Introduction to Linux
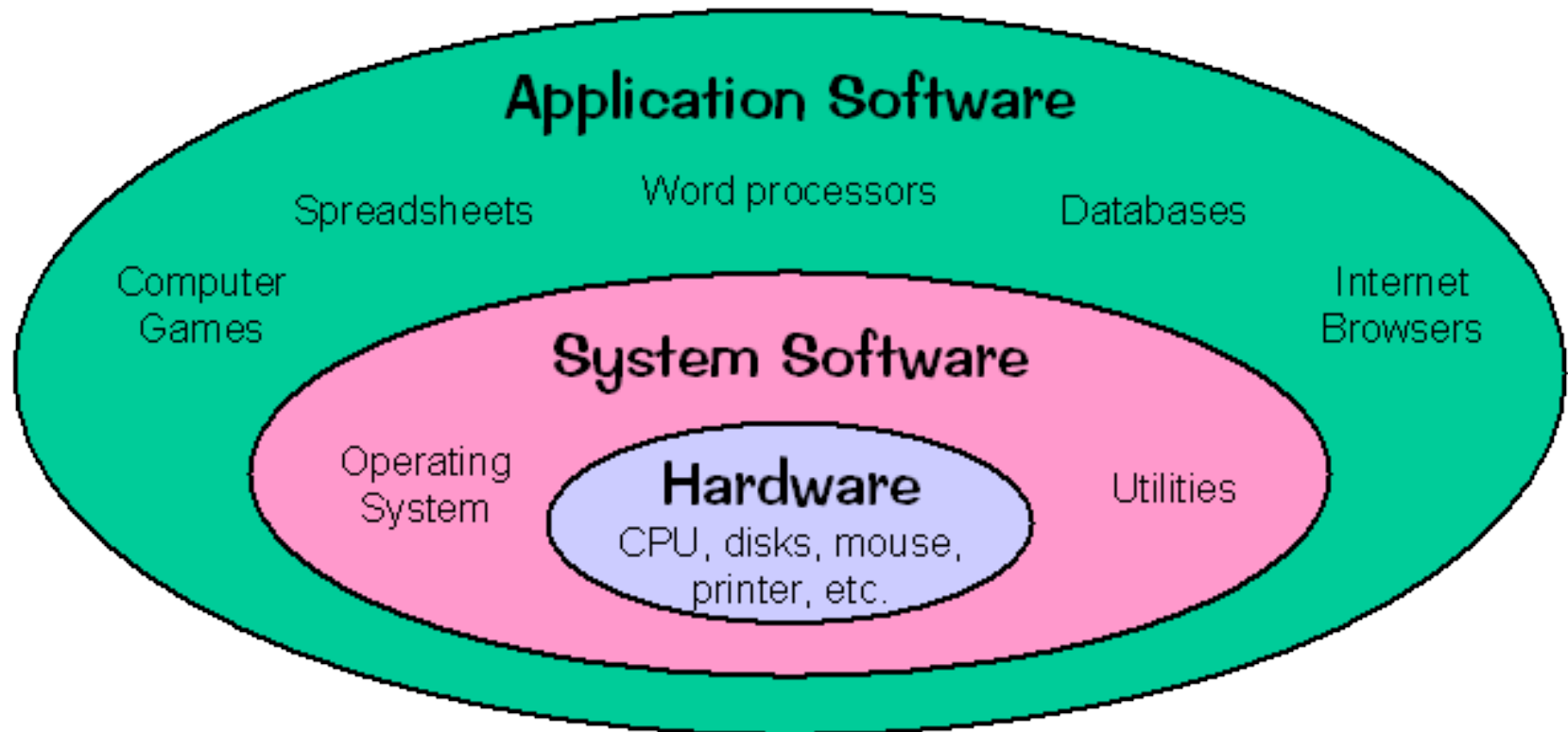
Chonnam National University
School of Electronics and Computer Engineering

Kyungbaek Kim

Computer System

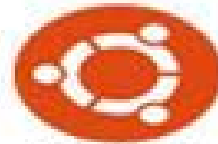**Application Software**
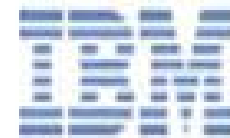
Spreadsheets Word processors Databases

Computer Games

Internet Browsers

System Software

Operating System

Hardware
CPU, disks, mouse, printer, etc.

Utilities

Operating Systems

Windows · ANDROID · APPLE · Ubuntu · IBM · Oracle
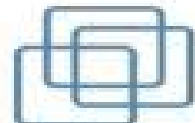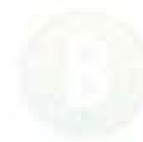
OS X · HP · Linux · Xen · VMWare

Red Hat · Fedora · CentOS · Debian · Sun · Mint

SUSE · Mageia · Arch Linux · Slackware · Mandriva · Gentoo
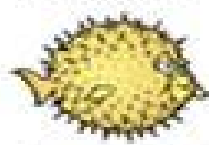
FreeBSD · OpenBSD · NetBSD · DragonFly BSD · Darwin · GOOGLE DHROME OS

What is UNIX?

- Unix is a multi-user, multi-tasking operating system.
  - You can have many users logged into a system simultaneously
  - Each user runs many applications
- Unix Kernel
  - The main component of operating system
  - Keep each process and user separate
  - Regulate access to system hardware (cpu, memory, disk and other I/O devices)
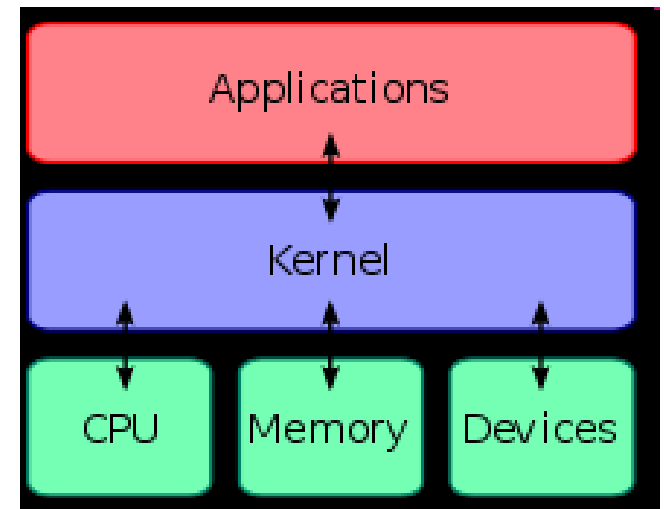
UNIX structure
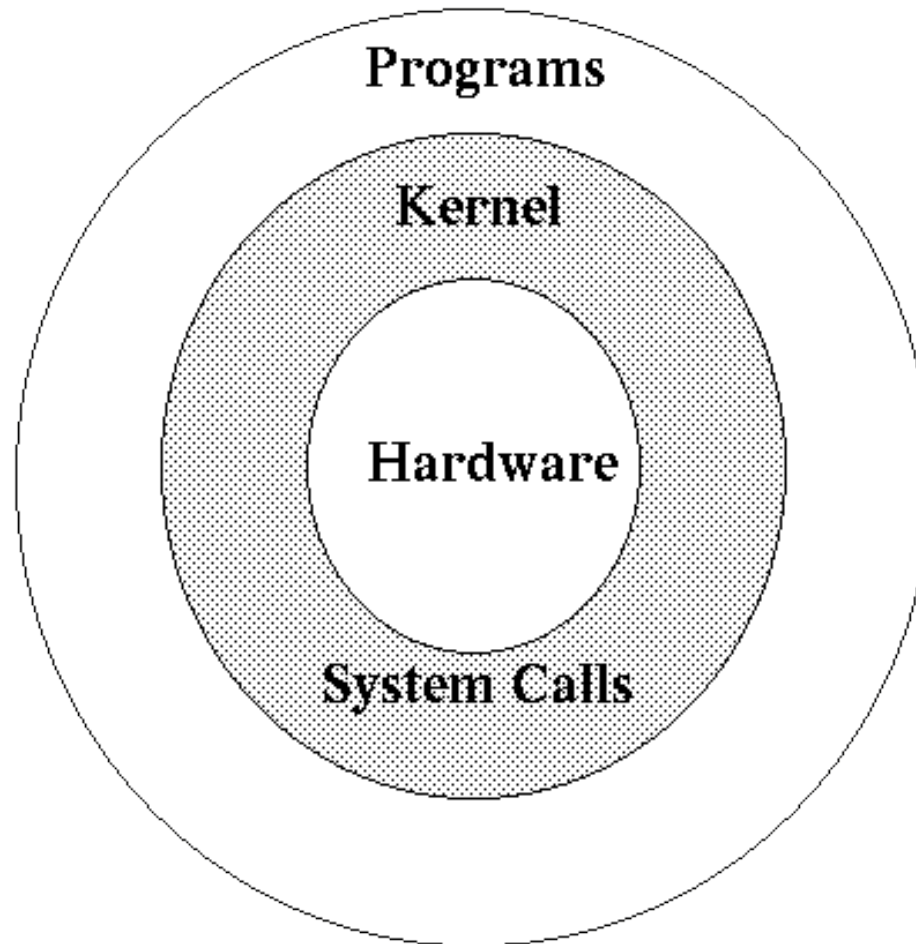
The First UNIX

