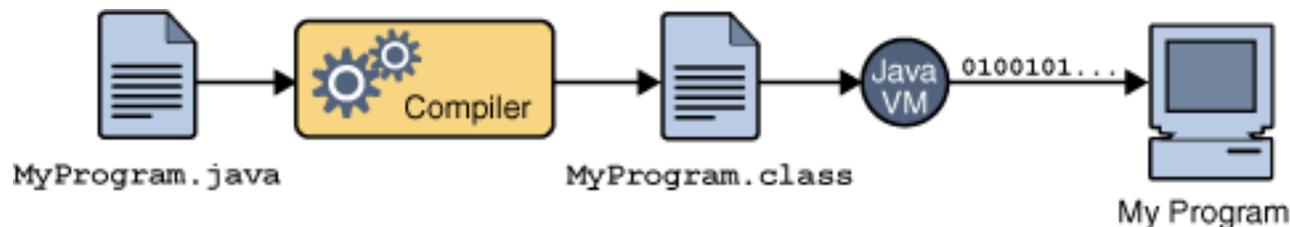

Connections: Using Programs in the World

IST 256

Application Programming for Information Systems

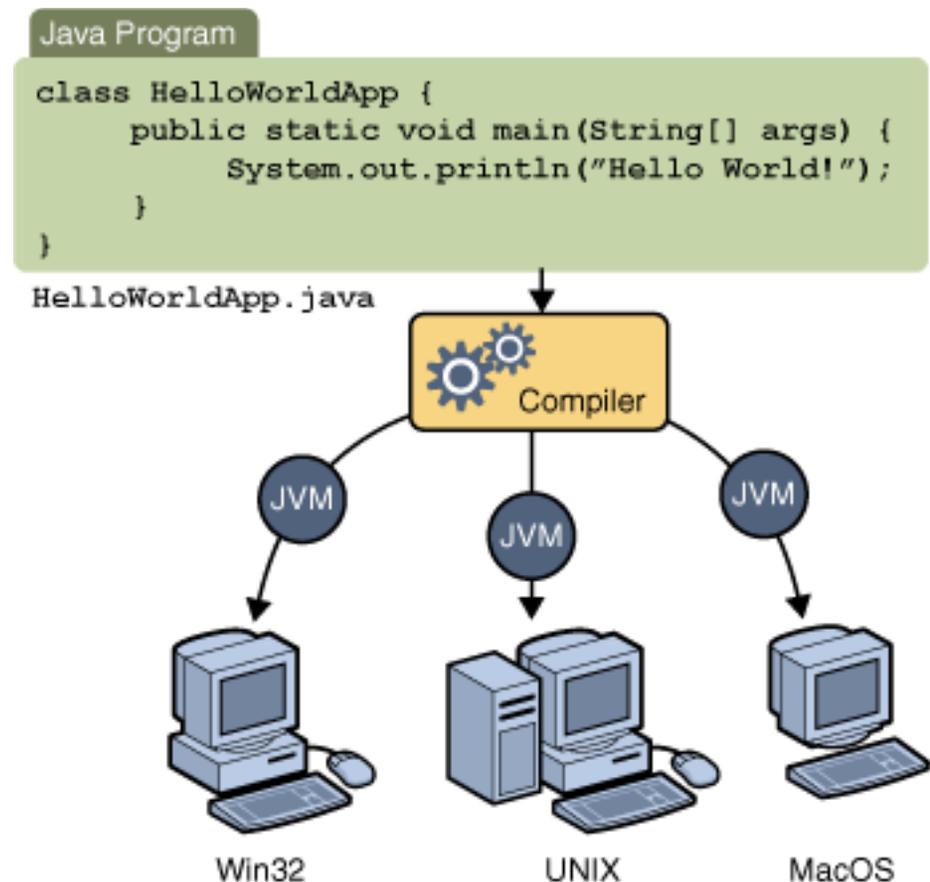
Java software development process

- 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?

