Hadoop

Reference: http://codingxiaxw.cn/2016/12/06/59-mac-hadoop/

1.安裝Homebrew与Cask (Cask有點問題，要用 $ brew install brew-cask-completion)

https://www.jianshu.com/p/7d055bebab46

2. 安裝JAVA (/usr/libexec/java_home -V 或是 java -version)

https://blog.csdn.net/vvv_110/article/details/72897142

記得設置環境變數

echo $JAVA_HOME 去檢查

/Library/Java/JavaVirtualMachines/jdk-10.0.1.jdk/Contents/Home

用 $vim ~/.bash_profile 去設置環境變數，然後用 $source .bash_profile 去生效

3. 配置ssh

```
$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/Users/alumi5566/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /Users/alumi5566/.ssh/id_rsa.
Your public key has been saved in /Users/alumi5566/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:f3G/tp2TyvIR+VAAovP+8PYSYi738KVIhfBjKMZXN9o
alumi5566@ucrwpa-1-7-10-25-26-210.wnet.ucr.edu
The key's randomart image is:
+---[RSA 2048]----+
|        . ...    |
|        . .   .  |
|        + . o   .|
|        .   B = . o |
|        + oSB E.+.  |
|        . o o+o. o+.|
|        o=o oo .o|
|        ..oB=+ .++|
|        o.o*==o++|
+----[SHA256]-----+
```

安裝成功的話

```
$ ssh localhost
Enter passphrase for key '/Users/alumi5566/.ssh/id_rsa':
Last login: Mon Jun  4 13:01:03 2018 from ::1
```

4. 安裝Hadoop

$ brew install hadoop

Hadoop安裝在 /usr/local/Cellar/hadoop/3.1.0/ 之下 (版本號可能不同)

(a) 打開 /usr/local/Cellar/hadoop/3.1.0/libexec/etc/hadoop/hadoop-env.sh，把export HADOOP_OPTS="-Djava.net.preferIPv4Stack=true"

修改成

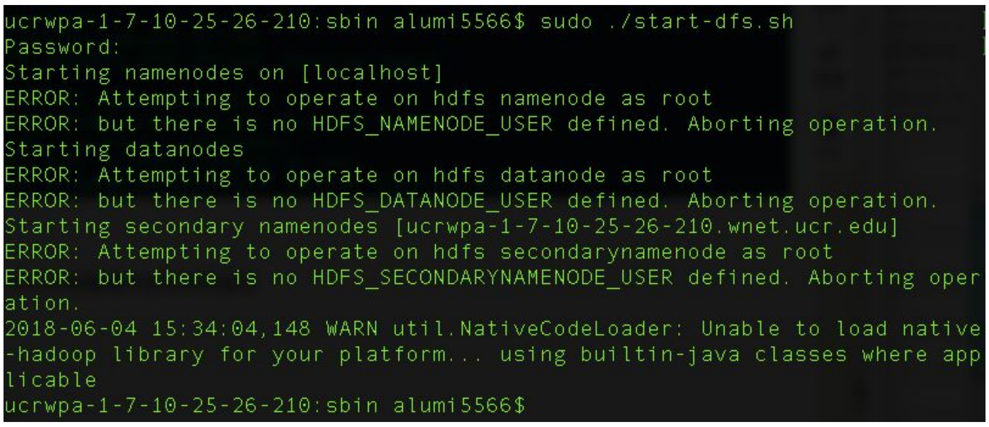
```
export HADOOP_OPTS="$HADOOP_OPTS -Djava.net.preferIPv4Stack=true
-Djava.security.krb5.realm= -Djava.security.krb5.kdc="
export JAVA_HOME="/Library/Java/JavaVirtualMachines/jdk-10.0.1.jdk/Contents/Home"
```

