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# More about Using Java, and Programming Languages for Information Applications

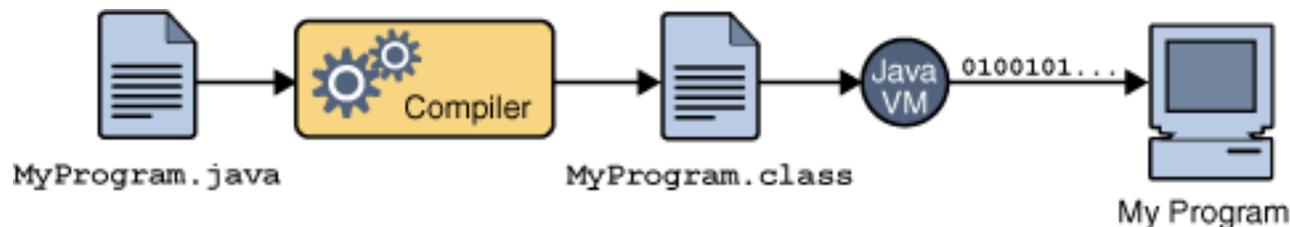
IST 256

Application Programming for Information Systems

# Java software development process

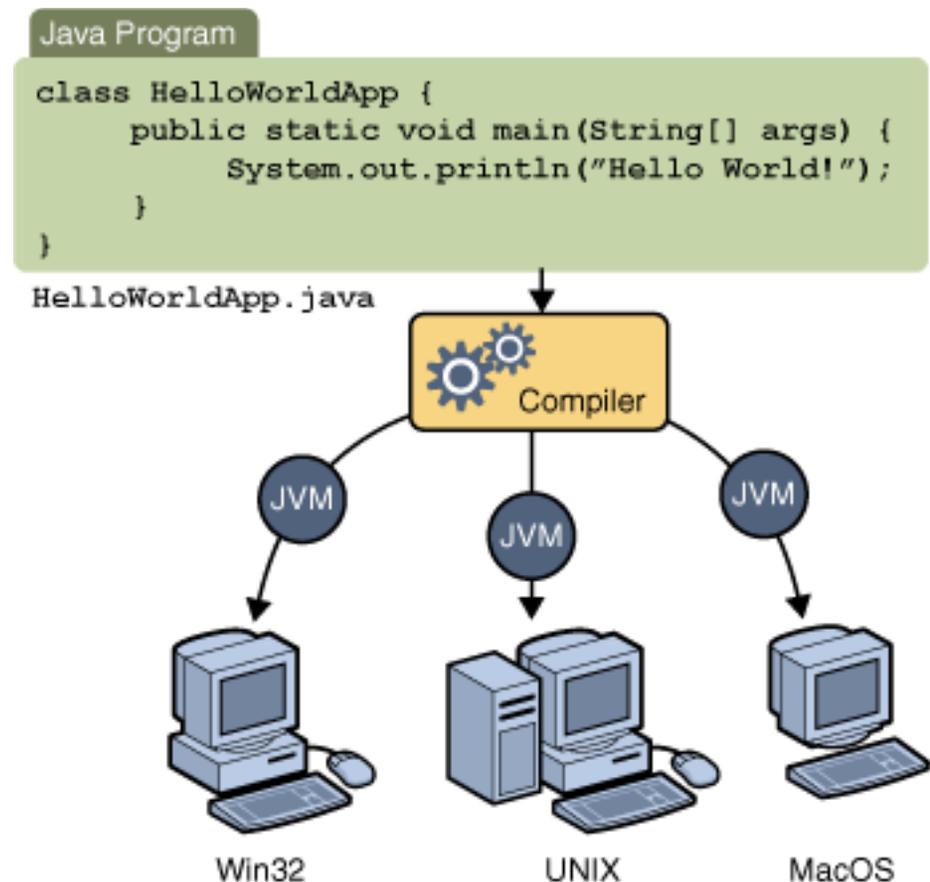
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- In Java, all programs are written as source code in files ending in the extension `.java`
- These are compiled into programs in `.class` files by the compiler (known as the program *javac*)
- These compiled programs are in an instruction set called the *bytecodes* or the Java Virtual Machine (Java VM), which is a set of machine instructions actually independent of any real machine.
- To run your program, the launcher tool (known as the program *java*) then runs an instance of the Java VM for your particular machine.



