

Hadoop Multi Nodes Cluster Setup

底下步驟將建立一個 Hadoop Multi Nodes Cluster，包含三個 VM

伺服器名稱	類別	HDFS	YARN
HadoopMaster	Master	NameNode	ResourceManager
HadoopSlave1	Node	DataNode	NodeManager
HadoopSlave2	Node	DataNode	NodeManager

1. 複製 single node cluster 到 hadoopslave1

- 若下為使用VMWare 個人版的做法，若為專業版可以非常簡單的複製已存在的VM
- 先於 VM 儲存資料夾中建立要放置三個VM檔案的資料夾

名稱	修改日期	類型	大小
HadoopMaster	2016/12/8 下午 0...	檔案資料夾	
HadoopServer	2016/12/8 下午 0...	檔案資料夾	
HadoopServer_20161112	2016/11/13 上午 ...	檔案資料夾	
HadoopSlave1	2016/12/8 下午 0...	檔案資料夾	
HadoopSlave2	2016/12/8 下午 0...	檔案資料夾	

- 將之前建好的single node cluster VM資料夾中的檔案複製到 HadoopSlave1中

OneDrive > 文件 > Virtual Machines > HadoopSlave1 >			
名稱	修改日期	類型	大小
HadoopServer.vmx.lck	2016/12/3 下午 0...	檔案資料夾	
HadoopServer.nvram	2016/12/3 下午 0...	NVRAM 檔案	9 KB
HadoopServer	2016/12/3 下午 0...	VMware virtual d...	1 KB
HadoopServer.vmsd	2016/12/2 下午 0...	VMSD 檔案	0 KB
HadoopServer	2016/12/3 下午 0...	VMware virtual ...	4 KB
HadoopServer.vmx	2016/12/2 下午 0...	VMXF 檔案	1 KB
HadoopServer-s001	2016/12/3 下午 0...	VMware virtual d...	3,164,544...
HadoopServer-s002	2016/12/3 下午 0...	VMware virtual d...	931,584 KB
HadoopServer-s003	2016/12/3 下午 0...	VMware virtual d...	559,808 KB
HadoopServer-s004	2016/12/3 下午 0...	VMware virtual d...	443,584 KB
HadoopServer-s005	2016/12/3 下午 0...	VMware virtual d...	183,104 KB
HadoopServer-s006	2016/12/3 下午 0...	VMware virtual d...	64 KB
vmware			277 KB
vmware-0			276 KB
vmware-1			358 KB

7-Zip

CRC SHA

Edit with Notepad++

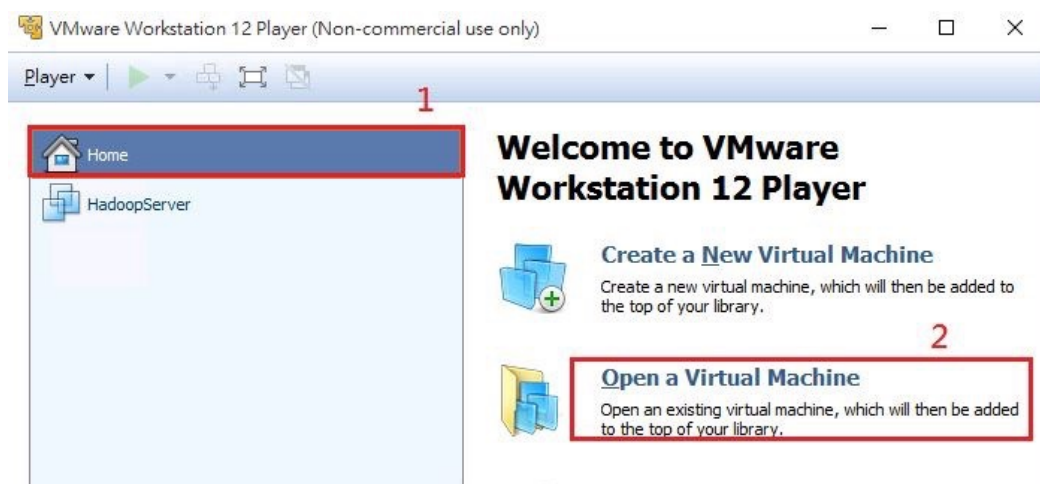
共用對象(H)

