

What is a Java Virtual Machine and What is a JAR File?

Time required: 30 minutes

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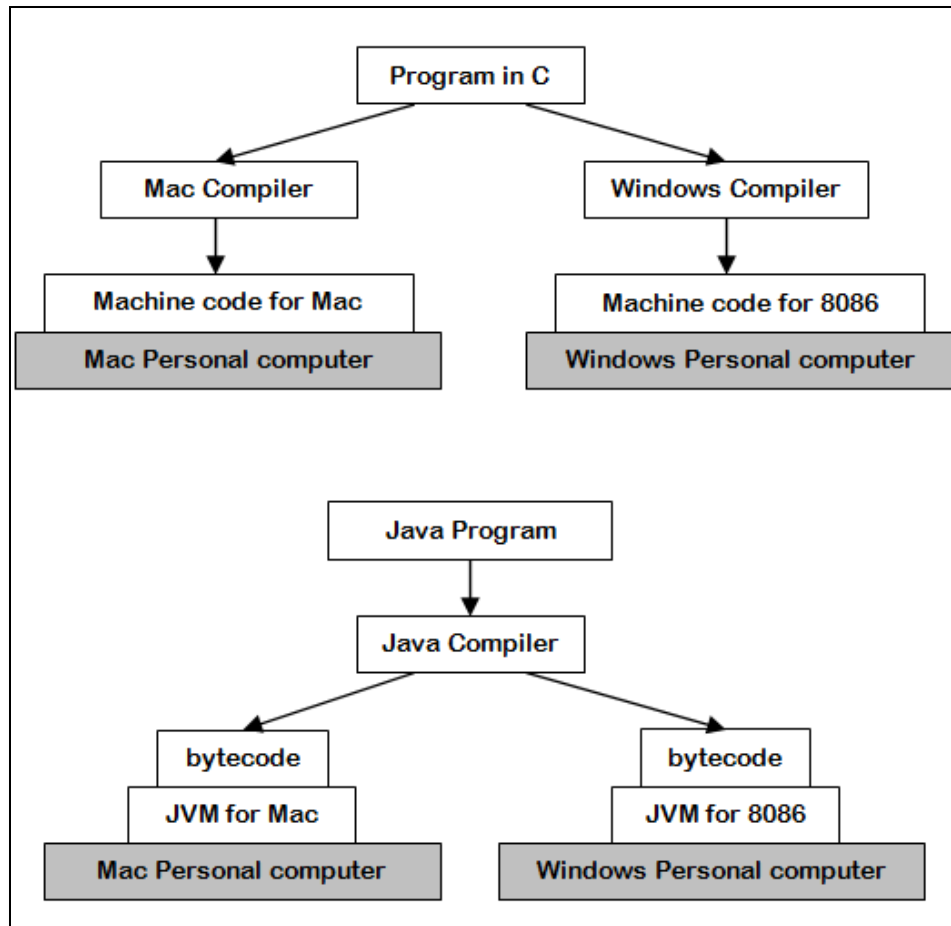
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In this tutorial we will see how to create an executable file for a java application for our game. A java program needs a virtual machine to be executed. Below we will explain what a virtual java machine is and how it works.

Java Virtual Machine (JVM)

Before Java, we wrote a program in a high-level programming language like C or Pascal and then we had to translate it to machine language with a compiler. The "machine language" or "machine code" is the language which the machine understands. A machine with Windows and a Mac talk different machine languages. That is why we need a different compiler for each machine.

In the case of Java, when we use the compiler, we don't obtain machine code. We obtain a code called bytecode which doesn't execute directly on a real machine. This bytecode can only execute on a virtual machine. A virtual machine is a program which works as if it was a machine. For each different operating system there will be a specific virtual machine program but the bytecode executed will be the same.



As the bytecode is potentially the same, it can be executed in any operating system when there is an implementation of the JVM for that operating system. The following famous sentence is based in this idea: "Write once, run anywhere" (WORA).

Compilation and Execution in Java

There are two installation versions for Java for each operating system JRE and JDK. JRE Java Runtime Environment, is a reduced version which contains the JVM, but doesn't include the java compiler. JDK Java Development Kit contains the JVM, the java compiler and other additional tools for the development of java applications.

If we have the JDK installed, we have a directory with all the files which make up the java platform. This directory is known as java Home or JAVA_HOME. An example would be "C:\Program Files\Java\jdk1.8.0_161".

Inside JAVA_HOME there is a folder bin which contains the executable with the compiler: javac.exe and the virtual machine: java.exe.

