WEB TECHNOLOGY AND ITS APPLICATIONS

MODULE 4 - SYLLABUS

- PHP Arrays and Superglobals, Arrays, $_GET and $_POST Superglobal Arrays,$_SERVER Array, $_Files Array, Reading/Writing Files, PHP Classes andObjects, Object-Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, What are Errors and Exceptions?, PHP Error Reporting, PHP Error and Exception Handling

PHP Arrays and Superglobals

Chapter 9

Section 1 of 5

ARRAYS

Arrays

Background

An array is a data structure that

- Collects a number of related elements together in a single variable.
- Allows the set to be Iterated
- Allows access of any element

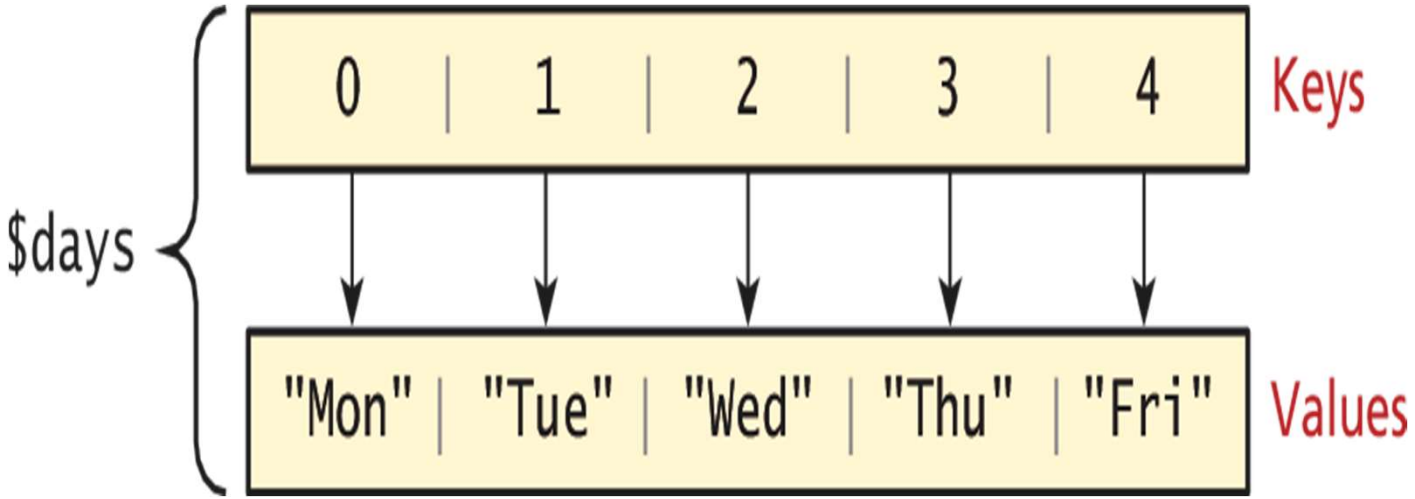
Since PHP implements an array as a dynamic structure:

- Add to the array
- Remove from the array

Arrays

Key Value

In PHP an array is actually an **ordered map**, which associates each value in the array with a key.



Arrays

Keys

Array keys are the means by which you reer to single element in the array.

In most programming languages array keys are limited to integers, start at 0, and go up by 1.

In PHP, array keys *must* be either integers or strings and need not be sequential.

- Don’t mix key types i.e. “1” vs 1
- If you don’t explicitly define them they are 0,1,…

Arrays

Values

Array values, unlike keys, are not restricted to integers and strings.

They can be any object, type, or primitive supported in PHP.

You can even have objects of your own types, so long as the keys in the array are integers and strings.

Arrays

Defining an array

The following declares an empty array named days:

$days = array();

You can also initialize it with a comma-delimited list of values inside the ( ) braces using either of two following syntaxes:

$days = array("Mon","Tue","Wed","Thu","Fri");

$days = ["Mon","Tue","Wed","Thu","Fri"]; *// alternate*

Arrays

Defining an array

You can also declare each subsequent element in the array individually:

```
$days = array();

$days[0] = "Mon"; //set 0th key's value to "Mon"

$days[1] = "Tue";

// also alternate approach

$daysB = array();

$daysB[] = "Mon"; //set the next sequential value to "Mon"

$daysB[] = "Tue";
```

Arrays

Access values

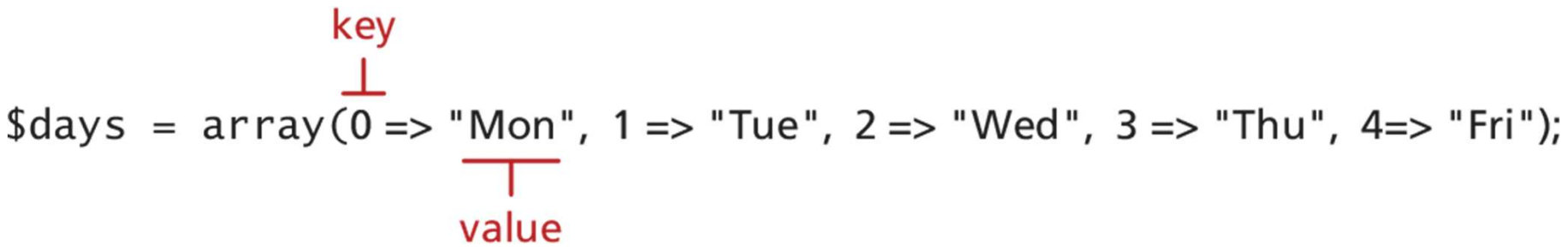
To access values in an array you refer to their key using the square bracket notation.

```
echo "Value at index 1 is ". $days[1];
```

Keys and Values

In PHP, you are also able to explicitly define the keys in addition to the values.

This allows you to use keys other than the classic 0, 1, 2, . . . , n to define the indexes of an array.



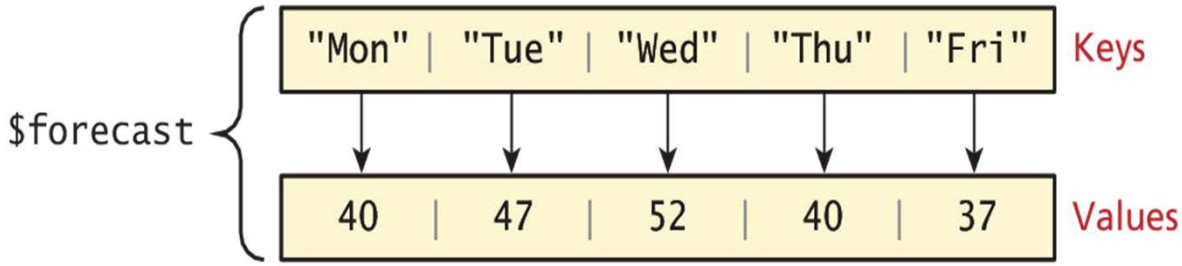
Super Explicit

Array declaration with string keys, integer values

```
$forecast = array("Mon" => 40, "Tue" => 47, "Wed" => 52, "Thu" => 40, "Fri" => 37);
```

key

value




```
echo $forecast["Tue"];  // outputs 47
echo $forecast["Thu"];  // outputs 40
```

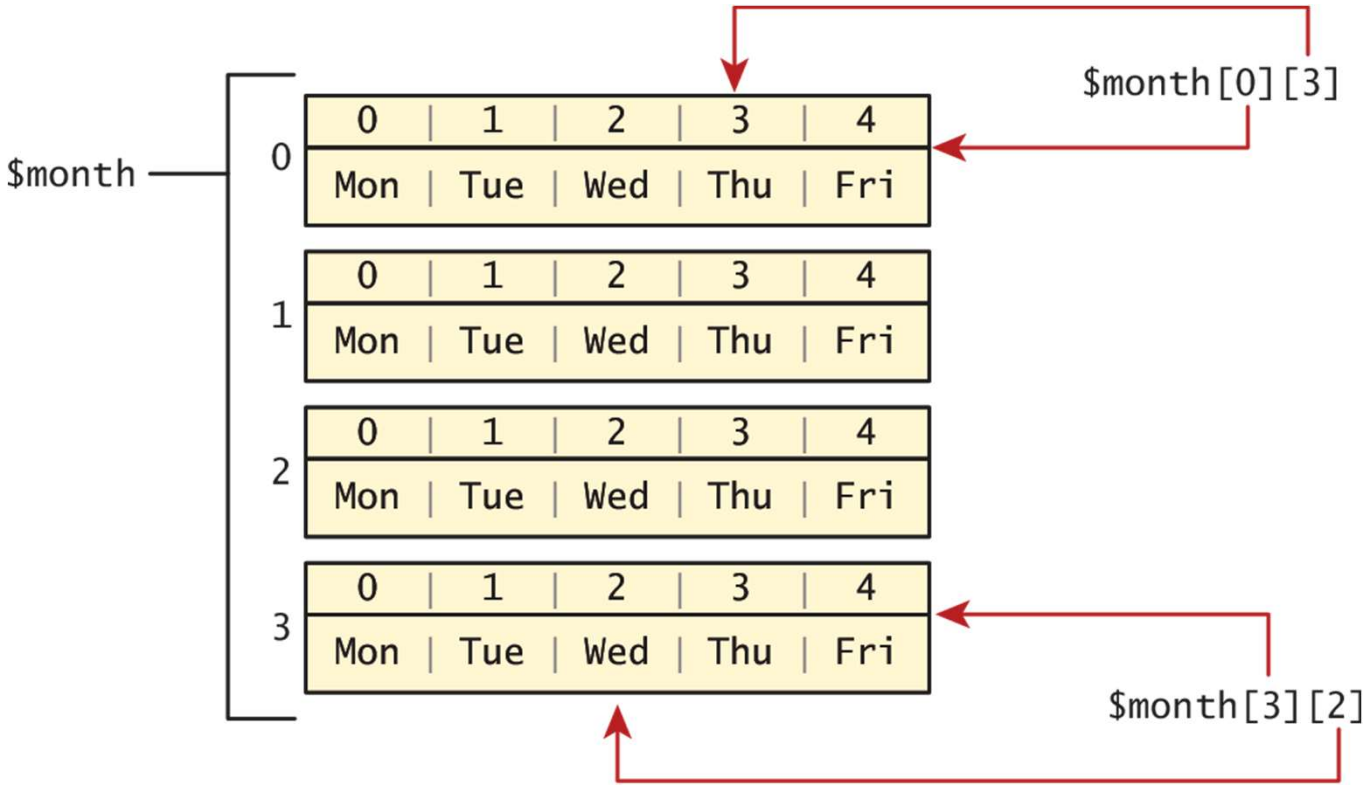
Multidimensional Arrays

Creation

```
$month = array(
        array("Mon","Tue","Wed","Thu","Fri"),
        array("Mon","Tue","Wed","Thu","Fri"),
        array("Mon","Tue","Wed","Thu","Fri"),
        array("Mon","Tue","Wed","Thu","Fri")
);
echo $month[0][3]; // outputs Thu
```

Multidimensional Arrays

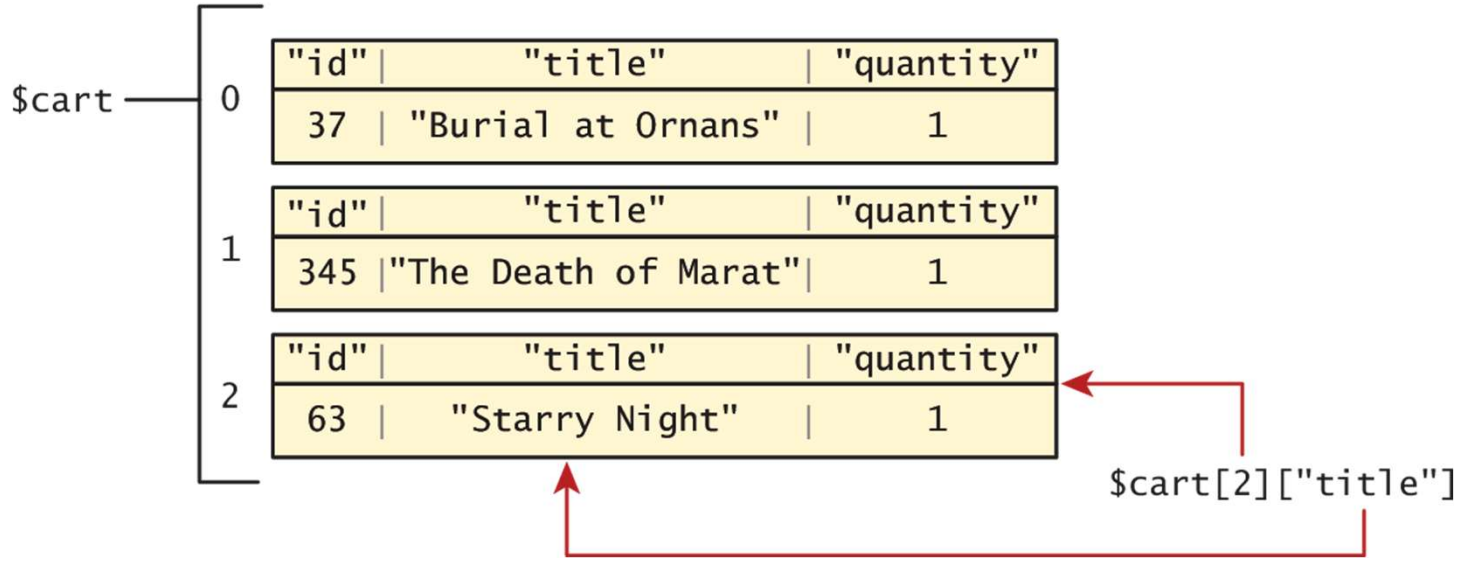
Access



Multidimensional Arrays

Another example

```
$cart = array();

$cart[] = array("id" => 37, "title" => "Burial at Ornans", "quantity" => 1);

$cart[] = array("id" => 345, "title" => "The Death of Marat", "quantity" => 1);

$cart[] = array("id" => 63, "title" => "Starry Night", "quantity" => 1);
```



