



# ENCE 688R Civil Information Systems

## *Introduction to Java*

Mark Austin

E-mail: `austin@isr.umd.edu`

Department of Civil and Environmental Engineering, University of Maryland,  
College Park

# Lecture 2: Topics

## **Part 1: History and Features**

- A Little History
- The Java Buzzwords - How Java was sold in the mid 1990s.

## **Part 2: First Java Application Program**

- Source code, compilation, execution.
- Features of the source code.

## **Part 3: First Java Applet Program**

- See examples on class web page. Applets have been deprecated as of Java 9 ...

# Part 1. History and Features



## History and Features

# A Little History

## State of the World in 1990-1991

- Early 1990s. Microsoft is well on its way to ruling the software world.
- Bill Gates talks about smart televisions and smart consumer devices (e.g., coffee makers).
- At SUN Microsystems the original “Oak” programming language was written for ...  
**... the development of small multimedia applications embedded within consumer electronics devices such as toasters, microwave ovens, and personal digital assistants (PDAs).**

These so-called intelligent consumer devices have their own peculiar tasks to perform, and their day-to-day performance must be very reliable.

- SUN’s development team is incorporated into a new company named FirstPerson.
- FirstPerson fails because the marketplace for intelligent consumer electronic devices was not developing...

# A Little History

## State of the World in 1990-1991

- In the late 1980s, Tim Berners-Lee and co-workers develop the first version of the World Wide Web.
- Soon thereafter, researchers at NCSA develop Mosaic, the first graphical browser for the Web.
- The developers of Oak realized that ...
  - ... an architecture-neutral language would be ideal for programming interactive applications on the Web because a program accessed within a web page could run anywhere and without having to be installed.**
- SUN developers add functionality to the language for networking tasks.
- They also changed the name Oak to Java.

# Features

## Java Buzzwords

Here's how SUN Microsystems promoted Java in the mid 1990s ...

- Simple
- Object-Oriented
- Network Savvy (Distributed)
- Interpreted
- Architecture Neutral → Portable
- High Performance
- Robust / Secure
- Multi-Threaded

# Java Buzzword 1. Simple

**Claim: Learn Java, its simple!**

Simplicity in a programming language means ...

**... leaving out features that are not needed and making the supported features work in a clear concise way.**

**Implementation Strategy**

Experience in the development of other languages, such as C, indicates that a good way of achieving this goal is to ...

**... keep the set of language structures and reserved words small,**

and then

**... provide for additional functionality with software libraries.**

# Java Buzzword 1. Simple

**Java 6 has only 50 reserved keywords. '**

```
=====
abstract      double      int         super
assert        else        interface   switch
boolean       enum        long        synchronized
break         extends    native      this
byte          for         new         throw
case          final       package     throws
catch         finally     private     transient
char          float       protected   try
class         goto        public      void
const         if          return      volatile
continue      implements short       while
default       import     static
do            instanceof strictfp
=====
```

**Note.** The keywords goto and const are reserved, but not used in Java.

**Note.** C has only 32 keywords. Support for input/output is provided by libraries.

# Java Buzzword 1. Simple

**Reality.** Programming is hard ... **it's always hard.**

Packages in the Java Development Kit ....

**Java 1.0 (Jan. 1996).** The first public release of Java contained 212 classes organized into **8 packages**.

**Java 1.4 (Feb. 2002).** The major release increased the number of classes to 2,991 classes and interfaces located in **135 packages**.

....

**Java 1.7 (July, 2011).** New support for dynamic languages.

**Java 1.8.** Initial release, March 2014. **4240 packages**.

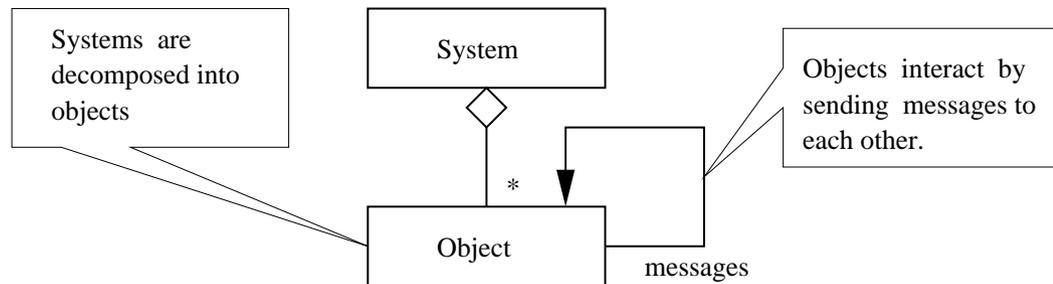
**Java 1.9.** Adds support for lambda expressions (a feature that you can play with in Python!). Released, September 2017.

