

連線至 <http://www.virtualbox.org/wiki/Downloads>  
下載 VirtualBox 虛擬化工具



# VirtualBox

Settings Register  Help/Guide

## Download VirtualBox

Here, you will find links to VirtualBox binaries and its source code.

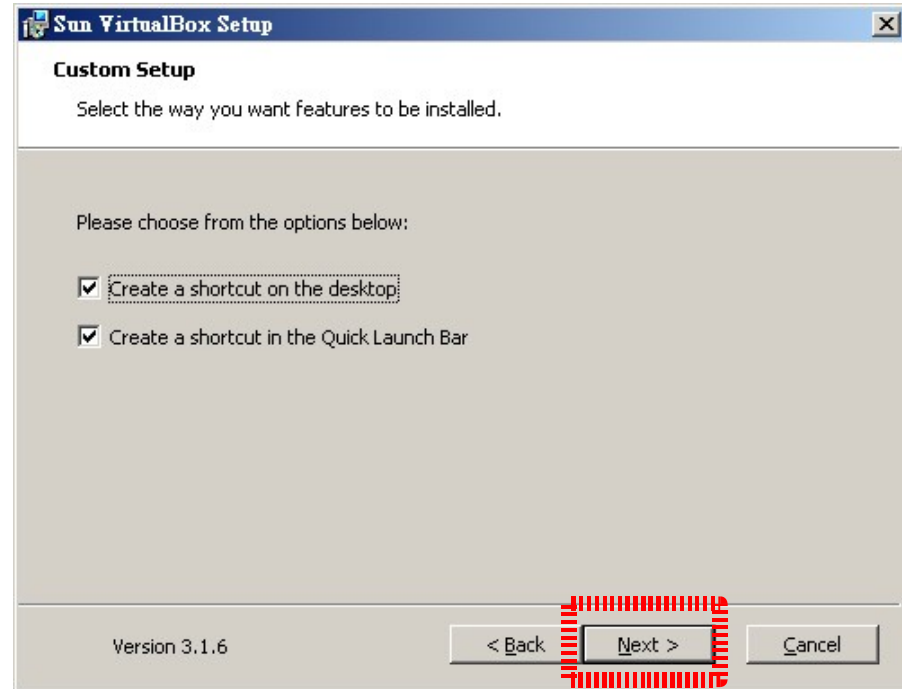
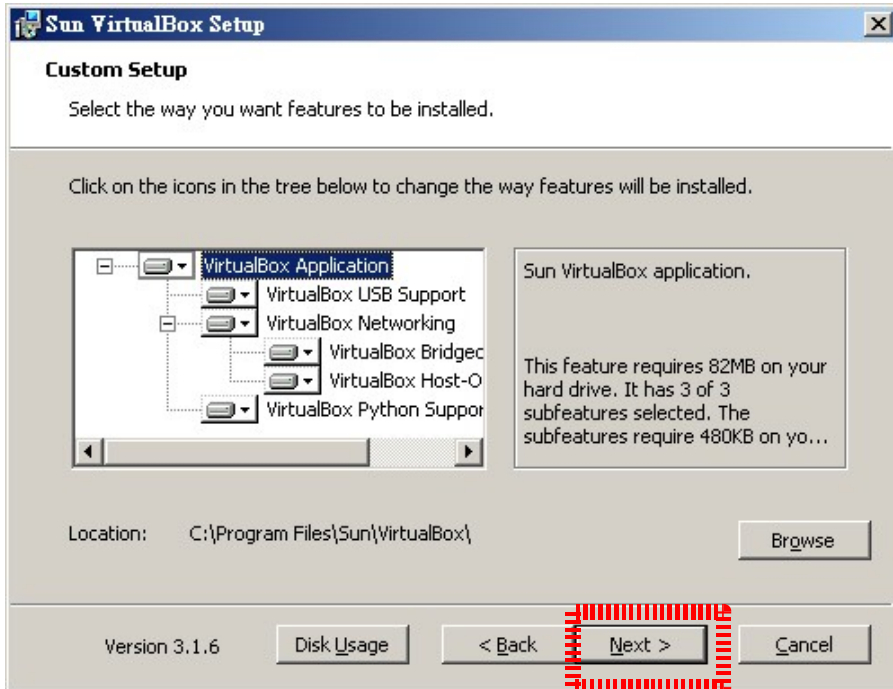
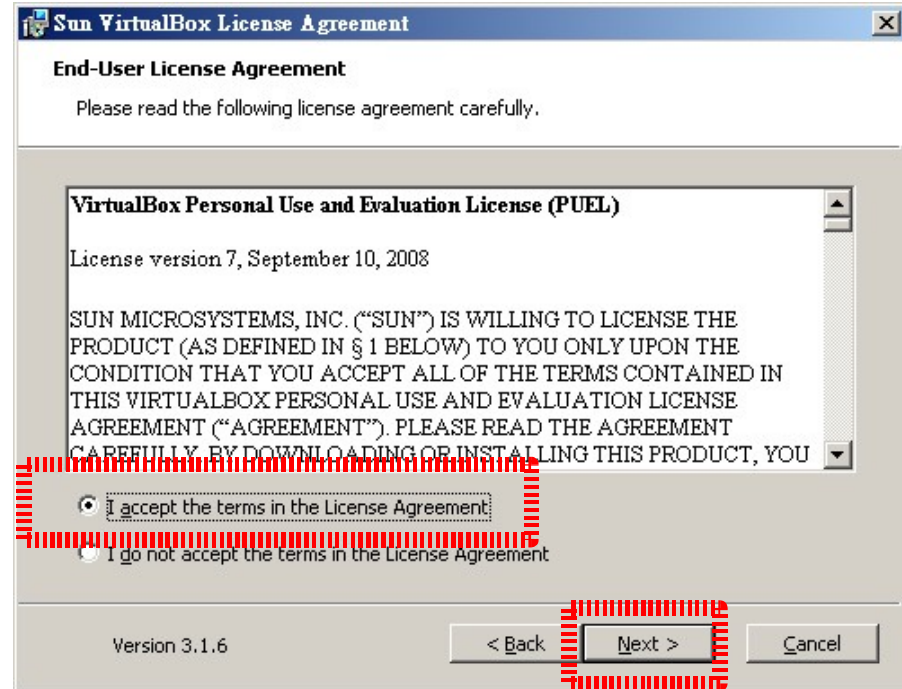
### VirtualBox binaries

The binaries in this section are all released under the [VirtualBox Personal Use and Evaluation License \(PUEL\)](#). By downloading, you agree to the terms and conditions of that license.

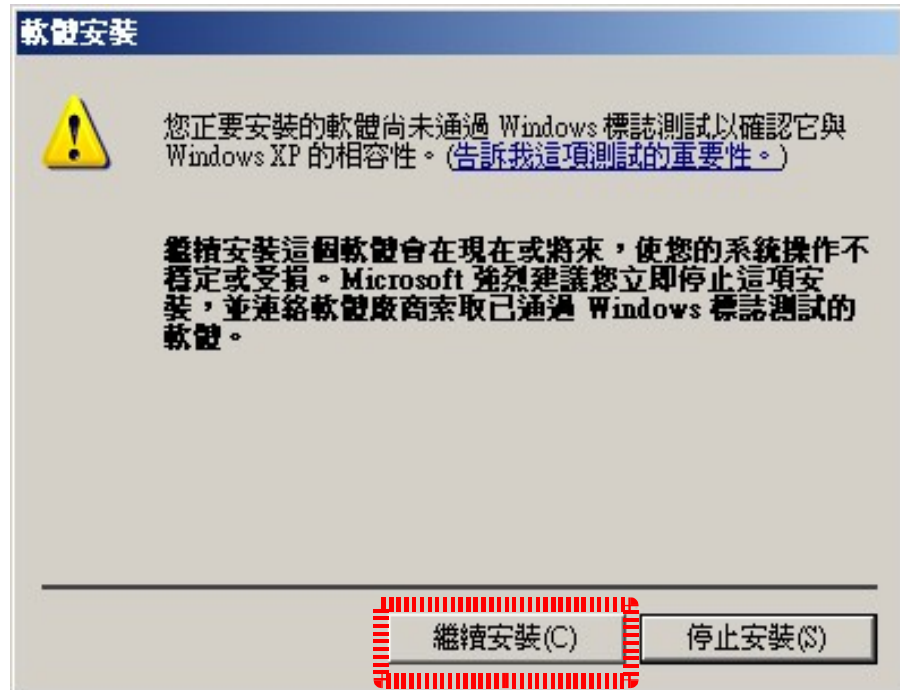
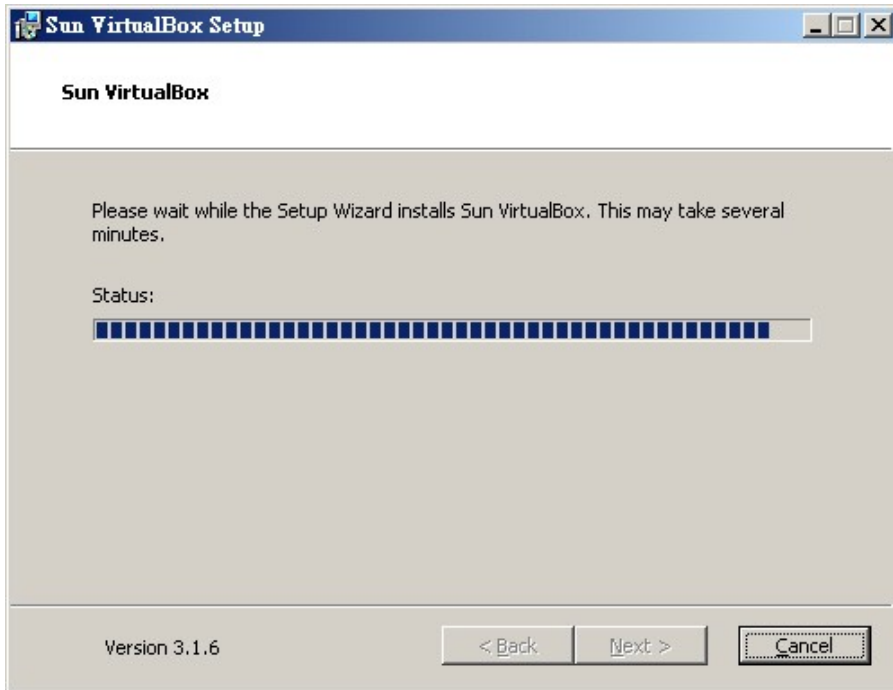
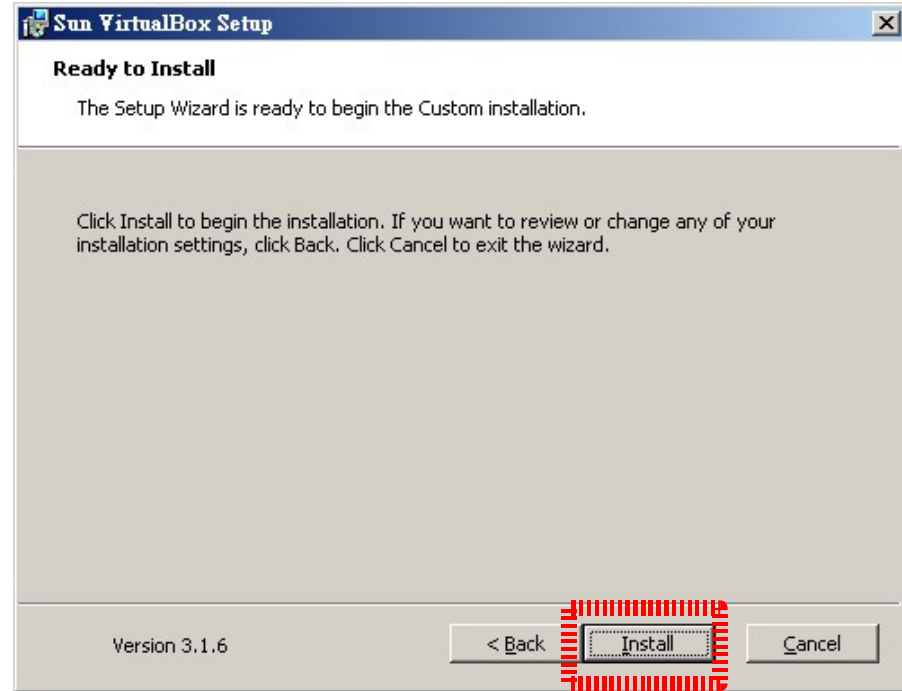
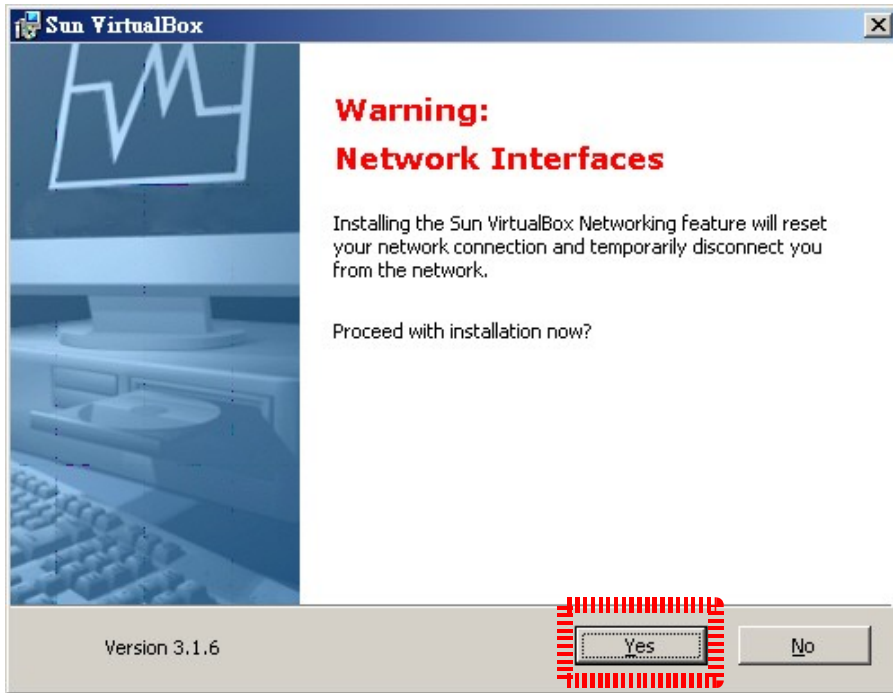
- **VirtualBox 3.1.6 for Windows hosts** [⇨ x86/amd64](#)
- **VirtualBox 3.1.6 for OS X hosts** [⇨ Intel Macs](#)  
*Due to an accident the original 3.1.6 Mac OS X package (build 59338) was broken. Please install the fixed package if you installed the broken package. Sorry for the inconveniences!*
- **VirtualBox 3.1.6 for Linux hosts**
- **VirtualBox 3.1.6 for Solaris and OpenSolaris hosts** [⇨ x86/amd64](#)
- **VirtualBox 3.1.6 Software Developer Kit (SDK)** [⇨ All platforms](#) (registration required)

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# 安裝 VirtualBox (1)



# 安裝 VirtualBox (2)



# 安裝 VirtualBox (3)

**硬體安裝**


 您正要為這個硬體安裝的軟體:  
VirtualBox Bridged Networking Driver Miniport

尚未通過 Windows 標誌測試以確認它與 Windows XP 的相容性。(告訴我這項測試的重要性。)

**繼續安裝這個軟體會在現在或將來，使您的系統操作不穩定或受損。Microsoft 強烈建議您立即停止這項安裝，並連絡硬體廠商索取已通過 Windows 標誌測試的軟體。**

**繼續安裝(C)**   **停止安裝(S)**

**硬體安裝**

 您正要為這個硬體安裝的軟體:  
VirtualBox Host-Only Ethernet Adapter

尚未通過 Windows 標誌測試以確認它與 Windows XP 的相容性。(告訴我這項測試的重要性。)

**繼續安裝這個軟體會在現在或將來，使您的系統操作不穩定或受損。Microsoft 強烈建議您立即停止這項安裝，並連絡硬體廠商索取已通過 Windows 標誌測試的軟體。**

**繼續安裝(C)**   **停止安裝(S)**

**Sun VirtualBox Setup**

**Sun VirtualBox installation is complete.**

Click the Finish button to exit the Setup Wizard.

Start Sun VirtualBox after installation

Version 3.1.6

**Finish**

**Sun VirtualBox**

檔案(F) 機器(M) 說明(H)

新增(N) 設定值(S) 啟動(T) 捨棄(L)

詳細資料(D) 快取(S) 描述(E)

**歡迎使用 VirtualBox !**

這個視窗的左側部分是在您電腦中的所有虛擬機器清單。清單現在是空的因為您尚未建立任何虛擬機器。

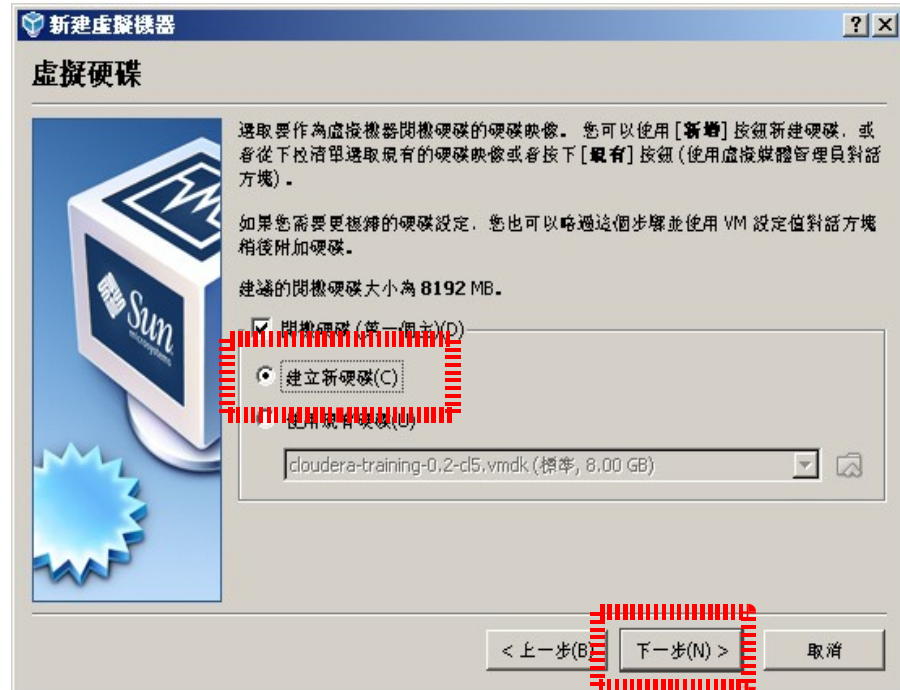
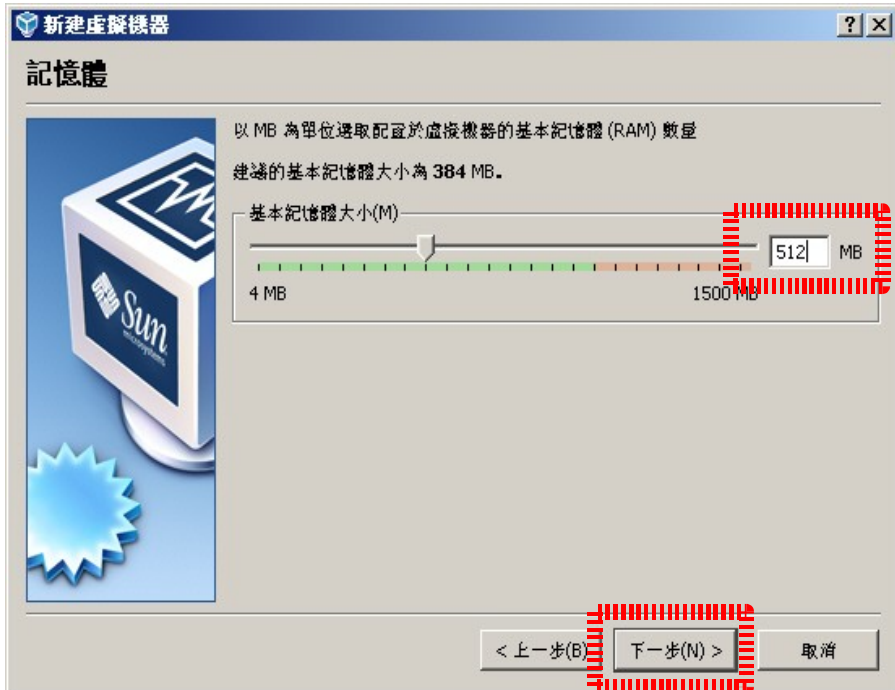
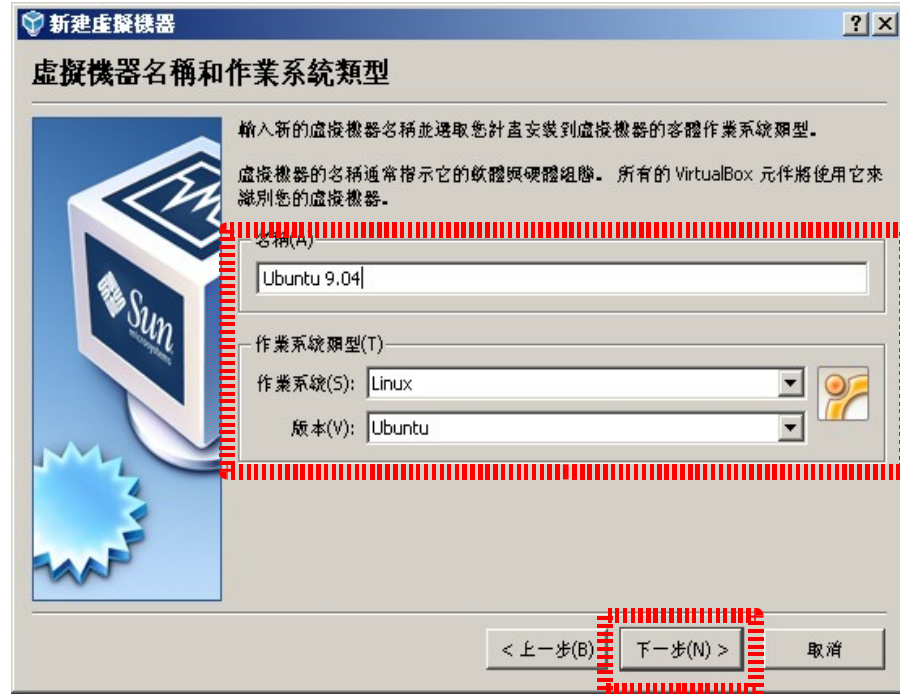
為了新建虛擬機器，在視窗上方位置的主工具列按下 **[新增]** 按鈕。

您可以按下 **[F1]** 按鍵取得即時說明，或訪問 [www.virtualbox.org](http://www.virtualbox.org) 取得最新資訊與新聞。

刪除選取的虛擬機器

# Lab 1 : 安裝 Ubuntu 9.10 GNU/Linux

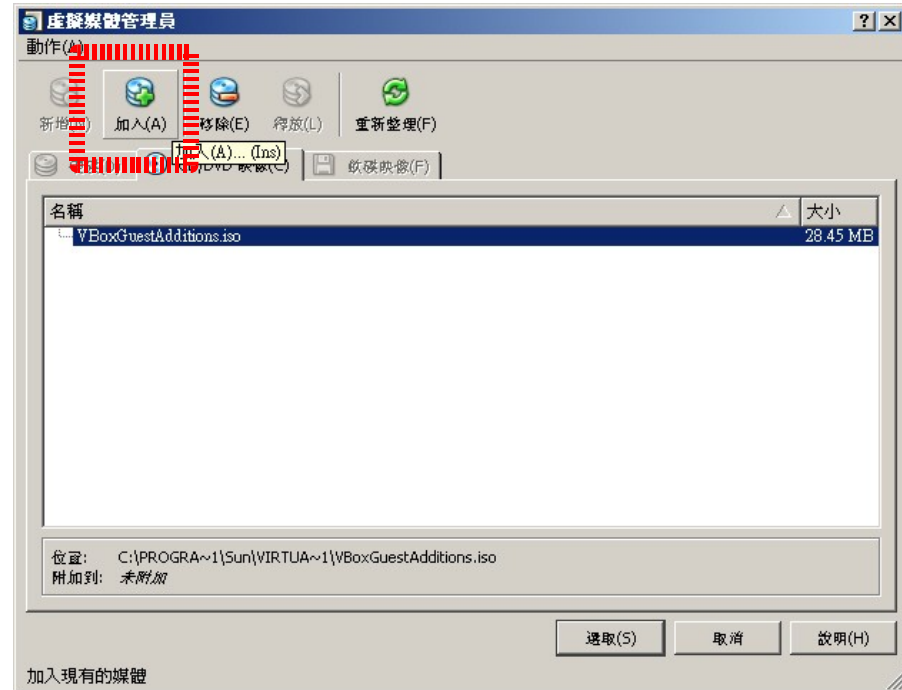
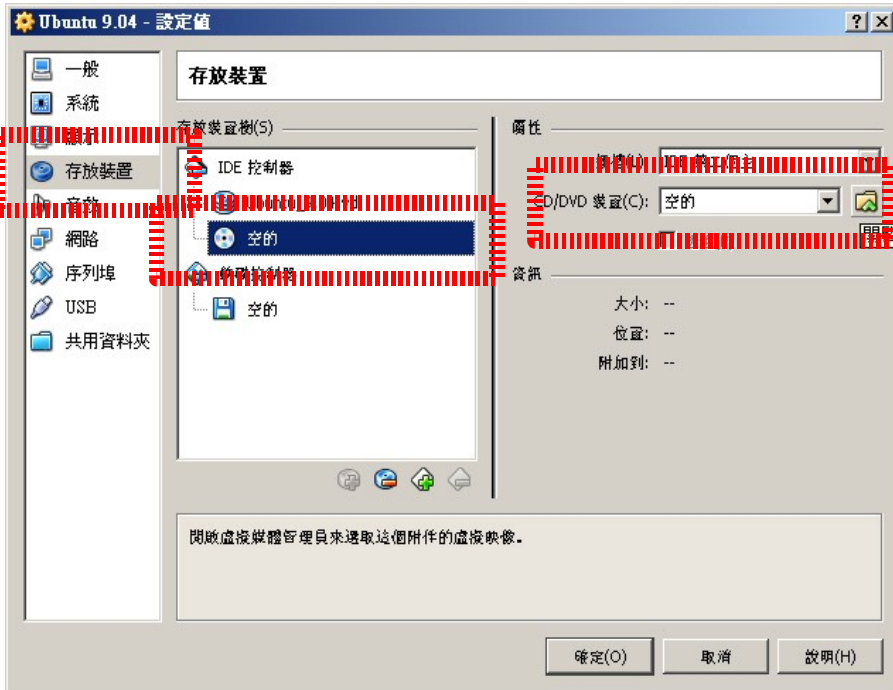
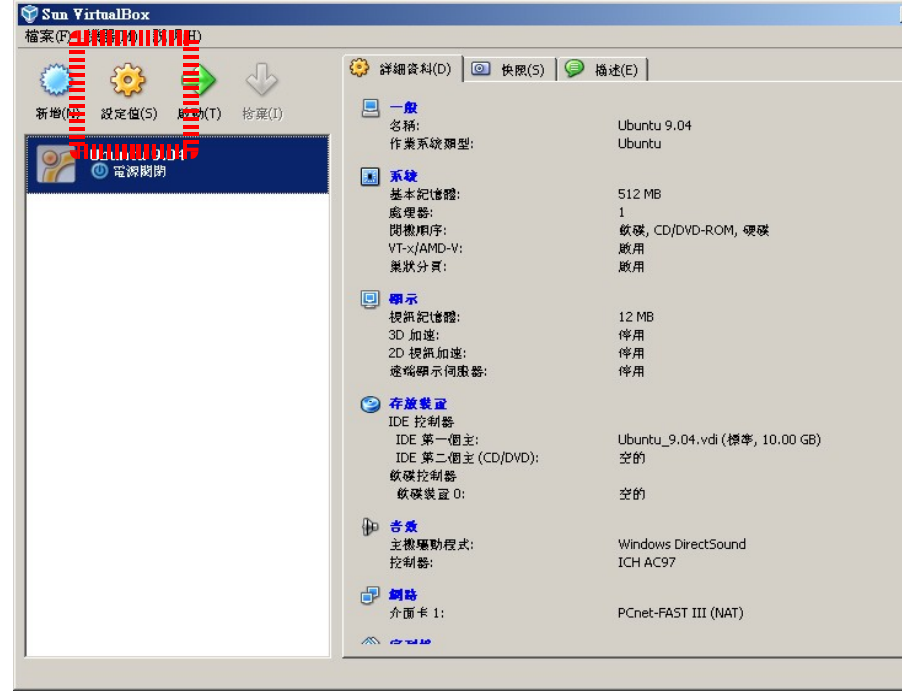
# 安裝 Ubuntu 9.10 (1)