Iterating through an array

```php
// while loop
$i=0;
while ($i < count($days)) {
   echo $days[$i] . "<br>";
   $i++;
}


// do While loop
$i=0;
do {
   echo $days[$i] . "<br>";
   $i++;
} while ($i < count($days));


// for loop
for ($i=0; $i<count($days); $i++) {
   echo $days[$i] . "<br>";
}
```

LISTING 9.2 Iterating through an array using while, do while, and for loops

Iterating through an array

Foreach loop is pretty nice

The challenge of using the classic loop structures is that when you have nonsequential integer keys (i.e., an associative array), you can't write a simple loop that uses the $i++ construct. To address the dynamic nature of such arrays, you have to use iterators to move through such an array.

```php
// foreach: iterating through the values
foreach ($forecast as $value) {
   echo $value . "<br>";
}

// foreach: iterating through the values AND the keys
foreach ($forecast as $key => $value) {
   echo "day" . $key . "=" . $value;
}
```

LISTING 9.3 Iterating through an associative array using a foreach loop

Adding to an array

To an array

An element can be added to an array simply by using a key/index that hasn't been used

```
$days[5] = "Sat";
```

A new element can be added to the end of any array

```
$days[ ] = "Sun";
```

Adding to an array

And quickly printing

PHP is more than happy to let you “skip” an index

```
$days = array("Mon","Tue","Wed","Thu","Fri");

$days[7] = "Sat";

print_r($days);
```

Array ([0] => Mon [1] => Tue [2] => Wed [3] => Thu [**4**] => Fri [**7**] => Sat)’

If we try referencing $days[6], it will return a **NULL** value

Deleting from an array

You can explicitly delete array elements using the unset() function

```
$days = array("Mon","Tue","Wed","Thu","Fri");

unset($days[2]);
unset($days[3]);

print_r($days); // outputs: Array ( [0] => Mon [1] => Tue [4] => Fri )

$days = array_values($days);
print_r($days); // outputs: Array ( [0] => Mon [1] => Tue [2] => Fri )
```

LISTING 9.4 Deleting elements

Deleting from an array

You can explicitly delete array elements using the unset() function.

array_values() reindexes the array numerically

```
$days = array("Mon","Tue","Wed","Thu","Fri");

unset($days[2]);
unset($days[3]);

print_r($days); // outputs: Array ( [0] => Mon [1] => Tue [4] => Fri )

$days = array_values($days);
print_r($days); // outputs: Array ( [0] => Mon [1] => Tue [2] => Fri )
```

LISTING 9.4 Deleting elements

Checking for a value

Since array keys need not be sequential, and need not be integers, you may run into a scenario where you want to check if a value has been set for a particular key.

To check if a value exists for a key, you can therefore use the isset() function, which returns true if a value has been set, and false otherwise

```
$oddKeys = array (1 => "hello", 3 => "world", 5 => "!");
if (isset($oddKeys[0])) {
   // The code below will never be reached since $oddKeys[0] is not set!
   echo "there is something set for key 0";
}
if (isset($oddKeys[1])) {
   // This code will run since a key/value pair was defined for key 1
   echo "there is something set for key 1, namely ". $oddKeys[1];
}
```

LISTING 9.5 Illustrating nonsequential keys and usage of isset( )

Array Sorting

Sort it out

There are many built-in sort functions, which sort by key or by value. To sort the $days array by its values you would simply use:

sort($days);

As the values are all strings, the resulting array would be:

Array ([0] => Fri [1] => Mon [2] => Sat [3] => Sun [4] => Thu [5] => Tue [6] => Wed)

A better sort, one that would have kept keys and values associated together, is:

asort($days);

Array ([4] => Fri [0] => Mon [5] => Sat [6] => Sun [3] => Thu [1] => Tue [2] => Wed)

More array operations

Too many to go over in depth here…

- array_keys($someArray)
- array_values($someArray)
- array_rand($someArray, $num=1)
- array_reverse($someArray)
- array_walk($someArray, function call, optionalParam)
- in_array($someArray, $value)
- shuffle($someArray)
- …

Superglobal Arrays

PHP uses special predefined associative arrays called **superglobal variables** that allow the programmer to easily access HTTP headers, query string parameters, and other commonly needed information.

They are called superglobal because they are always in scope, and always defined.

9.1.7 Superglobal Arrays

PHP uses special predefined associative arrays called superglobal variables that allow the programmer to easily access HTTP headers, query string parameters, and other commonly needed information (see Table 9.1). They are called superglobal because these arrays are always in scope and always exist, ready for the programmer to access or modify them without having to use the `global` keyword as in Chapter 8.

Name	Description
$GLOBALS	Array for storing data that needs superglobal scope
$_COOKIES	Array of cookie data passed to page via HTTP request
$_ENV	Array of server environment data
$_FILES	Array of file items uploaded to the server
$_GET	Array of query string data passed to the server via the URL
$_POST	Array of query string data passed to the server via the HTTP header
$_REQUEST	Array containing the contents of $_GET, $_POST, and $_COOKIES
$_SESSION	Array that contains session data
$_SERVER	Array containing information about the request and the server

TABLE 9.1 Sugerglobal Variables

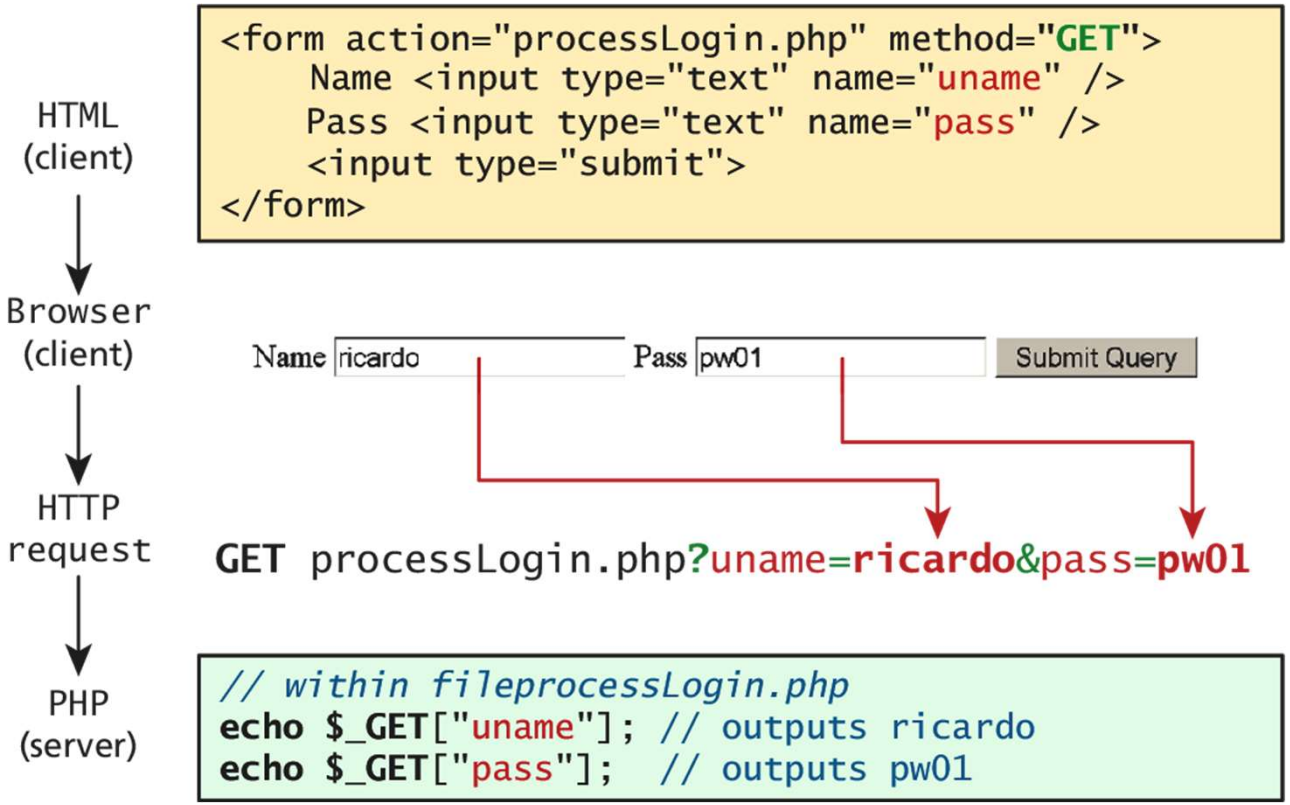
Section 2 of 5

$_GET AND $_POST SUPERGLOBAL ARRAYS

$_GET and $_POST

Sound familiar?

The $_GET and $_POST arrays are the most important superglobal variables in PHP since they allow the programmer to access data sent by the client in a query string.



$_GET and $_POST

Sound familiar?

- Get requests parse query strings into the $_GET array
- Post requests are parsed into the $_POST array

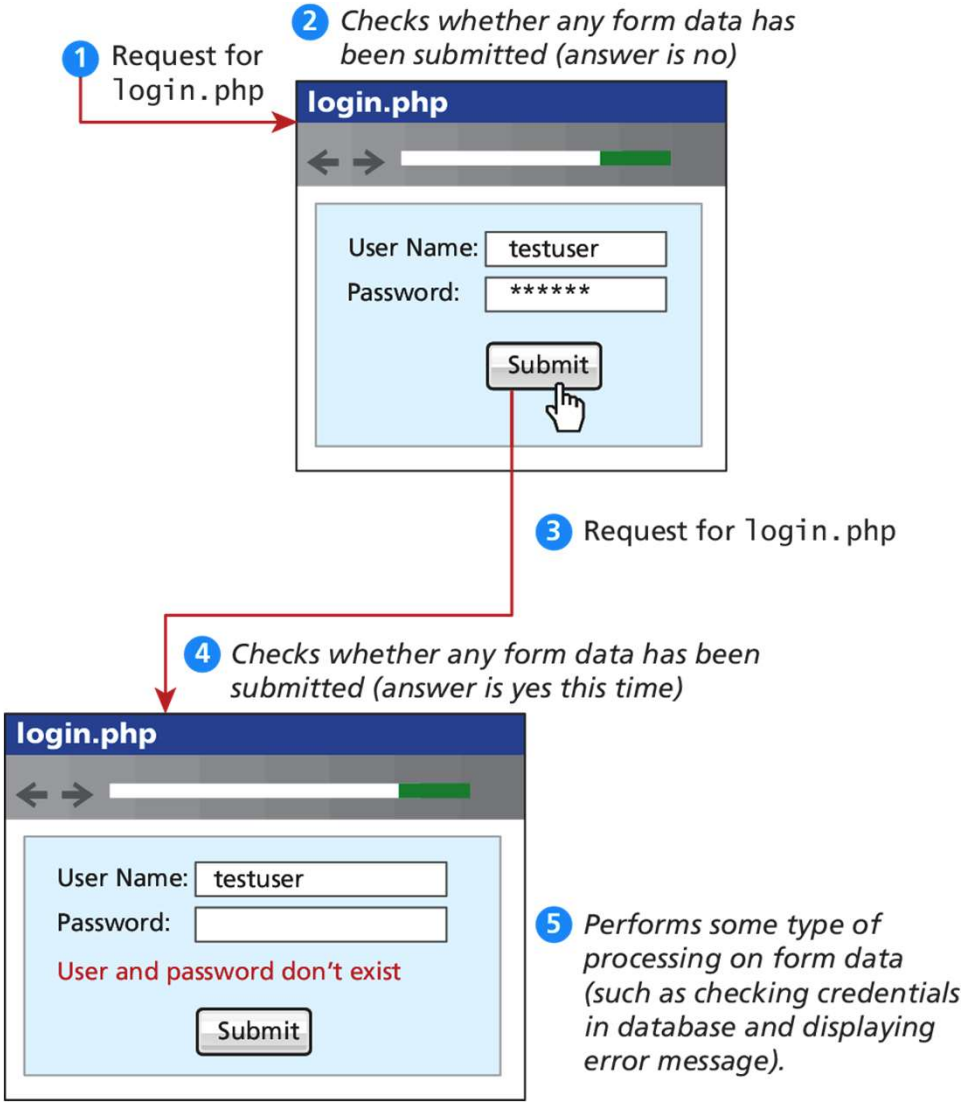
This mechanism greatly simplifies accessing the data posted by the user, since you need not parse the query string or the POST request headers!

Determine if any data sent

```
<!DOCTYPE html>
<html>
<body>
<?php
if ($_SERVER["REQUEST_METHOD"] == "POST") {
   if ( isset($_POST["uname"]) && isset($_POST["pass"]) ) {
      // handle the posted data.
      echo "handling user login now ...";
      echo "... here we could redirect or authenticate ";
      echo " and hide login form or something else";
   }
}
?>
<h1>Some page that has a login form</h1>
<form action="samplePage.php" method="POST">
   Name <input type="text" name="uname"/><br/>
   Pass <input type="password" name="pass"/><br/>
   <input type="submit">
</form>
</body>
</html>
```

LISTING 9.6 Using isset() to check query string data

Determine if any data sent



Accessing Form Array Data

Sometimes in HTML forms you might have multiple values associated with a single name;

```
<form method="get">
   Please select days of the week you are free.<br />
   Monday <input type="checkbox" name="day" value="Monday" /> <br />
   Tuesday <input type="checkbox" name="day" value="Tuesday" /> <br />
   Wednesday <input type="checkbox" name="day" value="Wednesday" /> <br />
   Thursday <input type="checkbox" name="day" value="Thursday" /> <br />
   Friday <input type="checkbox" name="day" value="Friday" /> <br />
   <input type="submit" value="Submit">
</form>
```

LISTING 9.7 HTML that enables multiple values for one name

Accessing Form Array Data

HTML tweaks for arrays of data

Unfortunately, if the user selects more than one day and submits the form, the $_GET['day'] value in the superglobal array *will only contain the last value from the list* that was selected.

