Java → Java internals → JVM, JRE, and JDK

Theory: JVM, JRE, and JDK

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Several basic Java Platform terms that often confuse beginner programmers are **JVM**, **JRE**, and **JDK**. Abbreviations might be hard to remember and tell apart at first, but getting familiar with them will help you feel more at ease with development for Java Platform.

§1. Java Virtual Machine (JVM)

JVM is a virtual simulation of a physical computer. It executes Java bytecode class files (as you remember, we usually get such files by compiling a source code file of a JVM language). **JVM**s are available for many hardware and software platforms, so you can run Java bytecode almost everywhere. A program compiled to Java bytecode is almost always **platform-independent**.

Today there is a variety of **JVM** implementations. For instance, **HotSpot** is the primary reference Java VM implementation.

§2. Java Runtime Environment (JRE)

JRE is an execution environment for **running** compiled JVM programs. JRE includes Java Virtual Machine (**JVM**) and Java Class Library (**JCL**).

JCL consists of many libraries including input/output, collections, security, classes for parsing XML, user interface toolkits, and many others. Your program can use these libraries.

When you run your compiled program in JRE, JVM uses bytecode class files of both your program and JCL.

§3. Java Development Kit (JDK)

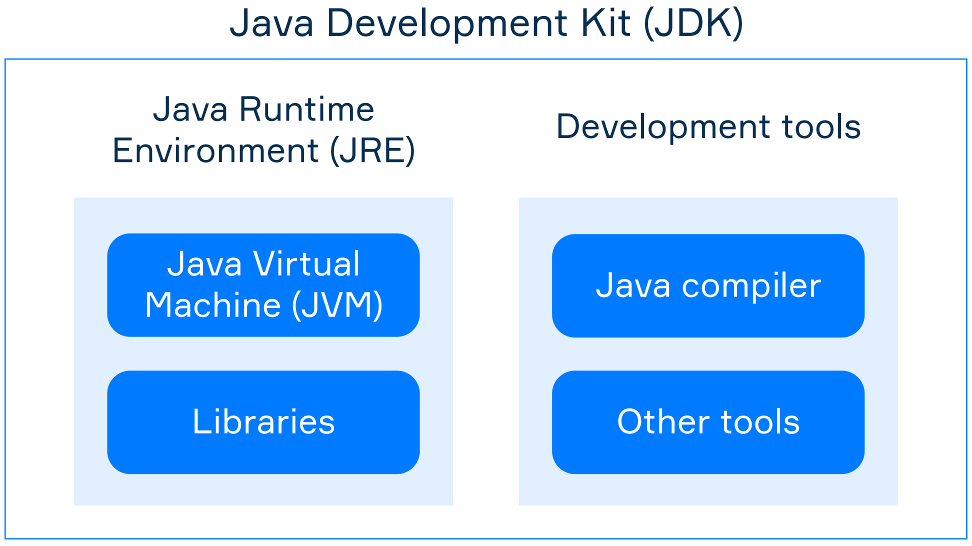
JDK is a package **to develop** programs for Java Platform. It includes **JRE** (so you can also run your programs) and tools for developers, such as Java compiler, debugger, archiver, etc.

Java compiler (usually it's the **javac** tool) translates **.java* into **.class*. Several files with **.class* extension can be packed together in a single Java Archive (**JAR-file**).

Other JVM languages such as Kotlin or Scala have their separate compilers, they aren't bundled with JDK.

§4. The relationship between JVM, JRE, and JDK

The following image illustrates the relationship between **JVM**, **JRE**, and **JDK**:


Java Development Kit (JDK)
Java Runtime Environment (JRE)
Development tools
Java Virtual Machine (JVM)
Libraries
Java compiler
Other tools

To recap, remember these abbreviations:

Current topic:

JVM, JRE, and JDK ···

Topic depends on:

✓ Write, compile, and run ··· Stage 3

Topic is required for:

Running programs on your computer ···

Java Archive ···

Gradle basics ···

Table of contents:

- **JVM** executes Java bytecode;
- **JRE** includes **JVM** and standard libraries: it is needed **to run** compiled programs;
- **JDK** includes **JRE** and development tools: it is needed **to develop** programs. As a developer, you need to install **JDK**.

> Before Java 11, if you wanted only to run a Java program, **JRE** was enough for you. However, since Java 11 was released, for most JVM implementations **JRE** is no longer downloadable as a separate component. If you want to run programs in JVM 11 or newer, you have to install **JDK**.

If you want deeper explanations, check other topics out.

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