- 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

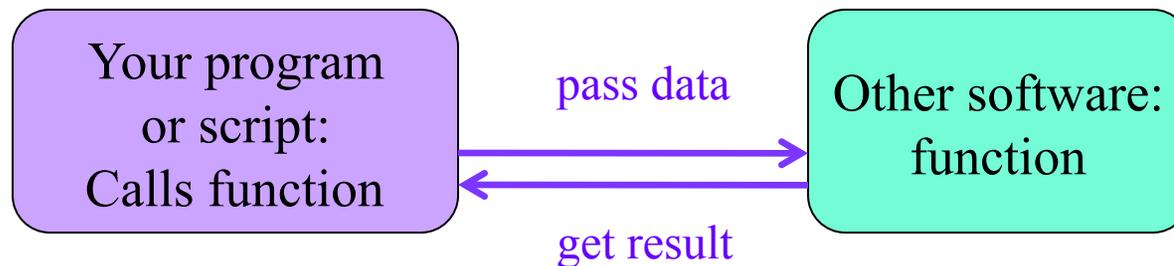
- The Java APIs give the fields and methods of the classes that have been provided with Java, as well as a number of libraries with software
- Large number of available classes
 - Collections – contains many other ways to collect data besides arrays
 - Swing – user interface components
 - This is what 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

- 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)
 - For someone who only wants to run Java programs and not write them, you get the JRE (Java Runtime Environment), which contains the Java VM for that machine
 - NetBeans for development
- In NetBeans, to prepare a program for someone else to run
 - 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

APIs

- 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

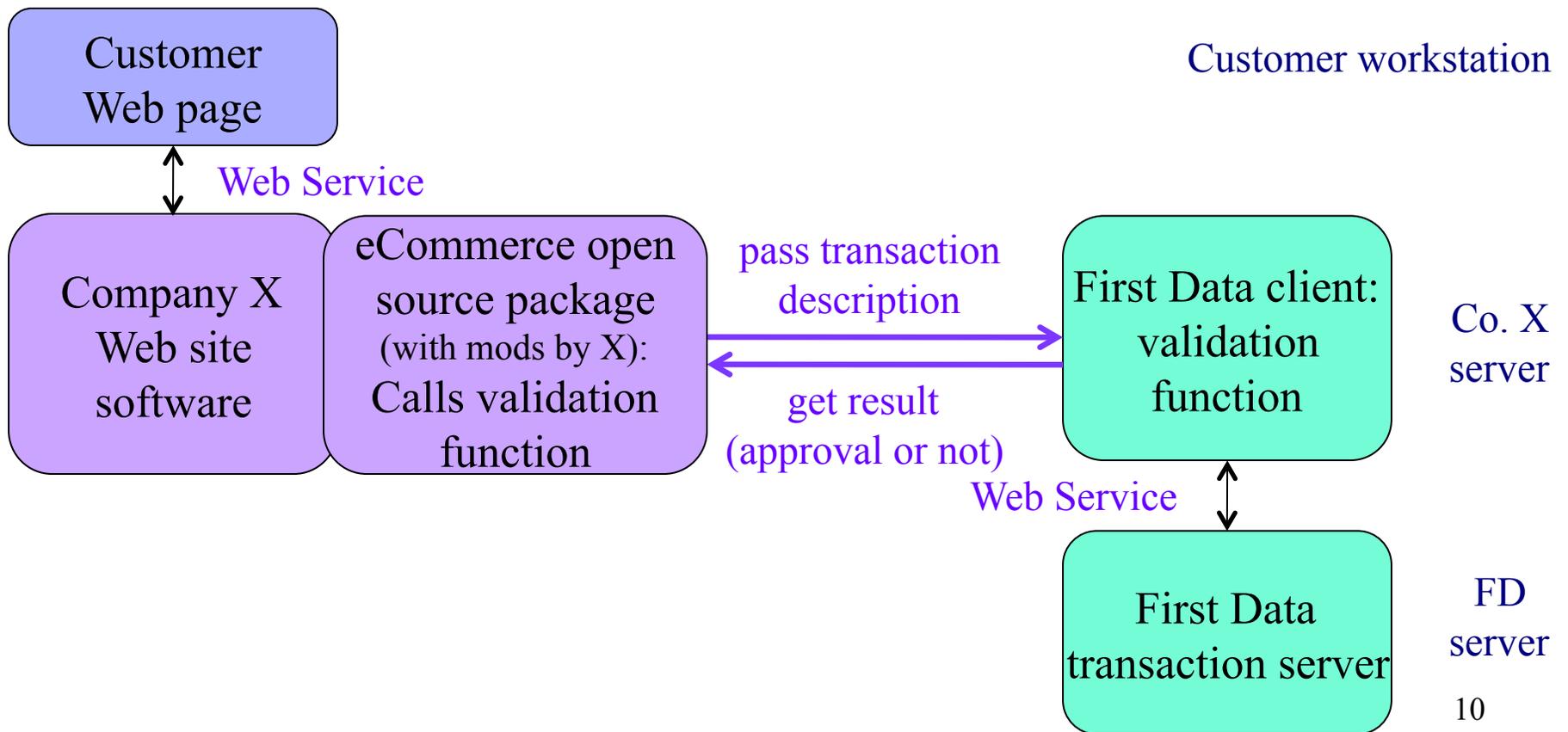
- The other software may be a package that you or your company buys or obtains
 - accounting, business intelligence . . . the list is endless!
- Often you obtain software in the same language as the one you use and include it in your software system as you compile and run
 - For example, in Java other 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