To overcome this limitation, you must change the name attribute for each checkbox from day to day[].

```
Monday <input type="checkbox" name="day[]" value="Monday" />

Tuesday <input type="checkbox" name="day[]" value="Tuesday" />
```

Accessing Form Array Data

Meanwhile on the server

After making this change in the HTML, the corresponding variable $_GET['day'] will now have a value that is of type array.

```
<?php

echo "You submitted " . count($_GET['day']) . "values";
foreach ($_GET['day'] as $d) {
   echo $d . ", ";
}

?>
```

LISTING 9.8 PHP code to display an array of checkbox variables

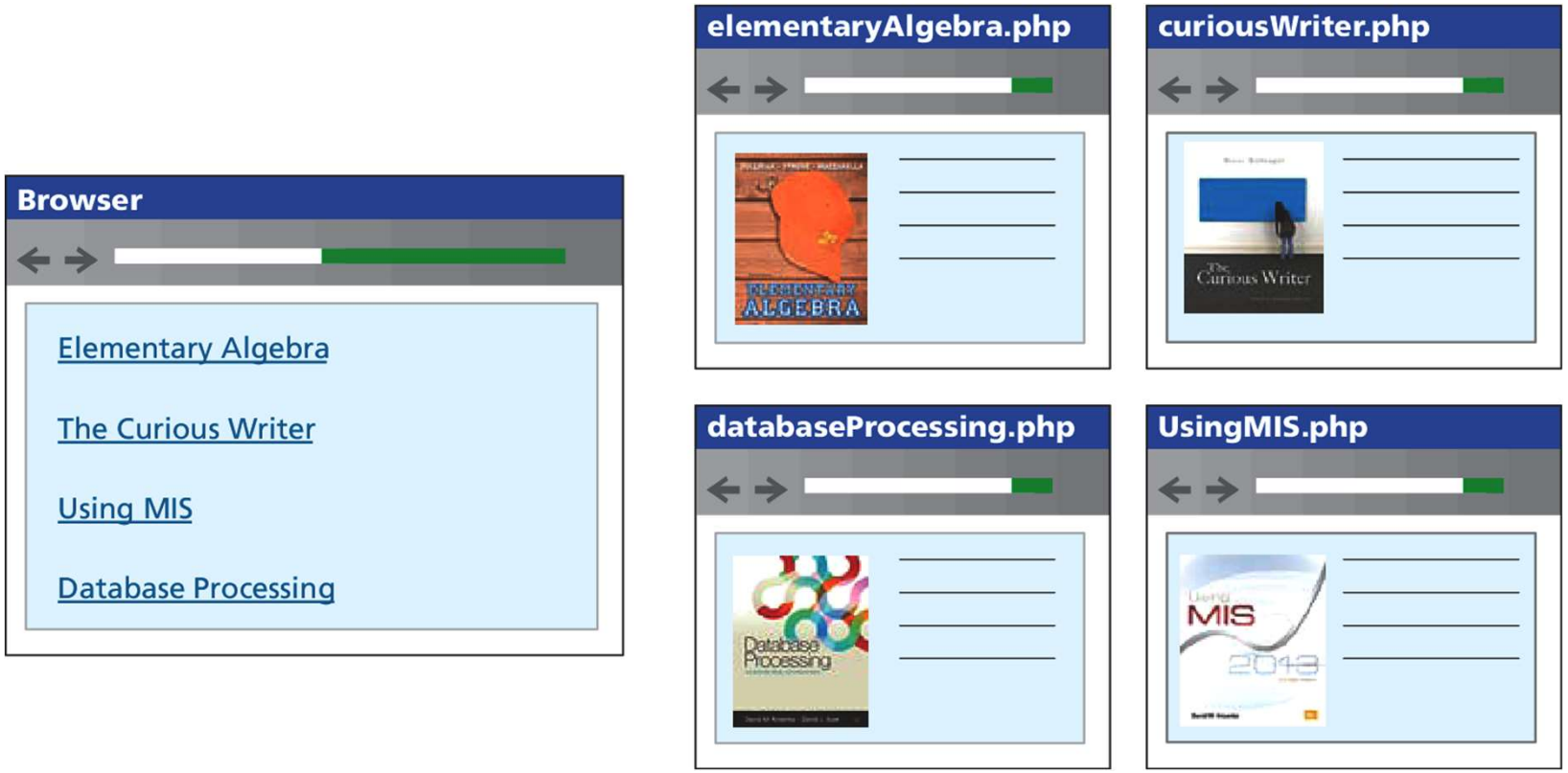
Using Query String in Links

Design idea

Imagine a web page in which we are displaying a list of book links. One approach would be to have a separate page for each book.

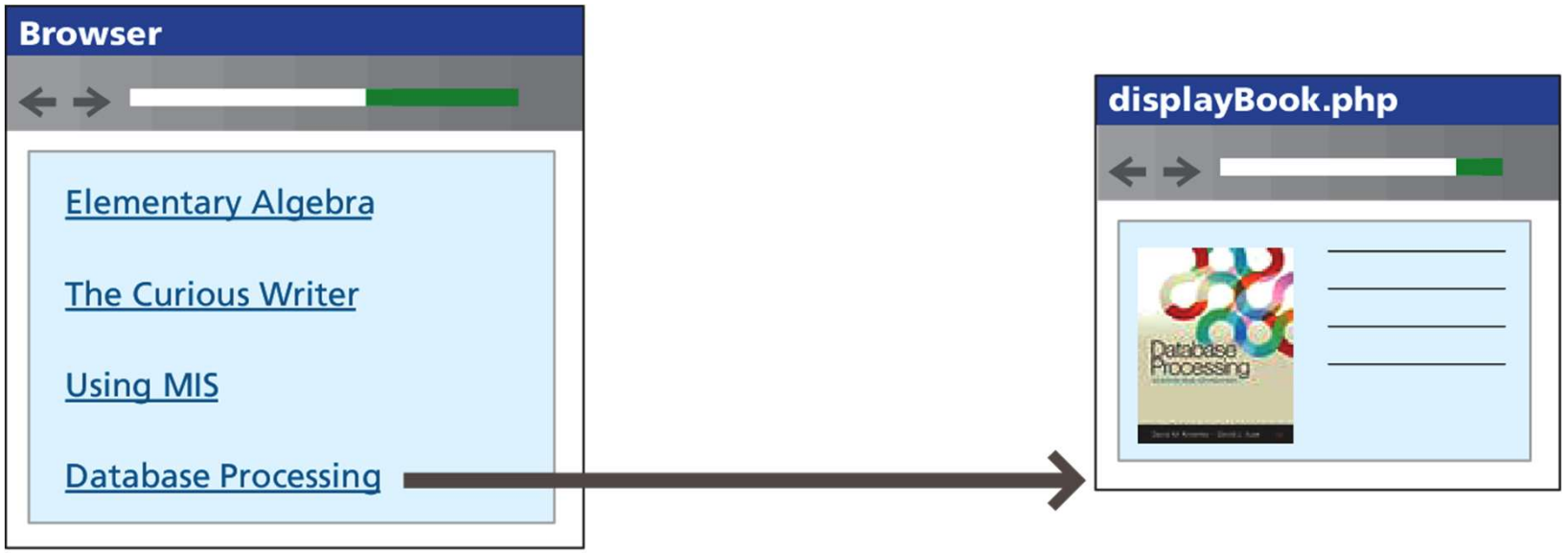
Using Query Strings in links

Not a great setup



Using Query Strings in links

Use the query string to reduce code duplication




```
<a href="displayBook.php?isbn=0132145375">Database Processing</a>
```

Query string

Sanitizing Query Strings

Just because you are expecting a proper query string, doesn't mean that you are going to get a properly constructed query string.

- **distrust all user input**

The process of checking user input for incorrect or missing information is sometimes referred to as the process of **sanitizing user inputs.**

Learn more about this in Chapter 11/12.

Sanitation

Don't forget trim()

```
// This uses a database API . . . we will learn about it in Chapter 11
$pid = mysqli_real_escape_string($link, $_GET['id']);

if ( is_int($pid) ) {
     // Continue processing as normal
}
else {
     // Error detected. Possibly a malicious user
}
```

LISTING 9.9 Simple sanitization of query string values

Section 3 of 5

$_SERVER ARRAY

$_SERVER

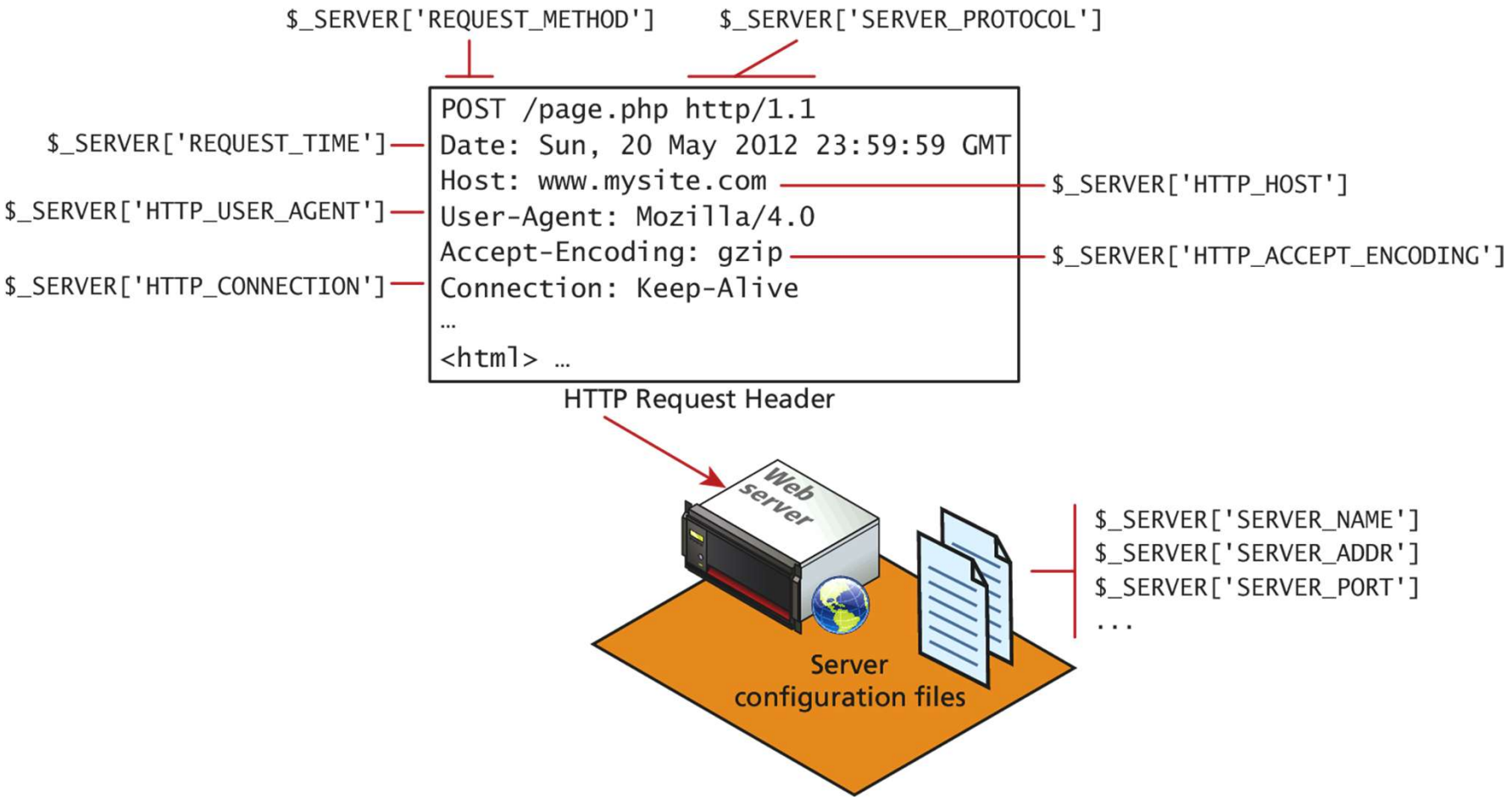
The $_SERVER associative array contains

- HTTP request headers (send by client)
- configuration options for PHP

To use the $_SERVER array, you simply refer to the relevant case-sensitive keyname:

```
echo $_SERVER["SERVER_NAME"] . "<br/>";

echo $_SERVER["SERVER_SOFTWARE"] . "<br/>";

echo $_SERVER["REMOTE_ADDR"] . "<br/>";
```

$_SERVER


$_SERVER['REQUEST_METHOD']
$_SERVER['SERVER_PROTOCOL']
POST /page.php http/1.1
Date: Sun, 20 May 2012 23:59:59 GMT
Host: www.mysite.com
User-Agent: Mozilla/4.0
Accept-Encoding: gzip
Connection: Keep-Alive
…
<html> …
$_SERVER['REQUEST_TIME']
$_SERVER['HTTP_USER_AGENT']
$_SERVER['HTTP_CONNECTION']
$_SERVER['HTTP_HOST']
$_SERVER['HTTP_ACCEPT_ENCODING']
HTTP Request Header
Web server
Server configuration files
$_SERVER['SERVER_NAME']
$_SERVER['SERVER_ADDR']
$_SERVER['SERVER_PORT']
...

SERVER INFORMATION KEYS

- SERVER_NAME contains the name of the site that was requested
- SERVER_ADDR tells us the IP of the server
- DOCUMENT_ROOT tells us the location from which you are currently running your script
- SCRIPT_NAME key that identifies the actual script being executed

Request Header Keys

- REQUEST_METHOD returns the request method that was used to access the page: that is, GET, HEAD, POST, PUT
- REMOTE_ADDR key returns the IP address of the requestor
- HTTP_USER_AGENT contains the operating system and browser that the client is using
- HTTP_REFERER contains the address of the page that referred us to this one (if any) through a link

Header Access Examples

```php
<?php
echo $_SERVER['HTTP_USER_AGENT'];

$browser = get_browser($_SERVER['HTTP_USER_AGENT'], true);
print_r($browser);
?>
```

LISTING 9.10 Accessing the user-agent string in the HTTP headers

```php
$previousPage = $_SERVER['HTTP_REFERER'];
// Check to see if referer was our search page
if (strpos("search.php",$previousPage) != 0) {
   echo "<a href='search.php'>Back to search</a>";
}
// Rest of HTML output
```

LISTING 9.11 Using the HTTP_REFERER header to provide context-dependent output

Security

Headers can be forged

All headers can be forged!

- The HTTP_REFERER header can lie about where the referral came from
- The USER_AGENT can lie about the operating system and browser the client is using.

9.4 $_Files Array

- The $_FILES associative array contains items that have been uploaded to the current script.

<input type = “file”>

Creates a user interface for uploading a file from the client to server.