(b) 打開 /usr/local/Cellar/hadoop/3.1.0/libexec/etc/hadoop/core-site.xml

在<configuration>中間加入：

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

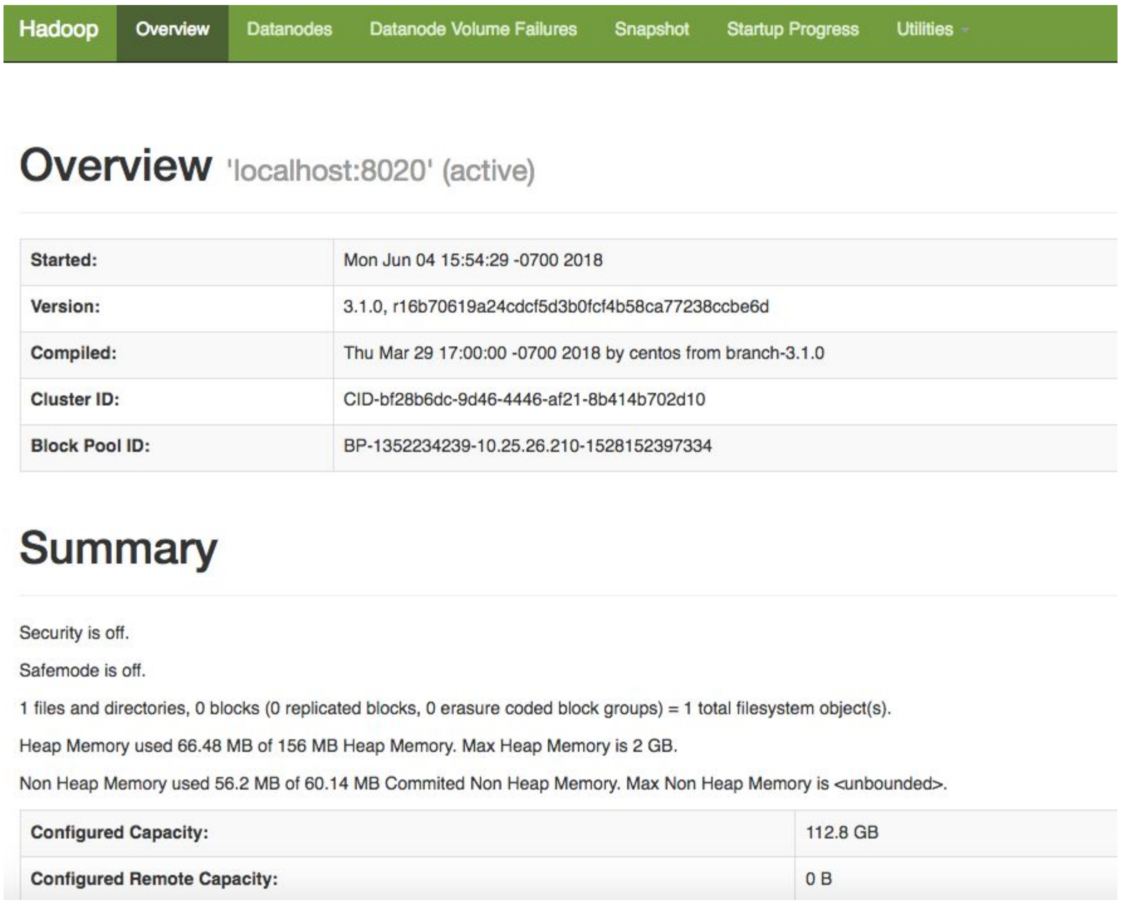
```
    <value>/usr/local/Cellar/hadoop/hdfs/tmp</value>
    <description>A base for other temporary directories.</description>
</property>
<property>
    <name>fs.default.name</name>
    <value>hdfs://localhost:8020</value>
</property>
```
(c) 打開 /usr/local/Cellar/hadoop/3.1.0/libexec/etc/hadoop/mapred-site.xml
在<configuration>中間加入
```
<property>
    <name>mapred.job.tracker</name>
    <value>localhost:8021</value>
</property>
```
(d) 设置hdfs的默认备份方式，在伪分布式系统中，需要修改为1
打開 /usr/local/Cellar/hadoop/3.1.0/libexec/etc/hadoop/hdfs-site.xml
在<configuration>中間加入
```
<property>
    <name>dfs.replication</name>
    <value>1</value>
</property>
```
(e) 格式化新安裝的HDFS, 并通过创建存储目录和初始化元数据创新空的文件系统
在/usr/local/Cellar/hadoop/3.1.0/libexec/etc/hadoop/底下
```
$hdfs namenode -format
```
5. 啟動Hadoop (script都放在sbin底下)
```
$./start-dfs.sh          //启动HDFS
$./stop-dfs.sh          //停止HDFS
```
用sudo啟動時遇到錯誤訊息 (無解)


```
ucrwpa-1-7-10-25-26-210:sbin alumi5566$ sudo ./start-dfs.sh
Password:
Starting namenodes on [localhost]
ERROR: Attempting to operate on hdfs namenode as root
ERROR: but there is no HDFS_NAMENODE_USER defined. Aborting operation.
Starting datanodes
ERROR: Attempting to operate on hdfs datanode as root
ERROR: but there is no HDFS_DATANODE_USER defined. Aborting operation.
Starting secondary namenodes [ucrwpa-1-7-10-25-26-210.wnet.ucr.edu]
ERROR: Attempting to operate on hdfs secondarynamenode as root
ERROR: but there is no HDFS_SECONDARYNAMENODE_USER defined. Aborting oper
ation.
2018-06-04 15:34:04,148 WARN util.NativeCodeLoader: Unable to load native
-hadoop library for your platform... using builtin-java classes where app
licable
ucrwpa-1-7-10-25-26-210:sbin alumi5566$
```

