Java Programming Language Overview

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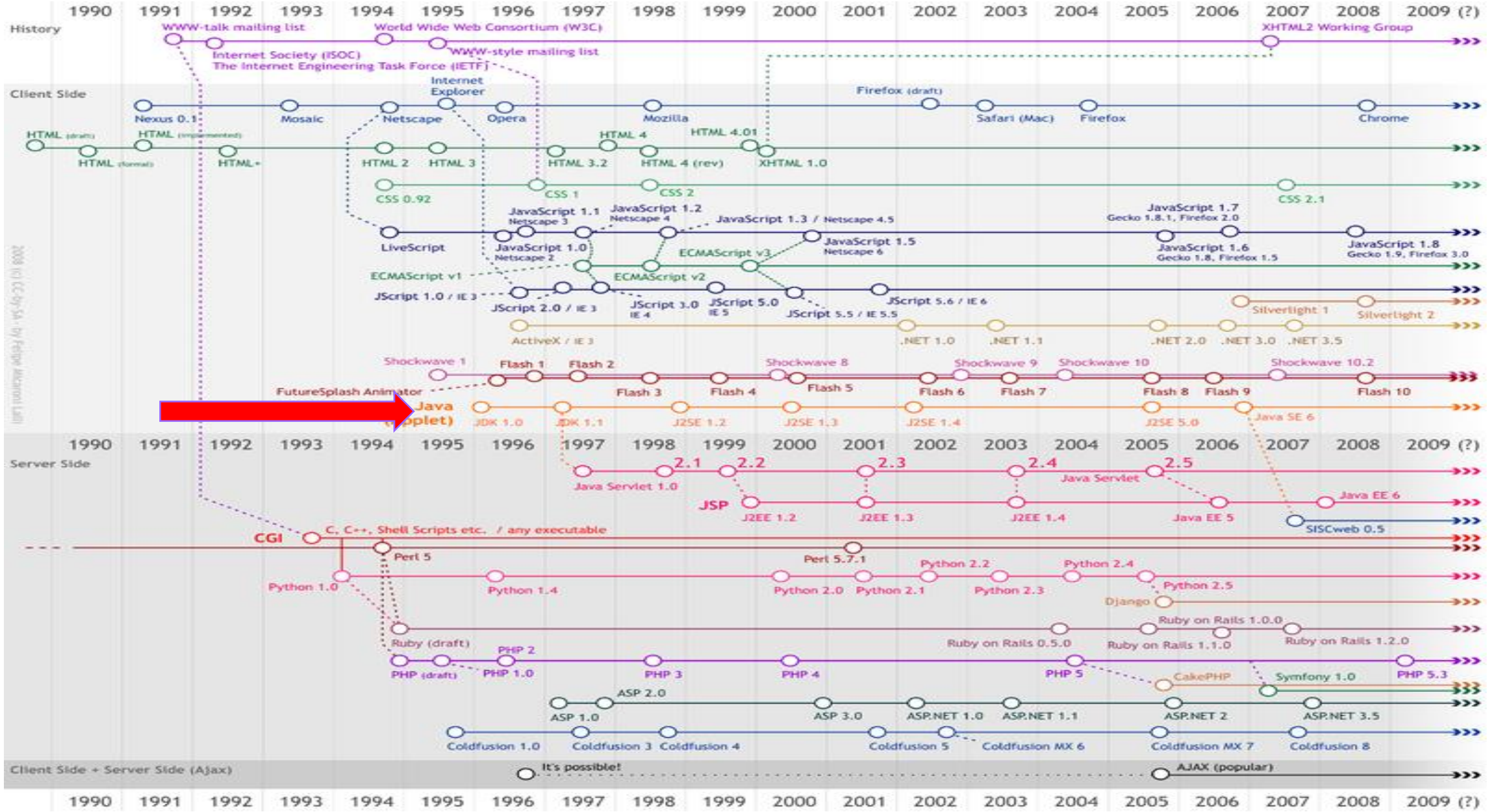
https://github.com/swacademy/JavaSE

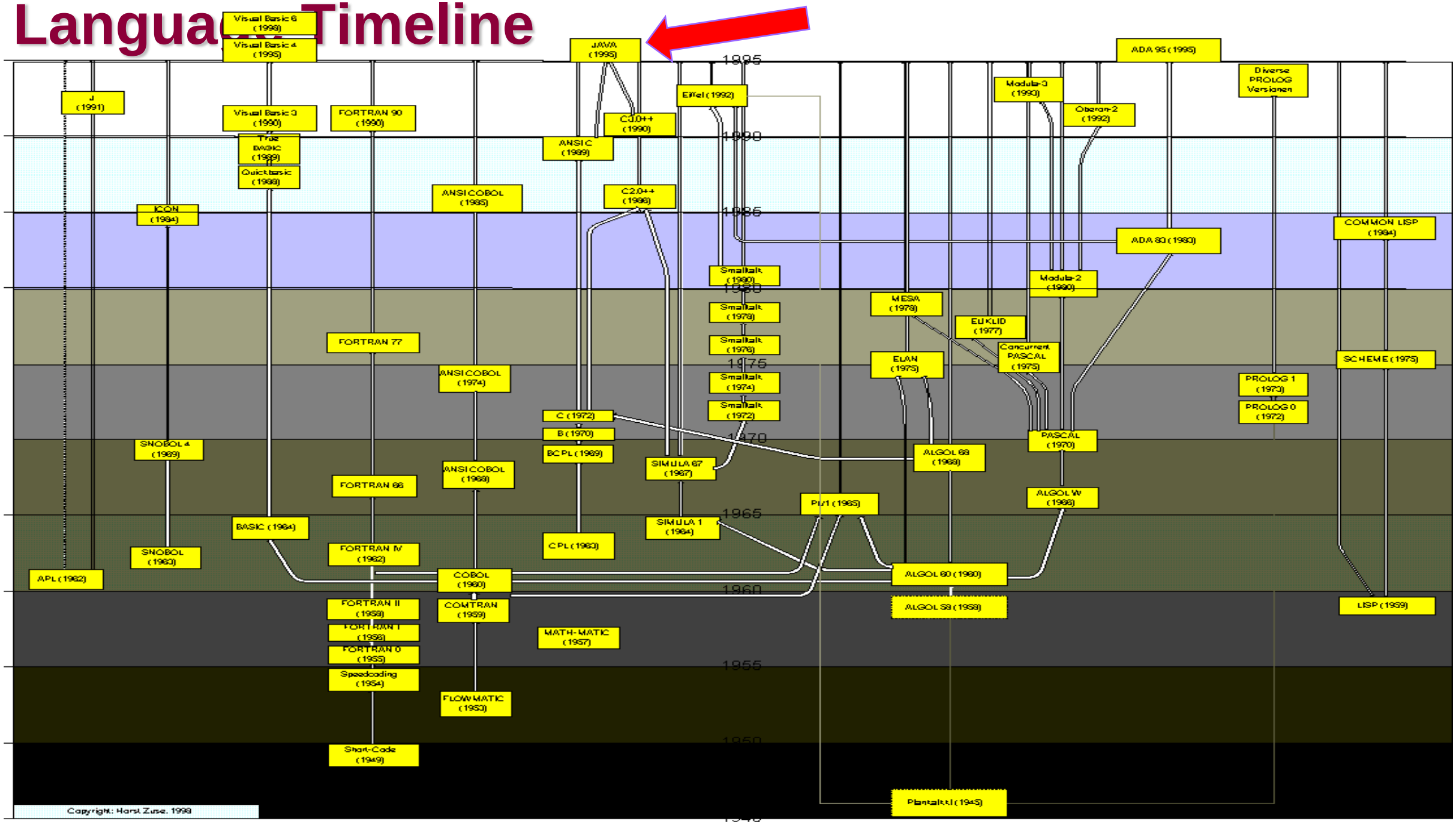
What is Java Technology?

- Is a programming language.
- Is a platform.