- A server Script must process the upload files in some way ($_FILES array helps in this process)

9.4.1 HTML Required for File Uploads

- To allow users to upload files, there are some specific things you must do,
  - First, you must ensure that the HTML form uses the HTTP post method, since transmitting a flie through the URL is not possible.
  - Second, You must add the enctype= “multipart/form-data” attribute to the html form that is performing the upload so that the HTTP request can submit multiple pieces of data (HTTP post body, the HTTP file attachment itself)

– Finally you must include an input type of file in your form.

  This will show up with a browse button beside it so the user can select a file from their computer to be uploaded.

```
<form enctype='multipart/form-data' method='post'>
   <input type='file' name='file1' id='file1' />
   <input type='submit' />
</form>
```

LISTING 9.12 HTML for a form that allows an upload

9.4.2 Handling the File Upload in PHP

- The Corresponding PHP file responsible for handling the upload will utilize the superglobal $_FILES array.
- This array will contain a key = value pair for each file uploaded in the post.
- The key for each element will be the name attribute from the HTML form, while the value will be an array containing information about the file as well as the file itself.
- The keys in that array are the name, type, tmp_name, error and size.

- **name** is a string containing the full file name used on the client machine, including any file extension. It does not include the file path on the client's machine.
- **type** defines the MIME type of the file. This value is provided by the client browser and is therefore not a reliable field.
- **tmp_name** is the full path to the location on your server where the file is bein temporarily stored. The file will cease to exist upon termination of the scrip so it should be copied to another location if storage is required.
- **error** is an integer that encodes many possible errors and is set to UPLOAD_ERR_OK (integer value 0) if the file was uploaded successfully.
- **size** is an integer representing the size in bytes of the uploaded file.

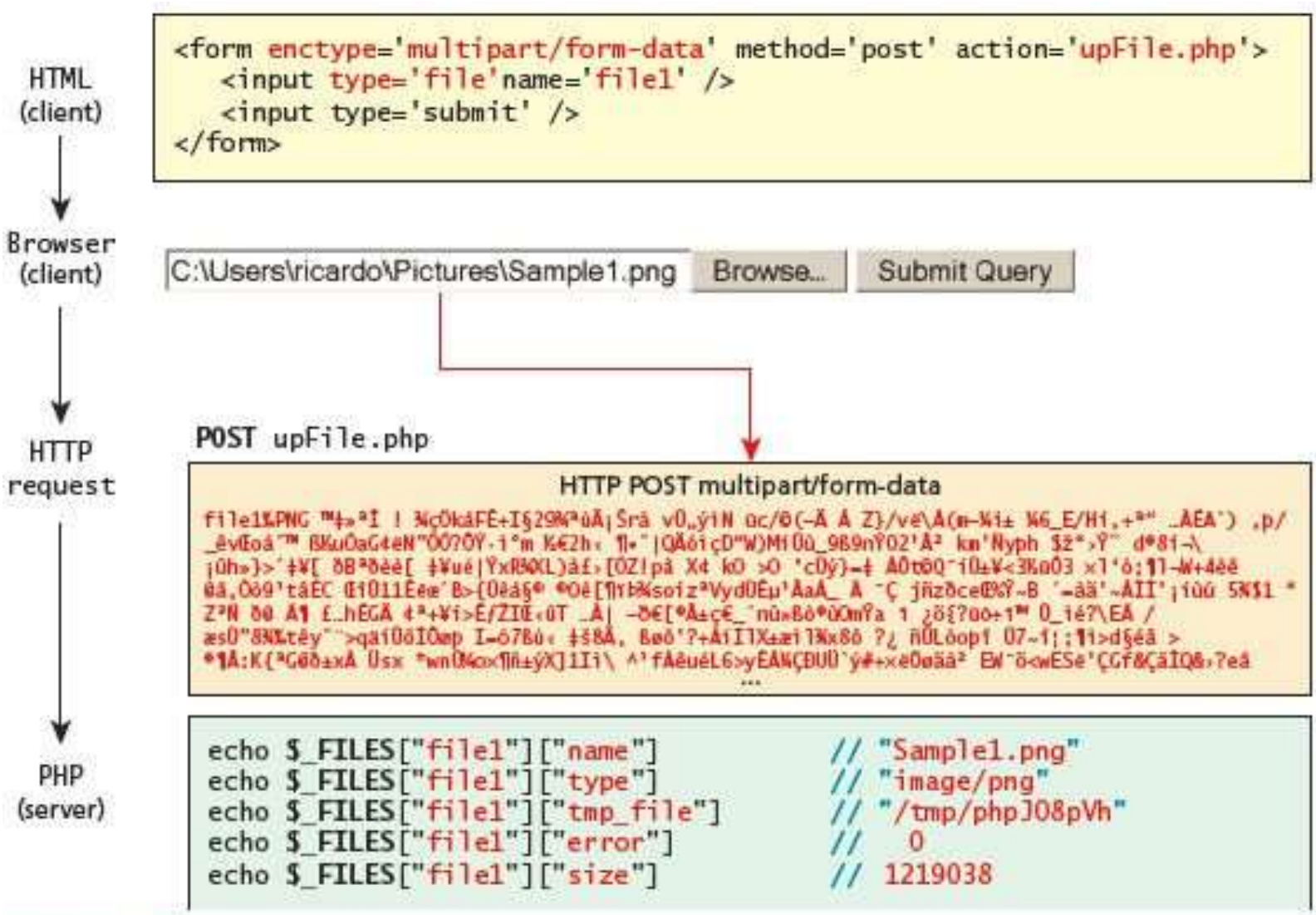


FIGURE 9.12 Data flow from HTML form through POST to PHP $_FILES array

9.4.3 Checking for Errors

Error Code	Integer	Meaning
UPLOAD_ERR_OK	0	Upload was successful.
UPLOAD_ERR_INI_SIZE	1	The uploaded file exceeds the `upload_max_filesize` directive in php.ini.
UPLOAD_ERR_FORM_SIZE	2	The uploaded file exceeds the `max_file_size` directive that was specified in the HTML form.
UPLOAD_ERR_PARTIAL	3	The file was only partially uploaded.
UPLOAD_ERR_NO_FILE	4	No file was uploaded. Not always an error, since the user may have simply not chosen a file for this field.
UPLOAD_ERR_NO_TMP_DIR	6	Missing the temporary folder.
UPLOAD_ERR_CANT_WRITE	7	Failed to write to disk.
UPLOAD_ERR_EXTENSION	8	A PHP extension stopped the upload.

TABLE 9.2 Error Codes in PHP for File Upload Taken from php.net.[6]

- A proper file upload script will therefore check each uploaded file by checking the various error codes as below,

```
foreach ($_FILES as $fileKey => $fileArray) {
   if ($fileArray["error"] != UPLOAD_ERR_OK) { // error
      echo "Error: " . $fileKey . " has error" . $fileArray["error"]
           . "<br>";
   }
   else {   // no error
      echo $fileKey . "Uploaded successfully ";
   }
}
```

LISTING 9.13 Checking each file uploaded for errors

9.4.4 File Size Restrictions

- There are three main mechanisms for maintaining uploaded file size restrictions:
  - Via HTML in the input form
  - Via JavaScript in the input form
  - Via PHP coding.

```
<form enctype='multipart/form-data' method='post'>
   <input type="hidden" name="MAX_FILE_SIZE" value="1000000" />
   <input type='file' name='file1' />
   <input type='submit' />
</form>
```

LISTING 9.14 Limiting upload file size via HTML

```
<script>
var file = document.getElementById('file1');
var max_size = document.getElementById("max_file_size").value;
if (file.files && file.files.length ==1){
   if (file.files[0].size > max_size) {
      alert("The file must be less than " + (max_size/1024) + "KB");
      e.preventDefault();
   }
}
</script>
```

LISTING 9.15 Limiting upload file size via JavaScript

```
$max_file_size = 10000000;
foreach($_FILES as $fileKey => $fileArray) {
   if ($fileArray["size"] > $max_file_size) {
      echo "Error: " . $fileKey . " is too big";
   }
   printf("%s is %.2f KB", $fileKey, $fileArray["size"]/1024);
}
```

LISTING 9.16 Limiting upload file size via PHP

9.4.5 Limiting the Type of File Upload

- You should also restrict the type of file uploaded.

```
$validExt = array("jpg", "png");
$validMime = array("image/jpeg","image/png");
foreach($_FILES as $fileKey => $fileArray ){
   $extension = end(explode(".", $fileArray["name"]));
   if (in_array($fileArray["type"],$validMime) &&
         in_array($extension, $validExt)) {
      echo "all is well. Extension and mime types valid";
   }
   else {
      echo $fileKey." Has an invalid mime type or extension";
   }
}
```

LISTING 9.17 PHP code to look for valid mime types and file extensions

9.4.6 Moving the File

- You can make use of PHP function move_uploaded_file, which takes in the temporary file location and the file's final destination.
- This function will work only if the source file exist and if the destination location is writable by web server.

```php
$fileToMove = $_FILES['file1']['tmp_name'];
$destination = "./upload/" . $_FILES["file1"]["name"];
if (move_uploaded_file($fileToMove,$destination)) {
   echo "The file was uploaded and moved successfully!";
}
else {
   echo "there was a problem moving the file";
}
```

LISTING 9.18 Using move_uploaded_file() function

9.5 Reading/Writing Files

- There are two basic techniques for read/writing files in PHP
  - Stream Access : In this technique, our code will read just a small portion of the file at a time. While this does require more careful programming, it is the most efficient approach when reading large files.
  - All – In – Memory access: In this technique, we can read the entire file into memory (I.e., into PHP variable). While not appropriate for large files, it does make processing of file extremely easy.

9.5.1 Stream Access

The function fopen() takes a file location or URL and access mode as parameters. The returned value is a **stream resource**, which you can then read sequentially. Some of the common modes are "r" for read, "rw" for read and write, and "c," which creates a new file for writing.

Once the file is opened, you can read from it in several ways. To read a single line, use the `fgets()` function, which will return false if there is no more data, and if it reads a line it will advance the stream forward to the next one so you can use the `===` check to see if you have reached the end of the file. To read an arbitrary amount of data (typically for binary files), use `fread()` and for reading a single character use `fgetsc()`. Finally, when finished processing the file you must close it using `fclose()`. Listing 9.19 illustrates a script using `fopen()`, `fgets()`, and `fclose()` to read a file and echo it out (replacing new lines with
 tags).

```
$f = fopen("sample.txt", "r");
$ln = 0;
while ($line = fgets($f)) {
   $ln++;
   printf("%2d: ", $ln);
   echo $line . "<br>";
}
fclose($f);
```

LISTING 9.19 Opening, reading lines, and closing a file

9.5.2 In-Memory File Access

Function	Description
`file()`	Reads the entire file into an array, with each array element corresponding to one line in the file
`file_get_contents`	Reads the entire file into a string variable
`file_put_contents`	Writes the contents of a string variable out to a file

TABLE 9.3 In-Memory File Functions

To Read an entire file into variable

```
$fileAsString = file_get_contents(FILENAME);
```

To write the contents of a string $writeme to a file, you use

```
file_put_contents(FILENAME, $writeme);
```

These functions are especially convenient when used in conjunction with PHP's many powerful string-processing functions. For instance, let us imagine we have a comma-delimited text file that contains information about paintings, where each line in the file corresponds to a different painting:

```
01070,Picasso,The Actor,1904
01080,Picasso,Family of Saltimbanques,1905
02070,Matisse,The Red Madras Headdress,1907
05010,David,The Oath of the Horatii,1784
```

To read and then parse this text file is quite straightforward, as shown in Listing 9.20.

```
// read the file into memory; if there is an error then stop processing
$paintings = file($filename) or die('ERROR: Cannot find file');

// our data is comma-delimited
$delimiter = ',';

// loop through each line of the file
foreach ($paintings as $painting) {

   // returns an array of strings where each element in the array
   // corresponds to each substring between the delimiters
   $paintingFields = explode($delimiter, $painting);

   $id= $paintingFields[0];
   $artist = $paintingFields[1];
   $title = $paintingFields[2];
   $year = $paintingFields[3];

   // do something with this data
   . . .
}
```

LISTING 9.20 Processing a comma-delimited file

PHP Classes and Objects

Chapter 10

Section 1 of 3

OBJECT-ORIENTED OVERVIEW

Overview

Object-Oriented Overview

PHP is a full-fledged object-oriented language with many of the syntactic constructs popularized in languages like Java and C++.

Earlier versions of PHP do not support all of these object-oriented features,

- PHP versions after 5.0 do

Terminology

Object-Oriented Terminology

- The notion of programming with objects allows the developer to think about an item with particular **properties** (also called attributes or **data members**) and methods (functions).
- The structure of these **objects** is defined by **classes**, which outline the properties and methods like a blueprint.
- Each variable created from a class is called an object or **instance**, and each object maintains its own set of variables, and behaves (largely) independently from the class once created.