# 安裝 Ubuntu 9.10 (2)

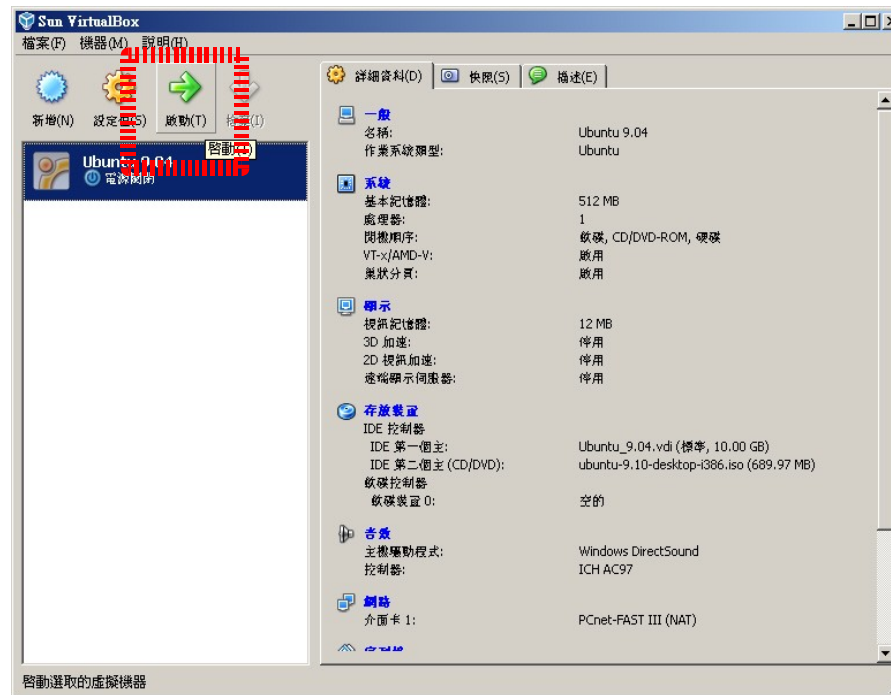
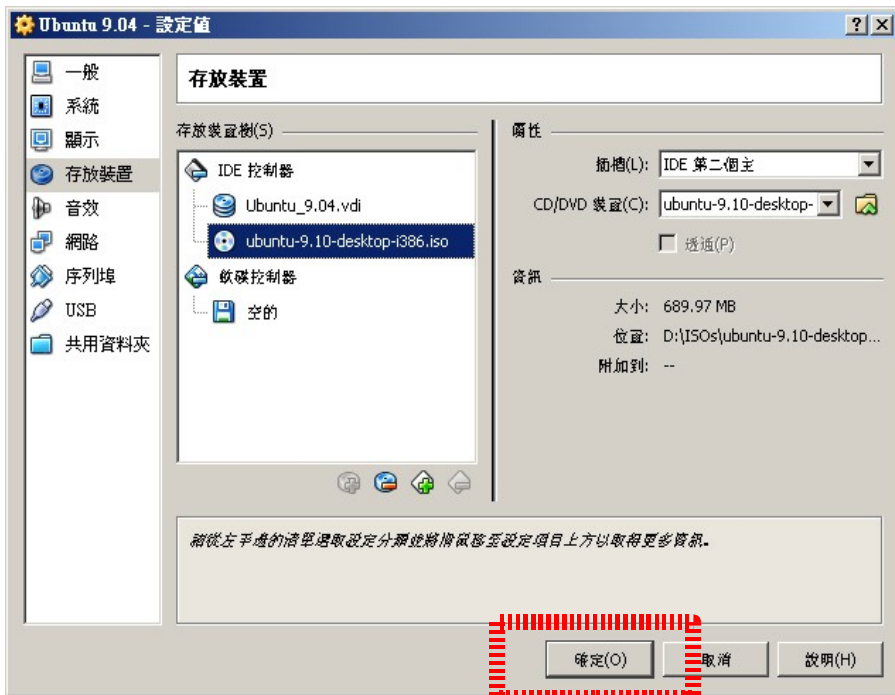
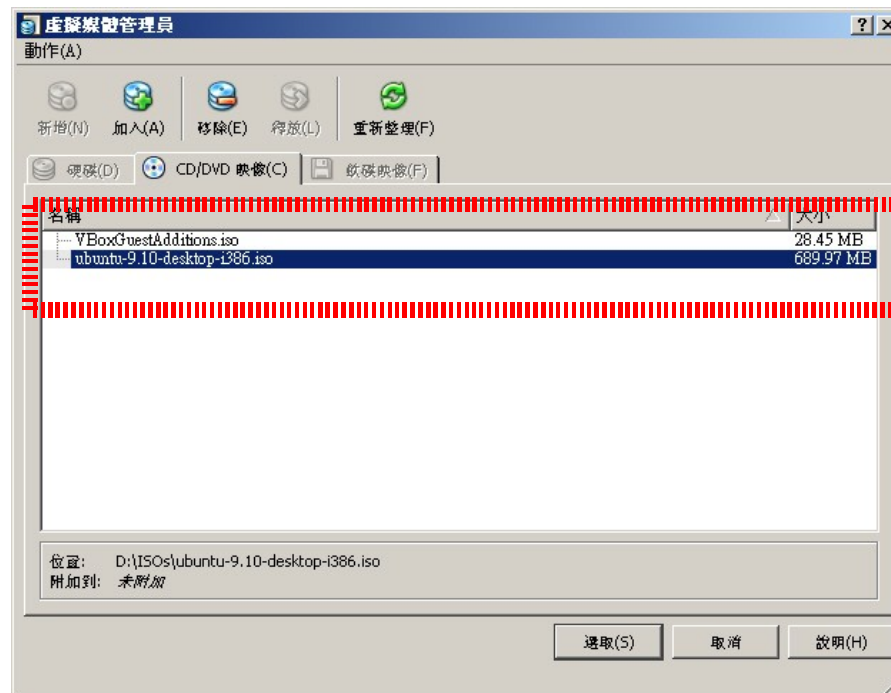
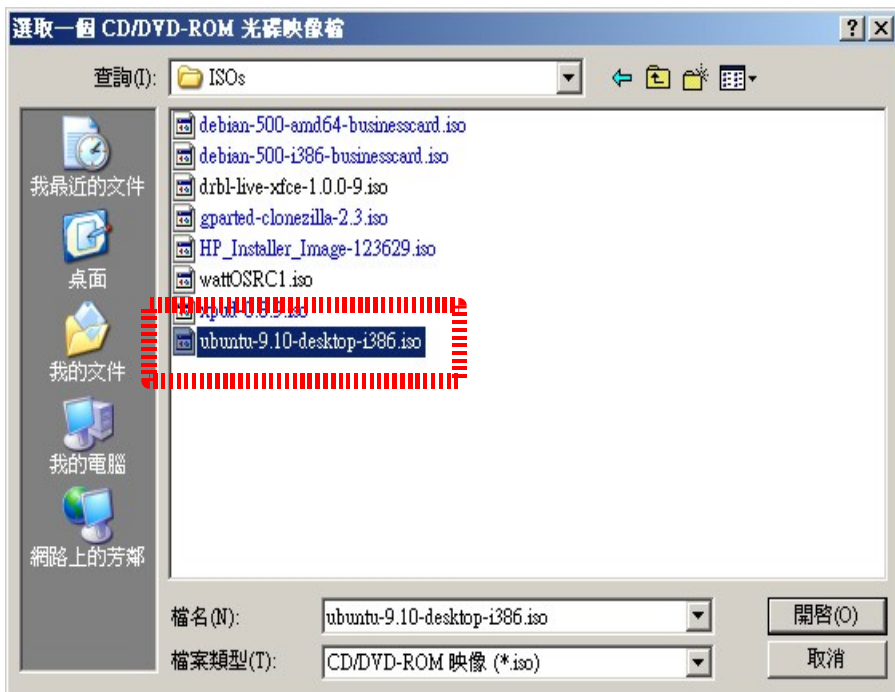


# 安裝 Ubuntu 9.10 (3)

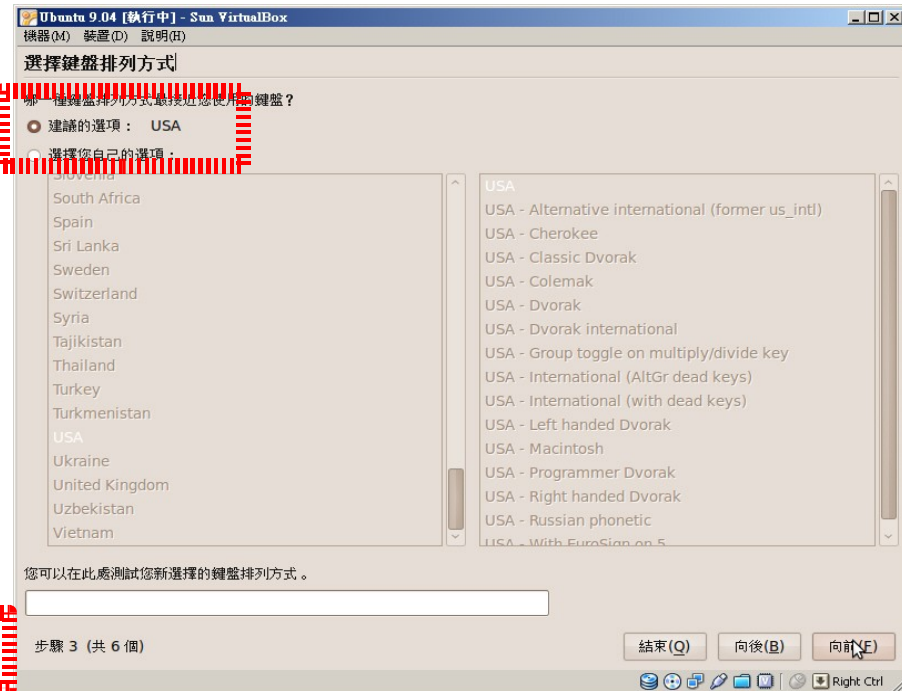
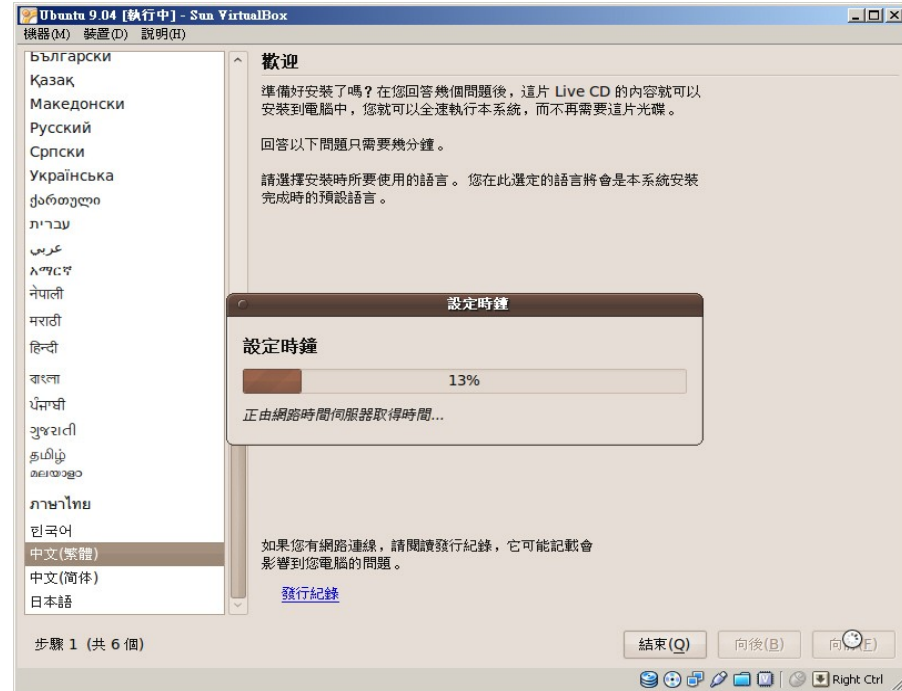
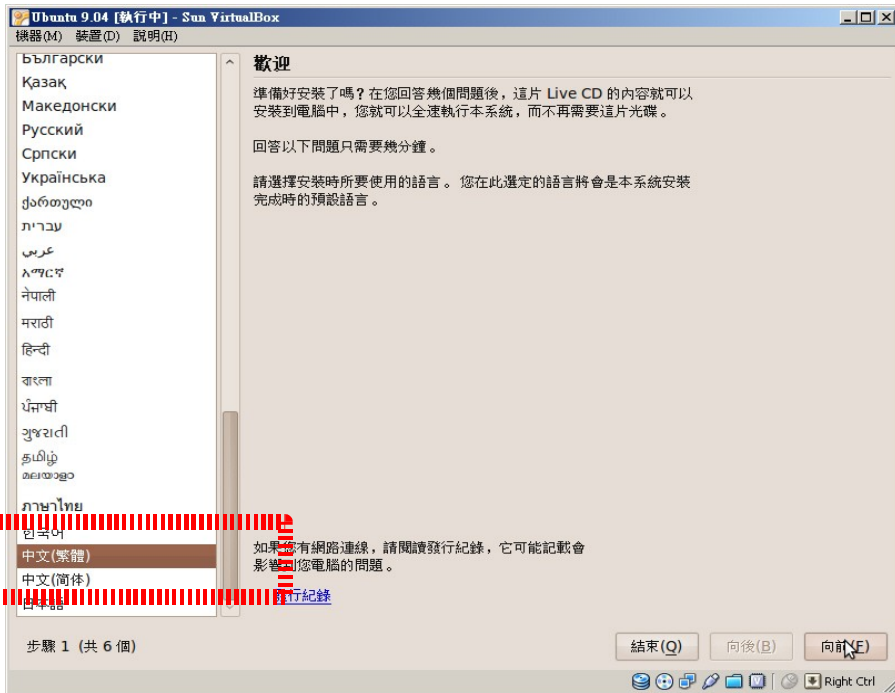




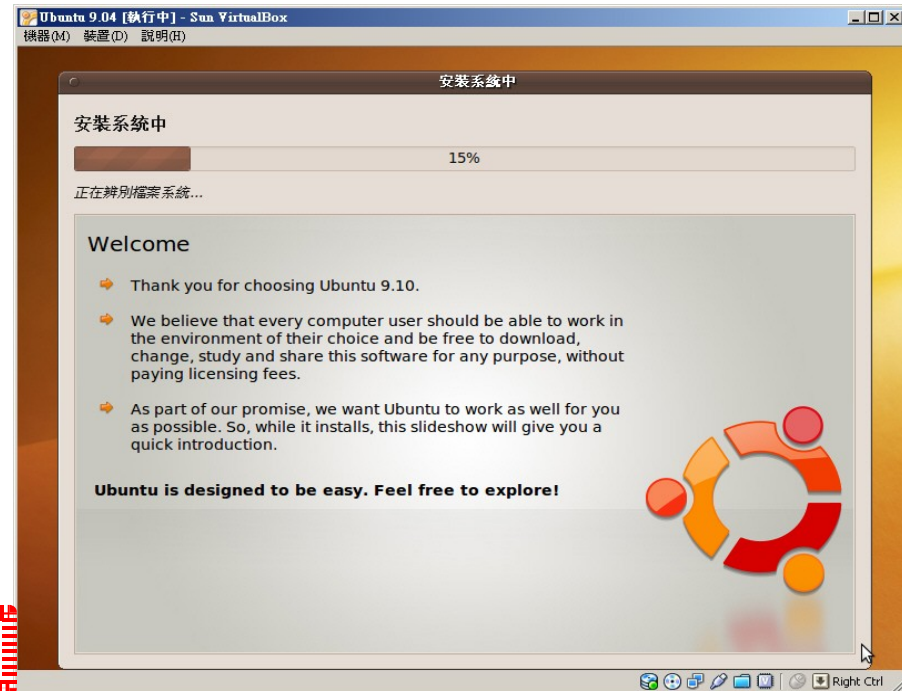
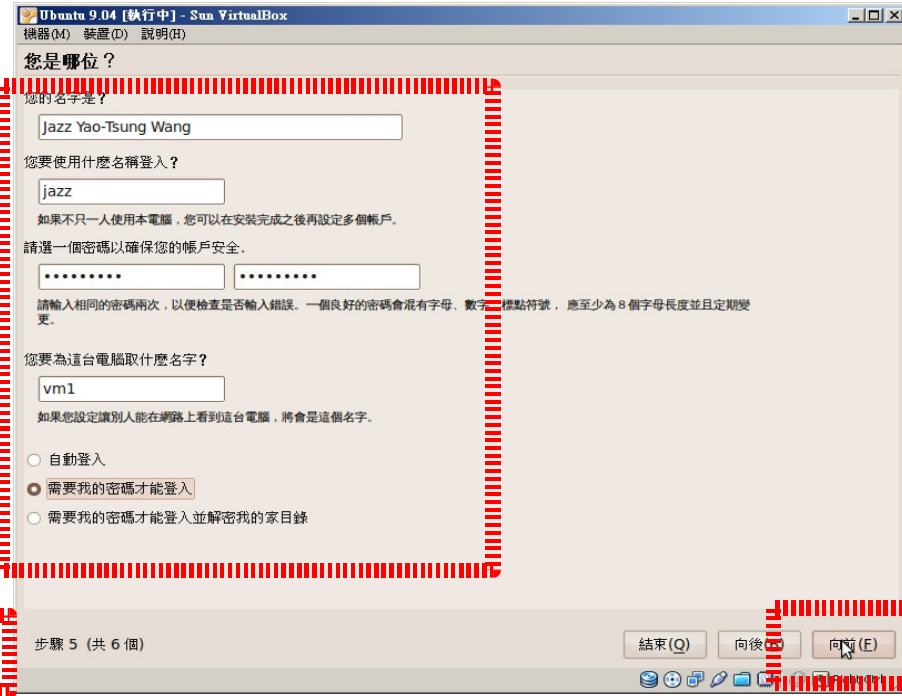
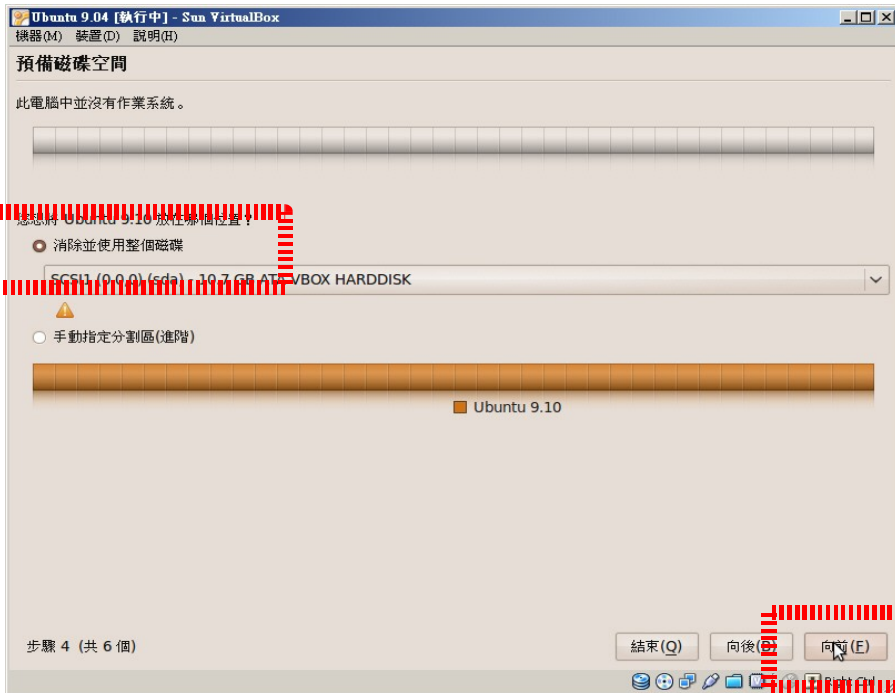
# 安裝 Ubuntu 9.10 (4)



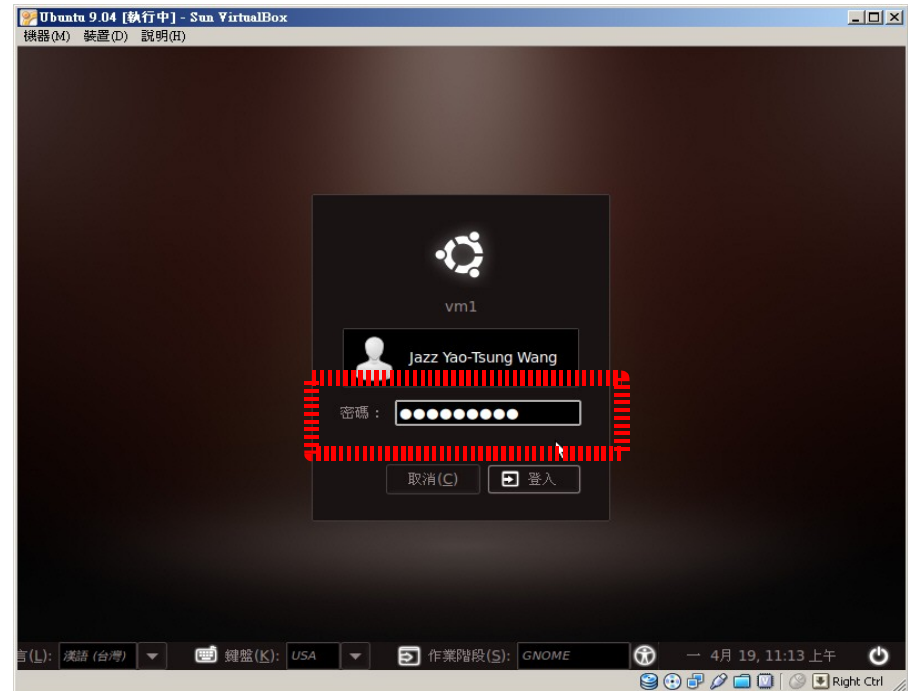
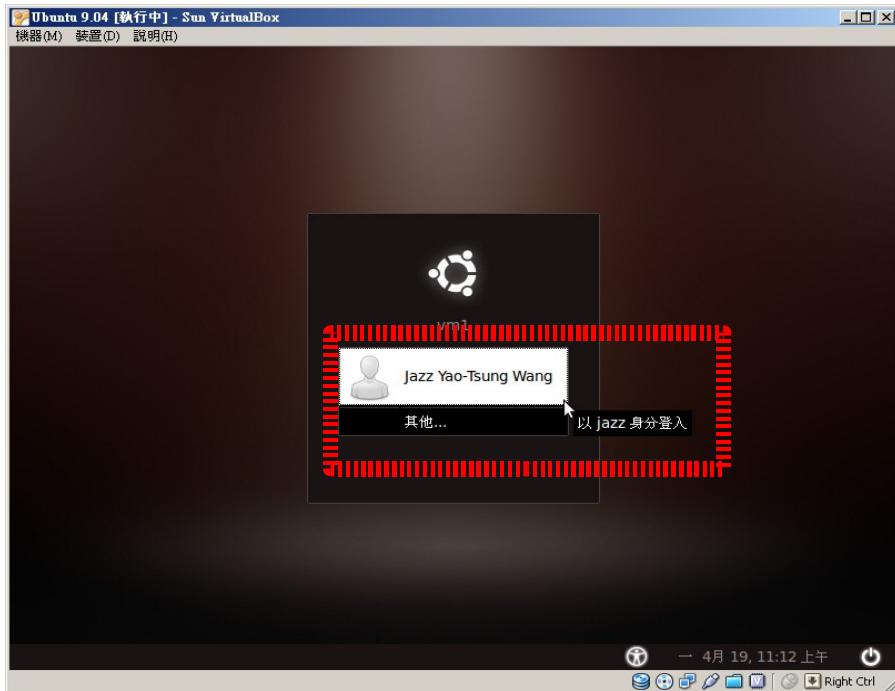
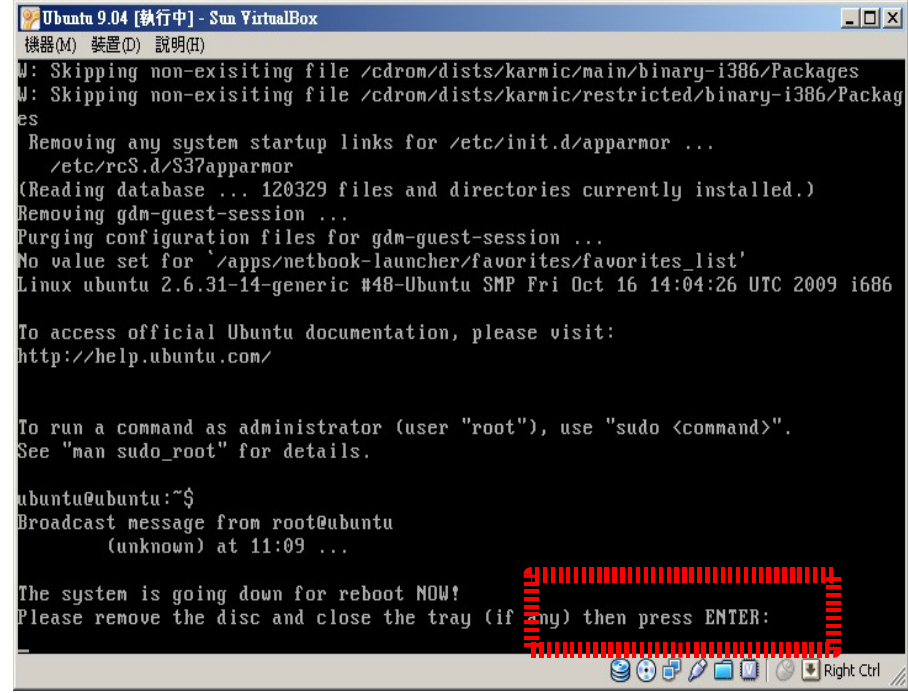
# 安裝 Ubuntu 9.10 (5)



