Introduction of Linux

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PART I

- Brief Introduction
- Basic Conceptions & Environment
- Install & Configure a Virtual Machine
- Basic Commands

PART II

- Shell Script
- Compile & Debug (for C)
- Text Editor (Vim, Sublime text, Atom)

PART I

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History

- 1969 - UNIX
- 1984 - GNU
- 1987 - MINIX
- 1995 - POSIX
- Internet

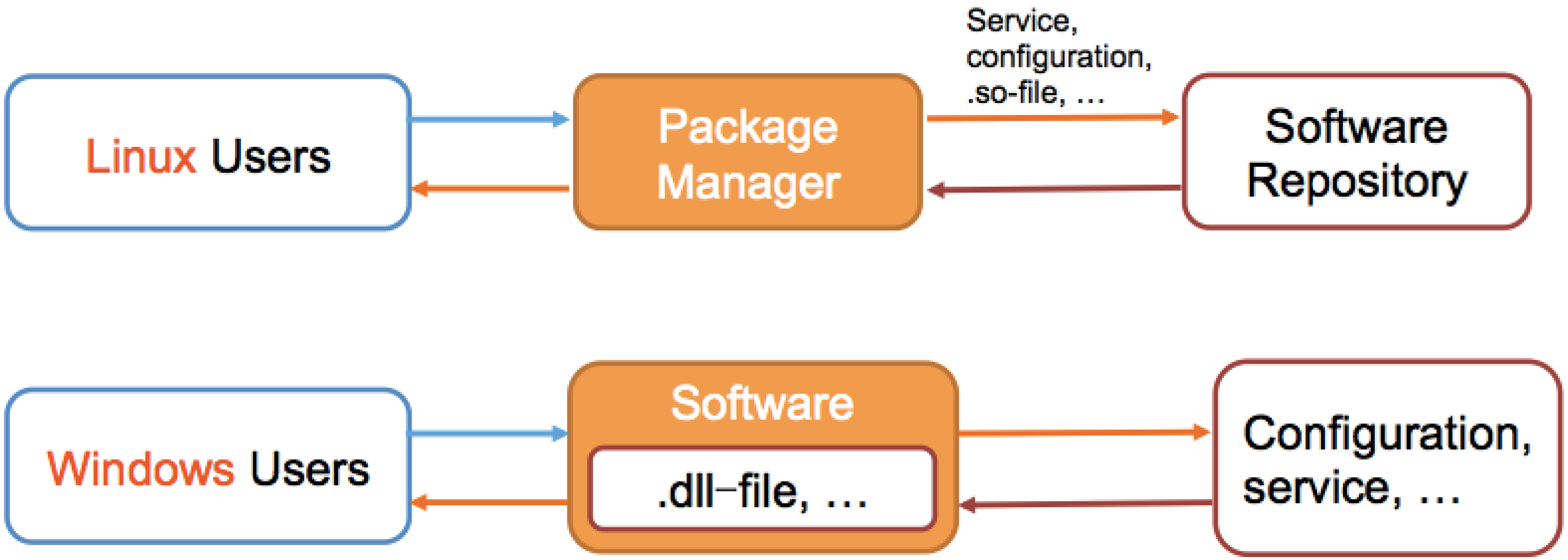
Distribution

- Ubuntu
- Debian
- CentOS
- Arch Linux
- Fedora
- …

Features

- Protable
- Open source
- Security
- Shell
- ...

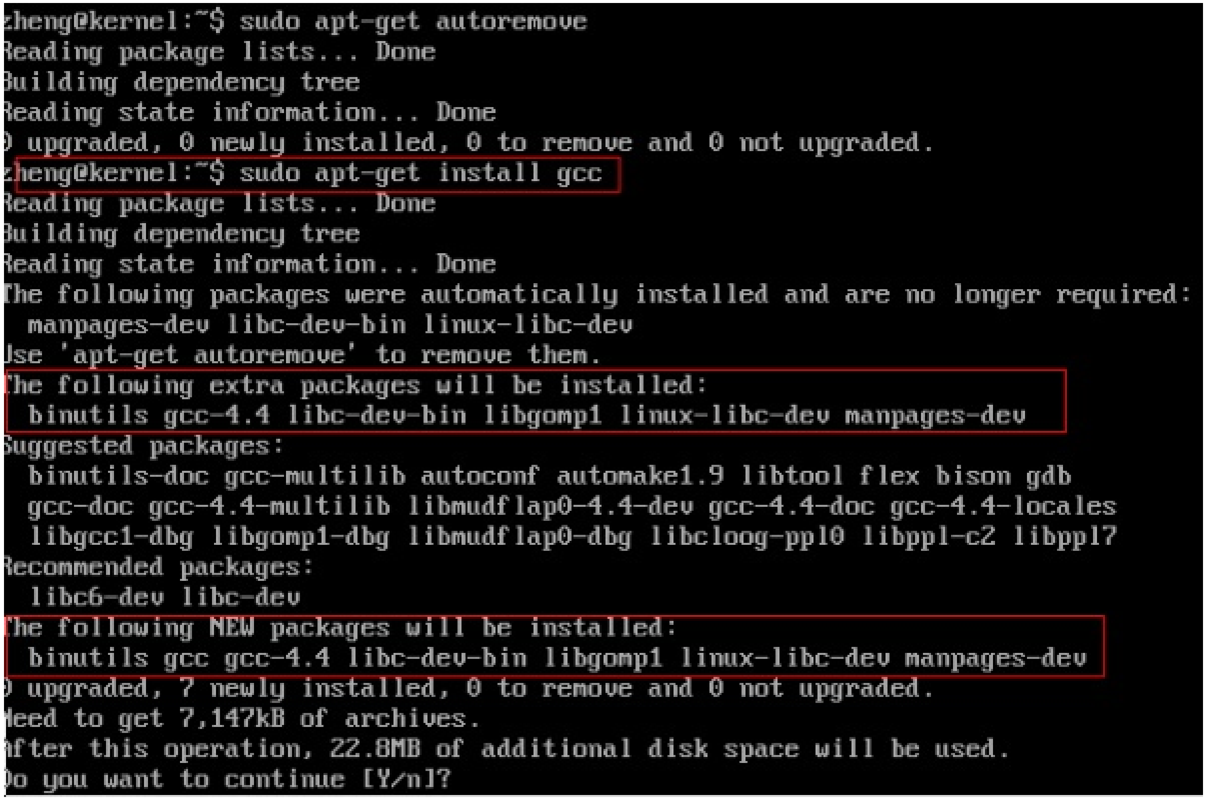
Linux vs Windows Software



Service, configuration, .so-file, …

Linux install software

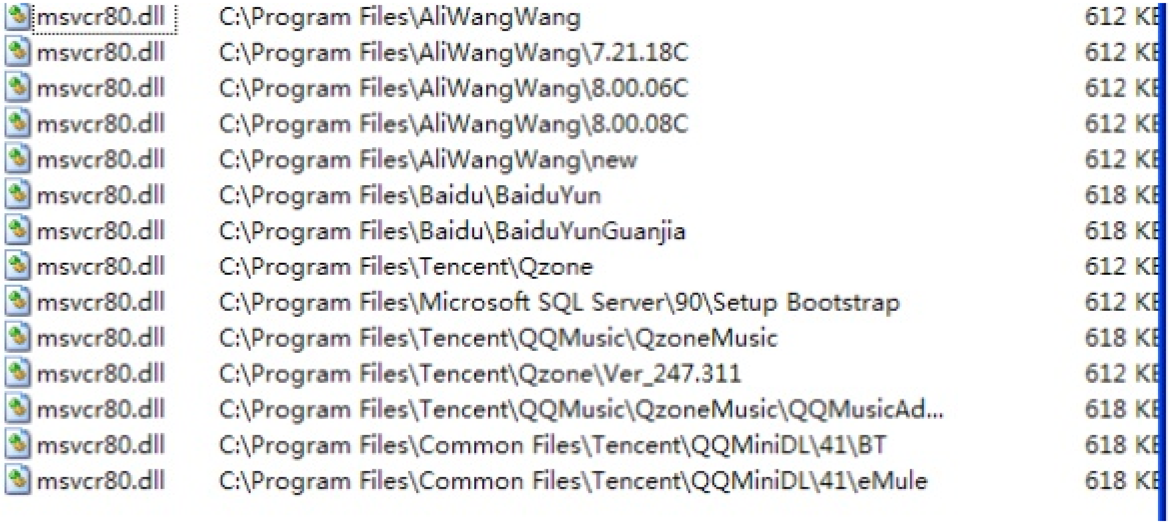
Package Manager： `apt-get` (Advanced Package Tool)



```
zheng@kernel:~$ sudo apt-get autoremove
Reading package lists... Done
Building dependency tree
Reading state information... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
zheng@kernel:~$ sudo apt-get install gcc
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  manpages-dev libc-dev-bin linux-libc-dev
Use 'apt-get autoremove' to remove them.
The following extra packages will be installed:
  binutils gcc-4.4 libc-dev-bin libgomp1 linux-libc-dev manpages-dev
Suggested packages:
  binutils-doc gcc-multilib autoconf automake1.9 libtool flex bison gdb
  gcc-doc gcc-4.4-multilib libmudflap0-4.4-dev gcc-4.4-doc gcc-4.4-locales
  libgcc1-dbg libgomp1-dbg libmudflap0-dbg libcloog-ppl0 libppl-c2 libppl7
Recommended packages:
  libc6-dev libc-dev
The following NEW packages will be installed:
  binutils gcc gcc-4.4 libc-dev-bin libgomp1 linux-libc-dev manpages-dev
0 upgraded, 7 newly installed, 0 to remove and 0 not upgraded.
Need to get 7,147kB of archives.
After this operation, 22.8MB of additional disk space will be used.
Do you want to continue [Y/n]?
```

Windows install software

msvcr80.dll



msvcr80.dll	C:\Program Files\AliWangWang	612 KB
msvcr80.dll	C:\Program Files\AliWangWang\7.21.18C	612 KB
msvcr80.dll	C:\Program Files\AliWangWang\8.00.06C	612 KB
msvcr80.dll	C:\Program Files\AliWangWang\8.00.08C	612 KB
msvcr80.dll	C:\Program Files\AliWangWang\new	612 KB
msvcr80.dll	C:\Program Files\Baidu\BaiduYun	618 KB
msvcr80.dll	C:\Program Files\Baidu\BaiduYunGuanjia	618 KB
msvcr80.dll	C:\Program Files\Tencent\Qzone	612 KB
msvcr80.dll	C:\Program Files\Microsoft SQL Server\90\Setup Bootstrap	612 KB
msvcr80.dll	C:\Program Files\Tencent\QQMusic\QzoneMusic	618 KB
msvcr80.dll	C:\Program Files\Tencent\Qzone\Ver_247.311	612 KB
msvcr80.dll	C:\Program Files\Tencent\QQMusic\QzoneMusic\QQMusicAd...	618 KB
msvcr80.dll	C:\Program Files\Common Files\Tencent\QQMiniDL\41\BT	618 KB
msvcr80.dll	C:\Program Files\Common Files\Tencent\QQMiniDL\41\eMule	618 KB

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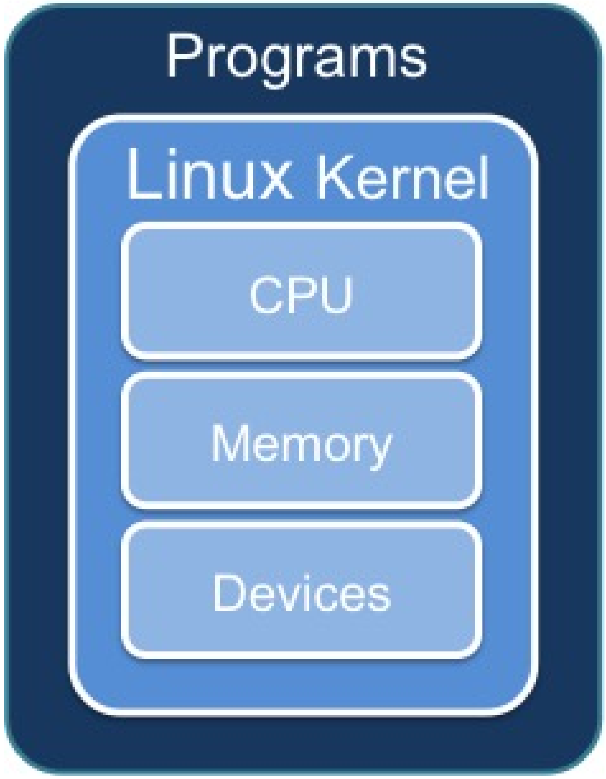
Linux Kernel

The most important component of Linux OS, containing all the operating system's core functions and the device drivers.