**Java 1.10.** March 2018.

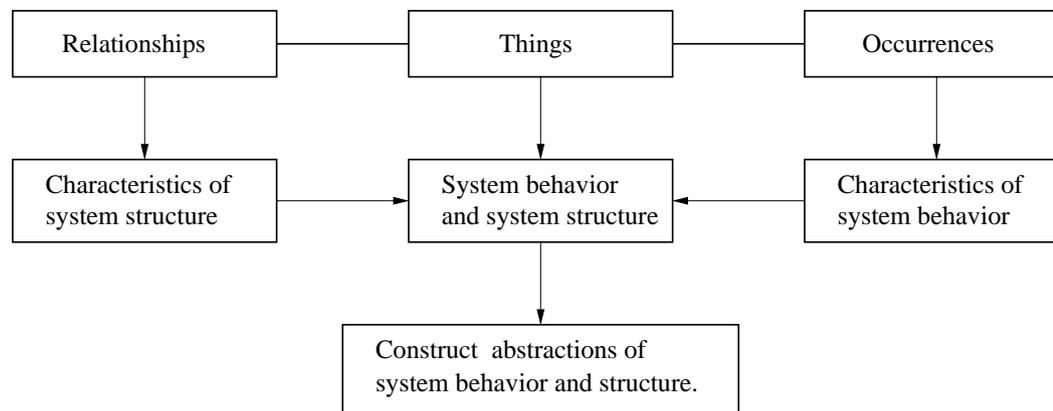
**Java 1.11.** September 2018.

# Java Buzzword 2. Object-Oriented

## Software Systems are created through the Composition of Objects



## Models have Behavior and Structure

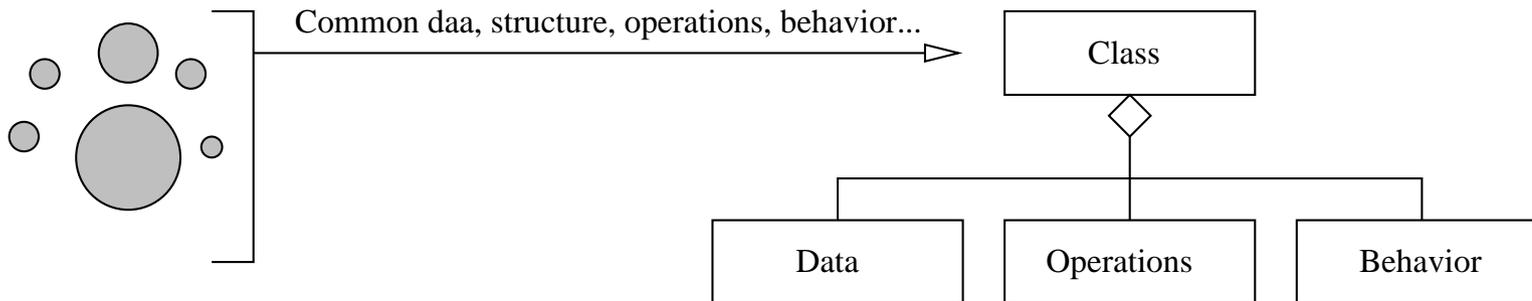


# Java Buzzword 2. Object-Oriented

## Working with Objects and Classes

1. Collections of objects share similar traits. They may store the same data and have the same structure and behavior.
2. Then, collections of objects will form relationships with other collections of objects.

