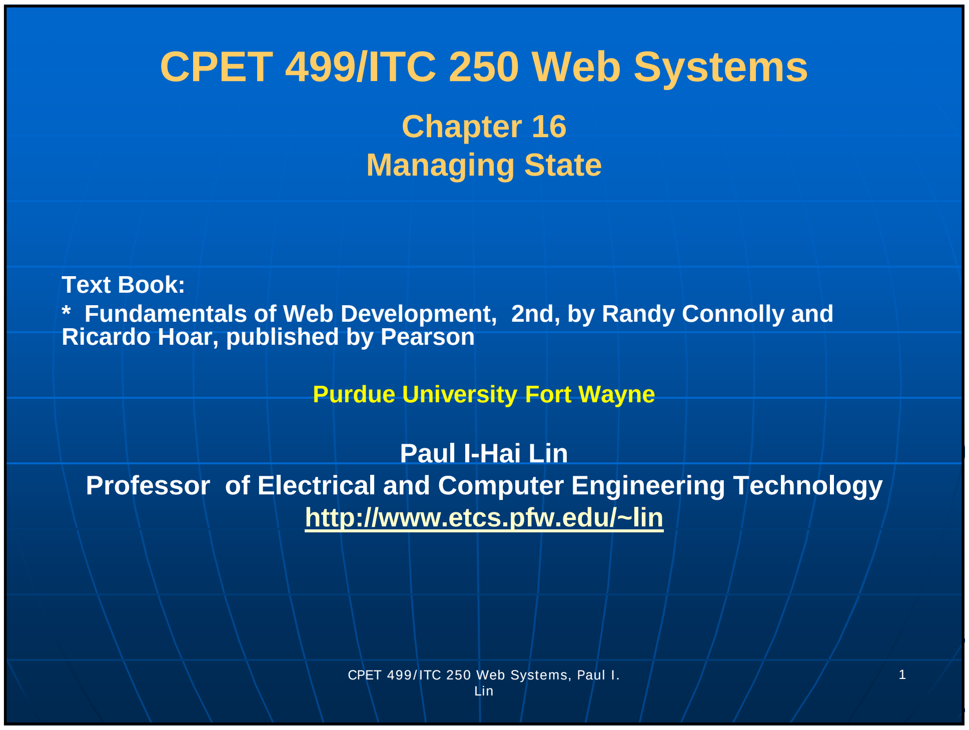

CPET 499/ITC 250 Web Systems

Chapter 16
Managing State

Text Book:
*** Fundamentals of Web Development, 2nd, by Randy Connolly and Ricardo Hoar, published by Pearson**

Purdue University Fort Wayne

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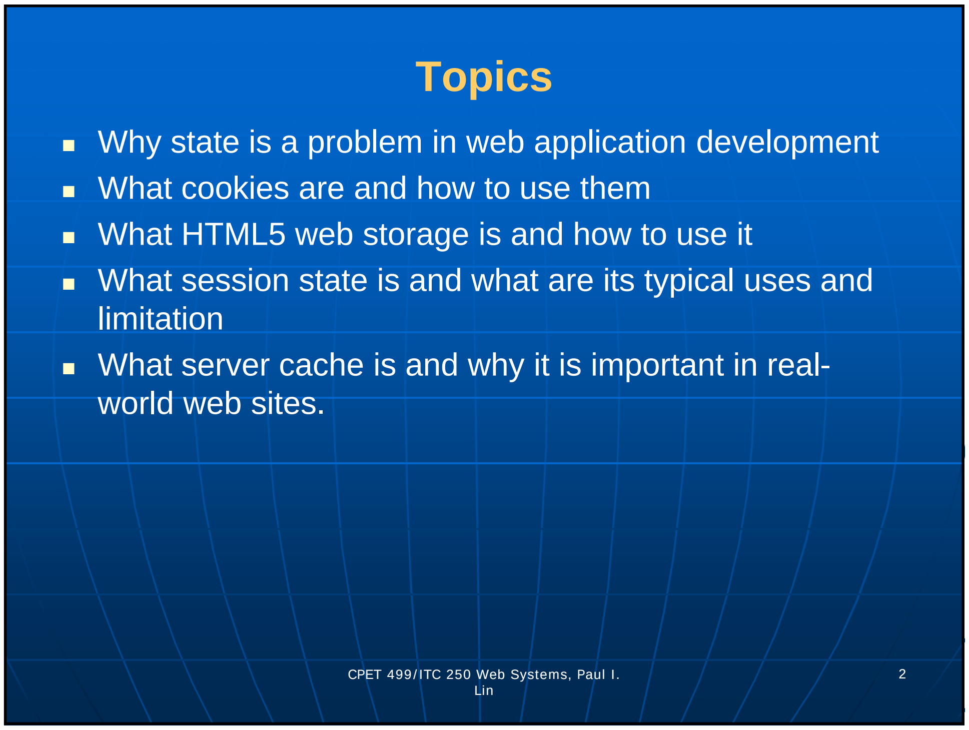
http://www.etcs.pfw.edu/~lin



Topics

- Why state is a problem in web application development
- What cookies are and how to use them
- What HTML5 web storage is and how to use it
- What session state is and what are its typical uses and limitation
- What server cache is and why it is important in real-world web sites.

The Problem of State in Web Applications

Figure 16.1 Desktop applications vs. web application

- All applications need to
  - Process user inputs
  - Output information, and
  - Read/write from databases or other storage media
- A web app consists of series of disconnected HTTP request to a web server

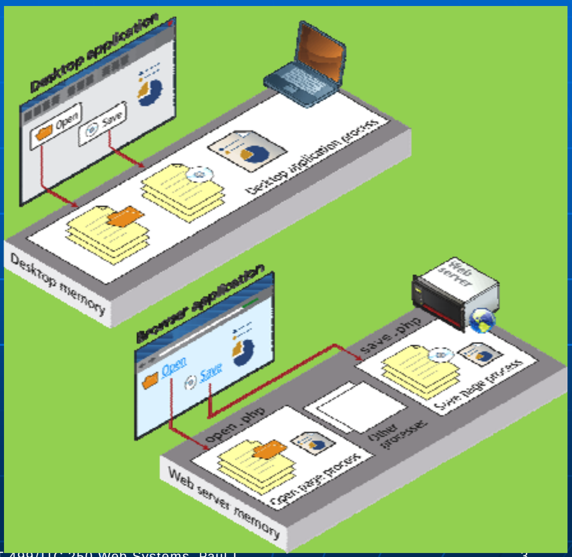


Figure 16.2 What the web server sees

- The web server sees only request
- The HTTP protocol does not without programming intervention, distinguish two requests

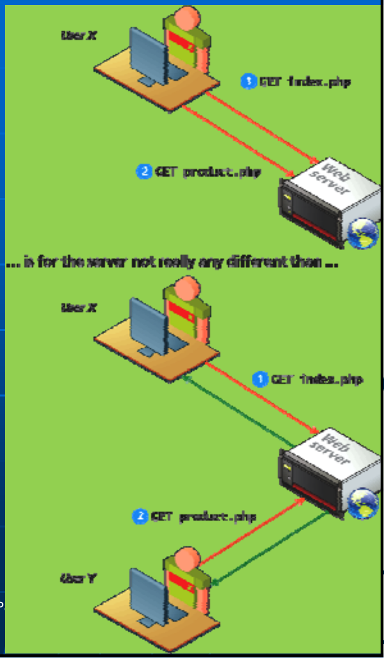
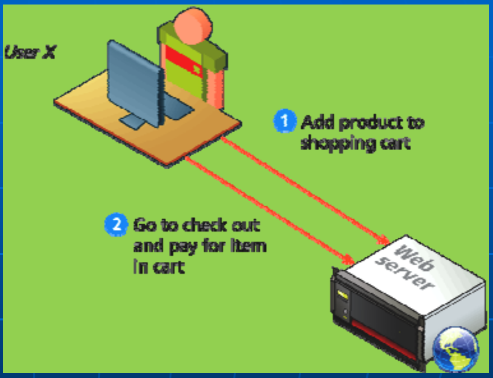


