

# Introduction to Computer Science

## Lecture 3: OPERATING SYSTEMS 作業系統

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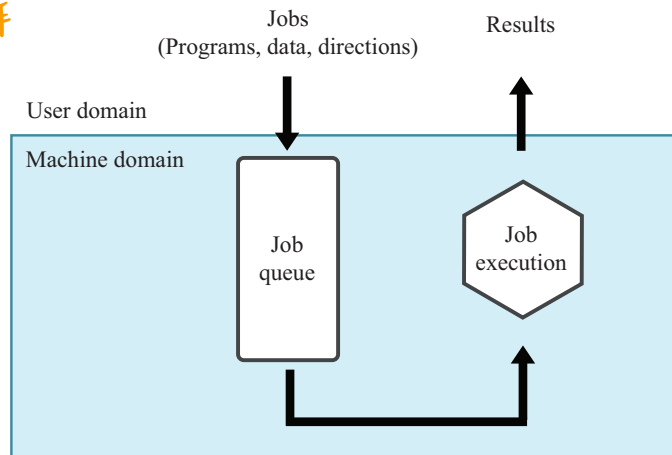


【本著作除另有註明外，採取創用CC「姓名標示—非商業性—相同方式分享」台灣3.0版授權釋出】

# Batch Processing

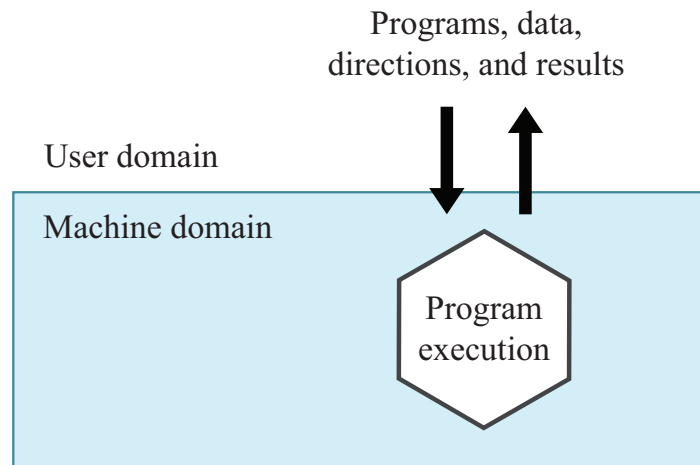
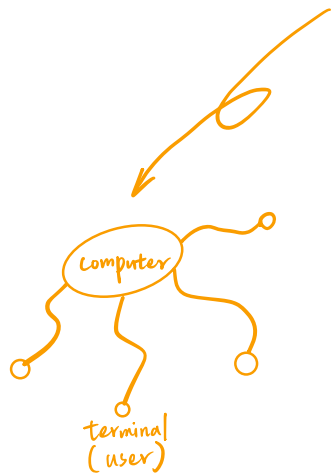
- Computer operators
- First-in, first-out (FIFO)

遠古時期的電腦運作



# Interactive Processing

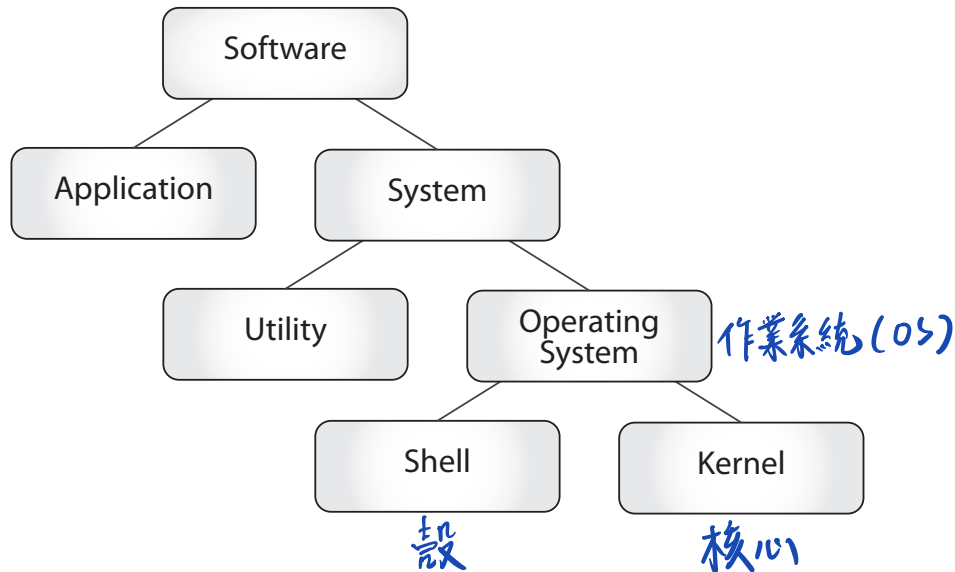
- OS with remote terminals



# Different Types of OS

- Batch 批次
- Interactive
- Real-time
  - Response time is critical
- Time-sharing and multitasking
  - Dividing time into intervals
  - Only one task is being performed at any given time
- Multiprocessor
  - Load balancing
  - Scaling