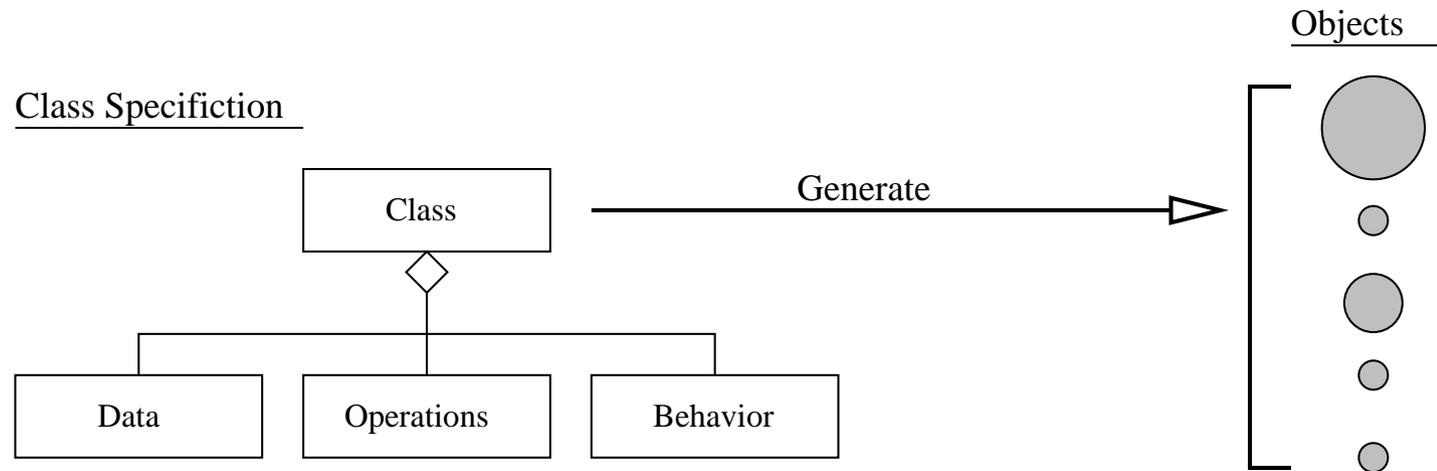
## Pathway from Collections of Objects to Classes



**A class is a specification (or blueprint) of an object's behavior and structure.**

# Java Buzzword 2. Object-Oriented

## Generation of Objects from Class Specifications



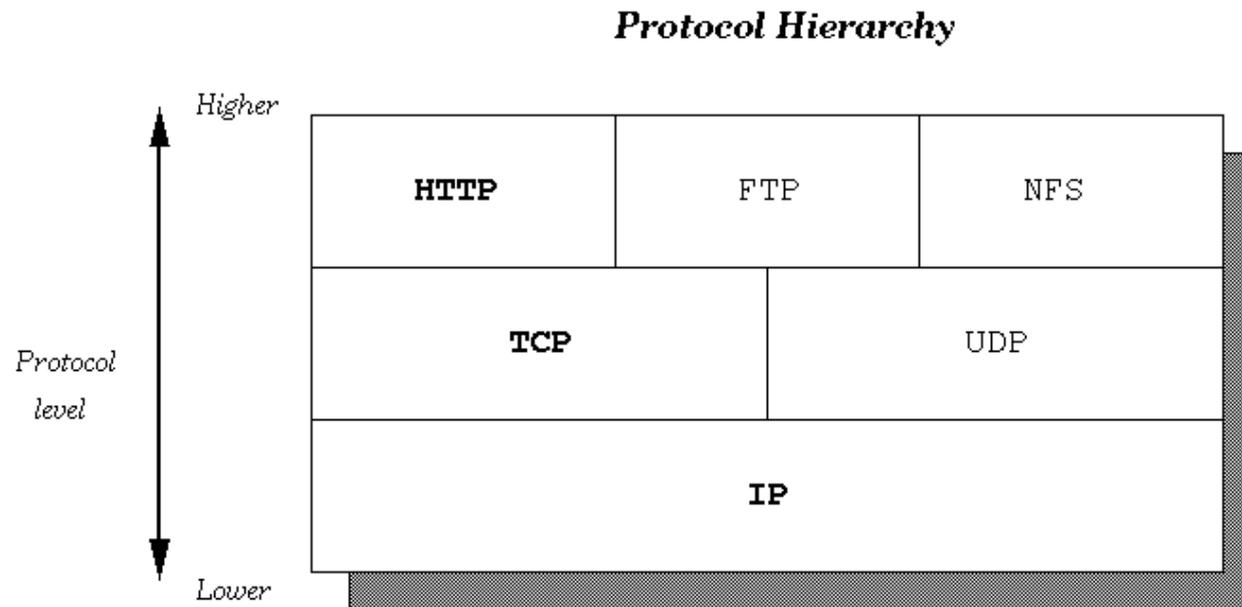
We say that ...

