Module 1

Introduction to Programming and Python

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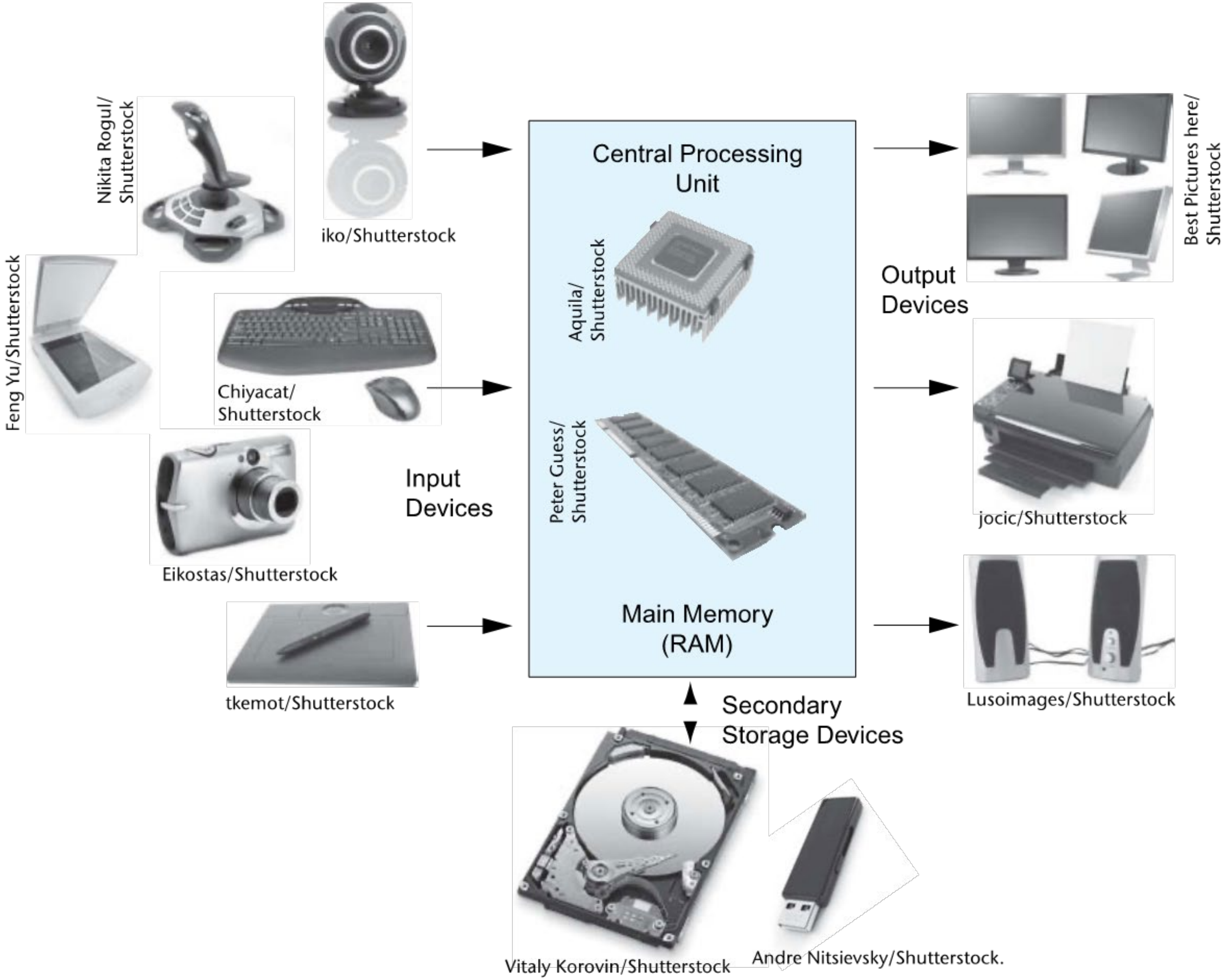
How a program works?