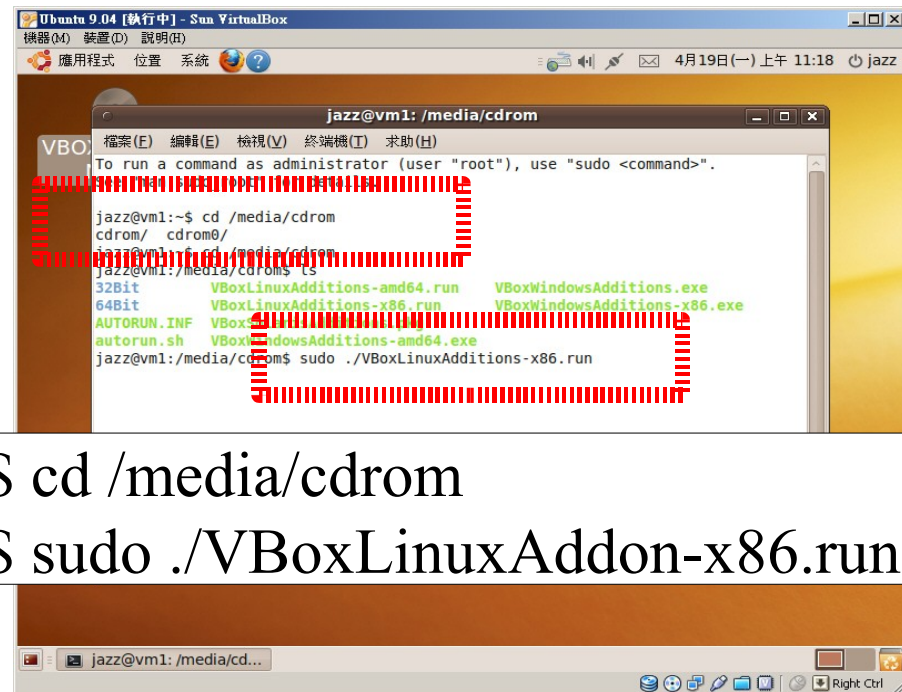
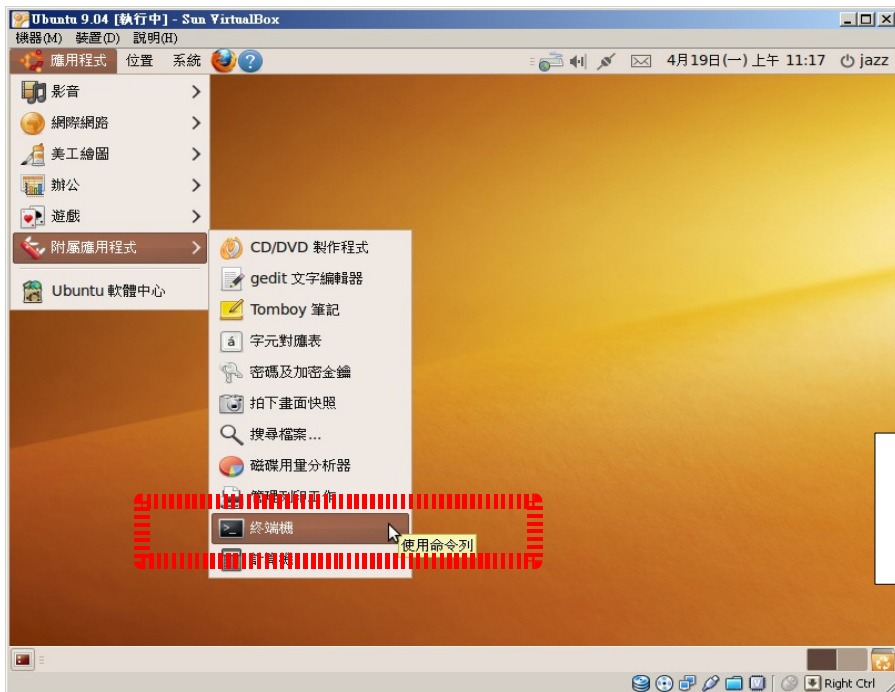
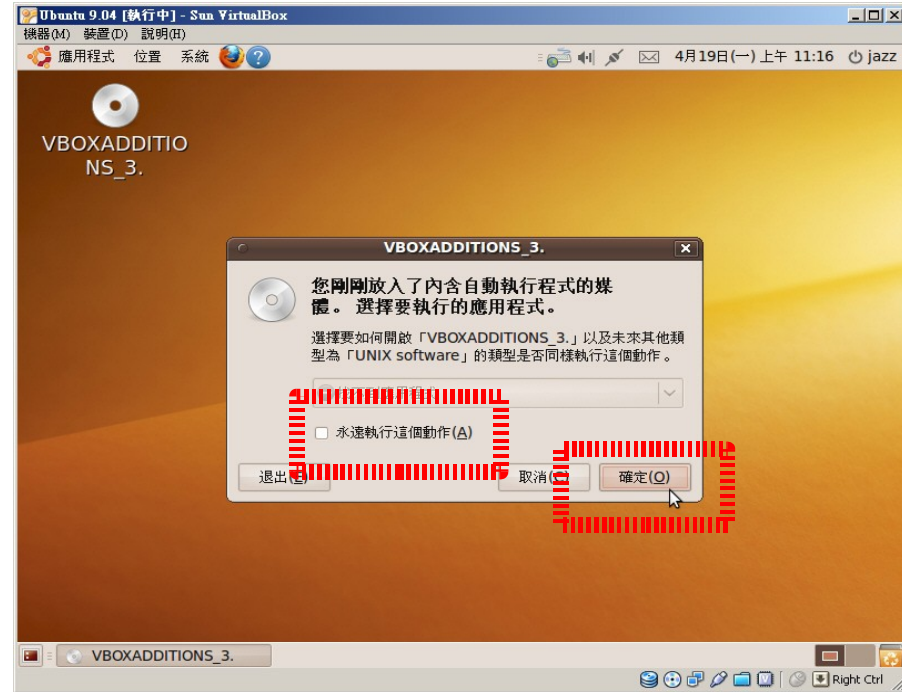
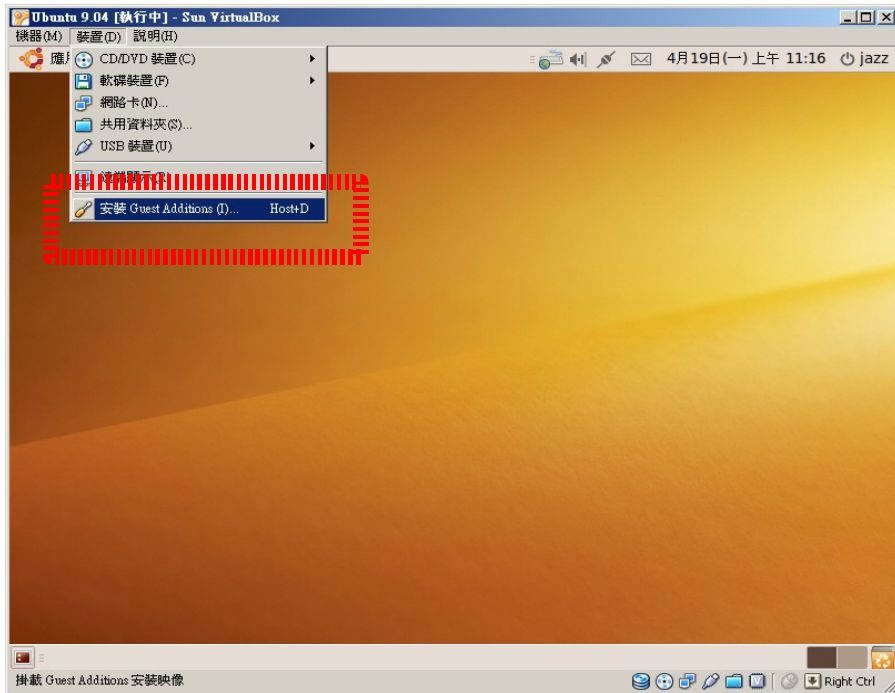
# 安裝 Ubuntu 9.10 (6)



# 安裝 Ubuntu 9.10 (7)

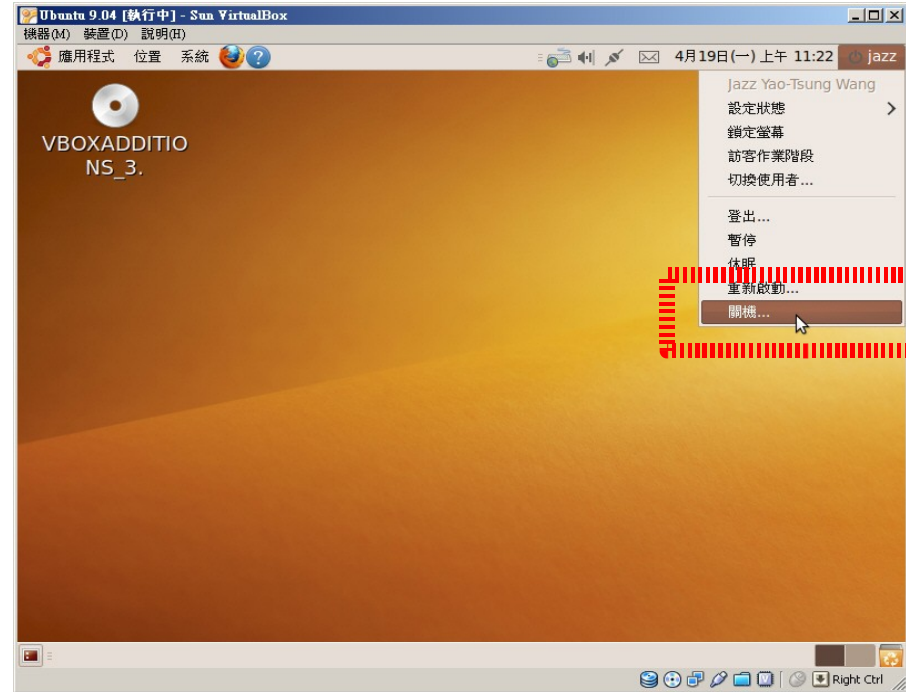
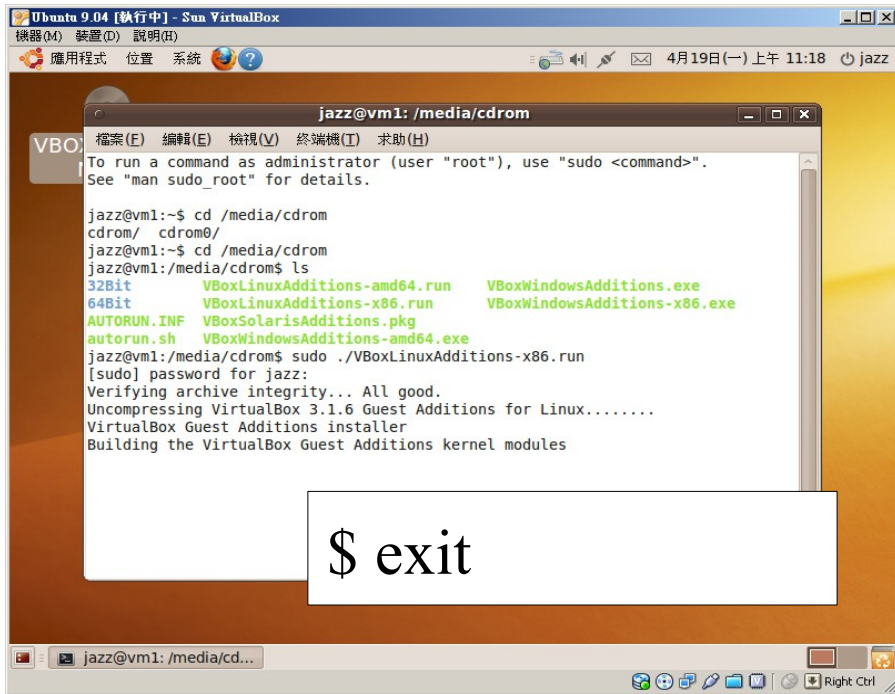


# 安裝 Ubuntu 9.10 (8)



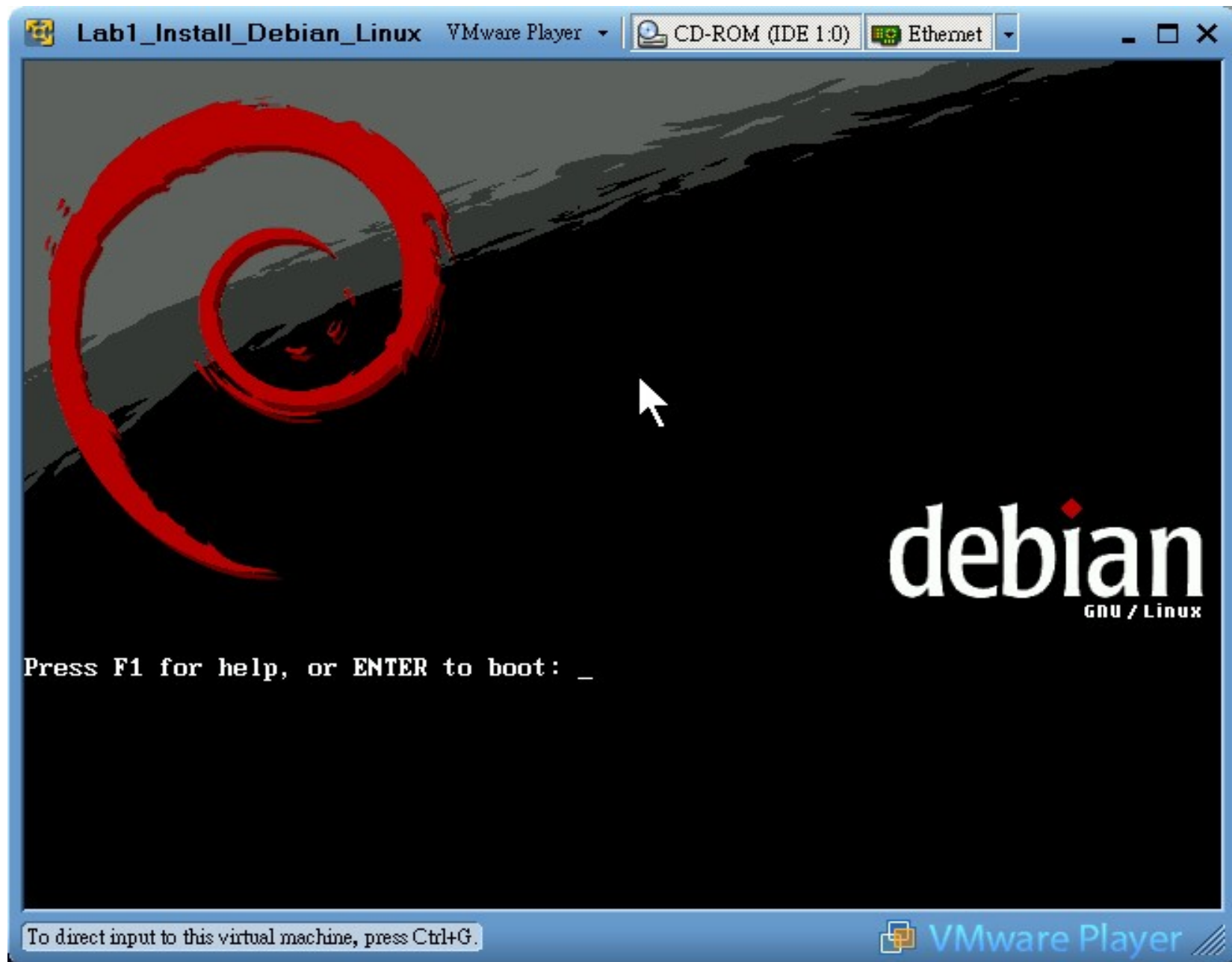
\$ cd /media/cdrom  
\$ sudo ./VBoxLinuxAddon-x86.run

# 安裝 Ubuntu 9.10 (9)



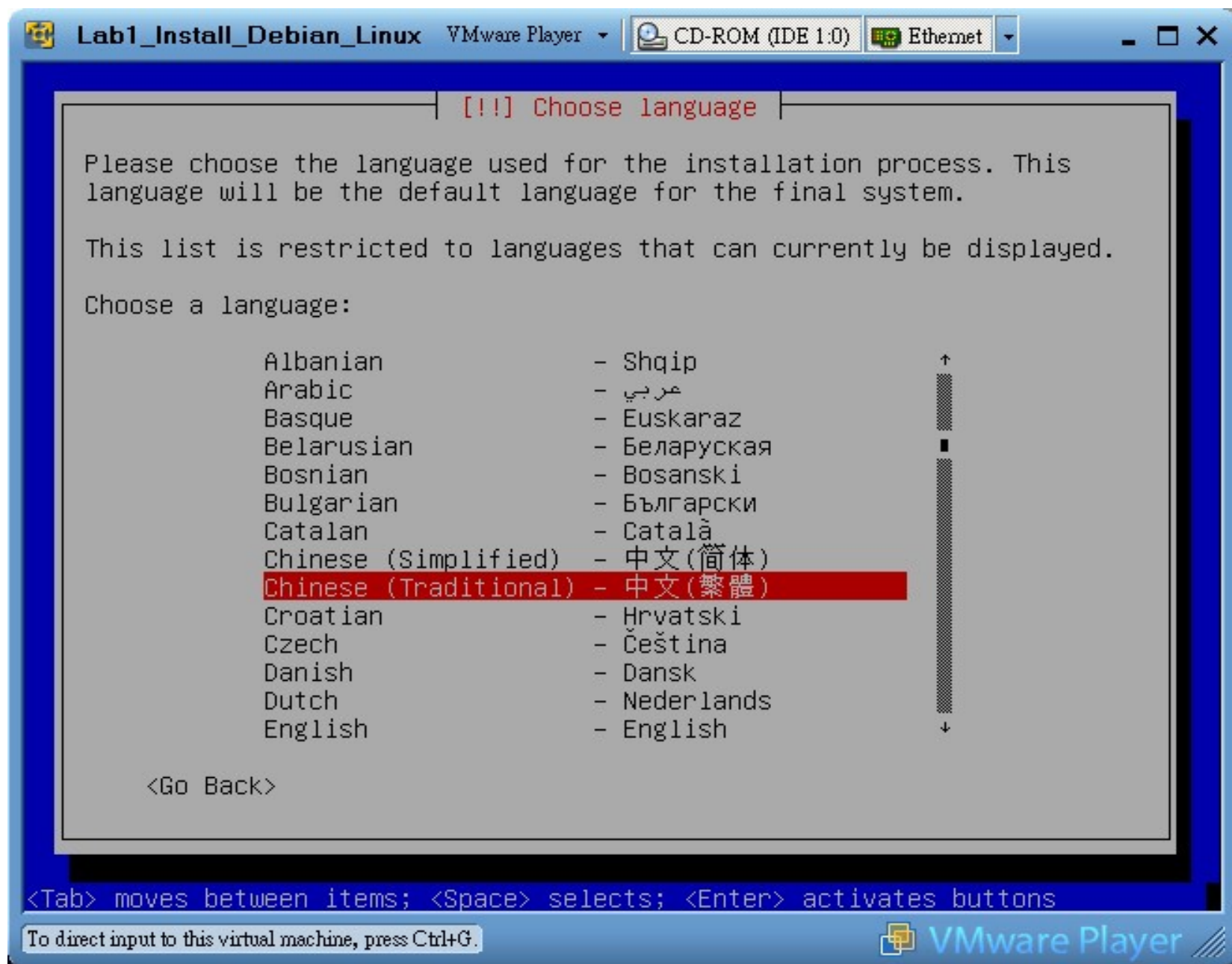
Appendex A :  
安裝 Debian 4.0r3 GNU/Linux

