COMPILERS

Fabio Stroppa

Machine language

Computers understand only one language: *machine language*.

Machine language consists of sets of instructions made of ones and zeros.

Binary Code

Example of a single instruction: **00000 10011110**

Everything in the computer is stored as a binary number that codifies specific information.

For example, the values of the data processed by programs are stored as binary numbers.

What is a compiler?

Example: input two numbers, add the two numbers together, and display the total.

Machine language

00000	10011110
00001	11110100
00010	10011110
00011	11010100
00100	10111111
00101	00000000

TRANSLATION

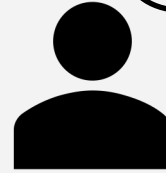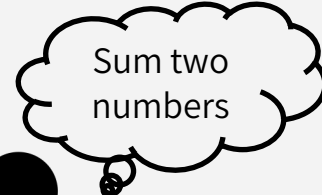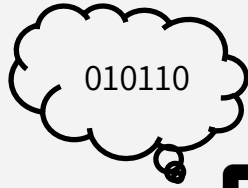Very tedious and error prone!

C

```
1:  int a, b, sum;
2:
3:  scanf("%d",&a);
4:  scanf("%d",&b);
5:
6:  sum = a + b;
7:  printf(sum);
```

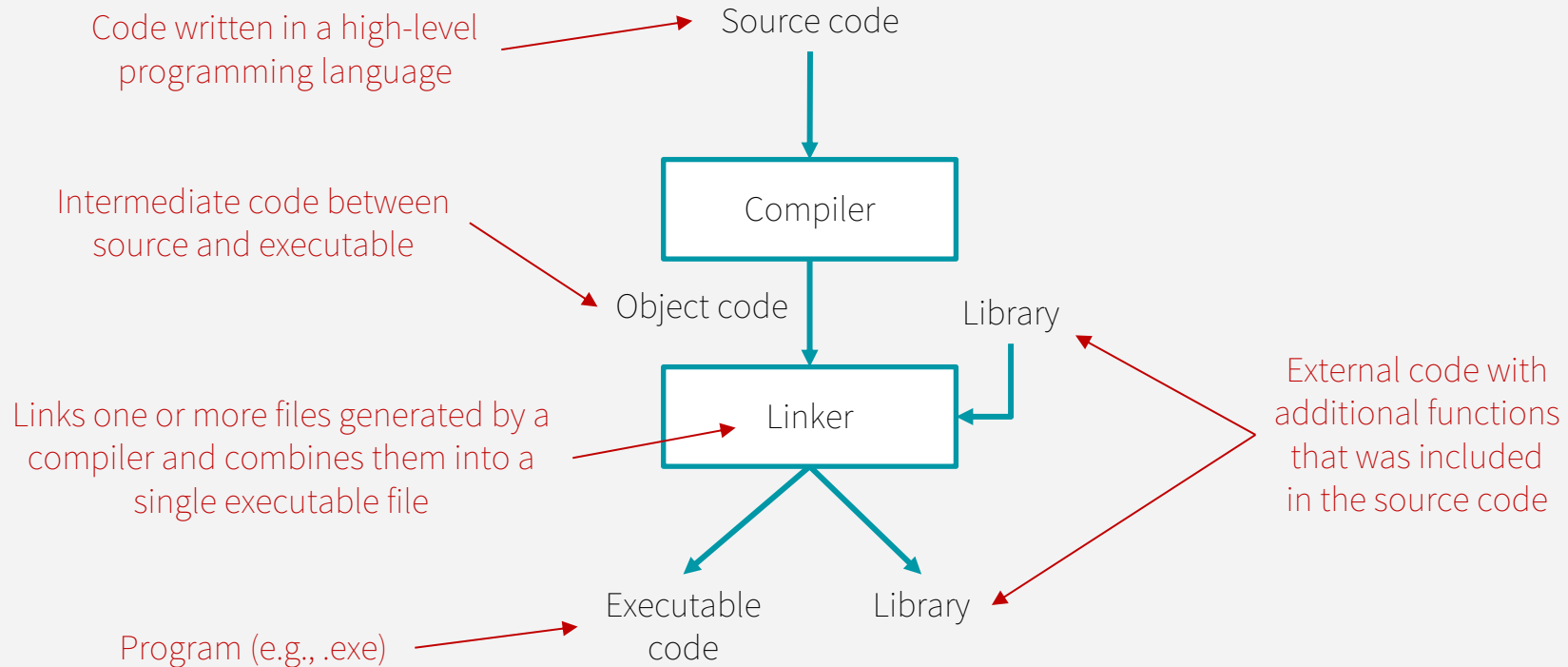Easier to read and write, to inspect, and less prone to errors.

What is a compiler?

A computer can only understand machine language and humans wish to write in high-level languages, these high-level languages must be translated (i.e., re-written) into machine language at some point.

This is done by special programs called compilers, interpreters, or assemblers that are built into the various programming applications.

Compilation scheme

Code written in a high-level programming language

Source code

Intermediate code between source and executable

Compiler

Object code

Library

Links one or more files generated by a compiler and combines them into a single executable file

Linker

External code with additional functions that was included in the source code

Executable code

Library

Program (e.g., .exe)

Console programs

Console programs are software that use text to communicate with the user and the environment (i.e., do not have a proper Graphical User Interface).

In this course we will focus on developing C++ console programs.

To develop and compile console programs, we will use an **Integrated Development Environment** (IDE).

Integrated development environment (IDE)

IDEs generally integrate several development tools, including:

- a **text editor**,
- a **compiler**, and
- a **linker**.

IDE on Mac

Visual Studio Code is recommended if you are on Mac.

Download: https://code.visualstudio.com/download
Video Tutorial: https://www.youtube.com/watch?v=JGsyJI8XG0Y
Install Debug: https://code.visualstudio.com/docs/editor/debugging

Make sure to install these three extensions:

- C/++,
- C/C++ Debugging with Flags,
- Code Runner.