- First version was created in Bell Labs in 1969.
  - It was given the name "UNIX" by Brian Kernighan."
  - 00:00:00 Hours, Jan 1, 1970 is time zero for UNIX. It is also called as epoch.
  - Firstly implemented with assembly language, but in 1973 UNIX is re-written mostly in C language.
    - Being written in a high-level language greatly decreases the effort needed to port it to new machines.

History of UNIX

- 1977 There were about 500 Unix sites world-wide.
- 1980 BSD 4.1 (Berkeley Software Development)
- 1983 SunOS, BSD 4.2, System V
- 1988 AT&T and Sun Microsystems jointly develop System V Release 4 (SVR4). This later developed into UnixWare and Solaris 2.
- 1991 Linux was originated.

Types of UNIX : BSD

- Berkeley Software Distribution
  - UNIX series distributed by University of California, Berkeley, USA.
- Main characteristics
  - C shell
  - Vi editor
  - Pascal Programming language
  - Supporting Networking
  - Socket communication between processes
  - Supporting Virtual memory

Types of UNIX : System V

- UNIX series developed by AT&T
- Version 6
    - Bourne shell
    - Ed text editor
- Version 7
    - Released by Bell Lab at 1978

Types of UNIX : Solaris

- From Sun Microsystems
- Usually provided with workstations
- Initial version : SunOS 4.x, Solaris 1.x
  - BSD Unix
- Solaris 2.x
  - System V Unix
- Currently Oracle holds Sun and distribute Solaris 11 in free.
  - http://www.oracle.com/technetwork/server-storage/solaris11/downloads/index.html

What is LINUX

- Linux is a free UNIX-type operating system
- It originated in 1991 as a personal project of Linus Torvalds.
- The Kernel version 1.0 was released in 1994
  - The latest stable version is 4.4
  - https://www.kernel.org/
- Developed under the GNU GPL (General Public License).
  - The source code for Linux is freely available to everyone.

GNU and free software

- GNU project
  - GNU is not Unix (pronounced "g'noo")
  - Launched in 1984 to develop the GNU system
- Free software
  - You should think of "free" as in "free speech", not as in "free bear".
  - Free software is a matter of the users' freedom to run, copy, distribute, study, change and improve the software
  - **Copylefted software**
    - A share-alike clause in a license

FLOSS

- Free/Libre Open Source Software
  - End users always have the following freedoms
    - 0) Run the program, for any purpose
    - 1) Closely examine and study the software, and freely modify and improve it to suit their needs better
    - 2) Give copies of the software to other people for whom the software will be useful, either gratis or for a fee
    - 3) Improve the software and freely distribute their improvements to the broader public

Linux Usage Share

Desktop operating system browsing statistics

Windows 7	55.92%
Windows XP	18.93%
Windows 8/8.1	15.22%
OS X	7.11%
Windows Vista	2.44%
Linux	1.34%
Other	0.51%
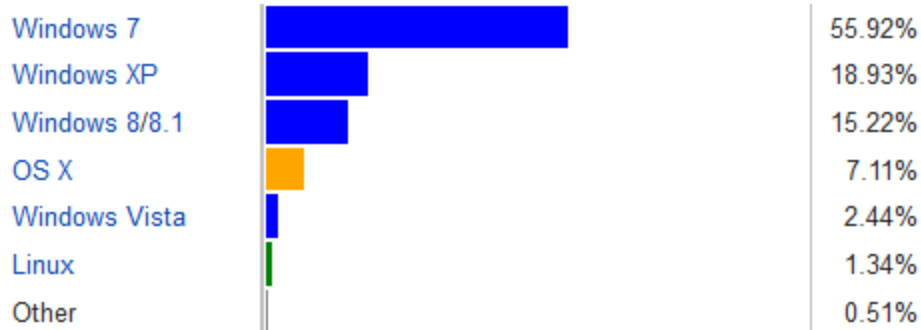
Desktop OS market share as of December 2014 according to Net Applications[1]

Source：Wikipedia

Web clients' OS family statistics

Windows	55.51%
Linux based	22.56%
iOS, OS X	17.21%
Symbian, S40	2.73%
Other	1.99%
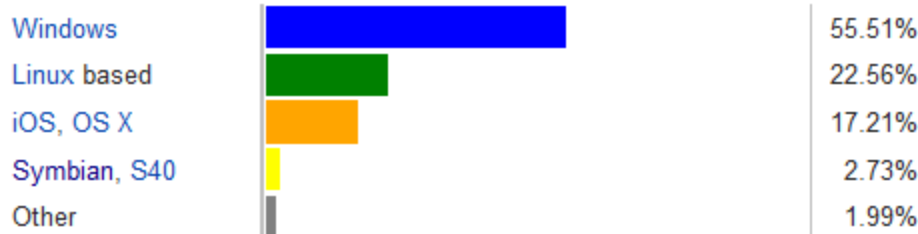
Web clients' OS family statistics in January 2015 StatCounter[4][5]

Source：Wikipedia

- Linux 64%
- Windows 20%
- FreeBSD 7%
- Solaris 4%
- AIX 2%
- HP-UX 1%
- OpenBSD 1%
- Mac OS X 1%
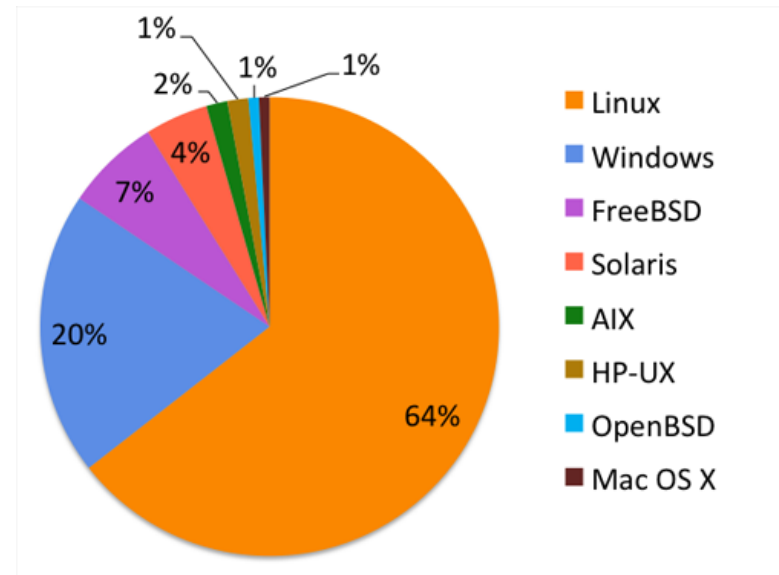
OS for Apache HTTP server, 2012

