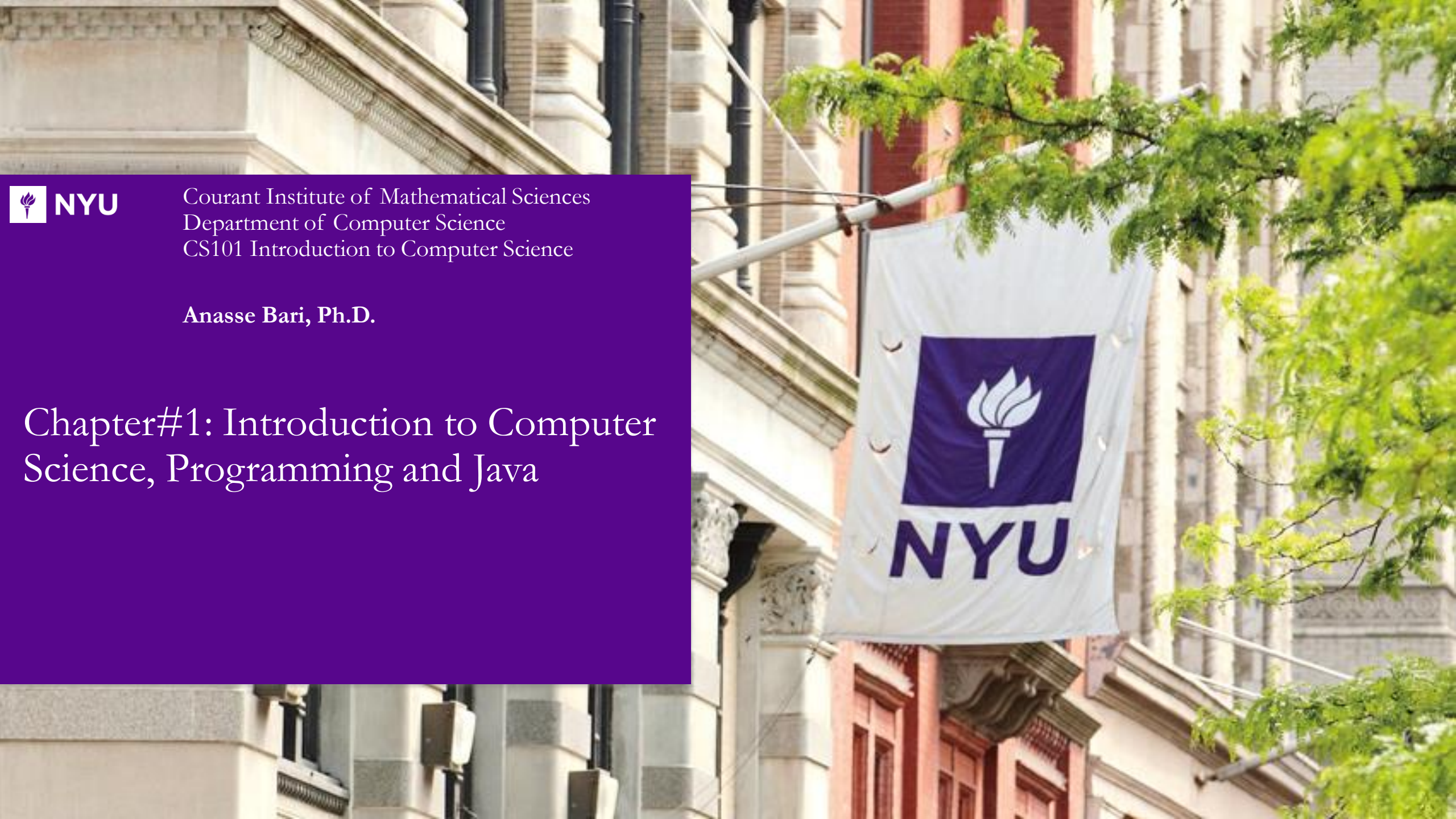


NYU

Courant Institute of Mathematical Sciences
Department of Computer Science
CS101 Introduction to Computer Science

Anasse Bari, Ph.D.