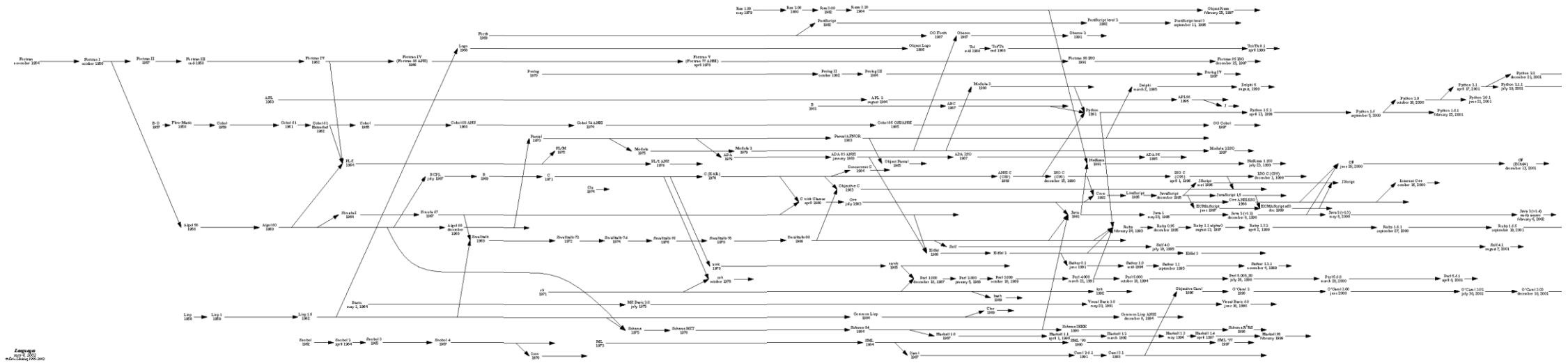
Web Timeline



Language Timeline



Language Timeline (Cont.)



http://www.cs.umd.edu/class/spring2002/cmsc434-0101/MUseum/applications/langtl2.html

Java Programming Language

- Is platform independent programming language.
- Similar to C++ in syntax.
- Similar to SmallTalk in mental paradigm.
- Is one of today's most popular software-development languages.
- Is used for Web programming
- Is used for developing standalone applications across platforms on servers, desktops, and mobile devices.
- Is a high-level language.

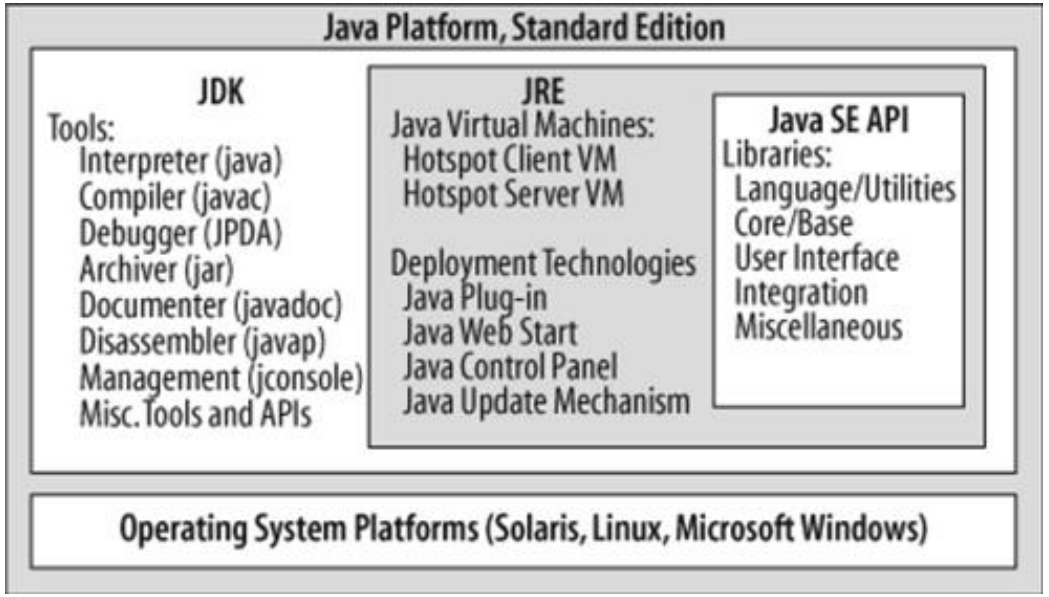
Java Programming Language (Cont.)

Jan 2016	Jan 2015	Change	Programming Language	Ratings	Change
1	2	↑	Java	21.465%	+5.94%
2	1	↓	C	16.036%	-0.67%
3	4	↑	C++	6.914%	+0.21%
4	5	↑	C#	4.707%	-0.34%
5	8	↑	Python	3.854%	+1.24%
6	6		PHP	2.706%	-1.08%
7	16	⇈	Visual Basic .NET	2.582%	+1.51%
8	7	↓	JavaScript	2.565%	-0.71%
9	14	⇈	Assembly language	2.095%	+0.92%
10	15	⇈	Ruby	2.047%	+0.92%
11	9	↓	Perl	1.841%	-0.42%
12	20	⇈	Delphi/Object Pascal	1.786%	+0.95%
13	17	⇈	Visual Basic	1.684%	+0.61%
14	25	⇈	Swift	1.363%	+0.62%
15	11	⇊	MATLAB	1.228%	-0.16%
16	30	⇈	Pascal	1.194%	+0.52%
17	82	⇈	Groovy	1.182%	+1.07%
18	3	⇊	Objective-C	1.074%	-5.88%
19	18	↓	R	1.054%	+0.01%
20	10	⇊	PL/SQL	1.016%	-1.00%

Source : http://www.tiobe.com/index.php/content/paperinfo/tpci/index.html

The Java Platform

- Platform : The hardware or software environment in which a program runs.
- Has two components:
  - The Java Virtual Machine
  - The Java Application Programming Interface (API)



From : [Java Pocket Guide], Robert Liguori ; Patricia Liguori, O'Reilly, 2008, 978-0-59-651419-8, p191

The Java Platform (Cont.) - JRE

- Java Runtime Environment
- Provides the backbone for running Java application.
- Is a collection of software.
- Allows a computer system to run a Java application.
- Consists of
  - JVMs, Java Virtual Machines, interpret Java ***bytecode*** into machine code.
  - Standard class libraries
  - User interface toolkits
  - A variety of utilities.

The Java Platform (Cont.) - JDK

- Java Development Kit
- Provides all of the components and necessary resources to develop Java applications.
- Is a programming environment for compiling, debugging, and running Java applets, applications, and Java Beans.
- Includes the JRE, Java Programming language, development tools and tool APIs.
- Refer to http://java-virtual-machine.net/other.html

The Java Platform (Cont.) - JDK

- Download the most recent version at http://java.sun.com
- Download older versions at http://java.sun.com/products/archive

Java Development Kits	Codename	Release
Java SE 8 with JDK 1.8.0	Spider	2014
Java SE 7 with JDK 1.7.0	Dolphin	2011
Java SE 6 with JDK 1.6.0	Mustang	2006
Java 2 SE 5.0 with JDK 1.5.0	Tiger	2004
Java 2 SE with SDK 1.4.0	Merlin	2002
Java 2 SE with SDK 1.3	Kestrel	2000
Java 2 with SDK 1.2	Playground	1998

