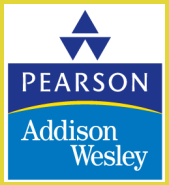
Chapter 1: Introduction to Computers and Programming

Starting Out with C++
Early Objects
Sixth Edition

by Tony Gaddis, Judy Walters, and Godfrey Muganda



Topics

1.2 Computer Systems: Hardware and Software

1.3 Programs and Programming Languages

1.5 Input, Processing, and Output

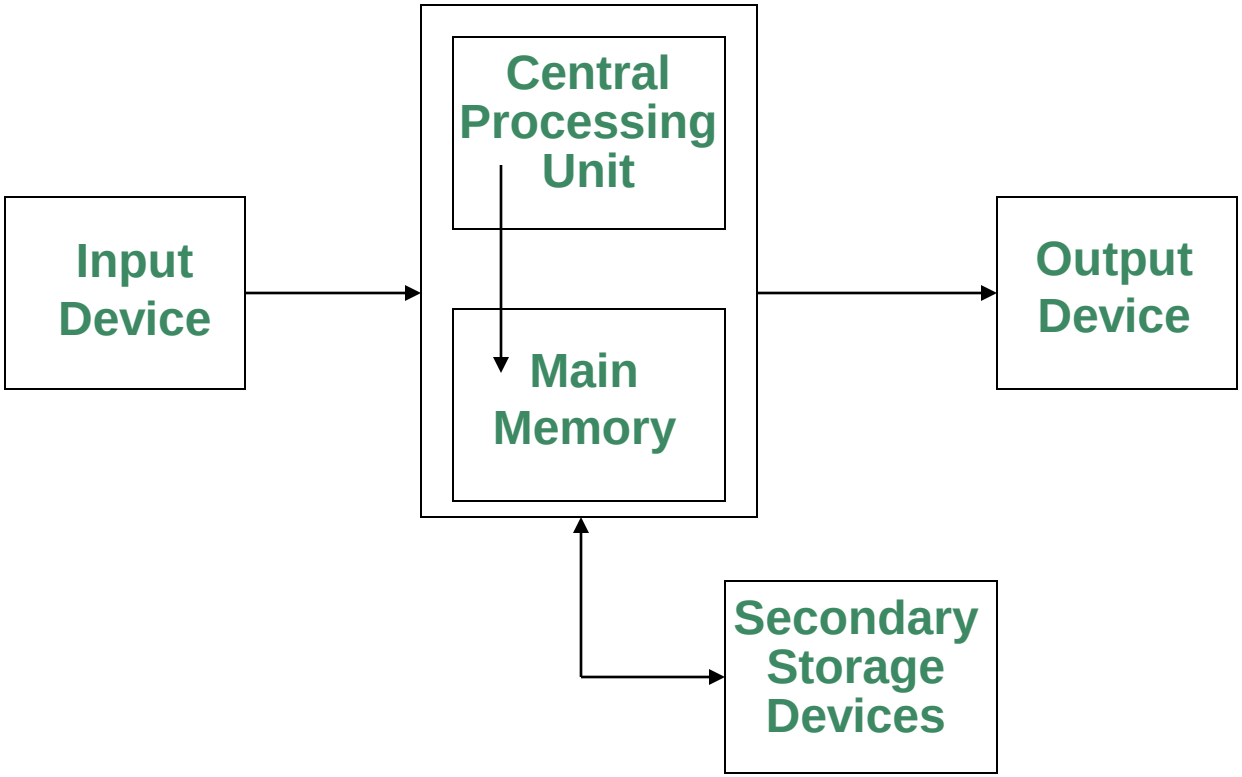
1.6 The Programming Process

1.2 Computer Systems: Hardware and Software

Main Hardware Component Categories

1. Central Processing Unit (CPU)
2. Main Memory
3. Secondary Memory / Storage
4. Input Devices
5. Output Devices

Main Hardware Component Categories



Central Processing Unit (CPU)

Includes

- Control Unit
  - Retrieves and decodes program instructions
  - Coordinates computer operations
- Arithmetic & Logic Unit (ALU)
  - Performs mathematical operations

The CPU's Role in Running a Program

Cycle through:

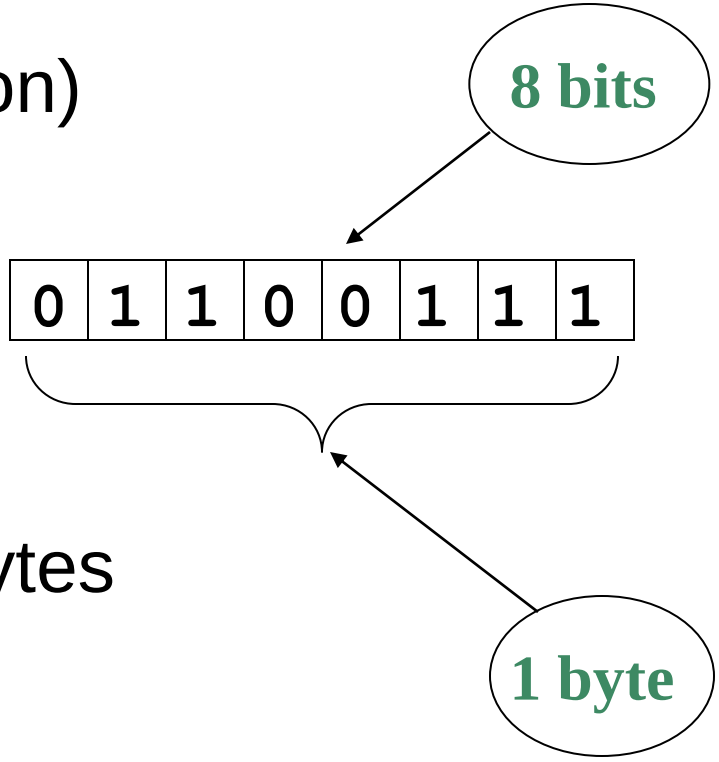
- Fetch: get the next program instruction from main memory
- Decode: interpret the instruction and generate a signal
- Execute: route the signal to the appropriate component to perform an operation

Main Memory

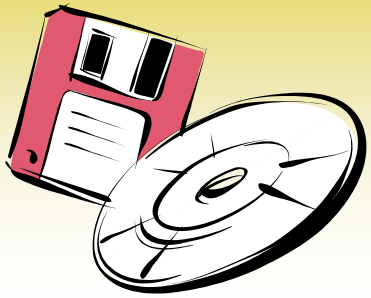
- Holds both program instructions and data
- Volatile – erased when program terminates or computer is turned off
- Also called Random Access Memory (RAM)

Main Memory Organization

- Bit
  - Smallest piece of memory
  - Stands for **b**inary dig**it**
  - Has values 0 (off) or 1 (on)
- Byte
  - Is 8 consecutive bits
- Word
  - Usually 4 consecutive bytes
  - Has an address



Secondary Storage

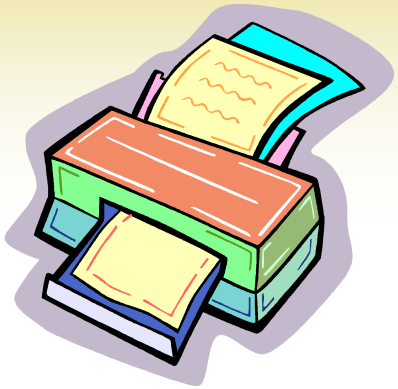


- Non-volatile - data retained when program is not running or computer is turned off
- Comes in a variety of media
  - magnetic: floppy disk, zip disk, hard drive
  - optical: CD
  - flash: thumb or flash drive

Input Devices

- Used to send information to the computer from outside
- Many devices can provide input
  - keyboard, mouse, microphone, scanner, digital camera, disk drive, CD drive, flash drive

Output Devices



- Used to send information from the computer to the outside
- Many devices can be used for output
  - Computer screen, printer, speakers, disk drive, writable CD drive, flash drive

Software Programs That Run on a Computer

- Operating system software
  - programs that manage the compute hardware and the programs that run on them
    Ex: Windows versions, UNIX
- Application software
  - programs that provide services to the user.
    Ex: word processing, games, programs to solve specific problems

1.3 Programs and Programming Languages

- **Program**

  a set of instructions directing a computer to perform a task

- **Programming Language**

  a language used to write programs

Programs and Programming Languages

Types of languages

- Low-level: used for communication with computer hardware directly. Often written in binary machine code using 0 and 1.
- High-level: closer to human language

From a High-level Program to an Executable File

a) Create file containing the program with a text editor.

b) Run preprocessor to convert source file directives to source code program statements.

c) Run compiler to convert source program statements into machine instructions.

