CE80665 Embedded Computer Systems Engineering

Class: Year 3 Computer Engineering

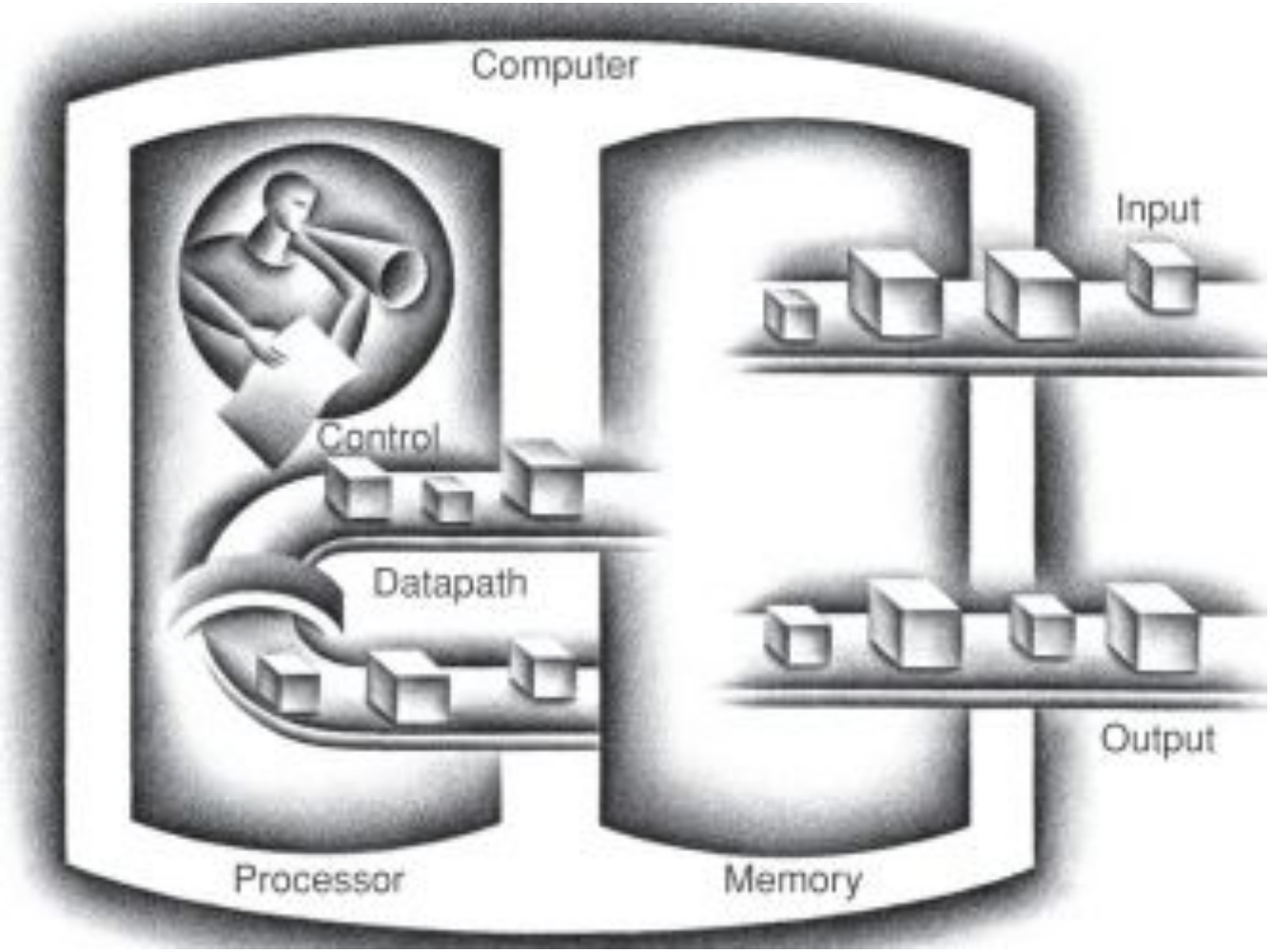
Lecture #1: Computer Abstractions #1

Department of Computer Engineering

02/02/2026 – 15/05/2026 (15 weeks)

Richard Mugisha

Five Classic Components of a Computer



Lecturer/Course Responsible

Richard Mugisha

Office: African Centre of Excellence in Energy for Sustainable Development (ACEESD) Building , Room 1R02 (First Floor)

E-mail: wir13.rmu@gmail.com

Phone: (+250) 0780495900

- **2020-2022: Teaching Assistant, Mid-Sweden University, Sundsvall-Sweden**
- **2018-2020: Assistant Lecturer, University of Rwanda, CSE department**
- **2014-2017: Masters in Wireless Communication, Lund University, Lund-Sweden**
- **2011-2014: Tutorial Assistant, University of Rwanda, EEE department**
- **2006-2010, Bachelor in Electronics and Telecommunication Engineering, CST/Former KIST**

