Capitolo 1 - Introduzione

Chapter Goals

- To learn about computers and programming
- To compile and run your first Java program
- To recognize compile-time and run-time errors
- To describe an algorithm with pseudocode

What Is Programming?

- Computers are programmed to perform tasks
- Different tasks = different programs
- Program
  - *Sequence of basic operations executed in succession to solve a task*
- Sophisticated programs require teams of highly skilled programmers and other professionals

- The physical computer and peripheral devices are called the hardware
- The programs the computer executes are called the software

Self Check 1.1

What is required to play a music CD on a computer?

Answer: A program that reads the data on the CD and sends output to speakers and the screen.

Self Check 1.2

Why is a CD player less flexible than a computer?

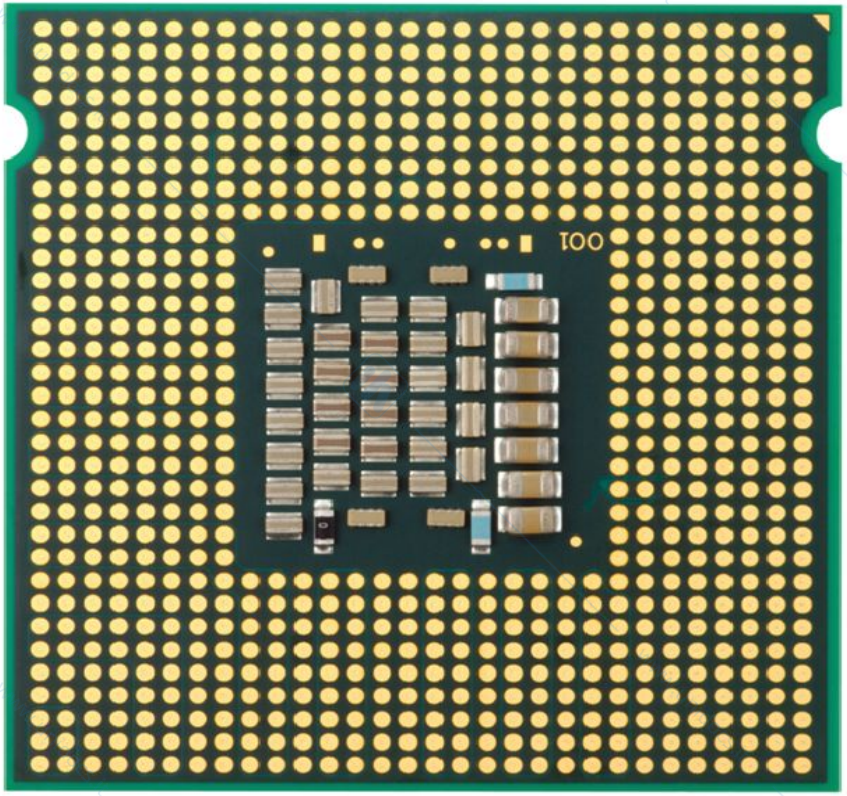
Answer: A CD player can do one thing — play music CDs. It cannot execute programs.

The Anatomy of a Computer

- Central processing unit (CPU) controls
  - Program execution
  - Data process
- Storage
  - Memory (Primary storage)
  - Secondary storage *(es. hard disk)*
- Peripherals
  - To interact with human users (*es. altoparlanti, stampanti, schermo, tastiera, mouse)*

- Executes very simple instructions
- Executes instructions very rapidly

Central Processing Unit



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La CPU controlla
l'esecuzione dei programmi e
l'elaborazione dei **dati**

La CPU

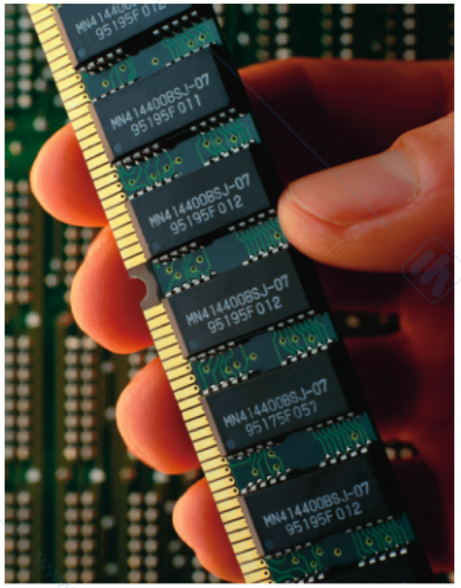
- individua ed esegue le istruzioni di un programma
- Reperisce i dati dalla memoria o dai dispositivi periferici, li elabora e memorizza i risultati

