無人載具技術與應用

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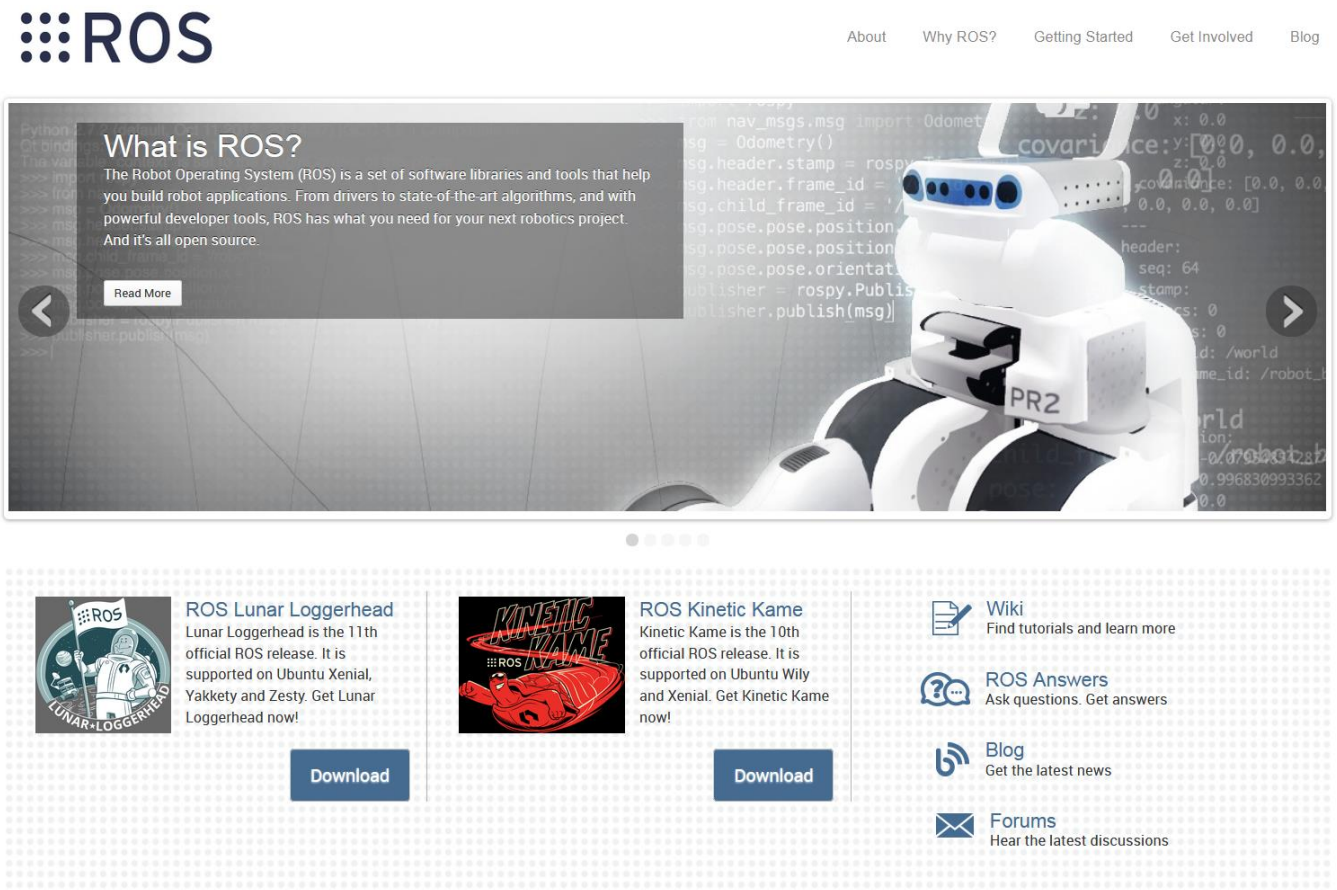
The Robot Operating System (ROS)

- ROS，是專為機器人軟體開發所設計出來的一套電腦作業系統架構 (資料傳輸系統架構)。它是一個開源的元級作業系統，提供類似於作業系統的服務，包括硬體抽象描述、底層驅動程序管理、共用功能的執行、程序間消息傳遞、程序發行包管理，它也提供一些工具和庫用於獲取、建立、編寫和執行多機融合的程序。 維基百科

The Robot Operating System (ROS)



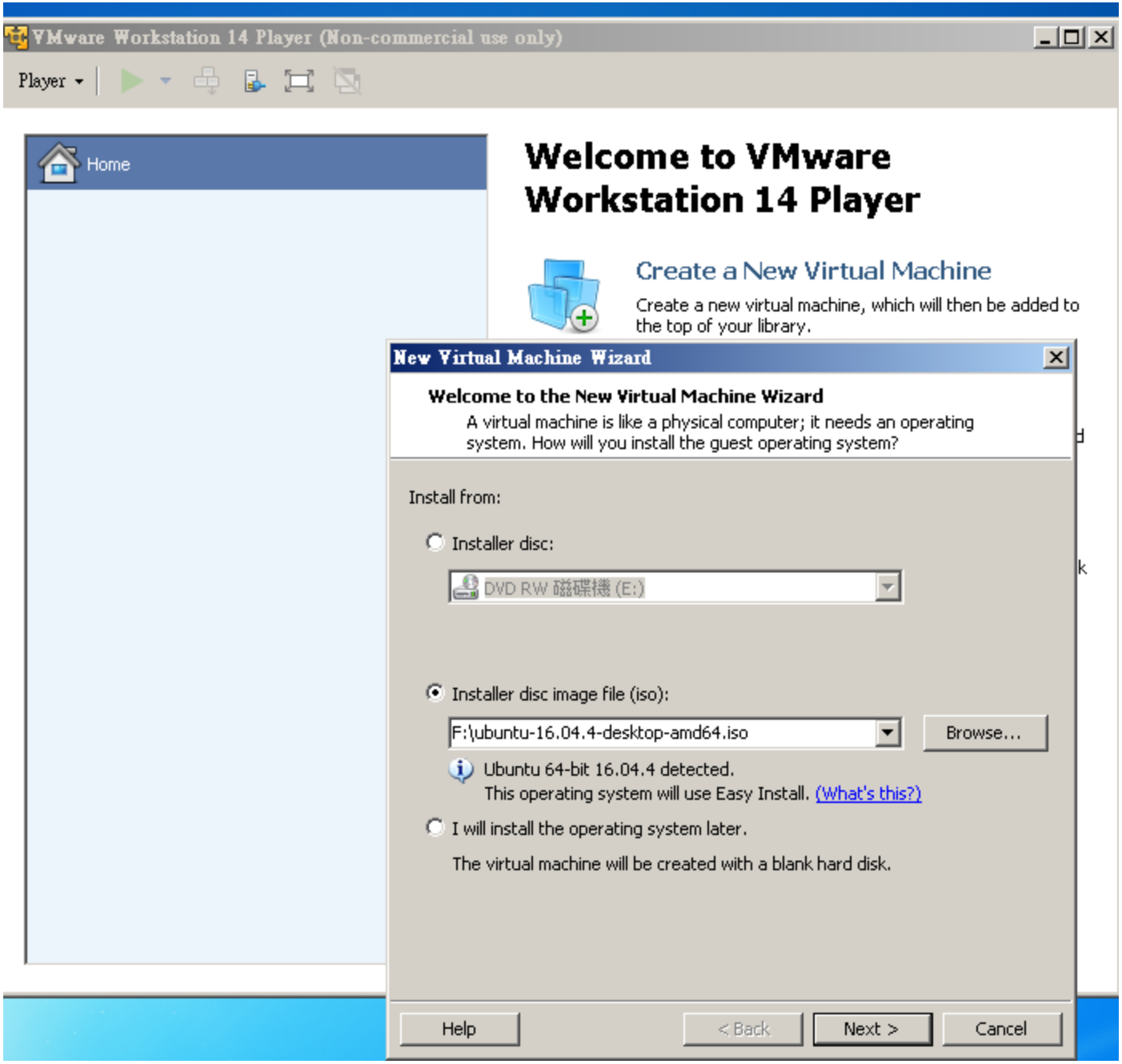
ROS navigation demo
https://www.youtube.com/watch?v=qziUJcUDfBc

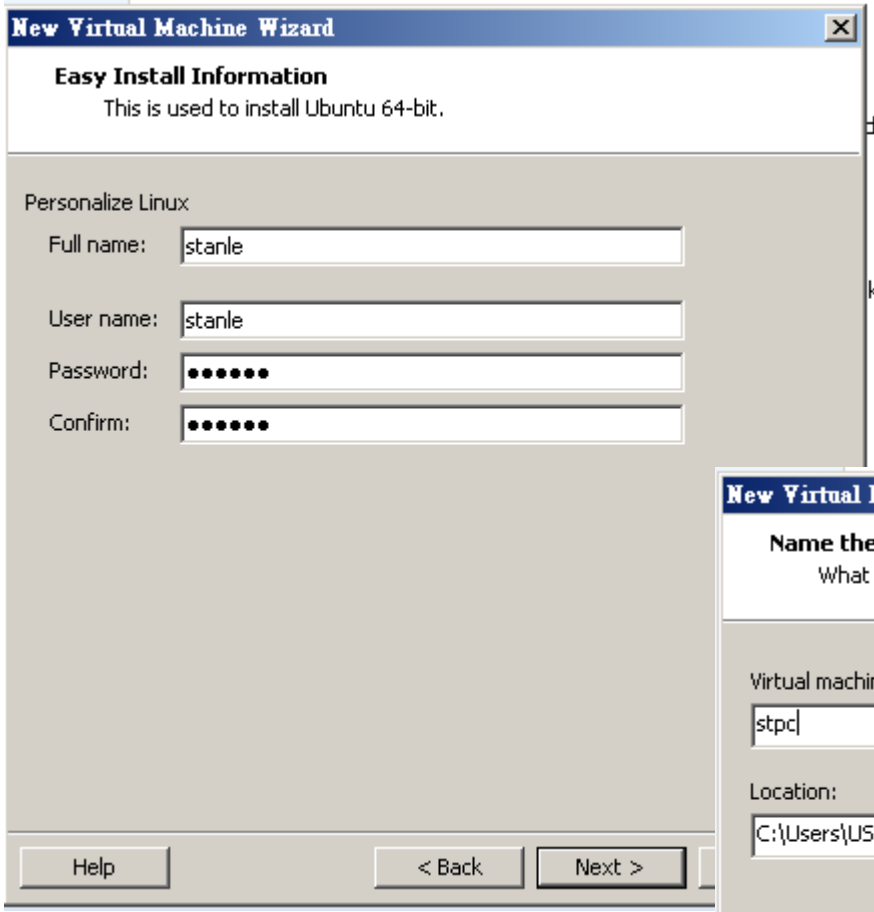
ROS-Ubuntu
VMware

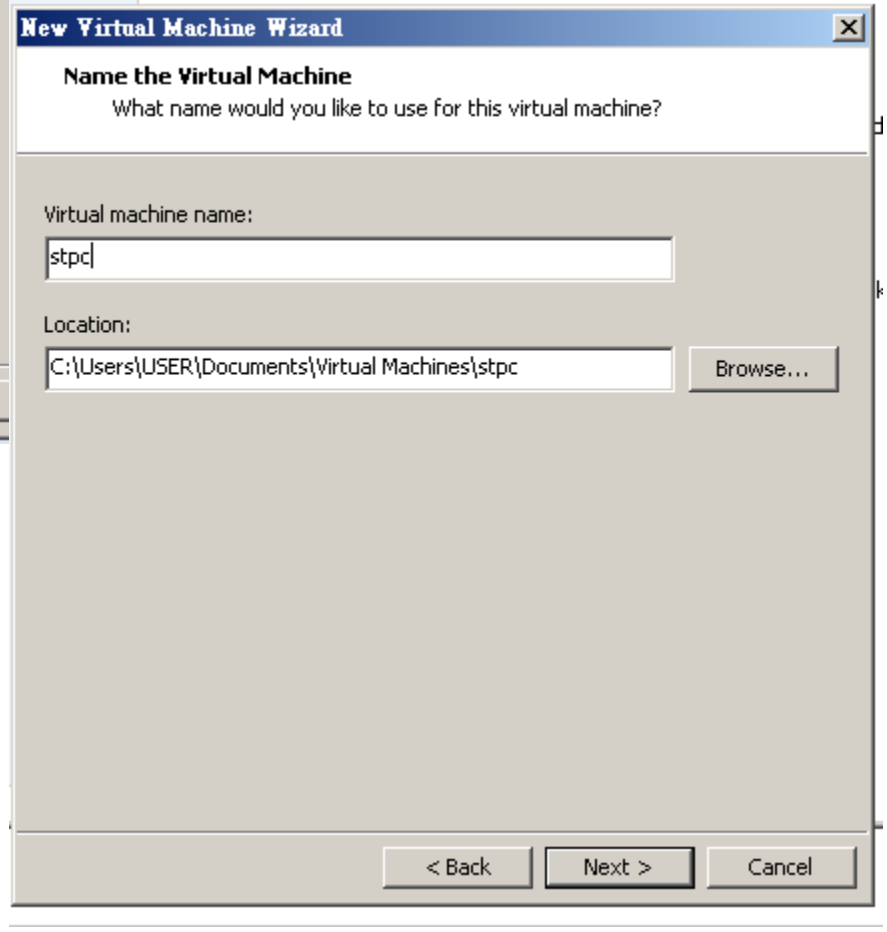
- 免費虛擬機器VMware Workstation 17 Player下載與安裝
- https://www.vmware.com/tw.html
- 點選免費產品下載的「Workstation Player」。
- VMware Workstation 17 Player for Windows 64-bit Operating Systems.

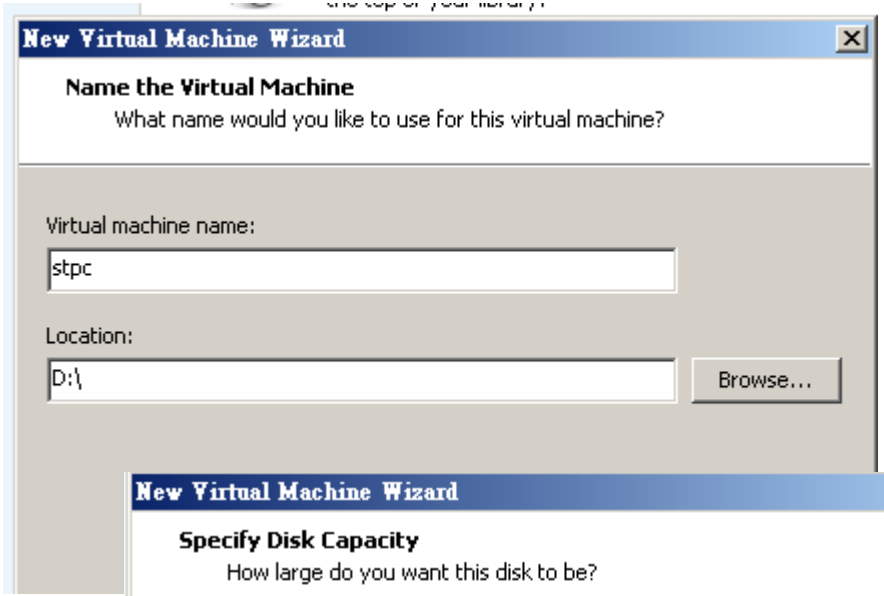
- Google關鍵字
  - Vmware player
  - Ubuntu 20.04

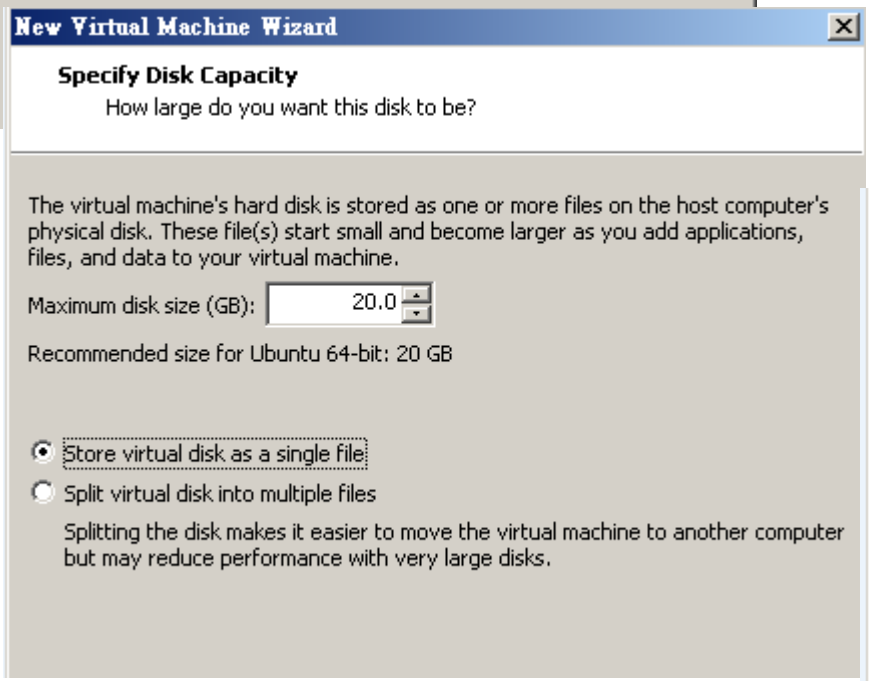
- Ubuntu 20.04.5 LTS (Focal Fossa)
- https://releases.ubuntu.com/focal/
- ubuntu-20.04.5-desktop-amd64.iso

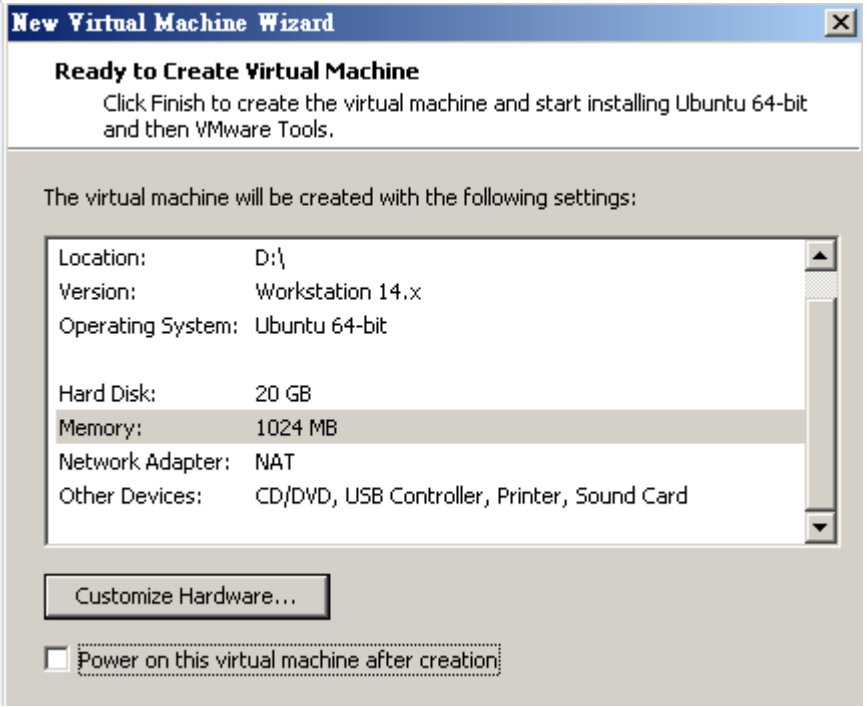

VMware Workstation 14 Player (Non-commercial use only)
Player
Home
Welcome to VMware Workstation 14 Player
Create a New Virtual Machine
Create a new virtual machine, which will then be added to the top of your library.
New Virtual Machine Wizard
Welcome to the New Virtual Machine Wizard
A virtual machine is like a physical computer; it needs an operating system. How will you install the guest operating system?
Install from:
Installer disc:
DVD RW 磁碟機 (E:)
Installer disc image file (iso):
F:\ubuntu-16.04.4-desktop-amd64.iso
Browse...
Ubuntu 64-bit 16.04.4 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.
Help
< Back
Next >
Cancel