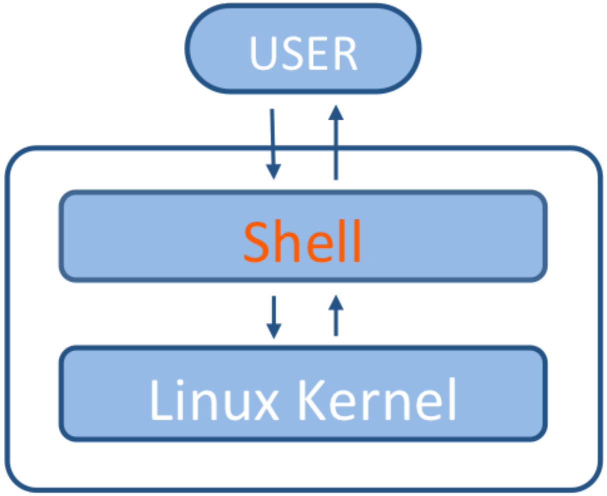
- memory management
- process scheduling
- file system
- ...



Shell (CLI shell)

Command Line Interface

A program which accepts commands as text input and converts commands to appropriate operating system functions.

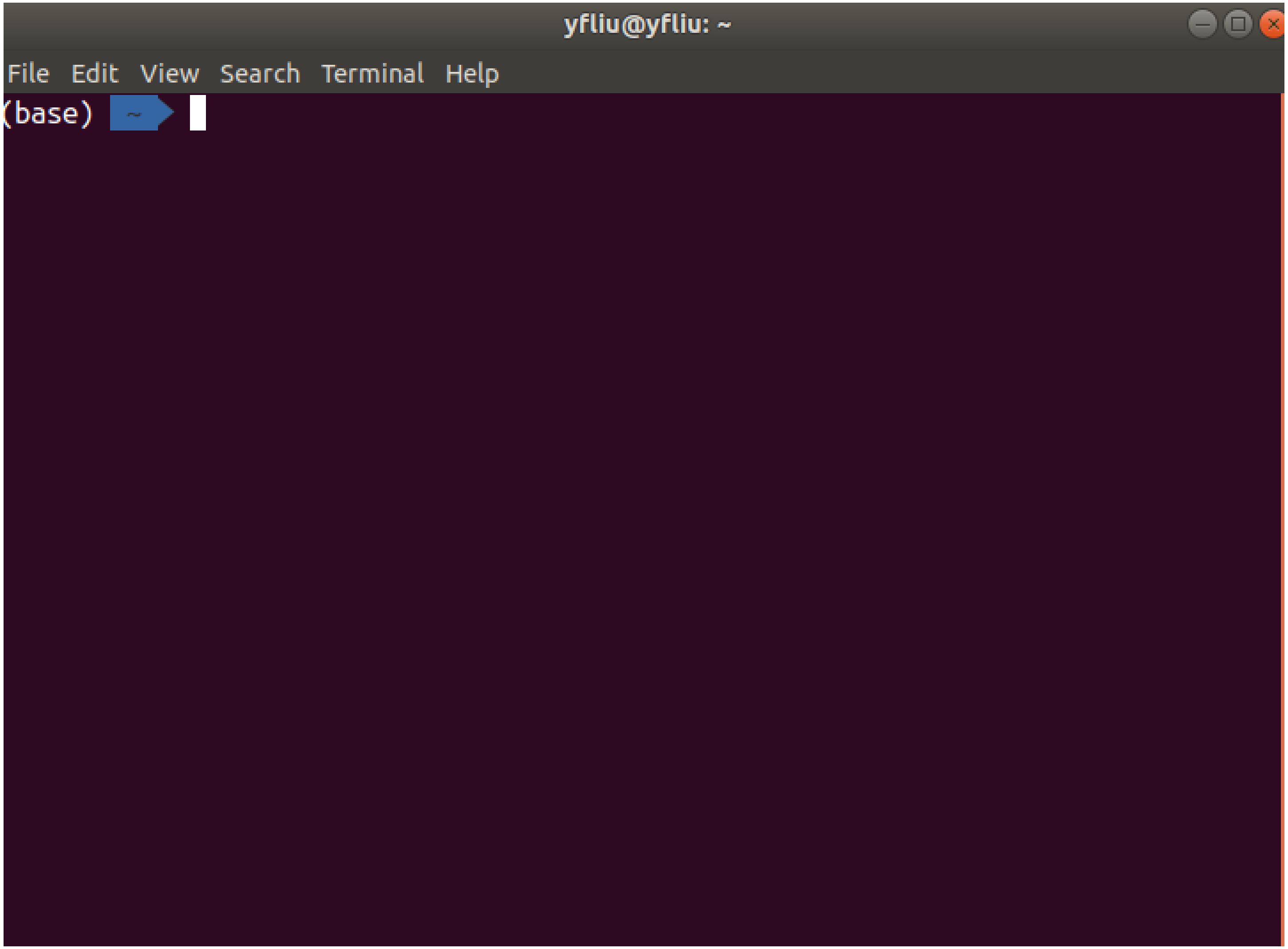


Terminal ⇔ Shell

The terminal send information to the shell, receive and display the information from the shell.

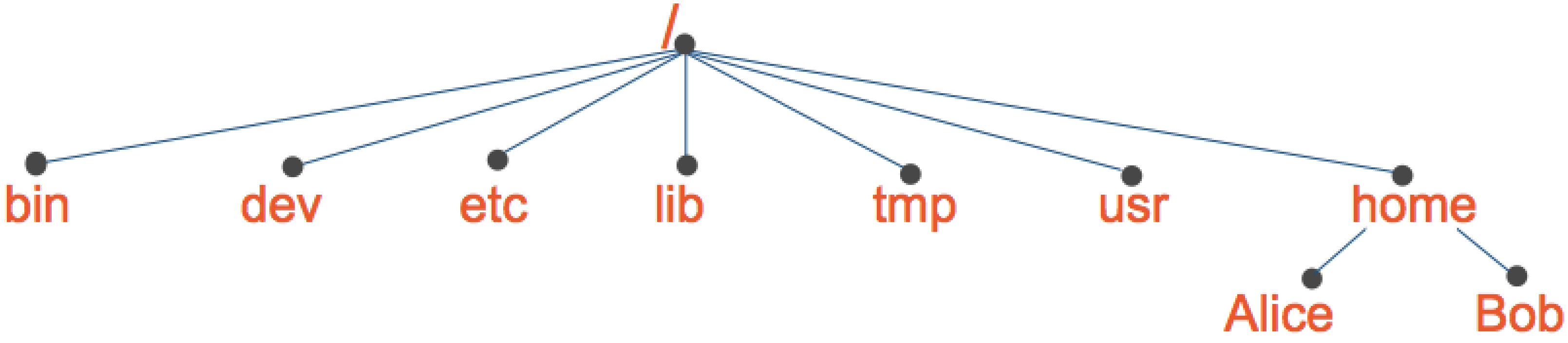
Open Terminal

keyboard accelerators: `CTRL+ALT+T`



```
(base)  ~ 
```

File System



Tree structure, with the root directory “ / ”

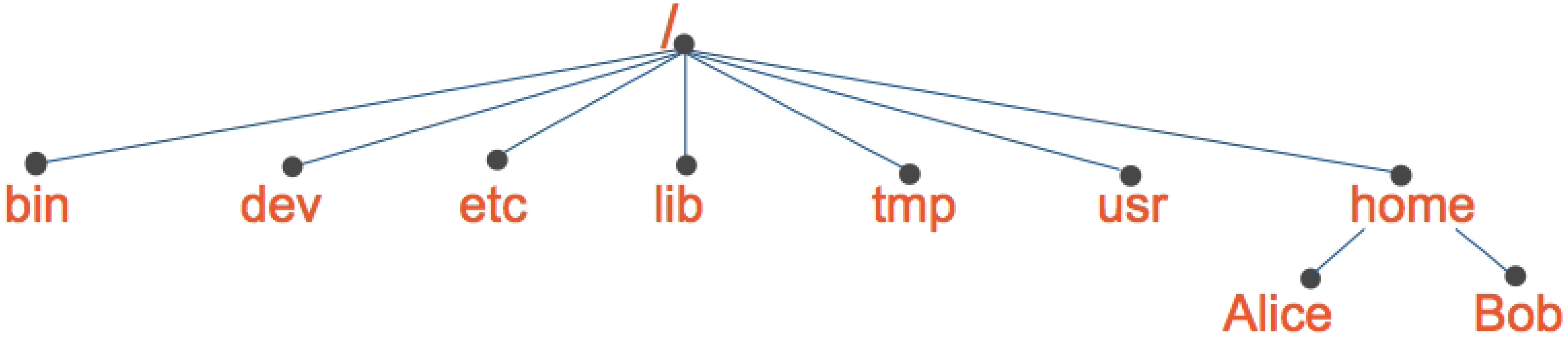
`/home/oslab/...`

`~` = `/home/oslab`

`.`

`..`

File System



`/bin` : essential tools and other programs

`/dev` : files representing the system’s hardware devices

`/etc` : system configuration files

`/home` : the home directory for all system’s users

`/lib` : essential system library files

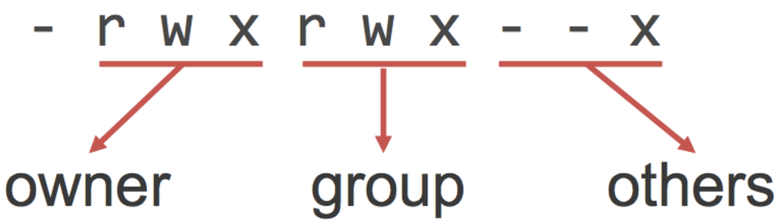
`/proc` : files that give information about current system

`/usr` : files related to user tools and applications

User & Group

The system determines whether or not a user or group can access a file or directory.
There is a special user called Super User or the root which has permission to access any file and directory.
Three Permissions:

- `r` = read
- `w` = write
- `x` = execute



Environment Variables

Environment variables are a set of values that can affect the way running processes will behave on a computer.

- `PATH` -- Contains a colon-separated list of directories that the shell searches for commands that do not contain a slash in their name.
- `HOME` -- Contains the location of the user's home directory.
- ...

Set The Environment Variables:

```
export VARIABLE = value    # temporary
/etc/profile               # permanent, all users

~/.profile                 # permanent, one user
~/.bashrc
```

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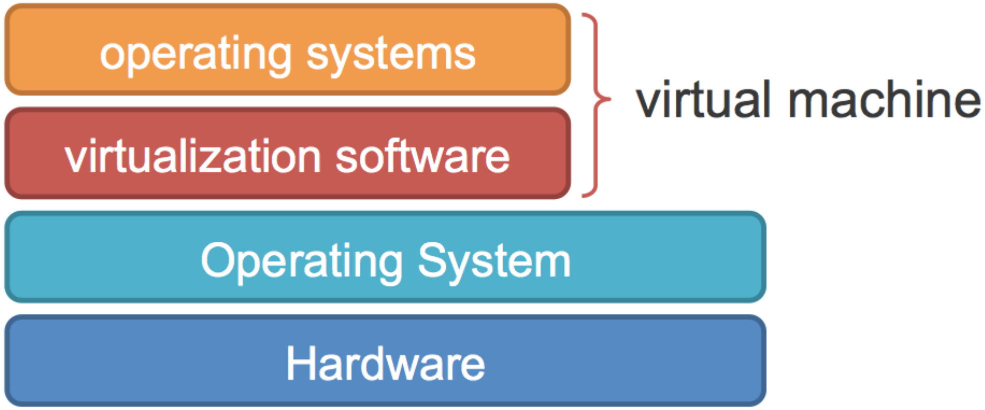
Virtual Machine

A virtual machine is an emulation of a particular computer system.



Virtualization Software provide (hardware) resources virtually to the new OS.

