Programming Fundamentals

Introduction to Java

Week 1 |Iresh Bandara

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Learning Outcomes

- Covers part of LO1 for Module
- On completion of this lecture, students are expected to be able to:
  - Identify main components in a Java programme.
  - Setup the development environment for java coding.
  - Demonstrate competence in using Java to solve problems.

WHAT IS JAVA?

- Java is a programming language and computing platform.
- The most current is Java 19 (JRE 19 - Java Runtime Environment)
- Java is Object-Oriented--that means everything in the language behaves like an object.
- What exactly that means will be explained in the coming during the course.

THE BEGINNING OF JAVA

- Java was invented by James Gosling and few others in 1994.
- Java was originally named as “**Oak”** and was developed as a part of the Green project at the Sun Company.
- Green project’s goal was to make Consumer Electronics devices talk to each other using a special programming.

THE BEGINNING OF JAVA

- Gosling first chose C++.
- But he soon gave up on C++,which was incapable of doing what he wanted.
- So, he started to modify C++ and soon, Gosling was writing a new language, which he named “Oak”.
- Oak became “**JAVA**”.

THE BEGINNING OF JAVA

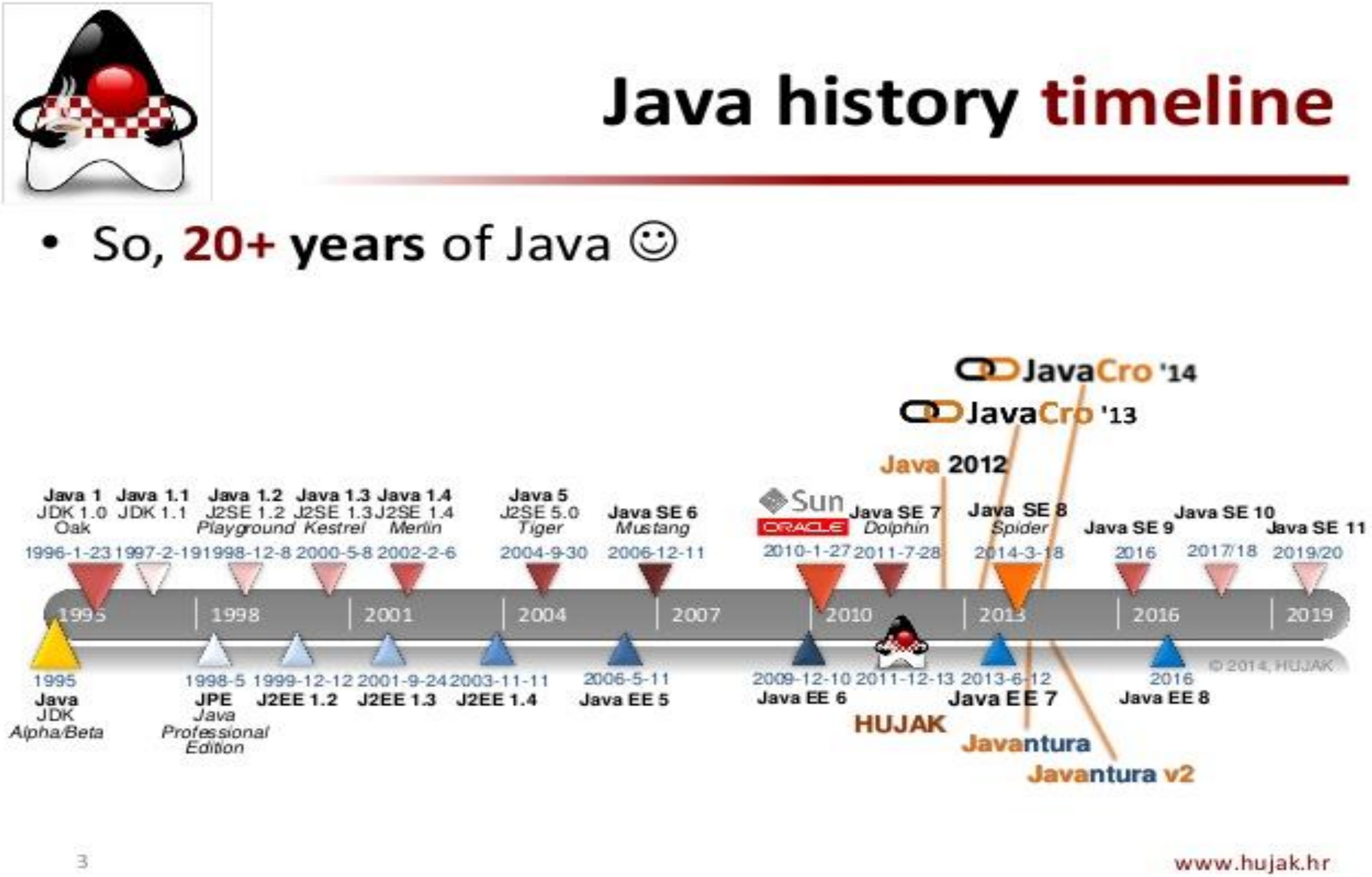
Duke the Icon

Another major byproduct of the Green project was a little cartoon character named **"Duke".** Duke was invented and first drawn by Joe Palrang and has become the icon for Java.