Example of usage of LINUX

Entertainment system inside of Airplain (DELTA Airline)

Extensions : Android

- Android
  - A Linux-based operating system
    - But Android is not Linux
    - No native windowing system, glibc support
  - Designed primarily for touch screen mobile devices

Extensions : RTLinux

- Hard Realtime RTOS microkernel

- Fully preemptive process

- Usage
  - Control Robots
  - Data acquisition systems
  - Manufacturing plants
  - Time-sensitive instruments

Extensions : INK

- I/O Node Kernel
  - Used by the input output nodes of the IBM Blue Gene Supercomputer

Most In-Demand Skills Mentioned In Cloud Computing Job Advertisements

(Source: WANTED Analytics; December 12, 2014)

Skill	Mentions
Structured query language	331,470
Java	249,056
Software development	241,421
Linux	194,235
JavaScript	160,726
Quality Assurance	154,724
UNIX	147,367
Systems Development Lifecycle	145,779
Microsoft SQL Server	140,062
Application development	126,639
Adobe LifeCycle ES	124,457
Technical support	123,104
Web services	121,904
Hypertext markup language	119,467
Microsoft .NET Framework	112,737
Extensible markup language	108,116
C-sharp	105,684
Relational Database Management System	102,324
Cascading Style Sheets	95,685
Python	83,649

Human-Machine-Interface

remote
(SSH, HTTP, …)

Keyboard & Mouse
also Braille, Touch-Display, Speech recognition, Graphics tablet, 3D-Mouse, Wii nunchak, etc.

Touch-Display
Attitude sensor, Motion sensor, Speech recognition

Speech recognition
Attitude sensor
Motion sensor

Display, Sound
Vibration

remote
(SSH, HTTP, Serial, I2C, …)

Hardware

Supercomputer
Computer Cluster
Mainframe computer
Distributed computing

Desktop Computer
Workstation
Home Computer
Desktop replacement laptop
Thin client

Mobile computer
Note-/ Net-/ Smartbook
Tablet
Smartphone
PDA / Handheld game console

Wearable Computer
Wristwatch
Virtual Retina Display
Head-mounted display

Embedded Computer
Customer-premises equipment
Measurement Equipment
Laboratory Equipment
Layer3-Switches
other embedded systems

Linux kernel

High-performance computing
(HPC)

Real-time computing
(RTC)

Linux Process Scheduler
Linux Security Modules
Linux Network scheduler
Network stack
Netfilter
Linux device drivers
Linux file system drivers

Pool of free and open-source and proprietary software

Web server solution stacks (LAMP)
Distributed Computing
Routing daemons
Software Development
Package management systems

CAD, CAM & CAE Software
Office
Image Processing
Desktop Publishing (DTP)

Windowing Systems
Graphical User Interfaces (Shells)

Desktop UI

Touch UI

Wearable UI

Video processing software
3D computer graphics
Computer animation
Motion graphics

Digital Audio Workstation
DJ Mixing Software
Video games
Home cinema solutions
Debian software archives: 37,000 software packages

Linux kernel supports various hardware architectures, providing a common platform for running free, open-source and proprietary software
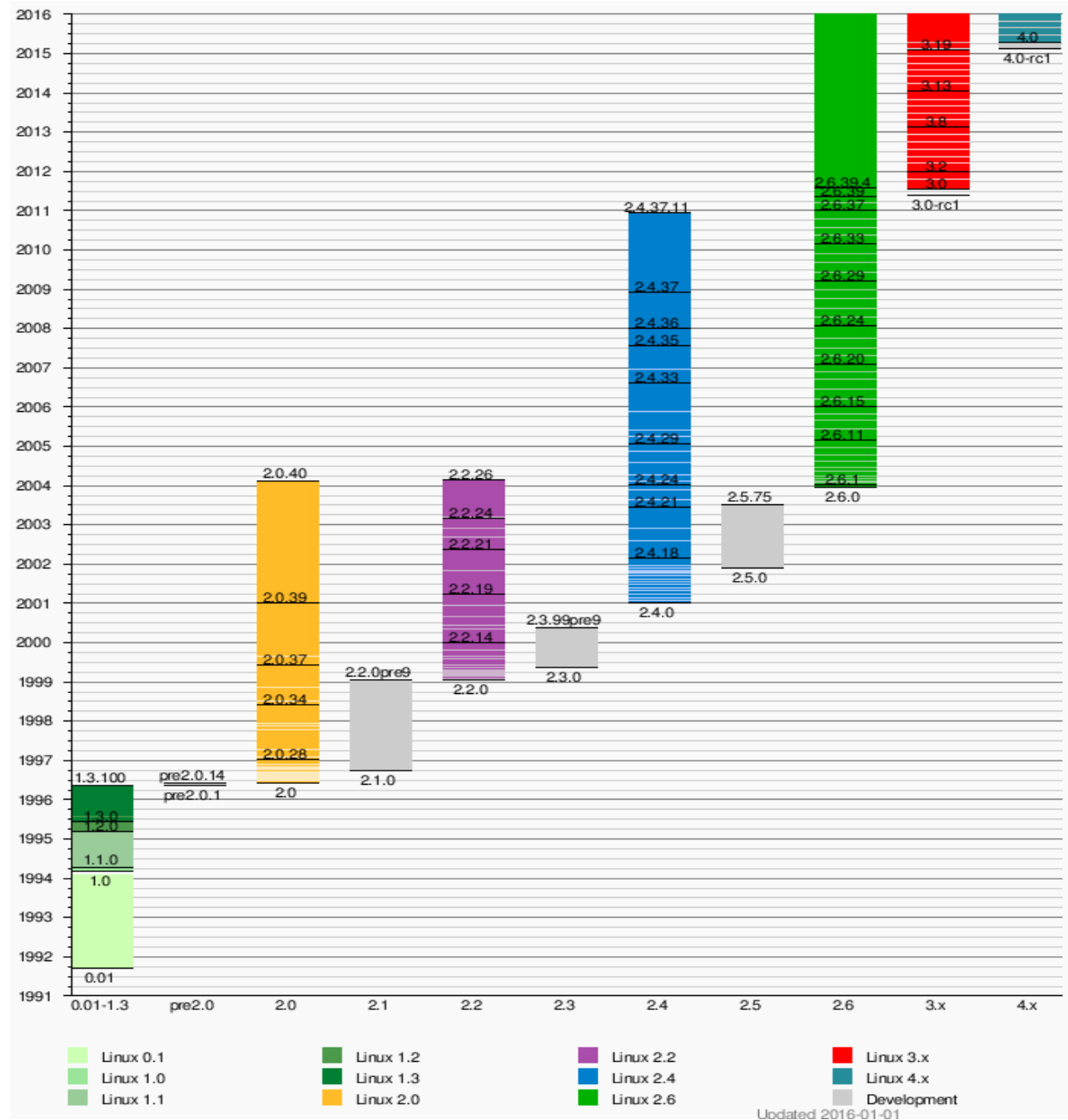
Source：Wikipedia

Linux kernel map

Active Kernel Releases

- Prepatch (RC)
  - Mostly aimed at other kernel developers and Linux enthusiasts
  - Must be compiled from source with new features for testing
  - Maintained and released by Linus Torvalds.

- Mainline
  - All new features are introduced and all the exciting new development happens

- Stable
  - After each mainline kernel is released, it is considered "stable."
  - Only a few bugfix kernel releases until next mainline kernel becomes available.
  - Stable kernel updates are released on as-needed basis, usually 2-3 a month.