Chapter#1: Introduction to Computer Science, Programming and Java

Objectives

- Introducing Computer Science as a Science.
- Learning the basics of Computer Hardware, Compilation Process, High-level Language, Machine Language and Java.
- Differentiating between Software Development and Computer Programming.
- Introducing the Fundamentals of Software Engineering Lifecycle
- Defining the term *Algorithm* and it is Correlation to Computer Programming

Outline

- What is a computer?
- What is computer science?
- Why study computer science?
- What is an algorithm?
- What is software development?
- What is computer programming?
- What is a computer programming language?
- What is a machine language?
- What is a high-level language?
- What is a source file?
- What is an Object file?
- What is the Object Oriented Programming (very brief overview)?
- What is an Integrated Development Environment (IDE)?
- What is Eclipse IDE?

Defining the term *"computer"*

What is a computer ?

- It is a machine that performs computations based on instructions.
- It is a machine that can receive, store, transform and output data of all kinds.
- It is an electronic device that stores and processes data.

Defining the term *"Science"*

What is a Science ?

- Science is a process of discovery.
- Discovery of everything in our world. Discovery of how things worked in the past, and how they are likely to work in the future.
- The discovery and the knowledge inferred from science can be reliable.
- Knowledge derived from the science can be used to develop new technologies, treat diseases, and solve other problems.

Defining the term *"Computer Science"*

What is Computer Science ?

- Computer science is the science of *information processes* and their *interactions* with the world. Reference: dl.acm.org
- Computers are tools to implement, study, and predict them.

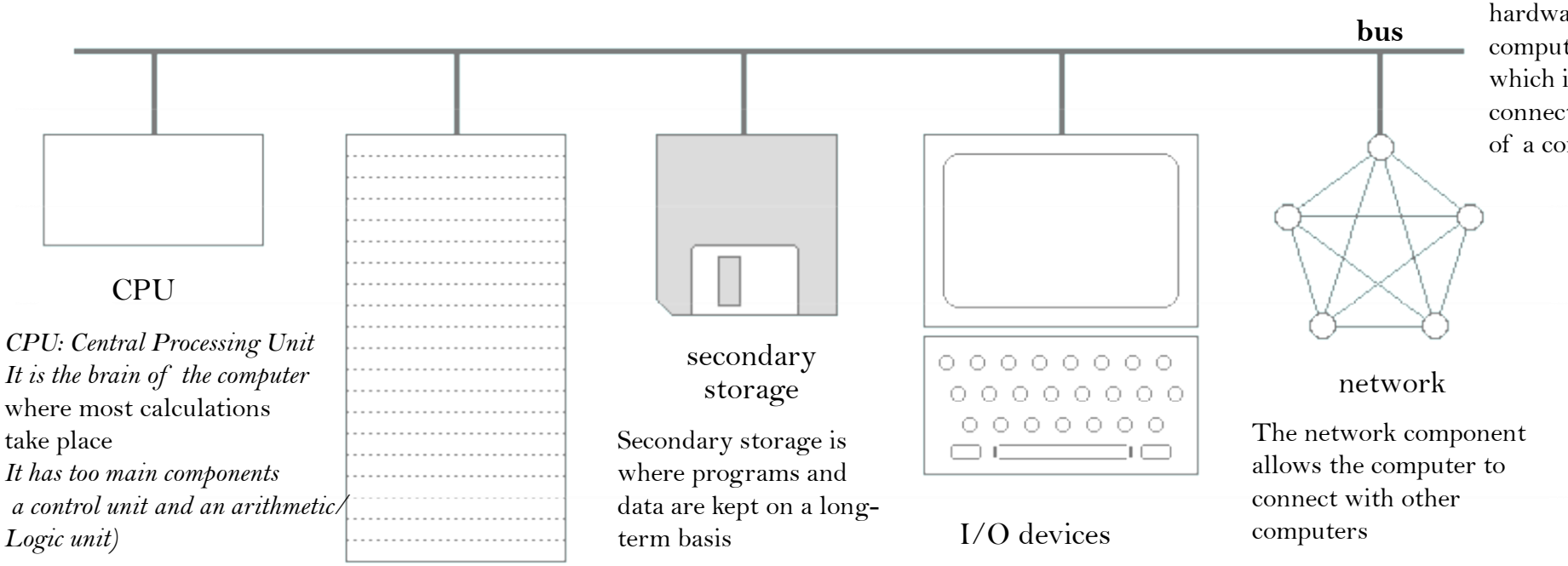
Computer = Hardware + Software

- Hardware represents the physical visible components of the computer.