傳送到(N)

剪下(T)

複製(C)

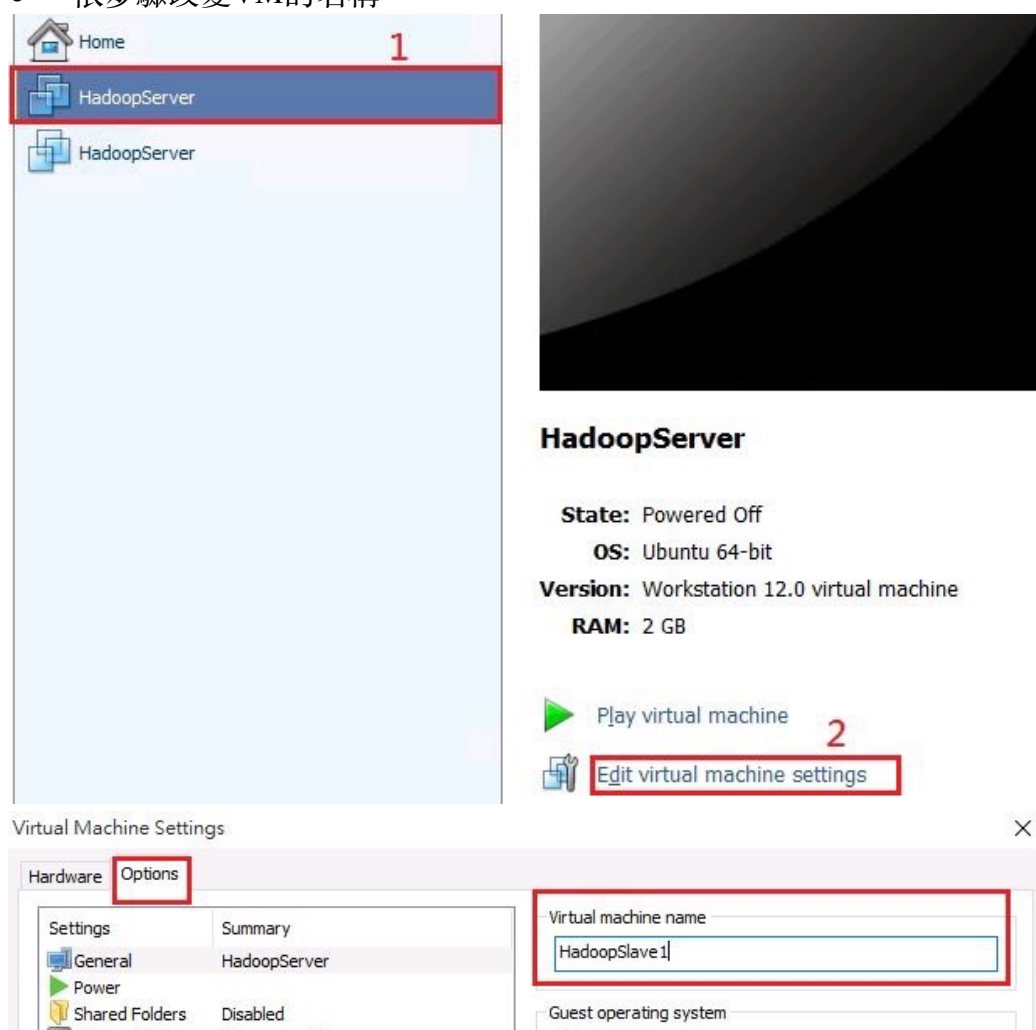
- 到VM介面，選擇 [Home]→[Open a Virtual Machine]