Machine language

Assembly language

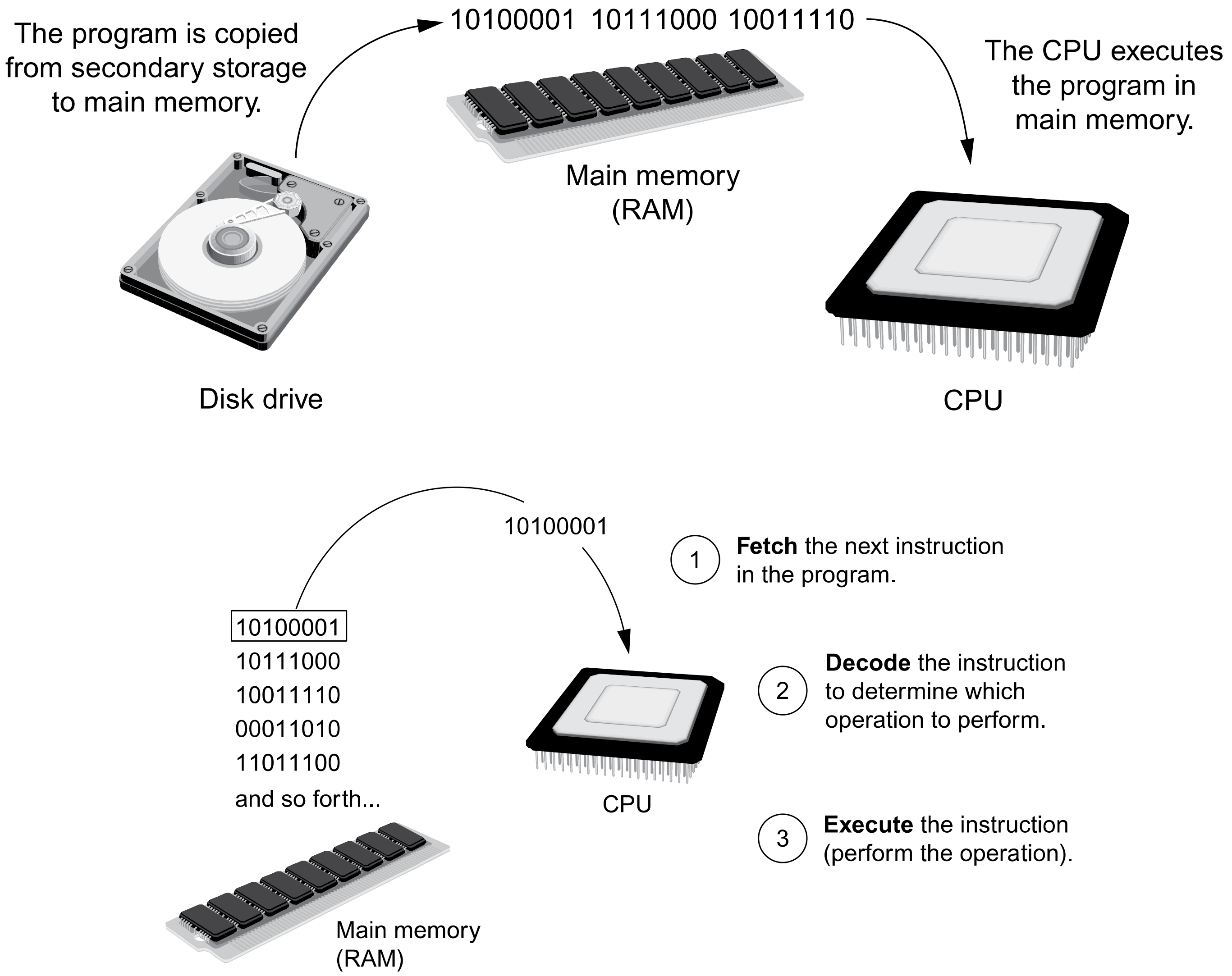
High-level language

Typical components of a computer system



Gaddis (2019), Starting Out with Python 4/e.

A program is copied into main memory and then executed



The program is copied from secondary storage to main memory.