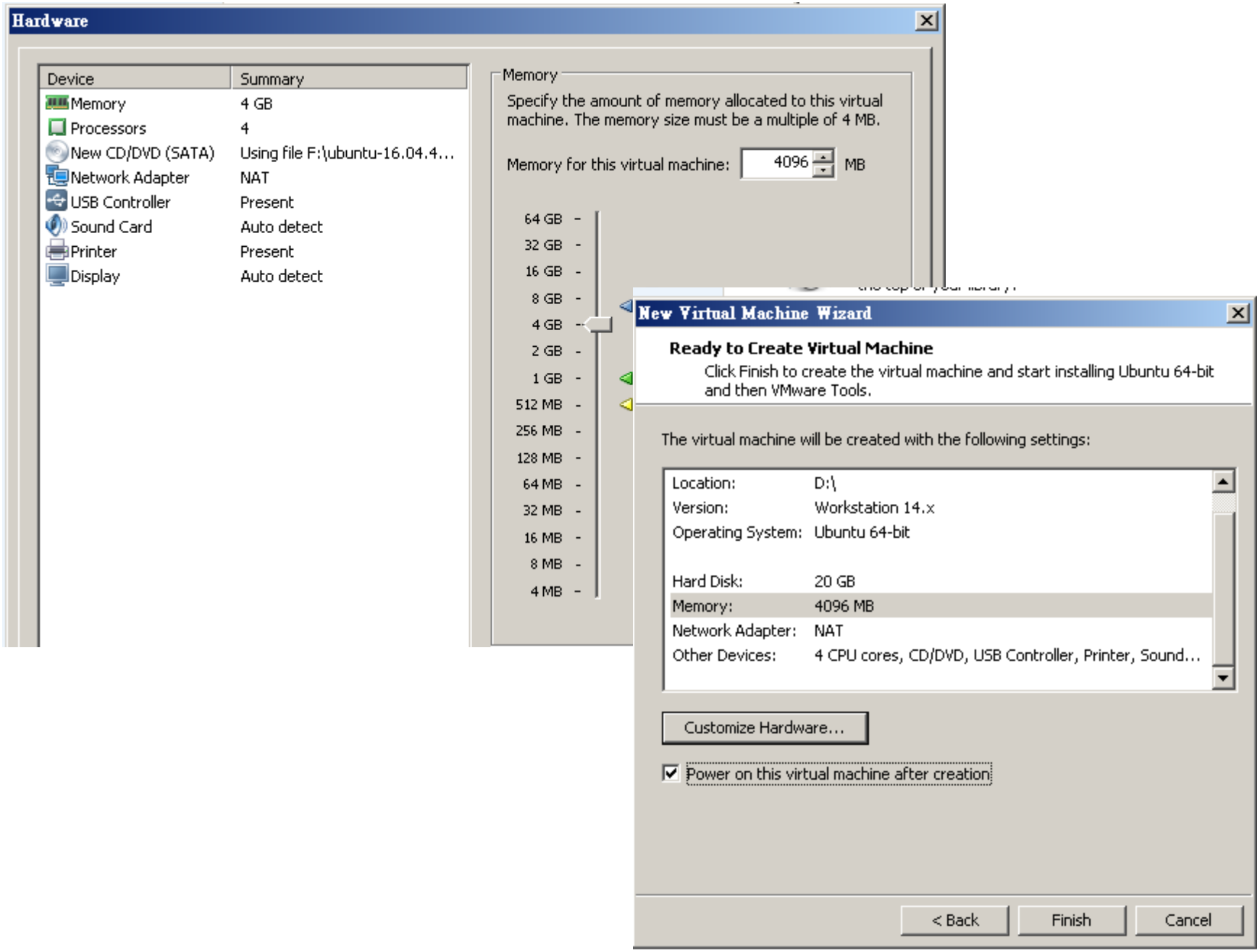

New Virtual Machine Wizard
Easy Install Information
This is used to install Ubuntu 64-bit.
Personalize Linux
Full name:
stanle
User name:
stanle
Password:
Confirm:
Help
< Back
Next >

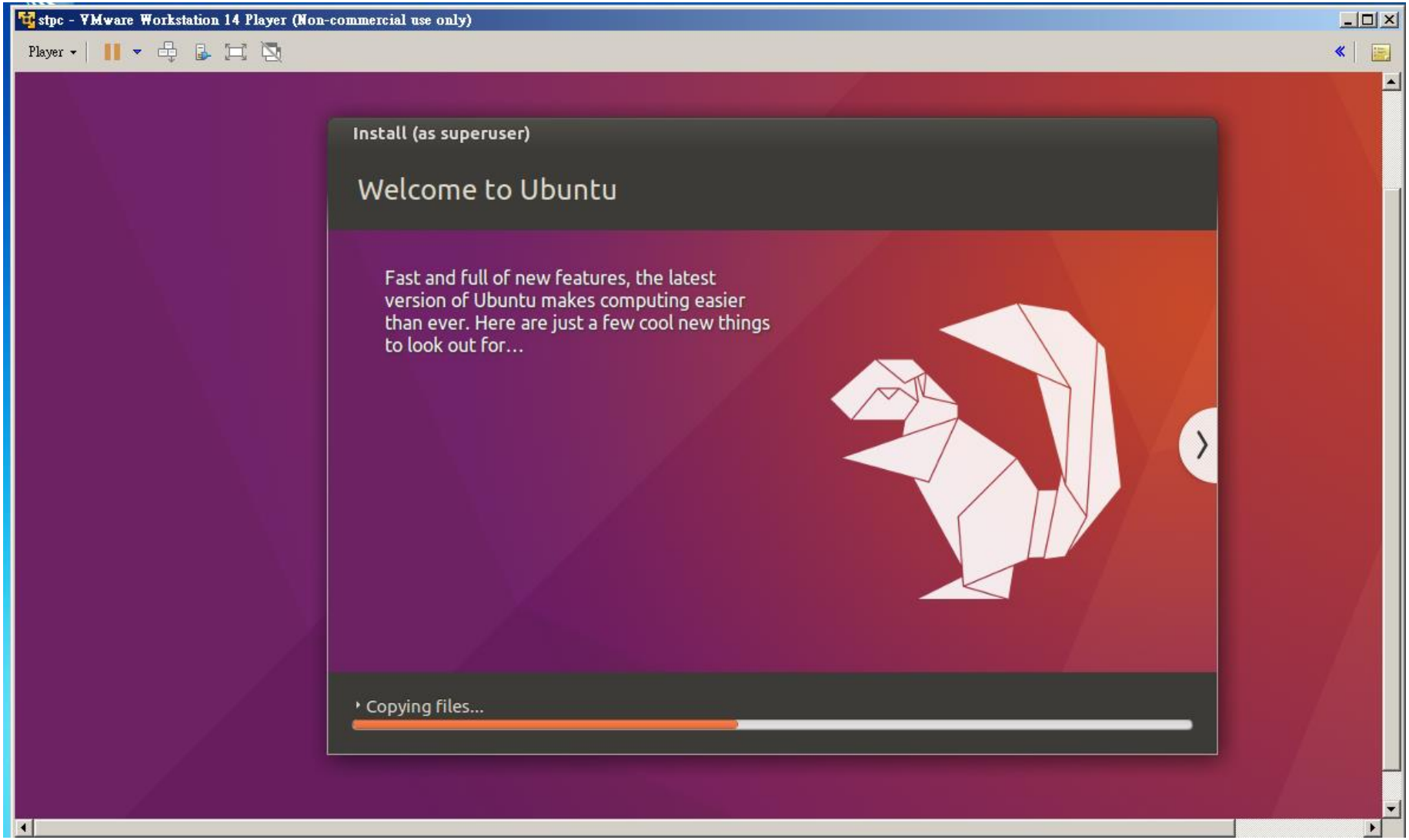

New Virtual Machine Wizard
Name the Virtual Machine
What name would you like to use for this virtual machine?
Virtual machine name:
stpc
Location:
C:\Users\USER\Documents\Virtual Machines\stpc
Browse...
< Back
Next >
Cancel

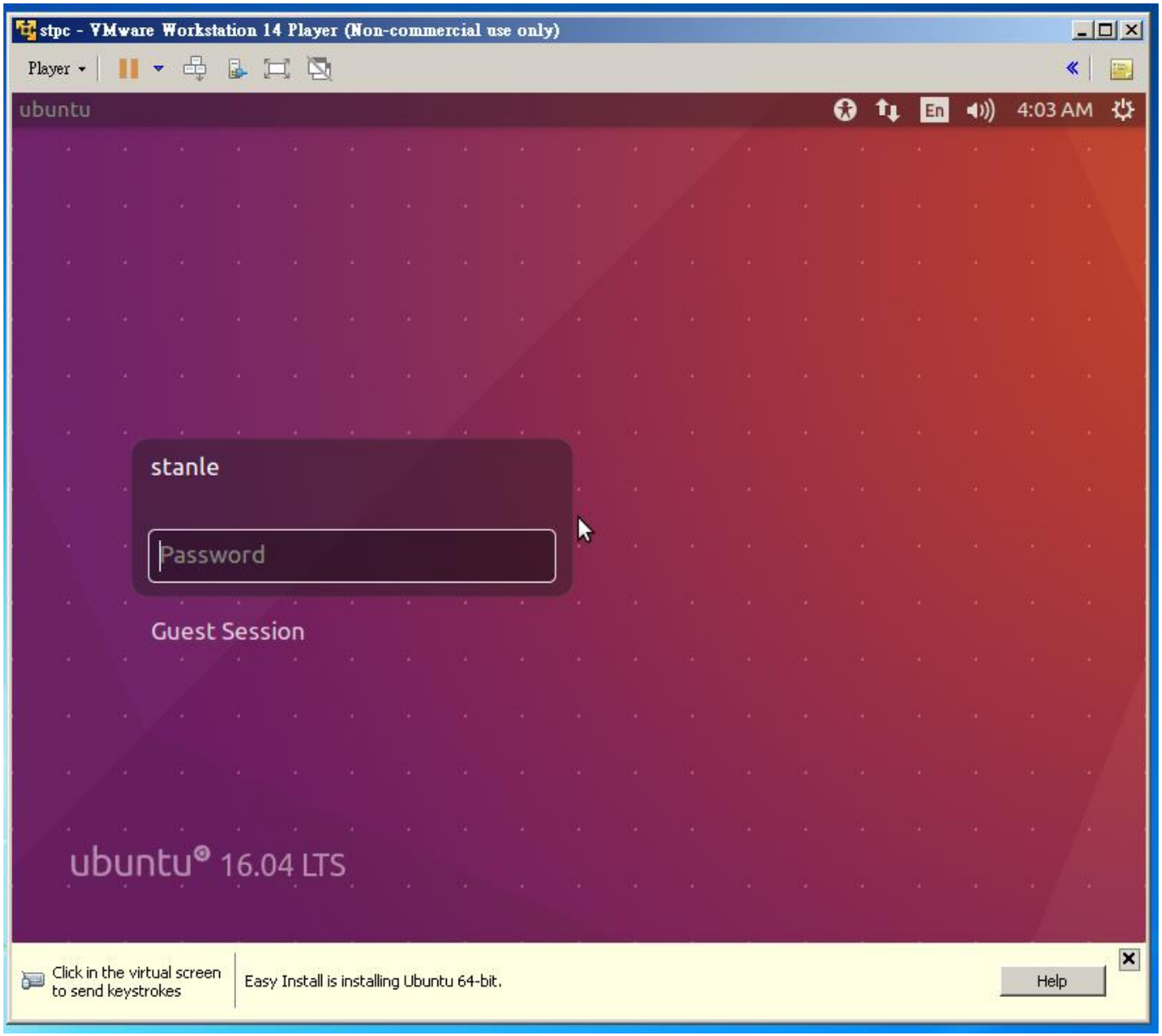

New Virtual Machine Wizard
Name the Virtual Machine
What name would you like to use for this virtual machine?
Virtual machine name:
stpc
Location:
D:\
Browse...

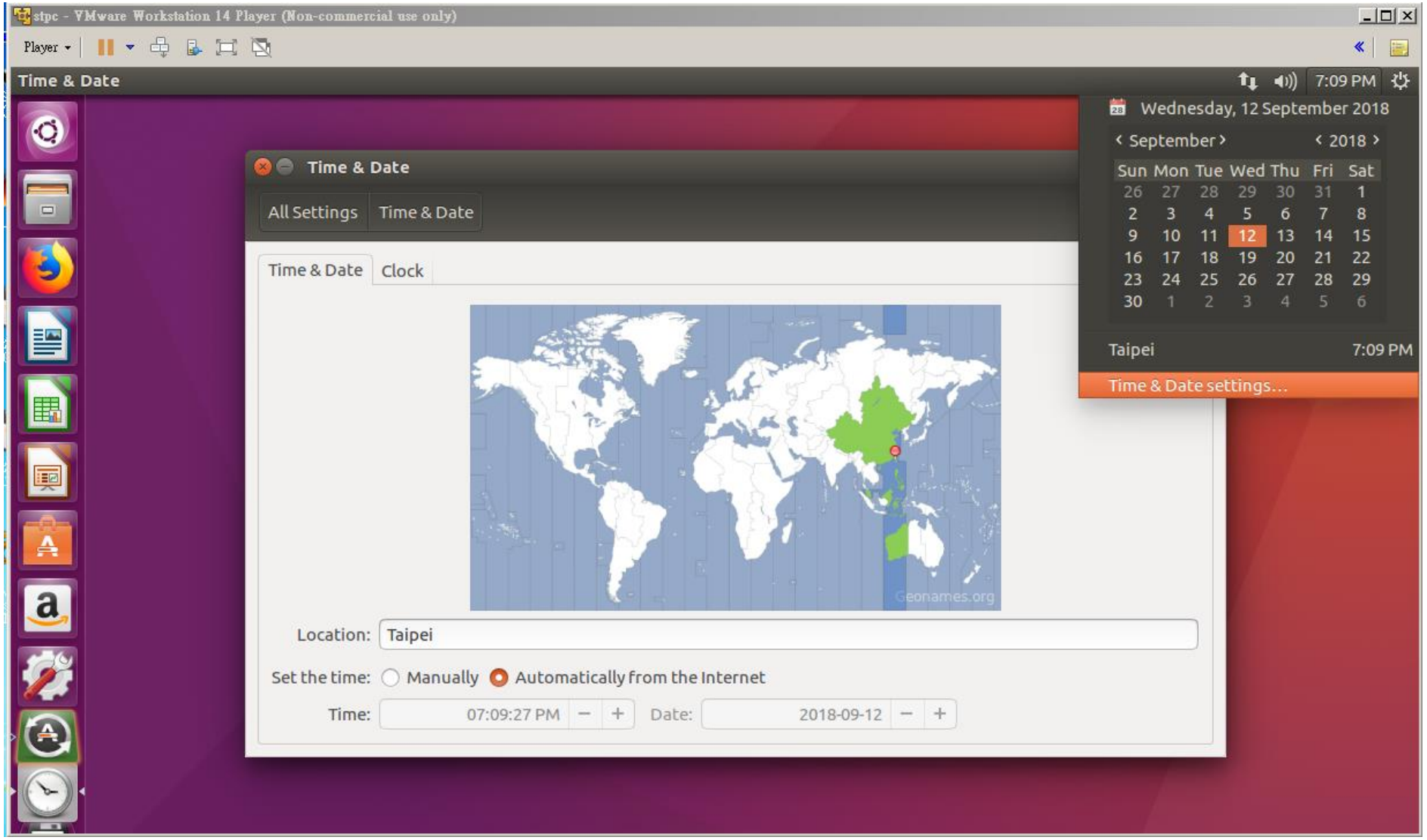

New Virtual Machine Wizard
Specify Disk Capacity
How large do you want this disk to be?
The virtual machine's hard disk is stored as one or more files on the host computer's physical disk. These file(s) start small and become larger as you add applications, files, and data to your virtual machine.
Maximum disk size (GB):
20.0
Recommended size for Ubuntu 64-bit: 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.

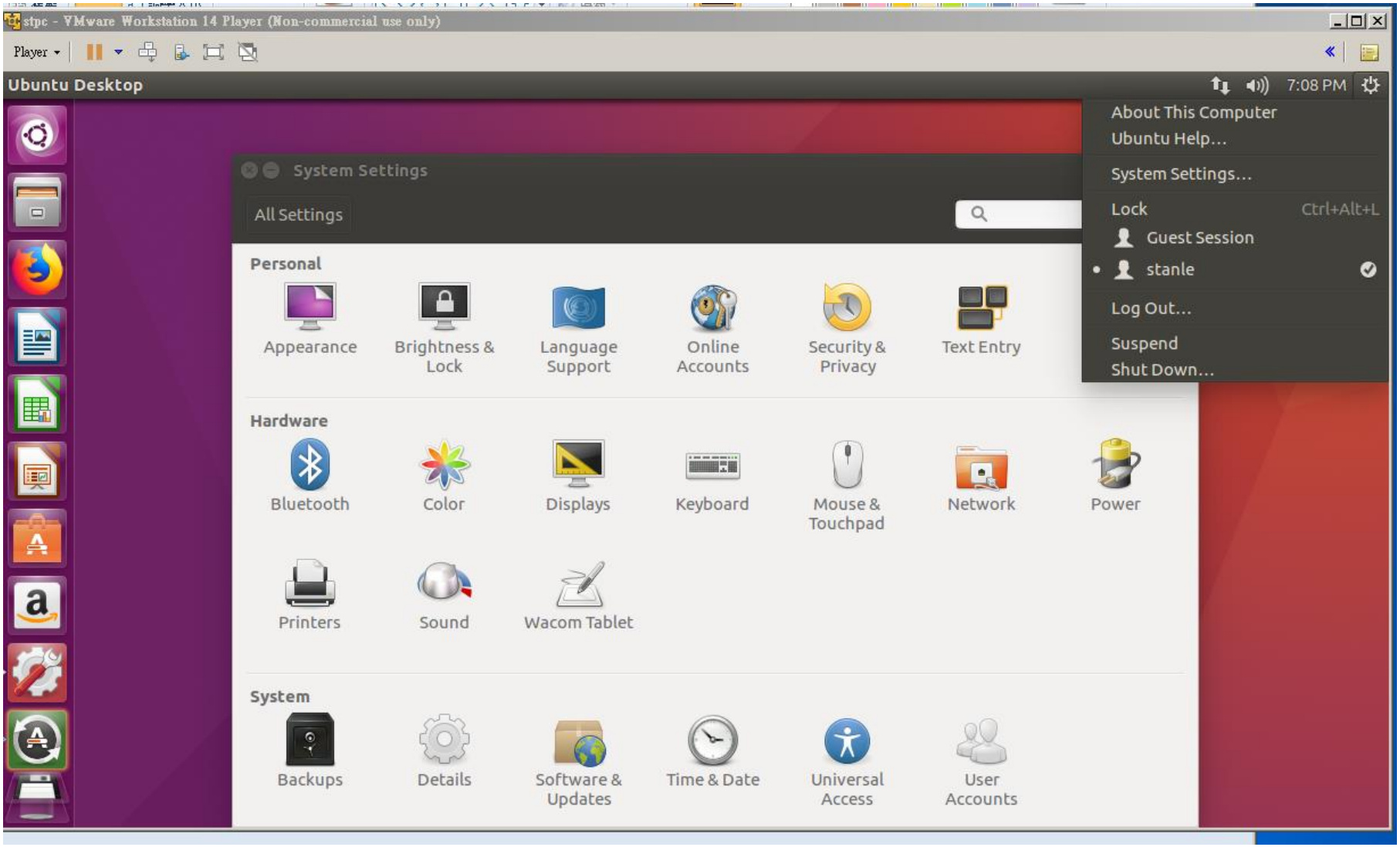

New Virtual Machine Wizard
Ready to Create Virtual Machine
Click Finish to create the virtual machine and start installing Ubuntu 64-bit and then VMware Tools.
The virtual machine will be created with the following settings:
Location: D:\
Version: Workstation 14.x
Operating System: Ubuntu 64-bit
Hard Disk: 20 GB
Memory: 1024 MB
Network Adapter: NAT
Other Devices: CD/DVD, USB Controller, Printer, Sound Card
Customize Hardware...
Power on this virtual machine after creation