# 開始模擬從光碟安裝

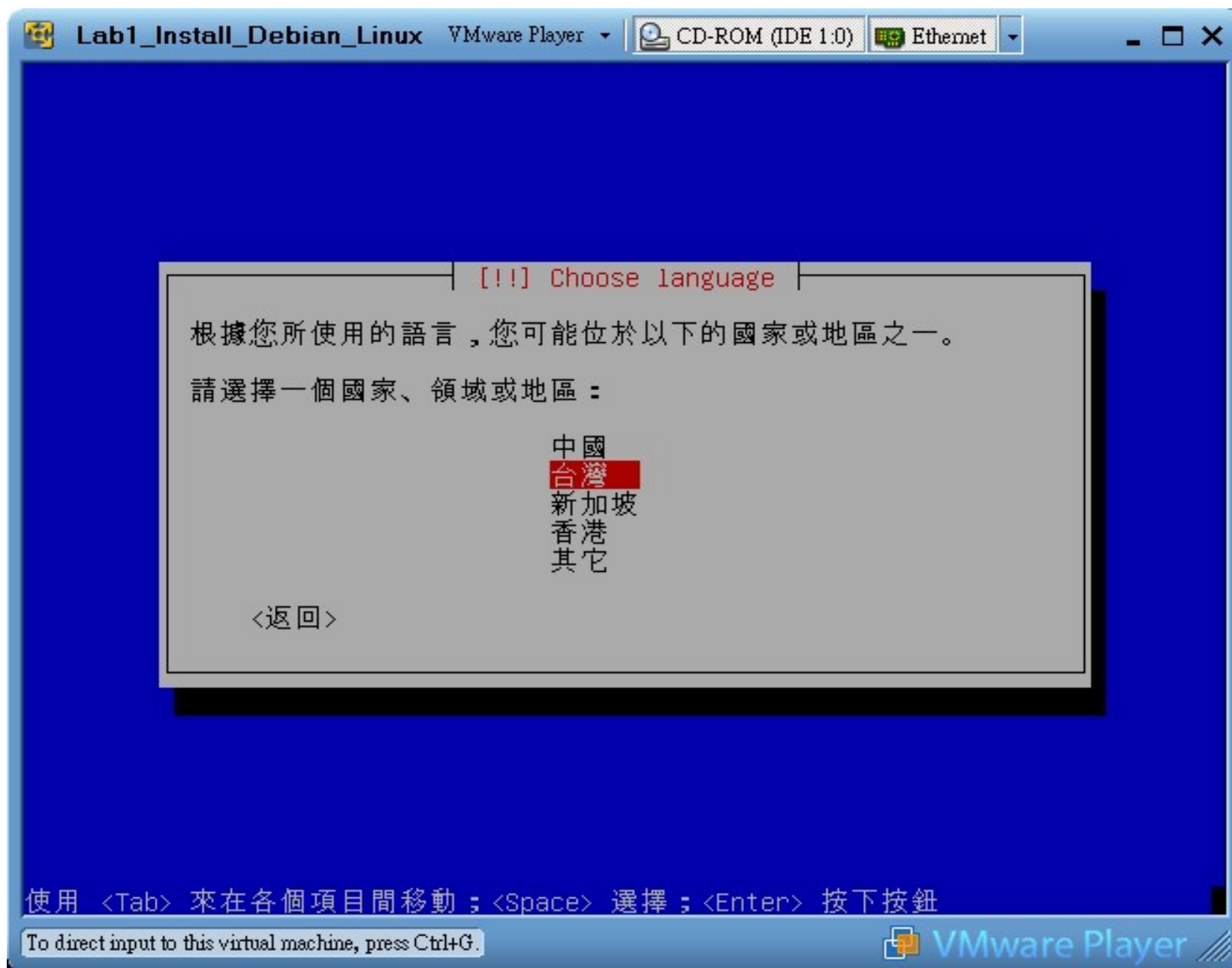




# 選擇中文(繁體)語系



# 選擇『台灣』



# 選擇『美語鍵盤』



輸入『主機名稱』 = drbl-srv



輸入『網域名稱』 = ym.edu.tw

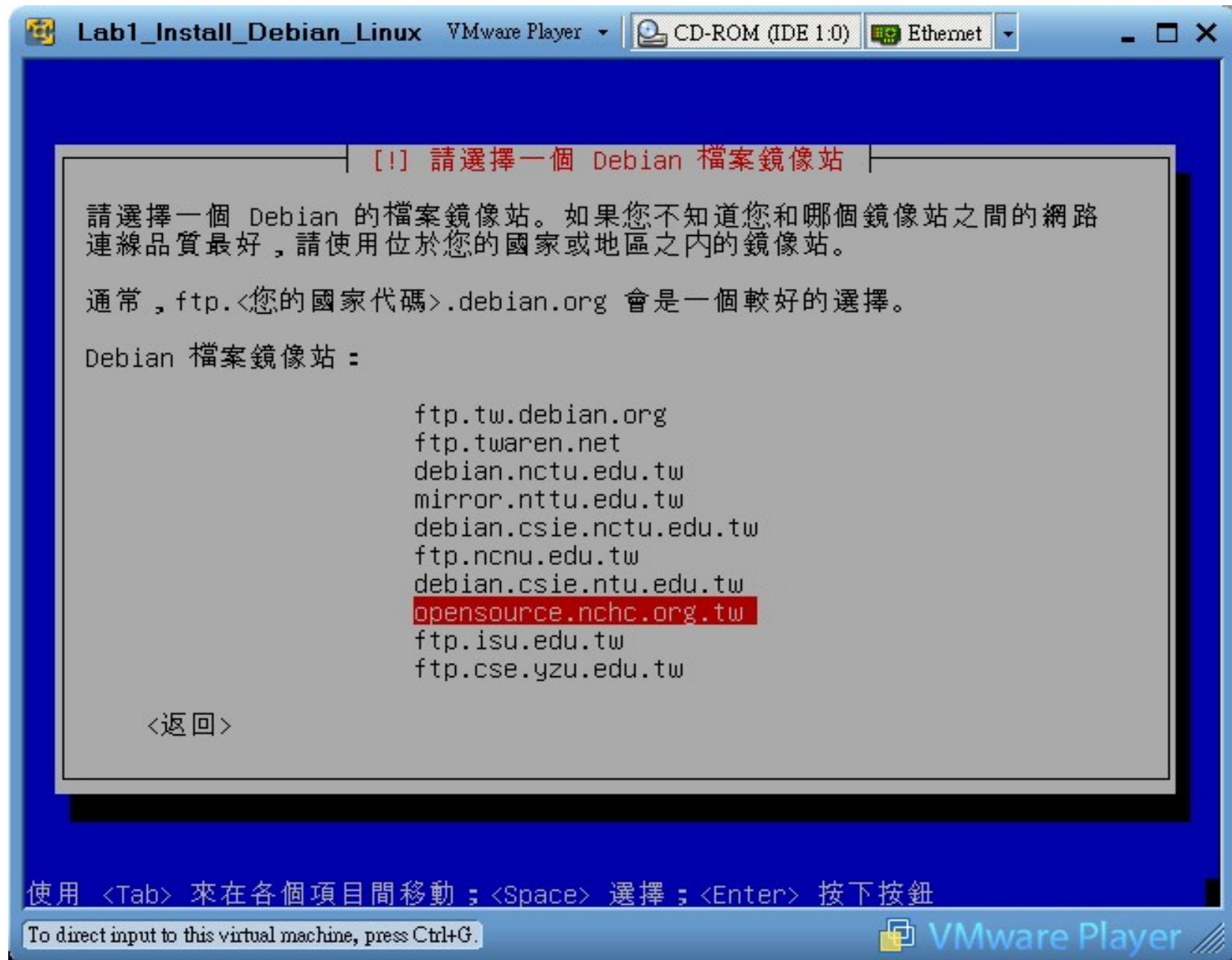


# 選擇『Debian 檔案映像站』(1) 台灣區



# 選擇『Debian 檔案映像站』(2)

## 推薦 [ftp.twaren.net](http://ftp.twaren.net) 或 [free.nchc.org.tw](http://free.nchc.org.tw)



## 選擇『Debian 檔案映象站』(3)

通常不需要輸入 Proxy，除非網路環境有限制





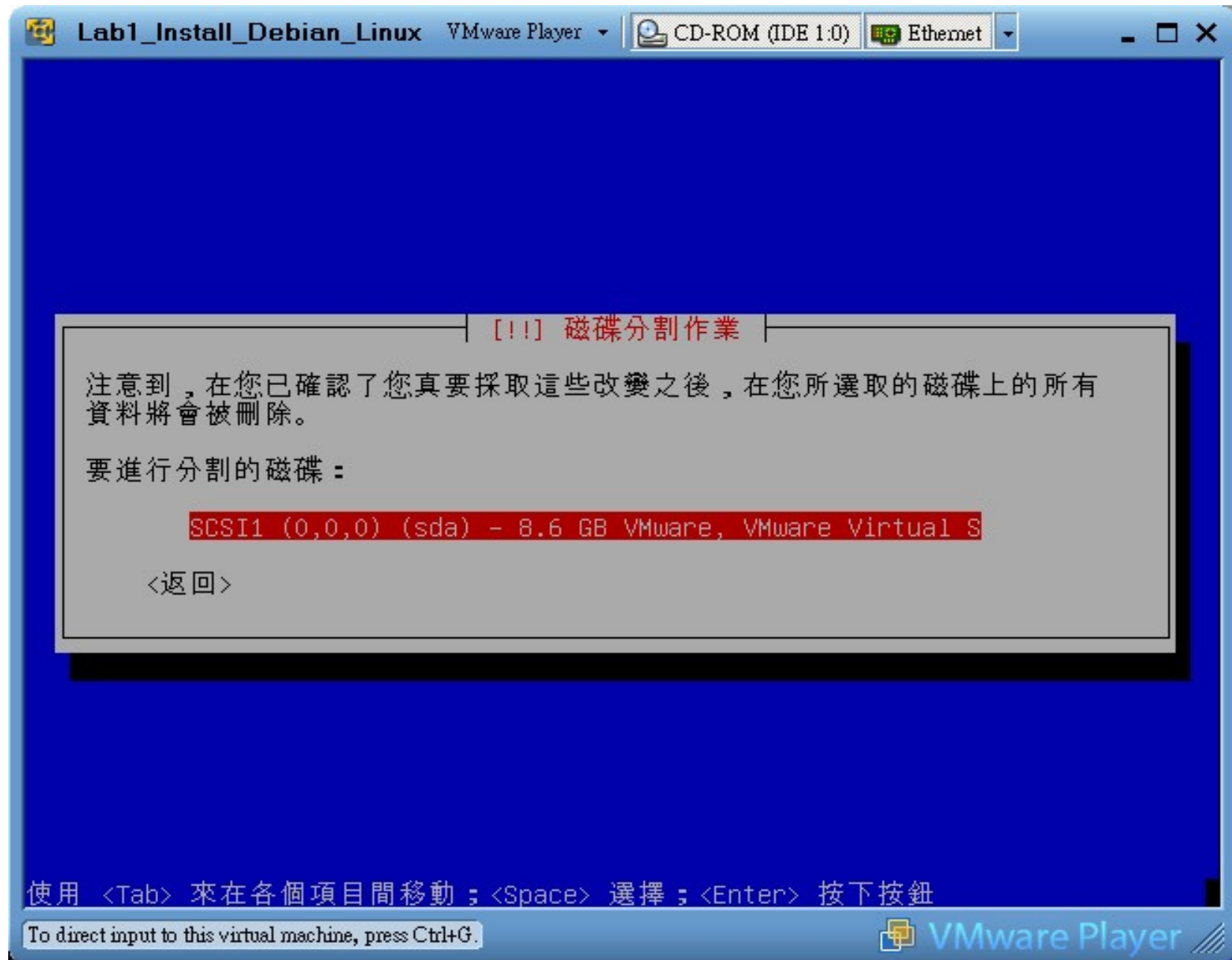
# 選擇『磁碟分割方式』

初學者建議採用第一種『引導 - 整顆硬碟』

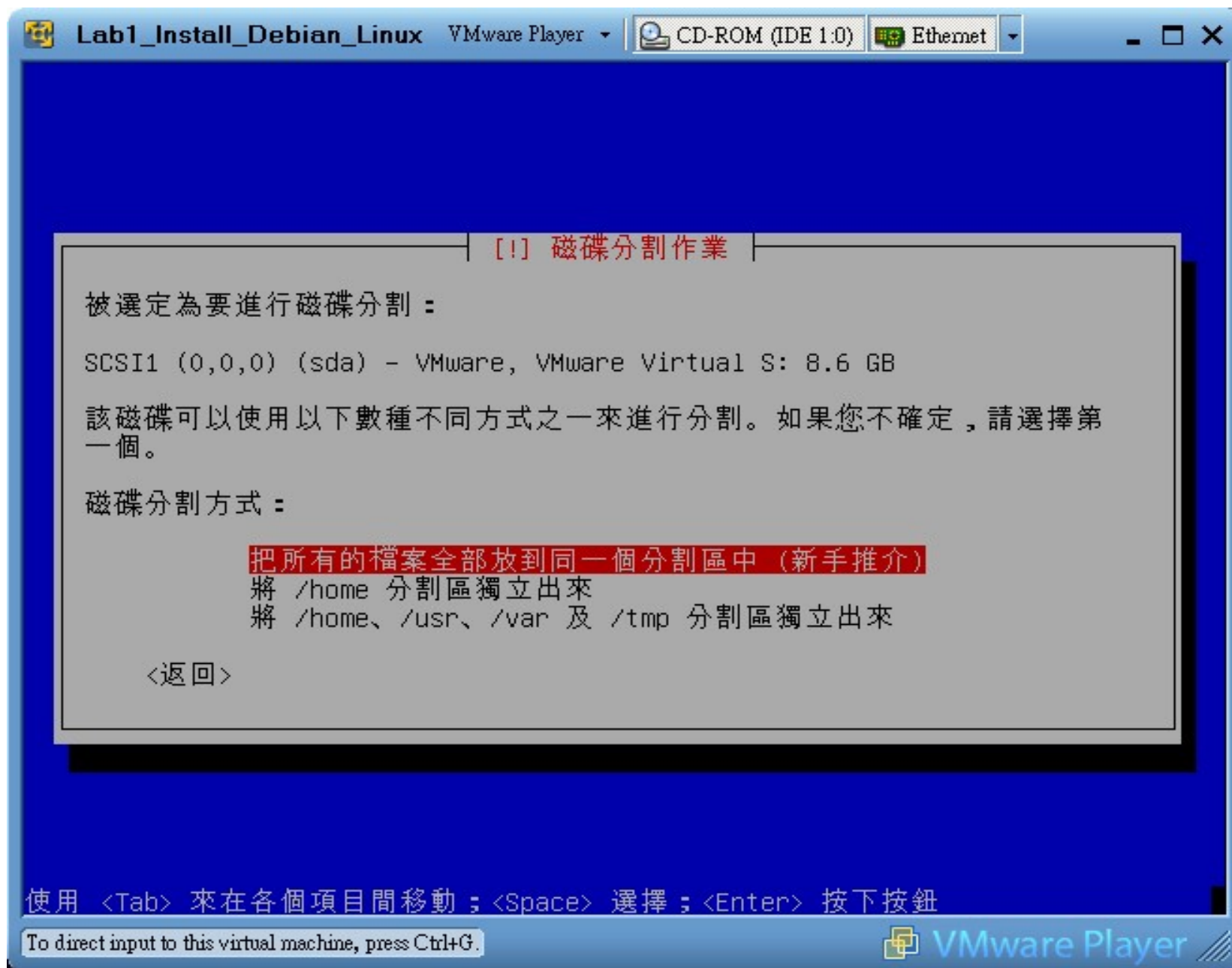


## 選擇『欲分割磁碟』

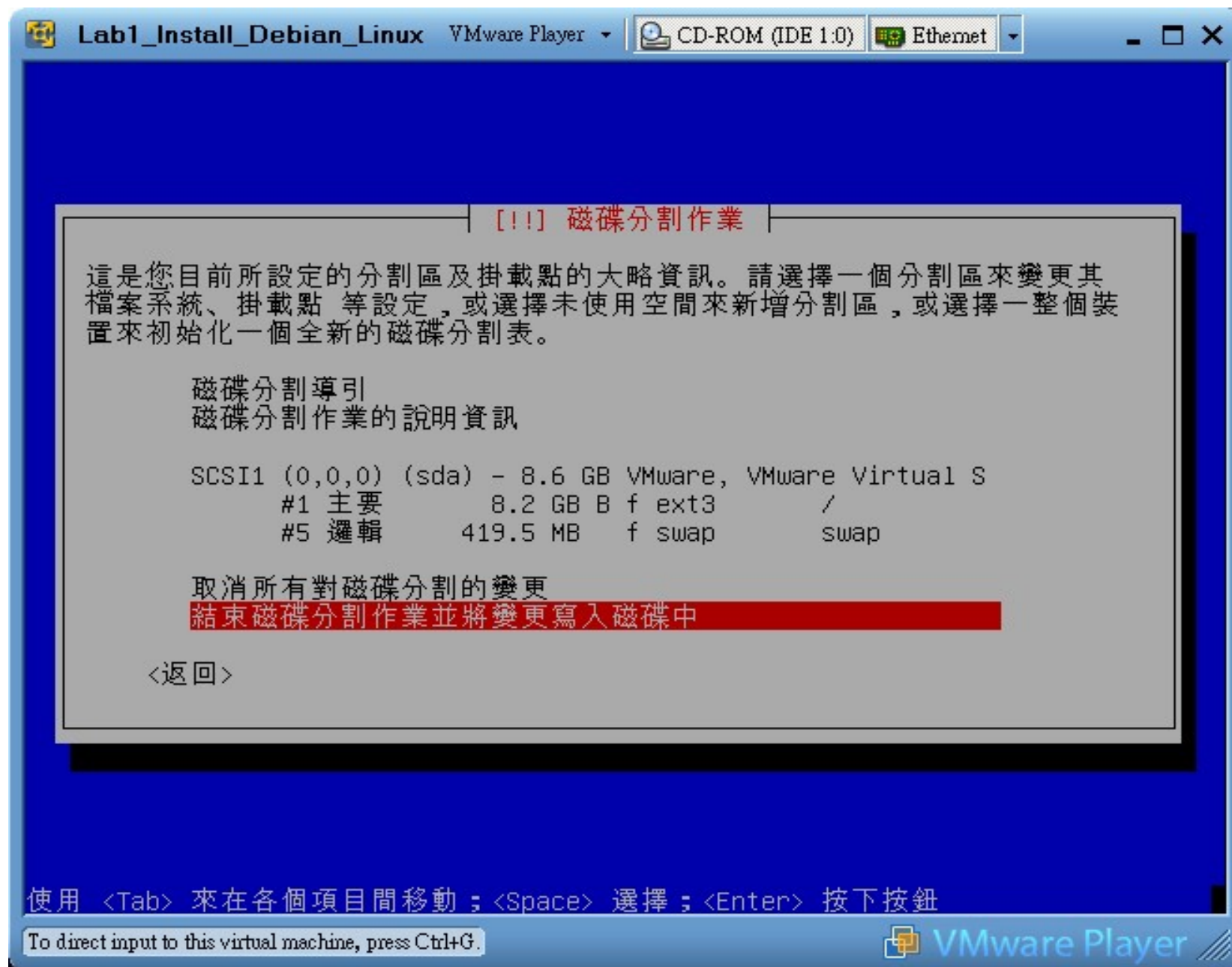
目前只有虛擬一顆硬碟，若實機有兩顆請小心！



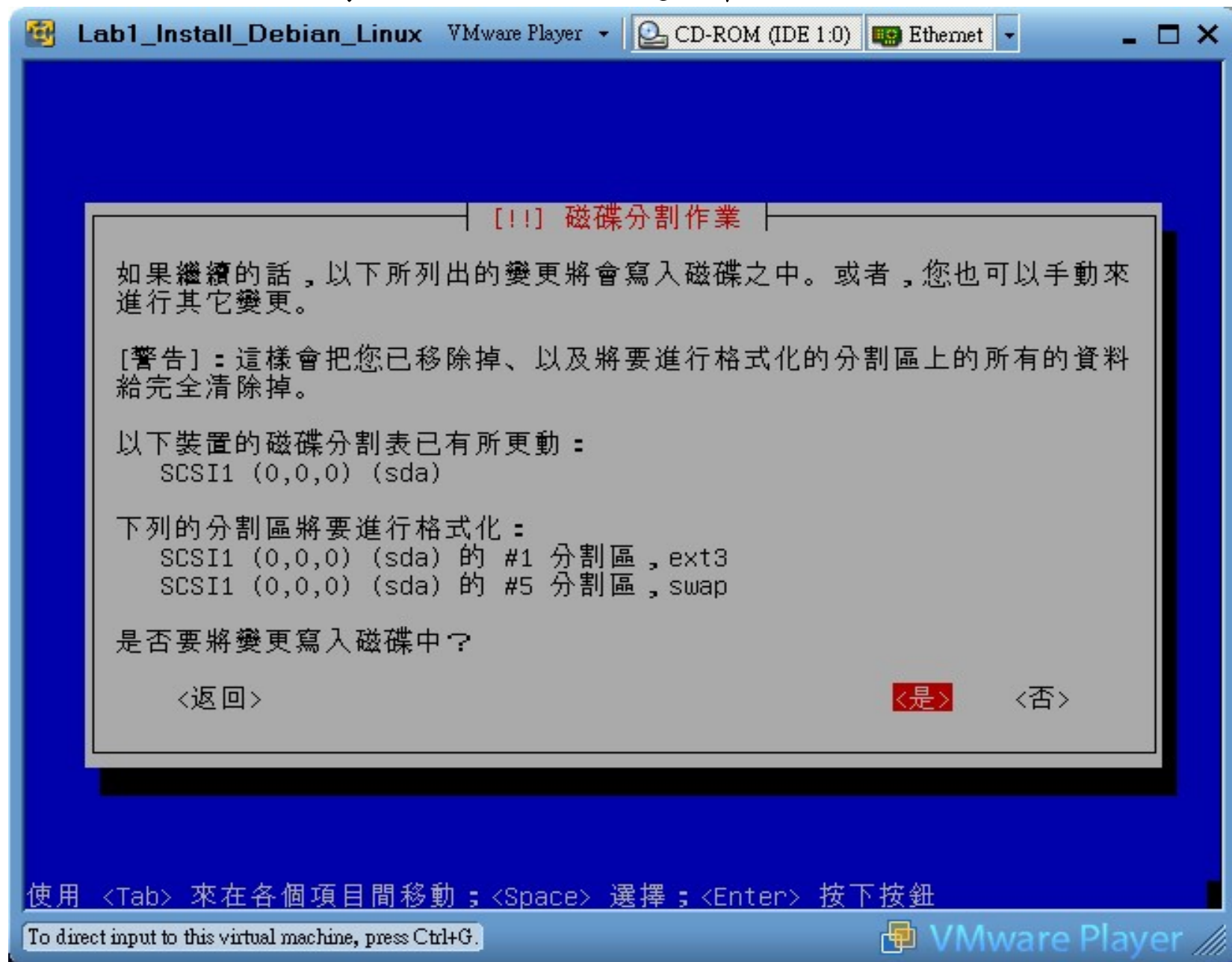
練習時可用同一個分割區，  
服務用系統請至少獨立出 /home 分割區



導引模式會切割兩個磁區，一個根目錄 (root)  
一個 swap (拿硬碟當記憶體空間用)



