JavaScript: Client-Side Scripting

Chapter 6

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Fundamentals of Web Development

Section 1 of 8

WHAT IS JAVASCRIPT

What is JavaScript

- JavaScript runs right inside the browser
- JavaScript is dynamically typed
- JavaScript is object oriented in that almost everything in the language is an object
    - the objects in JavaScript are prototype-based rather than class-based, which means that while JavaScript shares some syntactic features of PHP, Java or C#, it is also quite different from those languages

What isn’t JavaScript

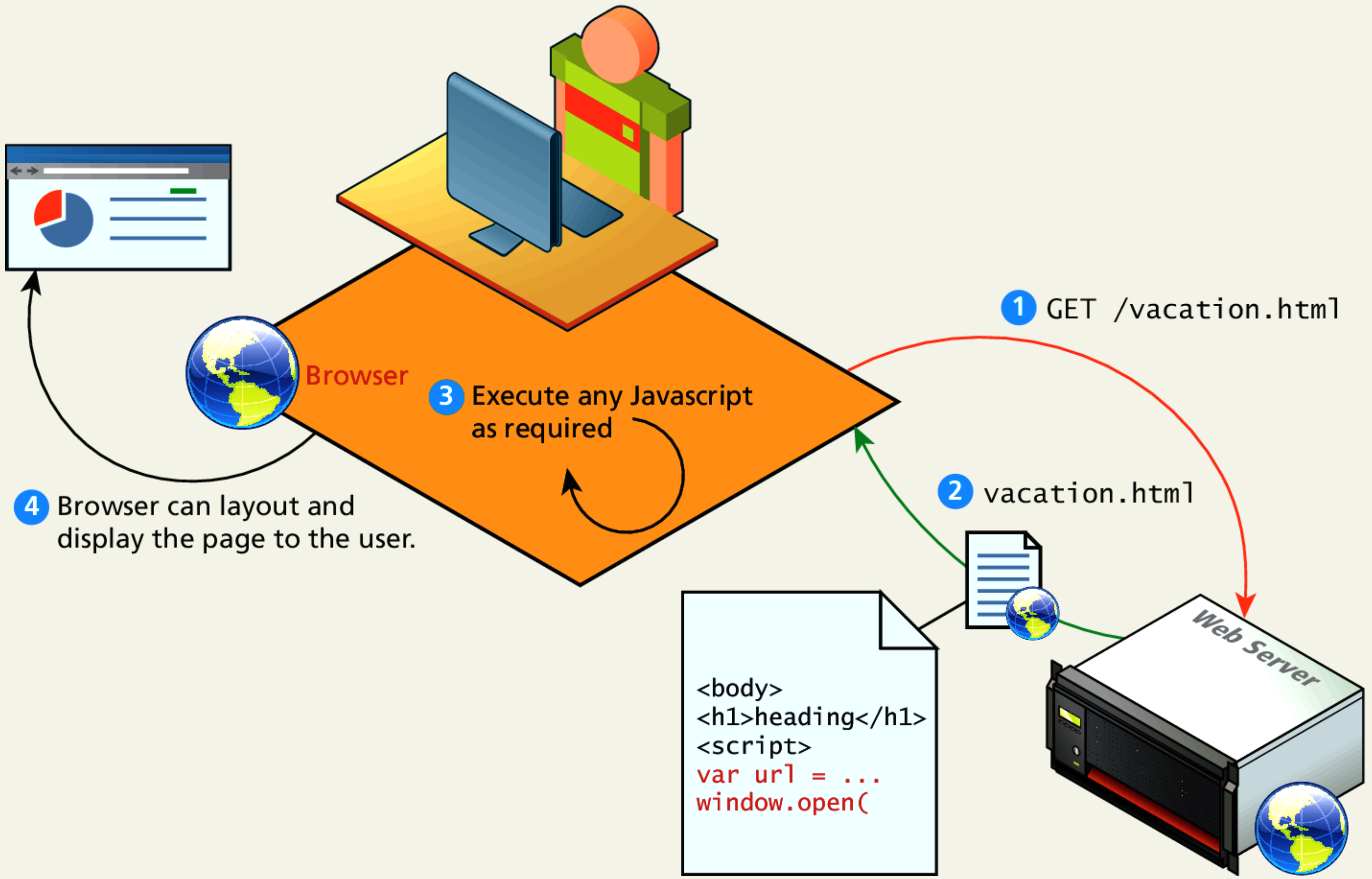
It’s not Java

Although it contains the word *Java*, JavaScript and Java are vastly different programming languages with different uses. Java is a full-fledged compiled, object-oriented language, popular for its ability to run on any platform with a JVM installed.

Conversely, JavaScript is one of the world’s most popular interpreted languages, with fewer of the object-oriented features of Java, and runs directly inside the browser, without the need for the JVM.

Client-Side Scripting

Let the client compute


1 GET /vacation.html
2 vacation.html
Browser
3 Execute any Javascript as required
4 Browser can layout and display the page to the user.
Web Server

```
<body>
<h1>heading</h1>
<script>
var url = ...
window.open(
```

Client-Side Scripting

It’s good

There are many **advantages** of client-side scripting:

- Processing can be offloaded from the server to client machines, thereby reducing the load on the server.
- The browser can respond more rapidly to user events than a request to a remote server ever could, which improves the user experience.
- JavaScript can interact with the downloaded HTML in a way that the server cannot, creating a user experience more like desktop software than simple HTML ever could.

Client-Side Scripting

There are challenges

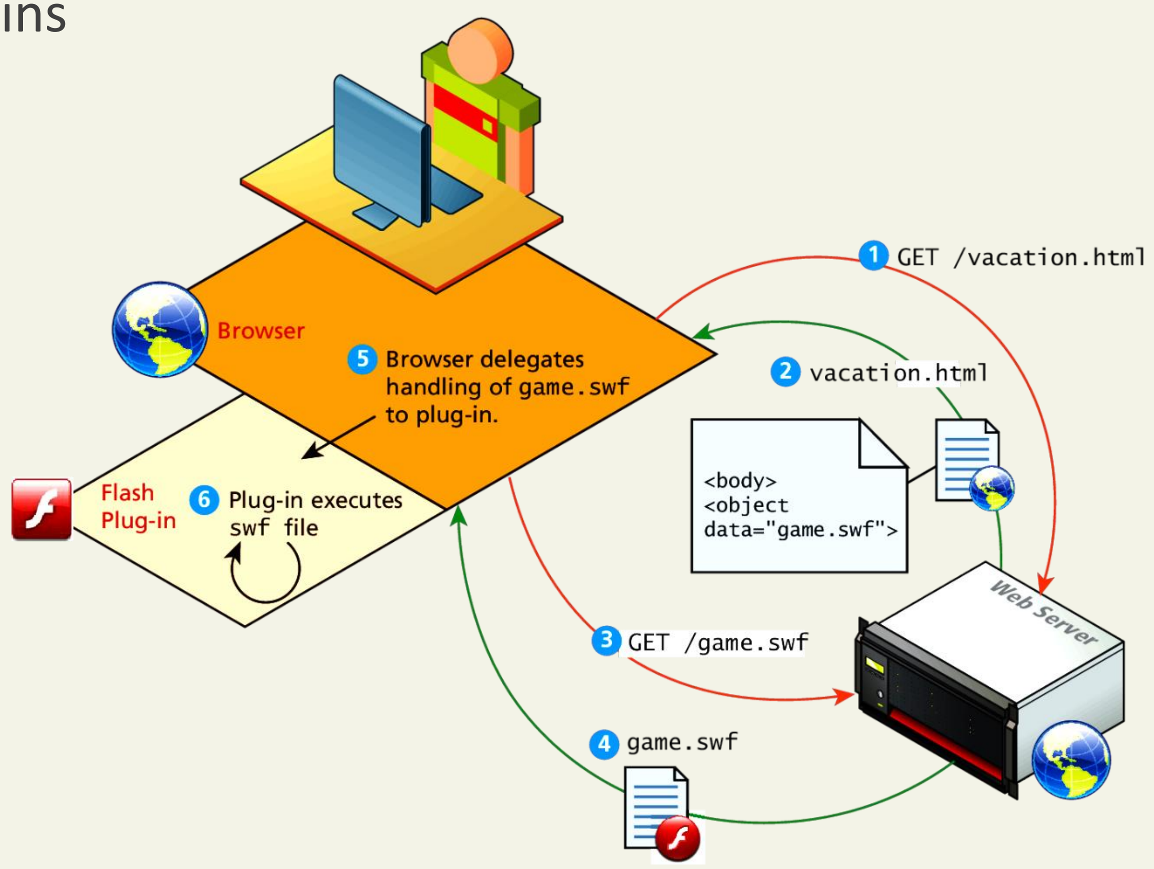
The disadvantages of client-side scripting are mostly related to how programmers use JavaScript in their applications.

- There is no guarantee that the client has JavaScript enabled
- The idiosyncrasies between various browsers and operating systems make it difficult to test for all potential client configurations. What works in one browser, may generate an error in another.
- JavaScript-heavy web applications can be complicated to debug and maintain.

Client-Side Flash

JavaScript is not the only type of client-side scripting.

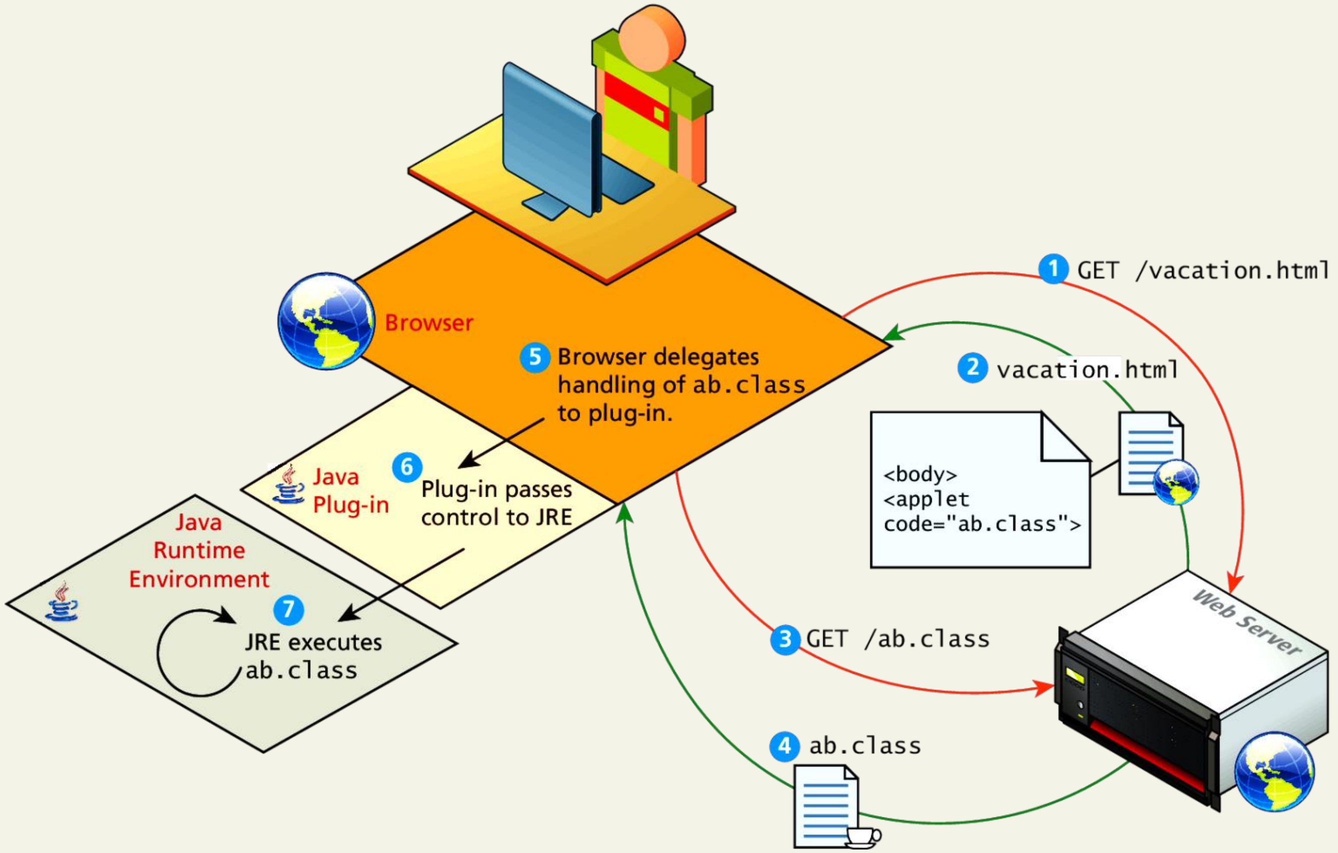
- Browser Plug-ins
    - Flash



Client-Side Applets

Java Applets

Java applets are written in and are separate objects included within an HTML document via the <applet> tag

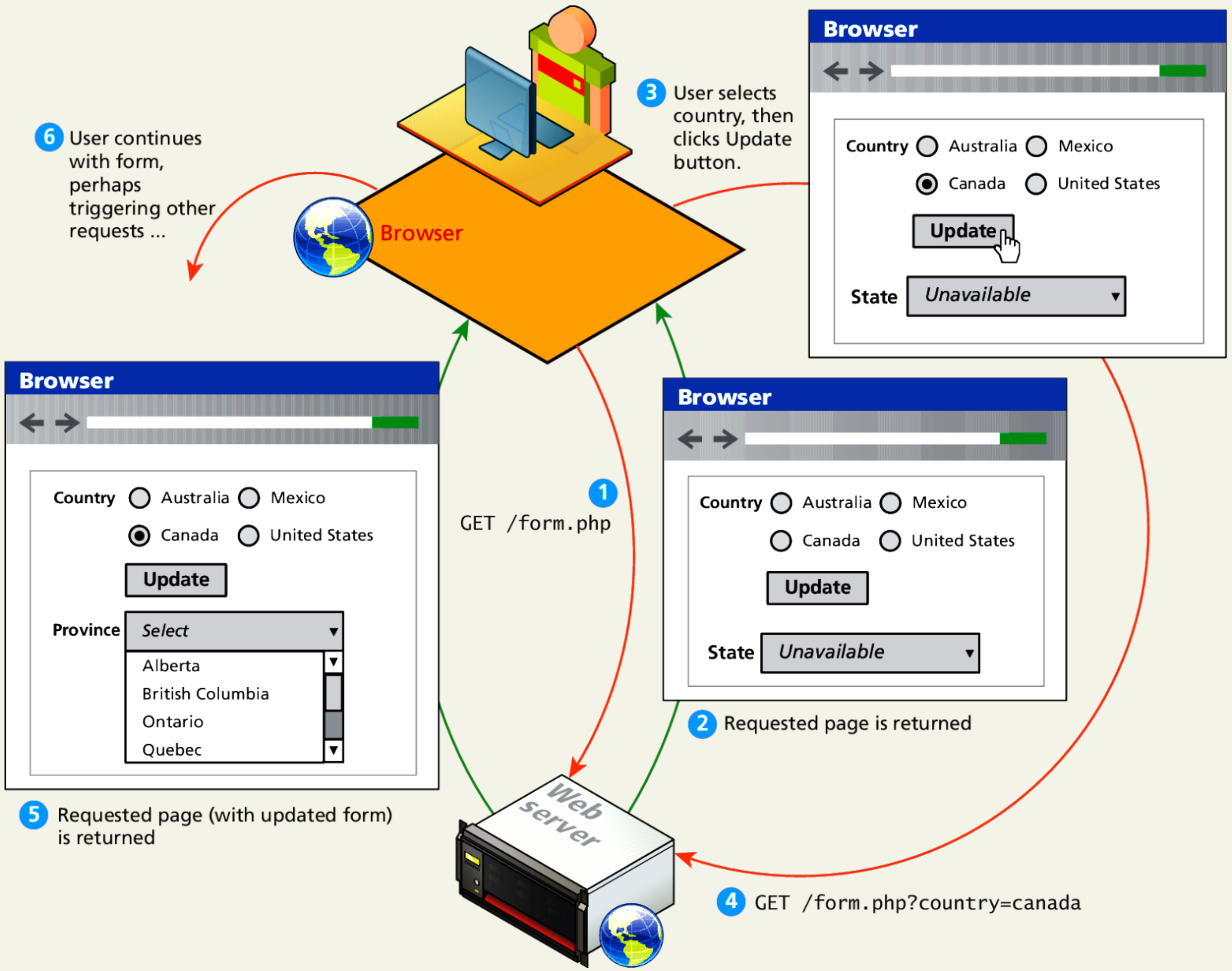


JavaScript History

- JavaScript was introduced by Netscape in their Navigator browser back in 1996.
- JavaScript is in fact an implementation of a standardized scripting language called **ECMAScript**
- JavaScript was only slightly useful to many users

HTTP request-reponse loop

Without JavaScript



Browser
6 User continues with form, perhaps triggering other requests ...
3 User selects country, then clicks Update button.
Browser
Country Australia Mexico Canada United States
Update
State Unavailable
Browser
Country Australia Mexico Canada United States
Update
Province Select
Alberta
British Columbia
Ontario
Quebec
1 GET /form.php
Browser
Country Australia Mexico Canada United States
Update
State Unavailable
2 Requested page is returned
5 Requested page (with updated form) is returned
Web server
4 GET /form.php?country=canada

JavaScript in Modern Times

AJAX

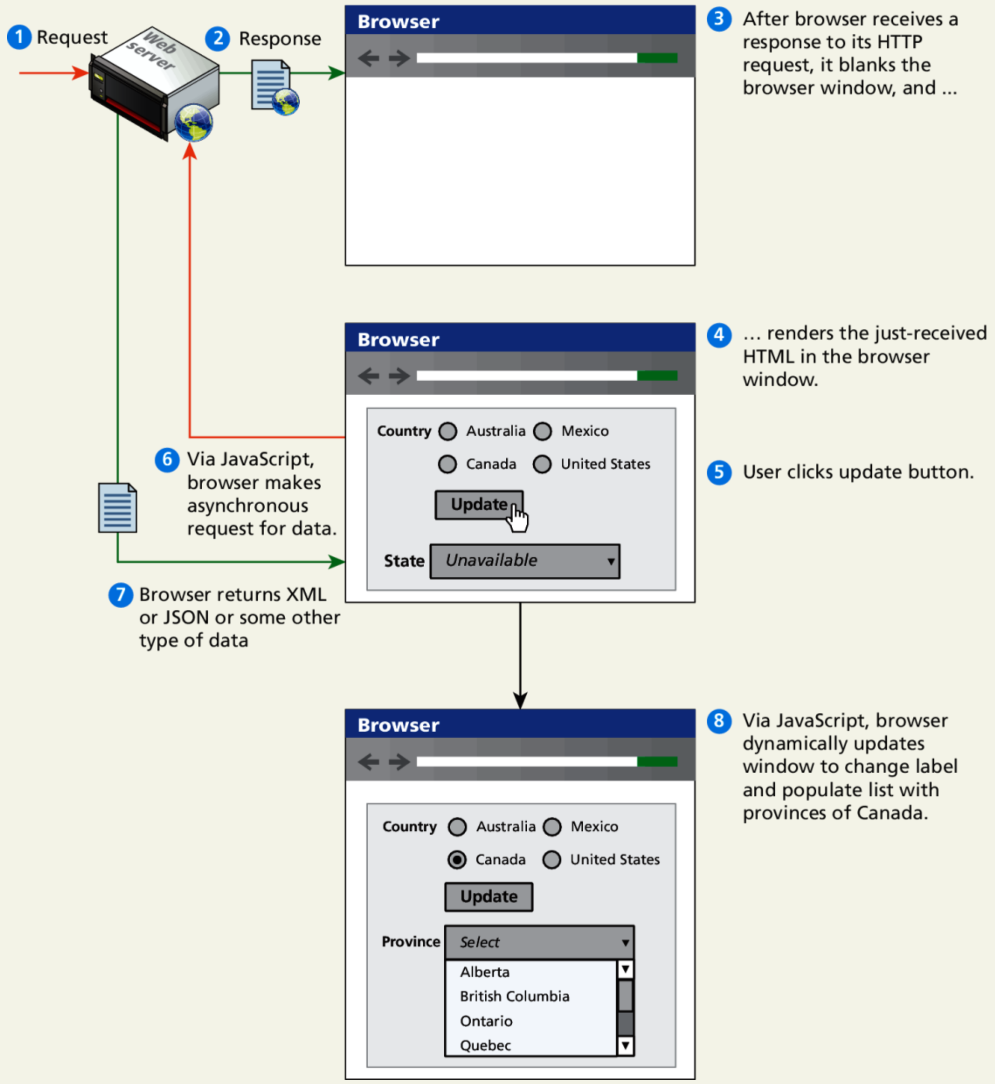
JavaScript became a much more important part of web development in the mid 2000s with **AJAX**.