Table 1-1. Java Development Kits

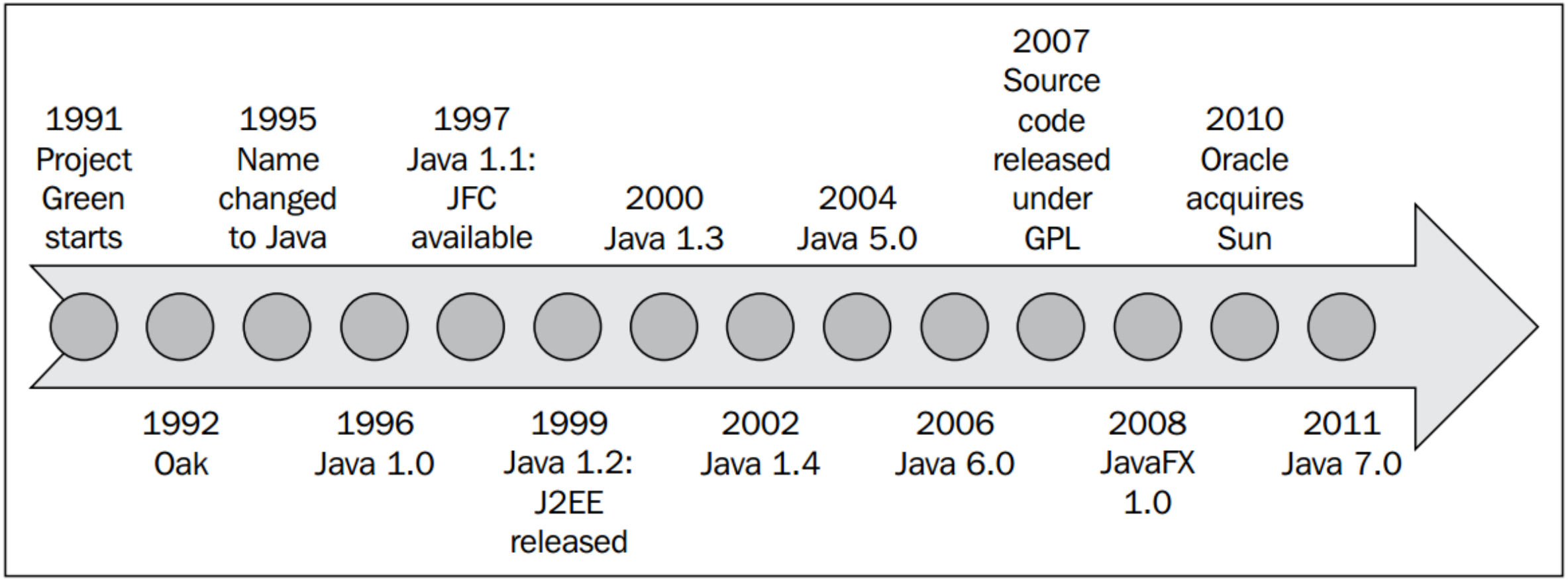
Java SE Code Names

Version	Code Name	Release Date
JDK 1.1.4	Sparkler	1997. 10. 11
JDK 1.1.5	Pumpkin	1997. 11. 03
JDK 1.1.6	Abigail	1998. 04. 24
JDK 1.1.7	Brutus	1998. 09. 28
JDK 1.1.8	Chelsea	1999. 04. 08
J2SE 1.2	Playground	1998. 11 04
J2SE 1.2.1	(none)	1999. 03. 30
J2SE 1.2.2	Cricket	1999. 07. 08
J2SE 1.3	Kestrel	2000. 08. 05
J2SE 1.3.1	Ladybird	2001. 05. 17
J2SE 1.4.0	Merlin	2002. 02. 13
J2SE 1.4.1	Hopper	2002. 09. 16
J2SE 1.4.2	Mantis	2003. 06. 26
Java SE 5.0(1.5.0)	Tiger	2004. 09. 29
Java SE 6.0(1.6.0)	Mustang	2005. 11. 20
Java SE 7.0(1.7.0)	Dolphin	2011. 07. 28
Java SE 8.0(1.8.0)	Spider	2014. 03. 18

History

- Originally named ***Oak***, designed in 1991.
- Main team members : Bill Joy, Patrick Naughton, Mike Sheridan, James Gosling.
- Original goal : use in embedded consumer electronic appliances.
- In 1994, team realized Oak was perfect for ***Internet***.
- In 1995, renamed Java, was redesigned for developing Internet applications.
- Announced ***in May 23 in 1995*** at SunWorld'95.
- First non-beta release January 23 in 1996.
- Refer to http://www.oracle.com/technetwork/java/javase/overview/javahistory-index-198355.html

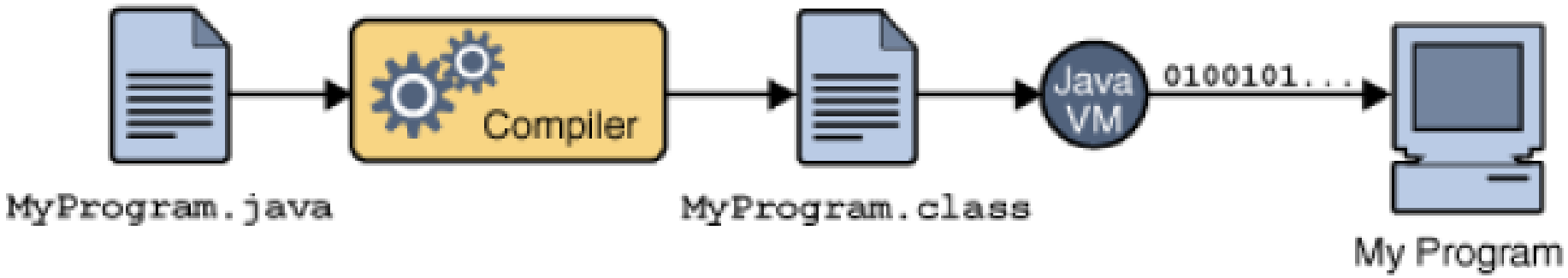
History (Cont.)



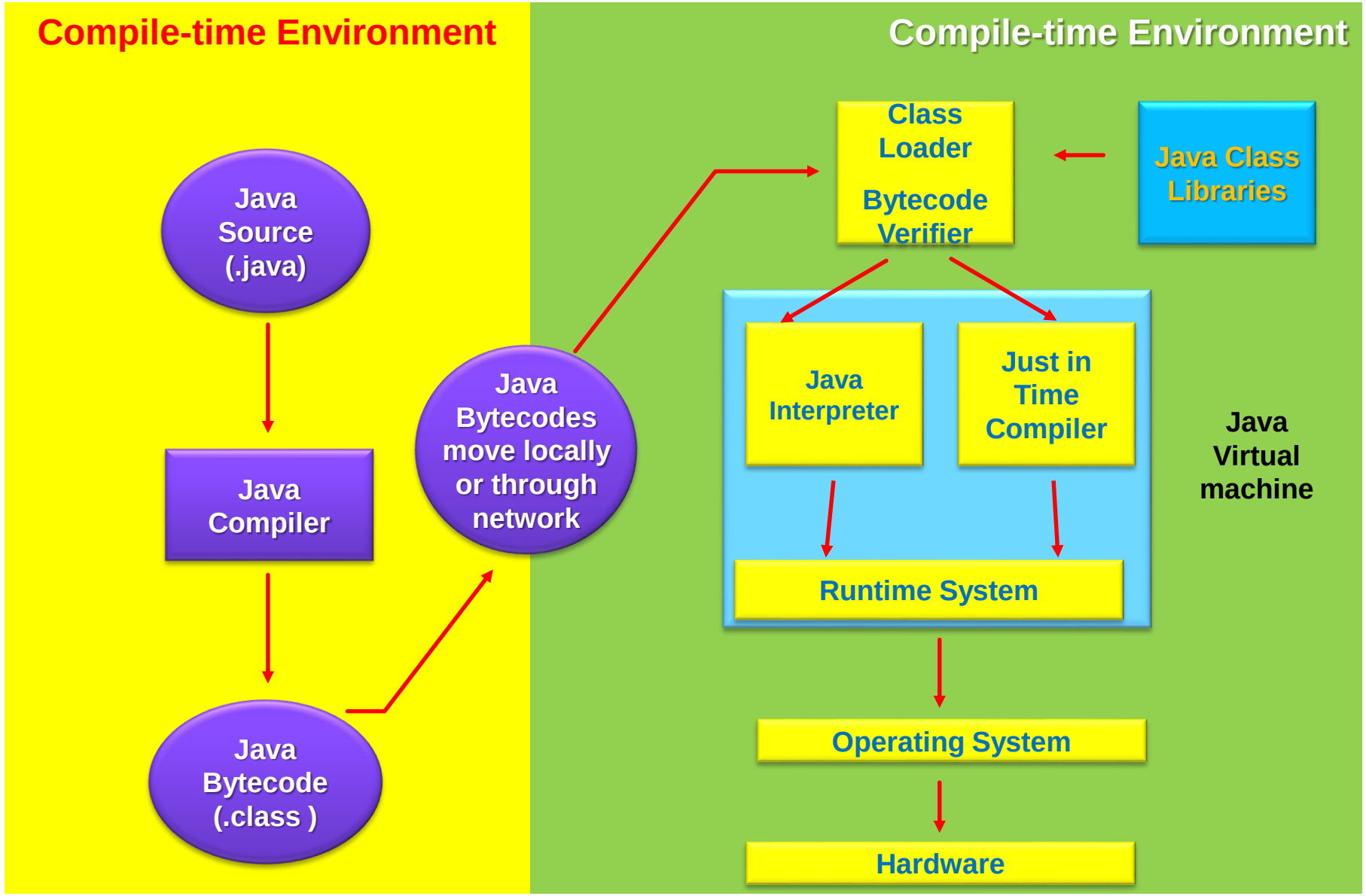
Source : Oracle Certified Associate Java SE 7 Programmer Study Guide 2012, PACKT Press, p8

Features

- Simple
- Object-Oriented
- Distributed
- Multithreaded
- Dynamic
- Architecture neutral
- Portable
- High performance
- Robust
- Secure
- Write Once, Run Anywhere™
- http://java.sun.com/docs/white/langenv/



How it works…!