- Software represents the invisible set of instructions that asks the computer hardware to perform a specific task.

Examples?

The Main Components of Computer Hardware



Bus: is a component that connects all other component in computer hardware (built into the computer's motherboard which is a circuit case that connects all of the parts of a computer)

CPU

CPU: Central Processing Unit
It is the brain of the computer where most calculations take place
It has too main components a control unit and an arithmetic/ Logic unit)

memory

Main memory is where programs and data are kept when the processor is actively using them

secondary storage

Secondary storage is where programs and data are kept on a long-term basis

I/O devices

Input and output devices allow the computer system to interact with the outside world by moving data *into* and *out of* the system (keyboard, mouse..)

network

The network component allows the computer to connect with other computers

Inspired from Prof. Eric Roberts of Stanford.

Defining the term "*algorithm*"

What is an algorithm?

- It is a procedure for solving a problem
- It is set of instructions that you will give to the computer to solve a particular problem.
- To meet its more formal definition, an algorithm has to be:
  - Clearly and unambiguously defined.
  - Effective, in the sense that its steps are executable.
  - Finite, in the sense that it terminates after a bounded number of steps.

Software Development Process at a Glance

- Software Development is the development of a software product.
- Software development process
  - Requirements Analysis
  - Design
  - Implementation
    - **Programming**
  - Testing
  - Documentation
  - Training and Support
  - Maintenance

In-class discussion

Real-world examples of Software Development Process

Defining Computer Programming

- Computer programming is the process of writing a computer programs.

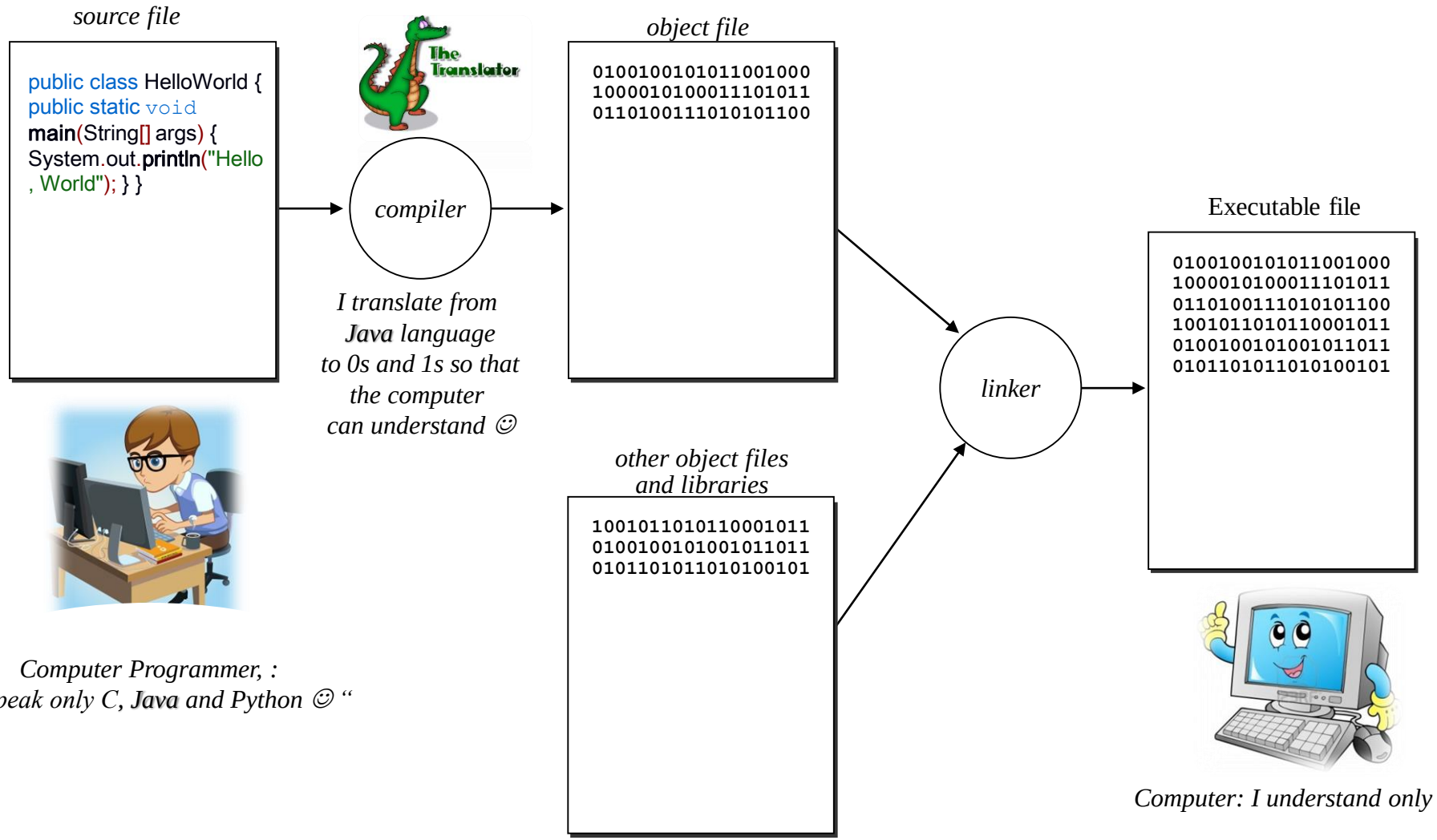
- A computer program is a sequence of instructions written to perform a specified task with a computer.
- A computer program is writing in specific language that a "computer" can understand"
- A programming language consists of vocabulary and set of grammatical rules for instructing a computer to perform specific tasks.
- Example: C Language, Java Language, C++…