AJAX is both an acronym as well as a general term.

- As an acronym it means **A**synchronous **J**avaScript **A**nd **X**ML.
- The most important feature of AJAX sites is the asynchronous data requests.

Asynchronous data requests

The better AJAX way


1 Request
Web server
2 Response
Browser
3 After browser receives a response to its HTTP request, it blanks the browser window, and ...
Browser
4 ... renders the just-received HTML in the browser window.
Country
Australia
Mexico
Canada
United States
Update
State
Unavailable
5 User clicks update button.
6 Via JavaScript, browser makes asynchronous request for data.
7 Browser returns XML or JSON or some other type of data
Browser
Country
Australia
Mexico
Canada
United States
Update
Province
Select
Alberta
British Columbia
Ontario
Quebec
8 Via JavaScript, browser dynamically updates window to change label and populate list with provinces of Canada.

Section 2 of 8

JAVASCRIPT DESIGN PRINCIPLES

Layers

They help organize

When designing software to solve a problem, it is often helpful to abstract the solution a little bit to help build a cognitive model in your mind that you can then implement.

Perhaps the most common way of articulating such a cognitive model is via the term **layer**.

In object-oriented programming, a software **layer** is a way of conceptually grouping programming classes that have similar functionality and dependencies.

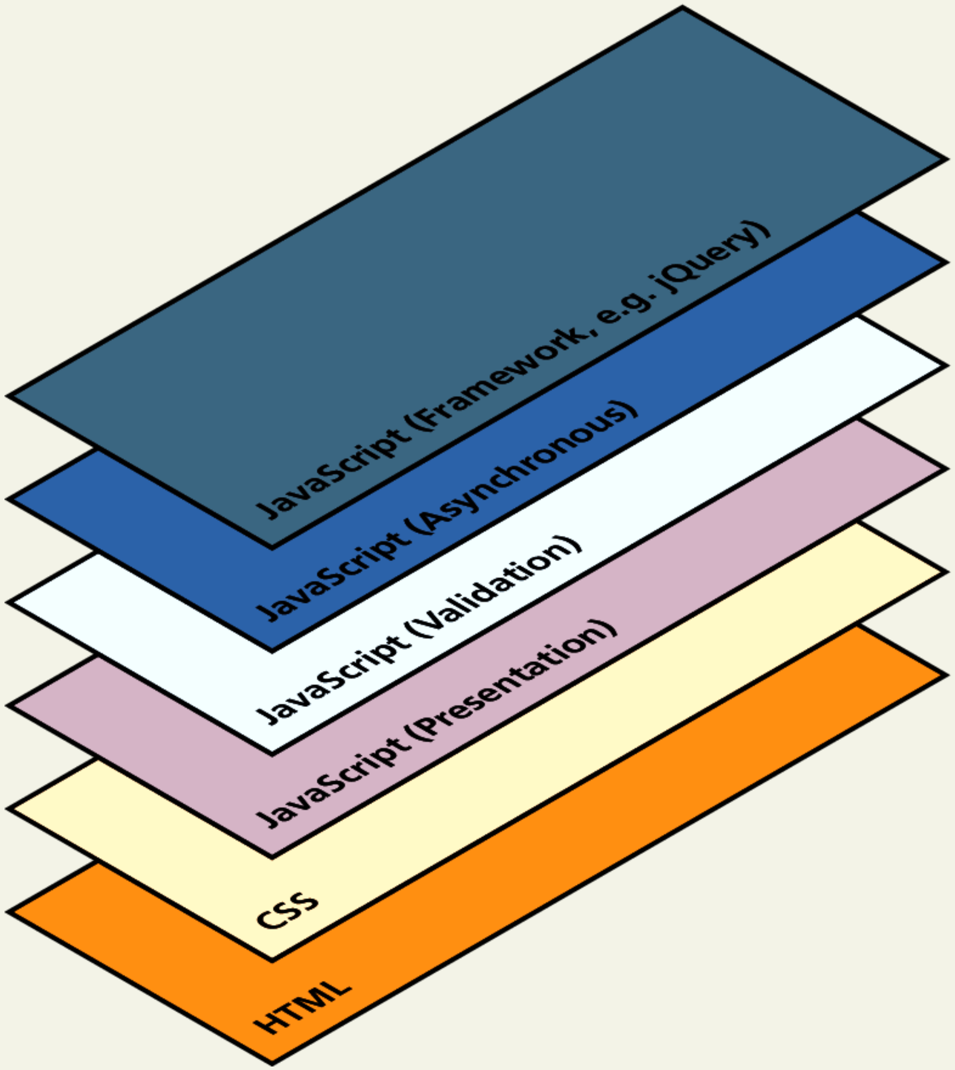
Layers

Common Layers

- **Presentation layer.** Classes focused on the user interface.
- **Business layer.** Classes that model real-world entities, such as customers, products, and sales.
- **Data layer.** Classes that handle the interaction with the data sources.

Layers

Just a conceptual idea


JavaScript (Framework, e.g. jQuery)
JavaScript (Asynchronous)
JavaScript (Validation)
JavaScript (Presentation)
CSS
HTML

Section 3 of 8

WHERE DOES JAVASCRIPT GO?

Where does JavaScript go?

JavaScript can be linked to an HTML page in a number of ways.

- Inline
- Embedded
- External

Inline JavaScript

Mash it in

Inline JavaScript refers to the practice of including JavaScript code directly within certain HTML attributes

Inline JavaScript is a real maintenance nightmare

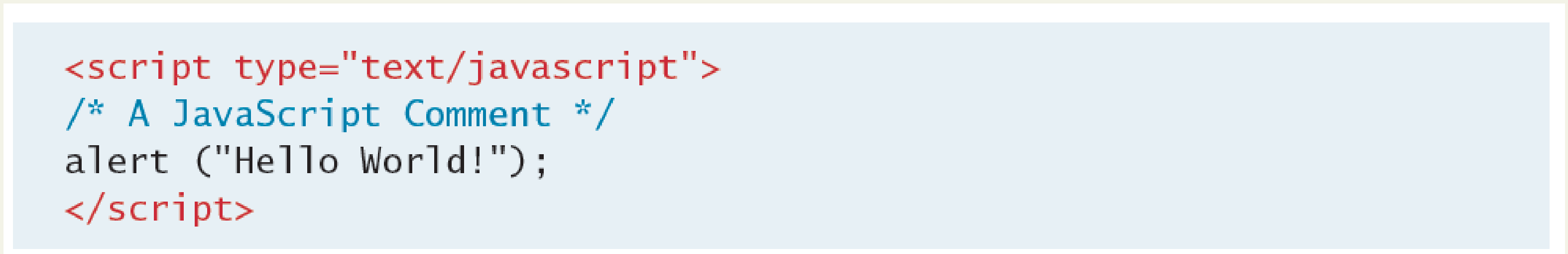
```
<a href="JavaScript:OpenWindow();"more info</a>
<input type="button” onclick="alert('Are you sure?');" />
```

LISTING 6.1 Inline JavaScript example

Embedded JavaScript

Better

Embedded JavaScript refers to the practice of placing JavaScript code within a <script> element



```
<script type="text/javascript">
/* A JavaScript Comment */
alert ("Hello World!");
</script>
```

LISTING 6.2 Embedded JavaScript example

External JavaScript

Better

JavaScript supports this separation by allowing links to an external file that contains the JavaScript.

By convention, JavaScript external files have the extension .js.

```
<head>
  <script type="text/JavaScript" src="greeting.js">
  </script>
</head>
```

LISTING 6.3 External JavaScript example

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SYNTAX

JavaScript Syntax

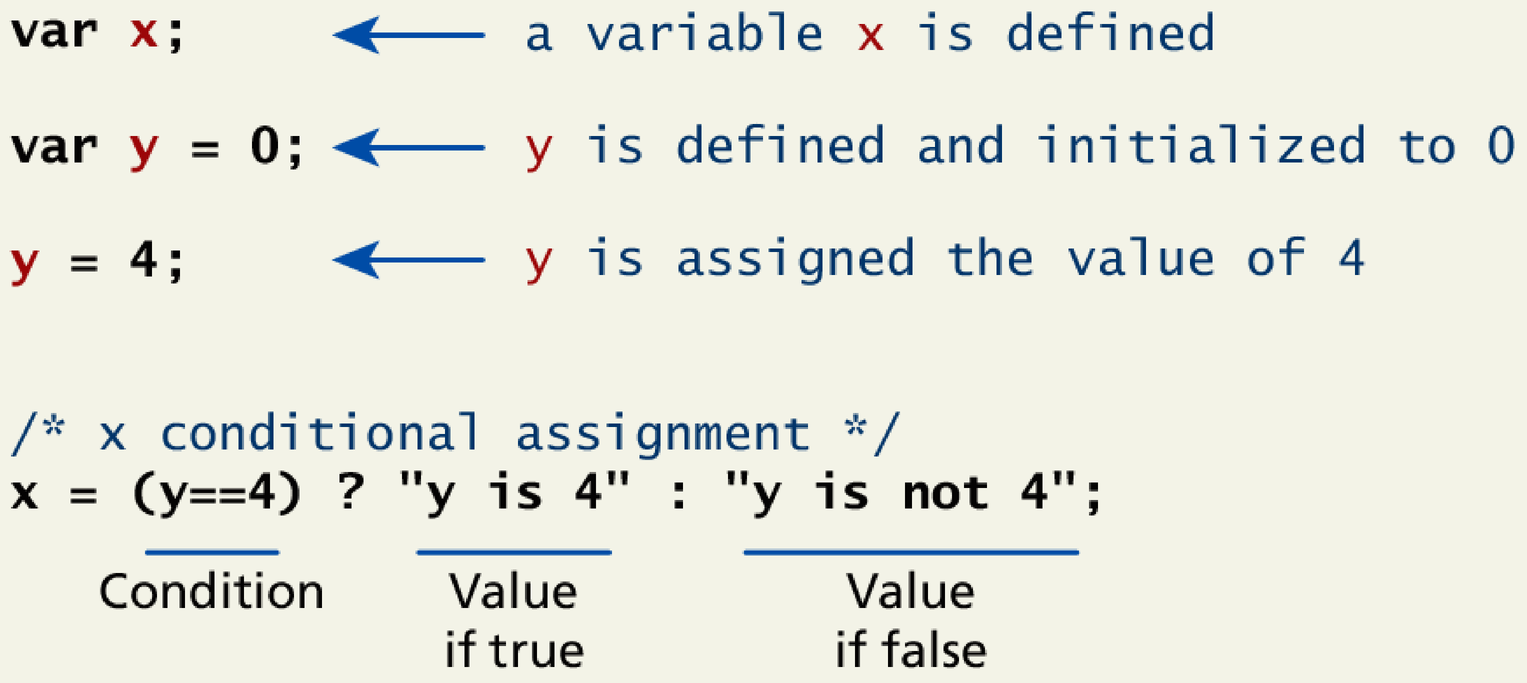
We will briefly cover the fundamental syntax for the most common programming constructs including

- **variables**,
- **assignment**,
- **conditionals**,
- **loops**, and
- **arrays**

before moving on to advanced topics such as **events** and **classes**.

Variables

Assignment



```
var x;        a variable x is defined
var y = 0;    y is defined and initialized to 0
y = 4;        y is assigned the value of 4

/* x conditional assignment */
x = (y==4) ? "y is 4" : "y is not 4";
```

Comparison Operators

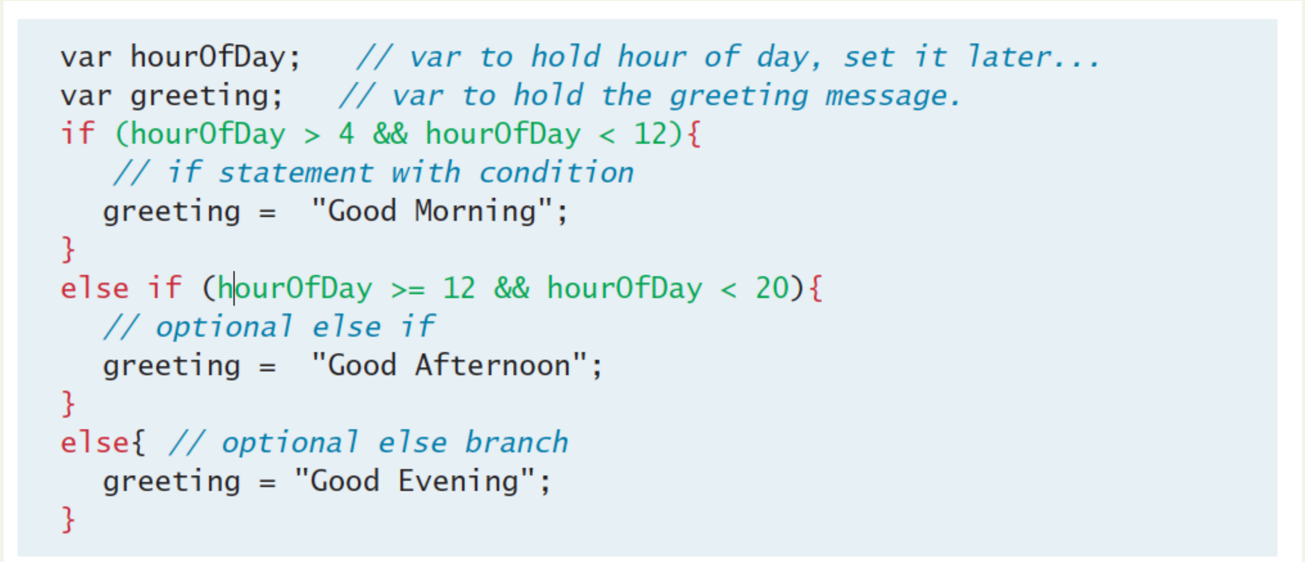
True or not True

Operator	Description	Matches (x=9)
==	Equals	(x==9) is true (x=="9") is true
===	Exactly equals, including type	(x==="9") is false (x===9) is true
< , >	Less than, Greater Than	(x<5) is false
<= , >=	Less than or equal, greater than or equal	(x<=9) is true
!=	Not equal	(4!=x) is true
!==	Not equal in either value or type	(x!=="9") is true (x!==9) is false

Conditionals

If, else if, …, else

JavaScript’s syntax is almost identical to that of PHP, Java, or C when it comes to conditional structures such as if and if else statements. In this syntax the condition to test is contained within ( ) brackets with the body contained in { } blocks.



```
var hourOfDay;    // var to hold hour of day, set it later...
var greeting;   // var to hold the greeting message.
if (hourOfDay > 4 && hourOfDay < 12){
   // if statement with condition
   greeting =  "Good Morning";
}
else if (hourOfDay >= 12 && hourOfDay < 20){
   // optional else if
   greeting =  "Good Afternoon";
}
else{ // optional else branch
   greeting = "Good Evening";
}
```

LISTING 6.4 Conditional statement setting a variable based on the hour of the day

Loops

Round and round we go

Like conditionals, loops use the ( ) and { } blocks to define the condition and the body of the loop.

You will encounter the **while** and **for** loops

While loops normally initialize a **loop control variable** before the loop, use it in the condition, and modify it within the loop.

```
var i=0;  // initialise the Loop Control Variable

while(i < 10){ //test the loop control variable

        i++;  //increment the loop control variable

}
```

Functions

Functions are the building block for modular code in JavaScript, and are even used to build **pseudo-classes**, which you will learn about later.

They are defined by using the reserved word **function** and then the function name and (optional) parameters.

Since JavaScript is dynamically typed, functions do not require a return type, nor do the parameters require type.

Functions

Example

Therefore a function to raise x to the yth power might be defined as:

```
function power(x,y){
        var pow=1;
        for (var i=0;i<y;i++){
                pow = pow*x;
        }
        return pow;
}
```

And called as

```
power(2,10);
```

Alert

Not really used anymore, console instead

The alert() function makes the browser show a pop-up to the user, with whatever is passed being the message displayed. The following JavaScript code displays a simple hello world message in a pop-up:

```
alert ( "Good Morning" );
```

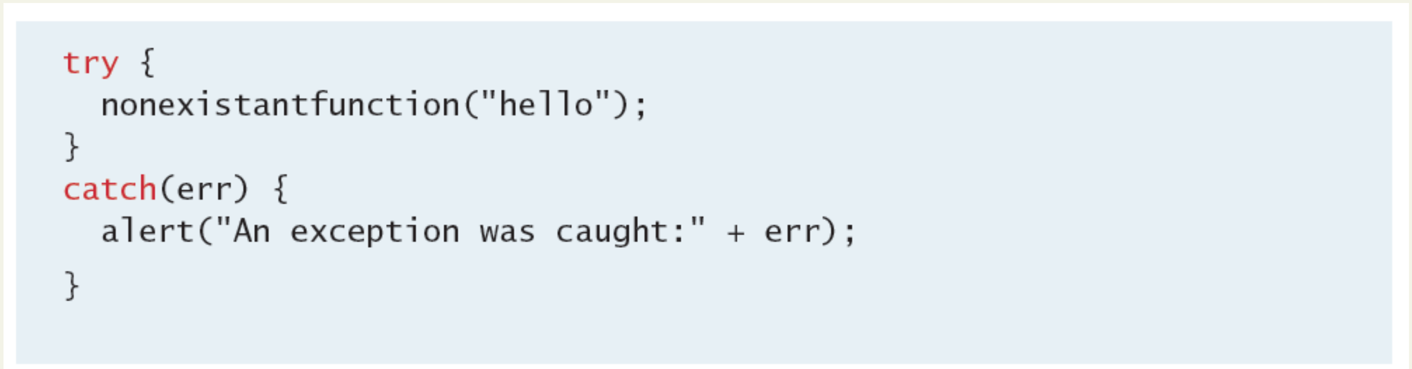
Using alerts can get tedious fast. When using debugger tools in your browser you can write output to a log with:

```
console.log("Put Messages Here");
```

And then use the debugger to access those logs.

