



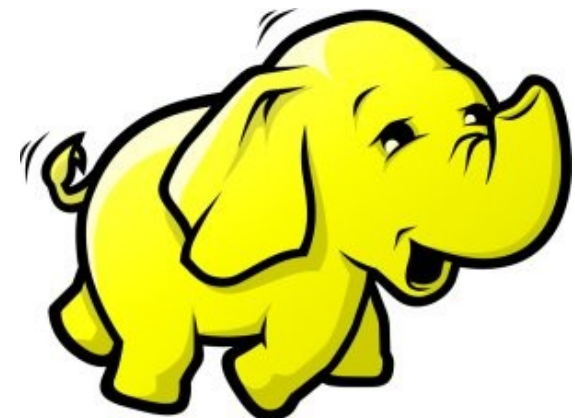
# Hadoop 簡介：源起與術語

Introduction to Hadoop : History and Terminology

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# What is Hadoop ?

用一句話解釋 **Hadoop** 是什麼 ??

*Hadoop is a **software platform** that lets one easily write and run applications that **process vast amounts of data.***

**Hadoop** 是一個讓使用者簡易撰寫並執行處理海量資料應用程式的軟體平台。

亦可以想像成一個處理海量資料的生產線，只須學會定義 **map** 跟 **reduce** 工作站該做哪些事情。

# Features of Hadoop ...

## **Hadoop** 這套軟體的特色是 ...

- **海量 Vast Amounts of Data**
  - 擁有儲存與處理大量資料的能力
  - Capability to **STORE** and **PROCESS** vast amounts of data.
- **經濟 Cost Efficiency**
  - 可以用在由一般 PC 所架設的叢集環境內
  - Based on large clusters built of **commodity hardware**.
- **效率 Parallel Performance**
  - 透過分散式檔案系統的幫助，以致得到快速的回應
  - With the help of HDFS, Hadoop **have better performance**.
- **可靠 Robustness**
  - 當某節點發生錯誤，能即時自動取得備份資料及佈署運算資源
  - Robustness to add and remove computing and storage resource without shutdown entire system.

# Founder of Hadoop – Doug Cutting

**Hadoop** 這套軟體的創辦人 **Doug Cutting**

Doug Cutting Talks About The Founding Of Hadoop

clouderahadoop

9 部影片

編輯訂閱項目



Doug Cutting Talks About The Founding Of Hadoop

<http://www.youtube.com/watch?v=qxC4urJOchs>

# History of Hadoop ... 2002~2004

## **Hadoop** 這套軟體的歷史源起 ... 2002~2004



- Lucene

- <http://lucene.apache.org/>
- 用Java 設計的高效能文件索引引擎API
- a high-performance, full-featured **text search engine library** written entirely in **Java**.
- 索引文件中的每一字，讓搜尋的效率比傳統逐字比較還要高的多
- Lucene create an **inverse index** of every word i n different documents. It enhance performance of text searching.

# History of Hadoop ... 2002~2004

## *Hadoop* 這套軟體的歷史源起 ... 2002~2004

- Nutch



- <http://nutch.apache.org/>
- Nutch 是基於開放原始碼所開發的網站搜尋引擎
- Nutch is open source **web-search** software.
- 利用 Lucene 函式庫開發
- It builds on **Lucene and Solr**, adding web-specifics, such as a **crawler**, a **link-graph database**, parsers for HTML and other document formats, etc.



# Three Gifts from Google ....

## 來自 **Google** 的三個禮物 ....

- Nutch 後來遇到儲存大量網站資料的瓶頸
- Nutch encounter storage issue
- Google 在一些會議分享他們的三大關鍵技術
- Google shared their design of web-search engine
  - SOSP 2003 : “The Google File System”
  - <http://labs.google.com/papers/gfs.html>
  - OSDI 2004 : “MapReduce : Simplified Data Processing on Large Cluster”
  - <http://labs.google.com/papers/mapreduce.html>
  - OSDI 2006 : “Bigtable: A Distributed Storage System for Structured Data”
  - <http://labs.google.com/papers/bigtable-osdi06.pdf>



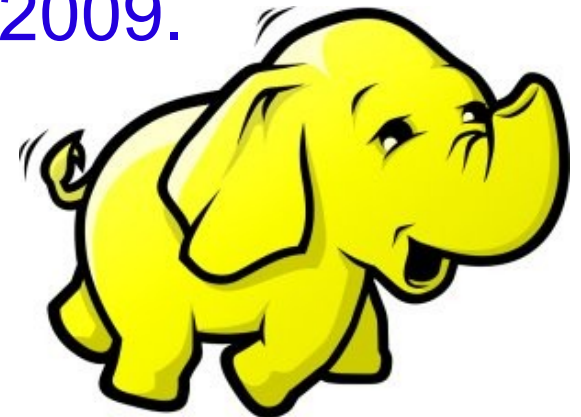
# History of Hadoop ... 2004 ~ Now

## Hadoop 這套軟體的歷史源起 ... 2004 ~ Now

- Dong Cutting reference from Google's publication
- Added DFS & MapReduce implement to Nutch
- According to **user feedback** on the mail list of Nutch ....
- Hadoop became separated project **since Nutch 0.8**
- Nutch DFS → Hadoop Distributed File System (HDFS)
- **Yahoo** hire Dong Cutting to build a team of web search engine at **year 2006**.
  - Only **14 team members** (engineers, clusters, users, etc.)
- Dong Cutting joined Cloudera at year 2009.

**YAHOO!**

 cloudera





# Who Use Hadoop ??

有哪些公司在用 **Hadoop** 這套軟體 ??

- **Yahoo** is the key contributor currently.
- **IBM** and **Google** teach Hadoop in universities ...
- [http://www.google.com/intl/en/press/pressrel/20071008\\_ibm\\_univ.html](http://www.google.com/intl/en/press/pressrel/20071008_ibm_univ.html)
- **The New York Times** used **100 Amazon EC2 instances** and a Hadoop application to process **4TB of raw image TIFF data** (stored in S3) into **11 million finished PDFs** in the space of **24 hours** at a computation cost of about **\$240** (not including bandwidth)
  - from <http://en.wikipedia.org/wiki/Hadoop>
- <http://wiki.apache.org/hadoop/AmazonEC2>
- <http://wiki.apache.org/hadoop/PoweredBy>
  - A9.com
  - ADSDAQ by Contextweb
  - EHarmony
  - Facebook
  - Fox Interactive Media
  - IBM
  - ImageShack
  - ISI
  - Joost
  - Last.fm
  - Powerset
  - The New York Times
  - Rackspace
  - Veoh
  - Metaweb

# Hadoop in production run ....

## 商業運轉中的 *Hadoop* 應用 ....

- February 19, 2008
- Yahoo! Launches World's Largest Hadoop Production Application
- <http://developer.yahoo.net/blogs/hadoop/2008/02/yahoo-worlds-largest-production-hadoop.html>

Number of links between pages in the index	roughly 1 trillion links
Size of output	over 300 TB, compressed!
Number of cores used to run single Map-Reduce job	over 10,000
Raw disk used in the production cluster	over 5 Petabytes

# Hadoop in production run ....

## 商業運轉中的 *Hadoop* 應用 ....

- September 30, 2008
- Scaling Hadoop to 4000 nodes at Yahoo!
- [http://developer.yahoo.net/blogs/hadoop/2008/09/scaling\\_hadoop\\_to\\_4000\\_nodes\\_a.html](http://developer.yahoo.net/blogs/hadoop/2008/09/scaling_hadoop_to_4000_nodes_a.html)

<b>Total Nodes</b>	<b>4000</b>
<b>Total cores</b>	<b>30000</b>
<b>Data</b>	<b>16PB</b>

	<b>500-node cluster</b>		<b>4000-node cluster</b>	
	<b>write</b>	<b>read</b>	<b>write</b>	<b>read</b>
<b>number of files</b>	990	990	14,000	14,000
<b>file size (MB)</b>	320	320	360	360
<b>total MB processes</b>	316,800	316,800	5,040,000	5,040,000
<b>tasks per node</b>	2	2	4	4
<b>avg. throughput (MB/s)</b>	<b>5.8</b>	<b>18</b>	<b>40</b>	<b>66</b>

# Comparison between Google and Hadoop

## *Google* 與 *Hadoop* 的比較表

<b>Develop Group</b>	Google	Apache
<b>Sponsor</b>	Google	Yahoo, Amazon
<b>Algorithm Method</b>	MapReduce	MapReduce
<b>Resource</b>	open document	open source
<b>File System (MapReduce)</b>	GFS	HDFS
<b>Storage System (for structure data)</b>	big-table	HBase
<b>Search Engine</b>	Google	Nutch
<b>OS</b>	Linux	Linux / GPL

# Why should we learn Hadoop ?

## 為何需要學習 **Hadoop ??**

[Search Jobs](#) [Browse Jobs](#) [Local Jobs](#) [Salaries](#) [Employment Trends](#)

**simplyhired**<sup>®</sup>  
job search made simple

Employment Trends

Xen, Hyper-V, Hadoop

Tip: You can compare trends by separating them with commas.

Xen, Hyper-v, Hadoop Trends



### Xen, Hyper-v, Hadoop Job Trends

This graph displays the percentage of jobs with your search terms anywhere in the job listing. Since November 2008, the following has occurred:

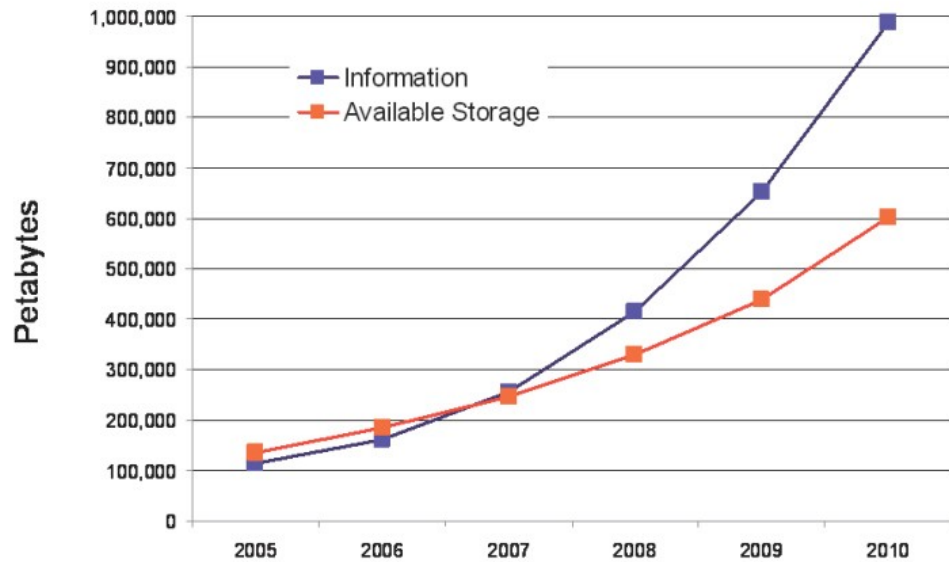
- [Xen jobs](#) increased 141%
- [Hyper-v jobs](#) increased 551%
- [Hadoop jobs](#) did not change or there is no data available

1. Data Explore  
資訊大爆炸

2. Data Mining Tool  
方便作資料探勘的工作

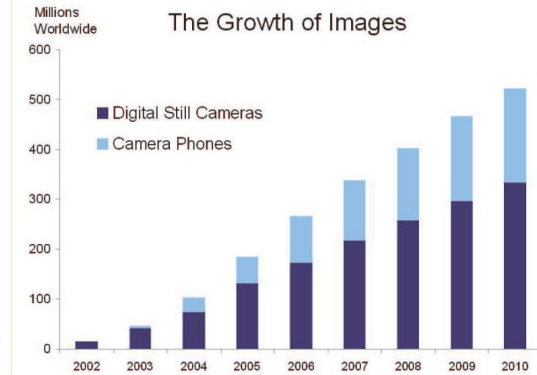
3. Looking for Jobs  
好找工作!!

# Information Versus Available Storage



# 2007 Data Explore

**Top 1 : Human Genomics - 7000 PB / Year**  
**Top 2 : Digital Photos - 1000 PB+ / Year**  
**Top 3 : E-mail (no Spam) - 300 PB+ / Year**

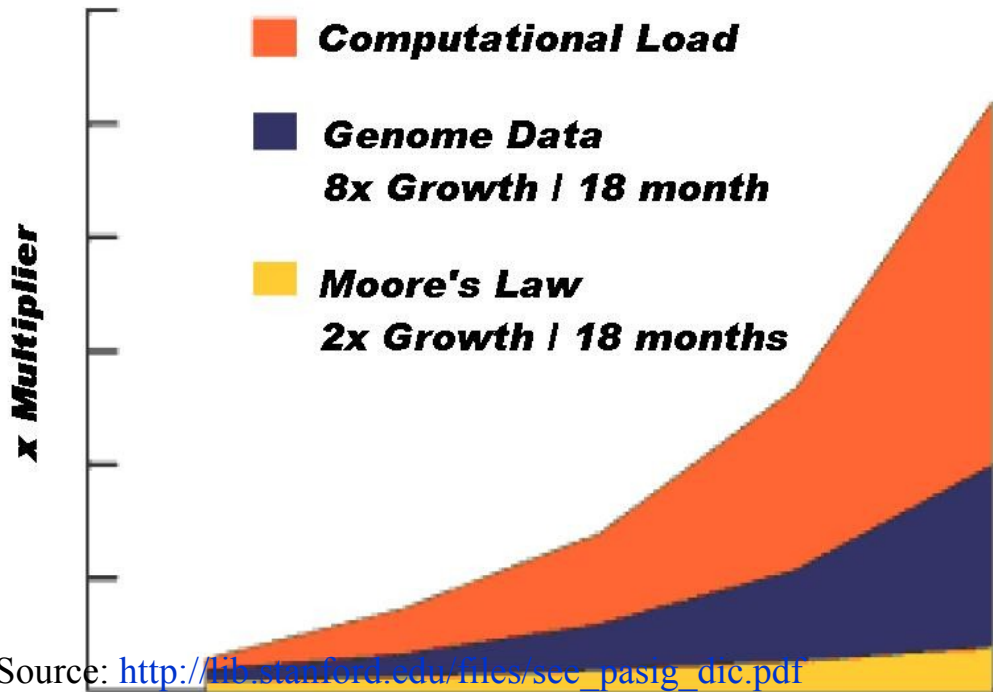


Source: <http://www.emc.com/collateral/analyst-reports/expanding-digital-idc-white-paper.pdf>

Source: IDC, 2007

Source: IDC, 2007

Source: IDC, 2007



Source: [http://lib.stanford.edu/files/sec\\_pasig\\_dtc.pdf](http://lib.stanford.edu/files/sec_pasig_dtc.pdf)

Particle Physics Large Hadron Collider (15PB)	Human Genomics (7000PB) 1GB / person 200PB+ captured 200% CAGR	World Wide Web (~1PB)	Wikipedia (10GB) 100% CAGR
Annual Email Traffic, no spam (300PB+)	Internet Archive (1PB+)	Estimated On-line RAM in Google (8PB)	Personal Digital Photos (1000PB+) 100% CAGR
200 of London's Traffic Cams (8TB/day)	2004 Walmart Transaction DB (500TB)	Typical Oil Company (350TB+)	Merck Bio Research DB (1.5TB/qtr)
UPMC Hospitals Imaging Data (500TB/yr)	MIT Babytalk Speech Experiment (1.4PB)	Terashake Earthquake Model of LA Basin (1PB)	One Day of Instant Messaging in 2002 (750GB)
Total digital data to be created this year <b>270,000PB</b> (IDC)			

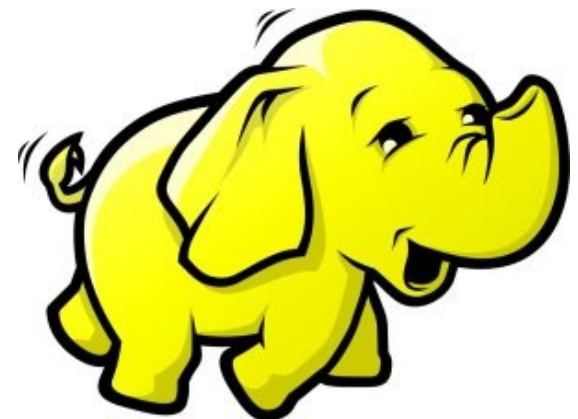
Phillip B. Gibbons, Data-Intensive Computing Symposium



# Hadoop 專業術語

## Introduction to Hadoop Terminology

**Jazz Wang**  
**Yao-Tsung Wang**  
**[jazz@nchc.org.tw](mailto:jazz@nchc.org.tw)**



# Two Key Elements of Operating System

## 作業系統兩大關鍵組成元素

Scheduler  
程序排程



File System  
檔案系統





# Terminologies of Hadoop

## *Hadoop* 文件中的專業術語

- Job
  - 任務
- Task
  - 小工作
- JobTracker
  - 任務分派者
- TaskTracker
  - 小工作的執行者
- Client
  - 發起任務的客戶端
- Map
  - 應對
- Reduce
  - 總和



- Namenode
  - 名稱節點
- Datanode
  - 資料節點
- Namespace
  - 名稱空間
- Replication
  - 副本
- Blocks
  - 檔案區塊 (64M)
- Metadata
  - 屬性資料



# Two Key Roles of HDFS

## HDFS 軟體架構的兩種關鍵角色

### 名稱節點 **NameNode**

- **Master Node**
- **Manage NameSpace of HDFS**
- **Control Permission of Read and Write**
- **Define the policy of Replication**
- **Audit and Record the NameSpace**
- **Single Point of Failure**

### 資料節點 **DataNode**

- **Worker Nodes**
- **Perform operation of Read and Write**
- **Execute the request of Replication**
- **Multiple Nodes**

# Two Key Roles of Job Scheduler

## 程序排程的兩種關鍵角色

### JobTracker

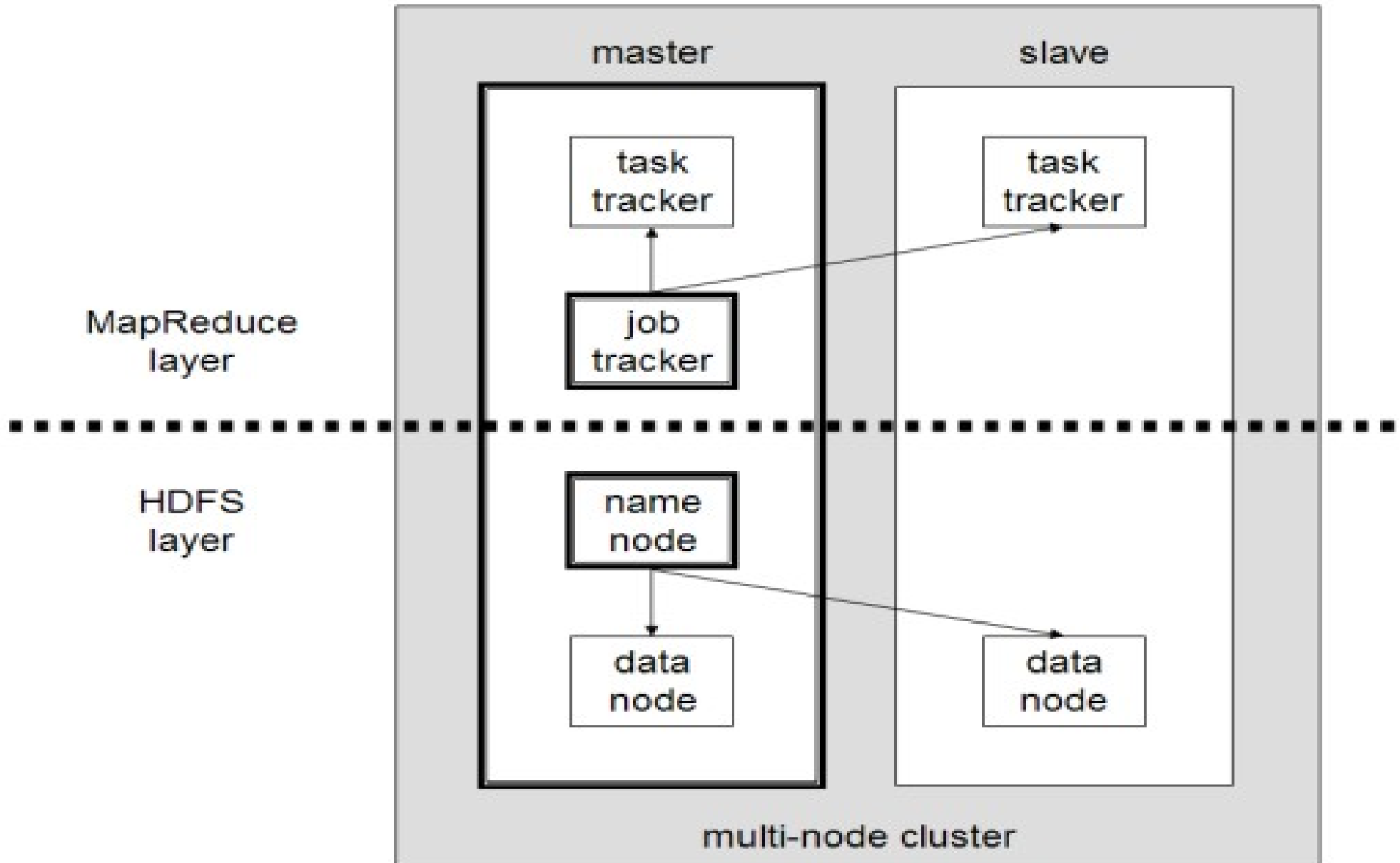
- **Master Node**
- **Receive Jobs from Hadoop Clients**
- **Assigned Tasks to TaskTrackers**
- **Define Job Queuing Policy, Priority and Error Handling**
- **Single Point of Failure**

### TaskTracker

- **Worker Nodes**
- **Excute Mapper and Reducer Tasks**
- **Save Results and report task status**
- **Multiple Nodes**

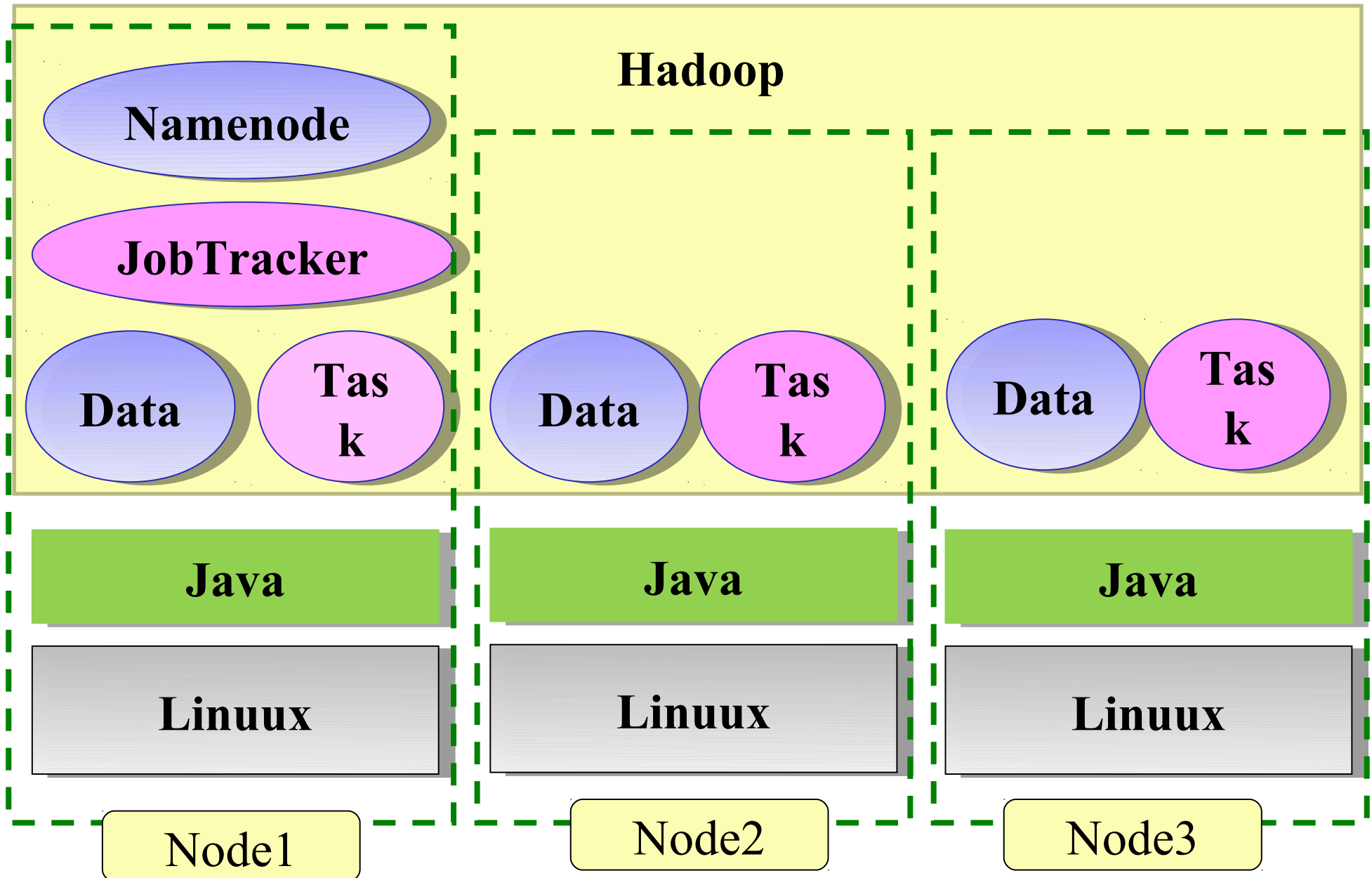
# Different Roles of Hadoop Architecture

## *Hadoop* 軟體架構中的不同角色



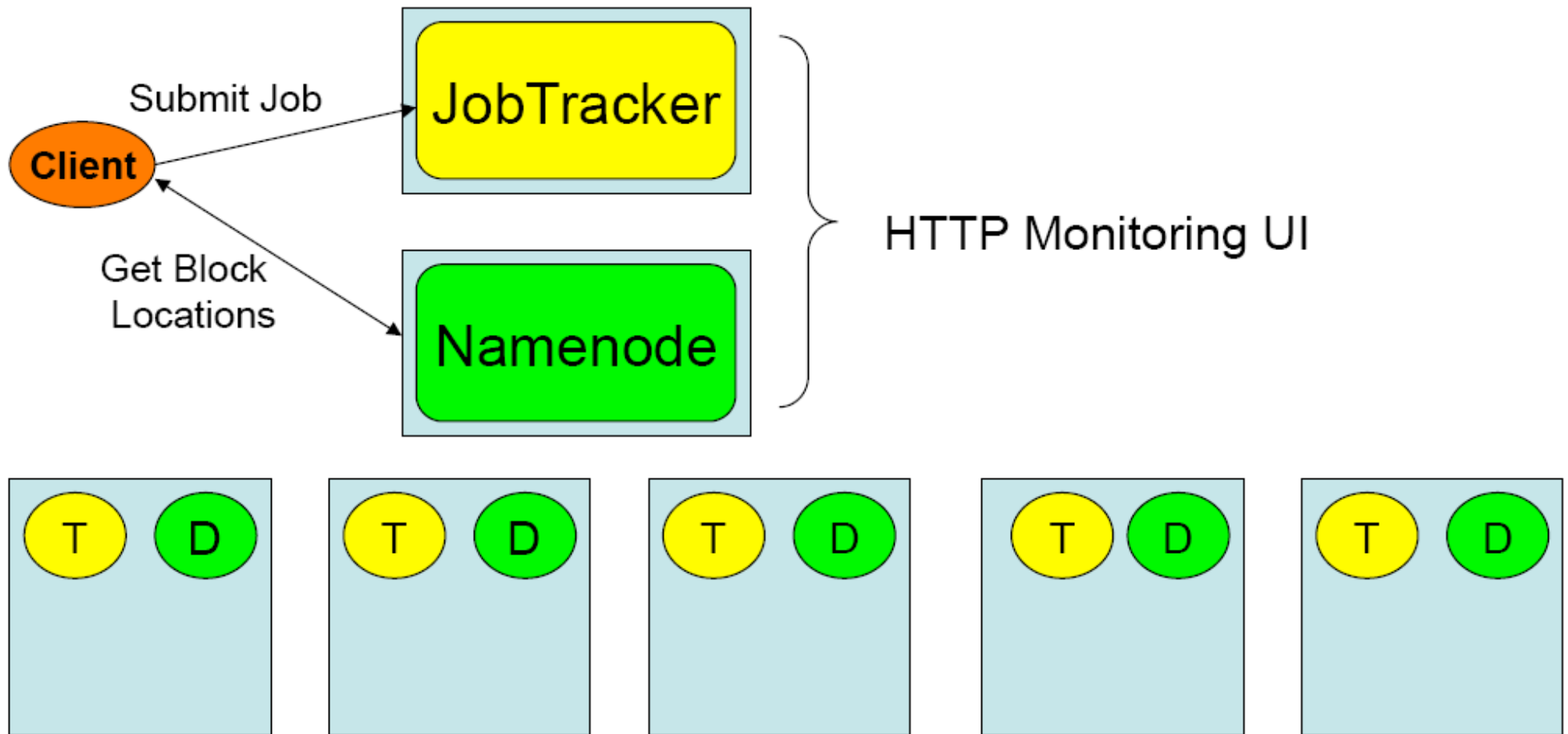
# Distributed Operating System of Hadoop

**Hadoop** 建構成一個分散式作業系統



# About Hadoop Client ...

## 不在雲裡的 *Hadoop Client*



# What we learn today ?

## WHAT

**Hadoop 是運算海量資料的軟體平台 !!**

hadoop is a software platform to process vast amount of data!!

## WHO

始祖是 Doug Cutting , Apache 社群支持 , Yahoo 贊助

From Doug Cutting to Apache Community, Yahoo and more !

## WHEN

**Hadoop 是 2004 年從 Nutch 分裂出來的專案 !!**

Hadoop became separate project since year 2004 !!

## WHY

**資料大爆炸、資料探勘、找工作**

Data Explore, Data Mining, Jobs !!

## HOW

**建構在大型的個人電腦叢集之上**

Install on large clusters built of commodity hardware !!



## Questions?

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

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Powered by DRBL



# Lab 0 : 準備實驗環境

- 下載 Ubuntu 9.10 安裝光碟 ISO 檔
- 下載 WinSCP 與 PieTTY
- 下載 VirtualBox
- 安裝 VirtualBox

## Ubuntu 9.10 (Karmic Koala)

---

This directory contains the most frequently downloaded Ubuntu images. Other images, including DVDs and source CDs, may be available on the [cdimage server](#). See also the [list of download mirrors](#).

### Select an image

---

Ubuntu is distributed on five types of images described below.

#### Desktop CD

---

The desktop CD allows you to try Ubuntu without changing your computer at all, and at your option to install it permanently later. This type of CD is what most people will want to use. You will need at least 256MB of RAM to install from this CD.