一般啟動時遇到錯誤訊息
```
Starting namenodes on [localhost]
localhost: U@localhost: Permission denied (publickey,password,keyboard-interactive).
Starting datanodes
```
解法：

Generate new keygen.
```
$ssh-keygen -t rsa -P '' -f ~/.ssh/id_rsa
```
Register key gen:
```
$cat ~/.ssh/id_rsa.pub >> ~/.ssh/authorized_keys
```
如果成功開啟，另外再用browser連接

http://localhost:9870



Overview 'localhost:8020' (active)

Started:	Mon Jun 04 15:54:29 -0700 2018
Version:	3.1.0, r16b70619a24cdcf5d3b0fcf4b58ca77238ccbe6d
Compiled:	Thu Mar 29 17:00:00 -0700 2018 by centos from branch-3.1.0
Cluster ID:	CID-bf28b6dc-9d46-4446-af21-8b414b702d10
Block Pool ID:	BP-1352234239-10.25.26.210-1528152397334

Summary

Security is off.

Safemode is off.

1 files and directories, 0 blocks (0 replicated blocks, 0 erasure coded block groups) = 1 total filesystem object(s).

Heap Memory used 66.48 MB of 156 MB Heap Memory. Max Heap Memory is 2 GB.

Non Heap Memory used 56.2 MB of 60.14 MB Commited Non Heap Memory. Max Non Heap Memory is <unbounded>.

Configured Capacity:	112.8 GB
Configured Remote Capacity:	0 B

6. 啟動yarn (mapreduce framework) (script都放在sbin底下)
```
$./start-yarn.sh    //启动yarn，一个MapReduce框架
$./stop-yarn.sh     //停止yarn
```
7. 也可以一鍵啟動全部
```
$./start-all.sh   ##启动Hadoop
$./stop-all.sh    ##停止Hadoop
```

用mahout來implement kmeans

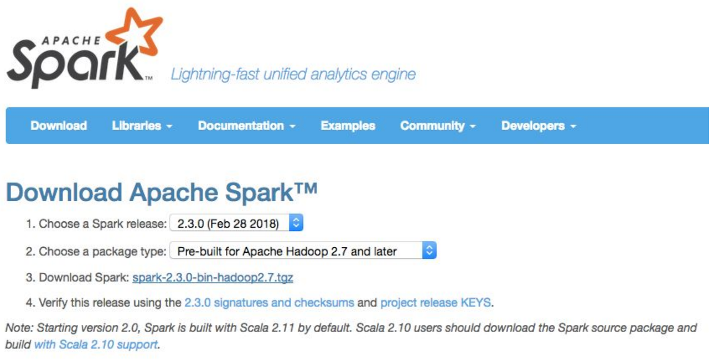
```
$brew install mahout
```
裝在/usr/local/Cellar/mahout/0.13.0