**... each object is an instance of a class.**

# Java Buzzword 3. Network Savvy

## Network Savvy (Distributed)

The Protocol Stack....

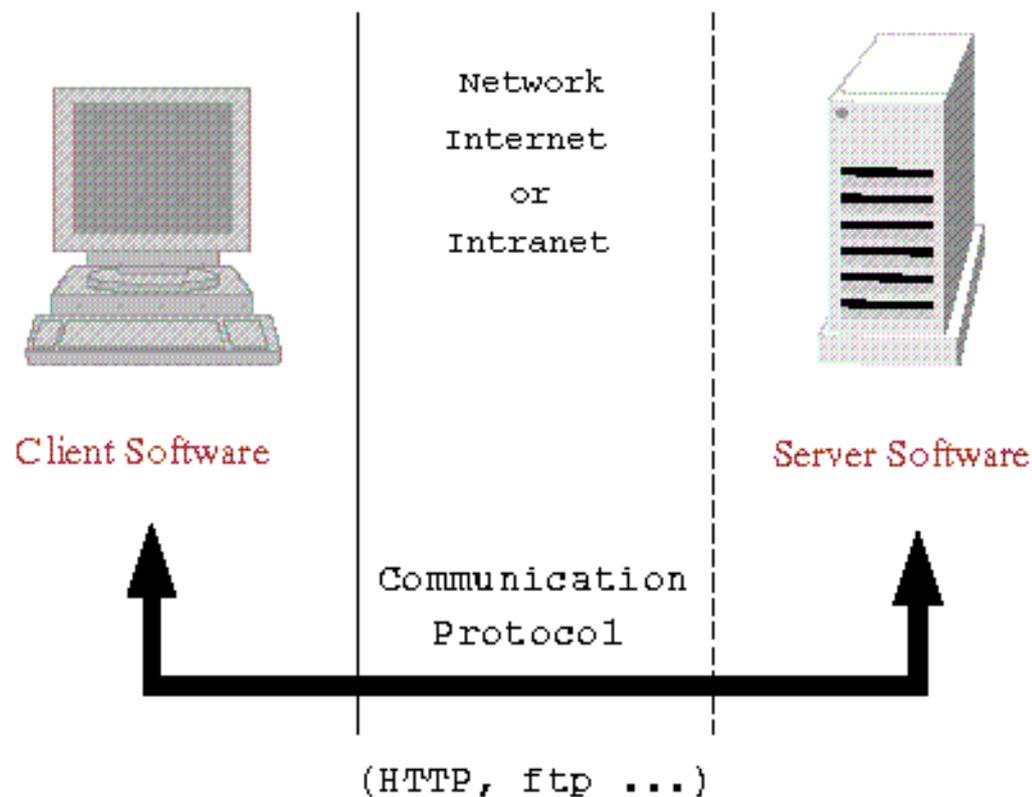


# Java Buzzword 3. Network Savvy

## Network Savvy (Distributed)