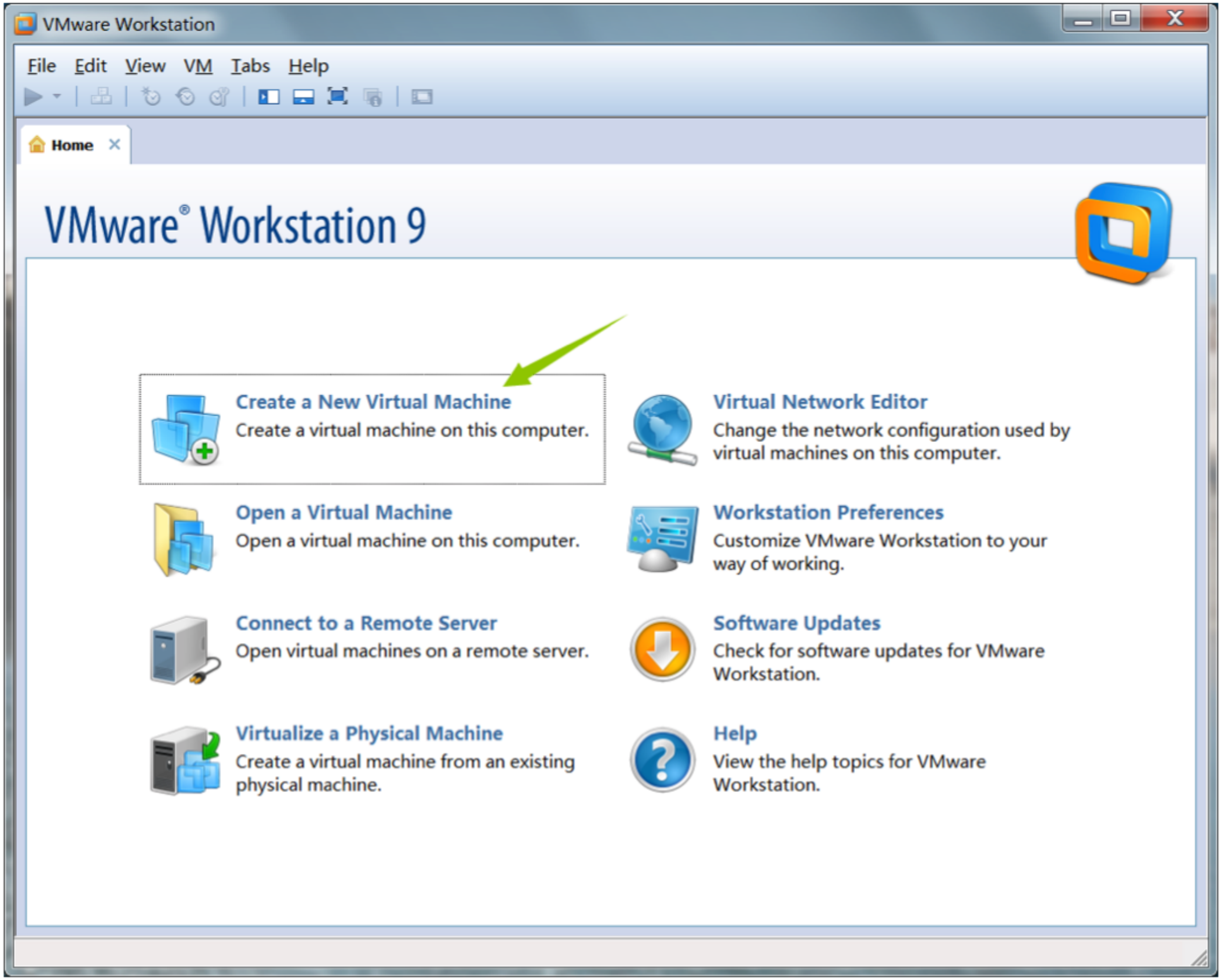
- VMware
- Virtual Box
- Virtual PC

Install the Virtual Machine

VMware Workstation 9.0 + Ubuntu 14.04 LTS (kernel 3.19)

1. Download the Setup File of Vmware 9.0
2. Download the Ubuntu Ubuntu 14.04 LTS from the official website www.ubuntu.com/download/desktop
3. Install VMware 9.0
4. Create a Virtual Machine in the VMware

Create a Virtual Machine



Create a New Virtual Machine
Create a virtual machine on this computer.

Virtual Network Editor
Change the network configuration used by virtual machines on this computer.

Open a Virtual Machine
Open a virtual machine on this computer.

Workstation Preferences
Customize VMware Workstation to your way of working.

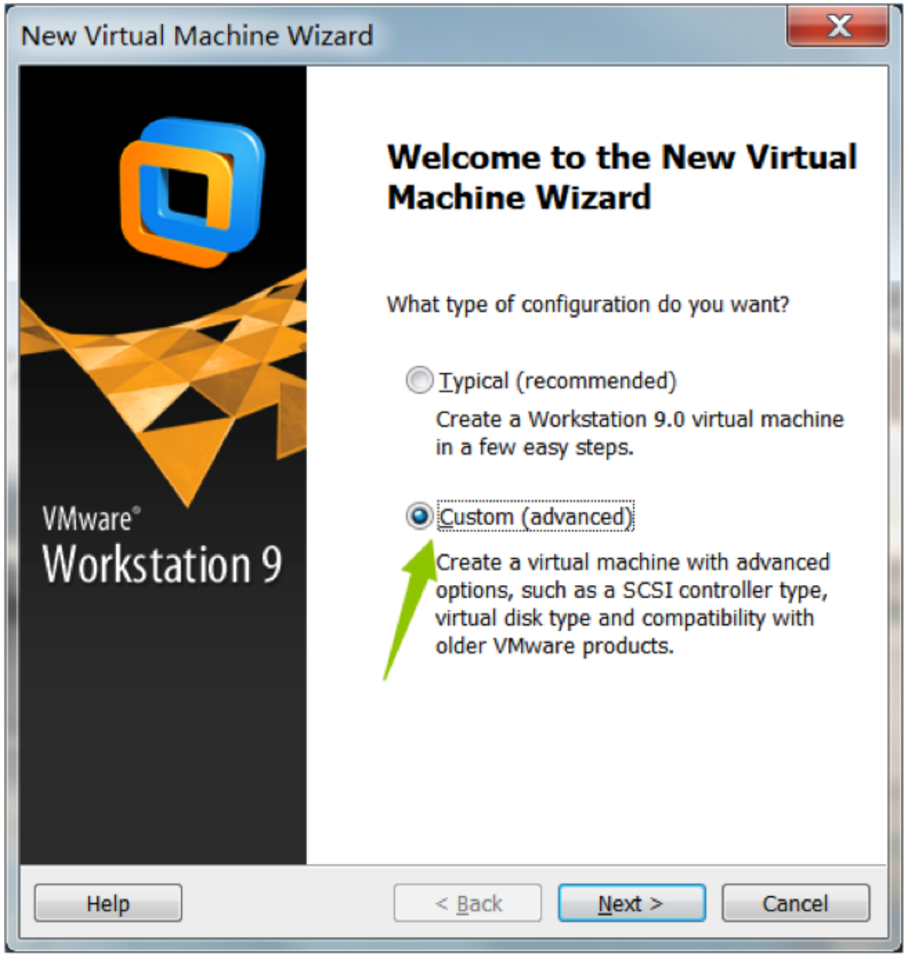
Connect to a Remote Server
Open virtual machines on a remote server.

Software Updates
Check for software updates for VMware Workstation.

Virtualize a Physical Machine
Create a virtual machine from an existing physical machine.

Help
View the help topics for VMware Workstation.

Create a Virtual Machine



New Virtual Machine Wizard

Welcome to the New Virtual Machine Wizard

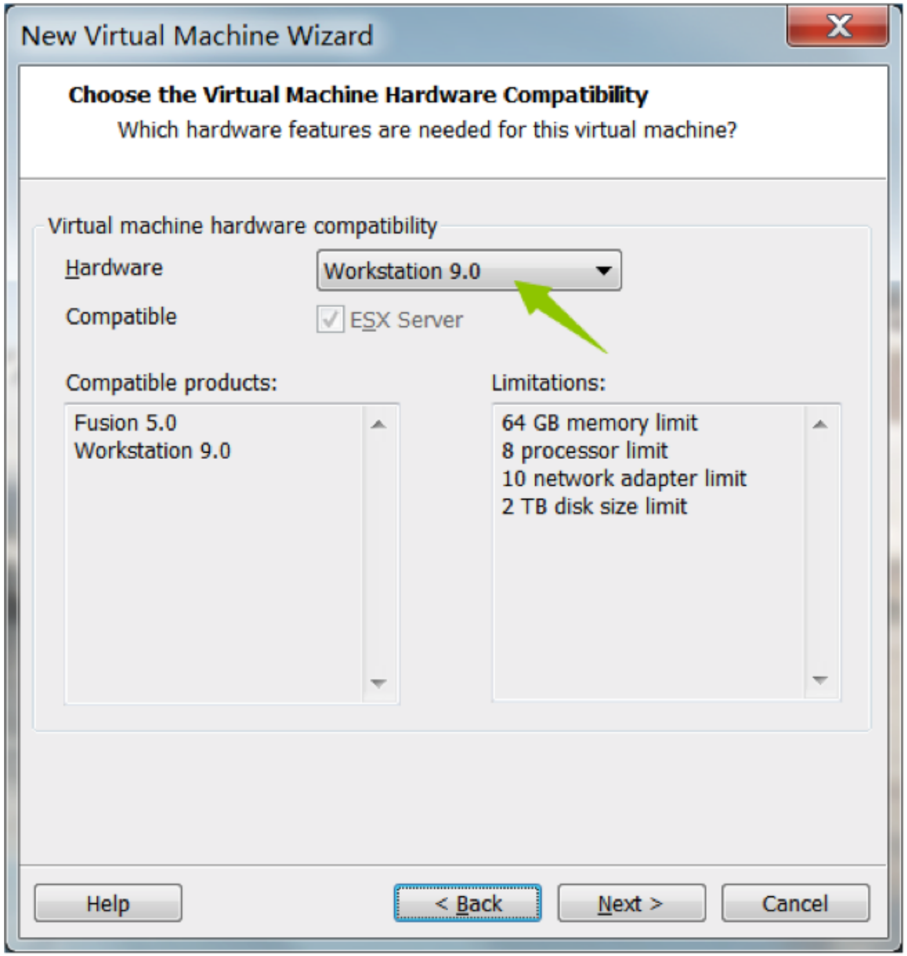
What type of configuration do you want?

○ Typical (recommended)

Create a Workstation 9.0 virtual machine in a few easy steps.

● Custom (advanced)

Create a virtual machine with advanced options, such as a SCSI controller type, virtual disk type and compatibility with older VMware products.



New Virtual Machine Wizard

Choose the Virtual Machine Hardware Compatibility

Which hardware features are needed for this virtual machine?

Virtual machine hardware compatibility

Hardware: Workstation 9.0

Compatible: ☑ ESX Server

Compatible products:

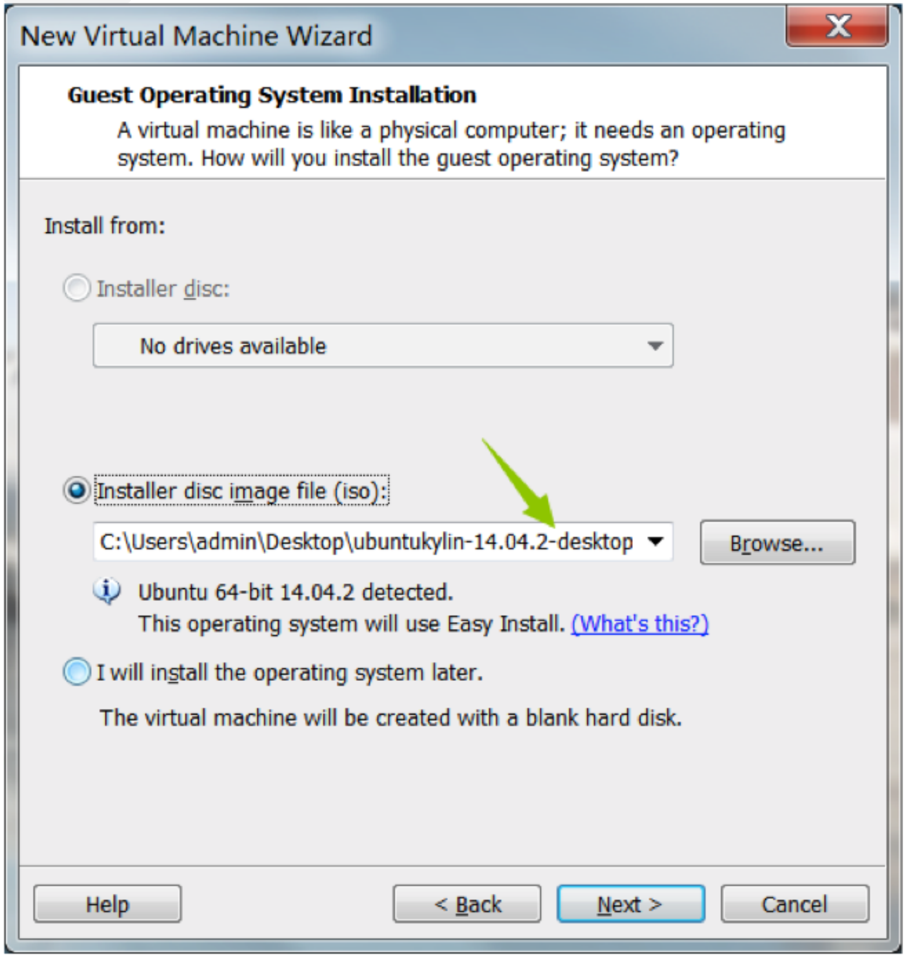
Fusion 5.0
Workstation 9.0

Limitations:

64 GB memory limit
8 processor limit
10 network adapter limit
2 TB disk size limit

Create a Virtual Machine

In the computers in our computer room, our `.iso-file` lies on path `E:/` of the system.



New Virtual Machine Wizard

Guest Operating System Installation

A virtual machine is like a physical computer; it needs an operating system. How will you install the guest operating system?

