暨南大学本科实验报告专用纸

课程名称 云计算实验 成绩评定

实验项目名称 分布式协同服务系统 Zookeeper& 数据 HBase

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实验项目编号 0806030804 实验项目类型 综合 实验地点 线上

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实验 1 分布式协同服务系统 Zookeeper

1.实验目的

1）理解 Zookeeper 工作原理。
2）通过实验掌握 Zookeeper 集群模式安装过程。
3）通过实验掌握 Zookeeper shell 命令的使用。
4）通过实验掌握基本的 Zookeeper 中的 JAVA API 编程方法。

2. Zookeeper 的安装

2.1 实验内容

完成分布式协同服务系统 Zookeeper 的安装。

2.2 实验环境

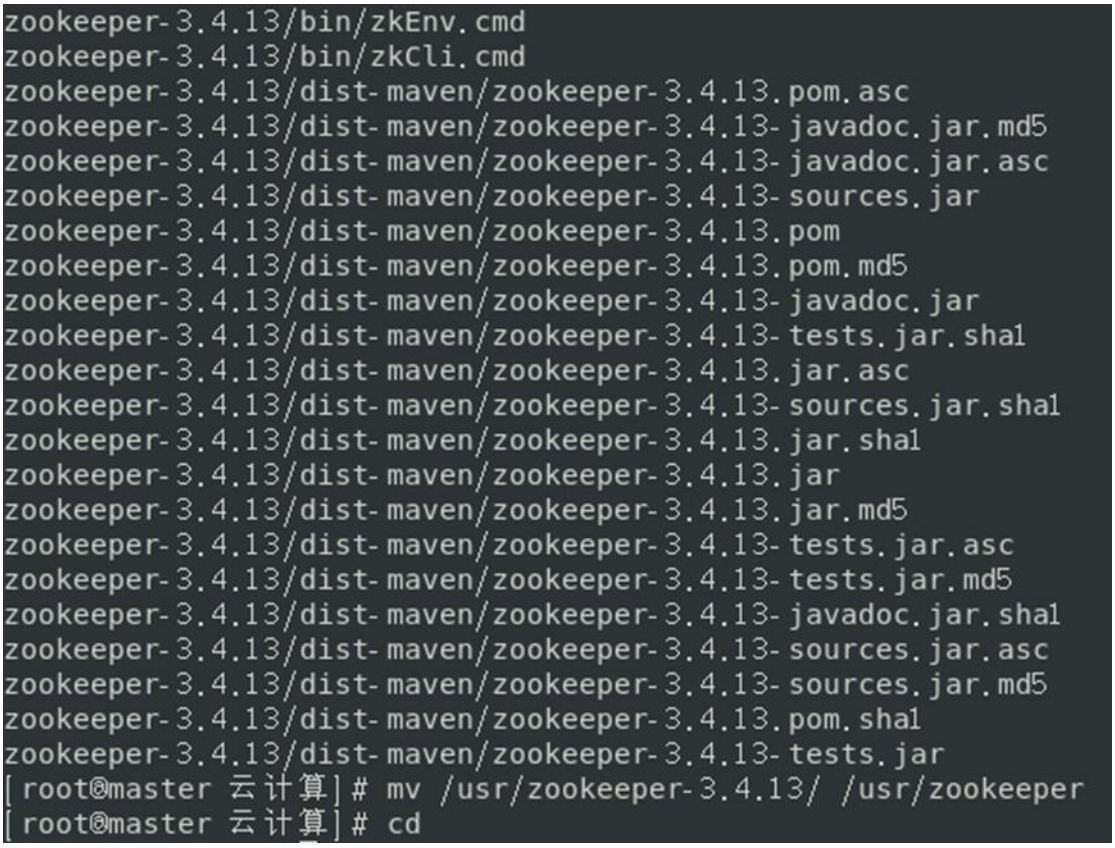
已经配置完成的 Hadoop 伪分布式或完全分布式环境。环境配置如下：

Hadoop01：192.168.24.91
Hadoop02：192.168.24.92
Hadoop03：192.168.24.93
管理员用户：root / admin@1
Hadoop 用户：hadoop / hadoop

2.3 实验步骤

1、使用 xftp 工具将 zookeeper-3.4.13.tar.gz 文件上传到服务器上，解压 zookeeper-3.4.13.tar.gz 文件，并重命名 zookeeper 文件夹。命令如下：

```
[root@master ~]# tar -zxvf zookeeper-3.4.13.tar.gz -C /usr/
[root@master ~]# mv /usr/zookeeper-3.4.13/ /usr/zookeeper
```



2、添加环境变量，并使其生效。命令如下：

```
[root@master ~]# vi /etc/profile
export ZOOKEEPER_HOME=/usr/zookeeper
export PATH=$ZOOKEEPER_HOME/bin:$PATH
[root@master ~]# source /etc/profile


[root@slave1~]# vi /etc/profile
export ZOOKEEPER_HOME=/usr/zookeeper
export PATH=$ZOOKEEPER_HOME/bin:$PATH
[root@ slave1~]# source /etc/profile
```

[root@ slave2~]# vi /etc/profile

export ZOOKEEPER_HOME=/usr/zookeeper

export PATH=$ZOOKEEPER_HOME/bin:$PATH

[root@ slave2~]# source /etc/profile

3、进入/usr/zookeeper/conf/目录，创建 zoo.cfg 文件。命令如下：

[root@master ~]# cd /usr/zookeeper/conf/

[root@master conf]# cp zoo_sample.cfg zoo.cfg

[root@master conf]# vi zoo.cfg

dataDir=/home/hadoop/zoo/data

dataLogDir=/home/hadoop/zoo/log

server.1=192.168.24.91:2188:3888

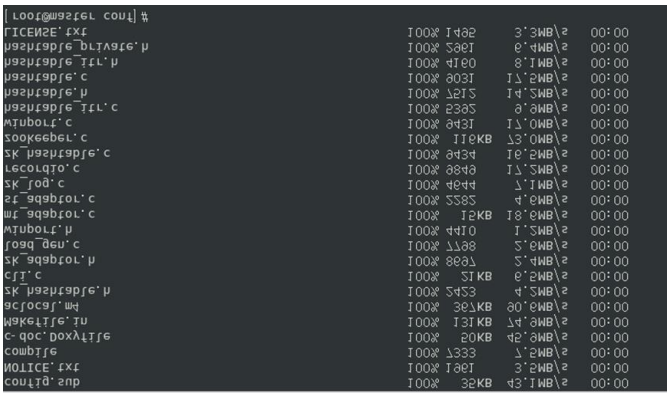
server.2=192.168.24.92:2188:3888

server.3=192.168.24.93:2188:3888

4、将 master 上的 Zookeeper 安装文件同步到 slave1、slave2 上。命令如下：

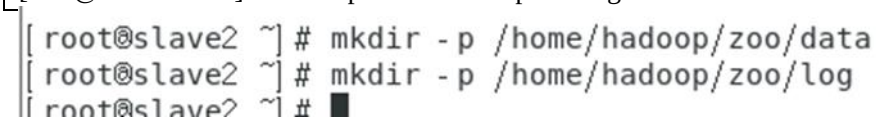
[root@master conf]# scp -r /usr/zookeeper/ root@slave1:/usr