Course Schedule & Location

Check the timetable @https://timetable-cst.ur.ac.rw/index.html

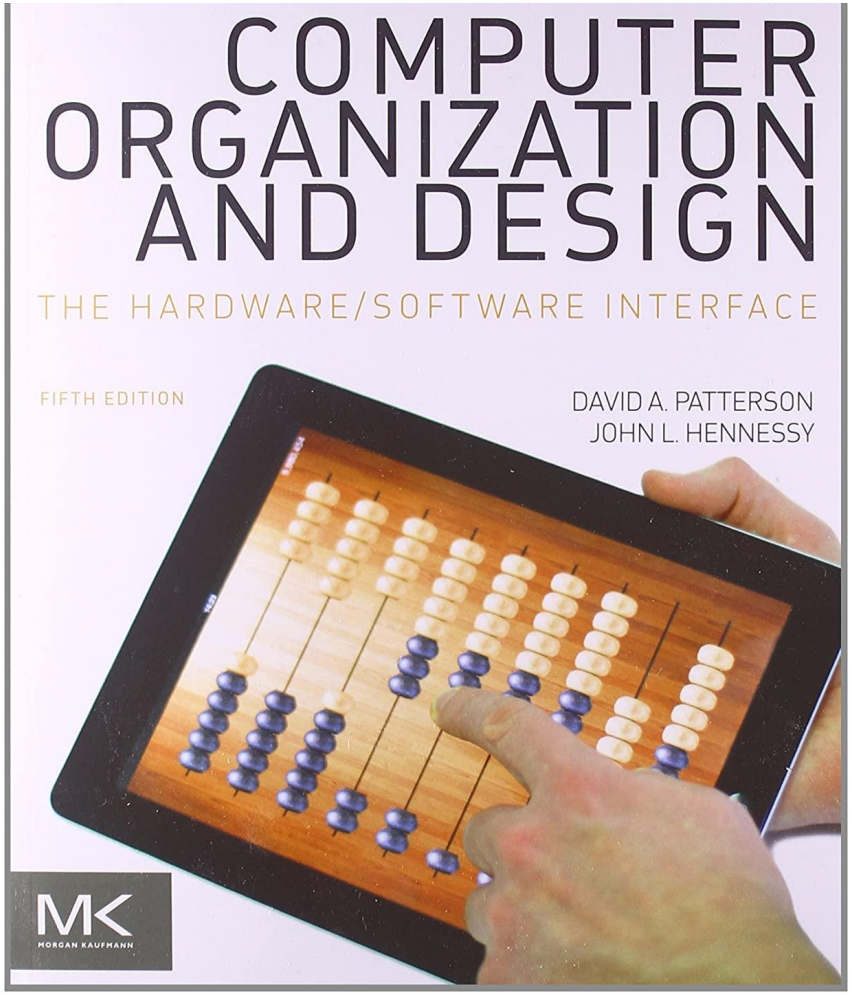
- **Year 3 CoE/Nyarugenge campus: 9.15 AM-12.00 PM @Tuesday @KARISIMBI Lab CIT 3F-04/Every week**
- **Year 3 CoE/Gako campus: 8.15 PM-11.00 AM @Thursday & 1.30 PM-4.30 PM @Thursday/Every 2 weeks**

Prerequisites

Prior knowledge in the following courses may be useful in this course

- **Digital Electronics**
- **Microprocessors**
- **Computer Architecture/Computer Organization**
- **System on Chip Design**

Literature (Freely available online)



Lecture Outline

- **Classes of Computing Applications**
- Below your Program
- From a High-Level Language to the Language of Hardware
- Computer Hardware

Classes of Computing Applications

Computer is everywhere

Lecture Outline

- Classes of Computing Applications
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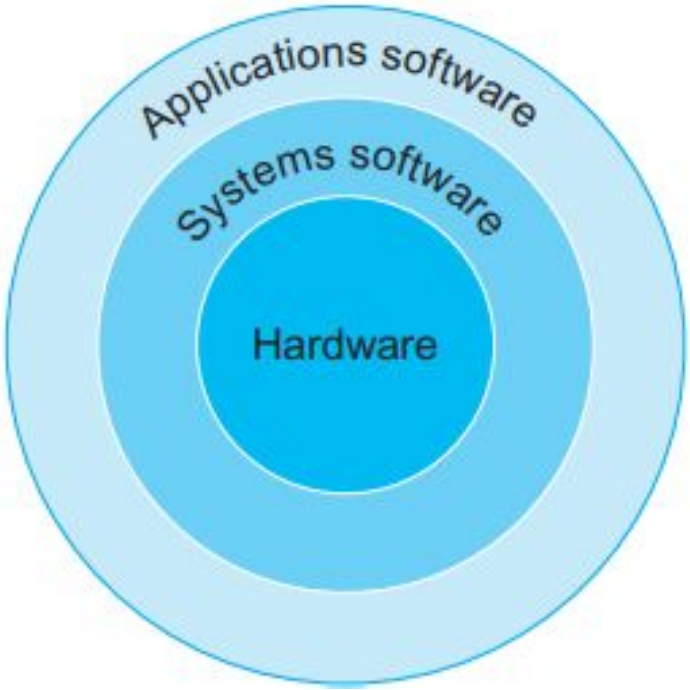
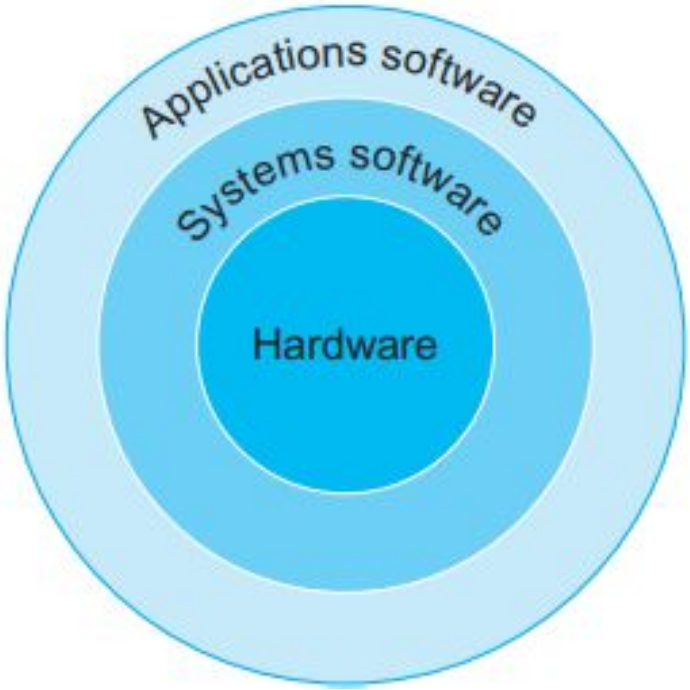
Below your program

A simplified view of hardware and software as hierarchical layers, shown as concentric circles with **hardware in the center** and **applications software outermost.**