Source : Java tutorial PPT, by Intelligo Technologies on Mar 08, 2011

Figure 1.1 J2SE vs. J2EE vs. J2ME

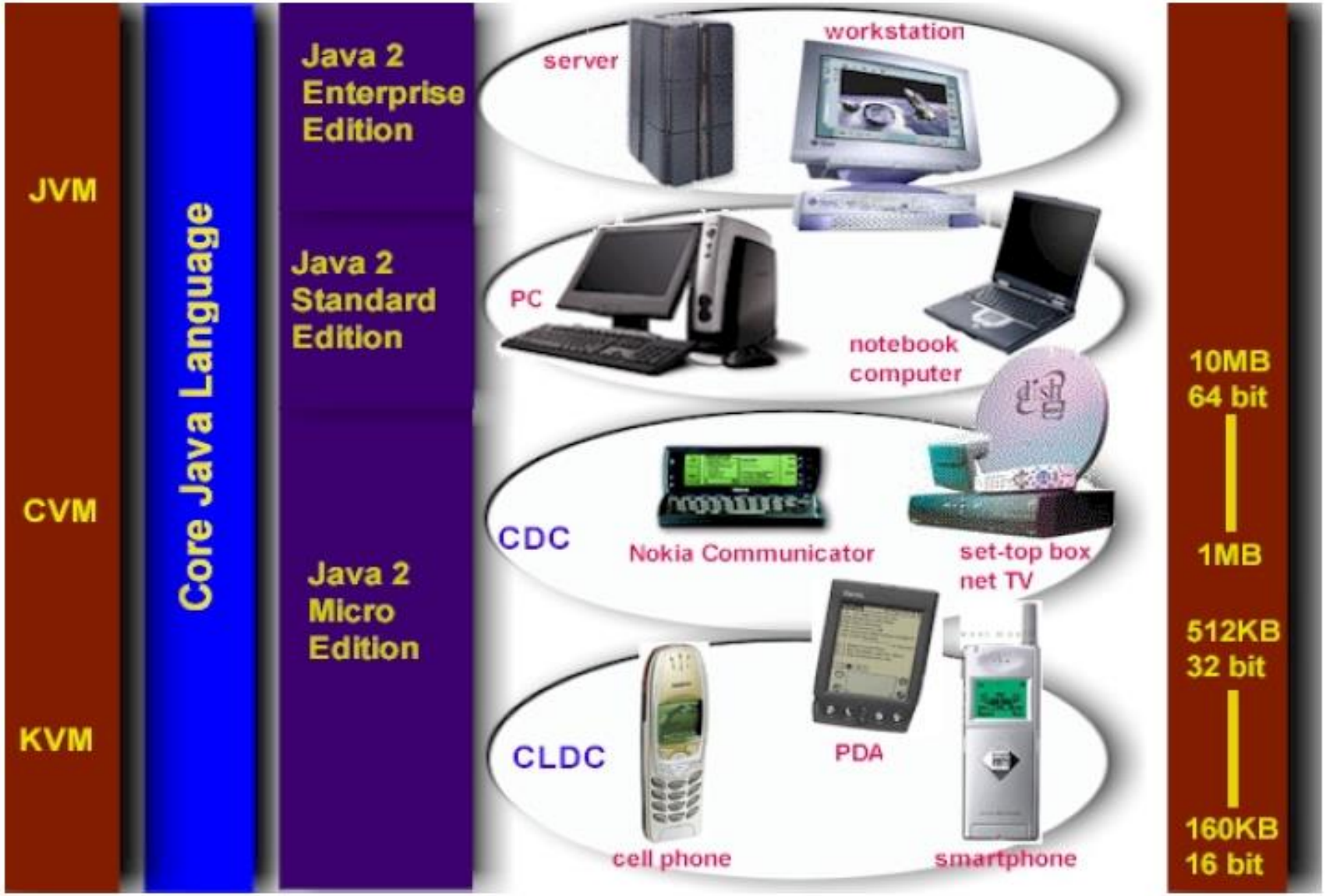
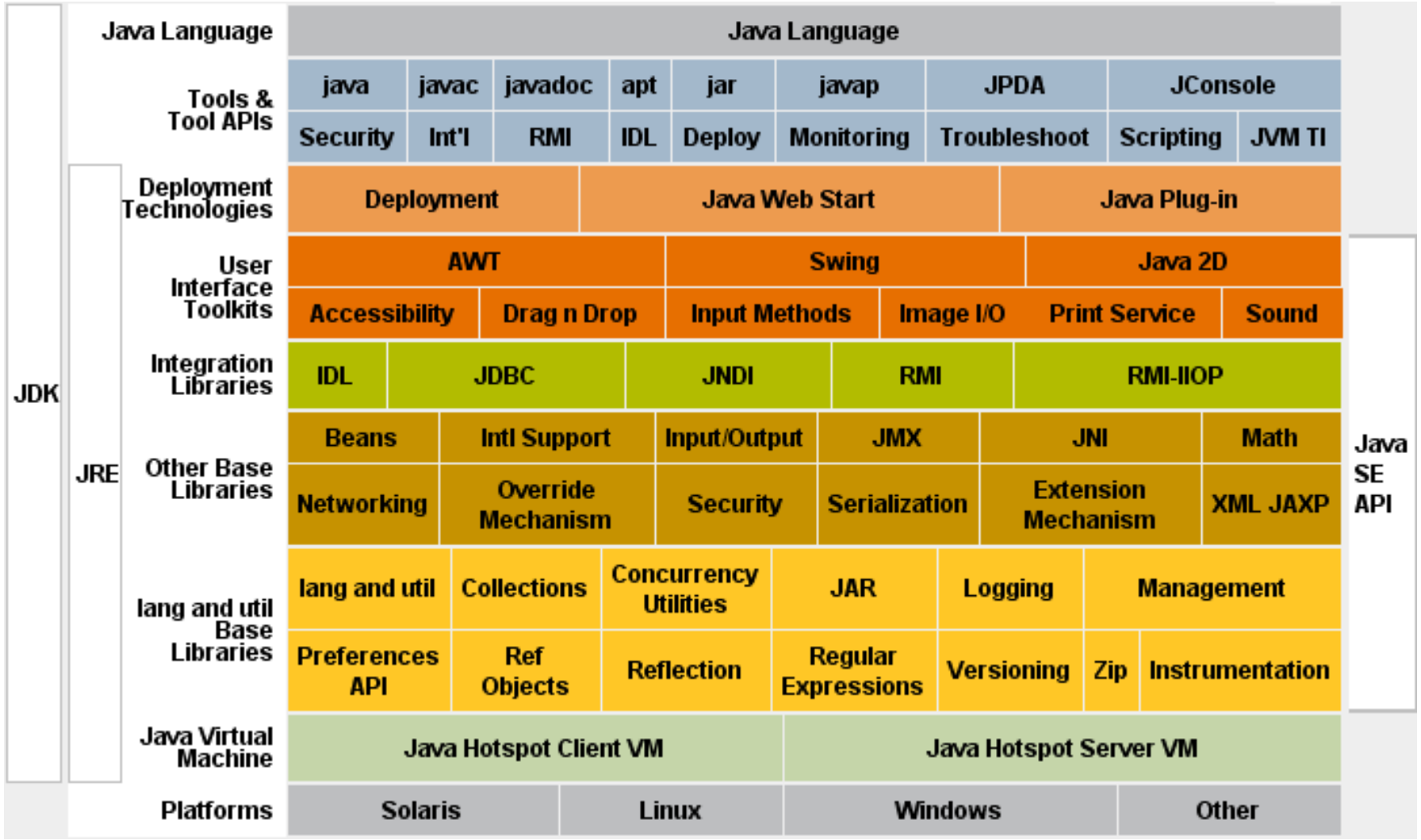
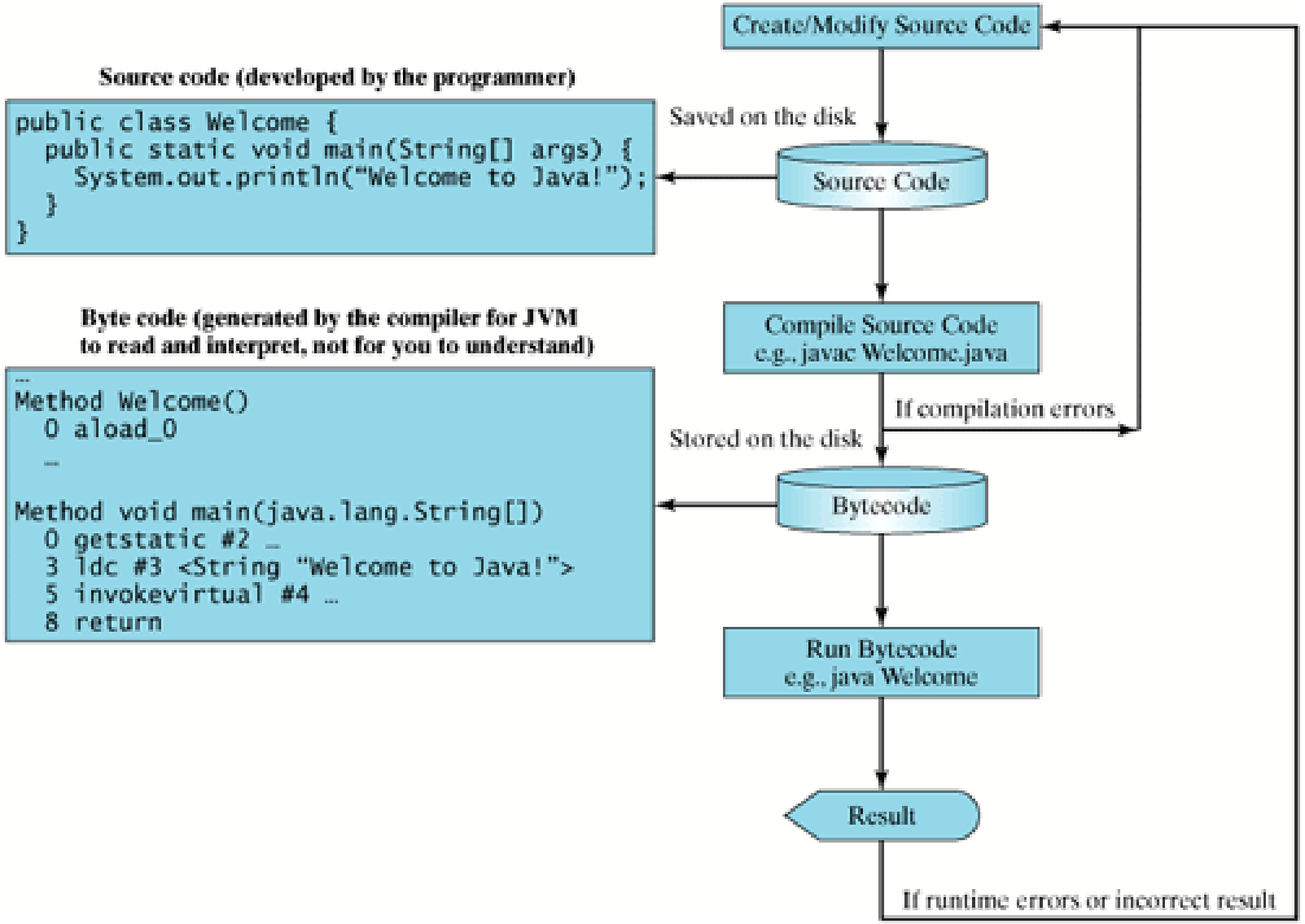