編輯環境變數$vim ~/.bash_profile
```
export MAHOUT_HOME=//usr/local/Cellar/mahout/0.13.0/libexec
MAHOUT_CONF_DIR=$MAHOUT_HOME/
export PATH=$MAHOUT_HOME/bin:$PATH
```
```
$source ~/.bash_profile
```
然後然後
```
$time bin/hadoop jar /usr/local/Cellar/mahout/0.13.0/libexec/mahout-examples-0.13.0-job.jar
org.apache.mahout.clustering.syntheticcontrol.kmeans.Job
```

Spark

1. 安裝scala，確認在/usr/local下面有scala的資料夾
(我們放在/usr/local/Cellar/scala/2.12.6 底下)
```
$brew install scala
```
修改環境變量
```
$sudo vim /etc/profile
```

export SCALA_HOME=/usr/local/Cellar/scala/2.12.6
export PATH=$PATH:$SCALA_HOME/bin
記得用 $source /etc/profile 讓修改生效
(輸入$scala測試一下)
2. 從apache下載spark安裝包 (記得選對應的版本)

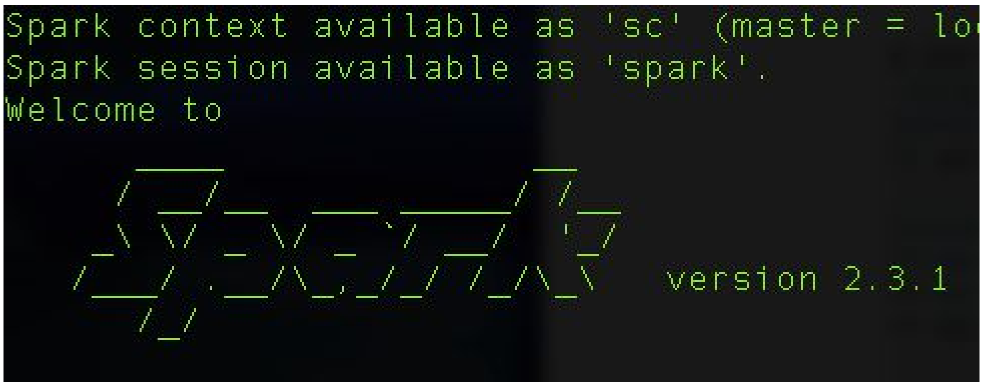


Download Apache Spark™

1. Choose a Spark release: 2.3.0 (Feb 28 2018)
2. Choose a package type: Pre-built for Apache Hadoop 2.7 and later
3. Download Spark: spark-2.3.0-bin-hadoop2.7.tgz
4. Verify this release using the 2.3.0 signatures and checksums and project release KEYS.

Note: Starting version 2.0, Spark is built with Scala 2.11 by default. Scala 2.10 users should download the Spark source package and build with Scala 2.10 support.