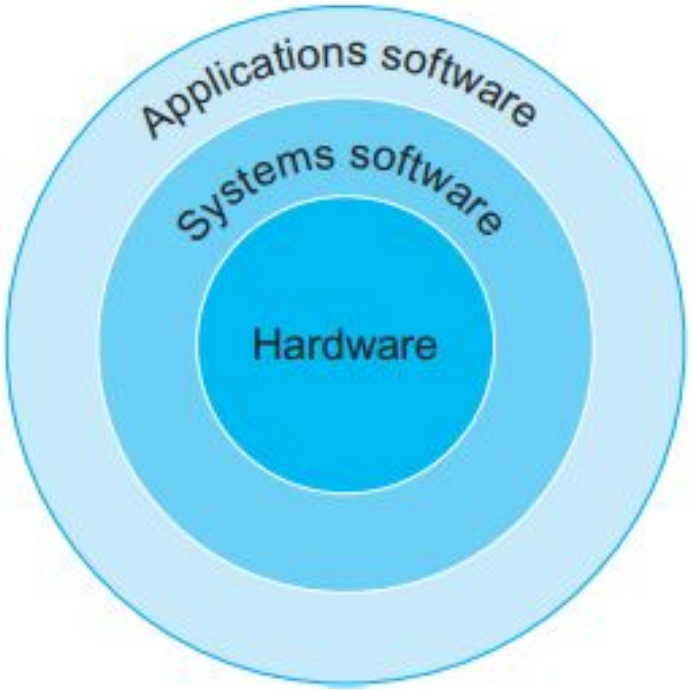
Below your program

Application Software:
Word, Excel, Facebook,
…



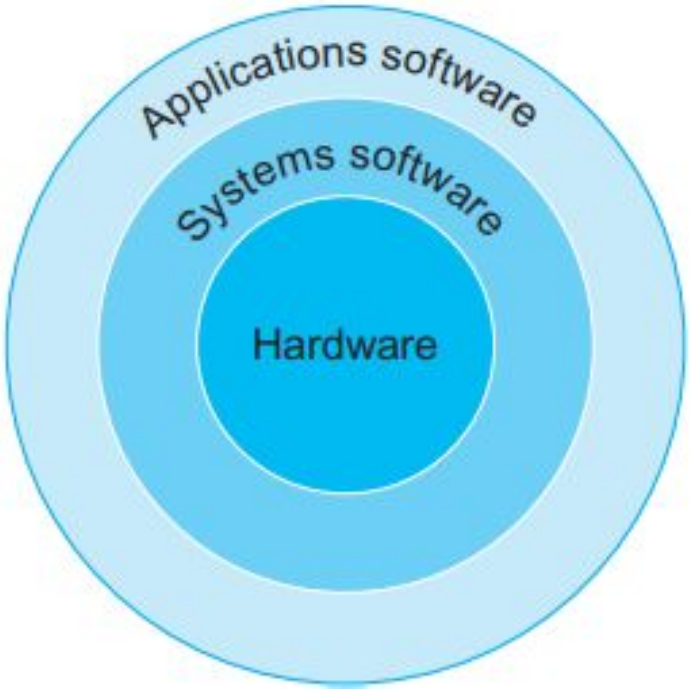
Below your program

The **hardware** in a computer can only execute extremely **simple low-level instructions.**



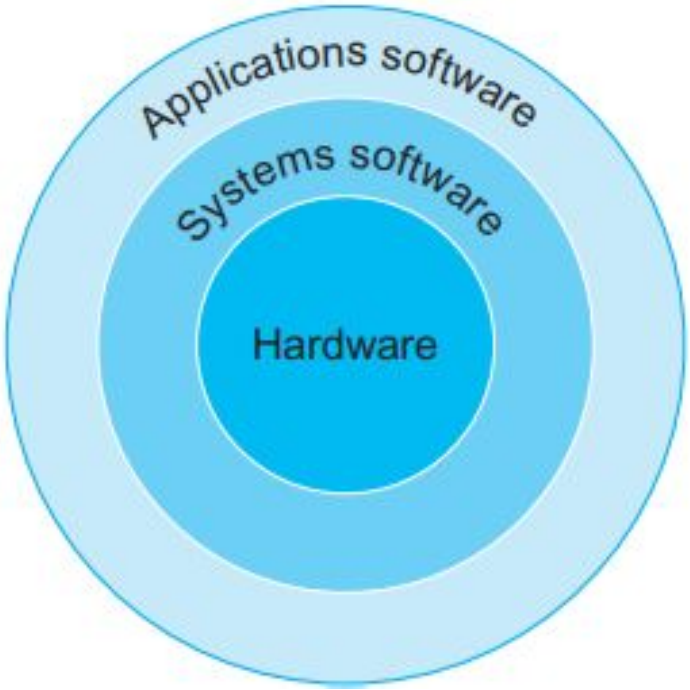
Below your program

Two types of **systems software** are central to every computer system today: an **operating system** and a **compiler.**



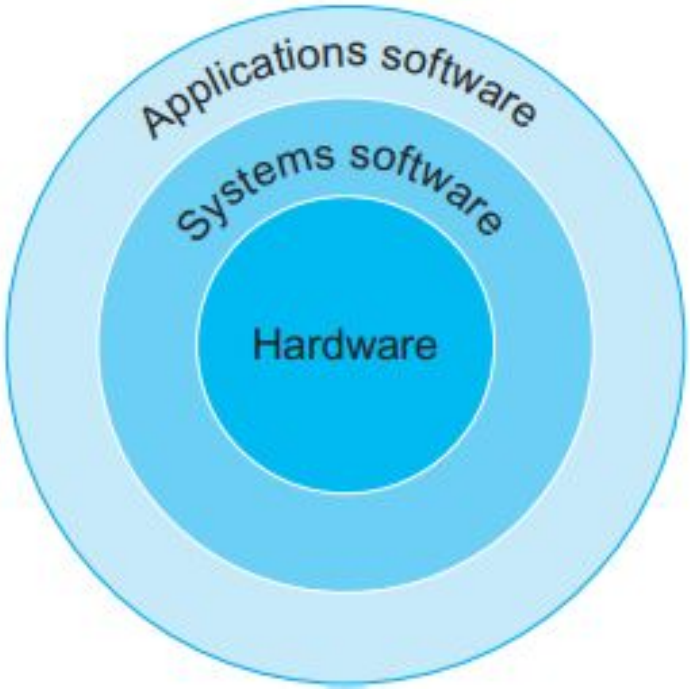
Below your program

An **Operating system** interfaces between a user's program and the hardware and provides a variety of services and supervisory functions.



Below your program

Compilers perform another vital function: the translation of a program written in a **high-level language, such as C, C++, Java, or Visual Basic** into instructions that the hardware can execute.