### Client/Server Architectures

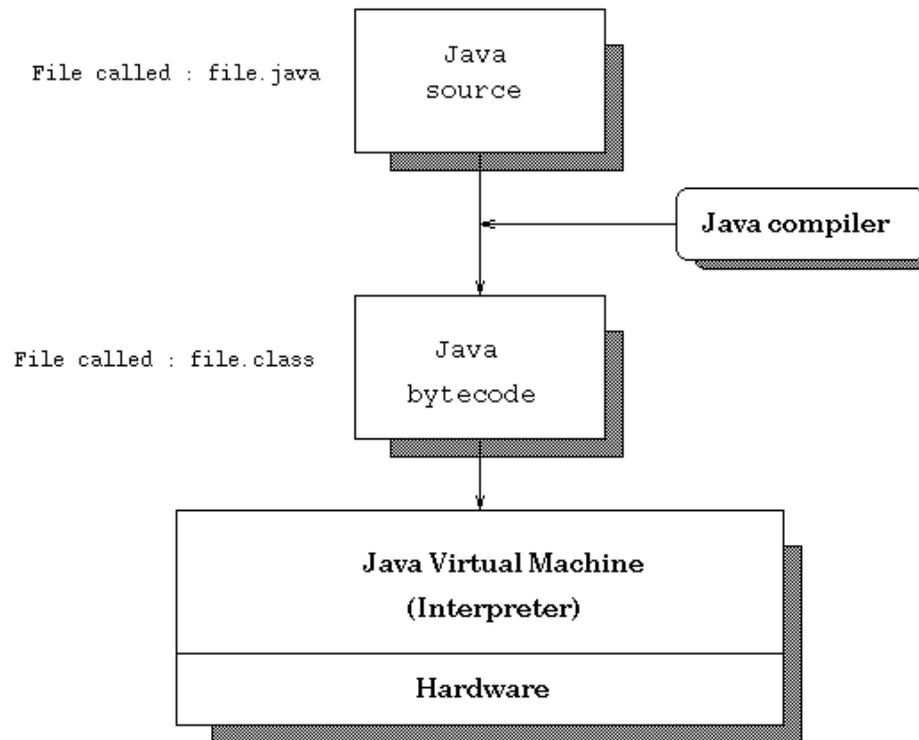
#### *Client/Server Architecture*



# Java Buzzword 4. Interpreted

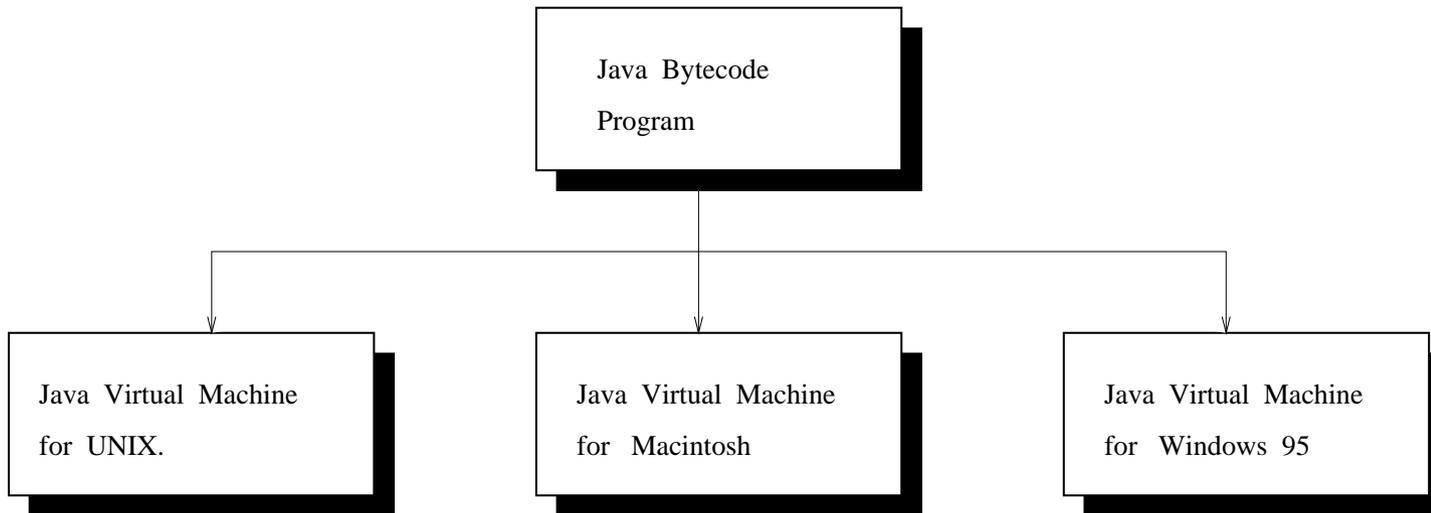
**Interpreted.** Compiling and Running a Java Program.