[root@master conf]# scp -r /usr/zookeeper/ root@slave2:/usr



5、分别创建 dataDir 和 dataLogDir 目录。命令如下：

```
[root@master conf]# mkdir -p /home/hadoop/zoo/data
[root@master conf]# mkdir -p /home/hadoop/zoo/log

[root@ slave1 conf]# mkdir -p /home/hadoop/zoo/data
[root@ slave1 conf]# mkdir -p /home/hadoop/zoo/log

[root@ slave2 conf]# mkdir -p /home/hadoop/zoo/data
[root@ slave2 conf]# mkdir -p /home/hadoop/zoo/log
```

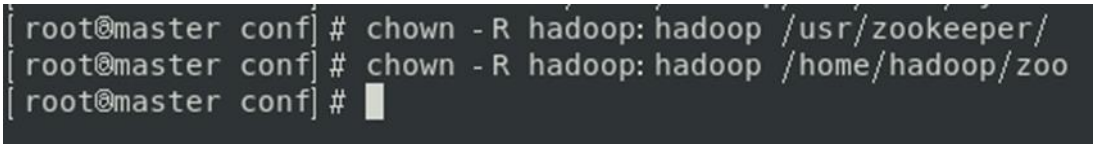


6、创建 myid 文件。命令如下：

```
[root@master conf]# echo "1" > /home/hadoop/zoo/data/myid

[root@slave1 conf]# echo "2" > /home/hadoop/zoo/data/myid

[root@slave2 conf]# echo "3" > /home/hadoop/zoo/data/myid
```

7、修改 zookeeper 目录的权限。命令如下：

```
[root@master conf]# chown -R hadoop:hadoop /usr/zookeeper/
[root@master conf]# chown -R hadoop:hadoop /home/hadoop/zoo

[root@ slave1 conf]# chown -R hadoop:hadoop /usr/zookeeper/
[root@ slave1 conf]# chown -R hadoop:hadoop /home/hadoop/zoo

[root@slave2 conf]# chown -R hadoop:hadoop /usr/zookeeper/
[root@ slave2 conf]# chown -R hadoop:hadoop /home/hadoop/zoo
```



8、启动 zookeeper。命令如下：

[root@ master conf]#cd

[root@master ~]#su hadoop

[hadoop@master ~]$ zkServer.sh start

[hadoop@master ~]$ jps

```
[hadoop@master ~]$ jps
29970 Jps
27971 ResourceManager
5317 RunJar
27734 SecondaryNameNode
20681 QuorumPeerMain
27499 NameNode
```

```
[hadoop@master ~]$ jps
4610 NodeManager
4167 SecondaryNameNode
4471 ResourceManager
5673 QuorumPeerMain
3868 NameNode
5711 Jps
```

[root@ slave1 conf]#cd

[root@slave1 ~]# su hadoop

[hadoop@slave1 ~]$ zkServer.sh start

[hadoop@slave1 ~]$jps

```
[hadoop@slave1 ~]$ jps
23056 NodeManager
23523 SecondaryNameNode
25829 Jps
22934 DataNode
16730 QuorumPeerMain
```

```
[hadoop@master ~]$ jps
4610 NodeManager
5796 Jps
4167 SecondaryNameNode
4471 ResourceManager
5673 QuorumPeerMain
3868 NameNode
```

[root@slave2 ~]# su hadoop

[root@ slave2 conf]#cd

[hadoop@slave2 ~]$ zkServer.sh start

[hadoop@slave2 ~]$jps

```
[hadoop@slave2 ~]$ jps
4576 QuorumPeerMain
4720 Jps
3817 SecondaryNameNode
3629 DataNode
4205 NodeManager
```

```
[hadoop@master ~]$ jps
4610 NodeManager
5796 Jps
4167 SecondaryNameNode
4471 ResourceManager
5673 QuorumPeerMain
3868 NameNode
```

[hadoop@master ~]$ zkServer.sh status

```
[hadoop@master ~]$ zkServer.sh status
ZooKeeper JMX enabled by default
Using config: /usr/zookeeper/bin/../conf/zoo.cfg
Mode: follower
```

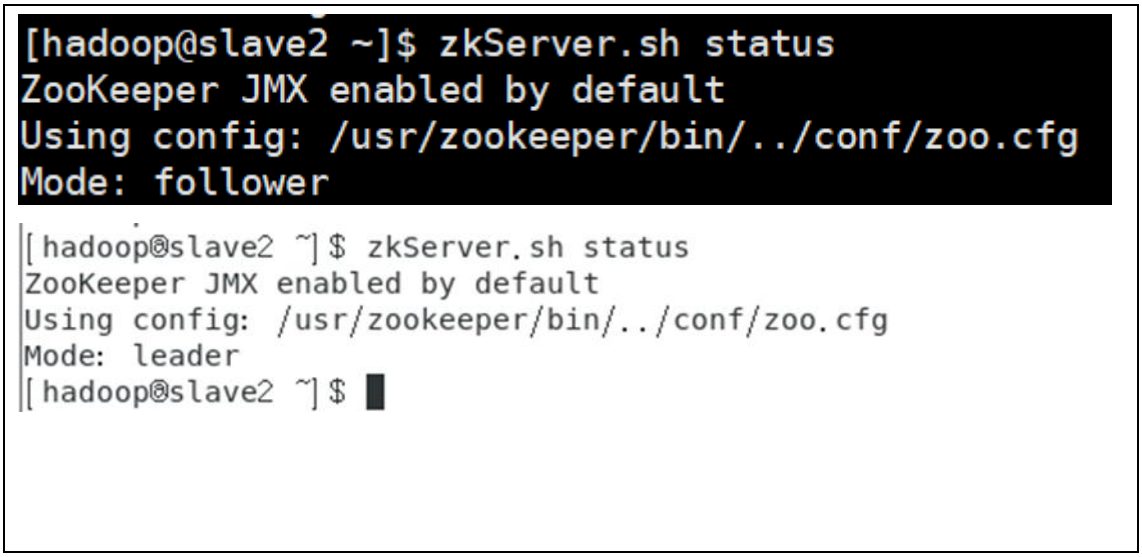
```
[hadoop@master ~]$ zkServer.sh status
ZooKeeper JMX enabled by default
Using config: /usr/zookeeper/bin/../conf/zoo.cfg
Mode: follower
```

[hadoop@ slave1 ~]$ zkServer.sh status

```
[hadoop@slave1 ~]$ zkServer.sh status
ZooKeeper JMX enabled by default
Using config: /usr/zookeeper/bin/../conf/zoo.cfg
Mode: leader
```

```
[hadoop@slave1 ~]$ zkServer.sh status
ZooKeeper JMX enabled by default
Using config: /usr/zookeeper/bin/../conf/zoo.cfg
Mode: follower
```

[hadoop@ slave2 ~]$ zkServer.sh status



实验 4.2 HBase 的安装与部署

1.实验目的

掌握 HBase 的安装方法。

2.实验内容

完成 HBase 数据库的安装。

3.实验环境

已经配置完成的 Hadoop 完全分布式环境。已经配置完成的 Zookeeper 集群模式环境。环境配置如下：

Hadoop01：192.168.24.91

Hadoop02：192.168.24.92

Hadoop03：192.168.24.93

管理员用户：root / admin@1

Hadoop 用户：hadoop / hadoop

4.实验步骤

1、分别在三台主机上安装 NTP 服务。命令如下：

```
[root@master ~]# yum install ntp
[root@salve1 ~]# yum install ntp
[root@ salve2 ~]# yum install ntp
```

```
[root@master ~]# yum install ntp
已加载插件：fastestmirror, langpacks
Loading mirror speeds from cached hostfile
 * base: ftp.ksu.edu.tw
 * extras: ftp.ksu.edu.tw
 * updates: mirror.lzu.edu.cn
base                                                     | 3.6 kB  00:00:00
extras                                                   | 2.9 kB  00:00:00
updates                                                  | 2.9 kB  00:00:00
软件包 ntp-4.2.6p5-29.el7.centos.2.x86_64 已安装并且是最新版本
无须任何处理
```