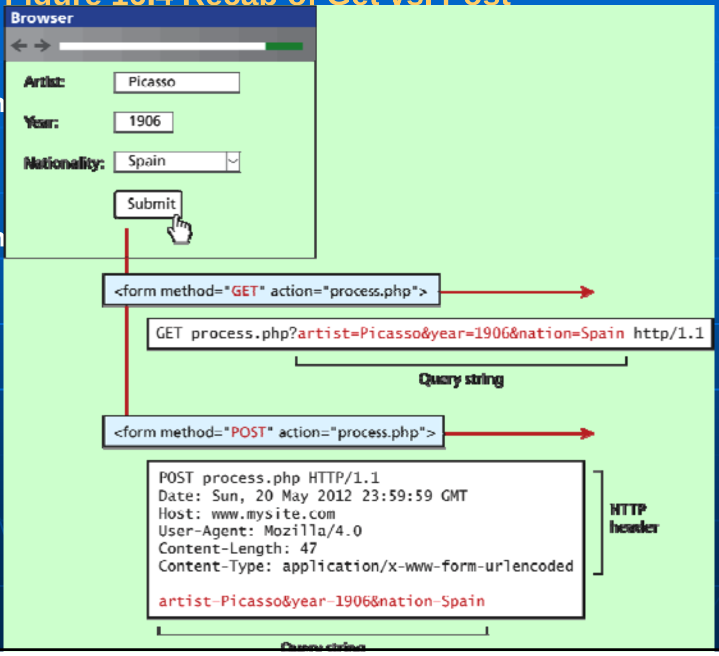
Figure 16.3 What the user wants the server to see

- User wants the web server to connect the request together: A web shopping cart example
- HTTP request-response interaction constrains information passing/using
- We can pass info using: Query strings, Cookies


User X
1 Add product to shopping cart
2 Go to check out and pay for item in cart
Web server

Passing Information via Query Strings
Figure 16.4 Recap of Get vs. Post

- A query string within the URL (GET)
- A query string within HTTP header (POST)

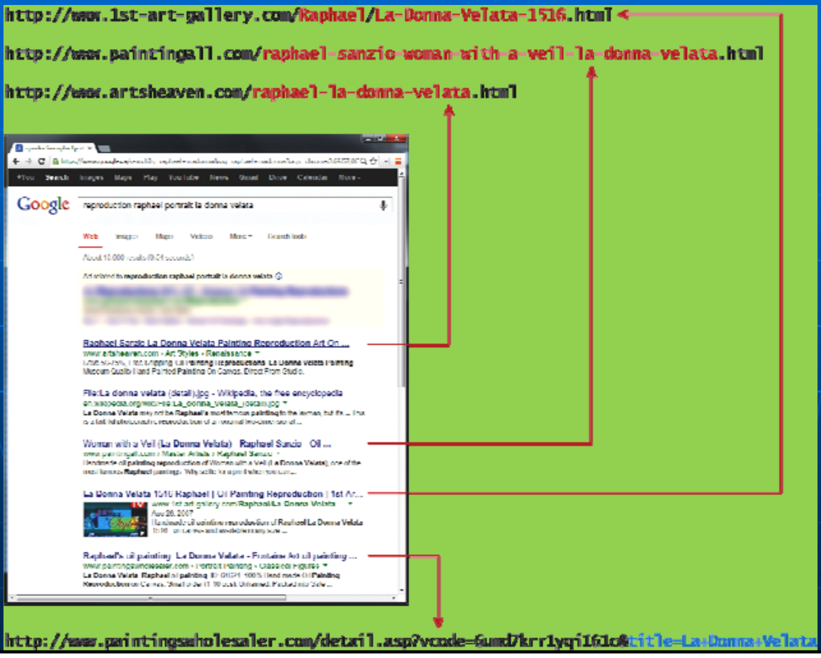


```
<form method="GET" action="process.php">
GET process.php?artist=Picasso&year=1906&nation=Spain http/1.1

<form method="POST" action="process.php">
POST process.php HTTP/1.1
Date: Sun, 20 May 2012 23:59:59 GMT
Host: www.mysite.com
User-Agent: Mozilla/4.0
Content-Length: 47
Content-Type: application/x-www-form-urlencoded

artist=Picasso&year=1906&nation=Spain
```

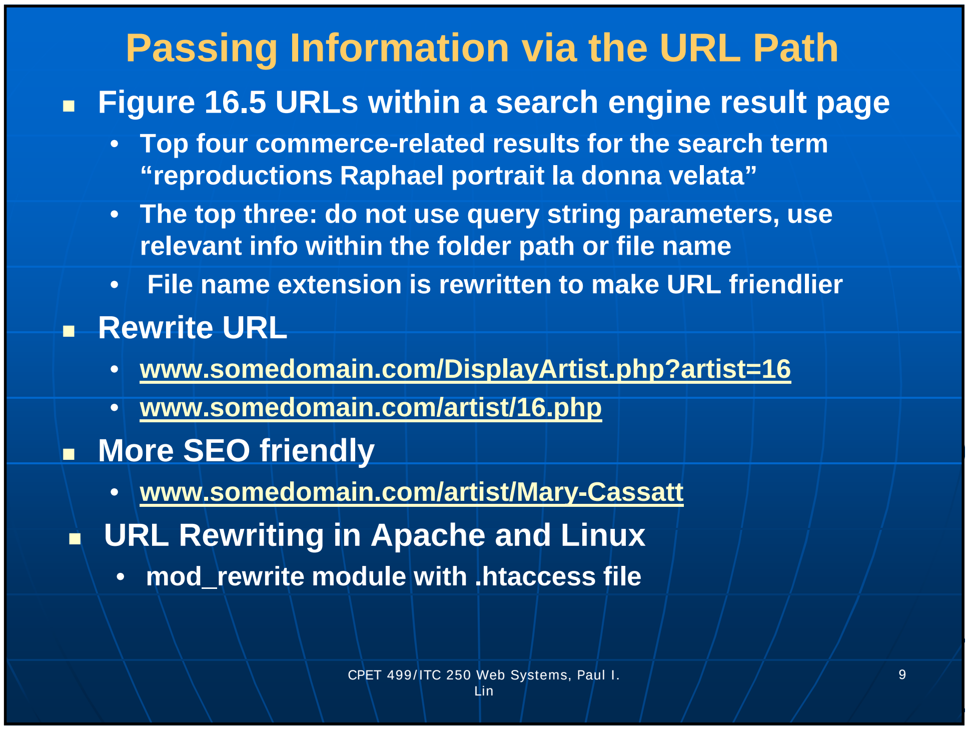
Passing Information via the URL Path

- **Drawbacks**
  - The URL path and query string can be long and complicated
- **For search engine application:**
  - A prefer method
  - SEO (Search Engine Optimization)
  - Dynamic URLs (query string parameters) – an essential part of web development
  - URL Rewriting – a process of rewrite the dynamic URL into static one (and vice versa)
- **Figure 16.5 URLs within a search engine result page**

Figure 16.5 URLs with a search engine result page

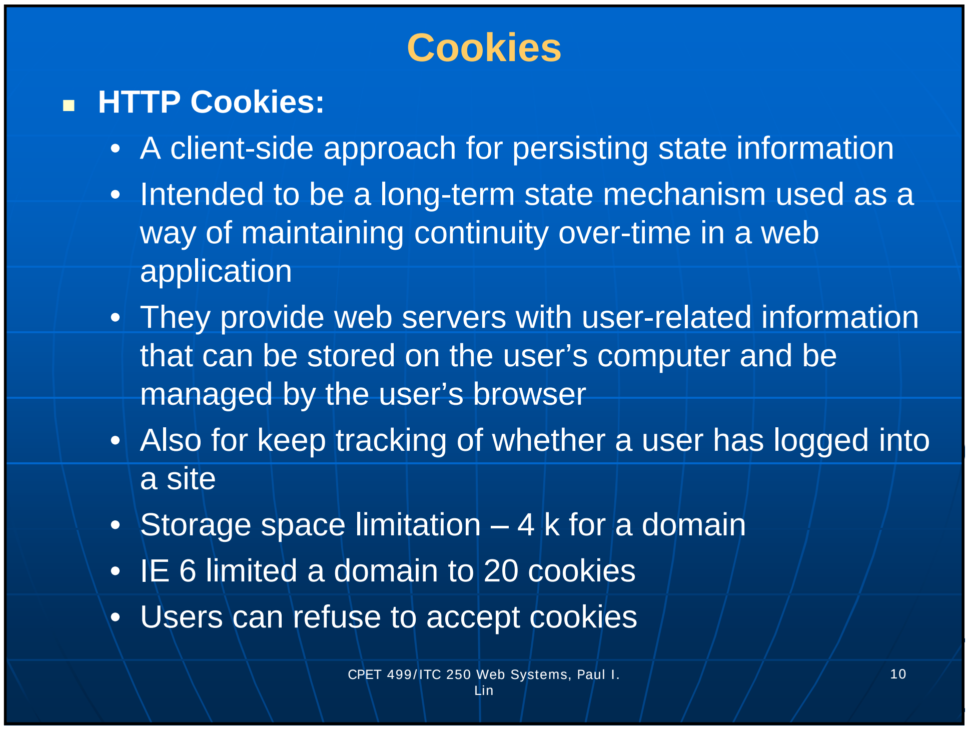


```
http://www.1st-art-gallery.com/Raphael/La-Donna-Velata-1516.html
http://www.paintingall.com/raphael-sanzio-woman-with-a-veil-la-donna-velata.html
http://www.artsheaven.com/raphael-la-donna-velata.html
http://www.paintingswholesaler.com/detail.asp?vcode=6umd7krr1yqi161c&title=La+Donna+Velata
```