# 確認將目前的磁區分割表寫入硬碟 請用 TAB 選擇 <是>



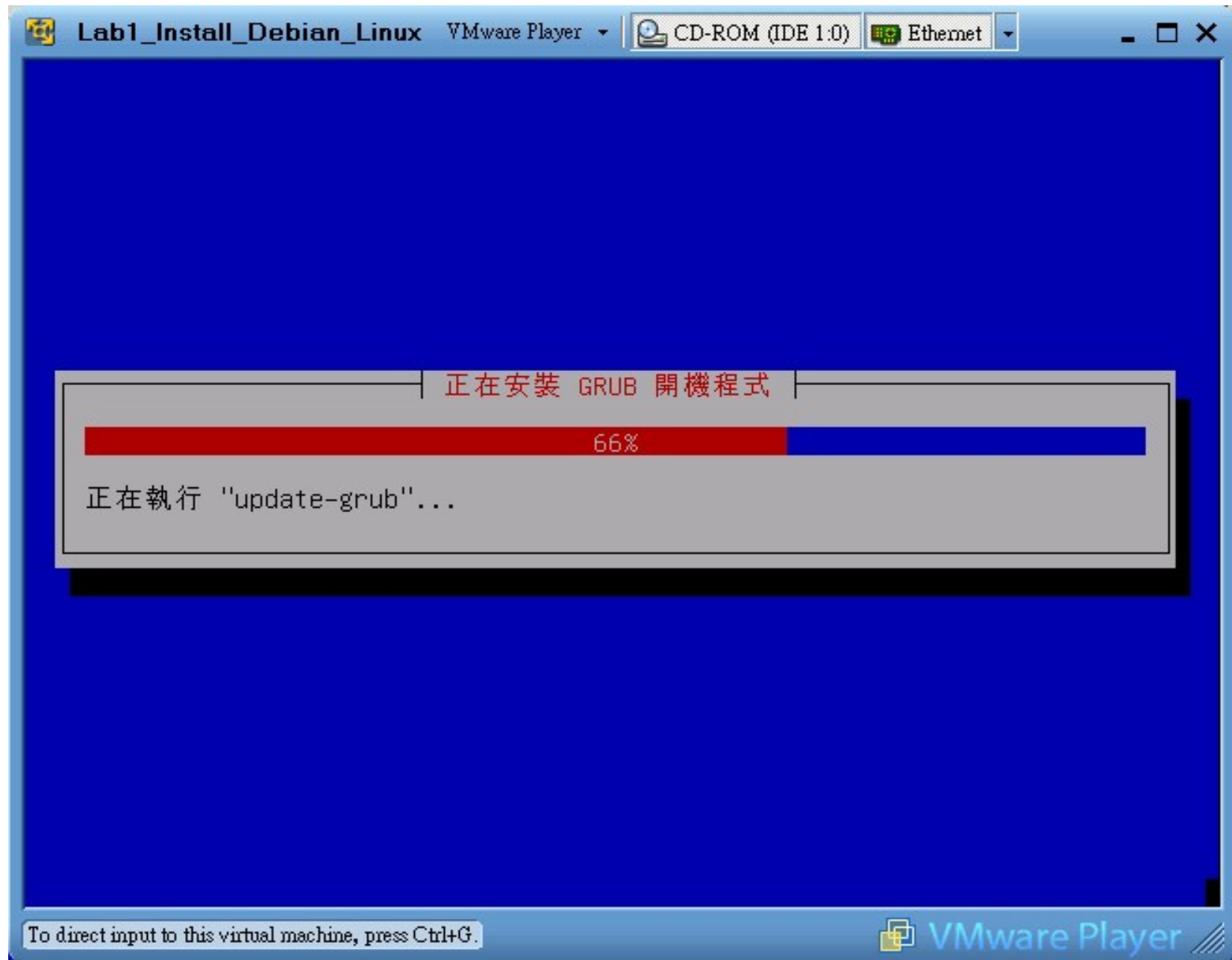
# 設定最高權限 root 管理者密碼



# 建立自己的帳號，習慣上不用 root 登入

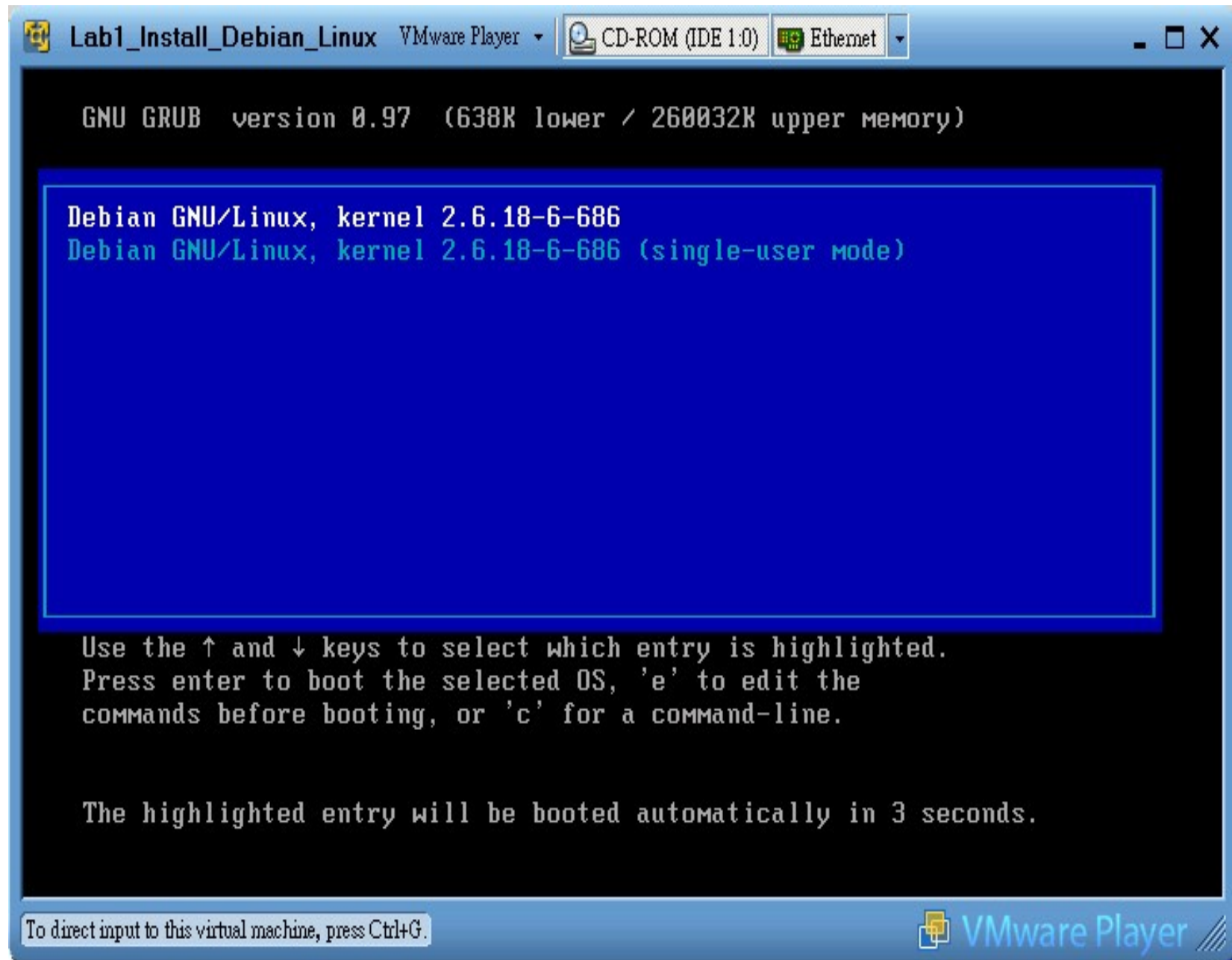


# 確認安裝 Grub Boot Loader

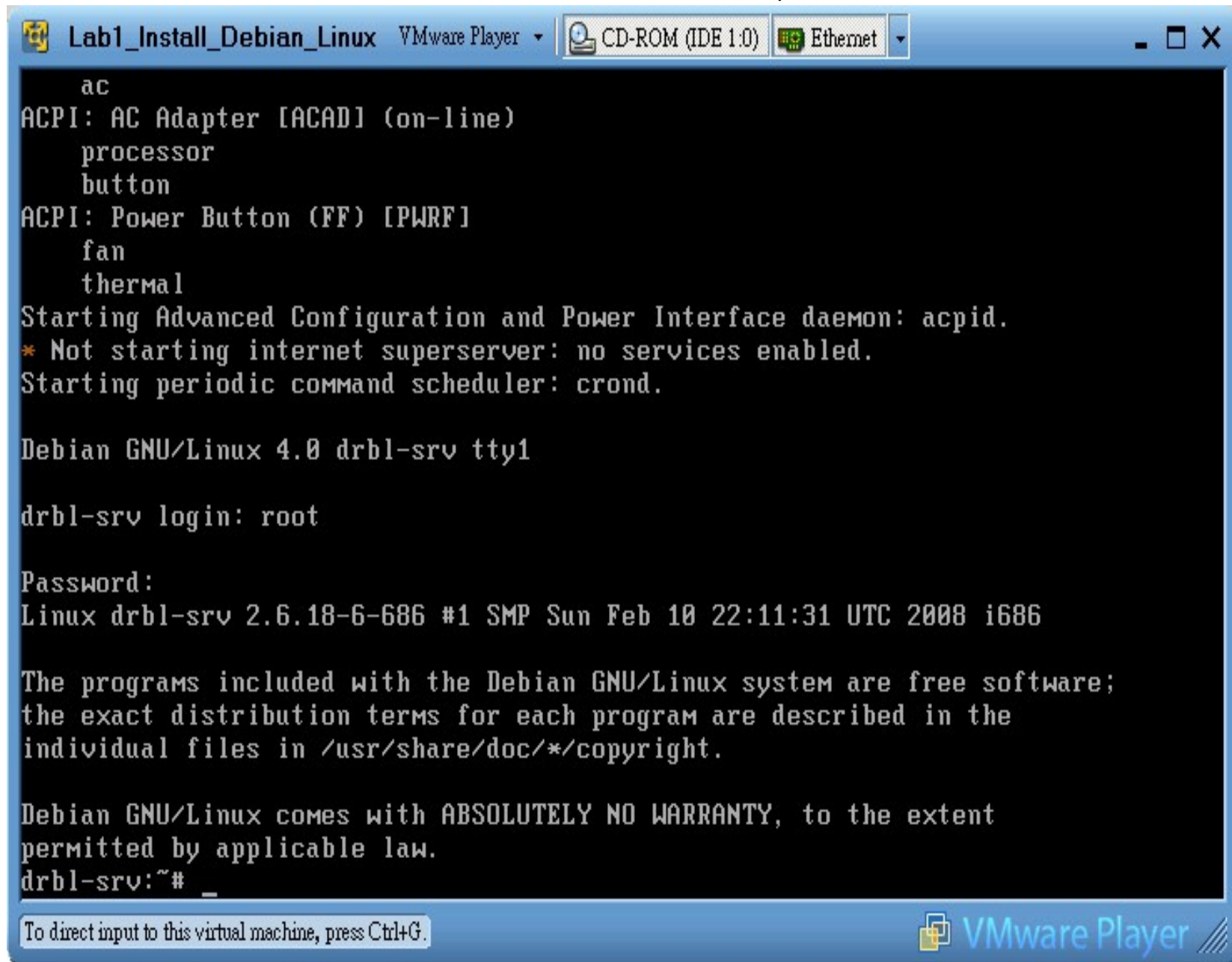




# 第一次系統開機



# 首次可使用 root 登入， 日後建議用一般身分登入



```
ac
ACPI: AC Adapter [ACAD] (on-line)
processor
button
ACPI: Power Button (FF) [PWRB]
fan
thermal
Starting Advanced Configuration and Power Interface daemon: acpid.
* Not starting internet superserver: no services enabled.
Starting periodic command scheduler: crond.

Debian GNU/Linux 4.0 drbl-srv tty1

drbl-srv login: root

Password:
Linux drbl-srv 2.6.18-6-686 #1 SMP Sun Feb 10 22:11:31 UTC 2008 i686

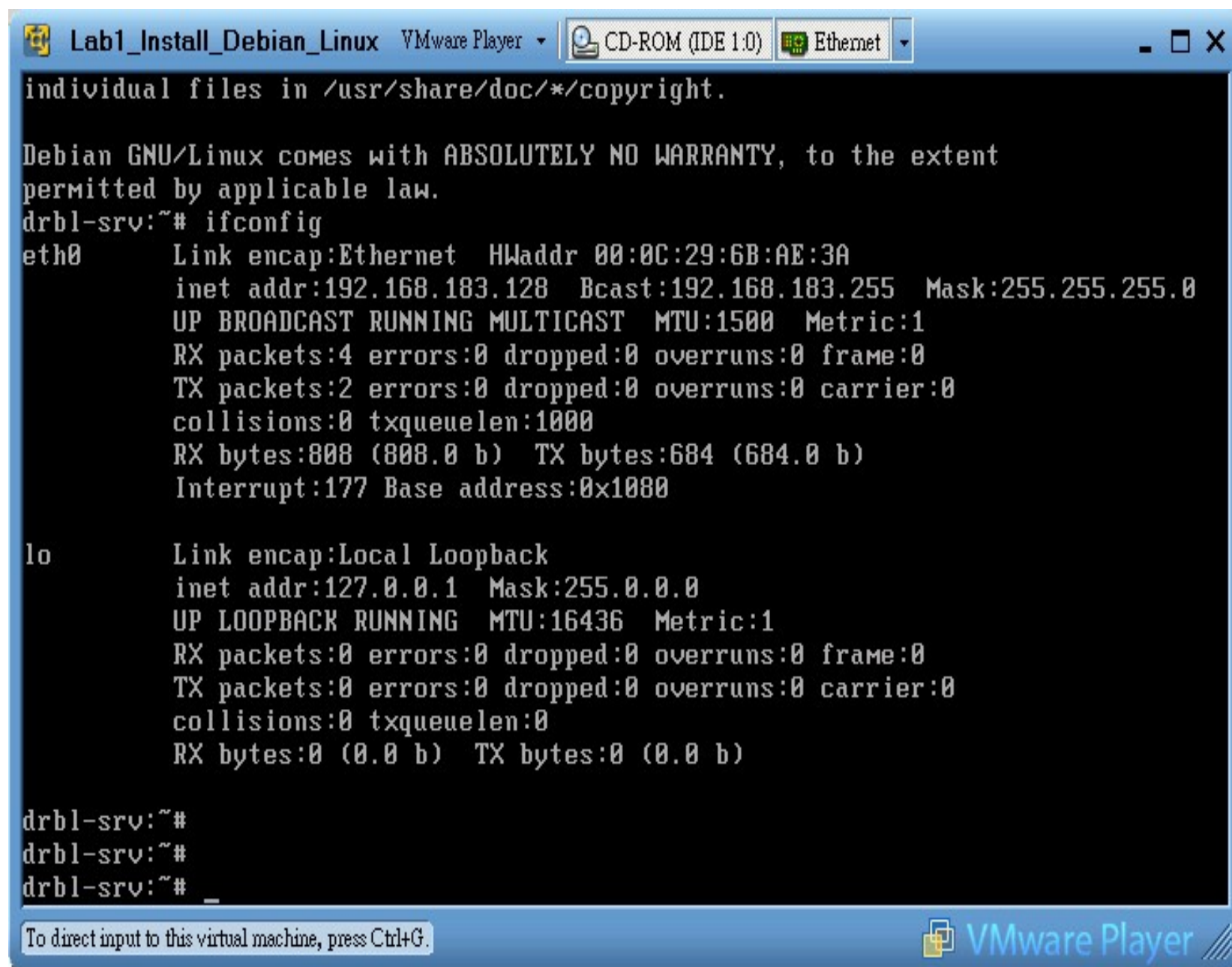
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
drbl-srv:~# _
```

To direct input to this virtual machine, press Ctrl+G.

VMware Player

# 基本管理篇 [1] 用 ifconfig 確認網路連線



```
Lab1_Install_Debian_Linux VMware Player | CD-ROM (IDE 1:0) | Ethernet | - □ X
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
drbl-srv:~# ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0C:29:6B:AE:3A
          inet addr:192.168.183.128  Bcast:192.168.183.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:4 errors:0 dropped:0 overruns:0 frame:0
          TX packets:2 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:808 (808.0 b)  TX bytes:684 (684.0 b)
          Interrupt:177 Base address:0x1080

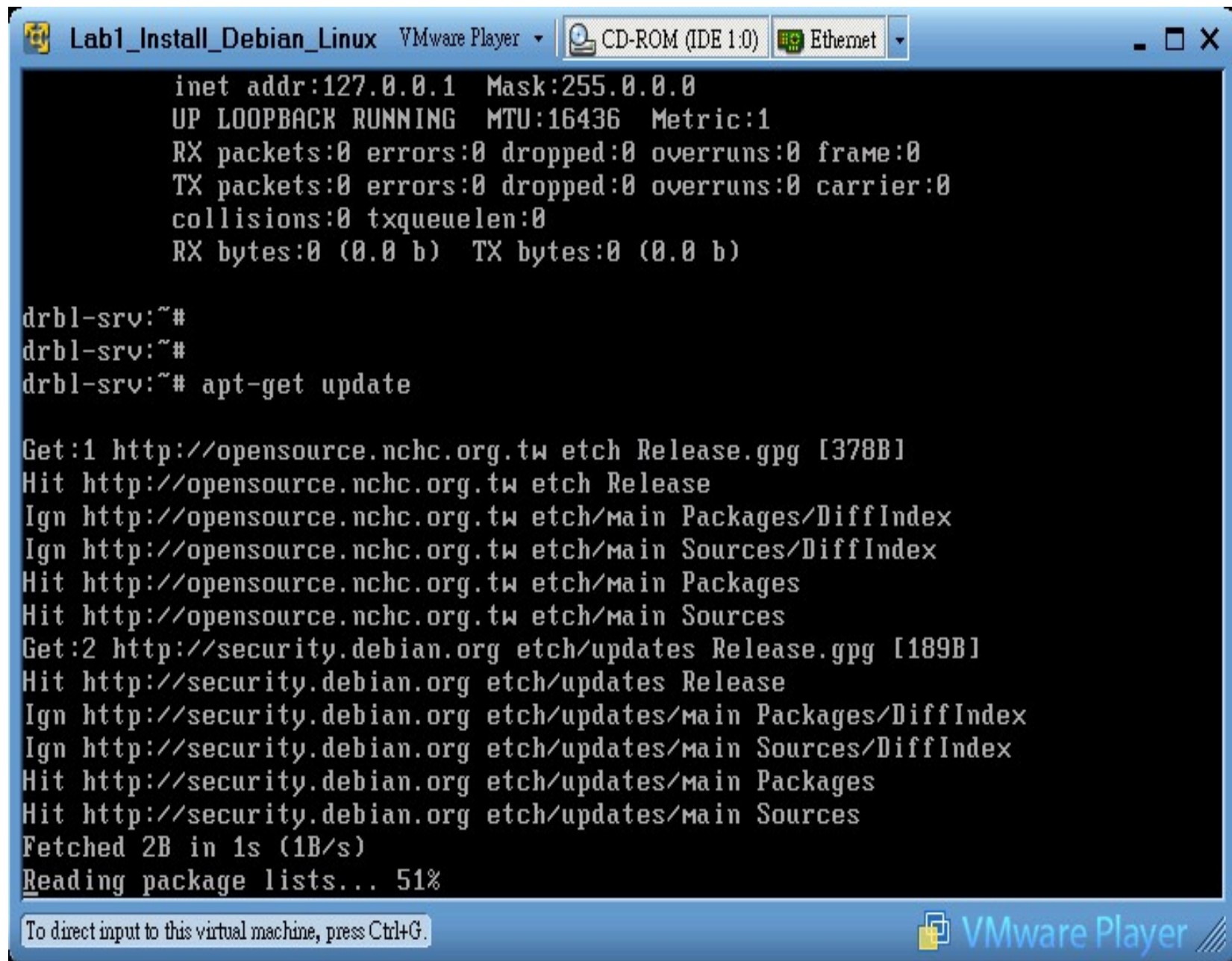
lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

drbl-srv:~#
drbl-srv:~#
drbl-srv:~# _
```

To direct input to this virtual machine, press Ctrl+G.

VMware Player

# 基本管理篇 [2] 用 apt-get update 更新套件



```
Lab1_Install_Debian_Linux VMware Player | CD-ROM (IDE 1:0) | Ethernet | . □ X
inet addr:127.0.0.1  Mask:255.0.0.0
UP LOOPBACK RUNNING  MTU:16436  Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

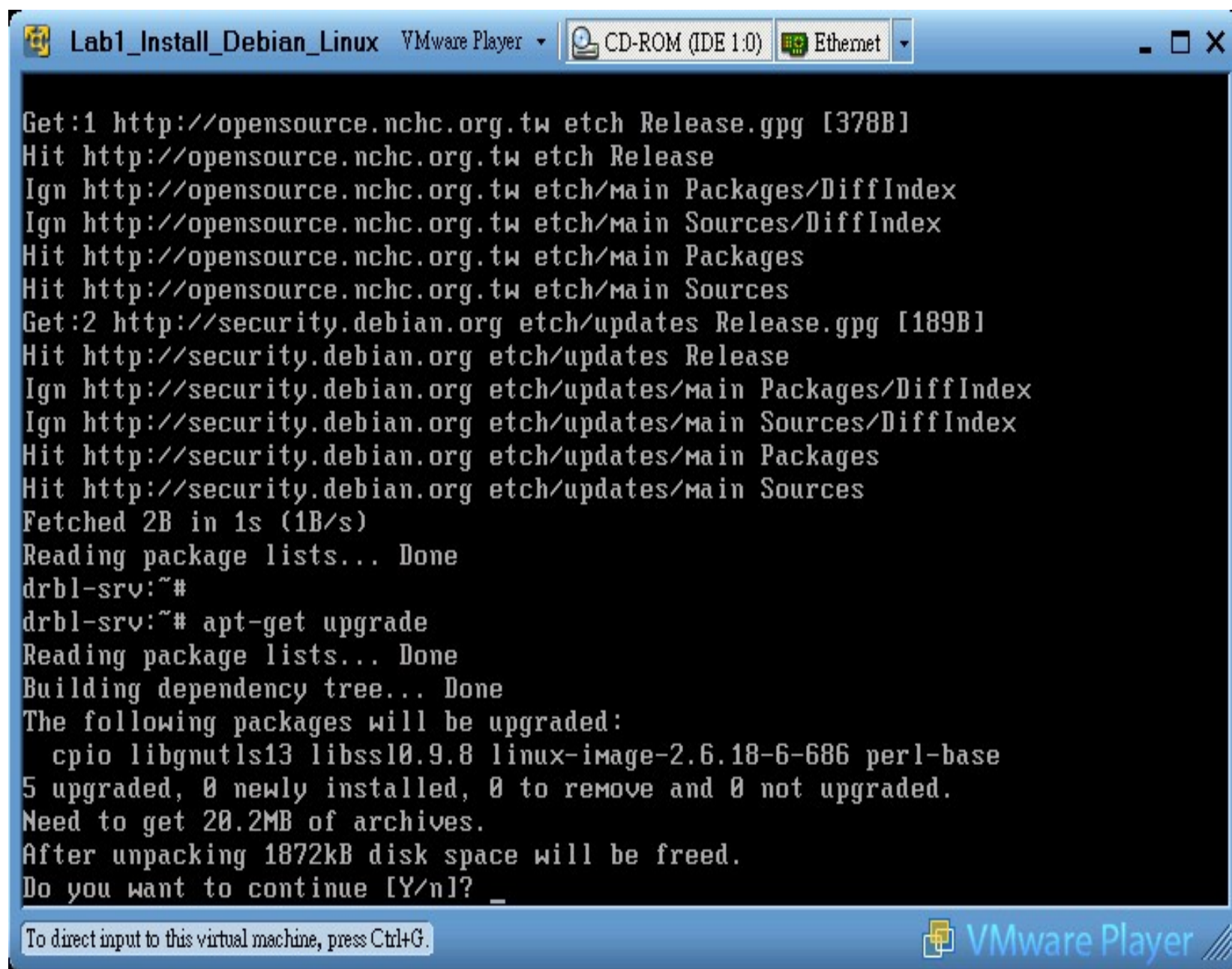
drbl-srv:~#
drbl-srv:~#
drbl-srv:~# apt-get update

Get:1 http://opensource.nchc.org.tw etch Release.gpg [378B]
Hit http://opensource.nchc.org.tw etch Release
Ign http://opensource.nchc.org.tw etch/main Packages/DiffIndex
Ign http://opensource.nchc.org.tw etch/main Sources/DiffIndex
Hit http://opensource.nchc.org.tw etch/main Packages
Hit http://opensource.nchc.org.tw etch/main Sources
Get:2 http://security.debian.org etch/updates Release.gpg [189B]
Hit http://security.debian.org etch/updates Release
Ign http://security.debian.org etch/updates/main Packages/DiffIndex
Ign http://security.debian.org etch/updates/main Sources/DiffIndex
Hit http://security.debian.org etch/updates/main Packages
Hit http://security.debian.org etch/updates/main Sources
Fetched 2B in 1s (1B/s)
Reading package lists... 51%
```

To direct input to this virtual machine, press Ctrl+G.

VMware Player

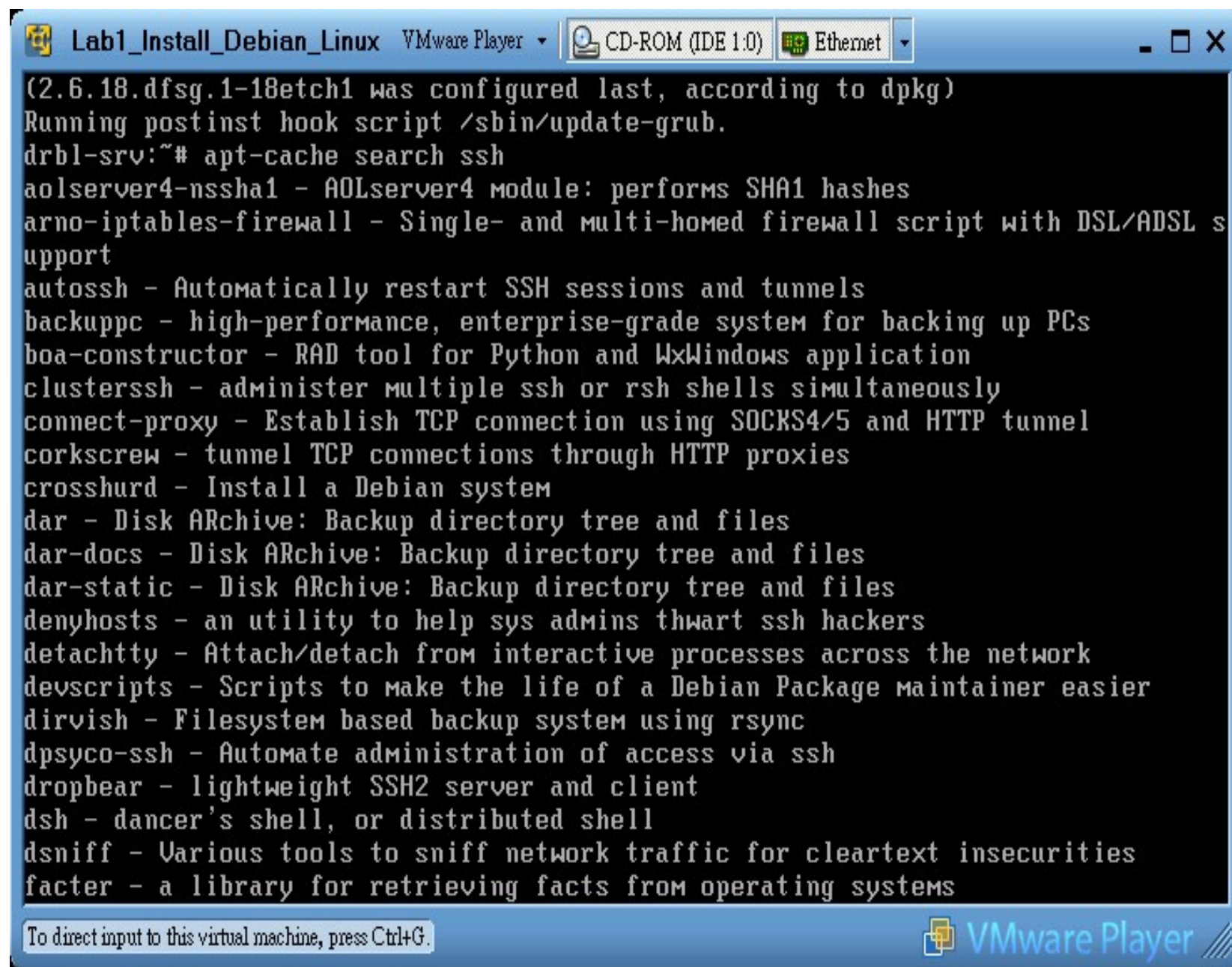
# 基本管理篇 [3] 用 apt-get upgrade 升級系統



```
Lab1_Install_Debian_Linux VMware Player | CD-ROM (IDE 1:0) | Ethernet | . □ X
Get:1 http://opensource.nchc.org.tw etch Release.gpg [378B]
Hit http://opensource.nchc.org.tw etch Release
Ign http://opensource.nchc.org.tw etch/main Packages/DiffIndex
Ign http://opensource.nchc.org.tw etch/main Sources/DiffIndex
Hit http://opensource.nchc.org.tw etch/main Packages
Hit http://opensource.nchc.org.tw etch/main Sources
Get:2 http://security.debian.org etch/updates Release.gpg [189B]
Hit http://security.debian.org etch/updates Release
Ign http://security.debian.org etch/updates/main Packages/DiffIndex
Ign http://security.debian.org etch/updates/main Sources/DiffIndex
Hit http://security.debian.org etch/updates/main Packages
Hit http://security.debian.org etch/updates/main Sources
Fetched 2B in 1s (1B/s)
Reading package lists... Done
drbl-srv:~#
drbl-srv:~# apt-get upgrade
Reading package lists... Done
Building dependency tree... Done
The following packages will be upgraded:
  cpio libgnutls13 libssl0.9.8 linux-image-2.6.18-6-686 perl-base
5 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
Need to get 20.2MB of archives.
After unpacking 1872kB disk space will be freed.
Do you want to continue [Y/n]? _
```

To direct input to this virtual machine, press Ctrl+G. VMware Player

# 基本管理篇 [4] 用 apt-cache search 搜尋

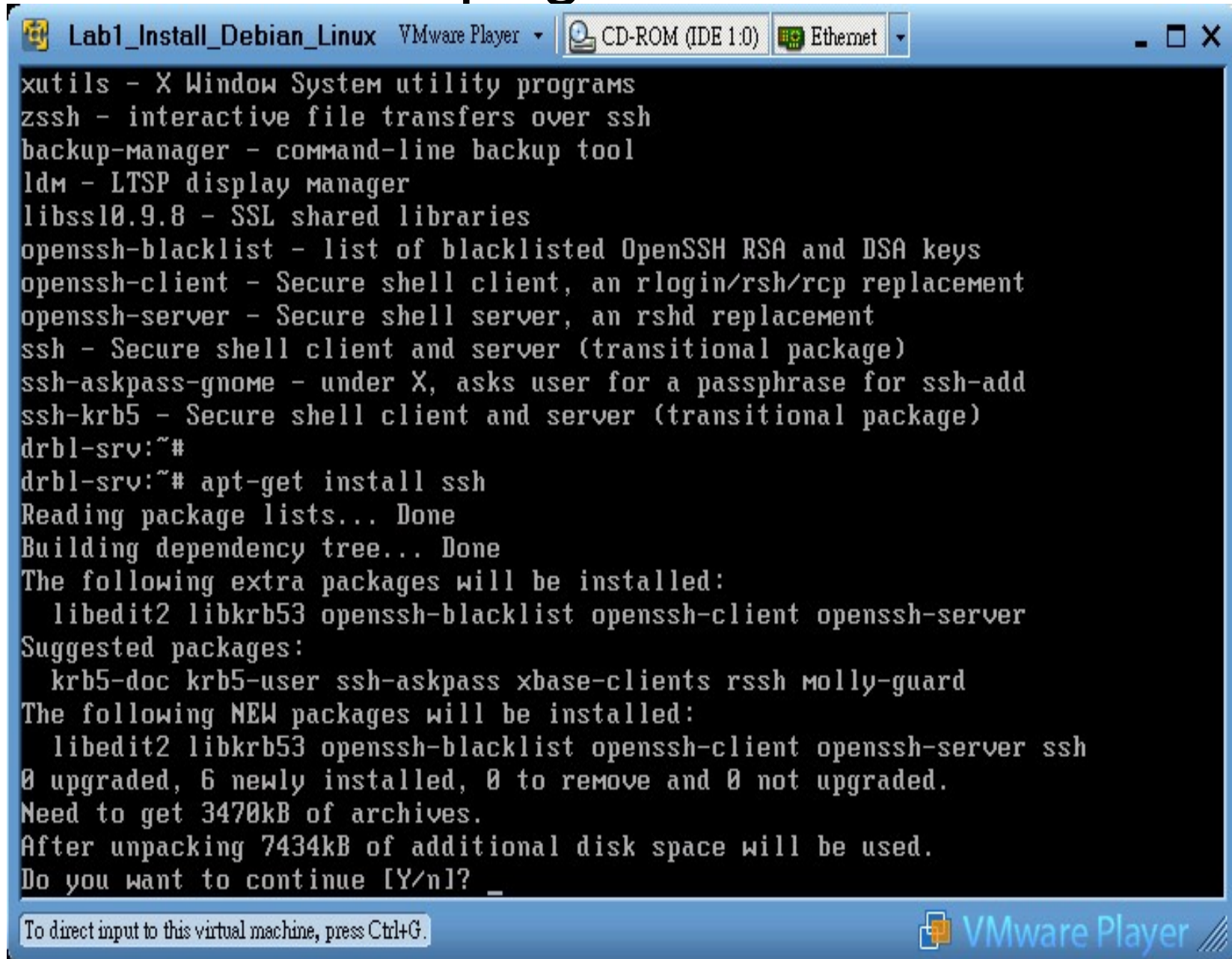


```
Lab1_Install_Debian_Linux VMware Player | CD-ROM (IDE 1:0) | Ethernet |
(2.6.18.dfsg.1-18etch1 was configured last, according to dpkg)
Running postinst hook script /sbin/update-grub.
drbl-srv:~# apt-cache search ssh
aolserver4-nssha1 - AOLserver4 module: performs SHA1 hashes
arno-iptables-firewall - Single- and multi-homed firewall script with DSL/ADSL support
autossh - Automatically restart SSH sessions and tunnels
backuppc - high-performance, enterprise-grade system for backing up PCs
boa-constructor - RAD tool for Python and WxWindows application
clusterssh - administer multiple ssh or rsh shells simultaneously
connect-proxy - Establish TCP connection using SOCKS4/5 and HTTP tunnel
corkscrew - tunnel TCP connections through HTTP proxies
crosshurd - Install a Debian system
dar - Disk ARchive: Backup directory tree and files
dar-docs - Disk ARchive: Backup directory tree and files
dar-static - Disk ARchive: Backup directory tree and files
denyhosts - an utility to help sys admins thwart ssh hackers
detachtty - Attach/detach from interactive processes across the network
devscripts - Scripts to make the life of a Debian Package maintainer easier
dirvish - Filesystem based backup system using rsync
dpsyco-ssh - Automate administration of access via ssh
dropbear - lightweight SSH2 server and client
dsh - dancer's shell, or distributed shell
dsniff - Various tools to sniff network traffic for cleartext insecurities
factor - a library for retrieving facts from operating systems

To direct input to this virtual machine, press Ctrl+G. | VMware Player
```

# 基本管理篇 [5] 用 apt-get install 安裝套件

## Ex. apt-get install ssh



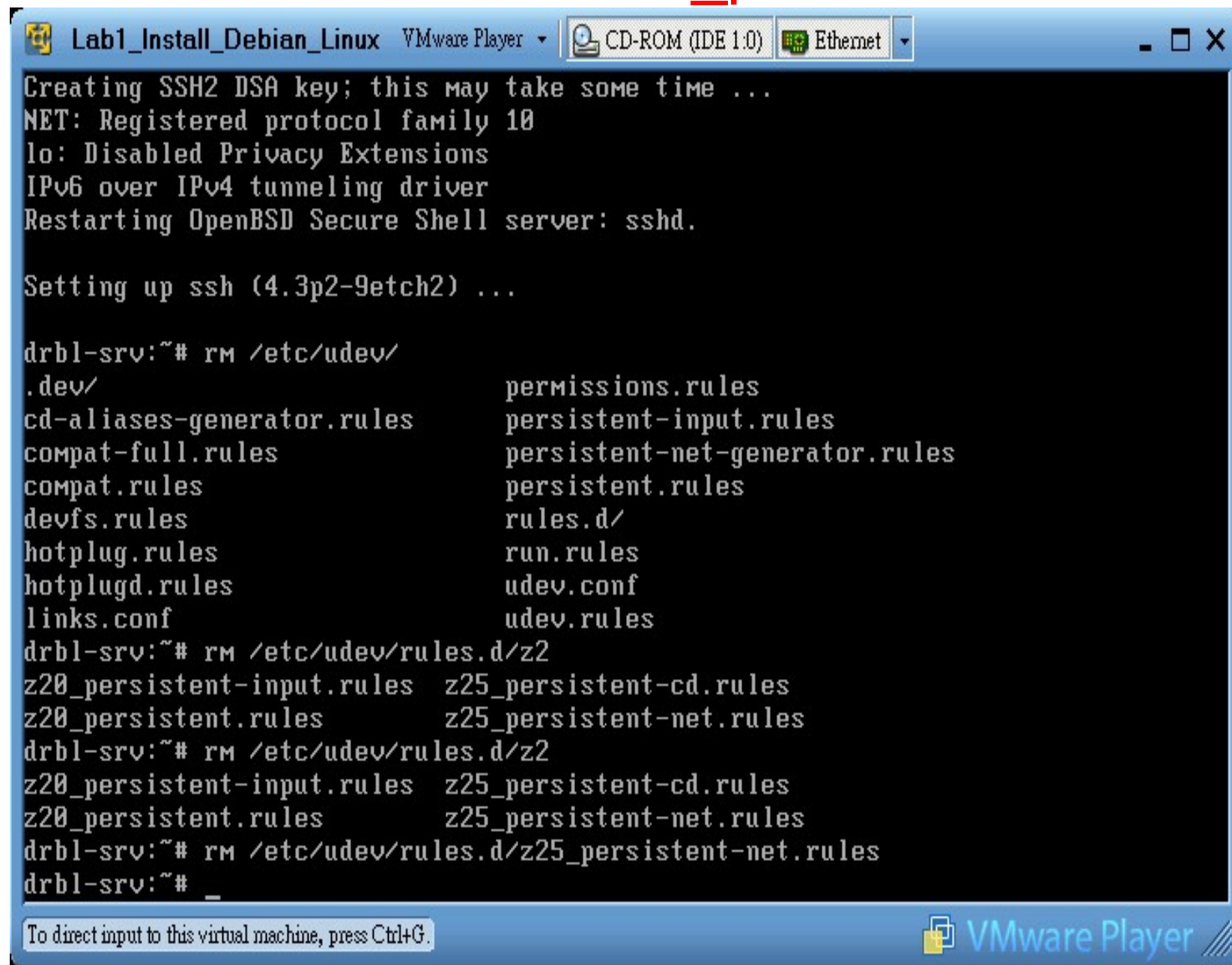
```
Lab1_Install_Debian_Linux VMware Player | CD-ROM (IDE 1:0) Ethernet
xutils - X Window System utility programs
zssh - interactive file transfers over ssh
backup-manager - command-line backup tool
ldm - LTSP display manager
libssl0.9.8 - SSL shared libraries
openssh-blacklist - list of blacklisted OpenSSH RSA and DSA keys
openssh-client - Secure shell client, an rlogin/rsh/rcp replacement
openssh-server - Secure shell server, an rshd replacement
ssh - Secure shell client and server (transitional package)
ssh-askpass-gnome - under X, asks user for a passphrase for ssh-add
ssh-krb5 - Secure shell client and server (transitional package)
drbl-srv:~#
drbl-srv:~# apt-get install ssh
Reading package lists... Done
Building dependency tree... Done
The following extra packages will be installed:
  libedit2 libkrb53 openssh-blacklist openssh-client openssh-server
Suggested packages:
  krb5-doc krb5-user ssh-askpass xbase-clients rssh molly-guard
The following NEW packages will be installed:
  libedit2 libkrb53 openssh-blacklist openssh-client openssh-server ssh
0 upgraded, 6 newly installed, 0 to remove and 0 not upgraded.
Need to get 3470kB of archives.
After unpacking 7434kB of additional disk space will be used.
Do you want to continue [Y/n]? _
```

To direct input to this virtual machine, press Ctrl+G.