Relationship between Class and Objects

Book class

Defines properties such as:
title, author, and number of pages

Objects (or instances of the Book class)

Each instance has its own title, author, and number of pages property values

UML

The Unified Modelling Language

- The standard diagramming notation for object-oriented design is **UML (Unified Modeling Language).**
- Class diagrams and object diagrams, in particular, are useful to us when describing the properties, methods, and relationships between classes and objects.
- For a complete definition of UML modeling syntax, look at the Object Modeling Group's living specification

UML Class diagram

By example

Every Artist has a

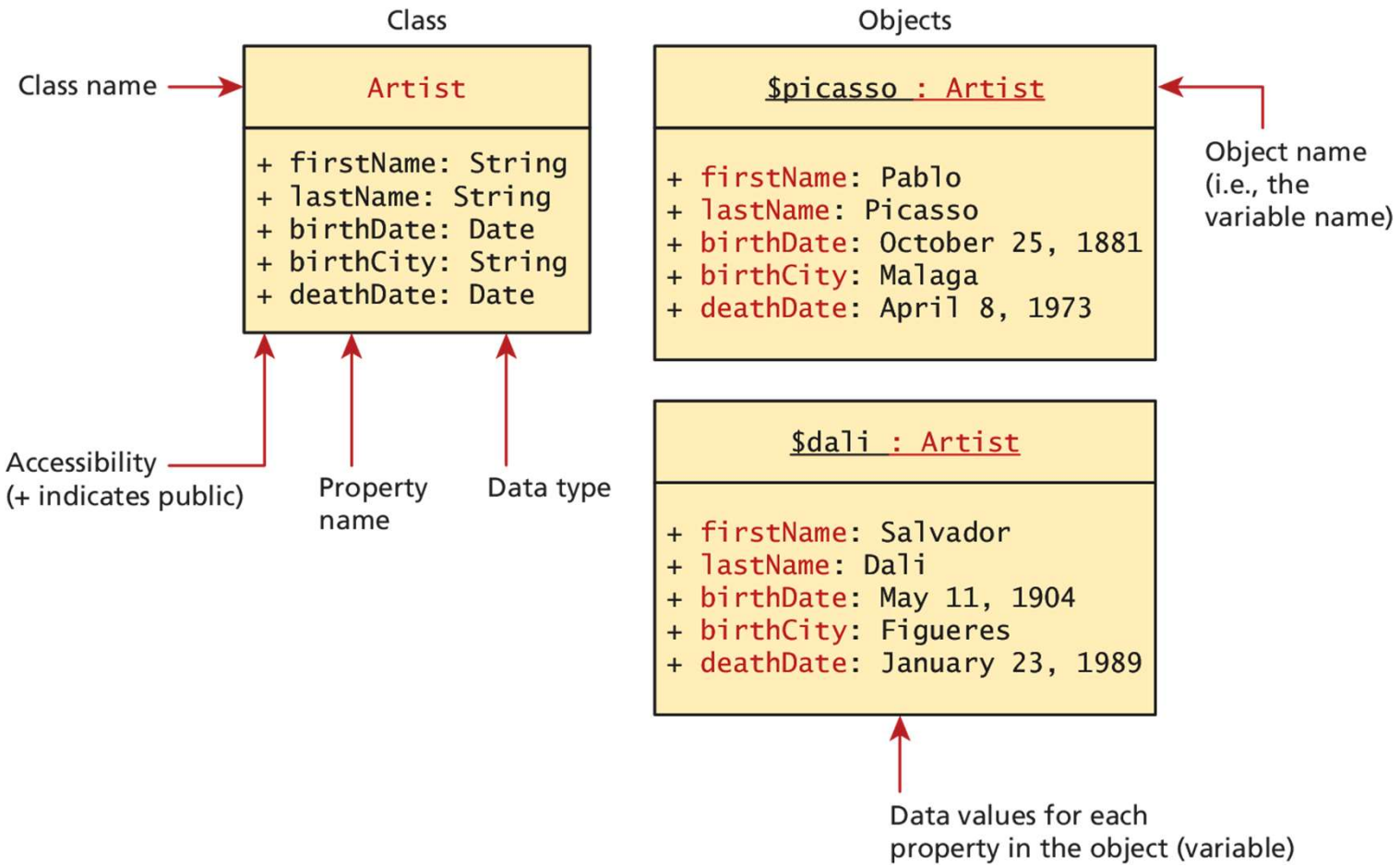
- first name,
- last name,
- birth date,
- birth city, and
- death date.

✓Using objects we can encapsulate those properties together into a class definition for an Artist.

✓UML articulates that design

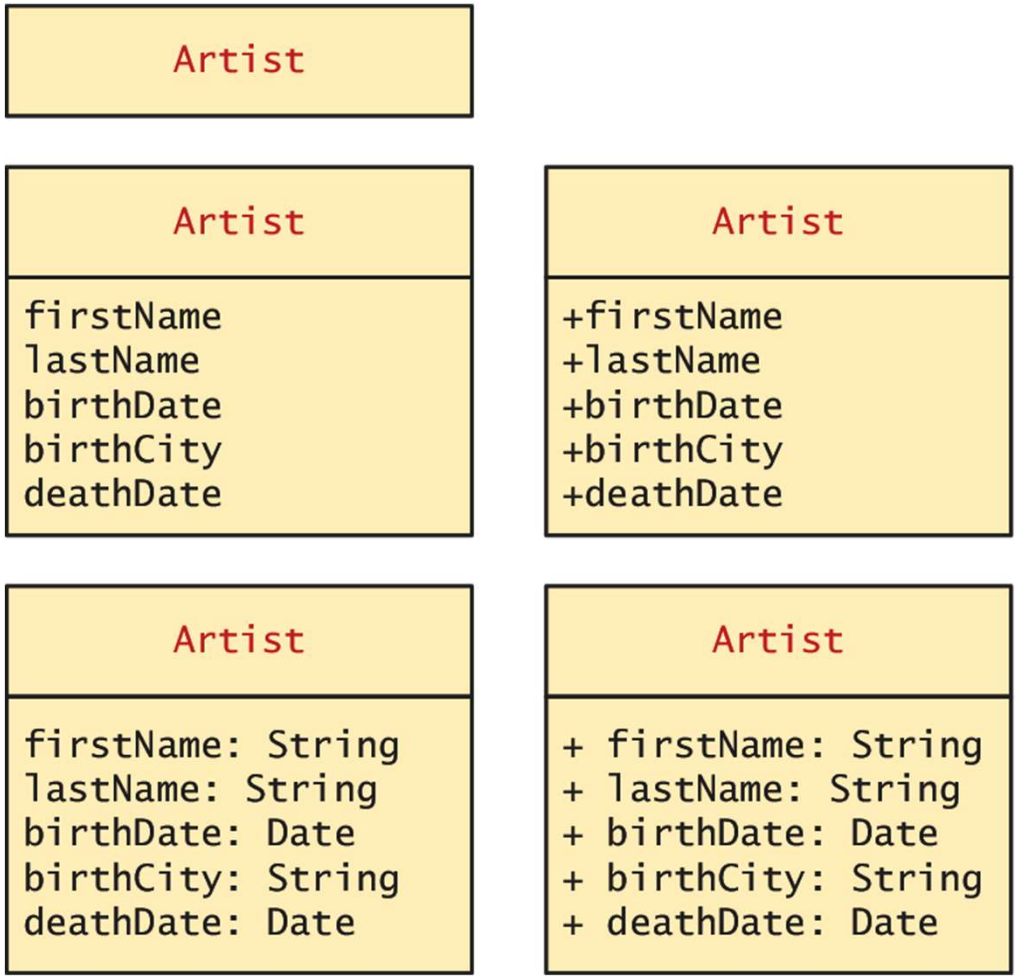
UML Class diagram

Class and a couple of objects



UML Class diagram

Different levels of detail



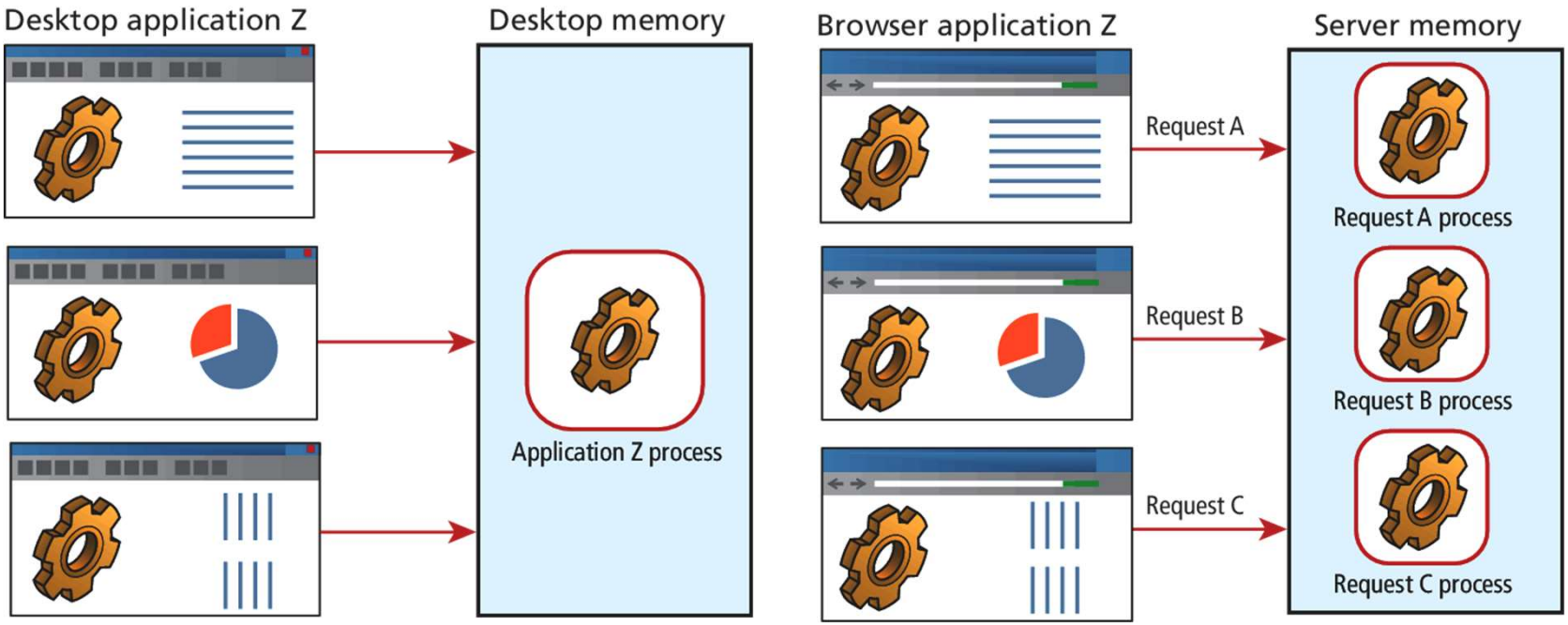
Server and Desktop Objects

Not the same

- While desktop software can load an object into memory and make use of it for several user interactions, a PHP object is loaded into memory only for the life of that HTTP request.
- We must use classes differently than in the desktop world, since the object must be recreated and loaded into memory
- Unlike a desktop, there are potentially many thousands of users making requests at once, so not only are objects destroyed upon responding to each request, but memory must be shared between many simultaneous requests, each of which may load objects into memory or each request that requires it

Server and Desktop Objects

Not the same



Section 2 of 3

OBJECTS AND CLASSES IN PHP

Defining Classes

In PHP

The PHP syntax for defining a class uses the class keyword followed by the class name and { } braces

```
class Artist {
    public   $firstName;
    public   $lastName;
    public   $birthDate;
    public   $birthCity;
    public   $deathDate;
}
```

LISTING 10.1 A simple Artist class

Instantiating Objects

In PHP

Defining a class is not the same as using it. To make use of a class, one must **instantiate** (create) objects from its definition using the *new* keyword.

$picasso = new Artist();

$dali = new Artist();

Properties

The things in the objects

Once you have instances of an object, you can access and modify the properties of each one separately using the variable name and an arrow (->).

```
$picasso = new Artist();
$dali = new Artist();
$picasso->firstName = "Pablo";
$picasso->lastName = "Picasso";
$picasso->birthCity = "Malaga";
$picasso->birthDate = "October 25 1881";
$picasso->deathDate = "April 8 1973";
```

LISTING 10.2 Instantiating two Artist objects and setting one of those object's properties

Constructors

A Better way to build

Constructors let you specify parameters during instantiation to initialize the properties within a class right away.

In PHP, constructors are defined as functions (as you shall see, all methods use the function keyword) with the name **__construct().(two underscore).**

Notice that in the constructor each parameter is assigned to an internal class variable using the $this-> syntax. you **must** always use the $this syntax to reference all properties and methods associated with this particular instance of a class.

Constructors

An Example

```
class Artist {
   // variables from previous listing still go here
   ...

   function __construct($firstName, $lastName, $city, $birth,
                        $death=null) {
      $this->firstName = $firstName;
      $this->lastName = $lastName;
      $this->birthCity = $city;
      $this->birthDate = $birth;
      $this->deathDate = $death;
   }
}
```

LISTING 10.3 A constructor added to the class definition

Constructors

Using the constructor

```
$picasso = new Artist("Pablo","Picasso","Malaga","Oct 25,1881","Apr 8,1973");

$dali = new Artist("Salvador","Dali","Figures","May 11 1904", "Jan 23 1989");
```

Methods

Functions In a class

Methods and are like functions, except they are associated with a class.