Errors using try and catch

When the browser's JavaScript engine encounters an error, it will *throw* an **exception**. These exceptions interrupt the regular, sequential execution of the program and can stop the JavaScript engine altogether. However, you can optionally catch these errors preventing disruption of the program using the **try–catch block**



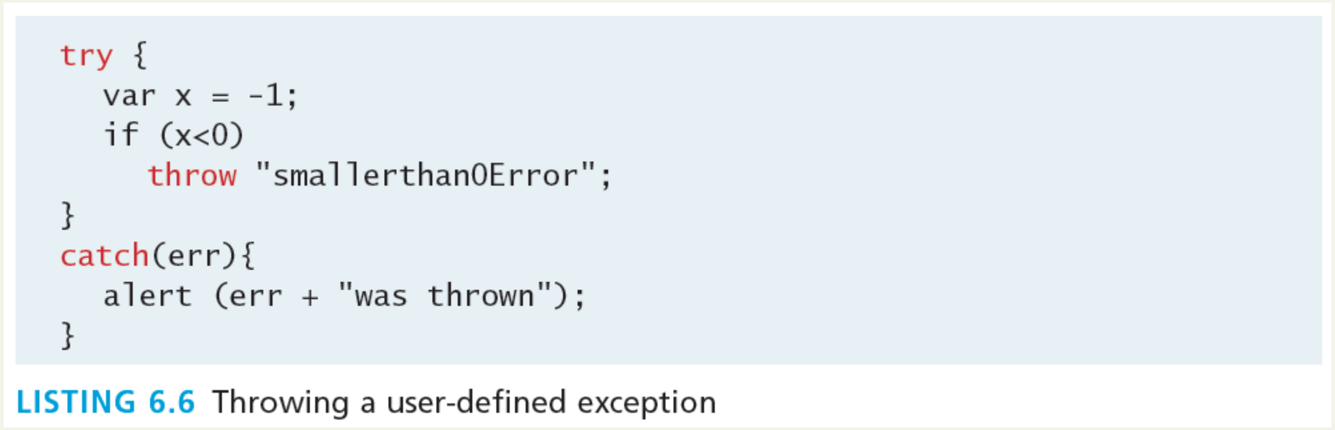
```
try {
  nonexistantfunction("hello");
}
catch(err) {
  alert("An exception was caught:" + err);
}
```

LISTING 6.5 Try-catch statement

Throw your own

Exceptions that is.

Although try-catch can be used exclusively to catch built-in JavaScript errors, it can also be used by your programs, to throw your own messages. The throw keyword stops normal sequential execution, just like the built-in exceptions



```
try {
   var x = -1;
   if (x<0)
      throw "smallerthan0Error";
}
catch(err){
   alert (err + "was thrown");
}
```

LISTING 6.6 Throwing a user-defined exception

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JAVASCRIPT OBJECTS

JavaScript Objects

Objects not Classes

JavaScript is not a full-fledged object-oriented programming language.

It does not have classes per se, and it does not support many of the patterns you'd expect from an object-oriented language like inheritance and polymorphism.

The language does, however, support objects.

JavaScript Objects

Not full-fledged O.O.

Objects can have **constructors**, **properties**, and **methods** associated with them.

There are objects that are included in the JavaScript language; you can also define your own kind of objects.

Constructors

Normally to create a new object we use the new keyword, the class name, and ( ) brackets with *n* optional parameters inside, comma delimited as follows:

var someObject = **new** ObjectName(p1,p2,..., pn);

For some classes, shortcut constructors are defined

var greeting = "Good Morning";

vs the formal:

var greeting = new String("Good Morning");

Properties

Use the dot

Each object might have properties that can be accessed, depending on its definition.

When a property exists, it can be accessed using **dot notation** where a dot between the instance name and the property references that property.

```
//show someObject.property to the user
alert(someObject.property);
```

Methods

Use the dot, with brackets

Objects can also have methods, which are **functions** associated with an instance of an object. These methods are called using the same dot notation as for properties, but instead of accessing a variable, we are calling a method.

someObject**.doSomething()**;

Methods may produce different output depending on the object they are associated with because *they can utilize the internal properties of the object.*

Objects Included in JavaScript

A number of useful objects are included with JavaScript including:

- Array
- Boolean
- Date
- Math
- String
- Dom objects

Arrays

Arrays are one of the most used data structures. In practice, this class is defined to behave more like a linked list in that it can be resized dynamically, but the implementation is browser specific, meaning the efficiency of insert and delete operations is unknown.

The following code creates a new, empty array named greetings:

```
var greetings = new Array();
```

Arrays

Initialize with values

To initialize the array with values, the variable declaration would look like the following:

```
var greetings = new Array("Good Morning", "Good Afternoon");
```

or, using the square bracket notation:

```
var greetings = ["Good Morning", "Good Afternoon"];
```

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THE DOCUMENT OBJECT MODEL (DOM)

The DOM

Document Object Model

JavaScript is almost always used to interact with the HTML document in which it is contained.

This is accomplished through a programming interface (API) called the **Document Object Model.**

According to the W3C, the DOM is a:

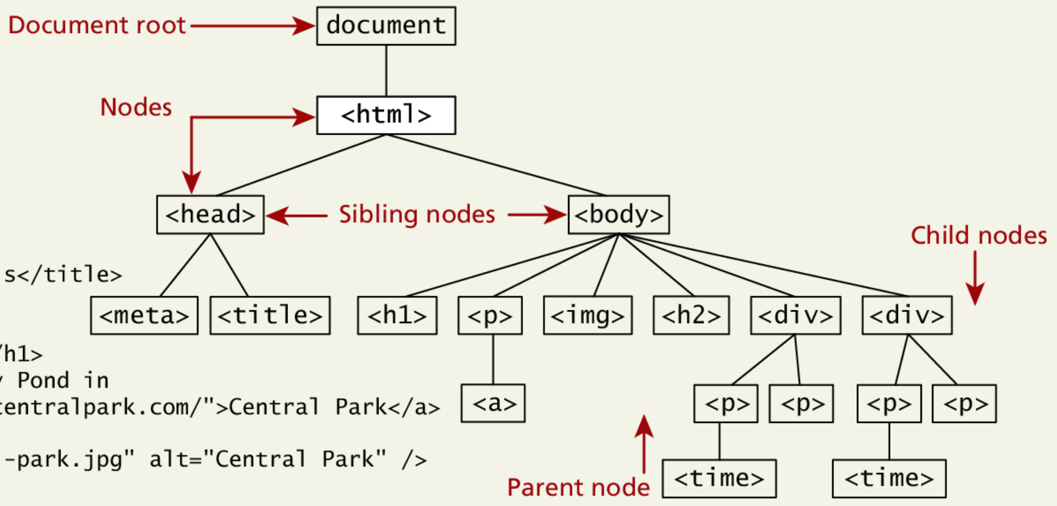
Platform- and language-neutral interface that will allow programs and scripts to dynamically access and update the content, structure and style of documents.

The DOM

Seems familiar, because it is!

We already know all about the DOM, but by another name. The tree structure from Chapter 2 (HTML) is formally called the **DOM Tree** with the root, or topmost object called the **Document Root**.

```
<html>
<head lang="en">
   <meta charset="utf-8">
   <title>Share Your Travels</title>
</head>
<body>
   <h1>Share Your Travels</h1>
   <p>Photo of Conservatory Pond in
      <a href="http://www.centralpark.com/">Central Park</a>
   </p>
   <img src="images/central-park.jpg" alt="Central Park" />
   <h2>Reviews</h2>
   <div id="latestComment">
      <p>By Ricardo on <time>September 15, 2012</time></p>
      <p>Easy on the HDR buddy.</p>
   </div>
   <div>
      <p>By Susan on <time>October 1, 2012</time></p>
      <p>I love Central Park.</p>
   </div>
</body>
</html>
```



DOM Nodes

In the DOM, each element within the HTML document is called a **node.** If the DOM is a tree, then each node is an individual branch.

There are:

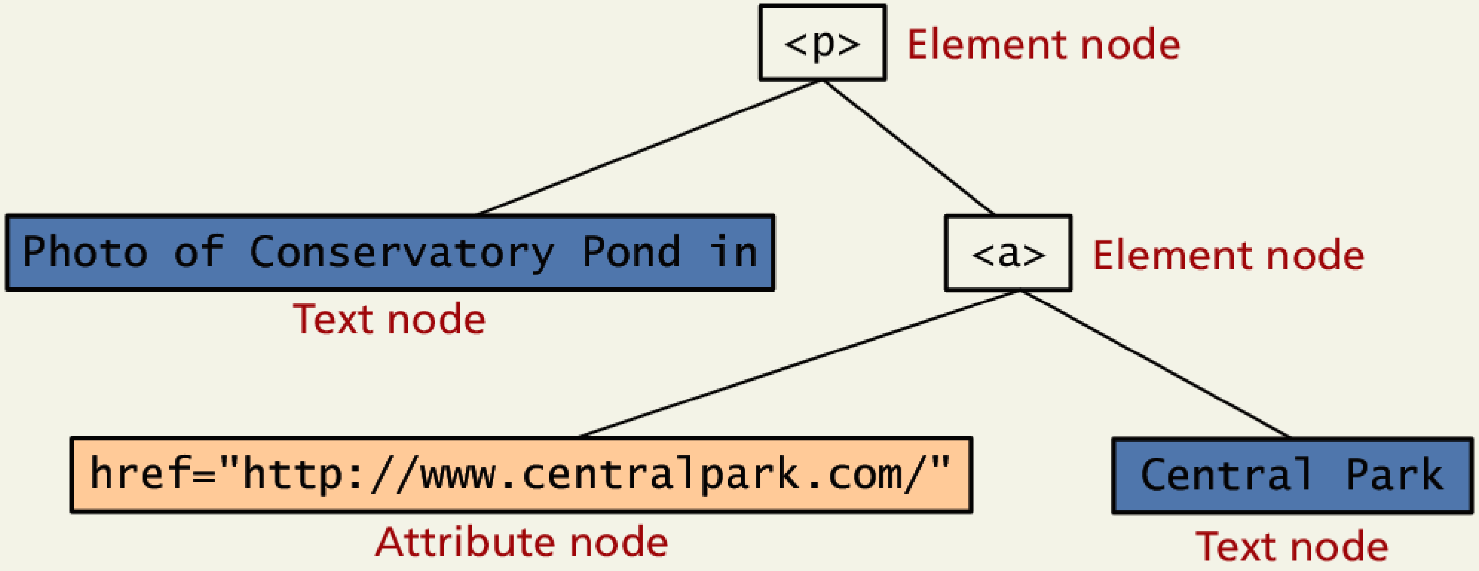
- element nodes,
- text nodes, and
- attribute nodes

All nodes in the DOM share a common set of properties and methods.

DOM Nodes

Element, text and attribute nodes

```
<p>Photo of Conservatory Pond in
   <a href="http://www.centralpark.com/">Central Park</a>
</p>
```



DOM Nodes

Essential Node Object properties

Property	Description
attributes	Collection of node attributes
childNodes	A NodeList of child nodes for this node
firstChild	First child node of this node.
lastChild	Last child of this node.
nextSibling	Next sibling node for this node.
nodeName	Name of the node
nodeType	Type of the node
nodeValue	Value of the node
parentNode	Parent node for this node.
previousSibling	Previous sibling node for this node.

Document Object

One root to ground them all

The **DOM document object** is the root JavaScript object representing the entire HTML document.

It contains some properties and methods that we will use extensively in our development and is globally accessible as **document**.

```
// specify the doctype, for example html

var a = document.doctype.name;

// specify the page encoding, for example ISO-8859-1

var b = document.inputEncoding;
```

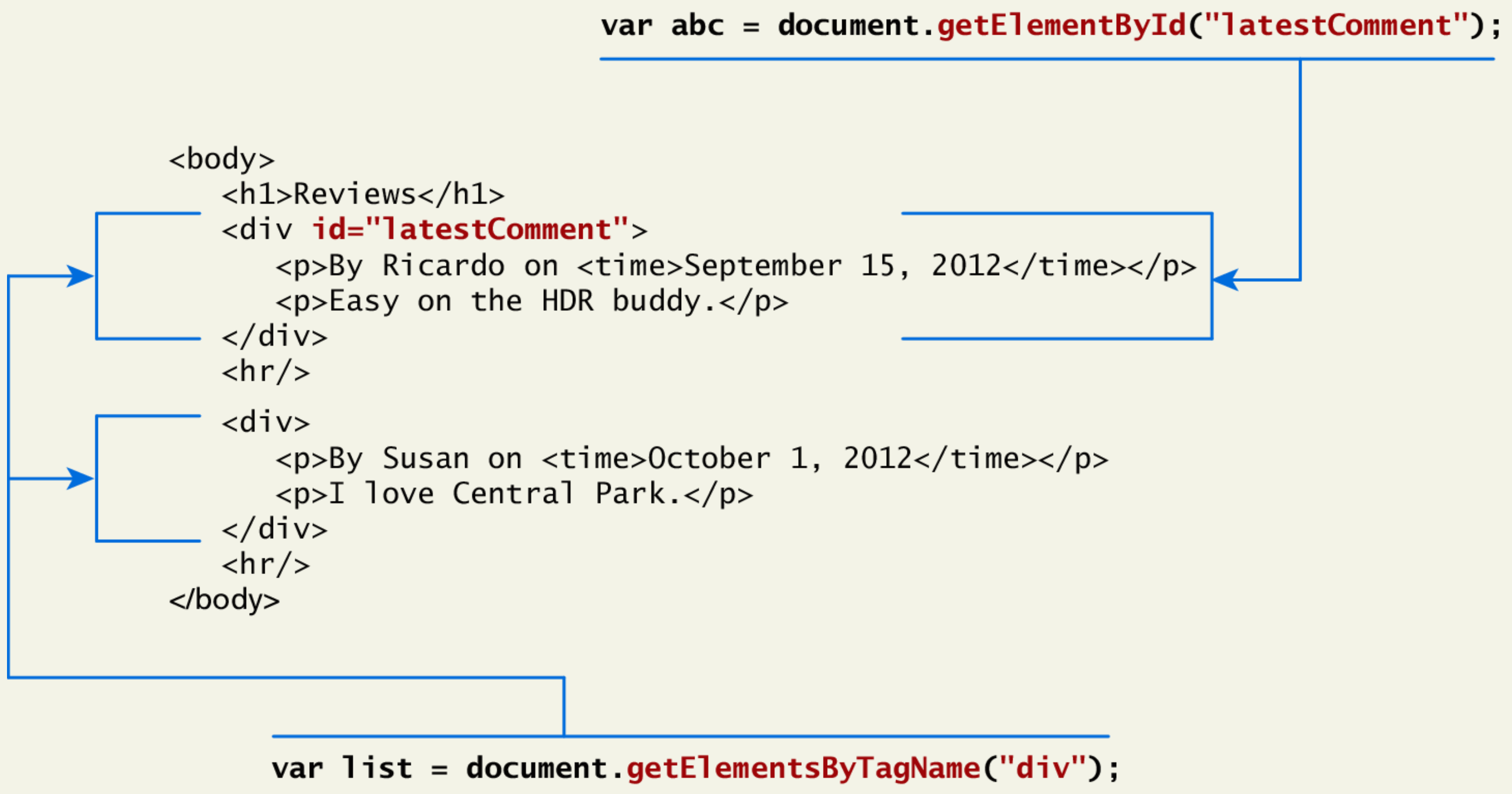
Document Object

Document Object Methods

Method	Description
createAttribute()	Creates an attribute node
createElement()	Creates an element node
createTextNode()	Create a text node
getElementById(id)	Returns the element node whose id attribute matches the passed id parameter.
getElementsByTagName(name)	Returns a nodeList of elements whose tag name matches the passed name parameter.

Accessing nodes

getElementById(), getElementsByTagName()



```
var abc = document.getElementById("latestComment");
```

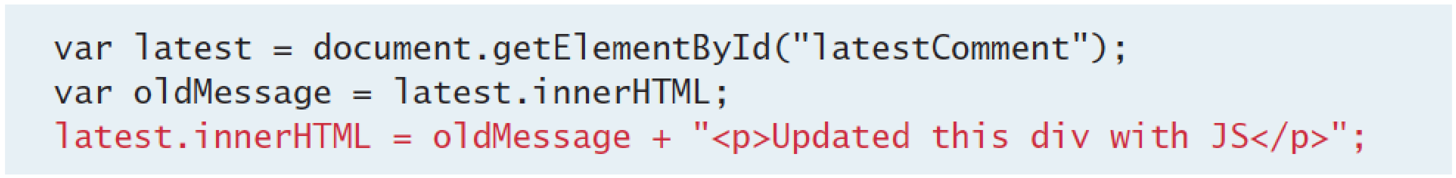
```
<body>
   <h1>Reviews</h1>
   <div id="latestComment">
      <p>By Ricardo on <time>September 15, 2012</time></p>
      <p>Easy on the HDR buddy.</p>
   </div>
   <hr/>

   <div>
      <p>By Susan on <time>October 1, 2012</time></p>
      <p>I love Central Park.</p>
   </div>
   <hr/>
</body>
```

```
var list = document.getElementsByTagName("div");
```

Modifying a DOM element

The document.write() method is used to create output to the HTML page from JavaScript. The modern JavaScript programmer will want to write to the HTML page, but in a particular location, not always at the bottom

Using the DOM document and HTML DOM element objects, we can do exactly that using the **innerHTML** property



```
var latest = document.getElementById("latestComment");
var oldMessage = latest.innerHTML;
latest.innerHTML = oldMessage + "<p>Updated this div with JS</p>";
```

LISTING 6.8 Changing the HTML using innerHTML

Modifying a DOM element

More verbosely, and validated

Although the innerHTML technique works well (and is very fast), there is a more verbose technique available to us that builds output using the DOM.

DOM functions createTextNode(), removeChild(), and appendChild() allow us to modify an element in a more rigorous way

```
var latest = document.getElementById("latestComment");
var oldMessage = latest.innerHTML;
var newMessage = oldMessage + "<p>Updated this div with JS</p>";
latest.removeChild(latest.firstChild);
latest.appendChild(document. createTextNode(newMessage));
```

LISTING 6.9 Changing the HTML using createTextNode( ) and appendChild( )

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JAVASCRIPT EVENTS

JavaScript Events

A JavaScript **event** is an action that can be detected by JavaScript.

We say then that an event is *triggered* and then it can be *caught* by JavaScript functions, which then do something in response.

JavaScript Events

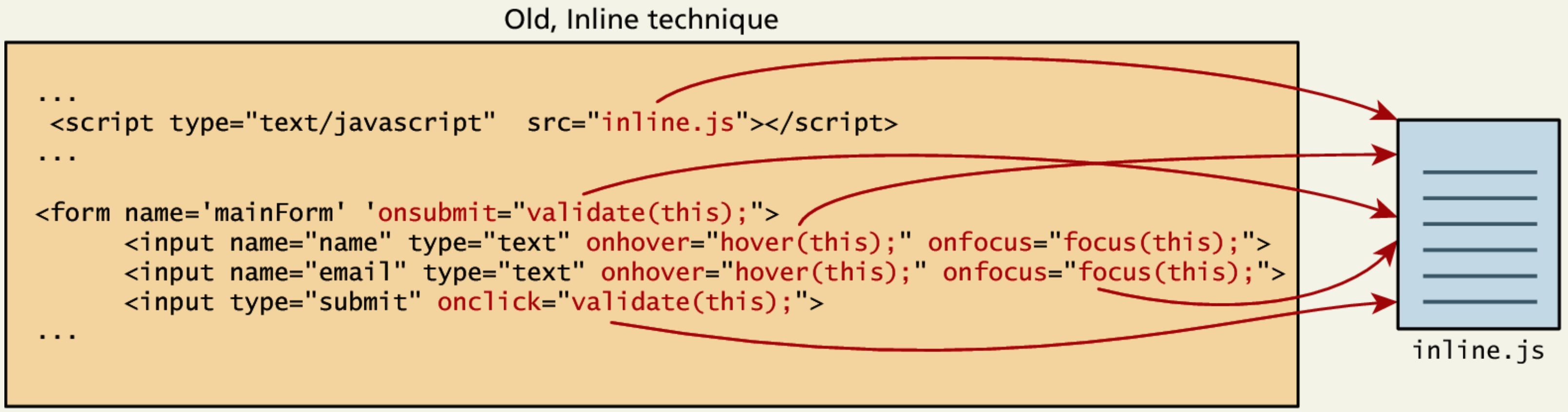
A brave new world

In the original JavaScript world, events could be specified right in the HTML markup with *hooks* to the JavaScript code (and still can).