Figure 1.2 Java SE 6 Platform at a Glance



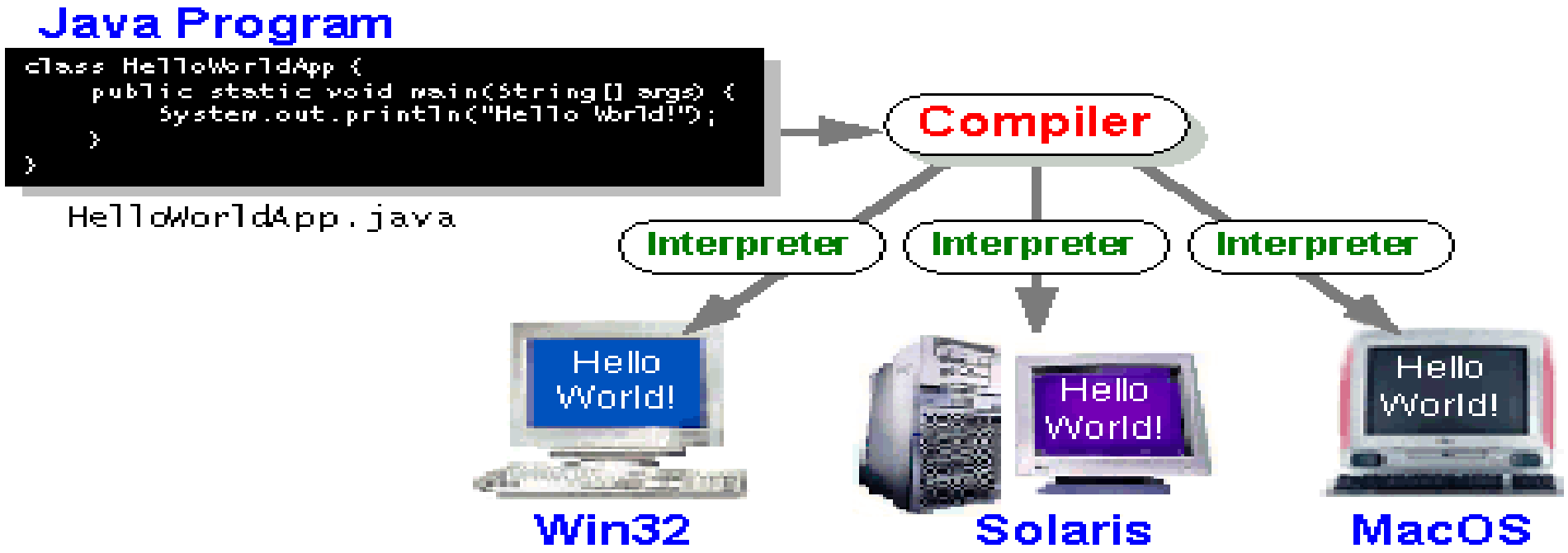
※ http://java.sun.com/javase/technologies/index.jsp

Development Process



Development Process (Cont.)