VMware Player

# 管理番外篇 [\*] 關於 udev 鎖住網卡 MAC

## rm /etc/udev/rules.d/z25\_persistent-net.rules



```
Lab1_Install_Debian_Linux VMware Player | CD-ROM (IDE 1:0) Ethernet
Creating SSH2 DSA key; this may take some time ...
NET: Registered protocol family 10
lo: Disabled Privacy Extensions
IPv6 over IPv4 tunneling driver
Restarting OpenBSD Secure Shell server: sshd.

Setting up ssh (4.3p2-9etch2) ...

drbl-srv:~# rm /etc/udev/
.dev/
permissions.rules
cd-aliases-generator.rules persistent-input.rules
compat-full.rules persistent-net-generator.rules
compat.rules persistent.rules
devfs.rules rules.d/
hotplug.rules run.rules
hotplugd.rules udev.conf
links.conf udev.rules
drbl-srv:~# rm /etc/udev/rules.d/z2
z20_persistent-input.rules z25_persistent-cd.rules
z20_persistent.rules z25_persistent-net.rules
drbl-srv:~# rm /etc/udev/rules.d/z2
z20_persistent-input.rules z25_persistent-cd.rules
z20_persistent.rules z25_persistent-net.rules
drbl-srv:~# rm /etc/udev/rules.d/z25_persistent-net.rules
drbl-srv:~# _
```

To direct input to this virtual machine, press Ctrl+G.

VMware Player



# 基本管理篇 [6] 用 halt -n 關機

```
Lab1_Install_Debian_Linux VMware Player | CD-ROM (IDE 1:0) Ethernet |
compat.rules          persistent.rules
devfs.rules           rules.d/
hotplug.rules         run.rules
hotplugd.rules       udev.conf
links.conf            udev.rules
drbl-srv:~# rm /etc/udev/rules.d/z2
z20_persistent-input.rules  z25_persistent-cd.rules
z20_persistent.rules        z25_persistent-net.rules
drbl-srv:~# rm /etc/udev/rules.d/z2
z20_persistent-input.rules  z25_persistent-cd.rules
z20_persistent.rules        z25_persistent-net.rules
drbl-srv:~# rm /etc/udev/rules.d/z25_persistent-net.rules
drbl-srv:~# halt -n

Broadcast message from root@drbl-srv (tty1) (Thu Jul 17 08:55:29 2008):

The system is going down for system halt NOW!
INIT: Switching to runlevel: 0
INIT: Sending processes the TERM signal
drbl-srv:~# Stopping periodic command scheduler: crond.
Stopping Advanced Configuration and Power Interface daemon: acpid.
Stopping internet superserver: inetd.
Stopping OpenBSD Secure Shell server: sshd.
Saving the system clock..
_
To direct input to this virtual machine, press Ctrl+G. VMware Player
```



財團法人國家實驗研究院

國家高速網路與計算中心

NATIONAL CENTER FOR HIGH-PERFORMANCE COMPUTING

# 設置Hadoop環境

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自由軟體實驗室

# Yahoo's Hadoop Cluster

- ~10,000 machines running Hadoop in US
- The largest cluster is currently 2000 nodes
- Nearly 1 petabyte of user data (compressed, unreplicated)
- Running roughly 10,000 research jobs / week



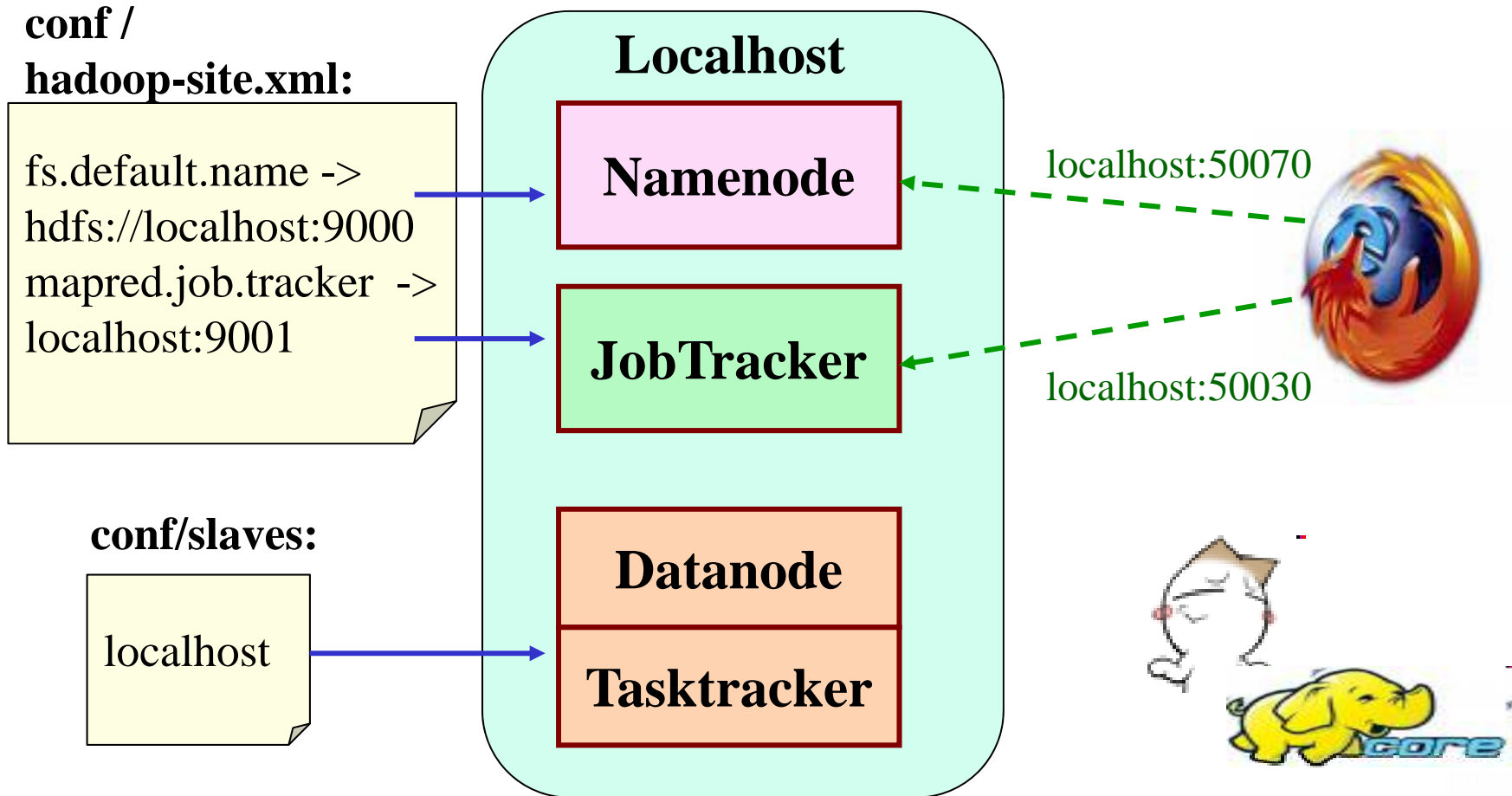
# Hadoop 單機設定與啟動

- step 1. 設定登入免密碼
- step 2. 安裝java
- step 3. 下載安裝Hadoop
- step 4.1 設定 hadoop-env.sh
  - export JAVA\_HOME=/usr/lib/jvm/java-6-sun
- step 4.2 設定 hadoop-site.xml
  - 設定Namenode-> hdfs://localhost:9000
  - 設定Jobtracker -> localhost:9001
- step 5.1 格式化HDFS
  - bin/hadoop namenode -format
- step 5.2 啟動Hadoop
  - bin/start-all.sh
- step 6. 完成！檢查運作狀態
  - Job admin <http://localhost:50030/> HDFS <http://localhost:50070/>



# Hadoop 單機環境示意圖

Node 1

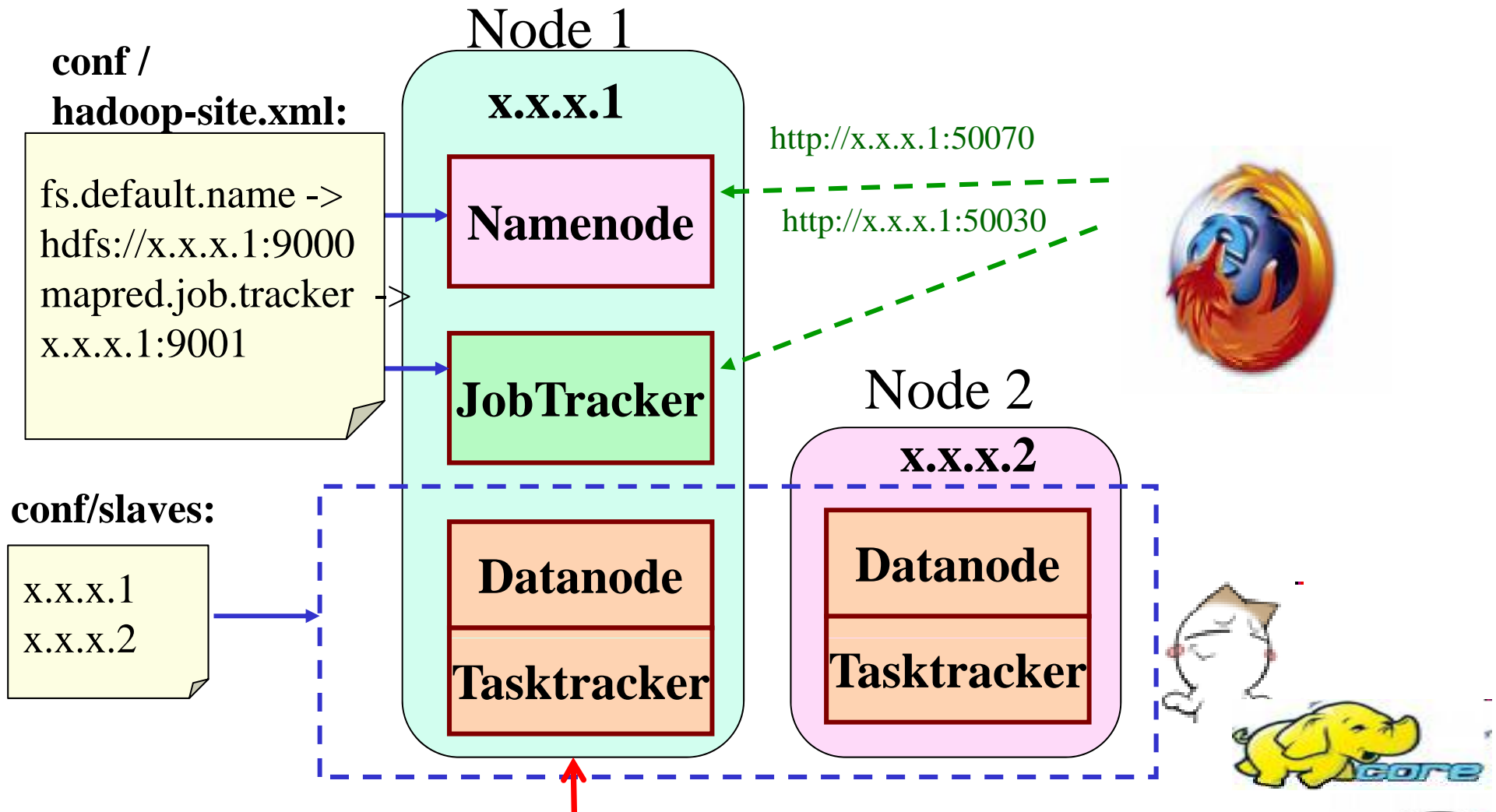


# Hadoop 叢集設定與啟動

- step 1. 設定登入免密碼
- step 2. 安裝java
- step 3. 下載安裝Hadoop
- step 4.1 設定 hadoop-env.sh
  - export JAVA\_HOME=/usr/lib/jvm/java-6-sun
- step 4.2 設定 hadoop-site.xml
  - 設定Namenode-> hdfs://x.x.x.1:9000
  - 設定Jobtracker -> x.x.x.2:9001
- step 4.3 設定slaves 檔
- step 4.4 將叢集內的電腦Hadoop都做一樣的配置
- step 5.1 格式化HDFS
  - bin/hadoop namenode -format
- step 5.2 啟動Hadoop
  - nodeN執行： bin/start-dfs.sh ; nodeJ執行： bin/start-mapred.sh
- step 6. 完成！檢查運作狀態
  - Job admin <http://x.x.x.2:50030/> HDFS <http://x.x.x.1:50070/>

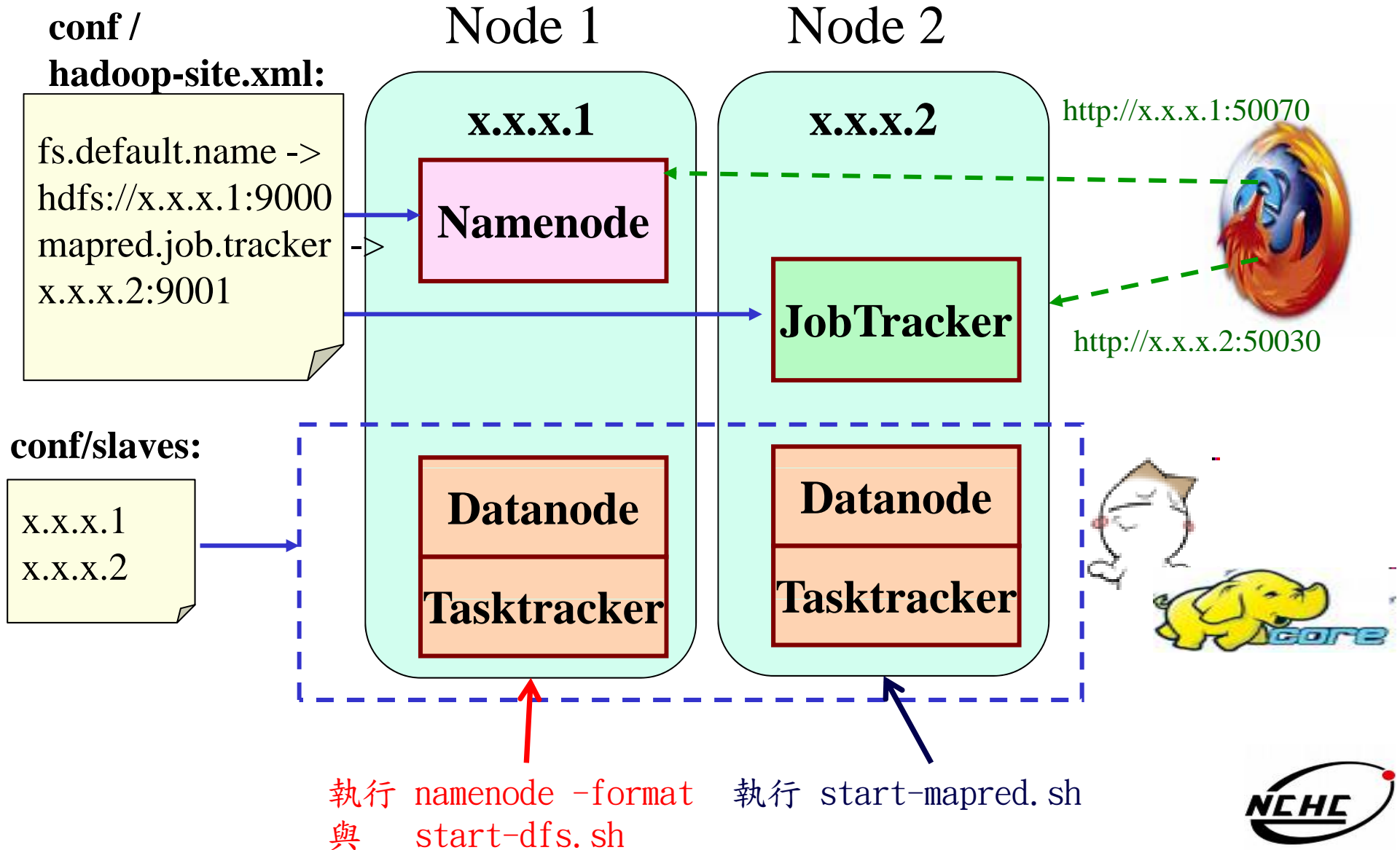


# 情況一



執行 `namenode -format`  
與 `start-all.sh`

# 情況二





# 情況三

**conf /  
hadoop.site.xml:**

```
fs-default.name ->  
hdfs://x.x.x.1:9000  
mapred.job.tracker  
x.x.x.1:9001
```

Node 1

x.x.x.1

**Namenode**

**JobTracker**

http://x.x.x.1:50070

http://x.x.x.1:50030



**conf/slaves:**

```
x.x.x.2  
.....  
x.x.x.n
```

Node 2

x.x.x.2

**Datanode**

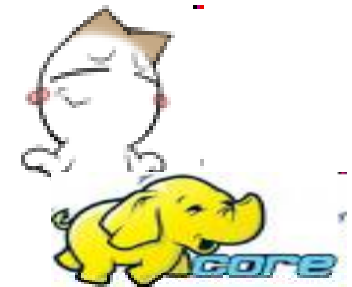
**Tasktracker**

Node N

x.x.x.n

**Datanode**

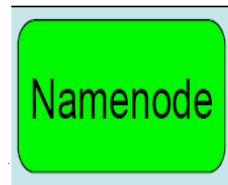
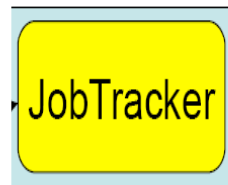
**Tasktracker**



# 情況四

**conf /  
hadoop-site.xml:**

```
mapred.job.tracker->  
x.x.x.2:9001  
fs.default.name ->  
hdfs://x.x.x.1:9000
```



http://x.x.x.2:50030

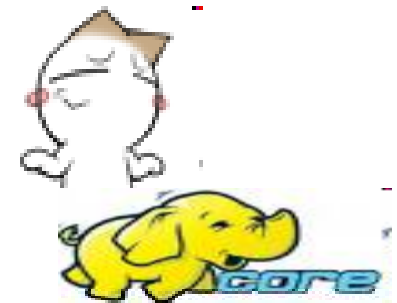
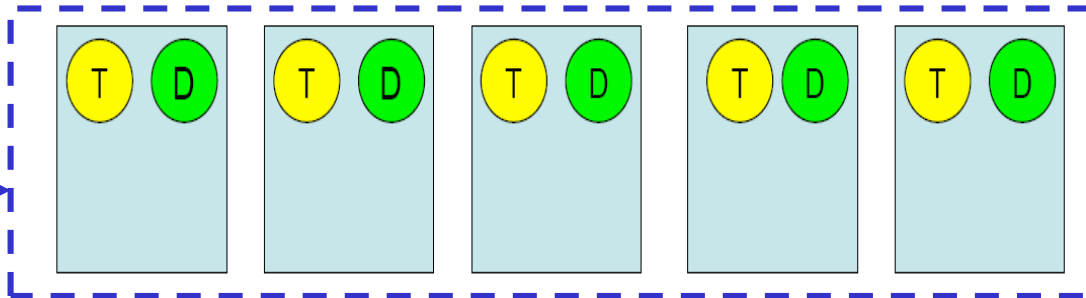
HTTP Monitoring UI

http://x.x.x.1:50070



**conf/slaves:**

```
x.x.x.3  
.....  
x.x.x.n
```

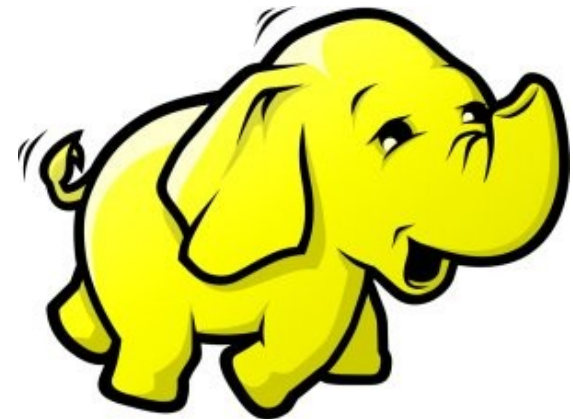




# Hadoop 相關計畫

*Hadoop Ecosystem*

**Jazz Wang**  
**Yao-Tsung Wang**  
**jazz@nchc.org.tw**





**Hadoop** 只支援用 **Java** 開發嘛？  
***Is Hadoop only support Java ?***

總不能全部都重新設計吧？如何與舊系統相容？

***Can Hadoop work with existing software ?***



可以跟資料庫結合嘛？

***Can Hadoop work with Databases ?***

開發者們有聽到大家的需求.....

***Yes, we hear the feedback of developers ...***



# Is Hadoop only support Java ?

- Although the Hadoop framework is implemented in Java<sup>™</sup>, **Map/Reduce applications need not be written in Java.**
- **Hadoop Streaming** is a utility which allows users to **create and run jobs with any executables (e.g. shell utilities)** as the mapper and/or the reducer.
- **Hadoop Pipes** is a SWIG-compatible **C++ API** to implement Map/Reduce applications (non JNI<sup>™</sup> based).

# Hadoop Pipes (C++, Python)

- Hadoop Pipes allows **C++** code to use Hadoop DFS and map/reduce.
- The C++ interface is "swigable" so that interfaces can be generated for **python** and other scripting languages.
- For more detail, check the API Document of [org.apache.hadoop.mapred.pipes](http://org.apache.hadoop.mapred.pipes)
- You can also find example code at [hadoop-\\*/src/examples/pipes](http://hadoop-*/src/examples/pipes)
- About the pipes C++ WordCount example code: <http://wiki.apache.org/hadoop/C++WordCount>

# Hadoop Streaming

- Hadoop Streaming is a utility which allows users to create and run Map-Reduce jobs **with any executables (e.g. Unix shell utilities)** as the mapper and/or the reducer.
- It's useful when you need to run **existing program** written in shell script, perl script or even PHP.
- Note: both the **mapper** and the **reducer** are **executables** that read the input from **STDIN** (line by line) and emit the output to **STDOUT**.
- For more detail, check the official document of **Hadoop Streaming**

# Running Hadoop Streaming

```
jazz@hadoop:~$ hadoop jar hadoop-streaming.jar -help
10/08/11 00:20:00 ERROR streaming.StreamJob: Missing required option -input
Usage: $HADOOP_HOME/bin/hadoop [--config dir] jar \
      $HADOOP_HOME/hadoop-streaming.jar [options]
```

Options:

```
-input      <path>          DFS input file(s) for the Map step
-output     <path>          DFS output directory for the Reduce step
-mapper     <cmd|JavaClassName>    The streaming command to run
-combiner   <JavaClassName> Combiner has to be a Java class
-reducer    <cmd|JavaClassName>    The streaming command to run
-file       <file>          File/dir to be shipped in the Job jar file
-dfs        <h:p>|local  Optional. Override DFS configuration
-jt         <h:p>|local  Optional. Override JobTracker configuration
-additionalconfspec specfile  Optional.
-inputformat TextInputFormat(default) |SequenceFileAsTextInputFormat |
JavaClassName Optional.
-outputformat TextOutputFormat(default) |JavaClassName  Optional.
```

... More ...



# Hadoop Streaming with shell commands (1)

```
hadoop:~$ hadoop fs -rmr input output
```

```
hadoop:~$ hadoop fs -put /etc/hadoop/conf input
```

```
hadoop:~$ hadoop jar hadoop-streaming.jar -input  
input -output output -mapper /bin/cat -reducer /  
usr/bin/wc
```

# Hadoop Streaming with shell commands (2)

```
hadoop:~$ echo "sed -e \"s/ /\n/g\" | grep ." >  
streamingMapper.sh
```

```
hadoop:~$ echo "uniq -c | awk '{print \$2 \"\t\"  
\$1}'" > streamingReducer.sh
```

```
hadoop:~$ chmod a+x streamingMapper.sh
```

```
hadoop:~$ chmod a+x streamingReducer.sh
```

```
hadoop:~$ hadoop fs -put /etc/hadoop/conf input
```

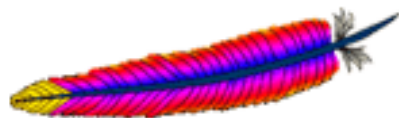
```
hadoop:~$ hadoop jar hadoop-streaming.jar -input  
input -output output -mapper streamingMapper.sh  
-reducer streamingReducer.sh -file  
streamingMapper.sh -file streamingReducer.sh
```

# Homework #3

- Try to run hadoop streaming job on <http://hadoop.nchc.org.tw>
  - Mapper: `/bin/cat`
  - Reducer: `/usr/bin/wc`
  - Input: `/etc/hadoop/conf`
  - Output: `/user/${id}/output`
- Run with extra parameter with `-numReduceTasks`
- Please take screenshot of both results and compare the results.
- Compare the time of 1 reducer with 8 reducers.
- Send a report of this homework to `jazz_AT_nchc_DOT_org_DOT_tw`

# There are several Hadoop subprojects

Apache > Hadoop >



Top

Common

Chukwa

HBase

HDFS

Hive

MapReduce

Pig

ZooKeeper

▼ About

▫ Welcome

▫ Who We Are?