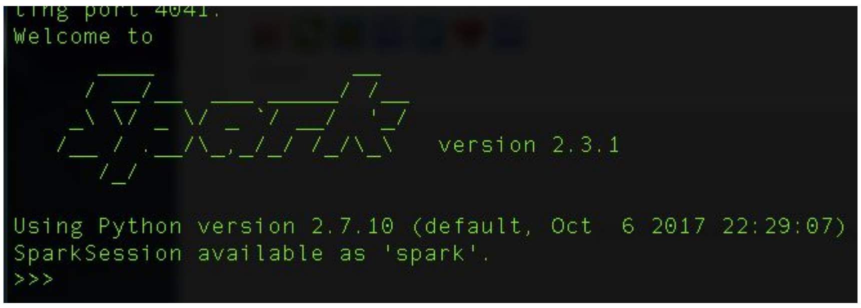
解壓縮之後放到 /usr/local 底下，並改名成/spark
一樣要去修改環境變量 $sudo vim /etc/profile
export SPARK_HOME=/usr/local/spark
export PATH=$PATH:$SPARK_HOME/bin
3. 把/usr/local/spark/conf/spark-env.sh.template 複製一份在同樣資料夾在，名稱為spark-env.sh
在/usr/local/spark/conf/spark-env.sh裡面加入以下內容
export SCALA_HOME=/usr/local/Cellar/scala/2.12.6
export SPARK_MASTER_IP=localhost
export SPARK_WORKER_MEMORY=4g
4. 跑$spark-shell 時出現很多錯誤訊息，
改用scala-2.11.12 (手動下載到/usr/local/Cellar/scala)
還是很多錯誤訊息，從jdk下手
5. 改裝jdk1.7
(http://www.oracle.com/technetwork/java/javase/downloads/java-archive-downloads-javase7-521261.html)
$vim ~/.bash_profile
JAVA_HOME=/Library/Java/JavaVirtualMachines/jdk1.7.0_80.jdk/Contents/Home
6. 再把scala 改成 scala-2.11.8
一樣下載之後解壓縮，放到 /usr/local/scala
$sudo vim /etc/profile
export SCALA_HOME=/usr/local/scala
還是有錯誤
7. 最後用這個
https://stackoverflow.com/questions/46436879/spark-shell-failed-to-initialize-compiler-error-on-a-mac
$ brew cask install java
$ brew install scala
$ brew install apache-spark
然後 $sudo spark-shell



```
Spark context available as 'sc' (master = lo
Spark session available as 'spark'.
Welcome to
      ____              __
     / __/__  ___ _____/ /__
    _\ \/ _ \/ _ `/ __/  '_/
   /___/ .__/\_,_/_/ /_/\_\   version 2.3.1
      /_/
```

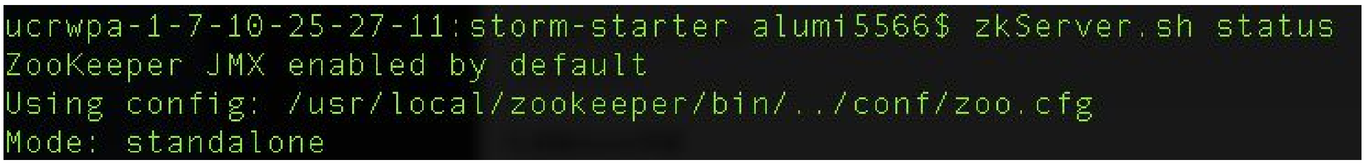
(如果之後要手動安裝，scala 2.11 + jdk 1.7 或1.8可能比較好，部落主試過可以)

用scala太麻煩了，想辦法裝pyspark
1. 去把 /etc/profile 裡面的 SPARK_HOME=/usr/local/spark 改成我們用brew裝的那個版本
(/usr/local/Cellar/apache-spark/2.3.1/bin)
或是乾脆著解掉 (brew會自動幫我們加路徑)
$sudo pyspark



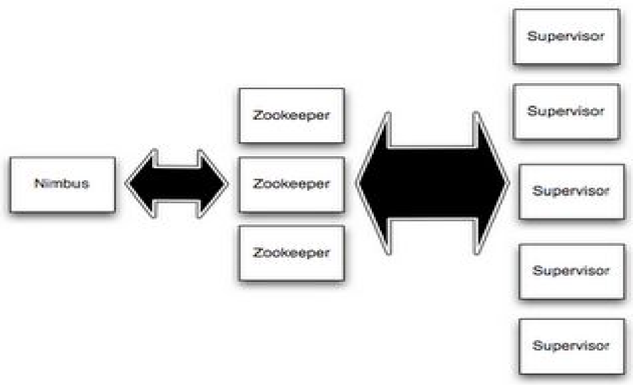
```
ting port 4041.
Welcome to
      ____              __
     / __/__  ___ _____/ /__
    _\ \/ _ \/ _ `/ __/  '_/
   /__ / .__/\_,_/_/ /_/\_\   version 2.3.1
      /_/

Using Python version 2.7.10 (default, Oct  6 2017 22:29:07)
SparkSession available as 'spark'.
>>>
```