10100001 10111000 10011110

The CPU executes the program in main memory.

Disk drive

Main memory (RAM)

CPU

10100001

10111000

10011110

00011010

11011100

and so forth...

Main memory (RAM)

10100001

CPU

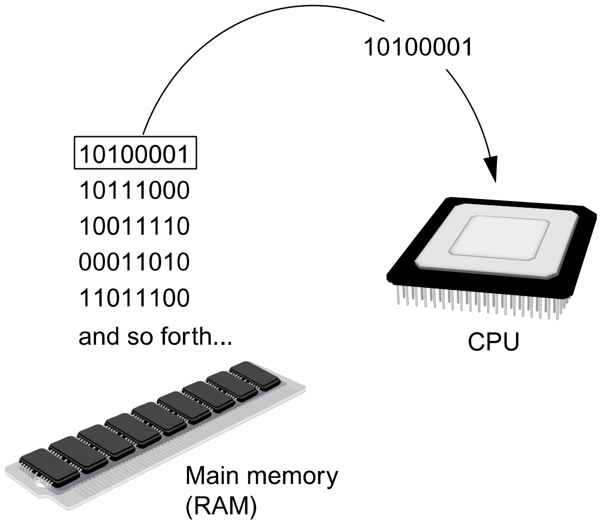
1 **Fetch** the next instruction in the program.

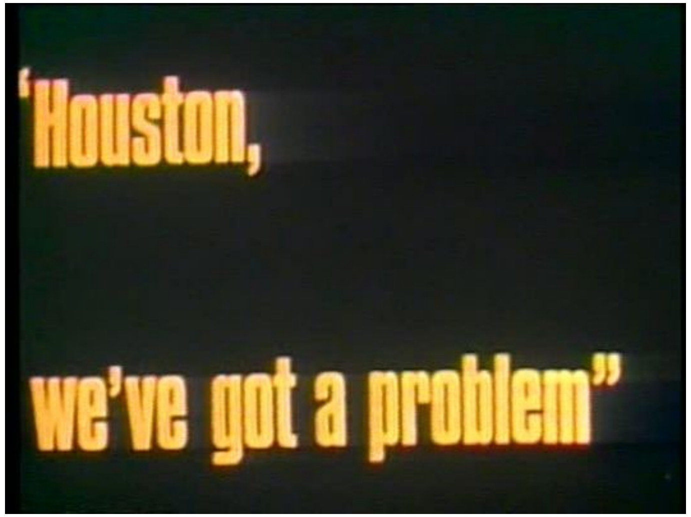
2 **Decode** the instruction to determine which operation to perform.

3 **Execute** the instruction (perform the operation).

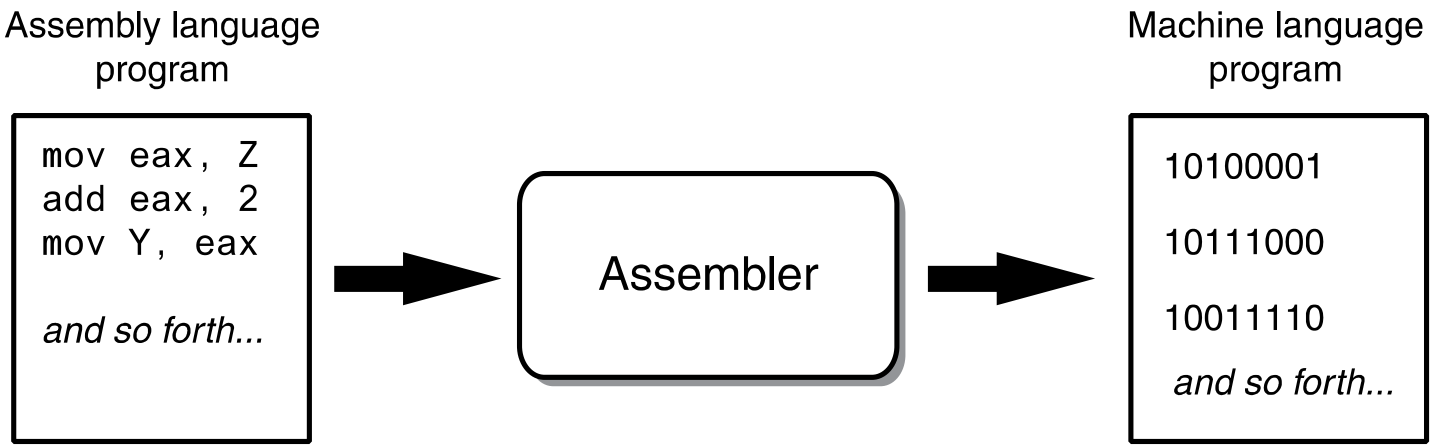
Machine language: the fetch-decode-execute cycle.

