Java Architecture

Agenda

1. Evolution of Java

2. Java Architecture

Evolution of Java

Key Founders

- Java was the brainchild of:
  - James Gosling
  - Patrick Naughton
  - Mike Sheridan
- The origin of Java can be traced back to the fall of 1991, and was initially called **Greentalk** later renamed to **Oak.**
- Oak was renamed as **Java** in **1995**

Design Goal

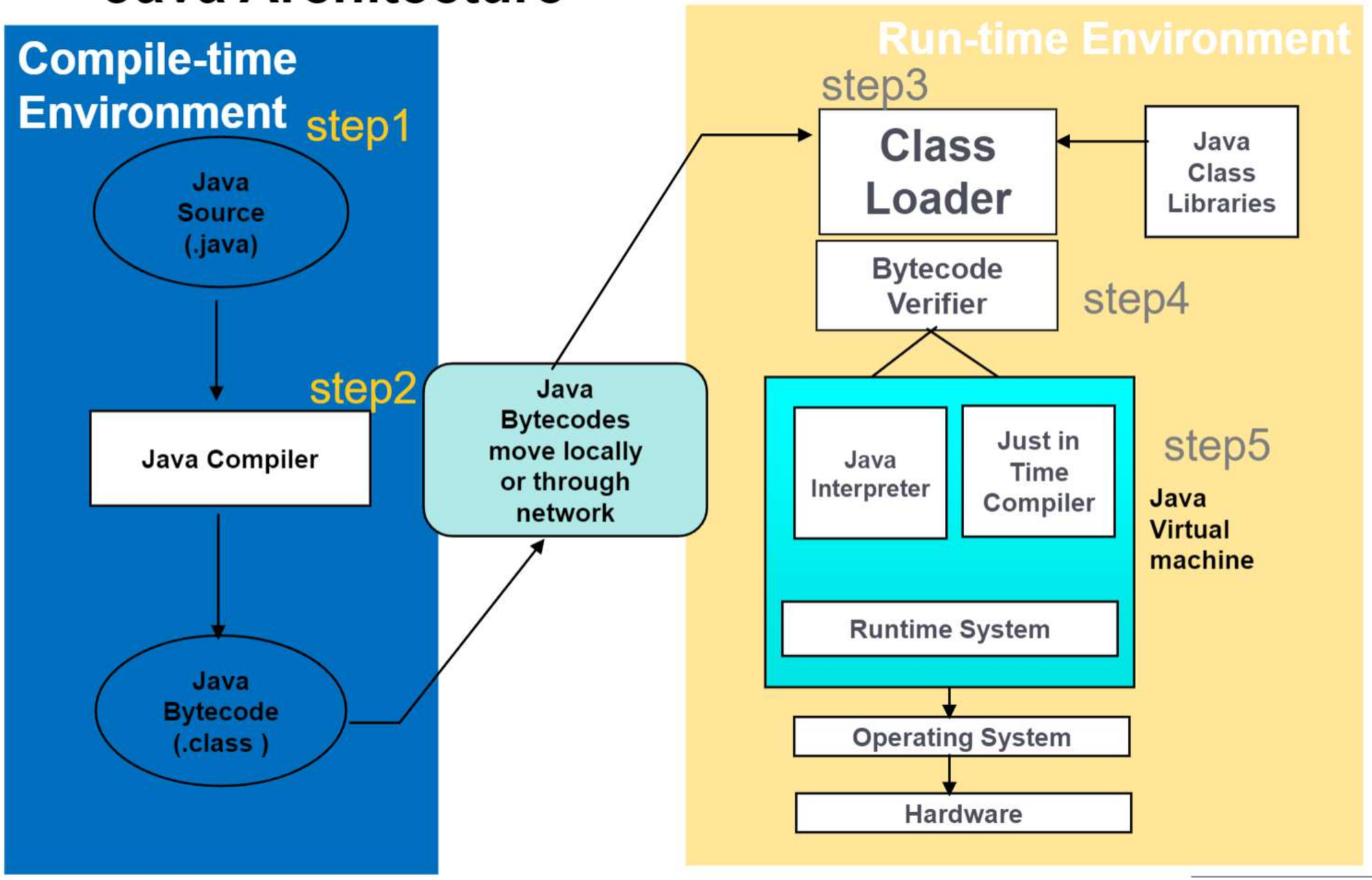
- Java was originally meant to be a platform-neutral language for embedded software in devices.