Storm
需要zookeeper 和python
1. 下載apache-storm的release版本 (http://storm.apache.org/downloads.html)
我們下載1.22版並把資料夾放到 /usr/local/storm 底下
一樣去改環境變數
$sudo vim /etc/profile
export STORM_HOME=/usr/local/storm
export PATH=$STORM_HOME/bin:$PATH
$source /etc/profile 讓它生效
2. 安裝zookeeper (https://zookeeper.apache.org/releases.html#download) 我們下載3.4.10
一樣下載，放到 /usr/local/zookeeper
把/usr/local/zookeeper/conf/zoo_sample.cfg 複製一份到 /usr/local/zookeeper/conf/zoo.cfg
一樣去改環境變數
$sudo vim /etc/profile
export ZOOKEEPER_HOME=/usr/local/zookeeper
export PATH=$PATH:$ZOOKEEPER_HOME/bin
$source /etc/profile 讓它生效
3. 後來查到OSX另外有dependency: zeromq
$brew install zeromq
4. 然後依序開啟 zookeeper,
$bin/zkServer.sh start
(用$bin/zkServer.sh status 看有沒有開起來)

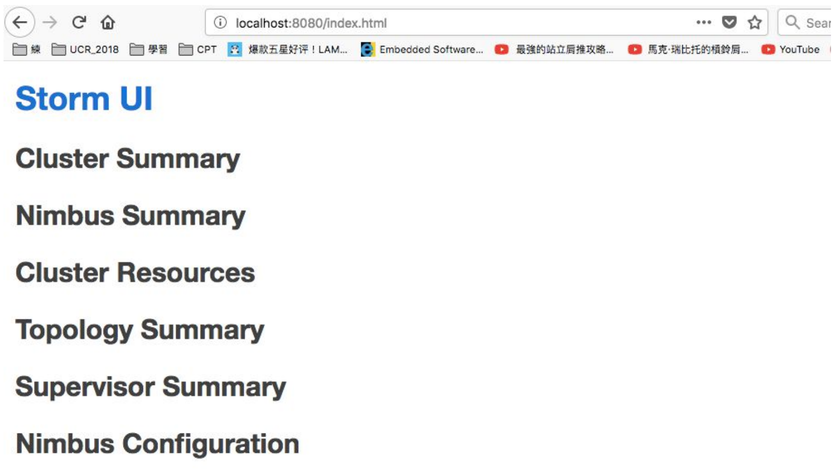


```
ucrwpa-1-7-10-25-27-11:storm-starter alumi5566$ zkServer.sh status
ZooKeeper JMX enabled by default
Using config: /usr/local/zookeeper/bin/../conf/zoo.cfg
Mode: standalone
```

5. 開啟storm的supervisor
$bin/storm nimbus & (master node)
$bin/storm supervisor & (slave node)
$bin/storm ui &