There are two images available, each for a different type of computer:

##### [PC \(Intel x86\) desktop CD](#)

---

For almost all PCs. This includes most machines with Intel/AMD/etc type processors and almost all computers that run Microsoft Windows, as well as newer Apple Macintosh systems based on Intel processors. Choose this if you are at all unsure.

##### [64-bit PC \(AMD64\) desktop CD](#)

---

Choose this to take full advantage of computers based on the AMD64 or EM64T architecture (e.g., Athlon64, Opteron, EM64T Xeon, Core 2). If you have a non-64-bit processor made by AMD, or if you need full support for 32-bit code, use the Intel x86 images instead.

連線至 <http://free.nchc.org.tw/ubuntu-cd/karmic/>  
下載 Ubuntu 9.10PC (Intel x86) desktop CD

PieTTY (pputty): piaip's reimplementation of PuTTY - Mozilla Firefox

http://ntu.csie.org/~piaip/pietty/ 選單 (M) vmplayer network manager

RELATED SITES: Official PuTTY | My personal website |

# pietty

{ piaip's PieTTY Project }

» Download 下載 | Donate! | Contact | PuTTY

## PieTTY/pputty/PuTTY 是什麼?

PuTTY 是個小巧方便的 Telnet/SSH 安全遠端連線程式，但用於非英語系文字時有非常多的問題，而且它對於初學者來說過於複雜的使用界面也為人詬病已久。PieTTY 則是源自於 PuTTY，修正與完整支援亞洲等多國語系字元，並在使用界面上大幅改進、易學易用的版本。



PieTTY is a free SSH client based on PuTTY and dedicated to multilingual (especially CJK) environments, accessibility, and simpler user interface.

PieTTY 使用 MIT License, 是免費而可自由重新散佈的。更詳細的歷史或是使用上有問題請見 [FAQ](#)。關於 PieTTY 為何要支援「Unicode 補完計畫」請見 [FAQ](#)。

## Downloads 下載

Stable Release: 06/14/2005

PieTTY 0.3.27

MD5:

1533c60d6a9fda4715eaf88d89c05dc0

Known Issue 已知問題:

- 第一次使用 PieTTY 時，若直接選 PuTTY 舊設定會連線失敗。請先隨便手動打入某些 IP 並建立連線後即可正常使用。
- Esc[1;11m" 這樣的 ANSI 控制碼(關鍵在 m 後面直接加 ") 在 Big5 mode 不開 Internal UCS 會導致中文全部被折開來成 ASCII 處理 (PuTTY 也會)。不詳

完成

連線至 <http://ntu.csie.org/~piaip/pietty/>  
下載 PieTTY (SSH Client)

WinSCP :: 介紹 - Mozilla Firefox

http://winscp.net/eng/docs/lang:cht

# WinSCP

Free SFTP, FTP and SCP client for Windows

News About Download Plugins to File Managers Donations Forum

Protocols Requirements Scripting F.A.Q. Awards Screenshots Translations

History Donations

## 介紹

- 取得與安裝WinSCP
- 特色
- 檔案操作
- 遠端主機連線
- 程式操作介面

WinSCP 是在Windows中使用SSH的開放原始碼的圖形化SFTP用戶端。WinSCP同時也支援SCP通訊協定。它主要的功能是安全的在電腦間傳輸檔案。

這是一個給正體中文讀者閱讀的介紹網頁。大部分的WinSCP文件都僅提供英文；在這裡有許多連結連到這些英文說明。

取得與安裝WinSCP [Edit](#)

### Site Search

powered by 

### This page

[Edit this page](#)

[Old revisions](#)

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[Index](#)

### Donate

DONATE

完成

連線至 <http://winscp.net>  
下載 WinSCP (SFTP Client)

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.

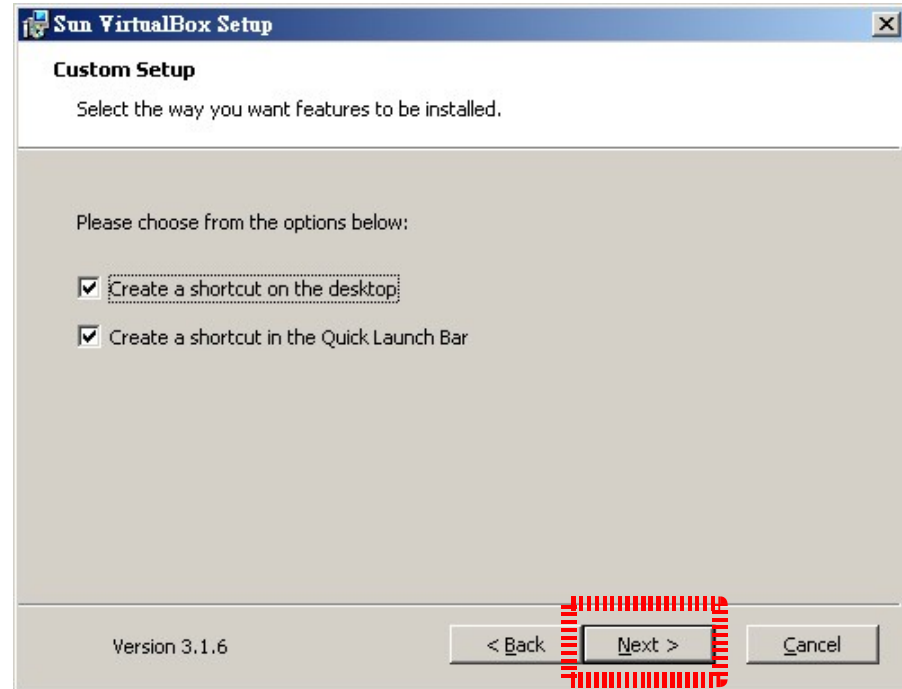
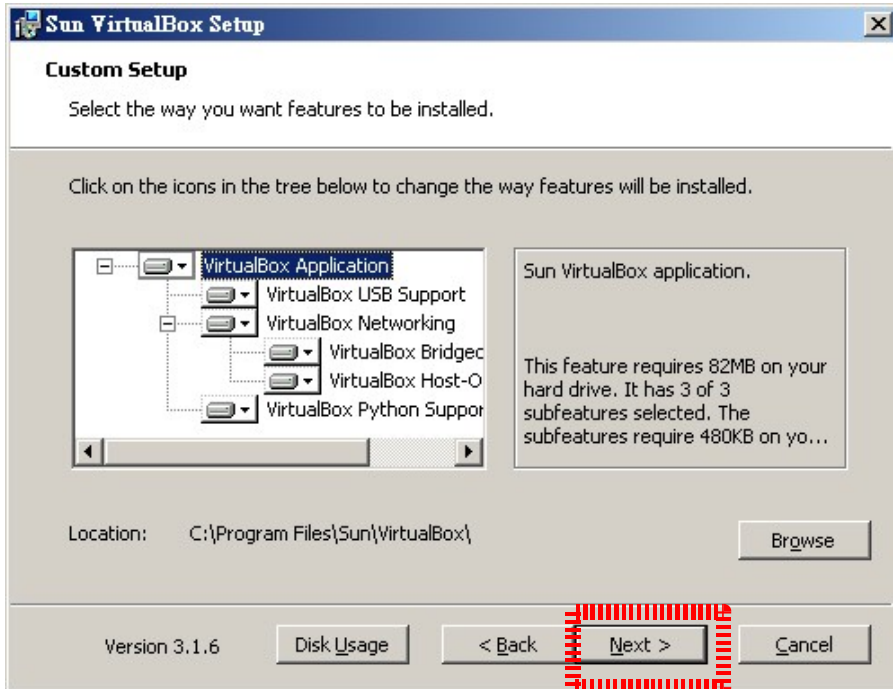
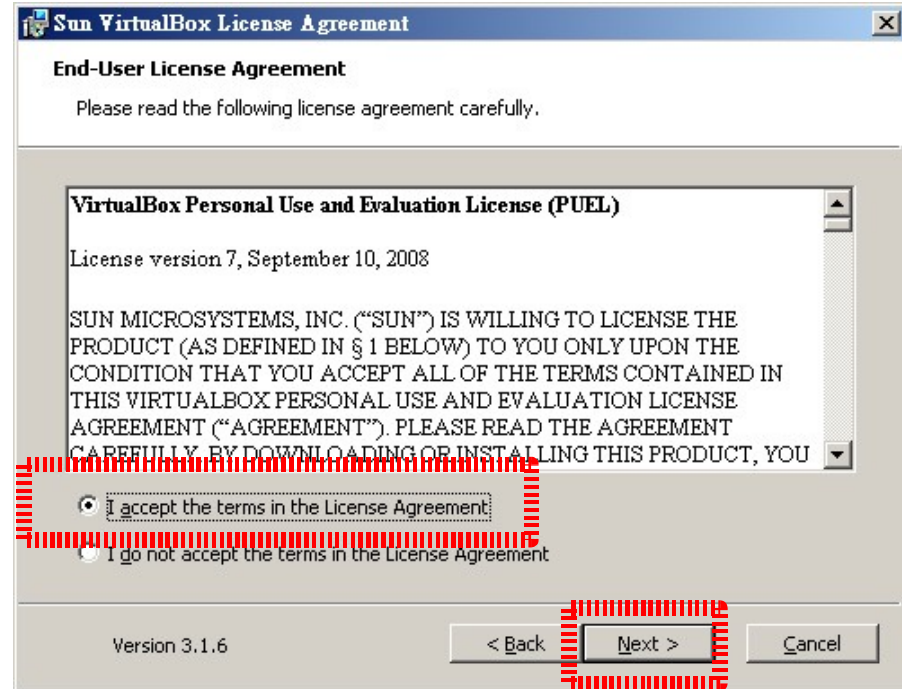
### VirtualBox binaries

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.

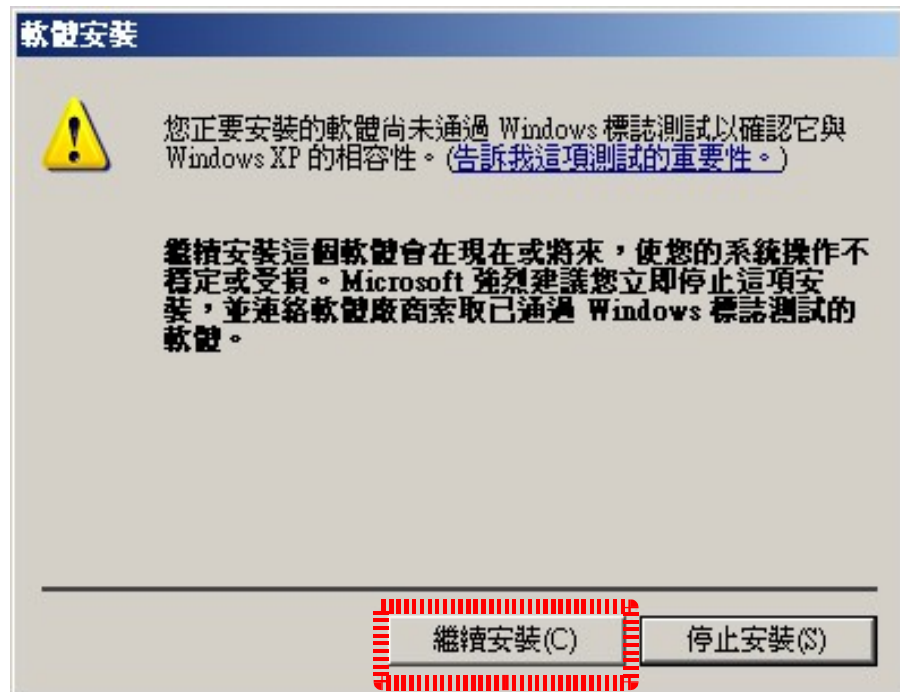
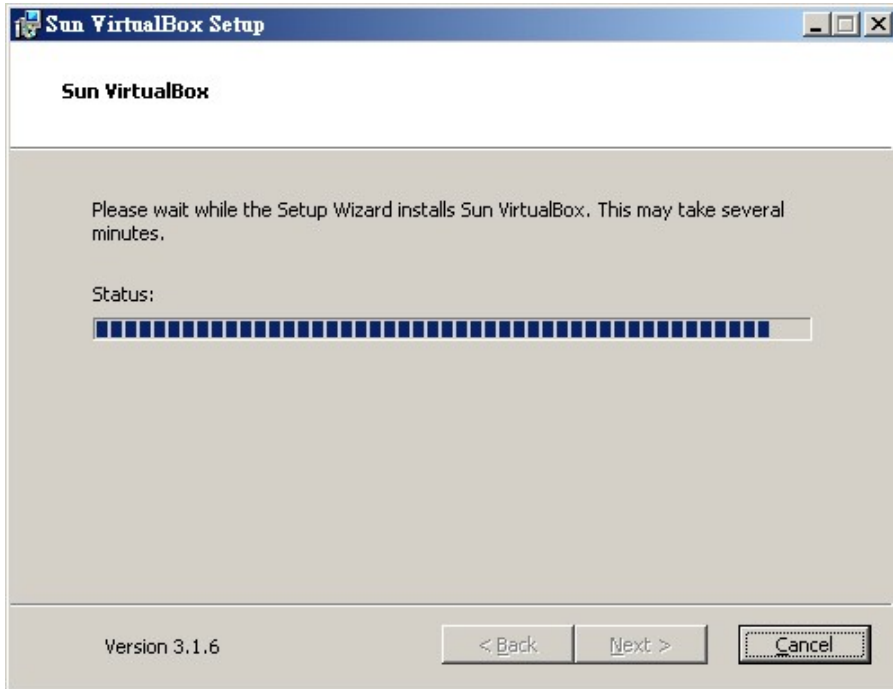
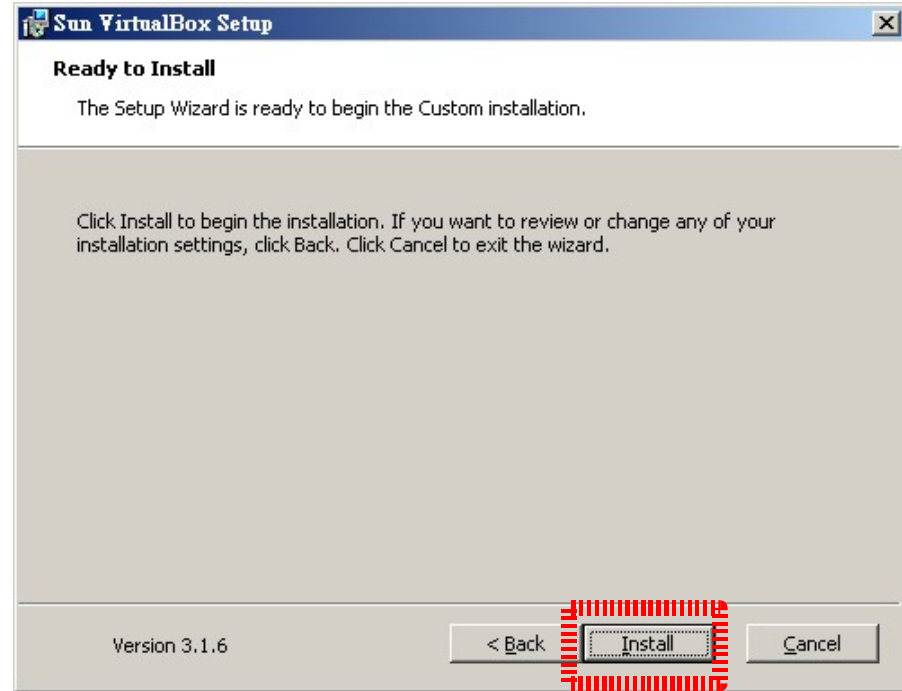
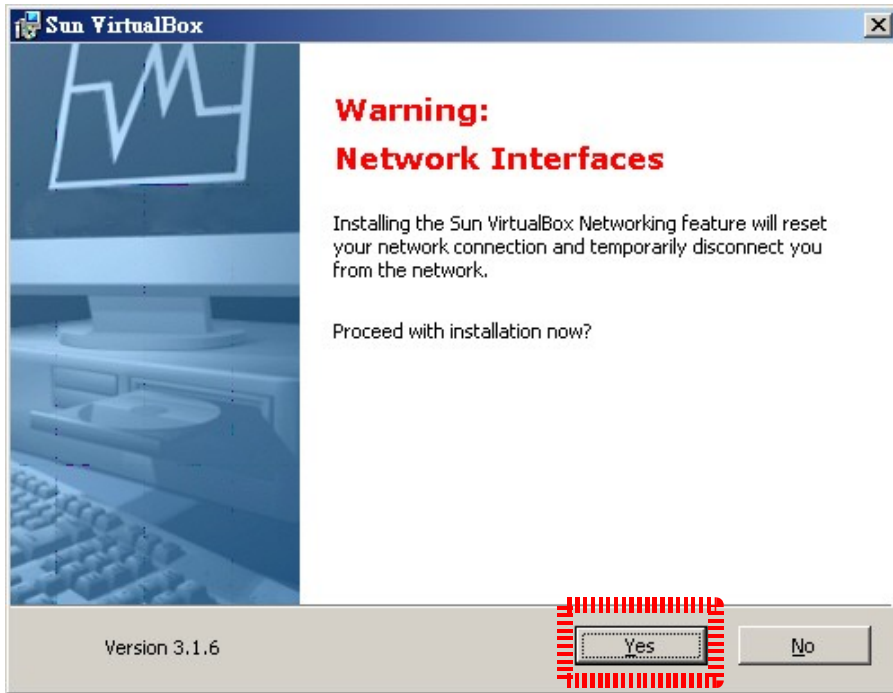
- **VirtualBox 3.1.6 for Windows hosts** [⇨ x86/amd64](#)
- **VirtualBox 3.1.6 for OS X hosts** [⇨ Intel Macs](#)  
*Due to an accident the original 3.1.6 Mac OS X package (build 59338) was broken. Please install the fixed package if you installed the broken package. Sorry for the inconveniences!*
- **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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    [End-user docs](#)  
    [Technical docs](#)  
[Contribute](#)  
[Community](#)

# 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。

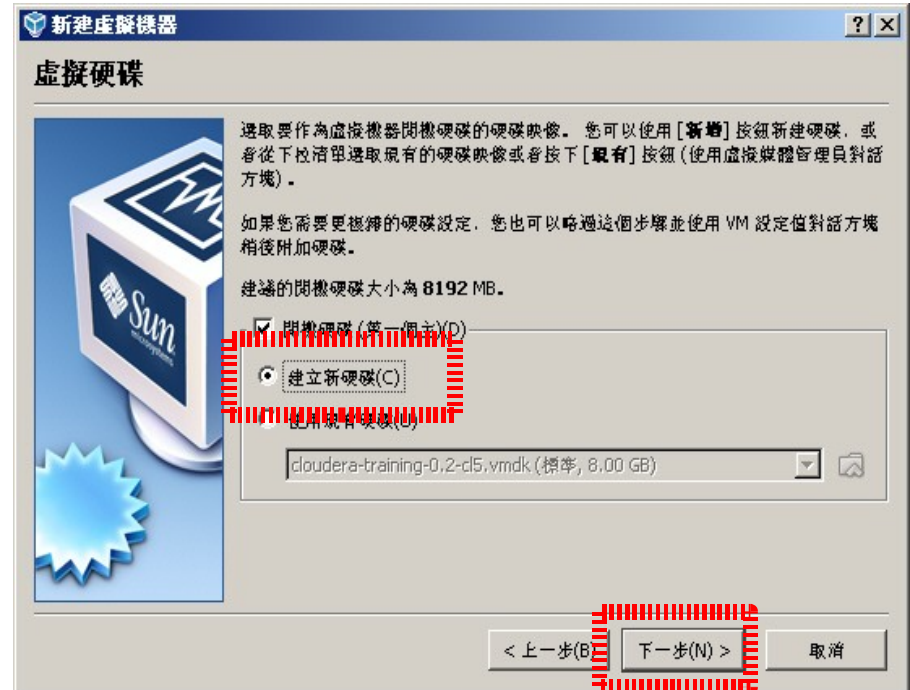
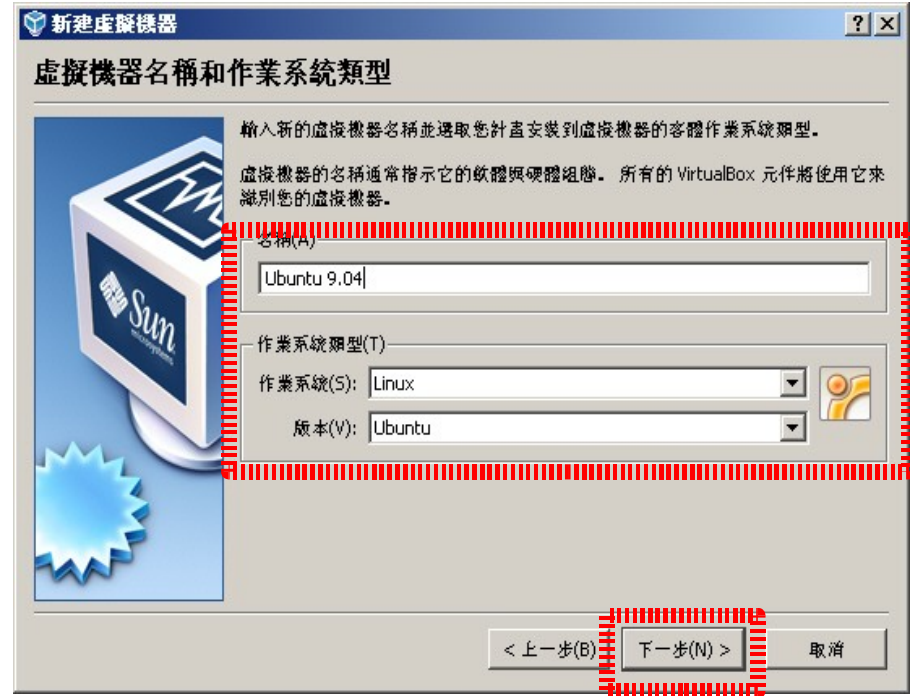
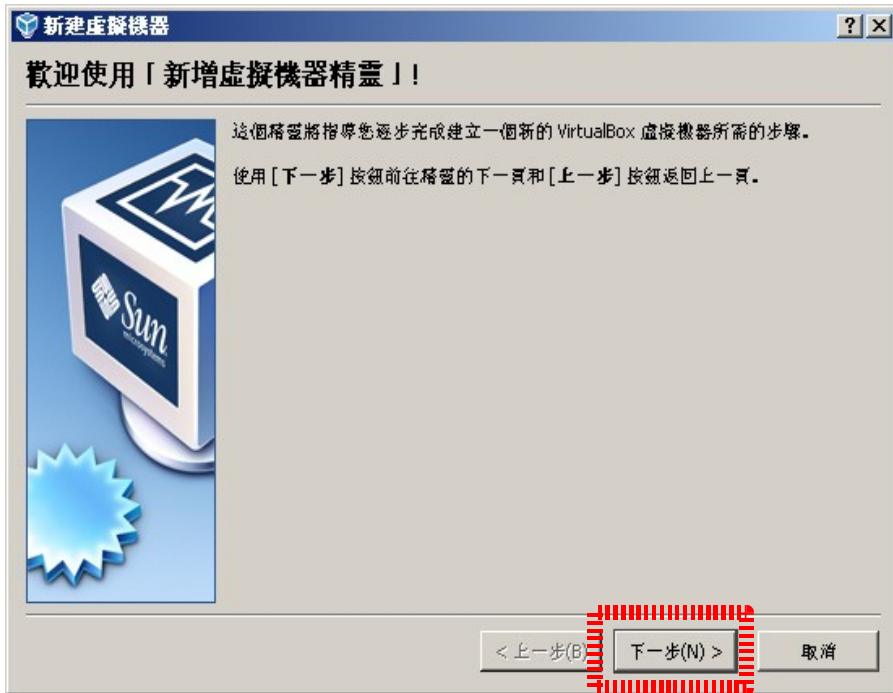
您可以按下 **[F1]** 按鍵取得即時說明，或訪問 [www.virtualbox.org](http://www.virtualbox.org) 取得最新資訊與新聞。

刪除選取的虛擬機器



# Lab 1 : 安裝 Ubuntu 9.10 GNU/Linux

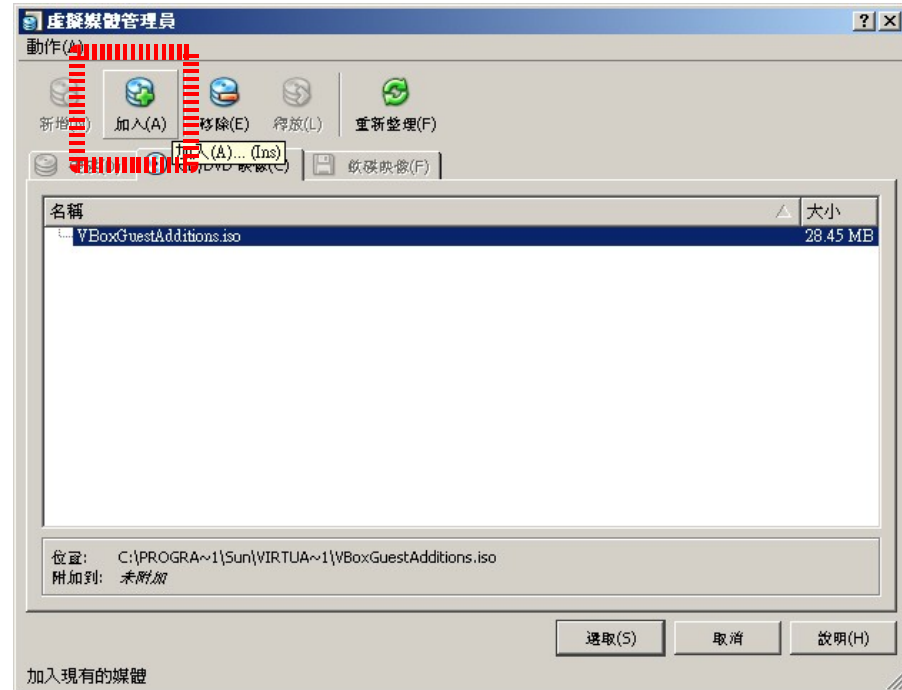
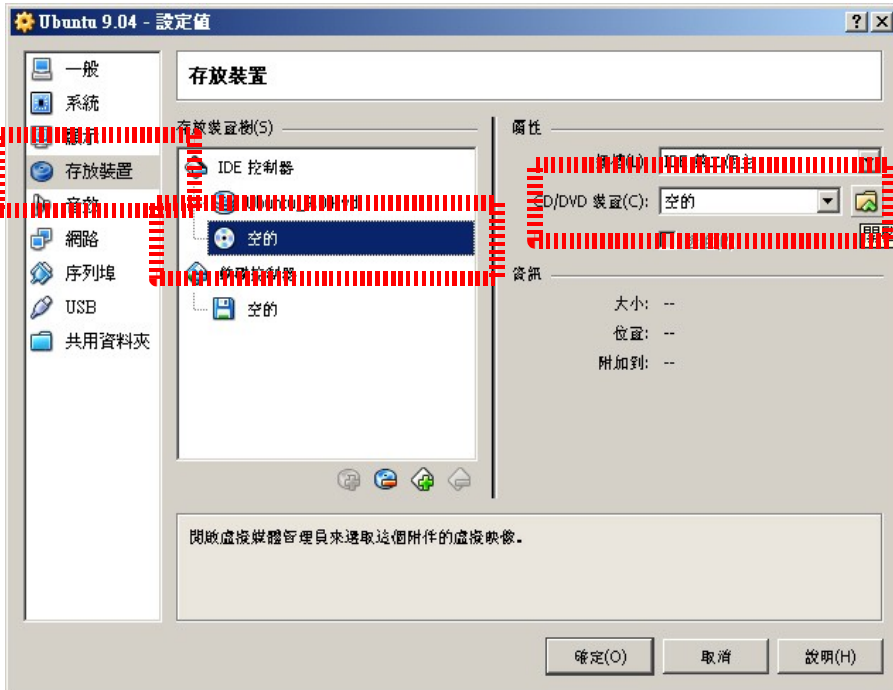
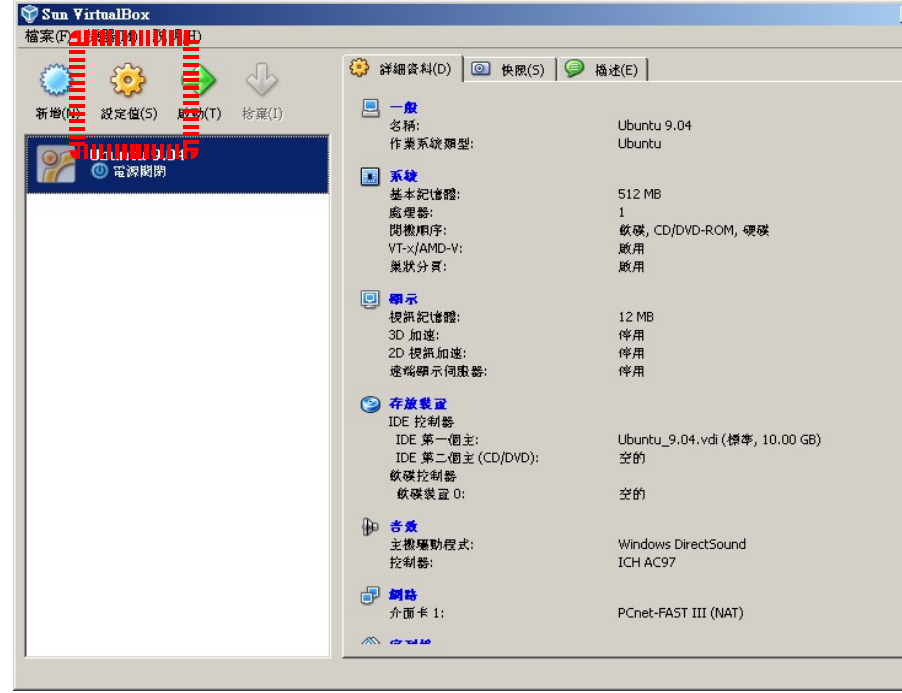
# 安裝 Ubuntu 9.10 (1)