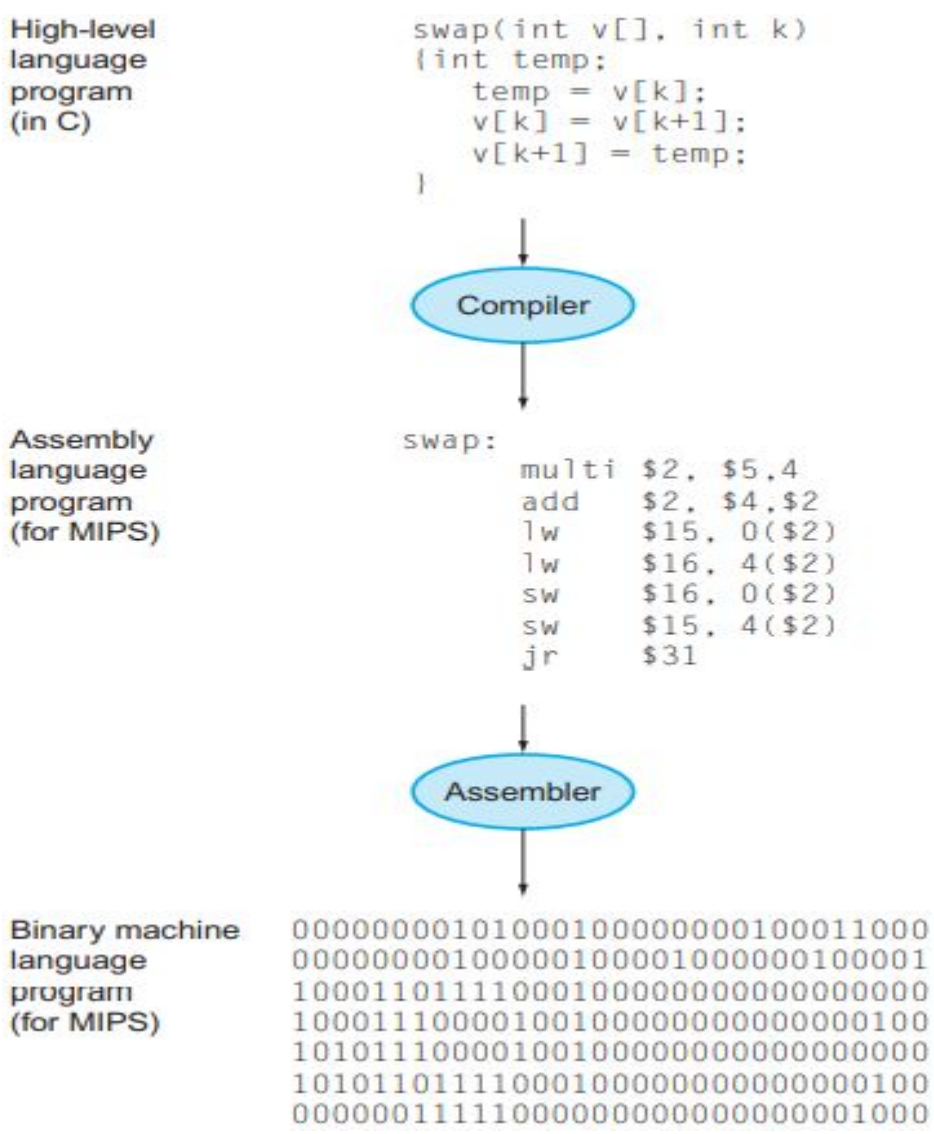


Lecture Outline

- Classes of Computing Applications
- Below your Program
- **From a High-Level Language to the Language of Hardware**
- Computer Hardware

From a High-Level Language to the Language of Hardware

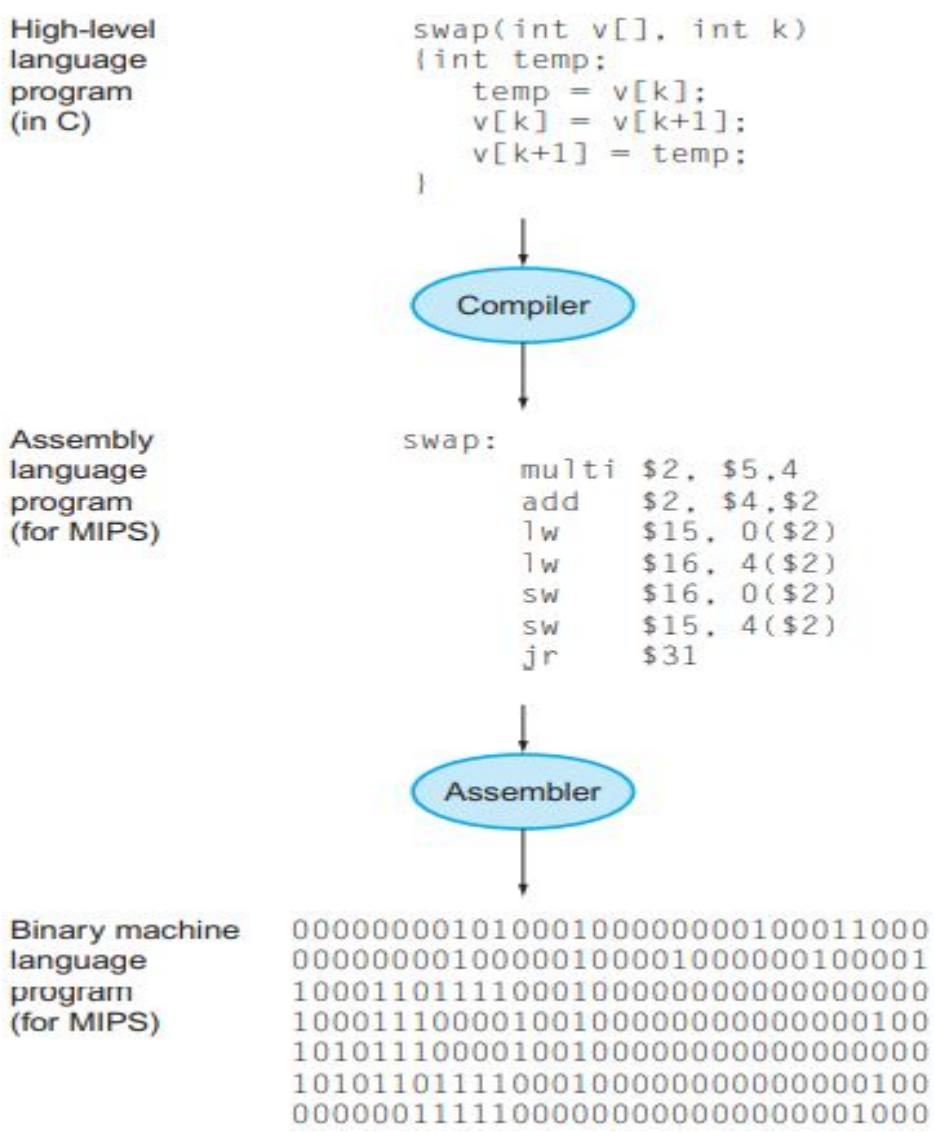
C program compiled into **Assembly language** and then assembled into **Binary Machine language.**