Gaddis (2019), Starting Out with Python 4/e.



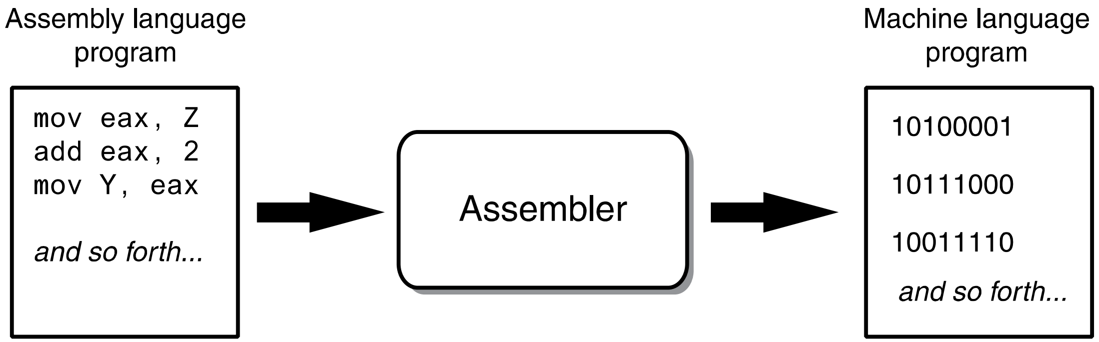

'Houston,
we've got a problem"

➢ From Machine Language to Assembly Language



```
mov eax, Z
add eax, 2
mov Y, eax

and so forth...
```

```
10100001

10111000

10011110
and so forth...
```



Assembly language program

```
mov eax, Z
add eax, 2
mov Y, eax
```

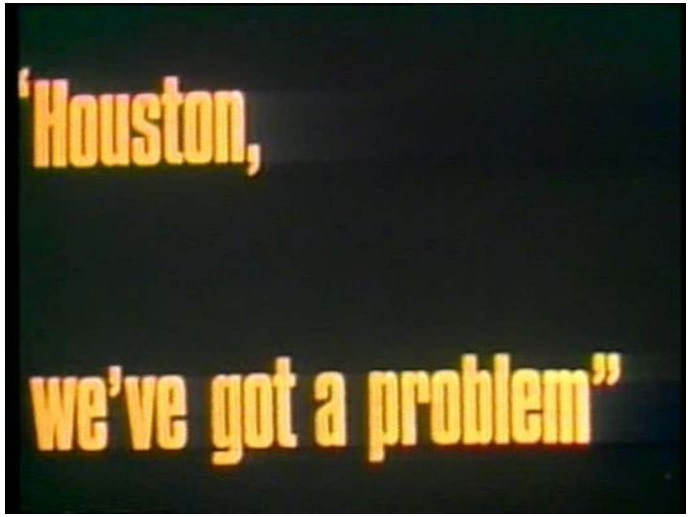
and so forth...