Memory

Memoria principale

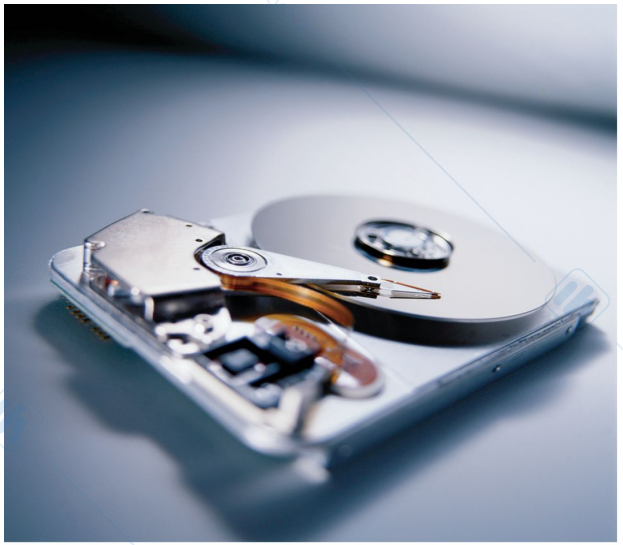
- Volatile
- Veloce

Figure 2
A Memory Module with Memory Chips

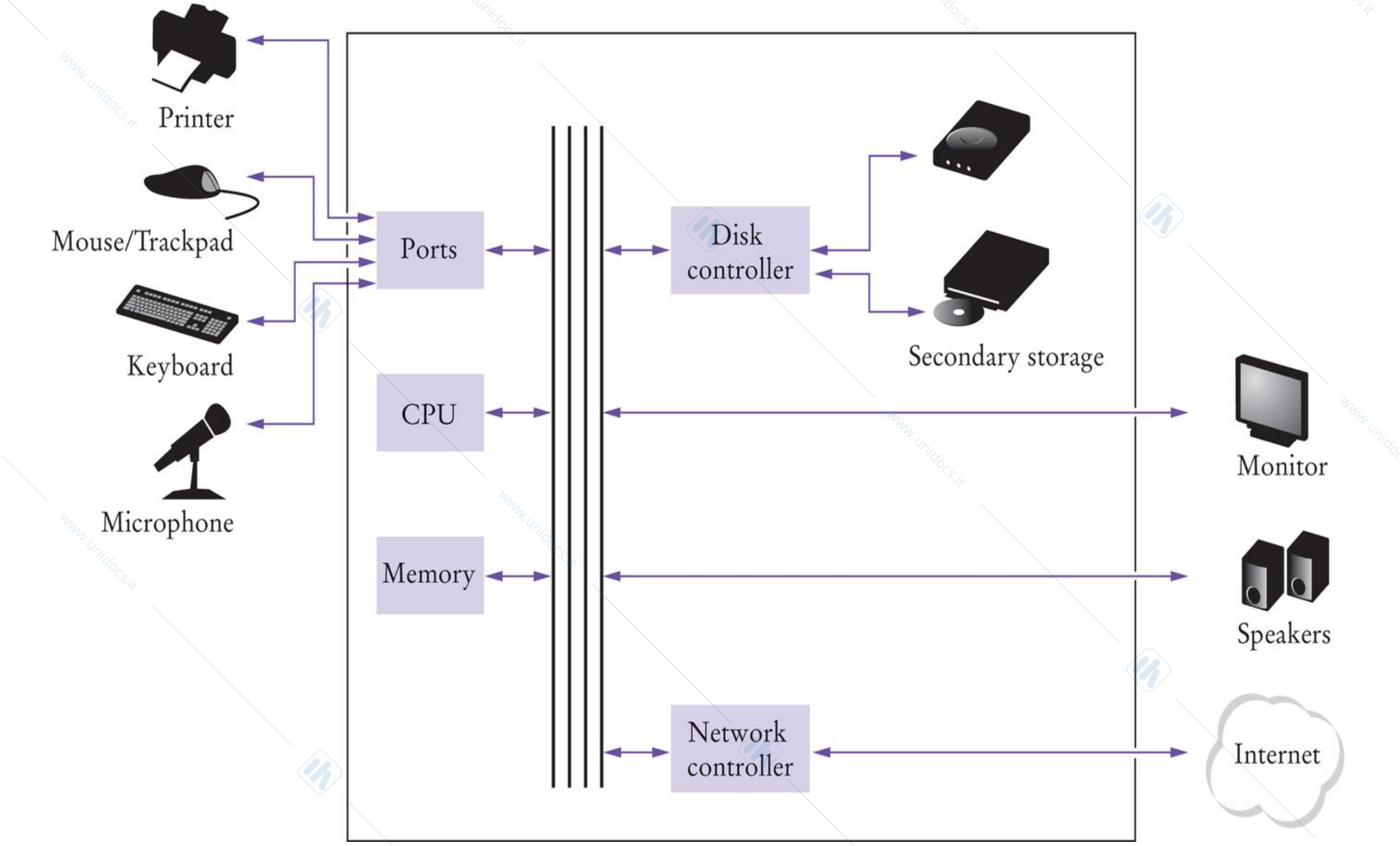


Memoria secondaria

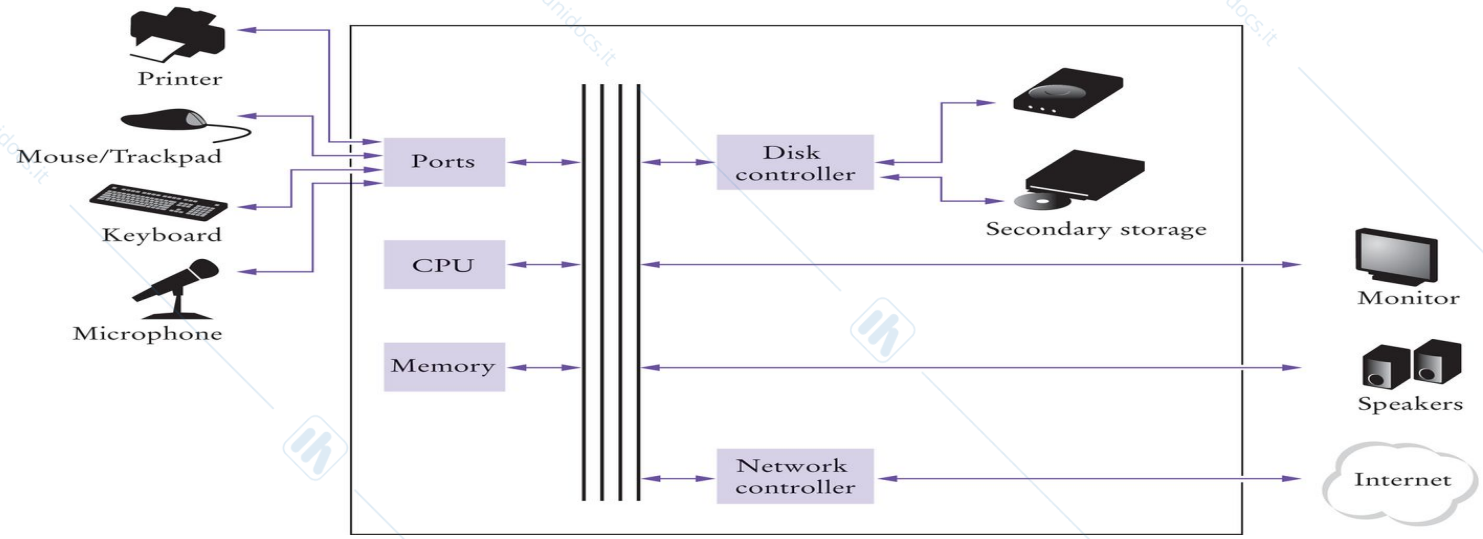
- Non volatile
- Più lenta



Schematic Diagram of a Computer



Schematic Diagram of a Computer

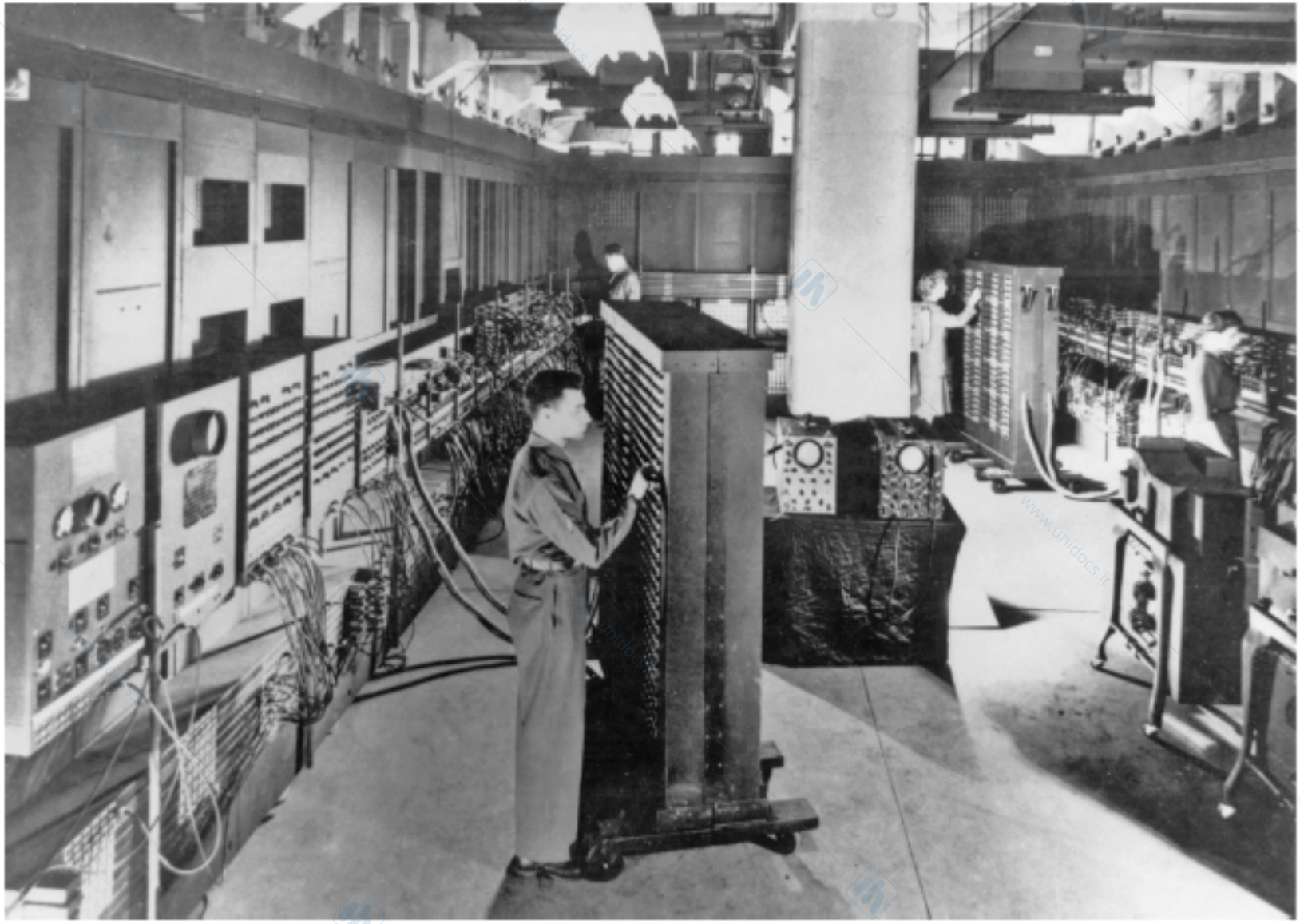


- Le **istruzioni dei programmi** e i relativi **dati** salvati nella memoria secondaria

- **All'avvio di un programma**
  - Istruzioni copiate nella memoria principale
  - La CPU legge ed esegue un'istruzione alla volta
    (legge e modifica i dati e li scrive nella memoria)

The ENIAC

Il primo computer elettronico, 1946



The ENIAC

Dimensioni enormi

Un computer veniva programmato collegando dei cavi sui pannelli

Self Check 1.4

Where is a program stored when it is not currently running?

Answer: In secondary storage, typically a hard disk.

Self Check 1.5

Which part of the computer carries out arithmetic operations, such as addition and multiplication?

Answer: The central processing unit.

