Oracle官网下载JAVA SDK：<http://www.oracle.com/technetwork/java/javase/downloads/index.html>

安装JDK包：sudo rpm -Uvh /path/to/binary/jdk-7u55-linux-x64.rpm

选择使用Oracle JDK：

## java ##

sudo alternatives --install /usr/bin/java java /usr/java/latest/jre/bin/java 200000

## javaws ##

sudo alternatives --install /usr/bin/javaws javaws /usr/java/latest/jre/bin/javaws 200000

## Java Browser (Mozilla) Plugin 64-bit ##

sudo alternatives --install /usr/lib64/mozilla/plugins/libjavaplugin.so libjavaplugin.so.x86\_64 /usr/java/latest/jre/lib/amd64/libnpjp2.so 200000

## Install javac only if you installed JDK (Java Development Kit) package ##

sudo alternatives --install /usr/bin/javac javac /usr/java/latest/bin/javac 200000

alternatives --install /usr/bin/jar jar /usr/java/latest/bin/jar 200000

## 安装Hadoop

下载Hadoop：<http://mirrors.hust.edu.cn/apache/hadoop/common/>

建立hadoop用户：useradd hadoop

建立hadoop文件夹的symbolink：ln -s ~/bin/hadoop-1.2.1 ~/bin/hadoop

把Hadoop解压到~/bin目录下，并更新~/.bashrc

# ~/.bashrc

# hadooop

export JAVA\_HOME="/usr/java/latest"

export HADOOP\_INSTALL="/home/hadoop/bin/hadoop"

export PATH=$PATH:$HADOOP\_INSTALL/bin:$HADOOP\_INSTALL/sbin

export CLASSPATH="/home/hadoop/bin/mysql-connector-java-bin.jar"

## 配置Hadoop

在hadoop-env.sh中需指定JAVA安装路径（JAVA\_HOME)

# ~/bin/hadoop/conf/hadoop-env.sh

export JAVA\_HOME=/usr/java/latest

在core-site.xml中需指定HDFS的端口号(fs.default.name)和根目录(hadoop.tmp.dir)，这里端口号设为8020，根目录设为~/hadoop\_root

# ~/bin/hadoop/conf/core-site.xml

<?xml version="1.0"?>

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

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

<configuration>

<property>

<name>fs.default.name</name>

<value>hdfs://master:8020</value>

</property>

<property>

<name>hadoop.tmp.dir</name>

<value>/home/hadoop/hadoop\_root</value>

</property>

</configuration>

在mapred-site.xml中需要设定Mapreduce Job Tracker端口(mapred.job.tracker)和Map reduce的临时文件目录()

# ~/bin/hadoop/conf/mapred-site.xml

<?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>http://master:8021</value>

</property>

<property>

<name>mapred.local.dir</name>

<value>/home/hadoop/hadoop\_root/mapred</value>

</property>

</configuration>

在hdfs-site.xml中需设定NameNode持久存储名字空间及事务日志的本地文件系统路径(dfs.name.dir)，HDFS数据路径(dfs.data.dir)和数据需要备份的数量(dfs.replication)，其中备份数量不能超过节点数。

# ~/bin/hadoop/conf/hdfs-site.xml

<?xml version="1.0"?>

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

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

<configuration>

<property>

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

<value>/home/hadoop/hadoop\_root/name</value>

<description> </description>

</property>

<property>

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

<value>/home/hadoop/hadoop\_root/hdfs</value>

<description> </description>

</property>

<property>

<name>dfs.replication</name>

<value>3</value>

</property>

</configuration>

最后配置master和slaves的机器名，即在hosts中写的名字。

~/bin/hadoop/conf/masters

master

~/bin/hadoop/conf/slaves

master

slave1

slave2

slave3

## SSH配置

开启SSH服务：sudo service sshd start

使主机可以不用密码SSH登录虚拟机：cat ~/.ssh/id\_rsa.pub

将终端输出的内容拷贝到虚拟机中的~/.ssh/authorized\_keys

尝试连接虚拟机：ssh 192.168.56.101

# 虚拟机上的准备

## 修改Hosts

vi /etc/hosts

192.168.56.1 master

192.168.56.101 slave1

192.168.56.102 slave2

192.168.56.103 slave3

## 安装JAVA

sudo add-apt-repository ppa:webupd8team/java

sudo apt-get update

sudo apt-get install oracle-java7-installer

## 安装SSH

sudo apt-get install ssh

## 安装Hadoop

直接把本机上的Hadoop拷贝过去： scp -r bin/ slave1:~/ # 在本机上执行

更新~/.bashrc，和主机唯一的差别是JAVA\_HOME。

# hadooop

export JAVA\_HOME="/usr/lib/jvm/java-7-oracle/"