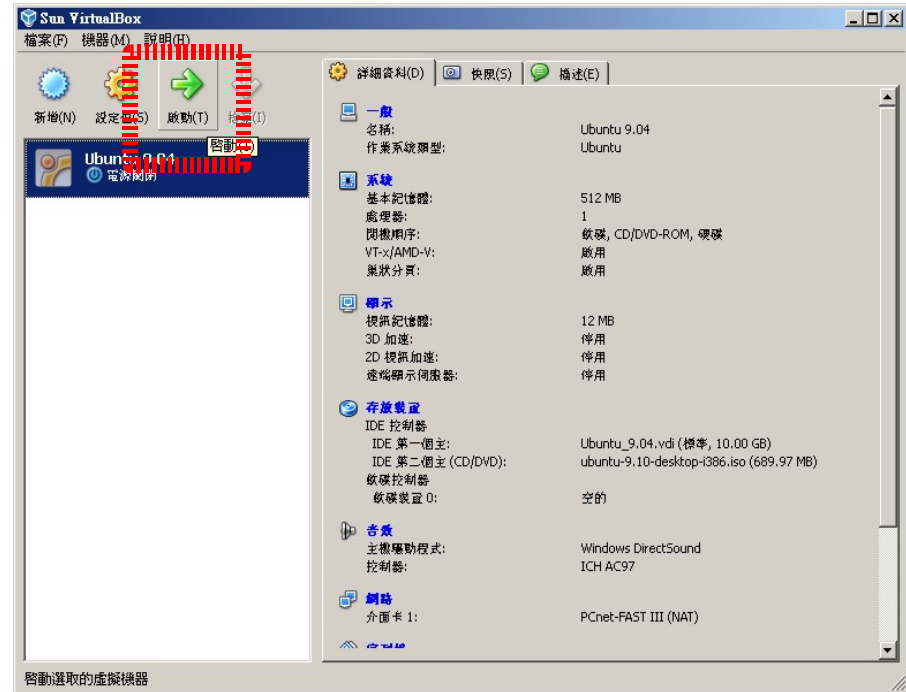
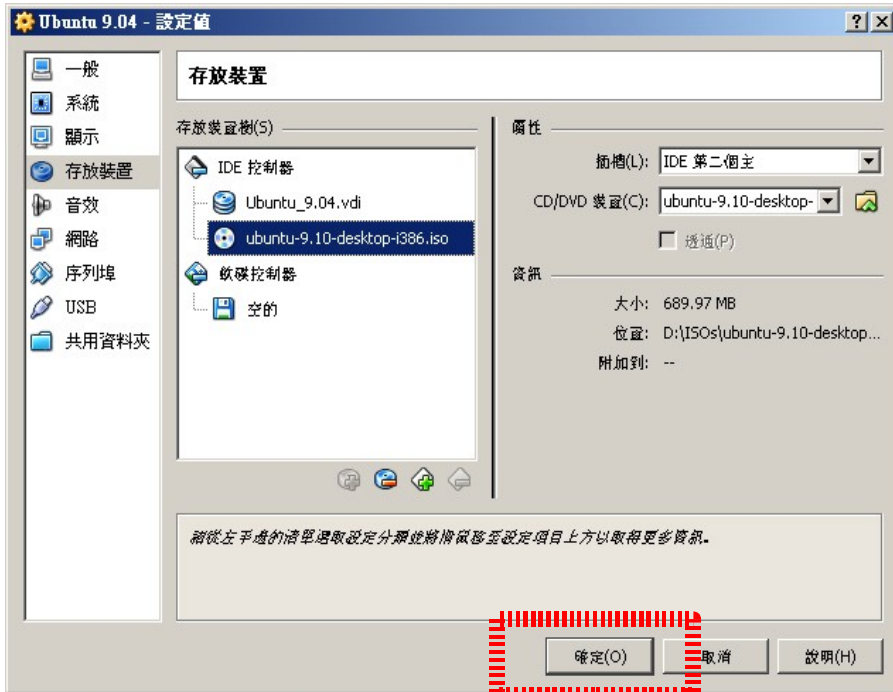
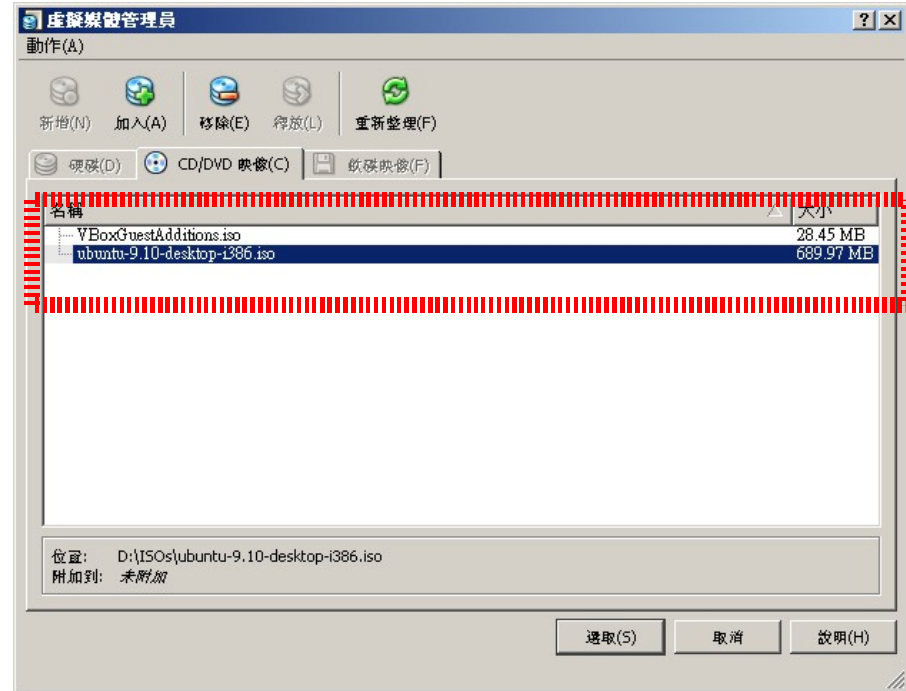
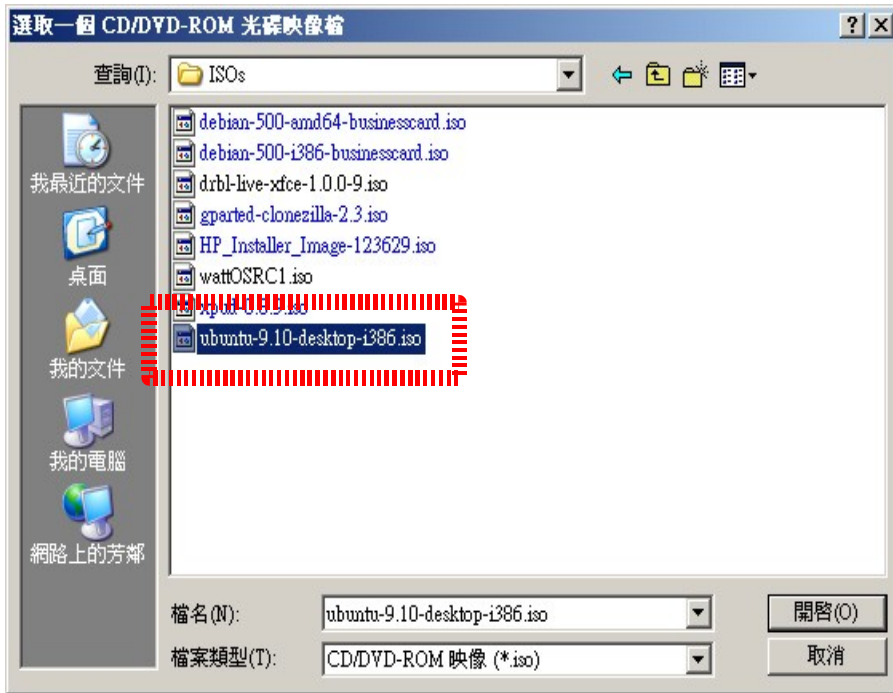
# 安裝 Ubuntu 9.10 (2)



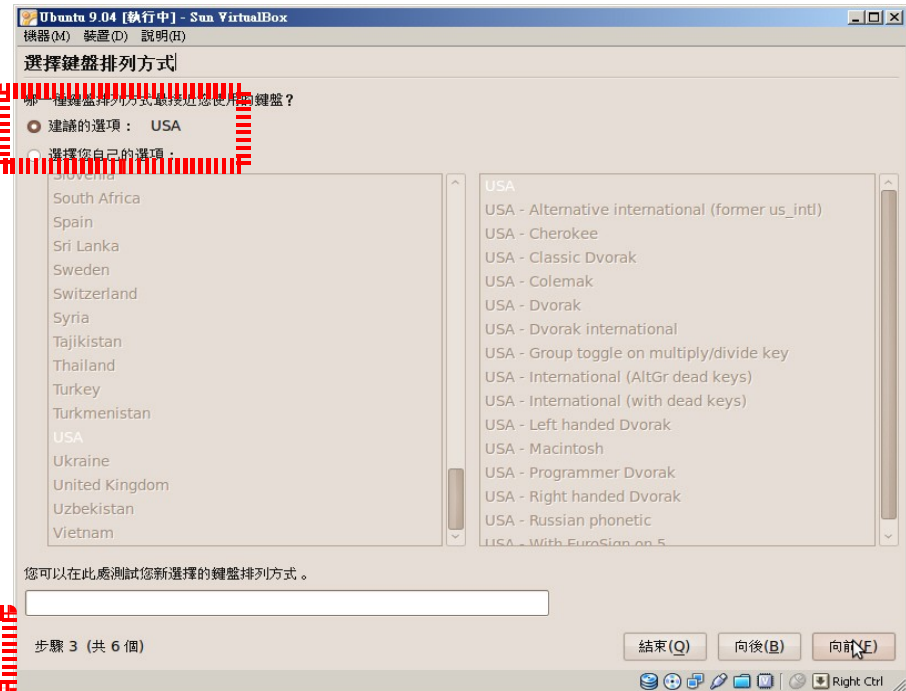
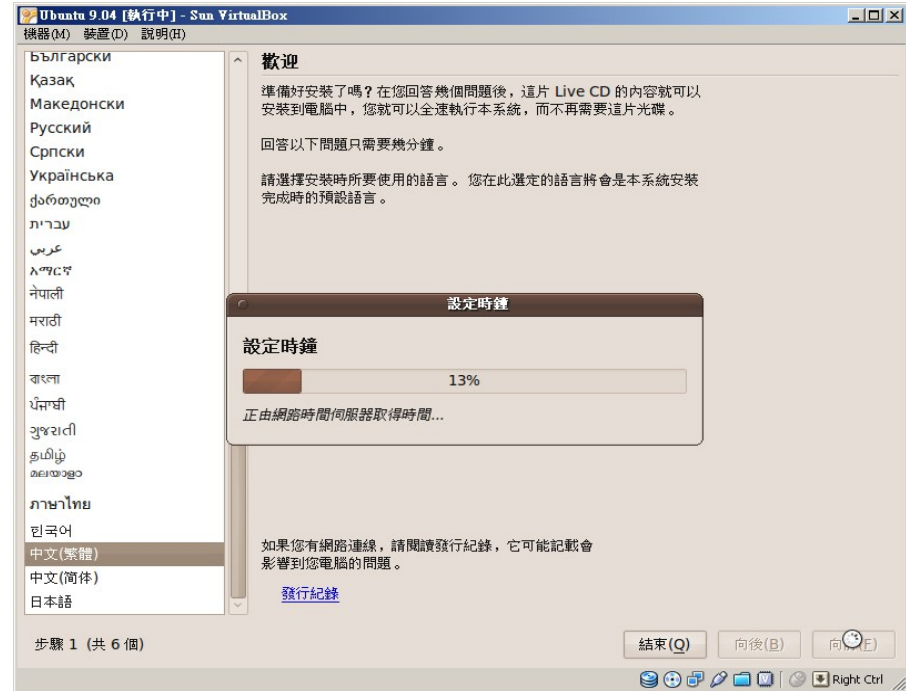
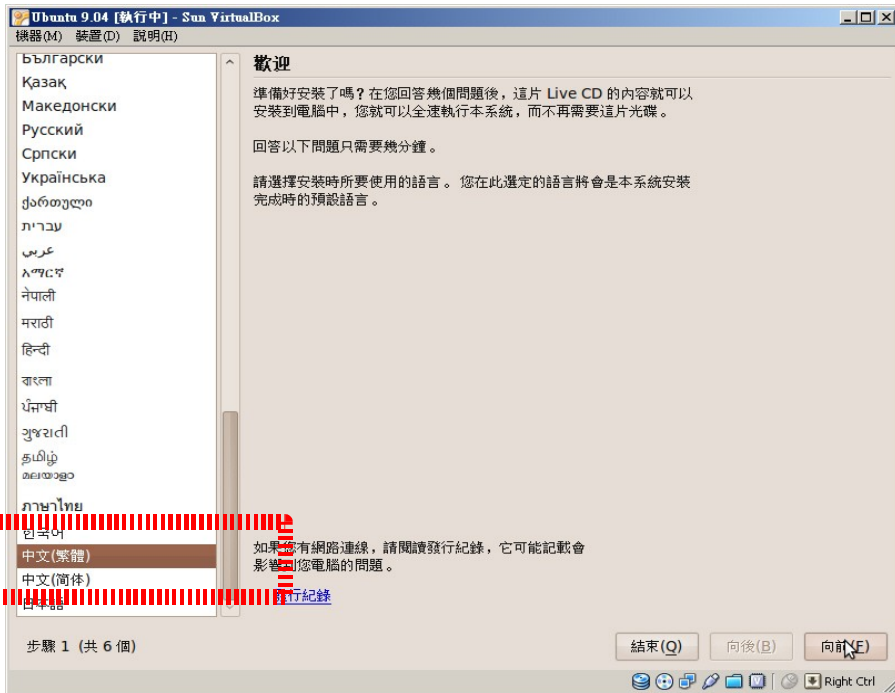
# 安裝 Ubuntu 9.10 (3)



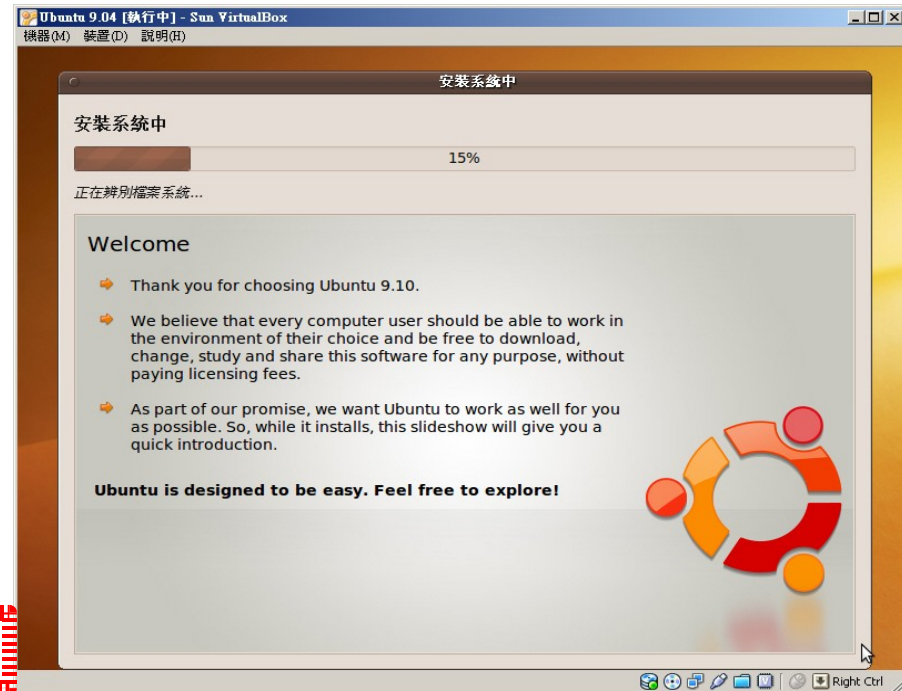
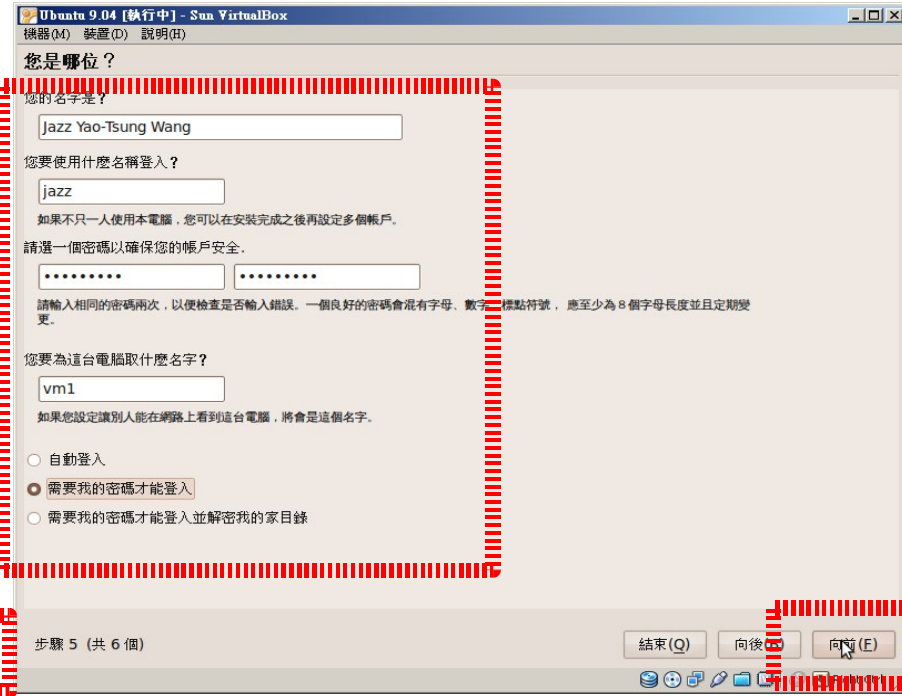
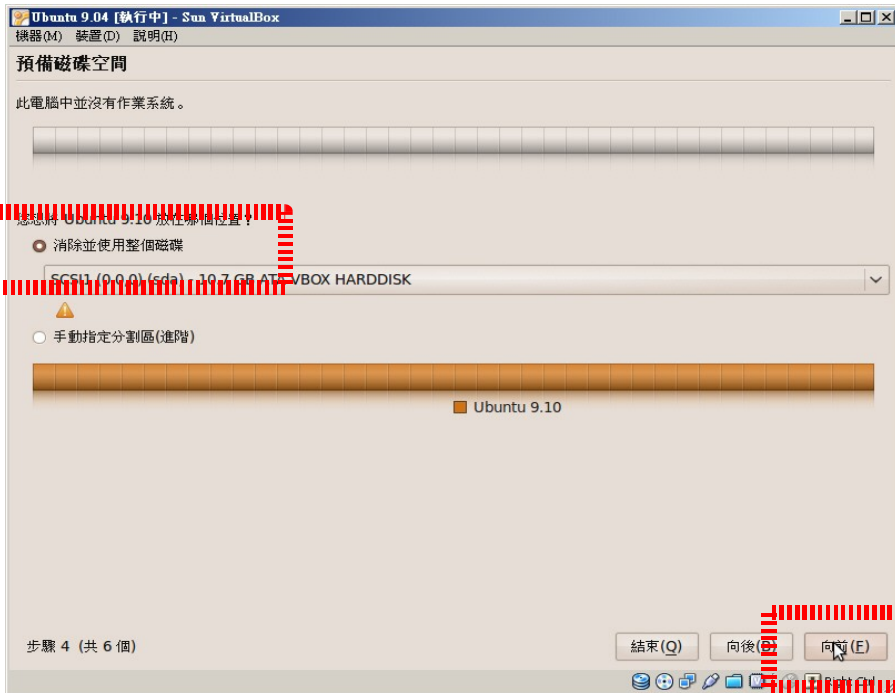
# 安裝 Ubuntu 9.10 (4)



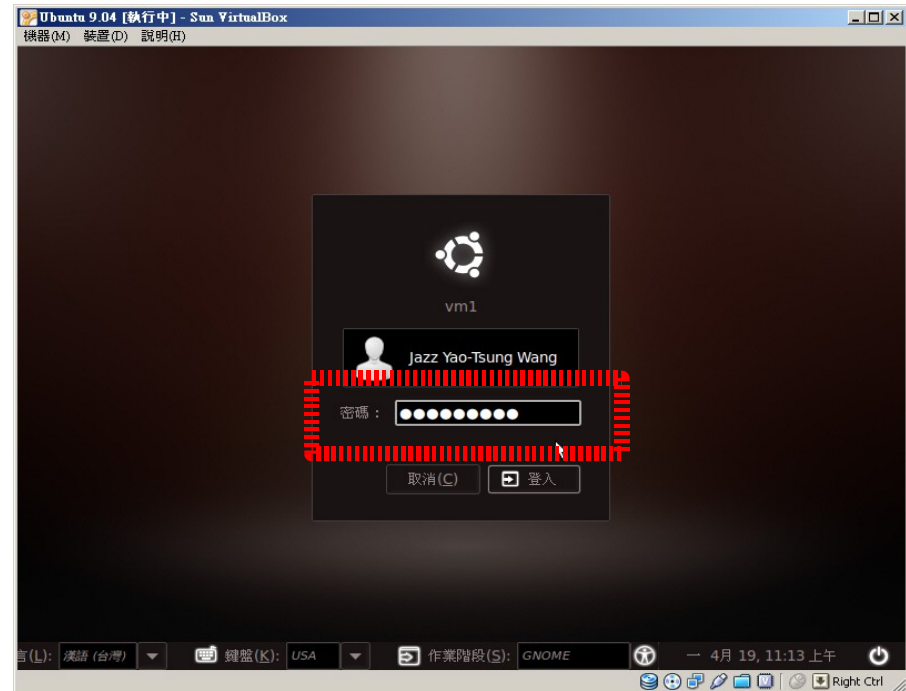
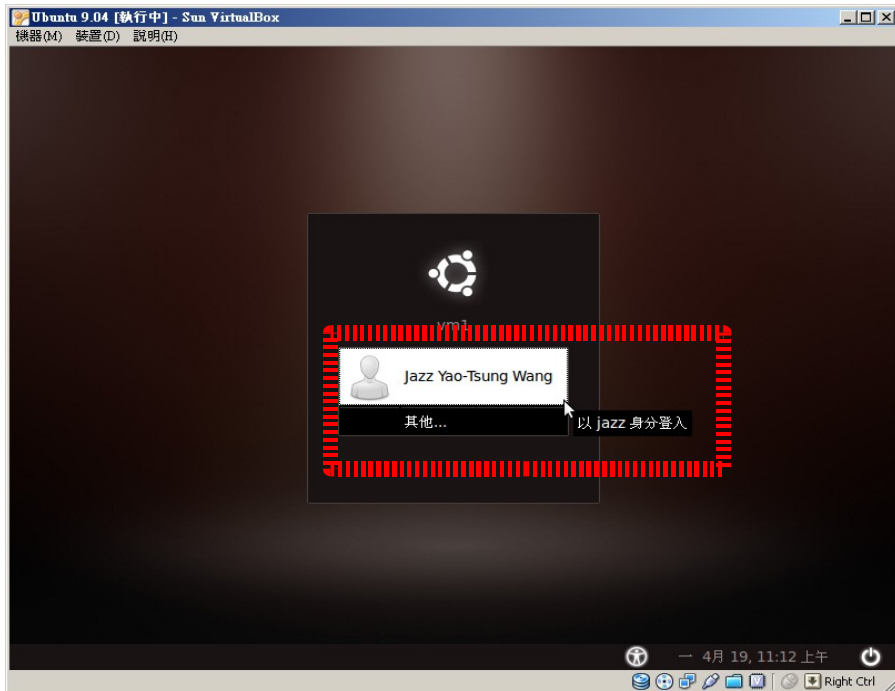
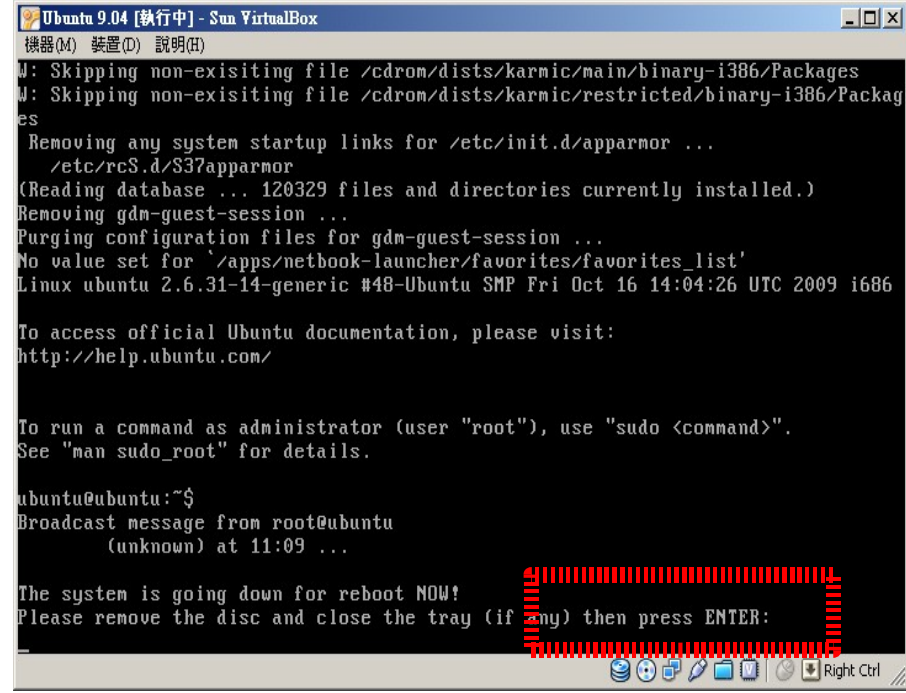
# 安裝 Ubuntu 9.10 (5)



# 安裝 Ubuntu 9.10 (6)

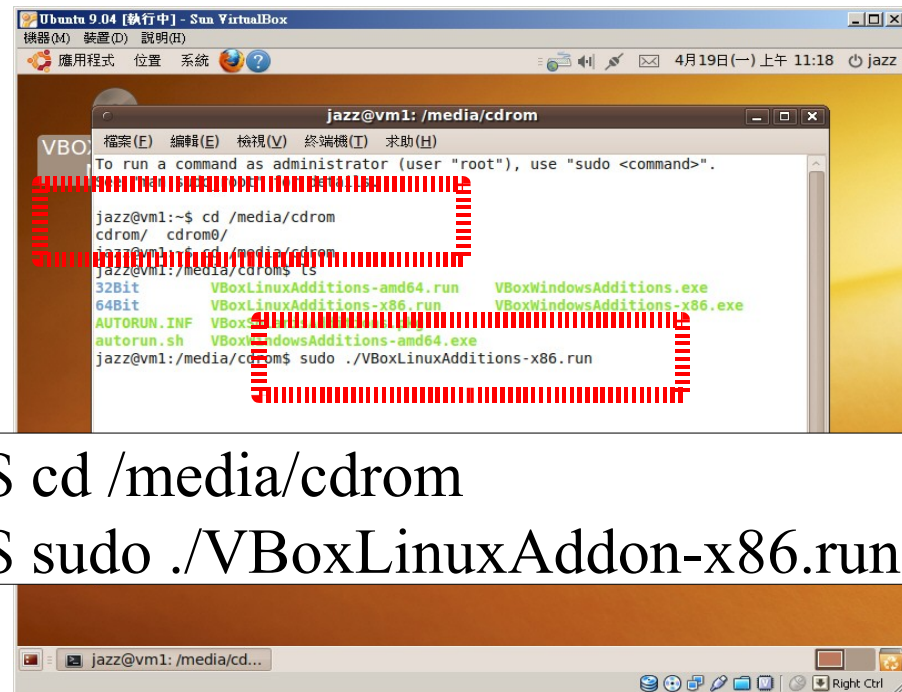
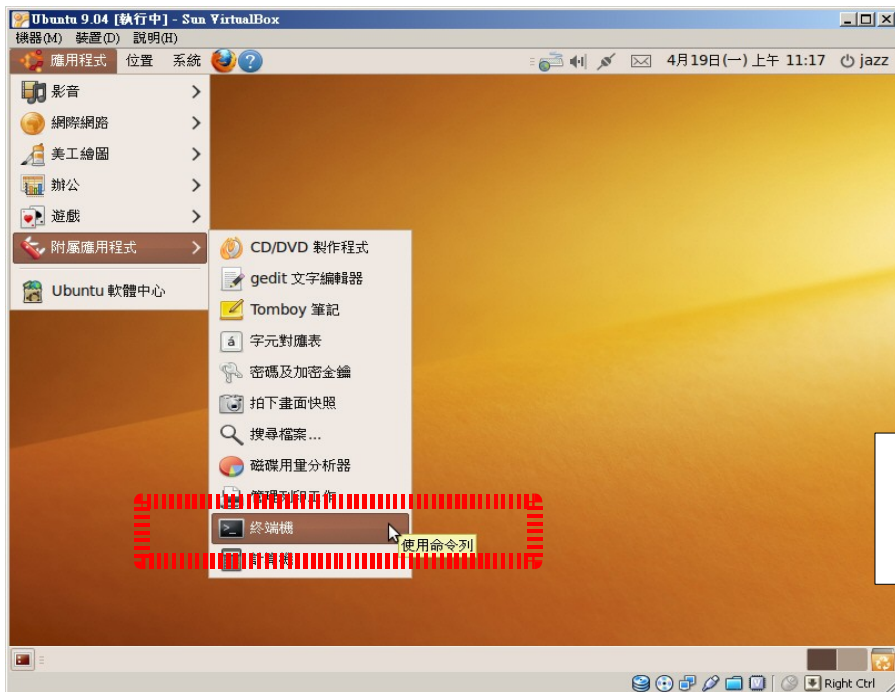
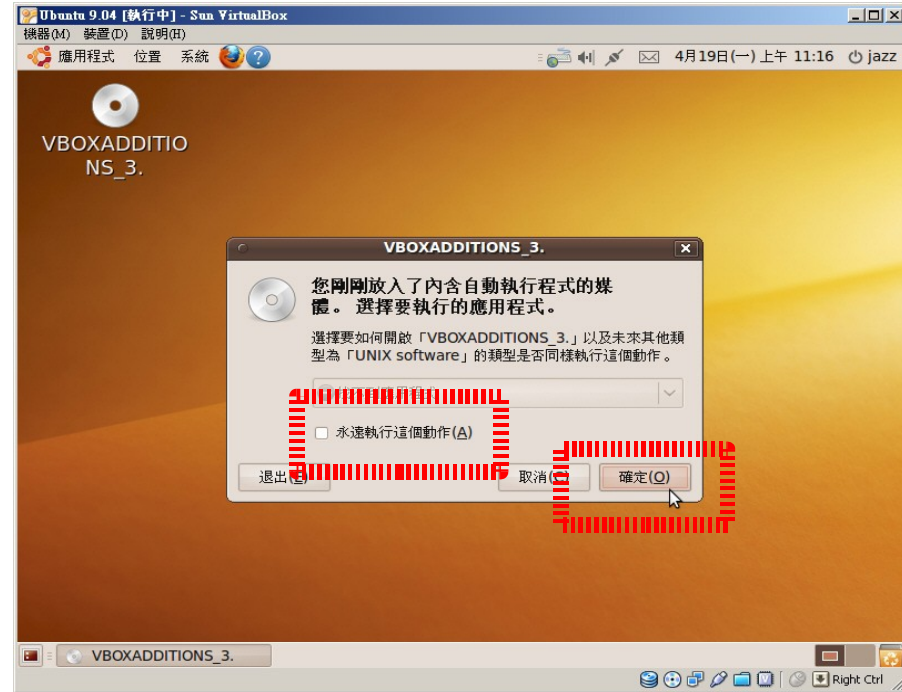
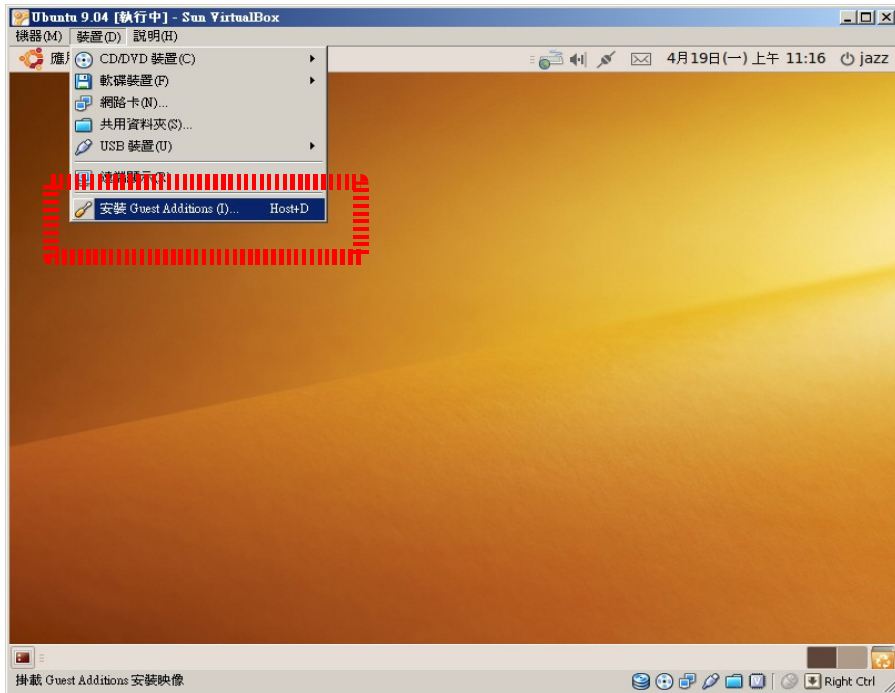