Machine Code

- La CPU esegue istruzioni macchina
- CPU di produttori diversi hanno insiemi di istruzioni macchina diverse
- **I programmi Java** contengono istruzioni macchina per **Java virtual machine** (JVM) e possono essere eseguiti senza modifiche da CPU diverse

Machine Code

- E' difficile scrivere programmi in codice macchina

  →linguaggi di programmazione ad alto livello (anni '50)

- Compiler translates high-level language to machine code

The Java Programming Language

- Safe
- Portable
- Platform-independent (write once, run anywhere)

  Distributed as instructions for Java virtual machine

- Vast set of library packages
- Designed for the Internet

HelloPrinter.java

```
public class HelloPrinter
{
   public static void main(String[] args)
   {
      // Display a greeting in the console window

      System.out.println("Hello, World!");
   }
}
```

Analyzing Your First Program: Class Declaration

- Classes are the fundamental building blocks of Java programs
- **Declaration** of a class called **`HelloPrinter`**

```
public class HelloPrinter
```

- In Java, every source file can contain, at most one public class
- The name of the public class must match the name of the file containing the class

  Class `HelloPrinter` must be contained

  in a file named `HelloPrinter.java`

Analyzing Your First Program: Methods

- **Each class** contains **declarations** of methods

- Each **method** contains a sequence of programming **instructions** that describe how to carry out a particular task

- A method is called by specifying
  - the method and
  - its arguments

Analyzing Your First Program: main Method

- **Every Java application** contains a class with a `main` method

  When the application starts,

  the instructions in the `main` method are executed

Dichiarazione di un metodo **main**

- Declaring a main method

```
public static void main(String[] args)
{
  . . .
}
```

Analyzing Your First Program: Statements

- **The *body*** of the `main` method contains **statements**
- Each statement ends with `;`

- Our method has a single statement:

```
System.out.println("Hello, World! ");
```