Computer Programming Process

- Each computer system understands a low-level language that is specific to that type of hardware, which is called its **machine language.**
- Programmers typically write their software in a **higher-level language** that is easier for humans to understand.
- To execute a programs written in a higher-level language, the computer must adopt one of two strategies:
  - The classical approach is to translate the higher-level language into machine language. This strategy is called **compilation.**
  - A second approach is to simulate the program operation without actually translating it to machine language.
  - This strategy is called **interpretation.**

Inspired from Prof. Eric Roberts of Stanford.

The Compilation Process



Reference: This figure was inspired from The Art and Science of Java book by Eric Roberts

Source File, Object File, Interpreter and Compiler

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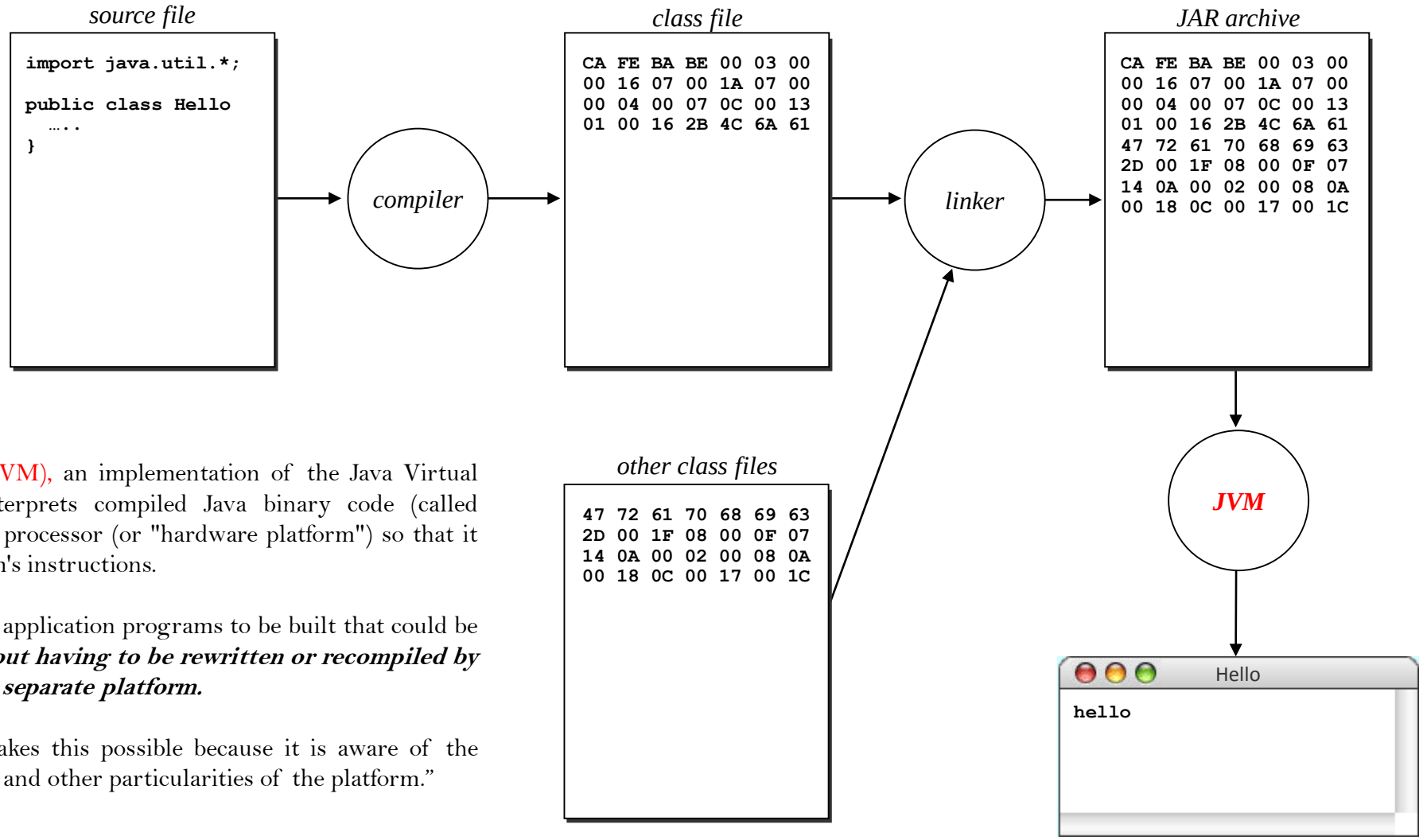
The Java Interpreter