2、使用 xftp 工具将 hbase-2.1.0-bin.tar.gz 文件上传到服务器上，解压 hbase-2.1.0-bin.tar.gz 文件，并重命名 hbase 文件夹。命令如下：

```
[root@master ~]# tar -zxvf hbase-2.1.0-bin.tar.gz -C /usr/
[root@master ~]# mv /usr/hbase-2.1.0/ /usr/hbase
```

```
hbase-2.1.0/lib/jackson-mapper-asl-1.9.13.jar
hbase-2.1.0/lib/hadoop-yarn-server-tests-2.7.4-tests.jar
hbase-2.1.0/lib/hadoop-yarn-server-nodemanager-2.7.4.jar
hbase-2.1.0/lib/hadoop-yarn-server-resourcemanager-2.7.4.jar
hbase-2.1.0/lib/hadoop-yarn-server-applicationhistoryservice-2.7.4.jar
hbase-2.1.0/lib/hadoop-yarn-server-web-proxy-2.7.4.jar
hbase-2.1.0/lib/hadoop-mapreduce-client-hs-2.7.4.jar
hbase-2.1.0/lib/hbase-resource-bundle-2.1.0.jar
hbase-2.1.0/lib/hbase-endpoint-2.1.0.jar
hbase-2.1.0/lib/spymemcached-2.12.2.jar
hbase-2.1.0/lib/shaded-clients/hbase-shaded-client-2.1.0.jar
hbase-2.1.0/lib/shaded-clients/hbase-shaded-client-byo-hadoop-2.1.0.jar
hbase-2.1.0/lib/shaded-clients/hbase-shaded-mapreduce-2.1.0.jar
hbase-2.1.0/lib/ruby/jruby-complete-9.1.13.0.jar
hbase-2.1.0/lib/client-facing-thirdparty/findbugs-annotations-1.3.9-1.jar
hbase-2.1.0/lib/client-facing-thirdparty/slf4j-api-1.7.25.jar
hbase-2.1.0/lib/client-facing-thirdparty/htrace-core4-4.2.0-incubating.jar
hbase-2.1.0/lib/client-facing-thirdparty/commons-logging-1.2.jar
hbase-2.1.0/lib/client-facing-thirdparty/htrace-core-3.1.0-incubating.jar
hbase-2.1.0/lib/client-facing-thirdparty/log4j-1.2.17.jar
hbase-2.1.0/lib/client-facing-thirdparty/audience-annotations-0.5.0.jar
hbase-2.1.0/lib/client-facing-thirdparty/slf4j-log4j12-1.7.25.jar
hbase-2.1.0/lib/zkcli/jline-0.9.94.jar
[root@master 云计算]# mv /usr/hbase-2.1.0/ /usr/hbase
[root@master 云计算]#
```

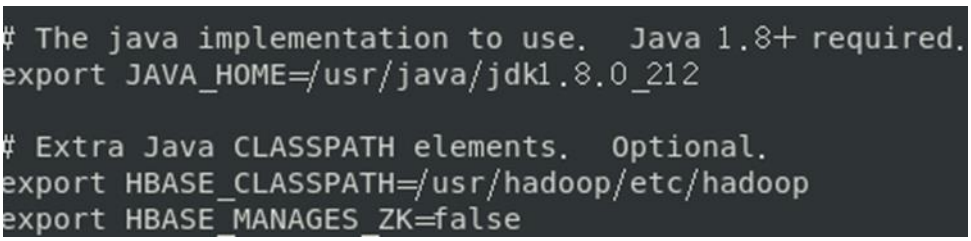
3、分别在三台主机上添加环境变量，并使其生效。命令如下：

```
[root@master ~]# vi /etc/profile
export HBASE_HOME=/usr/hbase
export PATH=$HBASE_HOME/bin:$PATH
[root@master ~]# source /etc/profile
```

```
[root@ salve21~]# vi /etc/profile
export HBASE_HOME=/usr/hbase
export PATH=$HBASE_HOME/bin:$PATH
[root@ salve1~]# source /etc/profile


[root@salve2 ~]# vi /etc/profile
export HBASE_HOME=/usr/hbase
export PATH=$HBASE_HOME/bin:$PATH
[root@ salve2 ~]# source /etc/profile
```

4、切换/usr/hbase/conf/目录，修改 hbase-env.sh 文件。命令如下：

```
[root@master ~]# cd /usr/hbase/conf/
[root@master conf]# vi hbase-env.sh
export JAVA_HOME=/usr/java/jdk1.8.0_144
export HBASE_CLASSPATH=/usr/hadoop/etc/hadoop
export HBASE_MANAGES_ZK=false
```



5、创建并配置 hbase-site.xml 文件。命令如下：

```
[root@master conf]# vi hbase-site.xml
<configuration>
<property>
        <name>hbase.rootdir</name>
        <value>hdfs://master:9000/hbase</value>
    </property>
    <property>
        <name>hbase.master.info.port</name>
        <value>60010</value>
```

```
    </property>
    <property>
        <name>hbase.zookeeper.property.clientPort</name>
        <value>2181</value>
    </property>
    <property>
        <name>zookeeper.session.timeout</name>
        <value>120000</value>
    </property>
    <property>
        <name>hbase.zookeeper.quorum</name>
        <value>master,slave1,slave2</value>
    </property>
    <property>
        <name>hbase.tmp.dir</name>
        <value>/usr/hbase/tmp</value>
    </property>
<property>
        <name>hbase.cluster.distributed</name>
        <value>true</value>
    </property>
    <property>
        <name>hbase.unsafe.stream.capability.enforce</name>
        <value>false</value>
</property>
</configuration>
```

6、修改 regionservers 文件（master 节点）。删除 localhost，添加 master 和 slave 的主机名或者 IP。

```
[root @master conf]$ vi regionservers
master
```

slave1

slave2

```
localhost
master
slave1
slave2
~
```

7、创建 tmp 目录。命令如下：

[root @master conf]$ mkdir /usr/hbase/tmp

8、将 htrace-core-3.1.0-incubating.jar 文件拷贝到$HBASE_HOME/lib/目录中。命令如下：

[root@master conf]# cp $HBASE_HOME/lib/client-facing-thirdparty/htrace-core-3.1.0-incubating.jar $HBASE_HOME/lib/

```
[root@master conf]# cp $HBASE_HOME/lib/client-facing-thirdparty/htrace-core-3.1.0-incub
ating.jar $HBASE_HOME/lib/
[root@master conf]#
```