*Java compiling scheme*



# Java Buzzword 4. Interpreted

**Interpreted.** Execution of Java bytecodes on various platforms.

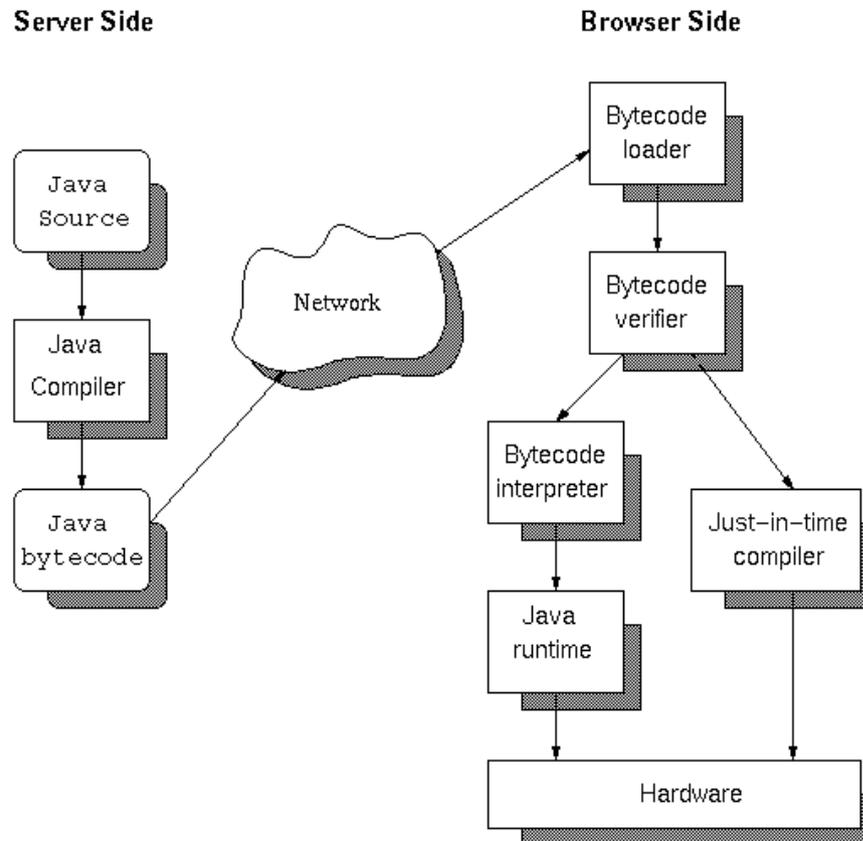


Obviously, this is an old pic!

# Java Buzzword 6. Architecture Neutral

## Compiling, Downloading, and Executing a Java Applet

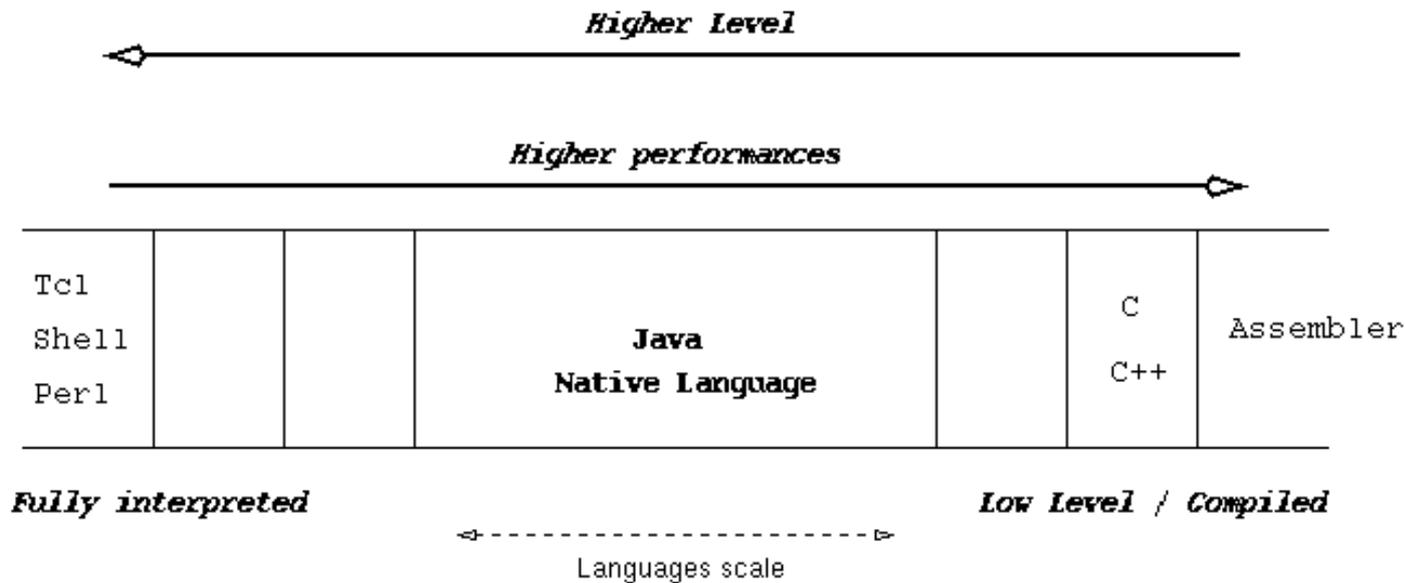
### *Executing a Java applet*



# Java Buzzword 7. High Performance

## High Performance

Where does Java sit on the scale of performance?



