Dynamic and "Databased" Web Sites

Most web sites are not just collections of HTML pages

- Some of the HTML pages include programs which run on the client (client side scripting)
 - e.g. to animate the page or make it different each time it appears
- Many URIs point not to HTML at all but to server side programs which generate HTML from:
 - i) input from the client e.g. form data ii) data held on the server - e.g. in databases
 - iii) templates for the HTML

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Three Tier Architecture

The server-side programs are written using some form of middleware technology which are: - either ordinary applications which use a print stream to send the HTML • i.e. it goes to the browser just like your Java program goes to the console - or HTML with embedded server-side scripts The structure is called a **three-tier architecture** where the tiers are: - the **presentation** tier - the **browser** with which the user interacts - the **application** layer - the program at the server end which implements the business logic the **data** layer - the files or database which holds the information being used MSc/Dip IT - ISD L10 - Advanced Internet (217-240) 218 22/10/2009

Dynamic Web Programming I

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Upon following a URI hyperlink, the resulting page can cause computation to occur either on the server or the client. Four situations may arise:

1. The URL is a simple HTML page as previously described: The HTML is displayed by the browser.



2. The URL is an HTML page containing a script or applet: The browser executes the script on the client.





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Dynamic Web Programming II

3. The URL is a program which generates simple HTML:

The server executes the program and the output is dynamically created HTML which is returned - the HTML is then displayed.



4. The URL is a program which generates HTML containing a script/applet:



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Web Languages

There are a number of languages which are commonly used in web programming:

JavaScript - a language for writing scripts:

- produced by Netscape, this is not a stripped down version of Java rather a renaming of LiveScript
- a C-like syntax, no inheritance, variables untyped, interpreted

VBScript - a similar Microsoft language for writing scripts

Java

- used to write Applets
- · also to write middleware programs called Servlets and JSP
- · Internet and Database Access packages provided

 $\ensuremath{\textbf{PERL}}\xspace$ - a language for text processing good at outputting HTML

• used for CGI middleware and the basis of PHP middleware

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Client Side Scripting

A **client side script** is a mini-program, written in a scripting language and embedded in the HTML

- It is delimited by the <script> tag which also specifies which language is being used - usually JavaScript or VBScript
- The program is executed by the browser to:
 - modify the content or the style of the page
 - check form data before submission
 - cause animation
- A script is called either when the page changes or the user does something
- The program has access to all the same data the browser has, i.e.
 - browser data such as the history, favourites, etc.
 - the web page structure such as the forms, tables, etc.

The next pages (for illustration only) show how a page can dynamically generate a different advert every time the page is loaded

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JavaScript Example - Random Adverts

<head><title>Random Ad</title> <scrip< th=""><th>t language="JavaScript"></th></scrip<></head>	t language="JavaScript">
// Comment so old browser can ignore</td <td></td>	
<pre>var num_ads = 4; // arrays of 4 possible imag</pre>	es, URLs, displayed and alternative texts
var adimg = new Array(); var adurl = new A	Array();
var adtxt = new Array(); var adalt = new A	Array();
adimg[0] = "adimage.gif"	// image file
adurl[0] = "http://www.rc.com/www/ad.html"	// URL of company
adtxt[0] = "The Cooper Company - Special no-	refund offer" // advert text
adalt[0] = "Get a good browser!"	// ALT text
// others defined up to num_ads - 1 - i.e. 3	
function ad()	
{ var now = new Date;	
var x = now.getSeconds() % num adds;	//randomise on time
print('Product of DCS Glasgow br/>'+	<a '="" '''="" +="" adurl[x]="" href="">' +
$' \leq img \operatorname{src} = '' + adimg[x] + ''' alt = ''' + adimg[x]$	a t[x] + '''/>/+
adtxt[x] + (
} //>	
<body></body>	
<sorint></sorint>	
au(), // generate the b	ouy using the script //>
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What the Random Adverts Program Turns Into

This makes the following HTML if the time is divisible by 4 which makes variable x=0:

Product of DCS Glasgow...

The Cooper Company - Special no-refund offer

<hr/>

Points to note:

- the print statement returned the html
- the ad function (method) was defined in the head and used in the body

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- the string handling was hard to get right

What You Can Do in a Script

As you have access to all of the HTML elements in the document, you can:

- interrogate the variables and content of an element
 - e.g. Has this form field been filled in?
- change values while the page is being displayed:
 - e.g. Moving things or changing the style
- react to events
 - e.g. when a button is pressed, when a form is submitted, when the cursor is over an element, etc.
- interact with the user
 - e.g. by putting up alert boxes, yes/no questions, etc.
- any **combination** of the above
 - e.g. checking the mandatory fields of a form when it is submitted and putting up an alert box if any are still blank

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Applets

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Web programming is one of the key application areas for which Java was designed

- It is also the start point for most early text books
- Web pages use a special kind of Java program called an applet
- Applets are not applications and cannot be run as a stand alone program
 - i.e. they don't have a *main* method

Applets are run either using:

- appletviewer a special program which simulates browser access; or
- by using a web browser, such as Netscape or Internet explorer

Applets are always accessed through an HTML page.