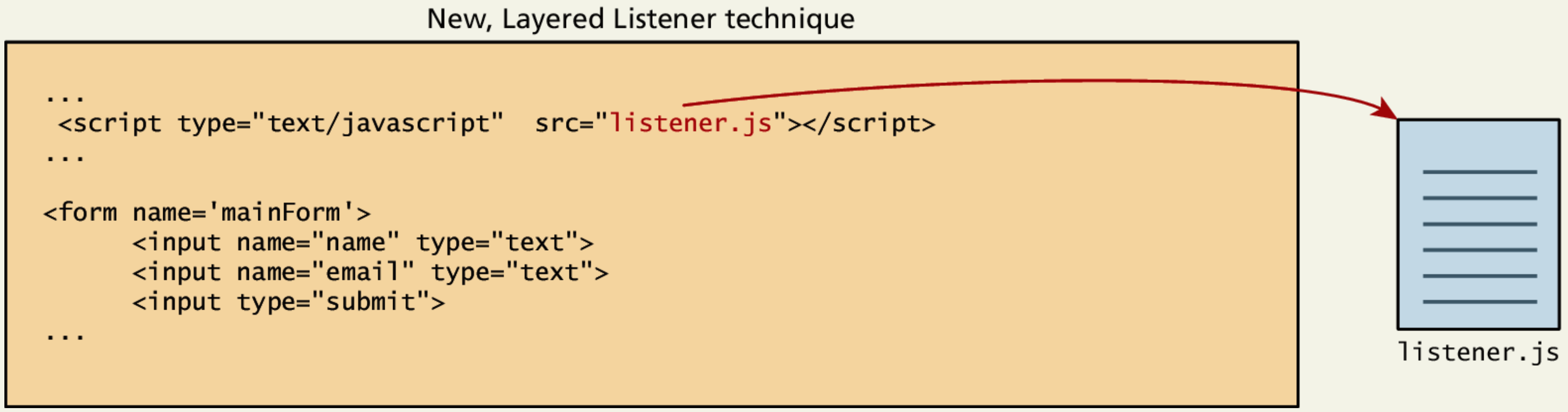
As more powerful frameworks were developed, and website design and best practices were refined, this original mechanism was supplanted by the **listener** approach.

JavaScript Events

Two approaches



```
...
 <script type="text/javascript"  src="inline.js"></script>
...

<form name='mainForm' 'onsubmit="validate(this);">
      <input name="name" type="text" onhover="hover(this);" onfocus="focus(this);">
      <input name="email" type="text" onhover="hover(this);" onfocus="focus(this);">
      <input type="submit" onclick="validate(this);">
...
```



```
...
 <script type="text/javascript"  src="listener.js"></script>
...

<form name='mainForm'>
      <input name="name" type="text">
      <input name="email" type="text">
      <input type="submit">
...
```

Inline Event Handler Approach

For example, if you wanted an alert to pop-up when clicking a <div> you might program:

```
<div id="example1" onclick="alert('hello')">Click for pop-up</div>
```

The problem with this type of programming is that the HTML markup and the corresponding JavaScript logic are woven together. It does not make use of layers; that is, it does not separate content from behavior.

Listener Approach

Two ways to set up listeners

```
var greetingBox = document.getElementById('example1');
greetingBox.onclick = alert('Good Morning');
```

LISTING 6.10 The "old" style of registering a listener.

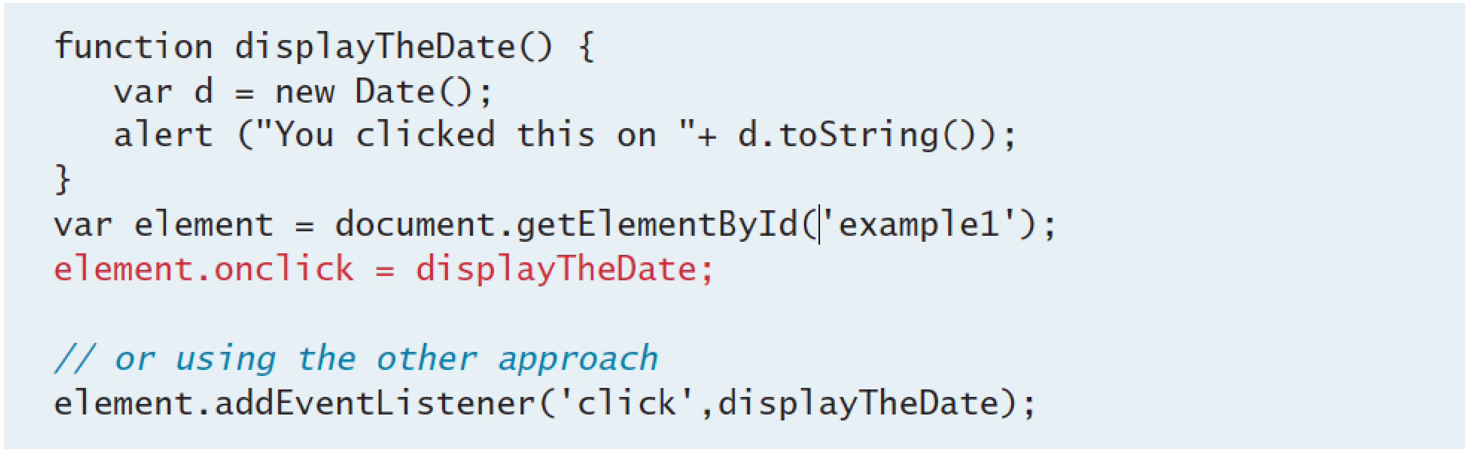
```
var greetingBox = document.getElementById('example1');
greetingBox.addEventListener('click', alert('Good Morning'));
greetingBox.addEventListener('mouseOut', alert('Goodbye'));

// IE 8
greetingBox.attachEvent('click', alert('Good Morning'));
```

LISTING 6.11 The "new" DOM2 approach to registering listeners.

Listener Approach

Using functions

What if we wanted to do something more elaborate when an event is triggered? In such a case, the behavior would have to be encapsulated within a function, as shown in Listing 6.12.



```
function displayTheDate() {
   var d = new Date();
   alert ("You clicked this on "+ d.toString());
}
var element = document.getElementById('example1');
element.onclick = displayTheDate;

// or using the other approach
element.addEventListener('click',displayTheDate);
```

LISTING 6.12 Listening to an event with a function

Listener Approach

Anonymous functions

An alternative to that shown in Listing 6.12 is to use an anonymous function (that is, one without a name), as shown in Listing 6.13.

```
var element = document.getElementById('example1');
element.onclick = function() {
   var d = new Date();
   alert ("You clicked this on " + d.toString());
};
```

LISTING 6.13 Listening to an event with an anonymous function

Event Object

No matter which type of event we encounter, they are all **DOM event objects** and the event handlers associated with them can access and manipulate them. Typically we see the events passed to the function handler as a parameter named *e*.

```
function someHandler(e) {
        // e is the event that triggered this handler.
}
```

Event Object

Several Options

- **Bubbles**. If an event's bubbles property is set to true then there must be an event handler in place to handle the event or it will bubble up to its parent and trigger an event handler there.
- **Cancelable**. The Cancelable property is also a Boolean value that indicates whether or not the event can be cancelled.
- **preventDefault**. A cancelable default action for an event can be stopped using the preventDefault() method in the next slide

Event Object

Prevent the default behaviour

```
function submitButtonClicked(e) {
  if(e.cancelable){
    e. preventDefault();
  }
}
```

LISTING 6.14 A sample event handler function that prevents the default event

Event Types

There are several classes of event, with several types of event within each class specified by the W3C:

- mouse events
- keyboard events
- form events
- frame events

Mouse events

Event	Description
onclick	The mouse was clicked on an element
ondblclick	The mouse was double clicked on an element
onmousedown	The mouse was pressed down over an element
onmouseup	The mouse was released over an element
onmouseover	The mouse was moved (not clicked) over an element
onmouseout	The mouse was moved off of an element
onmousemove	The mouse was moved while over an element

Keyboard events

Event	Description
onkeydown	The user is pressing a key (this happens first)
onkeypress	The user presses a key (this happens after onkeydown)
onkeyup	The user releases a key that was down (this happens last)

Keyboard events

Example

<input type="text" id="keyExample">

The input box above, for example, could be listened to and each key pressed echoed back to the user as an alert as shown in Listing 6.15.

```
document.getElementById("keyExample").onkeydown = function
myFunction(e){
   var keyPressed=e.keyCode;      //get the raw key code
   var character=String.fromCharCode(keyPressed); //convert to string
   alert("Key " + character + " was pressed");
}
```

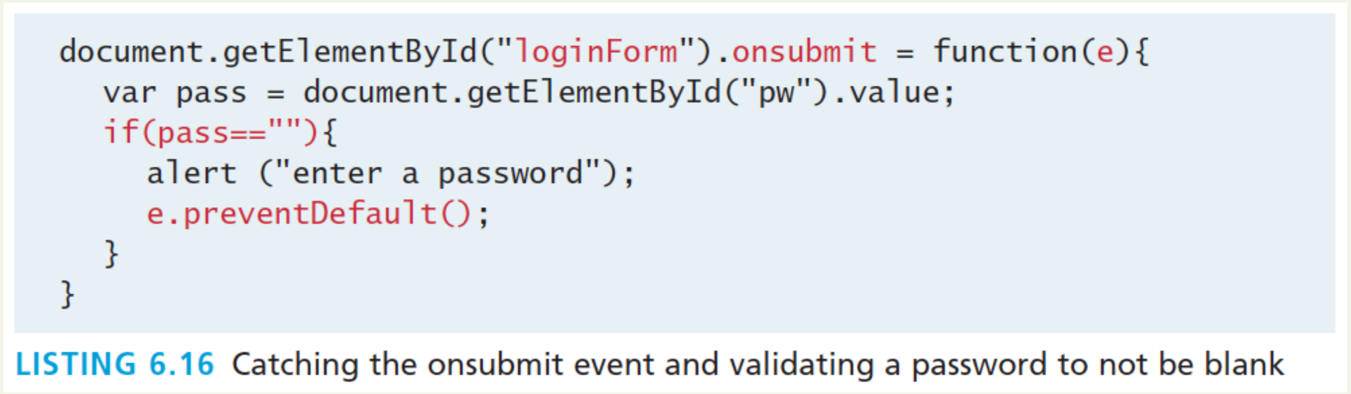
LISTING 6.15 Listener that hears and alerts keypresses

Form Events

Event	Description
onblur	A form element has lost focus (that is, control has moved to a different element, perhaps due to a click or Tab key press.
onchange	Some <input>, <textarea> or <select> field had their value change. This could mean the user typed something, or selected a new choice.
onfocus	Complementing the onblur event, this is triggered when an element gets focus (the user clicks in the field or tabs to it)
onreset	HTML forms have the ability to be reset. This event is triggered when that happens.
onselect	When the users selects some text. This is often used to try and prevent copy/paste.
onsubmit	When the form is submitted this event is triggered. We can do some pre-validation when the user submits the form in JavaScript before sending the data on to the server.

Form Events

Example



```
document.getElementById("loginForm").onsubmit = function(e){
  var pass = document.getElementById("pw").value;
  if(pass==""){
    alert ("enter a password");
    e.preventDefault();
  }
}
```

LISTING 6.16 Catching the onsubmit event and validating a password to not be blank

Section 8 of 8

FORMS

Validating Forms

You mean pre-validating right?

Writing code to prevalidate forms on the client side will reduce the number of incorrect submissions, thereby reducing server load.

There are a number of common validation activities including email validation, number validation, and data validation.

Validating Forms

Empty field

```
document.getElementById("loginForm").onsubmit = function(e){
  var fieldValue=document.getElementByID("username").value;
  if(fieldValue==null || fieldValue== ""){
    // the field was empty. Stop form submission
    e.preventDefault();
    // Now tell the user something went wrong
    alert("you must enter a username");
  }
}
```

LISTING 6.18 A simple validation script to check for empty fields

Validating Forms

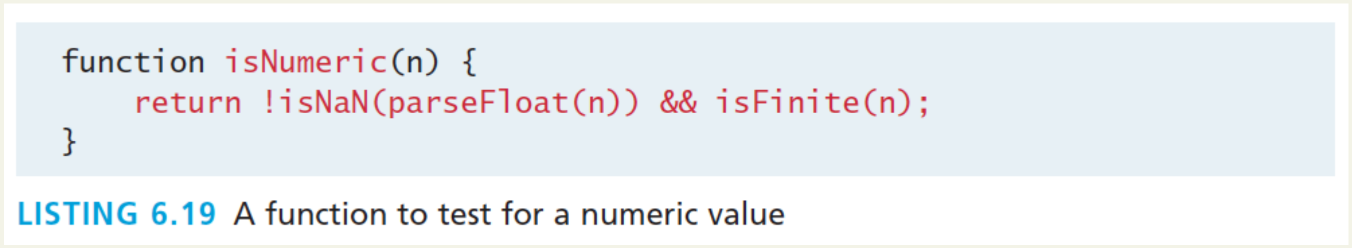
Empty field

If you want to ensure a checkbox is ticked, use code like that below.

```
var inputField=document.getElementByID("license");

if (inputField.type=="checkbox"){

        if (inputField.checked)

                //Now we know the box is checked

}
```

Validating Forms

Number Validation



```
function isNumeric(n) {
    return !isNaN(parseFloat(n)) && isFinite(n);
}
```

LISTING 6.19 A function to test for a numeric value

Submitting Forms

Submitting a form using JavaScript requires having a node variable for the form element. Once the variable, say, formExample is acquired, one can simply call the submit() method:

```
var formExample = document.getElementById("loginForm");

formExample.submit();
```

This is often done in conjunction with calling **preventDefault()** on the onsubmit event.

Introduction to Server-Side Development with PHP

Chapter 8

Randy Connolly and Ricardo Hoar

Objectives

1 Server-Side Development

2 Web Server's Responsabilities

3 Quick Tour of PHP

4 Program Control

5 Functions

Section 1 of 5

WHAT IS SERVER-SIDE DEVELOPMENT

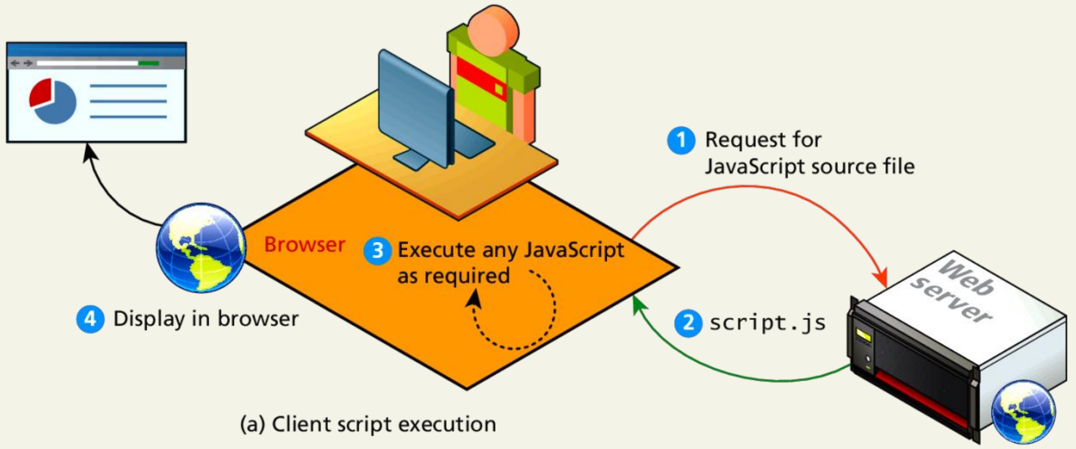
What is Server-Side Development

The basic hosting of your files is achieved through a web server.

