



# *An Overview of Java*



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- What is Java
- Major Java features
- Java virtual machine
- Java programming language
- Java class libraries (API)
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## 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 – Servlet, 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
<code>boolean</code>	<code>true</code> or <code>false</code>
<code>char</code>	16-bit Unicode character
<code>byte</code>	signed 8-bit integer
<code>short</code>	signed 16-bit integer
<code>int</code>	signed 32-bit integer
<code>long</code>	signed 64-bit integer
<code>float</code>	32-bit floating point (IEEE 754-1985)
<code>double</code>	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



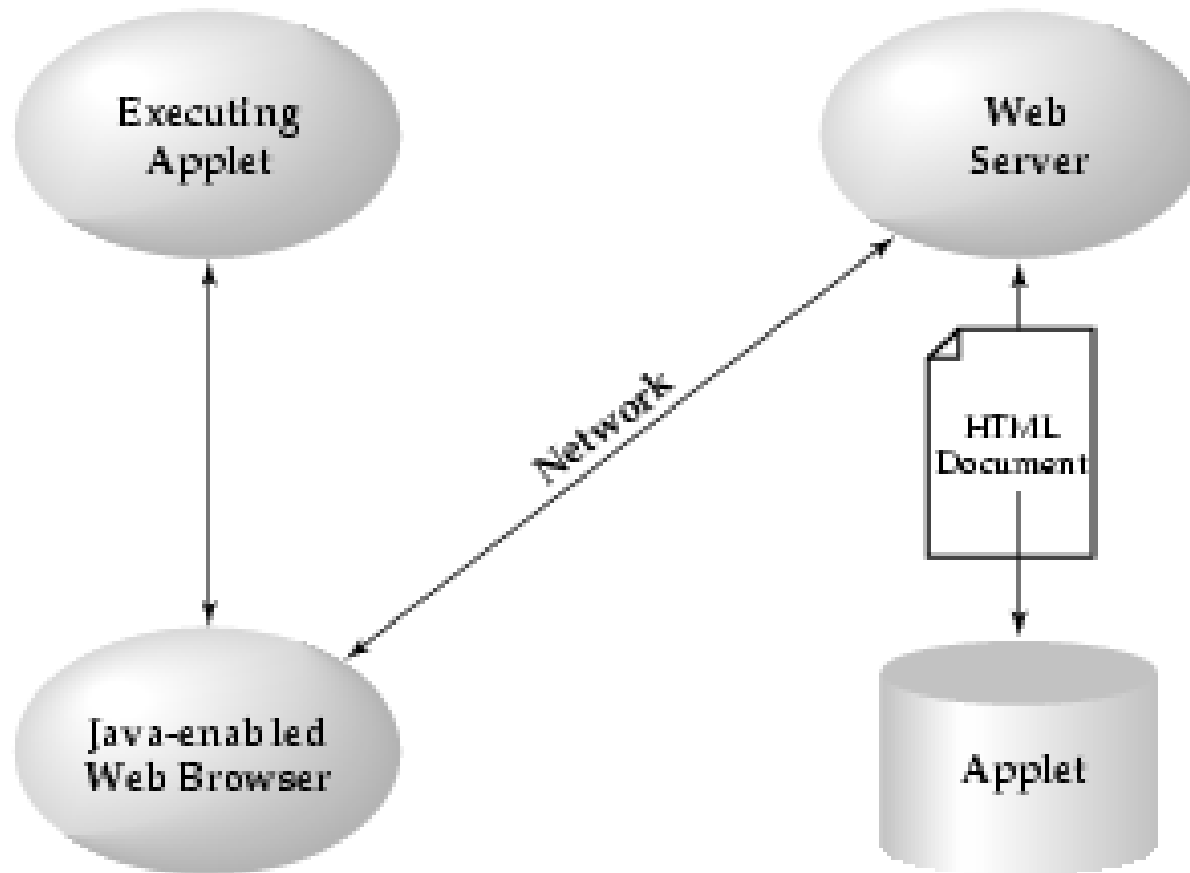
## Java Exceptions

```
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