9、将 master 上的 hbase 安装文件同步到 slave1 和 slave2 节点上。命令如下：

[root@master conf]# scp -r /usr/hbase/ root@slave1:/usr

[root@master conf]# scp -r /usr/hbase/ root@slave2:/usr

```
index.html                                    100%  872     1.7MB/s   00:00
web.xml                                       100% 5100     7.7MB/s   00:00
index.html                                    100%  876     1.8MB/s   00:00
bootstrap-theme.css                           100%   17KB  20.7MB/s   00:00
bootstrap-theme.min.css                       100%   15KB   9.1MB/s   00:00
hbase.css                                     100% 1293     2.4MB/s   00:00
bootstrap.min.css                             100%   95KB  66.7MB/s   00:00
bootstrap.css                                 100%  117KB  69.4MB/s   00:00
bootstrap.js                                  100%   57KB  42.3MB/s   00:00
tab.js                                        100% 1347     1.3MB/s   00:00
bootstrap.min.js                              100%   27KB  31.7MB/s   00:00
jquery.min.js                                 100%   85KB  60.0MB/s   00:00
glyphicons-halflings-regular.svg              100%   62KB  59.6MB/s   00:00
glyphicons-halflings-regular.eot              100%   14KB  17.1MB/s   00:00
glyphicons-halflings-regular.ttf              100%   29KB   7.2MB/s   00:00
glyphicons-halflings-regular.woff             100%   16KB  16.7MB/s   00:00
hbase_logo_med.gif                            100% 3592     4.3MB/s   00:00
hbase_logo_small.png                          100% 3206     4.6MB/s   00:00
jumping-orca_rotated_12percent.png            100% 2401     4.8MB/s   00:00
hbase_logo.png                                100% 2997     6.4MB/s   00:00
web.xml                                       100%  680     1.7MB/s   00:00
index.html                                    100%  873     2.1MB/s   00:00
web.xml                                       100%  666     1.2MB/s   00:00
index.html                                    100%  871     1.8MB/s   00:00
[root@master conf]#
```

10、修改 hbase 文件夹权限（注意，需要在三台机器上都进行权限更改）。命令如下：

```
[root@master conf]# chown -R hadoop:hadoop /usr/hbase/
```

```
[root@master conf]# chown -R hadoop:hadoop /usr/hbase/
[root@master conf]#
```

11、启动 Hadoop 集群。命令如下：

```
[root@master conf]# cd
[root@master ~]# su hadoop
[hadoop@master ~]$ start-all.sh
```

master 节点：

```
[hadoop@master ~]$ jps
1936 SecondaryNameNode
2176 ResourceManager
2482 Jps
1703 NameNode
```

```
[hadoop@master conf]$ jps
15377 Jps
13827 ResourceManager
13332 DataNode
5673 QuorumPeerMain
14138 NodeManager
13151 NameNode
13535 SecondaryNameNode
[hadoop@master conf]$
```

slave1 节点：

```
[hadoop@slave1 ~]$ jps
1586 DataNode
1835 Jps
1711 NodeManager
```

```
[hadoop@slave1 ~]$ jps
6177 Jps
5799 NodeManager
5672 DataNode
4042 QuorumPeerMain
```

slave2 节点：

```
[hadoop@slave2 ~]$ jps
1832 Jps
1708 NodeManager
1583 DataNode
```

```
[hadoop@slave2 ~]$ jps
5636 NodeManager
3817 QuorumPeerMain
5549 DataNode
6045 Jps
```

12、启动 Zookeeper 集群。命令如下：

[hadoop@master ~]$ zkServer.sh start

[hadoop@master ~]$ jps

```
[hadoop@master ~]$ jps
29970 Jps
27971 ResourceManager
5317 RunJar
27734 SecondaryNameNode
20681 QuorumPeerMain
27499 NameNode
```

```
[hadoop@slave1 ~]$ jps
5799 NodeManager
5672 DataNode
4042 QuorumPeerMain
6236 Jps
[hadoop@slave1 ~]$
```

[hadoop@slave1 ~]$ zkServer.sh start

[hadoop@slave1 ~]$jps

```
[hadoop@slave1 ~]$ jps
23056 NodeManager
23523 SecondaryNameNode
25829 Jps
22934 DataNode
16730 QuorumPeerMain
```

```
[hadoop@slave2 ~]$ jps
5636 NodeManager
6103 Jps
3817 QuorumPeerMain
5549 DataNode
[hadoop@slave2 ~]$
```

[hadoop@slave2 ~]$ zkServer.sh start

```
[hadoop@master ~]$ zkServer.sh status
ZooKeeper JMX enabled by default
Using config: /usr/zookeeper/bin/../conf/zoo.cfg
Mode: follower
[hadoop@master ~]$
```

[hadoop@slave2 ~]$jps

```
[hadoop@slave2 ~]$ jps
4576 QuorumPeerMain
4720 Jps
3817 SecondaryNameNode
3629 DataNode
4205 NodeManager
```

[hadoop@master ~]$ zkServer.sh status

```
[hadoop@master ~]$ zkServer.sh status
ZooKeeper JMX enabled by default
Using config: /usr/zookeeper/bin/../conf/zoo.cfg
Mode: follower
```

```
[hadoop@slave1 ~]$ zkServer.sh status
ZooKeeper JMX enabled by default
Using config: /usr/zookeeper/bin/../conf/zoo.cfg
Mode: follower
```

[hadoop@ slave1 ~]$ zkServer.sh status

```
[hadoop@slave1 ~]$ zkServer.sh status
ZooKeeper JMX enabled by default
Using config: /usr/zookeeper/bin/../conf/zoo.cfg
Mode: leader
```

```
[hadoop@slave2 ~]$ zkServer.sh status
ZooKeeper JMX enabled by default
Using config: /usr/zookeeper/bin/../conf/zoo.cfg
Mode: leader
```

[hadoop@ slave2 ~]$ zkServer.sh status

```
[hadoop@slave2 ~]$ zkServer.sh status
ZooKeeper JMX enabled by default
Using config: /usr/zookeeper/bin/../conf/zoo.cfg
Mode: follower
```

13、启动 HBase 集群。命令如下：

[hadoop@master ~]$ start-hbase.sh

Master 节点:

```
[hadoop@master ~]$ jps
1733 NameNode
2535 QuorumPeerMain
5272 HMaster
5482 Jps
2204 ResourceManager
1967 SecondaryNameNode
```

```
[hadoop@master ~]$ jps
13827 ResourceManager
13332 DataNode
16228 Jps
5673 QuorumPeerMain
14138 NodeManager
15949 HRegionServer
13151 NameNode
13535 SecondaryNameNode
15727 HMaster
[hadoop@master ~]$
```

Slave1 节点:

```
[hadoop@slave1 ~]$ jps
1729 NodeManager
1604 DataNode
1877 QuorumPeerMain
3946 Jps
3806 HRegionServer
```