# 安裝 Ubuntu 9.10 (7)



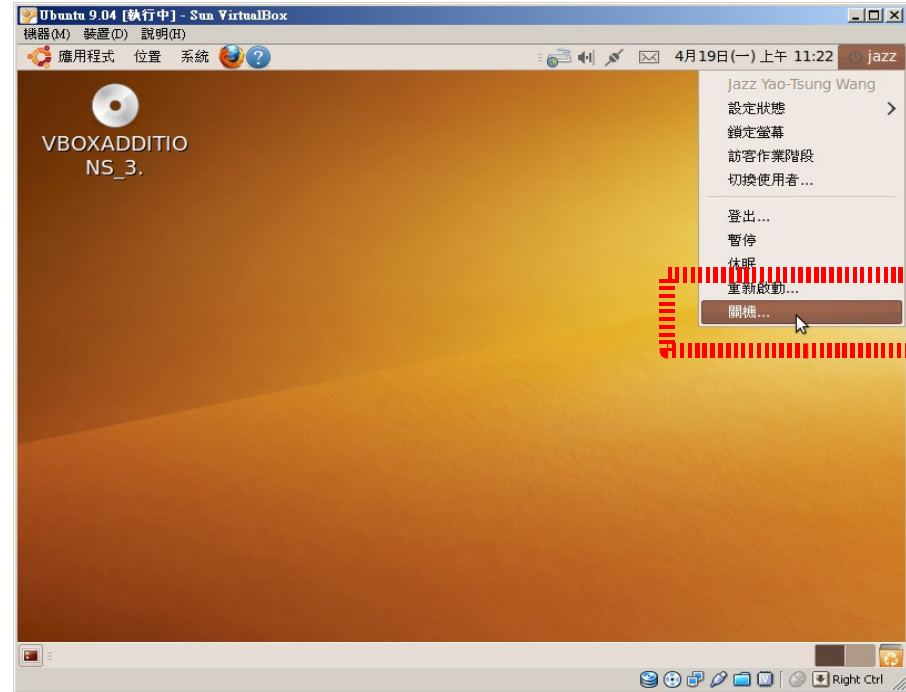
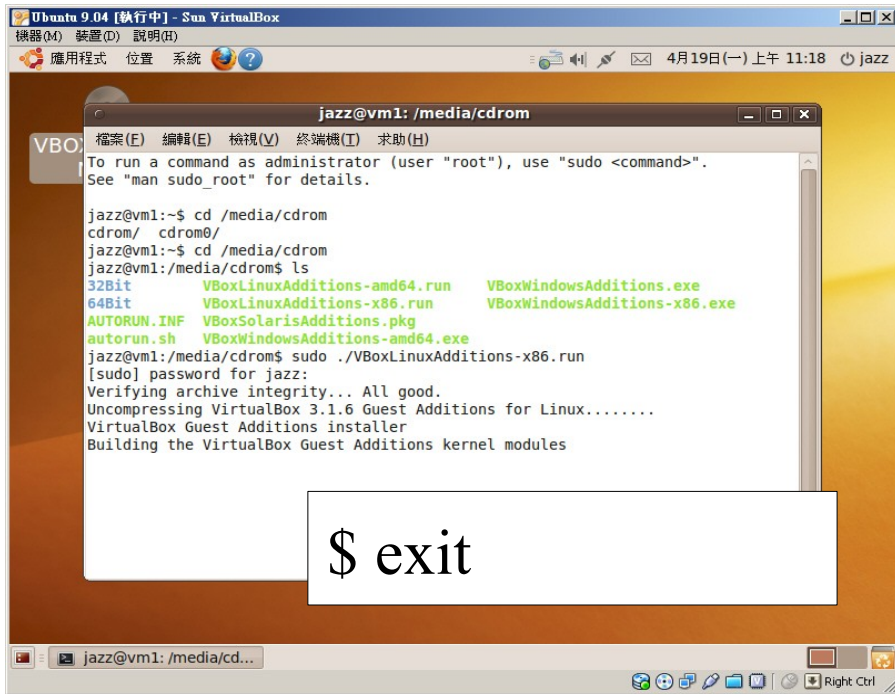


# 安裝 Ubuntu 9.10 (8)



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

# 安裝 Ubuntu 9.10 (9)



一個令人哭笑不得的說法



學習使用免費的 Linux ，  
除非你的時間也是免費的！！

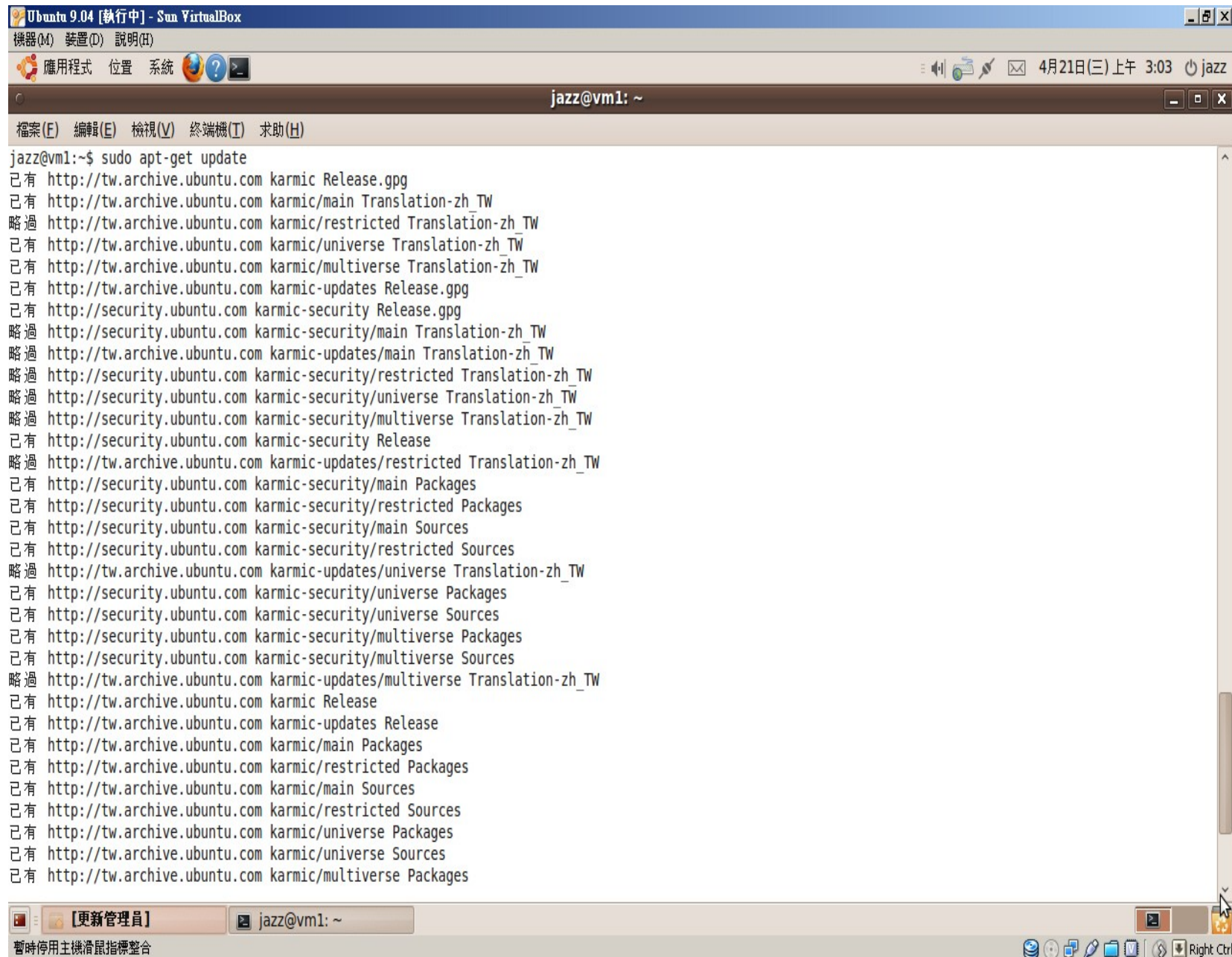
# Linux 入門資源

時間可以存起來嘛？把作過的事情紀錄下來吧！  
這部分的介紹，我 2001 年作過就請大家自己看了

[http://angkor.jazzbear.idv.tw/Linux\\_DivX/02.avi](http://angkor.jazzbear.idv.tw/Linux_DivX/02.avi)

- 如何找尋協助？
- Linux 基本指令操作
- Linux 管理者指令
- Linux 檔案系統簡介

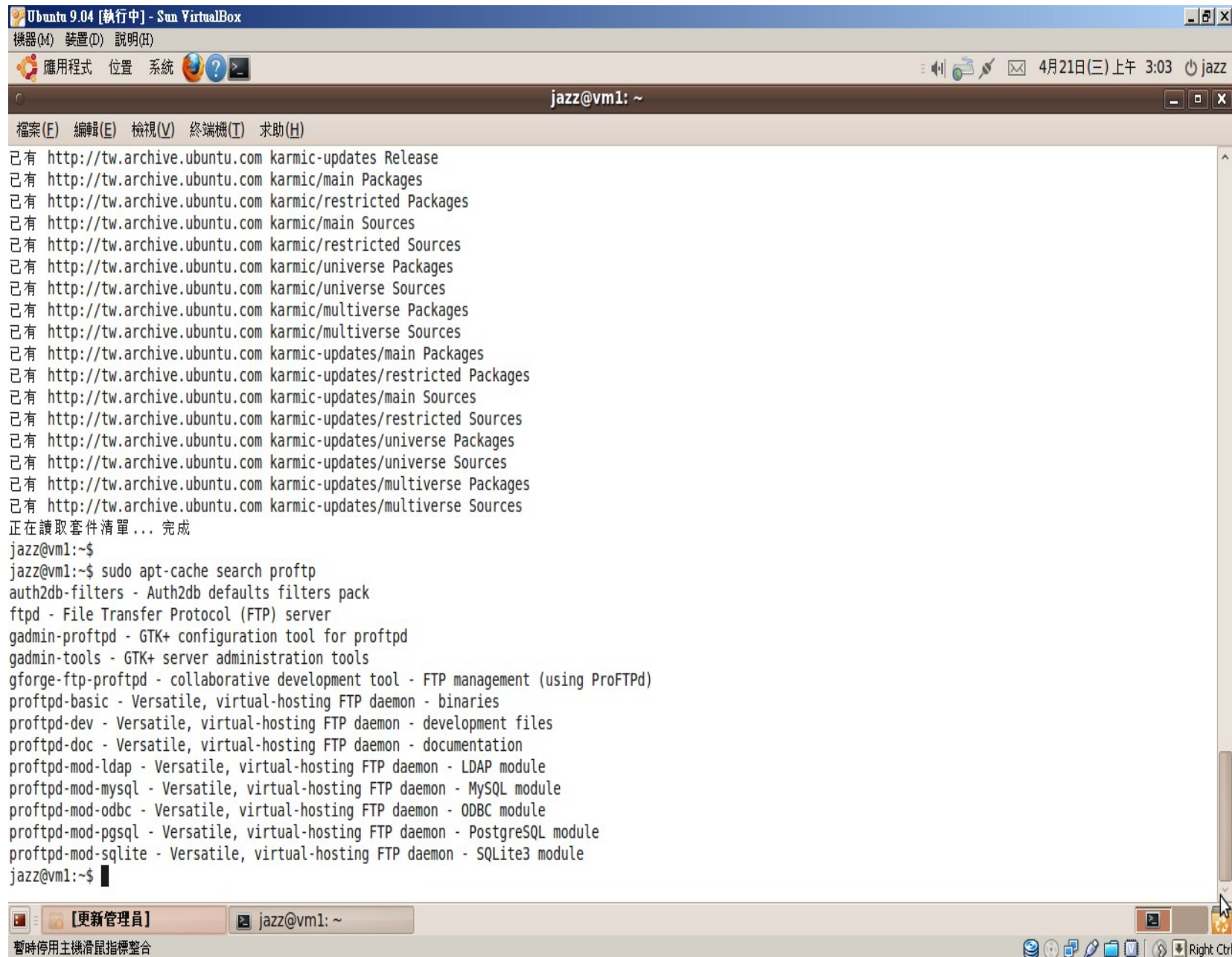
# 基本管理篇 [1] 用 apt-get update 更新套件



```
jazz@vml:~$ sudo apt-get update
已有一 http://tw.archive.ubuntu.com karmic Release.gpg
已有一 http://tw.archive.ubuntu.com karmic/main Translation-zh_TW
略過 http://tw.archive.ubuntu.com karmic/restricted Translation-zh_TW
已有一 http://tw.archive.ubuntu.com karmic/universe Translation-zh_TW
已有一 http://tw.archive.ubuntu.com karmic/multiverse Translation-zh_TW
已有一 http://tw.archive.ubuntu.com karmic-updates Release.gpg
已有一 http://security.ubuntu.com karmic-security Release.gpg
略過 http://security.ubuntu.com karmic-security/main Translation-zh_TW
略過 http://tw.archive.ubuntu.com karmic-updates/main Translation-zh_TW
略過 http://security.ubuntu.com karmic-security/restricted Translation-zh_TW
略過 http://security.ubuntu.com karmic-security/universe Translation-zh_TW
略過 http://security.ubuntu.com karmic-security/multiverse Translation-zh_TW
已有一 http://security.ubuntu.com karmic-security Release
略過 http://tw.archive.ubuntu.com karmic-updates/restricted Translation-zh_TW
已有一 http://security.ubuntu.com karmic-security/main Packages
已有一 http://security.ubuntu.com karmic-security/restricted Packages
已有一 http://security.ubuntu.com karmic-security/main Sources
已有一 http://security.ubuntu.com karmic-security/restricted Sources
略過 http://tw.archive.ubuntu.com karmic-updates/universe Translation-zh_TW
已有一 http://security.ubuntu.com karmic-security/universe Packages
已有一 http://security.ubuntu.com karmic-security/universe Sources
已有一 http://security.ubuntu.com karmic-security/multiverse Packages
已有一 http://security.ubuntu.com karmic-security/multiverse Sources
略過 http://tw.archive.ubuntu.com karmic-updates/multiverse Translation-zh_TW
已有一 http://tw.archive.ubuntu.com karmic Release
已有一 http://tw.archive.ubuntu.com karmic-updates Release
已有一 http://tw.archive.ubuntu.com karmic/main Packages
已有一 http://tw.archive.ubuntu.com karmic/restricted Packages
已有一 http://tw.archive.ubuntu.com karmic/main Sources
已有一 http://tw.archive.ubuntu.com karmic/restricted Sources
已有一 http://tw.archive.ubuntu.com karmic/universe Packages
已有一 http://tw.archive.ubuntu.com karmic/universe Sources
已有一 http://tw.archive.ubuntu.com karmic/multiverse Packages
```



# 基本管理篇 [3] 用 apt-cache search 搜尋



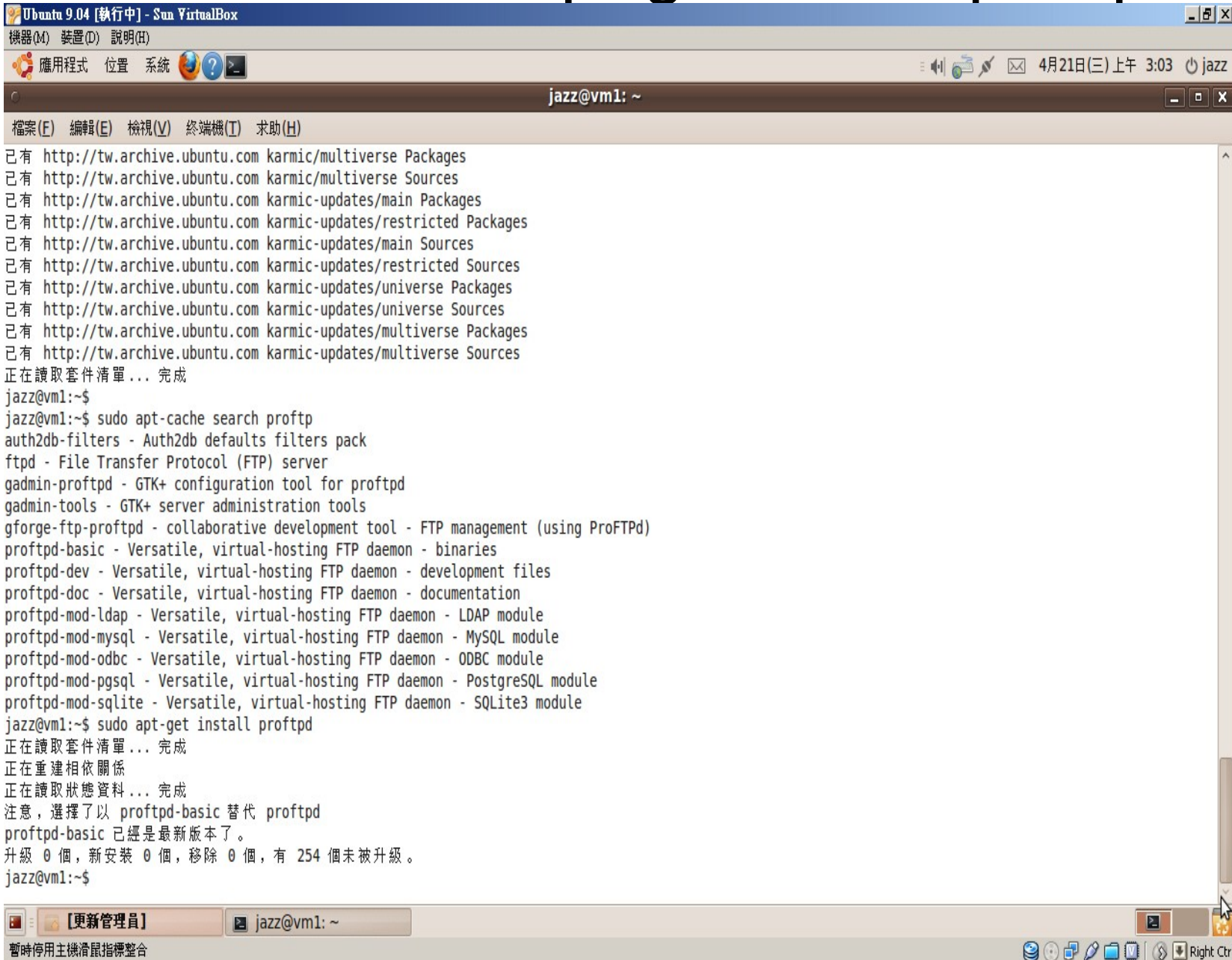
```
Ubuntu 9.04 [執行中] - Sun VirtualBox
機器(M) 裝置(D) 說明(H)
應用程式 位置 系統 4月21日(三)上午 3:03 jazz
jazz@vml: ~
檔案(E) 編輯(E) 檢視(V) 終端機(T) 求助(H)
已有 http://tw.archive.ubuntu.com karmic-updates Release
已有 http://tw.archive.ubuntu.com karmic/main Packages
已有 http://tw.archive.ubuntu.com karmic/restricted Packages
已有 http://tw.archive.ubuntu.com karmic/main Sources
已有 http://tw.archive.ubuntu.com karmic/restricted Sources
已有 http://tw.archive.ubuntu.com karmic/universe Packages
已有 http://tw.archive.ubuntu.com karmic/universe Sources
已有 http://tw.archive.ubuntu.com karmic/multiverse Packages
已有 http://tw.archive.ubuntu.com karmic/multiverse Sources
已有 http://tw.archive.ubuntu.com karmic-updates/main Packages
已有 http://tw.archive.ubuntu.com karmic-updates/restricted Packages
已有 http://tw.archive.ubuntu.com karmic-updates/main Sources
已有 http://tw.archive.ubuntu.com karmic-updates/restricted Sources
已有 http://tw.archive.ubuntu.com karmic-updates/universe Packages
已有 http://tw.archive.ubuntu.com karmic-updates/universe Sources
已有 http://tw.archive.ubuntu.com karmic-updates/multiverse Packages
已有 http://tw.archive.ubuntu.com karmic-updates/multiverse Sources
正在讀取套件清單... 完成
jazz@vml:~$
jazz@vml:~$ sudo apt-cache search proftpd
auth2db-filters - Auth2db defaults filters pack
ftpd - File Transfer Protocol (FTP) server
gadmin-proftpd - GTK+ configuration tool for proftpd
gadmin-tools - GTK+ server administration tools
gforge-ftp-proftpd - collaborative development tool - FTP management (using ProFTPD)
proftpd-basic - Versatile, virtual-hosting FTP daemon - binaries
proftpd-dev - Versatile, virtual-hosting FTP daemon - development files
proftpd-doc - Versatile, virtual-hosting FTP daemon - documentation
proftpd-mod-ldap - Versatile, virtual-hosting FTP daemon - LDAP module
proftpd-mod-mysql - Versatile, virtual-hosting FTP daemon - MySQL module
proftpd-mod-odbc - Versatile, virtual-hosting FTP daemon - ODBC module
proftpd-mod-pgsql - Versatile, virtual-hosting FTP daemon - PostgreSQL module
proftpd-mod-sqlite - Versatile, virtual-hosting FTP daemon - SQLite3 module
jazz@vml:~$
```

【更新管理員】 jazz@vml: ~

暫時停用主機滑鼠指標整合 Right Ctrl

# 基本管理篇 [4] 用 apt-get install 安裝套件

## Ex. apt-get install proftpd



```
Ubuntu 9.04 [執行中] - Sun VirtualBox
機器(M) 裝置(D) 說明(H)
應用程式 位置 系統 4月21日(三) 上午 3:03 jazz
jazz@vm1: ~
檔案(E) 編輯(E) 檢視(V) 終端機(T) 求助(H)
已有 http://tw.archive.ubuntu.com karmic/multiverse Packages
已有 http://tw.archive.ubuntu.com karmic/multiverse Sources
已有 http://tw.archive.ubuntu.com karmic-updates/main Packages
已有 http://tw.archive.ubuntu.com karmic-updates/restricted Packages
已有 http://tw.archive.ubuntu.com karmic-updates/main Sources
已有 http://tw.archive.ubuntu.com karmic-updates/restricted Sources
已有 http://tw.archive.ubuntu.com karmic-updates/universe Packages
已有 http://tw.archive.ubuntu.com karmic-updates/universe Sources
已有 http://tw.archive.ubuntu.com karmic-updates/multiverse Packages
已有 http://tw.archive.ubuntu.com karmic-updates/multiverse Sources
正在讀取套件清單... 完成
jazz@vm1:~$
jazz@vm1:~$ sudo apt-cache search proftpd
auth2db-filters - Auth2db defaults filters pack
ftpd - File Transfer Protocol (FTP) server
gadmin-proftpd - GTK+ configuration tool for proftpd
gadmin-tools - GTK+ server administration tools
gforge-ftp-proftpd - collaborative development tool - FTP management (using ProFTPd)
proftpd-basic - Versatile, virtual-hosting FTP daemon - binaries
proftpd-dev - Versatile, virtual-hosting FTP daemon - development files
proftpd-doc - Versatile, virtual-hosting FTP daemon - documentation
proftpd-mod-ldap - Versatile, virtual-hosting FTP daemon - LDAP module
proftpd-mod-mysql - Versatile, virtual-hosting FTP daemon - MySQL module
proftpd-mod-odbc - Versatile, virtual-hosting FTP daemon - ODBC module
proftpd-mod-pgsql - Versatile, virtual-hosting FTP daemon - PostgreSQL module
proftpd-mod-sqlite - Versatile, virtual-hosting FTP daemon - SQLite3 module
jazz@vm1:~$ sudo apt-get install proftpd
正在讀取套件清單... 完成
正在重建相依關係
正在讀取狀態資料... 完成
注意，選擇了以 proftpd-basic 替代 proftpd
proftpd-basic 已經是最新版本了。
升級 0 個，新安裝 0 個，移除 0 個，有 254 個未被升級。
jazz@vm1:~$
```

【更新管理員】 jazz@vm1: ~

暫時停用主機滑鼠指標整合 Right Ctrl



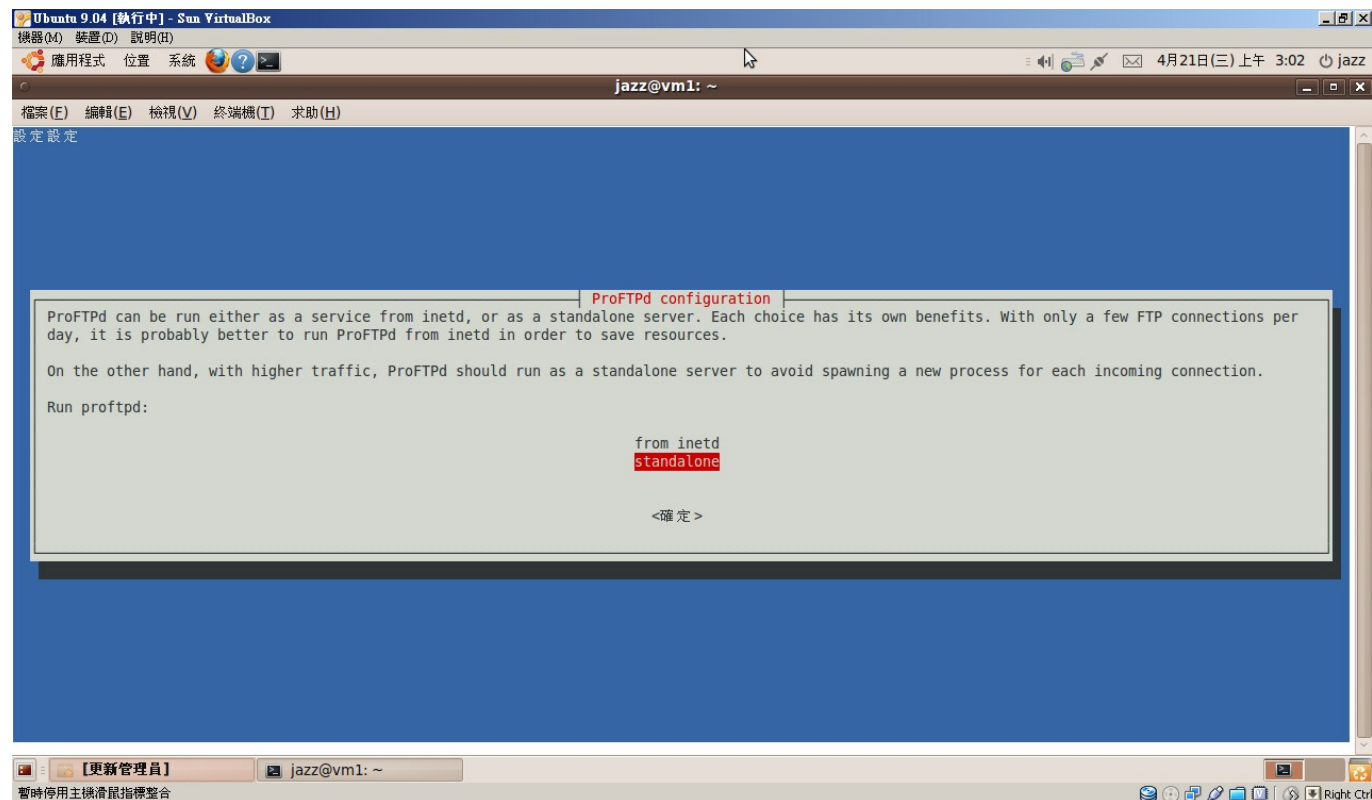
# 安裝 ProFTP

```
$ sudo apt-get install proftpd
```

```
$ sudo apt-get install ftp
```

