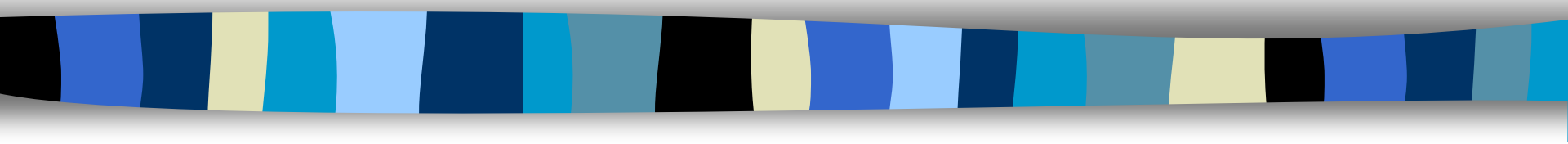
Java Tutorial



Write Once, Run Anywhere

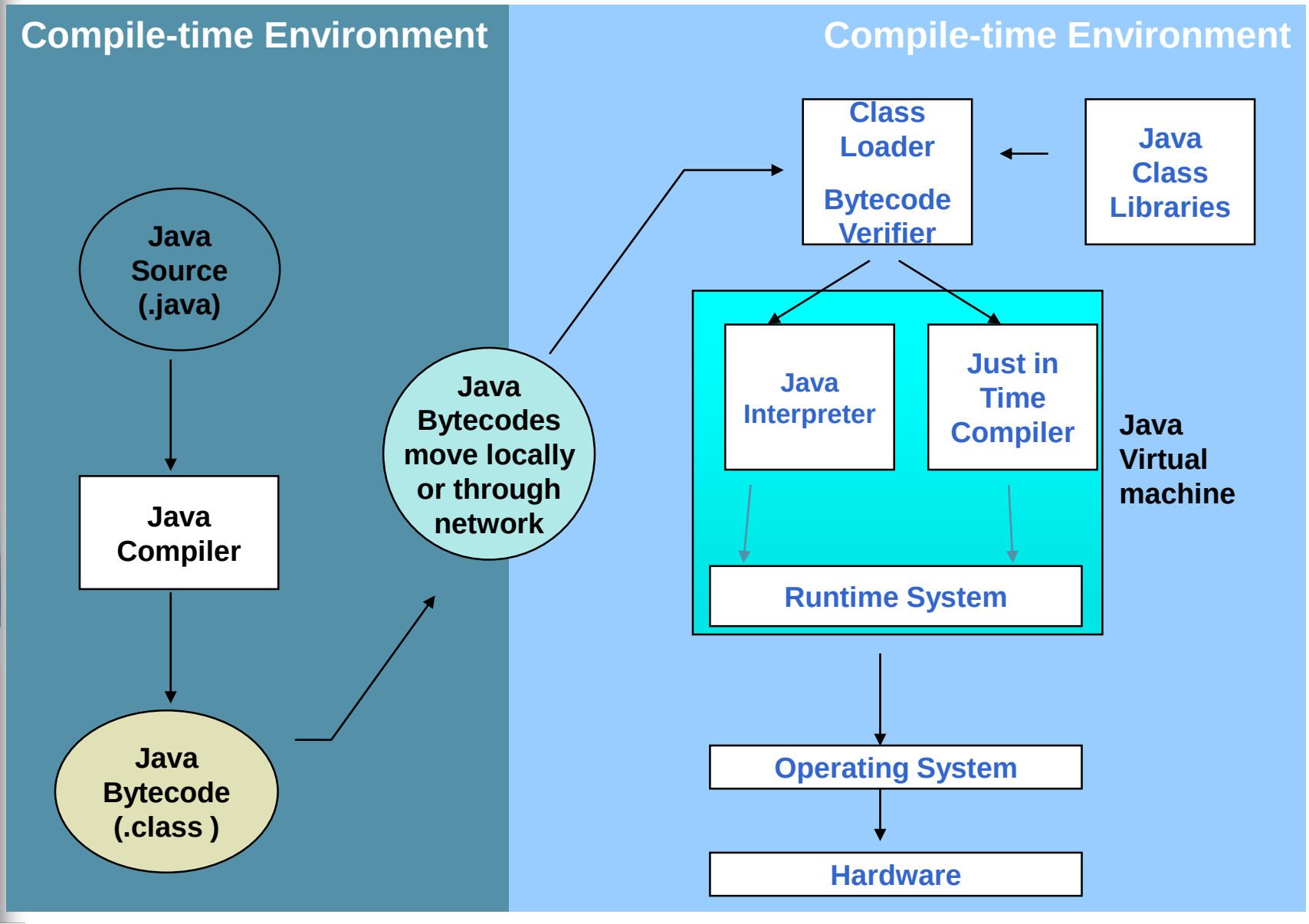
Java - General

- Java is:
  - platform independent programming language
  - similar to C++ in syntax
  - similar to Smalltalk in mental paradigm
- Pros: also ubiquitous to net
- Cons: interpreted, and still under development (moving target)

Java - General

- Java has some interesting features:
  - automatic type checking,
  - automatic garbage collection,
  - simplifies pointers; no directly accessible pointer to memory,
  - simplified network access,
  - multi-threading!