- Longterm
  - The purposes of backporting bugfixes for older kernel trees
  - Only important bugfixes are applied to such kernels.
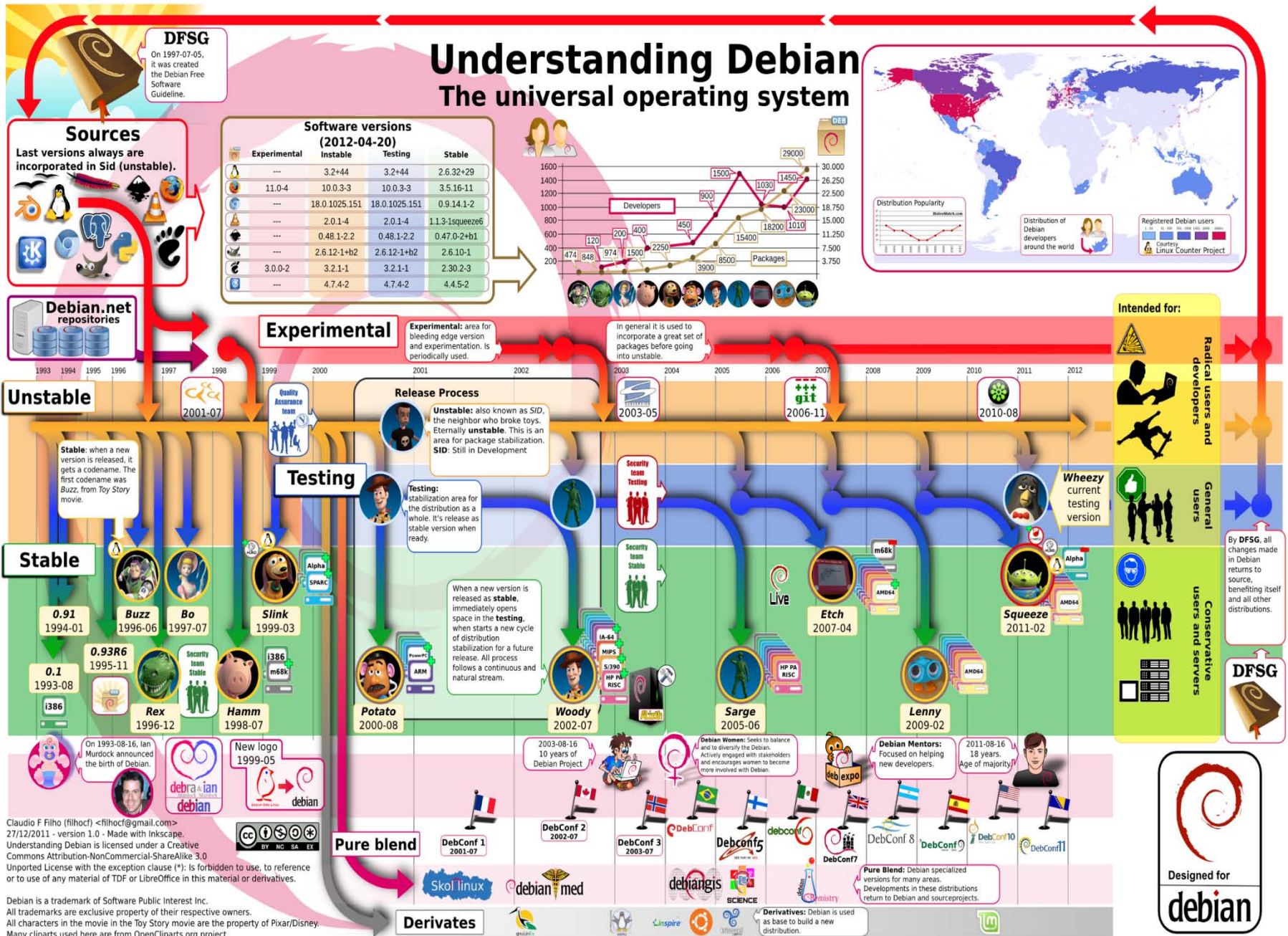
Linux Version

Source：Wikipedia

LINUX Distributions

- RedHat：http://www.redhat.com/
- Fedora：http://fedoraproject.org/
- OpenSUSE：http://www.opensuse.org/
- Debian：http://www.debian.org/
  - Ubuntu Linux (preferred for this course)

Understanding Debian
The universal operating system

DFSG
On 1997-07-05, it was created the Debian Free Software Guideline.

Sources
Last versions always are incorporated in Sid (unstable).

Debian.net repositories

Software versions (2012-04-20)

	Experimental	Instable	Testing	Stable
	---	3.2+44	3.2+44	2.6.32+29
	11.0-4	10.0.3-3	10.0.3-3	3.5.16-11
	---	18.0.1025.151	18.0.1025.151	0.9.14.1-2
	---	2.0.1-4	2.0.1-4	1.1.3-1squeeze6
	---	0.48.1-2.2	0.48.1-2.2	0.47.0-2+b1
	---	2.6.12-1+b2	2.6.12-1+b2	2.6.10-1
	3.0.0-2	3.2.1-1	3.2.1-1	2.30.2-3
	---	4.7.4-2	4.7.4-2	4.4.5-2

Developers
Packages

29000
23000
18200
15400
8500
3900
2250
1500
974
848
474
120 200 400 450 900 1030 1450 1500 1010

Distribution Popularity
DistroWatch.com

Distribution of Debian developers around the world

Registered Debian users
Courtesy Linux Counter Project

Intended for:

Experimental

Experimental: area for bleeding edge version and experimentation. Is periodically used.

In general it is used to incorporate a great set of packages before going into unstable.

Radical users and developers

Unstable

Release Process

Unstable: also known as SID, the neighbor who broke toys. Eternally unstable. This is an area for package stabilization. SID: Still in Development

2001-07   Quality Assurance team   2003-05   git 2006-11   2010-08

Testing

Testing: stabilization area for the distribution as a whole. It's release as stable version when ready.

Security team Testing

Security team Stable

Wheezy current testing version

General users

Stable

Stable: when a new version is released, it gets a codename. The first codename was Buzz, from Toy Story movie.

When a new version is released as stable, immediately opens space in the testing, when starts a new cycle of distribution stabilization for a future release. All process follows a continuous and natural stream.

0.91 1994-01
Buzz 1996-06
Bo 1997-07
Slink 1999-03

0.93R6 1995-11
Security team Stable
i386 m68k

0.1 1993-08
i386

Rex 1996-12
Hamm 1998-07

Alpha SPARC

Potato 2000-08
PowerPC ARM

Woody 2002-07
IA-64 MIPS S/390 HP PA RISC

Live

Sarge 2005-06
HP PA RISC

Etch 2007-04
m68k AMD64

Lenny 2009-02
AMD64

Squeeze 2011-02
Alpha AMD64

Conservative users and servers

By **DFSG**, all changes made in Debian returns to source, benefiting itself and all other distributions.

DFSG

On 1993-08-16, Ian Murdock announced the birth of Debian.

New logo 1999-05
debra & ian
debian

2003-08-16 10 years of Debian Project

Debian Women: Seeks to balance and to diversify the Debian. Actively engaged with stakeholders and encourages women to become more involved with Debian.

Debian Mentors: Focused on helping new developers.

2011-08-16 18 years. Age of majority.

debexpo

Pure blend

DebConf 1 2001-07
DebConf 2 2002-07
DebConf 3 2003-07
DebConf
Debconf5
debconf
DebConf7
DebConf 8
DebConf9
DebConf10
DebConf11

Pure Blend: Debian specialized versions for many areas. Developments in these distributions return to Debian and sourceprojects.

Skol linux
debian med
debiangis
SCIENCE
chemistry

Derivates

Derivatives: Debian is used as base to build a new distribution.

