Java in Education

Introduction

Choosing appropriate tool for creating multimedia is the first step in multimedia design and production. Various tools that are used by educators, designers and programmers include Visual Basic, Java, Flash, Dreamweaver (standalone and web based applications) etc. This paper deals with advantages and disadvantages of using Java in Education.

Significance

Java is a powerful programming language. It can be used to create complex standalone applications or small components which can be used over the network. But its potential seems to be unexploited in the field of education. This paper discusses some significant features of Java alongwith a discussion of why Java not so popular among educators. This discussion will be helpful for an educator who wants to implement technology in education.

Discussion

What is Java?

When Java was created by Sun Microsystems in 1995 it was not for the Internet. Instead, the primary motivation was the need for a platform independent language that could be used to create software to be embedded in various consumer electronic devices. This feature of platform independence made java very useful for the Internet where all kinds

of machines are networked. Java expands the universe of objects that can be moved freely in cyberspace.

Java: A simple, object-oriented, network-savvy, interpreted, robust, secure, architecture neutral, portable, high-performance, multithreaded, dynamic language.

Features of Java

Simple: Java is an extension of C and C++ with added feature of garbage collection and improved memory management.

Object-oriented: Object oriented programming deals with objects and there behaviors and hence an analogy of real world can be found in programs.

Network-savvy: Java has an extensive library of routines for coping easily with TCP/IP protocols like HTTP and FTP. This makes creating network connections much easier

Robust: Java is intended for writing programs that must be reliable in a variety of ways. Java puts a lot of emphasis on early checking for possible problems, later dynamic (runtime) checking, and eliminating situations that are error prone.

Secure: Java is intended for use in networked/distributed environments. Toward that end, a lot of emphasis has been placed on security. the changes to the semantics of pointers make it impossible for applications to forge access to the user's hard disk.

Architecture neutral: To enable a Java application to execute anywhere on the network, the compiler generates an architecture-neutral code – bytecode which is executable on many processors, given the presence of the Java runtime system.

Portable: There are no "implementation dependent" (machine/ processor dependent) aspects of the specification. The sizes of the primitive data types (integer, float) are specified.

Interpreted: Java bytecodes are translated on the fly to native machine instructions (interpreted) and not stored anywhere.

High performance: Java Bytecode is more efficient and its interpreted nature provides high performance.

Multithreaded: Multithreading is a way of building applications with multiple threads (more than one processes running at the same time). It is useful for better interactive responsiveness and real-time behavior.

Dynamic language: Java programs carry substancial amount of run time information

Java can be used to create programs of two types: Applications and Applets.

Application: A program that runs on a computer, under the operating system of that computer (stand alone applications).

I am going to discuss applets in detail.

Applets

It is an application designed to be transimitted over the Internet and executed by java compatible web browser. An Applet is actually a tiny Java program, dynamically downloaded across the Internet just like an image or sound clip. The important difference is that applet is an intelligent program. It can react to user input and change dynamically. Most important feature of applet is security. Java creates a 'firewall' between the

networked application and computer and thus confines the program to Java environment not allowing it to access other parts of the computer. Some more distinct advantages of Applets are:

- Multimedia can be incorporated in Applets

- Applets can provide better user interaction

- Applets are platform independent and portable

- Applets support distributed and Network computing

- Main program + Graphics + User interface are all embedded in unified environment

- Java-compliant WWW browsers as well as Java compiler, run time environments are freely available.

Applets can be included in HTML document by <Applet> ….. </Applet> or <Object>……</Object>

Example :

<html>

<body>

<applet code = "hi.class" width=300 height=200>

Please get a Java compatible browser to see this.

</applet>

</html>

The applet code label (**<applet code = {filename} ...>**) tells the browser what file contains your Java code and sets up the applet's size. Also, command line parameters for the applet can be passed in from here.

Java also provides Database connectivity (Java DataBase Connectivity JDBC) to enable search, random generation of questions and other database related operations

Applets in Education

Java applets can be classified as follows for educational settings:

Informational applets: Minimal user interactivity. Similar to HELP files

Concept illustrating applets: Maximum interactivity. User learns the concept by exploring the applet

Computational applets: Good user interactivity. Exaples, Illustrations, Visualization

Assessment applets: Less interactivity. Quizz, multiple choice questions

To use applets in classroom we have two options:

In-house development of applets

Use preexisting applets

It is difficult to develop applets particularly for those having little or no prior programming experience. Hence in-house development of applets by teacher may not be feasible (although Java compiler and run time environment are free).