Visualizza una linea di testo sul terminale

```
Hello, World!
```

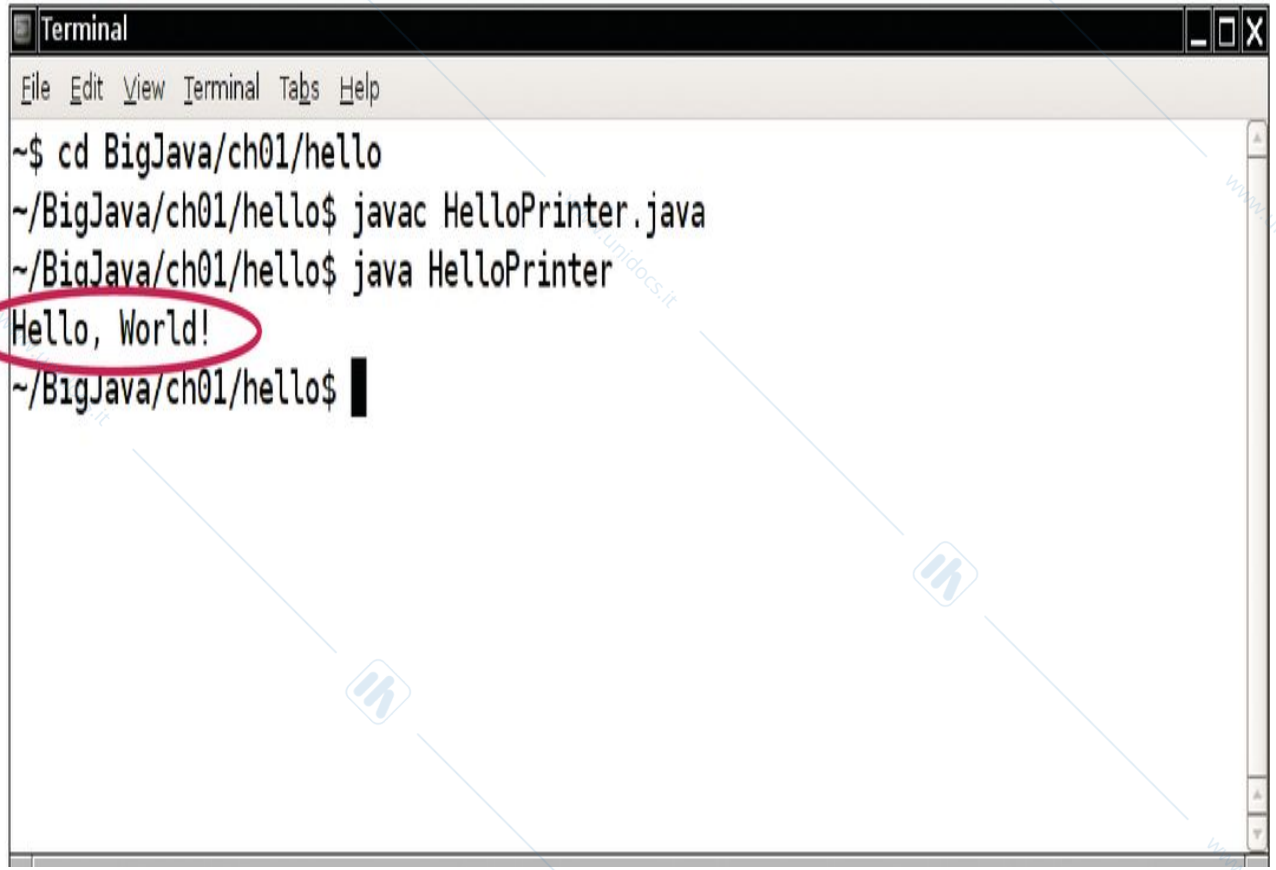
Gli enunciati presenti nel metodo **main** vengono eseguiti uno dopo l'altro in ordine

Analyzing Your First Program: Statements

```
System.out.println("Hello, World!");
```

Visualizza una linea di testo sul terminale

```
Hello, World!
```



Analyzing Your First Program: Method Call

Invocazione di un metodo

A method call:

```
System.out.println( "Hello, World!" );
```

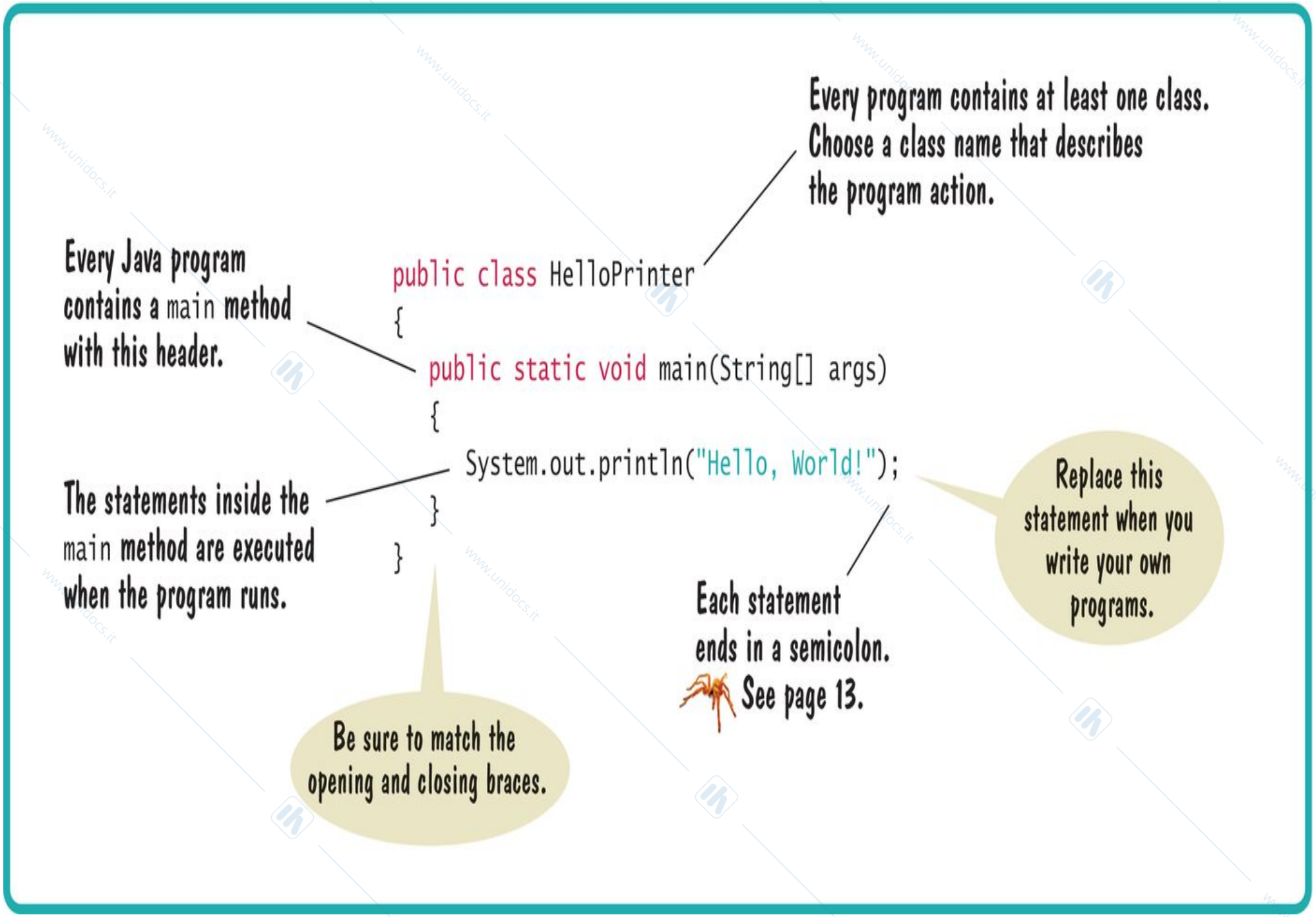
A method call requires:

1. **The method** you **want to use** (in this case, `System.out.println`)

2. **Any values** the method needs to carry out its task enclosed in parentheses (in this case, `"Hello, World!"`)

   The technical term for such values is "**arguments**"

Syntax 1.1 Java Program



Analyzing Your First Program: Strings

String:

a sequence of characters enclosed in double quotation marks:

```
"Hello, World!"
```

Analyzing Your First Program: Printing

- You can print numerical values

```
System.out.println(3 + 4);
```

It evaluates the expression 3+4 and

it displays the number 7

Analyzing Your First Program: Printing

- **`System.out.println`** method

  prints a string or a number and then starts a new line

  The sequence of statements:

  ```
  System.out.println("Hello");
  System.out.println("World!");
  ```

  Print two lines:

  ```
  Hello
  World!
  ```

- **`System.out.print`** method

  prints a string or a number without starting a new line

Self Check 1.11

How do you modify the `HelloPrinter` program to greet Dave instead?

Answer: Change `World` to Dave:

```
System.out.println("Hello, Dave!");
```

Self Check 1.12

How would you modify the `HelloPrinter` program to print the word "Hello" vertically?

Answer:

```
System.out.println("H");
System.out.println("e");
System.out.println("l");
System.out.println("l");
System.out.println("o");
```

Self Check 1.13

Would the program continue to work if you replaced line 7 with this statement?

```
System.out.println(Hello);
```

Answer: No. The compiler would look for an item whose name is `Hello`. You need to enclose `Hello` in quotation marks:

```
System.out.println("Hello");
```

Self Check 1.14

What does the following set of statements print?

```
System.out.print("My lucky number is");
System.out.println(3 + 4 + 5);
```

Answer: The printout is

```
My lucky number is12
```

It would be a good idea to add a space after the `is`.

Self Check 1.15

What do the following statements print?

```
System.out.println("Hello");
System.out.println("");
System.out.println("World");
```

Answer:

```
Hello
a blank line
World
```

Editing a Java program

- **Editor** is a program for entering and modifying text, such as a **Java program**

- **Java** is case sensitive

  Be careful to distinguish between upper- and lowercase letters

- Lay out your programs so that they are easy to read

Create un nuovo file e chiamatelo **HelloPrinter.java**

Compiling and running a Java program

- Java **compiler**

  translates **source code** into **class files** that contain

  instructions for the **Java Virtual Machine**

- A class file has extension **.class**

- The compiler does **not produce** a class file
  if it has **found errors** in your program

- The **Java Virtual Machine**
  - loads instructions from the program's class file
  - starts the program
  - loads library's files as they are required