Designed for debian

1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012

Installation of Linux

- Via network or an iso image
- If you have a single dedicated machine,
  - You can directly install a Linux on the machine
- If you have a machine with other operating systems such as Window 7,
  - You can use **a virtual machine** to install a Linux and run the Linux over the other OS

Virtual machine

- A simulator of a machine that is usually different from the target machine
- Examples
  - Using Linux on MS Windows
  - Using Windows on Linux
  - Using windows XP on Windows7
  - Using RedHat Linux on Ubuntu Linux
- Popular virtual machines
  - **VMware Workstation**
  - MS Virtual PC

Ubuntu Linux

Virtual Machine
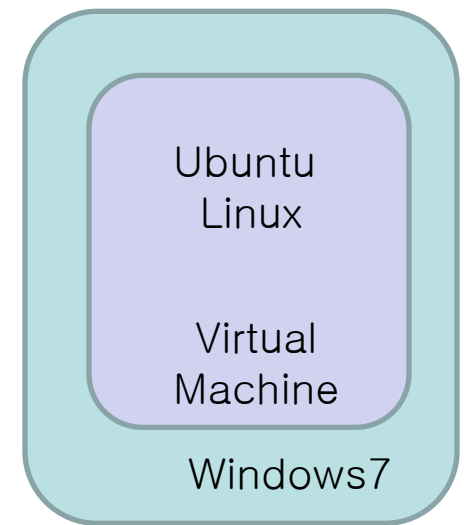
Windows7

Host OS : Windows7
Guest OS : Ubuntu Linux

Prepare Installation

- This class will use the following versions of VMware and Linux
  - VMware player 4.0.2
    - https://my.vmware.com/web/vmware/free#desktop_end_user_computing/vmware_player/4_0|PLAYER-402|product_downloads
  - Ubuntu Linux 10.04.4 desktop (iso file)
    - http://releases.ubuntu.com/10.04.4/
- Check the type of your machine
  - 32 bits(Intel x86) or 64 bits(AMD64)

VMware Player
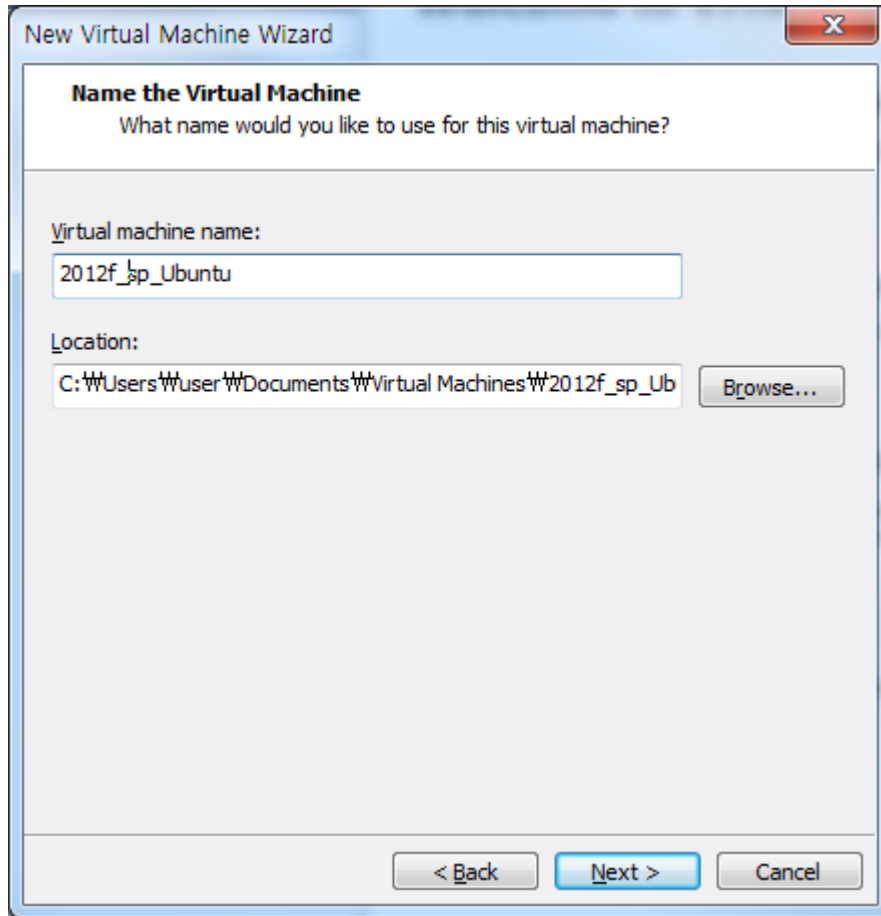
After installing VMware player you can create a new virtual machine