Java applets for education are available for free on the web. But these have to be searched for, tested and adapted for classroom use.

If applets are to be used effectively in classroom, random search for appropriate applet is not always the efficient way. The teachers might go through the following steps:

Getting Ready

- Decide what you want to teach.

- Go to the Java Applet Library

- Search and shortlist 2 to 5 applets (no thourough search at this step)

- Decide what kind of applet you want to use (Informational/ concept illustrating/ computational/ assessment)

- Check out the shortlisted applets for functionality

Preparing the lesson

- Visualize the complete lesson (for what part of the lesson you are using applet)

- Logistics – Computer availability, coordinatiion etc

- Lesson plan creation – Create a clear lesson plan

Delivering the lesson

- Test with one or two students for understaning

- In class give background content knowledge

- Give instructions on using the applet and let them know the objectives

- Review the lesson for students' reactions

Feedback

- Give feedback about the applet for other teachers to use

Applet library (Search for a specific Applet on the Internet)

Java applets are available for free on the Internet. http://java.sun.com/applets/ provides some sites where the applets are available. I have provided a list of applet libraries at the end of this document. EOE (Educational Object Economy) provides an Applet Library.

But most of the applets available are for Math Education or Science Education. I could not find applets for languages or social science. Some sites also give an easy template for applet creation/ design. Many of the applet libraries are found to be associated with various learning communities. On some sites like EOE teacher can even send a request if she wants some change/enhancement in some applet. These applets are of different types – Informational/concept illustrating/ computational/ assessment. Once the teacher has a shortlist of 2 to 5 applets she should check every applet for functionality. She should also see if the instructions provided are sufficient and if the applet satisfies the instructional objectives.

Java vs. Flash

So why is Java not as popular in education field as it was about two years back. Has Flash overtaken Java? What are the similarities and differences between Flash and Java? Can we use Flash for everything that can be accomplished with Java?

Let us discuss some of these questions here.

Java is a full blown programming language whereas Flash is mainly Animation tool (although it is equipped with ActionScript it is mainly for FrontEnd design). We can't really compare Java and Flash. They have different purposes different forte. But Java Applets can be compared to Flash. Both support multimedia and both were created to operate on the Internet.

Java	Flash
File size larger.	File size shorter.
Slow download.	Fast download.

No visual environment for design.	Visual coding environment.
Inefficient use of graphic element (eg bitmaps).	Supports a wide range of graphic elements (gif) and features (opacity).
Available for free.	Has to be purchased from Macromedia.
Open ended.	Very closed.
Scalable to any processor driven platforms (computers,cell phones, smart cards etc).	Not scalable.
Integrates easily with other web page elements.	Less so.
Look of the applications (bitmap/raster) depends on the designer.	Applications have a vector graphic look.
Complex computations easier in Java.	Complex computations or complex logic difficult to implement.
More secure.	Less secure.

Summary

In reality Flash can not replace Java because Java is a programming language with very high capabilities. But in the field of education where most of the applications do not require complex computing but high quality graphics and faster download rates, Flash seems to have overtaken Java. Most obvious reason for this is the ease of use. With the visual developing environment of Flash it is easy to create simple animations quickly which is not so easy with Java. But Java provides more user interactivity, more

dynamism, database connectivity, memory management, garbage collection, reusability and free open ended use because of which Java has maintained its own place.

References and Related Links

Use of Applets in Mathematics Edcuation

http://www.utc.edu/~cpmawata/instructor/tsukuba1.htm

Use of Applets in Chemistry Education

http://ir.chem.cmu.edu/irproject/applets/

Use of Applets in Physics Education

http://www3.adnc.com/~topquark/fun/fun.html

Applets for K-12 developed in UIUC

http://www.mste.uiuc.edu/java/

Educational Object Economy (Applet Library)

http://www.eoe.org/index.htm

Lessons for creating simple Applets

http://www.ies.co.jp/math/javalesson/menu.html

Educational Java Program

http://www.arcytech.org/java/java.shtml

Java Applets in Education

http://tech.irt.org/articles/js151/index.htm

The Java Language Overview

http://java.sun.com/docs/overviews/java/java-overview-1.html

Java vs. Flash

http://www.winneronline.com/articles/september2002/javavsflash.htm

This paper is written by Kavita Karandikar for the course EDC385G Interactive Multimedia Design &

Production at the University or Texas - Austin