Passing Information via the URL Path

- Figure 16.5 URLs within a search engine result page
  - Top four commerce-related results for the search term "reproductions Raphael portrait la donna velata"
  - The top three: do not use query string parameters, use relevant info within the folder path or file name
  - File name extension is rewritten to make URL friendlier
- Rewrite URL
  - www.somedomain.com/DisplayArtist.php?artist=16
  - www.somedomain.com/artist/16.php
- More SEO friendly
  - www.somedomain.com/artist/Mary-Cassatt
- URL Rewriting in Apache and Linux
  - mod_rewrite module with .htaccess file



Cookies

- HTTP Cookies:
  - A client-side approach for persisting state information
  - Intended to be a long-term state mechanism used as a way of maintaining continuity over-time in a web application
  - They provide web servers with user-related information that can be stored on the user's computer and be managed by the user's browser
  - Also for keep tracking of whether a user has logged into a site
  - Storage space limitation – 4 k for a domain
  - IE 6 limited a domain to 20 cookies
  - Users can refuse to accept cookies

Cookies

- **Types of Cookies**
  - **Session Cookie** – no expiry state, will be deleted at the end of the user browsing session
  - **Persistent Cookies** – have expiry date specified
- Third-party tracking cookies – source of concern for privacy advocates
- Writing and Reading Cookies - PHP

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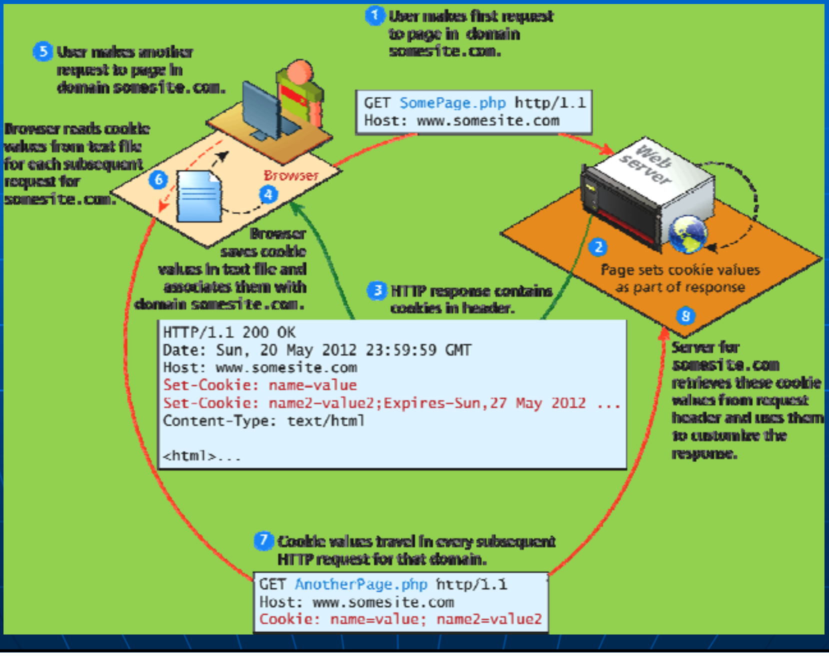
Figure 16.6 Cookies at work


1 User makes first request to page in domain somesite.com.
5 User makes another request to page in domain somesite.com.
Browser reads cookie values from text file for each subsequent request for somesite.com.
6
Browser
4
Browser saves cookie values in text file and associates them with domain somesite.com.
Web server
2 Page sets cookie values as part of response
3 HTTP response contains cookies in header.
8 Server for somesite.com retrieves these cookie values from request header and uses them to customize the response.
7 Cookie values travel in every subsequent HTTP request for that domain.

```
GET SomePage.php http/1.1
Host: www.somesite.com
```

```
HTTP/1.1 200 OK
Date: Sun, 20 May 2012 23:59:59 GMT
Host: www.somesite.com
Set-Cookie: name-value
Set-Cookie: name2-value2;Expires-Sun,27 May 2012 ...
Content-Type: text/html

<html>...
```

```
GET AnotherPage.php http/1.1
Host: www.somesite.com
Cookie: name=value; name2=value2
```

Cookies

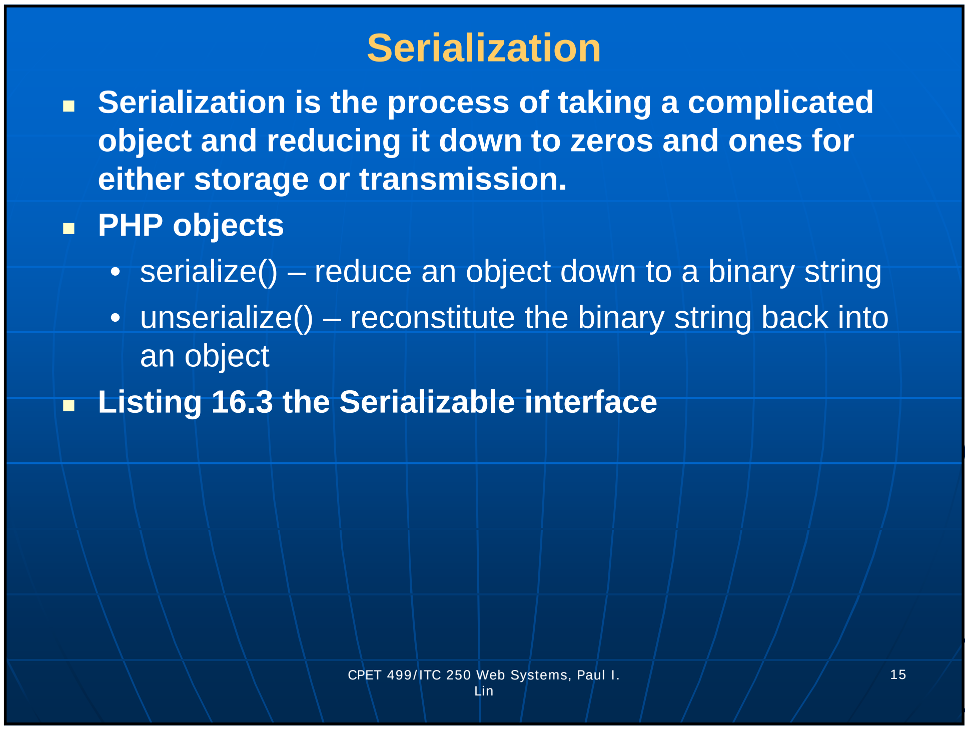
- **Writing Cookies – PHP**

```
<?php
//listing 16.1 Writing a cookie
// add 1 day to the current time for expiry time
$expiryTime = time()+60*60*24;
// create a persistent cookie
$name = "Username";
$value = "Ricardo";
setcookie($name, $value, $expiryTime);
?>
```

Cookies

- **Reading Cookies – PHP**

```
<?php
//listing 16.2 Reading a cookie <-visit Listing13.01.php
to set the cookie.
if( !isset($_COOKIE['Username']) ) {
  //no valid cookie found
}
else {
  echo "The username retrieved from the cookie is:";
  echo $_COOKIE['Username'];
}
?>
```



Serialization

- **Serialization is the process of taking a complicated object and reducing it down to zeros and ones for either storage or transmission.**
- **PHP objects**
  - serialize() – reduce an object down to a binary string
  - unserialize() – reconstitute the binary string back into an object
- **Listing 16.3 the Serializable interface**