Java's Major Advantage over C & C++

- Because pointers were a major source of bugs in C and C++, Gosling omitted pointers entirely from Java.
- Actually, pointers are still an important part of the language -- all objects are referenced by pointers -- but the language handles them, not the programmer.

How Java Evolved



Java history timeline

- So, **20+ years** of Java ☺

Java Architecture

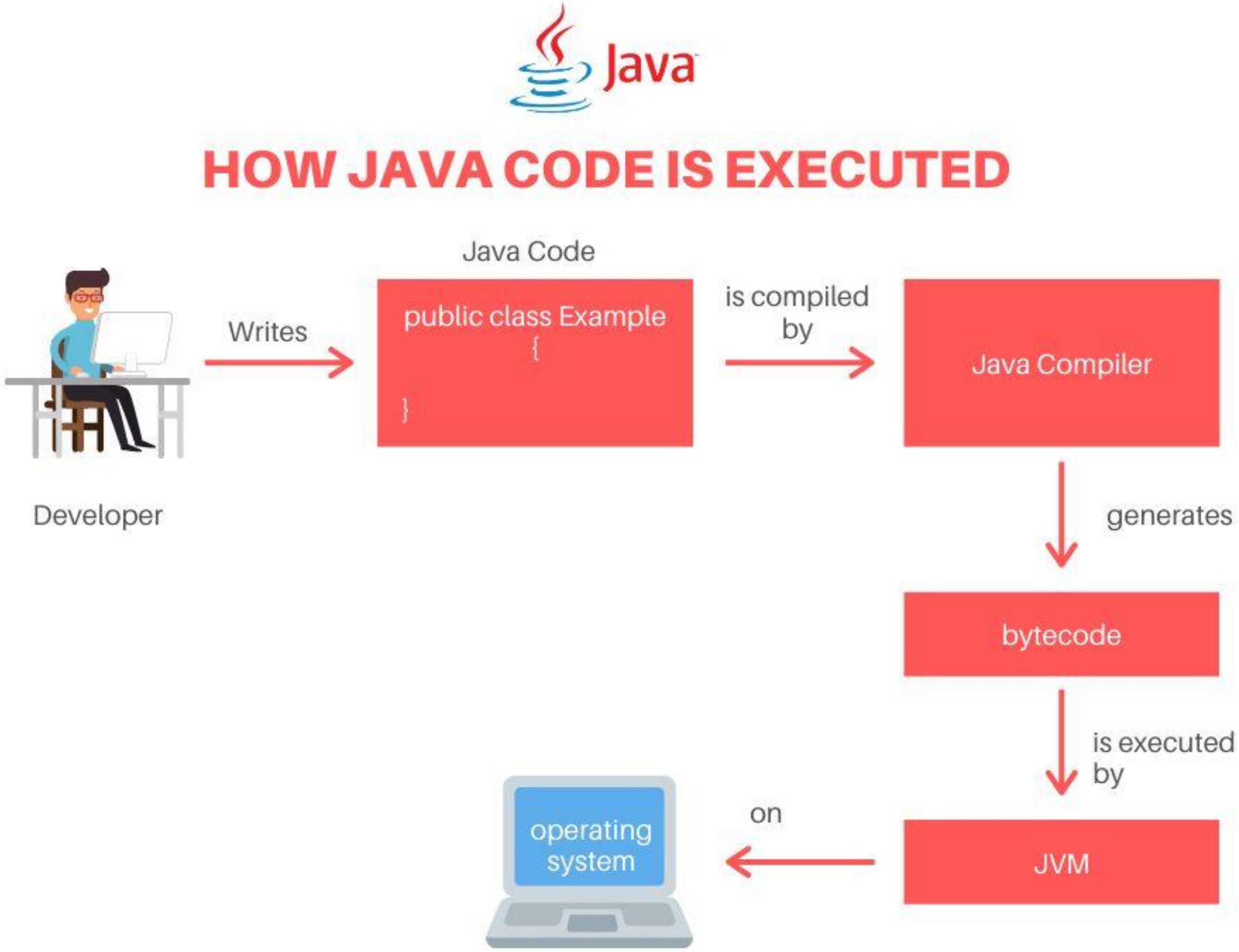
Java’s Architecture comes from four separate but intertwined technologies:

- Java Programming Language
- Java class file
- Java API
- Java Virtual Machine

Java Architecture contd…

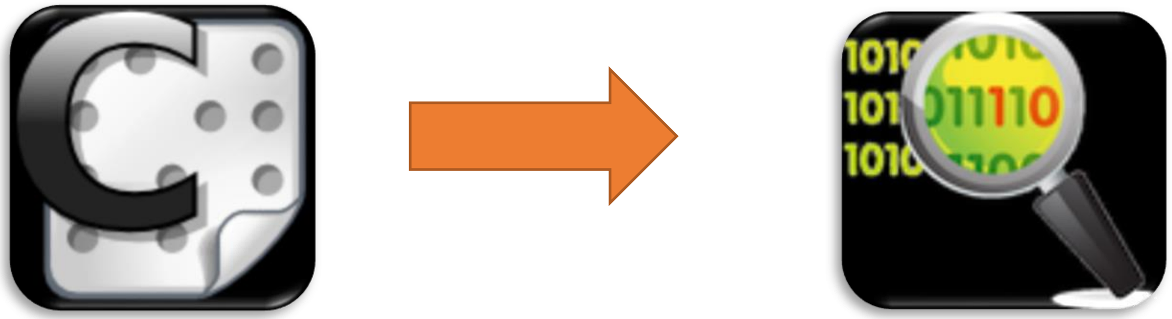
- Source programs are written in the Java Programming Language.
- Programs are compiled into Java class files.
- Classes run in the Java Virtual Machine.
- When a Java program runs, it is assisted by other classes in the Java the Application Programming Interface (API).

Java Architecture contd…



Typical Procedural Program

- In a typical C program, the source code is compiled into a native machine language module that consists of 1’s and 0’s.



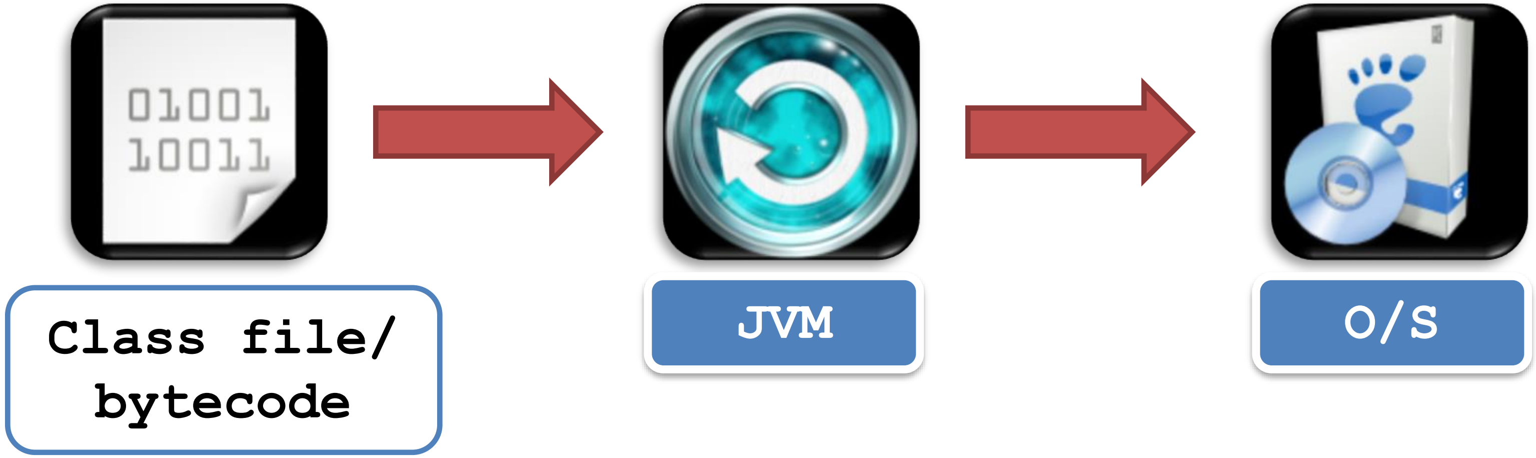
- The machine language is specifically tailored to one OS, be it Windows, Mac or UNIX.

Java Class file(“Bytecode”)

- In contrast to conventional programming languages, a Java program is not compiled into machine language.
- Instead, Java makes bytecode.
- Bytecode is the result of a Java “compile”, a low-level code similar to machine language, but generic and not specific to any particular processor.
- Bytecode is been fed to the Java Virtual Machine (JVM) .

Java Virtual Machine (JVM)

- The JVM is a software-only sub-computer within the OS that converts Java bytecode into machine language and executes.
- JVM is platform dependent so there are different JVM's for each OS.
- The bytecode talks to the JVM, and the JVM talks to the Operating System.



Class file/ bytecode

JVM

O/S

Java Class file("Bytecode")