From a High-Level Language to the Language of Hardware

Computers are slaves to our commands, which are called **Instructions.**

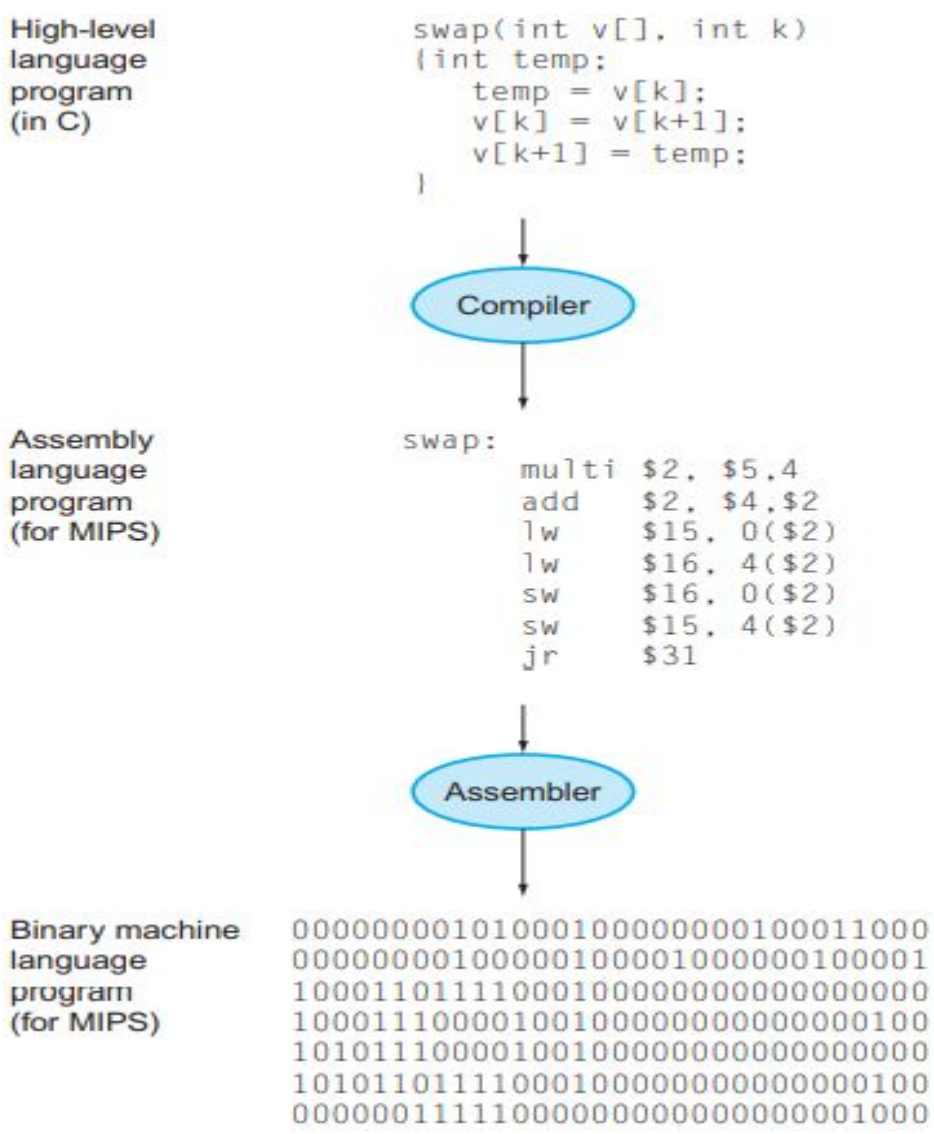
For example, the bits **1000110010100000** tell one computer to add two numbers.



From a High-Level Language to the Language of Hardware

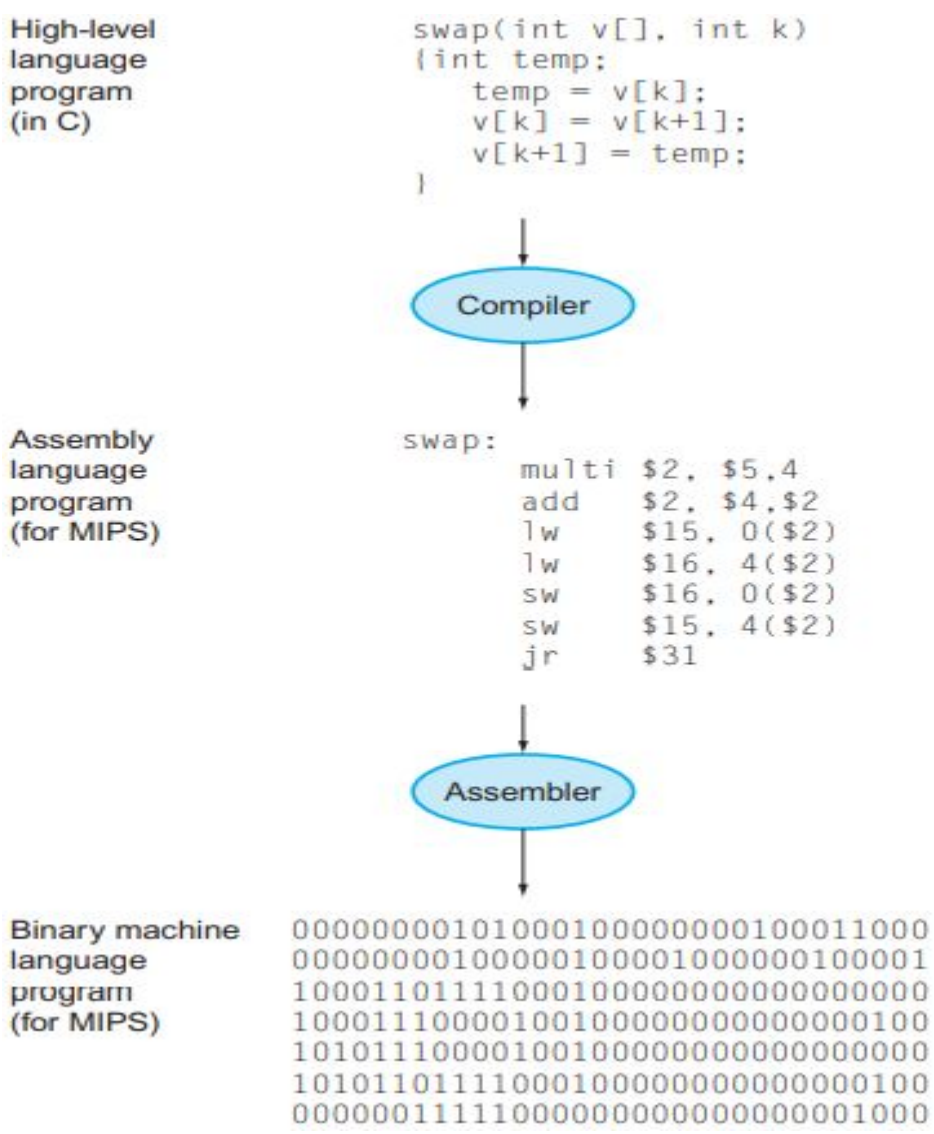
For example, the programmer would write **add A,B** and the assembler would translate this notation into **1000110010100000**

This instruction tells the computer to add the two numbers A and B.



