Chapter 1

Computer Systems and Java Programming

Computer Systems and Java Programming

- **Computer Systems**
- Computer Programming
- Why Java Programming?
- Java Program Translation

NB: A number of terminologies to capture and understand

Computer Systems

Computer systems = Hardware + Software

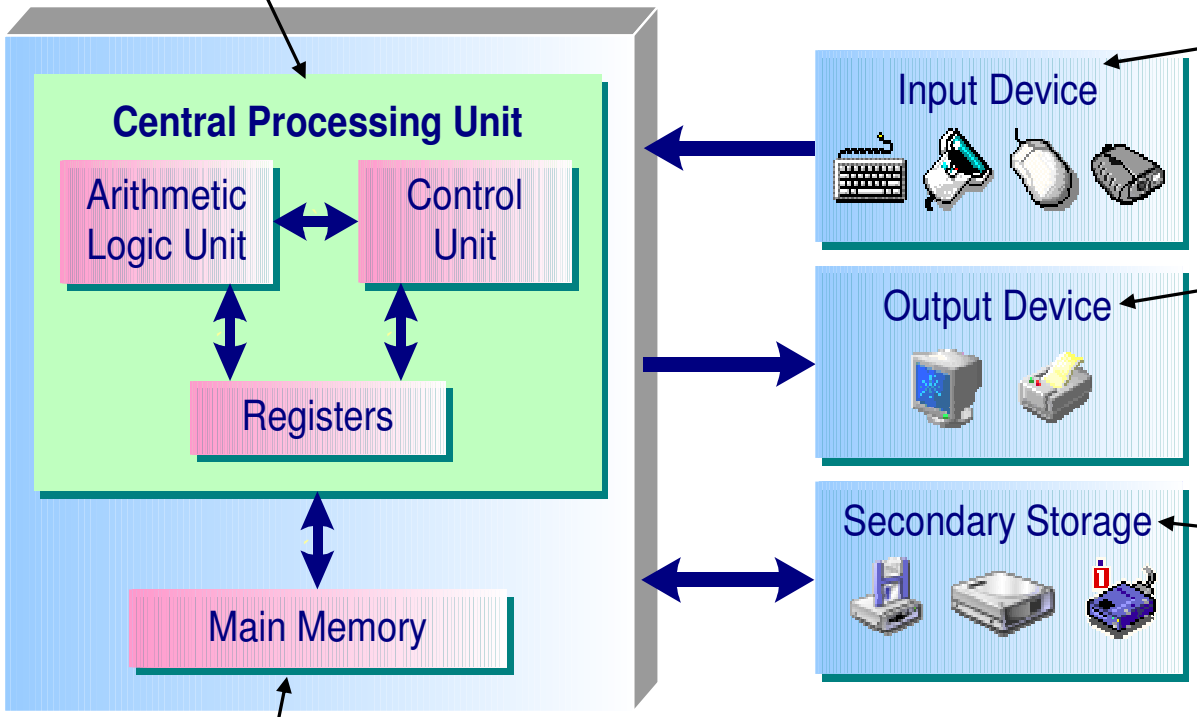
Hardware – Physical components/devices

Software – Computer programs with instructions that perform a particular task based on the hardware

Computer Hardware

1. CPU

- interprets and executes instructions



Give instruction!!!

3. Input Device

-mouse, keyboard, etc.

Feedback!!!

4. Output Device

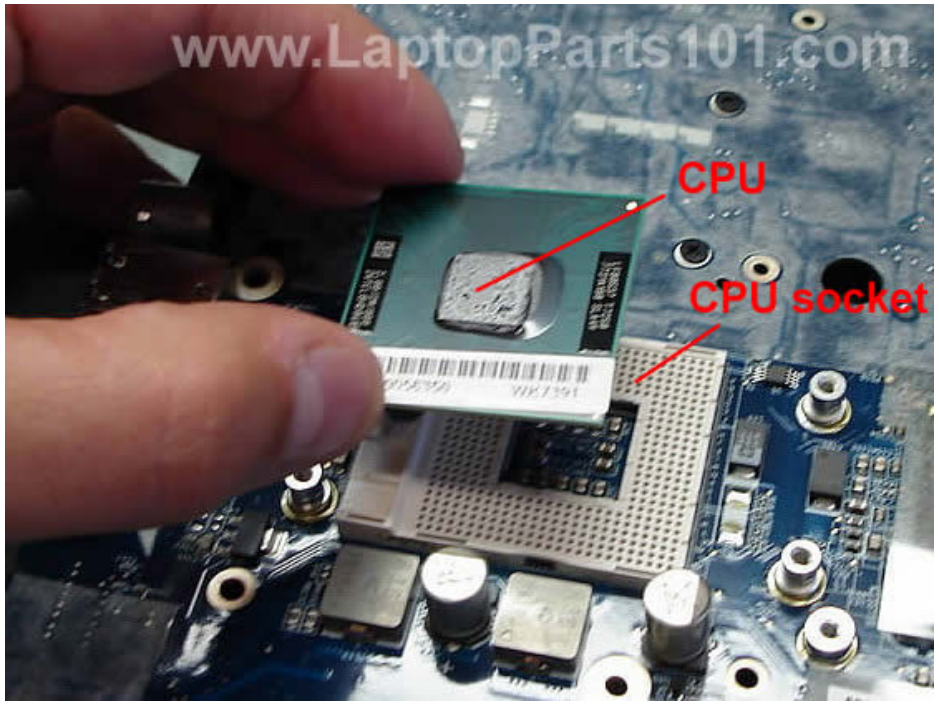
-printer, monitor, etc.