▫ Mailing Lists

## Welcome to Apache Hadoop!

- **Hadoop Common:** The common utilities that support the other Hadoop subprojects.
- **HDFS:** A distributed file system that provides high throughput access to application data.
- **MapReduce:** A software framework for distributed processing of large data sets on compute clusters.

## Other Hadoop related projects

- **Chukwa**: A data collection system for managing large distributed systems.
- **HBase**: A scalable, distributed database that supports structured data storage for large tables.
- **Hive**: A data warehouse infrastructure that provides data summarization and ad hoc querying.
- **Pig**: A high-level data-flow language and execution framework for parallel computation.
- **ZooKeeper**: A high-performance coordination service for distributed applications.

# Hadoop Ecosystem

<b><i>Pig</i></b>	<b><i>Chukwa</i></b>	<b><i>Hive</i></b>	<b><i>HBase</i></b>
<b><i>MapReduce</i></b>		<b><i>HDFS</i></b>	<b><i>ZooKeeper</i></b>
<b><i>Hadoop Core (Hadoop Common)</i></b>		<b><i>Avro</i></b>	

Source: *Hadoop: The Definitive Guide*

# Avro

- Avro is a **data serialization system**.
- It provides:
  - *Rich data structures.*
  - *A compact, fast, binary data format.*
  - *A container file, to store persistent data.*
  - *Remote procedure call (RPC).*
  - *Simple integration with dynamic languages.*
- Code generation is not required to read or write data files nor to use or implement RPC protocols. Code generation as an optional optimization, only worth implementing for statically typed languages.
- For more detail, please check the official document:  
<http://avro.apache.org/docs/current/>



# Zoo Keeper



- <http://hadoop.apache.org/zookeeper/>
- ZooKeeper is a **centralized service** for maintaining **configuration** information, naming, **providing distributed synchronization**, and providing group services. All of these kinds of services are used in some form or another by distributed applications.
- *Each time they are implemented there is a lot of work that goes into fixing the bugs and **race conditions** that are inevitable. Because of the difficulty of implementing these kinds of services, applications initially usually skimp on them, which make them brittle in the presence of change and difficult to manage. Even when done correctly, different implementations of these services lead to management complexity when the applications are deployed.*



# Pig

- <http://hadoop.apache.org/pig/>
- Pig is a platform for analyzing large data sets that consists of a high-level language for expressing data analysis programs, coupled with infrastructure for evaluating these programs.
- Pig's infrastructure layer consists of a compiler that produces sequences of Map-Reduce programs
- Pig's language layer currently consists of a textual language called Pig Latin, which has the following key properties:
  - Ease of programming
  - Optimization opportunities
  - Extensibility



# Hive

- <http://hadoop.apache.org/hive/>
- Hive is a **data warehouse** infrastructure built on top of Hadoop that provides tools to enable easy **data summarization**, **adhoc querying** and analysis of large datasets data stored in Hadoop files.
- **Hive QL** is based on SQL and enables users familiar with SQL to query this data.



# Chukwa

- <http://hadoop.apache.org/chukwa/>
- Chukwa is an open source **data collection system** for monitoring large distributed systems.
- built on top of HDFS and Map/Reduce framework
- includes a flexible and powerful toolkit for displaying, monitoring and analyzing results to make the best use of the collected data.



# Mahout

- <http://mahout.apache.org/>
- Mahout is a scalable **machine learning libraries**.
- implemented on top of Apache Hadoop using the map/reduce paradigm.
- Mahout currently has
  - Collaborative Filtering
  - User and Item based recommenders
  - **K-Means, Fuzzy K-Means clustering**
  - Mean Shift clustering
  - More ...

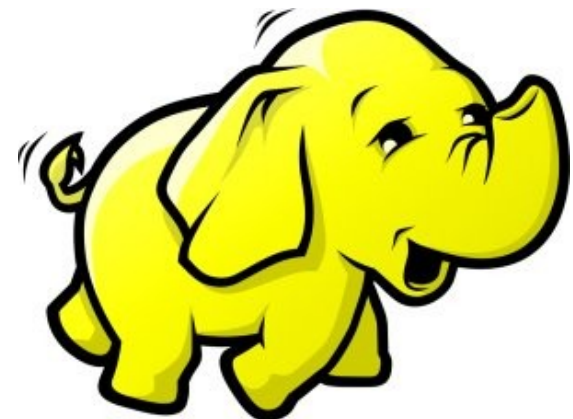




# HBase 雲端資料庫

*Introduction to HBase*

***Jazz Wang***  
***Yao-Tsung Wang***  
***jazz@nchc.org.tw***



# It's all about SCALE!!



**Warning:** fopen(/home/dodgers/public\_html/./logs/oracle\_error\_log.txt) [function.fopen]: failed to open stream: Permission denied in /usr/local/apache/htdocs/include2007/oracle/db\_oracle.inc.php on line 194

Cannot open Database Error Log, please check!! (/home/dodgers/public\_html/./logs/oracle\_error\_log.txt)

**Warning:** fopen(/home/dodgers/public\_html/./logs/oracle\_error\_log.txt) [function.fopen]: failed to open stream: Permission denied in /usr/local/apache/htdocs/include2007/oracle/db\_oracle.inc.php on line 194

Cannot open Database Error Log, please check!! (/home/dodgers/public\_html/./logs/oracle\_error\_log.txt)

**Warning:** fopen(/home/dodgers/public\_html/./logs/oracle\_error\_log.txt) [function.fopen]: failed to open stream: Permission denied in /usr/local/apache/htdocs/include2007/oracle/db\_oracle.inc.php on line 194

Cannot open Database Error Log, please check!! (/home/dodgers/public\_html/./logs/oracle\_error\_log.txt)

**Warning:** fopen(/home/dodgers/public\_html/./logs/oracle\_error\_log.txt) [function.fopen]: failed to open stream: Permission denied in /usr/local/apache/htdocs/include2007/oracle/db\_oracle.inc.php on line 194

Cannot open Database Error Log, please check!! (/home/dodgers/public\_html/./logs/oracle\_error\_log.txt)



訂購歷史紀錄

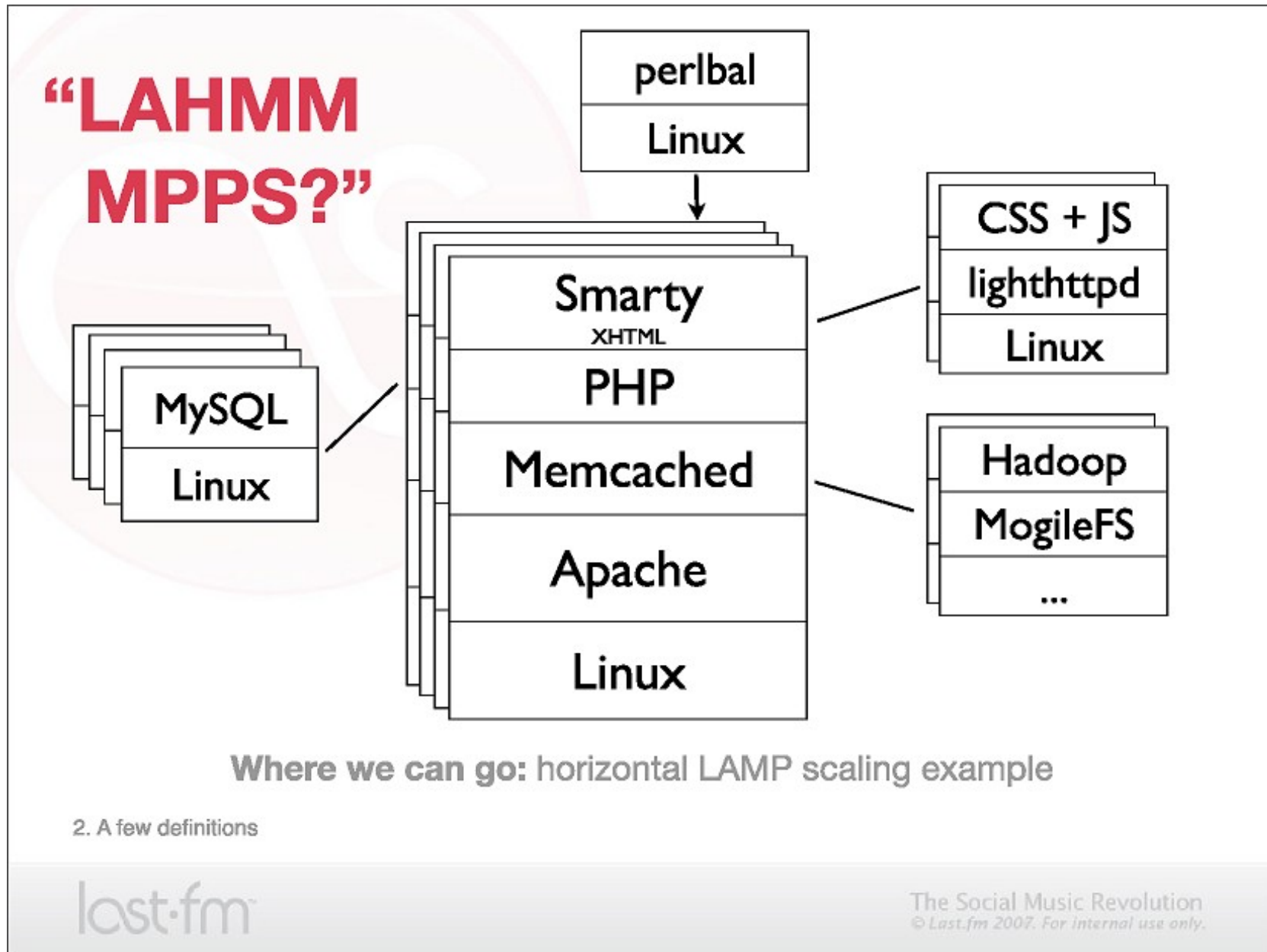


denied in /usr/local/apache/htdocs/include2007/oracle/db\_oracle.inc.php on line 194

Cannot open Database Error Log, please check!! (/home/dodgers/public\_html/./logs/oracle\_error\_log.txt)

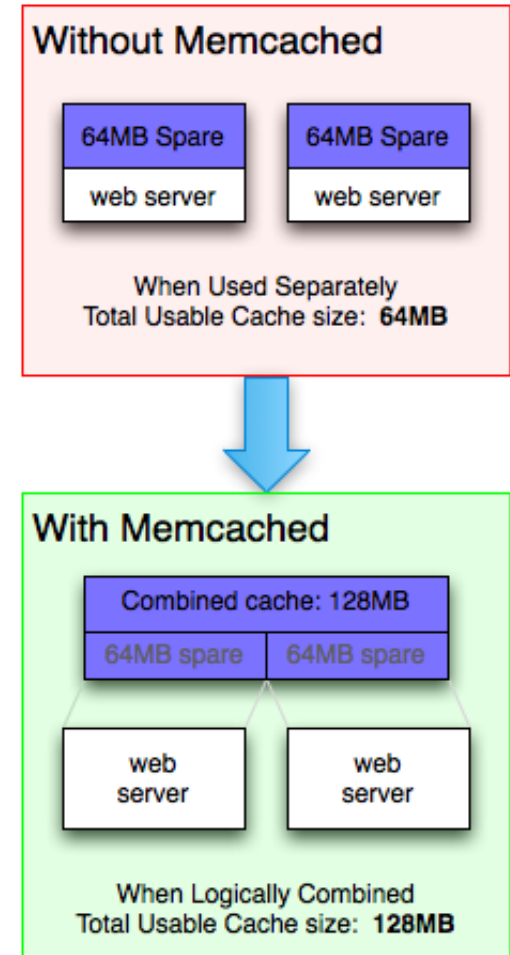
**Warning:** fopen(/home/dodgers/public\_html/./logs/oracle\_error\_log.txt) [function.fopen]: failed to open stream: Permission

# How to scale up web service in the past ?



# Tools used by large scale websites

- Perlbal - <http://www.danga.com/perlbal/>
  - ◆ 多個網頁伺服器的負載平衡
  - ◆ Load balancer
- MogileFS - <http://www.danga.com/mogilefs/>
  - ◆ 分散式檔案系統
  - ◆ Distributed File System for small files
  - ◆ 有公司認為 MogileFS 比起 Hadoop 適合拿來處理小檔案
- memcached - <http://memcached.org/>
  - ◆ 共享記憶體??
  - ◆ Share Memory
  - ◆ 把資料庫或經常讀取的部分，用記憶體快取 (Cache) 方式存放
- Moxi - <http://code.google.com/p/moxi/>
  - ◆ Memcache 的 PROXY
- More Resource:
  - ◆ <http://code.google.com/p/memcached/wiki/HowToLearnMoreScalability>
  - ◆ <http://www.slideshare.net/techdude/scalable-web-architectures-common-patterns-and-approaches>

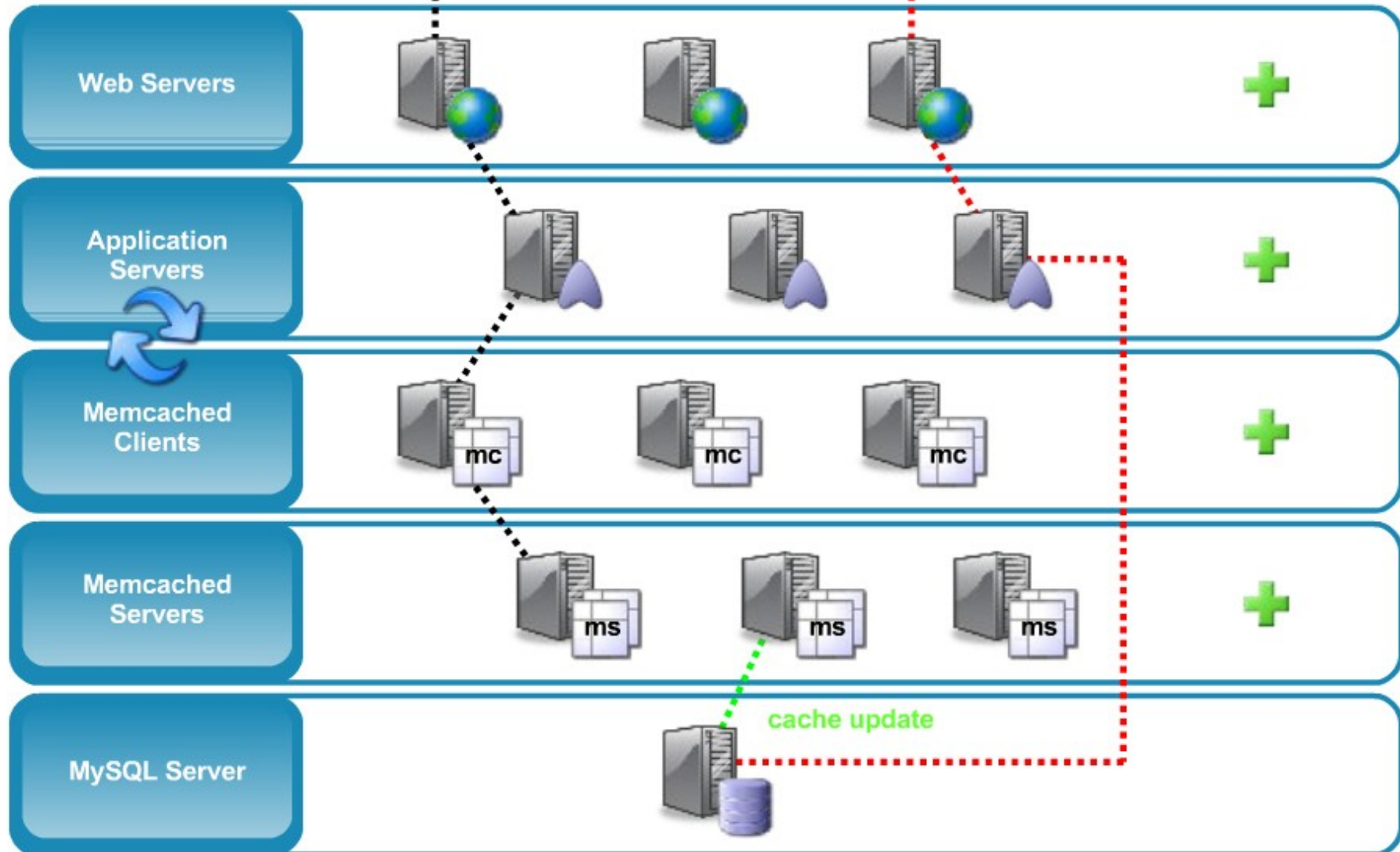




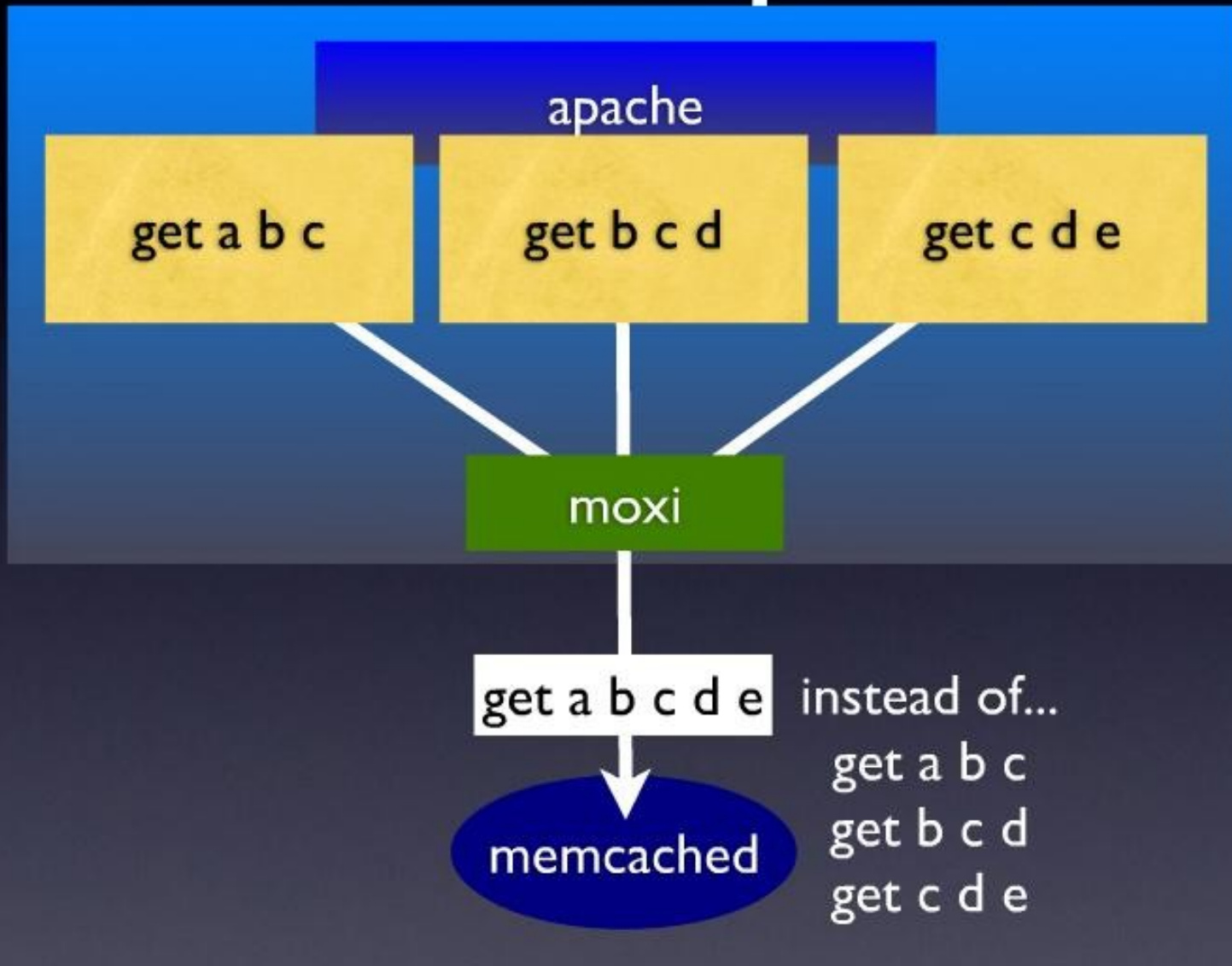
# Memcached & MySQL

read

write

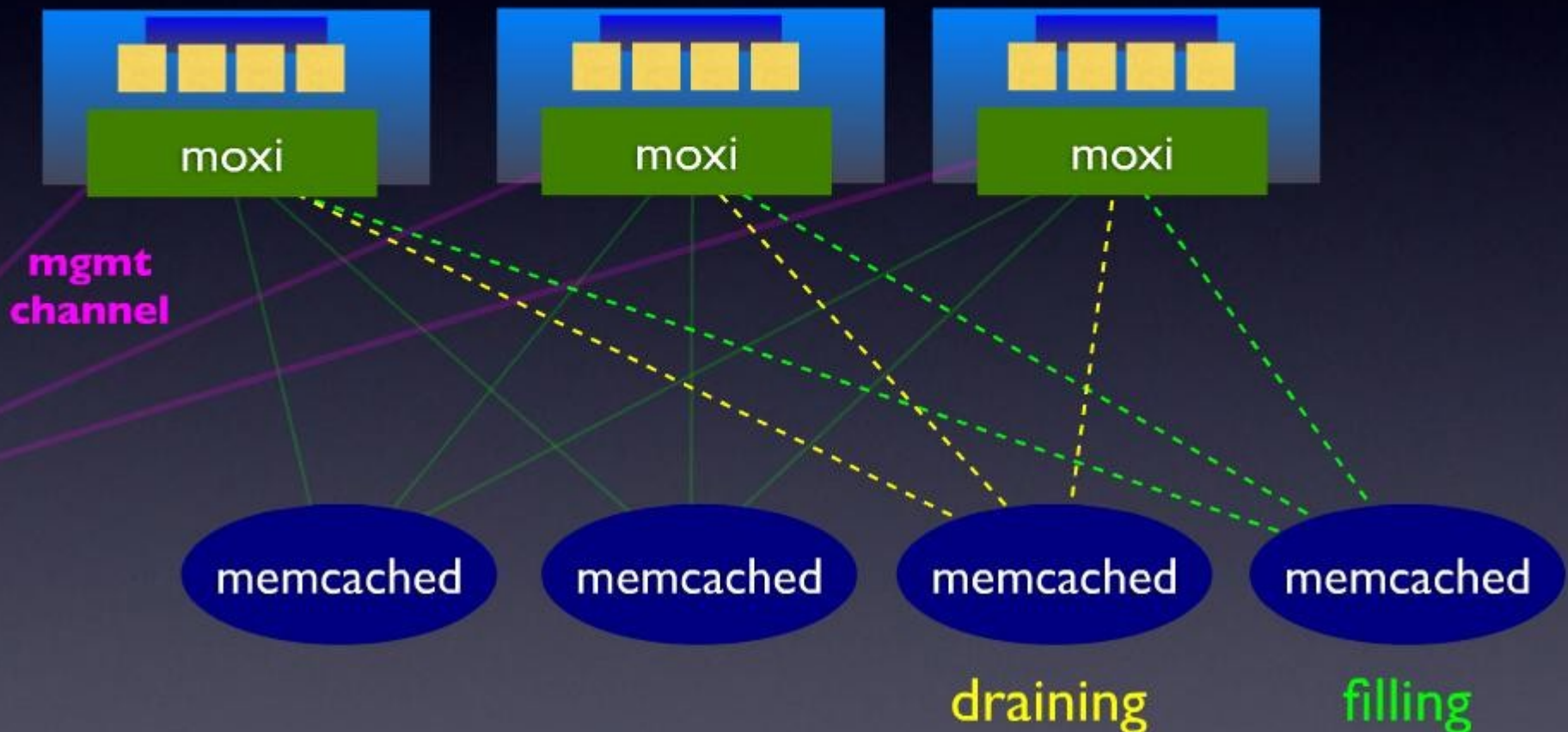


# GET de-duplication



# draining and filling

lazily migrate items from old server to new server



# HBase is ..

- HBase is a distributed **column-oriented database** built on top of HDFS.
- A distributed data store that can scale horizontally to 1,000s of commodity servers and **petabytes** of indexed storage.
- Designed to operate on top of the Hadoop distributed file system (**HDFS**) or Kosmos File System (**KFS**, aka Cloudstore) for scalability, fault tolerance, and high availability.
- Integrated into the Hadoop **map-reduce** platform and paradigm.

# Benefits

- Distributed storage
- Table-like in data structure
  - multi-dimensional map
- High scalability
- High availability
- High performance

# Who use HBase

- Adobe
  - 內部使用 (Structure data)
- Kalooga
  - 圖片搜尋引擎 <http://www.kalooga.com/>
- Meetup
  - 社群聚會網站 <http://www.meetup.com/>
- Streamy
  - Migrate from MySQL to Hbase <http://www.streamy.com/>
- Trend Micro
  - 雲端掃毒架構 <http://trendmicro.com/>
- Yahoo!
  - 儲存文件 fingerprint 避免重複 <http://www.yahoo.com/>
- More - <http://wiki.apache.org/hadoop/Hbase/PoweredBy>

# Backdrop

- Started toward by Chad Walters and Jim
- 2006.11
  - Google releases paper on **BigTable**
- 2007.2
  - Initial HBase prototype created as Hadoop contrib.
- 2007.10
  - First useable HBase
- 2008.1
  - Hadoop become Apache top-level project and HBase becomes subproject
- 2008.10~
  - HBase 0.18, 0.19 released

# HBase Is Not ...

- Tables have **one primary index**, the *row key*.
- **No join operators.**
- Scans and queries can select a subset of available columns, perhaps by using a wildcard.
- There are three types of lookups:
  - Fast lookup using row key and optional timestamp.
  - Full table scan
  - Range scan from region start to end.



## HBase Is Not ... (2)

- Limited atomicity and transaction support.
  - HBase supports **multiple batched mutations of single rows** only.
  - Data is unstructured and untyped.
- No accessed or manipulated via SQL.
  - Programmatic access via Java, REST, or **Thrift APIs**.
  - Scripting via JRuby.

