

Block One: Overview

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1 Brief Contents

- Laying the Groundwork
- The Information Layer
- The Hardware Layer
- The programming Layer
- The Operating System Layer
- The Application Layer
- The Communicaton Layer
- Conclusion

2 Preface

2.1 Organization

Computer system is like an **onion**. The processor with its machine language forms the **heart** of the “onion”.

This book is designed to:

- provide an overview of the *layers*.
- introducing the underlying hardware and software technologies
- give an appreciation
- understanding of all aspects of computing

This book choose a method called: **inside-out** method. (i.e. begin with the concrete machine and examine the layers in the order in which they were created)

2.2 Synopsis

- chapter 1: explaining the rationale for **this book Organization**
- chapter 2-3: Information Layer (**how data is represented in the computer**)
- chapter 4-5: Hardware Layer (**electronic circuitry and logical gates to CPU**)
- chapter 6-9: programming Layer (**from machine language to programming language**)
- chapter 10-11: Operating system Layer
- chapter 12-14: Application Layer (**information systems and AI**)
- chapter 15-17: Communicaton Layer (**introducing how computer communicate, WWW, security problem**)
- chapter 18: Conclusion with its limitations

3 Chapter 1: The big picture

Abstract

This chapter provides some **common terminology** and creating the basic platform for exploring CS

3.1 Computing Systems

Computer is a device but computer system is a **dynamic entity**, to interact with its environment. Computer system is composed of hardware and software.

Layer of a computing system is a flow from inside to outside:

Information → **Hardware** → **programming** → **Operating System**
→ **Application** → **Communicaton**

Computer do only very simple task, but finish them so bindingly **fast** that many simple tasks can be combined to acomplish larger, more complicated tasks.

6 Layers explaining in detail:

Information It is a *conceptual* layer. This Layer is about understanding binary format and transforming other format into binary system.

Hardware This Layer investigates using **electronic circuirty** to control the flow of electricity (i.e. using CPU)

Programming This Layer is about the **instructions** to accomplish computations and manage data

OS It is the **key** to understand computer system. This layer is to help manage the computer's resources

Application This layer focuses on solving real-world problems

Communicaton This layer explores how different computer communicates with each other

abstraction is a mental model that removes complex details. It is the **key** to computing

3.2 The history of computing

In 1936, **Alan M. Turing** invented an abstract mathematical model called a *Turing machine*.

This section includes the history of “Hardware” and “Software” (not very important) as follows:

- Hardware
 1. First Generation(1951-1959): Using **vacuum tubes**
 2. Second Generation(1959-1965): Using **transistor**
 3. Third Generation(1965-1971): Using **circuit boards**
 4. Fourth Generation(1971-now): Using **Large-scale integration** silicon chip
- Software
 1. First Generation(1951-1959): Written in **machine language** and develop a tool called **Assembly language**
 2. Second Generation(1959-1965): Written in **high-level languages** without Operating system
 3. Third Generation(1965-1971): Focusing on **Operating systems** and using some Application packages
 4. Fourth Generation(1971-1989): Written in **structured programming** e.g. C++
 5. Fifth Generation(1989-now): Developing in **object-oriented** and **web design**

3.3 Computing as a tool and a discipline

Tool: everyone except for toolmakers.

Discipline: focusing on a field of study