core WEB programming

Introduction to Java

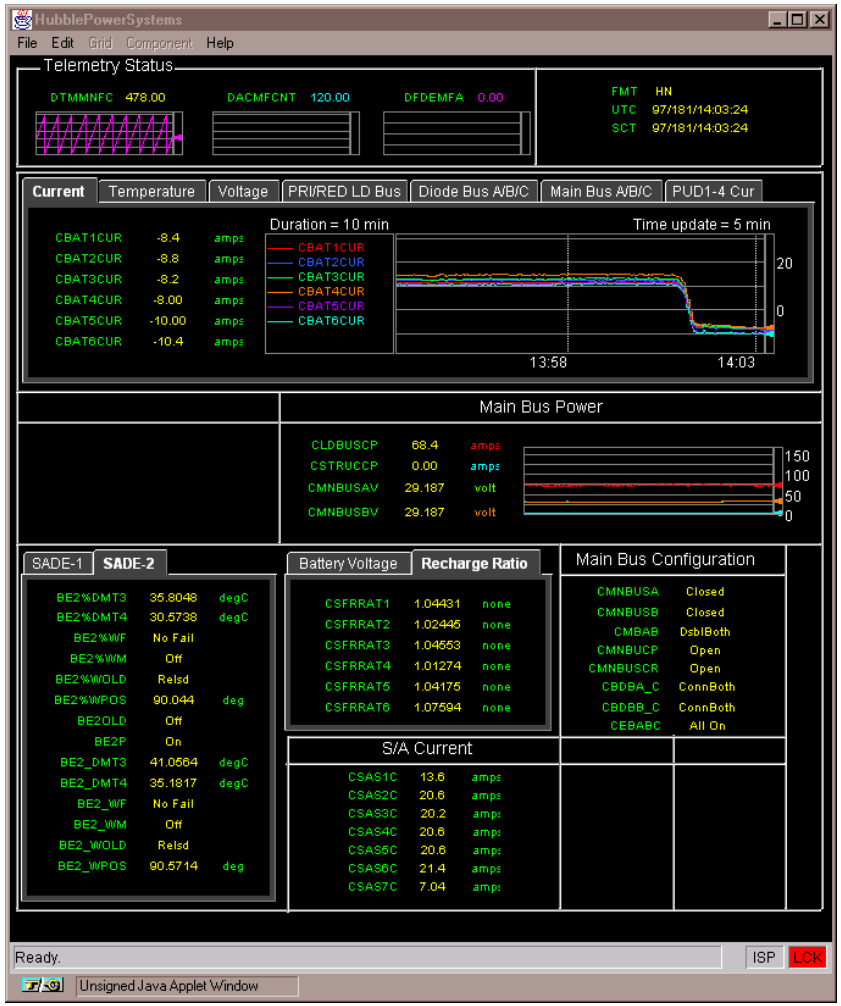
Agenda

- Unique Features of Java
- Java versions
- Installation and running Java programs
- Basic Hello World application
- Command line arguments
- Basic Hello WWW applet

Java is Web-Enabled and Network Savvy

- **Safety in Java programs can be enforced**
  - Array bounds never violated; no address manipulation
  - Types enforced
- **The Web can deliver Software**
  - No more installation or updates; just a bookmark
- **Java's client/server library is easy to use**
  - Ordinary mortals can do network programming
- **Distributed Object Protocol and DBMS API**
  - RMI and JDBC

Hubble Space Telescope Monitoring



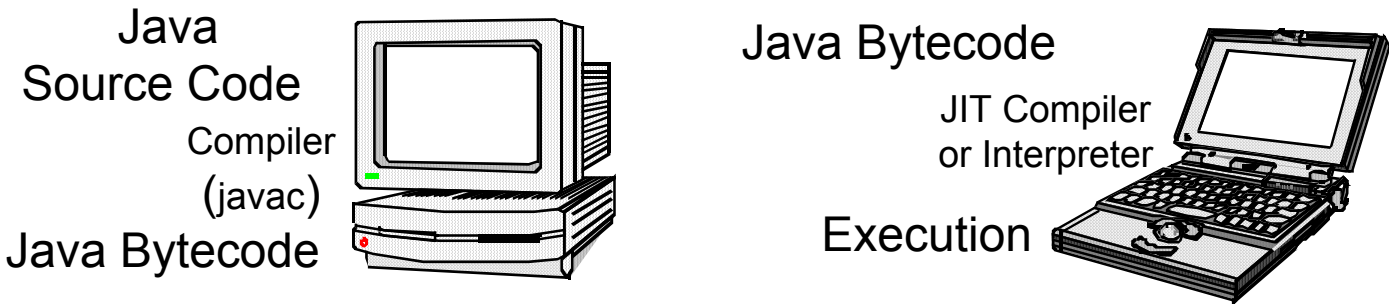
"NASA Goddard's Most Successful Software Project Ever"