Choose the image and insert your information
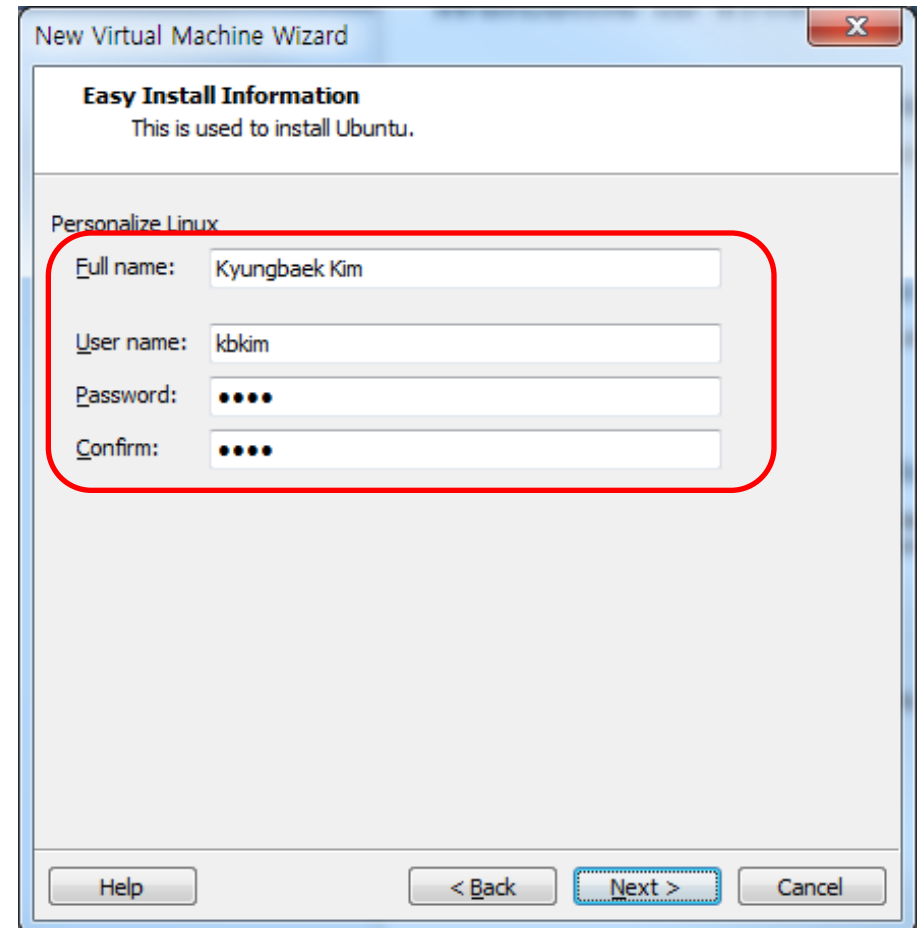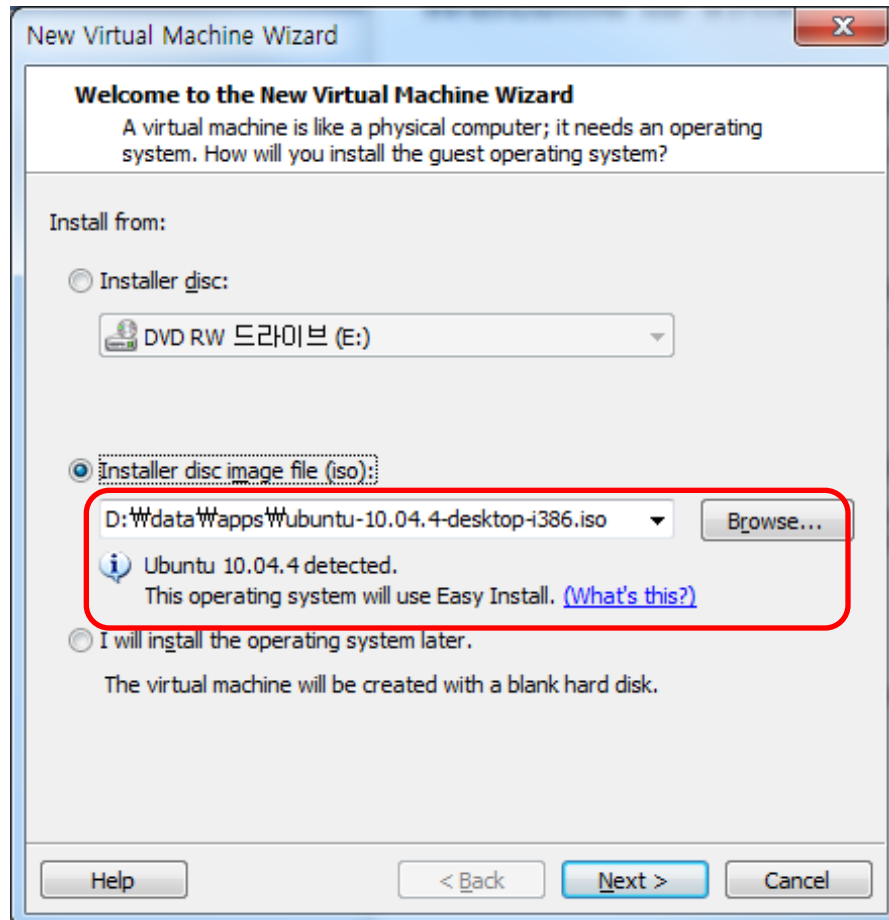
Setting the name of VM
and Specify Disk Capacity
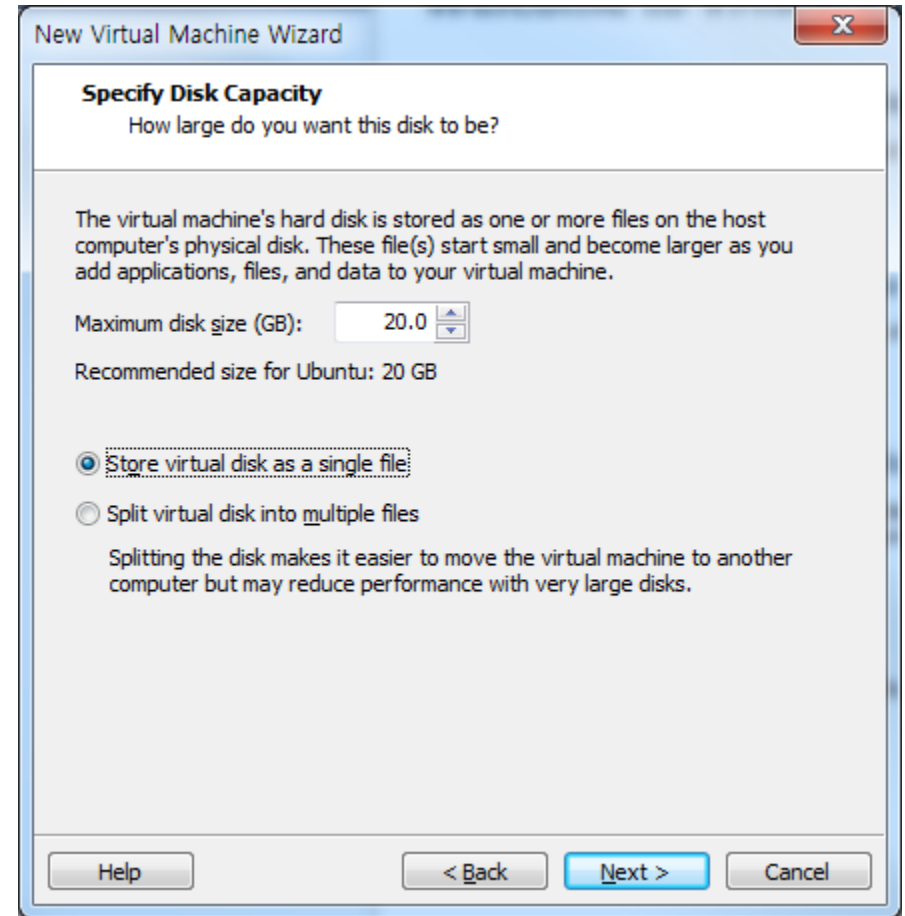
New Virtual Machine Wizard

Name the Virtual Machine
What name would you like to use for this virtual machine?

Virtual machine name:

2012f_sp_Ubuntu

Location:

C:₩Users₩user₩Documents₩Virtual Machines₩2012f_sp_Ub   [Browse...]

[< Back] [Next >] [Cancel]

New Virtual Machine Wizard

Specify Disk Capacity
How large do you want this disk to be?

The virtual machine's hard disk is stored as one or more files on the host computer's physical disk. These file(s) start small and become larger as you add applications, files, and data to your virtual machine.

Maximum disk size (GB):   20.0

Recommended size for Ubuntu: 20 GB

○ Store virtual disk as a single file

○ Split virtual disk into multiple files

Splitting the disk makes it easier to move the virtual machine to another computer but may reduce performance with very large disks.

[Help]   [< Back] [Next >] [Cancel]