How it works…!


Compile-time Environment
Compile-time Environment
Java Source (.java)
Java Compiler
Java Bytecode (.class)
Java Bytecodes move locally or through network
Class Loader
Bytecode Verifier
Java Class Libraries
Java Interpreter
Just in Time Compiler
Java Virtual machine
Runtime System
Operating System
Hardware

How it works…!

- Java is independent only for one reason:
  - Only depends on the Java Virtual Machine (JVM),
  - code is compiled to *bytecode*, which is interpreted by the resident JVM,
  - JIT (just in time) compilers attempt to increase speed.

Java - Security

- Pointer denial - reduces chances of virulent programs corrupting host,
- Applets even more restricted -
  - May not
    - run local executables,
    - Read or write to local file system,
    - Communicate with any server other than the originating server.

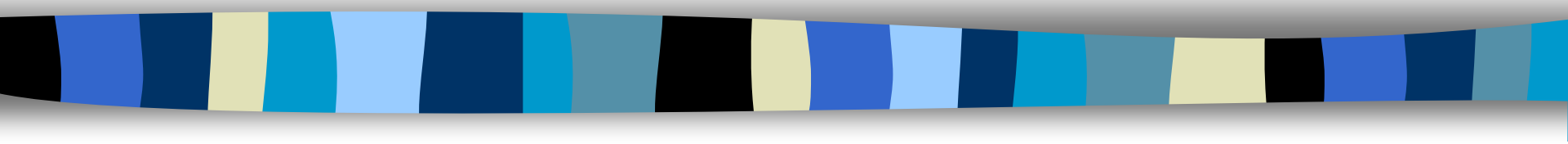
Object-Oriented

- Java supports OOD
  - Polymorphism
  - Inheritance
  - Encapsulation
- Java programs contain nothing but definitions and instantiations of classes
  - Everything is encapsulated in a class!

Java Advantages

- Portable - Write Once, Run Anywhere
- Security has been well thought through
- Robust memory management
- Designed for network programming
- Multi-threaded (multiple simultaneous tasks)
- Dynamic & extensible (loads of libraries)
  - Classes stored in separate files
  - Loaded only when needed

Basic Java Syntax



Primitive Types and Variables

- boolean, char, byte, short, int, long, float, double etc.
- These basic (or primitive) types are the only types that are not objects (due to performance issues).
- This means that you don't use the new operator to create a primitive variable.
- Declaring primitive variables:

```
float initVal;
int retVal, index = 2;
double gamma = 1.2, brightness
boolean valueOk = false;
```

Initialisation

- If no value is assigned prior to use, then the compiler will give an error
- Java sets primitive variables to zero or false in the case of a boolean variable
- All object references are initially set to null
- An array of anything is an object
  - Set to null on declaration
  - Elements to zero false or null on creation

Declarations

```
int index = 1.2;                  // compiler error
boolean retOk = 1;                // compiler error
double fiveFourths = 5 / 4;   // no error!
float ratio = 5.8f;               // correct
double fiveFourths = 5.0 / 4.0;   // correct
```

- 1.2f is a float value accurate to 7 decimal places.
- 1.2 is a double value accurate to 15 decimal places.

Assignment

- All Java assignments are right associative

```
int a = 1, b = 2, c = 5
a = b = c
System.out.print(
“a= “ + a + “b= “ + b + “c= “ + c)
```

- **What is the value of a, b & c**
- **Done right to left: a = (b = c);**

Basic Mathematical Operators

- **`* / %` + – are the mathematical operators**
- **`* / %` have a higher precedence than + or –**

```
double myVal = a + b % d – c * d / b;
```

- **Is the same as:**

```
double myVal = (a + (b % d)) –
                    ((c * d) / b);
```

Statements & Blocks

- A simple statement is a command terminated by a semi-colon:

  name = “Fred”;

- **A block is a compound statement enclosed in curly brackets:**

  {

  name1 = “Fred”; name2 = “Bill”;

  }

- **Blocks may contain other blocks**

Flow of Control

- Java executes one statement after the other in the order they are written
- Many Java statements are flow control statements:

Alternation:	**if, if else, switch**
Looping:	**for, while, do while**
Escapes:	**break, continue, return**

If – The Conditional Statement

- **The if statement evaluates an expression and if that evaluation is true then the specified action is taken**

```
if ( x < 10 ) x = 10;
```

- **If the value of x is less than 10, make x equal to 10**
- **It could have been written:**

```
if ( x < 10 )
x = 10;
```

