Exercise #1: Exploring Open-Source Operating Systems with Virtual Machines

J. H. Wang

Objectives

- To get you familiar with some open-source operating systems like Linux
- To use virtualization tools such as VMware Player, or VirtualBox
- To explore the source code of Linux kernel

Exploring Linux Operating Systems

- The usual (and more difficult) way
  - Download one of the Linux distributions as CDs or DVDs
    - E.g. Ubuntu, Redhat, Debain, …
  - Partition your hard disk and start installing the Linux distribution
  - Configure your system parameters such as network, display, I/O devices, …
  - Download the latest Linux kernel, compile it and replace the original kernel
- Since we will not focus on directly installing Linux from scratch, this is not what we will do…

- The easier way (that will not depend on hard disk partitions and your OS platform)
  - Download the virtual machine manager
    - VMware Player or VirtualBox
  - Download a virtual machine image pre-installed with OS and applications
  - Boot the virtual machine image
  - Download the latest Linux kernel, compile it and replace the original kernel

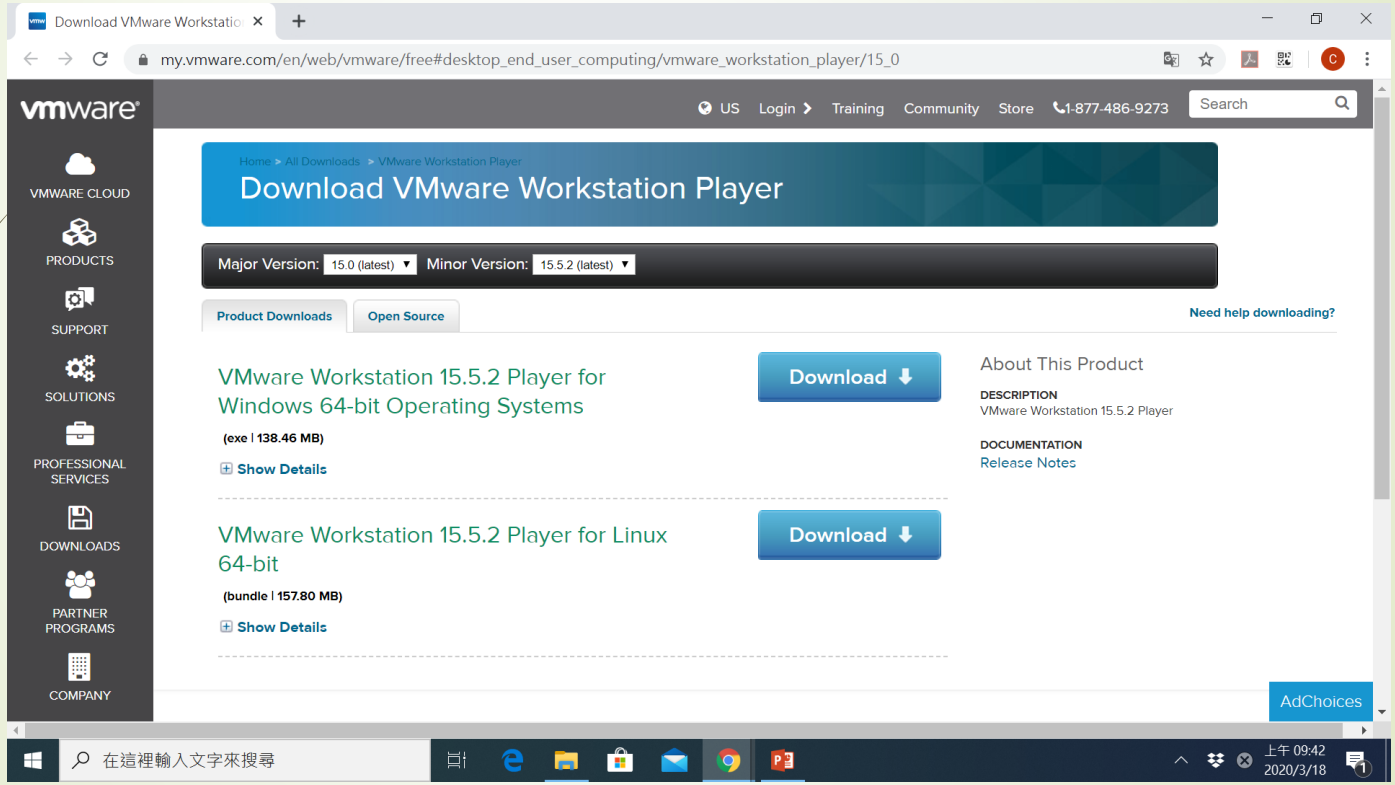
- Other (indirect) ways
  - Connecting to remote Linux hosts or workstations
    - using *telnet, ssh*
  - Installing UNIX-like environment such as *cygwin*
    - http://www.cygwin.com/