Ready to install
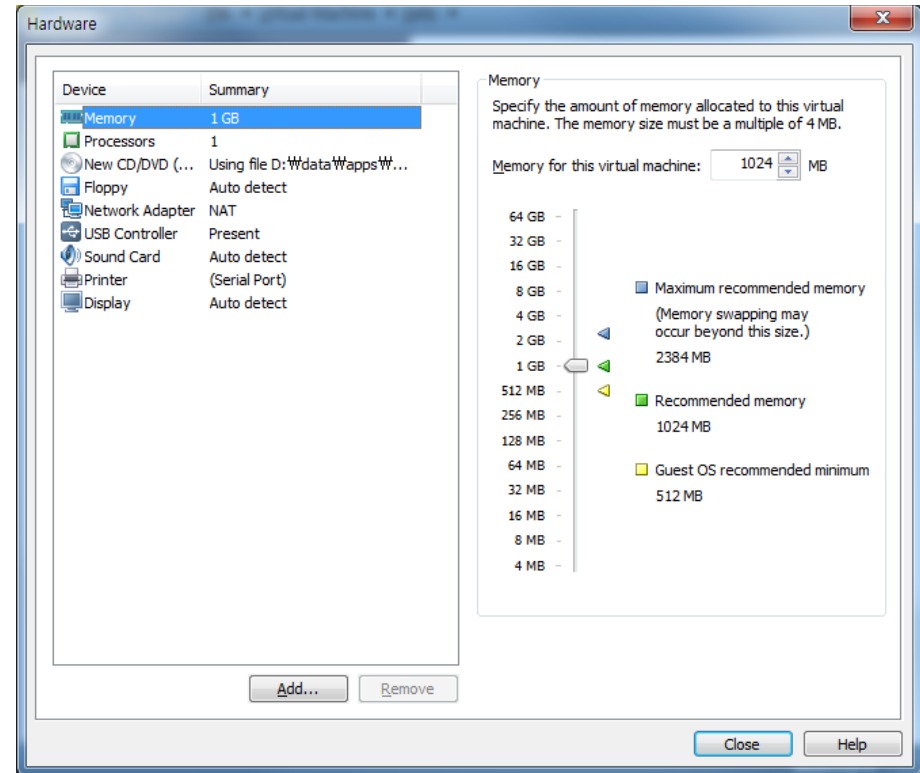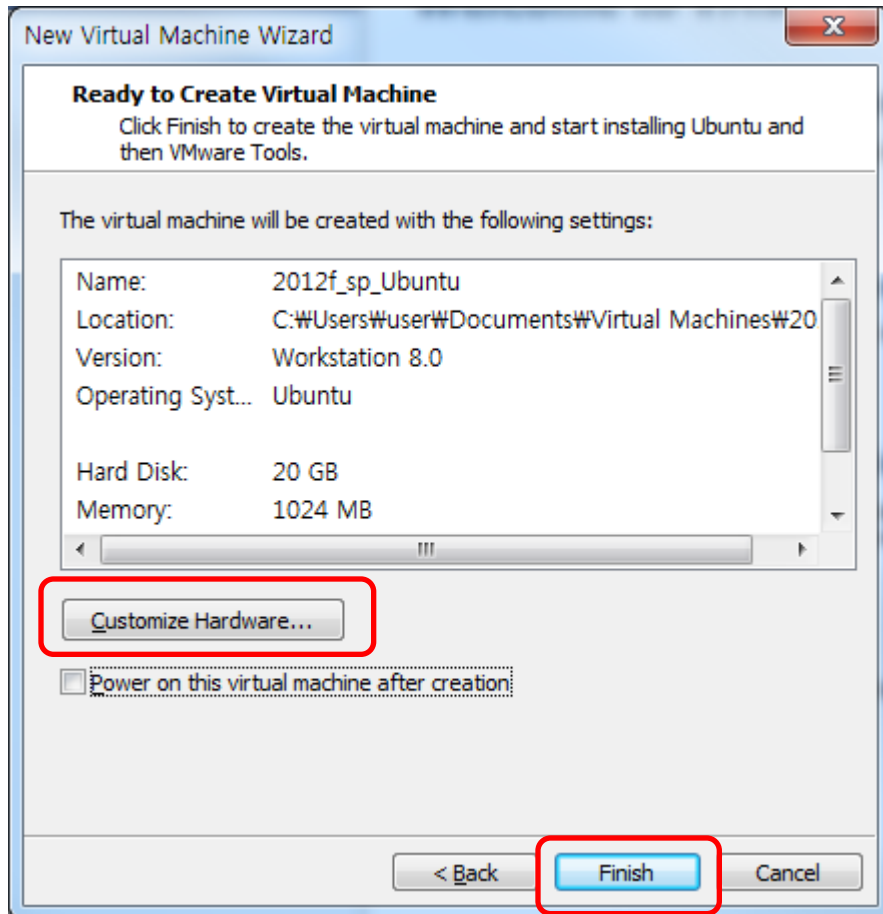
Just look around, currently no need to change

Warning!!：Install VMware tools during installing Ubuntu.

Play virtual machine and Play with Linux
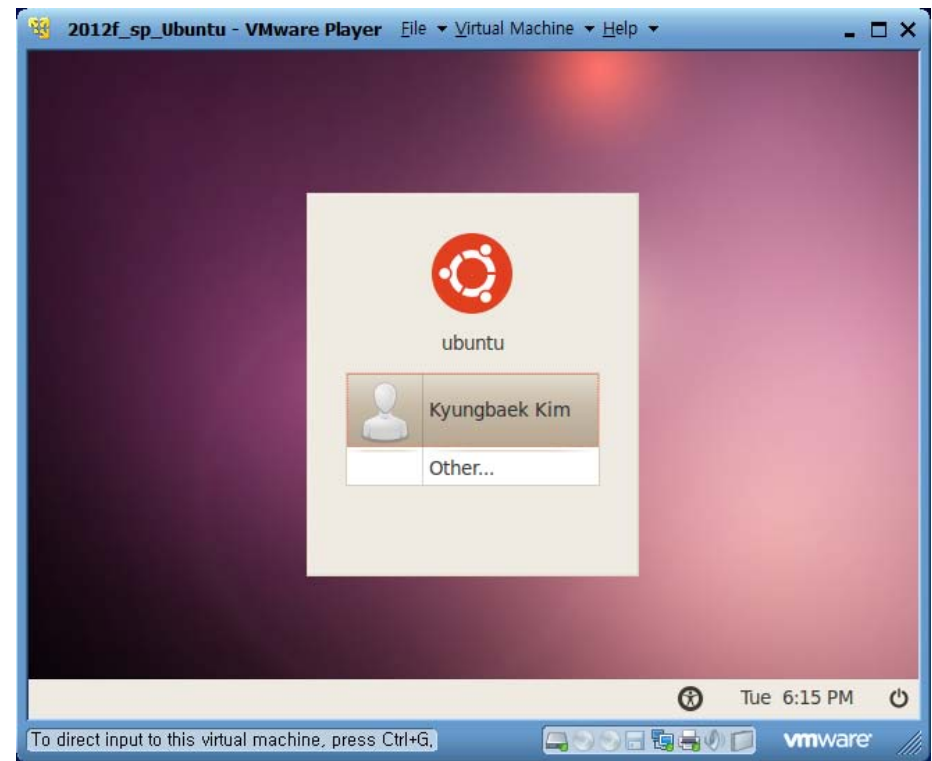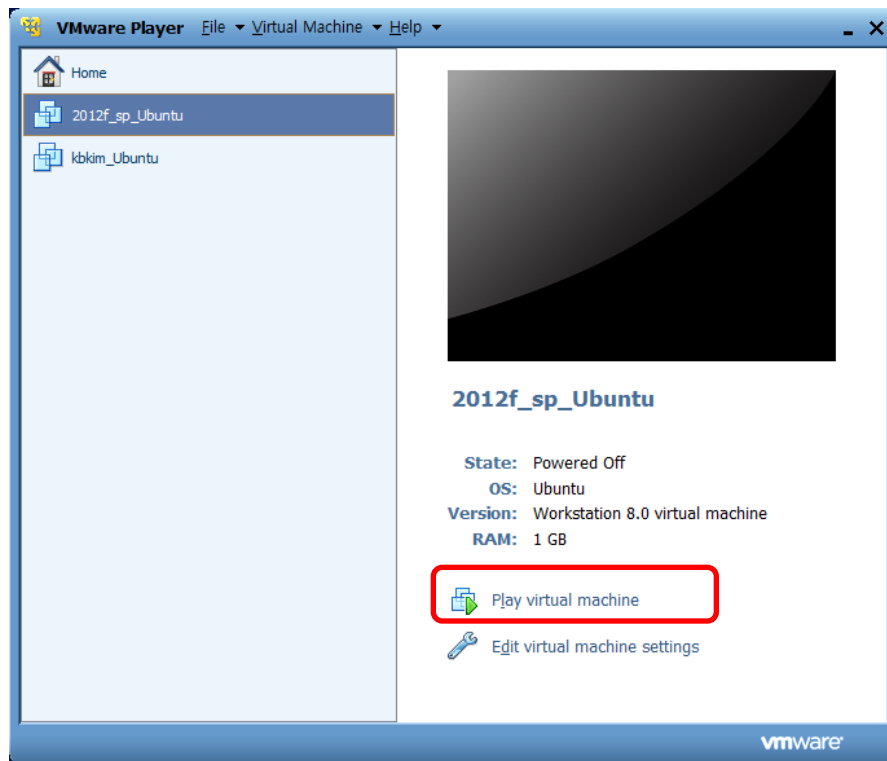
Shared File System
with your real machine