"A Java virtual machine (JVM), an implementation of the Java Virtual Machine Specification, interprets compiled Java binary code (called bytecode) for a computer's processor (or "hardware platform") so that it can perform a Java program's instructions.

Java was designed to allow application programs to be built that could be run on ***any platform without having to be rewritten or recompiled by the programmer for each separate platform.***

A Java virtual machine makes this possible because it is aware of the specific instruction lengths and other particularities of the platform."

Reference: http://searchsoa.techtarget.com/definition/Java-virtual-machine

Reference: This figure was inspired from The Art and Science of Java book by Eric Roberts

Defining Source file, Object file, Interpreter and Compiler

- a program written in a high-level language (e.g. Java) is called a source program or source code.
- It is written in a file called *source file*. For instance, a program named *HelloNYU* written in Java is saved in a file *HelloNYU.java*
- *HelloNYU.java* is the source file that contains the source code written in Java.
- The computer does not understand a source program written in high-level language.
- The source program needs to be converted (translated) into machine code so it can be executed.
- The translation is can be done using another program called an Interpreter or a compiler.
- Interpreter converts and translates one statement from the source code and executes it right away.
- A compiler translates the entire source code into a machine language file, then the machine code file is being executed.

Defining Operating System (OS)

- The operating system (OS) is the computer program that runs and controls a computer.

- The operating system manages a computer.
  - Major tasks of an operating system:
    - Controlling and monitoring system activities
    - Allocating and assigning system resources
    - Scheduling operations

Objects and Classes

Please note that we will cover the Object-Oriented Paradigm in details in a later chapter – this is a just a very brief overview as you will encounter the word "class" in our first Java program .

- A Java program consists of one or more classes
- A class is an abstract description of objects
  - Analogy: A class is like a cookie cutter, objects are like cookies.

Picture Reference:
http://www.certona.com/personalize-triggered-emails-to-get-more-conversions/

Picture Reference:
http://stephenmatlock.com/2013/02/cookie-cutter/

Questions

Next: The Road to Your First Java Using Command Line

Reference: Turks and Caicos airport: source: http://www.globeimages.net/img-turks-and-caicos-islands-airport-926.htm

Resources of the Object Oriented Programming

(if you want to be proactive and get stated on OOP)

https://docs.oracle.com/javase/tutorial/java/concepts/

http://www.oracle.com/technetwork/java/oo-140949.html

http://beginnersbook.com/2013/04/oops-concepts/

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End of Chapter#1: Introduction to Computer Science, Programming and Java