Install from:

○ Installer disc:

No drives available

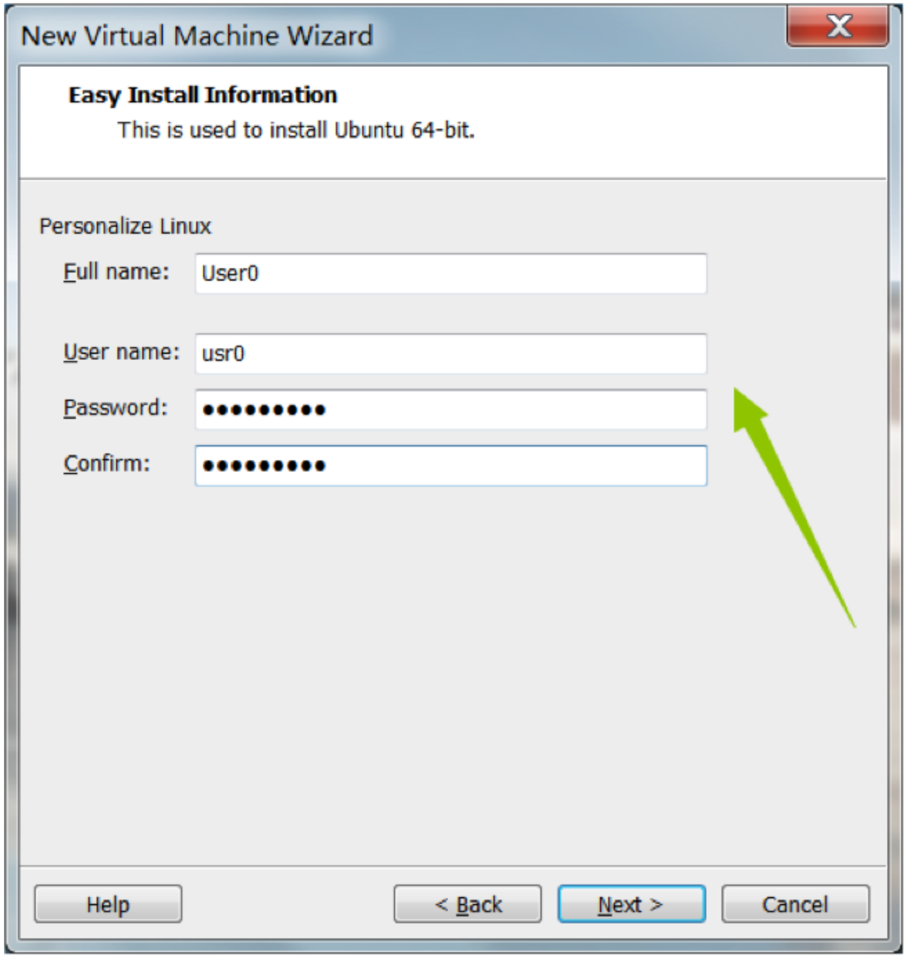
● Installer disc image file (iso):

C:\Users\admin\Desktop\ubuntukylin-14.04.2-desktop

Ubuntu 64-bit 14.04.2 detected.
This operating system will use Easy Install. (What's this?)

○ I will install the operating system later.

The virtual machine will be created with a blank hard disk.



New Virtual Machine Wizard

Easy Install Information

This is used to install Ubuntu 64-bit.

Personalize Linux

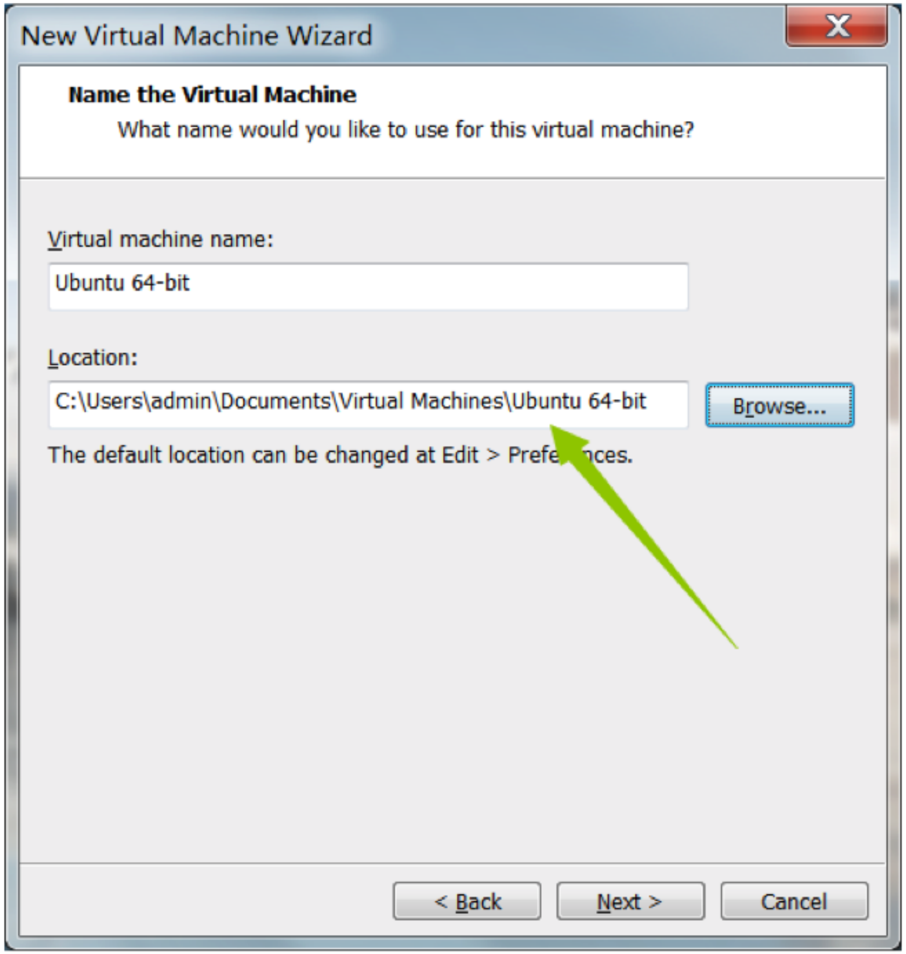
Full name: User0

User name: usr0

Password: ●●●●●●●●●

Confirm: ●●●●●●●●●

Create a Virtual Machine



New Virtual Machine Wizard

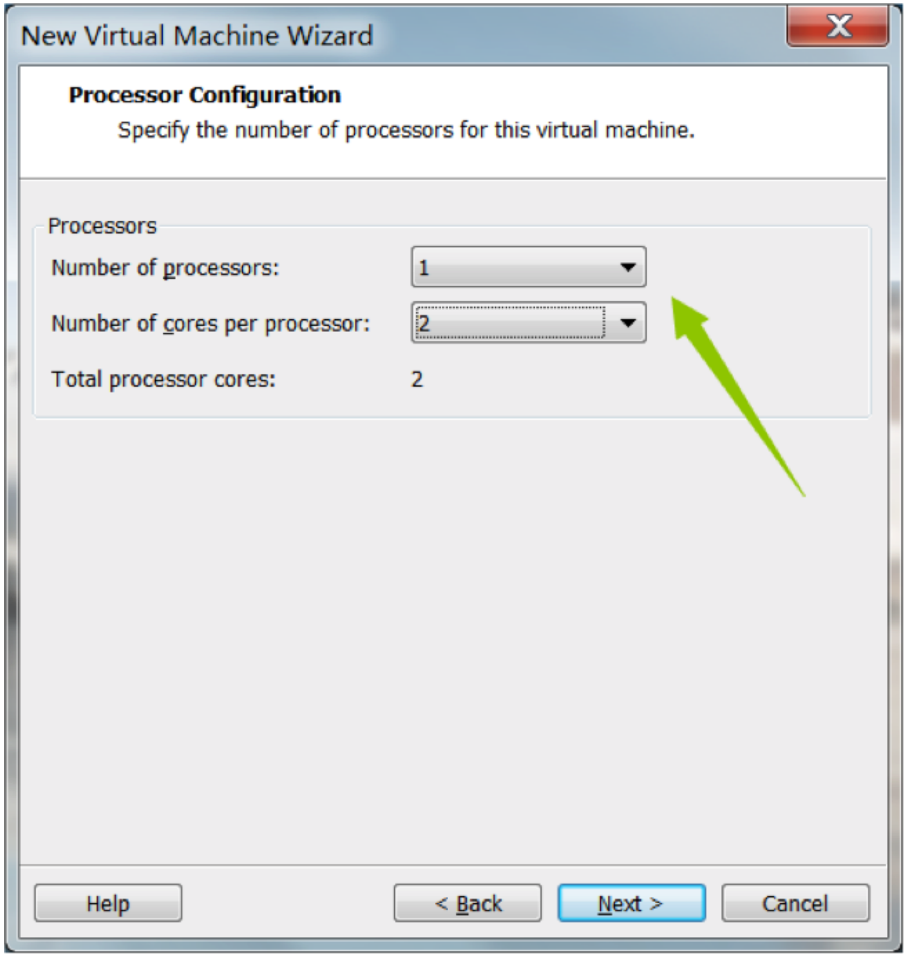
Name the Virtual Machine

What name would you like to use for this virtual machine?

Virtual machine name: Ubuntu 64-bit

Location: C:\Users\admin\Documents\Virtual Machines\Ubuntu 64-bit

The default location can be changed at Edit > Preferences.



New Virtual Machine Wizard

Processor Configuration

Specify the number of processors for this virtual machine.

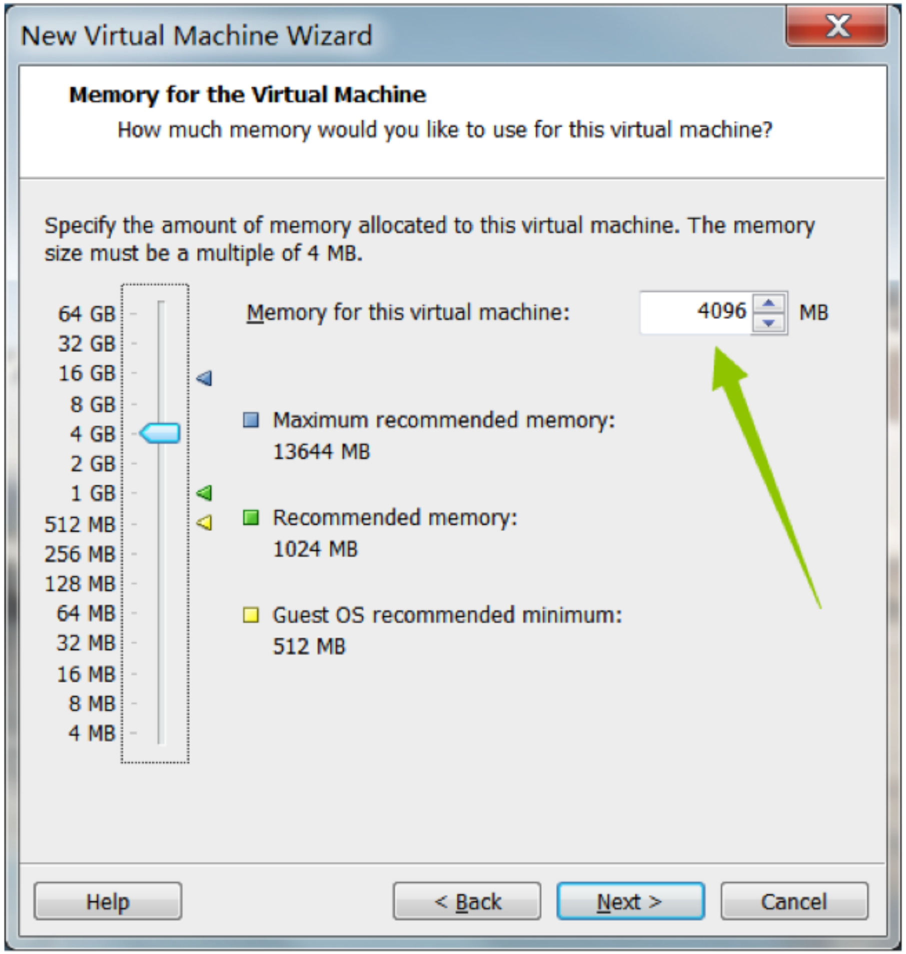
Processors

Number of processors: 1

Number of cores per processor: 2

Total processor cores: 2

Create a Virtual Machine



Memory for the Virtual Machine

How much memory would you like to use for this virtual machine?