Browsers lag badly the JDK version

- This means that testing with applet viewer doesn't guarantee the program to work in the browser.
- Applets have some restrictions on what can be programmed e.g. no file access.

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AJAX

AJAX is a new development of client side scripting which allows a script to:

- go back to the browser to get some new information
- add this to the display without refreshing the whole page

Example – press button with name and the grade panel gets updated

DBIT	DBIT TEST	
John Black Jane Green Jack White June Brown	Jack White got a C	2
AJAX = Asynchronous Java MSc/Dip IT – ISD L10 – Advanced Internet (217-240)	ript and XML Grade Panel	/2009

A First Applet

The Java:

The web page:

<html><head> <title>Applet Test</title> </head> <body> <h1>Applet Test </h1> <applet code = "AppletTest.class" height="200" width="200" /> </body></html>

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HTTP Requests

To request a page dynamically, a web browser must specify:

- a **Uniform Resource Indicator** either a local program file or a URL referring to a program file
- and a method with which to send data
- The method affects the way in which form data is sent to the program. There are two main options:
 - **GET** This method appends the data to the URI as key-value pairs as follows:
 - URI ? key= "value" & key2 = "value2"
 - **POST** This method sends the data packaged up into an object sent with the request
- NB. GET values are cached (which might cause errors if they change), are visible to the user and are more limited in size
- The browser packages this up together with contextual information as a **request object** which it sends to the server

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Server Side Programming

Although the URL may point to a static HTML page, a sophisticated web

• e.g. Microsoft Active Server Pages, JSP and Cold Fusion

- the print statements in the program write HTML to the response object

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site will include "pages" which are really programs

- HTML which includes scripts which generate HTML

• ASP example next slides – bold bits are scripts

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These take two forms:

1. Server side scripting

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HTTP Responses What is returned is called the **response object** (example on Slide 123) and

- the MIME type of the data being returned some descriptive information. The browser then checks the data and renders it appropriately, i.e. - if this "text/html" - it expects the data to be an HTML page and it renders it as if it were an HTML file that had been requested - if it is "img/jpg" it will render the image instead MSc/Dip IT - ISD L10 - Advanced Internet (217-240) 230 22/10/2009 An ASP Example <%@ language="VBSCRIPT" %> <html> <head><title>Sample ASP</title></head> <body> <h1>Good afternoon.<</h1>>> Welcome to the sample. It is now approximately <%=Time()%> at the server. Some simple text formatting done using HTML: style="font-size: 10pt;">Hello Size 10 point style="font-size: 11pt;"> Hello Size 11 point
 - Hello Size 12 point
- The same text formatting using server-side code:
- <% For intCounter = 10 to 12 %>
- style="font-size: <%=intCounter%>pt;">Hello Size <%=intCounter%> point

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<% Next %>

will include:

- a header defining the size

- </body> </html>

2. Programs which output HTML

- e.g. CGI and Java Servlets

- PHP allows you to mix the styles

Program code

is in bold

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The Session and the Context The Structure of a Server Side Program The server side programs manage the communication with the site visitors The server side program can in the face of HTTP statelessness (slide 124) - access a template of the HTML page it will return to the browser - access any information **sent by the browser** (e.g. form data) through the To preserve the unity of the conversation with the visitor and to link the request object programs, the system maintains a session object - access information held in the server session and context objects - This holds all the information which has been told it by the visitor access data held in a database - e.g. preferences, shopping cart, etc. - merge these into an HTML page and sent it back to the browser through To enable shared communication with visitors, the systems also maintains the response object a context object - This holds all the information shared between visitors - e.g. who is currently visiting the site MSc/Dip IT - ISD L10 - Advanced Internet (217-240) 233 22/10/2009 MSc/Dip IT - ISD L10 - Advanced Internet (217-240) 234 22/10/2009

Generating Pages from a Database

Many web sites contain a set of product pages. These should all look the same (HCI principle of consistency) and will only differ by product information that can (and probably already is) held in a database.

- Example - courses offered by DCS, one page for each lecturer:

The Courses Given by Richard Cooper

- Internet Technology
- The HTML for this is (NB page specific information is italicised the rest can be created as a standard template):

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Retrieving Data

- The data may be found in a database which holds all of the departmental information
- A query can be written which retrieves a set of records holding the Lecturer Name, Course Code and Course Title

One of the records retrieved will be:

code	title	name
ITEC	Internet Technology	Richard Cooper

This is precisely the information we need to fill in the Lecturer template.

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How does a program get at this data?



JSP

<% page language="java" import="java.sql.*" %> <% Connection DBcon = DriverMgr.getConnection(URL); Statement stmt = Dbcon.createStatement(); String login = request.getParameter("login"); String sql = "select code, title, name from Course, Lecturer where login ="& login &" and course = code";ResultSet data = stmt.executeQuery(sql); %> <html><head>.....</head> <body> <h1>The Courses Given by <%=data.getString("name")%> </h1> <% while data.next() $\{\%>$ <a href="<%= data.getString("code")%>.html"> <%= data. getString("title")%> <% } %> // end of while loop </body></html> 239 22/10/2009