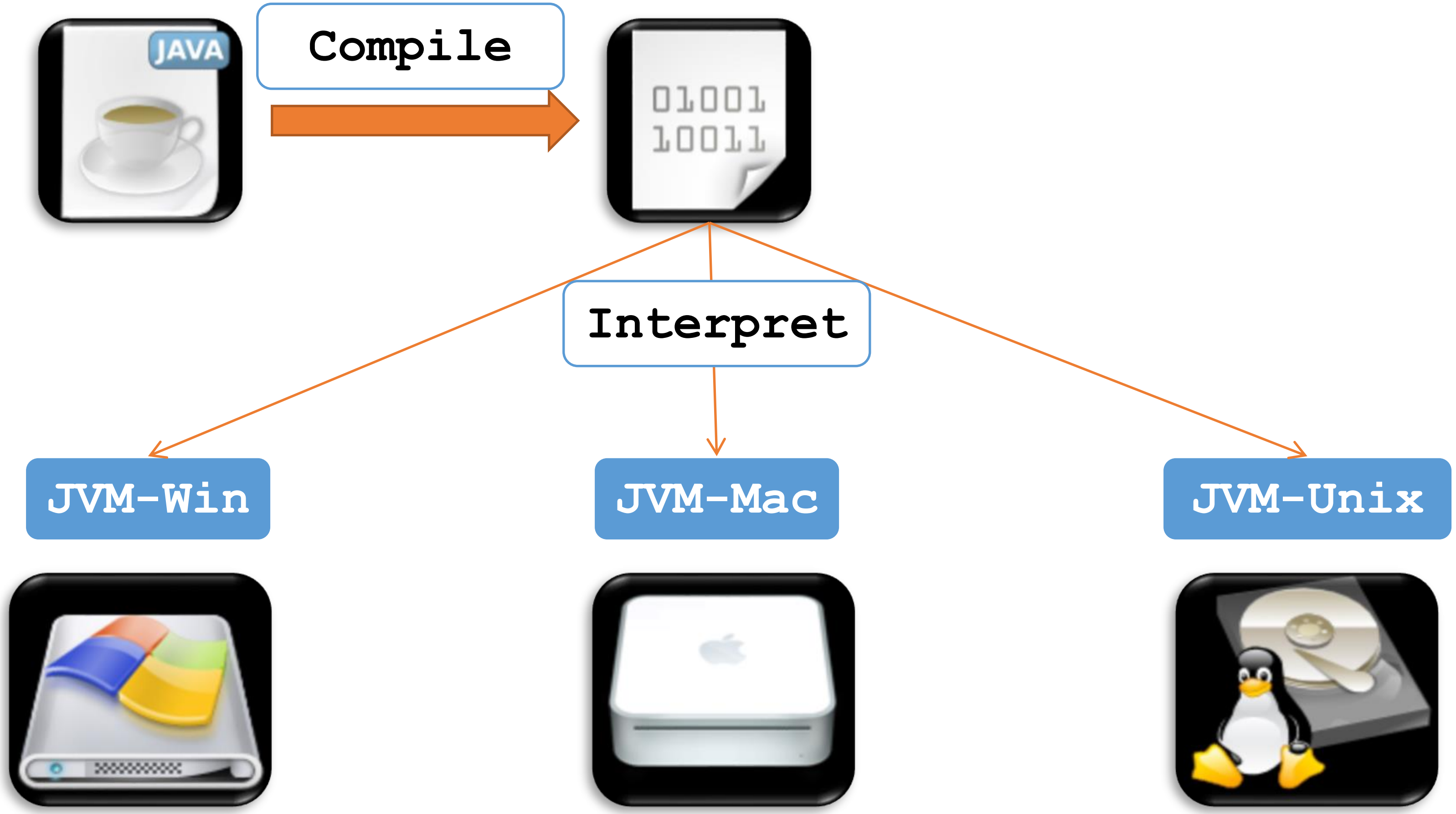
- Java API (Application Programming Interface) is a set of classes and interfaces that comes with the JRE.
- It is a huge collection of library routines that performs basic programming tasks such as looping, displaying etc.

The Way Java Works…

- Because of the bytecode and JVM,

“You compile your program once into bytecode, but it is interpreted newly every time it runs.”

“Write Once Run Anywhere”

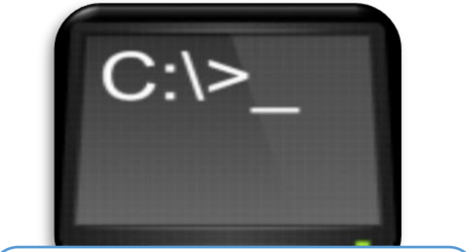


Types of Programs in Java

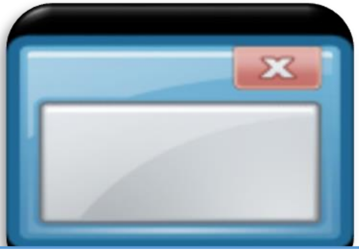
- A Java Application is a free-standing program that is capable of running directly in the Java Virtual Machine.
- A Java Applet is a mini-program that is much more limited in its abilities. An Applet can only run within the context of an HTML browser.