5. Secondary Storage

- permanent
- floppy disks, hard disks, CDs, tapes, USB flash drives, etc.

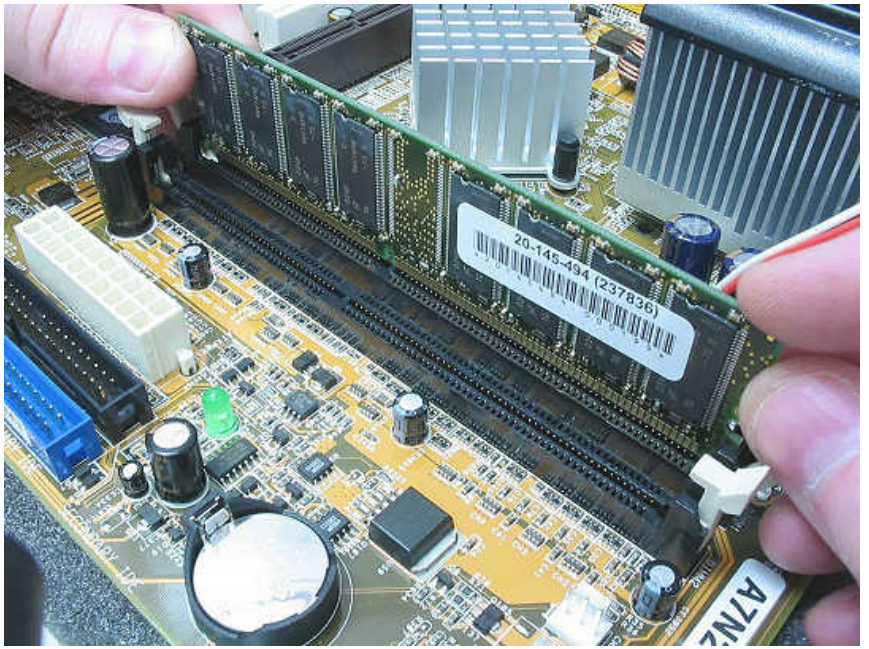
2. Main Memory

- store data and instructions
- 1 byte = 8 bits

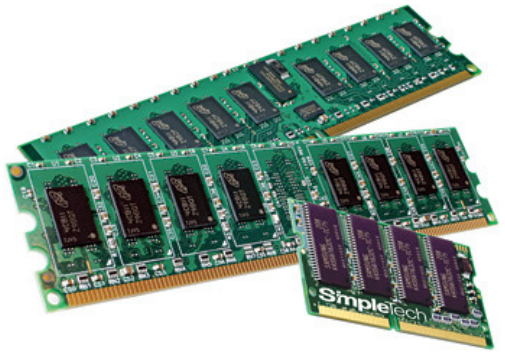


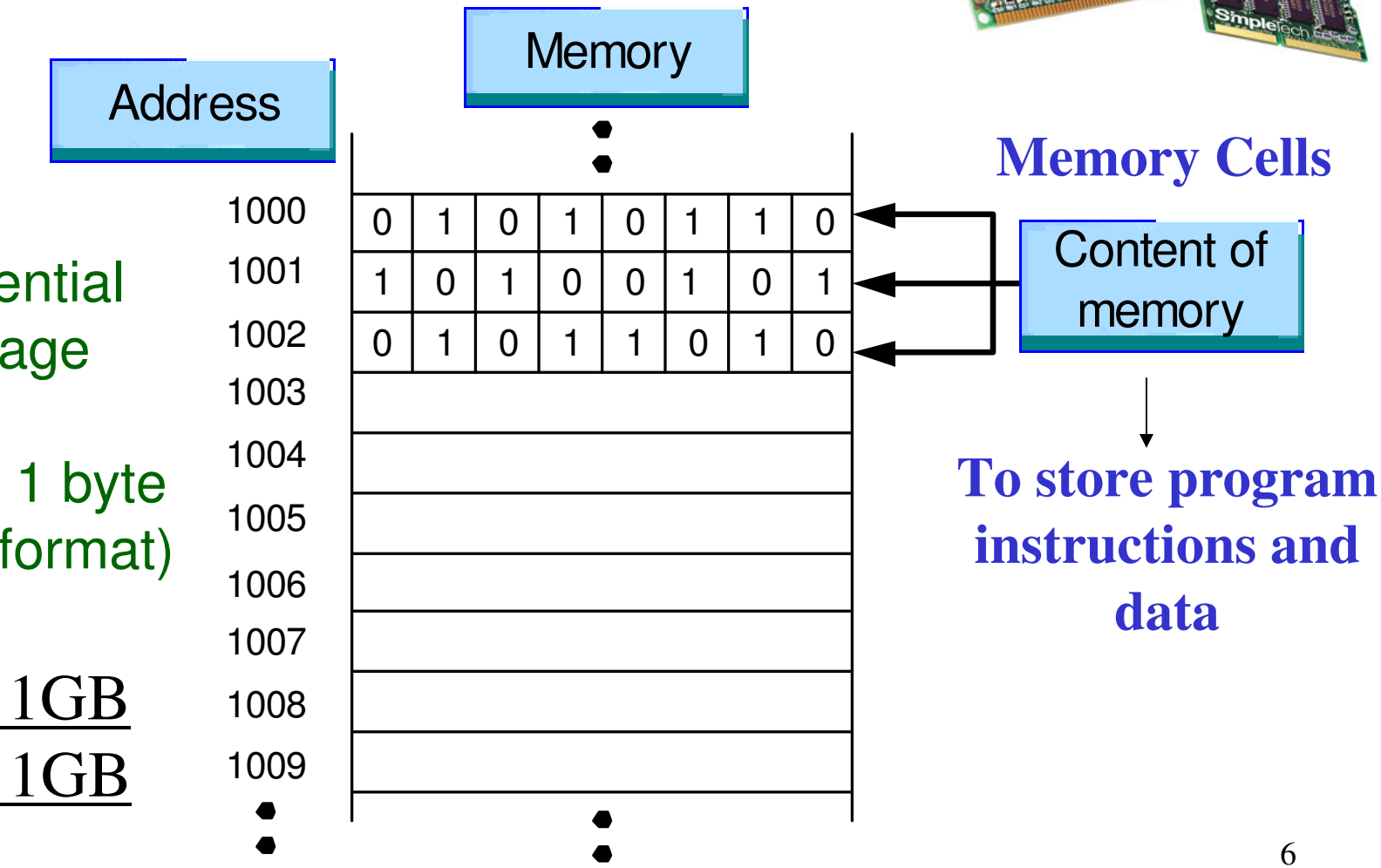
CPU

Memory



Computer Memory





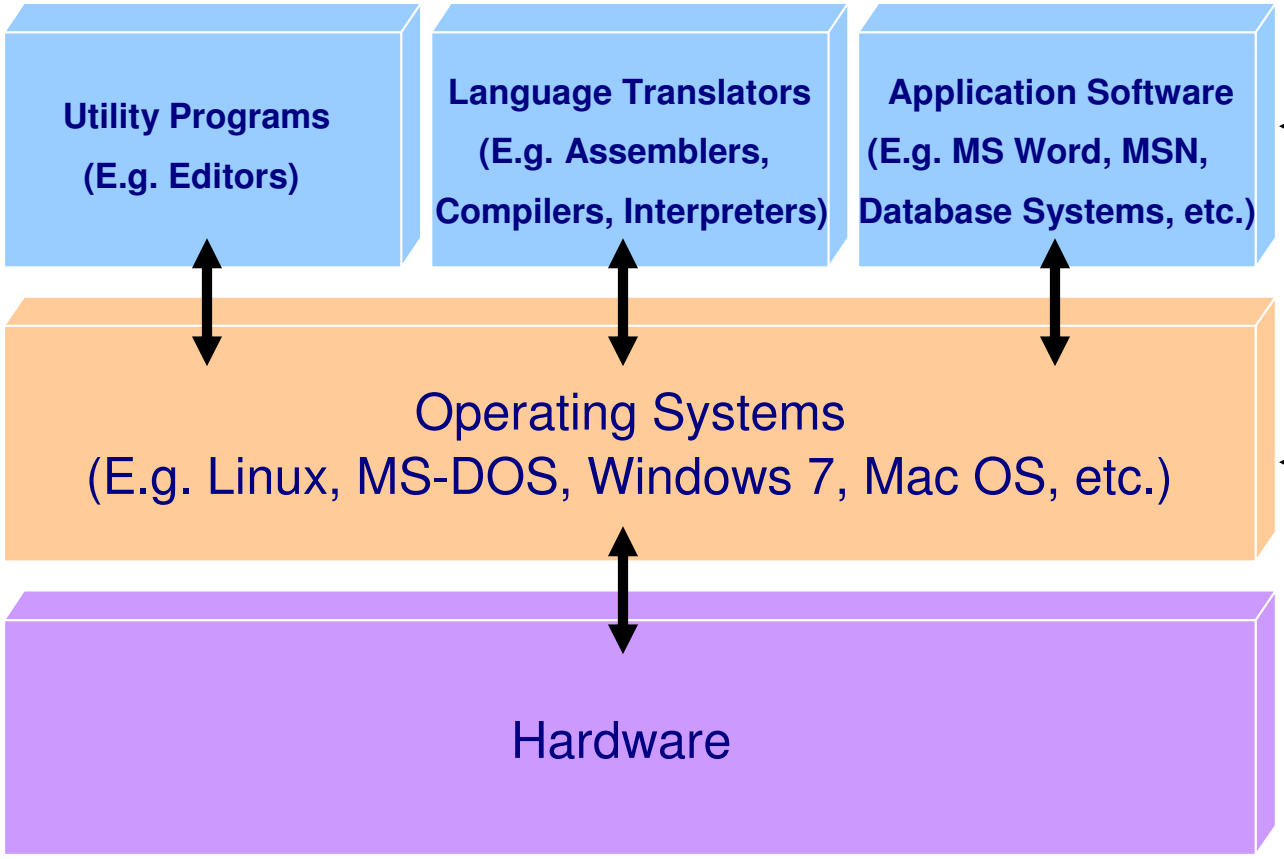
Number Systems

- Binary numbers: 0s and 1s or base 2
- Octal numbers: 0-7 or base 8
- Decimal numbers: 0-9 or base 10
- Hexadecimal numbers: 0-9, A-F or base 16

- Converting from **binary** to **decimal** (e.g., 10010)
  - $0x2^0 + 1x2^1 + 0x2^2 + 0x2^3 + 1x2^4 = 2 + 16 = 18$
- Converting from **decimal** to **binary** (e.g., 18)
  - 2|18 …0
    2 |9 …1
    2|4 …0 => 10010
    2|2 …0
    1

http://www.mathsisfun.com/binary-digits.html