# Multiple Platforms

- Java VMs have been written for many platforms:
  - Microsoft Windows, Solaris, Linux, Mac OS
- The same .class files for your program can run on any of these machines



# What is an API?

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- API stands for Application Programming Interface and generally means the protocol that allows you to run another program
- In Java, the API is used for any class containing software and consists of
  - All the public fields
  - All the public methods
    - Each method gives the method header giving the number and types of parameters and the result type
      - This is the protocol that allows you to call the method and get back a result

# Java APIs

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- The Java APIs give the fields and methods of the classes that have been provided with Java, as well as a number of libraries with software
- Large number of available classes
  - Collections – contains many other ways to collect data besides arrays
  - Swing – user interface components
    - This is what NetBeans uses to make the forms of a GUI
  - JDBC – Java Database Connection – allows Java to pass SQL commands to access and modify data in a database (server version)
  - applets – Java programs that can be linked to an HTML page and run the main Frame in the browser
  - graphics – several packages have drawing classes and image classes
  - Other packages in the Java Enterprise Edition (EE) for web and business applications

# How to let others run your programs

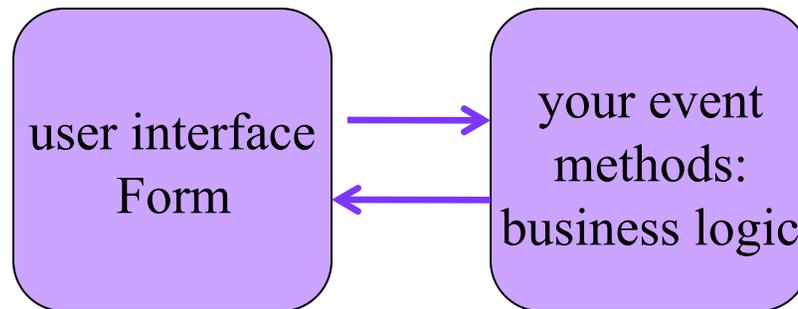
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- If you need to prepare programs on another machine, make sure that you have downloaded for Java SE (Standard Edition)
  - The JDK (Java Development Kit)
  - NetBeans for development
- In NetBeans, to prepare a program for someone else to run (unless it reads and writes to files)
  - Clean and Build, under the Build menu
  - Creates a .jar file, which contains all the .class files and all the other resource files, such as images, to make a compressed self-contained program file
    - If you have .txt files, move them to the Resources folder
  - If Java JRE is installed, just double-click on the .jar file to run
- Even when program is created in NetBeans, you can use command-line syntax to compile and run programs.

# NetBeans Java Form architecture

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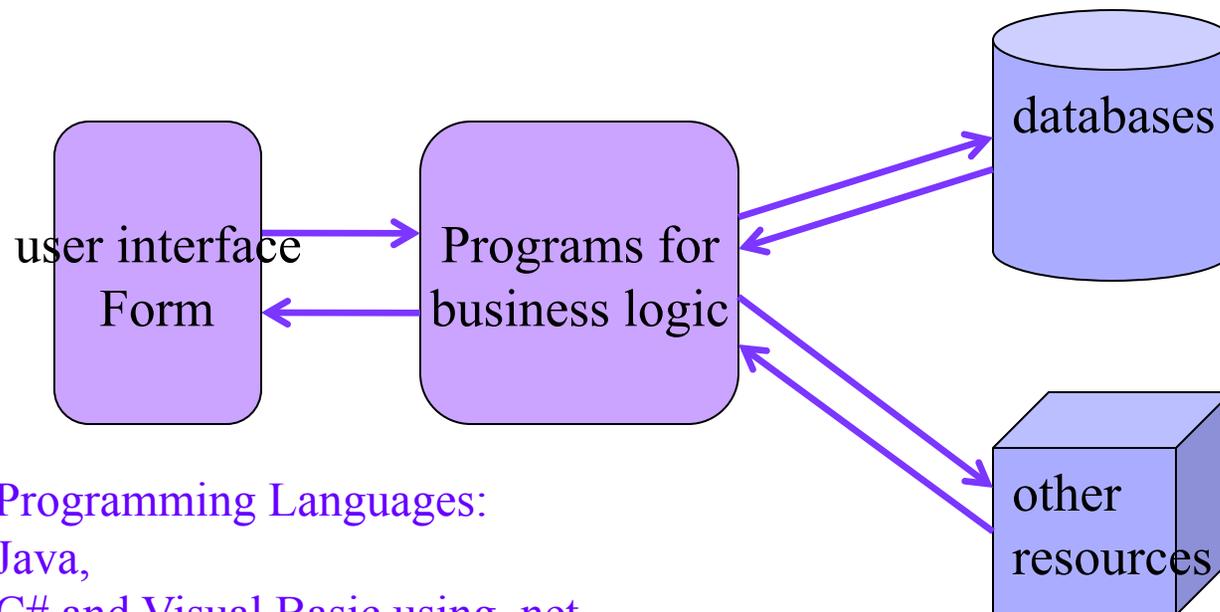
- Our programs for User Interfaces in NetBeans use
  - Java for the user interface (NetBeans generates this code)
  - Java for the application (you write this code in event methods)
    - This is sometimes known as the “business logic”