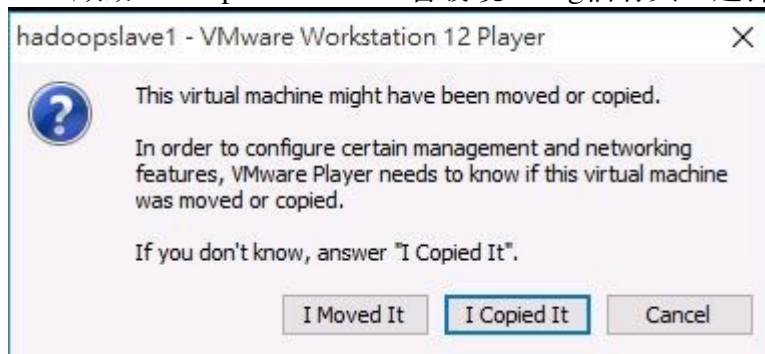
- 到HadoopSlave1資料夾選擇configuration檔



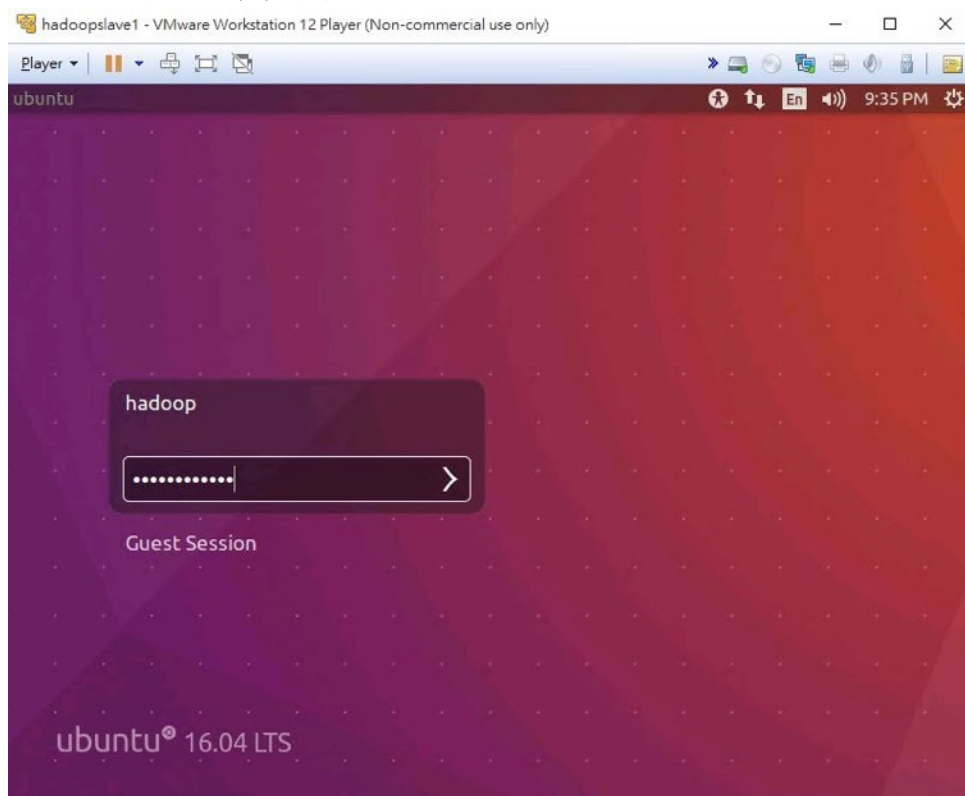
- 依步驟改變VM的名稱



- 啟動HadoopSlave1，VM會發現config檔有異，選擇 **I Copied It**

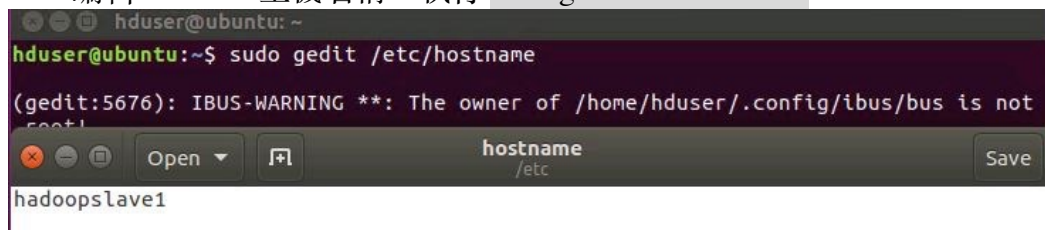


- 即可順利複製完成



2. 設定HadoopSlave1

- 啟動HadoopSlave1 虛擬機
- 編輯hostname主機名稱，執行 `sudo gedit /etc/hostname`



- 編輯core-site.xml，執行 `sudo gedit /usr/local/hadoop/etc/hadoop/core-site.xml`，指定NameNode位置，將原本設定 localhost 處改為 hadoopmaster

```
hduser@ubuntu: ~  
hduser@ubuntu:~$ sudo gedit /usr/local/hadoop/etc/hadoop/core-site.xml  
*core-site.xml  
/usr/local/hadoop/etc/hadoop  
Save  
<!-- Put site-specific property overrides in this file. -->  
<configuration>  
  <property>  
    <name>fs.default.name</name>  
    <value>hdfs://hadoopmaster:9000</value>  
  </property>  
</configuration>
```

- 編輯 yarn-site.xml，執行 `sudo gedit /usr/local/hadoop/etc/hadoop/yarn-site.xml`，設定 ResourceManager 的屬性，輸入以下指令

```
<property>  
  <name>yarn.resourcemanager.resource-tracker.address</name>  
  <value>hadoopmaster:8025</value>  
</property>  
<property>  
  <name>yarn.resourcemanager.scheduler.address</name>  
  <value>hadoopmaster:8030</value>  
</property>  
<property>  
  <name>yarn.resourcemanager.address</name>  