1. Create a ***source file***
2. Compile the source file into a ***bytecode*** file
3. Run the program contained in the ***bytecode*** file



Creating a Source Code – HelloWorld.java

instructor@Ubuntu64-00:/home/instructor/JavaRoom

```
/*
* Author : Peter Bok
* When : August, 1,  2014
* Objective : Hello World Code Test
* Environment : Ubuntu 14.04 LTS Desktop, JDK 1.8.0_11, vi editor
*/

public class HelloWorld {
     public static void main(String [] args) {
           String msg = "Hello, World";
           System.out.println("msg = " + msg);
     }
}
~
~
~
~
~
~
~
~
:wq
```

Compiling the Source Code – HelloWorld.java

- Java Compiler – **`javac.exe`**

```
instructor@Ubuntu64-00:~/JavaRoom$ ls
HelloWorld.java
instructor@Ubuntu64-00:~/JavaRoom$ javac HelloWorld.java
instructor@Ubuntu64-00:~/JavaRoom$
instructor@Ubuntu64-00:~/JavaRoom$ ls
HelloWorld.class  HelloWorld.java
```

Interpreting the *bytecode* – HelloWorld.class

- Java Interpreter – **`java.exe`**

```
instructor@Ubuntu64-00:~/JavaRoom$ ls
HelloWorld.class  HelloWorld.java
instructor@Ubuntu64-00:~/JavaRoom$
instructor@Ubuntu64-00:~/JavaRoom$
instructor@Ubuntu64-00:~/JavaRoom$ java HelloWorld
msg = Hello, World
instructor@Ubuntu64-00:~/JavaRoom$
```

Command Line Tools

- JDK provides several command-line tools.
- Commonly used tools is a compiler, launcher/interpreter, archiver, documenter.
- Refer to http://java.sun.com/javase/6/docs/technotes/tools

Command Line Tools - Compiler

- Translates Java source files into Java *bytecode*.
- Creates a *bytecode* file with the same name as the source file but with the `.class` extension.
- **`javac [-options] [source files]`**
  - **`javac`** HelloWorld.java
  - **`javac -cp`** ./dir/classes/ HelloWorld.java
  - **`javac -d`** ./opt/hwapp/classes HelloWorld.java
  - **`javac -source`** 1.4 HelloWorld.java
  - **`javac -version`**
  - **`javac -help`**
- Refer to http://www.javaexpert.co.kr/entry/22
- Refer to http://pllab.kw.ac.kr/j2seAPIs/tooldocs/windows/java.html

Command Line Tools - Interpreter

- Handles the program execution, including launching the application.
- **`java [-options] class [arguments…] or java [-options] -jar jarfile [arguments…]`**
  - **`java`** HelloWorld
  - **`java -cp`** .:./dir/Classes HelloWorld
  - **`java -ea`** HelloWorld
  - **`java -version`**
  - **`java -help`**
  - **`javaw <classname>`**
- Refer to http://javaexpert.co.kr/entry/23
- Refer to http://pllab.kw.ac.kr/j2seAPIs/tooldocs/windows/java.html

Command Line Tools - Packager

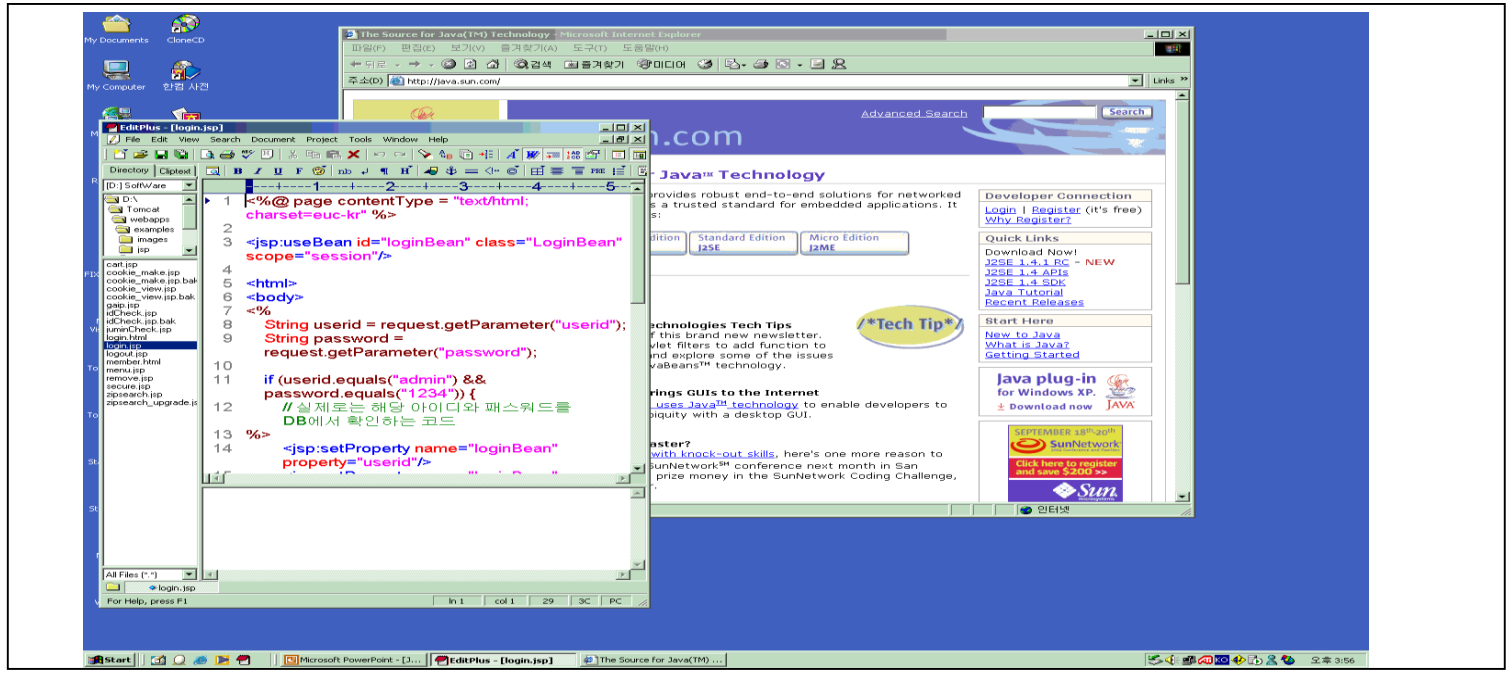
- JAR, Java Archive, utility is an archiving and compression tool.
- Used to combine multiple files into a single file called a JAR file.
- JAR consists of a ZIP archive containing a manifest file (JAR content describer) and optional signature files (for security).
- **`jar [options] [jar-file] [manifest-files] [entry-point] [-C dir] files`**…
  - **`jar cf`** files.jar HelloWorld.java kr/co/javaexpert/HelloWorld.class
  - **`jar tfv`** files.jar
  - **`jar xf`** files.jar
- Refer to http://javaexpert.co.kr/entry/24
- Refer to http://pllab.kw.ac.kr/j2seAPIs/tooldocs/windows/jar.html

Command Line Tools – JAR Execution

- Can be created to be executable.
- Specifies the file within the JAR where the **`main`** class resides.
- Refer to http://javaexpert.co.kr/entry/25

1. Compile **`.java`** file with package option.
2. Create a file **`Manifest.txt`** using editor.
3. Create a JAR file that adds the Manifest.txt contents to the manifest file, **`MANIFEST.MF`**.
4. Display the contents of the JAR file.
5. Execute the JAR file using **`java -jar`** option.

Figure 1.3. shows an examples of this basic communication.