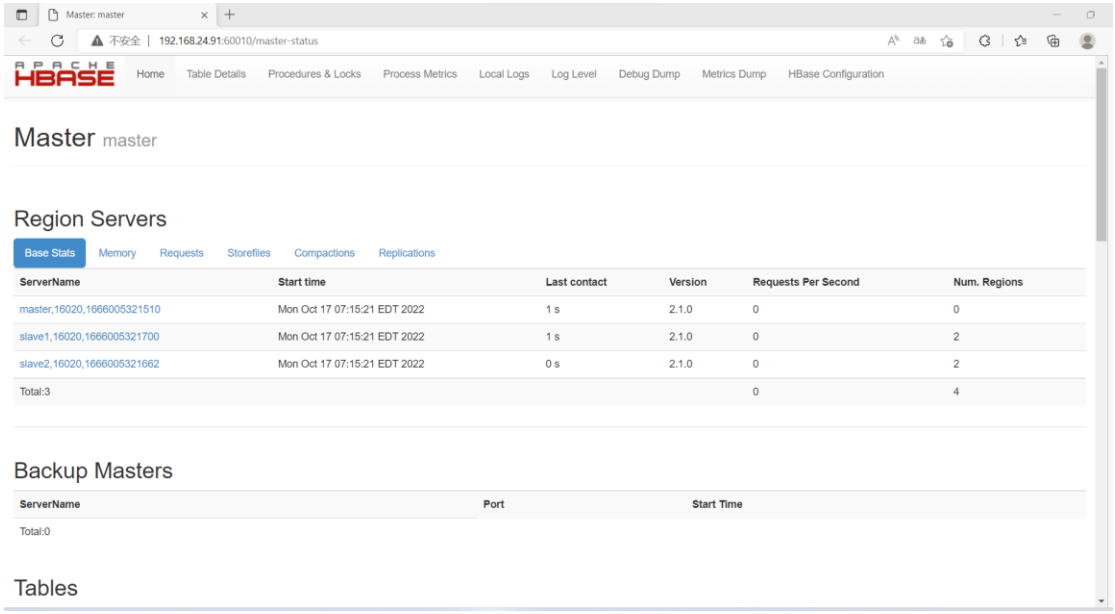
```
[hadoop@slave1 ~]$ jps
6354 HRegionServer
5799 NodeManager
5672 DataNode
4042 QuorumPeerMain
6508 Jps
```

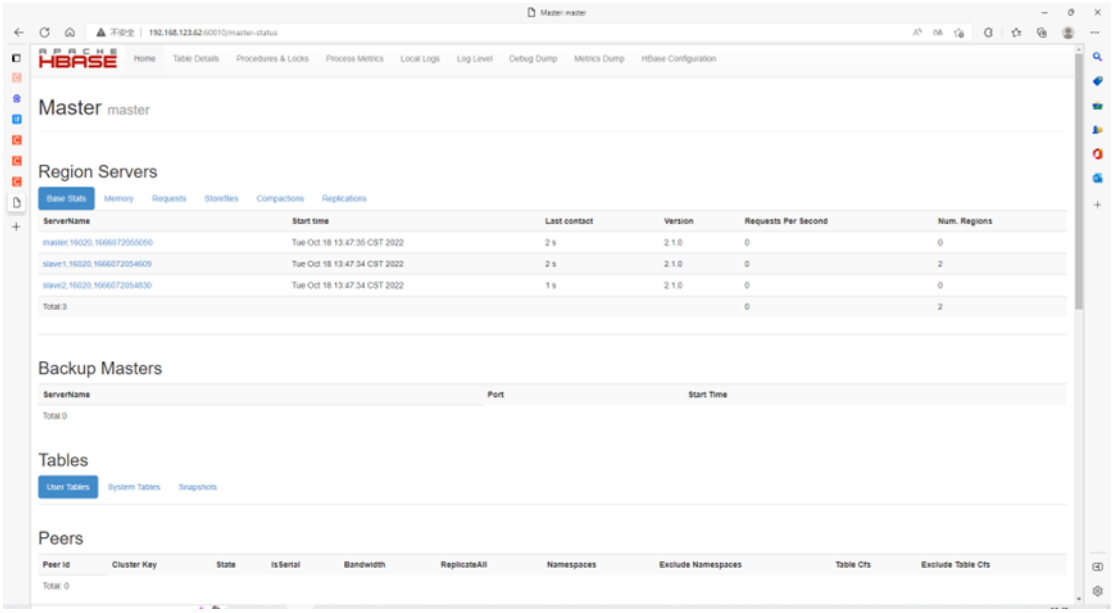
Slave2 节点:

```
[hadoop@slave2 ~]$ jps
2100 Jps
1589 DataNode
1717 NodeManager
1881 QuorumPeerMain
1997 HRegionServer
```

```
[hadoop@slave2 ~]$ jps
5636 NodeManager
6216 HRegionServer
6360 Jps
3817 QuorumPeerMain
5549 DataNode
[hadoop@slave2 ~]$
```

14、在浏览器输入 192.168.24.91:60010 出现如下图所示的界面。


Master: master
不安全 | 192.168.24.91:60010/master-status
APACHE HBASE
Home
Table Details
Procedures & Locks
Process Metrics
Local Logs
Log Level
Debug Dump
Metrics Dump
HBase Configuration
Master master
Region Servers
Base Stats
Memory
Requests
Storefiles
Compactions
Replications
ServerName
Start time
Last contact
Version
Requests Per Second
Num. Regions
master,16020,1666005321510
Mon Oct 17 07:15:21 EDT 2022
1 s
2.1.0
0
0
slave1,16020,1666005321700
Mon Oct 17 07:15:21 EDT 2022
1 s
2.1.0
0
2
slave2,16020,1666005321662
Mon Oct 17 07:15:21 EDT 2022
0 s
2.1.0
0
2
Total:3
0
4
Backup Masters
ServerName
Port
Start Time
Total:0
Tables


Master: master
不安全 | 192.168.123.62:60010/master-status
APACHE HBASE
Home
Table Details
Procedures & Locks
Process Metrics
Local Logs
Log Level
Debug Dump
Metrics Dump
HBase Configuration
Master master
Region Servers
Base Stats
Memory
Requests
Storefiles
Compactions
Replications
ServerName
Start time
Last contact
Version
Requests Per Second
Num. Regions
master,16020,1666072055050
Tue Oct 18 13:47:35 CST 2022
2 s
2.1.0
0
0
slave1,16020,1666072054609
Tue Oct 18 13:47:34 CST 2022
2 s
2.1.0
0
2
slave2,16020,1666072054630
Tue Oct 18 13:47:34 CST 2022
1 s
2.1.0
0
0
Total:3
0
2
Backup Masters
ServerName
Port
Start Time
Total:0
Tables
User Tables
System Tables
Snapshots
Peers
Peer Id
Cluster Key
State
isSerial
Bandwidth
ReplicateAll
Namespaces
Exclude Namespaces
Table Cfs
Exclude Table Cfs
Total: 0

实验 4.3 HBase Shell 命令

1.实验环境

1）已经配置完成的 Hadoop 完全分布式环境。

2）已经配置完成的 Zookeeper 集群模式环境。

3）已经安装好的 NTP 时钟同步服务。

4）环境说明

集群中包括 3 个节点：1 个 Master，2 个 Salve，节点之间局域网连接，可以相互 ping 通。节点 IP 地址分布如下：

机器名称	IP 地址
master	192.168.24.213
slave1	192.168.24.214
slave2	192.168.24.215

2.实验内容

1）进入 Hbase 命令行。

[Hadoop@master ~]$ hbase shell

2）建立表 scores，两个列簇：grade 和 course

hbase(main):001:0> create 'score','grade','course'

```
[root@master ~]# hbase shell
HBase Shell
Use "help" to get list of supported commands.
Use "exit" to quit this interactive shell.
Version 2.1.0, re1673bb0bbfea21d6e5dba73e013b09b8b49b89b, Tue Jul 10 17:26
:48 CST 2018
Took 0.0025 seconds
hbase(main):001:0> create 'score','grade','course'
Created table score
Took 1.2253 seconds
=> Hbase::Table - score
```

```
[hadoop@master ~]$ hbase shell
SLF4J: Class path contains multiple SLF4J bindings.
SLF4J: Found binding in [jar:file:/usr/hadoop/share/hadoop/common/lib/slf4j-log4j12
.25.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: Found binding in [jar:file:/usr/hbase/lib/client-facing-thirdparty/slf4j-log
-1.7.25.jar!/org/slf4j/impl/StaticLoggerBinder.class]
SLF4J: See http://www.slf4j.org/codes.html#multiple_bindings for an explanation.
SLF4J: Actual binding is of type [org.slf4j.impl.Log4jLoggerFactory]
HBase Shell
Use "help" to get list of supported commands.
Use "exit" to quit this interactive shell.
Version 2.1.0, re1673bb0bbfea21d6e5dba73e013b09b8b49b89b, Tue Jul 10 17:26:48 CST 2
Took 0.0032 seconds
hbase(main):001:0> create 'score','grade','course'
Created table score
Took 2.5988 seconds
=> Hbase::Table - score
```