Computer Software (Programs)



Application Software
- Utility Programs
- Language Tran.

System Software
-Operating Systems

Operating Systems and Linux

- An **operating system** is a collection of programs that coordinates the operation of computer **hardware** and **software**.
- The **Linux** operating system is **Unix-like** and is one of the most popular operating systems nowadays.
- Creator: Linus Torvalds in 1991
- Go back and read:
  - Linux Online: http://www.linux.org/
  - Also look at the faq (frequently asked questions): http://www.linux.org/info/faq1.htm#faq.q1
- **Lab 1** will give you some practices on using Linux.

The Linux File System

- A file system is a collection of files.
- A file is usually stored on a disk.
- Files can be grouped into directories and organized into a hierarchical directory structure.
- The top of this hierarchical directory structure is called the root directory.
- The Home directory is the directory assigned to you.
- The path name of a file enables you to identify a file uniquely to the Unix file system.

More Example: Working with Files

- **To list the files in a directory:** ($ - command prompt)

  $ls

- **To examine the contents of a file:**

  (1) $cat file1

  (2) $more file1

- **To make a copy of a file:**

  $cp file1 file1.backup

- **To rename a file:**

  $mv file1 newFile1

- **To remove a file:**

  $rm rubbish

Working with Directories

- **To display your working directory:**

  $pwd

- **To create a directory:**

  $mkdir lab1

- **To change directory:**

  $cd lab1
  $cd /home/user1/hp123456/lab2
  $cd ..