Mars Pathfinder Mission Simulator

Used for world-wide data viewing

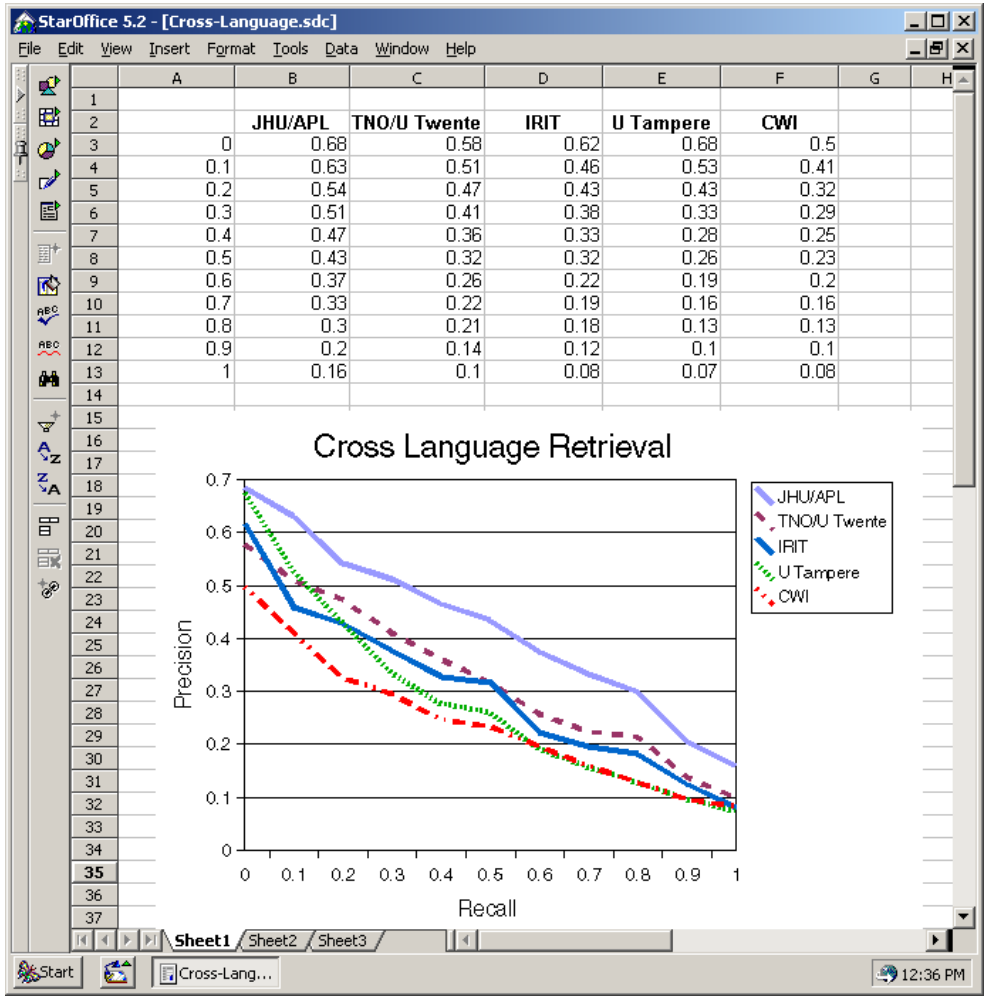
Java is Cross Platform

- **Compiles to machine-independent bytecode**



- **Windows, MacOS, OS/2, Solaris, …**
- **Java has a portable graphics library**
- **Java avoids hard-to-port constructs**