- The goal was to move away from platform and OS-specific compilers that would compile source for a particular target platform to a language that would be portable, and platform-independent.

- The language could be used to produce platform-neutral code.

Java Architecture

Java Architecture



Java Architecture (Contd.).

Step1:

Create a java source code with .java extension

Step2:

Compile the source code using java compiler, which will create bytecode file with .class extension

Step3:

Class loader reads both the user defined and library classes into the memory for execution

Java Architecture (Contd.).

Step4:

Bytecode verifier validates all the bytecodes are valid and do not violate Java's security restrictions

Step5:

JVM reads bytecodes and translates into machine code for execution. While execution of the program the code will interact to the operating system and hardware

The 5 phases of Java Programs

Java programs can typically be developed in five stages:

1. Edit

   Use an editor to type Java program (**Welcome.java**)

2. Compile

   - Use a compiler to translate Java program into an intermediate language called bytecodes, understood by Java interpreter (**javac Welcome.java)**
   - Use a compiler to create **.class** file, containing bytecodes (**Welcome.class**)

3. Loading

   Use a class loader to read bytecodes from **.class** file into memory

The 5 phases of Java Programs (Contd.).

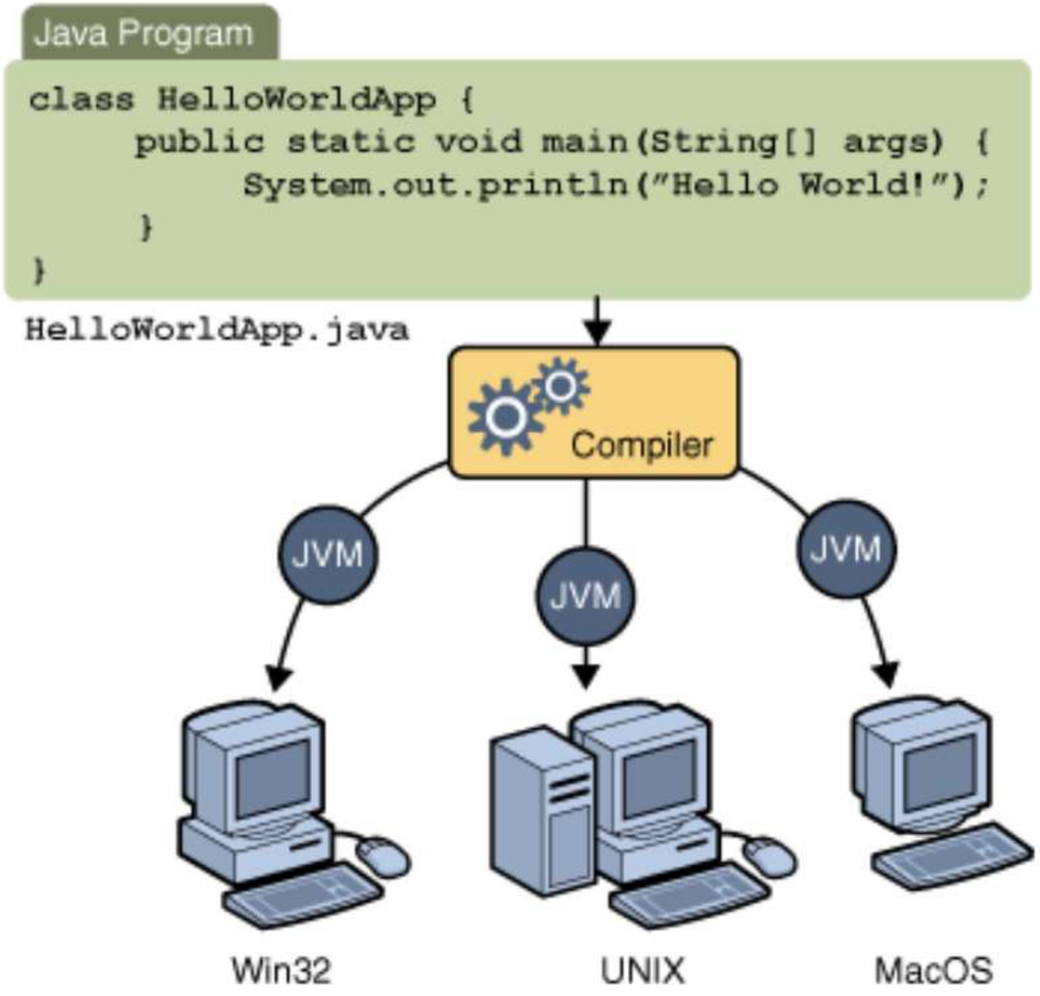
4. Verify

   Use a Bytecode verifier to make sure bytecodes are valid and do not violate security restrictions

5. Execute

   - Java Virtual Machine (JVM) uses a combination of interpretation and just-in-time compilation to translate bytecodes into machine language
   - Applications are run on user's machine, i.e. executed by interpreter with java command (java Welcome)

Java Virtual Machine



- The output of the compiler is bytecode
- The bytecodes are executed by JVM
- It is an interpreter which converts the byte code to machine specific instructions and executes
- JVM is platform specific

The Java Architecture – The JVM (Contd.).

- Most modern languages are designed to be compiled
- Compilation is a one-time exercise and executes faster
- Execution of compiled code over the Internet an impossibility
- Executable code always generated to a CPU-OS combination
- Interpreting a Java program into byte code facilitates its execution in a wide variety of environments

The Java Architecture – The JVM (Contd.).