Assembler

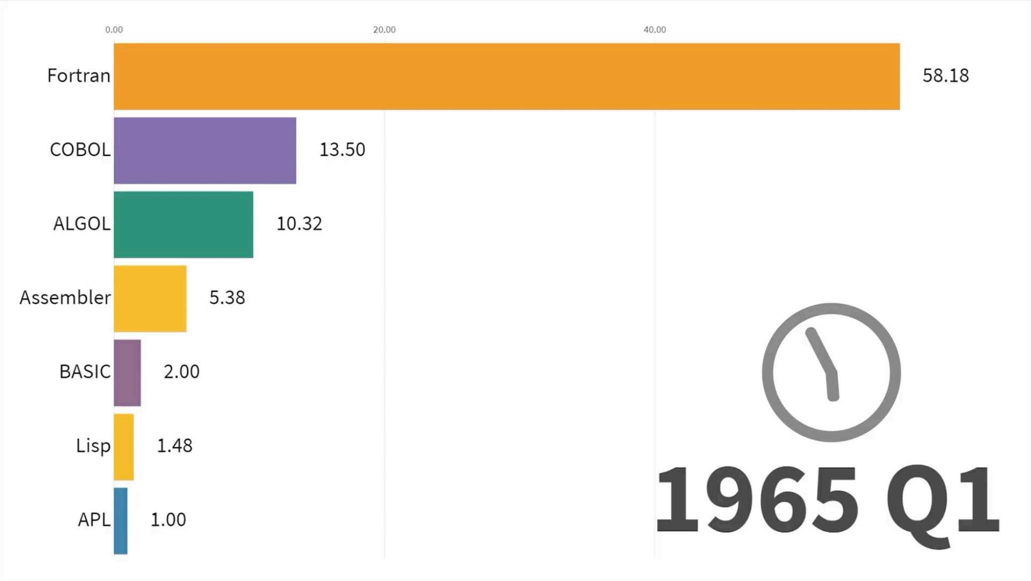
Machine language program

```
10100001

10111000

10011110
```

and so forth...



- **From Assembly Language to High Level Language**



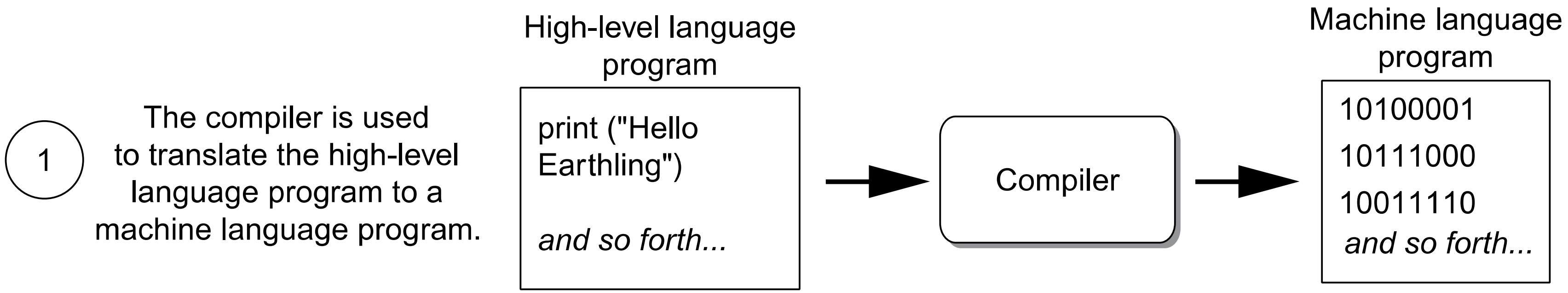
High-Level Languages

- **Low-level language: close in nature to machine language**
  - Example: assembly language.