- **Or, alternatively:**

```
if ( x < 10 ) { x = 10; }
```

Relational Operators

==	Equal (careful)
!=	Not equal
>=	Greater than or equal
<=	Less than or equal
>	Greater than
<	Less than

If… else

- The if … else statement evaluates an expression and performs one action if that evaluation is true or a different action if it is false.

```
if (x != oldx) {
  System.out.print("x was changed");
}
else {
  System.out.print("x is unchanged");
}
```

Nested if … else

```
if ( myVal > 100 ) {
  if ( remainderOn == true) {
     myVal = mVal % 100;
  }
  else {
   myVal = myVal / 100.0;
  }
}
else
{
  System.out.print("myVal is in range");
}
```

else if

- Useful for choosing between alternatives:

```
if ( n == 1 ) {
  // execute code block #1
}
else if ( j == 2 ) {
  // execute code block #2
}
else {
  // if all previous tests have failed,
  execute code block #3
}
```

A Warning…

WRONG!

```
if( i == j )
     if ( j == k )
      System.out.print(
         "i equals k");
     else
      System.out.print(
      "i is not equal
      to j");
```

CORRECT!

```
if( i == j ) {
   if ( j == k )
   System.out.print
("i equals k");
}
else
   System.out.print
("i is not equal
to j"); // Correct!
```

The switch Statement

```
switch ( n ) {
  case 1:
   // execute code block #1
   break;
  case 2:
   // execute code block #2
   break;
   default:
   // if all previous tests fail then
   //execute code block #4
   break;
}
```

The for loop

- Loop n times

```
for ( i = 0; i < n; n++ ) {
  // this code body will execute n times
  // ifrom  0 to n-1
}
```

- **Nested for:**

```
for ( j = 0; j < 10; j++ ) {
  for ( i = 0; i < 20; i++ ){
   // this code body will execute 200 times
  }
}
```

while loops

```
while(response == 1) {
  System.out.print( "ID =" +
  userID[n]);
  n++;
  response = readInt( "Enter ");
}
```

What is the minimum number of times the loop is executed?

What is the maximum number of times?

do {… } while loops

```
do {
  System.out.print( "ID =" + userID[n] );
  n++;
  response = readInt( "Enter " );
}while (response == 1);
```

What is the minimum number of times the loop is executed?

What is the maximum number of times?

Break

- **A break statement causes an exit from the innermost containing while, do, for or switch statement.**

```
for ( int i = 0; i < maxID, i++ ) {
  if ( userID[i] == targetID ) {
   index = i;
   break;
  }
} // program jumps here after break
```

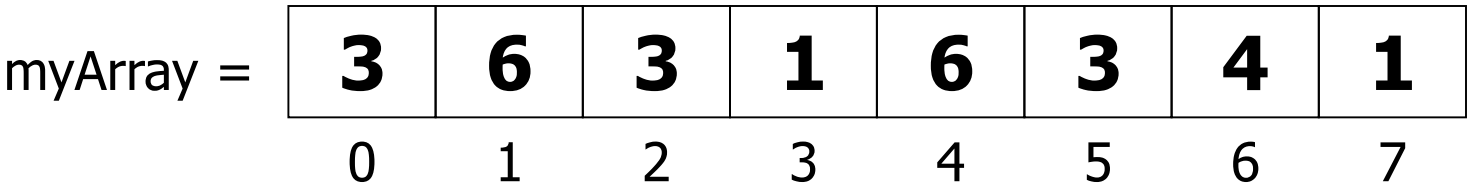
Continue

- Can only be used with while, do or for.
- The continue statement causes the innermost loop to **start the next iteration immediately**

```
for ( int i = 0; i < maxID; i++ ) {
  if ( userID[i] != -1 ) continue;
  System.out.print( "UserID " + i + " :" +
   userID);
}
```

Arrays

- Am array is a list of similar things
- An array has a fixed:
  - name
  - type
  - length
- These must be declared when the array is created.
- Arrays sizes cannot be changed during the execution of the code



myArray has room for 8 elements

- the elements are accessed by their index
- in Java, array indices start at 0

Declaring Arrays

int myArray[];

declares *myArray* to be an array of integers

myArray = new int[8];

sets up 8 integer-sized spaces in memory, labelled *myArray[0]* to *myArray[7]*

int myArray[] = new int[8];

combines the two statements in one line

Assigning Values

- **refer to the array elements by index to store values in them.**

  myArray[0] = 3;

  myArray[1] = 6;

  myArray[2] = 3; ...

- **can create and initialise in one step:**

  int myArray[] = {3, 6, 3, 1, 6, 3, 4, 1};

Iterating Through Arrays

- *for* loops are useful when dealing with arrays:

```
for (int i = 0; i <
  myArray.length; i++) {
   myArray[i] = getsomevalue();
}
```