They define the tasks each instance of a class can perform and are useful since they associate behavior with objects.

```
$picasso = new Artist( . . . )

echo $picasso->outputAsTable();
```

Methods

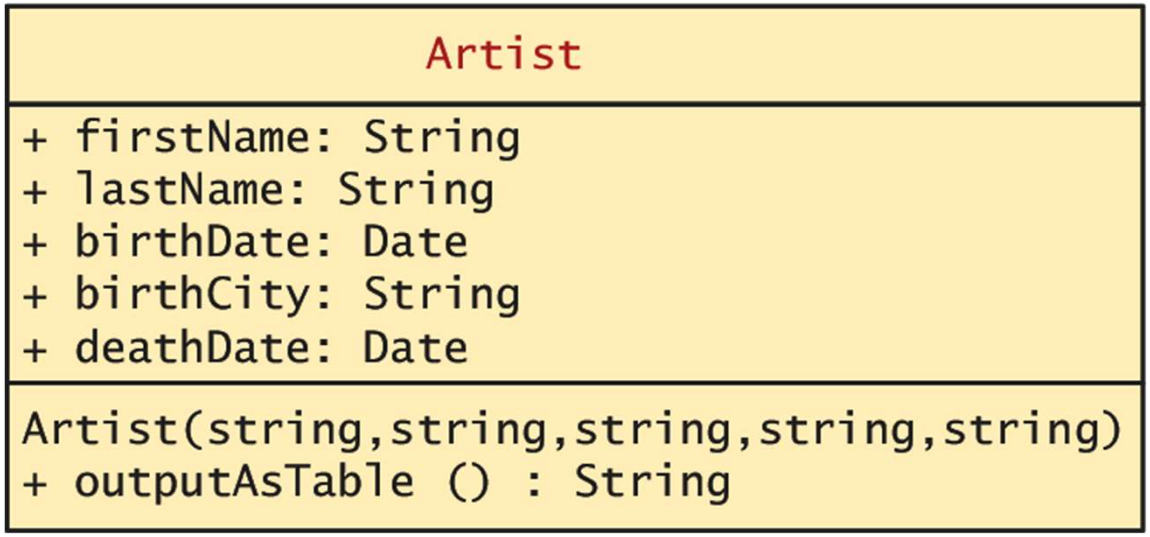
The example definition

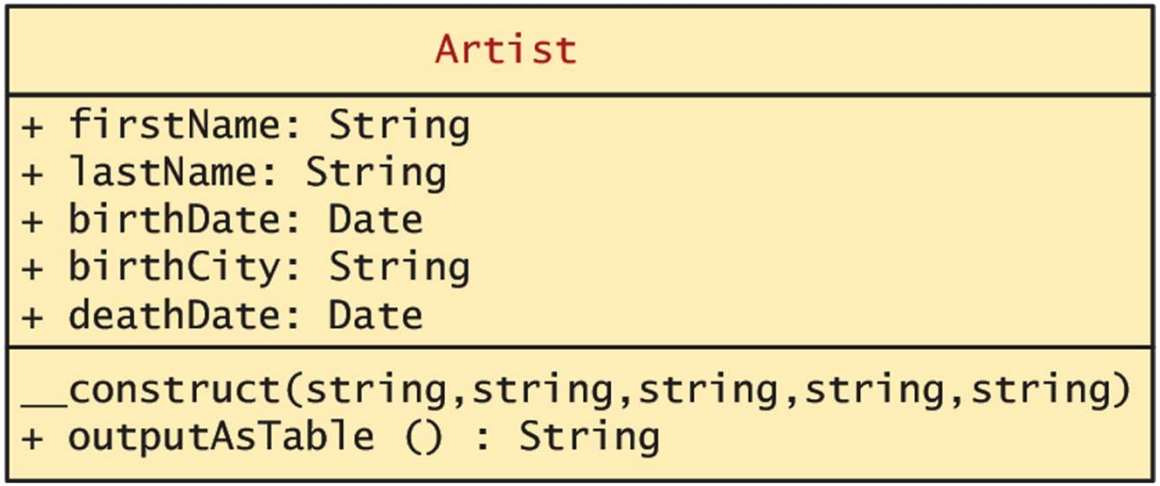
```
class Artist {
    ...
    public function outputAsTable() {
      $table = "<table>";
      $table .= "<tr><th colspan='2'>";
      $table .= $this->firstName . " " . $this->lastName;
      $table .= "</th></tr>";
      $table .= "<tr><td>Birth:</td>";
      $table .= "<td>" . $this->birthDate;
      $table .= "(" . $this->birthCity . ")</td></tr>";
      $table .= "<tr><td>Death:</td>";
      $table .= "<td>" . $this->deathDate . "</td></tr>";
      $table .= "</table>";
      return $table;
    }
}
```

LISTING 10.4 Method definition

Methods

UML class diagrams adding the method





Visibility

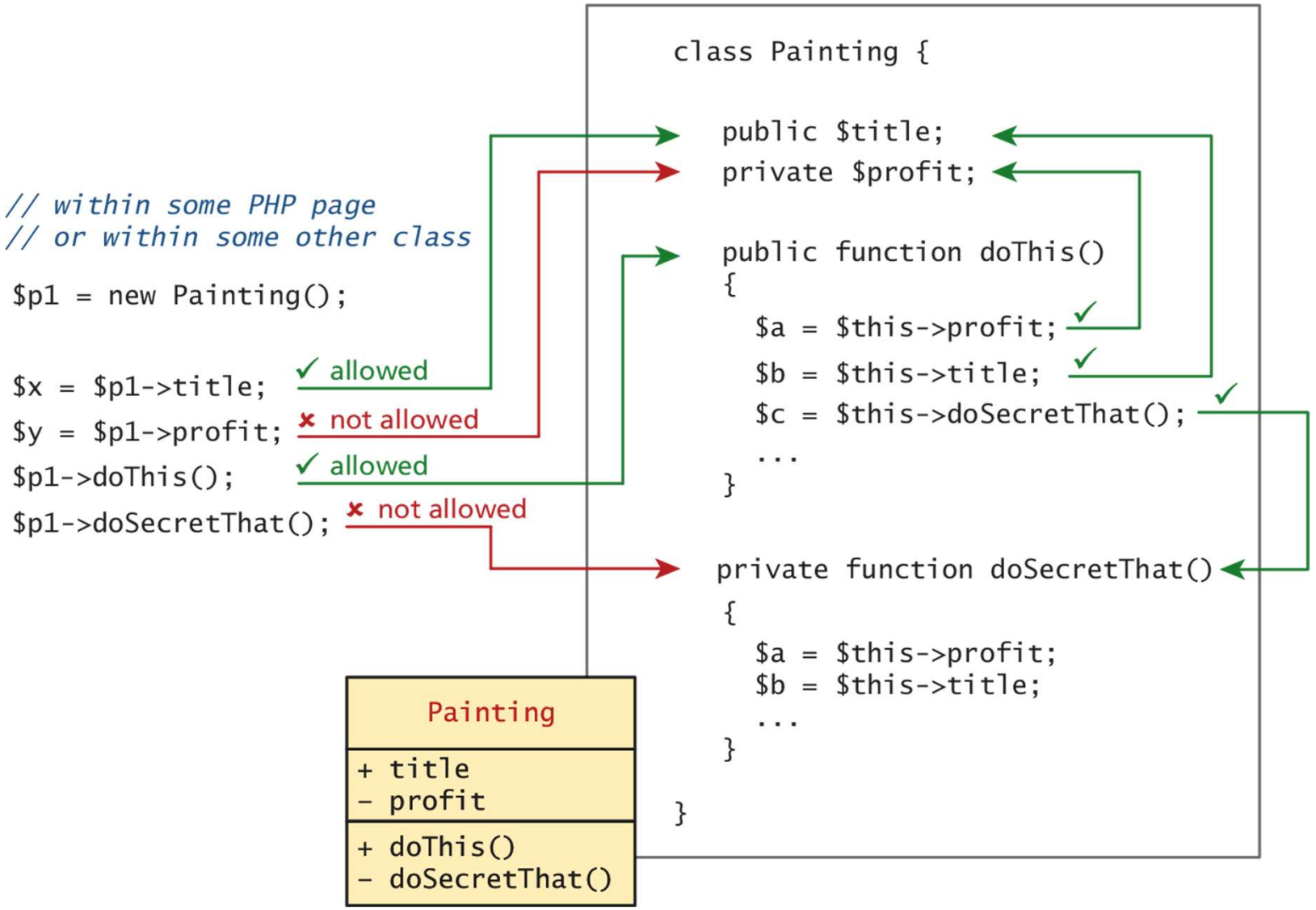
Or accessibility

The **visibility** of a property or method determines the accessibility of a **class member** and can be set to:

- **Public** the property or method is accessible to any code that has a reference to the object
- **Private** sets a method or variable to only be accessible from within the class
- **Protected** is related to inheritance…

Visibility

Or accessibility



Static Members

❖A **static** member is a property or method that all instances of a class share.

❖Unlike an instance property, where each object gets its own value for that property, there is only one value for a class's static property.

❖Static members use the self:: syntax and are not associated with one object

❖They can be accessed without any instance of an Artist object by using the class name, that is, via **Artist::$artistCount.**

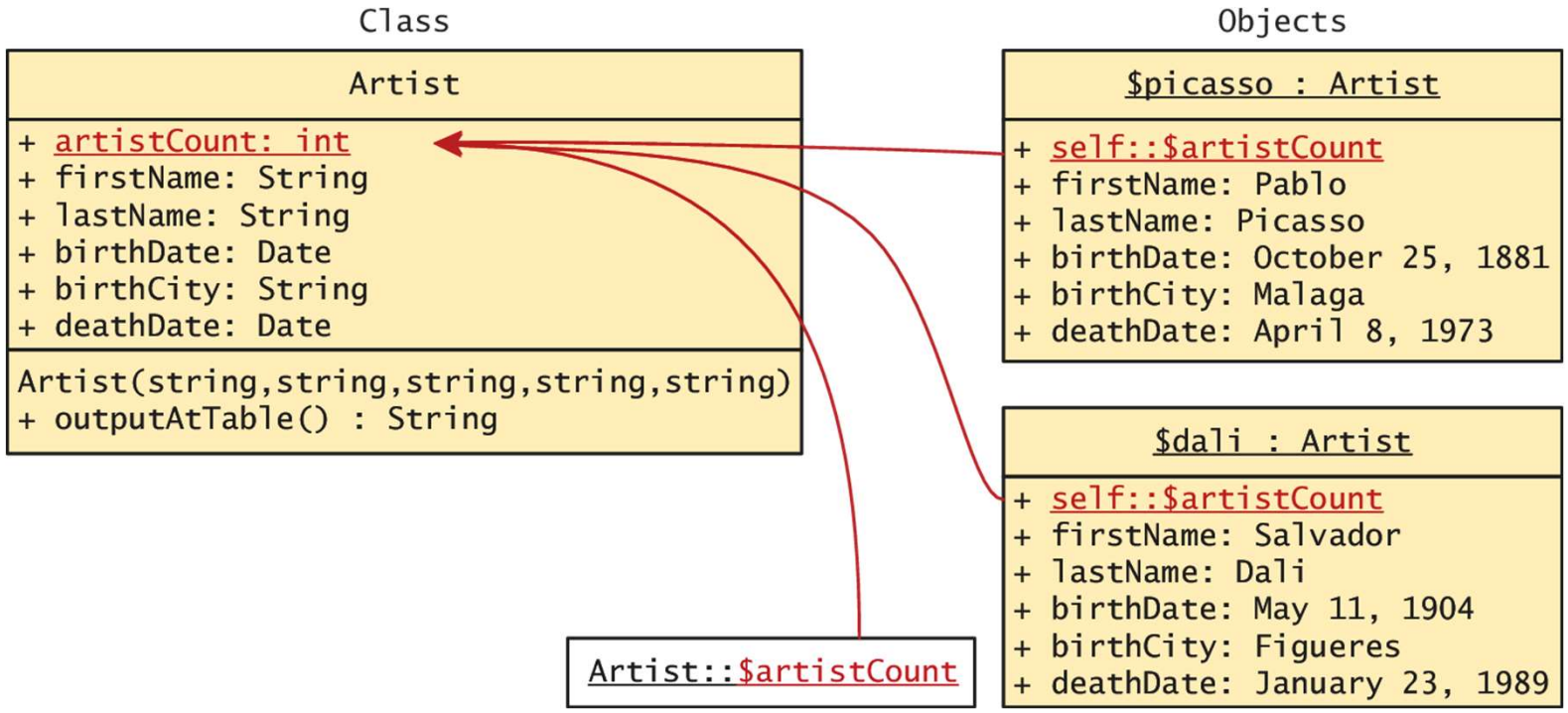
Static Members

```
class Artist {
    public static $artistCount = 0;
    public   $firstName;
    public   $lastName;
    public   $birthDate;
    public   $birthCity;
    public   $deathDate;

    function __construct($firstName, $lastName, $city, $birth,
                         $death=null) {
       $this->firstName = $firstName;
       $this->lastName = $lastName;
       $this->birthCity = $city;
       $this->birthDate = $birth;
       $this->deathDate = $death;
       self::$artistCount++;
    }
 }
```

LISTING 10.5 Class definition modified with static members

Static Members

Uml again



Class constants

Never changes

Constant values can be stored more efficiently as class constants so long as they are not calculated or updated

They are added to a class using the **const** keyword.

```
const EARLIEST_DATE = 'January 1, 1200';
```

Unlike all other variables, constants don’t use the $ symbol when declaring or using them.

Accessed both inside and outside the class using

- **self::EARLIEST_DATE** in the class and
- **classReference::EARLIEST_DATE** outside.

Section 3 of 3

OBJECT ORIENTED DESIGN

Data Encapsulation

What is it?

- Perhaps the most important advantage to object-oriented design is the possibility of **encapsulation**, which generally refers to restricting access to an object's internal components.
- Another way of understanding encapsulation is: it is the hiding of an object's implementation details
- A properly encapsulated class will define an interface to the world in the form of its public methods, and leave its data, that is, its properties, hidden (that is, private).

Data Encapsulation

Getters and setters

If a properly encapsulated class makes its properties private, then how do you access them?

- **getters**
- **setters**

Data Encapsulation

Getters

A getter to return a variable's value is often very straightforward and should not modify the property.

```
public function getFirstName() {

        return $this->firstName;

}
```