- 測試

```
$ ftp localhost 21
```



# 安裝 SSH

```
$ sudo apt-get install ssh
```

```
$ ssh localhost
```



```
Ubuntu 9.04 [執行中] - Sun VirtualBox
機器(M) 裝置(D) 說明(H)
瀏覽及執行已安裝的程式
jazz@vm1: ~
檔案(E) 編輯(E) 檢視(V) 終端機(T) 求助(H)
jazz@vm1:~$ sudo apt-get install ssh
[sudo] password for jazz:
正在讀取套件清單... 完成
正在重建相依關係
正在讀取狀態資料... 完成
ssh 已經是最新版本了。
升級 0 個，新安裝 0 個，移除 0 個，有 254 個未被升級。
jazz@vm1:~$ ssh localhost
jazz@localhost's password:
Linux vm1 2.6.31-14-generic #48-Ubuntu SMP Fri Oct 16 14:04:26 UTC 2009 i686

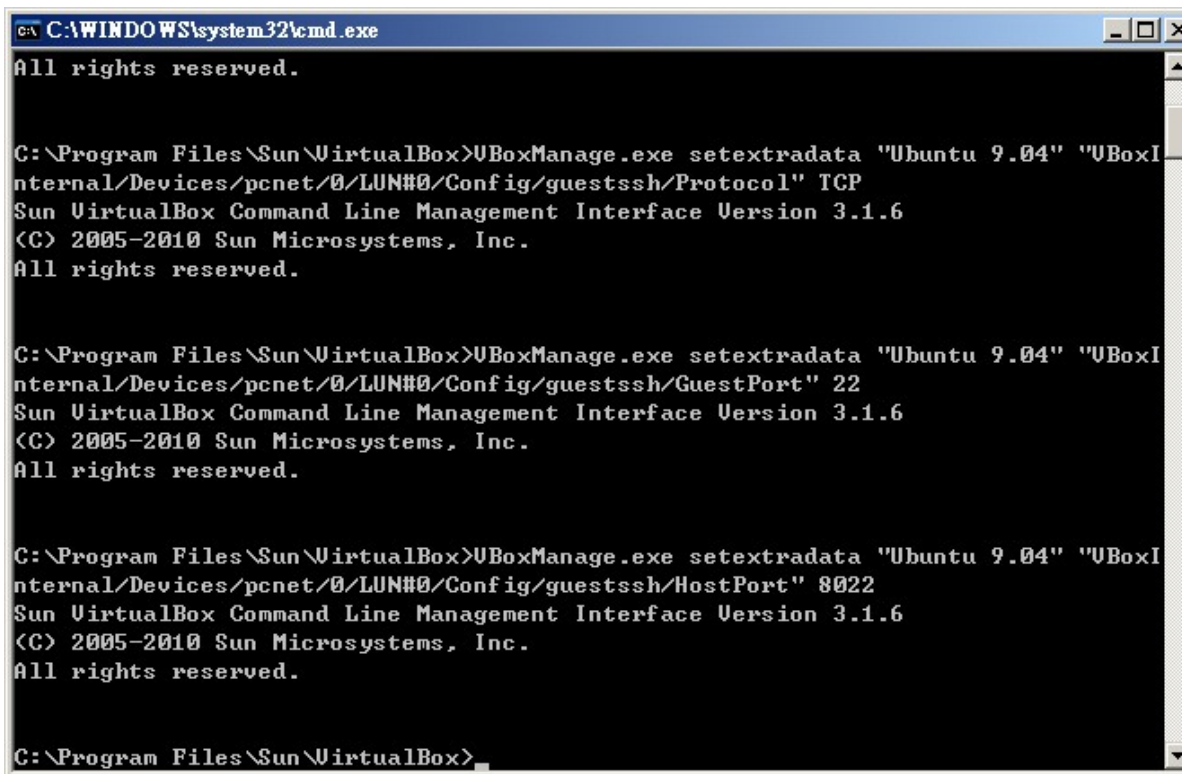
To access official Ubuntu documentation, please visit:
http://help.ubuntu.com/

259 packages can be updated.
106 updates are security updates.

Last login: Wed Apr 21 16:05:51 2010 from localhost
jazz@vm1:~$
```

# 讓 Windows 可以連到虛擬機器

- VBoxManage.exe setextradata "Ubuntu 9.04" "VBoxInternal/Devices/pcnet/0/LUN#0/Config/guestssh/Protocol" TCP
- VBoxManage.exe setextradata "Ubuntu 9.04" "VBoxInternal/Devices/pcnet/0/LUN#0/Config/guestssh/GuestPort" 22
- VBoxManage.exe setextradata "Ubuntu 9.04" "VBoxInternal/Devices/pcnet/0/LUN#0/Config/guestssh/HostPort" 8022



```
C:\WINDOWS\system32\cmd.exe
All rights reserved.

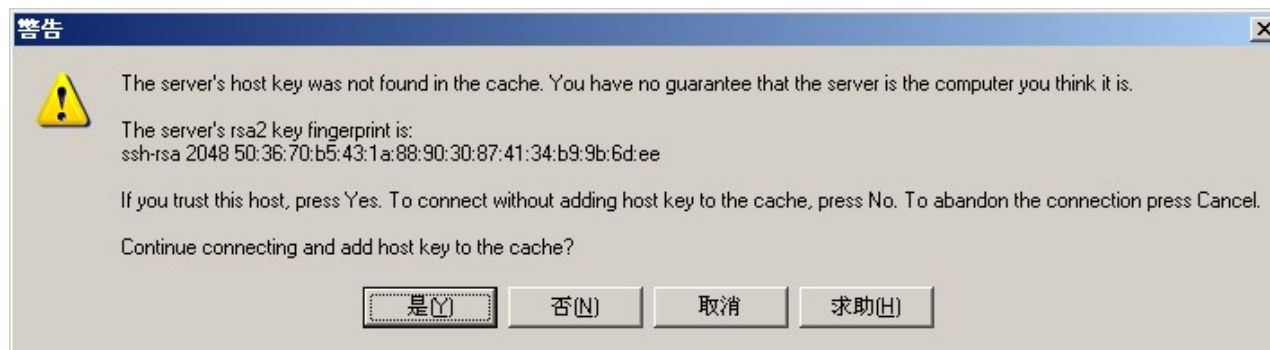
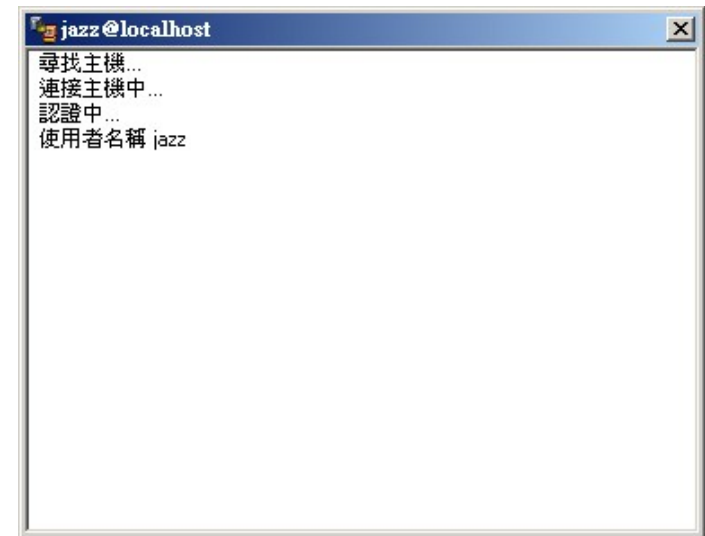
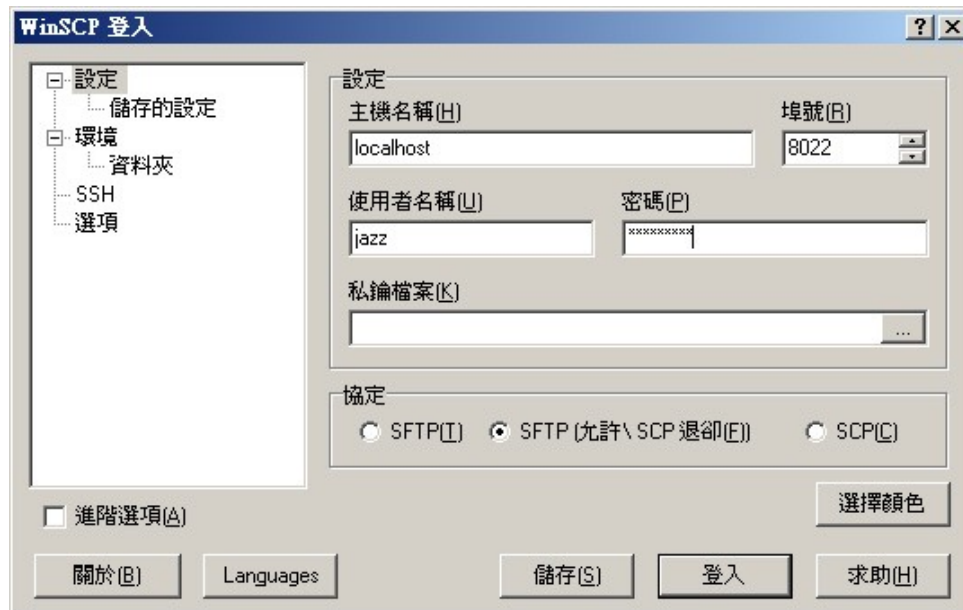
C:\Program Files\Sun\VirtualBox>VBoxManage.exe setextradata "Ubuntu 9.04" "VBoxInternal/Devices/pcnet/0/LUN#0/Config/guestssh/Protocol" TCP
Sun VirtualBox Command Line Management Interface Version 3.1.6
(C) 2005-2010 Sun Microsystems, Inc.
All rights reserved.

C:\Program Files\Sun\VirtualBox>VBoxManage.exe setextradata "Ubuntu 9.04" "VBoxInternal/Devices/pcnet/0/LUN#0/Config/guestssh/GuestPort" 22
Sun VirtualBox Command Line Management Interface Version 3.1.6
(C) 2005-2010 Sun Microsystems, Inc.
All rights reserved.

C:\Program Files\Sun\VirtualBox>VBoxManage.exe setextradata "Ubuntu 9.04" "VBoxInternal/Devices/pcnet/0/LUN#0/Config/guestssh/HostPort" 8022
Sun VirtualBox Command Line Management Interface Version 3.1.6
(C) 2005-2010 Sun Microsystems, Inc.
All rights reserved.

C:\Program Files\Sun\VirtualBox>
```

# 使用 WinSCP 上下傳檔案 (1)



# 使用 WinSCP 上下傳檔案 (2)

The screenshot displays the WinSCP interface with two panels. The left panel shows the local file system (C:\SYSTEM) with a list of folders and files. The right panel shows the remote file system (/home/jazz) with a list of folders and files. The bottom status bar shows the transfer progress: 5,464 B / 97 B, SFTP (v3), 0:00:49.

**Local File System (C:\SYSTEM)**

名稱	離開	大小	類型	Change
..			Parent directory	2010/4
Aptana Studio			File Folder	2009/1
Bluetooth			File Folder	2010/1
DataCardGKU			File Folder	2010/4
Downloads			File Folder	2009/1
etax			File Folder	2009/5
JPG files			File Folder	2008/8
MP3 files			File Folder	2008/8
My Music			File Folder	2009/1
My Pictures			File Folder	2010/2
My Videos			File Folder	2009/6
My Virtual Machines			File Folder	2009/7
TXT Files			File Folder	2008/8
我已接收的檔案			File Folder	2008/6
捷徑			File Folder	2007/3
ssh-key		601	檔案	2009/4
PAPER.DOT		23,552	Microsoft Word ...	2005/8
desktop.ini		90	Notepad++ Docu...	2008/1
我的共用資料夾.lnk		951	Shortcut	2009/2
ssh-key.pub		703	PHP 檔案	2009/4

**Remote File System (/home/jazz)**

名稱	離開	大小	類型	Changed
..			File Folder	2010/4/21 上午 03:02:53
?.*			File Folder	2010/4/19 上午 11:14:03
?單?			File Folder	2010/4/19 上午 11:14:03
? ?			File Folder	2010/4/19 上午 11:14:03
? 辣			File Folder	2010/4/19 上午 11:14:03
銼 ?			File Folder	2010/4/19 上午 11:14:03
隙梁?			File Folder	2010/4/19 上午 11:14:03
獮			File Folder	2010/4/19 上午 11:14:03
環上			File Folder	2010/4/19 上午 11:14:03
gstreamer-0.10			File Folder	2010/4/19 上午 11:14:22
cache			File Folder	2010/4/21 下午 04:05:37
config			File Folder	2010/4/19 上午 11:14:15
.dbus			File Folder	2010/4/19 上午 11:14:04
fontconfig			File Folder	2010/4/19 上午 11:14:08
gconf			File Folder	2010/4/21 下午 04:39:38
gconfd			File Folder	2010/4/21 下午 04:40:36
gnome2			File Folder	2010/4/21 下午 04:09:45
gnome2_private			File Folder	2010/4/19 上午 11:14:11
gnupg			File Folder	2010/4/21 下午 04:39:37
out			File Folder	2010/4/21 下午 04:39:37

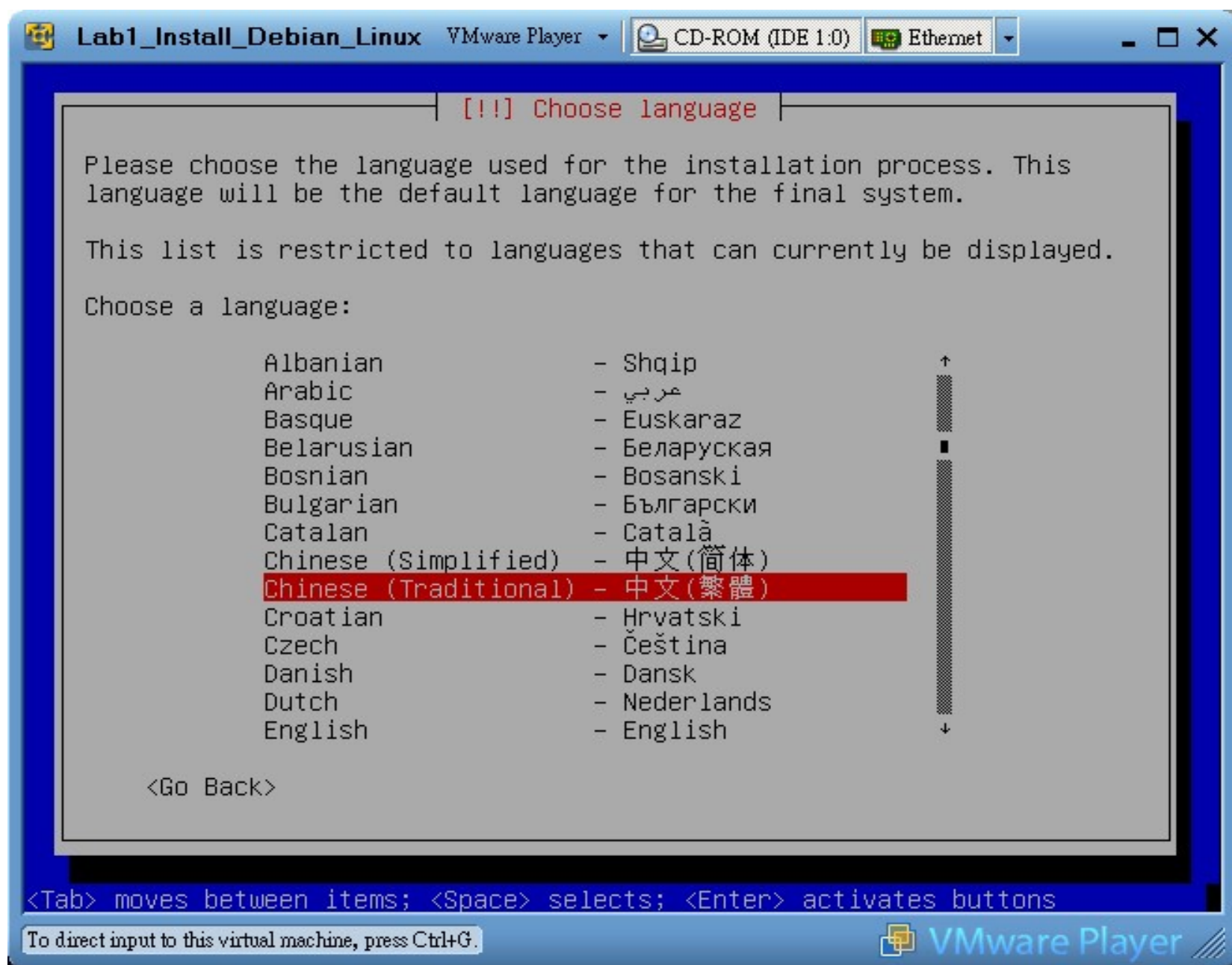
**Status Bar:** 5,464 B / 97 B | SFTP (v3) | 0:00:49

Appendex A :  
安裝 Debian 4.0r3 GNU/Linux

# 開始模擬從光碟安裝

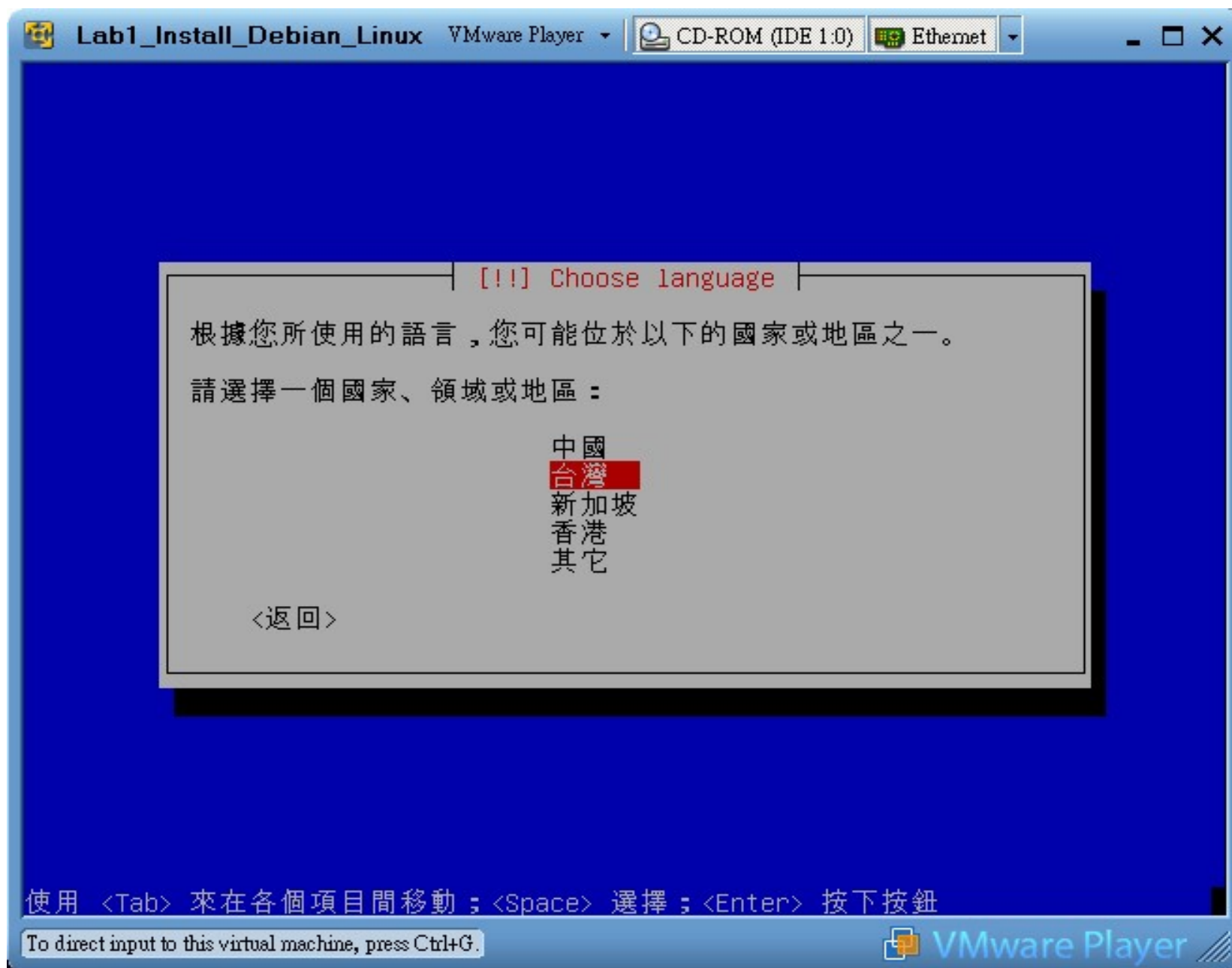


# 選擇中文(繁體)語系





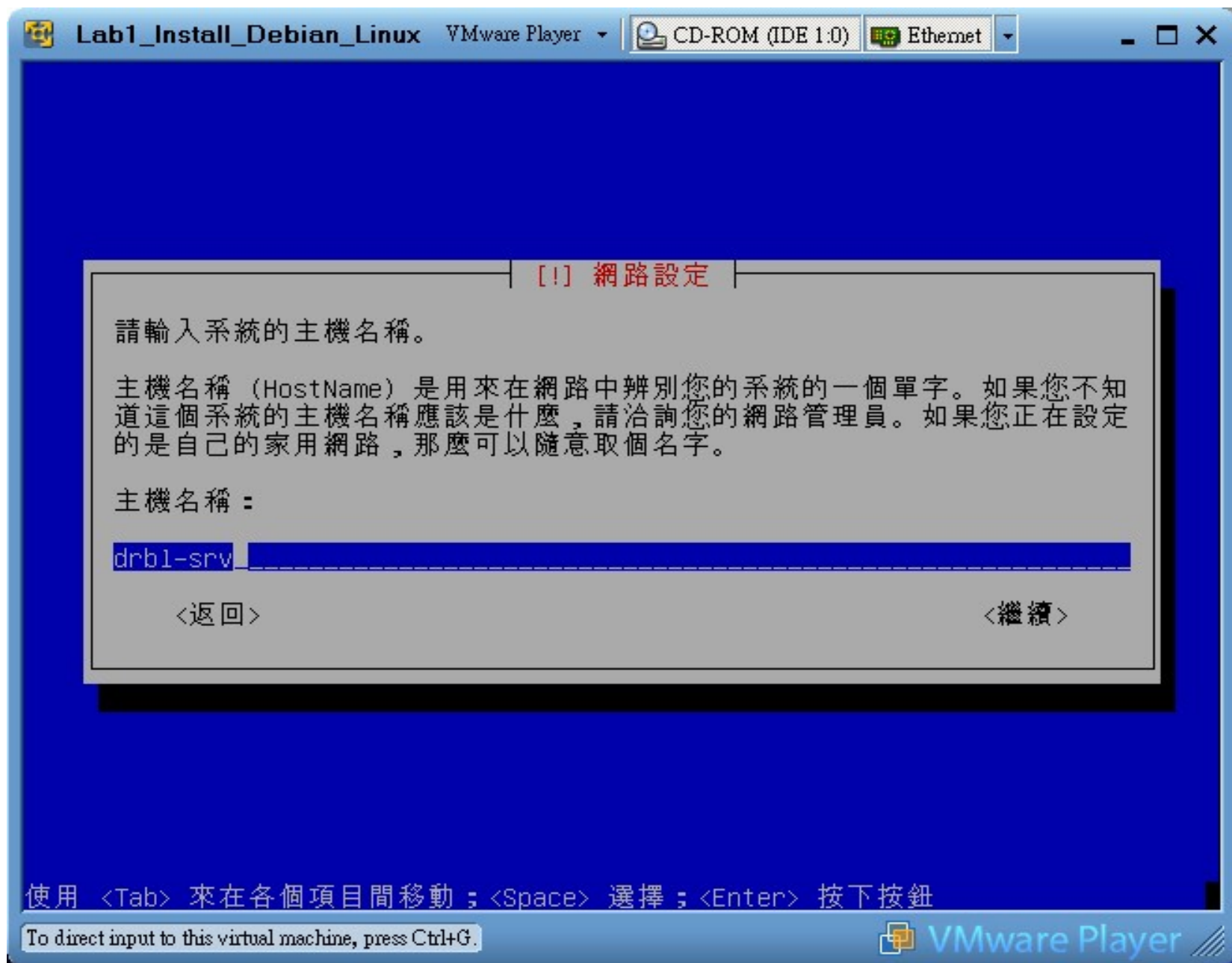
# 選擇『台灣』



# 選擇『美語鍵盤』



輸入『主機名稱』 = drbl-srv



輸入『網域名稱』 = ym.edu.tw

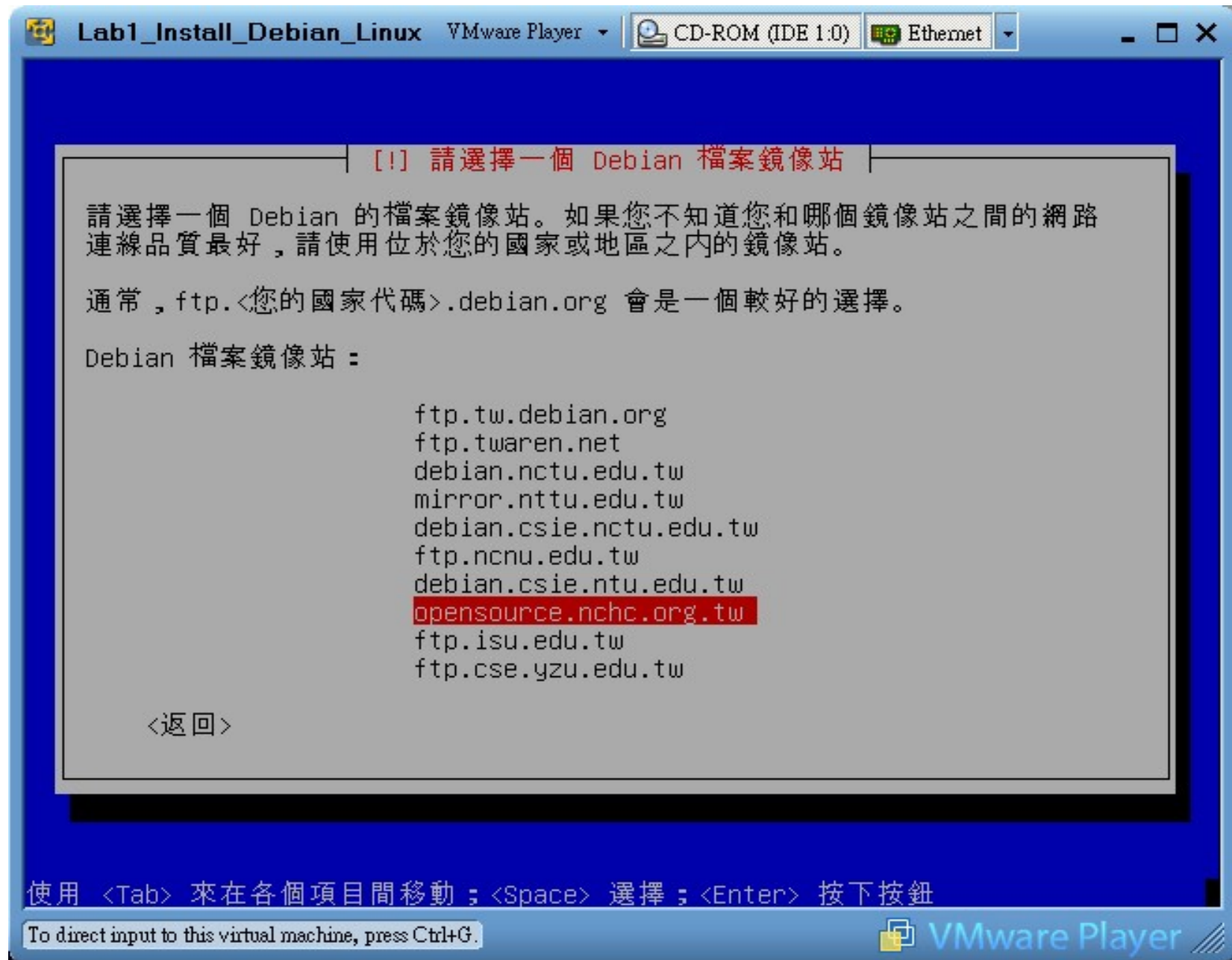


# 選擇『Debian 檔案映像站』(1) 台灣區



# 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)



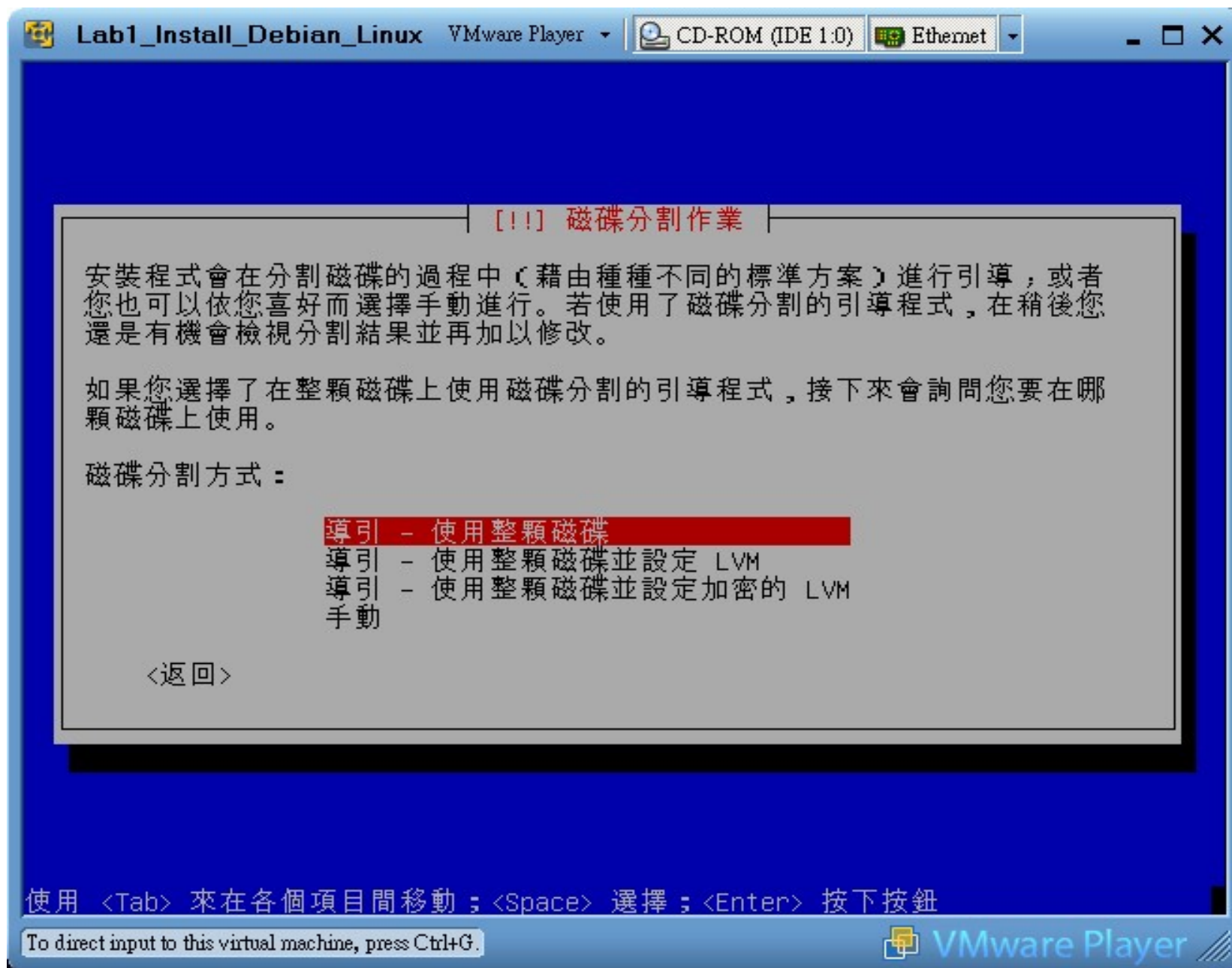
## 選擇『Debian 檔案映象站』(3)