  <value>hadoopmaster:8050</value>  
</property>  
</configuration>
```

- 編輯 mapred-site.xml，執行 `sudo gedit /usr/local/hadoop/etc/hadoop/mapred-site.xml`，設定監控 MapReduce 的 JobTracker 工作分配狀況，將原本設定 localhost 處改為 hadoopmaster


```
hduser@ubuntu: ~  
hduser@ubuntu:~$ sudo gedit /usr/local/hadoop/etc/hadoop/mapred-site.xml
```

```
<!-- Put site-specific property overrides in this file. -->  
<configuration>  
  <property>  
    <name>mapred.job.tracker</name>  
    <value>hadoopmaster:54311</value>  
  </property>  
</configuration>
```

- 編輯hdfs-site.xml，執行 `sudo gedit /usr/local/hadoop/etc/hadoop/hdfs-site.xml`，設定 HDFS 分散式檔案組態

```
hduser@ubuntu:~$ sudo gedit /usr/local/hadoop/etc/hadoop/hdfs-site.xml
```

```
<!-- Put site-specific property overrides in this file. -->  
<configuration>  
  <property>  
    <name>dfs.replication</name>  
    <value>2</value>  
  </property>  
  <property>  
    <name>dfs.datanode.data.dir</name>  
    <value>file:/usr/local/hadoop/hadoop_data/hdfs/datanode</value>  
  </property>  
</configuration>
```

- 將 HadoopSlave1 關機

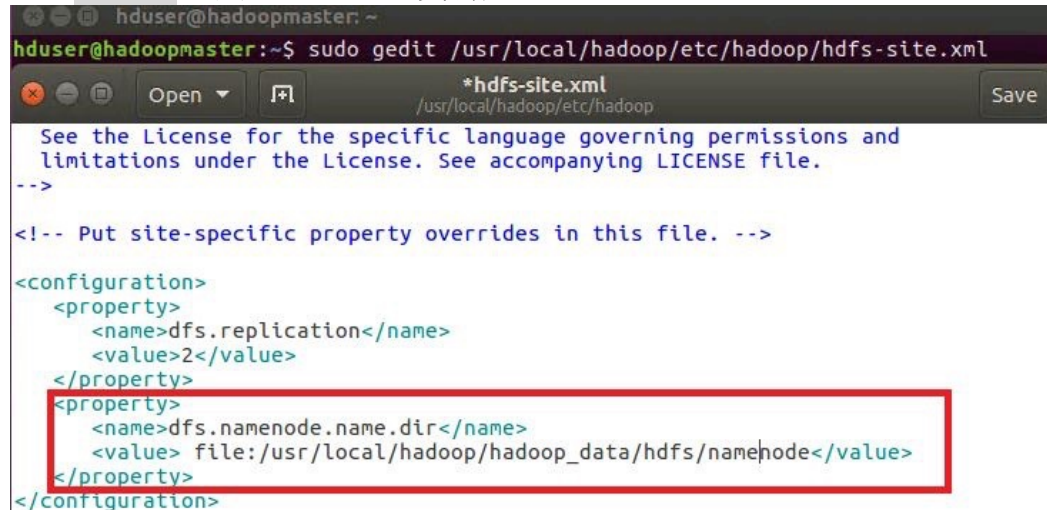


1. 複製HadoopSlave1的虛擬機設定檔，來產生HadoopMaster、HadoopSlave2等兩台虛擬機，修改 /etc/hostname 內的伺服器名稱分別為hadoopmaster和