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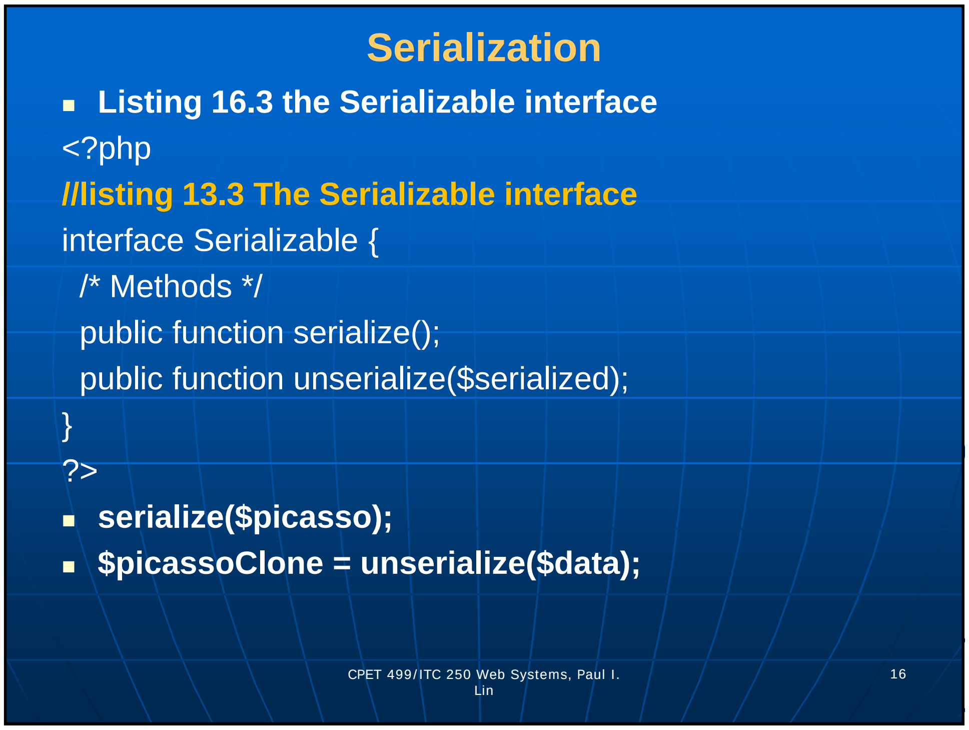

Serialization

- **Listing 16.3 the Serializable interface**

```
<?php
//listing 13.3 The Serializable interface
interface Serializable {
  /* Methods */
  public function serialize();
  public function unserialize($serialized);
}
?>
```

- **serialize($picasso);**
- **$picassoClone = unserialize($data);**

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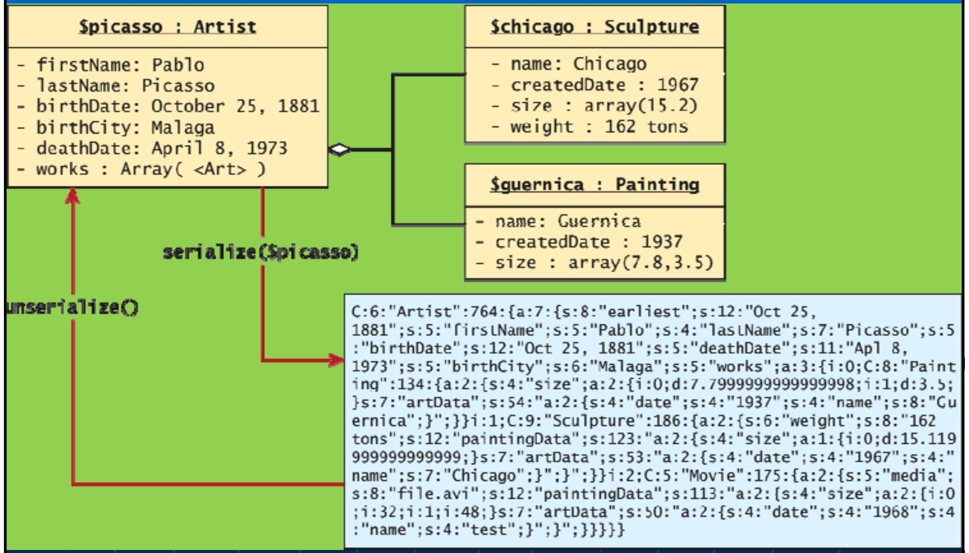
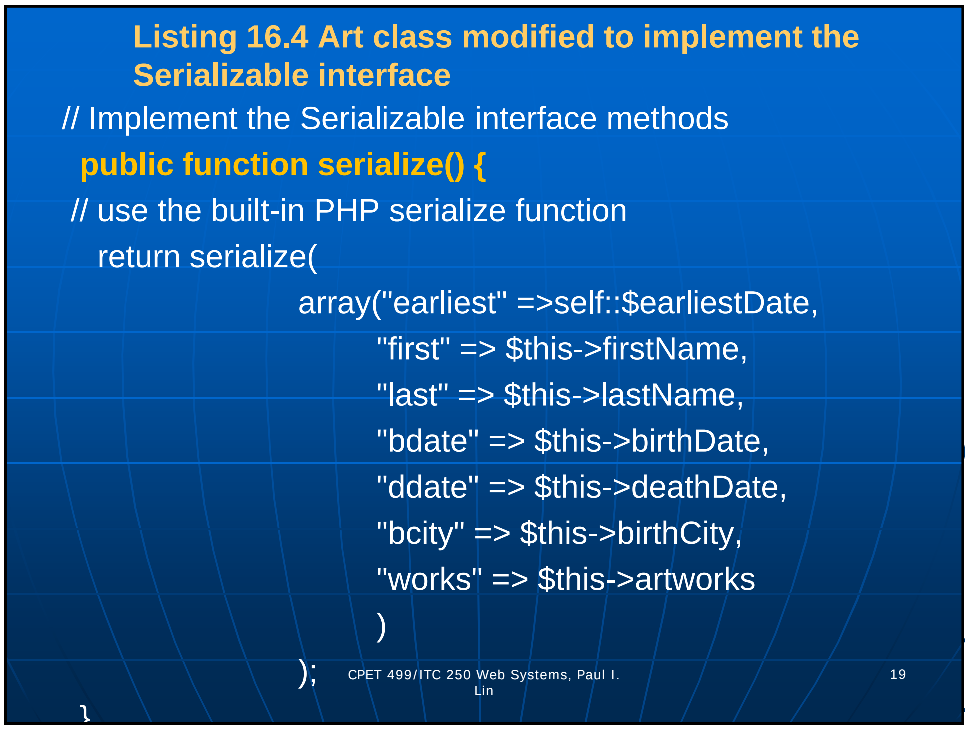
Figure 16.7 Serialization and deserialization



```
C:6:"Artist":764:{a:7:{s:8:"earliest";s:12:"Oct 25,
1881";s:5:"firstName";s:5:"Pablo";s:4:"lastName";s:7:"Picasso";s:5
:"birthDate";s:12:"Oct 25, 1881";s:5:"deathDate";s:11:"Apl 8,
1973";s:5:"birthCity";s:6:"Malaga";s:5:"works";a:3:{i:0;C:8:"Paint
ing":134:{a:2:{s:4:"size";a:2:{i:0;d:7.7999999999999998;i:1;d:3.5;
}s:7:"artData";s:54:"a:2:{s:4:"date";s:4:"1937";s:4:"name";s:8:"Gu
ernica";}";}}i:1;C:9:"Sculpture":186:{a:2:{s:6:"weight";s:8:"162
tons";s:12:"paintingData";s:123:"a:2:{s:4:"size";a:1:{i:0;d:15.119
999999999999;}s:7:"artData";s:53:"a:2:{s:4:"date";s:4:"1967";s:4:"
name";s:7:"Chicago";}";}";}}i:2;C:5:"Movie":175:{a:2:{s:5:"media";
s:8:"file.avi";s:12:"paintingData";s:113:"a:2:{s:4:"size";a:2:{i:0
;i:32;i:1;i:48;}s:7:"artData";s:50:"a:2:{s:4:"date";s:4:"1968";s:4
:"name";s:4:"test";}";}";}}}}}
```