StarOffice 5.2



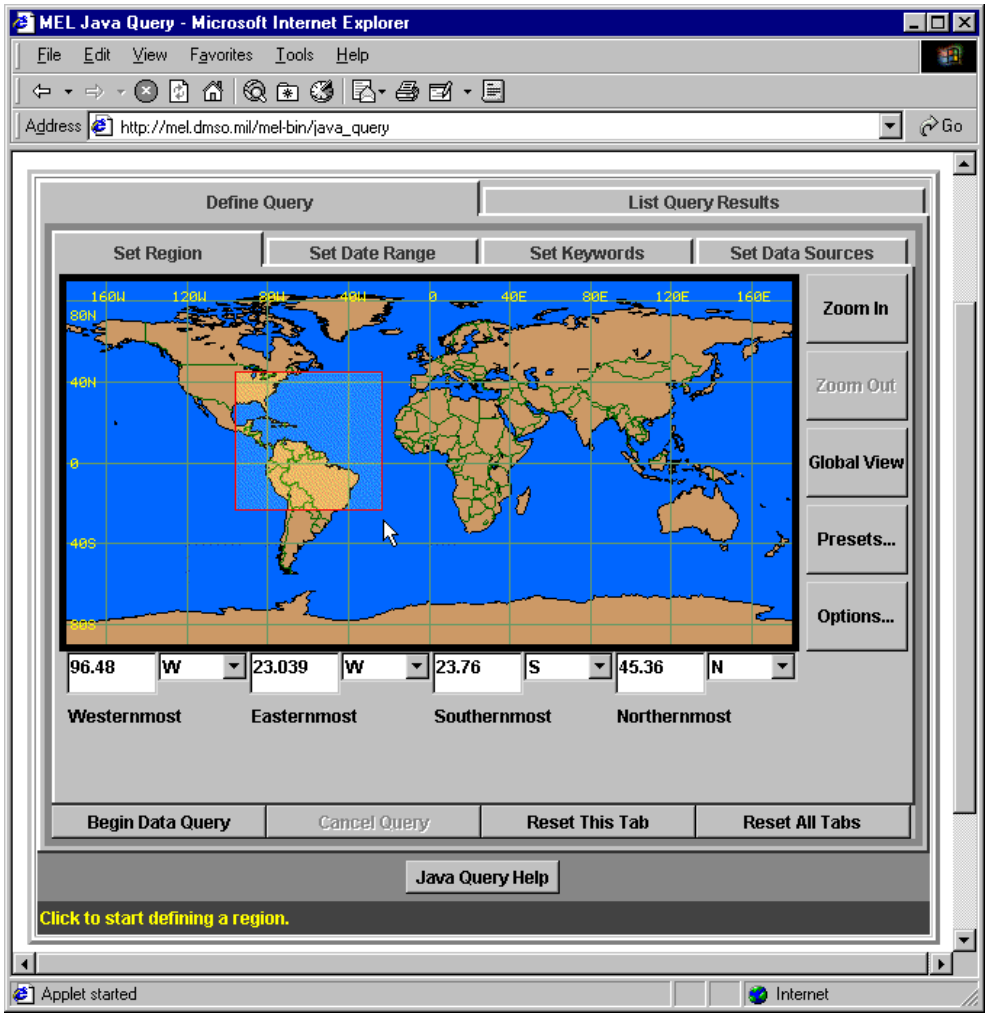
	A	B	C	D	E	F
2		JHU/APL	TNO/U Twente	IRIT	U Tampere	CWI
3	0	0.68	0.58	0.62	0.68	0.5
4	0.1	0.63	0.51	0.46	0.53	0.41
5	0.2	0.54	0.47	0.43	0.43	0.32
6	0.3	0.51	0.41	0.38	0.33	0.29
7	0.4	0.47	0.36	0.33	0.28	0.25
8	0.5	0.43	0.32	0.32	0.26	0.23
9	0.6	0.37	0.26	0.22	0.19	0.2
10	0.7	0.33	0.22	0.19	0.16	0.16
11	0.8	0.3	0.21	0.18	0.13	0.13
12	0.9	0.2	0.14	0.12	0.1	0.1
13	1	0.16	0.1	0.08	0.07	0.08

Cross-platform office suite completely written in Java

Java is Simple

- **Java has automatic memory management**
  - No dangling pointers
  - No memory leaks
- **Java simplifies pointer handling**
  - No reference/dereference operations
- **No makefiles/No header files**
- **C++ syntax streamlined**

MEL - Master Environmental Library



Interactive geospatial data discovery and retrieval

Java is Object Oriented

- **All functions are associated with objects**
  - "Member functions" are only functions
  - Some describe it "object-obsessed"
- **Almost all datatypes are objects**
  - Files, arrays, strings, sockets, etc.
  - Still have "primitive" types for efficiency
    - byte, short, int, long, float, double, char, boolean
- **`Object` is a common ancestor of all classes**