hadoopslave2，設定完之後，虛擬機需重開。

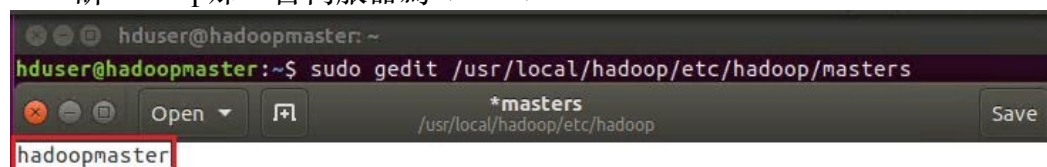
2. 設定HadoopMaster伺服器

- 編輯hostname主機名稱，執行 `sudo gedit /etc/hostname`，檔案內填入 **hadoopmaster**
- 重開機HadoopMaster
- 編輯 hdfs-site.xml，執行 `sudo gedit /usr/local/hadoop/etc/hadoop/hdfs-site.xml`，設定NameNode資料夾



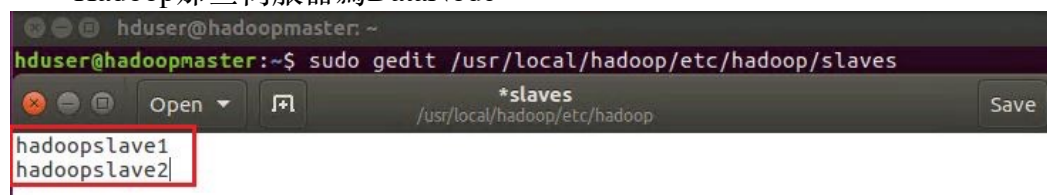
```
hduser@hadoopmaster: ~  
hduser@hadoopmaster:~$ sudo gedit /usr/local/hadoop/etc/hadoop/hdfs-site.xml  
*hdfs-site.xml  
/usr/local/hadoop/etc/hadoop  
See the License for the specific language governing permissions and  
limitations under the License. See accompanying LICENSE file.  
-->  
<!-- Put site-specific property overrides in this file. -->  
<configuration>  
  <property>  
    <name>dfs.replication</name>  
    <value>2</value>  
  </property>  
  <property>  
    <name>dfs.namenode.name.dir</name>  
    <value> file:/usr/local/hadoop/hadoop_data/hdfs/namehnode</value>  
  </property>  
</configuration>
```

- 編輯 masters，執行 `sudo gedit /usr/local/hadoop/etc/hadoop/masters`，告訴Hadoop那一台伺服器為NameNode



```
hduser@hadoopmaster: ~  
hduser@hadoopmaster:~$ sudo gedit /usr/local/hadoop/etc/hadoop/masters  
*masters  
/usr/local/hadoop/etc/hadoop  
hadoopmaster
```

- 編輯 slaves，執行 `sudo gedit /usr/local/hadoop/etc/hadoop/slaves`，告訴Hadoop那些伺服器為DataNode



```
hduser@hadoopmaster: ~  
hduser@hadoopmaster:~$ sudo gedit /usr/local/hadoop/etc/hadoop/slaves  
*slaves  
/usr/local/hadoop/etc/hadoop  
hadoopslave1  
hadoopslave2
```

3. 設定各節點主機名稱和相應的IP位址

- 啟動三台虛擬機



- 分別至各虛擬機中，執行ifconfig，取得伺服器IP

```
hduser@hadoopmaster: ~$ ifconfig
ens33: Link encap:Ethernet HWaddr 00:0c:29:3f:1b:32
       inet addr:192.168.59.137 Bcast:192.168.59.255 Mask:255.255.255.0
       inet6 addr: fe80::f0da:c69d:8c33:159f/64 Scope:Link
       UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
       RX packets:170 errors:0 dropped:0 overruns:0 frame:0
       TX packets:82 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:1000
       RX bytes:21763 (21.7 KB) TX bytes:8925 (8.9 KB)
```