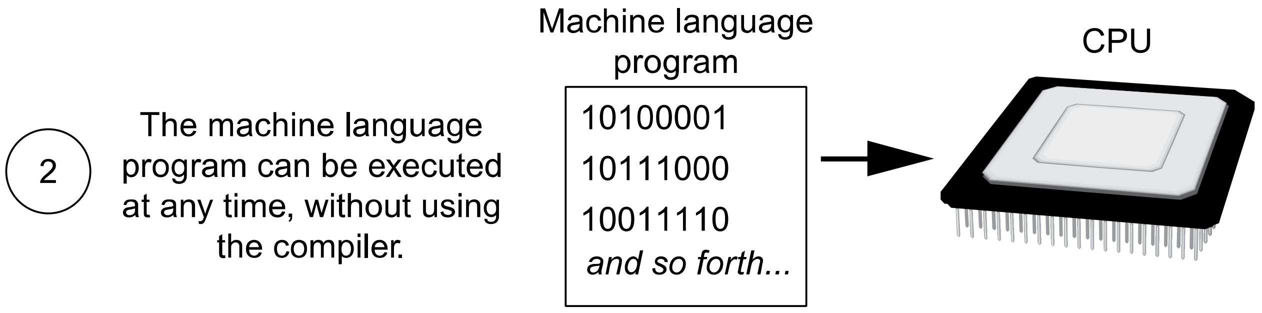
- **High-Level language: allows simple creation of powerful and complex programs**
  - No need to know how CPU works or write large number of instructions.
  - More intuitive to understand.

High Level Languages (1/2)

First：Compiler (Strong Type, Static)



1
The compiler is used to translate the high-level language program to a machine language program.
High-level language program
print ("Hello Earthling")
and so forth...
Compiler
Machine language program
10100001
10111000
10011110
and so forth...

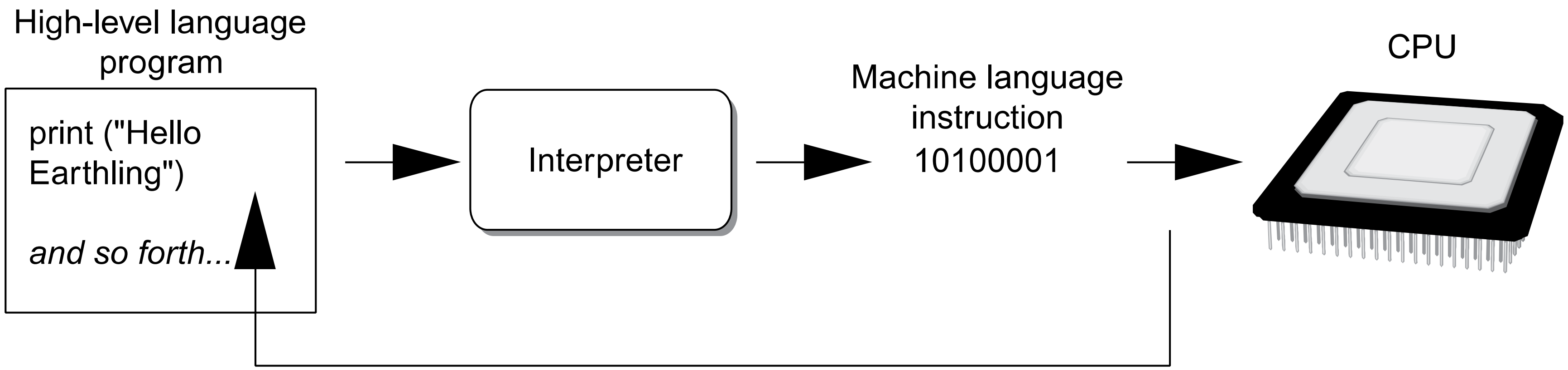


2
The machine language program can be executed at any time, without using the compiler.
Machine language program
10100001
10111000
10011110
and so forth...
CPU

Gaddis (2019), Starting Out with Python 4/e.

High Level Languages (2/2)

Second：Interpreter (Weak Type, Dynamic)


High-level language program
print ("Hello Earthling")
and so forth...
Interpreter
Machine language instruction
10100001
CPU

The interpreter translates each high-level instruction to its equivalent machine language instructions then immediately executes them.

This process is repeated for each high-level instruction.

Gaddis (2019), Starting Out with Python 4/e.

Using Python

Using Python

Version 3.x

See Accompanying Note: Python Installation and Programming Environment

Summary

- This module covered:
  - Machine language and fetch-decode-execute cycle between RAM and CPU.
  - Two kinds of high-level languages and their behavior.
  - Installing Python 3.x and programming Python using JupyterLab or PyCharm.

To be continued…