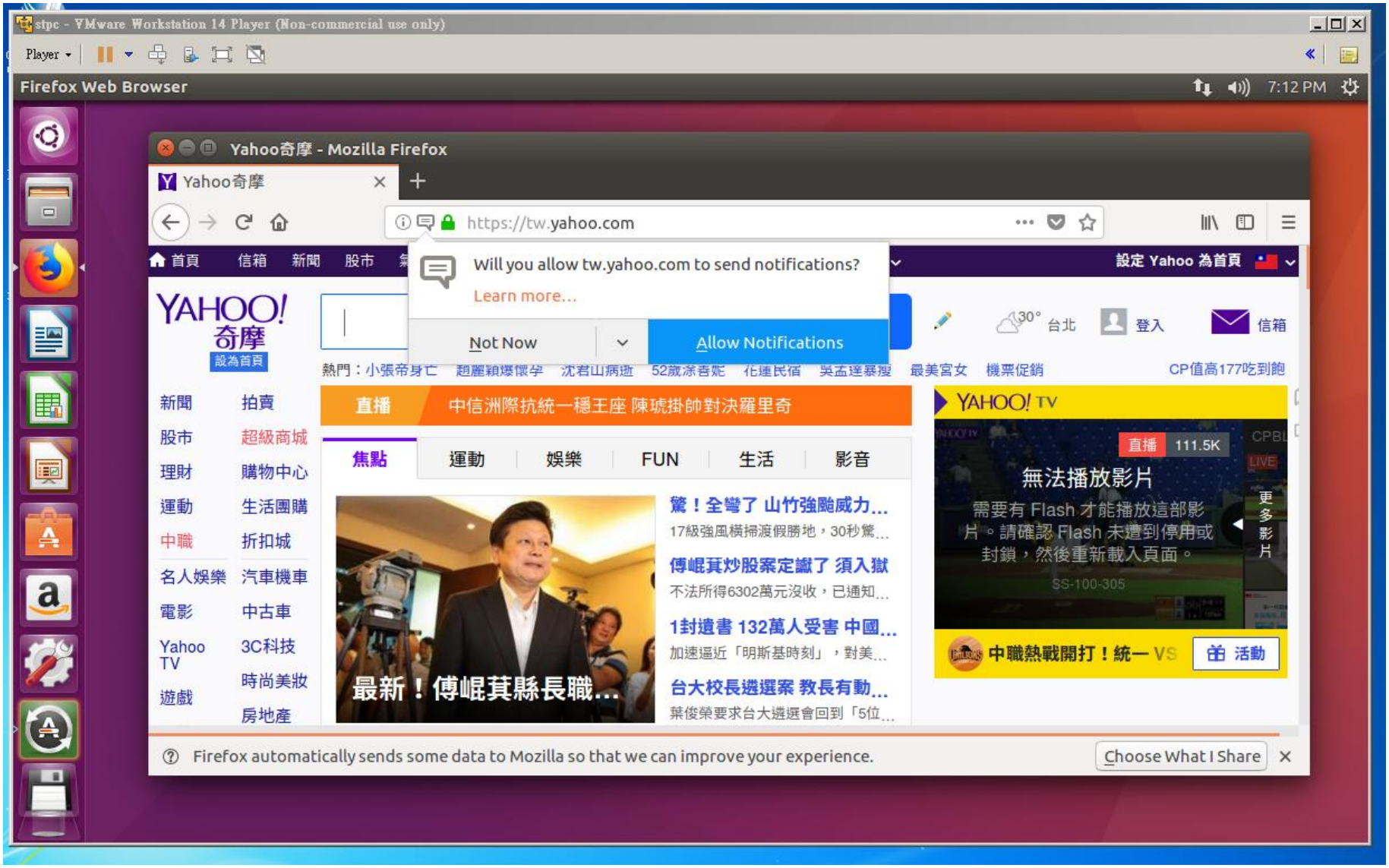

Hardware
Device
Summary
Memory
4 GB
Processors
4
New CD/DVD (SATA)
Using file F:\ubuntu-16.04.4...
Network Adapter
NAT
USB Controller
Present
Sound Card
Auto detect
Printer
Present
Display
Auto detect
Memory
Specify the amount of memory allocated to this virtual machine. The memory size must be a multiple of 4 MB.
Memory for this virtual machine:
4096
MB
64 GB
32 GB
16 GB
8 GB
4 GB
2 GB
1 GB
512 MB
256 MB
128 MB
64 MB
32 MB
16 MB
8 MB
4 MB
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:
Location:
D:\
Version:
Workstation 14.x
Operating System:
Ubuntu 64-bit
Hard Disk:
20 GB
Memory:
4096 MB
Network Adapter:
NAT
Other Devices:
4 CPU cores, CD/DVD, USB Controller, Printer, Sound...
Customize Hardware...
Power on this virtual machine after creation
< Back
Finish
Cancel

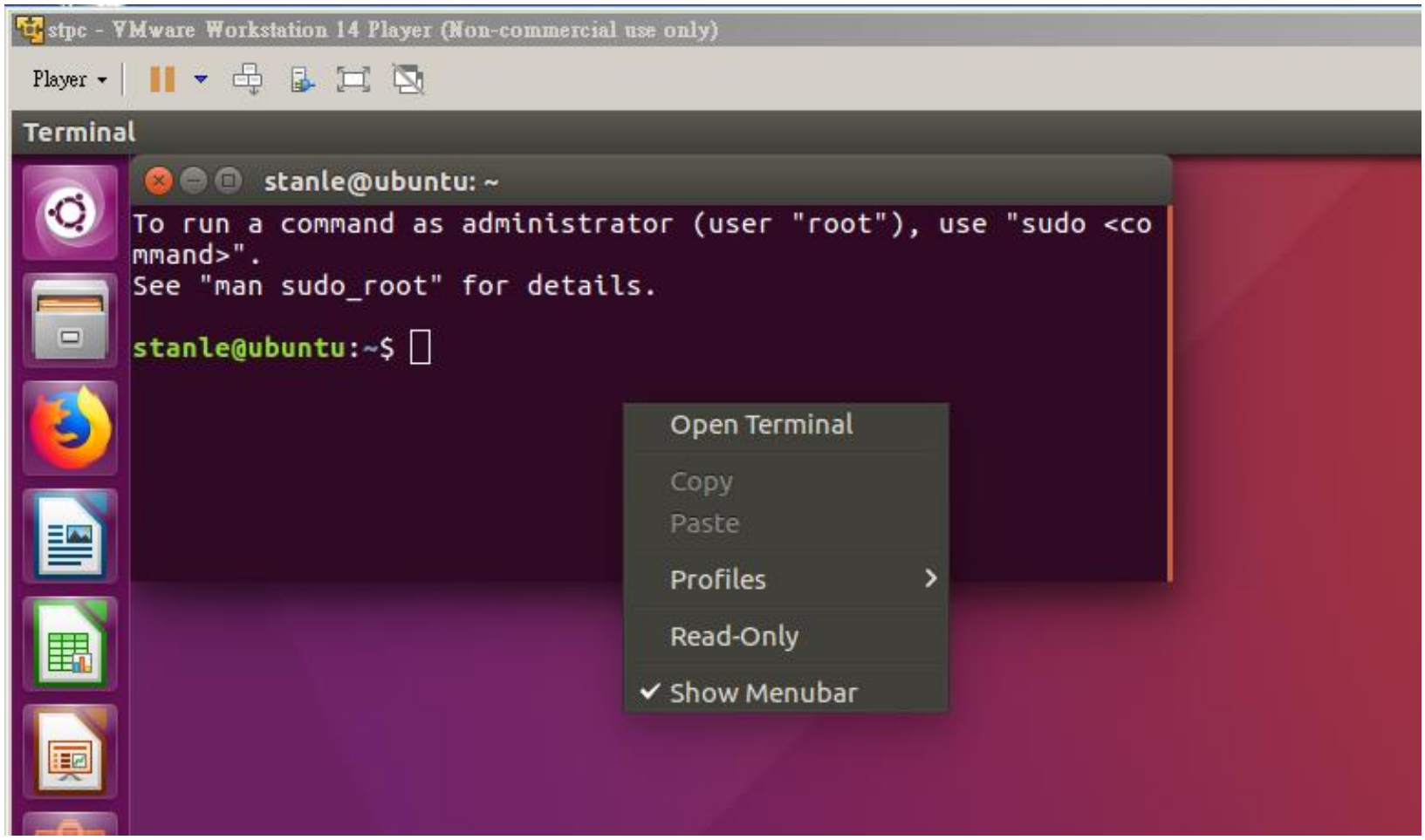

stpc - VMware Workstation 14 Player (Non-commercial use only)
Player
Install (as superuser)
Welcome to Ubuntu
Fast and full of new features, the latest version of Ubuntu makes computing easier than ever. Here are just a few cool new things to look out for…
Copying files...


stpc - VMware Workstation 14 Player (Non-commercial use only)
Player
ubuntu
En
4:03 AM
stanle
Password
Guest Session
ubuntu® 16.04 LTS
Click in the virtual screen to send keystrokes
Easy Install is installing Ubuntu 64-bit.
Help


stpc - VMware Workstation 14 Player (Non-commercial use only)
Player
Time & Date
7:09 PM
Wednesday, 12 September 2018
September
2018
Sun Mon Tue Wed Thu Fri Sat
26 27 28 29 30 31 1
2 3 4 5 6 7 8
9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30 1 2 3 4 5 6
Taipei
7:09 PM
Time & Date settings...
Time & Date
All Settings
Time & Date
Time & Date
Clock
Geonames.org
Location:
Taipei
Set the time:
Manually
Automatically from the Internet
Time:
07:09:27 PM
Date:
2018-09-12


stpc - VMware Workstation 14 Player (Non-commercial use only)
Player
Ubuntu Desktop
7:08 PM
About This Computer
Ubuntu Help...
System Settings...
Lock Ctrl+Alt+L
Guest Session
stanle
Log Out...
Suspend
Shut Down...
System Settings
All Settings
Personal
Appearance
Brightness & Lock
Language Support
Online Accounts
Security & Privacy
Text Entry
Hardware
Bluetooth
Color
Displays
Keyboard
Mouse & Touchpad
Network
Power
Printers
Sound
Wacom Tablet
System
Backups
Details
Software & Updates
Time & Date
Universal Access
User Accounts

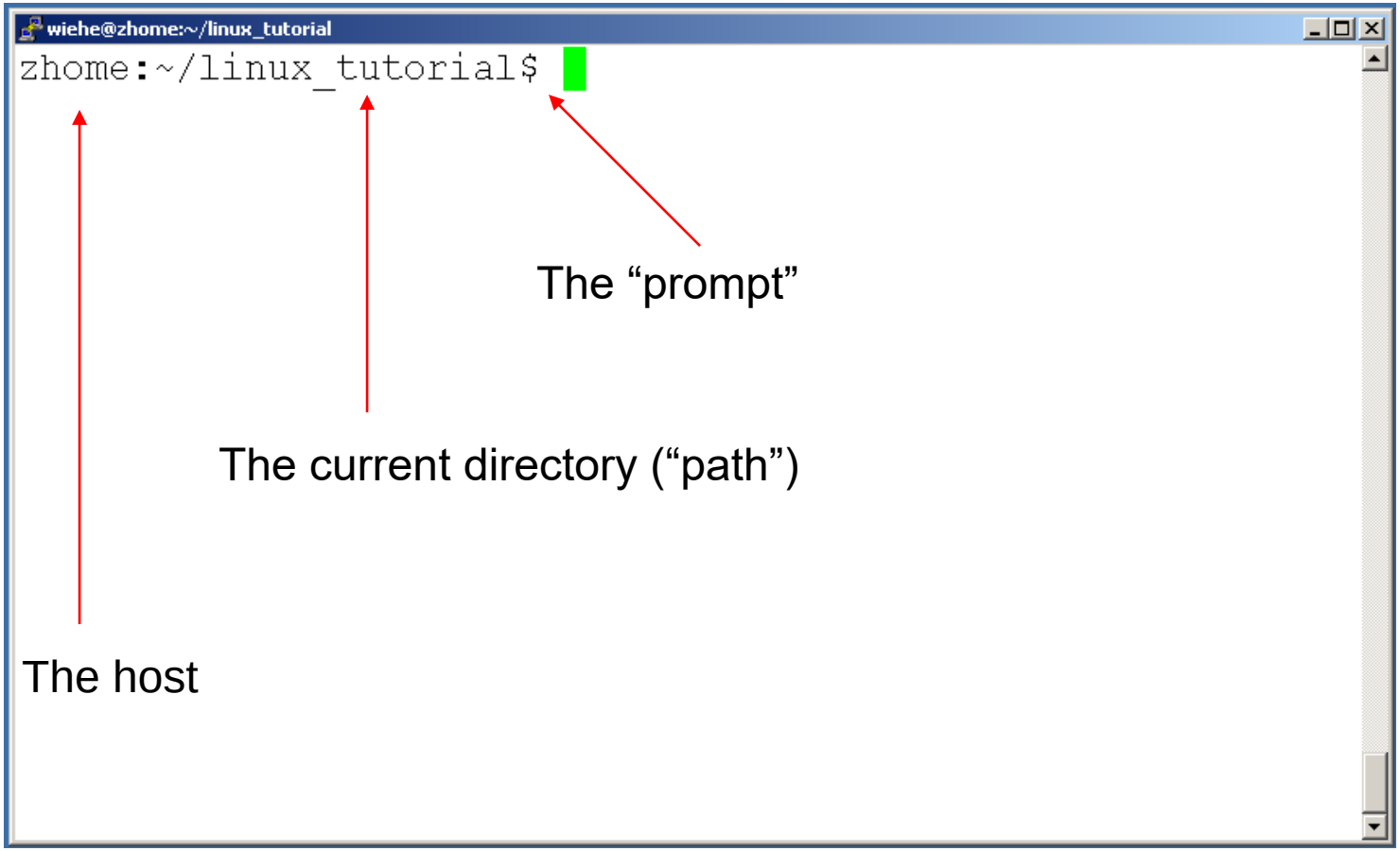

stpc - VMware Workstation 14 Player (Non-commercial use only)
Player
Firefox Web Browser
7:12 PM
Yahoo奇摩 - Mozilla Firefox
Yahoo奇摩
https://tw.yahoo.com
Will you allow tw.yahoo.com to send notifications?
Learn more...
Not Now
Allow Notifications
首頁 信箱 新聞 股市
設定 Yahoo 為首頁
YAHOO! 奇摩
設為首頁
30° 台北
登入
信箱
熱門：小張帝身亡 趙麗穎懷孕 沈君山病逝 52歲涂吉妮 花蓮民宿 吳孟達暴瘦 最美宮女 機票促銷 CP值高177吃到飽
新聞 拍賣
股市 超級商城
理財 購物中心
運動 生活團購
中職 折扣城
名人娛樂 汽車機車
電影 中古車
Yahoo TV 3C科技
時尚美妝
遊戲
房地產
直播 中信洲際抗統一穩王座 陳琥掛帥對決羅里奇
焦點 運動 娛樂 FUN 生活 影音
最新！傅崐萁縣長職...
驚！全彎了 山竹強颱威力...
17級強風橫掃渡假勝地，30秒驚...
傅崐萁炒股案定讞了 須入獄
不法所得6302萬元沒收，已通知...
1封遺書 132萬人受害 中國...
加速逼近「明斯基時刻」，對美...
台大校長遴選案 教長有動...
葉俊榮要求台大遴選會回到「5位...
YAHOO! TV
直播 111.5K
無法播放影片
需要有 Flash 才能播放這部影片。請確認 Flash 未遭到停用或封鎖，然後重新載入頁面。
SS-100-305
更多影片
中職熱戰開打！統一 VS
活動
Firefox automatically sends some data to Mozilla so that we can improve your experience.
Choose What I Share


stpc - VMware Workstation 14 Player (Non-commercial use only)
Player
Terminal
stanle@ubuntu: ~
To run a command as administrator (user "root"), use "sudo <co
mmand>".
See "man sudo_root" for details.
stanle@ubuntu:~$
Open Terminal
Copy
Paste
Profiles
Read-Only
Show Menubar

Linux Commands

Connecting to a Unix/Linux system

- Open up a terminal:

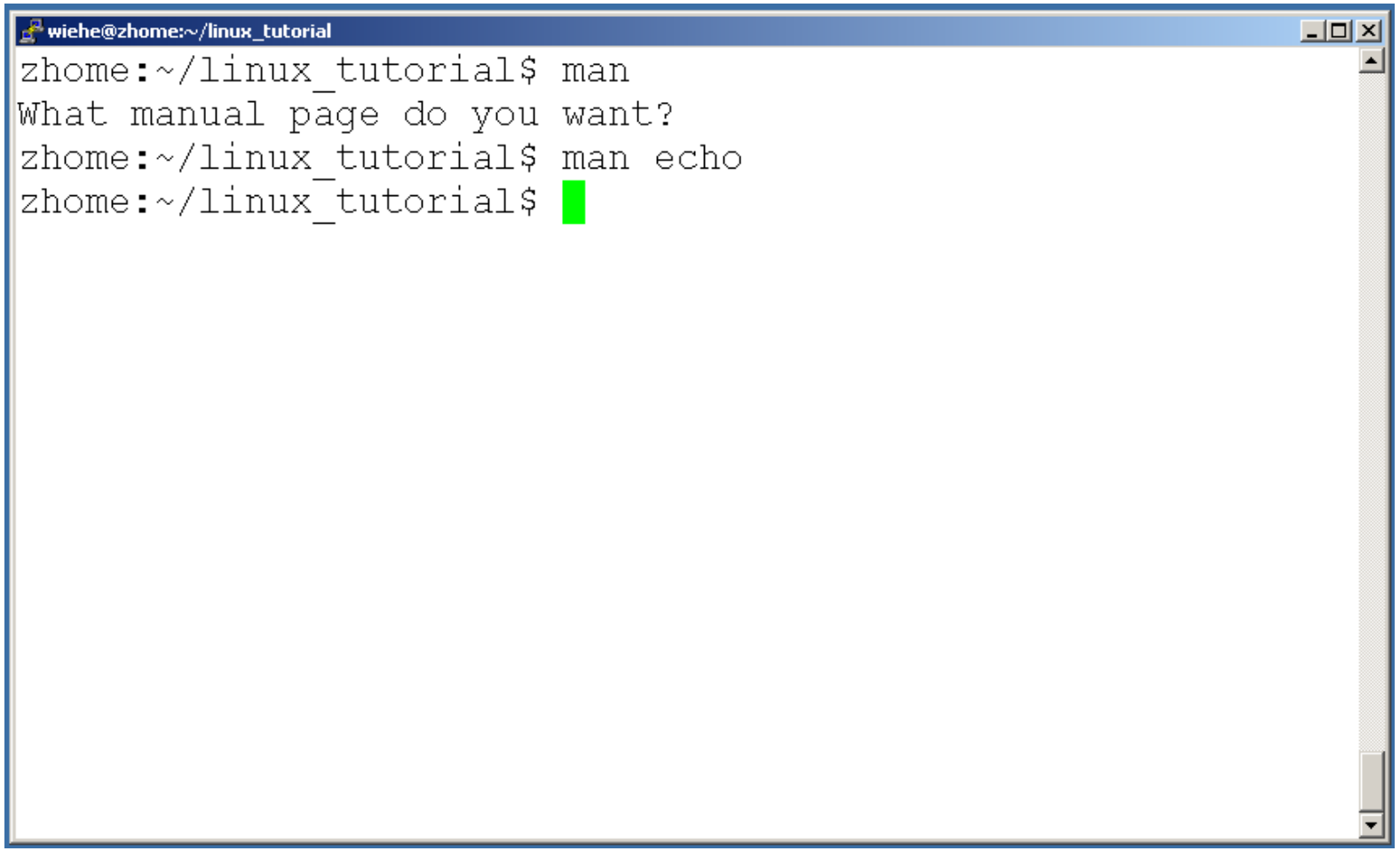


What exactly is a “shell”?