VMware Player

- A popular free virtualization tool
  - You can run many different OS on various platforms
- Easy to use
- There are other virtualization tools, as introduced in Sec. 1.12

Details

- Download VMware Player
  - http://www.vmware.com/products/player/
  - Latest version: Workstation 15.5.2 Player
- Download a virtual machine image
  - http://www.vmware.com/appliances/
- Boot the virtual machine within VMware Player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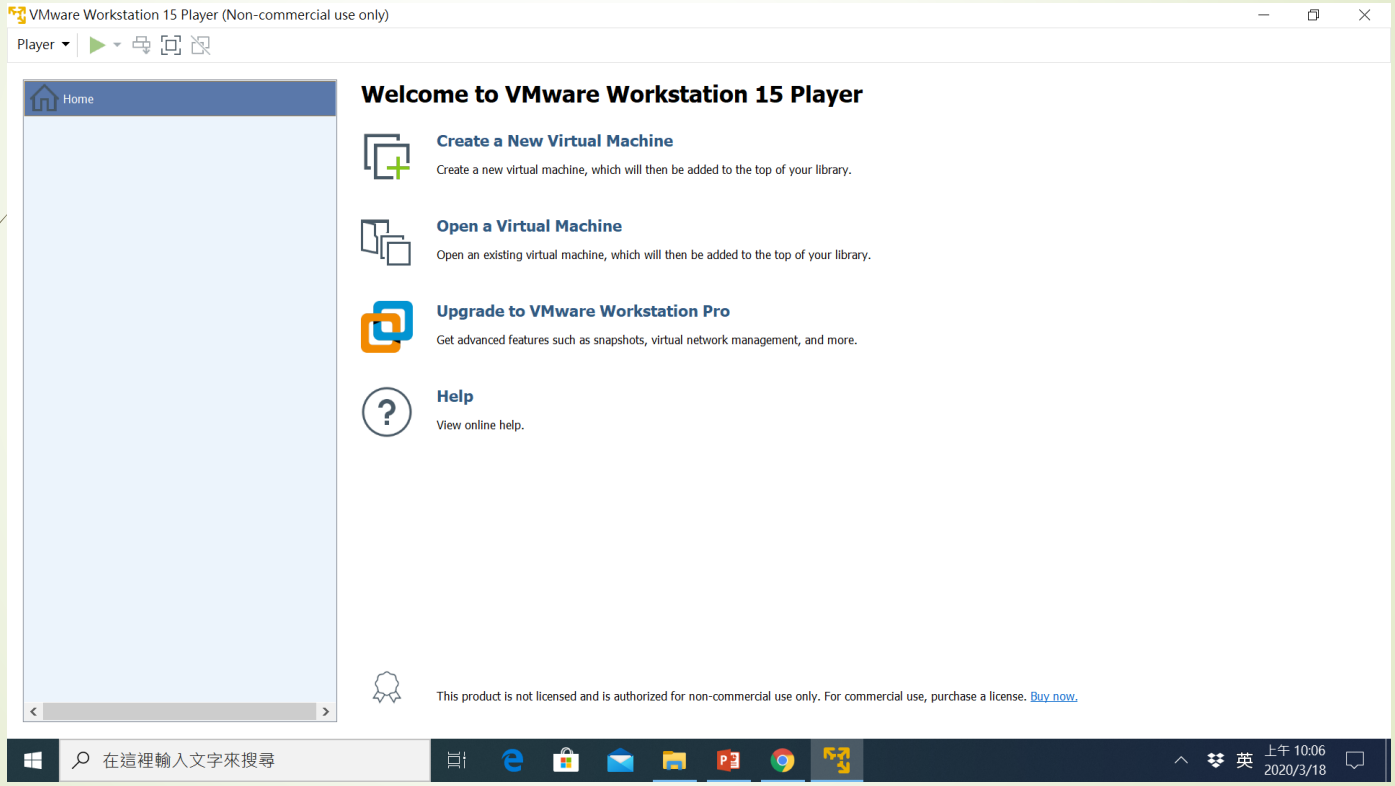