- 至各虛擬機中，編輯/etc/hosts，執行sudo gedit /etc/hosts，將節點主稱和IP位址填入

```
hduser@hadoopmaster: ~$ sudo gedit /etc/hosts
*hosts
/etc
Save

127.0.0.1    localhost
127.0.1.1    ubuntu
192.168.59.137 hadoopmaster
192.168.59.134 hadoopslave1
192.168.59.135 hadoopslave2

# 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
```

4. Master連線至slave1、slave2建立HDFS目錄

- 切換至HadoopMaster伺服器
- 由HadoopMaster經過SSH連至HadoopSlave1，執行 ssh hadoopslave1，注意連線成功後會如圖紅線標示


```
hduser@hadoopslave1: ~
hduser@hadoopmaster:~$ ssh hadoopslave1
The authenticity of host 'hadoopslave1 (192.168.59.134)' can't be established.
ECDSA key fingerprint is SHA256:l5HfVz2GKon2xpmavQSLRqfvPdxuogiqaf/Xjx5XV3E.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'hadoopslave1,192.168.59.134' (ECDSA) to the list of
known hosts.
hduser@hadoopslave1's password:
Welcome to Ubuntu 16.04.1 LTS (GNU/Linux 4.4.0-31-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

282 packages can be updated.
115 updates are security updates.

hduser@hadoopslave1:~$
```

- 執行
 - i. 移除hdfs目錄，`sudo rm -rf /usr/local/hadoop/hadoop_data/hdfs`
 - ii. 建立DataNode儲存目錄，`mkdir -p /usr/local/hadoop/hadoop_data/hdfs/datanode`
 - iii. 修改目錄擁有者，`sudo chown -R hduser:hduser /usr/local/hadoop/`
 - iv. 中斷連線

```
hduser@hadoopmaster: ~
hduser@hadoopslave1:~$ sudo rm -rf /usr/local/hadoop/hadoop_data/hdfs
[sudo] password for hduser:
hduser@hadoopslave1:~$ sudo mkdir -p /usr/local/hadoop/hadoop_data/hdfs/datanode
hduser@hadoopslave1:~$ sudo chown hduser:hduser -R /usr/local/hadoop
hduser@hadoopslave1:~$ exit
logout
Connection to hadoopslave1 closed.
hduser@hadoopmaster:~$
```

- 重複上述步驟，設定hadoopslave2
- 建立NameNode HDFS目錄
 - v. 首先刪除HDFS目錄，執行 `sudo rm -rf /usr/local/hadoop/hadoop_data/hdfs`
 - vi. 建立NameNode目錄，執行 `mkdir -p /usr/local/hadoop/hadoop_data/hdfs/namenode`
 - vii. 修改目錄擁有者，`sudo chown -R hduser:hduser /usr/local/hadoop/`

```
hduser@hadoopmaster: ~
hduser@hadoopmaster:~$ sudo rm -rf /usr/local/hadoop/hadoop_data/hdfs
hduser@hadoopmaster:~$ mkdir -p /usr/local/hadoop/hadoop_data/hdfs/namenode
hduser@hadoopmaster:~$ sudo chown -R hduser:hduser /usr/local/hadoop
hduser@hadoopmaster:~$
```