Data Encapsulation

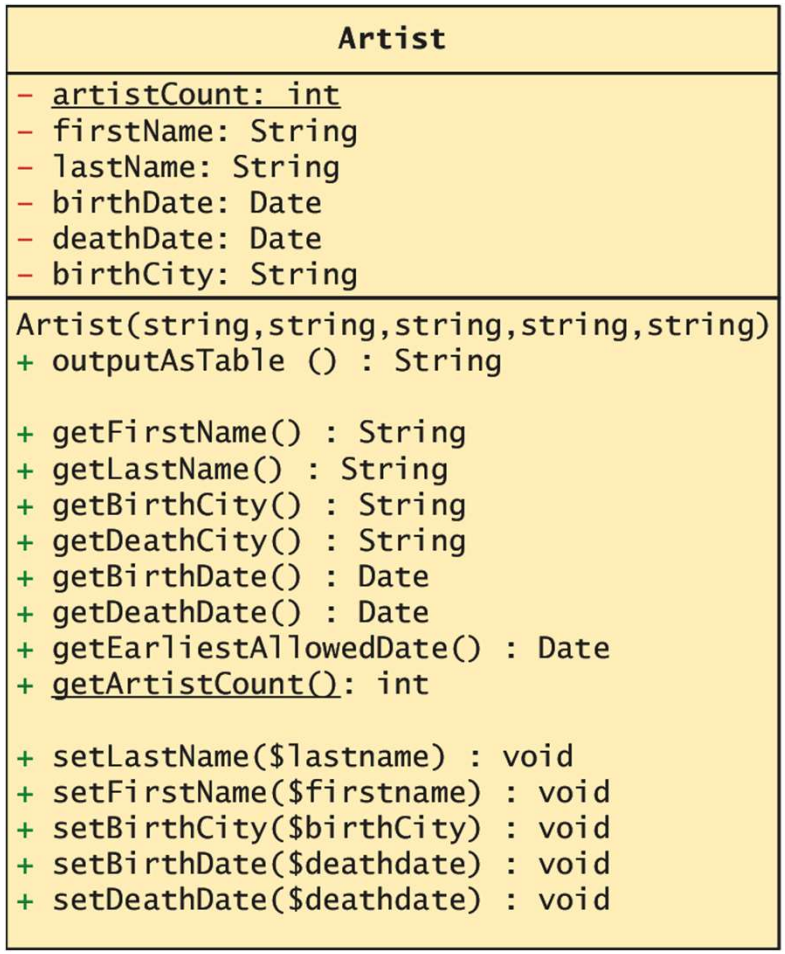
Setters

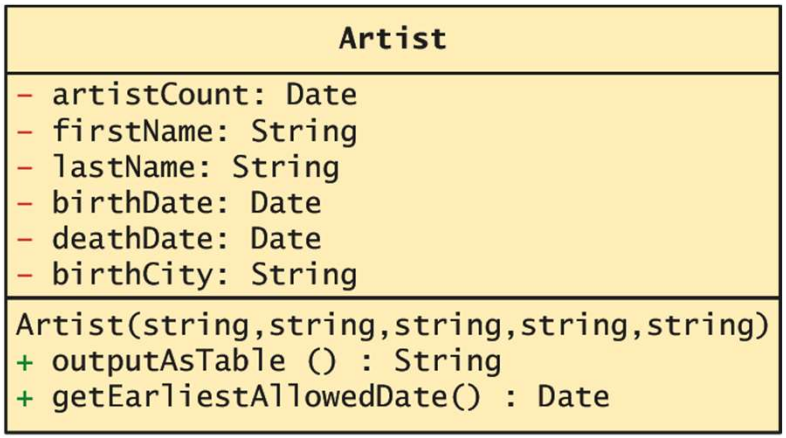
Setter methods modify properties, and allow extra logic to be added to prevent properties from being set to strange values.

```
public function setBirthDate($birthdate){
        // set variable only if passed a valid date string
        $date = date_create($birthdate);
        if ( ! $date ) {
                $this->birthDate = $this->getEarliestAllowedDate();
        }
        else {
        // if very early date then change it to
        // the earliest allowed date
                if ( $date < $this->getEarliestAllowedDate() ) {
                    $date = $this->getEarliestAllowedDate();
                }
                $this->birthDate = $date;
        }

}
```

Data Encapsulation

UML





Data Encapsulation

Using an encapsulated class

```
<html>
 <body>
 <h2>Tester for Artist class</h2>

 <?php
 // first must include the class definition
 include 'Artist.class.php';

 // output some of its fields to test the getters
 echo $picasso->getLastName() . ': ';
 echo date_format($picasso->getBirthDate(),'d M Y') . ' to ';
 echo date_format($picasso->getDeathDate(),'d M Y') . '<hr>';

 // create another instance and test it
 $dali = new Artist("Salvador","Dali","Figures","May 11,1904",
                    "January 23,1989");

 echo $dali->getLastName() . ': ';
 echo date_format($dali->getBirthDate(),'d M Y') . ' to ';
 echo date_format($dali->getDeathDate(),'d M Y'). '<hr>';

 // test the output method
 echo $picasso->outputAsTable();

 // finally test the static method: notice its syntax
 echo '<hr>';
 echo 'Number of Instantiated artists: ' . Artist::getArtistCount();

 ?>
 </body>
 </html>
```

LISTING 10.7 Using the encapsulated class

Inheritance

Inheritance enables you to create new PHP classes that reuse, extend, and modify the behavior that is defined in another PHP class.

- PHP only allows you to inherit from one class at a time
- A class that is inheriting from another class is said to be a **subclass** or a **derived class**
- The class that is being inherited from is typically called a **superclass** or a **base class**

A PHP class is defined as a subclass by using the ***extends*** keyword.

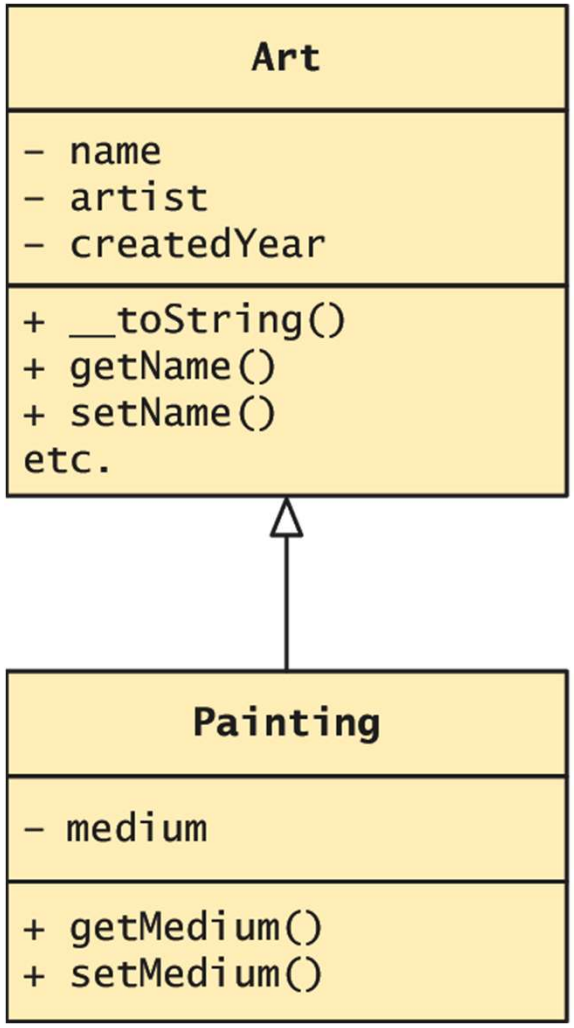
class Painting **extends** Art { . . . }

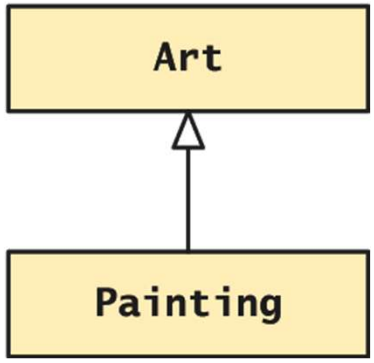
Example usage

```
$p = new Painting();

. . .

echo $p->getName(); // defined in base class

echo $p->getMedium(); // defined in subclass
```

Inheritance

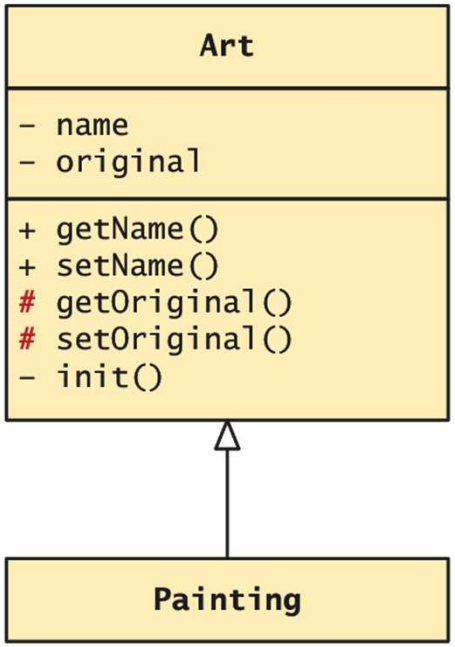
There's UML for that too





Protected access modifier

Remember Protected?

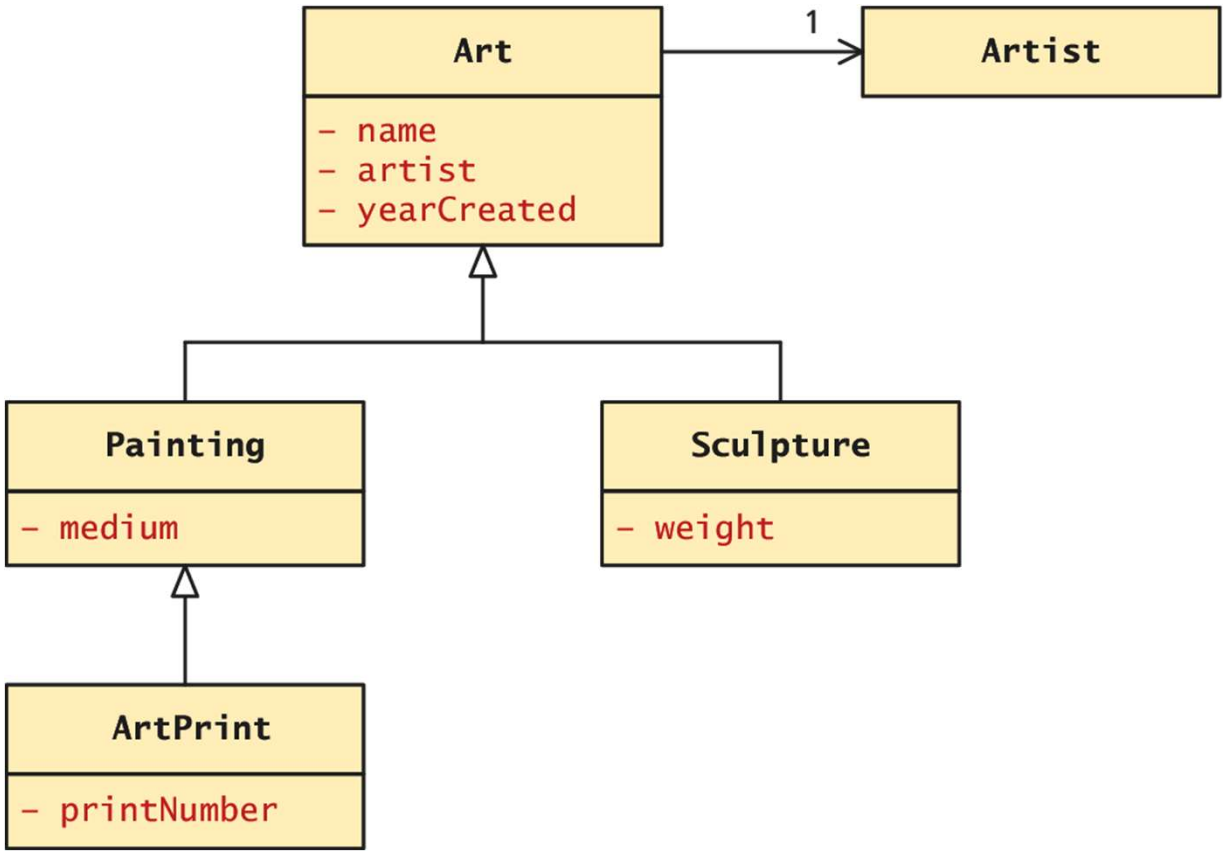



```
class Painting extends Art {
   …
   private function foo() {
      …
      // these are allowed
✓     $w = parent::getName();
✓     $x = parent::getOriginal();

      // this is not allowed
✘     $y = parent::init();
   }
}
```

```
// in some page or other class
$p = new Painting();
$a = new Art();

// neither of these references are allowed
✘ $w = $p->getOriginal();
✘ $y = $a->getOriginal();
```

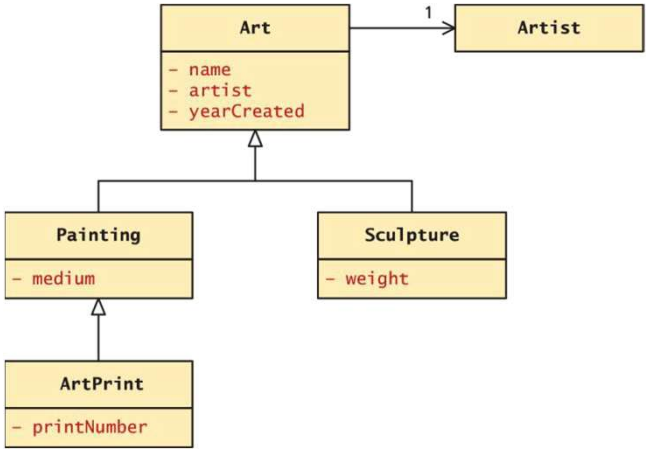
A More Complex Example

Using inheritance



Extended example

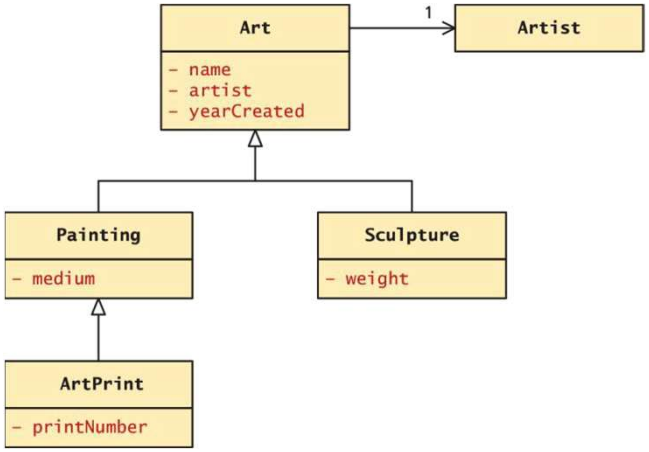
All art has certain properties




```
/* The abstract class that
 contains functionality required by
 all types of Art */

abstract class Art {

        private $name;

        private $artist;

        private $yearCreated;

        //... constructor, getters, setters
```

Extended example

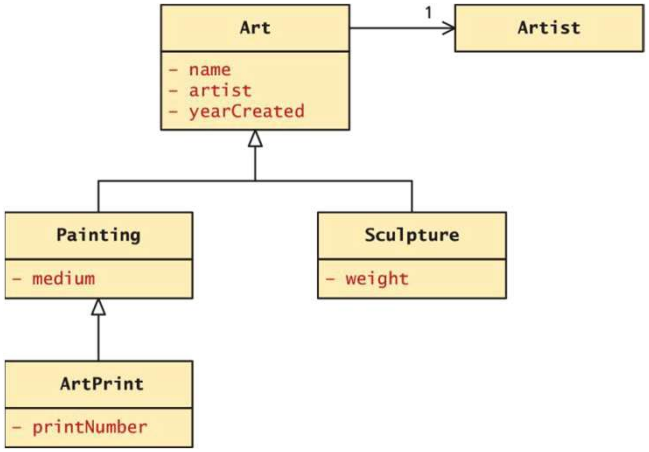
Painting require a "medium"




```
class Painting extends Art {

        private $medium;

        //...constructor, getters, setters

        public function__toString() {

        return parent::__toString() . ", Medium: " .
                                                $this->getMedium();

    }

}
```

Extended example

Sculptures have weight




```
class Sculpture extends Art {

        private $weight;

        //...constructor, getters, setters

        public function__toString() {

                return parent::__toString() . ", Weight: " .

                                $this->getWeight() ."kg";

        }
}
```

Extended example

Using the classes

```
...

$picasso = new Artist("Pablo","Picasso","Malaga","May 11,904”,"Apr 8, 1973");

$guernica = new Painting("1937",$picasso,"Guernica”, "Oil on canvas");

$woman = new Sculpture("1909",$picasso,"Head of a Woman", 30.5);

?>

<h2>Paintings</h2>

<p><em>Use the___toString() methods </em></p>

<p><?php echo $guernica; ?></p>

<h2>Sculptures</h2>

<p> <?php echo $woman; ?></p>
```

Polymorphism

No thank you, I'll have water

- **Polymorphism** is the notion that an object can in fact be multiple things at the same time.