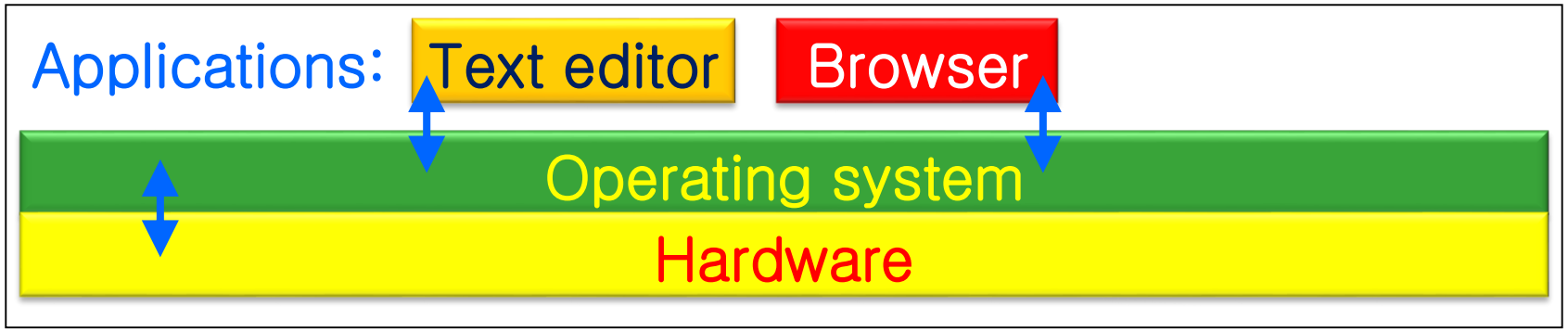
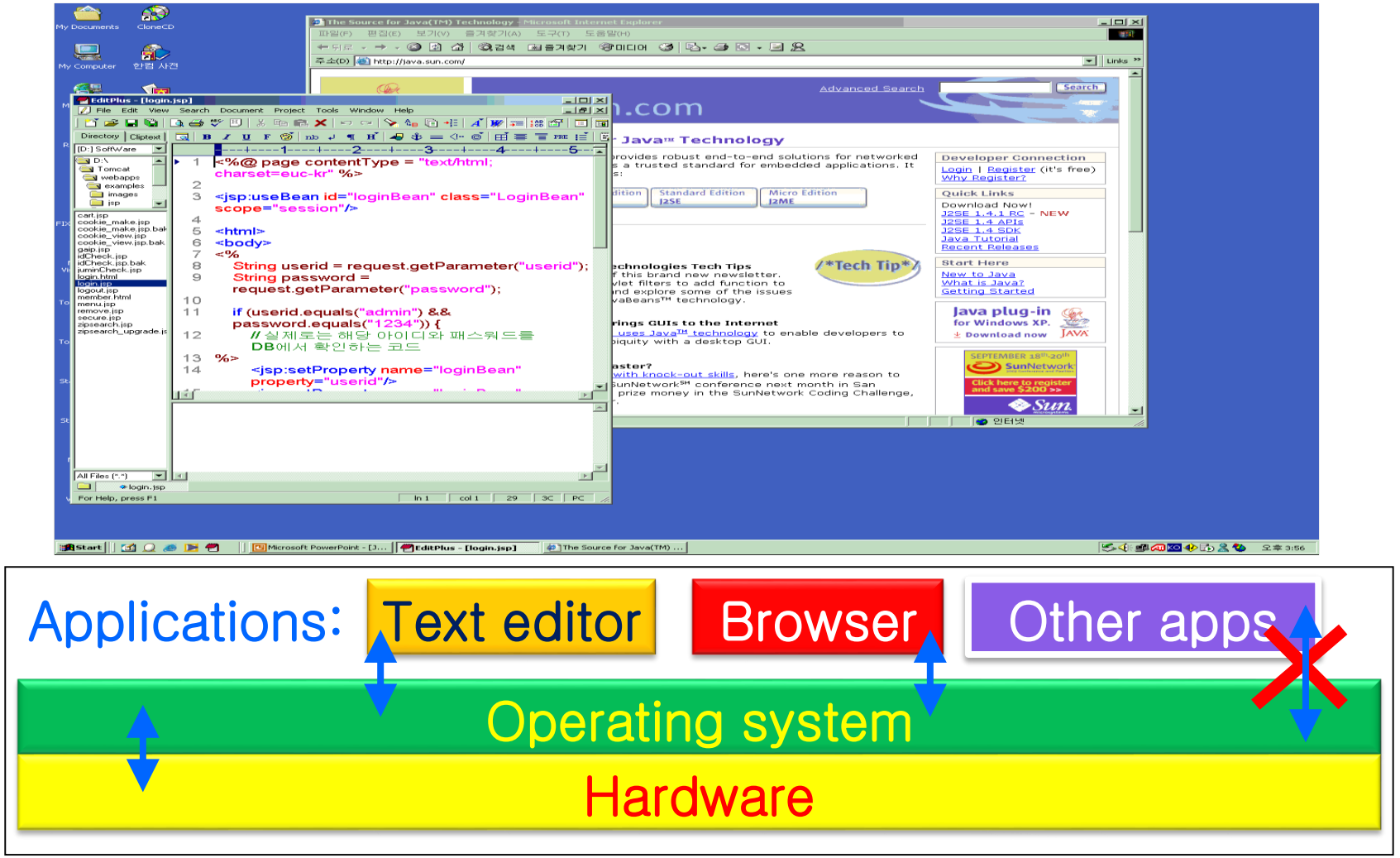


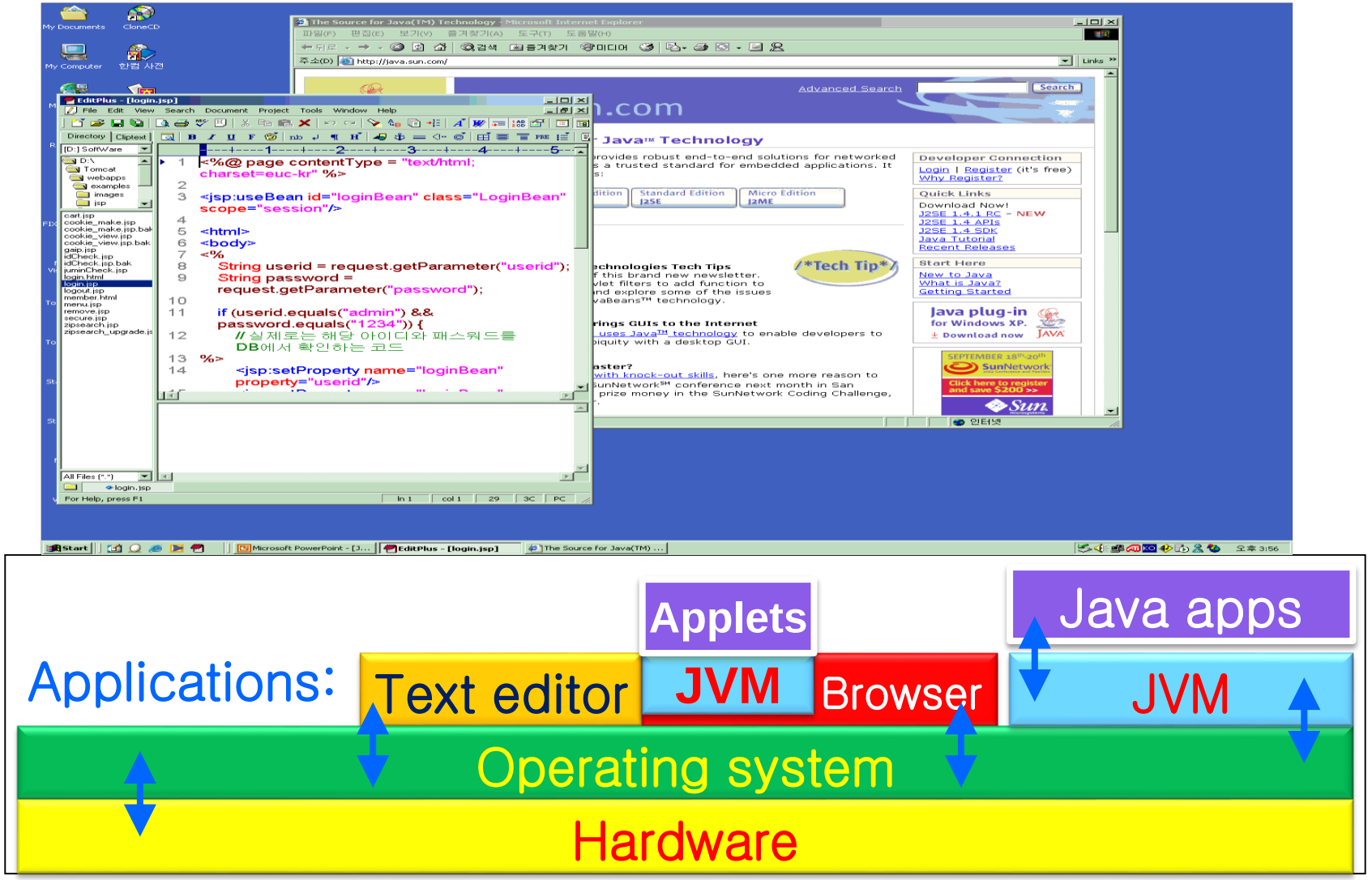
Figure 1.4. Computer Communication Problem



How Java Technology Solves the Communication Problem

- Uses compiling and interpretation.
- A little slower than compiled programs, but runs on any operating system.
- Compiles source code to ***bytecode***.
- Uses Java virtual machine (JVM™), interprets ***bytecode***.
- Uses a different JVM for every operating system.