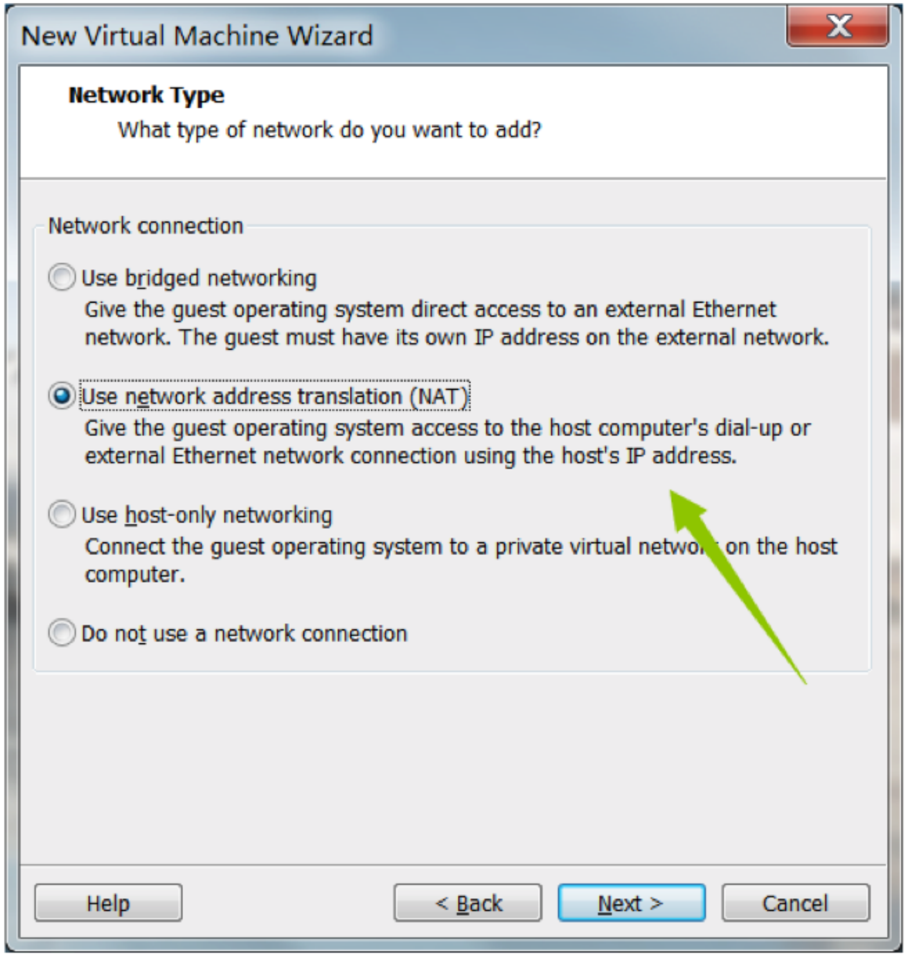
Specify the amount of memory allocated to this virtual machine. The memory size must be a multiple of 4 MB.

Memory for this virtual machine: 4096 MB

■ Maximum recommended memory: 13644 MB

■ Recommended memory: 1024 MB

□ Guest OS recommended minimum: 512 MB



Network Type

What type of network do you want to add?

Network connection

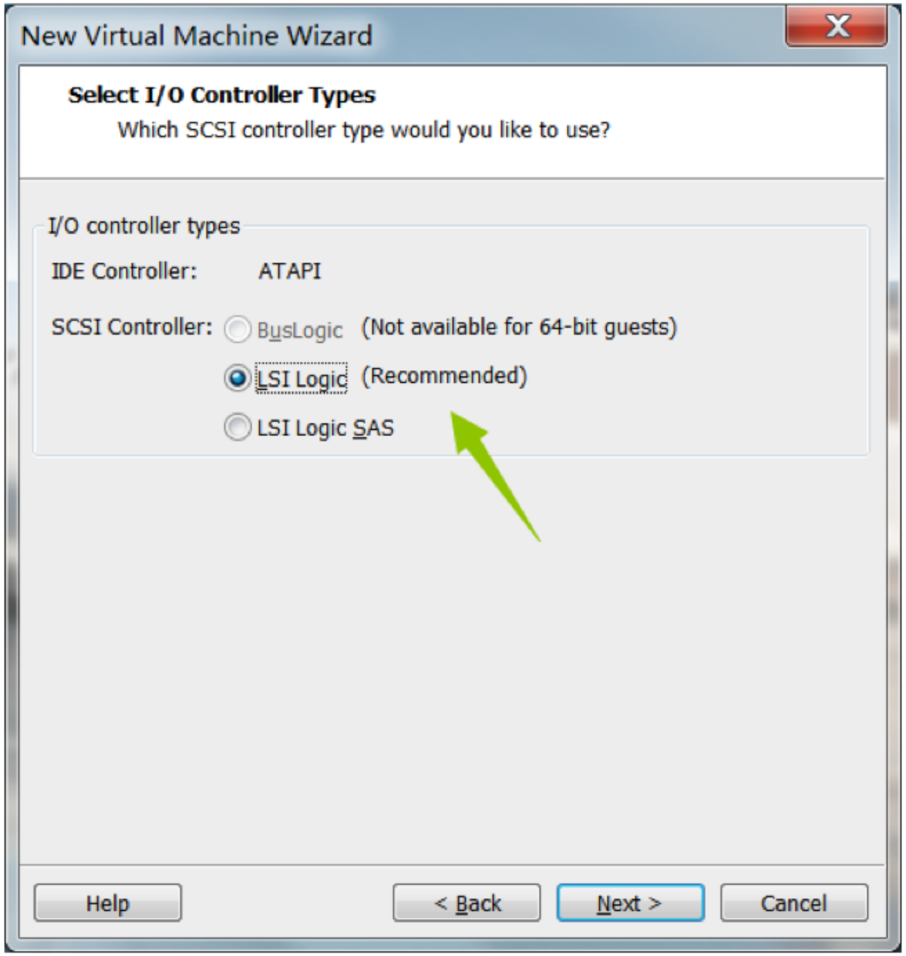
○ Use bridged networking
Give the guest operating system direct access to an external Ethernet network. The guest must have its own IP address on the external network.

● Use network address translation (NAT)
Give the guest operating system access to the host computer's dial-up or external Ethernet network connection using the host's IP address.

○ Use host-only networking
Connect the guest operating system to a private virtual network on the host computer.

○ Do not use a network connection

Create a Virtual Machine



New Virtual Machine Wizard

Select I/O Controller Types

Which SCSI controller type would you like to use?

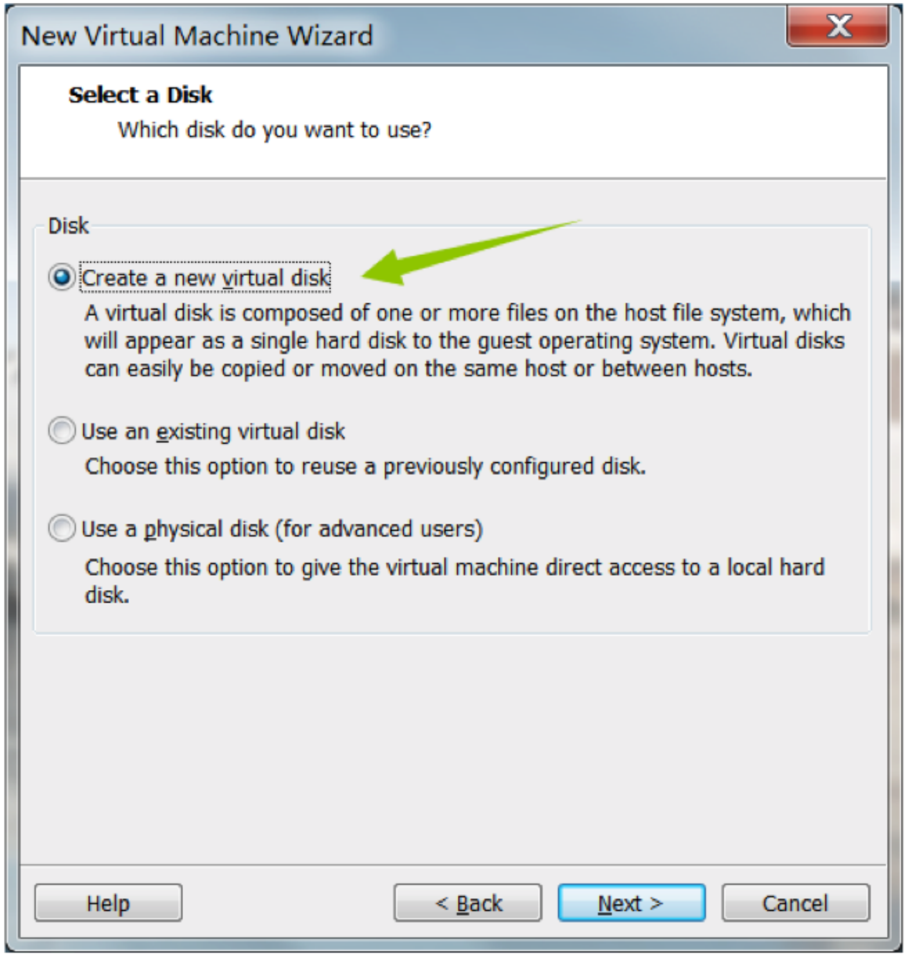
I/O controller types

IDE Controller: ATAPI

SCSI Controller: ○ BusLogic (Not available for 64-bit guests)

● LSI Logic (Recommended)

○ LSI Logic SAS



New Virtual Machine Wizard

Select a Disk

Which disk do you want to use?

Disk

● Create a new virtual disk

A virtual disk is composed of one or more files on the host file system, which will appear as a single hard disk to the guest operating system. Virtual disks can easily be copied or moved on the same host or between hosts.

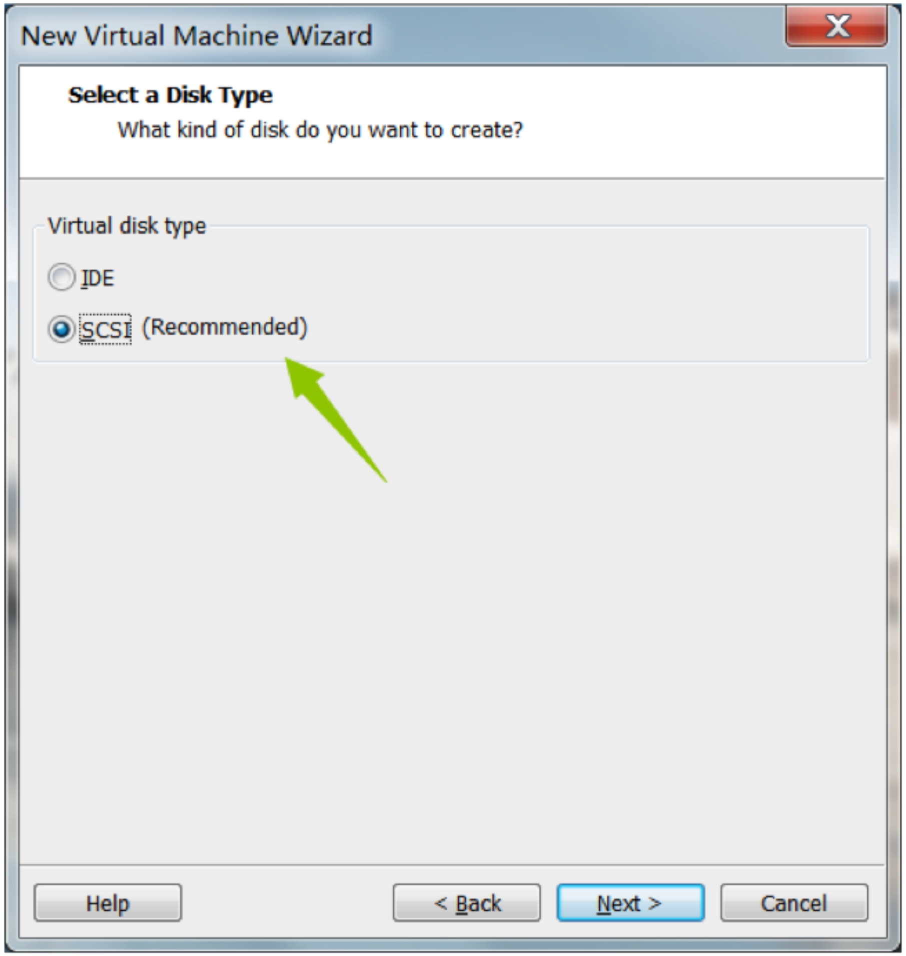
○ Use an existing virtual disk

Choose this option to reuse a previously configured disk.

○ Use a physical disk (for advanced users)

Choose this option to give the virtual machine direct access to a local hard disk.