3）查看数据库状态

hbase(main):002:0> status

```
hbase(main):002:0> status
1 active master, 0 backup masters, 2 servers, 0 dead, 1.5000 average load
Took 0.0960 seconds
```

```
hbase(main):002:0> status
1 active master, 0 backup masters, 3 servers, 0 dead, 1.0000 average load
Took 0.0895 seconds
```

4）查看数据库版本

hbase(main):003:0> version

```
hbase(main):003:0> version
2.1.0, re1673bb0bbfea21d6e5dba73e013b09b8b49b89b, Tue Jul 10 17:26:48 CST
2018
Took 0.0004 seconds
```

```
hbase(main):003:0> version
2.1.0, re1673bb0bbfea21d6e5dba73e013b09b8b49b89b, Tue Jul 10 17:26:48 CST 2018
Took 0.0003 seconds
```

5）查看表

hbase(main):004:0> list

```
hbase(main):004:0> list
TABLE
score
1 row(s)
Took 0.0370 seconds
=> ["score"]
```

```
hbase(main):004:0> list
TABLE
score
1 row(s)
Took 0.0261 seconds
=> ["score"]
```

6）插入记录 1：jie,grade: 143cloud

hbase(main):005:0> put

'score','jie','grade','146cloud'

```
hbase(main):005:0> put 'score','jie','grade','146cloud'
Took 0.1530 seconds
```

```
hbase(main):005:0> put 'score','jie','grade','146cloud'
Took 0.2605 seconds
```

7）插入记录 2：jie,course:math,86

hbase(main):006:0> put 'score','jie','course:math','86'

```
hbase(main):006:0> put 'score','jie','course:math','86'
Took 0.0082 seconds
```

```
hbase(main):006:0> put 'score','jie','course:math','86'
Took 0.0137 seconds
```

7）插入记录 3：jie,course:cloud,92

hbase(main):007:0> put 'score','jie','course:cloud','92'

```
hbase(main):007:0> put 'score','jie','course:cloud','92'
Took 0.0061 seconds
```

```
hbase(main):007:0> put 'score','jie','course:cloud','92'
Took 0.0100 seconds
```

8）插入记录 4：shi,grade:133soft

hbase(main):008:0> put 'score','shi','grade:','133soft'

```
hbase(main):008:0> put 'score','shi','grade:','133soft'
Took 0.0070 seconds
```

```
hbase(main):008:0> put 'score','shi','grade:','133soft'
Took 0.0056 seconds
```

9）插入记录 5：shi,grade:math,87

hbase(main):009:0> put 'score','shi','course:math','87'

```
hbase(main):009:0> put 'score','shi','course:math','87'
Took 0.0053 seconds
```

```
hbase(main):009:0> put 'score','shi','course:math','87'
Took 0.0044 seconds
```

10）插入记录 6：shi,grade:cloud,96

hbase(main):010:0> put 'score','shi','course:cloud','96'

```
hbase(main):010:0> put 'score','shi','course:cloud','96'
Took 0.0046 seconds
```

```
hbase(main):010:0> put 'score','shi','course:cloud','96'
Took 0.0063 seconds
```

11）读取 jie 的记录

hbase(main):011:0> get 'score','jie'

```
hbase(main):011:0> get 'score','jie'
COLUMN                CELL
 course:cloud         timestamp=1535506705781, value=92
 course:math          timestamp=1535506628209, value=86
 grade:               timestamp=1535506343954, value=146cloud
1 row(s)
Took 0.0533 seconds
```

```
hbase(main):011:0> get 'score','jie'
COLUMN                CELL
 course:cloud         timestamp=1666072450540, value=92
 course:math          timestamp=1666072421308, value=86
 grade:               timestamp=1666072385836, value=146cloud
1 row(s)
Took 0.0866 seconds
```

12）读取 jie 的班级

hbase(main):012:0> get 'score','jie','grade '

```
hbase(main):012:0> get 'score','jie','grade'
COLUMN                CELL
 grade:               timestamp=1535506343954, value=146cloud
1 row(s)
Took 0.0115 seconds
```

```
hbase(main):013:0> get 'score','jie','grade'
COLUMN                CELL
 grade:               timestamp=1666072385836, value=146cloud
1 row(s)
Took 0.0054 seconds
```

13）查看整个表记录

hbase(main):013:0> scan 'score'

```
hbase(main):013:0> scan 'score'
ROW                   COLUMN+CELL
 jie                  column=course:cloud, timestamp=1535506705781, value=92
 jie                  column=course:math, timestamp=1535506628209, value=86
 jie                  column=grade:, timestamp=1535506343954, value=146cloud
 shi                  column=course:cloud, timestamp=1535506863258, value=96
 shi                  column=course:math, timestamp=1535506816687, value=87
 shi                  column=grade:, timestamp=1535506755452, value=133soft
2 row(s)
Took 0.0146 seconds
```

```
hbase(main):014:0> scan 'score'
ROW                   COLUMN+CELL
 jie                  column=course:cloud, timestamp=1666072450540, value=92
 jie                  column=course:math, timestamp=1666072421308, value=86
 jie                  column=grade:, timestamp=1666072385836, value=146cloud
 shi                  column=course:cloud, timestamp=1666072529953, value=96
 shi                  column=course:math, timestamp=1666072502316, value=87
 shi                  column=grade:, timestamp=1666072478793, value=133soft
2 row(s)
Took 0.0605 seconds
```

14）按例查看表记录

hbase(main):014:0> scan 'score',{COLUMNS=>'course'}

```
hbase(main):014:0> scan 'score',{COLUMNS=>'course'}
ROW                   COLUMN+CELL
 jie                  column=course:cloud, timestamp=1535506705781, value=92
 jie                  column=course:math, timestamp=1535506628209, value=86
 shi                  column=course:cloud, timestamp=1535506863258, value=96
 shi                  column=course:math, timestamp=1535506816687, value=87
2 row(s)
Took 0.1156 seconds
hbase(main):015:0> scan 'score',{COLUMNS=>'course'}
ROW                   COLUMN+CELL
 jie                  column=course:cloud, timestamp=1666072450540, value=92
 jie                  column=course:math, timestamp=1666072421308, value=86
 shi                  column=course:cloud, timestamp=1666072529953, value=96
 shi                  column=course:math, timestamp=1666072502316, value=87
2 row(s)
Took 0.0127 seconds
```