From Source Code to Running Problem

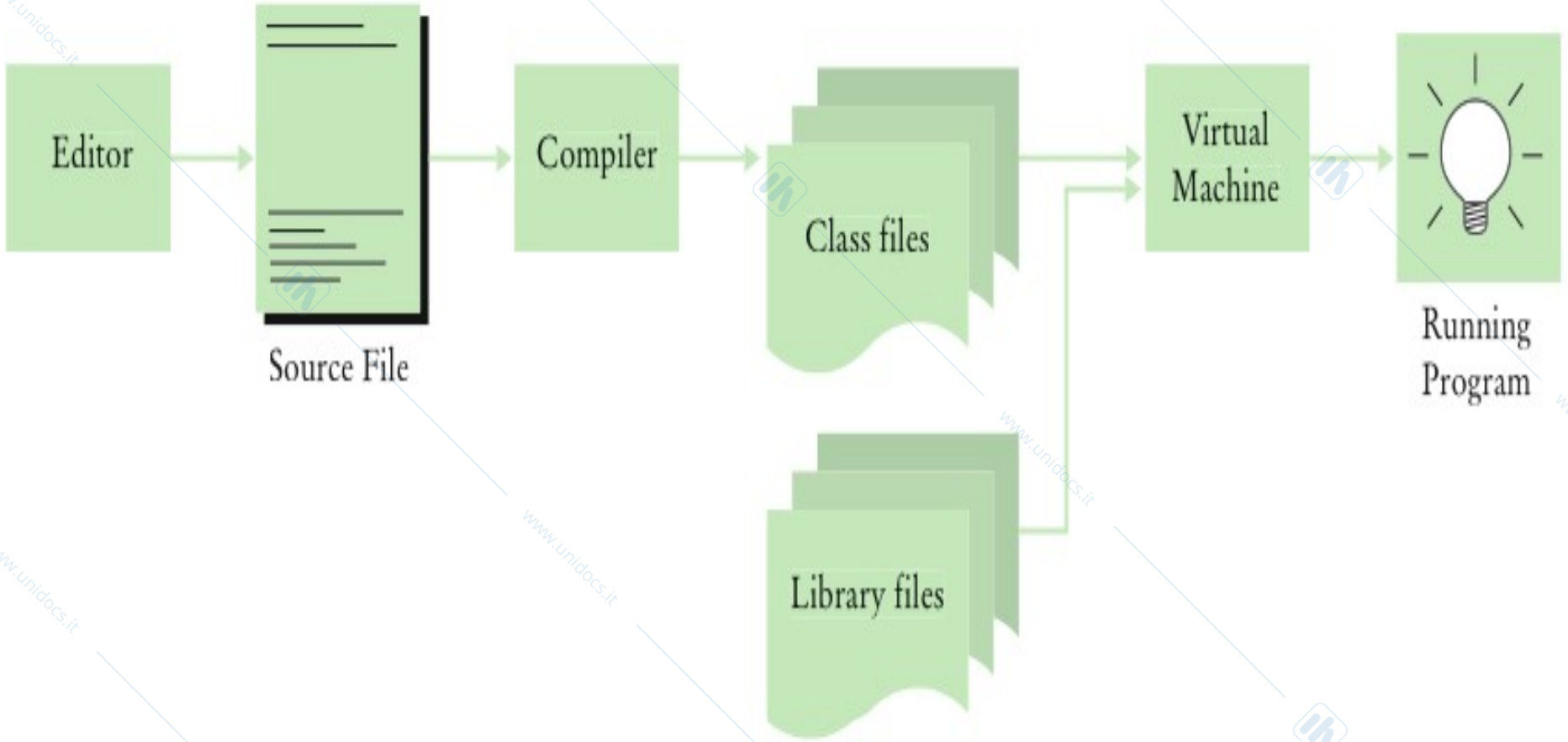
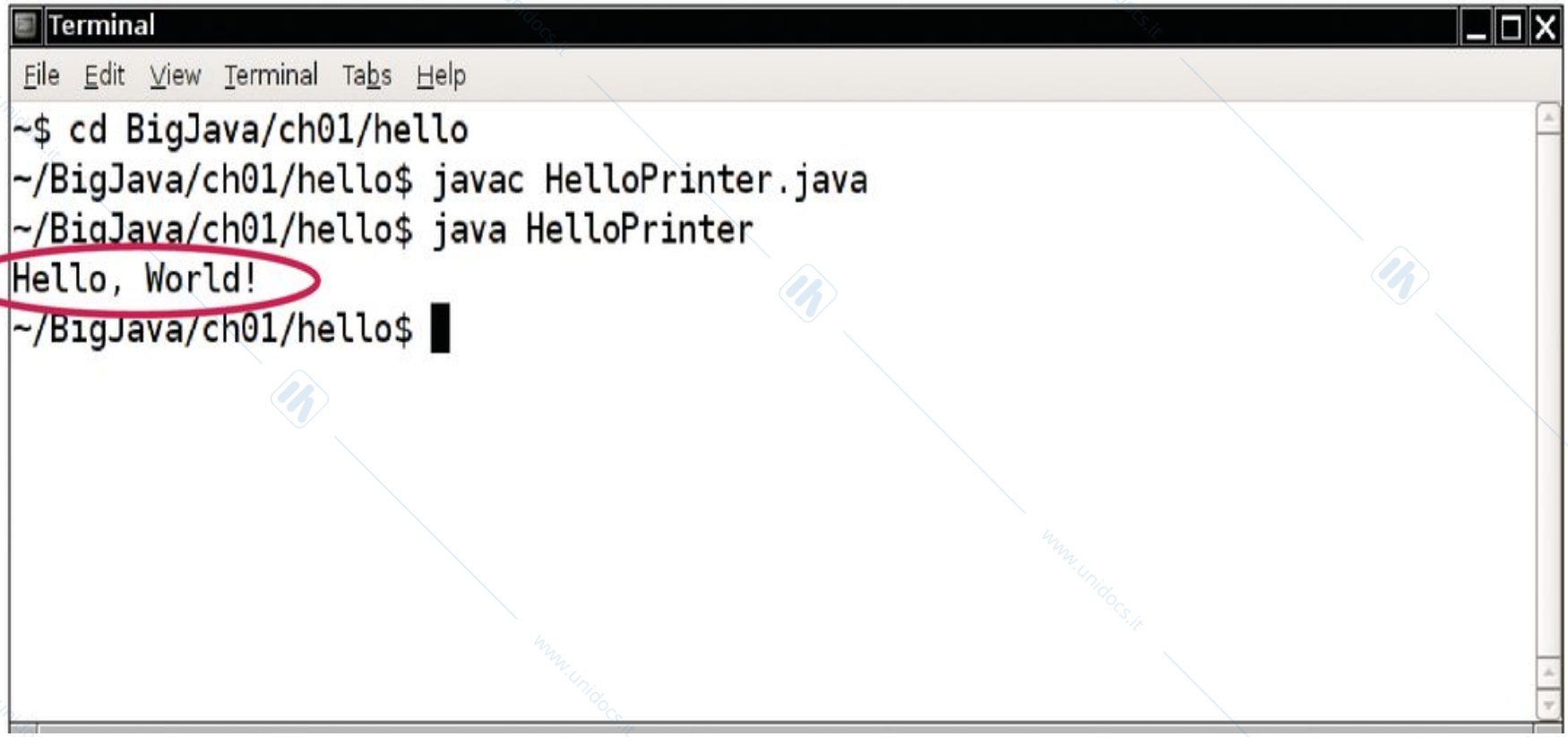


