An Overview of Java

Contents

What is Java

- A Sun Microsystem Development (James Gosling)
- An effective OOP language
- Run-time environment (Interpreter w. GC and threads)
- Portable (architecture-neutral via Java Virtual Machine)
- `java`, `javac`, class library, tools, documentation
- Designed for easy Web/Internet applications
- Widespread acceptance

Java Products

From Sun Micro Systems and other companies:

- SDK or JDK (Software Development Kit) – JVM, compiler, interpreter, JFC, JavaDoc, Jdb, AppletViewer ...
- Java Plug-in for browsers to run applets
- JavaBeans – reusable Java component API
- Java IDEs – integrated development environments
- JavaOS – compact os for running Java programs
- Server side – Servelet, JSP, JDBC, Application Web server
- Many, many other tools and applications.

Java Language Features

- Platform independence
- Totally Object-oriented, but simpler than C++
- Dynamic incremental loading and linking
- Automatic GC
- Multithreaded
- Systematic class, package, and source file naming
- GUI and graphics programming
- Web and network applications support
- Internationalization (programs in Unicode)

Java Virtual Machine

- Compact JVM interprets bytecode, does GC
- Written in C, has OS/platform layer
- Uses threads
- Has just-in-time compilation
- JVM has simple instruction set
- Bytecode register based, byte order independent
- Easy to generate machine code

The Java Language

- Easy to learn: similar to C++
- Packages and interfaces
- Strings and arrays as objects
- Classes as objects
- No:
  - structs, unions, typedefs
  - operator overloading
  - pointer arithmetic or `->`
  - preprocessor or header files
  - un-attached functions
  - implementation-dependent features

- `inline`, `register`, `const`, `friend`, or multiple base classes
- need to free memory or recompile on different platforms

Java Primitive Data Types

Primitive Type	Description
`boolean`	`true` or `false`
`char`	16-bit Unicode character
`byte`	signed 8-bit integer
`short`	signed 16-bit integer
`int`	signed 32-bit integer
`long`	signed 64-bit integer
`float`	32-bit floating point (IEEE 754-1985)
`double`	64-bit floating point (IEEE 754-1985)

A First Java Program

```
///////    File: Average.java    ///////

public class Average
{
   public static void main(String[] args)
   {   int i = 11, j = 20;
       double a = (i + j)/2.0;
       System.out.println("i is " + i
         + " and j is " + j);
       System.out.println("Average is " + a);
   }
}
```

Compile and Run

- **javac** `Average.java`: produces `Average.class`
- **java** `Average`: to run
- Use `CLASSPATH` environment variable to locate class code
- **java** returns `exit code` not `main`.

```
neptune:{57}java Average

i is 11 and j is 20
Average is 15.5
```