Just-in-time-compiler is now built into to the Java Virtual Machine!

Current systems are 10-20% slower than C++.

# Java Buzzword 8. Robust / Secure

## **Robust / Secure**

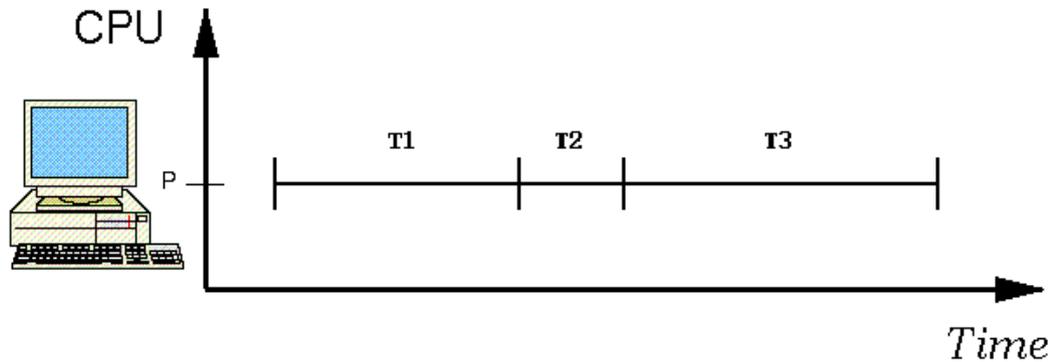
Restrictions on permissible operations can be enforced.

By default, Applets are prohibited from:

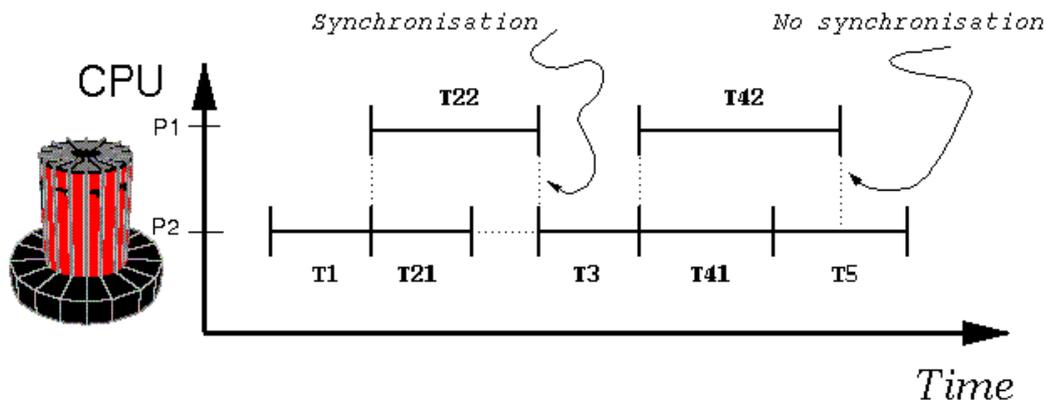
- Reading from the local disk
- Writing to the local disk
- Executing local programs
- Opening network connections other than to the HTTP server that the applet came from
- Discovering private info about user (username, directories, OS patch level, applications installed, etc.).