Types of Programs in Java

- Applications



Console Interfaces



Graphical User Interfaces

- Applets

What you need to run java

- Download and install Java Development Kit (select your OS)

https://www.oracle.com/java/technologies/javase-jdk14-downloads.html

- Install an IDE (Optional)

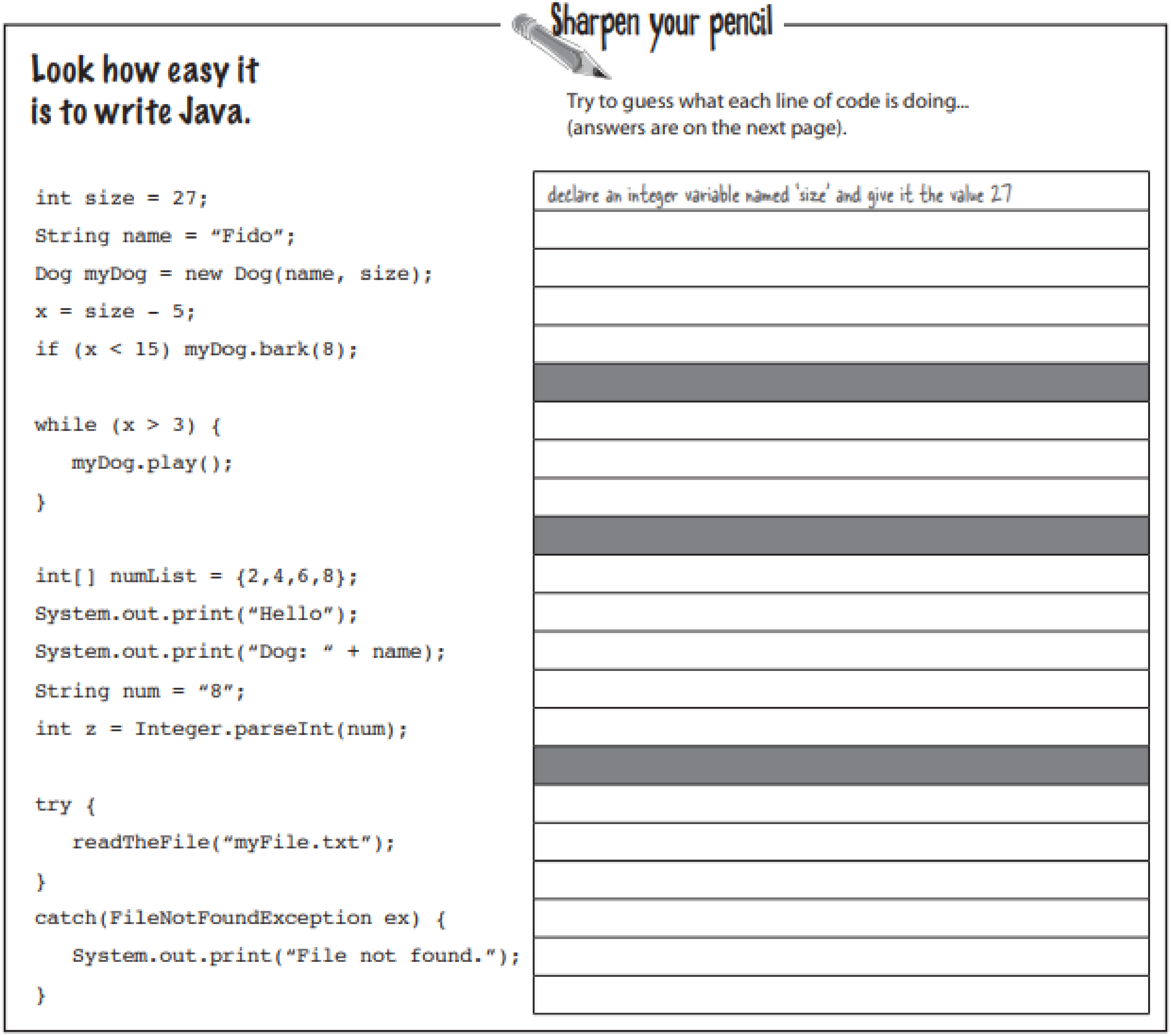
Netbeans :https://netbeans.apache.org/download/index.html

Eclipse : https://www.eclipse.org/downloads/

IntelliJ IDEA : https://www.jetbrains.com/idea/download/#section=linux

- Use a text Editor

Notepad or Notepad++



Sharpen your pencil

Look how easy it is to write Java.