Robustness

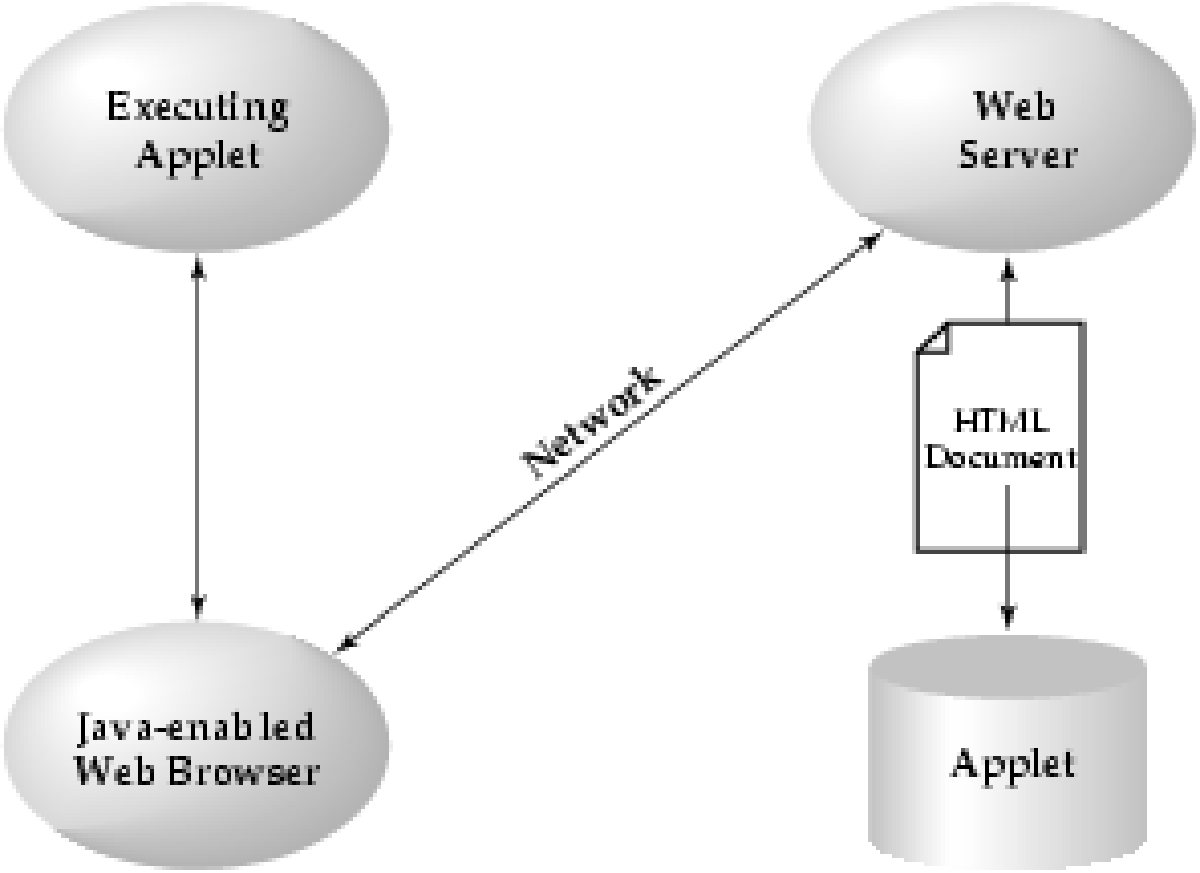
- No implicit declarations
- Automatic GC
- Link-time type checks
- No pointer manipulations
- Array and string objects

Java Exceptions

```
import java.io.*;

class Lowercase
{
    public static void main(String[] args)
        throws IOException
    {  int i;  char c;
       while ( (i = System.in.read()) != -1 )
       {    c = Character.toLowerCase( (char) i);
            System.out.print(c);
       }
    }
}
```

Web Application



Web Application: applets

- Java code can supply *executable content* in Web documents
- Java-enabled Web browsers can execute such contents
- The Sun Java-Plugin supports applets for popular browsers
- The `<applet>` `</applet>` HTML tags
- Simple `applet` tag is similar to the `img` tag
- `<applet code="`*filename*`.class" width="100" height="40">`
- `<applet code="`*filename*`.class" codebase="`*url*`" ...`
- `<param name="`*name*`" value="`*value*`">`

Java Class Libraries

- `java.lang` – core language support
- `java.io` and `javax.nio`– I/O streams
- `java.net` and `java.rmi` – networking and remote method invocation support
- `java.math` – support for big numbers
- `java.awt` and `javax.swing` – cross-platform windowing toolkits
- `java.text`– support for international text strings, dates, and numbers.
- `java.util` – generic containers and other utilities

API documentation in HTML.

Java Supports GUI Programming

JFC (Java Foundation Classes) supplies GUI components:

- Buttons, Canvases
- Checkboxes, Choices
- Dialogs
- Frames
- Labels
- Lists
- Menus, Scrollbars
- Text areas

Java Supports Networking

The `java.net` package supplies networking tools:

- `URL` object helps URL parsing, URL document reading (normal `InputStream` reading, via `openStream` method)
- `URLConnection` object allows I/O to an HTTP-server.
- `Socket` objects makes socket-based networking easier.

In addition, `RMI` enables remote object invocation and servlets support web servers.

Threads in Java

- Java uses and allows multi-threaded programs
- `Thread` class and `Runnable` interface
- Mutual Exclusion via `synchronized` methods
- Synchronization via `wait` and `notify`

Java Documentation

- Available for browsing on the Web or download to your own computer
- Demos, tutorials, guides to topics
- description of Java tools
- *Application Programming Interface* (API) specification:
  1. all packages
  2. all classes, interfaces, and exceptions within a package
  3. all member constructors, methods, and fields within a class