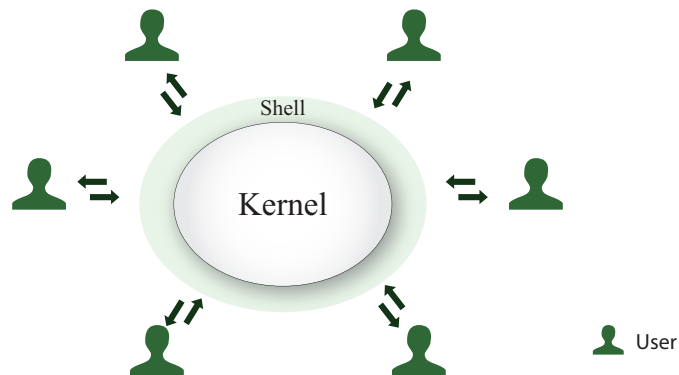
# Software Classification



# Shells

- Communication with users

- Text based. 文字介面
- GUI (graphics user interface), such as window manager. 圖形介面



# Kernel

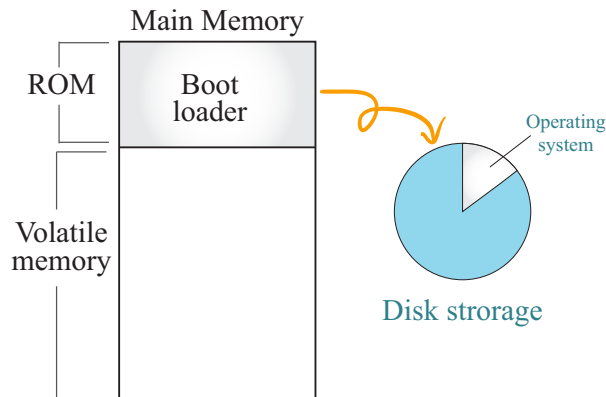
- File manager
  - Directory/folder, path
- Device drivers 裝置驅動程式
- Memory manager 記憶體管理
  - Allocating main memory
  - Paging, virtual memory 虛擬記憶體(硬碟)
- Scheduler
- Dispatcher
  
- Can you recognize these shell and kernel components on your PC?

# Linux World

- Originally made by Linus Torvalds in 1991.
- <http://www.linux.org>
- Freeware & open-source
- Many **distro** (Linux distributions, <http://distrowatch.com/>)
  - For beginner: Linux Mint (<http://www.linuxmint.com/>)
  - Personal favorite: Gentoo (<http://www.gentoo.org/>)
- In fact, **Linux means only the kernel.**
- Better call it GNU/Linux?
- Servers, PCs, embedded systems (Android's kernel is based on Linux).



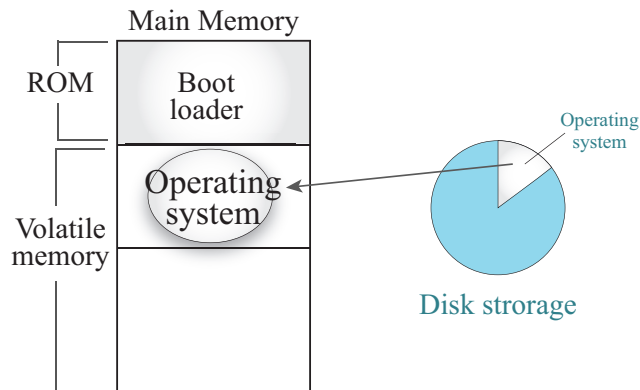
- Boot strapping (booting)
- You may change the booting sequence in **BIOS** (basic input/output system).



### Step 1

Execute the **boot loader** program which is already in **ROM**. Operating system is stored in mass storage.

↳ 唯讀記憶體 (Read Only Memory)



### Step 2

Boot loader program directs the transfer of the operating system into main memory and then transfers control to it.

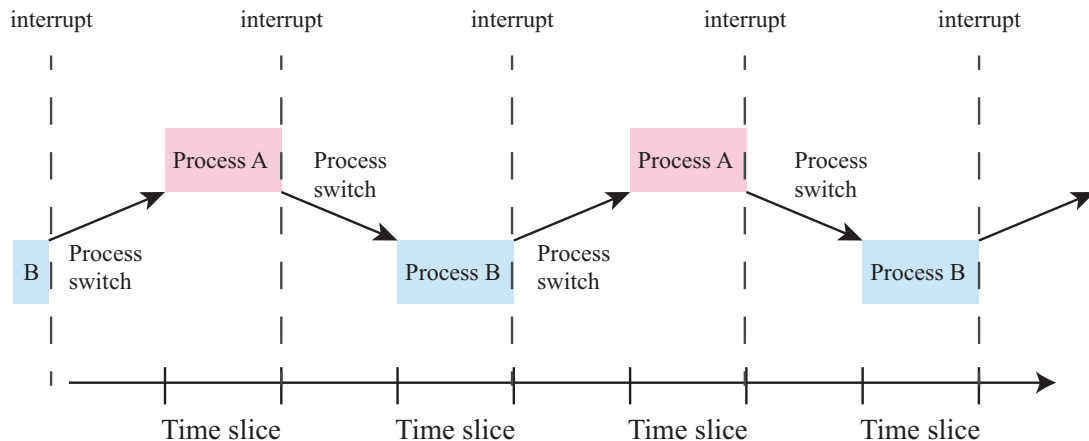
# Process

- Process
  - The activity of executing a program.
- Process state
  - Program counter
  - General purpose registers
  - Associated memory cells
- Process table → 工作管理員
  - Memory area assigned to the process
  - Priority
  - Ready/waiting