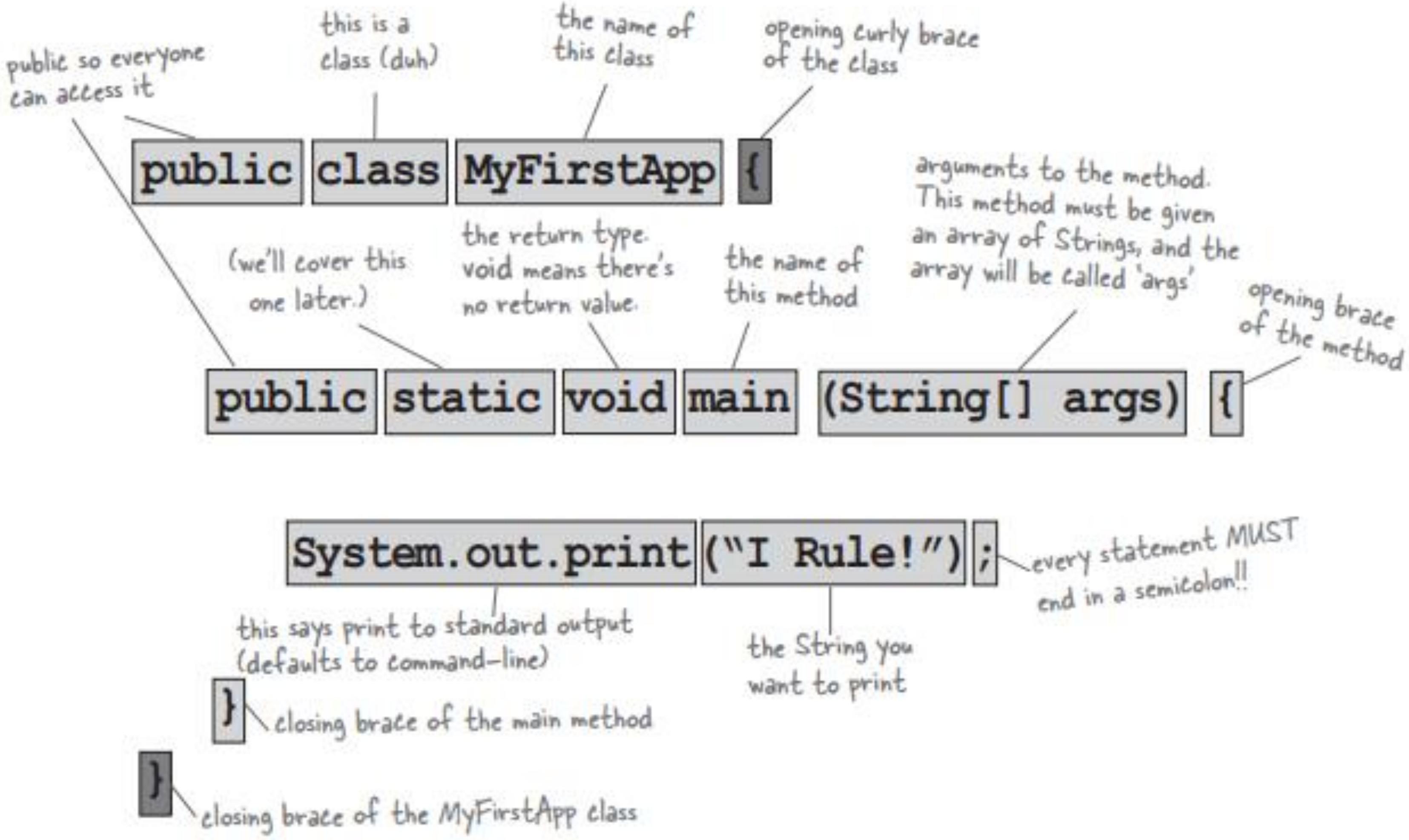
Try to guess what each line of code is doing...
(answers are on the next page).

```
int size = 27;
String name = “Fido”;
Dog myDog = new Dog(name, size);
x = size - 5;
if (x < 15) myDog.bark(8);

while (x > 3) {
   myDog.play();
}

int[] numList = {2,4,6,8};
System.out.print(“Hello”);
System.out.print(“Dog: ” + name);
String num = “8”;
int z = Integer.parseInt(num);

try {
   readTheFile(“myFile.txt”);
}
catch(FileNotFoundException ex) {
   System.out.print(“File not found.”);
}
```

declare an integer variable named 'size' and give it the value 27

In class activity

A Simple Java Application



```
public class MyFirstApp {
    public static void main (String[] args) {
        System.out.print("I Rule!");
    }
}
```

public so everyone can access it

this is a class (duh)

the name of this class

opening curly brace of the class

(we'll cover this one later.)

the return type. void means there's no return value.

the name of this method

arguments to the method. This method must be given an array of Strings, and the array will be called 'args'

opening brace of the method

every statement MUST end in a semicolon!!

this says print to standard output (defaults to command-line)

the String you want to print

closing brace of the main method

closing brace of the MyFirstApp class

A Simple Java Application

- The double slashes denote a “C++” style comment. Everything on the line after the double slashes is ignored by the compiler.