export HADOOP\_INSTALL="/home/hadoop/bin/hadoop"

export PATH=$PATH:$HADOOP\_INSTALL/bin:$HADOOP\_INSTALL/sbin

同理，hadoop\_env.sh中也需要相应修改JAVA\_HOME。

**准备完成后备份虚拟机文件，以防止后续配置出错而导致需要重装。然后将虚拟机文件拷贝两份。然后需要在/etc/hostname中修改host名称为对应的slave1, slave2或slave3。**

# 启动Hadoop

格式化一个新的文件系统：

[hadoop@localhost ~]$ hadoop namenode -format

14/04/26 17:35:02 INFO namenode.NameNode: STARTUP\_MSG:

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

STARTUP\_MSG: Starting NameNode

STARTUP\_MSG: host = localhost.localdomain/127.0.0.1

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 = 1.7.0\_51

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14/04/26 17:35:02 INFO util.GSet: Computing capacity for map BlocksMap

14/04/26 17:35:02 INFO util.GSet: VM type = 64-bit

14/04/26 17:35:02 INFO util.GSet: 2.0% max memory = 932184064

14/04/26 17:35:02 INFO util.GSet: capacity = 2^21 = 2097152 entries

14/04/26 17:35:02 INFO util.GSet: recommended=2097152, actual=2097152

14/04/26 17:35:03 INFO namenode.FSNamesystem: fsOwner=hadoop

14/04/26 17:35:03 INFO namenode.FSNamesystem: supergroup=supergroup

14/04/26 17:35:03 INFO namenode.FSNamesystem: isPermissionEnabled=true

14/04/26 17:35:03 INFO namenode.FSNamesystem: dfs.block.invalidate.limit=100

14/04/26 17:35:03 INFO namenode.FSNamesystem: isAccessTokenEnabled=false accessKeyUpdateInterval=0 min(s), accessTokenLifetime=0 min(s)

14/04/26 17:35:03 INFO namenode.FSEditLog: dfs.namenode.edits.toleration.length = 0

14/04/26 17:35:03 INFO namenode.NameNode: Caching file names occuring more than 10 times

14/04/26 17:35:03 INFO common.Storage: Image file /home/hadoop/hadoop\_root/name/current/fsimage of size 112 bytes saved in 0 seconds.

14/04/26 17:35:03 INFO namenode.FSEditLog: closing edit log: position=4, editlog=/home/hadoop/hadoop\_root/name/current/edits

14/04/26 17:35:03 INFO namenode.FSEditLog: close success: truncate to 4, editlog=/home/hadoop/hadoop\_root/name/current/edits

14/04/26 17:35:04 INFO common.Storage: Storage directory /home/hadoop/hadoop\_root/name has been successfully formatted.

14/04/26 17:35:04 INFO namenode.NameNode: SHUTDOWN\_MSG:

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

SHUTDOWN\_MSG: Shutting down NameNode at localhost.localdomain/127.0.0.1

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启动Hadoop集群：start-all.sh

注意这里不能使用ctrl + C强制退出，否则会集群会陷入Safe Mode。

其他错误解析：

INFO org.apache.hadoop.mapred.TaskTracker: Failed to get system directory...

需要在mapred目录下创建system目录。（需要在每个node执行）

Can not start task tracker because java.io.IOException: Call to master/192.168.56.1:8021 failed on local exception: java.net.NoRouteToHostException: No route to host

端口被防火墙关闭了，可以选择增加防火墙规则或者关闭防火墙。

成功后可以访问Name node master页面[http://master:50070](http://master:50070/)和JobTracker页面[http://master:50030](http://master:50030/)。