VMware Workstation 15 Player (Non-commercial use only)
Player
Home
Welcome to VMware Workstation 15 Player
Create a New Virtual Machine
Create a new virtual machine, which will then be added to the top of your library.
Open a Virtual Machine
Open an existing virtual machine, which will then be added to the top of your library.
Upgrade to VMware Workstation Pro
Get advanced features such as snapshots, virtual network management, and more.
Help
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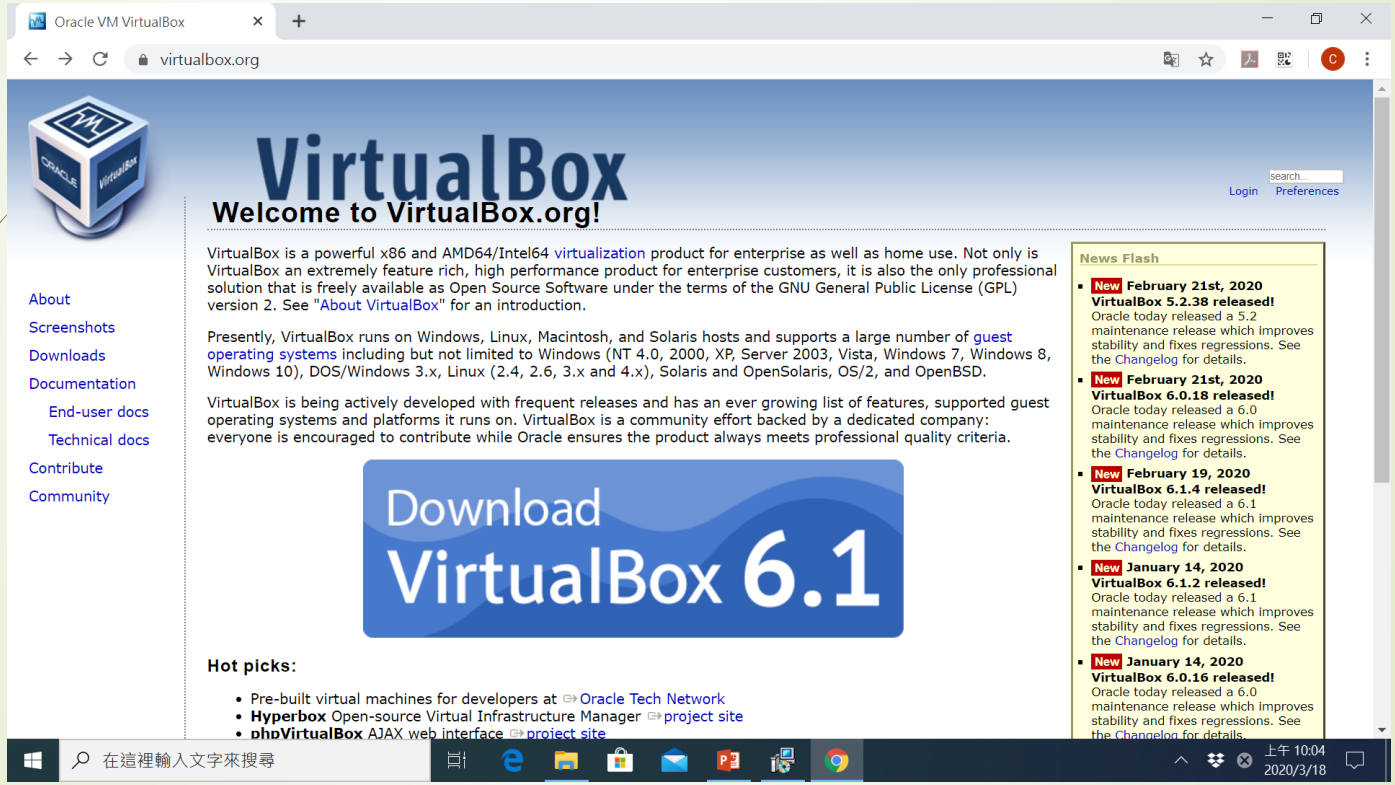
Oracle VirtualBox