- 格式化HDFS目錄，執行`hadoop namenode -format`


```

hduser@hadoopmaster: ~
hduser@hadoopmaster:~$ hadoop namenode -format
DEPRECATED: Use of this script to execute hdfs command is deprecated.
Instead use the hdfs command for it.

16/11/27 20:10:13 INFO namenode.NameNode: STARTUP_MSG:
/*****
STARTUP_MSG: Starting NameNode
STARTUP_MSG:   host = hadoopmaster/192.168.59.132
STARTUP_MSG:   args = [-format]
STARTUP_MSG:   version = 2.7.3
STARTUP_MSG:   classpath = /home/hduser/hadoop-2.7.3/etc/hadoop:/home/hduser/had
oop-2.7.3/share/hadoop/common/lib/asm-3.2.jar:/home/hduser/hadoop-2.7.3/share/ha
dooop/common/lib/jsp-api-2.1.jar:/home/hduser/hadoop-2.7.3/share/hadoop/common/li
b/gson-2.2.4.jar:/home/hduser/hadoop-2.7.3/share/hadoop/common/lib/jetty-6.1.26.
jar:/home/hduser/hadoop-2.7.3/share/hadoop/common/lib/jersey-server-1.9.jar:/hom
e/hduser/hadoop-2.7.3/share/hadoop/common/lib/activation-1.1.jar:/home/hduser/ha
dooop-2.7.3/share/hadoop/common/lib/commons-io-2.4.jar:/home/hduser/hadoop-2.7.3/
share/hadoop/common/lib/api-util-1.0.0-M20.jar:/home/hduser/hadoop-2.7.3/share/h
adooop/common/lib/commons-logging-1.1.3.jar:/home/hduser/hadoop-2.7.3/share/hadoo
p/common/lib/hadoop-annotations-2.7.3.jar:/home/hduser/hadoop-2.7.3/share/hadoo

```

5. 啟動Hadoop Multi Nodes Cluster

- 切換至HadoopMaster
- 執行 start-all.sh

```

hduser@hadoopmaster: ~
hduser@hadoopmaster:~$ start-all.sh
This script is Deprecated. Instead use start-dfs.sh and start-yarn.sh
Starting namenodes on [hadoopmaster]
The authenticity of host 'hadoopmaster (192.168.59.137)' can't be established.
ECDSA key fingerprint is SHA256:l5HfVz2GKon2xpmavQSLRqfvPdxuogiqaf/Xjx5XV3E.
Are you sure you want to continue connecting (yes/no)? yes
hadoopmaster: Warning: Permanently added 'hadoopmaster,192.168.59.137' (ECDSA) t
o the list of known hosts.
hadoopmaster: starting namenode, logging to /usr/local/hadoop/logs/hadoop-hduser
-namenode-hadoopmaster.out
hadoopslave2: starting datanode, logging to /usr/local/hadoop/logs/hadoop-hduser
-datanode-hadoopslave2.out
hadoopslave1: starting datanode, logging to /usr/local/hadoop/logs/hadoop-hduser
-datanode-hadoopslave1.out

starting yarn daemons
starting resourcemanager, logging to /usr/local/hadoop/logs/yarn-hduser-resource
manager-hadoopmaster.out
hadoopslave1: starting nodemanager, logging to /usr/local/hadoop/logs/yarn-hduse
r-nodemanager-hadoopslave1.out
hadoopslave2: starting nodemanager, logging to /usr/local/hadoop/logs/yarn-hduse
r-nodemanager-hadoopslave2.out

```

- 查看 HadoopMaster所執行的行程，輸入 jps

```

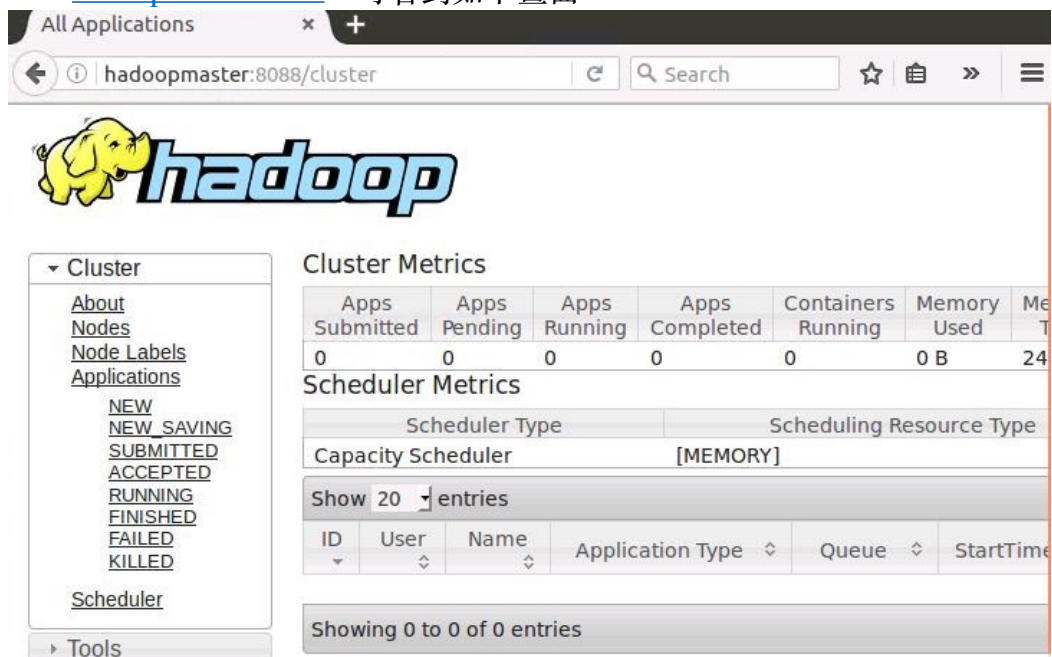
hduser@hadoopmaster: ~
hduser@hadoopmaster:~$ jps
33605 ResourceManager
33240 NameNode
33883 Jps
33454 SecondaryNameNode
hduser@hadoopmaster:~$