3）查看数据库状态

hbase(main):002:0> status

```
hbase(main):002:0> status
1 active master, 0 backup masters, 2 servers, 0 dead, 1.5000 average load
Took 0.0960 seconds
```

```
hbase(main):016:0> status
1 active master, 0 backup masters, 3 servers, 0 dead, 1.0000 average load
Took 0.1164 seconds
```

4）查看数据库版本

hbase(main):003:0> version

```
hbase(main):003:0> version
2.1.0, re1673bb0bbfea21d6e5dba73e013b09b8b49b89b, Tue Jul 10 17:26:48 CST
2018
Took 0.0004 seconds
```

```
hbase(main):017:0> version
2.1.0, re1673bb0bbfea21d6e5dba73e013b09b8b49b89b, Tue Jul 10 17:26:48 CST 2018
Took 0.0002 seconds
```

5）查看表

hbase(main):004:0> list

```
hbase(main):004:0> list
TABLE
score
1 row(s)
Took 0.0370 seconds
=> ["score"]
```

```
hbase(main):018:0> list
TABLE
score
1 row(s)
Took 0.0182 seconds
=> ["score"]
```

5）插入记录 1：jie,grade: 143cloud

hbase(main):005:0> put 'score','jie','grade','146cloud'

```
hbase(main):005:0> put 'score','jie','grade','146cloud'
Took 0.1530 seconds
```

```
hbase(main):019:0> put 'score','jie','grade','146cloud'
Took 0.0047 seconds
```

6）插入记录 2：jie,course:math,86

hbase(main):006:0> put 'score','jie','course:math','86'

```
hbase(main):006:0> put 'score','jie','course:math','86'
Took 0.0082 seconds
```

```
hbase(main):020:0> put 'score','jie','course:math','86'
Took 0.0053 seconds
```

7）插入记录 3：jie,course:cloud,92

hbase(main):007:0> put 'score','jie','course:cloud','92'

```
hbase(main):007:0> put 'score','jie','course:cloud','92'
Took 0.0061 seconds
```

```
hbase(main):021:0> put 'score','jie','course:cloud','92'
Took 0.0073 seconds
```

8）插入记录 4：shi,grade:133soft

hbase(main):008:0> put 'score','shi','grade:','133soft'

```
hbase(main):008:0> put 'score','shi','grade:','133soft'
Took 0.0070 seconds
```

```
hbase(main):022:0> put 'score','shi','grade:','133soft'
Took 0.0055 seconds
```

9）插入记录 5：shi,grade:math,87

hbase(main):009:0> put 'score','shi','course:math','87'

```
hbase(main):009:0> put 'score','shi','course:math','87'
Took 0.0053 seconds
```

```
hbase(main):023:0> put 'score','shi','course:math','87'
Took 0.0049 seconds
```

10）插入记录 6：shi,grade:cloud,96

hbase(main):010:0> put 'score','shi','course:cloud','96'

```
hbase(main):010:0> put 'score','shi','course:cloud','96'
Took 0.0046 seconds
```

```
hbase(main):024:0> put 'score','shi','course:cloud','96'
Took 0.0062 seconds
```

11）读取 jie 的记录

hbase(main):011:0> get 'score','jie'

```
hbase(main):011:0> get 'score','jie'
COLUMN                CELL
 course:cloud         timestamp=1535506705781, value=92
 course:math          timestamp=1535506628209, value=86
 grade:               timestamp=1535506343954, value=146cloud
1 row(s)
Took 0.0533 seconds
```

```
hbase(main):025:0> get 'score','jie'
COLUMN                CELL
 course:cloud         timestamp=1666072988013, value=92
 course:math          timestamp=1666072961919, value=86
 grade:               timestamp=1666072865174, value=146cloud
1 row(s)
Took 0.0123 seconds
```

12）读取 jie 的班级

hbase(main):012:0> get 'score','jie','grade '

```
hbase(main):012:0> get 'score','jie','grade'
COLUMN                CELL
 grade:               timestamp=1535506343954, value=146cloud
1 row(s)
Took 0.0115 seconds
```

```
hbase(main):025:0> get 'score','jie'
COLUMN                  CELL
 course:cloud           timestamp=1666072988013, value=92
 course:math            timestamp=1666072961919, value=86
 grade:                 timestamp=1666072865174, value=146cloud
1 row(s)
Took 0.0123 seconds
```

13）查看整个表记录

hbase(main):013:0> scan 'score'

```
hbase(main):013:0> scan 'score'
ROW                     COLUMN+CELL
 jie                    column=course:cloud, timestamp=1535506705781, value=92
 jie                    column=course:math, timestamp=1535506628209, value=86
 jie                    column=grade:, timestamp=1535506343954, value=146cloud
 shi                    column=course:cloud, timestamp=1535506863258, value=96
 shi                    column=course:math, timestamp=1535506816687, value=87
 shi                    column=grade:, timestamp=1535506755452, value=133soft
2 row(s)
Took 0.0146 seconds
```

```
hbase(main):028:0> scan 'score'
ROW                     COLUMN+CELL
 jie                    column=course:cloud, timestamp=1666072988013, value=92
 jie                    column=course:math, timestamp=1666072961919, value=86
 jie                    column=grade:, timestamp=1666072865174, value=146cloud
 shi                    column=course:cloud, timestamp=1666073065039, value=96
 shi                    column=course:math, timestamp=1666073038312, value=87
 shi                    column=grade:, timestamp=1666073014797, value=133soft
2 row(s)
Took 0.0148 seconds
```

14）按例查看表记录

hbase(main):014:0> scan 'score',{COLUMNS=>'course'}

```
hbase(main):014:0> scan 'score',{COLUMNS=>'course'}
ROW                     COLUMN+CELL
 jie                    column=course:cloud, timestamp=1535506705781, value=92
 jie                    column=course:math, timestamp=1535506628209, value=86
 shi                    column=course:cloud, timestamp=1535506863258, value=96
 shi                    column=course:math, timestamp=1535506816687, value=87
2 row(s)
Took 0.1156 seconds
```

```
hbase(main):029:0> scan 'score',{COLUMNS=>'course'}
ROW                     COLUMN+CELL
 jie                    column=course:cloud, timestamp=1666072988013, value=92
 jie                    column=course:math, timestamp=1666072961919, value=86
 shi                    column=course:cloud, timestamp=1666073065039, value=96
 shi                    column=course:math, timestamp=1666073038312, value=87
2 row(s)
Took 0.0059 seconds
```

15）删除指定记录

hbase(main):015:0>delete 'score','shi','grade'

```
hbase(main):015:0> delete 'score','shi','grade'
Took 0.0422 seconds
```

```
hbase(main):030:0> delete 'score','shi','grade'
Took 0.1232 seconds
```

16）删除后，执行 scan 命令

hbase(main):016:0> scan 'score'

```
hbase(main):016:0> scan 'score'
ROW                   COLUMN+CELL
 jie                  column=course:cloud, timestamp=1535506705781, value=92
 jie                  column=course:math, timestamp=1535506628209, value=86
 jie                  column=grade:, timestamp=1535506343954, value=146cloud
 shi                  column=course:cloud, timestamp=1535506863258, value=96
 shi                  column=course:math, timestamp=1535506816687, value=87
2 row(s)
Took 0.0077 seconds
```

```
hbase(main):031:0> scan 'score'
ROW                   COLUMN+CELL
 jie                  column=course:cloud, timestamp=1666072988013, value=92
 jie                  column=course:math, timestamp=1666072961919, value=86
 jie                  column=grade:, timestamp=1666072865174, value=146cloud
 shi                  column=course:cloud, timestamp=1666073065039, value=96
 shi                  column=course:math, timestamp=1666073038312, value=87
 shi                  column=grade:, timestamp=1666072478793, value=133soft
2 row(s)
Took 0.0095 seconds
```