Server-side development is much more than web hosting: it involves the use of a programming technology like PHP or ASP.NET to create scripts that dynamically generate content

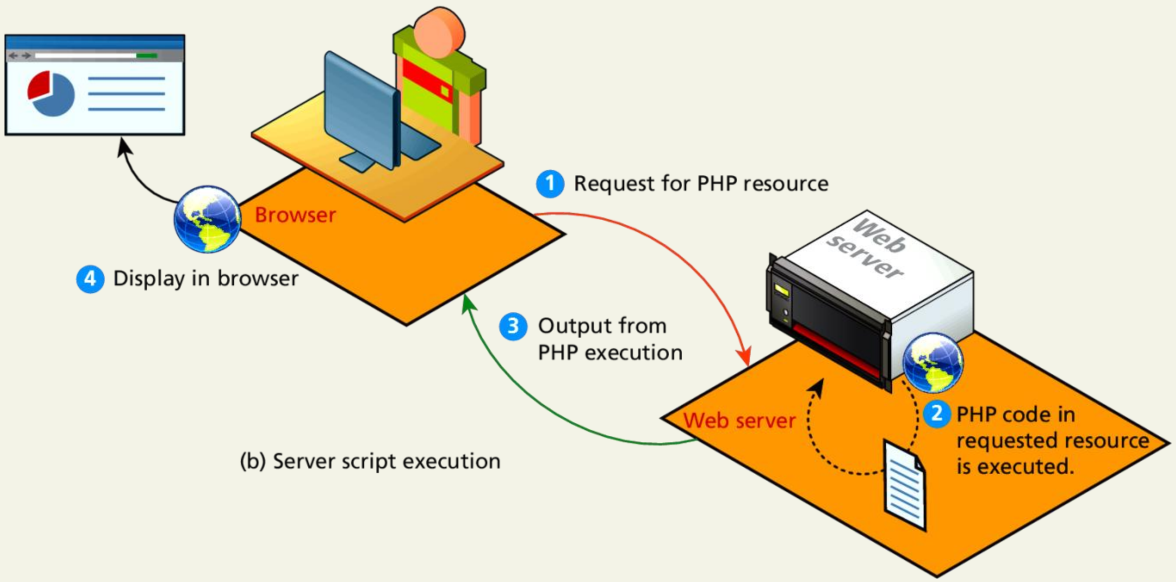
Consider distinction between client side and server side…

Comparing Client and Server Scripts



1 Request for JavaScript source file
Web server
2 script.js
Browser
3 Execute any JavaScript as required
4 Display in browser

(a) Client script execution

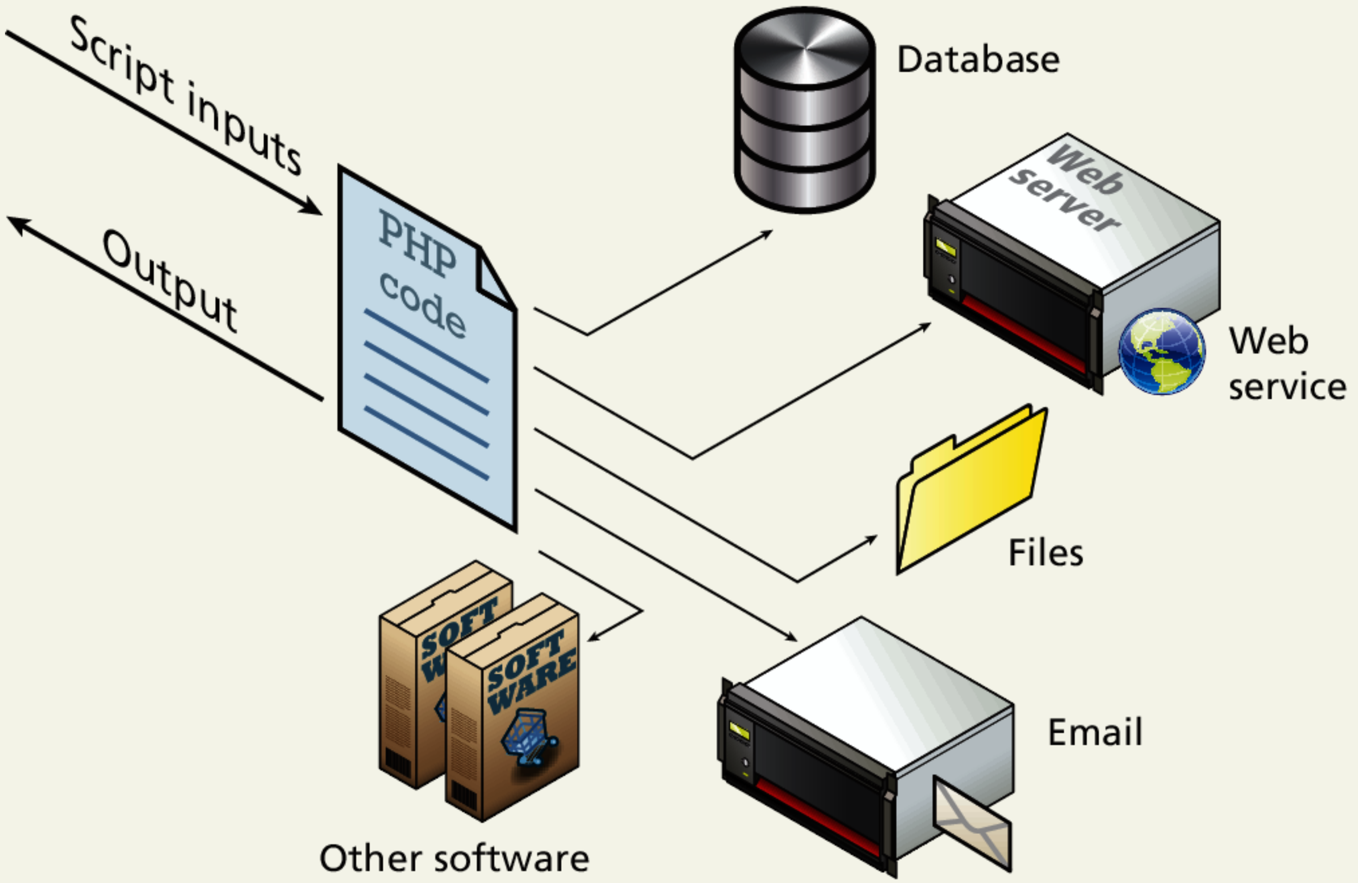


1 Request for PHP resource
Browser
4 Display in browser
Web server
3 Output from PHP execution
Web server
2 PHP code in requested resource is executed.

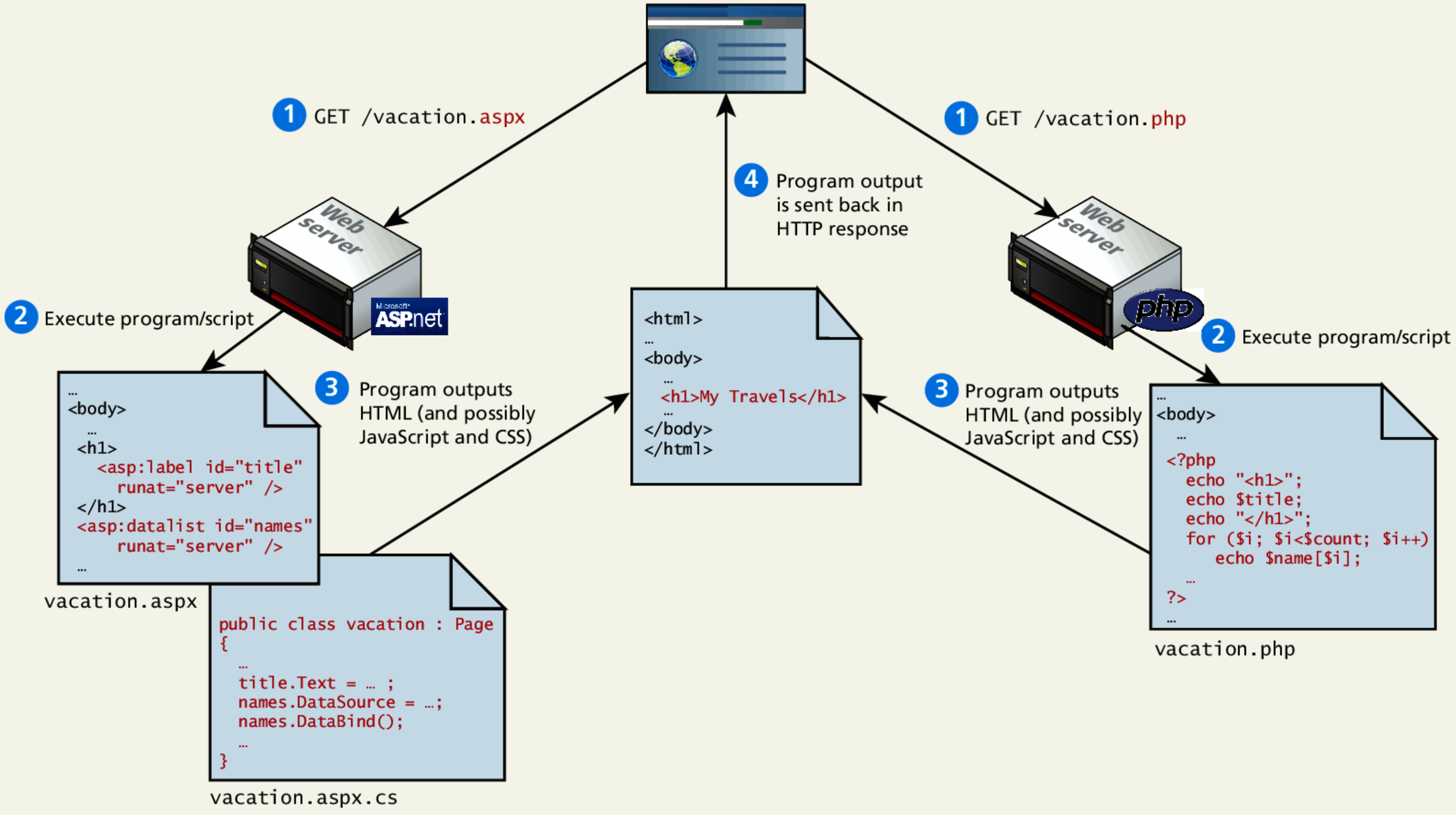
(b) Server script execution

Server-Side Script Resources

So many tools in your kit



Web Development Technologies


1 GET /vacation.aspx
1 GET /vacation.php
Web server
Web server
Microsoft ASP.net
php
2 Execute program/script
2 Execute program/script
3 Program outputs HTML (and possibly JavaScript and CSS)
3 Program outputs HTML (and possibly JavaScript and CSS)
4 Program output is sent back in HTTP response

vacation.aspx

```
…
<body>
  …
 <h1>
   <asp:label id="title"
      runat="server" />
 </h1>
 <asp:datalist id="names"
      runat="server" />
…
```

vacation.aspx.cs

```
public class vacation : Page
{
  …
  title.Text = … ;
  names.DataSource = …;
  names.DataBind();
  …
}
```

```
<html>
…
<body>
  …
  <h1>My Travels</h1>
  …
</body>
</html>
```

vacation.php

```
…
<body>
  …
 <?php
   echo "<h1>";
   echo $title;
   echo "</h1>";
   for ($i; $i<$count; $i++)
      echo $name[$i];
   …
 ?>
…
```

Comparing Server-Side Technologies

- **ASP (Active Server Pages)**. Like PHP, ASP code (using the VBScript programming language) can be embedded within the HTML. ASP programming code is interpreted at run time, hence it can be slow in comparison to other technologies.
- **ASP.NET**. ASP.NET is part of Microsoft's .NET Framework and can use any .NET programming language (though C# is the most commonly used). ASP.NET uses an explicitly object-oriented approach. It also uses special markup called web server controls that encapsulate common web functionality such as database-driven lists, form validation, and user registration wizards. ASP.NET pages are compiled into an intermediary file format called MSIL that is analogous to Java's byte-code. ASP.NET then uses a Just-In-Time compiler to compile the MSIL into machine executable code so its performance can be excellent. However, ASP.NET is essentially limited to Windows servers.

Comparing Server-Side Technologies

- **JSP (Java Server Pages)**. JSP uses Java as its programming language and like ASP.NET it uses an explicit object-oriented approach and is used in large enterprise web systems and is integrated into the J2EE environment. Since JSP uses the Java Runtime Engine, it also uses a JIT compiler for fast execution time and is cross-platform. While JSP's usage in the web as a whole is small, it has a substantial market share in the intranet environment, as well as with very large and busy sites.
- **Node.js**. This is a more recent server environment that uses JavaScript on the server side, thus allowing developers already familiar with JavaScript to use just a single language for both client-side and server-side development. Unlike the other development technologies listed here, node.js also is its own web server software, thus eliminating the need for Apache, IIS, or some other web server software.

Comparing Server-Side Technologies

- **Perl**. Until the development and popularization of ASP, PHP, and JSP, Perl was the language typically used for early server-side web development. As a language, it excels in the manipulation of text. It was commonly used in conjunction with the **Common Gateway Interface (CGI)**, an early standard API for communication between applications and web server software.

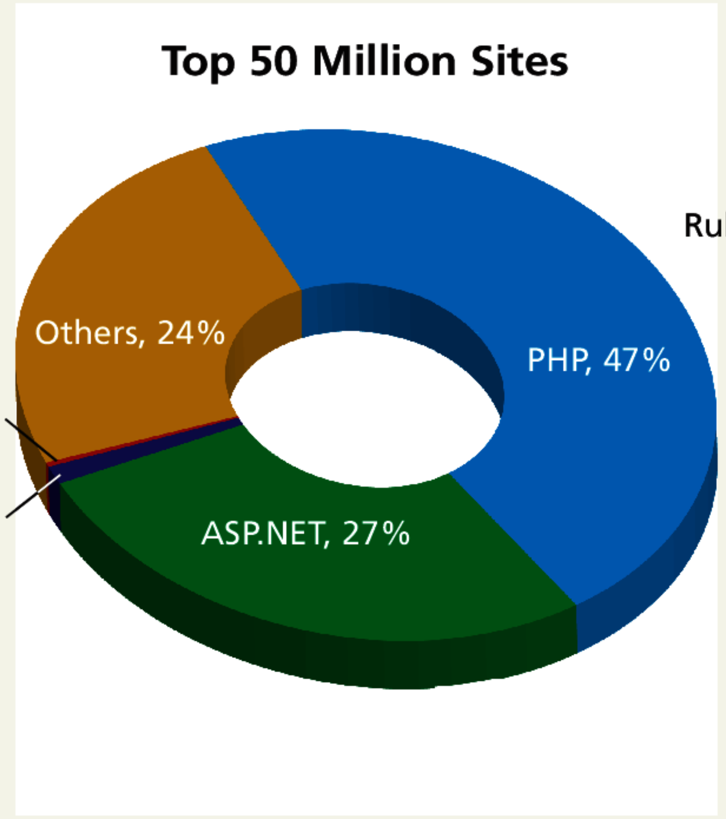
- **PHP**. Like ASP, PHP is a dynamically typed language that can be embedded directly within the HTML, though it now supports most common object-oriented features, such as classes and inheritance. By default, PHP pages are compiled into an intermediary representation called **opcodes** that are analogous to Java's byte-code or the .NET Framework's MSIL. Originally, PHP stood for *personal home pages*, although it now is a recursive acronym that means *PHP: Hypertext Processor*.

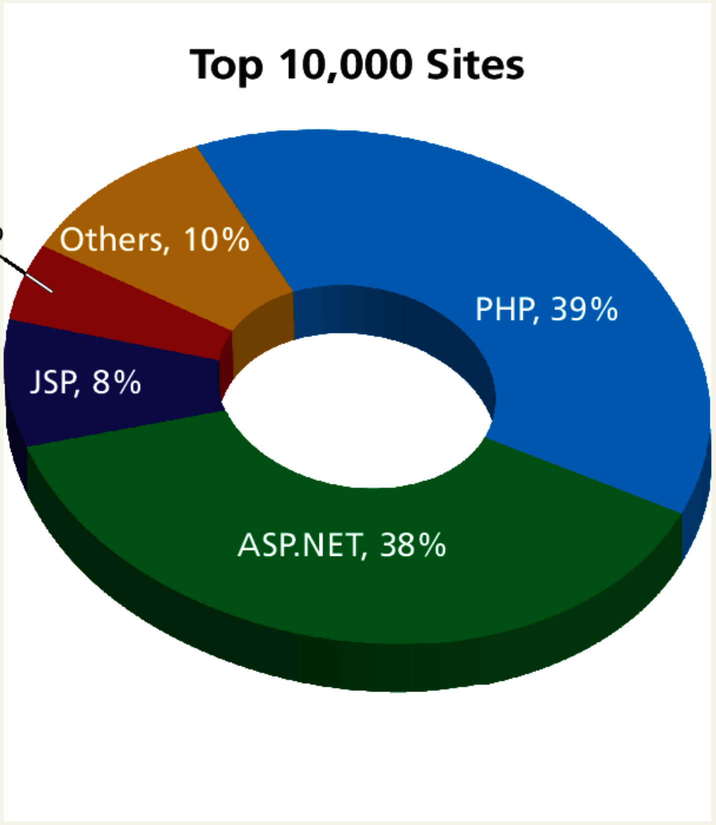
Comparing Server-Side Technologies

- **Python**. This terse, object-oriented programming language has many uses, including being used to create web applications. It is also used in a variety of web development frameworks such as Django and Pyramid.
- **Ruby on Rails**. This is a web development framework that uses the Ruby programming language. Like ASP.NET and JSP, Ruby on Rails emphasizes the use of common software development approaches, in particular the MVC design pattern. It integrates features such as templates and engines that aim to reduce the amount of development work required in the creation of a new site.

Market Share

Of web development environments





Section 2 of 5

WEB SERVER'S RESPONSIBILITIES

A Web Server's Responsibilities

A web server has many responsibilities:

- handling HTTP connections
- responding to requests for static and dynamic resources
- managing permissions and access for certain resources
- encrypting and compressing data
- managing multiple domains and URLs
- managing database connections
- managing cookies and state
- uploading and managing files

LAMP stack

WAMP, MAMP, …

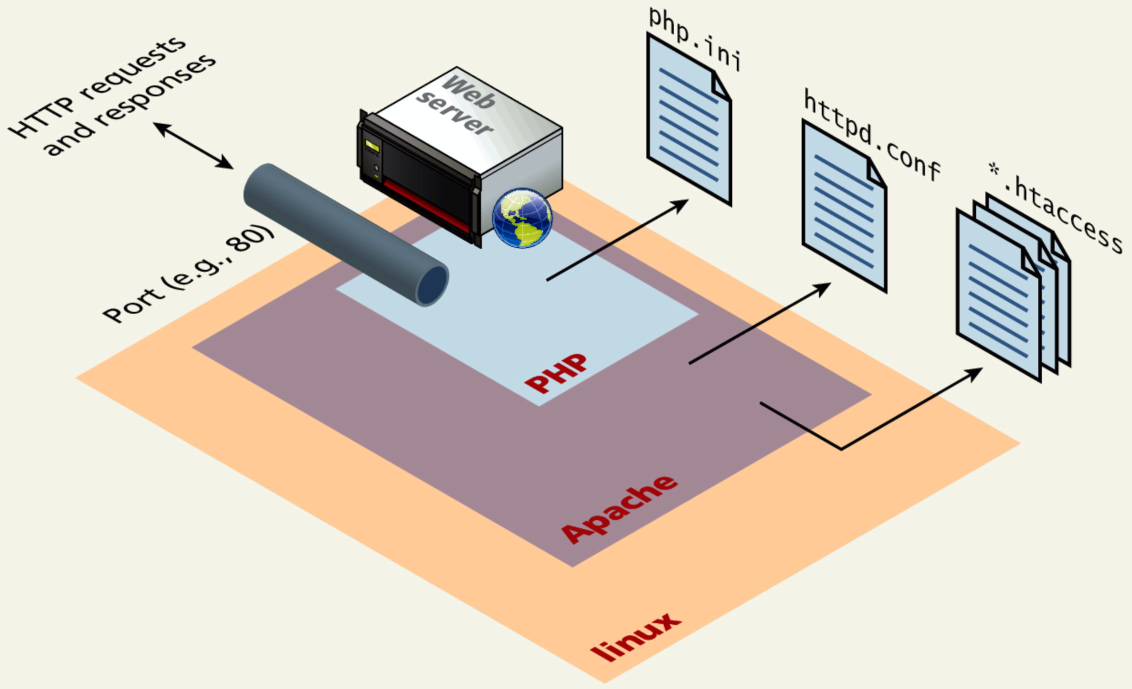
You will be using the LAMP software stack

- **L**inux operating system
- **A**pache web server
- **M**ySQL DBMS
- **P**HP scripting language

Apache and Linux

LA

Consider the **Apache** web server as the intermediary that interprets HTTP requests that arrive through a network port and decides how to handle the request, which often requires working in conjunction with PHP.