- Consider an instance of a Painting object named $guernica created as follows:

```
$guernica = new Painting("1937",$picasso,"Guernica","Oil on canvas");
```

- The variable $guernica is both a *Painting* object and an *Art* object due to its inheritance.

- The advantage of polymorphism is that we can manage a list of Art objects, and call the same overridden method on each.

Polymorphism

```
$picasso = new Artist("Pablo","Picasso","Malaga","Oct 25, 1881",
                      "Apr 8, 1973");

// create the paintings
$guernica = new Painting("1937",$picasso,"Guernica","Oil on canvas");
$chicago = new Sculpture("1967",$picasso,"Chicago", 454);
```

```
// create an array of art
$works = array();
$works[0] = $guernica;
$works[1] = $chicago;
// to test polymorphism, loop through art array
foreach ($works as $art)
{
// the beauty of polymorphism:
// the appropriate __toString() method will be called!
   echo $art;
}

// add works to artist ... any type of art class will work
$picasso->addWork($guernica);
$picasso->addWork($chicago);
// do the same type of loop
foreach ($picasso->getWorks() as $art) {
   echo $art;  // again polymorphism at work
}
```

LISTING 10.10 Using polymorphism

Interfaces

Defining the interface

❖An object **interface** is a way of defining a formal list of methods that a class **must** implement without specifying their implementation.

❖Interfaces are defined using the interface keyword, and look similar to standard PHP classes, except an interface contains no properties and its methods do not have method bodies defined.

```
interface Viewable {

        public function getSize();

        public function getPNG();

}
```

Interfaces

Implementing the Interface

- In PHP, a class can be said to *implement* an interface, using the implements keyword:

  class *Painting* extends Art **implements** Viewable { ... }

- This means then that the class *Painting* must provide implementations for the getSize() and getPNG() methods.

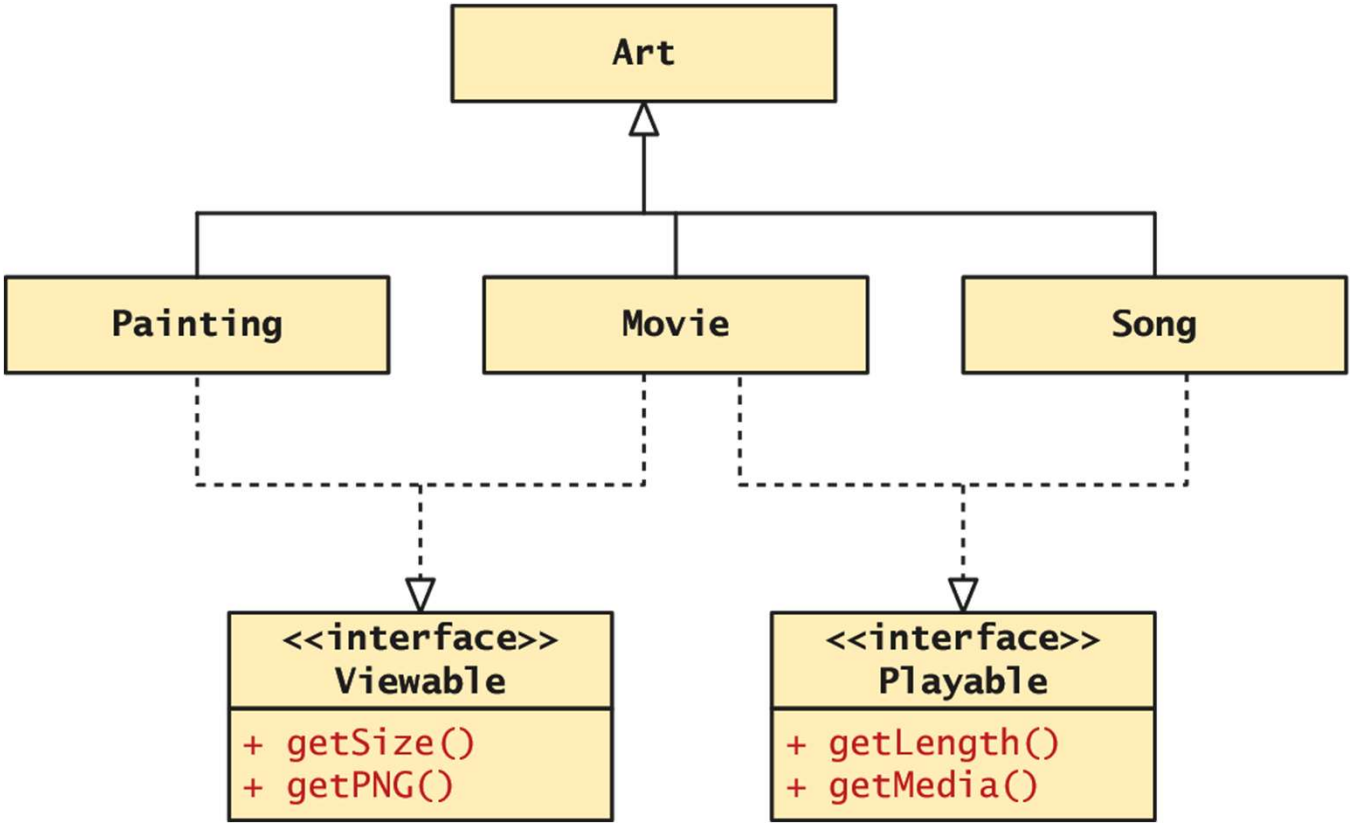
Interface Example

```
interface Viewable {
   public function getSize();
   public function getPNG();
}

class Painting extends Art implements Viewable {
   ...
   public function getPNG() {
      //return image data would go here
      ...
   }
   public function getSize() {
      //return image size would go here
      ...
   }
}
```

LISTING 10.11 Painting class implementing an interface

Interfaces

An Extended example



Error Handling and Validation

Chapter 12

Section 1 of 6

WHAT ARE ERRORS AND EXCEPTIONS?

Types of Errors

- Expected errors

  Things that you expect to go wrong. Bad user input, database connection, etc…

- Warnings

  problems that generate a PHP warning message but will not halt the execution of the page

- Fatal errors

  are serious in that the execution of the page will terminate unless handled in some way

Isset() : returns true if a variable is not null.

Empty() : returns true if a variable is null, false, zero or an empty string.

Checking user input

Checking for values

Example query string: `id=0&name1=&name2=smith&name3=%20`

Notice that this parameter has no value.

This parameter's value is a space character (URL encoded).

`isset($_GET['id'])`	returns	**true**
`isset($_GET['name1'])`	returns	**true**
`isset($_GET['name2'])`	returns	**true**
`isset($_GET['name3'])`	returns	**true**
`isset($_GET['name4'])`	returns	**false**

Notice that a missing value for a parameter is still considered to be `isset`.

Notice that only a missing parameter name is considered to be not `isset`.

`empty($_GET['id'])`	returns	**true**
`empty($_GET['name1'])`	returns	**true**
`empty($_GET['name2'])`	returns	**false**
`empty($_GET['name3'])`	returns	**false**
`empty($_GET['name4'])`	returns	**true**

Notice that a value of zero is considered to be empty. This may be an issue if zero is a "legitimate" value in the application.

Notice that a value of space is considered to be **not** empty.

Checking user input

Checking for a number

```
$id = $_GET['id'];
if (!empty($id) && is_numeric($id) ) {
   // use the query string since it exists and is a numeric value
   ...
}
```

LISTING 12.1 Testing a query string to see if it exists and is numeric

Exceptions vs Errors

Not the same thing

- An **error** is some type of problem that generates a nonfatal warning message or that generates an error message that terminates the program's execution.
- An **exception** refers to objects that are of type Exception and which are used in conjunction with the object-oriented try . . . catch language construct for dealing with runtime errors.

Section 2 of 6

PHP ERROR REPORTING

PHP error reporting

Lots of control

PHP has a flexible and customizable system for reporting warnings and errors that can be set programmatically at runtime or declaratively at design-time within the **php.ini** file. There are three main error reporting flags:

- error_reporting
- display_errors
- log_errors

The error_reporting setting

What is an error?

The **error_reporting** setting specifies which type of errors are to be reported.

It can be set programmatically inside **any** PHP file:

```
error_reporting(E_ALL);
```

It can also be set within the **php.ini** file:

```
error_reporting = E_ALL
```

The error_reporting setting

Some error reporting constants

Constant Name	Value	Description
E_ALL	8191	Report all errors and warnings
E_ERROR	1	Report all fatal runtime errors
E_WARNING	2	Report all nonfatal runtime errors (that is, warnings)
	0	No reporting

The display_errors setting

To show or not to show

The **display_error** setting specifies whether error messages should or should not be displayed in the browser.

It can be set programmatically via the ini_set() function:

```
ini_set('display_errors','0');
```

It can also be set within the **php.ini** file:

```
display_errors = Off
```

The log_error setting

To record or not to record

The **log_error** setting specifies whether error messages should or should not be sent to the server error log.

It can be set programmatically via the ini_set() function:

```
ini_set('log_errors','1');
```

It can also be set within the **php.ini** file:

```
log_errors = On
```

The log_error setting

Where to store.

The location to store logs in can be set programatically:

```
ini_set('error_log', '/restricted/my-errors.log');
```

It can also be set within the **php.ini** file:

```
error_log = /restricted/my-errors.log
```

The log_error setting

Error_log()

You can also programmatically send messages to the error log at any time via the error_log() function

```
$msg = 'Some horrible error has occurred!';

// send message to system error log (default)
error_log($msg,0);

// email message
error_log($msg,1,'support@abc.com','From: somepage.php@abc.com');

// send message to file
error_log($msg,3, '/folder/somefile.log');
```

Section 3 of 6

PHP ERROR AND EXCEPTION HANDLING

Procedural Error Handling

Recall connecting to a database, that there may be an error…

```
$connection = mysqli_connect(DBHOST, DBUSER, DBPASS, DBNAME);

$error = mysqli_connect_error();
if ($error != null) {
   // handle the error
   ...
}
```

LISTING 12.2 Procedural approach to error handling

OO Exception Handling

Try, catch,finally

- When a runtime error occurs, PHP *throws* an *exception*.
- This exception can be *caught* and handled either by the function, class, or page that generated the exception or by the code that called the function or class.
- If an exception is not caught, then eventually the PHP environment will handle it by terminating execution with an “Uncaught Exception” message.

OO Exception Handling

Try, catch,finally

```php
// Exception throwing function
function throwException($message = null,$code = null) {
  throw new Exception($message,$code);
}

try {
  // PHP code here
  $connection = mysqli_connect(DBHOST, DBUSER, DBPASS, DBNAME)
    or throwException("error");
 //...
}
catch (Exception $e) {
  echo ' Caught exception: ' .  $e->getMessage();
  echo ' On Line : ' .  $e->getLine();
  echo ' Stack Trace: '; print_r($e->getTrace());
} finally {
  // PHP code here that will be executed after try or after catch
}
```

LISTING 12.3 Example of try . . . catch block

OO Exception Handling

Finally

- The finally block is optional. Any code within it will always be executed *after* the code in the try or in the catch blocks, even if that code contains a return statement.
- The finally block is only available in PHP 5.5 and later

Throw your own exception

Object oriented way of dealing with the unexpected

```
try {
  // PHP code here
}
catch (Exception $e) {
    // do some application-specific exception handling here
    ...
    // now rethrow exception
    throw $e;
}
```

LISTING 12.5 Rethrowing an exception

Custom Handlers

Error and Exception Handlers

❖It is possible to define your own handler for uncaught errors and exceptions, the mechanism for doing so varies depending upon whether you are using the procedural or object oriented mechanism for responding to errors.

❖If using the procedural approach(i.e, not using try…catch) you can define a custom error handling function and then register it with

set_error_handler()

❖If you are using the object oriented exception approach with try… catch blocks, you can define a custom exception handling function and then register it with

set_exception_handler()

Custom Handlers

Error and Exception Handlers

✓What should a custom error or exception handler do?

✓It should provide the *developer* with detailed information about the state of the application when the exception occurred, information about the exception, and when it happened.

✓It should hide any of those details from the regular end user, and instead provide the user with a generic message such as “Sorry but there was a problem”

✓Once a handler function is defined, it must be registered, using the following code:

```
set_exception_handler('my_exception_handler');
```

Custom Handlers

```
function my_exception_handler($exception) {

  // put together a detailed exception message
  $msg = "<p>Exception Number " . $exception->getCode();
  $msg .= $exception->getMessage() . " occurred on line ";
  $msg .= "<strong>" . $exception->getLine() . "</strong>";
  $msg .= "and in the file: ";
  $msg .= "<strong>" . $exception->getFile() . "</strong> </p>";

  // email error message to someone who cares about such things
  error_log($msg, 1, 'support@domain.com',
            'From: reporting@domain.com');
  // if exception serious then stop execution and tell maintenance fib
  if ($exception->getCode() !== E_NOTICE) {
     die("Sorry the system is down for maintenance. Please try
          again soon");
  }
}
```

LISTING 12.6 Custom exception handler

END

OF

MODULE 4