(這三者的關係，spout和bolt是處理data flow的分工)
6. 成功的話用 http://localhost:8080/index.html 檢查



Storm UI

Cluster Summary

Nimbus Summary

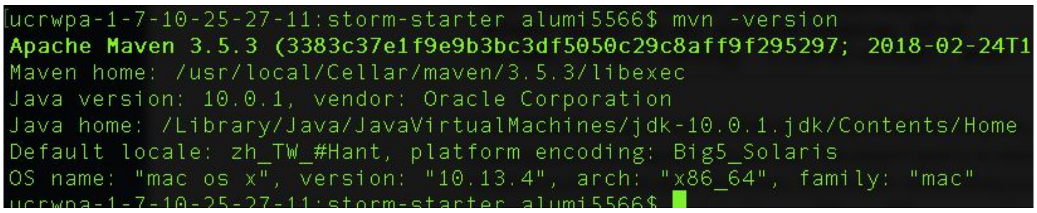
Cluster Resources

Topology Summary

Supervisor Summary

Nimbus Configuration

1. 為了開發，安裝maven
$brew install maven
用 $mvn -version 檢查

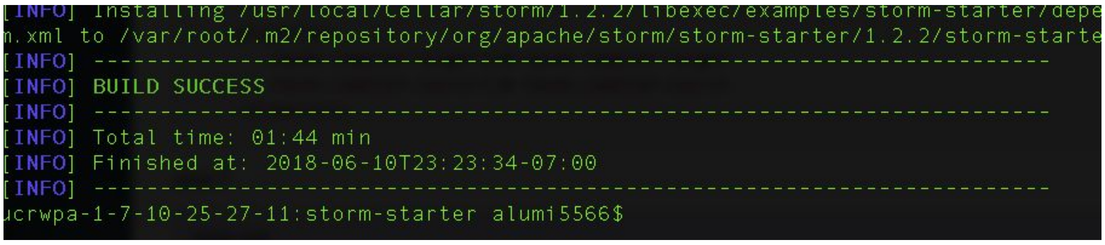


```
ucrwpa-1-7-10-25-27-11:storm-starter alumi5566$ mvn -version
Apache Maven 3.5.3 (3383c37e1f9e9b3bc3df5050c29c8aff9f295297; 2018-02-24T1
Maven home: /usr/local/Cellar/maven/3.5.3/libexec
Java version: 10.0.1, vendor: Oracle Corporation
Java home: /Library/Java/JavaVirtualMachines/jdk-10.0.1.jdk/Contents/Home
Default locale: zh_TW_#Hant, platform encoding: Big5_Solaris
OS name: "mac os x", version: "10.13.4", arch: "x86_64", family: "mac"
ucrwpa-1-7-10-25-27-11:storm-starter alumi5566$
```

2. 去到 /usr/local/storm/examples/storm-starter
$ mvn clean install -DskipTest
Fail，在build的時候一直出現
Could not find artifact jdk.tools:jdk.tools:jar:1.7 at specified path mac

不知道為什麼maven一直去找jdk 10 的 tools.jar，這個jar在jdk 9之後消失了
最後在pom.xml裡面手動指定

```
<dependency>
<groupId>jdk.tools</groupId>
<artifactId>jdk.tools</artifactId>
<version>1.7</version>
<scope>system</scope>
<systemPath>/Library/Java/JavaVirtualMachines/jdk1.7.0_80.jdk/Contents/Home/lib/tools.jar</systemPath>
</dependency>
```



```
[INFO] Installing /usr/local/Cellar/storm/1.2.2/libexec/examples/storm-starter/depe
n.xml to /var/root/.m2/repository/org/apache/storm/storm-starter/1.2.2/storm-starte
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 01:44 min
[INFO] Finished at: 2018-06-10T23:23:34-07:00
[INFO] ------------------------------------------------------------------------
ucrwpa-1-7-10-25-27-11:storm-starter alumi5566$
```

3. `$sudo mvn compile exec:java -Dstorm.topology=storm.starter.WordCountTopology`
還是失敗，改裝java 8就可以了

Storm的架構： data flow由spout和bolt組成
以word count為例：
核心组件包括：一个spout，两个bolt，一个Topology。
spout径读取文件，然后readLine，向bolt发射，一个文件处理完毕后，重命名，以不再重复处理。
第一个bolt将从spout接收到的字符串tuple按空格split，产生word，发射给下一个bolt。
第二个bolt接收到word后，统计、计数，放到HashMap容器中。

Useful Link
[1] Hadoop cmd
http://hadoopspark.blogspot.com/2015/09/6-hadoop-hdfs.html
[2]Hadoop IO performance
https://blog.csdn.net/bhq2010/article/details/8740154
[3] Spark 投影片
https://www.slideshare.net/imac-cloud/spark-61970801?next_slideshow=1
[4] Zookeeper
https://blog.csdn.net/liuxinghao/article/details/42747625
[5] Storm wordcount 架構
https://blog.csdn.net/wuliusir/article/details/49910873
[6] Word count and other code
https://github.com/storm-book