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』

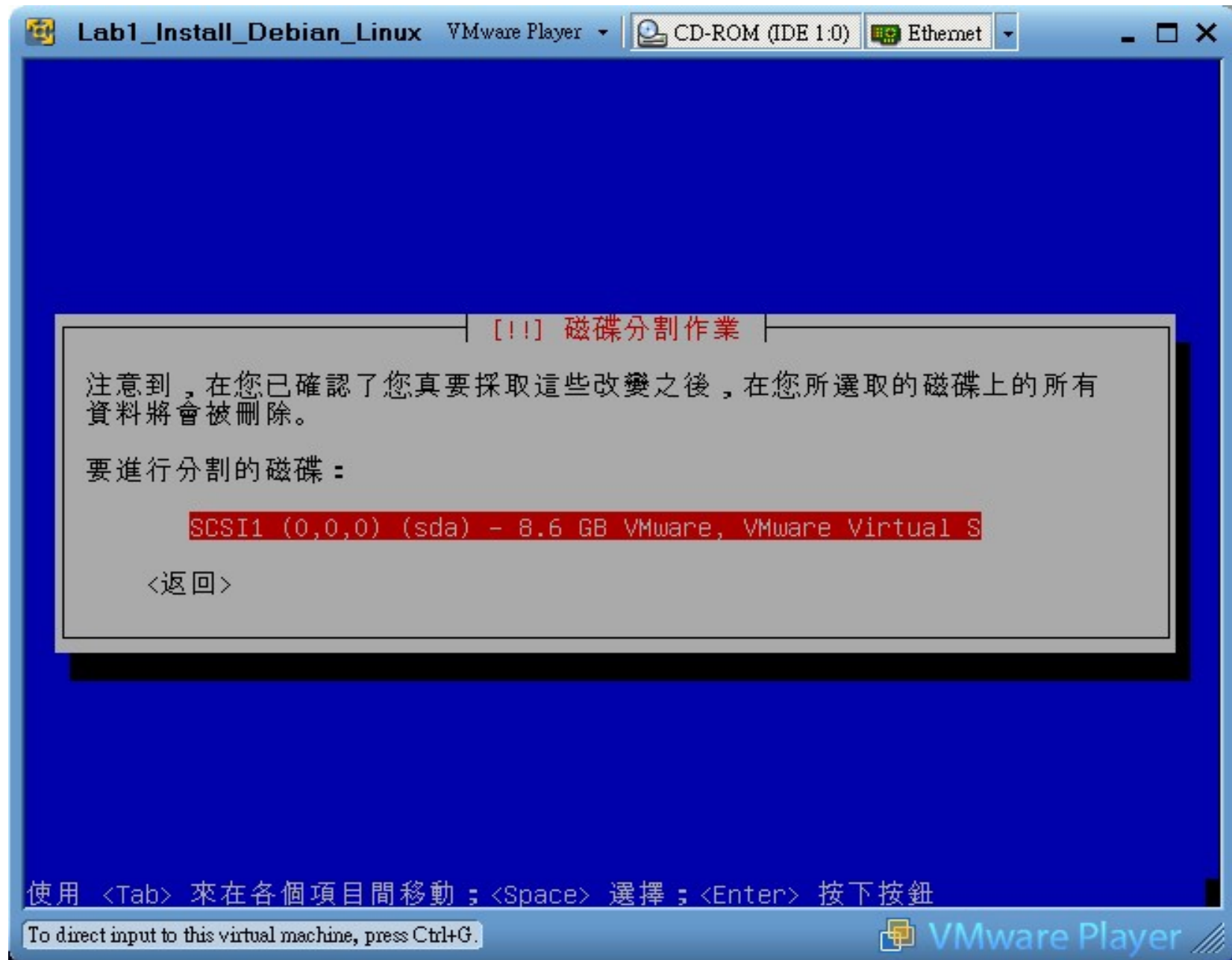
初學者建議採用第一種『引導 - 整顆硬碟』



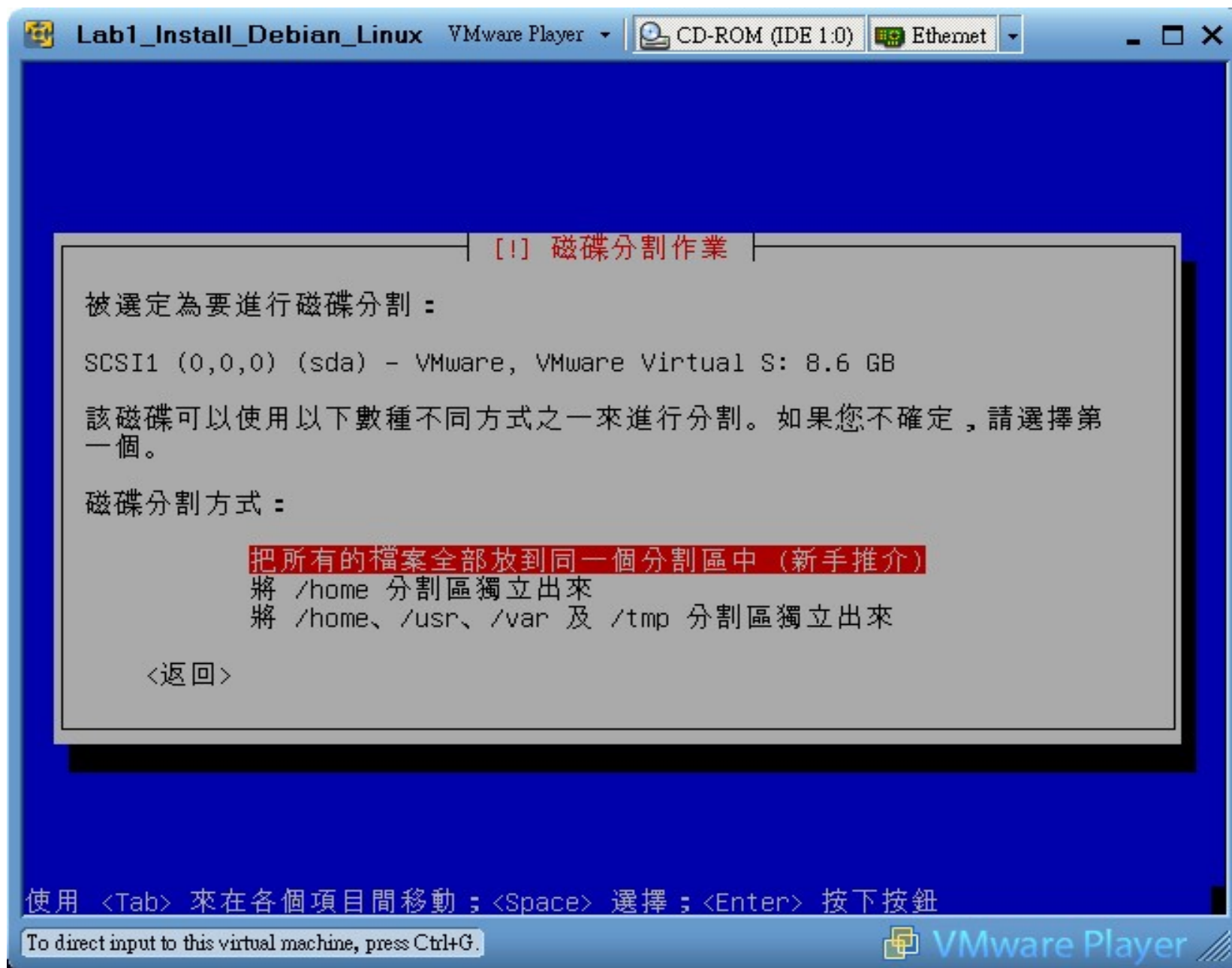


## 選擇『欲分割磁碟』

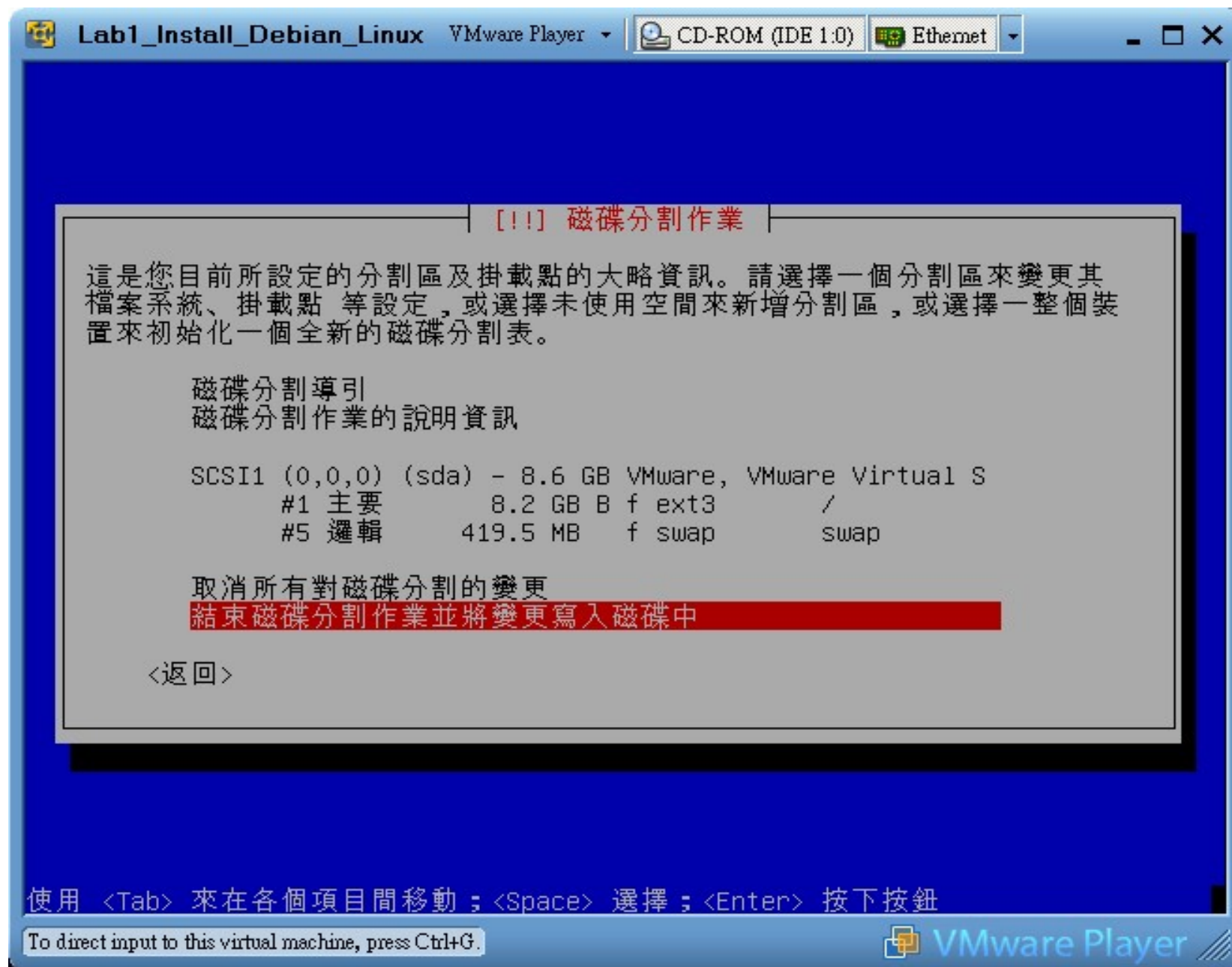
目前只有虛擬一顆硬碟，若實機有兩顆請小心！



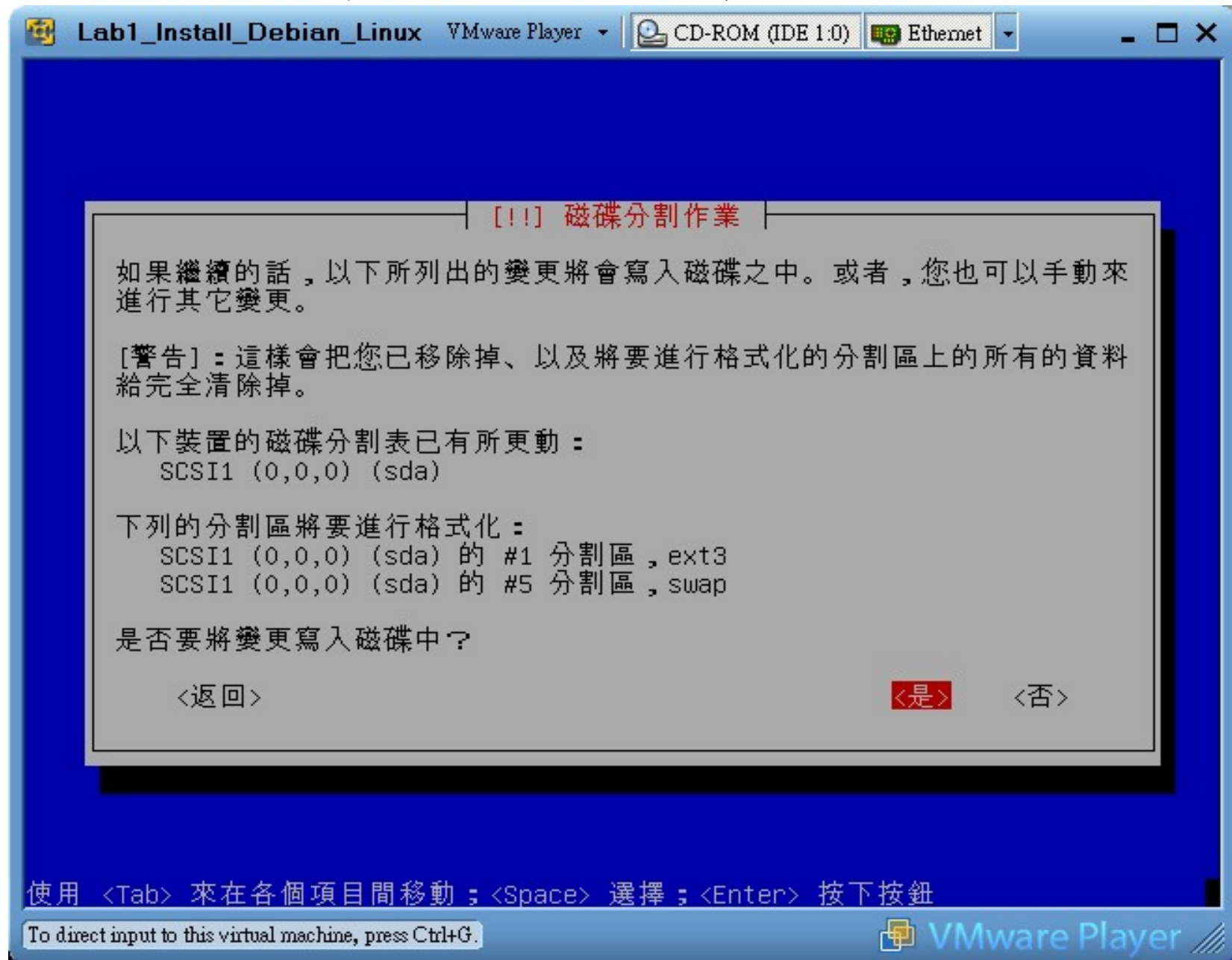
練習時可用同一個分割區，  
服務用系統請至少獨立出 /home 分割區



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>



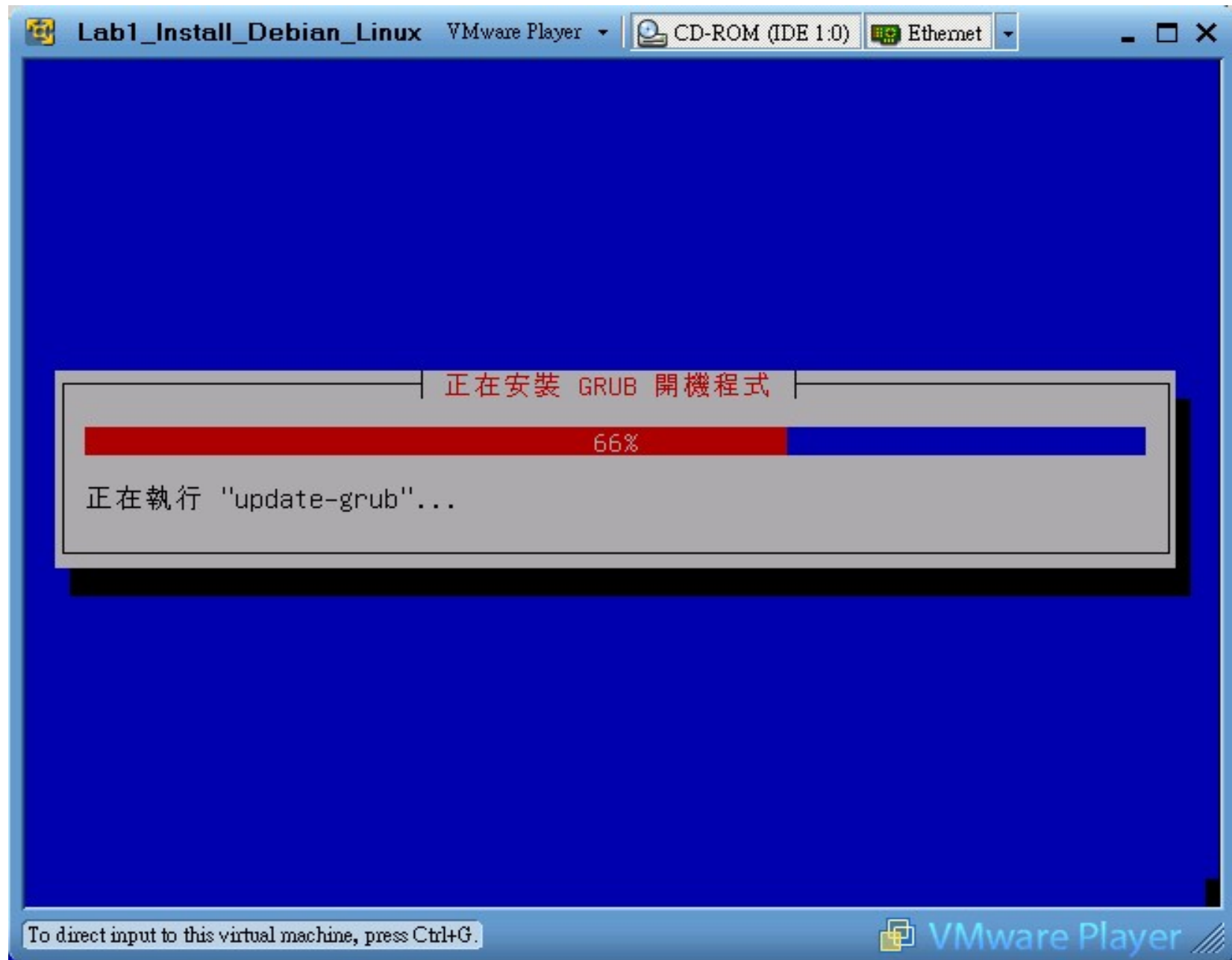
# 設定最高權限 root 管理者密碼



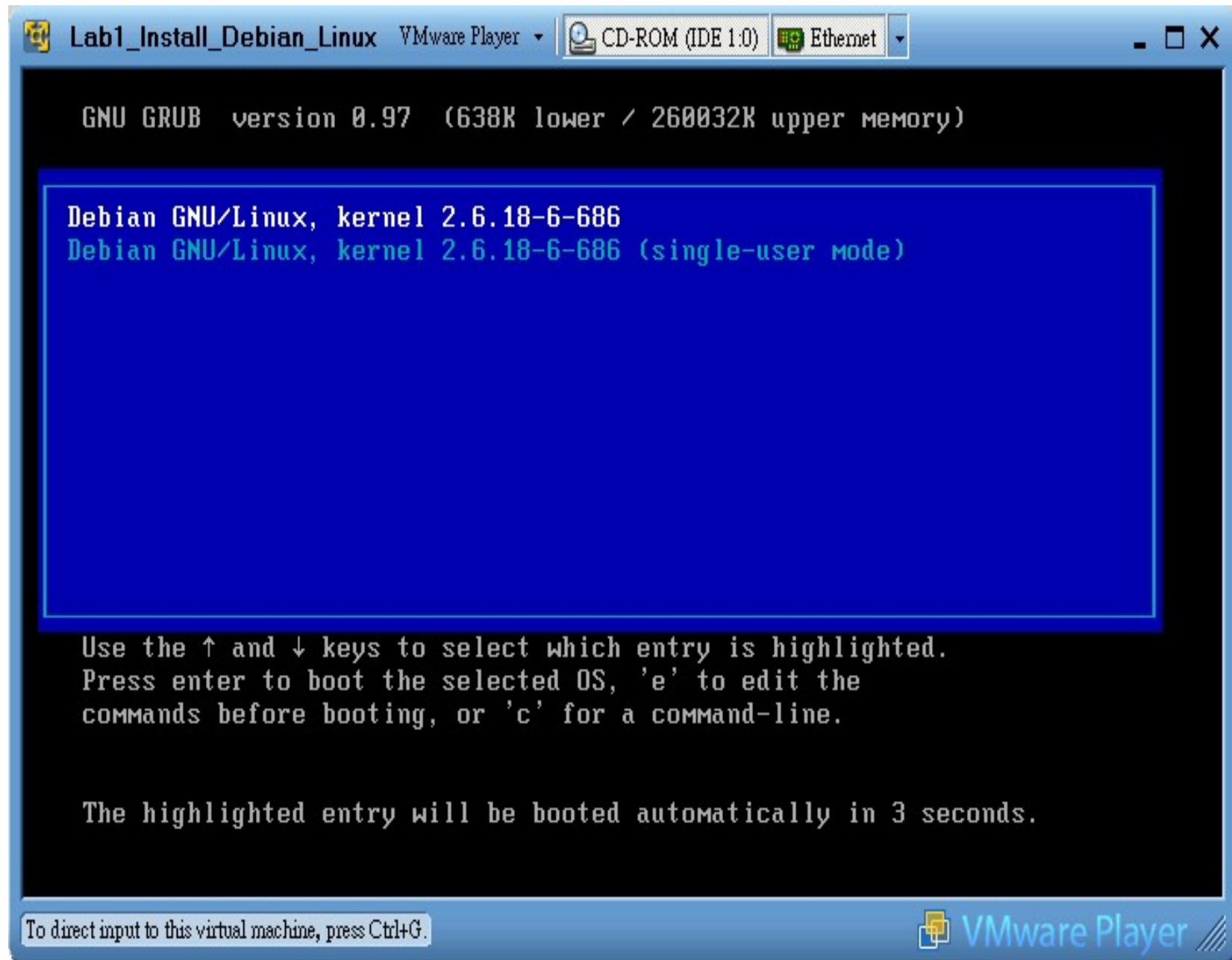
# 建立自己的帳號，習慣上不用 root 登入



# 確認安裝 Grub Boot Loader

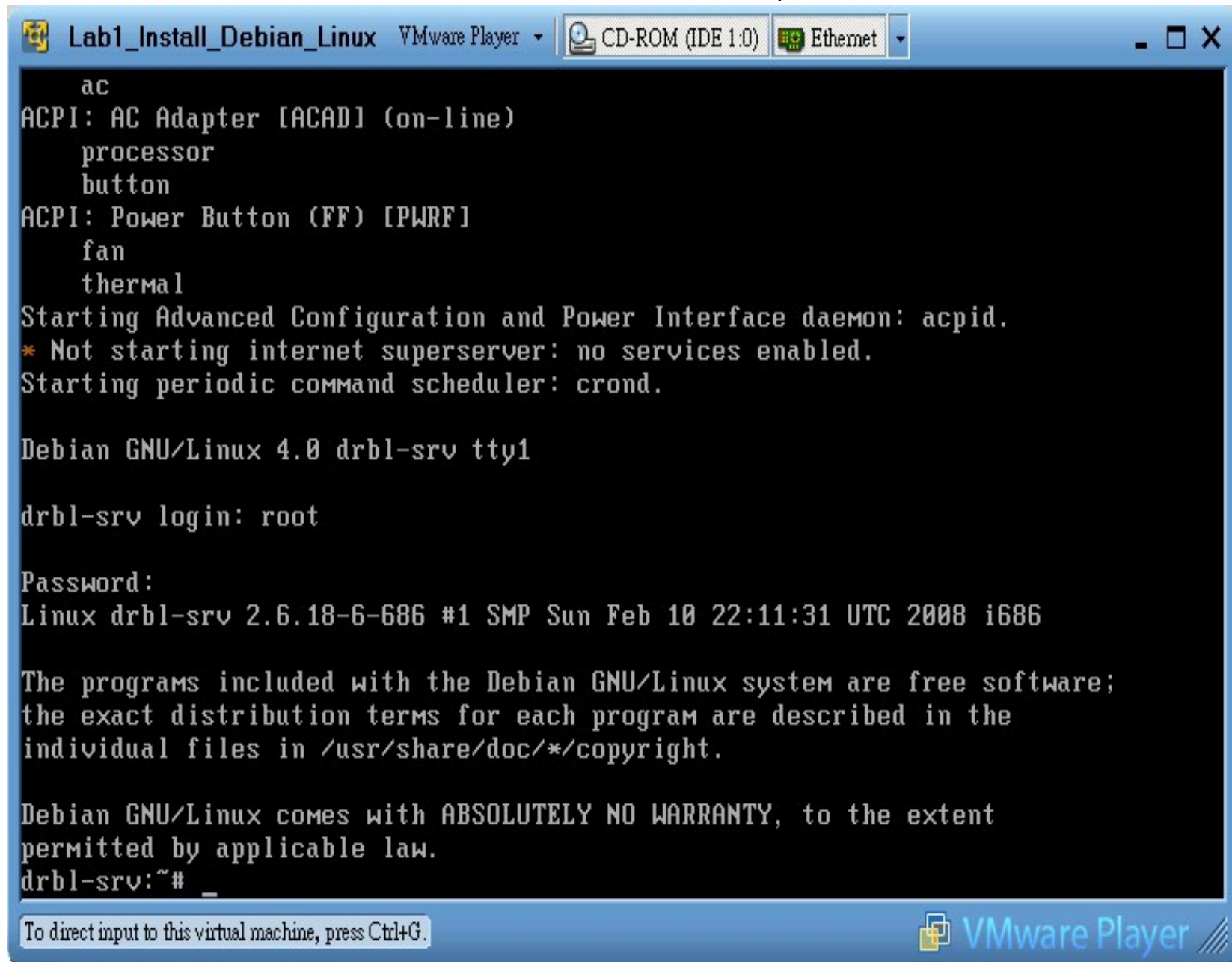


# 第一次系統開機





# 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

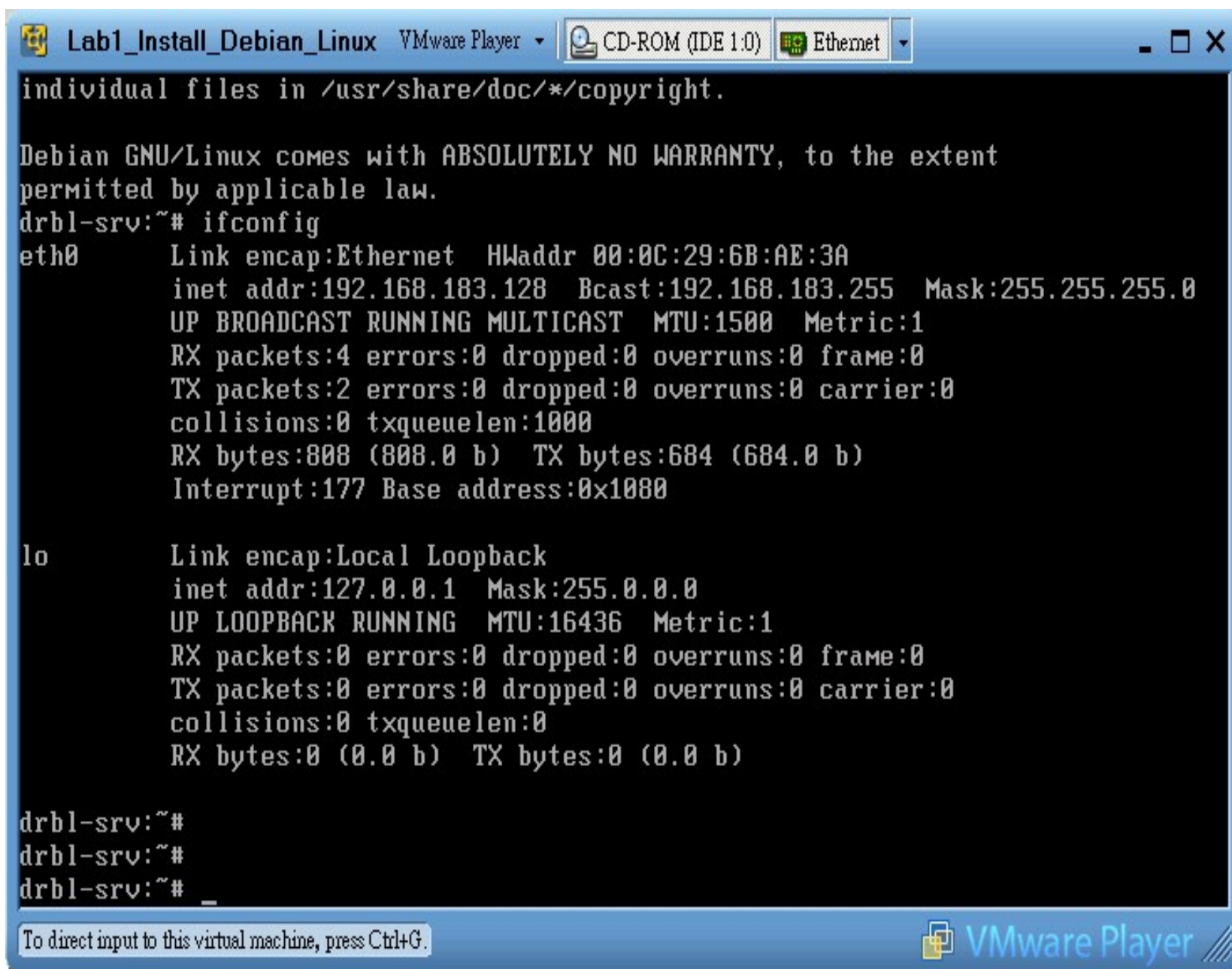
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