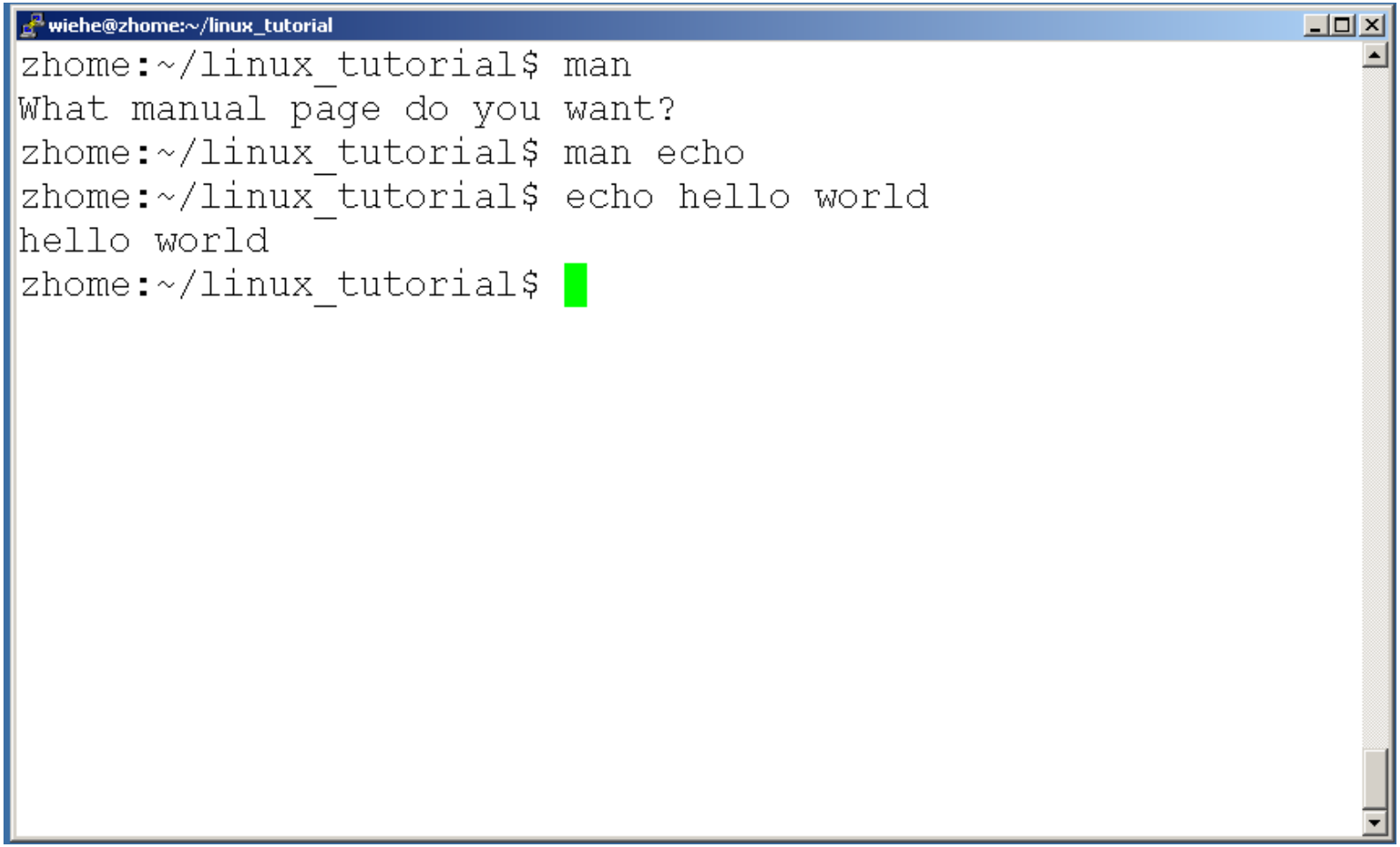
- After logging in, Linux/Unix starts another program called the **shell**
- The shell interprets commands the user types and manages their execution
    - The shell communicates with the internal part of the operating system called the **kernel**
    - The most popular shells are: tcsh, csh, korn, and bash
    - The differences are most times subtle
    - For this tutorial, we are using bash
- Shell commands are **CASE SENSITIVE!**

Help!

Whenever you need help with a command type “man” and the command name

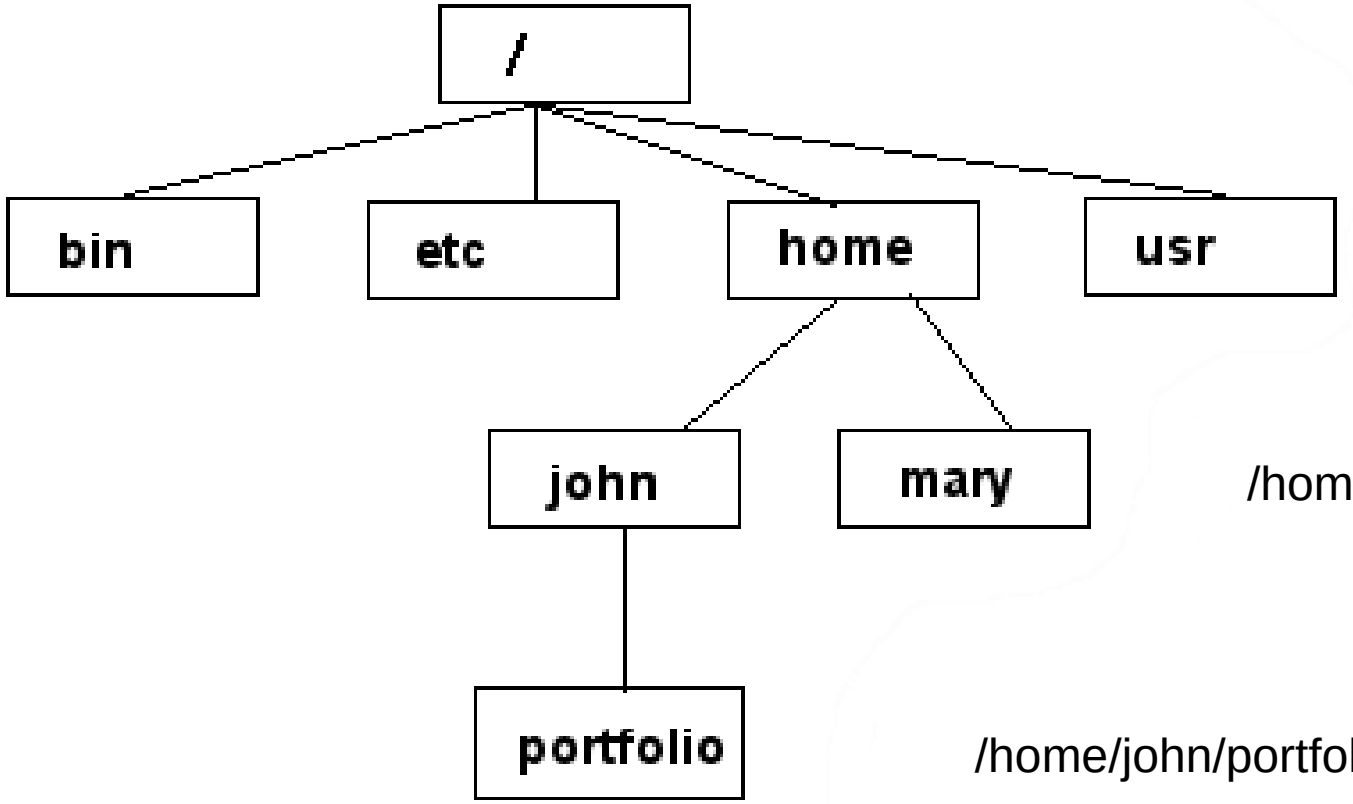


Help!


wiehe@zhome:~/linux_tutorial
zhome:~/linux_tutorial$ man
What manual page do you want?
zhome:~/linux_tutorial$ man echo
zhome:~/linux_tutorial$ echo hello world
hello world
zhome:~/linux_tutorial$

Unix/Linux File System

NOTE: Unix file names are **CASE SENSITIVE!**



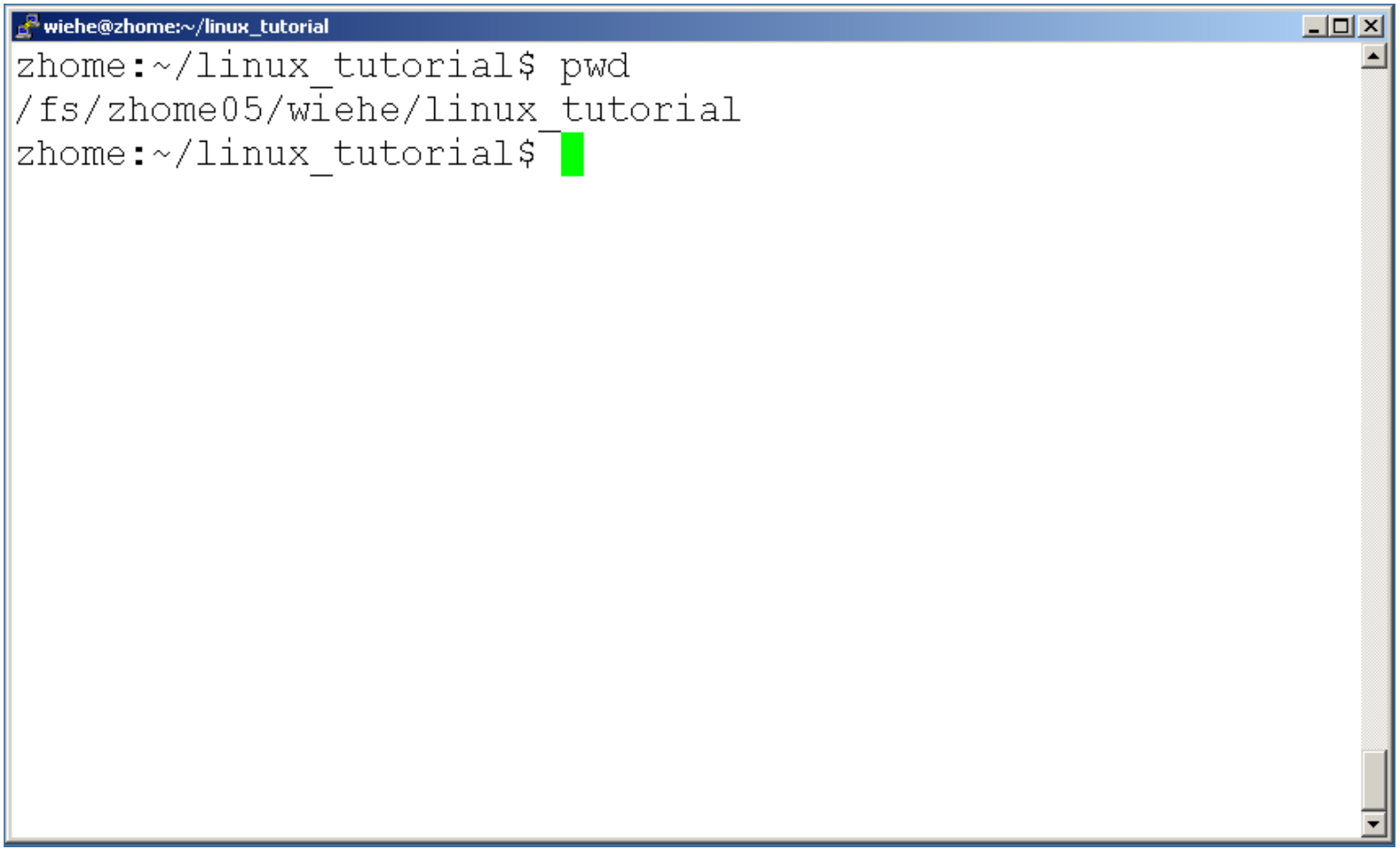
/home/mary/

/home/john/portfolio/

The Path

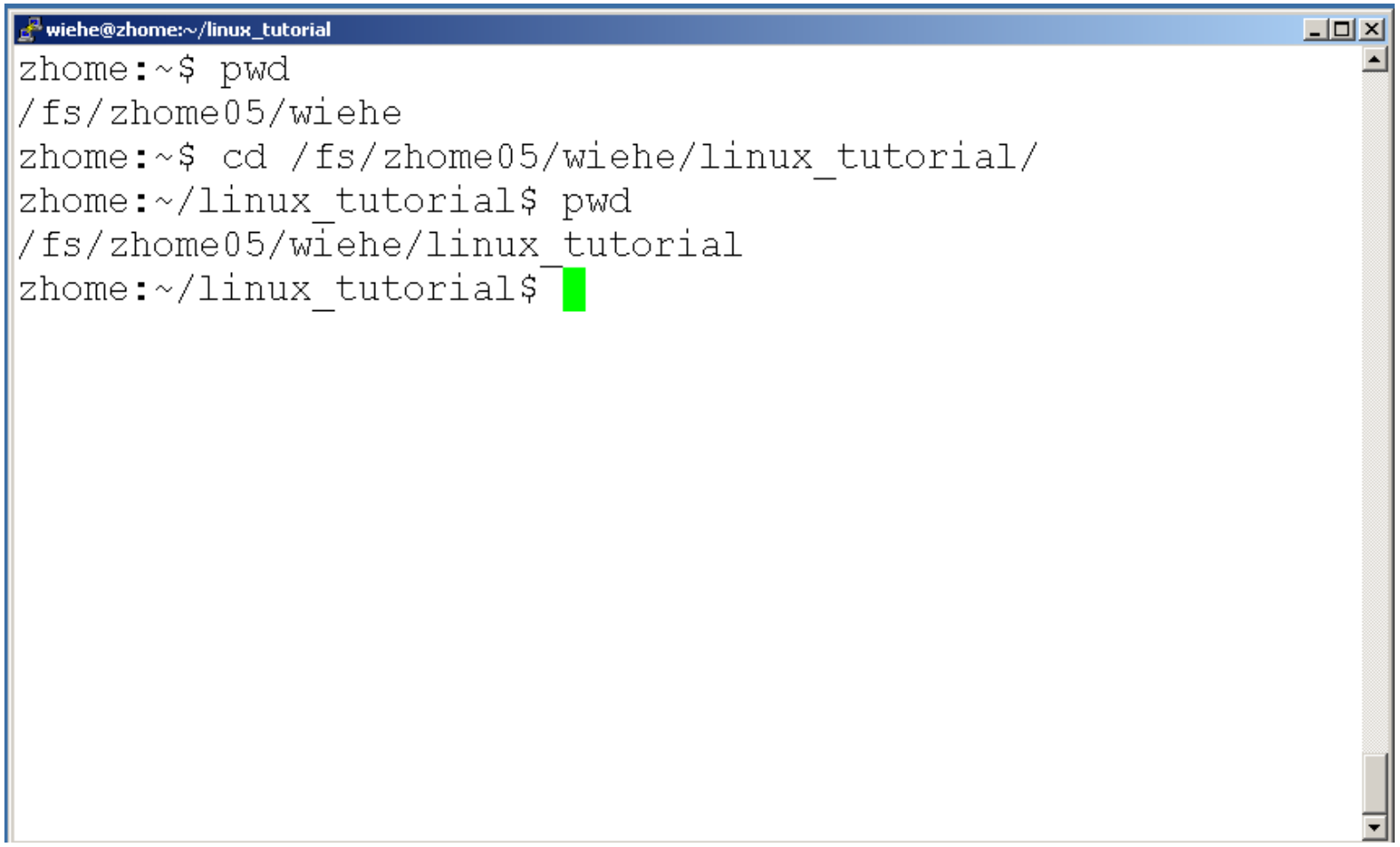
Command: pwd

- To find your current path use “pwd”



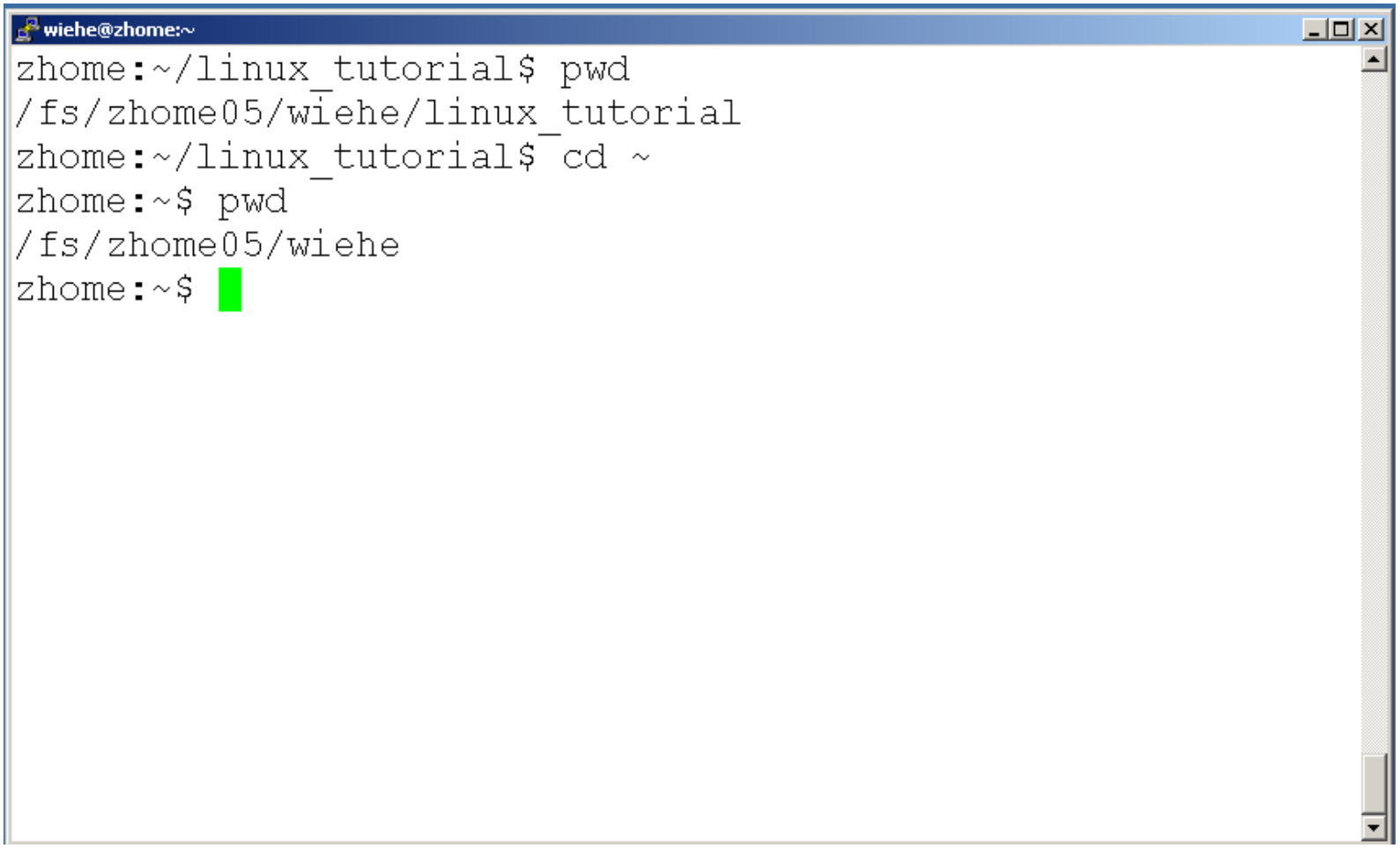
Command: cd

- To change to a specific directory use “cd”