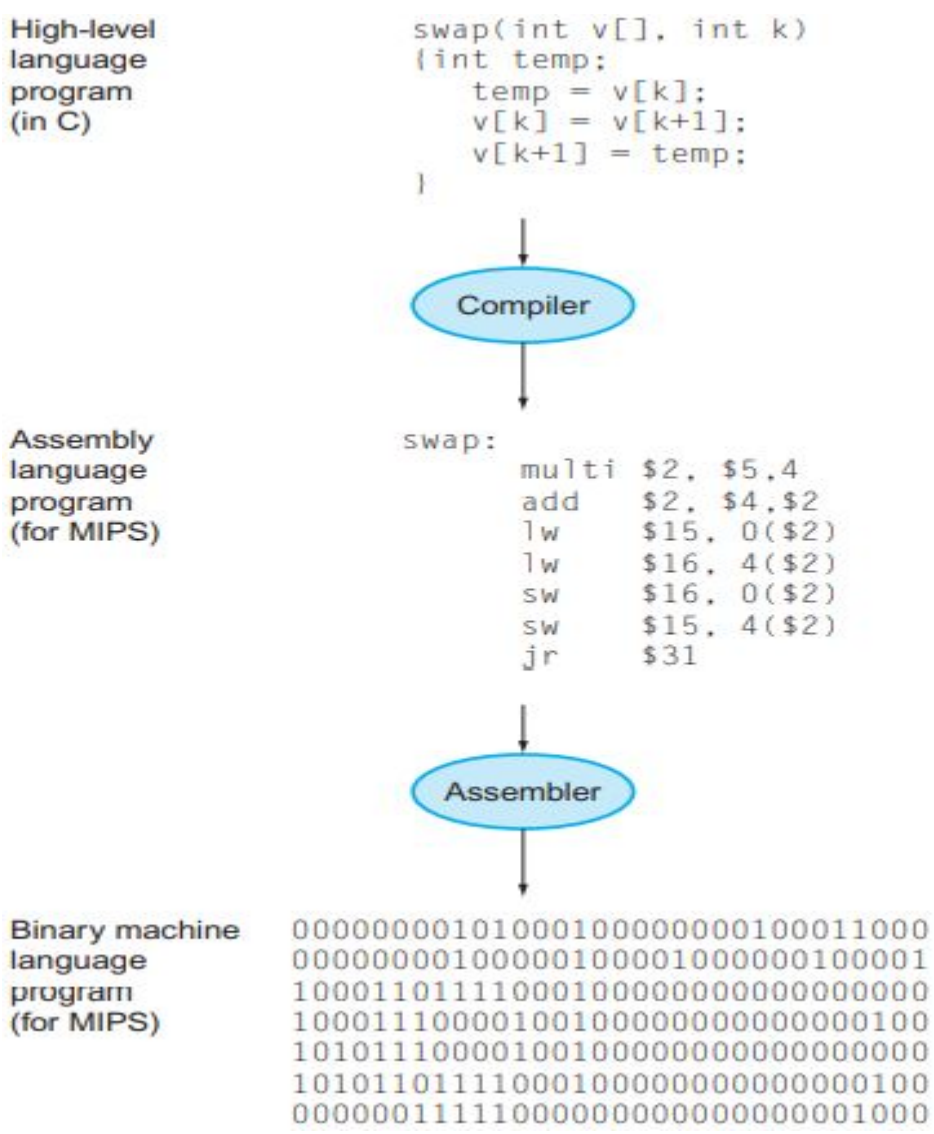
From a High-Level Language to the Language of Hardware

Assembler: A program that translates a symbolic version of instructions into the binary version.



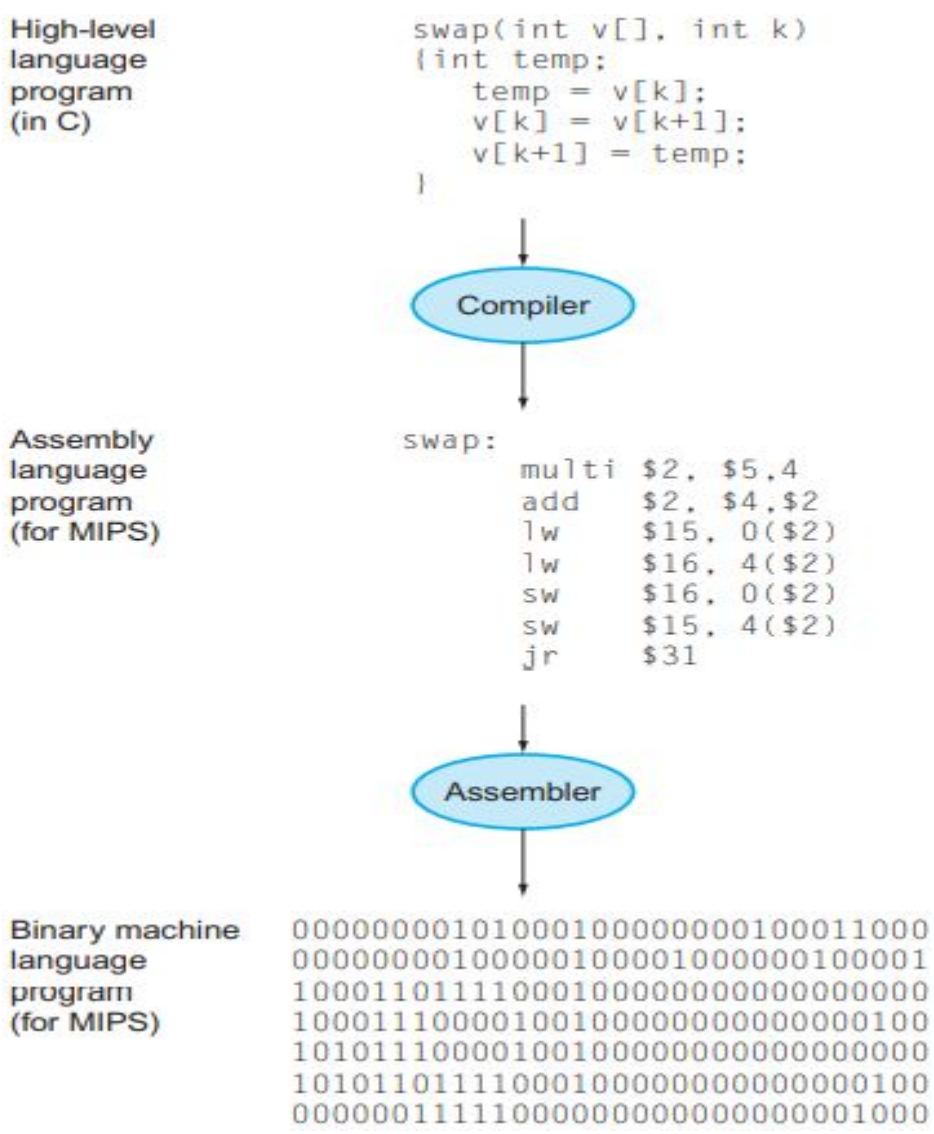
From a High-Level Language to the Language of Hardware