# Why Bigtable?

- Performance of RDBMS system is good for transaction processing but for very large scale analytic processing, the solutions are commercial, expensive, and specialized.
- Very large scale analytic processing
  - Big queries – typically range or table scans.
  - Big databases (100s of TB)

## Why Bigtable? (2)

- Map reduce on Bigtable with optionally Cascading on top to support some relational algebras may be a cost effective solution.
- Sharding is not a solution to scale open source RDBMS platforms
  - Application specific
  - Labor intensive (re)partitioning

# Why HBase ?

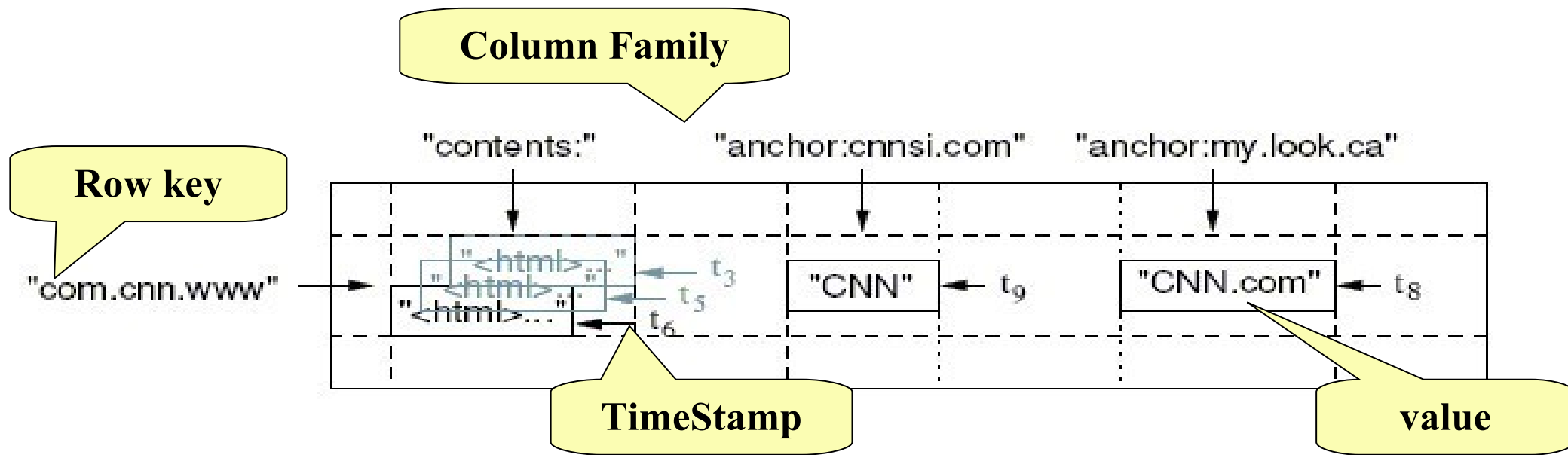
- HBase is a Bigtable clone.
- It is open source
- It has a good community and promise for the future
- It is developed on top of and has good integration for the Hadoop platform, if you are using Hadoop already.
- It has a Cascading connector.

# HBase benefits than RDBMS

- *No real indexes*
- *Automatic partitioning*
- *Scale linearly and automatically with new nodes*
- *Commodity hardware*
- *Fault tolerance*
- *Batch processing*

# Data Model

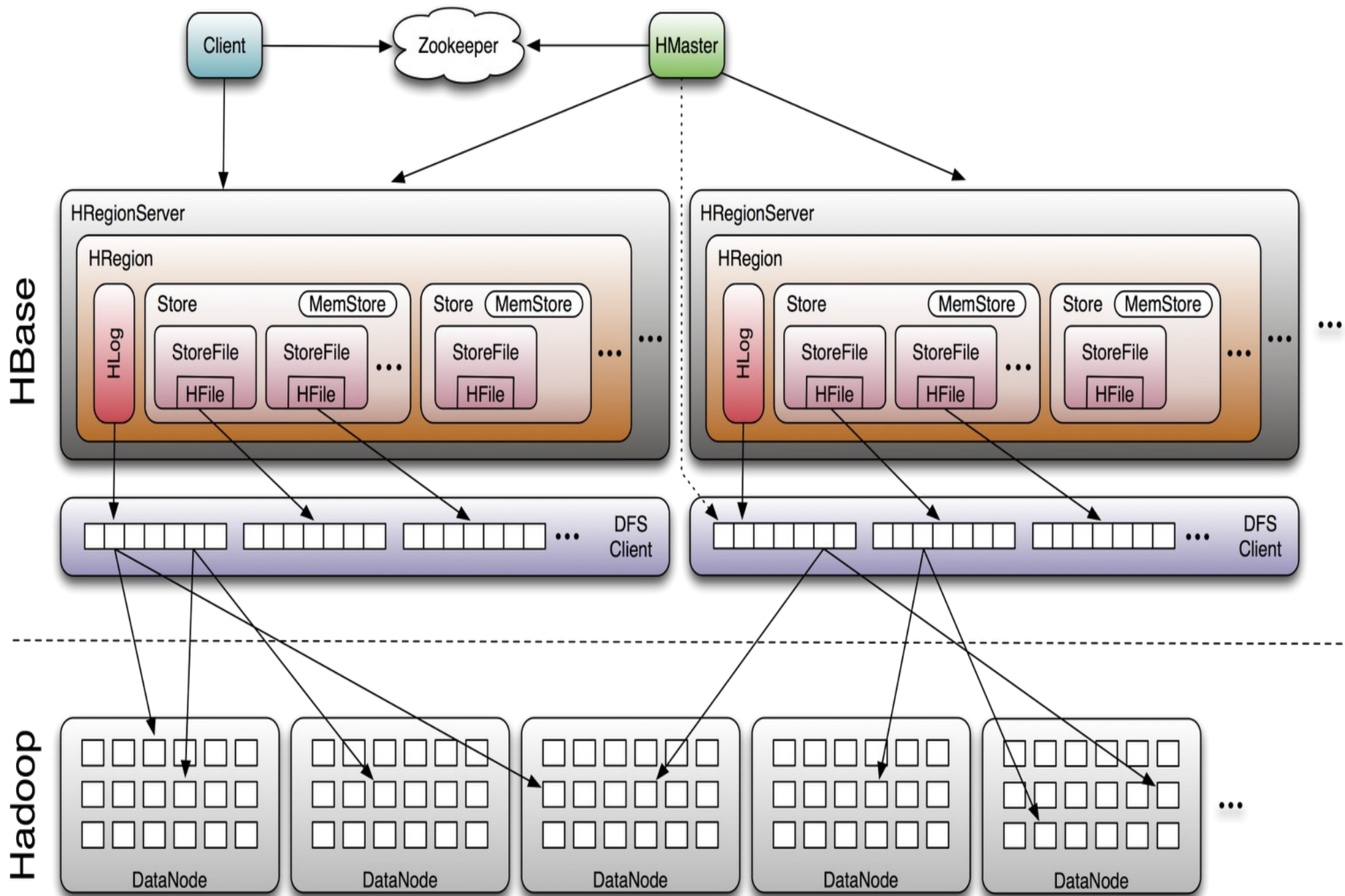
- Tables are sorted by **Row**
- Table schema only define it's *column families* .
  - Each family consists of any number of columns
  - Each column consists of any number of versions
  - Columns only exist when inserted, NULLs are free.
  - Columns within a family are sorted and stored together
- Everything except table names are byte[]
- **(Row, Family: Column, Timestamp) → Value**



# Members

- *Master*
  - Responsible for monitoring region servers
  - Load balancing for regions
  - Redirect client to correct region servers
  - The current SPOF
- *regionserver slaves*
  - Serving requests(Write/Read/Scan) of Client
  - Send HeartBeat to Master
  - Throughput and Region numbers are scalable by region servers

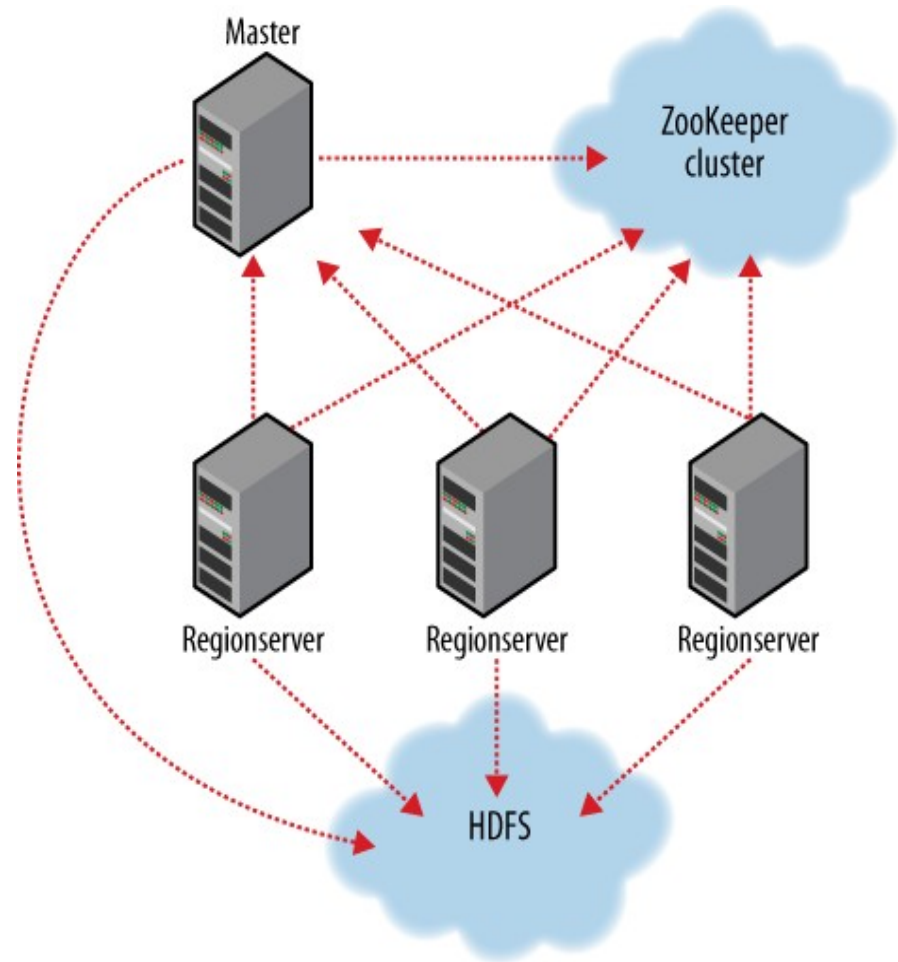
# Architecture





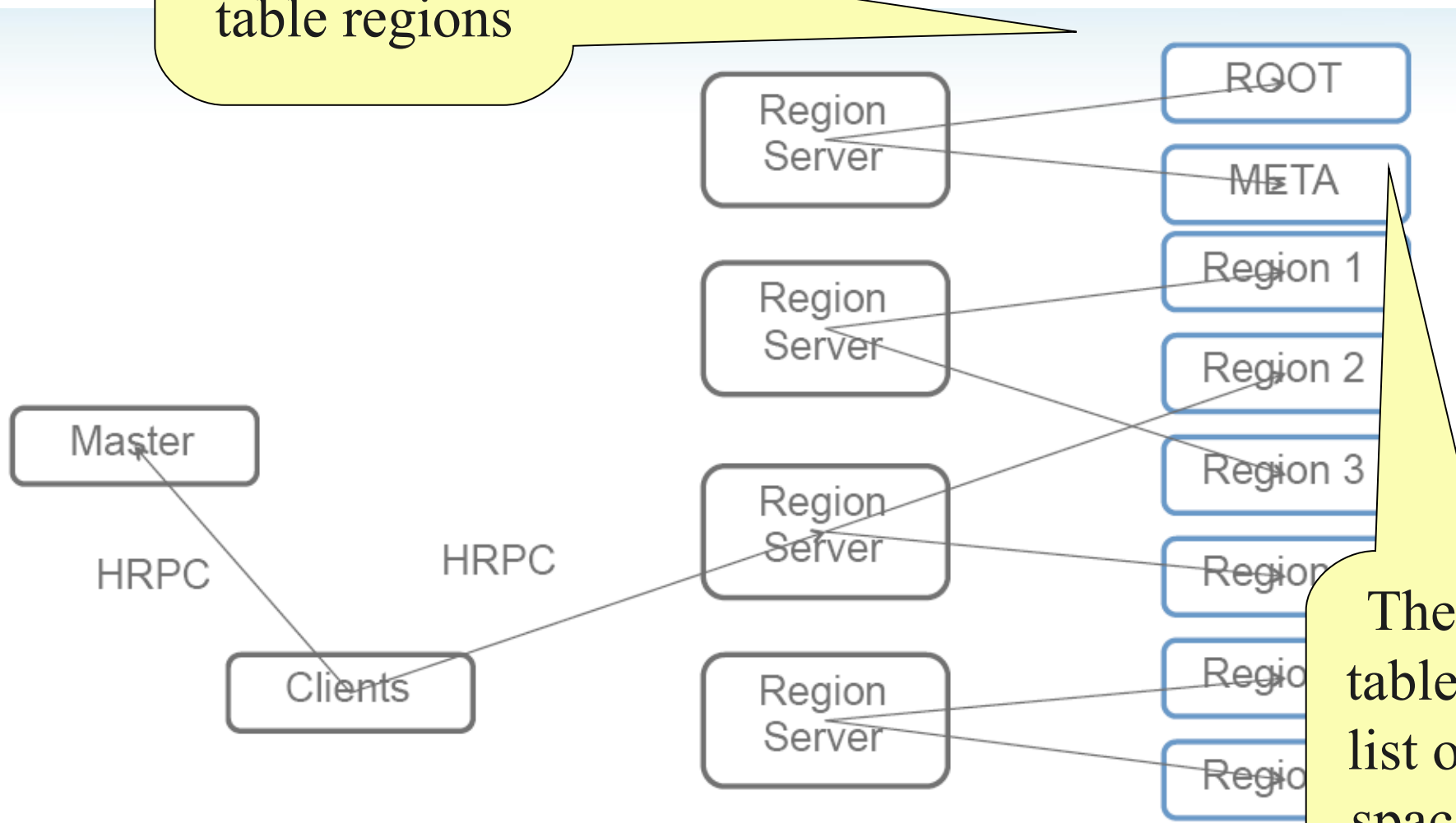
# ZooKeeper

- HBase depends on ZooKeeper (Chapter 13) and by default it manages a ZooKeeper instance as the authority on cluster state



# Operation

The `-ROOT-` table holds the list of `.META.` table regions



The `.META.` table holds the list of all user-space regions.



## **Questions?**

***Slides - <http://trac.nchc.org.tw/cloud>***

***Jazz Wang***  
***Yao-Tsung Wang***  
***jazz@nchc.org.tw***



Powered by **DRBL**

# 輕鬆入手的叢集式搜尋引擎 -



**CRAWLZILLA**

Crawlzilla Develop Team  
Free Software Lab @ NCHC



TAIWAN

[www.nchc.org.tw](http://www.nchc.org.tw)

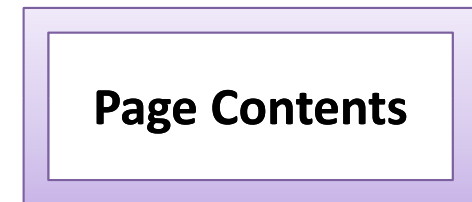
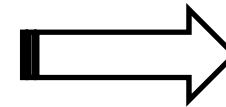
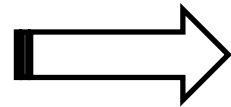


National Applied  
Research Laboratories



# 搜尋引擎運作原理 – Phase1

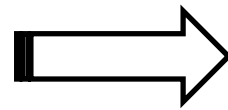
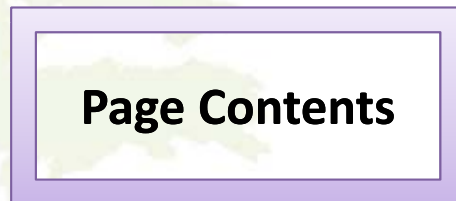
- Crawling the Web



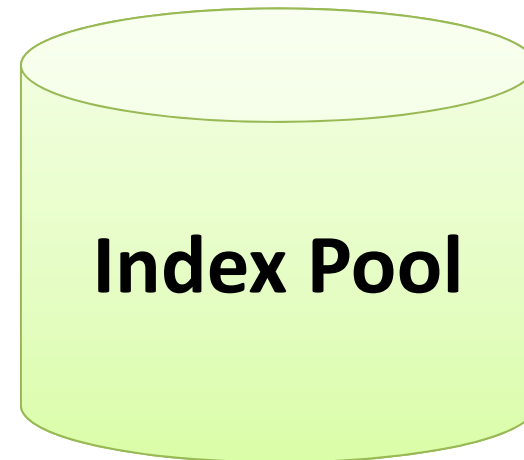
Crawler visits the web pages of the links

# 搜尋引擎運作原理 – Phase2

- Building the Index Pool



Parse Contents

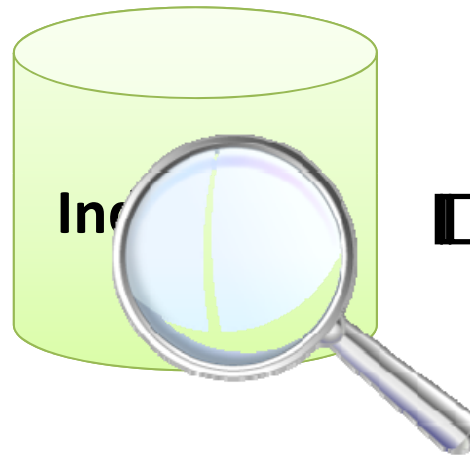
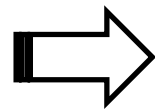


# 搜尋引擎運作原理 – Phase3

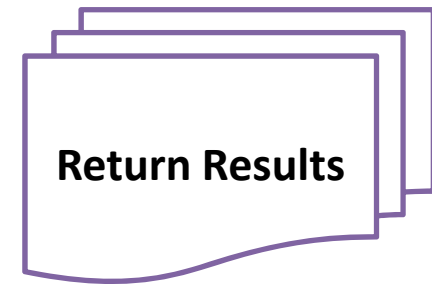
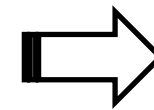
- Serving Queries



User Sent a Query



Search from Index Pool



Return Results

# What is Crawlzilla?

- Crawlzilla 簡介

- 於2009推出實驗版
- Crawlzilla 於2010更名並延續實驗版開發更多新功能
- 提供簡單安裝及操作管理介面，輕鬆建立搜尋引擎的套件工具
- 提供索引資料庫瀏覽功能，搜尋引擎資料庫資訊一目了然



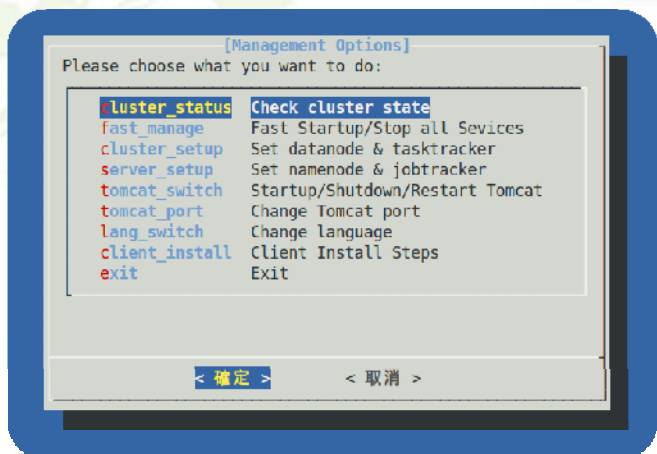
# Why Crawlzilla?

- 開放式搜尋引擎不適用於企業內部網站
- 使用Opensource建立搜尋引擎的技術門檻太高
- 叢集環境架設不易
- 使用Crawlzilla優點
  - Opensource專案，使用者可依自己的需求修改源始碼
  - 使用簡單，可輕鬆建立叢集環境
  - 友善的操作環境，節省適應系統時間
  - 支援中文分詞，提高搜尋精準度

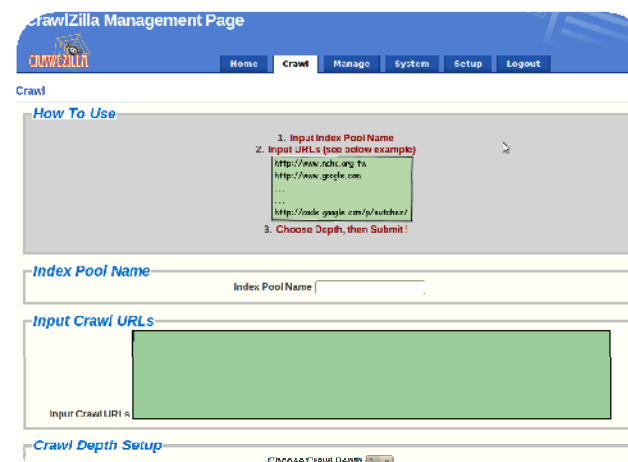
# Crawlzilla 操作介面特色

```
check_sunJava
Crawlzilla need Sun Java JDK 1.6.x or above version
System has Sun Java 1.6 above version.
System has ssh.
System has ssh Server (sshd).
System has dialog.
Welcome to use Crawlzilla, this install program will create a new account and to
assist you to setup the password of crawler.
Set password for crawler:
password:
keyin the password again:
password:
Master IP address is: 140.110.138.186
Master MAC address is: 08:00:27:99:4d:09
Please confirm the install information of above : 1.Yes 2.No
```

(1) Easy to Deploy Crawling Cluster Environment



(2) Easy to Manage

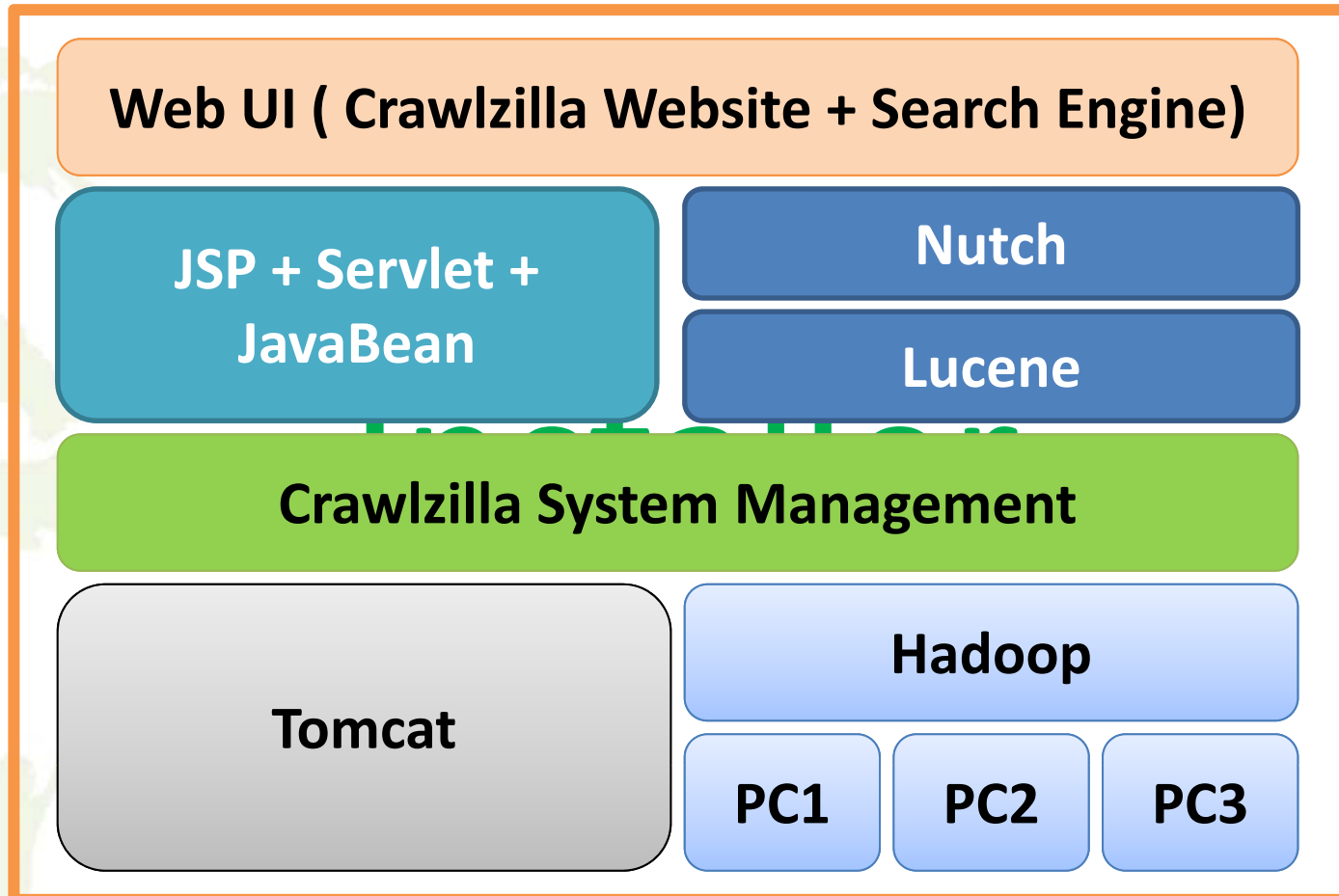


(3) Easy to Use

# Crawlzilla 系統功能

- 支援叢集運算及顧全安全性
- 支援中文分詞功能
- 支援多工網頁爬取
- 支援多重搜尋引擎
- 即時瀏覽資料庫資訊
- 解決中文亂碼及中文支援
- 支援多國語言
- 網頁管理

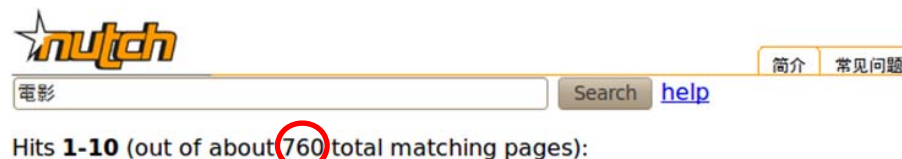
# 系統架構



# 搜尋引擎加入中文分詞功能

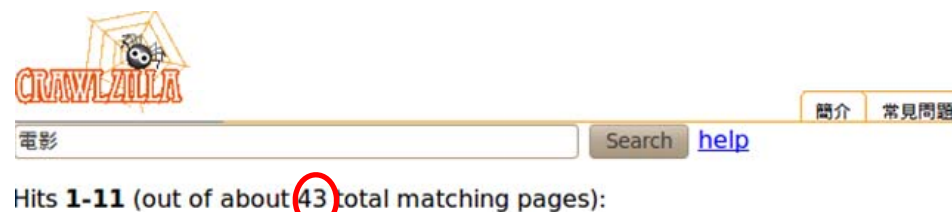
- 索引資料庫會以中文字詞為基本單位建立索引
- 加入中文分詞針對同一網站爬取進行搜尋
  - 搜尋引擎**無**中文分詞功能時，搜尋關鍵字 - 電影

- 760 筆搜尋結果



- 搜尋引擎**加入**中文分詞功能時，搜尋關鍵字 - 電影

- 43 筆搜尋結果



- 可提高搜尋的精準度

# Crawlzilla - 叢集環境需求

- 如果你覺得...
  - 一台電腦無法滿足你的運算需求
  - 閒置電腦太多
  - 解：讓多台電腦分工運算
- 但是...
  - 架設叢集環境很麻煩!?
  - 解：Crawlzilla 提供叢集安裝模式，只要三分鐘即可建立叢集式搜尋引擎!!!

# Resources

- **Crawlzilla @ Google Code Project Hosting (中文說明頁)**
  - <http://code.google.com/p/crawlzilla/>
- **Crawlzilla @ SourceForge(英文說明頁)**
  - <http://sourceforge.net/p/crawlzilla/home/>
- **Crawlzilla User Group @ Google**
  - <http://groups.google.com/group/crawlzilla-user>
- **NCHC Cloud Computing Research Group**
  - <http://trac.nchc.org.tw/cloud>