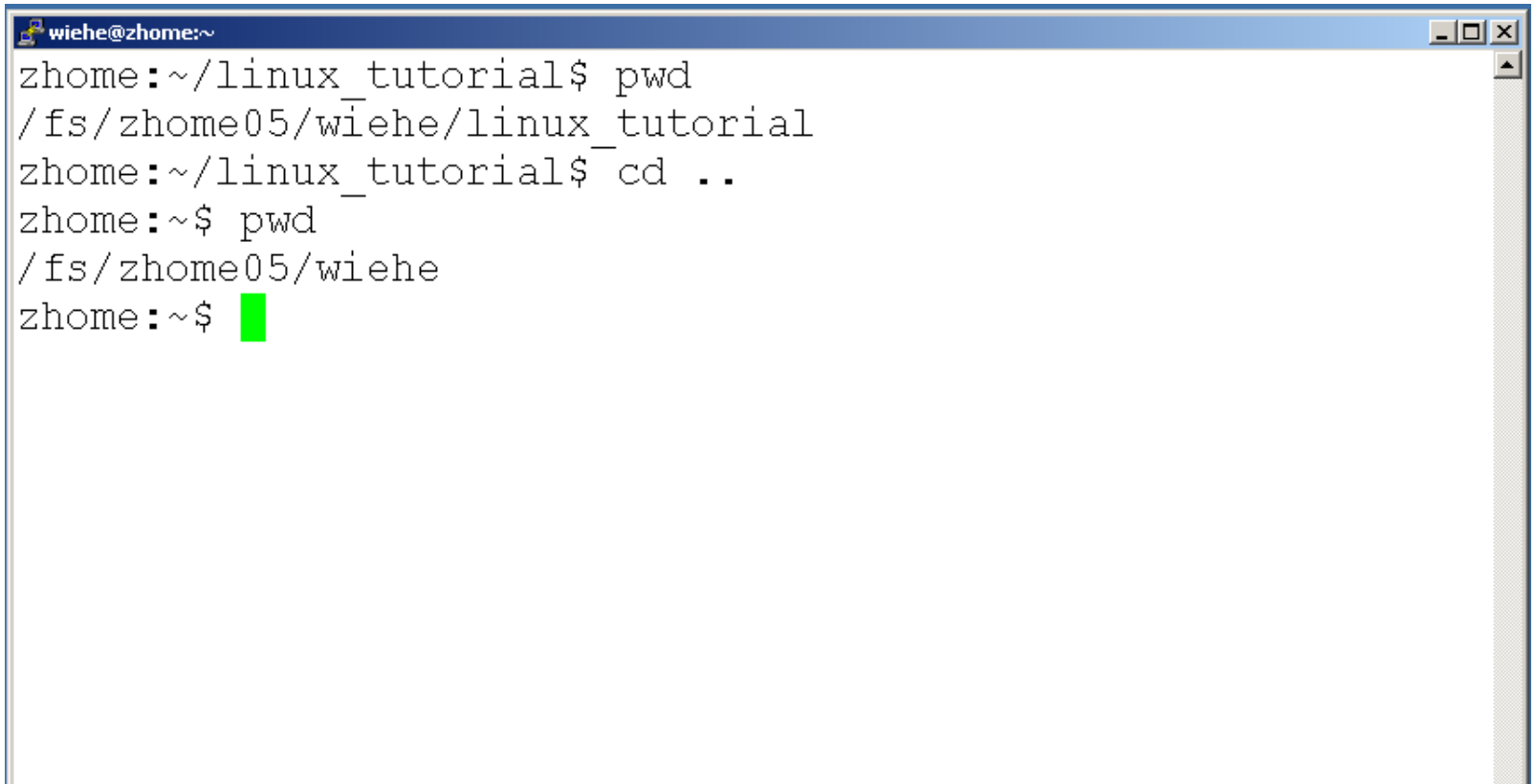
Command: cd

- “~” is the location of your home directory



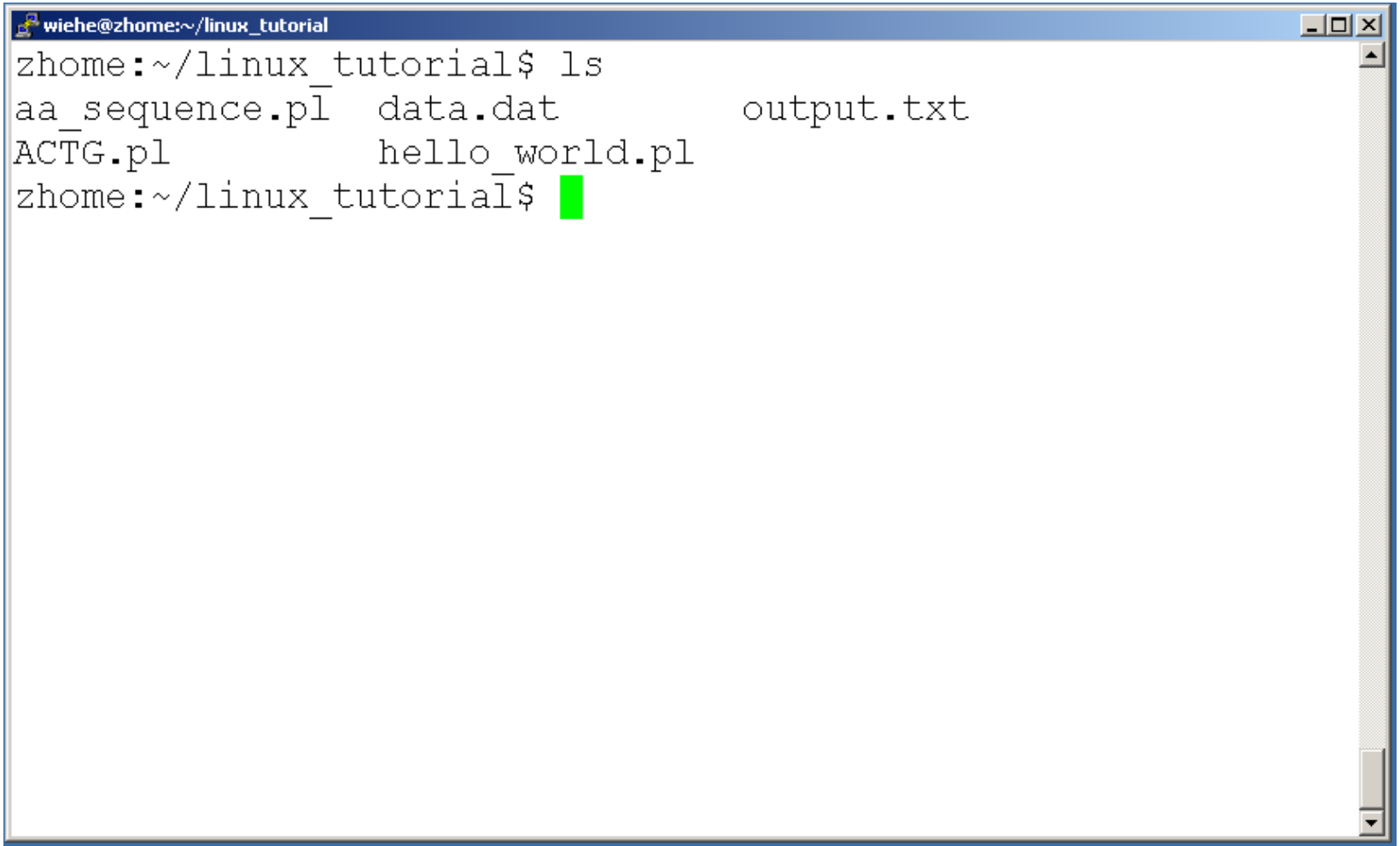
Command: cd

- ".." is the location of the directory below current one



Command: ls

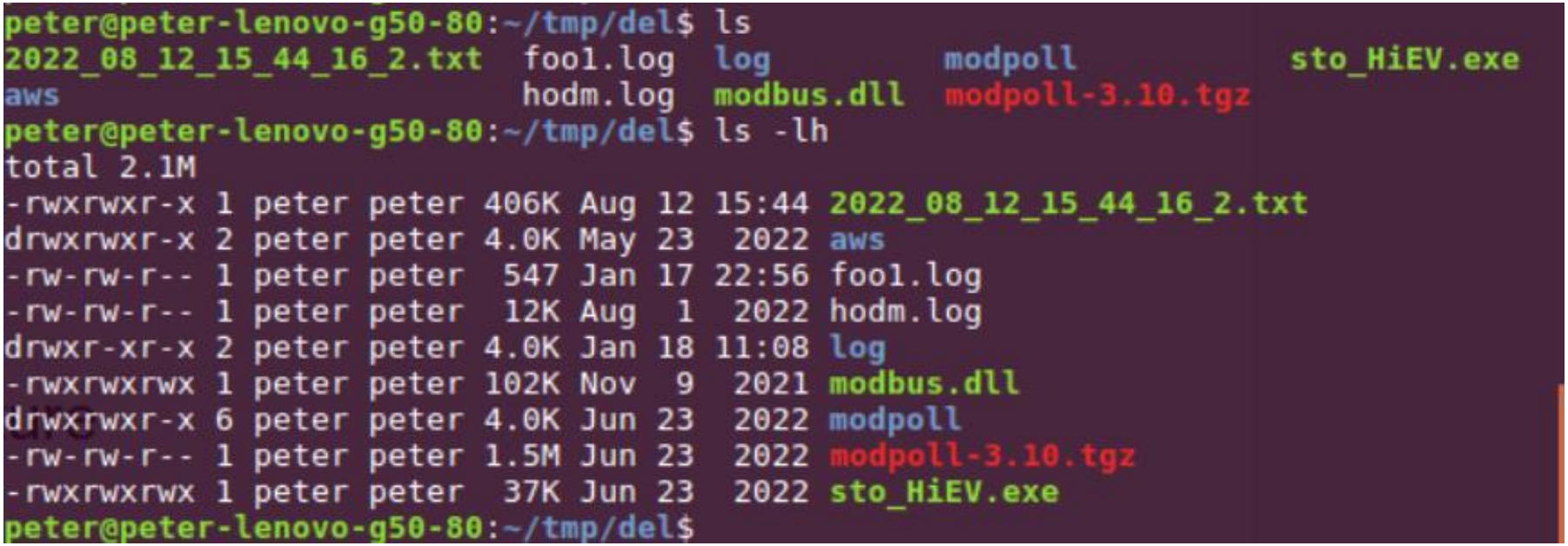
- To list the files in the current directory use “ls”



Command: ls

- ls has many options
  - -l long list (displays lots of info)
  - -t sort by modification time
  - -S sort by size
  - -h list file sizes in human readable format
  - -r reverse the order
- "man ls" for more options
- Options can be combined: "ls -ltr"

Command: ls -lh



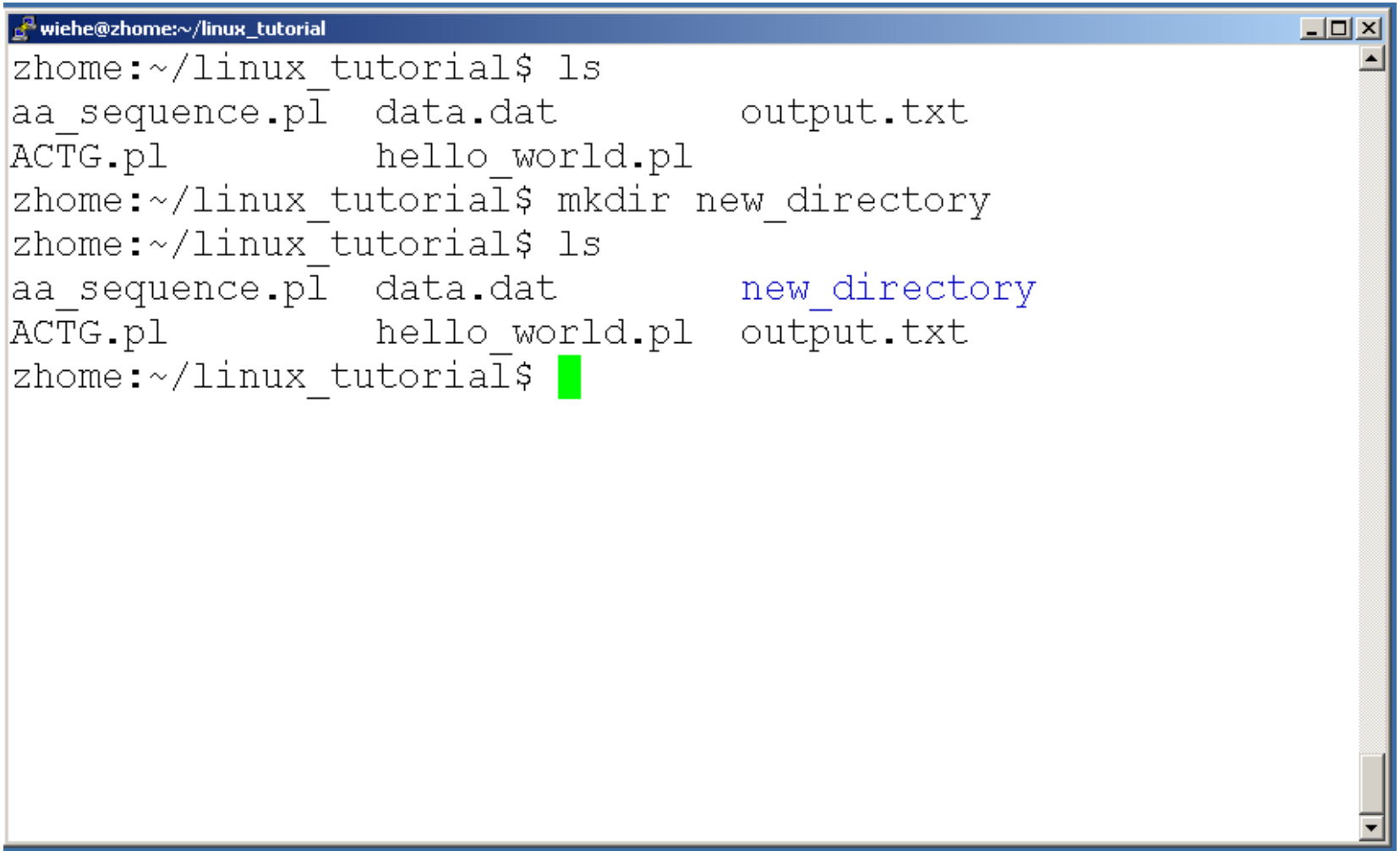
General Syntax: *

- “*” can be used as a wildcard in unix/linux

```
peter@peter-lenovo-g50-80:~/tmp/del$ ls -lh
total 2.1M
-rwxrwxr-x 1 peter peter 406K Aug 12 15:44 2022_08_12_15_44_16_2.txt
drwxrwxr-x 2 peter peter 4.0K May 23  2022 aws
-rw-rw-r-- 1 peter peter  547 Jan 17 22:56 foo1.log
-rw-rw-r-- 1 peter peter  12K Aug  1  2022 hodm.log
drwxr-xr-x 2 peter peter 4.0K Jan 18 11:08 log
-rwxrwxrwx 1 peter peter 102K Nov  9  2021 modbus.dll
drwxrwxr-x 6 peter peter 4.0K Jun 23  2022 modpoll
-rw-rw-r-- 1 peter peter 1.5M Jun 23  2022 modpoll-3.10.tgz
-rwxrwxrwx 1 peter peter  37K Jun 23  2022 sto_HiEV.exe
peter@peter-lenovo-g50-80:~/tmp/del$ ls *.log -lh
-rw-rw-r-- 1 peter peter 547 Jan 17 22:56 foo1.log
-rw-rw-r-- 1 peter peter 12K Aug  1  2022 hodm.log
peter@peter-lenovo-g50-80:~/tmp/del$
```

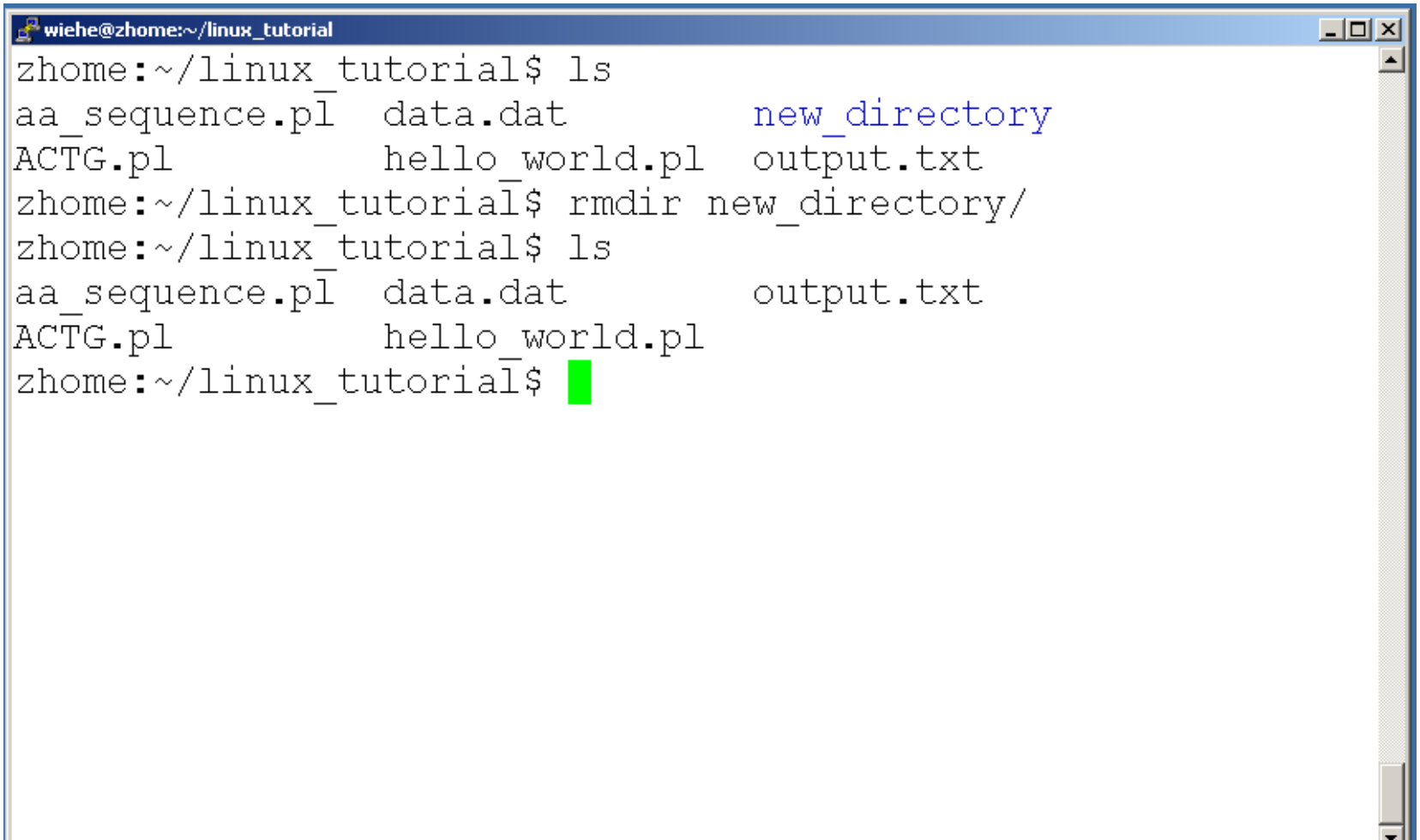
Command: mkdir

- To create a new directory use “mkdir”