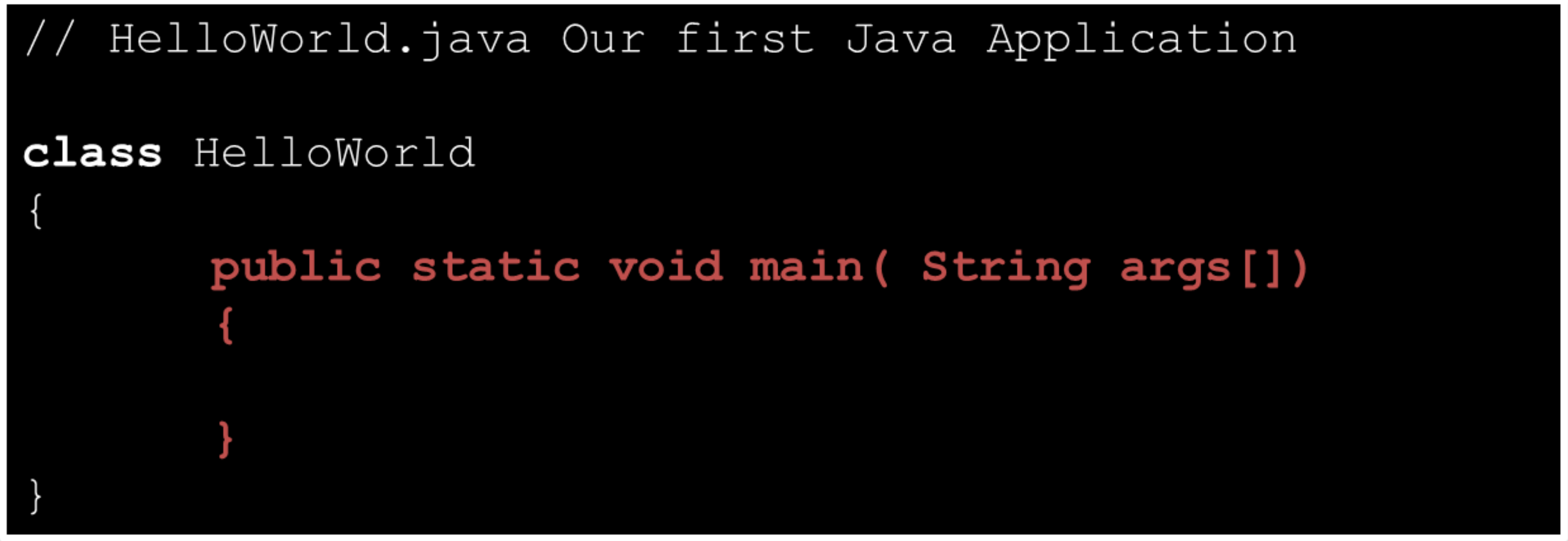
```
// HelloWorld.java Our first Java Application
```

A Simple Java Application

```
// HelloWorld.java Our first Java Application

class HelloWorld
{


}
```

- This is the class name.
- Every single bit of code in Java must sit in curly brackets.
- Class names are capitalized.
- Words within the name are also capitalized.

A Simple Java Application



```
// HelloWorld.java Our first Java Application

class HelloWorld
{
        public static void main( String args[])
        {

        }
}
```

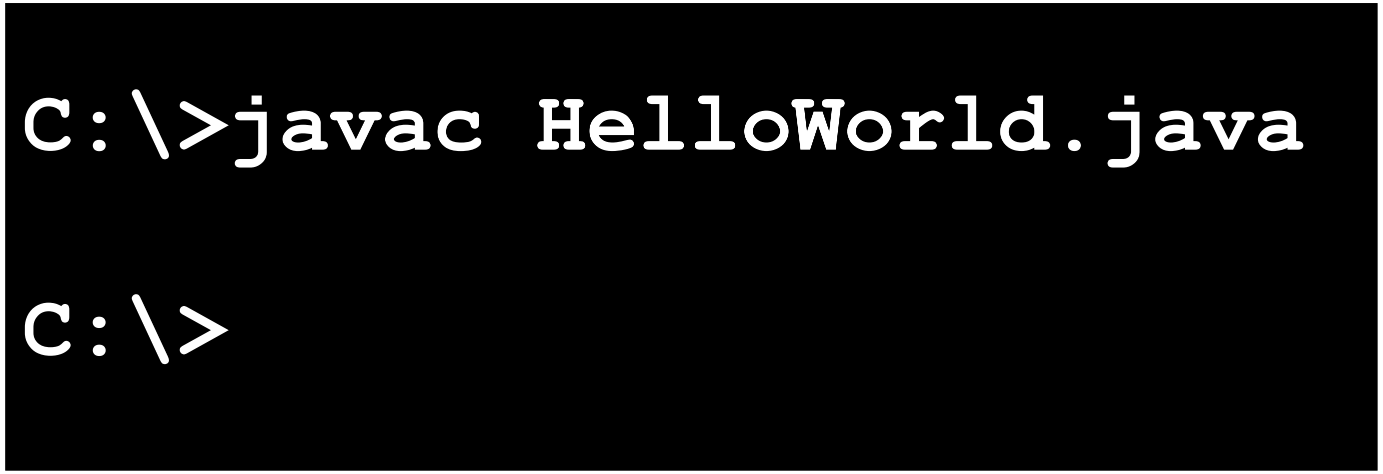
- Now our Application is complete. We have added the method “main”. All methods are written in lower case.
- main is a special method--execution of any program start with the main().

A Simple Java Application

```
// HelloWorld.java Our first Java Application

class HelloWorld
{
        public static void main( String args[])
        {
                System.out.println( “Hello World!” );
        }
}
```

- The print command is used to print “Hello World!” to the console.