- **To copy a file from one directory to another:**

  $cp program.java lab1

- **To move a file from one directory to another:**

  $mv program.java lab1

- **To remove a directory:**

  $rmdir dir1

GO TO LAB 1 and
You will **capture** more and **practise** more
http://www3.ntu.edu.sg/SCE/labs/cpl/index.htm

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- **Computer Programming**
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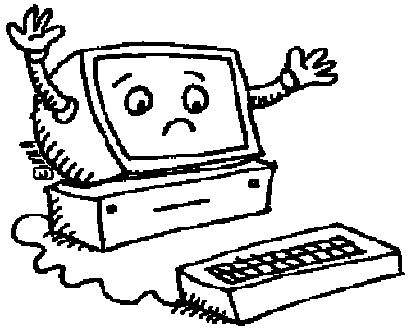
Computer Programming



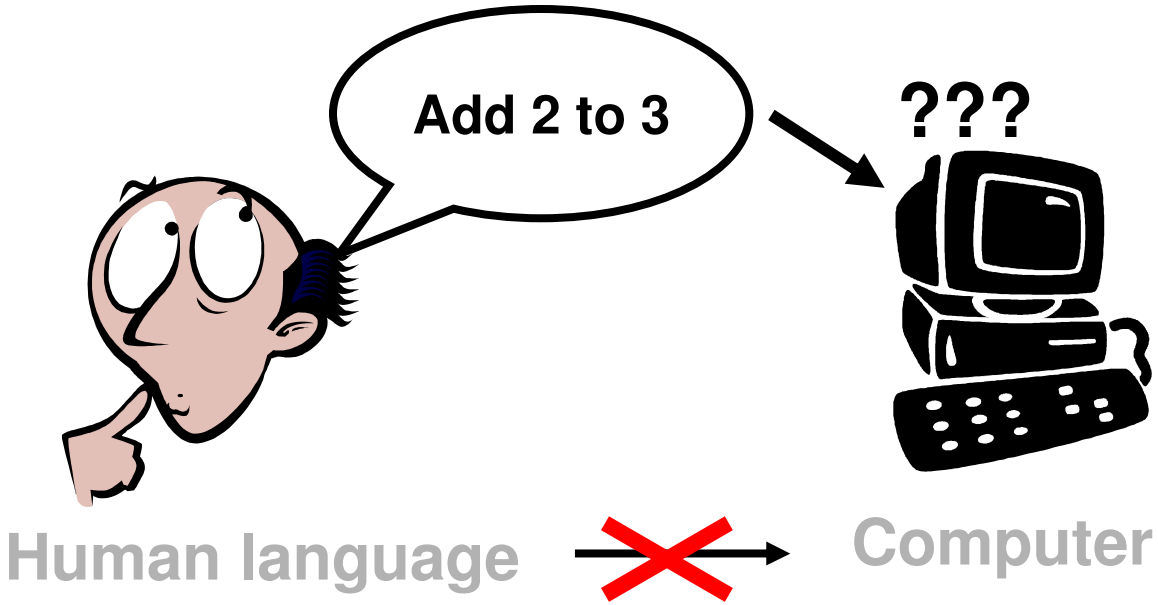
- **Computer Programs**
  - Set of **step-by-step instructions**
  - Perform a specific task to solve a **problem**

```
public class HelloStudents {
  public static void main(String[] args){
    System.out.println("Hello Students");
  }
}
```

  - Examples: Computer games, word processors, web browsers, database systems, etc
- **Computer programming is** to **design** and **implement** computer programs

Computer Programming

Learning computer programming is just **like** learning a new language such as Japanese, Chinese, Malay, etc.



A **programming language** defines **a set of instructions** (with specific format) that can be given to a computer.

Computer Programming

Two important issues on writing **programs**:

(1) Program **logic**

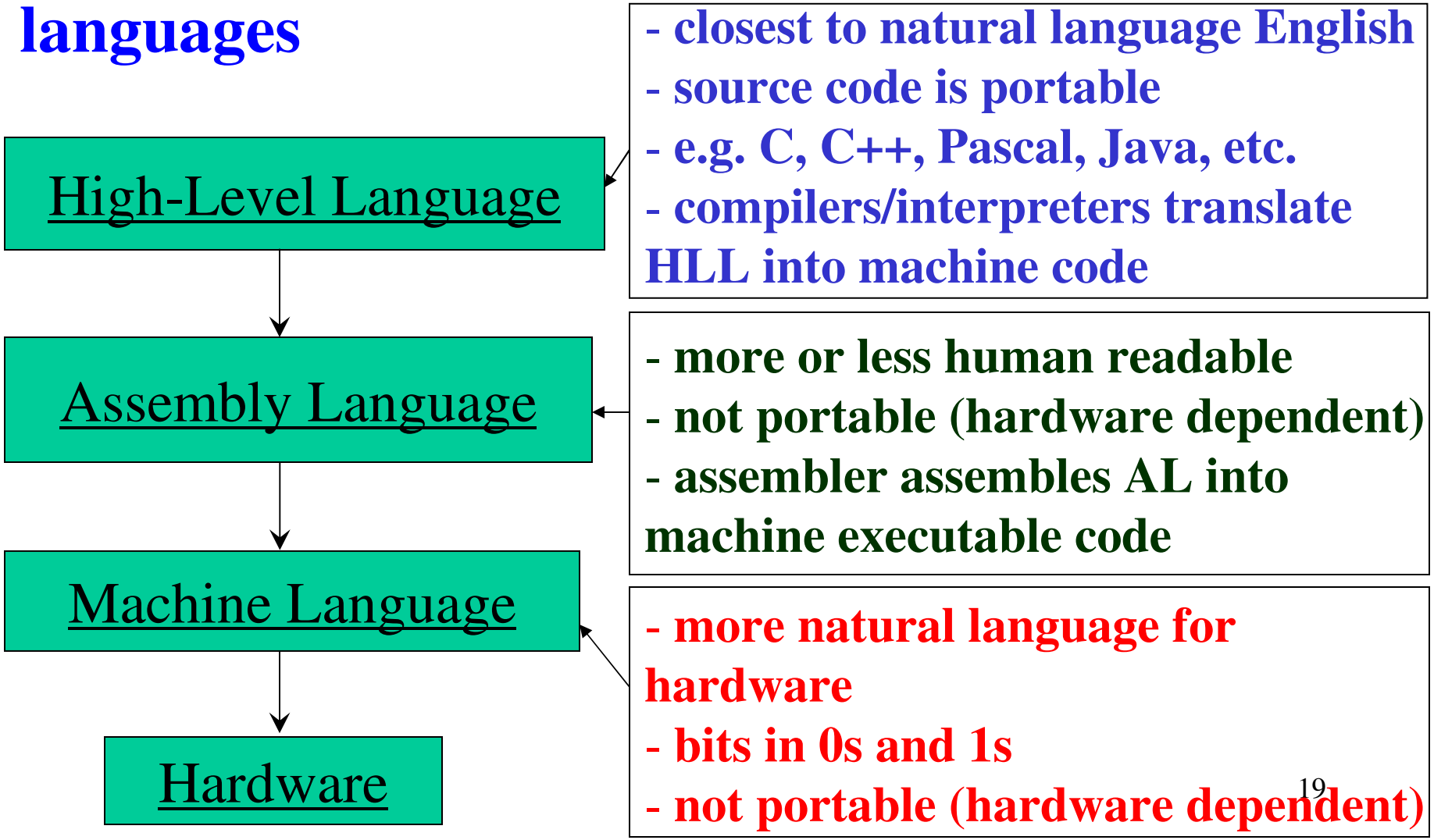
– in order to understand the contents

(2) Program **syntax**

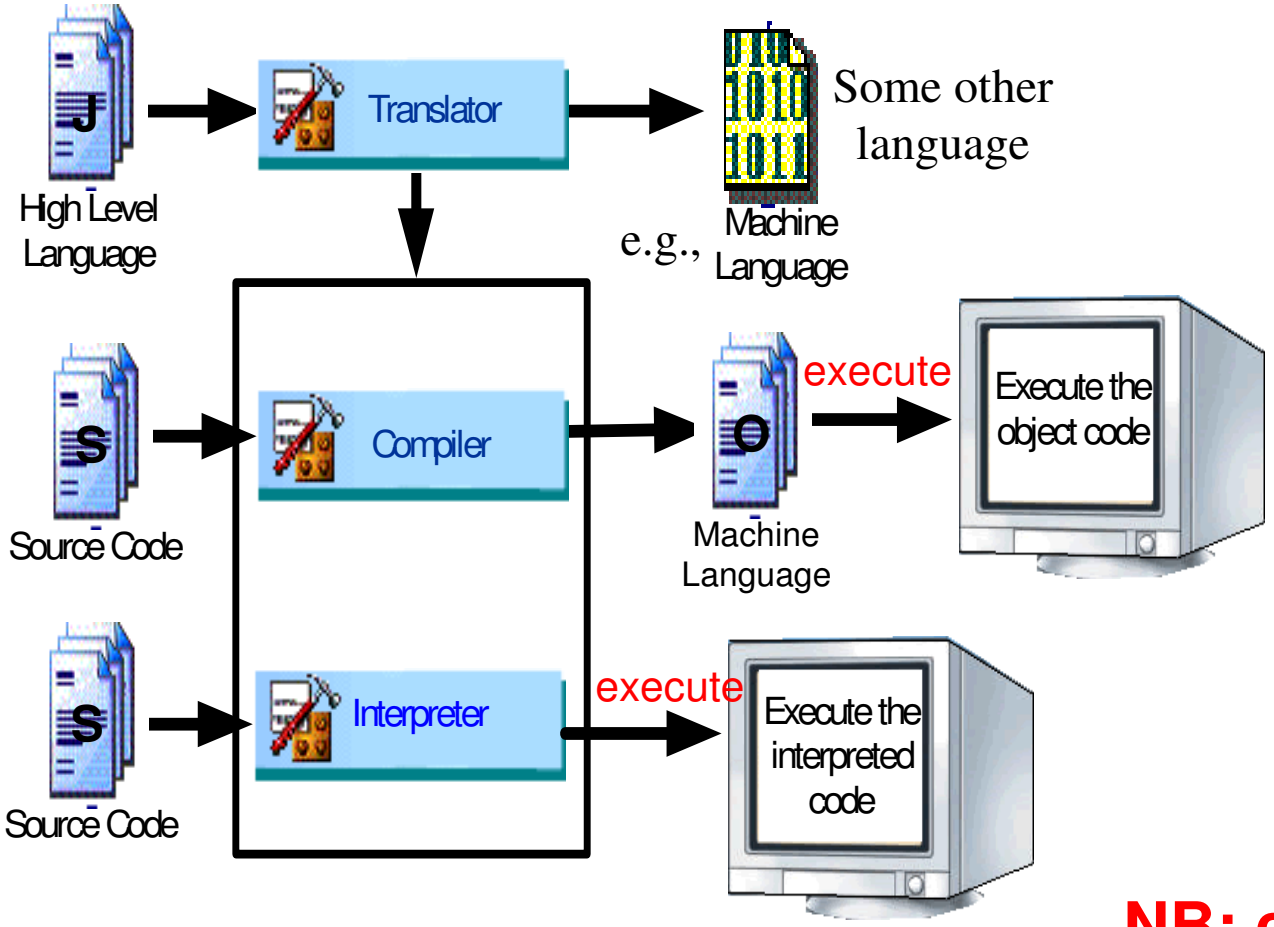
– like English grammar

Programming Languages

Computer programs are written in **programming languages**



Translator: Compiler and Interpreter



Compilers

- converts HLL programs into lower level languages
- translation is off-line, not at runtime

Interpreters

- translation to ML is on-line (at runtime)
- HLL programs could be executed directly

NB: compiled code can be executed faster

High-Level Programming

- **Procedural or Structured Programming**
  - COBOL, Pascal, C, etc.
  - Algorithm, **task-driven** – "How does?" (Chp 8)

- **Object-Oriented Programming (OOP)**
  - C++, Java, C# (with classes and objects)
  - Paradigms, **object-driven** – "What is?" (Chp 9)
  - Why?
    - Better Code Reuse
    - Easier for Debugging

NB: Not understanding? Later in Chp 8 and 9.

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- **Why Java Programming?**
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Take a break…want a cup of coffee?

Java – A Brief History

- James Gosling,
  Sun Microsystems Inc., 1991
- Originally a language for programming **embedded consumer electronic applications**
- Initially named as **Oak**. Then changed to **Java** after visiting a local coffee shop
- In 1995 – Java is a language for developing **Internet** applications
- Now – one of the most important **general-purpose** programming languages
- Sun is recently (2009-2010) becomes part of Oracle

Why OAK?
Because, while trying to think of a name, James Gosling looked out of his office window and saw an oak tree!

Java 2 Platform

- **Java 2 Platform, Standard Edition (J2SE)**
  - for developing client side standalone applications or applets
- Java 2 Platform, Enterprise Edition (J2EE)
  - for developing client side applications or servlets
- Java 2 Platform, Micro Edition (J2ME)
  - for developing applications for mobile devices such as smart phones

We use the **Standard Edition Version 5.0** (or J2SE 5.0), Java Development Kit 5.0 (also known as **JDK 1.5**) or higher (JDK 1.6).

Latest: J2SE 6 (released in Jul 2010), but we use J2SE5

Why Java Programming?

