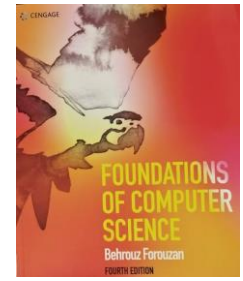
Chapter 7

Operating Systems

作業系統



7.1

Objectives 學習目標

After studying this chapter, students should be able to:

- ❑ **Understand the role of the operating system作業系統角色 in a computer.**
- ❑ **Give the definition of an operating system.**
- ❑ **Understand the process of bootstrapping 啟動過程 to load the operating system into memory.**
- ❑ **List the components of an operating system (OS).**
- ❑ **Discuss the role of the memory manager記憶體管理 in an OS.**
- ❑ **Discuss the role of the process manager程序管理 in an OS.**
- ❑ **Discuss the role of the device manager裝置管理 in an OS.**
- ❑ **Discuss the role of the file manager檔案管理 in an OS.**
- ❑ **Understand the main features of three common operating systems: UNIX, Linux and Windows.**

7.2

Bootstrap Process 開機啟動程序

The operating system provides supports for other programs. For example, it is responsible for loading other programs into memory for execution. However, **the operating system itself is a program that needs to be loaded into the memory and be run**. How is this dilemma困境 solved?

The solution is a two-stage process. A very small section of memory is made of **ROM** and **holds a small program called the bootstrap program**. **When the computer is turned on, the CPU program counter is set to the first instruction of this bootstrap program and executes the instructions in this program**. When loading is done, **the program counter is set to the first instruction of the operating system in RAM**.

7.3

Memory manager

One of the responsibilities of a modern computer system is **memory management**. Although the memory size of computers has increased tremendously in recent years, so has the size of the programs and data to be processed. **Memory allocation must be managed to prevent applications from running out of memory保護程式在執行時避免記憶體不足**. Operating systems can be divided into two broad categories of memory management: **monoprogramming單程式執行** and **multiprogramming多程式執行**.

7.4

Process manager 程序管理

A second function of an operating system is process management, but before discussing this concept, we need to define some terms.

Program, job, and process

- **A *program* is a non-active set of instructions stored on disk** 在硬碟上稱程式.
- A program becomes **a *job*** from the moment it **is selected for execution until it has finished running** and becomes a program again.執行到完成改稱為工作
- **A *process*** is a program in execution. It is a program that **has started but has not finished**. 執行中稱為程序

7.5

Device manager 裝置管理

The device manager, or input/output manager, **is responsible for access to input/ output devices**. There are limitations on the number and speed of input/output devices in a computer system.

- **The device manager monitors every input/output device constantly長期監控I/O裝置 to ensure that the device is functioning properly.**
- **The device manager maintains a queue for each input/output device or one or more queues for similar input/output devices.以佇列排程管理I/O裝置**
- **The device manager controls the different policies for accessing input/output devices.以不同策略存取I/O裝置**

7.6

File manager 檔案管理

Operating systems today use a file manager to control access to files. A detailed discussion of the file manager also requires advanced knowledge of operating system principles and file access concepts that are beyond the scope of this book. The file manager:

- ❑ **controls access to files.** 檔案存取
- ❑ **supervises the creation, deletion, and modification of files.** 督導開新檔案、刪除檔案及修改檔案
- ❑ **controls the naming of files.** 檔案命名
- ❑ **supervises the storage of files.**檔案儲存
- ❑ **is responsible for archiving and backups.**庫存與備分

7.7

Linux

In 1991, Linus Torvalds, a Finish student at the University of Helsinki at the time, developed a new operating system that is known today as **Linux**. The initial kernel, which was similar to **a small subset of UNIX**, has grown into a full-scale operating system today. **The Linux 2.0 kernel, released in 1997**, was accepted as a commercial operating system: it has all features traditionally attributed to UNIX.

The Components of Linux operating system

Linux has three components: **kernel, system libraries, and system utilities**

7.8

Windows

In the late 1980s Microsoft, under the leadership of Dave Cutler, started development of a new single-user operating system to replace MS-DOS (Microsoft Disk Operating System). Several versions of windows are followed, such as Windows NT (NT standing for New Technology), Windows 2000, Windows XP (XP stands for eXPerience in 2001), Windows 7 (supports the functions for touch-controlled screen and has released this year of 2009), Windows 8/8.1, **Windows 10**, and so on.

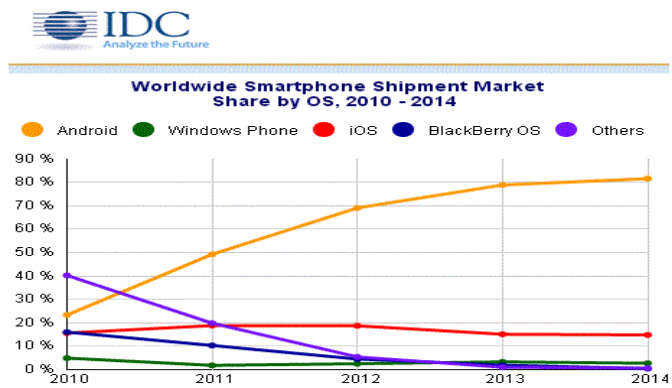
Design goals

Extensibilities, portability, reliability, compatibility, and performance.

7.9

Operating Systems for Cellphones / Mobile phones

- **Android over 80% ➔ 85% (2019)**
- **iOS near 15%**
- **Windows Phone under 3% ➔ 0.1% (2019)**
- **BlackBerry under 1% ➔ ≈ 0% (2019)**



Source: IDC

7.10

Operating Systems for Mobile /PC market

Source: StatCounter 統計2018.8 月份操作系統市場份額數據

7.11

Review Questions

- What is **the definition** of **operating system** (**OS**)?
- Please describe **the bootstrap process** when PC is turned on.
- Explain the following **terminologies**:
  Deadlock, **Starvation, RTOS, and GUI,** .
- What is **demand paging** in the multiprogramming?
- Please give **three latest kind of OS** for PCs, iPad, and mobile phones.
- Please describe **their functions** of memory manager, process manager, device manager, and file manager.

7.12