- Only the Java Virtual Machine (JVM) needs to be implemented for each platform
- Once the Java runtime package exists for a given system, any Java program can run on it
- The JVM will differ from platform to platform, and is, platform-specific
- All versions of JVM interprets the Java byte codes.

The Java Architecture – The JVM (Contd.).

- Interpreted code runs much slower compared to executable code
- The use of bytecode enables the Java runtime system to execute programs much faster
- Java facilitates on-the-fly compilation of bytecode into native code

The Java Architecture – The Adaptive optimizer

- Another type of execution engine is an adaptive optimizer
- The virtual machine starts by interpreting bytecodes
- It also keeps a tab on the code that is running and identifies only the heavily used areas
- The JVM compiles these heavily used areas of code into native code
- The rest of the code, which is not heavily used continues to be interpreted and executed

The Java Architecture - The Class Loader

- The class loader is that part of the VM that is important from:
  - A security standpoint
  - Network mobility

- The class loader loads a compiled Java source file (**.class** files represented as bytecode) into the Java Virtual Machine (JVM)

- The bootstrap class loader is responsible for loading the classes, programmer defined classes as well as Java's API classes

The Java Architecture - The Java .class file

- The Java class file is designed for
  - platform independence
  - network mobility

- The class file is compiled to a target JVM, but independent of underlying host platforms

- **The Java class file is a binary file** that has the capability to run on any platform

Quiz

1. **Write the correct order of the Java program execution.**

A. Class Loader

B. Interpretation

C. Compilation

D. Byte Code Verification

E. Java Source Code

F. Execution

2. **Which of the following is used to load a .class file?**

A. Class Loader

B. Byte Code Verifier

C. JIT Compiler

D. Interpreter

Quiz(Contd.).

3. **When a java program is compiled, it creates a**

A. an obj file

B. an exe file

C. a .class file

D. a .sh file

4. **The JDK is a superset of the JRE, and contains everything that is in the JRE, plus tools such as the compilers and debuggers necessary for developing applets and applications.**

A. TRUE

B. FALSE

Summary

In this session, you were able to :

- Learn about Evolution of Java and forces that shaped it.
- Understand Java Architecture along with JVM concepts.

Thank You