Create a Virtual Machine



New Virtual Machine Wizard

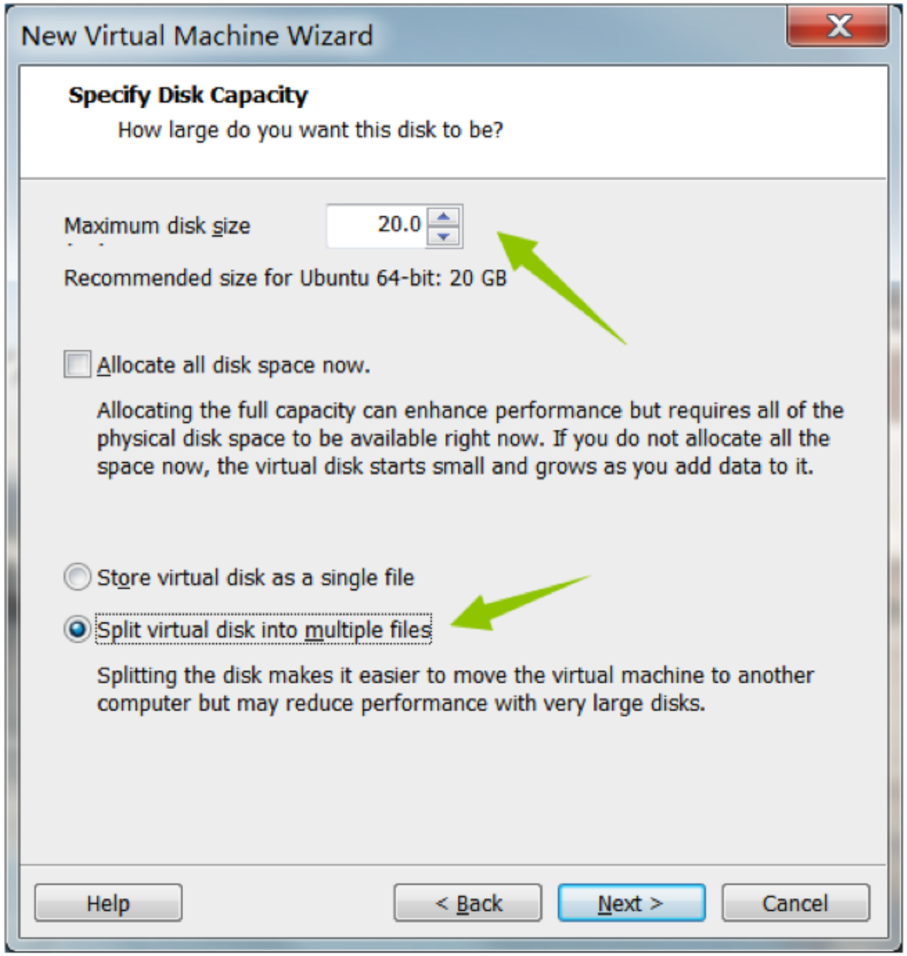
Select a Disk Type

What kind of disk do you want to create?

Virtual disk type

○ IDE

● SCSI (Recommended)



New Virtual Machine Wizard

Specify Disk Capacity

How large do you want this disk to be?

Maximum disk size 20.0

Recommended size for Ubuntu 64-bit: 20 GB

□ Allocate all disk space now.

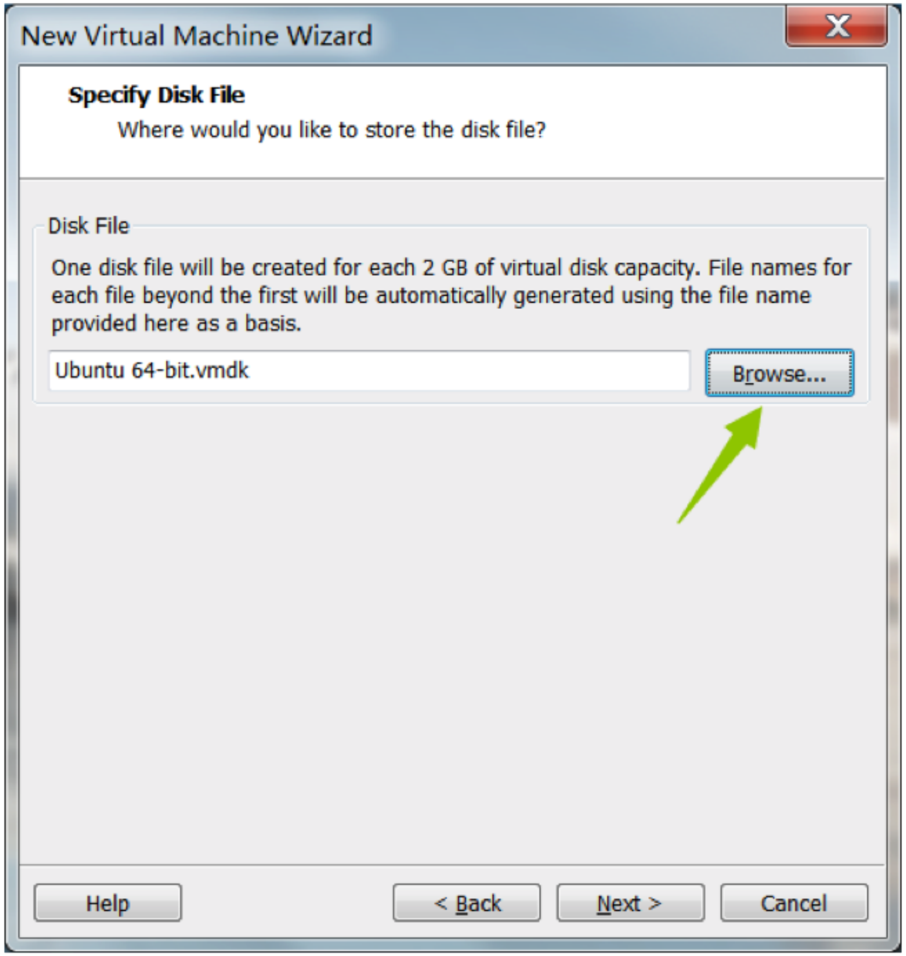
Allocating the full capacity can enhance performance but requires all of the physical disk space to be available right now. If you do not allocate all the space now, the virtual disk starts small and grows as you add data to it.

○ 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.

Create a Virtual Machine



New Virtual Machine Wizard

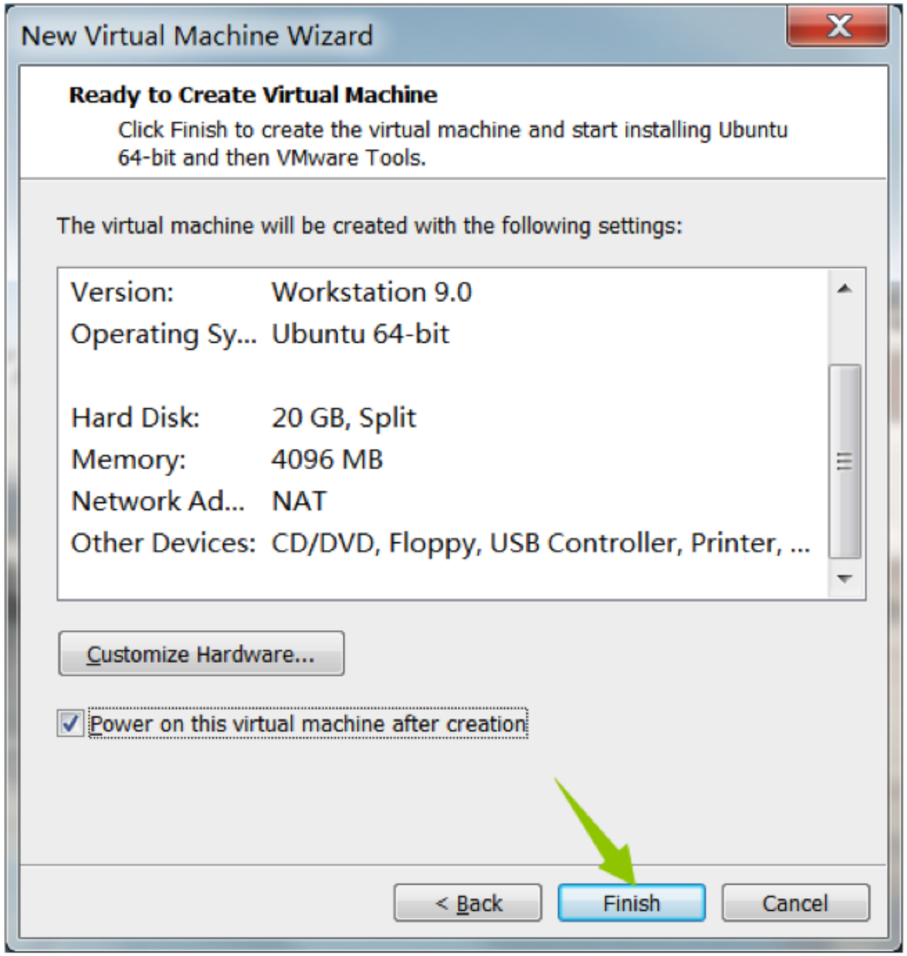
Specify Disk File

Where would you like to store the disk file?

Disk File

One disk file will be created for each 2 GB of virtual disk capacity. File names for each file beyond the first will be automatically generated using the file name provided here as a basis.

Ubuntu 64-bit.vmdk



New Virtual Machine Wizard

Ready to Create Virtual Machine

Click Finish to create the virtual machine and start installing Ubuntu 64-bit and then VMware Tools.

The virtual machine will be created with the following settings:

Version:	Workstation 9.0
Operating Sy...	Ubuntu 64-bit
Hard Disk:	20 GB, Split
Memory:	4096 MB
Network Ad...	NAT
Other Devices:	CD/DVD, Floppy, USB Controller, Printer, ...

☑ Power on this virtual machine after creation

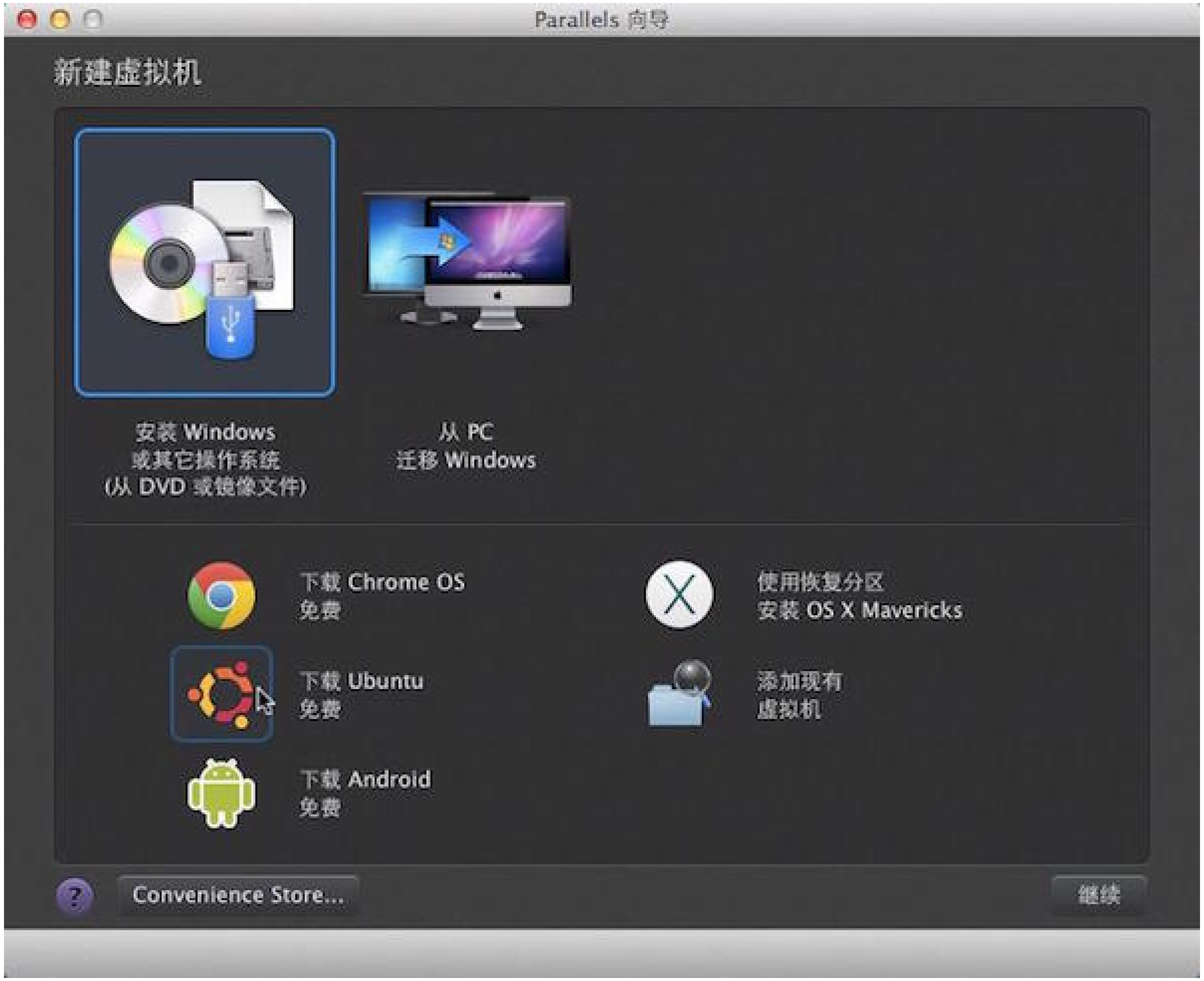
Create a Virtual Machine (Mac)