Example

- Suppose that Company X has an eCommerce site and wants to do credit card transaction processing
- Company X arranges with their bank to subscribe to a credit card transaction service from First Data Corporation
 - Company web site: http://www.firstdata.com/en_us/home
 - Description in wikipedia: http://en.wikipedia.org/wiki/First_Data
- The service is structured as a program that you install with your software, but which is a client that uses a web service to get the actual transaction processing from another server at First Data
- The client software can be provided in almost any programming language

Credit Card Transaction Software Architecture

- In addition to the software from the First Data company, there are open source software packages to help X write the transaction processing code



Overview Credit Card program

- The Company X web site software is written in the programming language PHP.
 - Has classes, fields and methods with different notation
 - This program could also have been written in Java
- Each customer request (usually by clicking button on web page) comes to the web site software
- It uses the eCommerce software to get
 - the data from the user's request into a variable called `$_POST`
 - and the session data into a variable called `$_SESSION`
 - These variables are dictionaries and are like arrays except that the indices are strings instead of integers from 0 to n-1
 - In Java, dictionaries are available as HashMaps from the Collections package

Code Snippet in preparing data

- The data to be passed to the validation function goes into a dictionary called \$myorder.
- As the customer put items in the shopping cart, the web site software collected data into a class called \$order. This class has a public field called info, which is a dictionary with the order information
- In this code snippet, parts of the order information are put into the \$myorder dictionary:

- Note that PHP uses -> instead of . to access fields and methods in a class.

```
// ORDER INFO
```

```
$myorder["subtotal"] = $order->info['subtotal'];
```

```
$myorder["tax"]      = $order->info['tax'];
```

```
$myorder["shipping"] = ($order->info['shipping_cost'] == 'f')  
                        ? 0 : $order->info['shipping_cost'];
```

```
$myorder["chargetotal"] = $order->info['total'];
```

- Additional code put the transaction items into the \$myorder dictionary as well.

More on preparing data

- On a previous web page, the customer enter billing information, so that is in the session data
- On this web page, the customer has entered the credit card information, so that is in the post data from this page
- Another code snippet adding more information to the \$myorder dictionary

```
// CARD INFO  $myorder["cardnumber"] = $_POST['cc_number'];  
$myorder["cardexpmonth"] = $_POST['cc_expires_month'];  
$myorder["cardexpyear"] = $_POST['cc_expires_year'];  
$myorder["cvmindicator"] = "provided";  
$myorder["cvmvalue"] = $_POST['cc_cvv'];
```

```
// BILLING INFO  $myorder["userid"] = $_SESSION['customer_id'];  
$myorder["customerid"] = $_SESSION['customer_id'];
```

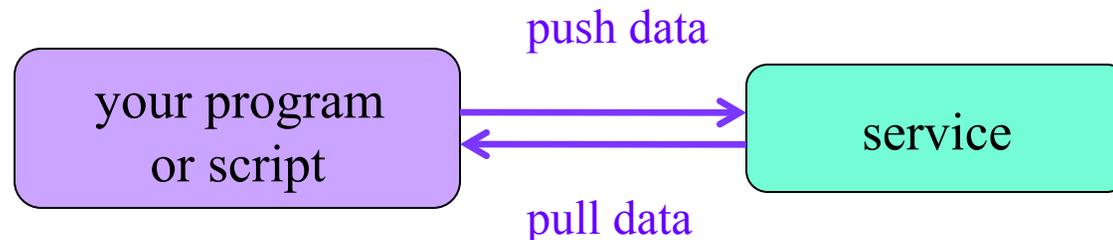
Using the validation function from the API

- Finally, the code creates an instance of the linkpoint_api class.
 - First Data was formerly called LinkPoint
 - In PHP, you first include the libraries (similar to import in Java)
- The API steps then
 - Calls the validation function named “curl_process” with the \$myorder data as a parameter
 - Gets back a result dictionary which includes an index “r_approved”

```
include(_require(DIR_FS_CATALOG . DIR_WS_MODULES . 'payment/  
linkpoint_api/class.linkpoint_api.php));  
$mylphp = new lphp;  
// method call to send transaction data for validation  
$result = $mylphp->curl_process($myorder);  
$failure = ($result["r_approved"] != "APPROVED");
```

Using APIs in General

- 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

- 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