

The Process of Programming

The word *code* describes program fragments (“these four lines of code”) or the act of programming (“Let’s code this into Java.”). Once a program has been written, you can *execute* it.

Program Execution

The act of carrying out the instructions contained in a program. The process of execution is often called *running*. A computer program is stored internally as a series of binary numbers known as the *machine language* of the computer. In the early days, programmers entered numbers like these directly into the computer.

Modern programmers write in what are known as high-level programming languages, such as Java. Such programs cannot be run directly on a computer: They first must be translated into a different form by a special program known as a *compiler*.

Compiler

A program that translates a computer program written in one language into an equivalent program in another language (often, but not always, translating from a high-level language into machine language). A compiler that translates directly into machine language creates a program that can be executed directly on the computer, known as an *executable*. We refer to such compilers as *native compilers* because they compile code to the lowest possible level (the native machine language of the computer).

This approach works well when you know exactly what computer you want to use to run your program. But what if you want to execute a program on many different machines. These bytecodes represent an intermediate level: They aren’t quite as high level as Java or as low-level as machine language. In fact, they are the machine language of a theoretical computer known as the *Java Virtual Machine (JVM)*.

Java Virtual Machine (JVM)

A theoretical computer whose machine language is the set of Java bytecodes. A JVM isn’t an actual machine, but it’s like one. When we compile programs to this level, there isn’t much work remaining to turn the Java bytecodes into actual machine instructions.

To execute a Java program, you need another program that will execute the Java bytecodes. Such programs are known generically as *Java runtimes*, and the standard environment distributed by Sun Microsystems is known as the *Java Runtime Environment (JRE)*.

Java Runtime

A program that executes compiled Java bytecodes. Most people have Java runtimes on their computers, even if they don't know about them. For example, Apple's Mac OS X includes a Java runtime, and many Windows applications install a Java runtime.