Figure 1.5. How the JVM Interacts With the Operating System and Java Applets

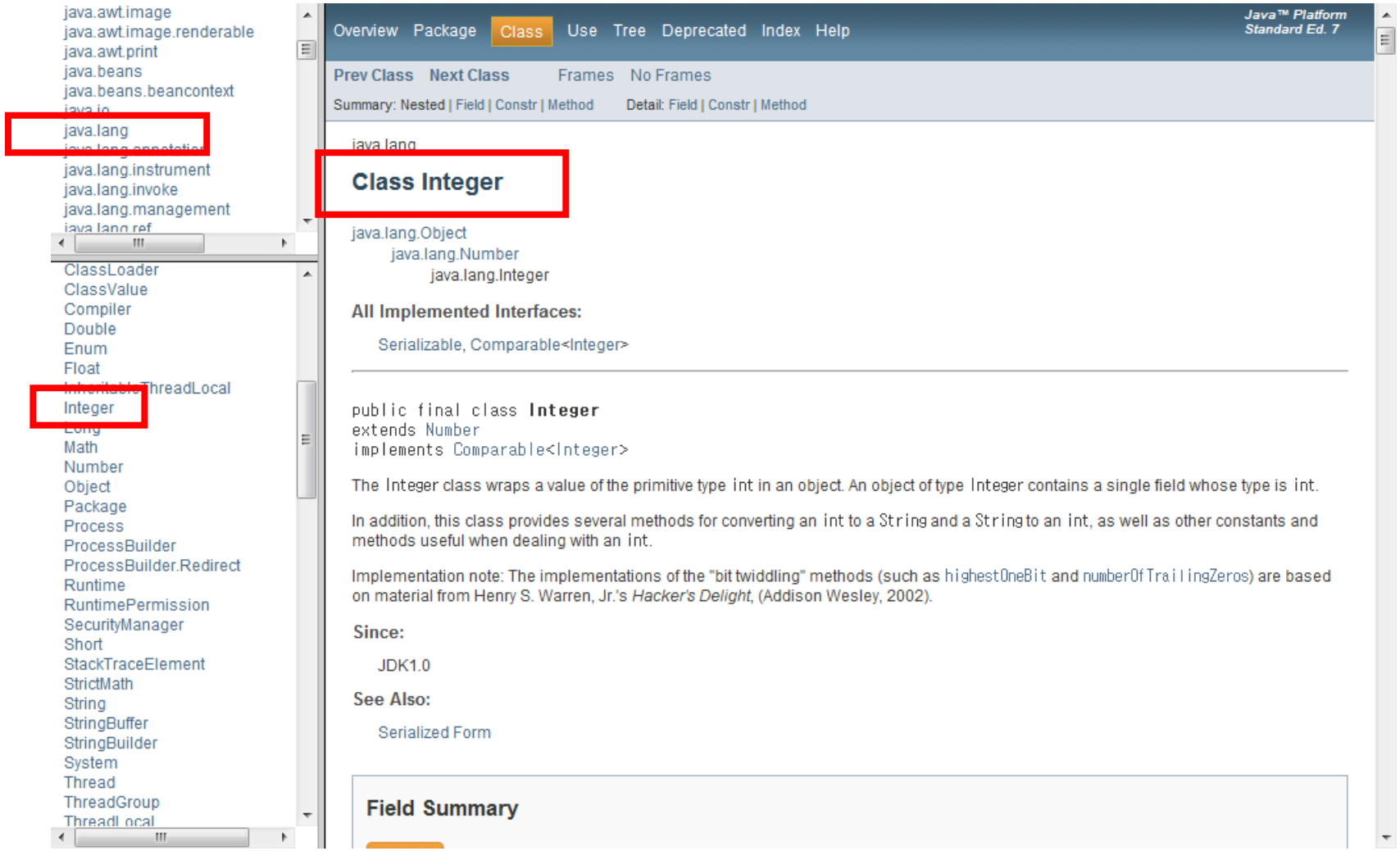


Java API Documentation

- Detailed information API
- Very valuable resource: download, or view online at:

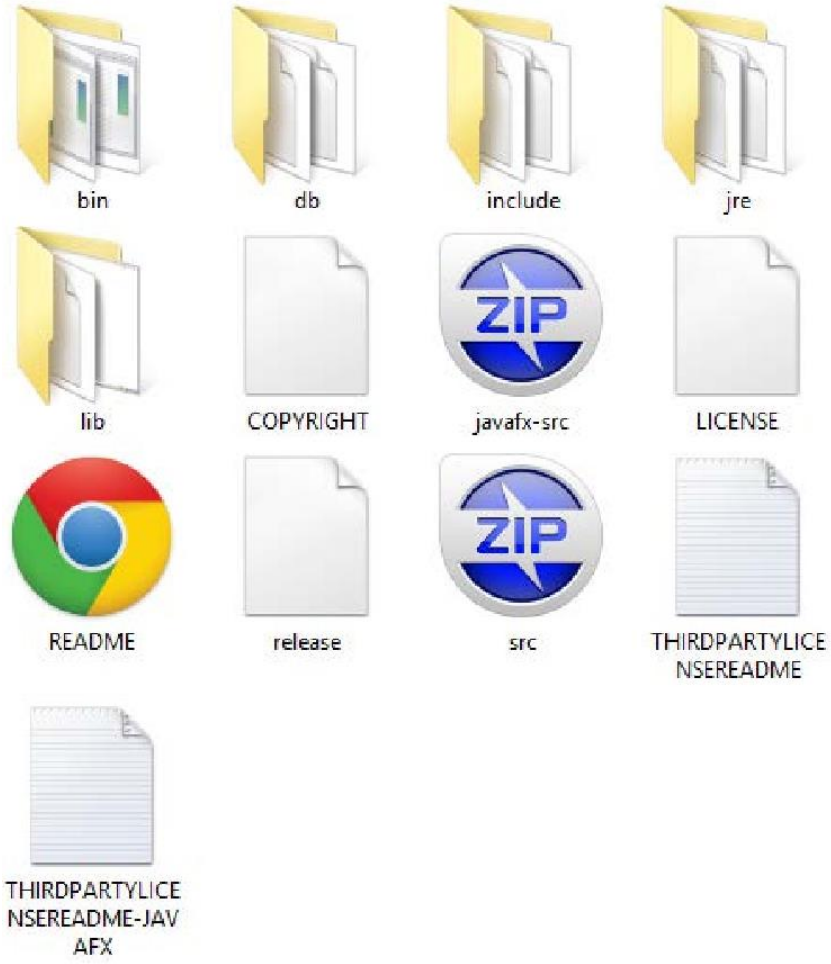
  http://docs.oracle.com/javase/7/docs/api/

Figure 1.6. Java 2 Platform Specification, `java.lang` Package, `Integer` Class



JDK File Structure

- bin : contains the tools used for developing a Java application including the compiler and JVM.
- db : is the Apache Derby relational database.
- include : contains header files used to interact with C applications.
- jre : is a JRE used by the JDK.
- src.zip : includes the actual code for the core classes, called the SDK.



Additional Resource

- Java Technology : An Early History
  - http://oracle.com.edgesuite.net/timeline/java/
  - http://www.cs.umd.edu/class/spring2002/cmsc434-0101/MUIseum/applications/index.html
- Java Language and Virtual Machine Specifications
  - http://docs.oracle.com/javase/specs/
- Java SE6 API Hangul Documentation
  - http://docs.xrath.com/java/se/6/docs/ko/
  - http://docs.xrath.com/java/se/6/docs/ko/api/index.html
- Comparison of Java and C++
  - http://en.wikipedia.org/wiki/Comparison_of_Java_and_C%2B%2B
  - http://verify.stanford.edu/uli/java_cpp.html