# Java Buzzword 9. Multi-Threaded

## Single Processor, Single Thread



## Multiple Processors, Multiple Threads



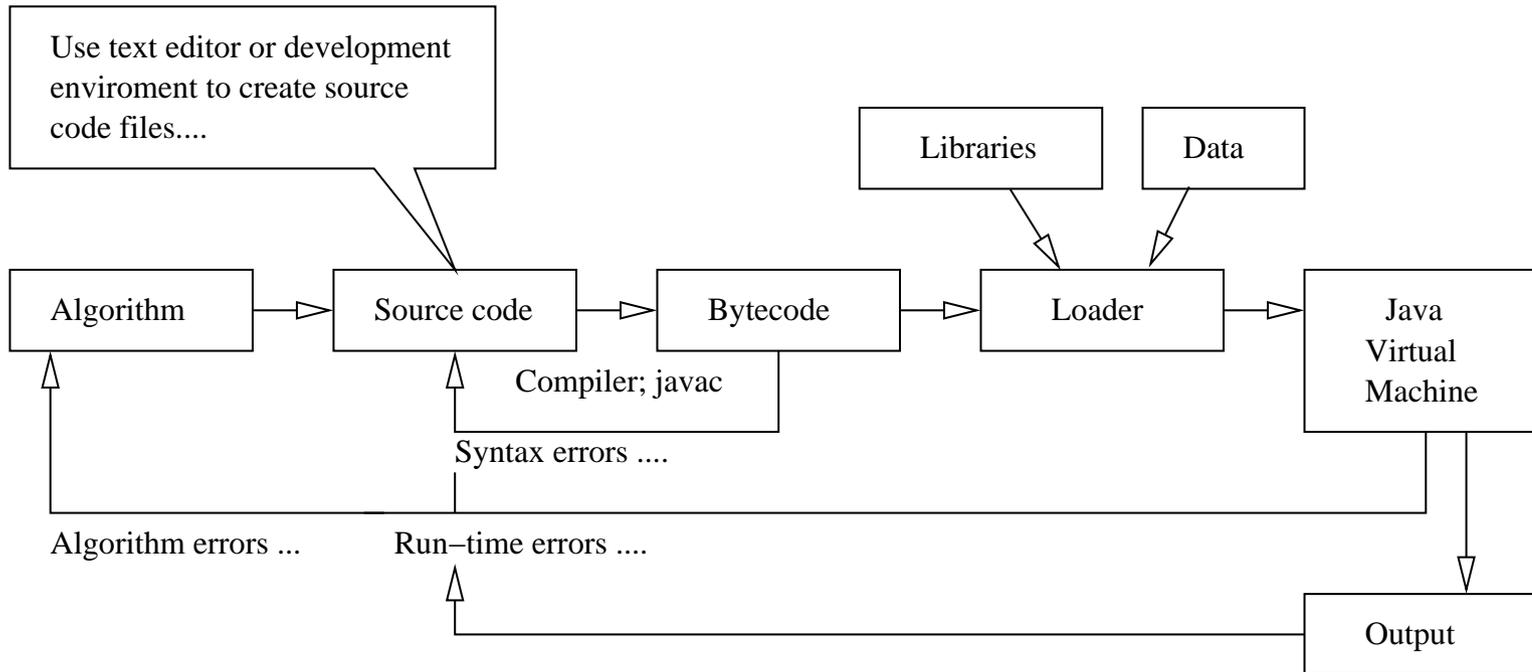
# First Java Application Program



## Part 2. First Java Application Program

# Program Development with Java

## Flowchart for Software Development in Java



# First Java Application Program

## Source Code

```
/*
 * =====
 * Peace.java: My first java program ....
 * =====
 */

public class Peace {
    public static void main ( String args[] ) {
        System.out.println( "*** Peace on Earth!" );
    }
}
```

## Compile and Run

```
prompt >> javac Peace.java
prompt >> java Peace
*** Peace on Earth!
prompt >>
```

# First Java Application Program

## Key Points. Writing and Running the Program

- The source code contains a definition for a class called `Peace`. It needs to be in a file called `Peace.java`
- The java compiler is called `javac`.
- The java virtual machine is called `java`.
- The command `javac Peace.java` compiles the source code into a bytecode file called `Peace.class`.
- The command `java Peace` executes the bytecode.

# First Java Application Program

## Key Points. Source code

- Java supports three styles of comment statement. The syntax `/* ... */` is the C-style.

- The fragment of code:

```
public class Peace { ... body of the class .... }
```

announces the class `Peace` and sets up the boundaries for the body of the class.

- `Peace` contains one user-defined method called `main()`, i.e.,

```
public static void main ( String args[] ) { ....
```

- The method declaration is defined by three keywords: (1) `public` → method can be accessed by the public, (2) `static` → it's a class method – no need to create an object first, and (3) `void` → that method does not return a value.

- The statement:

```
System.out.println( "*** Peace on Earth!" );
```

calls the method `println`, within the class `out`, within the `System` package.