"Virtual Machine" -> "Virtual Machine Settings"
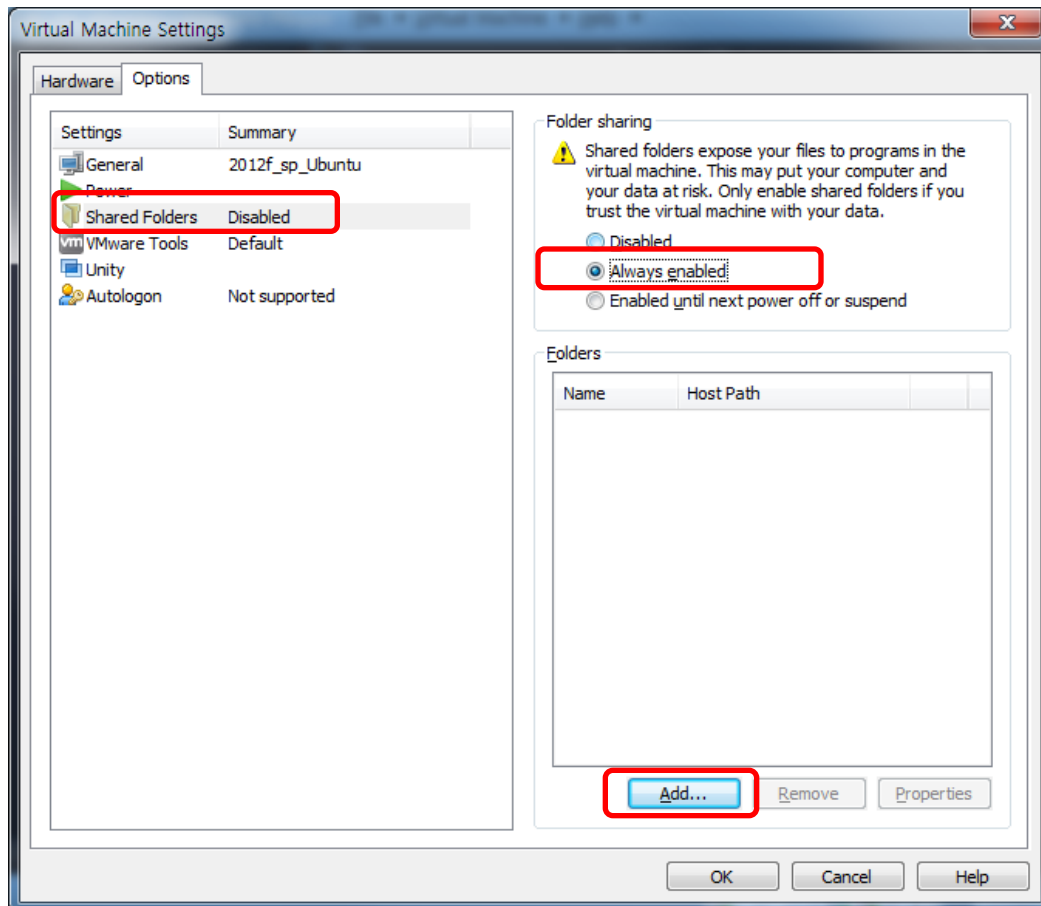
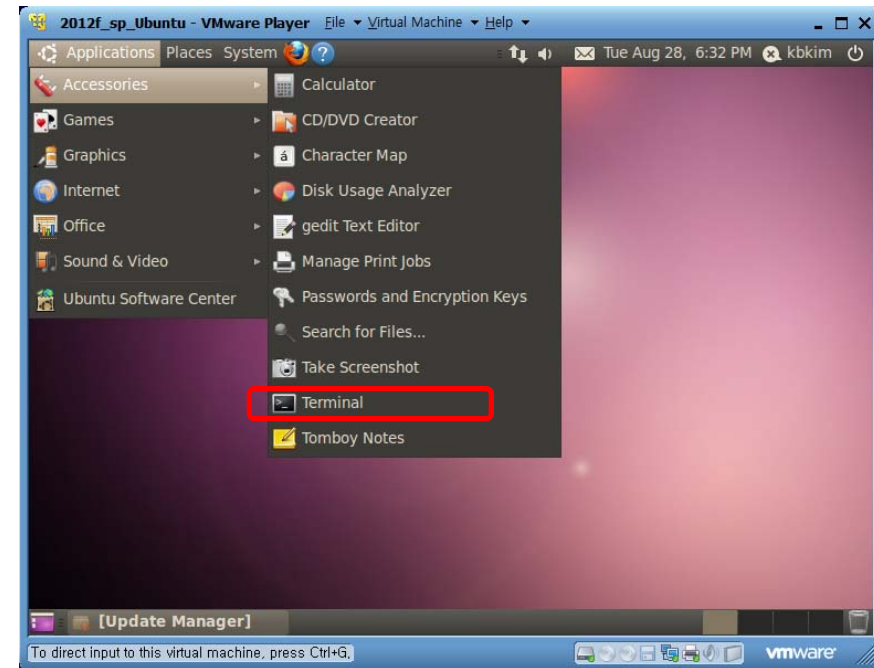# Set up local shared folder

Make a confirm for your shared folder
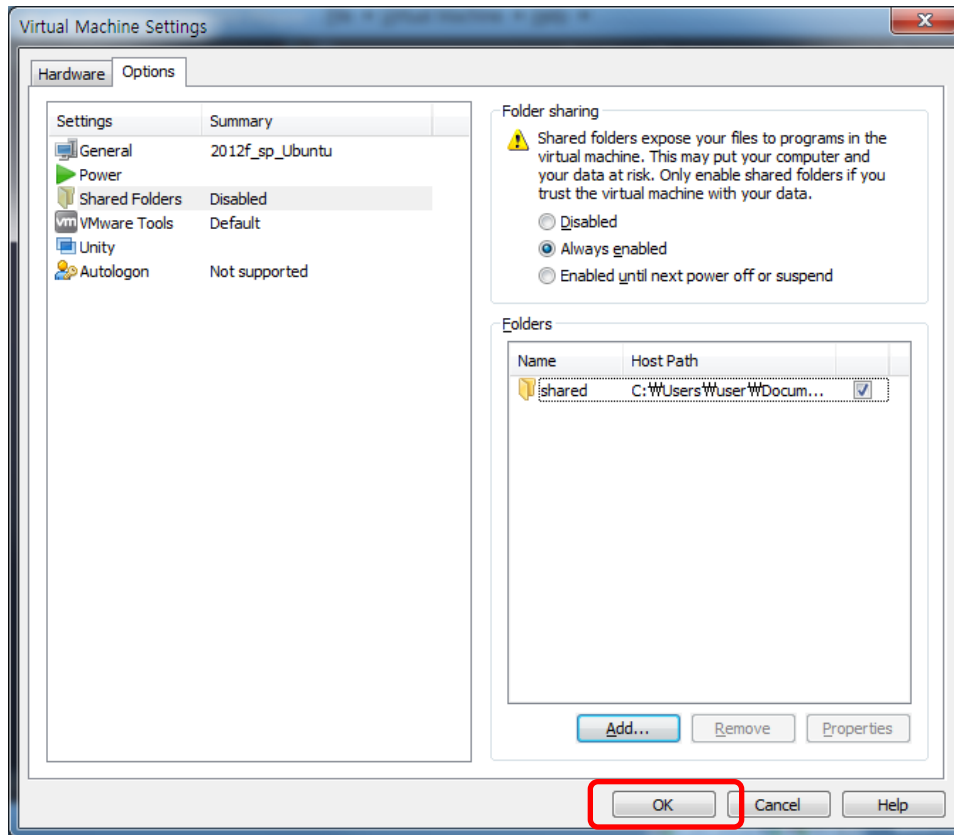
Let's check out the shared folder

Make a Linux file on the shared folder