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

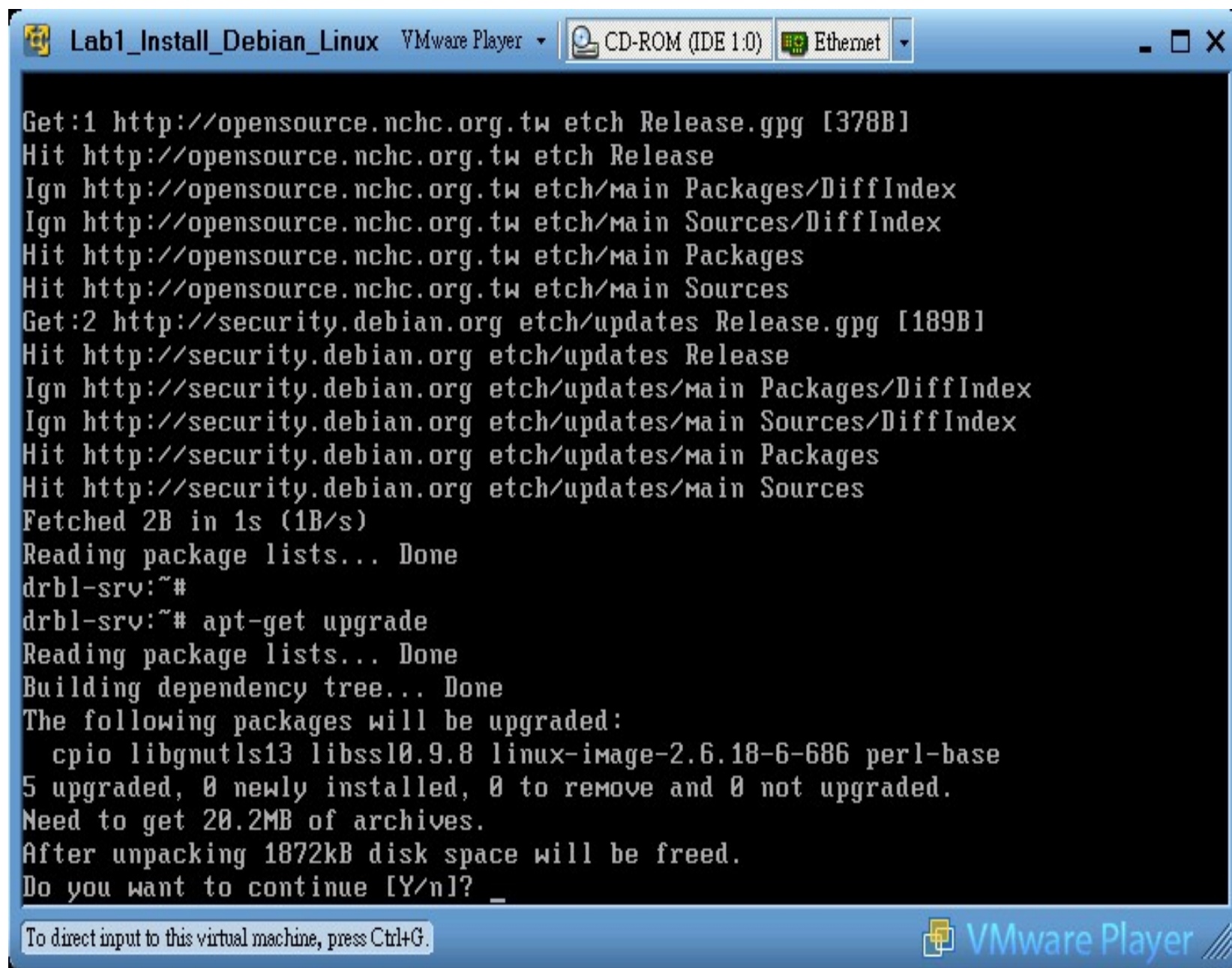
```
Lab1_Install_Debian_Linux VMware Player | CD-ROM (IDE 1:0) Ethernet | . □ X
inet addr:127.0.0.1  Mask:255.0.0.0
UP LOOPBACK RUNNING  MTU:16436  Metric:1
RX packets:0 errors:0 dropped:0 overruns:0 frame:0
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:0 (0.0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

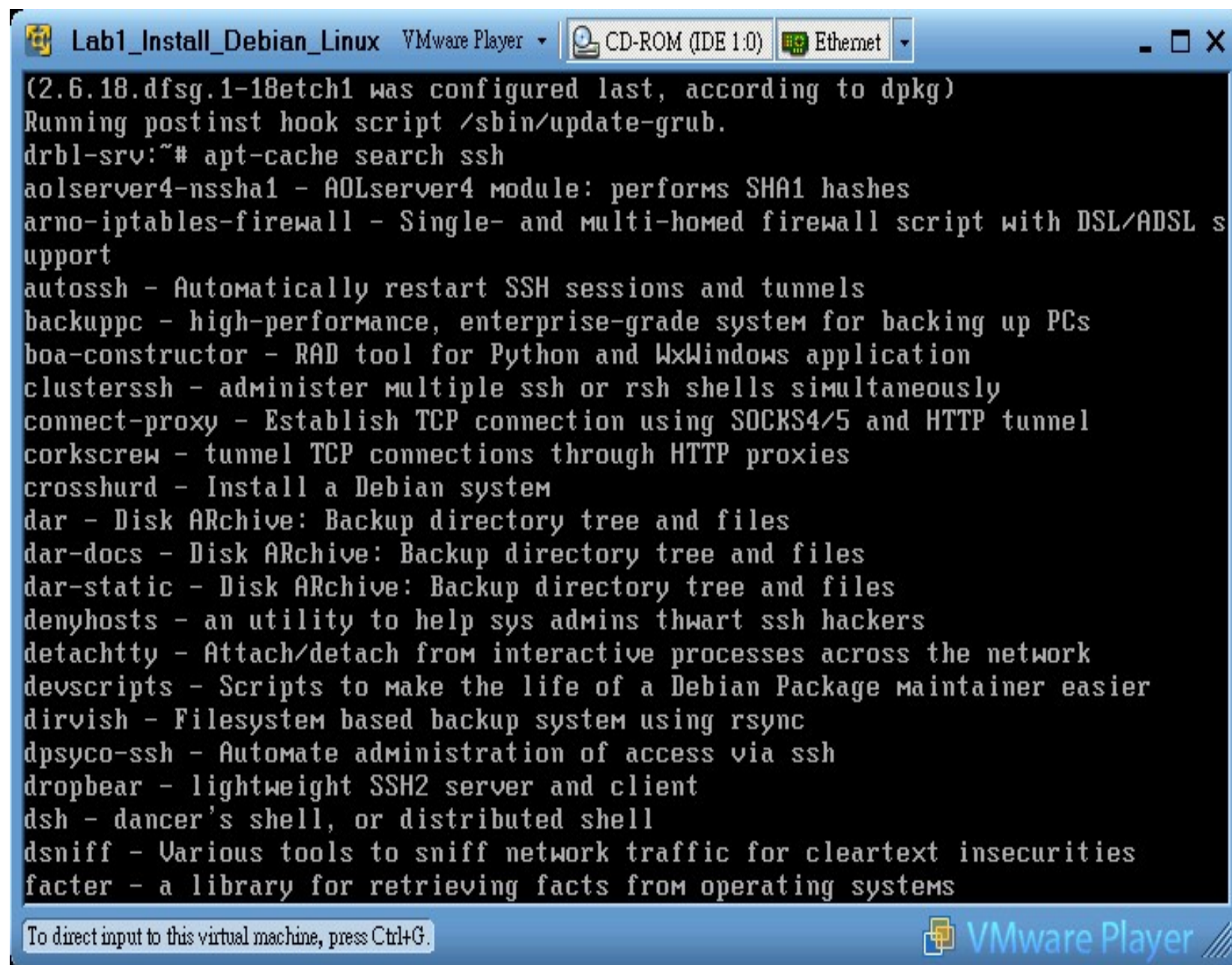
# 基本管理篇 [3] 用 apt-get upgrade 升級系統



```
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

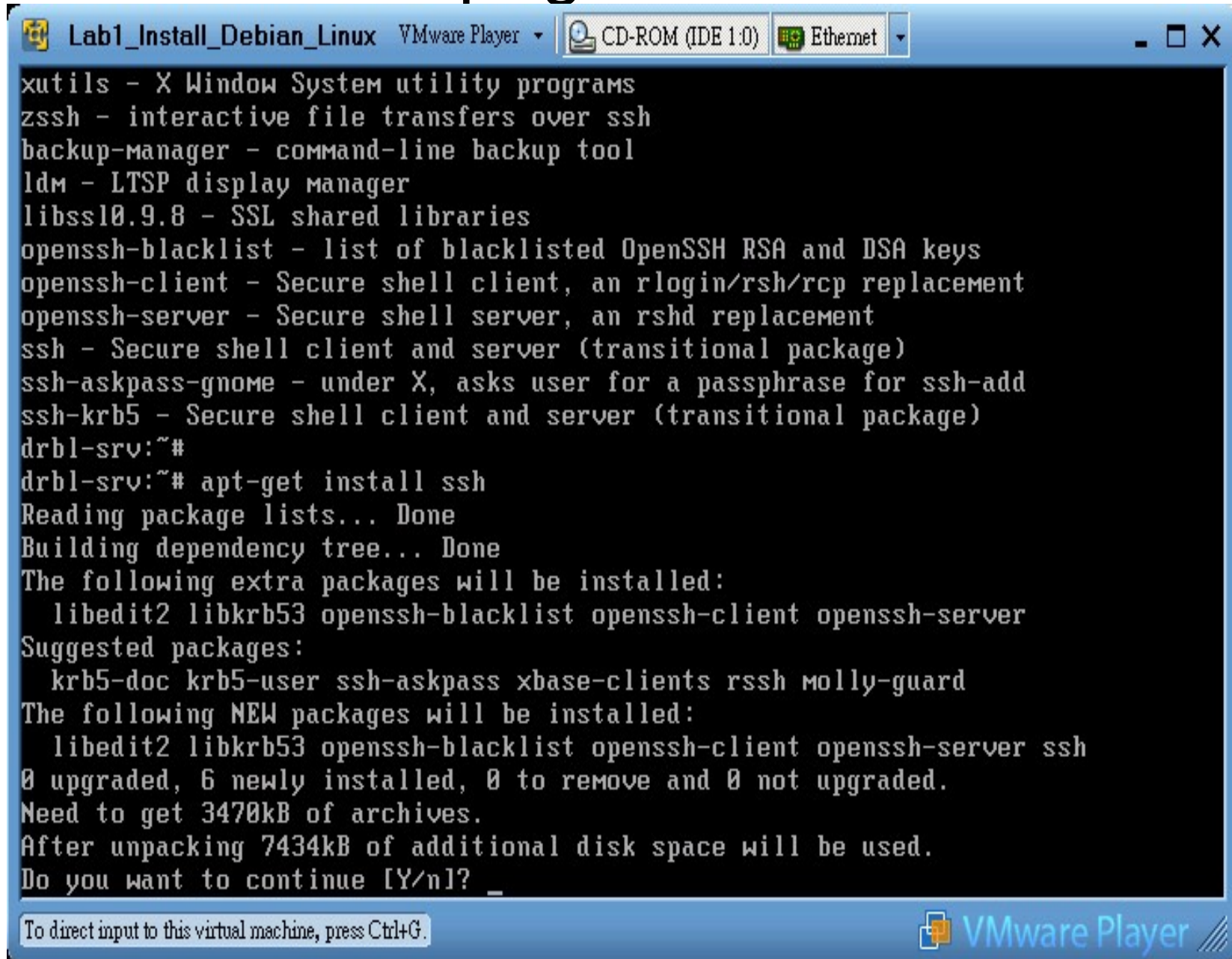


```
Lab1_Install_Debian_Linux VMware Player | CD-ROM (IDE 1:0) | Ethernet |
(2.6.18.dfsg.1-18etch1 was configured last, according to dpkg)
Running postinst hook script /sbin/update-grub.
drbl-srv:~# apt-cache search ssh
aolserver4-nssha1 - AOLserver4 module: performs SHA1 hashes
arno-iptables-firewall - 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



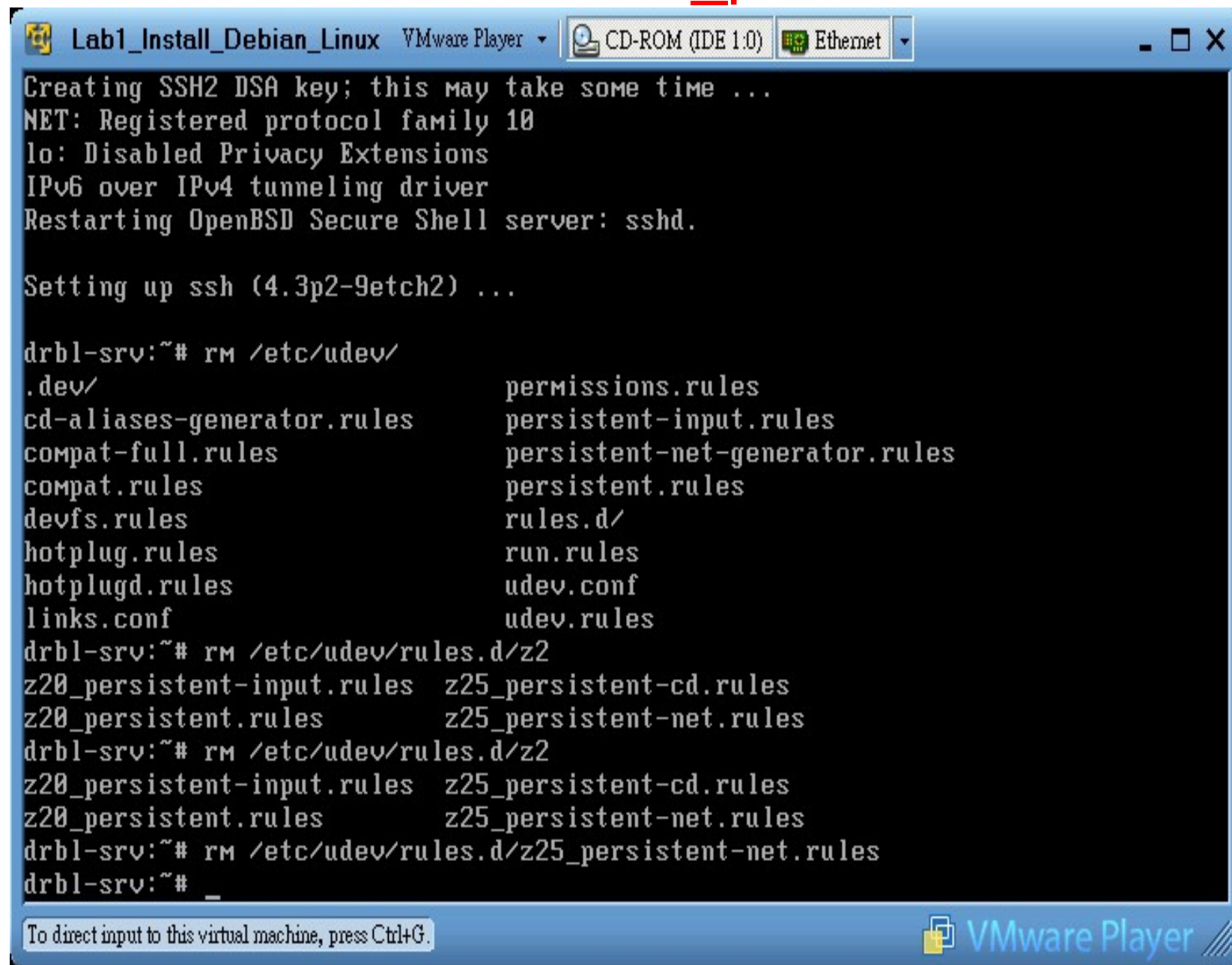
```
Lab1_Install_Debian_Linux VMware Player | CD-ROM (IDE 1:0) Ethernet | . □ X
xutils - X Window System utility programs
zssh - interactive file transfers over ssh
backup-manager - command-line backup tool
ldm - LTSP display manager
libssl0.9.8 - SSL shared libraries
openssh-blacklist - list of blacklisted 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 | . □ X
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
```

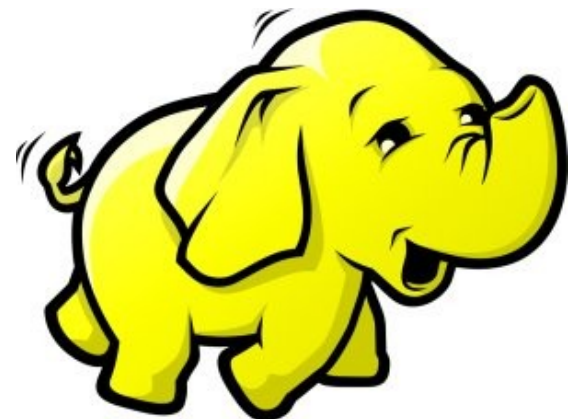




# Hadoop 叢集設定解說

## Setup Hadoop Fully Distributed Mode

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



# Yahoo's Hadoop Cluster

## 雅虎的大象軍團

- ~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 Pseudo-Distributed Mode

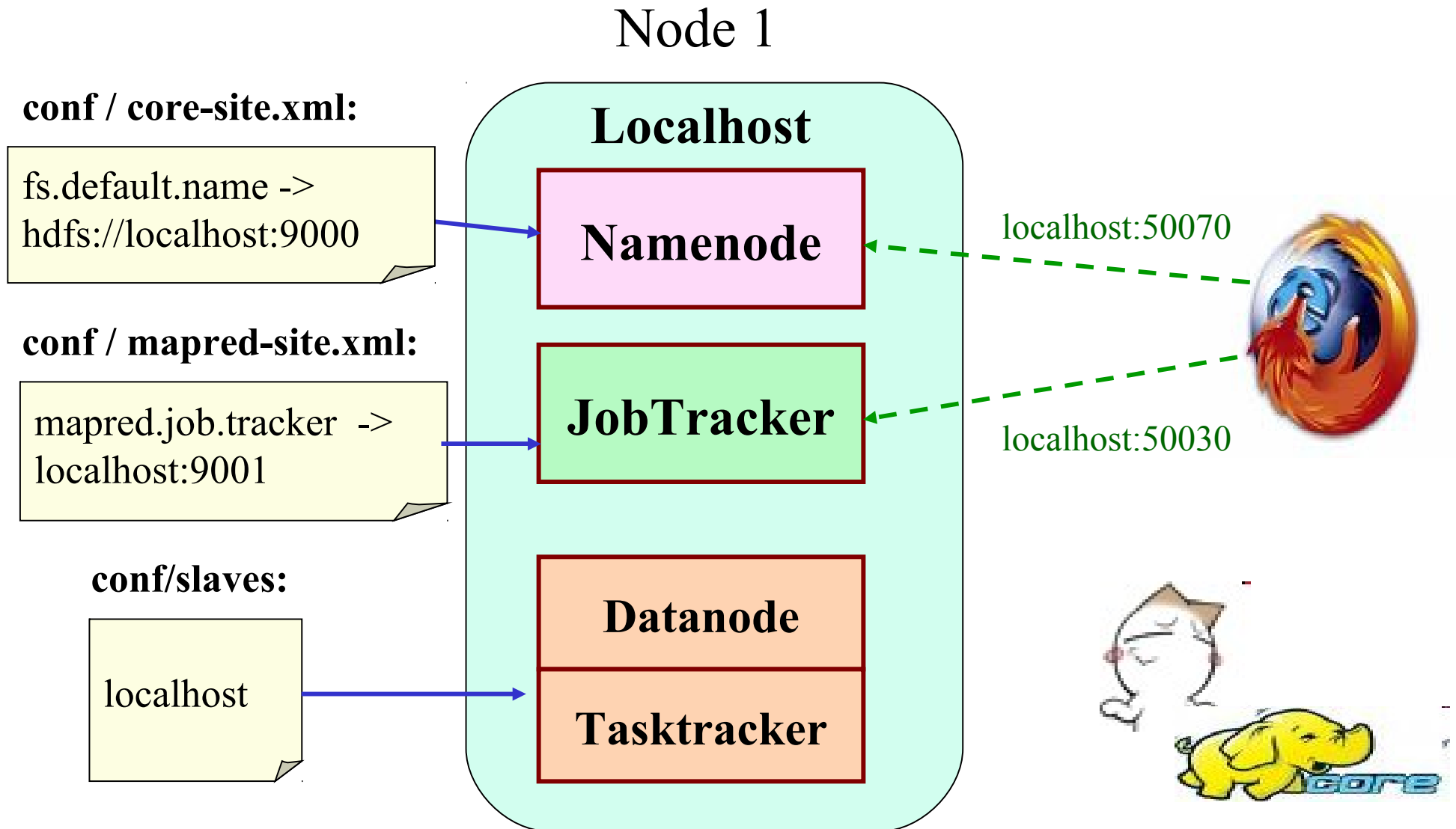
## 我們已經實作過單機模式

- Step 1: Setup SSH key exchange
- Step 2: Install Java
- Step 3: Download Hadoop Source Package
- Step 4: Configure `hadoop-env.sh`
  - `export JAVA_HOME=/usr/lib/jvm/java-6-sun`
- Step 5: Configure `*-site.xml`
  - Set Namenode to `hdfs://localhost:9000`
  - Set Jobtracker to `localhost:9001`
  - `bin/hadoop namenode -format`
- Step 6: Format HDFS
- Step 7: Start Hadoop
  - `bin/start-all.sh`
- Step 8: Complete!! Let's check the status of Hadoop
  - Job admin <http://localhost:50030/> HDFS <http://localhost:50070/>



# Diagram of Pseudo-Distributed Mode

## Hadoop 單機環境示意圖



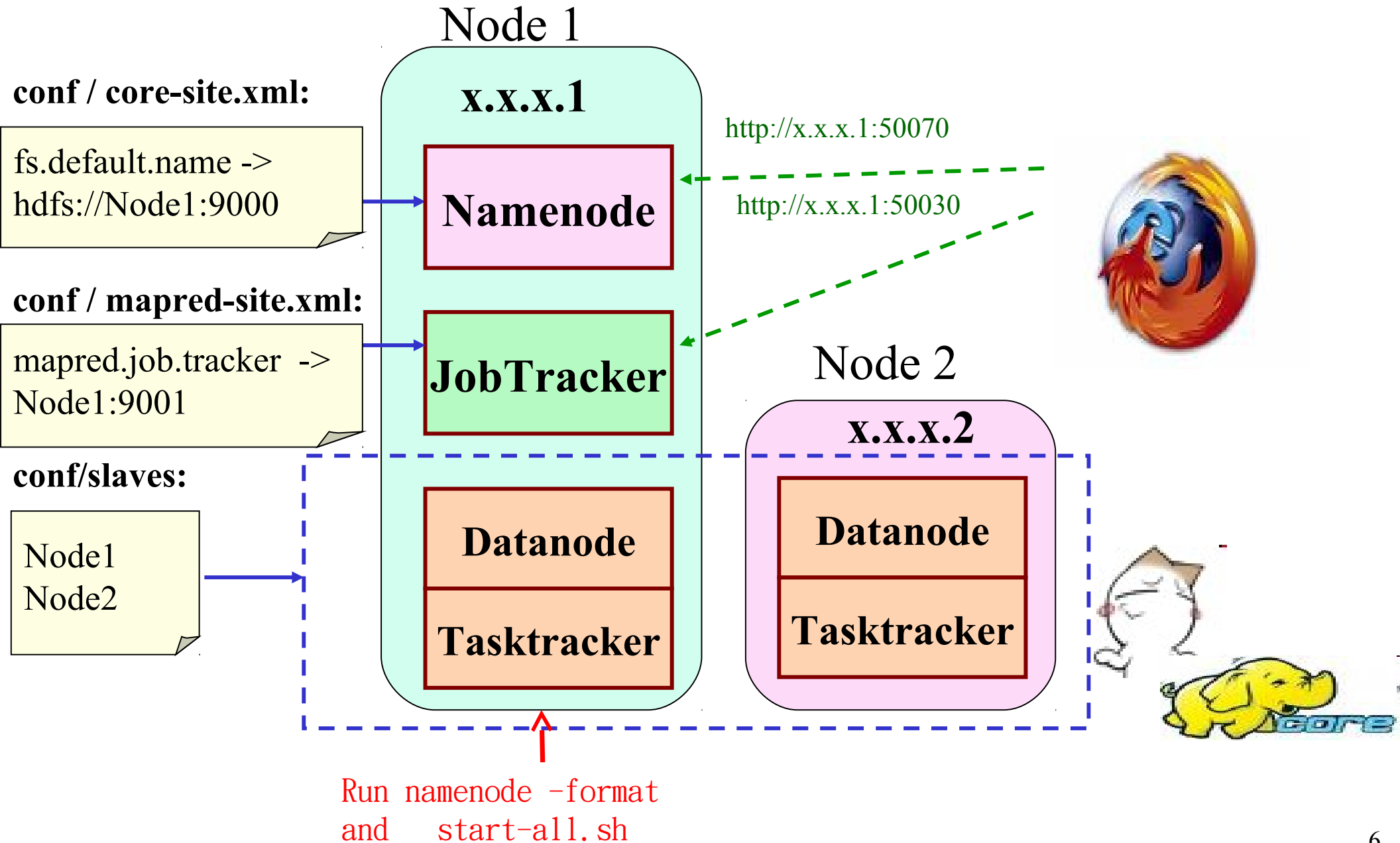
# Hadoop Fully-Distributed Mode

## 我們接著要用兩台電腦實作叢集模式

- Step 1: Setup SSH key exchange
- Step 2: Install Java
- Step 3: Download Hadoop Source Package
- Step 4: Configure `hadoop-env.sh`
  - `export JAVA_HOME=/usr/lib/jvm/java-6-sun`
- Step 5: Configure `*-site.xml`
  - Set Namenode to `hdfs://x.x.x.1:9000`
  - Set Jobtracker to `x.x.x.2:9001`
- Step 6: Configure Slaves
- Step 7: Synchronization of all slaves
- Step 8: Format HDFS
  - `bin/hadoop namenode -format`
- Step 9: Start Hadoop
  - On NameNode : `bin/start-dfs.sh`
  - On JobTracker : `bin/start-mapred.sh`
- Step 10: Complete!! Let's check the status of Hadoop
  - Job admin `http://x.x.x.2:50030/` HDFS `http://x.x.x.1:50070/`

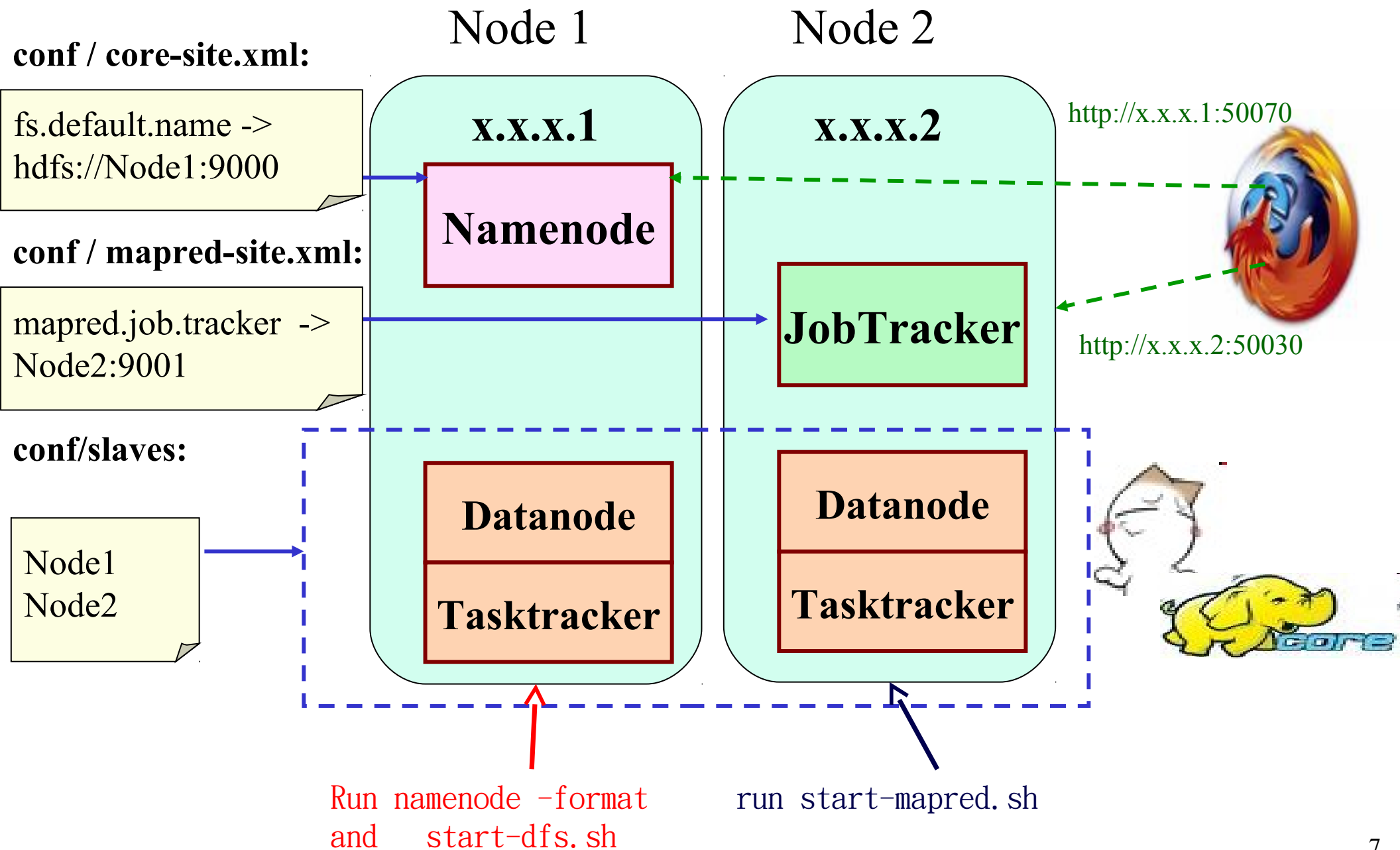
# Use case #1

## 設定情境一



# Use case #2

## 設定情境二



# Use case #3

## 設定情境三

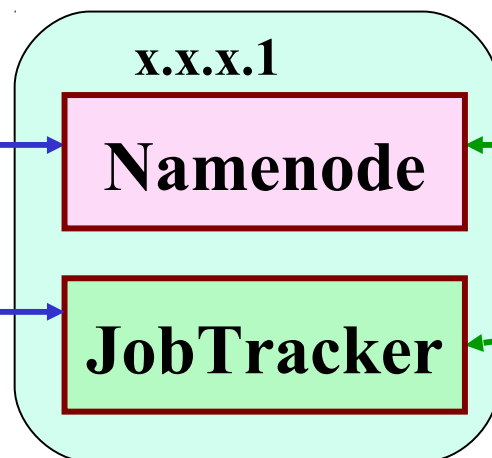
**conf / core-site.xml:**

fs.default.name ->  
hdfs://Node1:9000

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

mapred.job.tracker ->  
Node1:9001

Node 1



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

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



**conf/slaves:**

Node2  
.....  
NodeN

Node 2

**x.x.x.2**

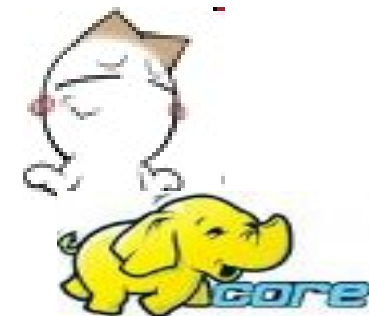
**Datanode**  
**Tasktracker**

...

Node N

**x.x.x.n**

**Datanode**  
**Tasktracker**





# Use case #4

## 設定情境四

### conf / core-site.xml:

fs.default.name ->  
hdfs://Node1:9000

Client

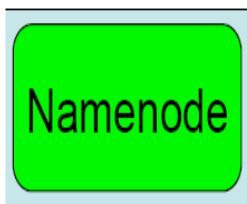


http://x.x.x.2:50030

### conf / mapred-site.xml:

mapred.job.tracker ->  
Node2:9001

G

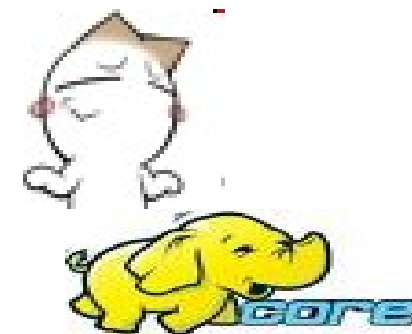
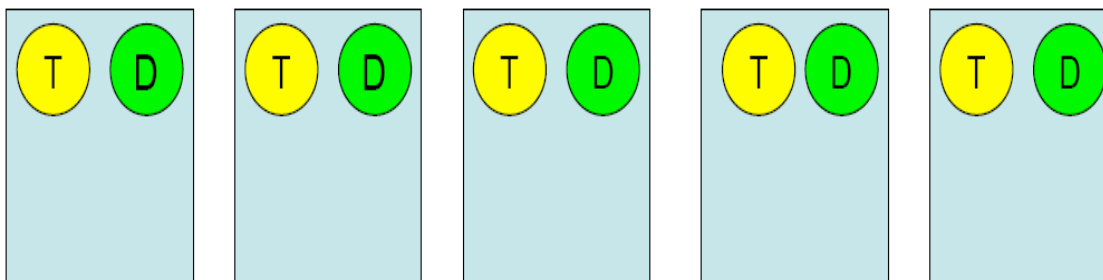


HTTP Monitoring UI

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

### conf/slaves:

Node3  
.....  
NodeN

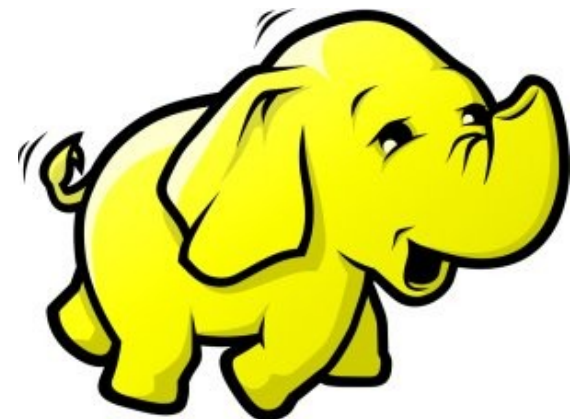




# Hadoop 叢集佈署工具

Hadoop Deployment Tool : SmartFog and DRBL

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



# Programmer v.s. System Admin.



Source: <http://www.funnyjunksite.com/wp-content/uploads/2007/08/programmer.jpg>



Source: <http://www.sysadminday.com/images/people/136-3697.JPG>



**PART 1**

# PC Cluster 101

**Jazz Wang**

**Yao-Tsung Wang**

**[jazz@nchc.org.tw](mailto:jazz@nchc.org.tw)**



Powered by **DRBL**



At First, We have “4 + 1” PC Cluster

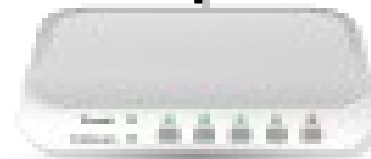
It'd better be  
**2<sup>n</sup>**



Manage  
**Scheduler**

**Then, We connect 5 PCs with  
Gigabit Ethernet Switch**

**GiE Switch**



**10/100/1000  
Mbps**

**WAN**



**Add 1 NIC  
for WAN**



## Compute Nodes

**4 Compute Nodes** will communicate via **LAN Switch**. Only **Manage Node** have **Internet Access** for Security!



WAN



Manage Node

# Compute Nodes

## Basic System Setup for Cluster

Messaging

**MPICH**

Account Mgmt.

**SSHD**

**NIS**

**YP**

**GCC**

**GNU Libc**

**Bash**

**Perl**



**Kernel Module**

**Linux Kernel**

**Boot Loader**



On **Manage Node**,  
We need to install **Scheduler** and  
**Network File System** for sharing  
Files with **Compute Node**

Job Mgmt.

**OpenPBS**

File Sharing

**NFS**

**Extra**

Messaging

MPICH

GCC

Bash

Perl

Account Mgmt.

SSHD

NIS

YP

GNU Libc



Kernel Module

Linux Kernel

Boot Loader

# Challenges of Cluster Computing

- **Hardware**

- **Ethernet Speed / PC Density**
- **Power / Cooling / Heat**
- **Network and Storage Architecture**

- **Software**

- **Job Scheduler ( Cluster level )**
- **Account Management**
- **File Sharing / Package Management**

- **Limitation**

- **Shared Memory**
- **Global Memory Management**

# Common Method to deploy Cluster



**1. Setup one  
Template  
machine**

**2. Cloning  
to  
multiple  
machine**



**3. Configure  
Settings**



**4. Install  
Job  
Scheduler**



**5. Running  
Benchmark**

# Challenges of Common Method

**Add New User Account ?**

**Upgrade Software ?**

**How to share user data ?**

**Configuration Synchronization**

# How to deploy 4000+ Nodes ????

資料標題：Scaling Hadoop to 4000 nodes at Yahoo!

資料日期：September 30, 2008

<b>Total Nodes</b>	<b>4000</b>
<b>Total cores</b>	<b>30000</b>
<b>Data</b>	<b>16PB</b>

	<b>500-node cluster</b>		<b>4000-node cluster</b>	
	<b>write</b>	<b>read</b>	<b>write</b>	<b>read</b>
<b>number of files</b>	990	990	14,000	14,000
<b>file size (MB)</b>	320	320	360	360
<b>total MB processes</b>	316,800	316,800	5,040,000	5,040,000
<b>tasks per node</b>	2	2	4	4
<b>avg. throughput (MB/s)</b>	<b>5.8</b>	<b>18</b>	<b>40</b>	<b>66</b>

# Advanced Methods to deploy Cluster

- **SSI ( Single System Image )**
  - **Multiple PCs as Single Computing Resources**
  - **Image-based**
    - **homogeneous**
    - **ex. SystemImager, OSCAR, Kadeploy**
  - **Package-based**
    - **heterogeneous**
    - **easy update and modify packages**
    - **ex. FAI, DRBL**
- **Other deploy tools**
  - **Rocks : RPM only**
  - **cfengine : configuration engine**

# Comparison of Cluster Deploy Tools

	Distribution	Support Diskless/ Sysmless	Type	Node configuration tools	Cluster management tools	Database installation
<b>System Imager</b>	<b>ALL</b>	<b>Yes</b>	<b>Image</b>	<b>Yes</b>	<b>No</b>	<b>No</b>
<b>OSCAR</b>	<b>RPM- based</b>	<b>Yes</b>	<b>Image</b>	<b>Yes</b>	<b>Yes</b>	<b>No</b>
<b>Kadeploy</b>	<b>ALL</b>	<b>No</b>	<b>Image</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>
<b>DRBL</b>	<b>ALL</b>	<b>Yes</b>	<b>Package</b>	<b>Yes</b>	<b>Yes</b>	<b>No</b>
<b>FAI</b>	<b>Debian- Based</b>	<b>Yes</b>	<b>Package</b>	<b>Yes</b>	<b>No</b>	<b>No</b>



**PART 2-1 :**

# Hadoop Deployment Tool

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Powered by **DRBL**





- Make Hadoop deployment *agile*
- Integrate with dynamic cluster deployments

Source: Deploying hadoop with smartfrog

[http://people.apache.org/~stevell/slides/deploying\\_hadoop\\_with\\_smartfrog.pdf](http://people.apache.org/~stevell/slides/deploying_hadoop_with_smartfrog.pdf)

12 June 2008

# SmartFrog - HPLabs' CM tool

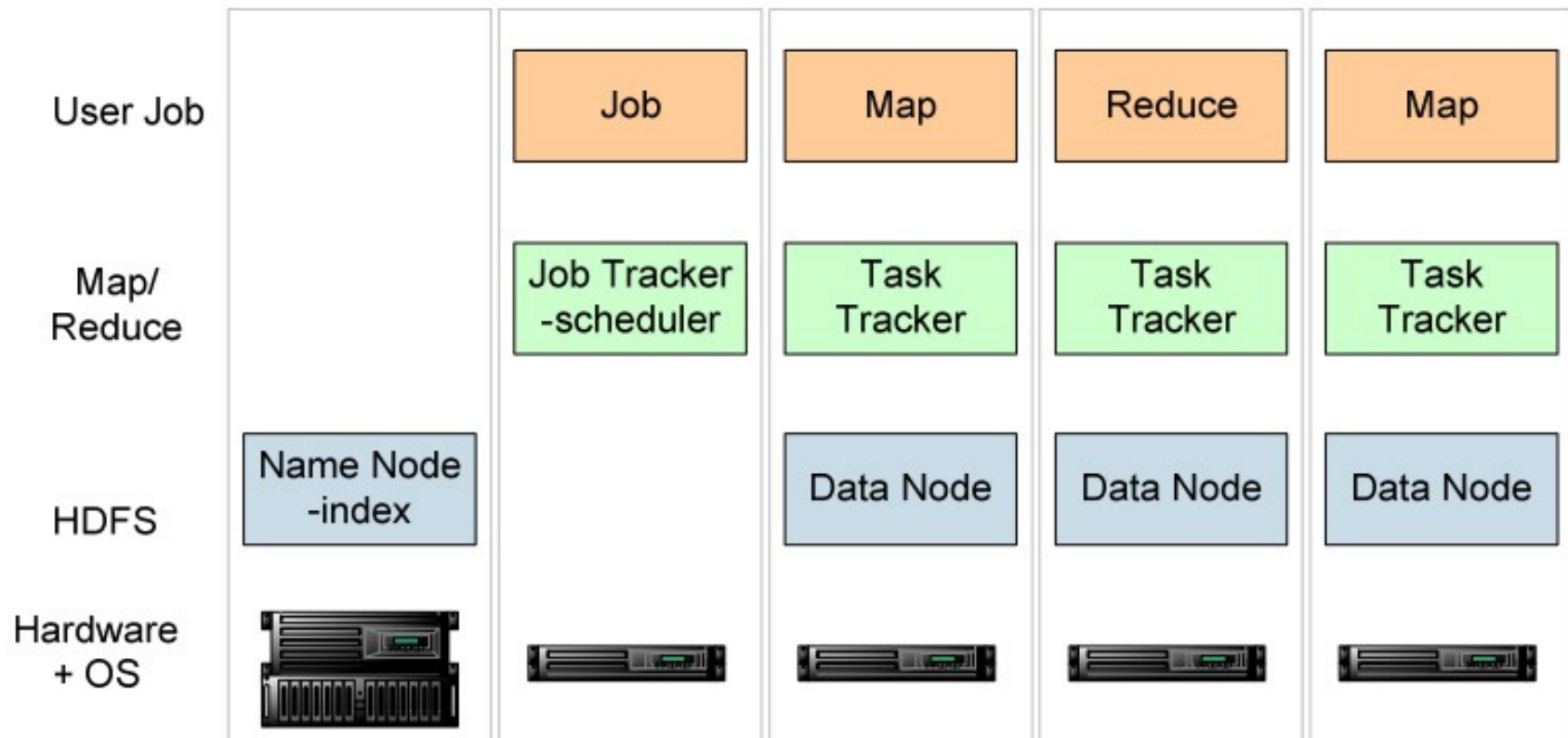
- Language for describing systems to deploy  
—everything from datacentres to test cases
  - Runtime to create *components* from the model
  - Components have a lifecycle
  - LGPL Licensed, Java 5+
- <http://smartfrog.org/>

Source: Deploying hadoop with smartfrog

12 [http://people.apache.org/~stevell/slides/deploying\\_hadoop\\_with\\_smartfrog.pdf](http://people.apache.org/~stevell/slides/deploying_hadoop_with_smartfrog.pdf)



# Basic problem: deploying Hadoop



*one namenode, 1+ Job Tracker, many data nodes and task trackers*

Source: Deploying hadoop with smartfrog

[http://people.apache.org/~stevell/slides/deploying\\_hadoop\\_with\\_smartfrog.pdf](http://people.apache.org/~stevell/slides/deploying_hadoop_with_smartfrog.pdf)

# The hand-managed cluster

- Manual install onto machines
- SCP/FTP in Hadoop zip
- copy out hadoop-site.xml and other files
- edit /etc/hosts, /etc/rc5.d, SSH keys ...
- Installation scales  $O(N)$
- Maintenance, debugging scales worse

Source: Deploying hadoop with smartfrog

12 [http://people.apache.org/~stevell/slides/deploying\\_hadoop\\_with\\_smartfrog.pdf](http://people.apache.org/~stevell/slides/deploying_hadoop_with_smartfrog.pdf)



# The locked-down cluster

- PXE Preboot of OS images
- RedHat Kickstart to serve up (see [instalinux.com](http://instalinux.com))
- Maybe: LDAP to manage state, or custom RPMs

## Requires:

uniform images, central LDAP service, good ops team, stable configurations, home-rolled RPMs

**Source: Deploying hadoop with smartfrog**

[http://people.apache.org/~stevell/slides/deploying\\_hadoop\\_with\\_smartfrog.pdf](http://people.apache.org/~stevell/slides/deploying_hadoop_with_smartfrog.pdf)



# CM-tool managed cluster

## Configuration Management tools

- State Driven: observe system state, push it back into the desired state
- Workflow: apply a sequence of operations to change a machine's state
- Centralized: central DB in charge
- Decentralized: machines look after themselves

CM tools are the only way to manage big clusters

Source: [Deploying hadoop with smartfrog](http://people.apache.org/~stevell/slides/deploying_hadoop_with_smartfrog.pdf)

12 [http://people.apache.org/~stevell/slides/deploying\\_hadoop\\_with\\_smartfrog.pdf](http://people.apache.org/~stevell/slides/deploying_hadoop_with_smartfrog.pdf)



# Model the system in the SmartFrog language