17）增加新的列簇

hbase(main):017:0> alter 'score',NAME=>'age'

```
hbase(main):017:0> alter 'score',NAME=>'age'
Updating all regions with the new schema...
1/1 regions updated.
Done.
Took 1.9544 seconds
```

```
hbase(main):032:0> alter 'score',NAME=>'age'
Updating all regions with the new schema...
1/1 regions updated.
Done.
Took 3.1826 seconds
```

18）查看表结构

hbase(main):018:0> describe 'score'

```
hbase(main):018:0> describe 'score'
Table score is ENABLED
score
COLUMN FAMILIES DESCRIPTION
{NAME => 'age', VERSIONS => '1', EVICT_BLOCKS_ON_CLOSE => 'false', NEW_VER
SION_BEHAVIOR => 'false', KEEP_DELETED_CELLS => 'FALSE', CACHE_DATA_ON_WRI
TE => 'false', DATA_BLOCK_ENCODING => 'NONE', TTL => 'FOREVER', MIN_VERSIO
NS => '0', REPLICATION_SCOPE => '0', BLOOMFILTER => 'ROW', CACHE_INDEX_ON_
WRITE => 'false', IN_MEMORY => 'false', CACHE_BLOOMS_ON_WRITE => 'false',
PREFETCH_BLOCKS_ON_OPEN => 'false', COMPRESSION => 'NONE', BLOCKCACHE => '
true', BLOCKSIZE => '65536'}
{NAME => 'course', VERSIONS => '1', EVICT_BLOCKS_ON_CLOSE => 'false', NEW_
VERSION_BEHAVIOR => 'false', KEEP_DELETED_CELLS => 'FALSE', CACHE_DATA_ON_
WRITE => 'false', DATA_BLOCK_ENCODING => 'NONE', TTL => 'FOREVER', MIN_VER
SIONS => '0', REPLICATION_SCOPE => '0', BLOOMFILTER => 'ROW', CACHE_INDEX_
ON_WRITE => 'false', IN_MEMORY => 'false', CACHE_BLOOMS_ON_WRITE => 'false
', PREFETCH_BLOCKS_ON_OPEN => 'false', COMPRESSION => 'NONE', BLOCKCACHE =
> 'true', BLOCKSIZE => '65536'}
{NAME => 'grade', VERSIONS => '1', EVICT_BLOCKS_ON_CLOSE => 'false', NEW_V
ERSION_BEHAVIOR => 'false', KEEP_DELETED_CELLS => 'FALSE', CACHE_DATA_ON_W
RITE => 'false', DATA_BLOCK_ENCODING => 'NONE', TTL => 'FOREVER', MIN_VERS
IONS => '0', REPLICATION_SCOPE => '0', BLOOMFILTER => 'ROW', CACHE_INDEX_O
N_WRITE => 'false', IN_MEMORY => 'false', CACHE_BLOOMS_ON_WRITE => 'false'
, PREFETCH_BLOCKS_ON_OPEN => 'false', COMPRESSION => 'NONE', BLOCKCACHE =>
 'true', BLOCKSIZE => '65536'}
3 row(s)
Took 0.0254 seconds
```

```
hbase(main):033:0> describe 'score'
Table score is ENABLED
score
COLUMN FAMILIES DESCRIPTION
{NAME => 'age', VERSIONS => '1', EVICT_BLOCKS_ON_CLOSE => 'false', NEW_VERSION_BEHAVIOR
 => 'false', KEEP_DELETED_CELLS => 'FALSE', CACHE_DATA_ON_WRITE => 'false', DATA_BLOCK_
ENCODING => 'NONE', TTL => 'FOREVER', MIN_VERSIONS => '0', REPLICATION_SCOPE => '0', BL
OOMFILTER => 'ROW', CACHE_INDEX_ON_WRITE => 'false', IN_MEMORY => 'false', CACHE_BLOOMS
_ON_WRITE => 'false', PREFETCH_BLOCKS_ON_OPEN => 'false', COMPRESSION => 'NONE', BLOCKC
ACHE => 'true', BLOCKSIZE => '65536'}
{NAME => 'course', VERSIONS => '1', EVICT_BLOCKS_ON_CLOSE => 'false', NEW_VERSION_BEHAV
IOR => 'false', KEEP_DELETED_CELLS => 'FALSE', CACHE_DATA_ON_WRITE => 'false', DATA_BLO
CK_ENCODING => 'NONE', TTL => 'FOREVER', MIN_VERSIONS => '0', REPLICATION_SCOPE => '0',
 BLOOMFILTER => 'ROW', CACHE_INDEX_ON_WRITE => 'false', IN_MEMORY => 'false', CACHE_BLO
OMS_ON_WRITE => 'false', PREFETCH_BLOCKS_ON_OPEN => 'false', COMPRESSION => 'NONE', BLO
CKCACHE => 'true', BLOCKSIZE => '65536'}
{NAME => 'grade', VERSIONS => '1', EVICT_BLOCKS_ON_CLOSE => 'false', NEW_VERSION_BEHAVI
OR => 'false', KEEP_DELETED_CELLS => 'FALSE', CACHE_DATA_ON_WRITE => 'false', DATA_BLOC
K_ENCODING => 'NONE', TTL => 'FOREVER', MIN_VERSIONS => '0', REPLICATION_SCOPE => '0',
BLOOMFILTER => 'ROW', CACHE_INDEX_ON_WRITE => 'false', IN_MEMORY => 'false', CACHE_BLOO
MS_ON_WRITE => 'false', PREFETCH_BLOCKS_ON_OPEN => 'false', COMPRESSION => 'NONE', BLOC
KCACHE => 'true', BLOCKSIZE => '65536'}
3 row(s)
Took 0.0359 seconds
hbase(main):034:0>
```

19）删除列簇

hbase(main):019:0> alter 'score',NAME=>'age',METHOD=>'delete'

```
hbase(main):019:0> alter 'score',NAME=>'age',METHOD=>'delete'
Updating all regions with the new schema...
All regions updated.
Done.
Took 1.7209 seconds
```

```
hbase(main):034:0> alter 'score',NAME=>'age',METHOD=>'delete'
Updating all regions with the new schema...
1/1 regions updated.
Done.
Took 2.3251 seconds
```

20）删除表

hbase(main):020:0> disable 'score'

```
hbase(main):020:0> disable 'score'
Took 0.4465 seconds
```

```
hbase(main):035:0> disable 'score'
Took 0.6818 seconds
```

hbase(main):021:0> drop 'score'

```
hbase(main):021:0> drop 'score'
Took 0.4445 seconds
```

22）退出

hbase(main):022:0> quit

```
hbase(main):022:0> quit
[root@master ~]#
```

```
hbase(main):001:0> quit
[hadoop@master ~]$
```

实验总结

理解 Zookeeper 工作原理。
通过实验掌握 Zookeeper 集群模式安装过程。
通过实验掌握 Zookeeper shell 命令的使用。
通过实验掌握基本的 Zookeeper 中的 JAVA API 编程方法。
通过实验掌握了分布式数据库 hbase 的安装与部署
在实验过程中，由于前几次的实验经验总结，实验的错误和速度都大大上升