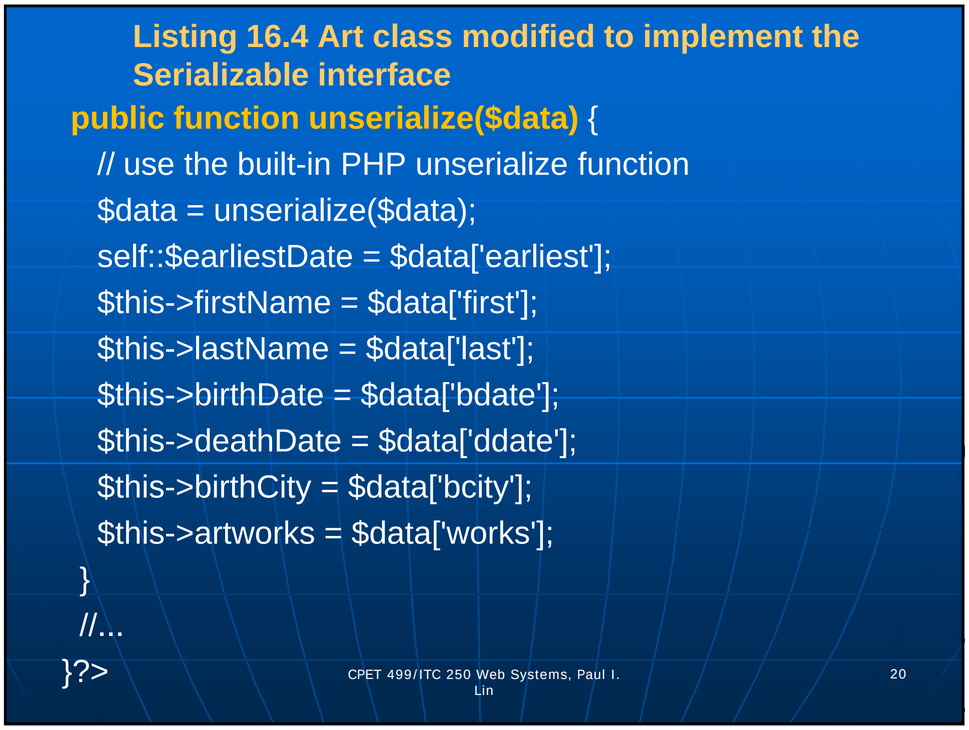
Listing 16.4 Art class modified to implement the Serializable interface

```
<?php
class Artist implements Serializable {
  //some parts borrowed from earlier chapters.
  const EARLIEST_DATE = 'January 1, 1200';
  private static $artistCount = 0;
  private $firstName;
  private $lastName;
  private $birthDate;
  private $deathDate;
  private $birthCity;
  private $artworks;
```



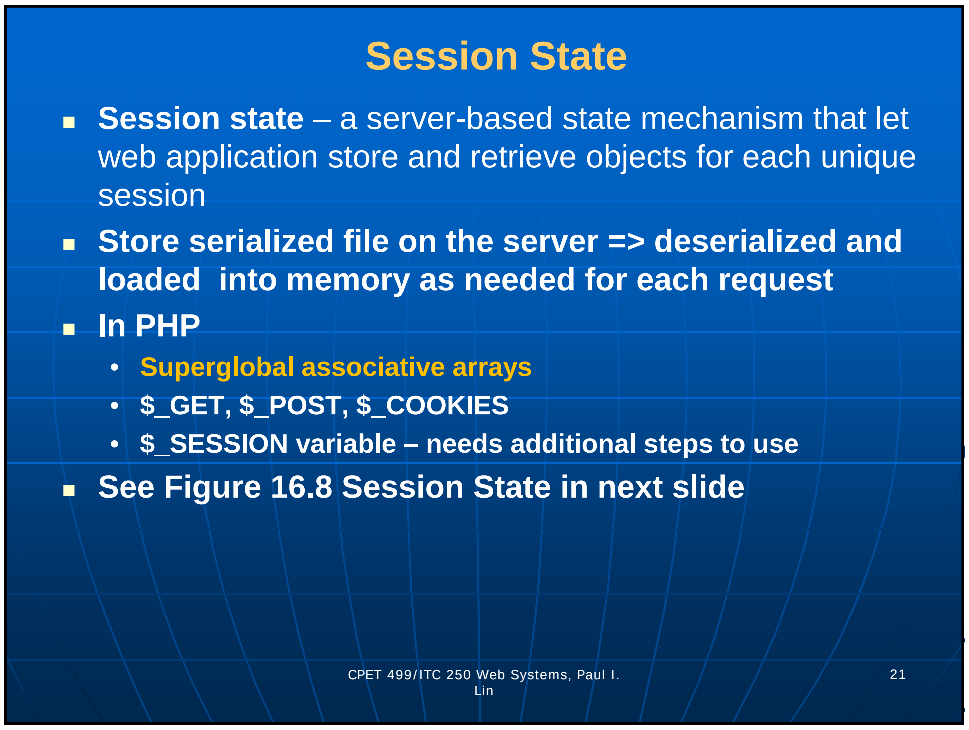
Listing 16.4 Art class modified to implement the Serializable interface

```
// Implement the Serializable interface methods
 public function serialize() {
// use the built-in PHP serialize function
   return serialize(
                        array("earliest" =>self::$earliestDate,
                                 "first" => $this->firstName,
                                 "last" => $this->lastName,
                                 "bdate" => $this->birthDate,
                                 "ddate" => $this->deathDate,
                                 "bcity" => $this->birthCity,
                                 "works" => $this->artworks
                                 )
                        );
 }
```



Listing 16.4 Art class modified to implement the Serializable interface

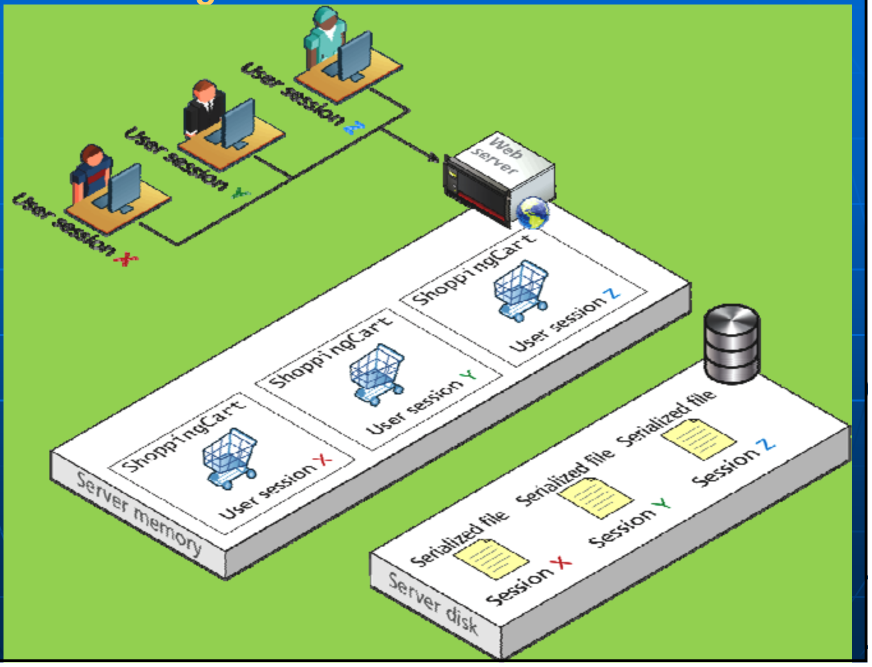
```
 public function unserialize($data) {
   // use the built-in PHP unserialize function
   $data = unserialize($data);
   self::$earliestDate = $data['earliest'];
   $this->firstName = $data['first'];
   $this->lastName = $data['last'];
   $this->birthDate = $data['bdate'];
   $this->deathDate = $data['ddate'];
   $this->birthCity = $data['bcity'];
   $this->artworks = $data['works'];
  }
  //...
}?>
```



Session State

- **Session state** – a server-based state mechanism that let web application store and retrieve objects for each unique session
- **Store serialized file on the server => deserialized and loaded into memory as needed for each request**
- **In PHP**
  - **Superglobal associative arrays**
  - **$_GET, $_POST, $_COOKIES**
  - **$_SESSION variable – needs additional steps to use**
- **See Figure 16.8 Session State in next slide**

Figure 16.8 Session State



Session State

Listing 16.5 Accessing session state

```
<?php
//listing 16.5 Accessing session state
session_start();
if ( isset($_SESSION['user']) ) {
  // User is logged in
}
else {
  // No one is logged in (guest)
}
?>
```

Session State

- **Listing 16.6 Checking session existence**

```
<?php
//listing 16.6 Checking session existence
include_once("ShoppingCart.class.php"); //file not provided.
session_start();
// always check for existence of session object before
accessing it
if ( !isset($_SESSION["Cart"]) ) {
  //session variables can be strings, arrays, or objects, but
  // smaller is better
  $_SESSION["Cart"] = new ShoppingCart();
}
$cart = $_SESSION["Cart"];
?>
```