Apache

Continued

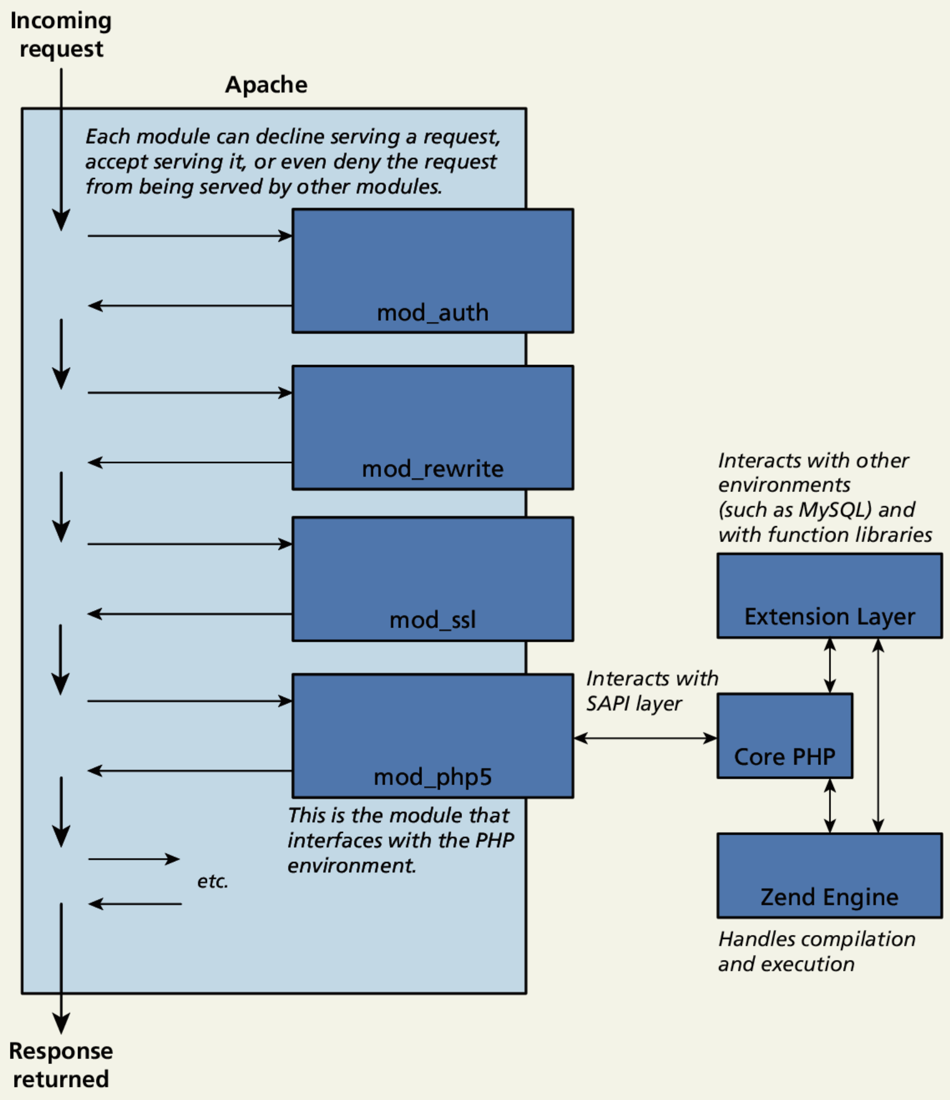
Apache runs as a daemon on the server. A **daemon** is an executing instance of a program (also called a **process**) that runs in the background, waiting for a specific event that will activate it.

When a request arrives, Apache then uses modules to determine how to respond to the request.

In Apache, a **module** is a compiled extension (usually written in the C programming language) to Apache that helps it *handle* requests. For this reason, these modules are also sometimes referred to as **handlers**.

Apache and PHP

PHP Module in Apache


Incoming request
Apache
Each module can decline serving a request, accept serving it, or even deny the request from being served by other modules.
mod_auth
mod_rewrite
mod_ssl
mod_php5
This is the module that interfaces with the PHP environment.
etc.
Response returned
Interacts with other environments (such as MySQL) and with function libraries
Extension Layer
Interacts with SAPI layer
Core PHP
Zend Engine
Handles compilation and execution

Section 3 of 5

QUICK TOUR OF PHP

Quick Tour

- PHP, like JavaScript, is a dynamically typed language.
- it uses classes and functions in a way consistent with other object-oriented languages such as C++, C#, and Java
- The syntax for loops, conditionals, and assignment is identical to JavaScript
- Differs when you get to functions, classes, and in how you define variables

PHP Tags

The most important fact about PHP is that the programming code can be embedded directly within an HTML file.

- A PHP file will usually have the extension **.php**
- programming code must be contained within an opening **<?php** tag and a matching closing **?>** tag
- any code outside the tags is echoed directly out to the client

PHP Tags

```
<?php
$user = "Randy";
?>
<!DOCTYPE html>
<html>
<body>
<h1>Welcome <?php echo $user; ?></h1>
<p>
The server time is
<?php
echo "<strong>";
echo date("H:i:s");
echo "</strong>";
?>
</p>
</body>
</html>
```

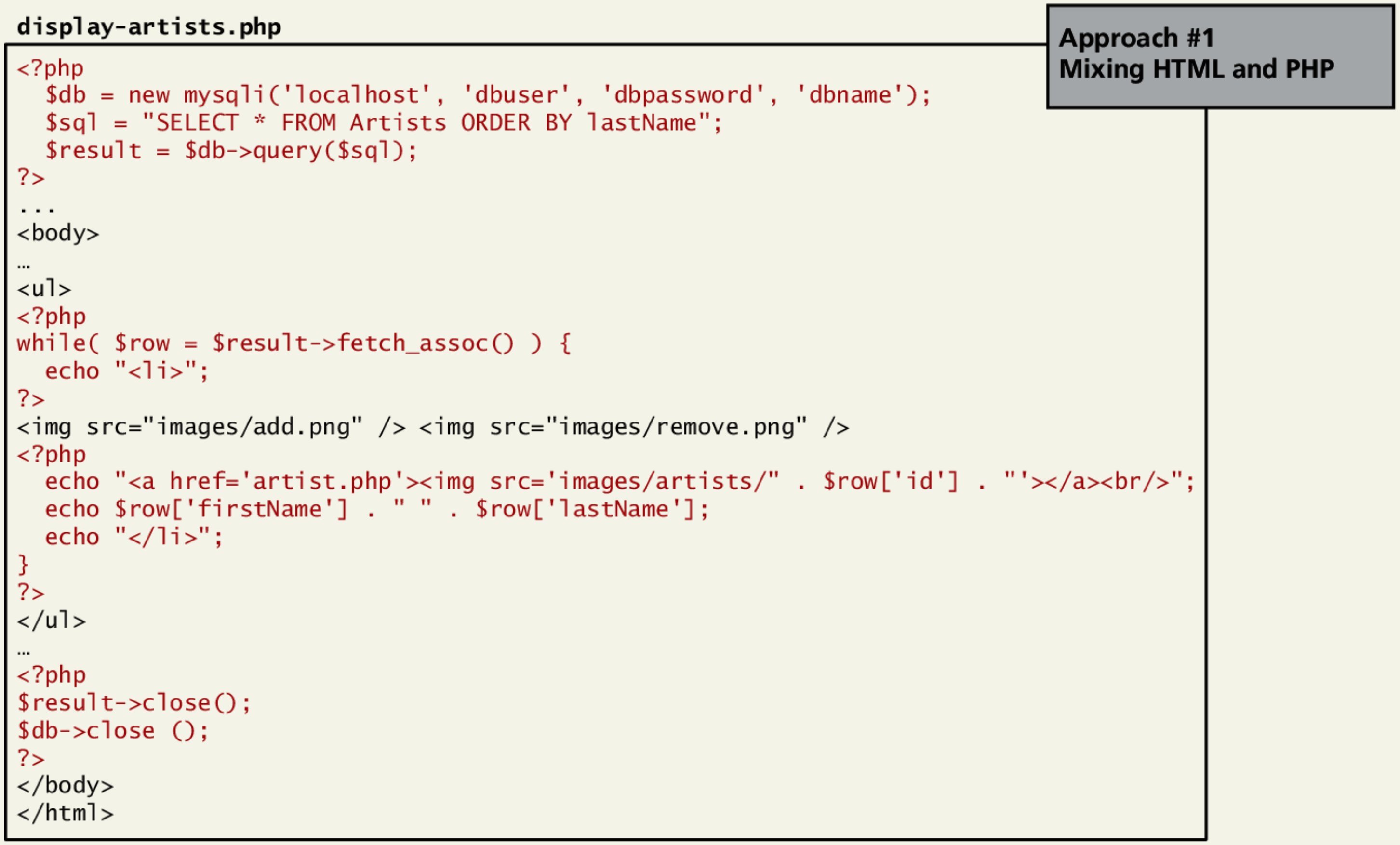
LISTING 8.1 PHP tags

```
<!DOCTYPE html>
<html>
<body>
<h1>Welcome Randy</h1>
<p>
The server time is <strong>02:59:09</strong>
</p>
</body>
</html>
```

LISTING 8.2 Listing 8.1 in the browser

HTML and PHP

Two approaches



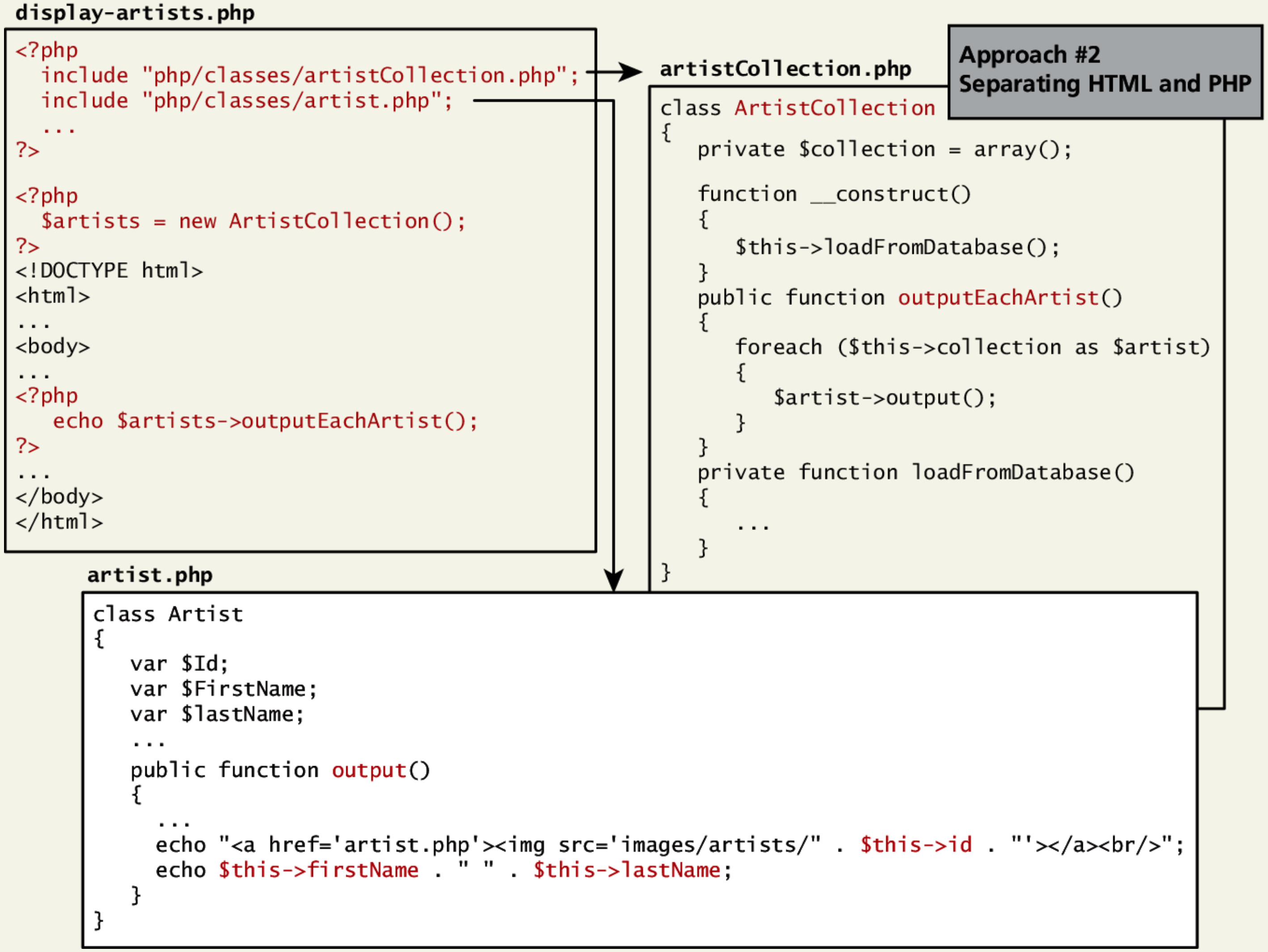
display-artists.php

Approach #1
Mixing HTML and PHP

```
<?php
  $db = new mysqli('localhost', 'dbuser', 'dbpassword', 'dbname');
  $sql = "SELECT * FROM Artists ORDER BY lastName";
  $result = $db->query($sql);
?>
...
<body>
…
<ul>
<?php
while( $row = $result->fetch_assoc() ) {
  echo "<li>";
?>
<img src="images/add.png" /> <img src="images/remove.png" />
<?php
  echo "<a href='artist.php'><img src='images/artists/" . $row['id'] . "'></a><br/>";
  echo $row['firstName'] . " " . $row['lastName'];
  echo "</li>";
}
?>
</ul>
…
<?php
$result->close();
$db->close ();
?>
</body>
</html>
```

HTML and PHP

Two approaches



display-artists.php

```
<?php
  include "php/classes/artistCollection.php";
  include "php/classes/artist.php";
  ...
?>

<?php
  $artists = new ArtistCollection();
?>
<!DOCTYPE html>
<html>
...
<body>
...
<?php
   echo $artists->outputEachArtist();
?>
...
</body>
</html>
```

artistCollection.php

```
class ArtistCollection
{
   private $collection = array();

   function __construct()
   {
      $this->loadFromDatabase();
   }
   public function outputEachArtist()
   {
      foreach ($this->collection as $artist)
      {
         $artist->output();
      }
   }
   private function loadFromDatabase()
   {
      ...
   }
}
```

artist.php

```
class Artist
{
   var $Id;
   var $FirstName;
   var $lastName;
   ...
   public function output()
   {
     ...
     echo "<a href='artist.php'><img src='images/artists/" . $this->id . "'></a><br/>";
     echo $this->firstName . " " . $this->lastName;
   }
}
```

PHP Comments

3 kinds

The types of comment styles in PHP are:

- **Single-line comments**. Lines that begin with a # are comment lines and will not be executed.
- **Multiline (block) comments**. These comments begin with a /* and encompass everything that is encountered until a closing */ tag is found.
- **End-of-line comments**. Whenever // is encountered in code, everything up to the end of the line is considered a comment.

PHP Comments

3 kinds

```
<?php
# single-line comment
/*
This is a multiline comment.
They are a good way to document functions or
complicated blocks of code
*/
$artist = readDatabase(); // end-of-line comment
?>
```

Variables

Variables in PHP are **dynamically typed.**

Variables are also **loosely typed** in that a variable can be assigned different data types over time

To declare a variable you must preface the variable name with the dollar ($) symbol.

```
$count = 42;
```

Data Types

Data Type	Description
Boolean	A logical true or false value
Integer	Whole numbers
Float	Decimal numbers
String	Letters
Array	A collection of data of any type (covered in the next chapter)
Object	Instances of classes

Constants

A **constant** is somewhat similar to a variable, except a constant’s value never changes . . . in other words it stays constant.

- Typically defined near the top of a PHP file via the **define()** function
- once it is defined, it can be referenced without using the $ symbol

Constants

```
<?php

# Uppercase for constants is a programming convention
define("DATABASE_LOCAL", "localhost");
define("DATABASE_NAME", "ArtStore");
define("DATABASE_USER", "Fred");
define("DATABASE_PASSWD", "F5^7%ad");
...
# notice that no $ prefaces constant names
$db = new mysqli(DATABASE_LOCAL, DATABASE_NAME, DATABASE_USER,
  DATABASE_NAME);

?>
```

LISTING 8.4 PHP constants

Writing to Output

Hello World

To output something that will be seen by the browser, you can use the echo() function.

echo ("hello"); //long form

echo "hello"; //shortcut

String Concatenation

Easy

Strings can easily be appended together using the concatenate operator, which is the period (.) symbol.

```
$username = "World";

echo "Hello". $username;
```

Will Output **Hello World**

String Concatenation

Example

```
$firstName = "Pablo";

$lastName = "Picasso";

/*

Example one:

The first four lines are equivalent. Notice that you can reference PHP variables within a string literal
defined with double quotes.

The resulting output for the first four lines is: <em>Pablo Picasso</em>
The last one displays: <em> $firstName $lastName </em>

*/

echo "<em>" . $firstName . " ". $lastName . "</em>";

echo '<em>' . $firstName . ' '. $lastName. '</em>';

echo '<em>' . $firstName . ' '. $lastName. "</em>";

echo "<em> $firstName $lastName </em>";

echo '<em> $firstName $lastName </em>';  Won’t Work!!
```

String Concatenation

Example

```
/*

Example two:

These two lines are also equivalent. Notice that you
can use either the single quote symbol or double quote
symbol for string literals.

*/

echo "<h1>";

echo '<h1>';
```

String Concatenation

Example

```
/*

Example three:

These two lines are also equivalent. In the second
example, the escape character (the backslash) is used
to embed a double quote within a string literal defined
within double quotes.

*/

echo '<img src="23.jpg" >';

echo "<img src=\"23.jpg\" >";
```

String escape Sequences

Sequence	Description
\n	Line feed
\t	Horizontal tab
\\	Backslash
\$	Dollar sign
\"	Double quote

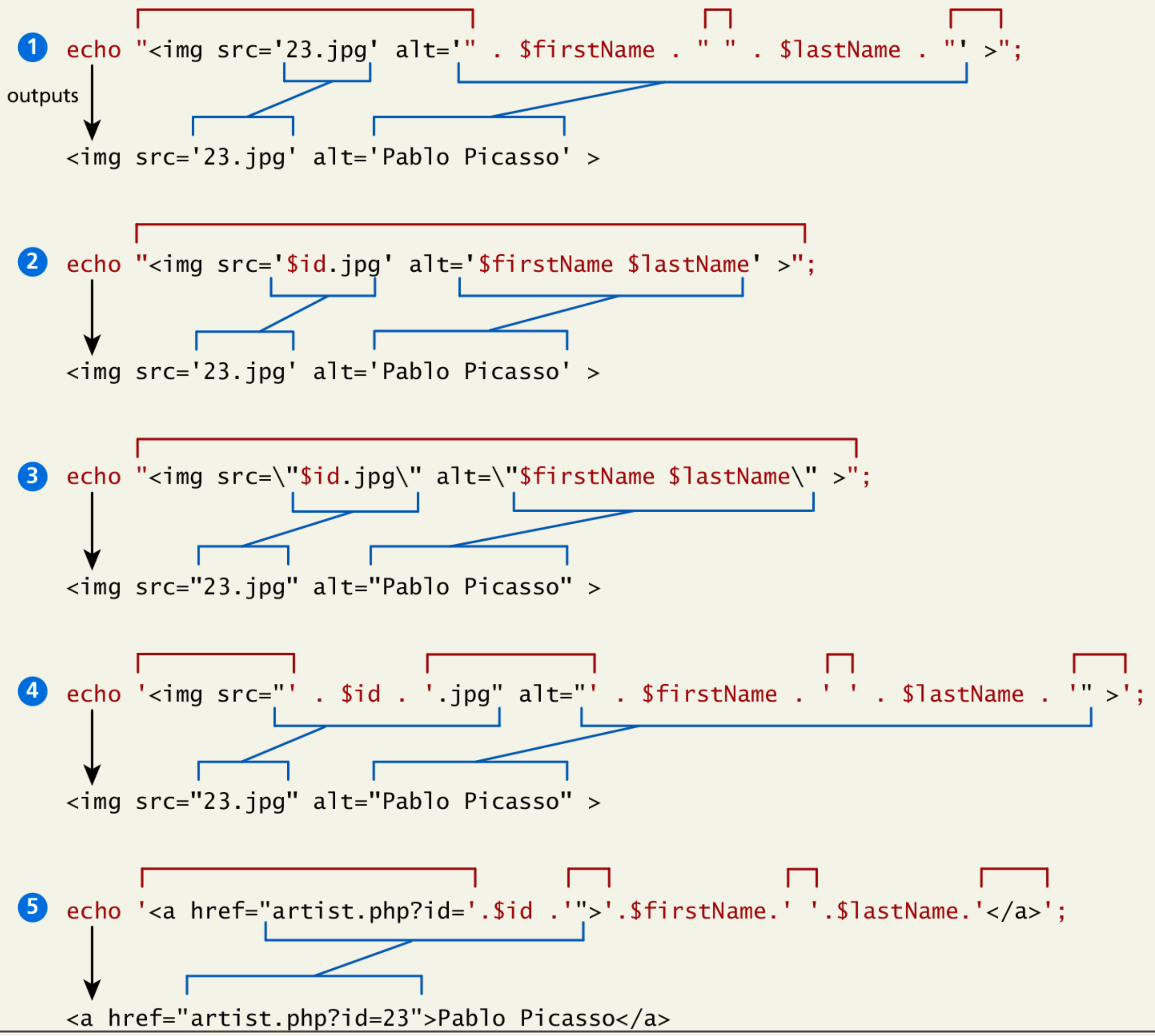
Complicated Concatenation

```
echo "<img src='23.jpg' alt='". $firstName . " ". $lastName . "' >";

echo "<img src='$id.jpg' alt='$firstName $lastName' >";

echo "<img src=\"$id.jpg\" alt=\"$firstName $lastName\" >";

echo '<img src="' . $id. '.jpg" alt="' . $firstName . ' ' . $lastName . '" >';

echo '<a href="artist.php?id=' .$id .'">' .$firstName .' ' . $lastName .'</a>';
```