- Java is object-oriented
- Java is simple
- Java is robust and readable
- Java is portable
- Java is secure and distributed
- Java is easy to learn
- Java has many useful features
- Java is general-purpose

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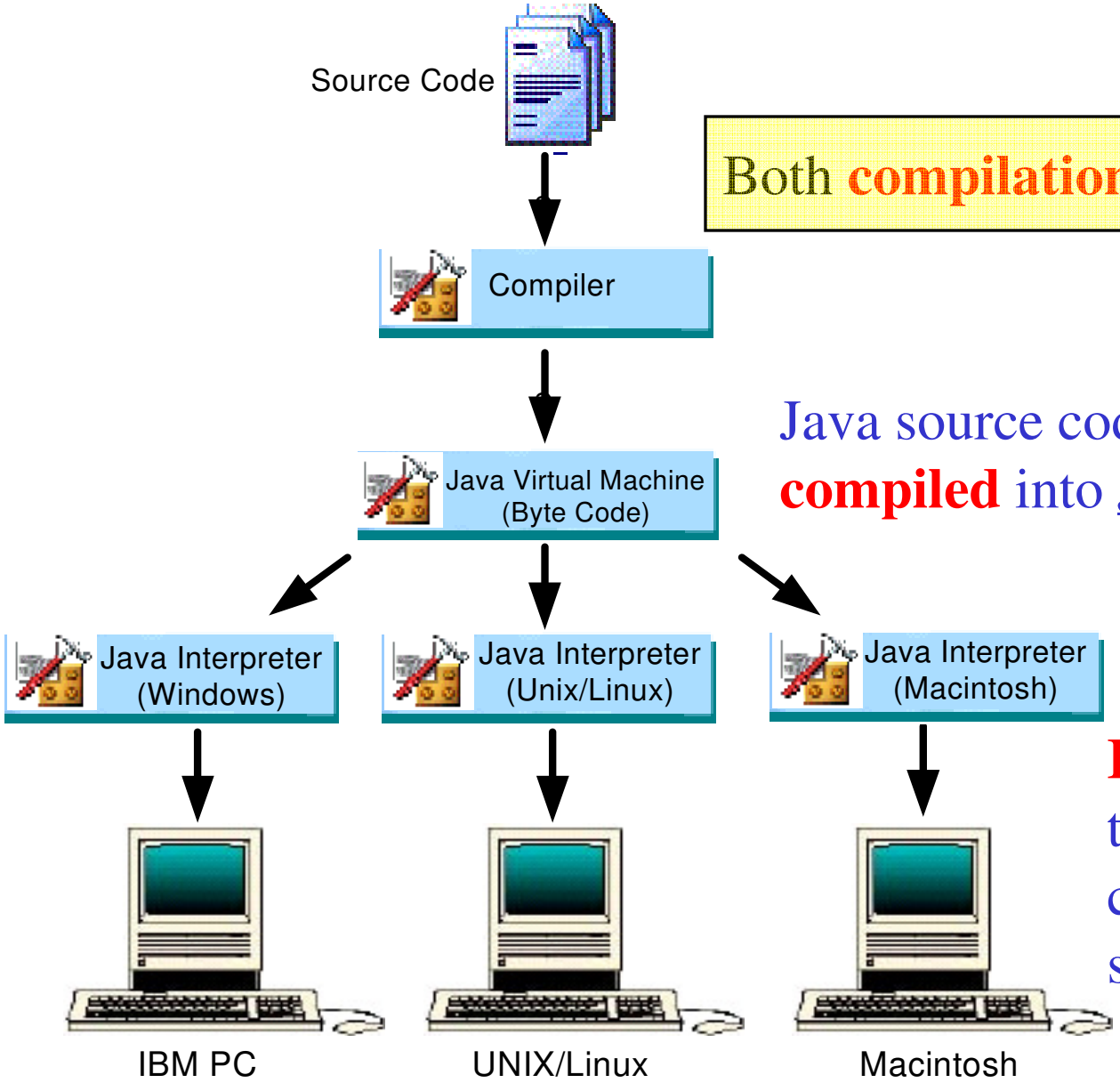
Java Program Translation



Both **compilation** and **interpretation**

Java source code is first **compiled** into **Java byte code**

*** cross-platform**

Interpreter (JVM) translates from byte code into hardware-specific machine code

Why such design?

Key Terms

- Computer systems
- Computer hardware, software
- Central Processing Unit (CPU)
- Operating systems: Directories and Files
- Main memory
- Machine language, assembly language, high-level language
- Compiler vs Interpreter
- Java Virtual Machine (JVM)
- Java Byte code instructions

NB: Please capture and understanding before next lecture

Further Reading

- Read Chapter 1 on
  “Computer Systems and Java Programming”
  of the textbook.