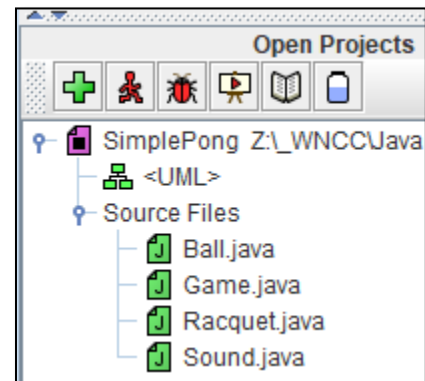
JAR file

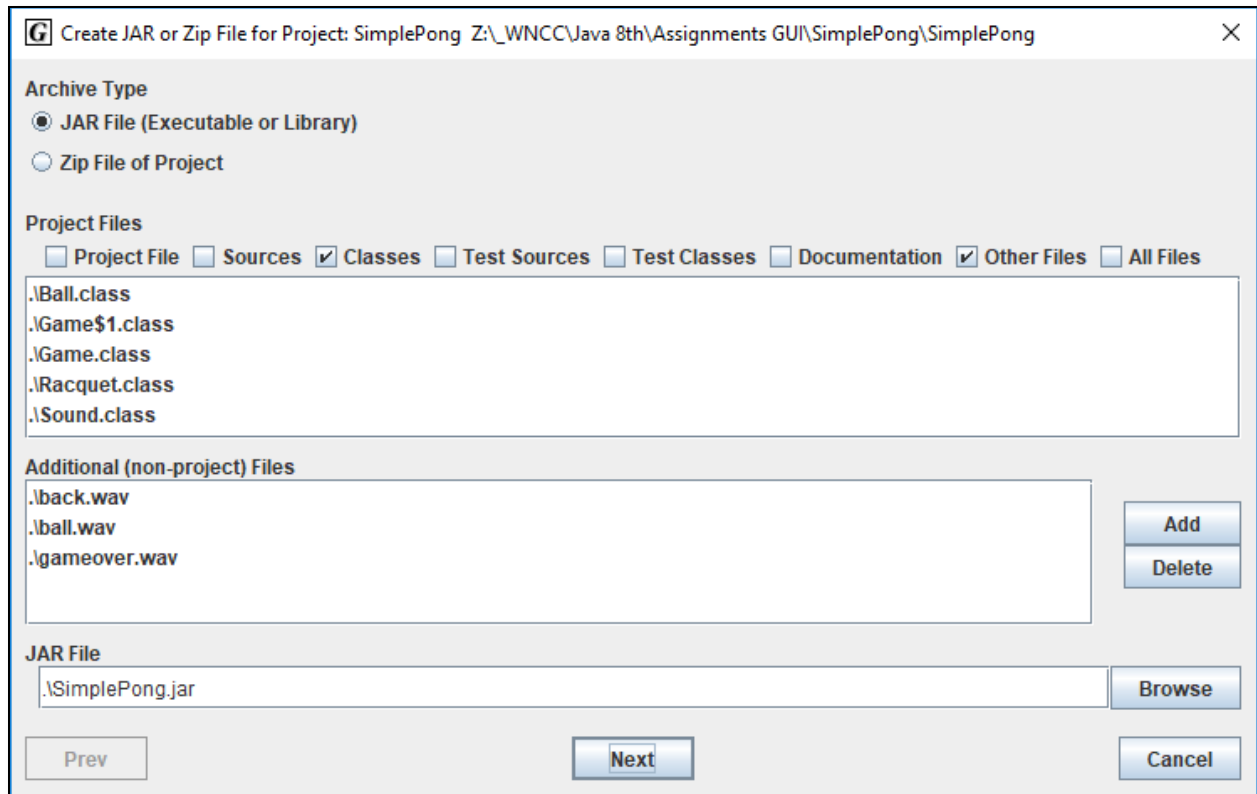
A jar file is a compressed file with the zip algorithm of compression, which can contain:

1. The *.class files which are generated from the compilation of the *.java files, which make up our application.
2. The resources files needed by our application (For example the sound file *.wav)
3. Optionally, we can include the source code files *.java
4. Optionally, we can have a configuration file "META-INF/MANIFEST.MF".

Create an Executable JAR file in jGrasp

1. Open Game.java in jGrasp.
2. Go to the **Project** Menu, then **New**.
3. Browse to the folder that has the .class and .wav files for the Simple Pong program.
4. Under Project Name: **Simple Pong**. Click **Next**.
5. Confirm Project Creation: Click **Add Files to Project Now**. Click **Create**.
6. Browse to the folder that has the .class and .wav files for the Simple Pong program.
7. Click each .java file and Click Add. Click Done.
Your project should look like the screenshot on the right.
8. Click the Green + button to compile the application.
9. Click the Run button to run the application.
10. Click the JAR button. Select the Classes and Other Files Checkmarks.
11. Click Add to Add the .wav files. Your screen should look like the following screenshot.
12. Name the jar file. Click Next. Click Create JAR.





13. Go to the program folder, and double click the JAR file. The program should execute.

14. This standalone file will execute on any computer with the JRE installed.

Assignment Submission

Attach and submit the JAR file in Blackboard.