Complicated Concatenation

```
echo "<img src='23.jpg' alt='". $firstName . " ". $lastName . "' >";

echo "<img src='$id.jpg' alt='$firstName $lastName' >";

echo "<img src=\"$id.jpg\" alt=\"$firstName $lastName\" >";

echo '<img src="' . $id. '.jpg" alt="' . $firstName . ' ' . $lastName . '" >';

echo '<a href="artist.php?id=' .$id .'">' .$firstName .' ' . $lastName .'</a>';
```

Illustrated Example



1
```
echo "<img src='23.jpg' alt='" . $firstName . " " . $lastName . "' >";
```
outputs
```
<img src='23.jpg' alt='Pablo Picasso' >
```

2
```
echo "<img src='$id.jpg' alt='$firstName $lastName' >";
```
```
<img src='23.jpg' alt='Pablo Picasso' >
```

3
```
echo "<img src=\"$id.jpg\" alt=\"$firstName $lastName\" >";
```
```
<img src="23.jpg" alt="Pablo Picasso" >
```

4
```
echo '<img src="' . $id . '.jpg" alt="' . $firstName . ' ' . $lastName . '" >';
```
```
<img src="23.jpg" alt="Pablo Picasso" >
```

5
```
echo '<a href="artist.php?id='.$id .'">'.$firstName.' '.$lastName.'</a>';
```
```
<a href="artist.php?id=23">Pablo Picasso</a>
```

PrintF

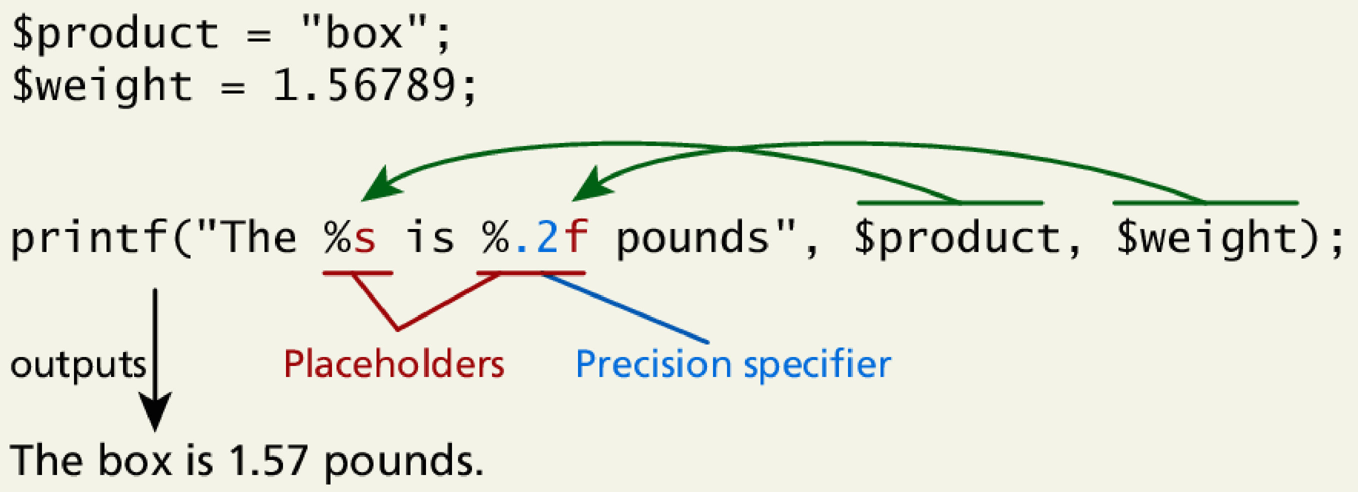
Good ol' printf

As an alternative, you can use the **printf()** function.

- derived from the same-named function in the C programming language
- includes variations to print to string and files (sprintf, fprintf)
- takes at least one parameter, which is a string, and that string optionally references parameters, which are then integrated into the first string by placeholder substitution
- Can also apply special formatting, for instance, specific date/time formats or number of decimal places

PrintF

Illustrated example



```
$product = "box";
$weight = 1.56789;

printf("The %s is %.2f pounds", $product, $weight);
```

```
The box is 1.57 pounds.
```

PrintF

Type specifiers

Each placeholder requires the percent (%) symbol in the first parameter string followed by a type specifier.

- b for binary
- d for signed integer
- f for float
- o for octal
- x for hexadecimal

PrintF

Precision

Precision allows for control over how many decimal places are shown. Important for displaying calculated numbers to the user in a “pretty” way.

Precision is achieved in the string with a period (.) followed by a number specifying how many digits should be displayed for floating-point numbers.

Section 4 of 5

PROGRAM CONTROL

If...else

The syntax for conditionals in PHP is almost identical to that of JavaScript

```
// if statement with condition
if ( $hourOfDay > 6 && $hourOfDay < 12 ) {
   $greeting = "Good Morning";
}
else if ($hourOfDay == 12) {   // optional else if
   $greeting = "Good Noon Time";
}
else {                         // optional else branch
   $greeting = "Good Afternoon or Evening";
}
```

LISTING 8.7 Conditional statement using if . . . else

If…else

Alternate syntax

```
<?php if ($userStatus == "loggedin") {  ?>
   <a href="account.php">Account</a>
   <a href="logout.php">Logout</a>
<?php }  else { ?>
   <a href="login.php">Login</a>
   <a href="register.php">Register</a>
<?php } ?>


<?php
   // equivalent to the above conditional
   if ($userStatus == "loggedin") {
      echo '<a href="account.php">Account</a> ';
      echo '<a href="logout.php">Logout</a>';
   }
   else {
      echo '<a href="login.php">Login</a> ';
      echo '<a href="register.php">Register</a>';
   }
?>
```

LISTING 8.8 Combining PHP and HTML in the same script

Switch…case

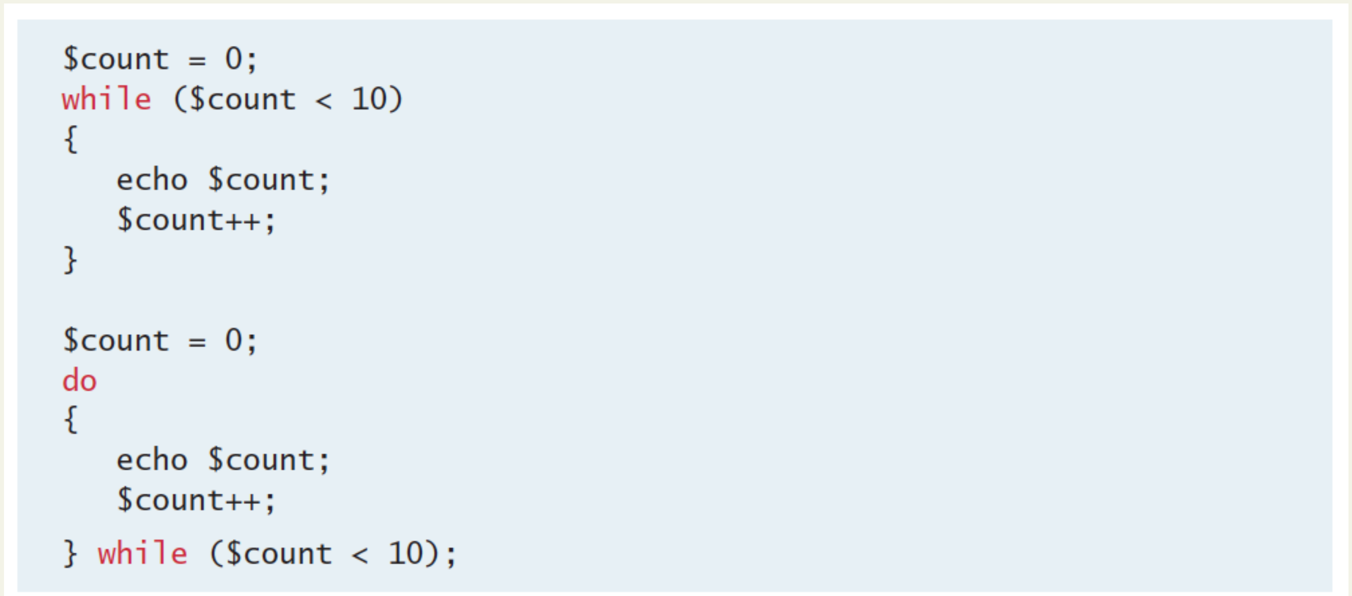
Nearly identical

```
switch ($artType) {
   case "PT":
   $output = "Painting";
     break;
     case "SC":
   $output = "Sculpture";
     break;
     default:
   $output = "Other";
}

// equivalent
if ($artType == "PT")
   $output = "Painting";
else if ($artType == "SC")
   $output = "Sculpture";
else
   $output = "Other";
```

LISTING 8.9 Conditional statement using switch

While and Do..while

Identical to other languages

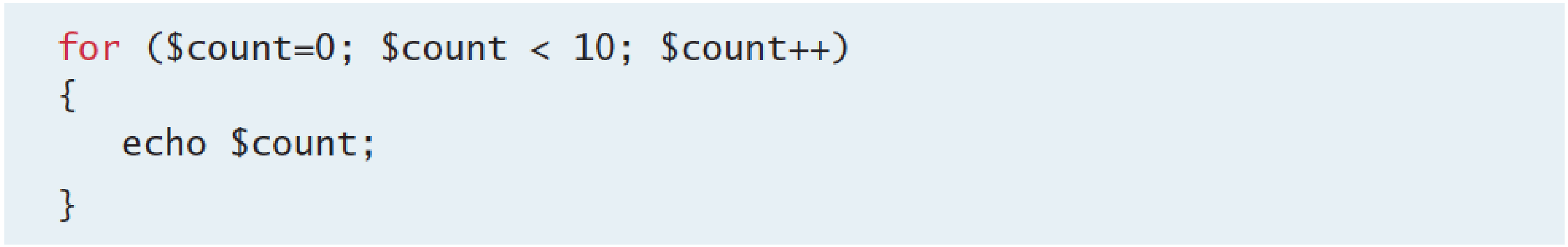


```
$count = 0;
while ($count < 10)
{
   echo $count;
   $count++;
}

$count = 0;
do
{
   echo $count;
   $count++;
} while ($count < 10);
```

LISTING 8.10 while loops

For

Identical to other languages



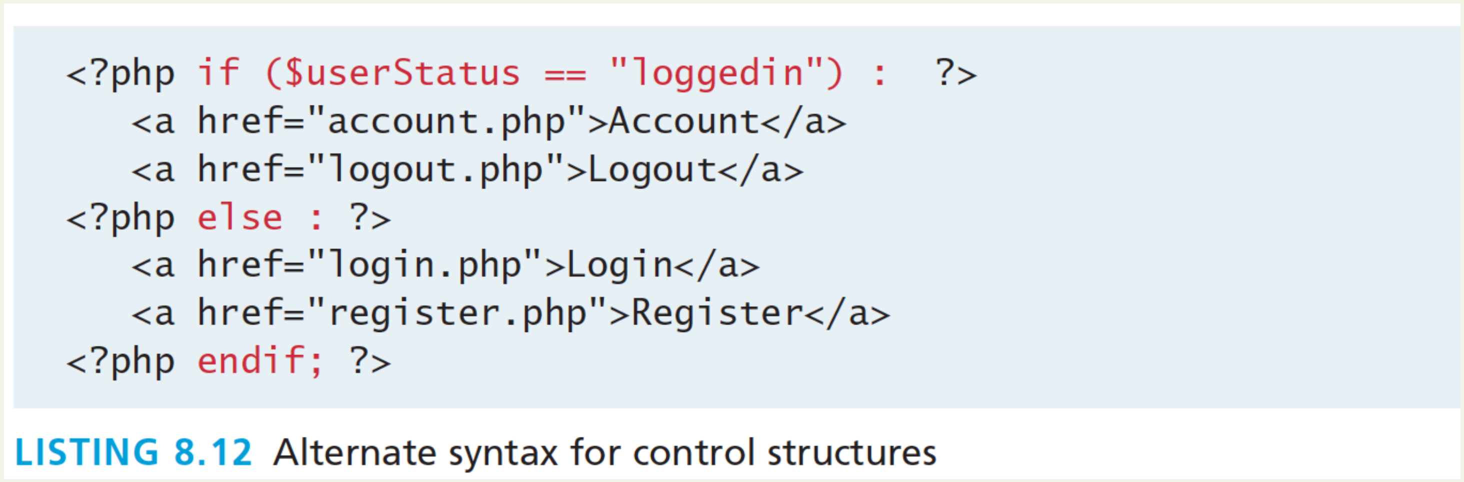
```
for ($count=0; $count < 10; $count++)
{
   echo $count;
}
```

LISTING 8.11 for loops

Alternate syntax for Control Structures

PHP has an alternative syntax for most of its control structures. In this alternate syntax

- the colon (:) replaces the opening curly bracket,
- while the closing brace is replaced with endif;, endwhile;, endfor;, endforeach;, or endswitch;



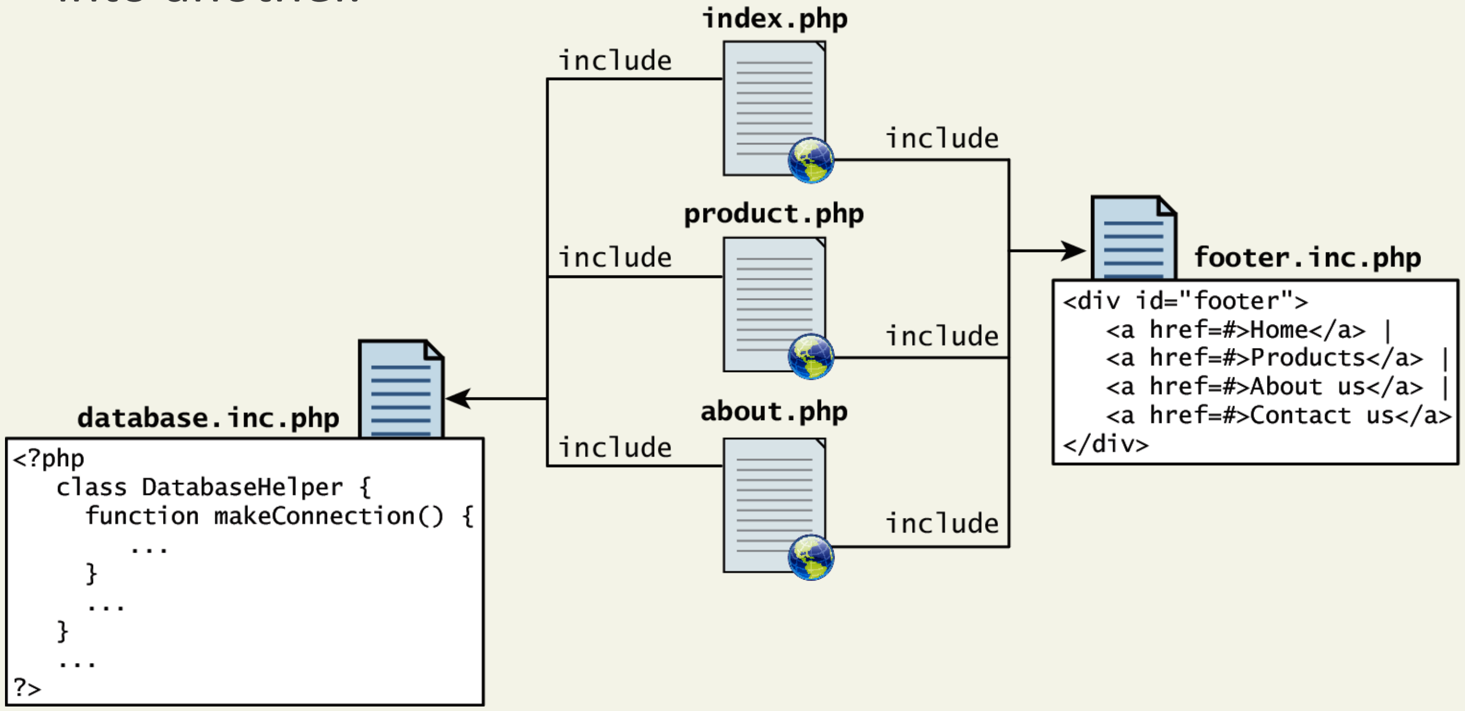
```
<?php if ($userStatus == "loggedin") :  ?>
   <a href="account.php">Account</a>
   <a href="logout.php">Logout</a>
<?php else : ?>
   <a href="login.php">Login</a>
   <a href="register.php">Register</a>
<?php endif; ?>
```

LISTING 8.12 Alternate syntax for control structures

Include Files

Organize your code

PHP does have one important facility that is generally unlike other nonweb programming languages, namely the ability to include or insert content from one file into another.



```
<?php
   class DatabaseHelper {
     function makeConnection() {
        ...
     }
     ...
   }
   ...
?>
```

```
<div id="footer">
   <a href=#>Home</a> |
   <a href=#>Products</a> |
   <a href=#>About us</a> |
   <a href=#>Contact us</a>
</div>
```

Include Files

Organize your code

PHP provides four different statements for including files, as shown below.

include "somefile.php";

include_once "somefile.php";

require "somefile.php";

require_once "somefile.php";

With include, a warning is displayed and then execution continues. With require, an error is displayed and execution stops.

Include Files

Scope

Include files are the equivalent of copying and pasting.

- Variables defined within an include file will have the scope of the line on which the include occurs
- Any variables available at that line in the calling file will be available within the called file
- If the include occurs inside a function, then all of the code contained in the called file will behave as though it had been defined inside that function

Section 5 of 5

FUNCTIONS

Functions

You mean we don't write everything in main?

Just as with any language, writing code in the main function (which in PHP is equivalent to coding in the markup between <?php and ?> tags) is not a good habit to get into.