Mac Virtual Machine -- Parallels desktop

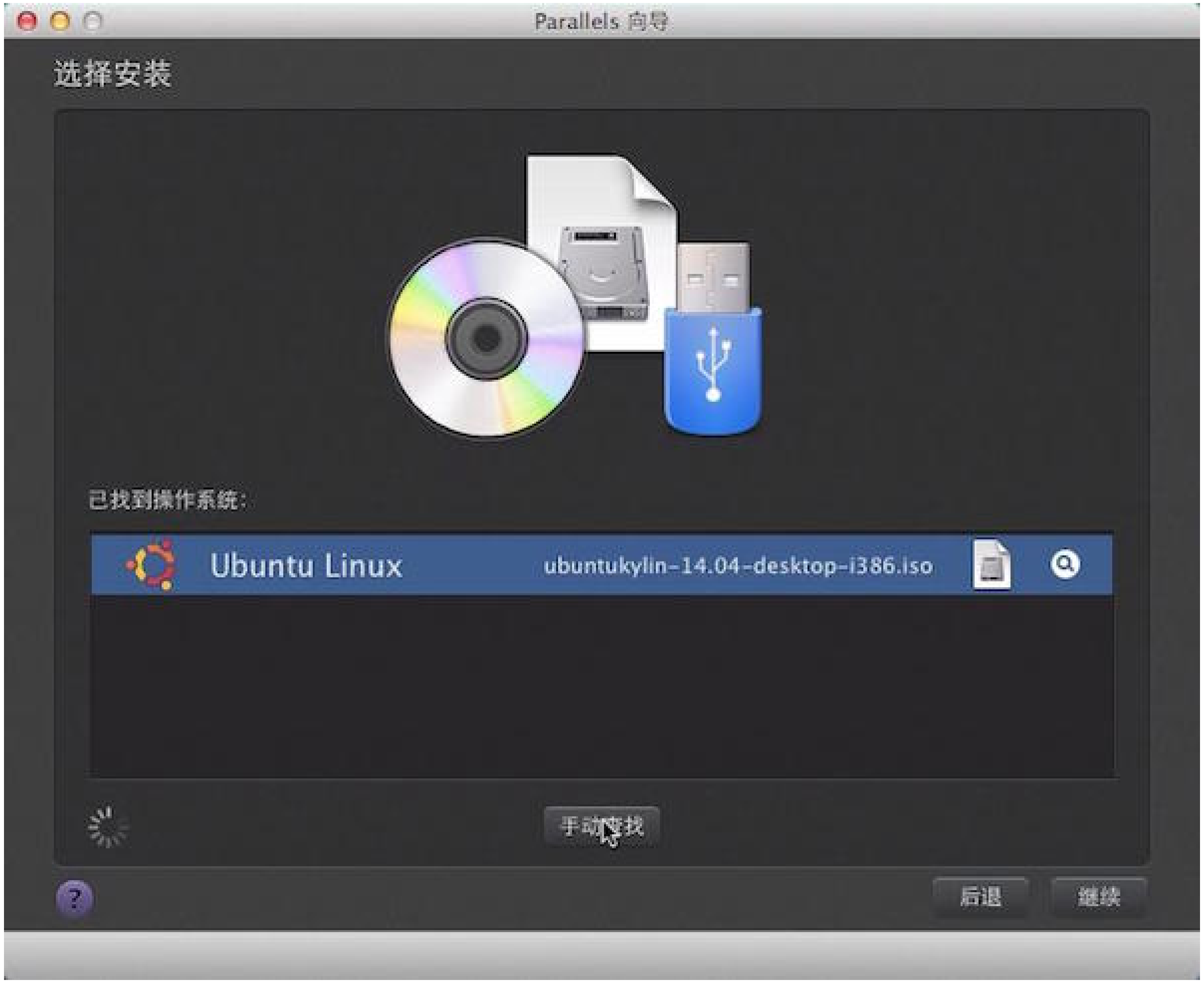
`Ubuntu14.iso->` `magnet:?xt=urn:btih:5EE7E1DC3E01F362B0E53BFEE9E4D6DCDEDAD61B`

`Parallels desktop->` `http://xclient.info/s/parallels-desktop.html?t=2c5f238779ee02ff6e1b5cda873deeacaeabc304`

Create a Virtual Machine (Mac)



Create a Virtual Machine (Mac)



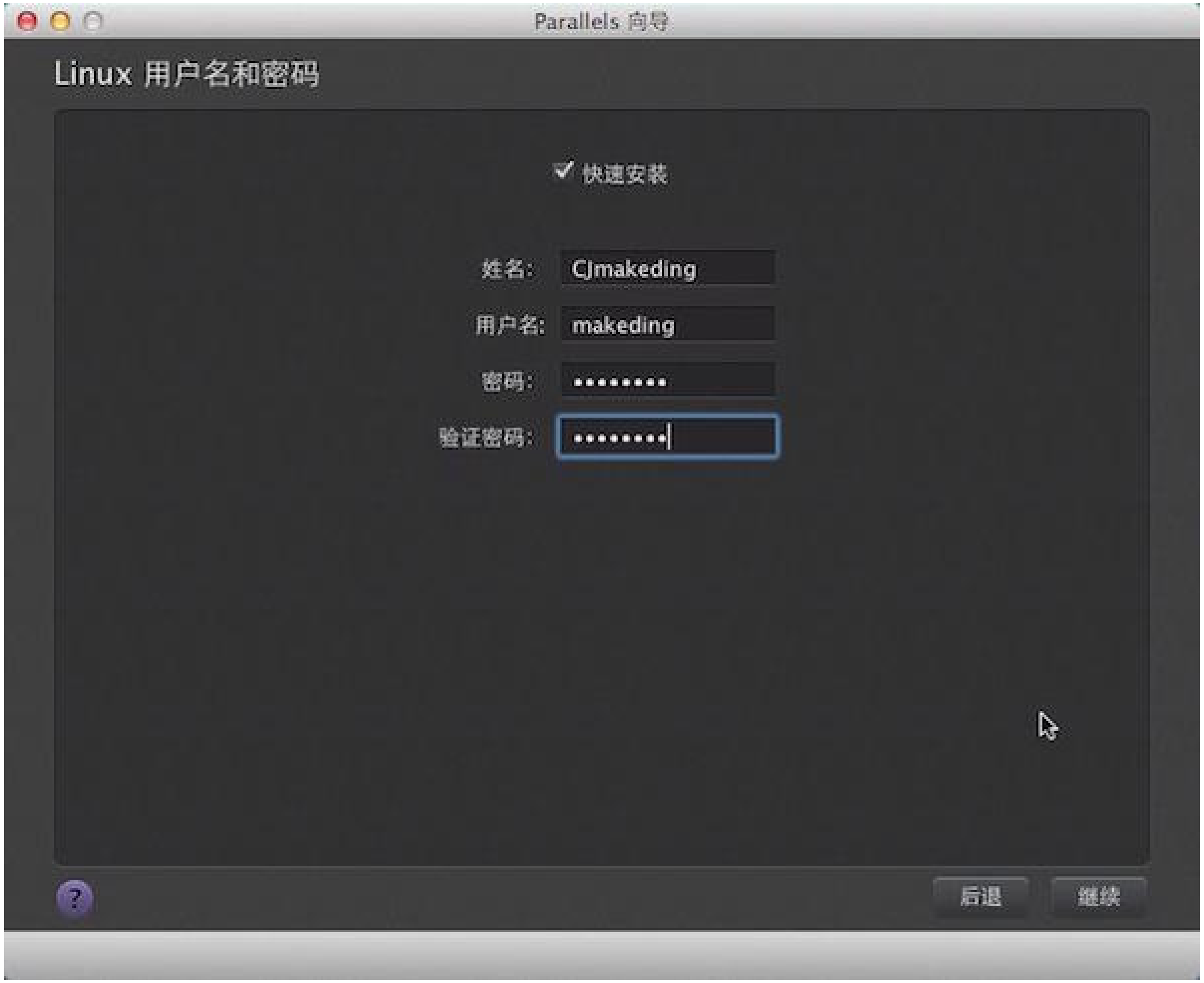
Parallels 向导

选择安装

已找到操作系统：

Ubuntu Linux ubuntukylin-14.04-desktop-i386.iso

Create a Virtual Machine (Mac)



Linux 用户名和密码

☑ 快速安装

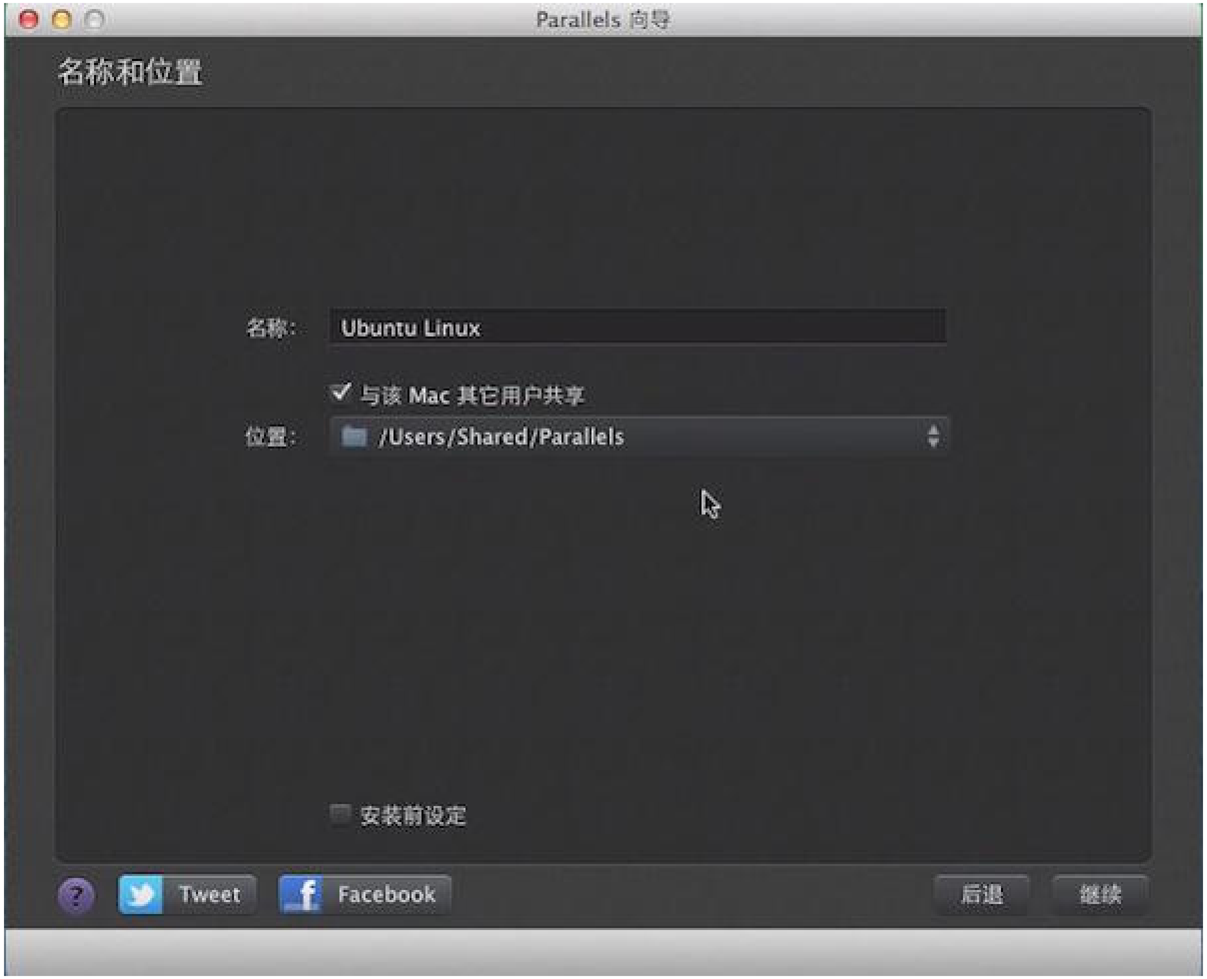
姓名： CJmakeding

用户名： makeding

密码： •••••••••

验证密码： •••••••••

Create a Virtual Machine (Mac)