Both parts of code written in Java

# General business application architecture

- General business programs written to run for in-house applications use many programming languages
  - User interface is not always present
  - If the user interface code and the business logic are on separate machines, this is called a **client/server architecture**

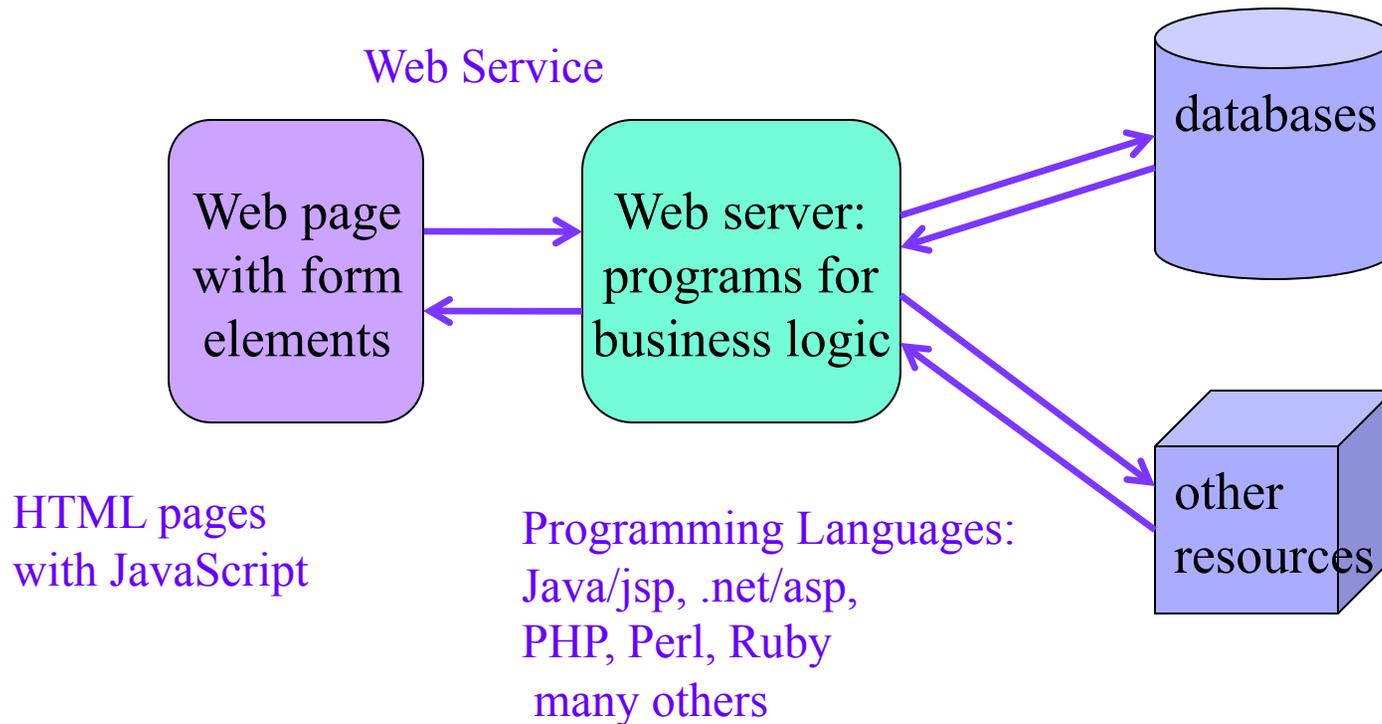


Programming Languages:  
Java,  
C# and Visual Basic using .net,  
C++, Cobol, many others

# Web application architecture

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- For web applications, the user interface form is available as a web page (via a URL from the web server)
  - Example of client/server architecture