- VirtualBox homepage:
  - https://www.virtualbox.org/
  - Latest version: 6.1.4
- You can also download the VirtualBox appliances or virtual machine images from the textbook author's website:
  - http://people.westminstercollege.edu/faculty/ggagne/osc10e/vm/index.html
  - Ubuntu 16.04.3 distribution, running kernel 4.4


Oracle VM VirtualBox
virtualbox.org
VirtualBox
Welcome to VirtualBox.org!
Login
Preferences
About
Screenshots
Downloads
Documentation
End-user docs
Technical docs
Contribute
Community
VirtualBox is a powerful x86 and AMD64/Intel64 virtualization product for enterprise as well as home use. Not only is VirtualBox an extremely feature rich, high performance product for enterprise customers, it is also the only professional solution that is freely available as Open Source Software under the terms of the GNU General Public License (GPL) version 2. See "About VirtualBox" for an introduction.
Presently, VirtualBox runs on Windows, Linux, Macintosh, and Solaris hosts and supports a large number of guest operating systems including but not limited to Windows (NT 4.0, 2000, XP, Server 2003, Vista, Windows 7, Windows 8, Windows 10), DOS/Windows 3.x, Linux (2.4, 2.6, 3.x and 4.x), Solaris and OpenSolaris, OS/2, and OpenBSD.
VirtualBox is being actively developed with frequent releases and has an ever growing list of features, supported guest operating systems and platforms it runs on. VirtualBox is a community effort backed by a dedicated company: everyone is encouraged to contribute while Oracle ensures the product always meets professional quality criteria.