Assembly language: A symbolic representation of machine instructions



From a High-Level Language to the Language of Hardware

Machine language: A binary representation of machine instructions.



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- Classes of Computing Applications
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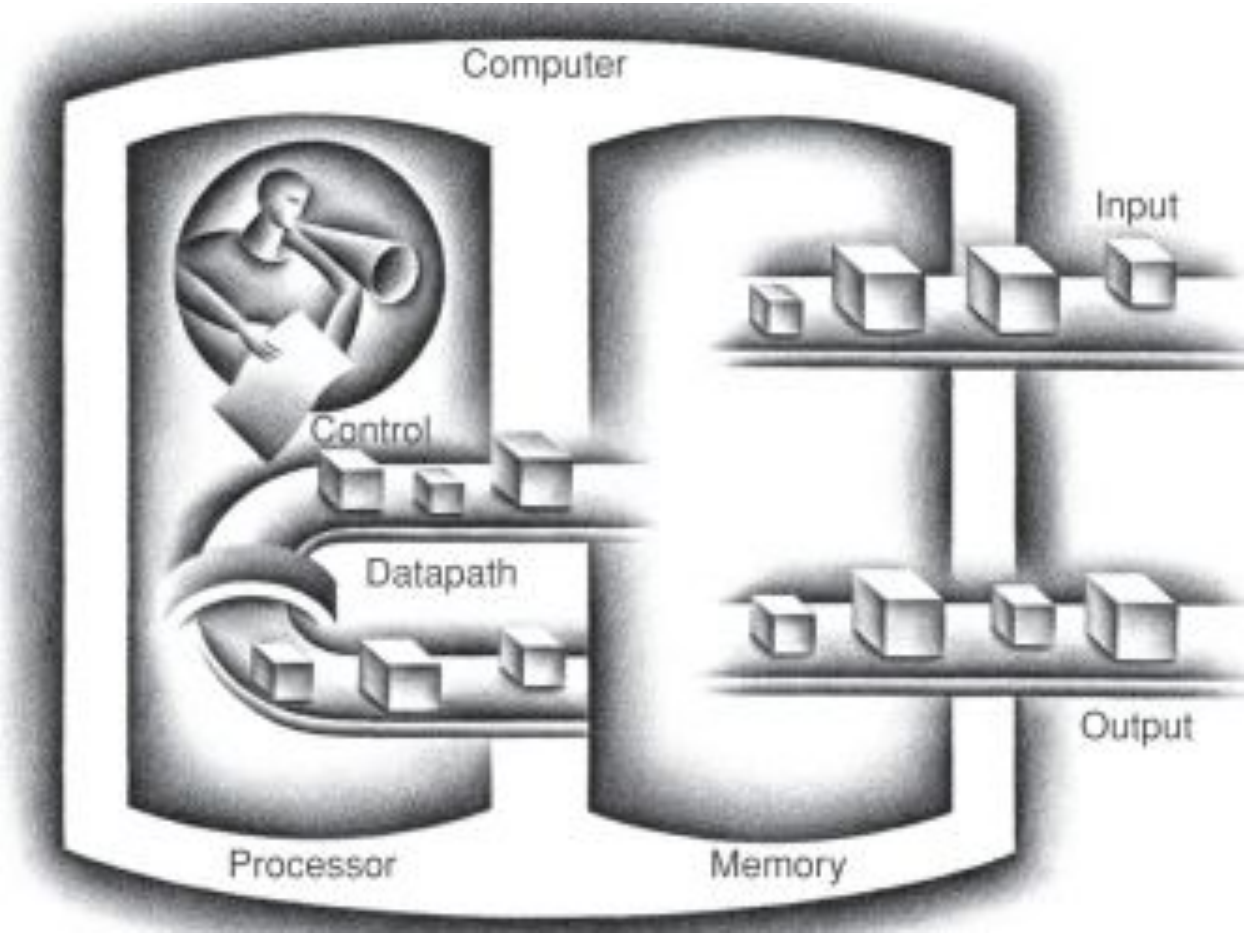
- **Computer Hardware**

Computer Hardware

The five classic components of a computer are **Input**, **Output, Memory, Datapath,** and **Control,** with the last two sometimes combined and called the **Processor.**