Java is Rich with Powerful Standard Libraries

- **Threads (lightweight processes)**
- **Building and using data structures – Java Foundation Classes**
- **Parsing strings/streams**
  - JDK 1.4 supports Regular Expressions
- **Arbitrary precision integers and fixed-point arithmetic**
- **Serialization (saving object state to disk or sending via socket)**
- **Invoking remove objects – RMI**
- **Interfacing with relational databases – JDBC**
- **And many more …**

Java Versions

- **Java 1.0 released in 1995**
- **Java 1.1 released in early 1997**
  - A new event-handling model based on listeners
  - Remote method invocation (RMI) and object serialization
  - Support for inner and anonymous classes
  - Arbitrary precision integers and floating-point numbers
  - Java DataBase Connectivity (JDBC) API for connecting relations databases
  - JavaBeans component architecture (Java's answer to ActiveX)
  - Digitally signed applets to extended security privileges without resorting to the "all or nothing" model of browser plug-ins or ActiveX

Java Versions, cont.

- **Java 2 Platform released in December 1998**
- **Standard Edition (JDK 1.2)**
  - Swing GUI components based on 100% Pure Java
  - Java 2D for professional, high-quality, two-dimensional graphics and imaging
  - The Collections Framework supporting advanced data structures like linked lists, trees, and sets
  - Audio enhancements to support .wav, .aiff, .au, .midi, and .rmf file formats
  - Printing of graphic objects
  - Java IDL API, which adds CORBA capability to Java

Java Versions, cont.

- **JDK 1.3 released in Spring of 2000**
  - Major Enhancements:
    - Java Naming and Directory Interface (JNDI)—a directory service for registering and looking up resources (objects)
    - RMI-IIOP—a protocol to communicate with distributed clients that are written in CORBA-compliant language
- **JDK 1.4 released in Spring 2002**
  - Major Enhancements
    - XML Processing
    - Logging API
    - Assertions
    - Next generation I/0 library (java.nio)
    - SSL
    - JAAS – authentication and authorization API

Java 2 Platform, Enterprise Edition

- **Focused at e-commerce solutions**
  - Java Servlets and JavaServer Pages—Sun's answer to Microsoft Active Server Pages and ColdFusion
  - Enterprise JavaBeans for bundling business logic in server-side components
  - JDBC data access for scrollable database queries (result sets)
  - JavaMail to send and receive mail with SMTP, POP3, or IMAP4 protocols
  - JAXP for parsing XML documents
  - Java Message Service for asynchronous communication between enterprise applications

Which Version Should You Use?

- **Applets**
  - Use JDK 1.1
  - Internet Explorer 4.0 and later and Netscape 4.06 through 4.72 support JDK 1.1. Netscape 6 and later support JDK 1.3.
  - Java Plug-In is required for later versions of Java
- **Applications**
  - For standard applications use JDK 1.4 (known as Java 2 SDK, Standard Edition, Version 1.4)
- **Best Approach**
  - Use JDK 1.4, but bookmark the JDK 1.1 API to check available methods when writing applets

Getting Started: Nuts and Bolts

1. **Install Java**
   - JDK 1.4
     - http://java.sun.com/j2se/1.4/
   - JDK 1.1
     - No longer supported by Sun
     - Compile to JDK 1.1 byte code using –target directive
2. **Install a Java-Enabled Browser**
   - Netscape Navigator
     - http://home.netscape.com/download/
   - Microsoft Internet Explorer
     - http://www.microsoft.com/ie/download/
   - Sun's HotJava
     - http://java.sun.com/products/hotjava/

Getting Started: Nuts and Bolts, cont.

3. **Bookmark or install the on-line Java API**
   - Java 2 SDK, Version 1.4 (JDK 1.4)
     - API Specification, http://java.sun.com/j2se/1.4.2/docs/api/
     - API Download, http://java.sun.com/j2se/1.4.2/download.html#docs
   - Java 1.1(JDK 1.1)
     - API and Documentation, http://java.sun.com/products/archive/jdk/1.1/index.html

4. **Create and run a Java program**
   - Create the file
   - Compile it
   - Run it

Getting Started: Details

1. **Create the File**
   - Write and save a file (say `Test.java`) that defines public class `Test`
   - File and class names are case sensitive and must match exactly
2. **Compile the program**
   - Compile `Test.java` through

```
javac Test.java
```

     - This step creates a file called `Test.class`
   - If you get a "deprecation" warning, this means you are using a Java construct that has a newer alternative
     - Use "`javac -deprecation Test.java`" for an explanation, then look the newer construct up in the on-line API

Getting Started: Details, cont.