```

- 查看HadoopSlave1、HadoopSlave2的行程，輸入 jps

```
hduser@hadoopmaster: ~  
hduser@hadoopmaster:~$ ssh hadoopslave1  
Welcome to Ubuntu 16.04.1 LTS (GNU/Linux 4.4.0-31-generic x86_64)  
  
* Documentation:  https://help.ubuntu.com  
* Management:    https://landscape.canonical.com  
* Support:       https://ubuntu.com/advantage  
  
276 packages can be updated.  
109 updates are security updates.  
  
Last login: Sun Nov 27 19:52:55 2016 from 192.168.59.132  
hduser@hadoopslave1:~$ jps  
6273 Jps  
6106 NodeManager  
5980 DataNode  
hduser@hadoopslave1:~$ exit  
logout  
Connection to hadoopslave1 closed.  
hduser@hadoopmaster:~$
```

- 開啟Hadoop ResourceManager Web介面，開啟瀏覽器，輸入<http://hadoopmaster:8088>，可看到如下畫面



- 查看已執行的節點，於瀏覽器→Nodes，可看到目前有三個節點

Nodes of the cluster

hadoopmaster:8088/cluster/nodes

Cluster Metrics

Apps Submitted	Apps Pending	Apps Running	Apps Completed	Containers Running	Memory Used	Memory Total
0	0	0	0	0	0 B	16 GB

Scheduler Metrics

Scheduler Type: Capacity Scheduler

Scheduling Resource Type: [MEMORY]

Show 20 entries

Node Labels	Rack	Node State	Node Address	Node HTTP Address
/default-rack	default-rack	RUNNING	hadoopslave2:45107	hadoopslave2:45107
/default-rack	default-rack	RUNNING	hadoopslave1:37314	hadoopslave1:37314

- 開啟NameNode HDFS Web介面，於瀏覽器，輸入<http://hadoopmaster:50070>

Namenode information

hadoopmaster:50070/dfshealth.html#tab-o

DFS Remaining:	23.99 GB (68.18%)
Block Pool Used:	48 KB (0%)
DataNodes usages% (Min/Median/Max/stdDev):	0.00% / 0.00% / 0.00% / 0.00%
Live Nodes	2 (Decommissioned: 0)
Dead Nodes	0 (Decommissioned: 0)
Decommissioning Nodes	0

- 查看DataNodes

Datanode Information

In operation

Node	Last contact	Admin State	Capacity	Used	Non DFS Used	Remaining	Blocks	Block pool used	Failed Volume
hadoopslave2:50010 (192.168.59.135:50010)	1	In Service	17.59 GB	24 KB	5.6 GB	11.99 GB	0	24 KB (0%)	0
hadoopslave1:50010 (192.168.59.134:50010)	1	In Service	17.59 GB	24 KB	5.6 GB	11.99 GB	0	24 KB (0%)	0

6. 欲結束Hadoop，執行`stop-all.sh`