Command: rmdir

- To remove and empty directory use “rmdir”



Displaying a file

- Various ways to display a file in Unix
  - cat
  - less
  - head
  - tail

Command: cat

- Dumps an entire file to standard output
- Good for displaying short, simple files

Command: less

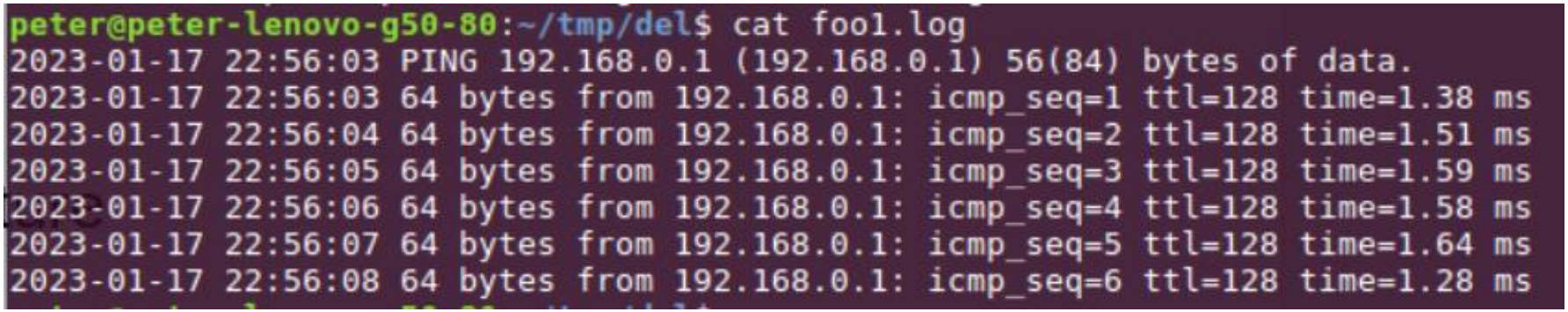
- "less" displays a file, allowing forward/backward movement within it
  - return scrolls forward one line, space one page
  - y scrolls back one line, b one page
- use "/" to search for a string
- Press q to quit

Command: head

- “head” displays the top part of a file
- By default it shows the first 10 lines
- -n option allows you to change that
- “head -n50 file.txt” displays the first 50 lines of file.txt

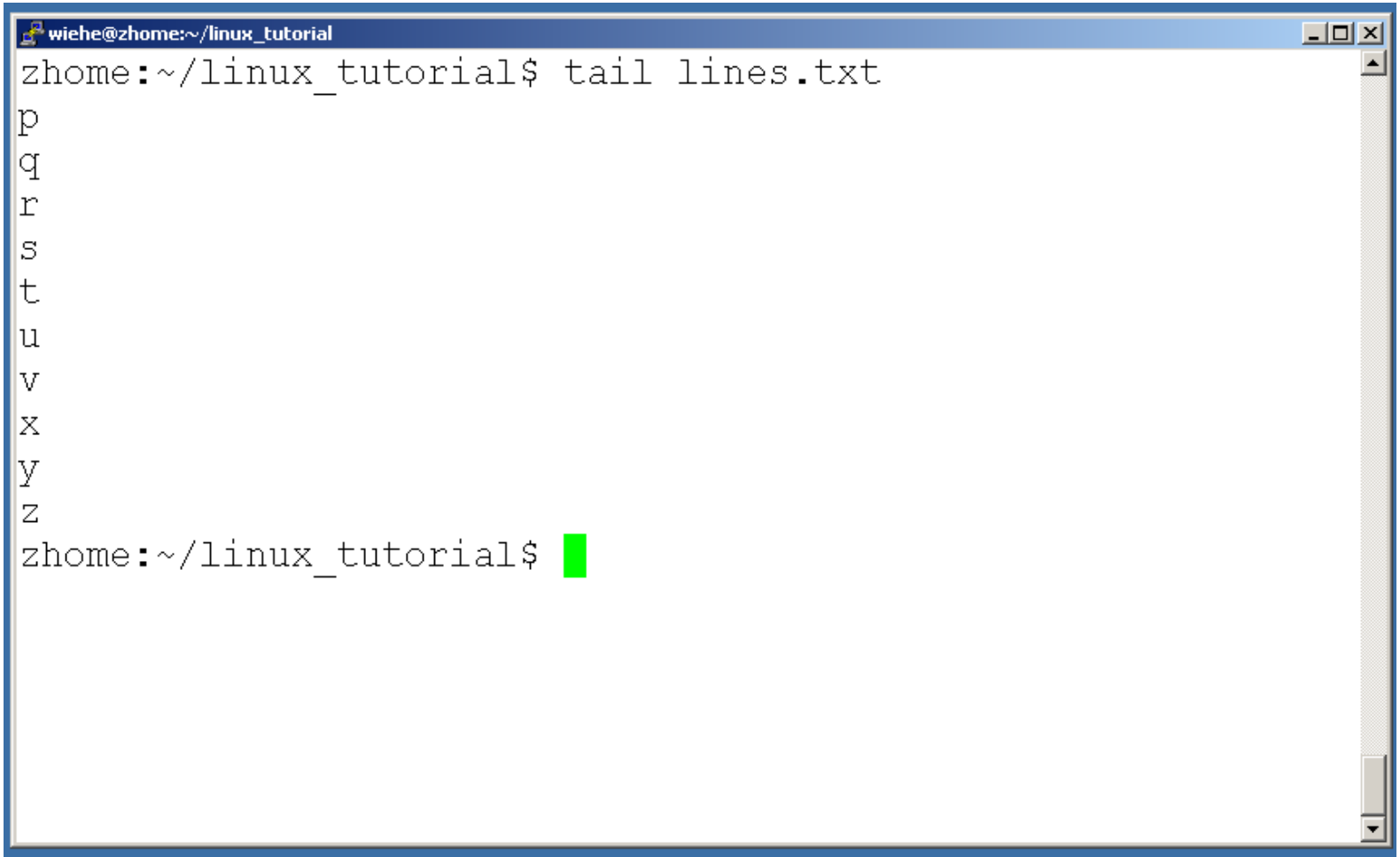
Command: cat

- Here's an example of using "cat":



Command: tail

- Same as head, but shows the last lines

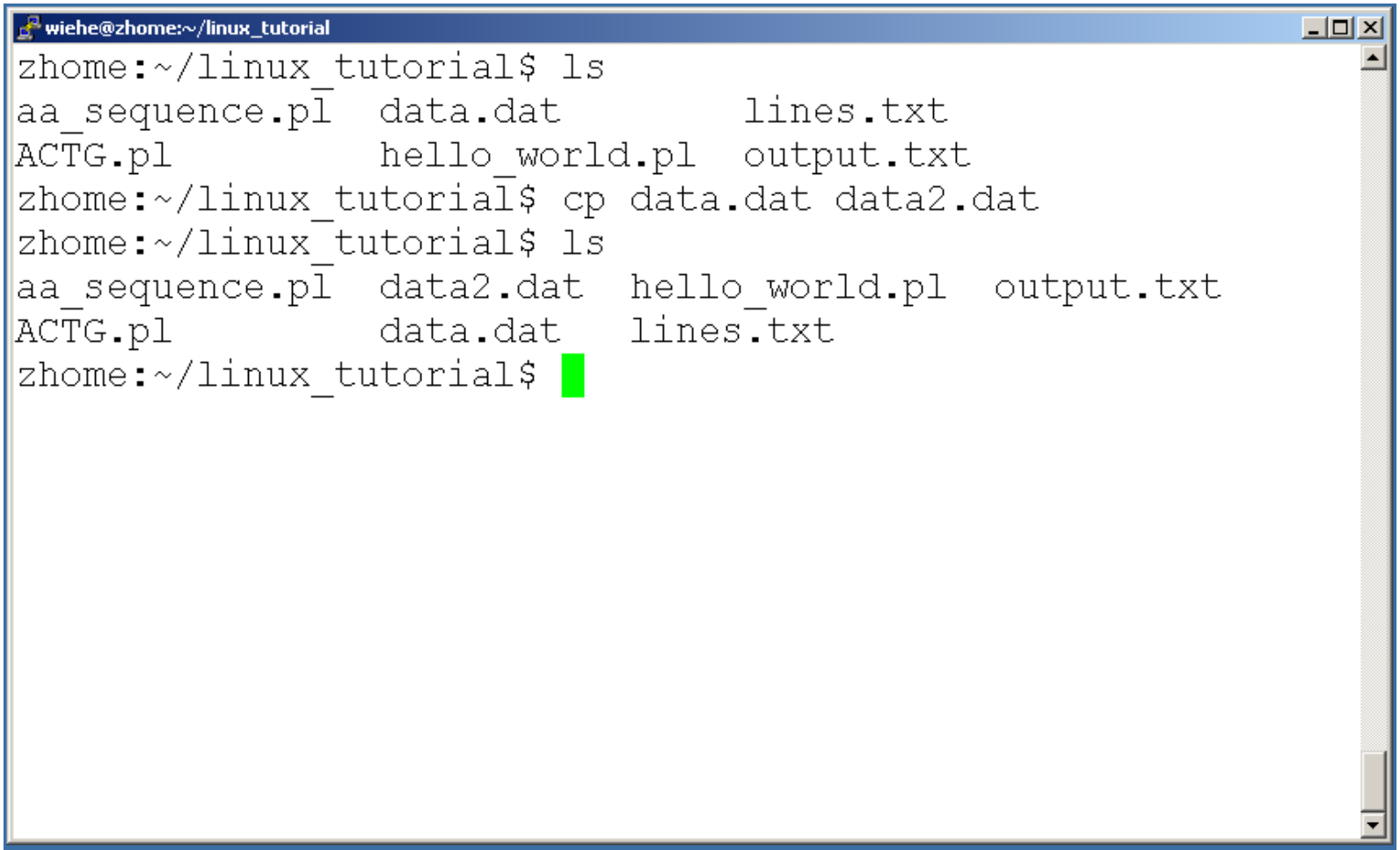


File Commands

- Copying a file: cp
- Move or rename a file: mv
- Remove a file: rm

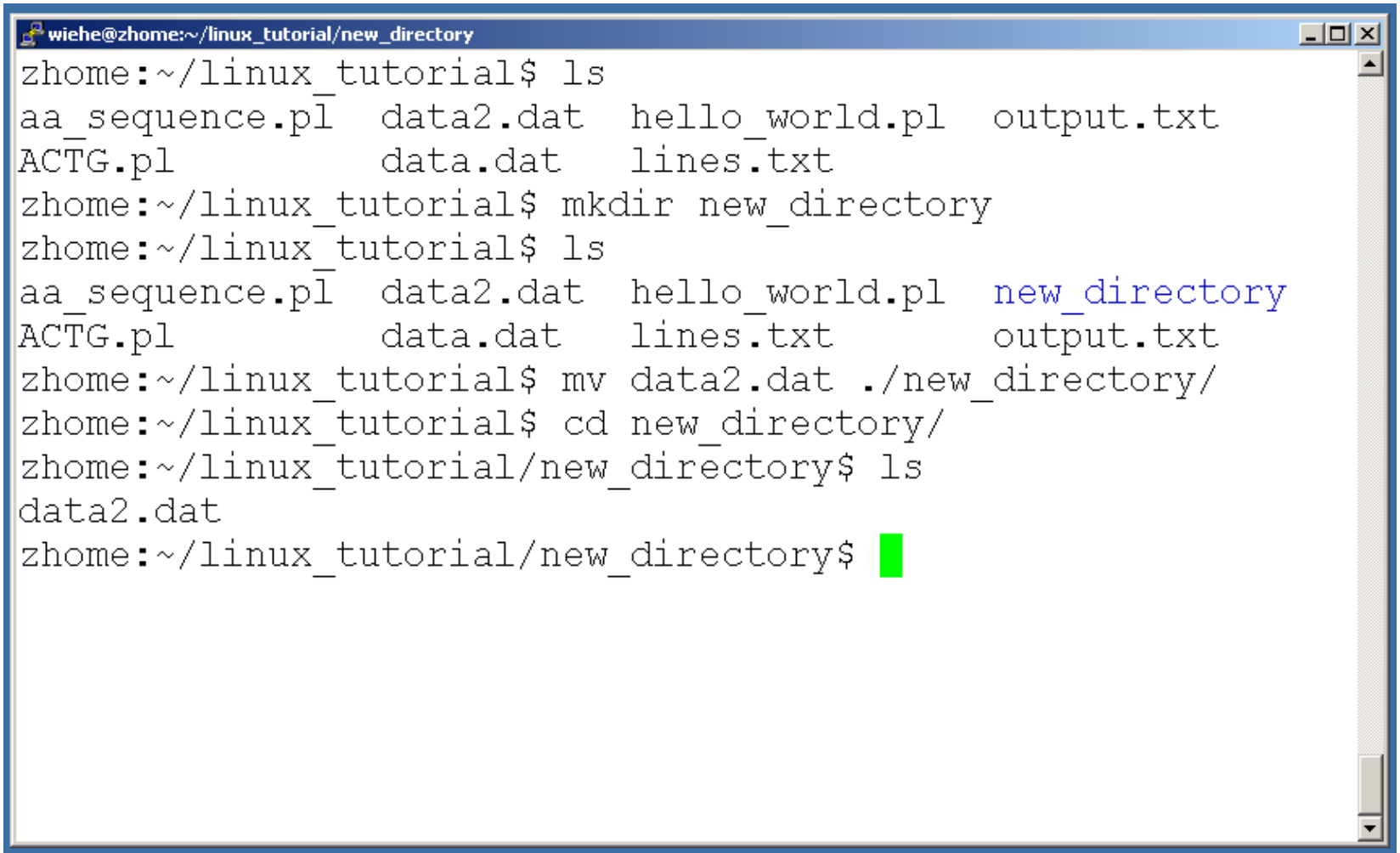
Command: cp

- To copy a file use “cp”



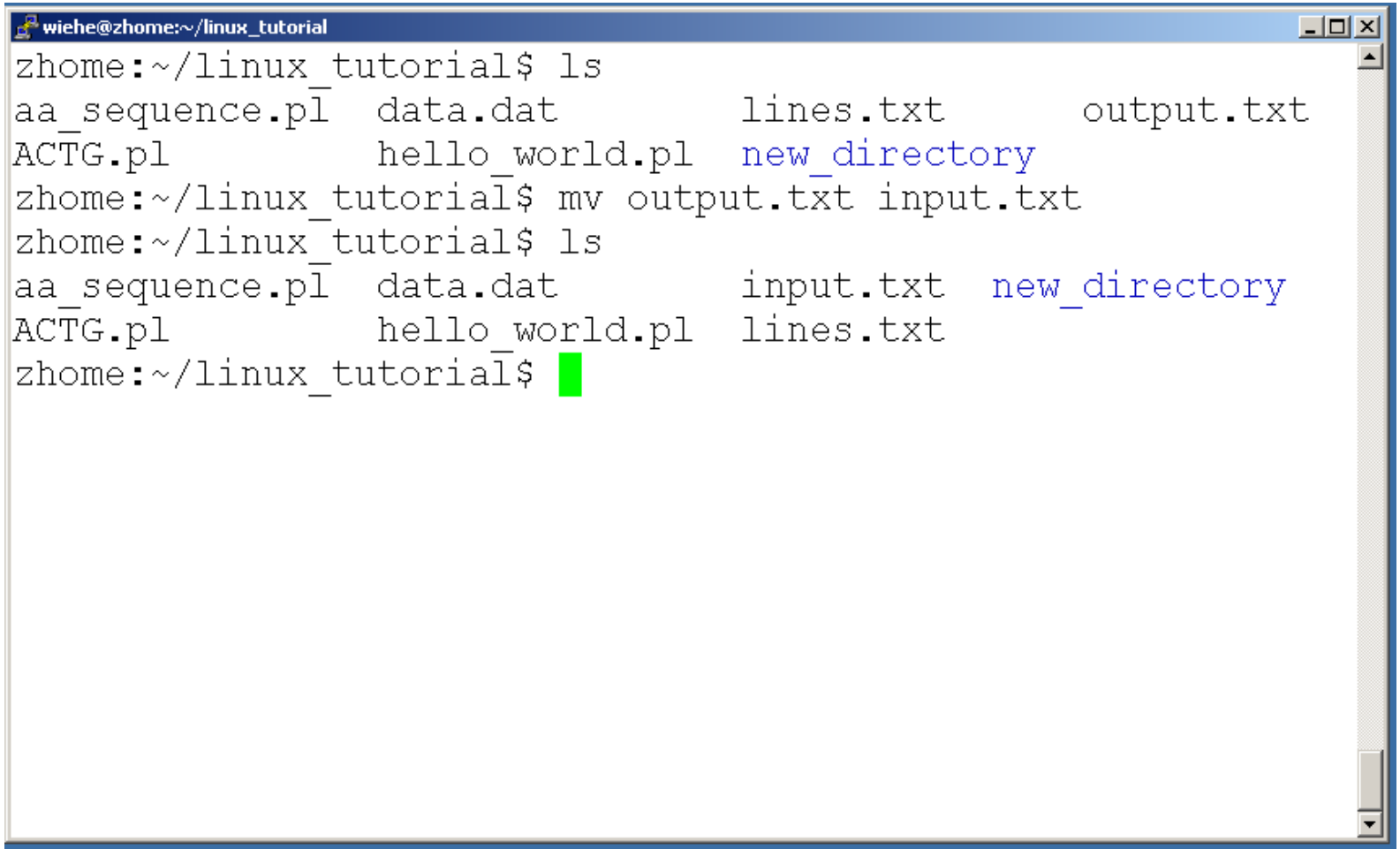
Command: mv

- To move a file to a different location use “mv”