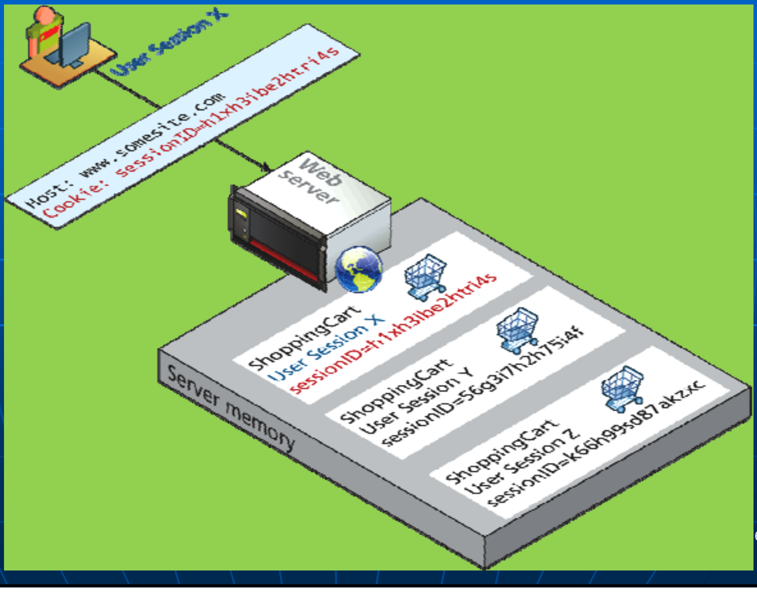
How Does Session State Work?

- HTTP is stateless
- Some type of user/session identification system is needed
- In PHP, see Figure 16-9
  - A session cookies
  - Server ⇔ a unique 32-byte string ⇔ User
- Listing 16.7 Configuration in php.ini to use a shared location for sessions

```
;listing 16.7 Configuration in php.ini to use a shared location for sessions
[Session]
; Handler used to store/retrieve data.
session.save_handler = memcache
session.save_path = "tcp://sessionServer:11211"
```

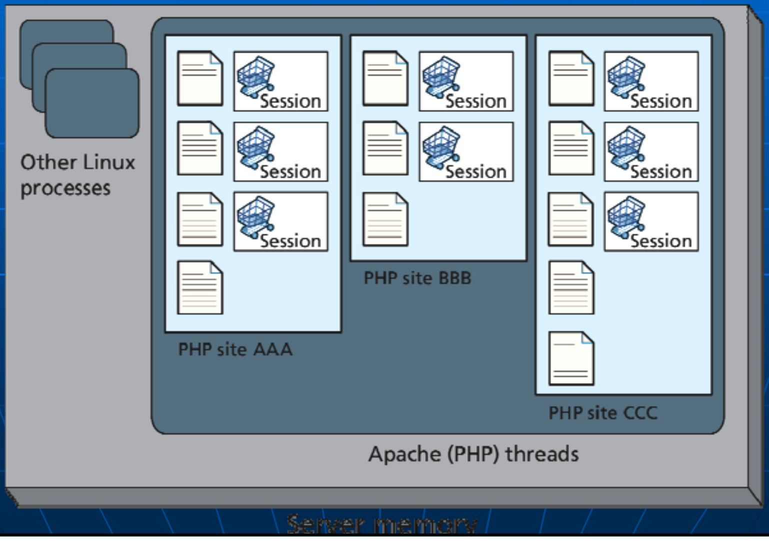
How Does Session State Work?

- Figure 16.9 Session IDs



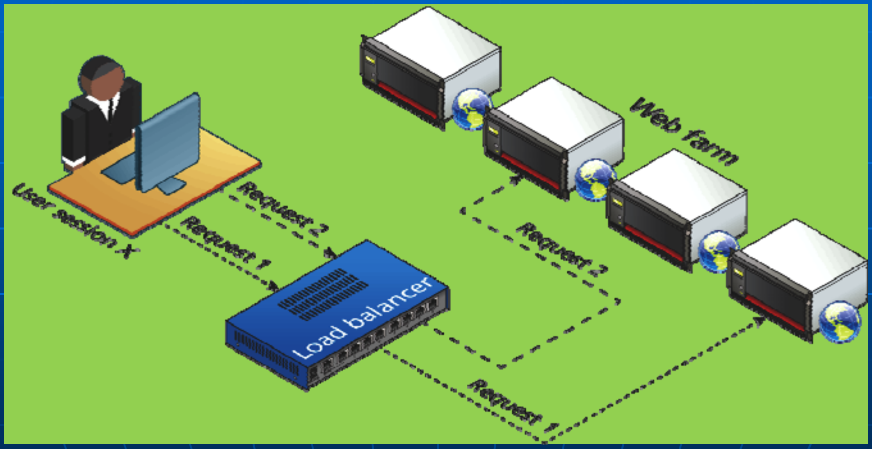
Session Storage and Configuration

- **Figure 16.10 Applications and server memory**
  - **Store session info, pages being executed, and caching info**