```
TwoNodeHDFS extends OneNodeHDFS {  
  
    localDataDir2 extends TempDirwithCleanup {  
  
    }  
  
    datanode2 extends datanode {  
        dataDirectories [LAZY localDataDir2];  
        dfs.datanode.https.address "https://localhost:0";  
    }  
}
```

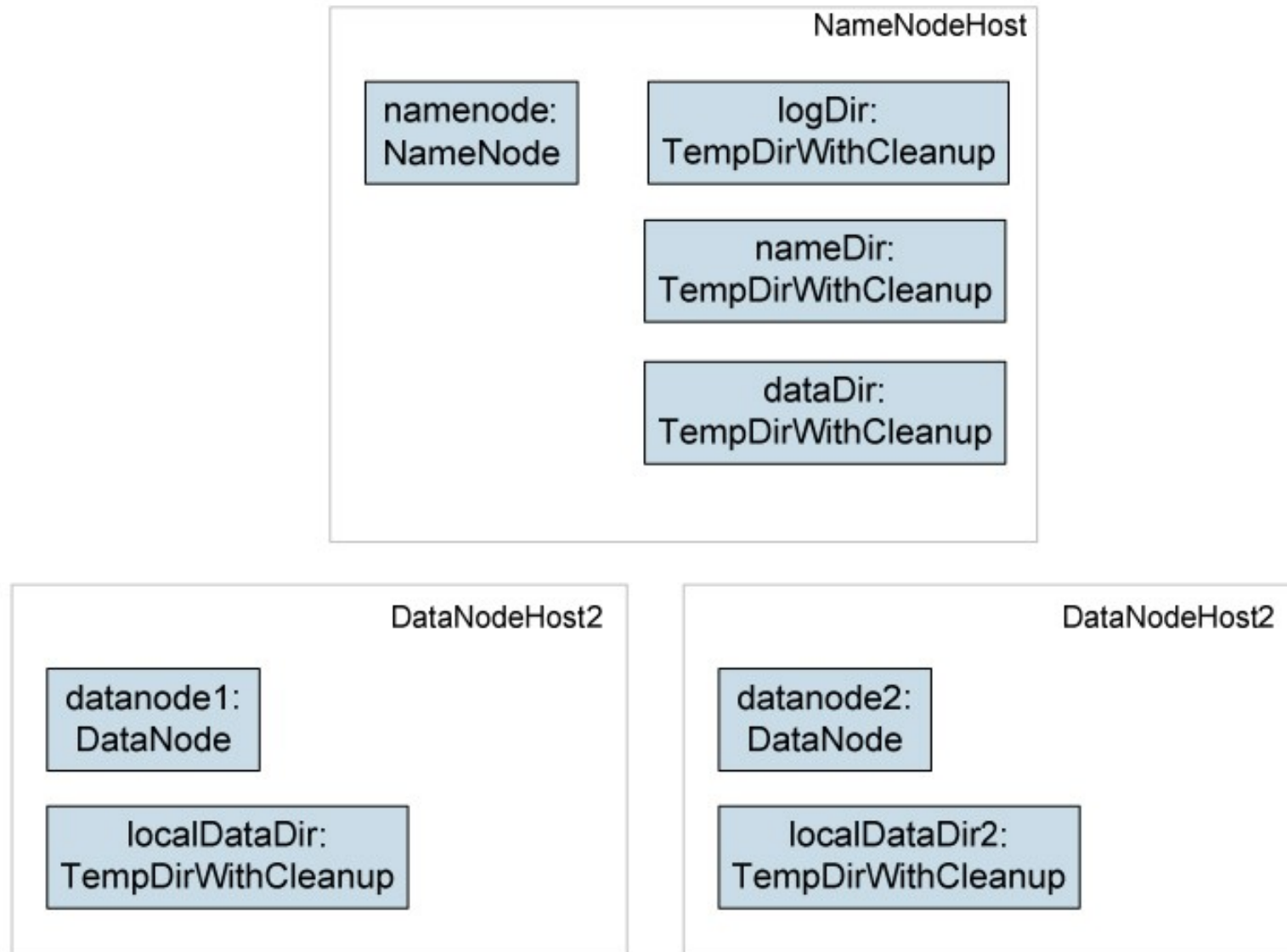
Inheritance, cross-referencing, templating

Source: [Deploying hadoop with smartfrog](#)

12 [http://people.apache.org/~stevell/slides/deploying\\_hadoop\\_with\\_smartfrog.pdf](http://people.apache.org/~stevell/slides/deploying_hadoop_with_smartfrog.pdf)



# The runtime deploys the model



Source: Deploying hadoop with smartfrog

[http://people.apache.org/~stevell/slides/deploying\\_hadoop\\_with\\_smartfrog.pdf](http://people.apache.org/~stevell/slides/deploying_hadoop_with_smartfrog.pdf)



# Steps to deployability

1. Configure Hadoop from an SmartFrog description
2. Write components for the Hadoop nodes
3. Write the functional tests
4. Add *workflow* components to work with the filesystem; submit jobs
5. Get the tests to pass

Source: Deploying hadoop with smartfrog

12 [http://people.apache.org/~stevell/slides/deploying\\_hadoop\\_with\\_smartfrog.pdf](http://people.apache.org/~stevell/slides/deploying_hadoop_with_smartfrog.pdf)





**PART 2-2 :**

# Introduction to DRBL

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Powered by **DRBL**

# What is DRBL ??

- **Diskless Remote Boot in Linux**
- Network is cheap, and our time is expansive
- In simple words, DRBL is .....
  - Replace IDE/SATA cable with network cable
  - 40+ student PCs connected to one DRBL server



**Diskfull  
PC**



=



+



+



**Diskless  
PC**



**Server**

# 1st, We install Base System of **GNU/Linux** on **Management Node**.

**You can choose:**

**Redhat, Fedora, CentOS, Mandriva,  
Ubuntu, Debian, ...**



2nd, We install **DRBL package** and  
configure it as **DRBL Server**.

There are lots of service needed:  
**SSHD, DHCPD, TFTP, NFS Server,**  
**NIS Server, YP Server ...**

Network Booting

Account Mgmt.

**NFS**

**TFTP**

**DHCPD**

**SSHD**

**NIS**

**YP**

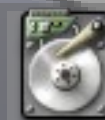
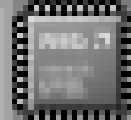
**Perl**

**Bash**

**GNU Libc**

**DRBL Server**

based on existing  
Open Source and  
keep Hacking!

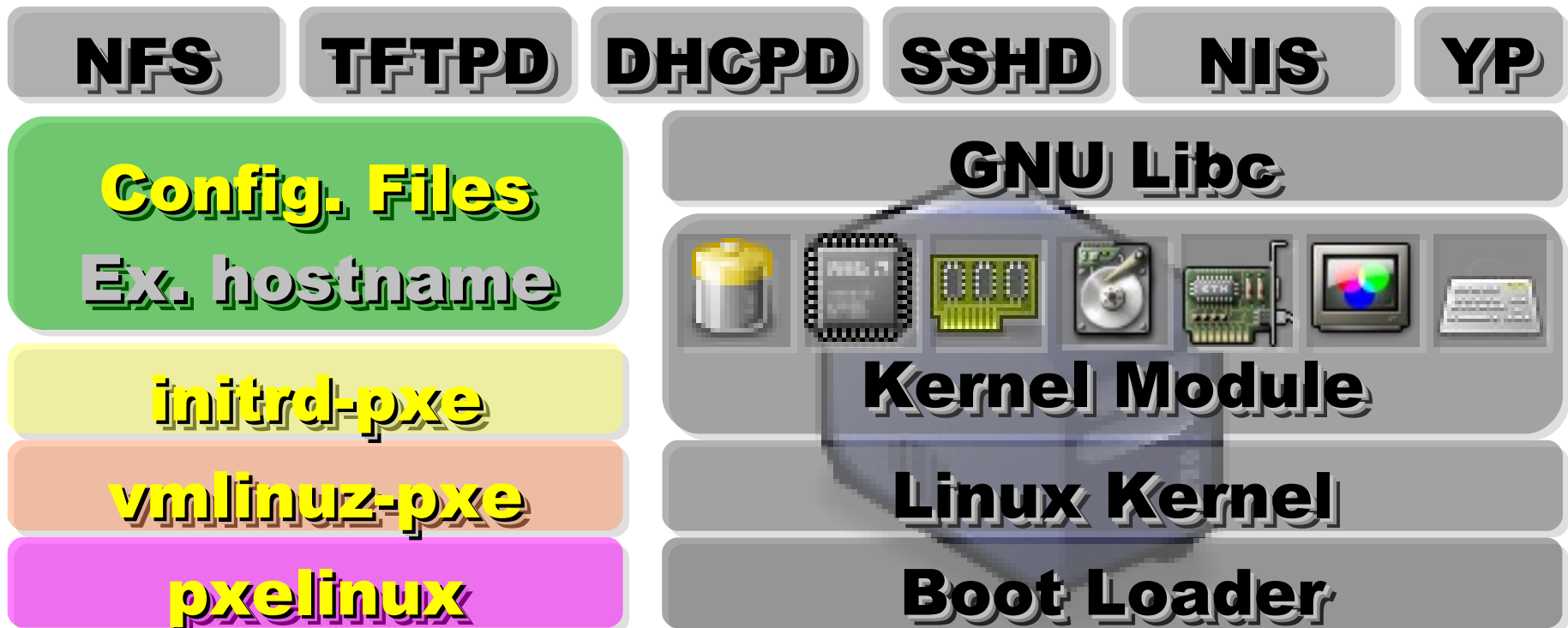


**Kernel Module**

**Linux Kernel**

**Boot Loader**

After running “**drblsrv -i**” & “**drblpush -i**”, there will be **pxelinux**, **vmlinux-pex**, **initrd-pxe** in TFTPROOT, and different **configuration files** for each Compute Node in NFSROOT



3rd, We enable **PXE** function in **BIOS** configuration.

**BIOS PXE**

**BIOS PXE**

**BIOS PXE**

**BIOS PXE**

**NFS**

**TFTPD**

**DHCPD**

**SSHD**

**NIS**

**YP**

**Config. Files**

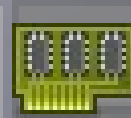
**Ex. hostname**

**initrd-pxe**

**vmlinux-pxe**

**pxelinux**

**GNU Libc**



**Kernel Module**

**Linux Kernel**

**Boot Loader**

While Booting, **PXE** will query IP address from **DHCPD**.

**BIOS PXE**

**BIOS PXE**

**BIOS PXE**

**BIOS PXE**

**NFS**

**TFTPD**

**DHCPD**

**SSHD**

**NIS**

**YP**

**Config. Files**  
**Ex. hostname**

**initrd-pxe**

**vmlinux-pxe**

**pxelinux**

**GNU Libc**



**Kernel Module**

**Linux Kernel**

**Boot Loader**



While Booting, **PXE** will query IP address from **DHCPD**.

**IP 1**

**IP 2**

**IP 3**

**IP 4**

**NFS**

**TFTPD**

**DHCPD**

**SSHD**

**NIS**

**YP**

**Config. Files**  
**Ex. hostname**

**initrd-pxe**

**vmlinuz-pxe**

**pxelinux**

**GNU Libc**



**Kernel Module**

**Linux Kernel**

**Boot Loader**

After PXE get its IP address, it will download booting files from **TFTPD**.

**IP 1**

**IP 2**

**IP 3**

**IP 4**

**NFS**

**TFTPD**

**DHCPD**

**SSHD**

**NIS**

**YP**

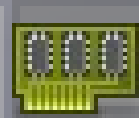
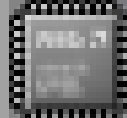
**Config. Files**  
**Ex. hostname**

**initrd-pxe**

**vmlinux-pxe**

**pxelinux**

**GNU Libc**



**Kernel Module**

**Linux Kernel**

**Boot Loader**



**NFS**   **TFTPD**   **DHCPD**   **SSHD**   **NIS**   **YP**

**Config. Files**  
**Ex. hostname**

**initrd-pxe**

**vmlinuz-pxe**

**pxelinux**

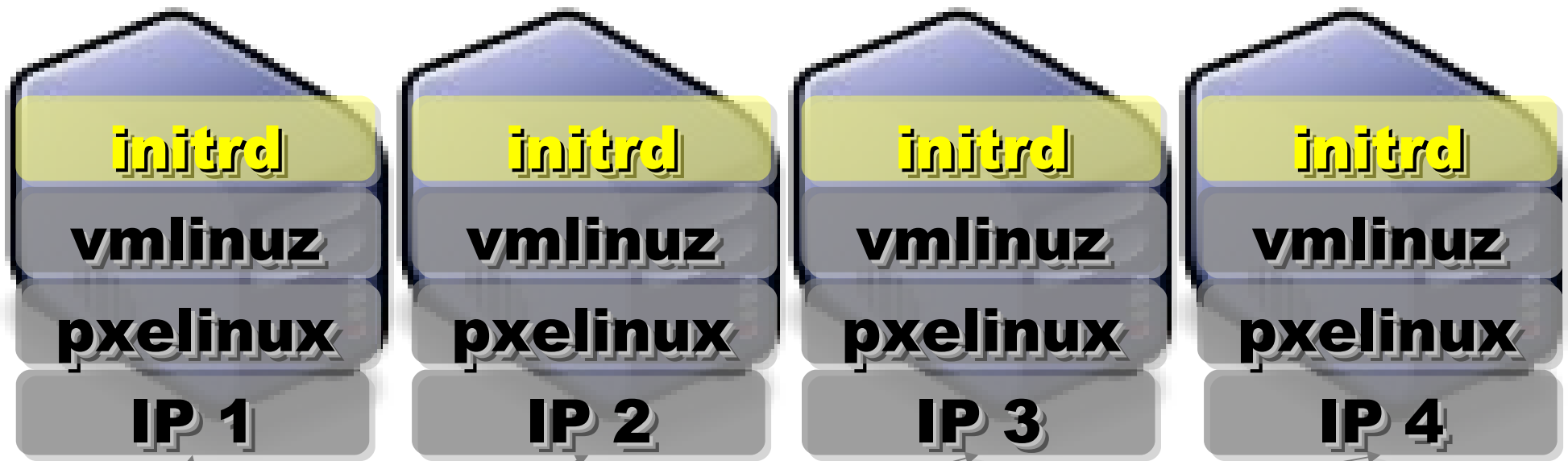
**GNU Libc**



**Kernel Module**

**Linux Kernel**

**Boot Loader**



**NFS**    **TFTPD**    **DHCPD**    **SSHD**    **NIS**    **YP**

Config. Files    GNU Libc

After downloading booting files,  
scripts in **initrd-pxe** will config  
**NFSROOT** for each Compute Node.

**pxelinux**

**Boot Loader**



- NFS**
- TFTPD
- DHCPD
- SSHD
- NIS
- YP

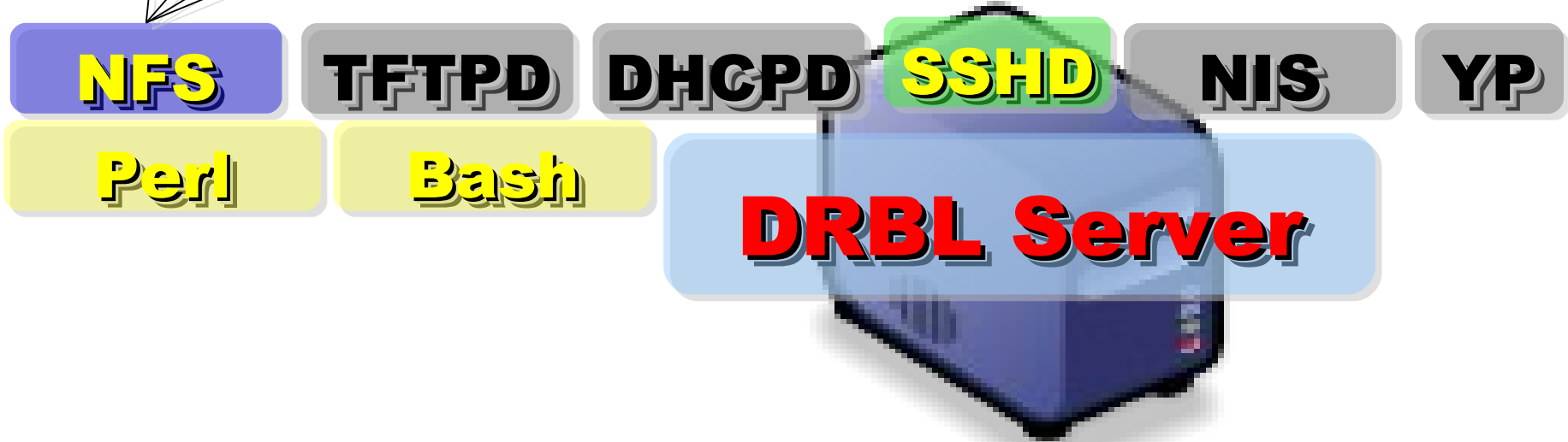
**Config. Files**  
 Ex. hostname

- initrd-pxe
- vmlinuz-pxe
- pxelinux





**Applications and Services** will also  
deployed to each **Compute Node**  
via **NFS** ....





With the help of **NIS** and **YP**,  
You can login each Compute Node  
with the **Same ID / PASSWORD**  
stored in **DRBL Server!**

**SSH Client**





## Questions?

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

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