截图如下所示





## 运行Hadoop样例程序计算Pi

[hadoop@master hadoop]$ hadoop jar hadoop-examples-1.2.1.jar pi 3 10

Number of Maps = 3

Samples per Map = 10

Wrote input for Map #0

Wrote input for Map #1

Wrote input for Map #2

Starting Job

14/04/26 22:06:57 INFO mapred.FileInputFormat: Total input paths to process : 3

14/04/26 22:06:57 INFO mapred.JobClient: Running job: job\_201404262204\_0003

14/04/26 22:06:58 INFO mapred.JobClient: map 0% reduce 0%

14/04/26 22:07:06 INFO mapred.JobClient: map 33% reduce 0%

14/04/26 22:07:08 INFO mapred.JobClient: map 66% reduce 0%

14/04/26 22:07:10 INFO mapred.JobClient: map 100% reduce 0%

14/04/26 22:07:14 INFO mapred.JobClient: map 100% reduce 33%

14/04/26 22:07:15 INFO mapred.JobClient: map 100% reduce 100%

14/04/26 22:07:16 INFO mapred.JobClient: Job complete: job\_201404262204\_0003

14/04/26 22:07:16 INFO mapred.JobClient: Counters: 31

14/04/26 22:07:16 INFO mapred.JobClient: Job Counters

14/04/26 22:07:16 INFO mapred.JobClient: Launched reduce tasks=1

14/04/26 22:07:16 INFO mapred.JobClient: SLOTS\_MILLIS\_MAPS=17991

14/04/26 22:07:16 INFO mapred.JobClient: Total time spent by all reduces waiting after reserving slots (ms)=0

14/04/26 22:07:16 INFO mapred.JobClient: Total time spent by all maps waiting after reserving slots (ms)=0

14/04/26 22:07:16 INFO mapred.JobClient: Rack-local map tasks=2

14/04/26 22:07:16 INFO mapred.JobClient: Launched map tasks=3

14/04/26 22:07:16 INFO mapred.JobClient: Data-local map tasks=1

14/04/26 22:07:16 INFO mapred.JobClient: SLOTS\_MILLIS\_REDUCES=9593

14/04/26 22:07:16 INFO mapred.JobClient: File Input Format Counters

14/04/26 22:07:16 INFO mapred.JobClient: Bytes Read=354

14/04/26 22:07:16 INFO mapred.JobClient: File Output Format Counters

14/04/26 22:07:16 INFO mapred.JobClient: Bytes Written=97

14/04/26 22:07:16 INFO mapred.JobClient: FileSystemCounters

14/04/26 22:07:16 INFO mapred.JobClient: FILE\_BYTES\_READ=72

14/04/26 22:07:16 INFO mapred.JobClient: HDFS\_BYTES\_READ=714

14/04/26 22:07:16 INFO mapred.JobClient: FILE\_BYTES\_WRITTEN=223075

14/04/26 22:07:16 INFO mapred.JobClient: HDFS\_BYTES\_WRITTEN=215

14/04/26 22:07:16 INFO mapred.JobClient: Map-Reduce Framework

14/04/26 22:07:16 INFO mapred.JobClient: Map output materialized bytes=84

14/04/26 22:07:16 INFO mapred.JobClient: Map input records=3

14/04/26 22:07:16 INFO mapred.JobClient: Reduce shuffle bytes=84

14/04/26 22:07:16 INFO mapred.JobClient: Spilled Records=12

14/04/26 22:07:16 INFO mapred.JobClient: Map output bytes=54

14/04/26 22:07:16 INFO mapred.JobClient: Total committed heap usage (bytes)=623648768

14/04/26 22:07:16 INFO mapred.JobClient: CPU time spent (ms)=2930

14/04/26 22:07:16 INFO mapred.JobClient: Map input bytes=72

14/04/26 22:07:16 INFO mapred.JobClient: SPLIT\_RAW\_BYTES=360

14/04/26 22:07:16 INFO mapred.JobClient: Combine input records=0

14/04/26 22:07:16 INFO mapred.JobClient: Reduce input records=6

14/04/26 22:07:16 INFO mapred.JobClient: Reduce input groups=6

14/04/26 22:07:16 INFO mapred.JobClient: Combine output records=0

14/04/26 22:07:16 INFO mapred.JobClient: Physical memory (bytes) snapshot=638951424

14/04/26 22:07:16 INFO mapred.JobClient: Reduce output records=0

14/04/26 22:07:16 INFO mapred.JobClient: Virtual memory (bytes) snapshot=2835275776

14/04/26 22:07:16 INFO mapred.JobClient: Map output records=6

Job Finished in 19.799 seconds

Estimated value of Pi is 3.60000000000000000000



# 参考文献

* Install Oracle Java JDK JRE 7u55 on Fedora 20 19 CentOS RHEL 6.5 5.10, If not true then false, <http://www.if-not-true-then-false.com/2010/install-sun-oracle-java-jdk-jre-7-on-fedora-centos-red-hat-rhel/>
* Ubuntu 12.10 Hadoop 1.2.1版本集群配置, 51CTO.COM, <http://os.51cto.com/art/201309/411793_all.htm>
* Hadoop 机群安装笔记, zhangbin.cc, <http://zhangbin.cc/archives/1288>