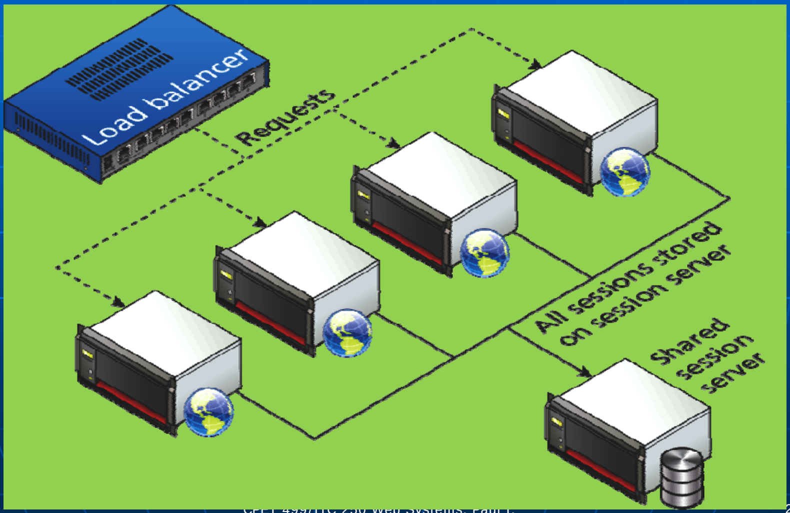
Session Storage and Configuration

- Figure 16.11 Web Farm



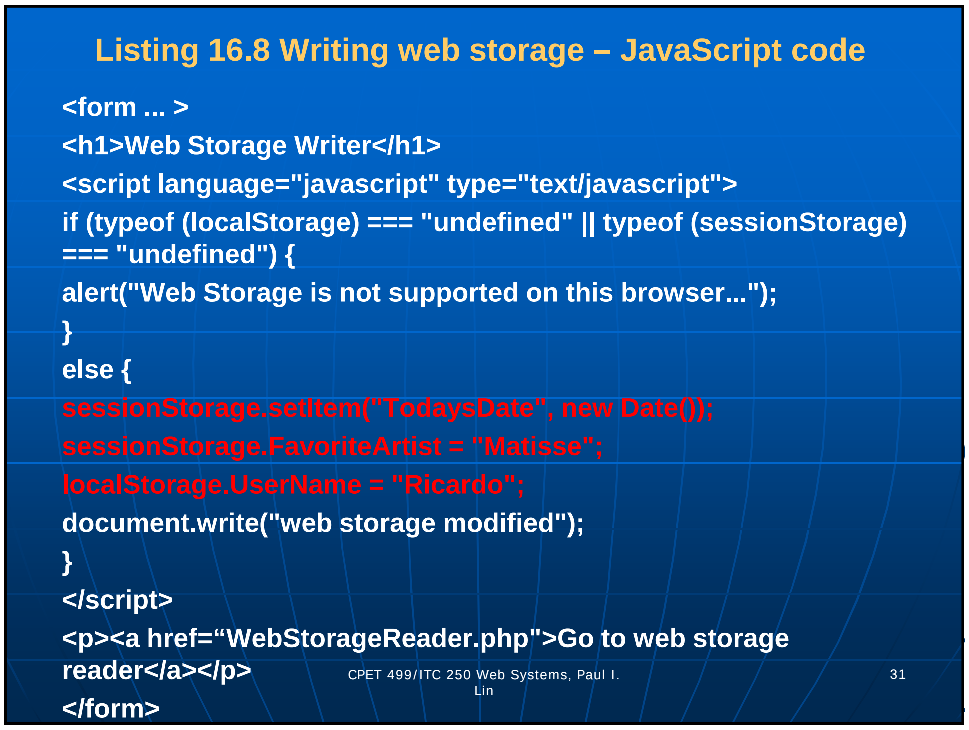
Session Storage and Configuration

- Figure 16.12 Shared session provider



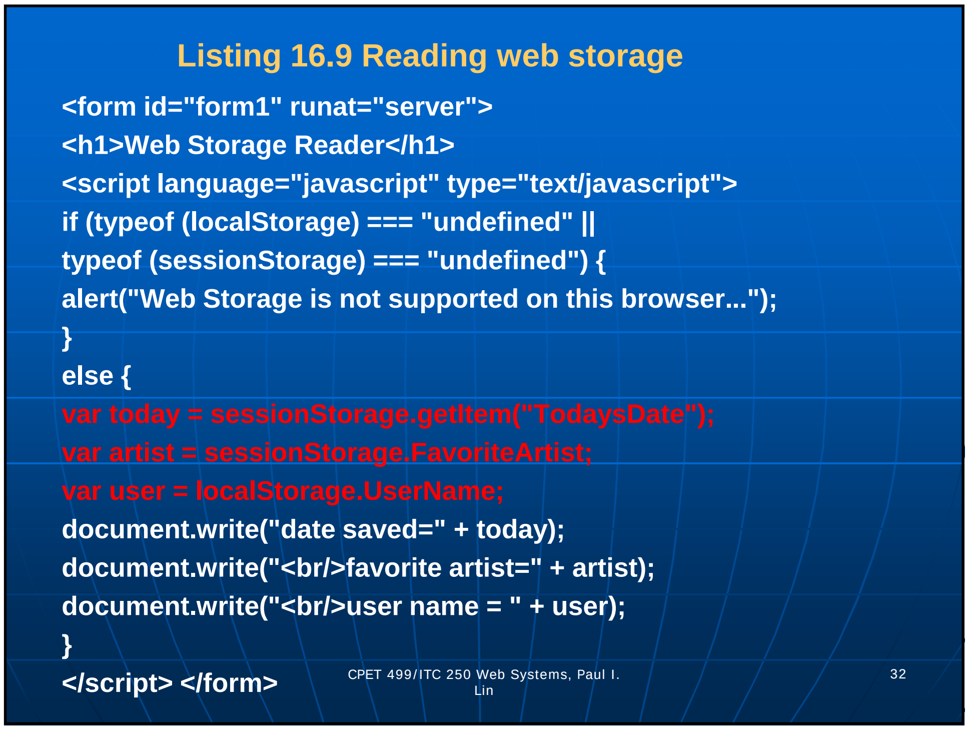
HTML5 Web Storage

- Web storage – a new JavaScript-only API introduced in HTML5; managed by the browser
- It is meant to be a replacement (supplement) to cookies
- W3C recommends a limit of 5MB, but browsers are allowed to store more per domain.
- Should not be used for mission-critical application functions
- Using asynchronous communications via JavaScript to push the info to the server
- Two types of global web storage objects (key-value collections):
  - **localStorage**
  - **sessionStorage**



Listing 16.8 Writing web storage – JavaScript code

```
<form ... >
<h1>Web Storage Writer</h1>
<script language="javascript" type="text/javascript">
if (typeof (localStorage) === "undefined" || typeof (sessionStorage)
=== "undefined") {
alert("Web Storage is not supported on this browser...");
}
else {
sessionStorage.setItem("TodaysDate", new Date());
sessionStorage.FavoriteArtist = "Matisse";
localStorage.UserName = "Ricardo";
document.write("web storage modified");
}
</script>
<p><a href="WebStorageReader.php">Go to web storage
reader</a></p>
</form>
```



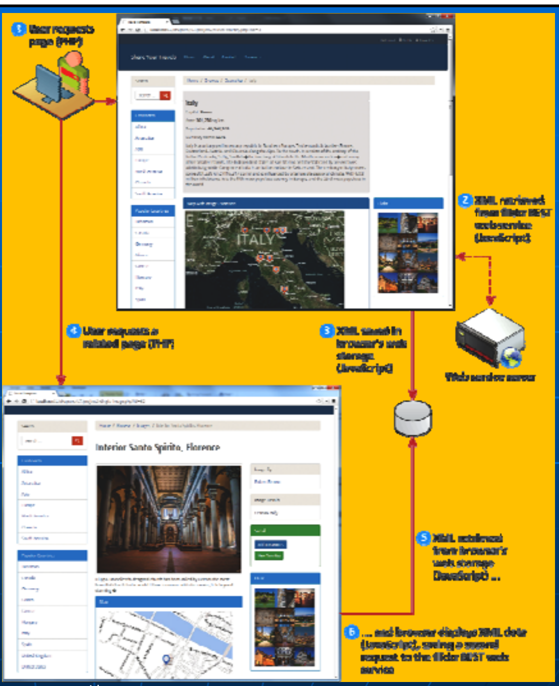
Listing 16.9 Reading web storage

```
<form id="form1" runat="server">
<h1>Web Storage Reader</h1>
<script language="javascript" type="text/javascript">
if (typeof (localStorage) === "undefined" ||
typeof (sessionStorage) === "undefined") {
alert("Web Storage is not supported on this browser...");
}
else {
var today = sessionStorage.getItem("TodaysDate");
var artist = sessionStorage.FavoriteArtist;
var user = localStorage.UserName;
document.write("date saved=" + today);
document.write("<br/>favorite artist=" + artist);
document.write("<br/>user name = " + user);
}
</script> </form>
```

Why Would We Use Web Storage

- Cookies Disadvantages
  - Limit in size (4 k)
  - Being send in every single request-response to/from a given domain
  - Potentially disabled by the user
  - Vulnerable to XSS (Cross-Site Scripting) attack
- Web Storage with JavaScript API
  - Local cache for relatively static items available to JavaScript
  - One practical use: store XML or JASON from a web service to reduce server load for subsequent requests by the session