# What is .net?

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- The .net Framework is a Microsoft software suite that runs under Windows operating systems on any machine
  - Languages include (Visual) Basic, C, C++, C#, etc.
  - Framework has interfaces to databases and other resources
  - Programs interface easily because of common runtime environment
- Programs using .net widely used on Windows mainframes and servers for large companies
  - Small web application servers tend to use Unix platform
    - with MySQL, php and other scripting languages

# Popularity of Languages

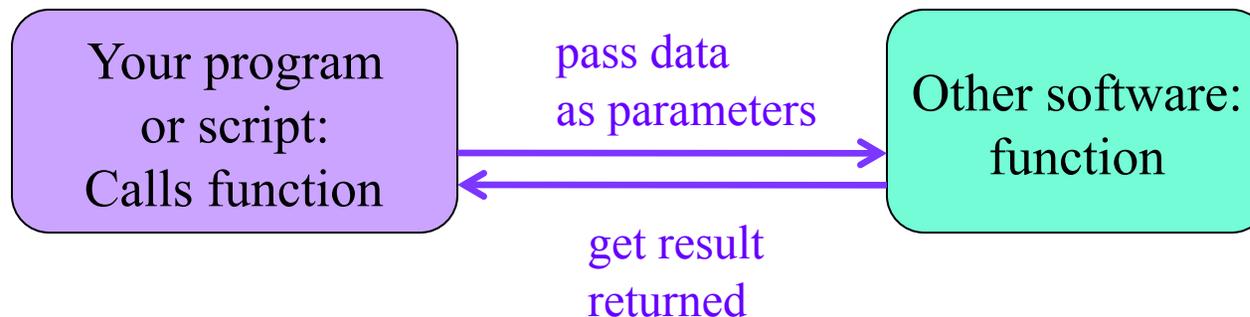
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- We have seen that languages are used in different types of applications,
- Which languages are used the most overall?
  - One source of data is the Tiobe index from Tiobe Software:
    - <http://www.tiobe.com/index.php/content/paperinfo/tpci/index.html>
  - For another view, see this set of slides from eWeek on Top 10 Languages to Keep you Employed:
    - <http://www.eweek.com/c/a/Application-Development/Top-10-Programming-Languages-to-Keep-You-Employed-719257/>

# How do you connect these programs?

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- APIs can be made available in any programming language to access the services provided by another program or software system
- The API usually provides one or more functions (aka methods or procedures) that you use by
  - Passing your data as parameters to the function
  - Receiving a result from the function



# Using other software

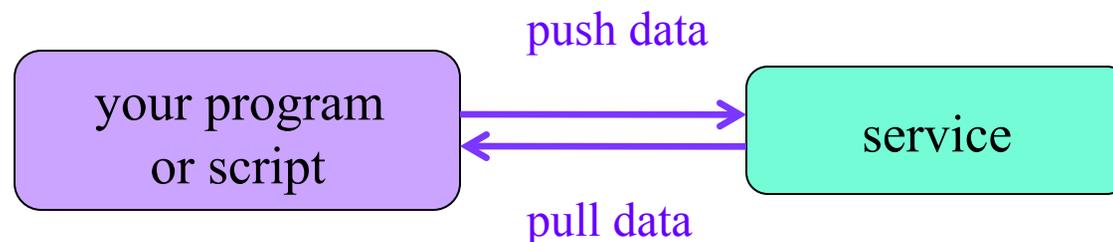
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- The other software may be a package that you or your company buys or obtains
  - accounting, business intelligence . . . the list is endless!
- Often you obtain software in the same language as the one you use and include it in your software system as you compile and run
  - For example, in Java other software is often packaged as a .jar file that you include in your library directories
  - NetBeans or any other IDE allows you to give the path of these libraries

# Using APIs in General

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- Leaving aside the programming protocol for APIs, using classes with fields and methods, there is a more general idea that an API specifies a protocol to use other programs
- The other program is viewed as providing a service and your program as a script passing data (pushing) or receiving data (pulling)



# APIs without programming

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- Several recent APIs use the http protocol directly to allow you to pass data to a service and get back a result
  - Google Developer Resources provide access to its APIs through http
  - Twitter does as well
    - Note that both Google and Twitter APIs have more functionality through the actual programming use of the APIs
- Data is commonly returned from such APIs in either
  - XML (Extensible Markup Language), a standard data transport format that uses tags to encase parts of data in a hierarchical format
  - JSON (Javascript Object Notation), although this started in Javascript, it is another language-independent data transport format. It aims to be simpler and more human readable than XML.