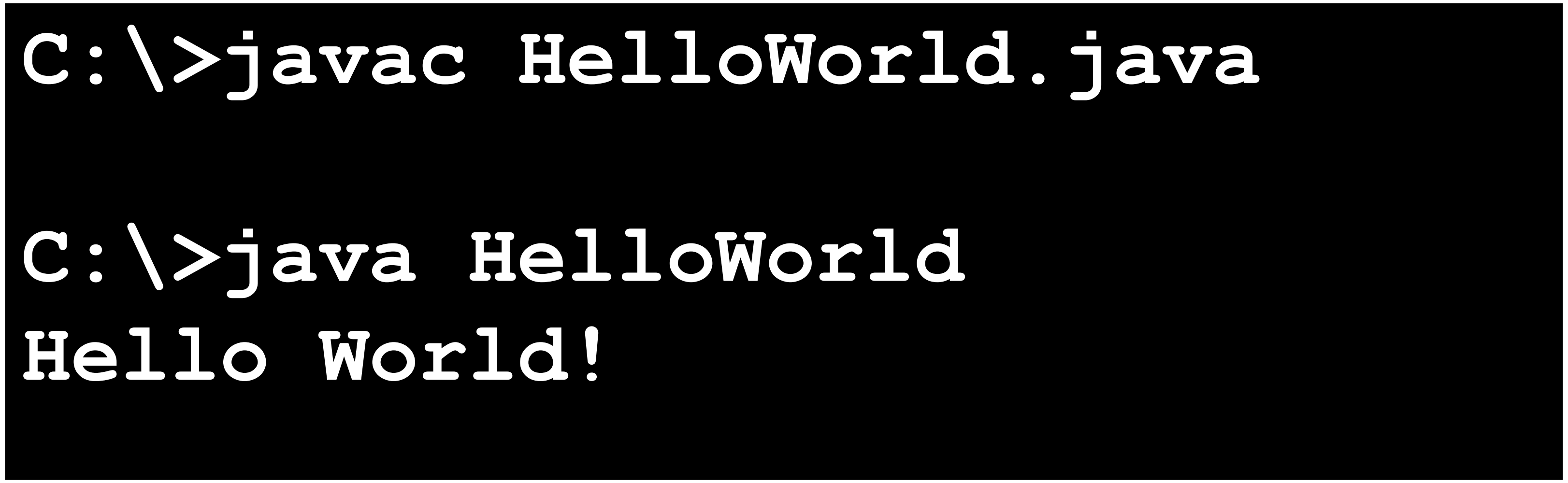
How to Compile



```
C:\>javac HelloWorld.java

C:\>
```

- A successful compilation of your java program will return to a bare cursor, as you see here.

How to Execute



```
C:\>javac HelloWorld.java

C:\>java HelloWorld
Hello World!
```

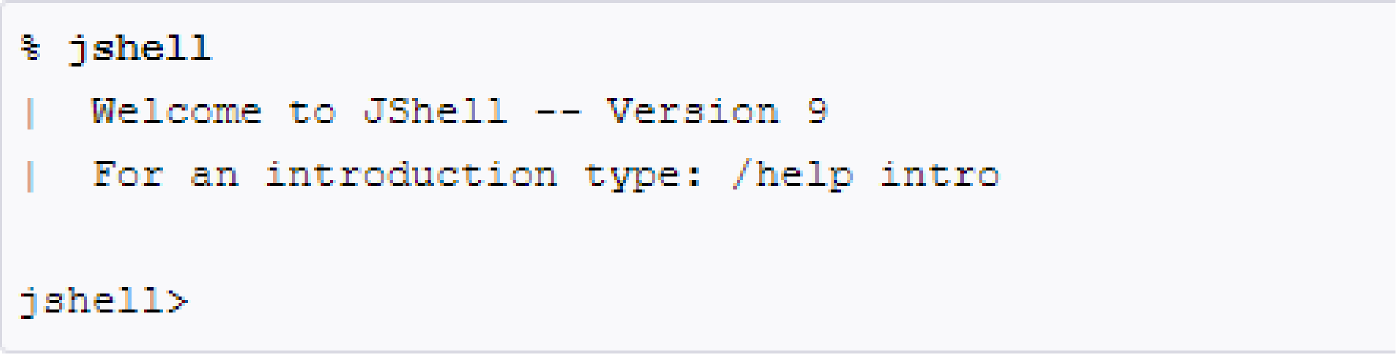
- Note: the “.class” extension is omitted.

JShell

The Java Shell tool (JShell) is an interactive tool for learning the Java programming language and prototyping Java code. JShell is a Read-Evaluate-Print Loop (REPL), which evaluates declarations, statements, and expressions as they are entered and immediately shows the results. The tool is run from the command line.

Running the Jshell

- Type **jshell** in command prompt
- To exit,type /exit
- To view variables /var



```
% jshell
|  Welcome to JShell -- Version 9
|  For an introduction type: /help intro

jshell>
```

Summary

- Java was invented by James Gosling and few others in 1994 and originally known as “Oak”
- Java architecture has four technologies called main Java Programming Language, Java class file, Java API and Java Virtual Machine.
- Java Programs are compiled into Java class files. Classes run in the Java Virtual Machine.
- The JVM is a software-only sub-computer within the OS that converts Java bytecode into machine language and executes
- compile your program once into bytecode, but it is interpreted newly every time it runs

Thank You !!