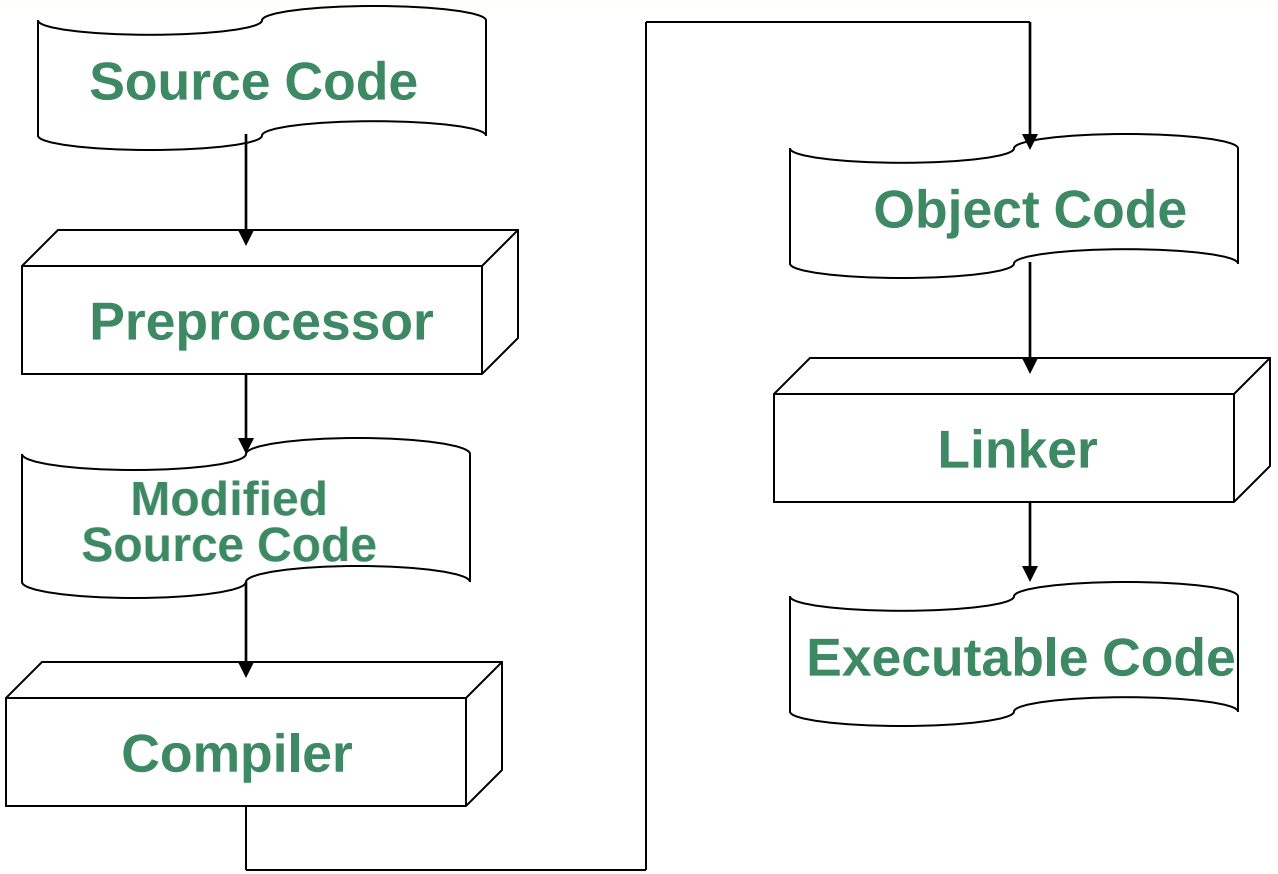
From a High-level Program to an Executable File

d) Run linker to connect hardware-specific library code to machine instructions, producing an executable file.

Steps b)–d) are often performed by a single command or button click.

Errors detected at any step will prevent execution of the following steps.

From a High-level Program to an Executable File



Example Program

```
#include <iostream>
#include <string>
using namespace std;

int main()
{
    string name;
    cout << "What is your name? ";
    cin  >> name;
    cout << "Hello there, " << name << endl;
    cin;
    return 0;
}
```

Chapter 1: Introduction to Computers and Programming

Starting Out with C++
Early Objects
Sixth Edition

by Tony Gaddis, Judy Walters, and Godfrey Muganda