名称和位置

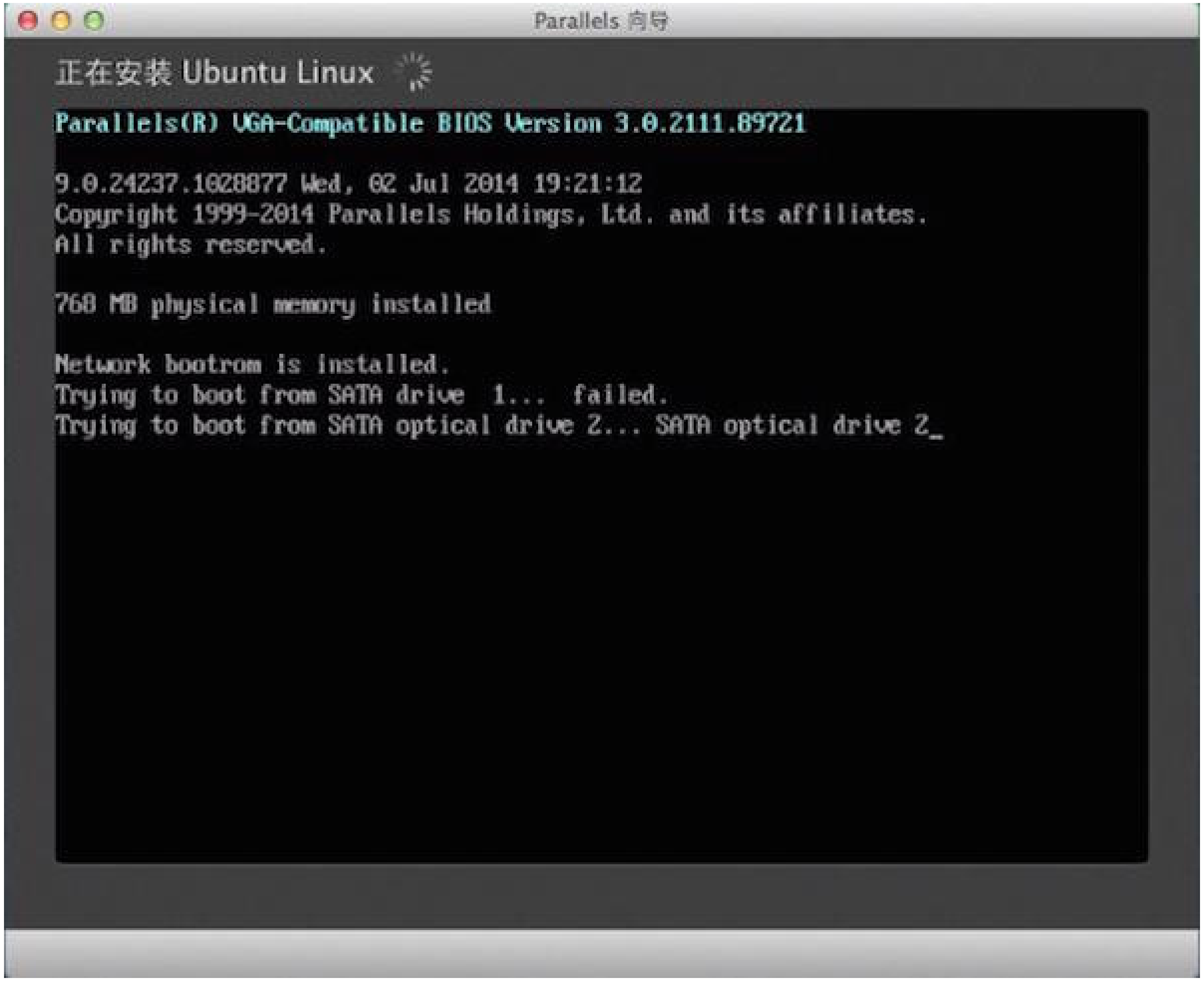
名称： Ubuntu Linux

☑ 与该 Mac 其它用户共享

位置： /Users/Shared/Parallels

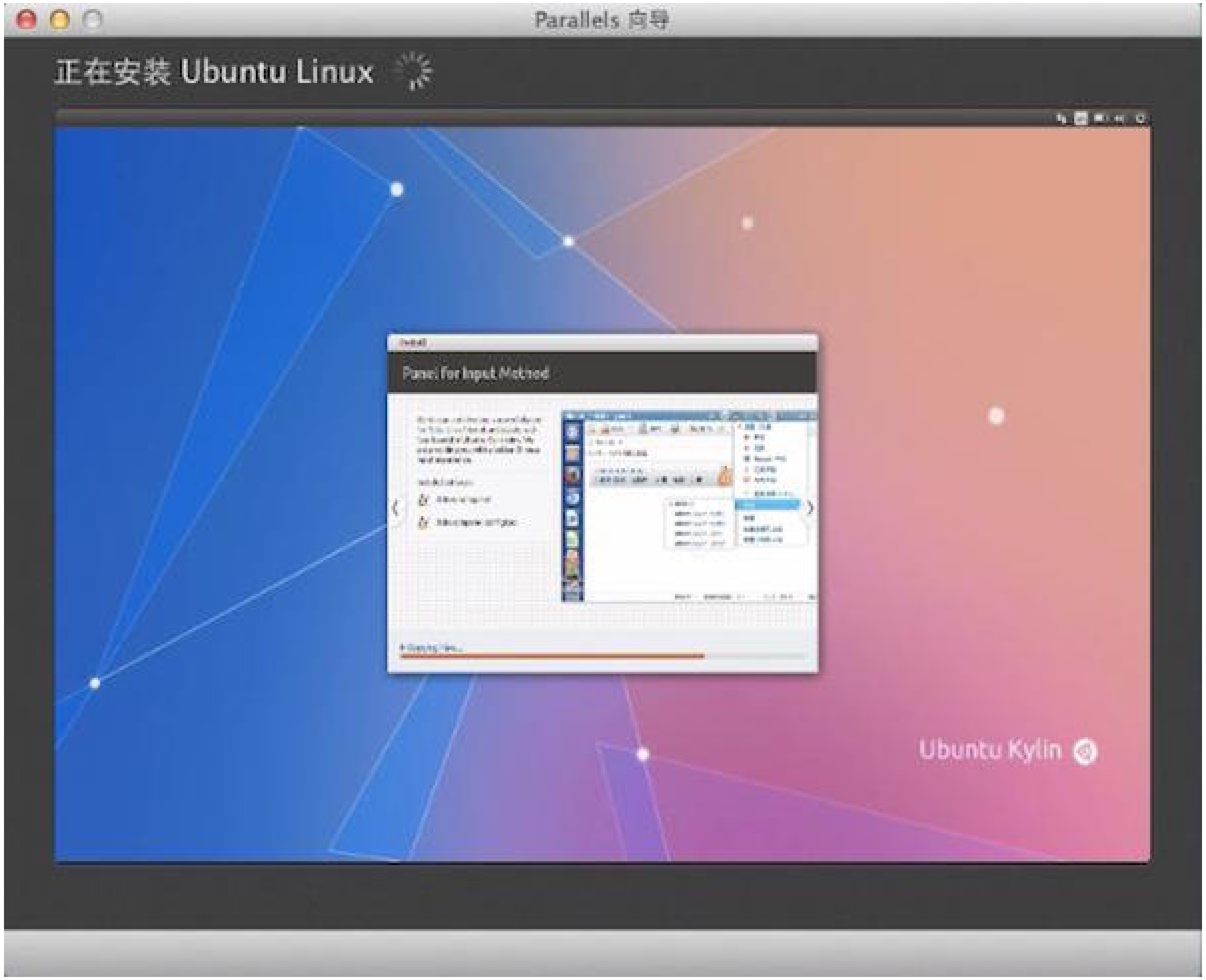
□ 安装前设定

Create a Virtual Machine (Mac)

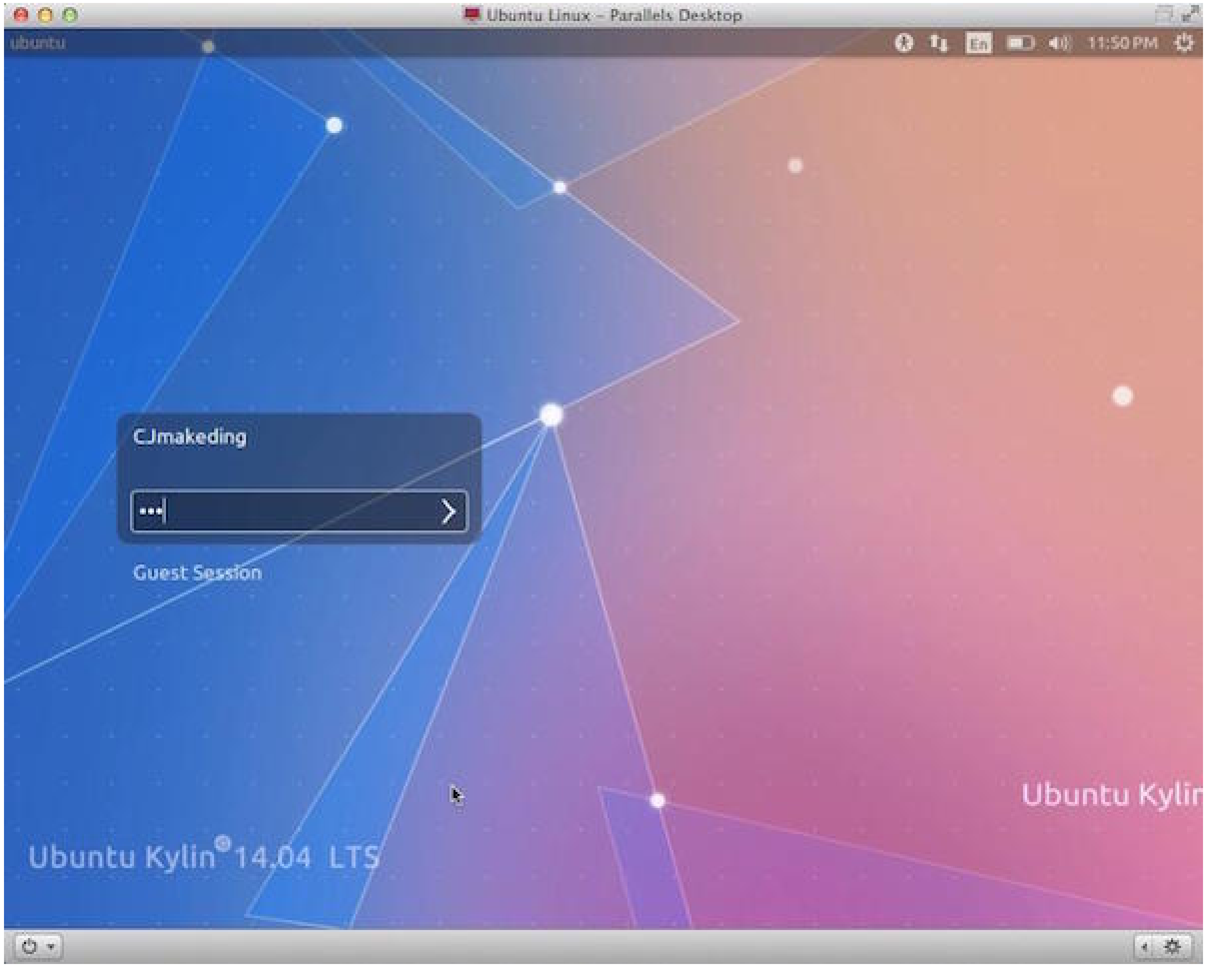


```
Parallels(R) VGA-Compatible BIOS Version 3.0.2111.89721

9.0.24237.1028877 Wed, 02 Jul 2014 19:21:12
Copyright 1999-2014 Parallels Holdings, Ltd. and its affiliates.
All rights reserved.

768 MB physical memory installed

Network bootrom is installed.
Trying to boot from SATA drive  1...  failed.
Trying to boot from SATA optical drive 2... SATA optical drive 2_
```

Create a Virtual Machine (Mac)



Create a Virtual Machine (Mac)



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Basic Commands

> command [-options] [arguments]

- `cd` `pwd` `ls`
- `su` `chmod` `cat`
- `touch` `rename` `mv` `cp`
- `mkdir` `rmdir` `rm`
- `find` `grep`
- `>` `>>` `|` `xargs`
- `awk`
- `man` `help` `--help`

`cd` (change directory)

```
cd
cd ~
cd -
cd ..
```

`pwd` (print working directory)

```
pwd
```

`ls` (list segment)

`-l`	long - Displaying long format
`-a`	all - Lists all files in the given directory
`-R`	recursive - Recursively lists subdirectories.
`-d`	directory - Shows information about a directory

```
ls
ls -l
ls -a
ls -R
ls -d
ls -la
ls -ld
...
```

`su` (switch user)

```
su oslab
```

`chmod` (change mode)

```
chmod 660 class1.txt
chmod u-r class1.txt
```

`cat` (concatenate)

```
cat class1.txt
cat oslab0.txt
```

touch

```
touch oslab.txt
```

rename

```
rename 's/oslab/oslab0/'  *.*
```

mv (move)

```
mv oslab00.txt oslab02.txt
mv oslab01.txt oslab02.txt /home/parallels
```

cp (copy)

```
cp oslab03.txt /home/parallels
```

`mkdir` (make directory)

```
mkdir Lesson1/rename
```

`rmdir` (remove empty directory)

```
rmdir empty
```

`rm` (remove)

`-r`	recursive
`-i`	interactive
`-f`	force

```
rm    -rf    Lesson1/*
rm -i oslab0.txt
```

`find`

```
find ~ -name "*.txt"
```

`grep`

> globally search a regular expression and print

```
grep match_pattern file_name
grep oslab oslab04.txt
grep -i oslab oslab04.txt
```

`>` & `>>` (redirection)

```
cat oslab05.txt oslab06.txt > oslab07.txt
cat oslab05.txt oslab06.txt >> oslab07.txt
```

`|` (pipeline)

```
command1 | command2
cat oslab08.txt | grep linux
```

`xargs`

```
cat oslab08.txt | ls -l
cat oslab08.txt | xargs ls -l
```

`awk` (Aho, Weinberg & Kernighan)

AWK is a programming language designed for text processing and typically used as a data extraction and reporting tool.

> pattern { action }
>
> BEGIN、regular expression、END
>
> { function calls, variable assignments, calculations }

```
awk 'BEGIN { print "Hello, world!" }'
```

`man` (manual)

```
man ls
```

`help`

```
help cd
```

`--help`

```
ls --help
```

Wikipedia

> https://en.wikipedia.org/wiki/AWK