3. Run the program

- For a stand-alone application, run it through

```
java Test
```

  - Note that the command is `java`, not `javac`, and that you refer to `Test`, not `Test.class`

- For an applet that will run in a browser, run it by loading the WWW page that refers to it

Basic Hello World Application

- **"Application" is Java lingo for a stand-alone Java program**
  - Note that the class name and the filename match
  - A file can contain multiple classes, but only one can be declared public, and that one's name must match the filename
- **File HelloWorld.java:**

```
public class HelloWorld {
  public static void main(String[] args) {
    System.out.println("Hello, world.");
  }
}
```

Basic Hello World Application, cont.

- **Compiling:**
  - javac HelloWorld.java
- **Running:**
  - java HelloWorld
- **Output:**
  - Hello, world.

Command Line Arguments

- **Differences from C**
  - In Java String is a real type
  - Java arrays have an associated length
  - The file name is not part of the command line arguments
- **File ShowArgs.java:**

```
public class ShowArgs {
  public static void main(String[] args) {
    for(int i=0; i<args.length; i++) {
      System.out.println("Arg " + i + " is " +
args[i]);
    }
  }
}
```

Command Line Arguments, Results

- **Compiling and Running:**

```
> javac ShowArgs.java
> java ShowArgs fee fie foe fum

Arg 0 is fee
Arg 1 is fie
Arg 2 is foe
Arg 3 is fum
```

Basic Hello WWW Applet

- File HelloWWW.java:

```
import java.applet.Applet;
import java.awt.*;

public class HelloWWW extends Applet {
  public void init() {
    setBackground(Color.gray);
    setForeground(Color.white);
    setFont(new Font("SansSerif", Font.BOLD, 30));
  }

  public void paint(Graphics g) {
    g.drawString("Hello, World Wide Web.", 5, 35);
  }
}
```

Basic Hello WWW Applet, cont.

- **File HelloWWW.html:**

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0
   Transitional//EN">
<HTML>
<HEAD>
  <TITLE>HelloWWW: Simple Applet Test.</TITLE>
</HEAD>

<BODY>
<H1>HelloWWW: Simple Applet Test.</H1>

<APPLET CODE="HelloWWW.class" WIDTH=400 HEIGHT=40>
  <B>Error! You must use a Java enabled browser.</B>
</APPLET>

</BODY>
</HTML>
```

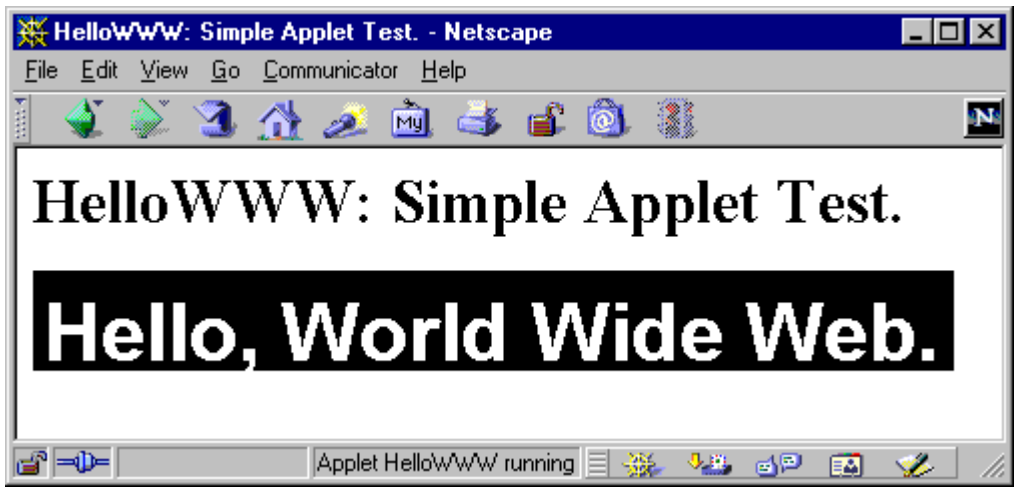
Basic Hello WWW Applet, cont.

- **Compiling:**