Download VirtualBox 6.1
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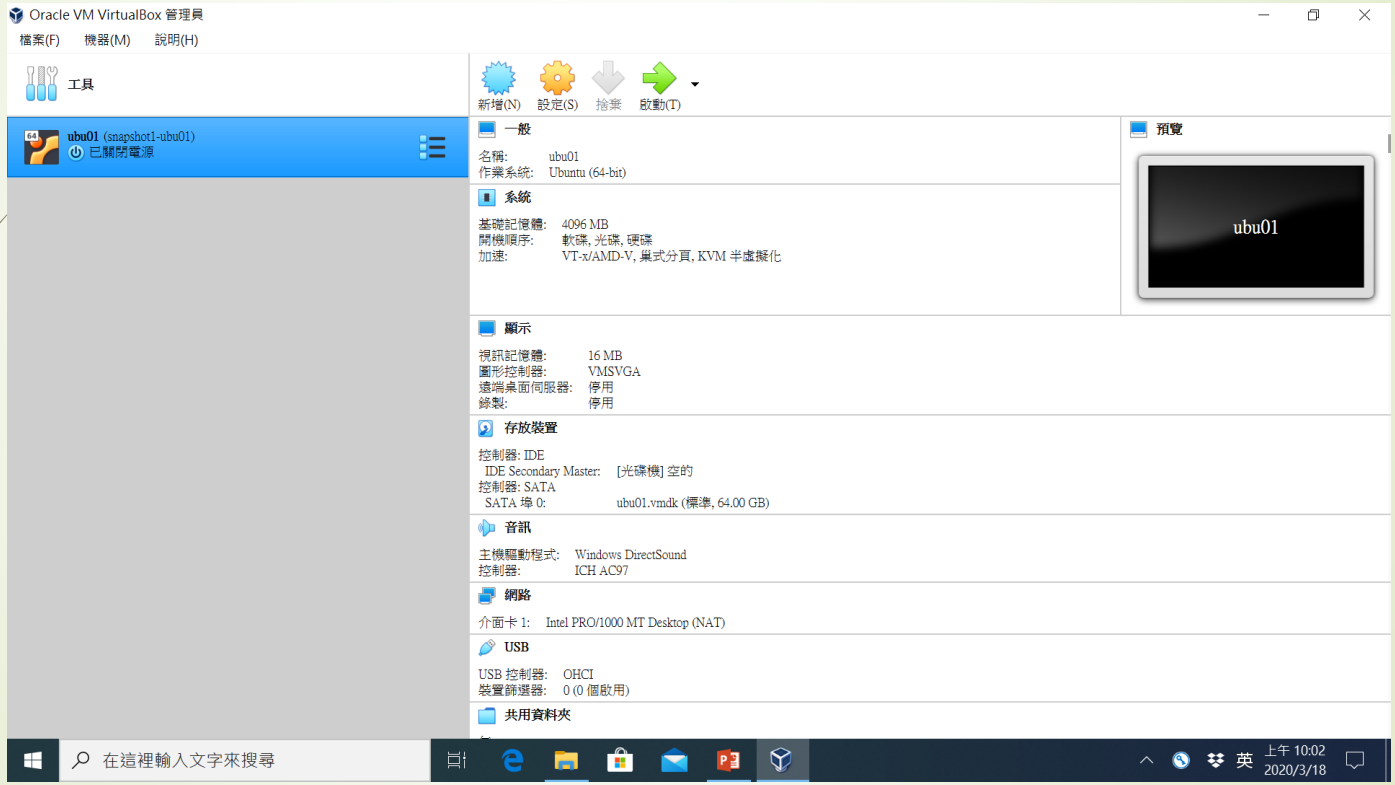
Oracle VM VirtualBox 管理員
檔案(F)
機器(M)
說明(H)
工具
新增(N)
設定(S)
捨棄
啟動(T)
ubu01 (snapshot1-ubu01)
已關閉電源
一般
名稱: ubu01
作業系統: Ubuntu (64-bit)
系統
基礎記憶體: 4096 MB
開機順序: 軟碟, 光碟, 硬碟
加速: VT-x/AMD-V, 巢式分頁, KVM 半虛擬化
預覽
ubu01
顯示
視訊記憶體: 16 MB
圖形控制器: VMSVGA
遠端桌面伺服器: 停用
錄製: 停用
存放裝置
控制器: IDE
IDE Secondary Master: [光碟機] 空的
控制器: SATA
SATA 埠 0: ubu01.vmdk (標準, 64.00 GB)
音訊
主機驅動程式: Windows DirectSound
控制器: ICH AC97
網路
介面卡 1: Intel PRO/1000 MT Desktop (NAT)
USB
USB 控制器: OHCI
裝置篩選器: 0 (0 個啟用)
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Example: Linux Virtual Machine

- http://cs.westminstercollege.edu/~greg/osc10e/vm/index.html
- a command-line based Ubuntu Server running version 4.4 of the Linux kernel
- Standard development tools are included with this software
- This will run using the freely-available VirtualBox software
- The virtual machine includes the source code for the 10th edition of *Operating System Concepts*

Obtaining the Latest Linux Kernel Source Code

- http://www.kernel.org/
  - The latest version: 5.5.9
  - Uncompress the downloaded file by: tar, gzip/gunzip or bzip2/bunzip2
    - tar xjf linux-5.5.9.tar.xz

A Tour of Linux Source Code

- Under /usr/src
  - Maybe /usr/src/linux or /usr/src/linux-x.y.z
- Different modules
  - drivers/
  - fs/
  - mm/
  - net/
  - …
- Procedures of Building a New Kernel
  - (See Programming Project)

Further Reading

- Programming Project in Chap.2
  - Creating Linux kernel Modules