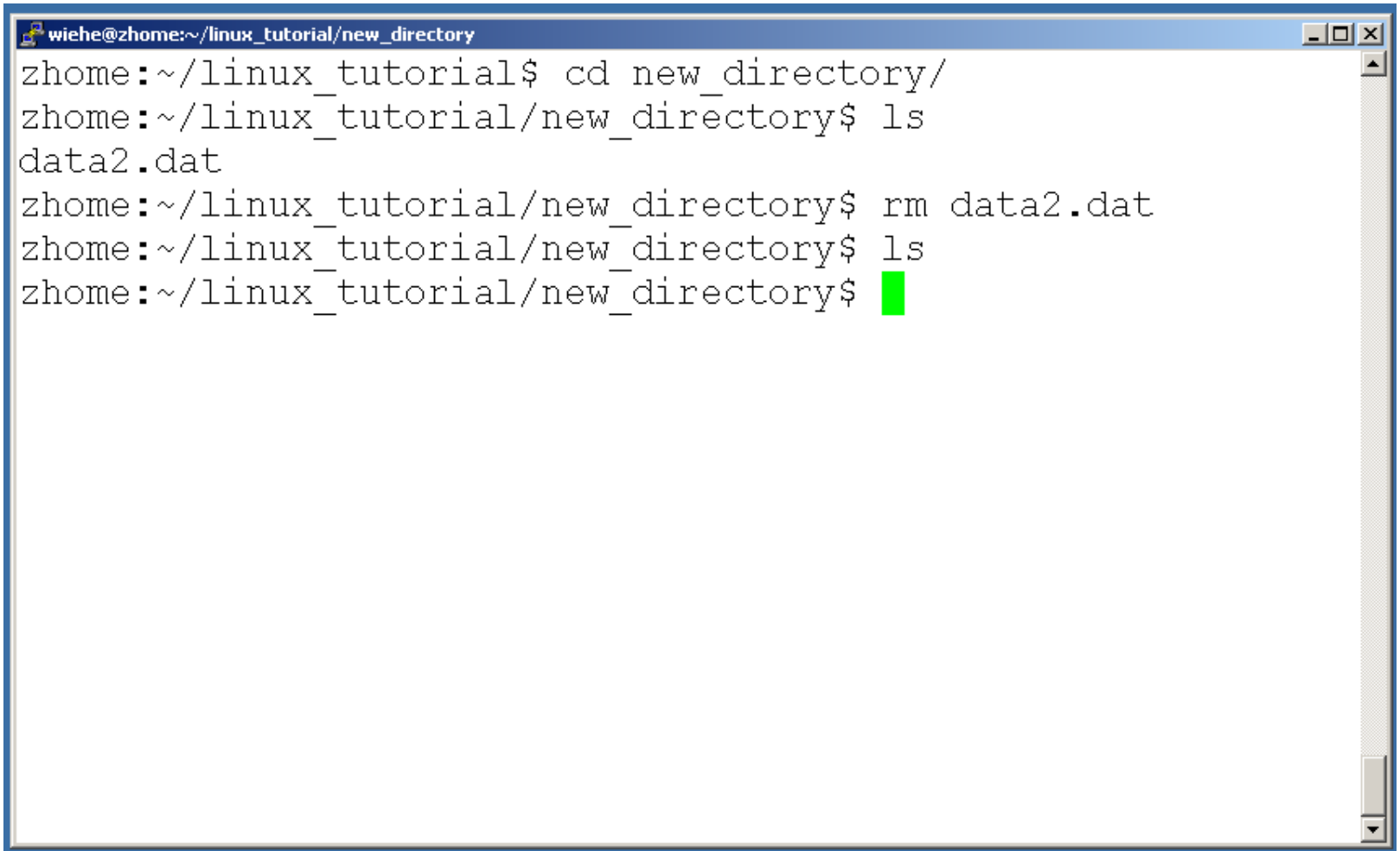
Command: mv

- mv can also be used to rename a file



Command: rm

- To remove a file use “rm”



Command: rm

- To remove a file “recursively”: rm –r
- Used to remove all files and directories
- Be very careful, deletions are permanent in Unix/Linux

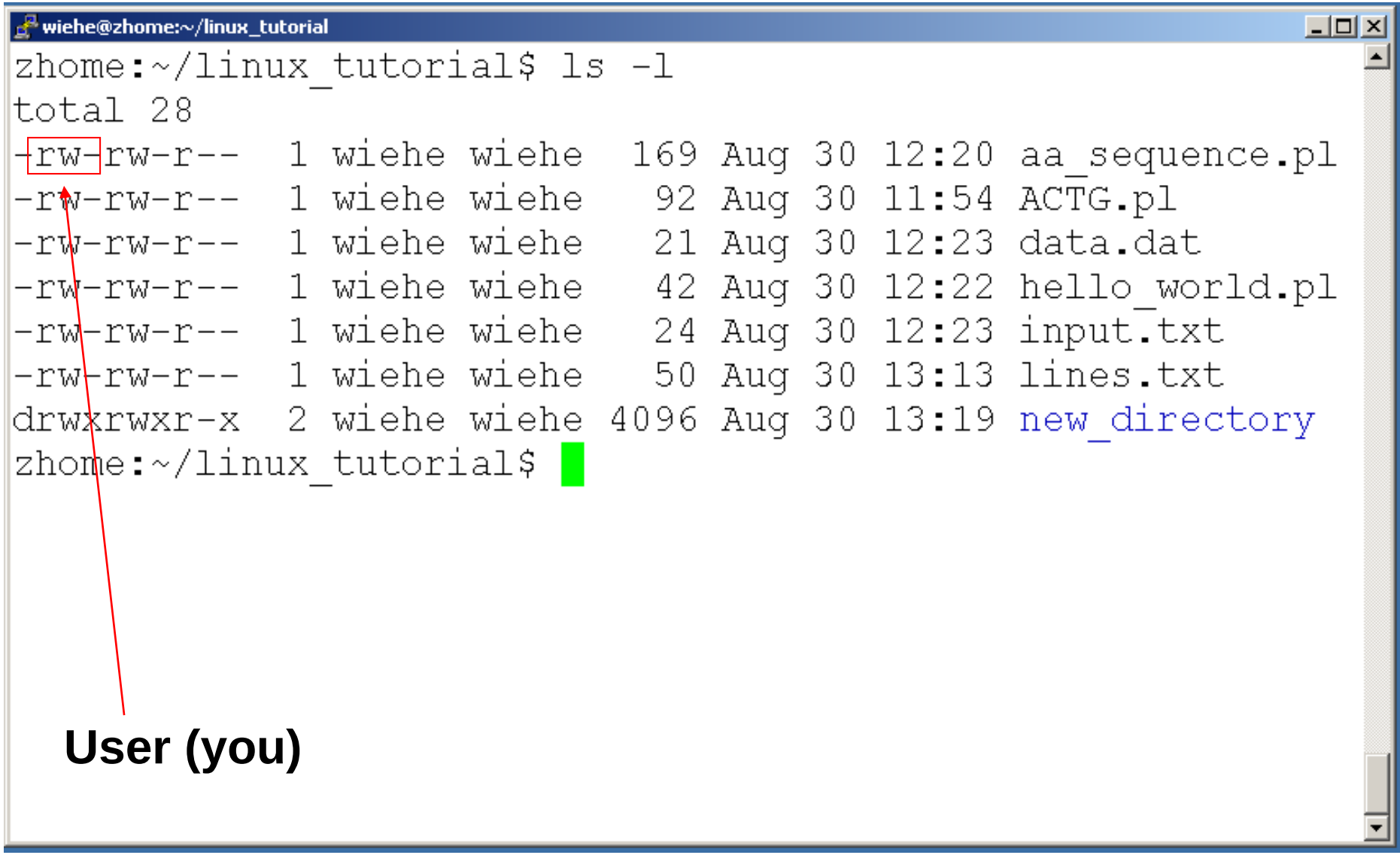
File permissions

- Each file in Unix/Linux has an associated permission level
- This allows the user to prevent others from reading/writing/executing their files or directories
- Use “ls -l *filename*” to find the permission level of that file

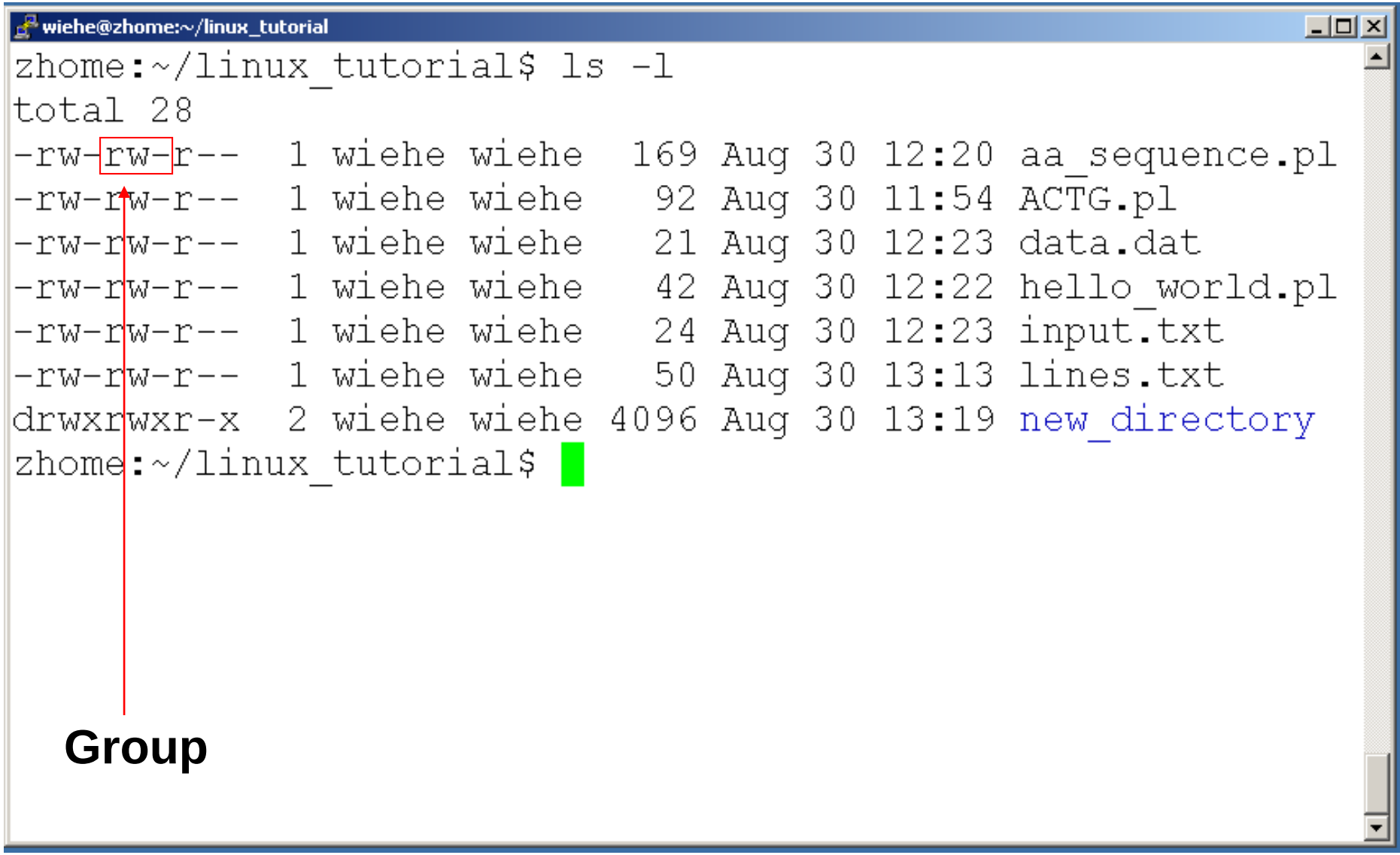
Permission levels

- “r” means “read only” permission
- “w” means “write” permission
- “x” means “execute” permission
  - In case of directory, “**x**” grants permission to list directory contents

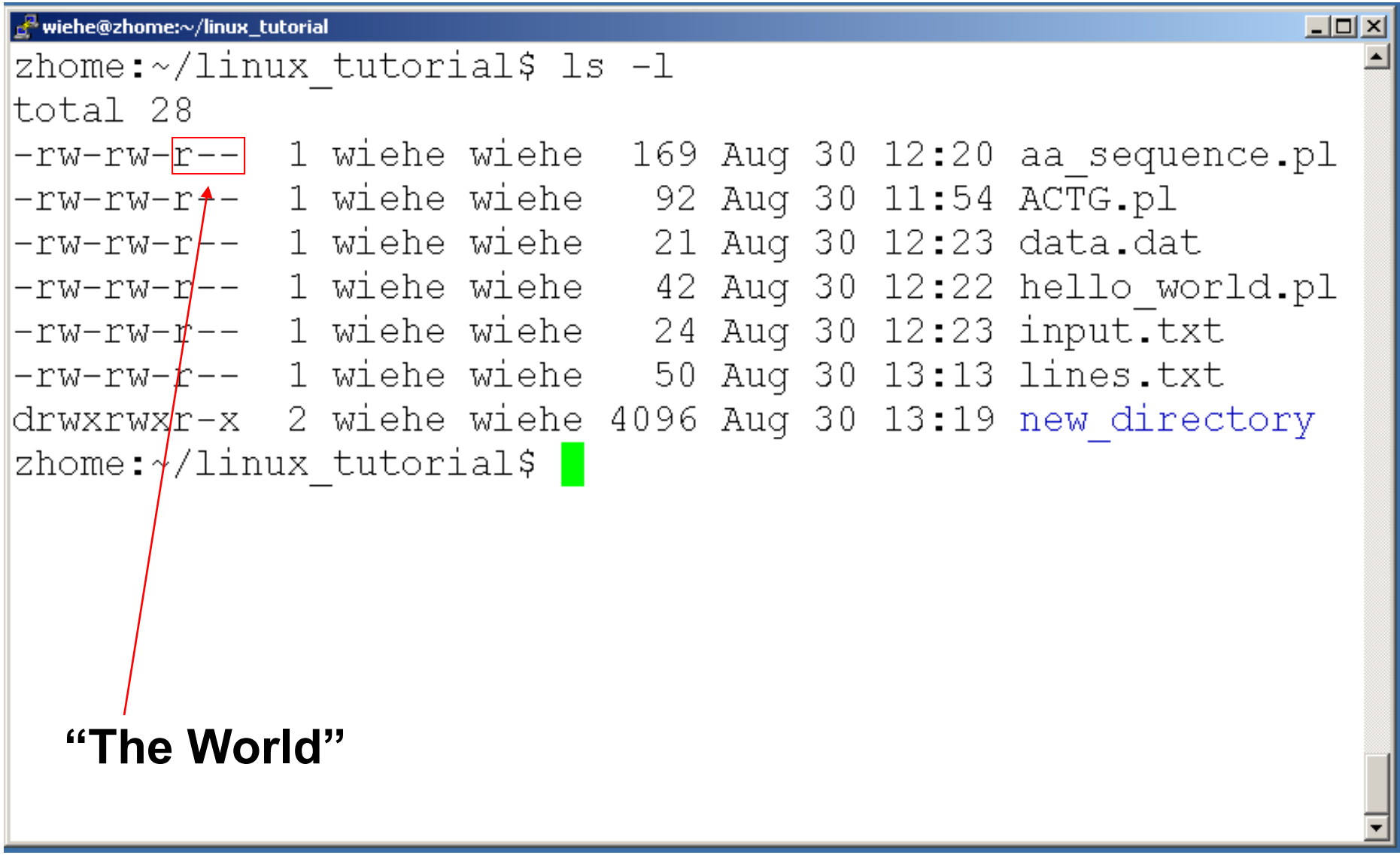
File Permissions



File Permissions

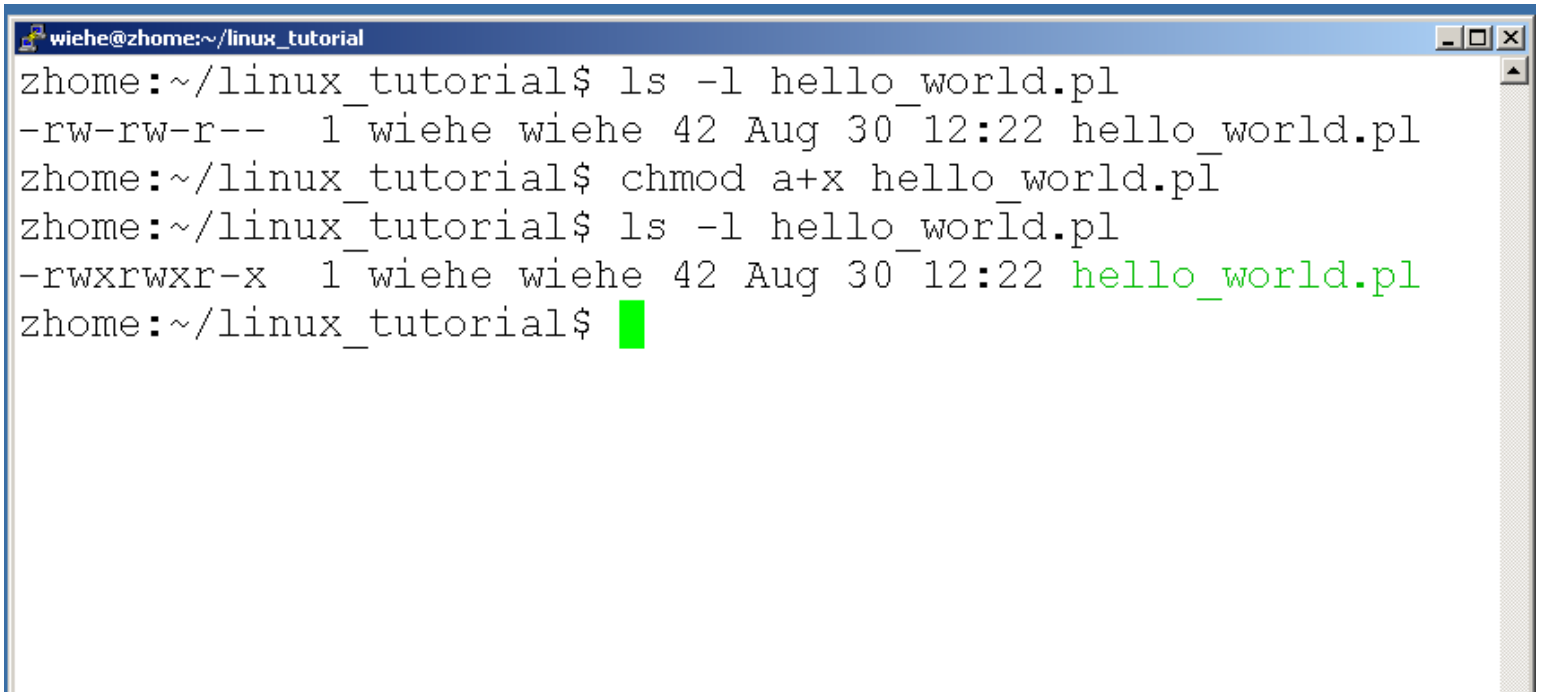


File Permissions



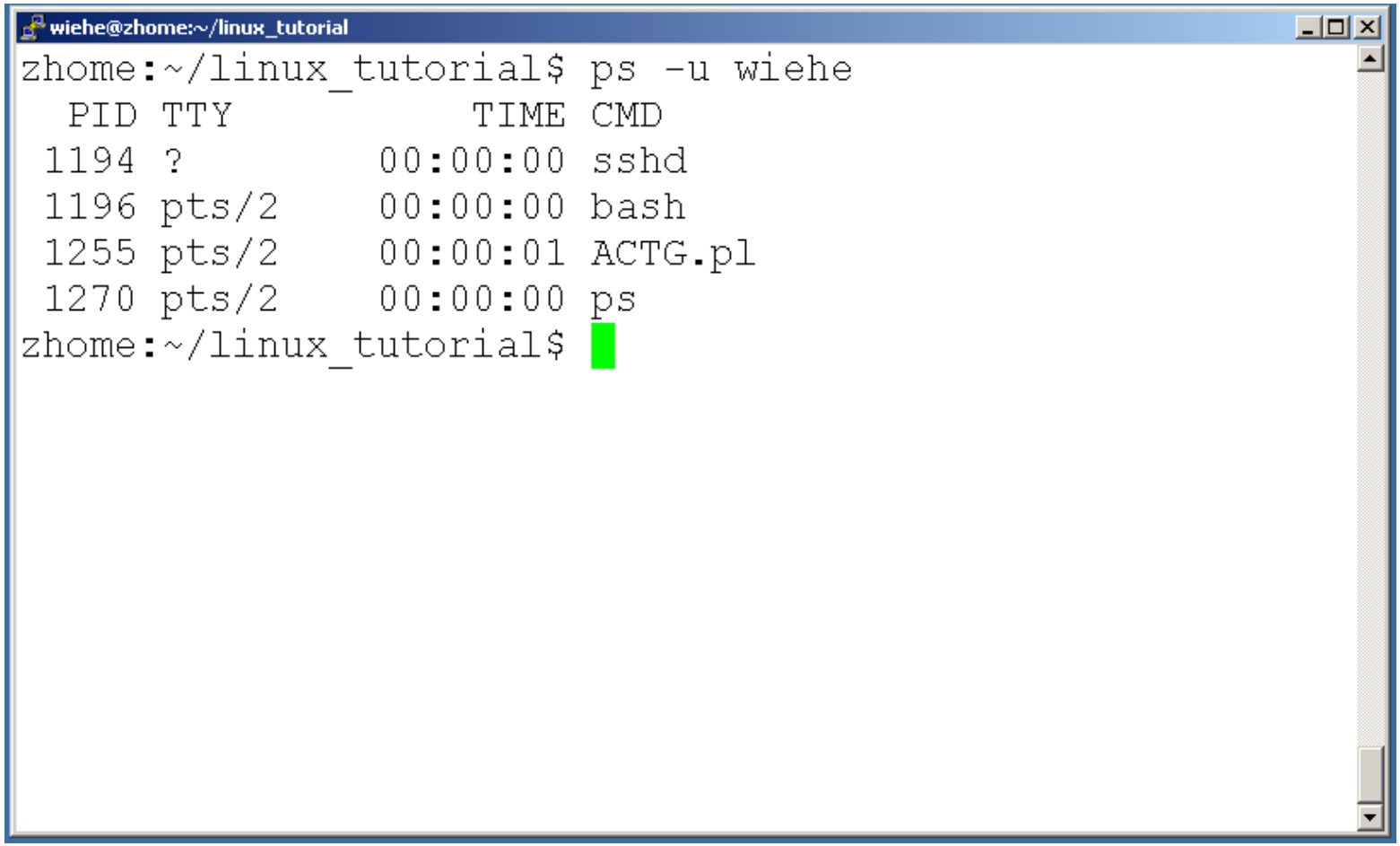
Command: chmod

- If you own the file, you can change it's permissions with "chmod"
  - Syntax: chmod [**u**ser/**g**roup/**o**thers/**a**ll]+[permission] [file(s)]
  - Below we grant execute permission to all:



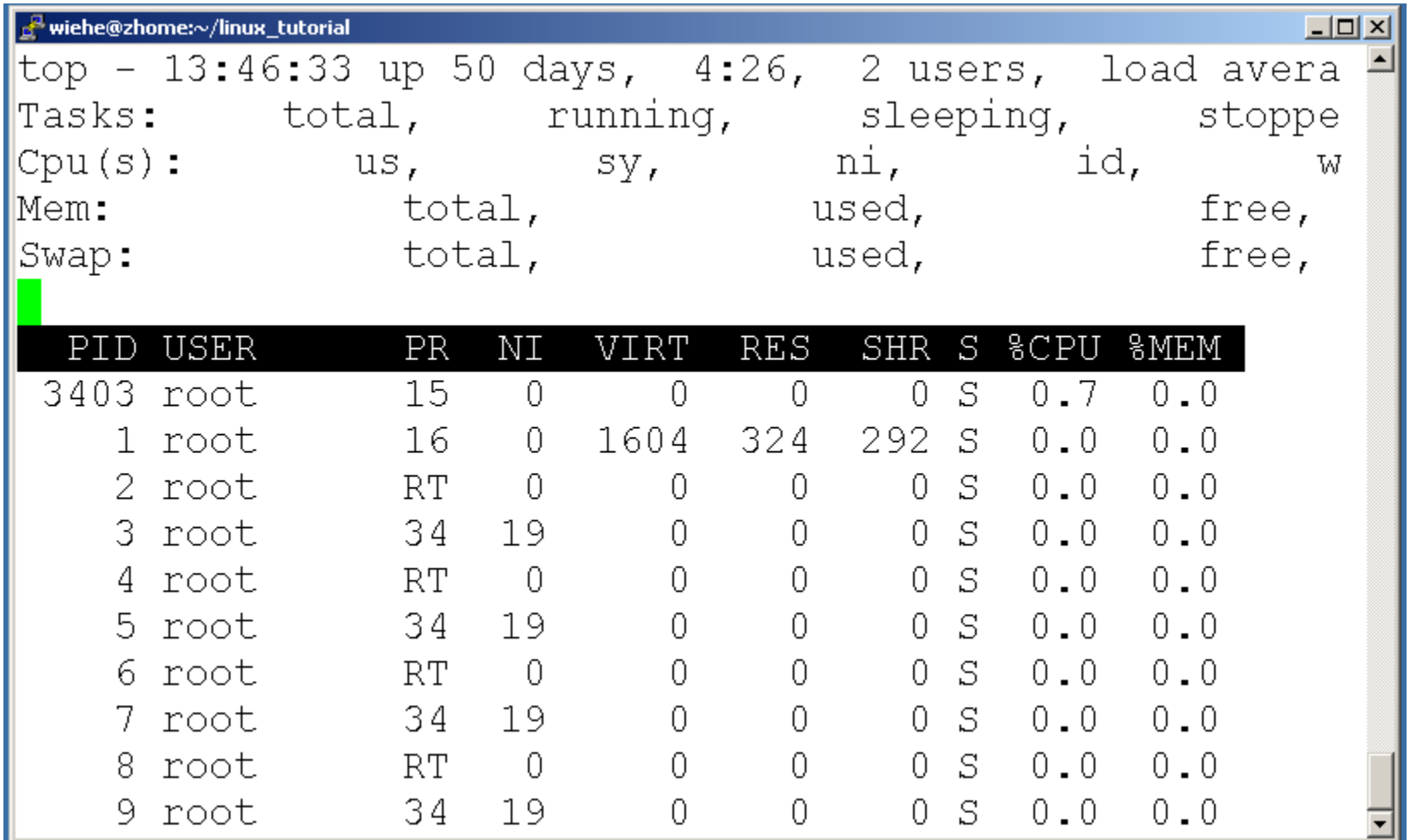
Command: ps

- To view the processes that you're running:



Command: top

- To view the CPU usage of all processes:



Command: kill

- To terminate a process use “kill”

```
peter@peter-lenovo-g50-80:~/tmp/del$ ps -u
USER         PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
peter       3712  0.0  0.0   2316  1668 pts/0    Ss+  Feb06   0:00 /bin/bash ./en
peter       3834  0.1  0.4 391384 153696 pts/0   Sl+  Feb06   2:50 node-red
peter       7652  0.0  0.0  25204  7404 pts/2    Ss+  Feb06   0:00 /bin/bash
peter       7710  0.0  0.0  25204  7404 pts/19   Ss+  Feb06   0:00 /bin/bash
peter       7764  0.0  0.0  25204  7552 pts/20   Ss+  Feb06   0:00 /bin/bash
peter       7818  0.0  0.0  26036  8408 pts/21   Ss+  Feb06   0:00 /bin/bash
peter      11189  0.0  0.1 723076 54876 pts/23   Ssl+ Feb06   0:00 /usr/lib/code-
peter      11209  0.0  0.1 657976 56308 pts/23   Sl+  Feb06   0:04 /usr/lib/code-
peter      35427  0.0  0.0  25204  7480 pts/0    Ss   11:39   0:00 bash
peter      36695  0.3  0.0  25204  7360 pts/22   Ss   11:49   0:00 bash
peter      36750  2.2  0.0  27696  4800 pts/22   S+   11:49   0:00 htop
peter      36762  0.0  0.0  37864  3448 pts/0    R+   11:49   0:00 ps -u
peter     119532  0.0  0.0  25204  7408 pts/26   Ss+  Feb06   0:00 bash
peter     120898  0.0  0.0  25204  7624 pts/27   Ss+  Feb06   0:00 bash
peter@peter-lenovo-g50-80:~/tmp/del$ kill -9 36750
```

Vim

- Vim是一款高度定製化的文字編輯器，被廣泛用於Linux和其他Unix系統中。Vim可以幫助你快速、高效地編輯各種文字文件。
  - sudo apt install vim
- 打開Vim 在終端中輸入vim，按Enter鍵即可打開Vim。
- 進入命令模式 Vim有三種模式
  - 分別是命令模式、插入模式和可視模式
  - 打開Vim後，你會進入命令模式，可以在這個模式下輸入各種命令。
  - 進入插入模式 在命令模式下按下 i 鍵，即可進入插入模式。
    - 在這個模式下，你可以編輯文字。
- 保存和退出 在命令模式下輸入 :wq，即可保存文件並退出Vim。
  - 如果只想保存文件，而不退出Vim，可以輸入 :w。
  - 退出但不存檔， :q!
- 移動游標 在命令模式下，可以使用 h、j、k、l 鍵來左、下、上、右移動游標。
- 刪除字元 在命令模式下，可以使用 x 鍵來刪除游標所在的字元。
- 撤銷操作 在命令模式下，可以使用 u 鍵來撤銷之前的操作。
- 尋找和替換 在命令模式下，可以使用 /text 來尋找文字，使用 :s/old/new/g 來替換文字中的 old 字串為 new 字串。

Nano

- 啟動 Nano
  - Nano
- 開啟一個文件
  - nano filename.txt
- 編輯文件
  - 一旦你打開了文件，你就可以開始編輯它了。
  - 在 Nano 中，可以使用標準的方向鍵來移動游標，使用鍵盤來輸入文字。
- 儲存文件
  - 若要儲存文件，可以按 Ctrl + O 來儲存。
  - 你也可以使用 Ctrl + X 退出 Nano，如果你已經對文件進行了更改，它會提示你是否要保存。
- 退出 Nano
  - 如果你想要關閉 Nano，可以按 Ctrl + X。
  - 如果你已經對文件進行了更改，它會提示你是否要保存。

apt / deb安裝程式

- apt update：更新軟體包列表。
- apt upgrade：升級所有可用的軟體包。
- apt install package：安裝指定的軟體包。
- apt remove package：刪除指定的軟體包。
- apt search term：搜尋包含指定關鍵詞的軟體包。
- apt show package：顯示指定軟體包的詳細資訊。
- apt list：列出已安裝的所有軟體包。
- apt autoremove：自動刪除不再需要的軟體包。
- apt clean：刪除本地儲存庫中已下載的軟體包。
- apt autoclean：刪除已過期的軟體包。
- 在執行 apt 命令時，可以在命令後加上選項來進行更細緻的操作。例如：

- aptitude 找套件的好工具
  - sudo apt install aptitude
- sudo aptitude search package-name

- dpkg 安裝已下載安裝包
- dpkg -i package_file.deb

練習1

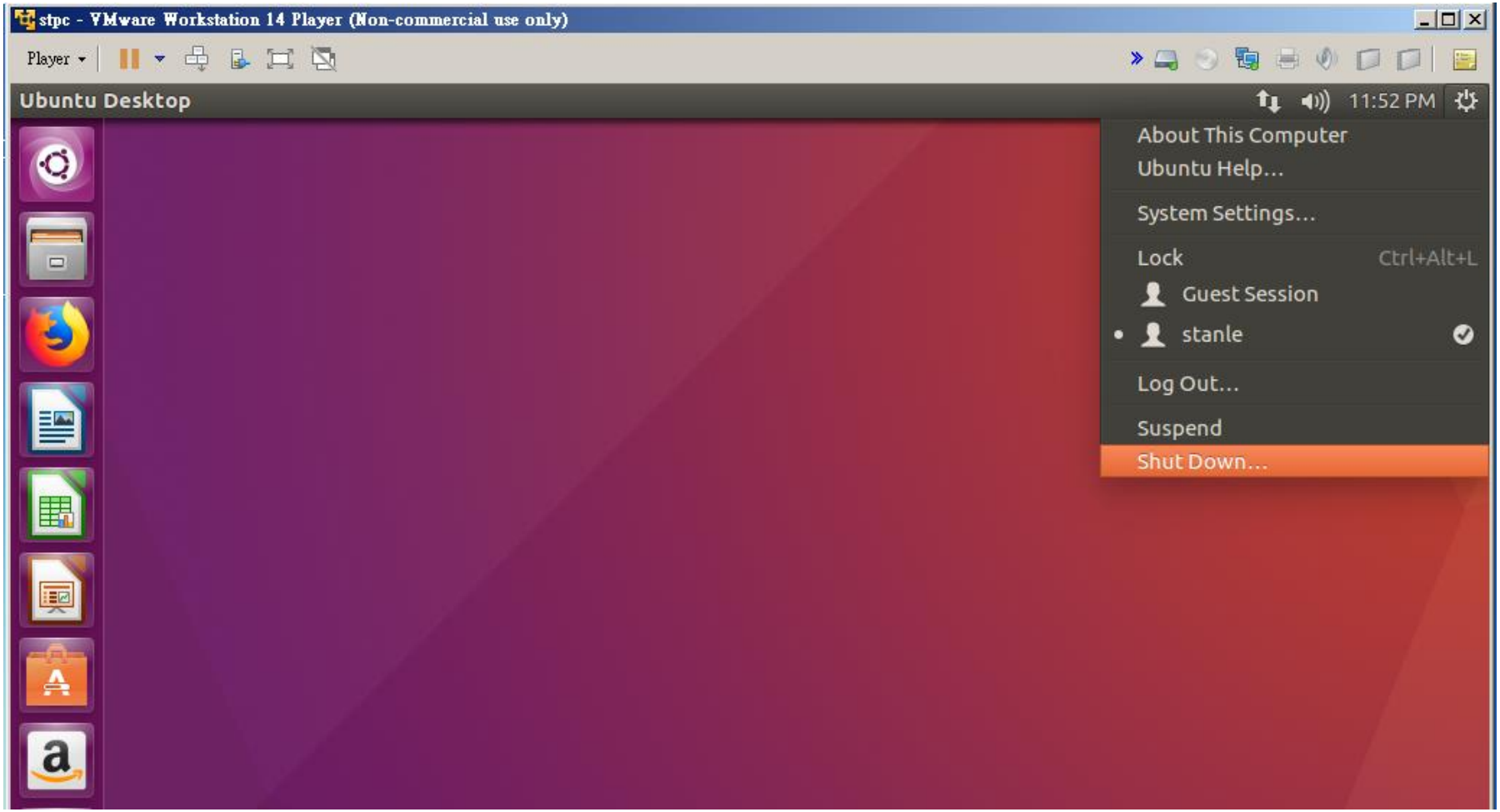
1. 創建一個目錄，並命名為「mydir」。
2. 在「mydir」目錄中創建一個文字文件，命名為「myfile」。
3. 在「myfile」文件中寫入一些文字內容。
4. 將「myfile」文件中的所有內容複製到「myfile2」文件中。
5. 將「myfile」文件中的內容顯示在終端機中。
6. 在「mydir」目錄中創建一個新的子目錄，命名為「subdir」。
7. 在「subdir」目錄中創建一個新文件，命名為「subfile」。
8. 將「myfile」文件中的內容移動到「subdir」目錄下的「subfile」中。
9. 刪除「myfile」文件。
10. 列出「mydir」目錄下的所有文件和子目錄。

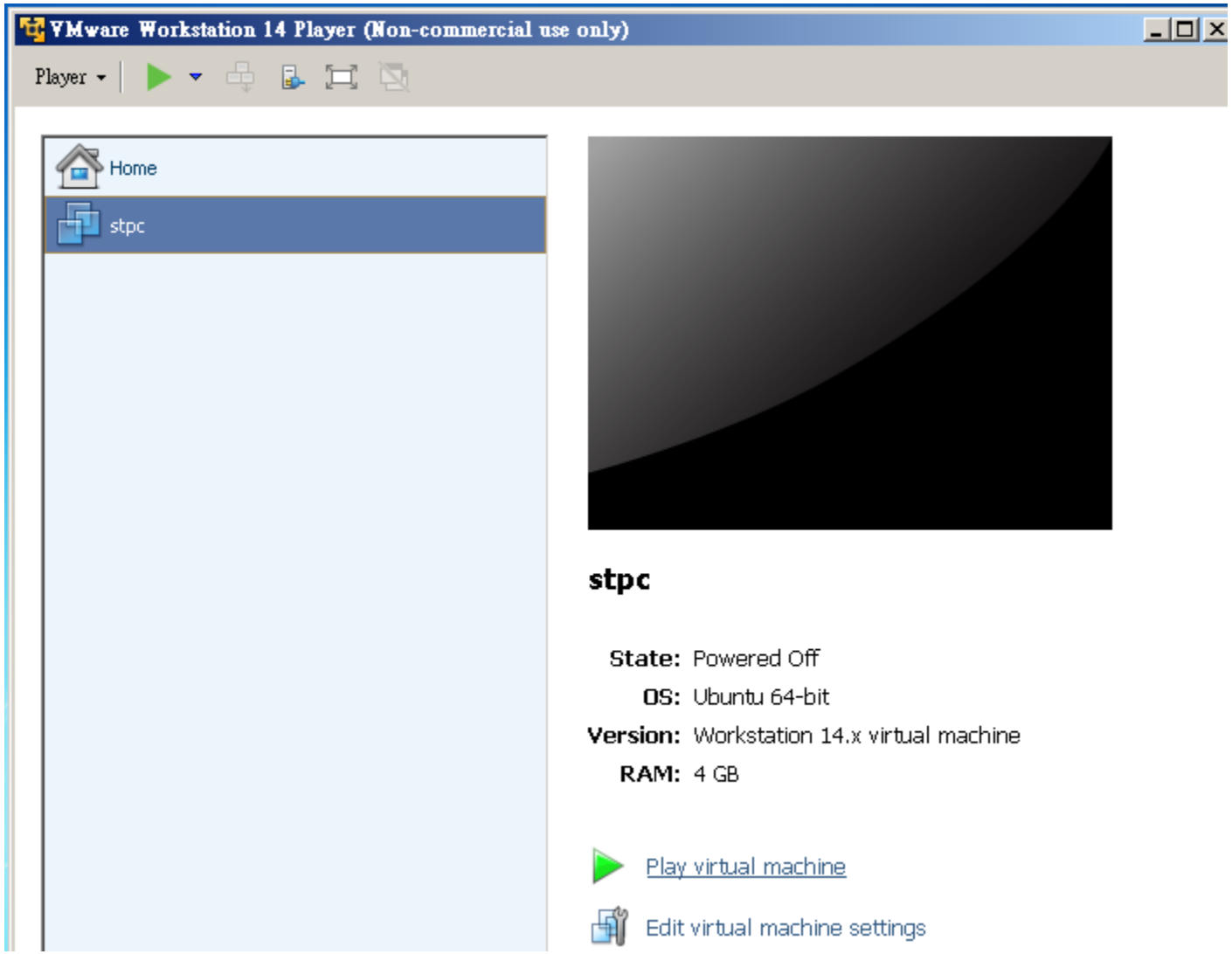
練習2

1. 建立一個名為 "homework" 的資料夾。
2. 在 "homework" 資料夾中建立 5 個檔案，命名為 file1.txt, file2.txt, file3.txt, file4.txt, file5.txt。
3. 使用 cat 命令查看每個檔案的內容。
4. 將檔案 file2.txt 的內容複製到 file6.txt 中。
5. 使用 ls 命令查看資料夾中的所有檔案。
6. 使用 rm 命令刪除檔案 file1.txt。
7. 使用 rmdir 命令刪除資料夾 "homework"。

關機

sudo init 0
sudo shutdown -h now
sudo poweroff
sudo halt -f (需要手動關閉最後電源)




VMware Workstation 14 Player (Non-commercial use only)
Player
Home
stpc
stpc
State: Powered Off
OS: Ubuntu 64-bit
Version: Workstation 14.x virtual machine
RAM: 4 GB
Play virtual machine
Edit virtual machine settings