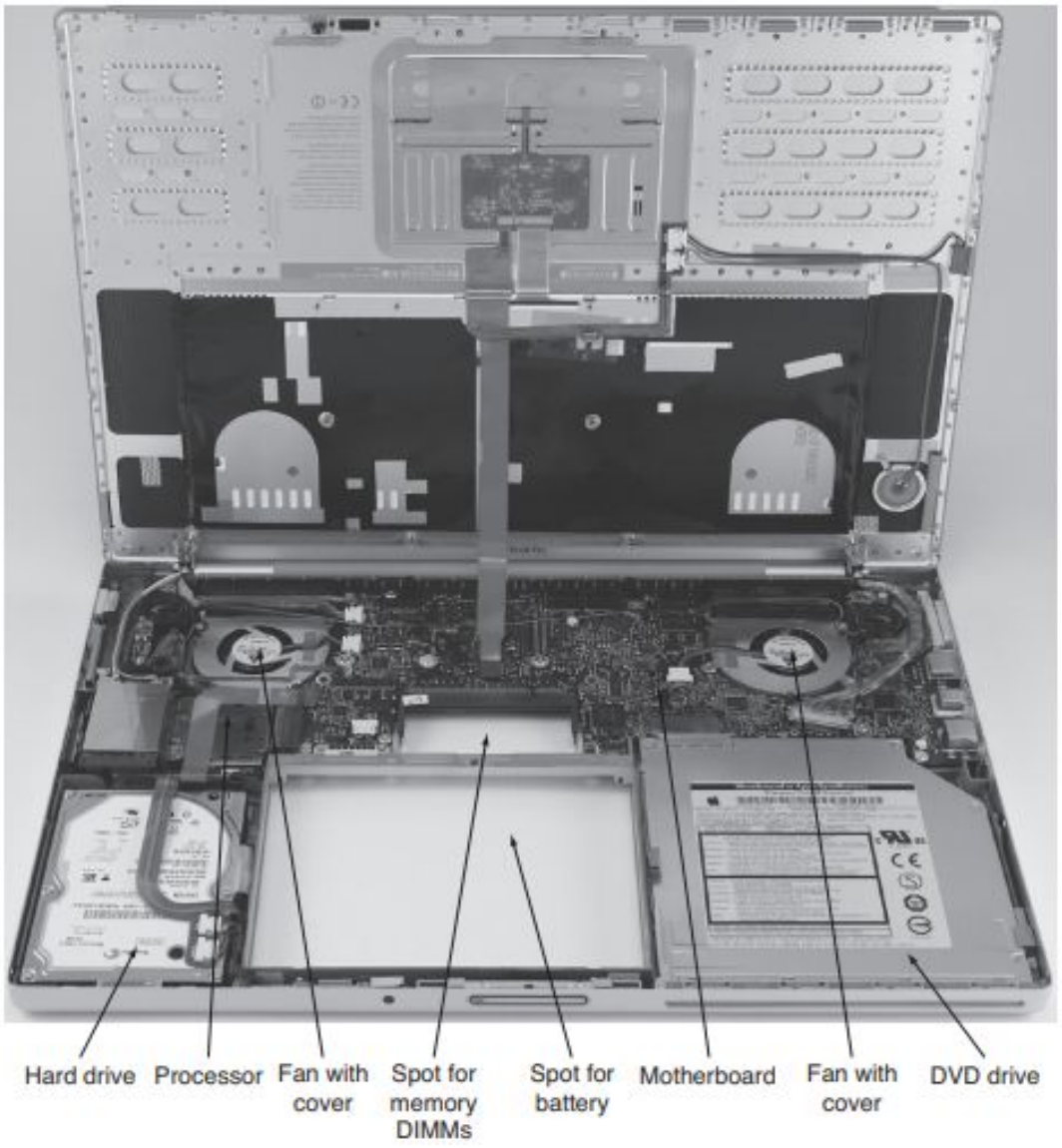


Computer Hardware

A desktop compute r.

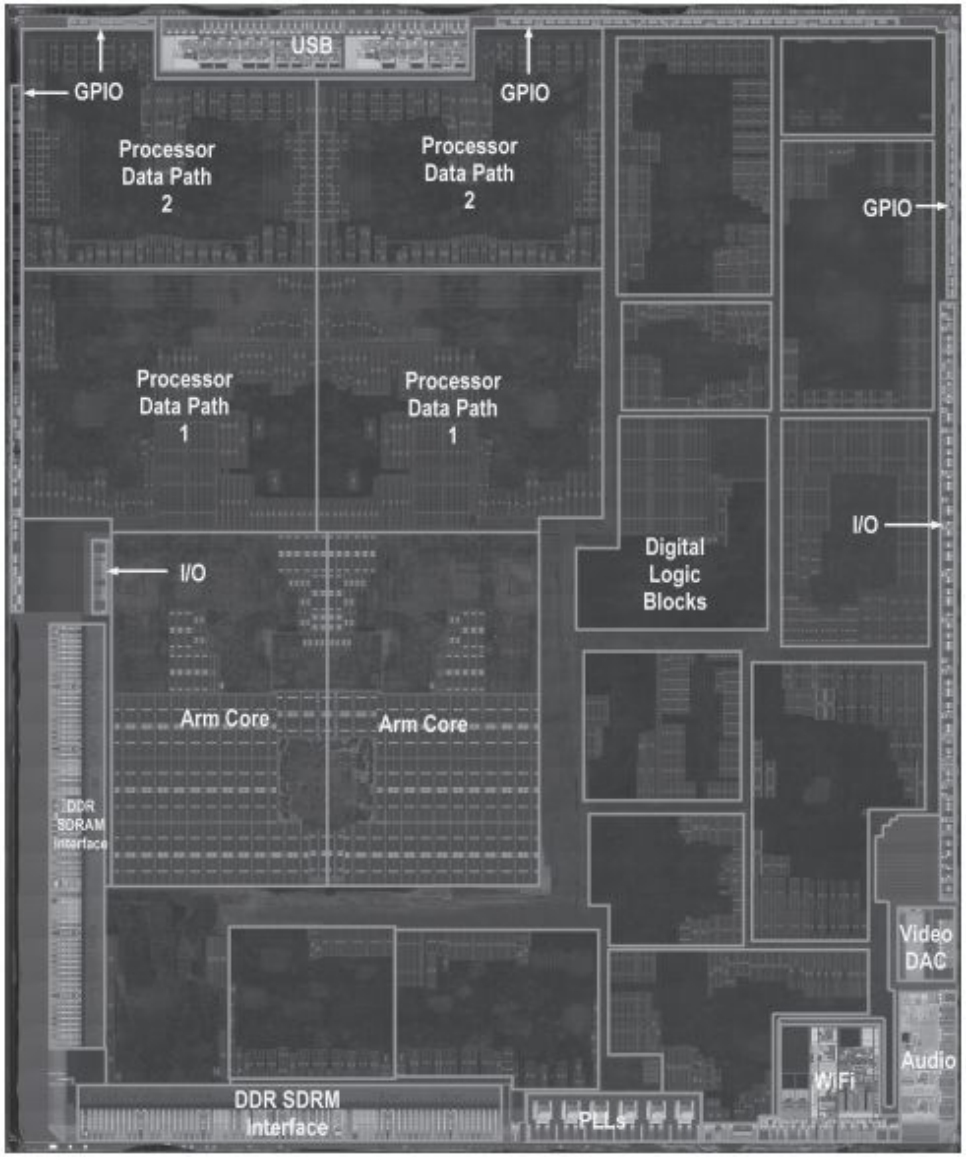
Computer Hardware

Inside the laptop computer



Computer Hardware

Inside the processor integrated circuit



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