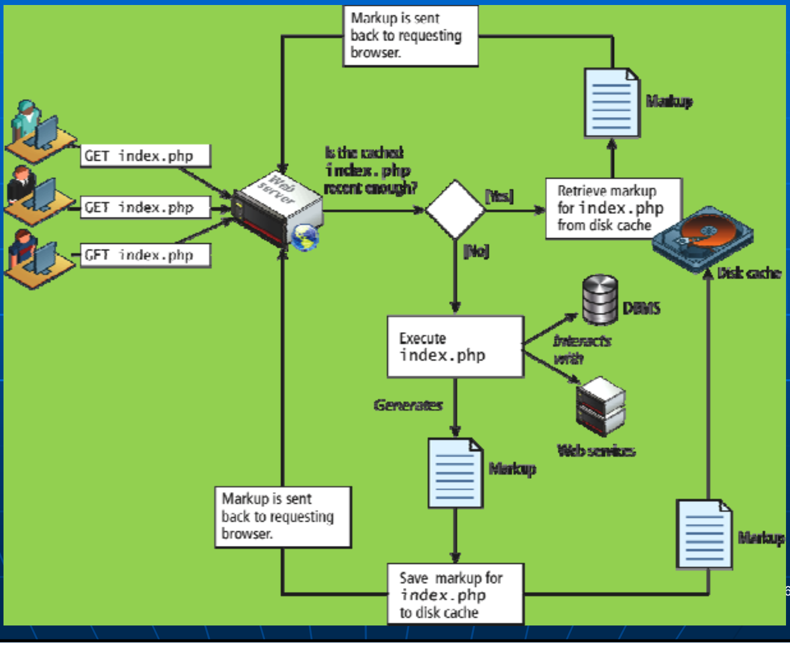
Figure 16.13 Using web storage

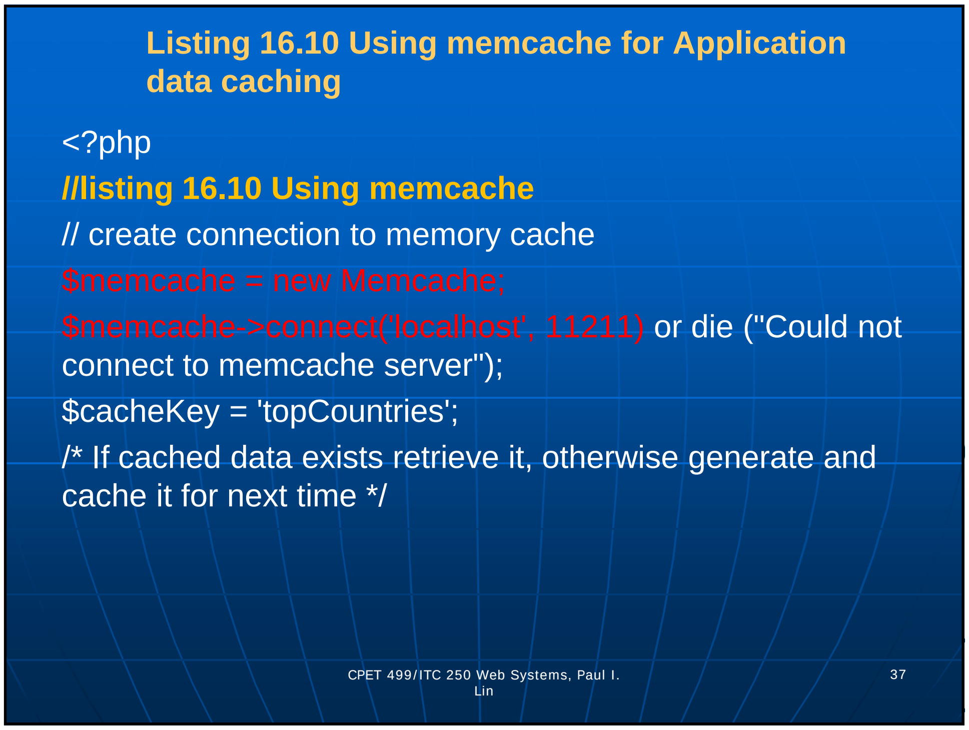

1 User requests page (PHP)
2 XML retrieved from flickr REST webservice (JavaScript)
Web service server
3 XML saved in browser's web storage (JavaScript)
4 User requests a related page (PHP)
Interior Santo Spirito, Florence
5 XML retrieved from browser's web storage (JavaScript) ...
6 ... and browser displays XML data (JavaScript), saving a second request to the flickr REST web service
ITALY

Caching

- Using local storage
- A vital way to improve the performance of web applications
- HTTP protocol headers related to caching
  - Expires
  - Cache-Control
  - Last-Modified
- Two strategies to caching web applications
  - Page output caching
  - Application data caching

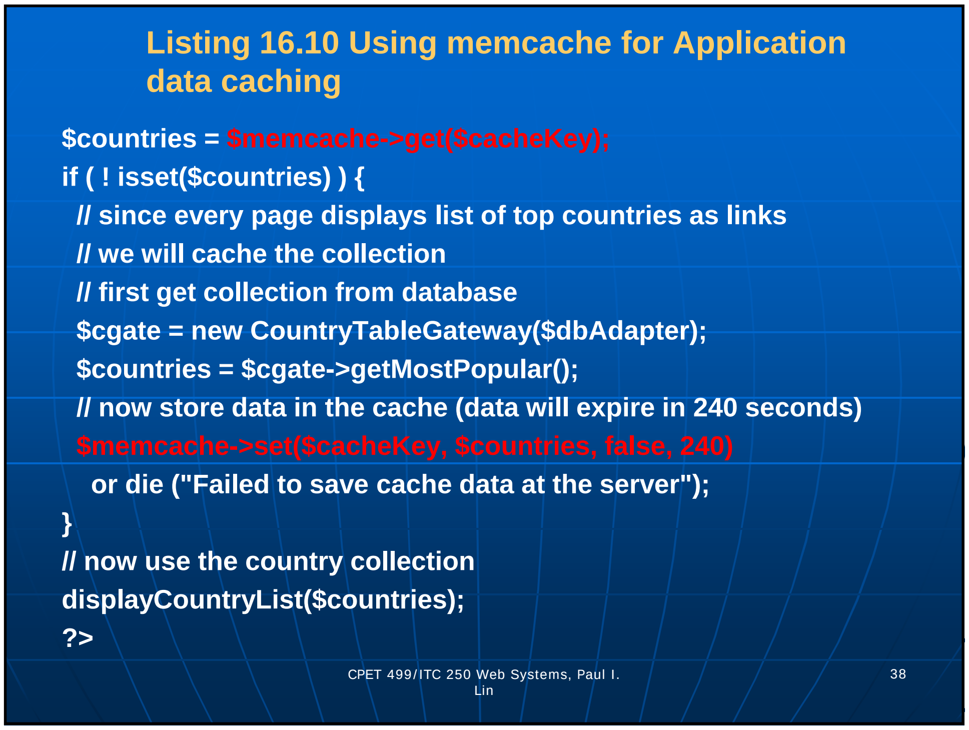
Fig 16.14 Page output caching


Markup is sent back to requesting browser.
Markup
GET index.php
GET index.php
GET index.php
Web server
Is the cached index.php recent enough?
[Yes]
[No]
Retrieve markup for index.php from disk cache
Disk cache
DBMS
Execute index.php
Interacts with
Web services
Generates
Markup
Markup is sent back to requesting browser.
Markup
Save markup for index.php to disk cache



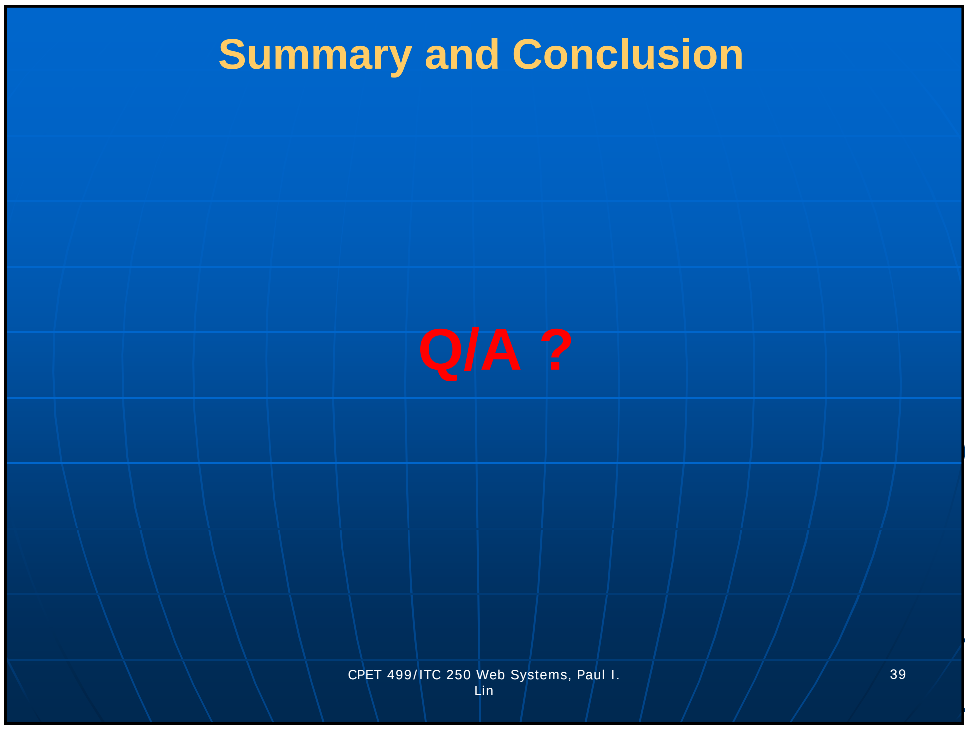
Listing 16.10 Using memcache for Application data caching

```
<?php
//listing 16.10 Using memcache
// create connection to memory cache
$memcache = new Memcache;
$memcache->connect('localhost', 11211) or die ("Could not
connect to memcache server");
$cacheKey = 'topCountries';
/* If cached data exists retrieve it, otherwise generate and
cache it for next time */
```



Listing 16.10 Using memcache for Application data caching

```
$countries = $memcache->get($cacheKey);
if ( ! isset($countries) ) {
  // since every page displays list of top countries as links
  // we will cache the collection
  // first get collection from database
  $cgate = new CountryTableGateway($dbAdapter);
  $countries = $cgate->getMostPopular();
  // now store data in the cache (data will expire in 240 seconds)
  $memcache->set($cacheKey, $countries, false, 240)
    or die ("Failed to save cache data at the server");
}
// now use the country collection
displayCountryList($countries);
?>
```



Summary and Conclusion

Q/A ?