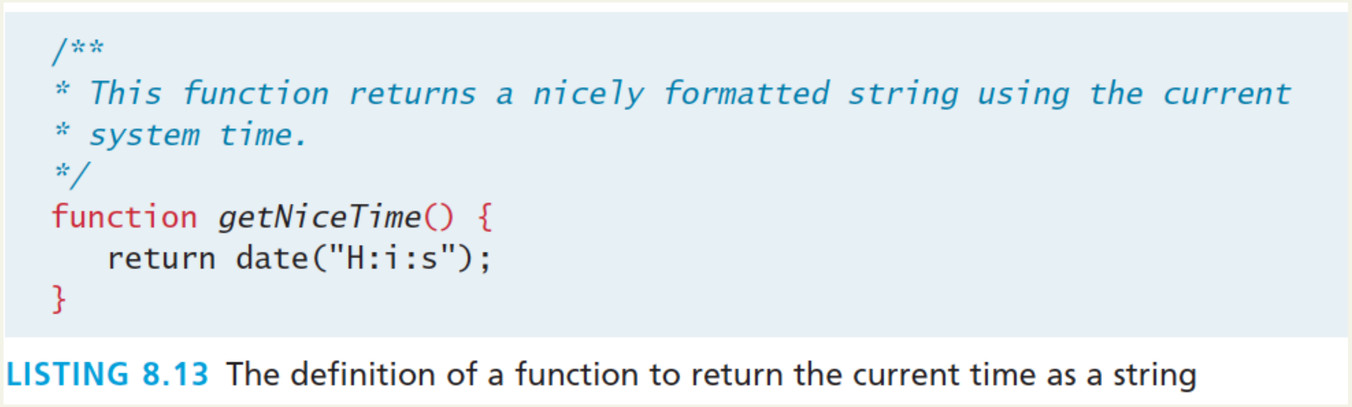
A **function** in PHP contains a small bit of code that accomplishes one thing. In PHP there are two types of function: user-defined functions and built-in functions.

1. A **user-defined function** is one that you the programmer define.

2. A **built-in function** is one of the functions that come with the PHP environment

Functions

syntax



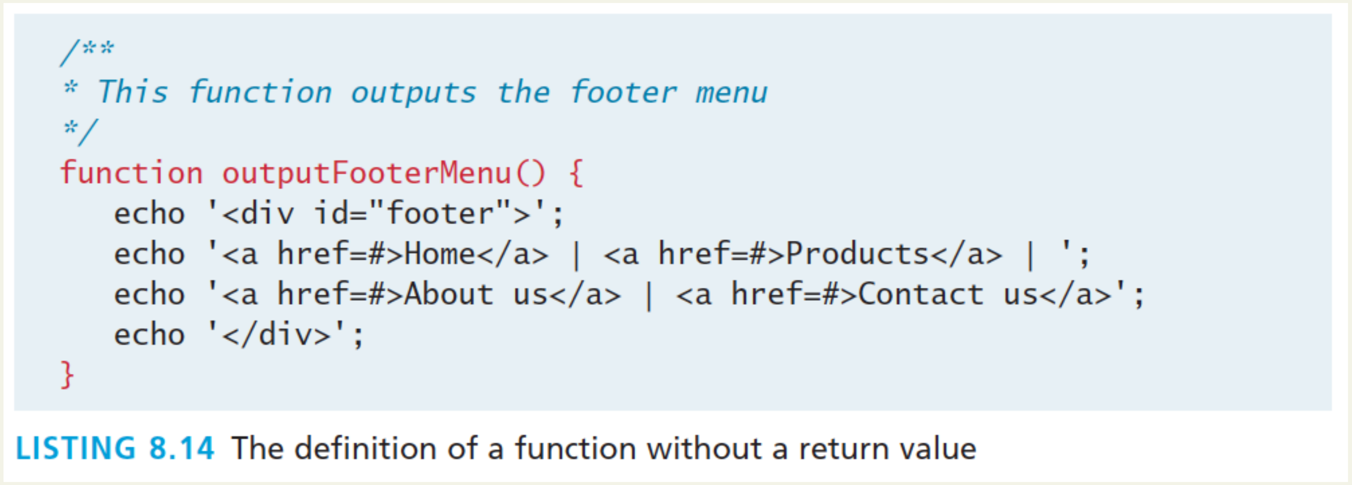
```
/**
* This function returns a nicely formatted string using the current
* system time.
*/
function getNiceTime() {
   return date("H:i:s");
}
```

LISTING 8.13 The definition of a function to return the current time as a string

While the example function in Listing 8.13 returns a value, there is no requirement for this to be the case.

Functions

No return – no big deal.



```
/**
* This function outputs the footer menu
*/
function outputFooterMenu() {
   echo '<div id="footer">';
   echo '<a href=#>Home</a> | <a href=#>Products</a> | ';
   echo '<a href=#>About us</a> | <a href=#>Contact us</a>';
   echo '</div>';
}
```

LISTING 8.14 The definition of a function without a return value

Call a function

Now that you have defined a function, you are able to use it whenever you want to. To call a function you must use its name with the () brackets.

Since getNiceTime() returns a string, you can assign that return value to a variable, or echo that return value directly, as shown below.

```
$output = getNiceTime();
```

```
echo getNiceTime();
```

If the function doesn’t return a value, you can just call the function:

```
outputFooterMenu();
```

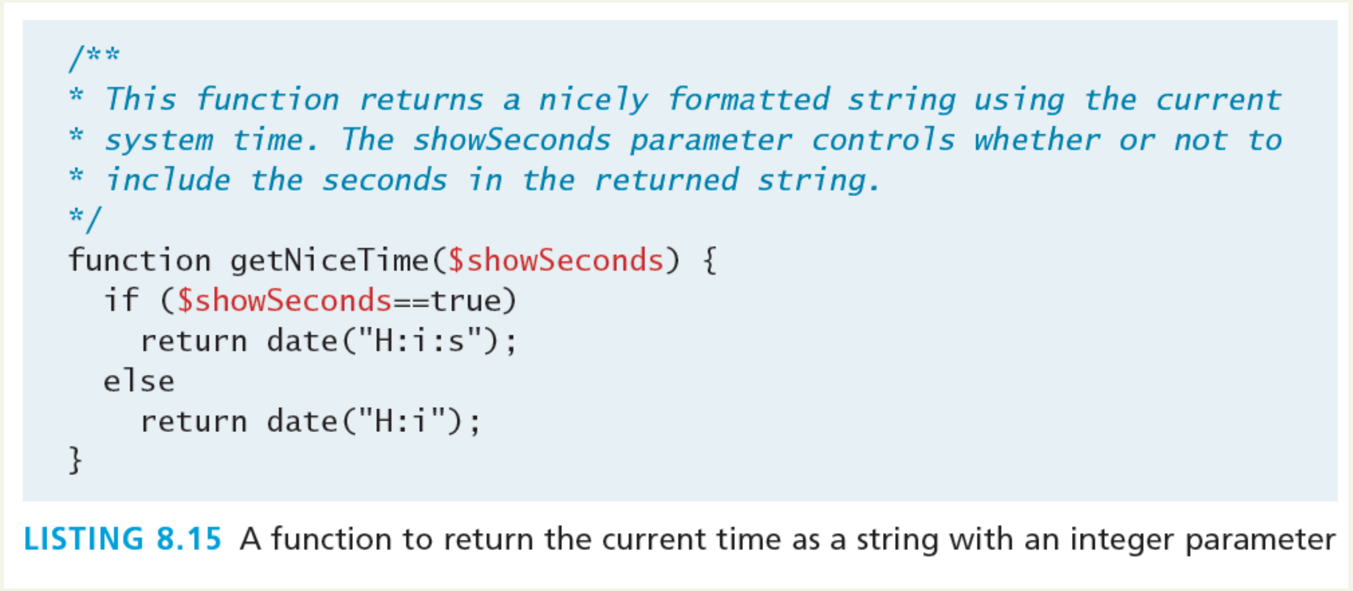
Parameters

Parameters are the mechanism by which values are passed into functions.

To define a function with parameters, you must decide

- how many parameters you want to pass in,
- and in what order they will be passed
- Each parameter must be named

Parameters



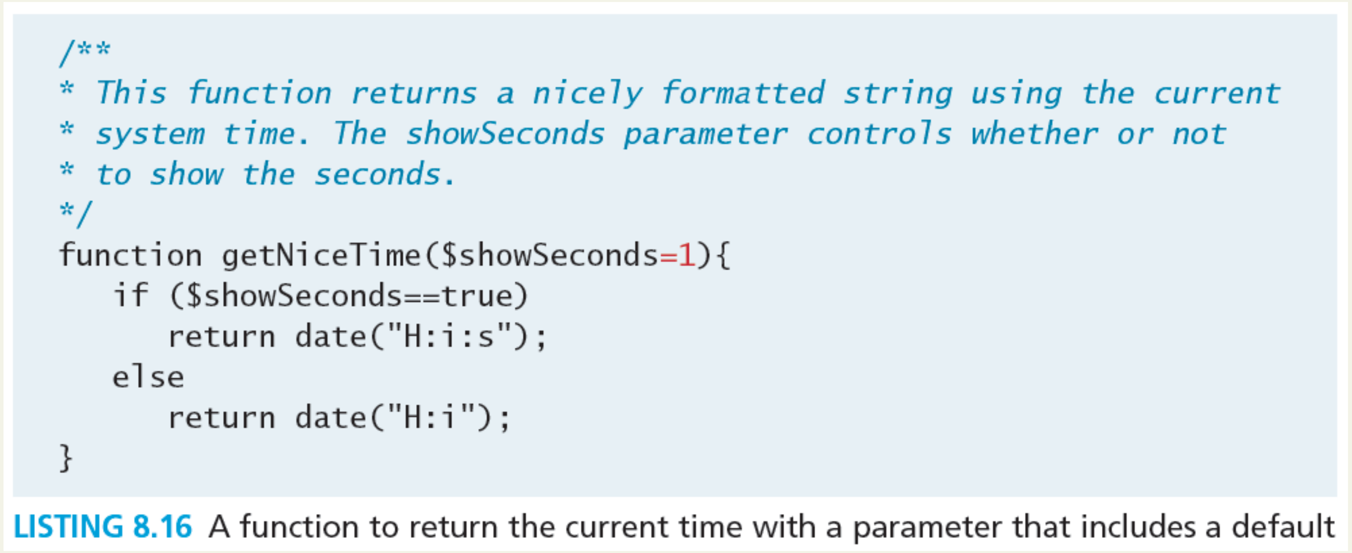
```
/**
* This function returns a nicely formatted string using the current
* system time. The showSeconds parameter controls whether or not to
* include the seconds in the returned string.
*/
function getNiceTime($showSeconds) {
  if ($showSeconds==true)
    return date("H:i:s");
  else
    return date("H:i");
}
```

LISTING 8.15 A function to return the current time as a string with an integer parameter

Thus to call our function, you can now do it in two ways:

echo getNiceTime(1); *// this will print seconds*
echo getNiceTime(0); *// will not print seconds*

Parameter Default Values



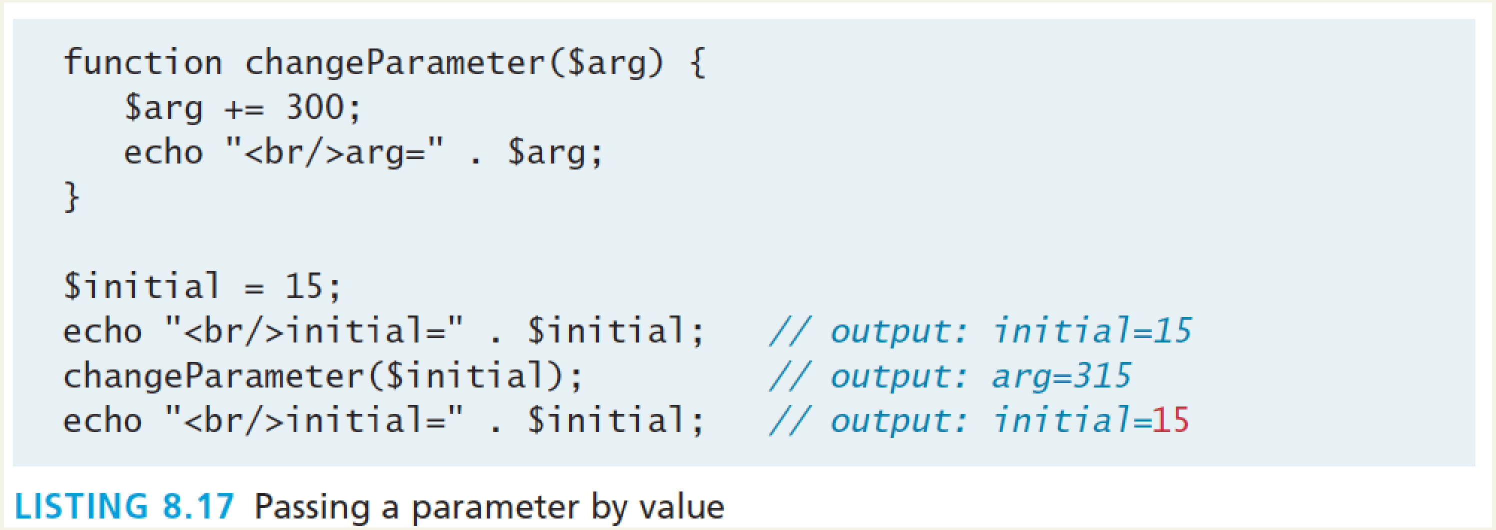
```
/**
* This function returns a nicely formatted string using the current
* system time. The showSeconds parameter controls whether or not
* to show the seconds.
*/
function getNiceTime($showSeconds=1){
   if ($showSeconds==true)
      return date("H:i:s");
   else
      return date("H:i");
}
```

LISTING 8.16 A function to return the current time with a parameter that includes a default

Now if you were to call the function with no values, the $showSeconds parameter would take on the default value, which we have set to 1, and return the string with seconds.

Pass Parameters by Value

By default, arguments passed to functions are **passed by value** in PHP. This means that PHP passes a copy of the variable so if the parameter is modified within the function, it does not change the original.



```
function changeParameter($arg) {
   $arg += 300;
   echo "<br/>arg=" . $arg;
}

$initial = 15;
echo "<br/>initial=" . $initial;   // output: initial=15
changeParameter($initial);          // output: arg=315
echo "<br/>initial=" . $initial;   // output: initial=15
```

LISTING 8.17 Passing a parameter by value

Pass Parameters by Reference

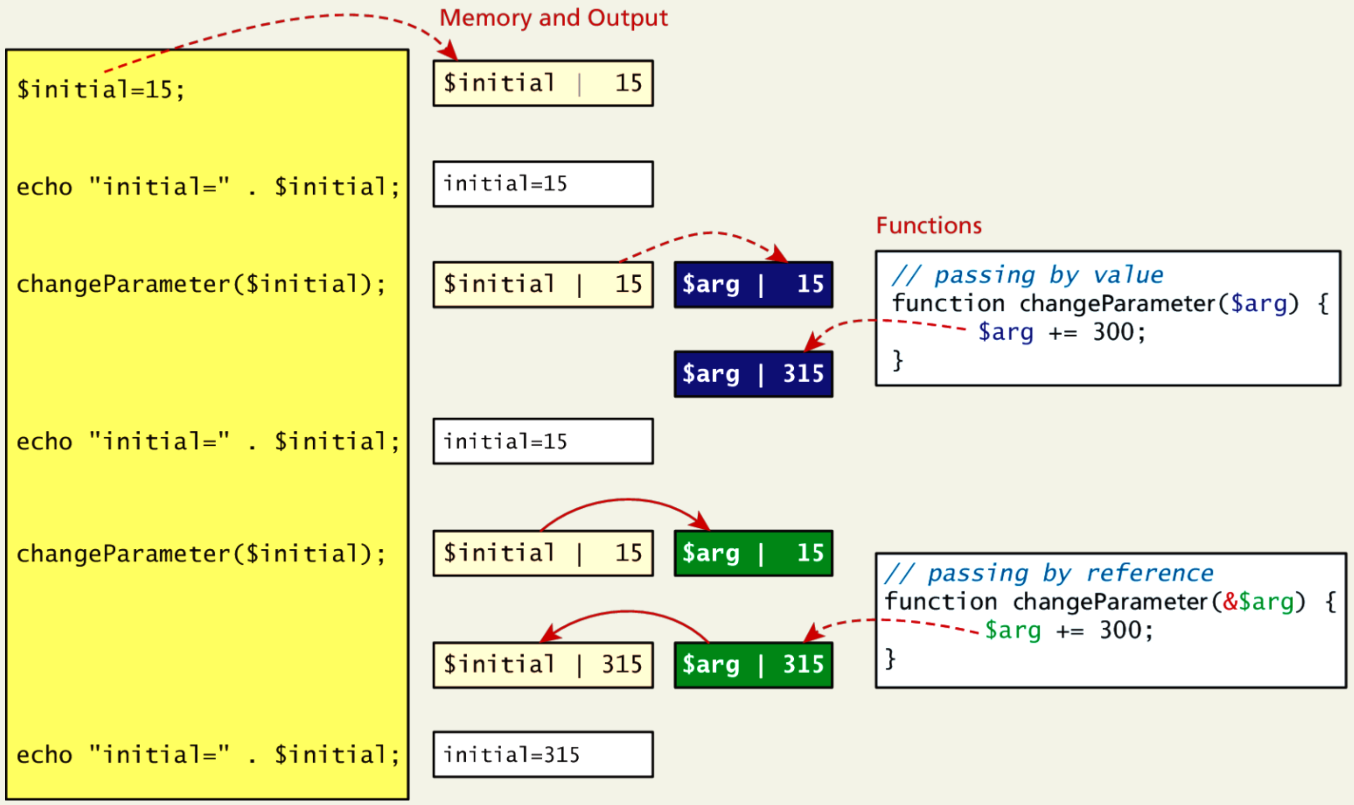
PHP also allows arguments to functions to be **passed by reference**, which will allow a function to change the contents of a passed variable.

The mechanism in PHP to specify that a parameter is passed by reference is to add an ampersand (&) symbol next to the parameter name in the function declaration

```
function changeParameter(&$arg) {
   $arg += 300;
   echo "<br/>arg=". $arg;
}

$initial = 15;
echo "<br/>initial=" . $initial;   // output: initial=15
changeParameter($initial);         // output: arg=315
echo "<br/>initial=" . $initial;   // output: initial=315
```

LISTING 8.18 Passing a parameter by reference

Value vs Reference



```
$initial=15;

echo "initial=" . $initial;

changeParameter($initial);

echo "initial=" . $initial;

changeParameter($initial);

echo "initial=" . $initial;
```

```
// passing by value
function changeParameter($arg) {
    $arg += 300;
}
```

```
// passing by reference
function changeParameter(&$arg) {
    $arg += 300;
}
```

Variable Scope in functions

All variables defined within a function (such as parameter variables) have **function scope**, meaning that they are only accessible within the function.

Any variables created outside of the function in the main script are unavailable within a function.

```
$count= 56;

function testScope() {
		echo $count;	// outputs 0 or generates run-
time
				//warning/error

}

testScope();
echo $count; // outputs 56
```

Global variables

Sometimes unavoidable

Variables defined in the main script are said to have **global scope.**

Unlike in other programming languages, a global variable is not, by default, available within functions.

PHP does allow variables with global scope to be accessed within a function using the **global** keyword

```
$count= 56;

function testScope() {
   global $count;
   echo $count;    // outputs 56
}

testScope();
echo $count;       // outputs 56
```

LISTING 8.19 Using the global keyword

What You've Learned

1 Server-Side Development

2 Web Server's Responsabilities

3 Quick Tour of PHP

4 Program Control

5 Functions