Figure 6 From Source Code to Running Program

HelloPrinter in a Console Window



- Per compilare: **javac HelloPrinter.java**
- Per eseguire: **java HelloPrinter**

Alla fine dell'esecuzione sul terminale comparirà la scritta

Hello, World!

Syntax 1.1 Java Program

RIPASSO

Every program contains at least one class. Choose a class name that describes the program action.

Every Java program contains a `main` method with this header.

```
public class HelloPrinter
{
   public static void main(String[] args)
   {
      System.out.println("Hello, World!");
   }
}
```

The statements inside the `main` method are executed when the program runs.

Replace this statement when you write your own programs.

Each statement ends in a semicolon.

See page 13.

Be sure to match the opening and closing braces.

Errors

- A **compile-time error** (syntax error)

  is a violation of the programming language rules detected by the compiler

```
System.ou.println("Hello, World!");
```

- A **run-time error** (logic error)

  causes a program to perform an action that the programmer did not intend.

```
System.out.println("Hello, Word!");
```

Errors

- **Exception** - a type of run-time error

  Generates an error message from the Java virtual machine

This statement

```
System.out.println(1 / 0)
```

generates this run-time error message

```
"Division by zero"
```

Self Check 1.16

```
System.out.println("Hello, World!");
```

Suppose you omit the "" characters around `Hello, World!` from the `HelloPrinter.java` program. Is this a compile-time error or a run-time error?

Answer: This is a compile-time error. The compiler will complain that it does not know the meanings of the words `Hello` and `World`.

Self Check 1.17

Suppose you change `println` to `printline` in the `HelloPrinter.java` program.
Is this a compile-time error or a run-time error?

Answer: This is a compile-time error.

The compiler will complain that `System.out` does not have a method called `printline`.

Self Check 1.18

Suppose you change `main` to `hello` in the `HelloPrinter.java` program.
Is this a compile-time error or a run-time error?

Answer: This is a run-time error.

- It is perfectly legal to give the name `hello` to a method, so the compiler won't complain.

- But when the program is run, the virtual machine will look for a `main` method and won't find one.

Consigli utili

- Attenzione ai ;
- main
- Errori di ortografia
- Parità delle parentesi
- Lettere maiuscole e minuscole
- Conoscere file system
- Fate backup spesso!!
- Fare copie di sicurezza su chiavetta e in un'altra directory

Algorithms

Algorithm: A sequence of steps for solving a task that is:

- *unambiguous*
- *executable*
- *terminating in a finite time*

Pseudocode

- **Pseudocode**: An **informal description** of an algorithm:
  - *Describe how a value is set or changed:*

    total cost = purchase price + operating cost

  - *Describe decisions and repetitions:*

    For each car
    operating cost = 10 x annual fuel cost
    total cost = purchase price + operating cost

    Use indentation to indicate which statements should be selected or repeated

  - *Indicate results:*

    Choose car1

Program Development Process