# Process Administration

- Scheduler 排程
  - maintains the process table
    - Introduces new processes.
    - Removes completed processes.
    - Decides whether a process is ready or waiting.
- Dispatcher 派遣
  - really execute the program
    - Controls the allocation of time slices to the processes in the process table.
    - Process switch (context switch) by calling interrupt. 中斷

# Multiprogramming (Time-sharing) Between 2 Processes



# Semaphores 信號

- A visual signaling apparatus with flags, lights, or mechanically moving arms, as one used on a railroad. ([www.dictionary.com](http://www.dictionary.com))

- Atomic TEST-AND-SET

- Critical region 確保不受其他程式干擾

- Mutual exclusion 互斥鎖



*Operating system concepts*

Silberschatz Galvin, 1995

Addison-Wedley

是一種用於多執行緒編程中，防止兩條執行緒同時對同一公共資源（比如全域變數）進行讀寫的機制

**repeat**

**while** TEST-AND-SET (*lock*) **do** *no-op*;

critical section

*lock* := *false*;

remainder section

**until** *false*;

# Prerequisites for Deadlock

死結

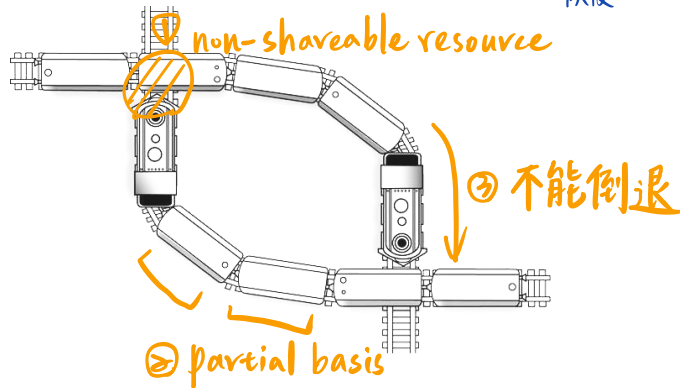
- Deadlock may occur only if all three of the following (necessary but insufficient) conditions are satisfied:

發生死結一定要達成以下條件，  
但滿足以下條件不一定會死結

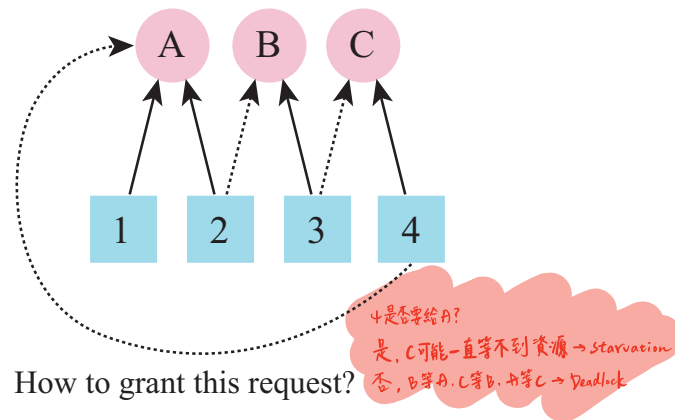
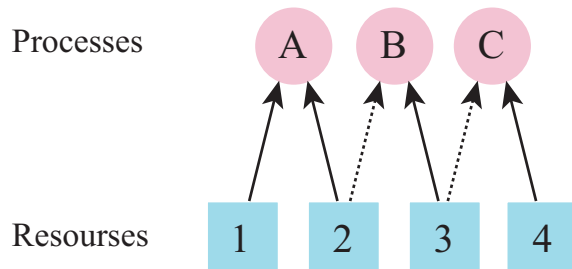
死結必要條件

- ① Competition for non-shareable resources.
- ② Resources are requested on a partial basis; that is, having received some resources, a process will return later to request more.
- ③ Once a resource has been allocated; it cannot be forcibly retrieved.

恢復



# Deadlock vs. Starvation



- **Starvation**: process cannot get the resources needed for a long time because the resources are being allocated to other processes.
- **Aging**: adding an aging factor to the priority of each request.

↳ 解決 starvation 方法

# Security

- Insecure passwords & bad habits *ex: 12345678*
- Auditing software (record and analyze activities)
- Sniffing software
- Virus/worms/Trojan horses *電腦病毒 / 電腦蠕蟲 / 木馬*
- Privilege levels & privileged instructions