```
javac -target 1.1 HelloWWW.java
```

- **Running:**

  Load `HelloWWW.html` in a Java-enabled browser



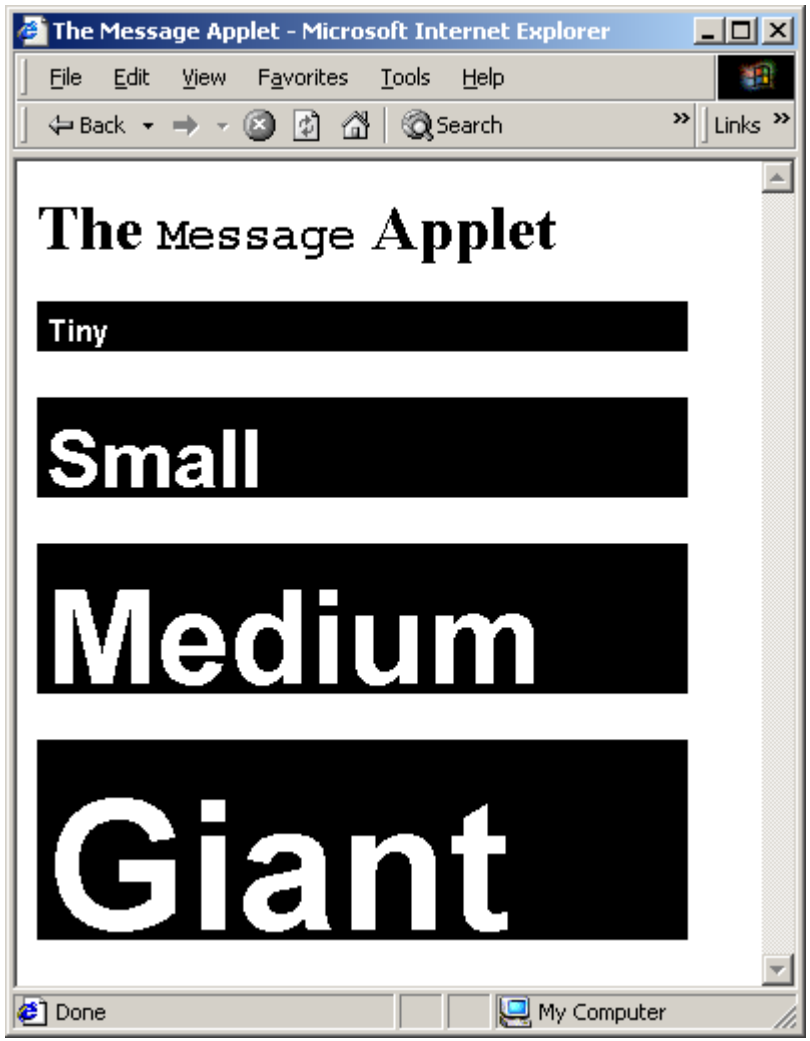
Customizing Applets with PARAM

```
import java.applet.Applet;
import java.awt.*;

public class Message extends Applet {
  private int fontSize;
  private String message;

  public void init() {
    setBackground(Color.black);
    setForeground(Color.white);
    fontSize = getSize().height - 10;
    setFont(new Font("SansSerif", Font.BOLD, fontSize));
    // Read heading message from PARAM entry in HTML.
    message = getParameter("MESSAGE");
  }

  public void paint(Graphics g) {
    if (message != null)
      g.drawString(message, 5, fontSize+5);
  }
}
```

Customizing Applets with PARAM, cont.

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">
<HTML>
<HEAD>
  <TITLE>The Message Applet</TITLE>
</HEAD>
<BODY BGCOLOR="WHITE">
<H1>The <CODE>Message</CODE> Applet</H1>
<P>
<APPLET CODE="Message.class" WIDTH=325 HEIGHT=25>
  <PARAM NAME="MESSAGE" VALUE="Tiny">
  <B>Sorry, these examples require Java</B>
</APPLET>
<P>
<APPLET CODE="Message.class" WIDTH=325 HEIGHT=50>
  <PARAM NAME="MESSAGE" VALUE="Small">
  <B>Sorry, these examples require Java</B>
</APPLET>
...
</BODY>
</HTML>
```

Customizing Applets with PARAM, Result



Summary

- Java is a complete language, supporting both standalone applications and Web development
- Java is complied to bytecode and can be run on any platform that supports a Java Virtual Machine
- Java 2 Platform is bundled as a Standard Edition and Enterprise Edition
- Most browsers support only JDK 1.1
- Install Java Plug-In for later versions of Java

core WEB programming

Questions?