CS 4/55231
Internet Engineering

Kent State University
Dept. of Math & Computer Science

LECT-12

Dynamic Documents

Why Dynamic Documents are needed?

- There are many situations when customization of the presented document is needed. Such customization can not be performed via. Regular web pages which are static.
- A program is generally needed to customize the documents based on user need expressed by user interest and interaction (such as Daily News)
- Also there were many other Network services available before Web, which were interactive, and needs to be on Web (such as online Library Catalog).

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What is a Script?

- Scripting is a mechanism by which A Web Client can request a document from the Server to be prepared and served by a third-party program instead of the Web Server.
- Web Script is this third party program.
- Scripts allows:
  - ACCESS to information from non-web source.
  - INTERACTION between the user and the server.
  - Script can create CUSTOM documents.

Can be shell Script, Pearl, C..
Can call even a forth server.
Can translate formats.
Always returns an HTML
Needs to return the type.

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What is the Role of HTTP Server?

- The HTTP server acts as a mediator between the Client and the Script program.
- When a request arrives:
  - Determine that the request is for a program.
  - Locate the program and check access permissions.
  - Start the Script
  - Ensure input from the client reaches to Script.
  - Wait for the Script to complete and read its output and pass it back to the Client.
  - In case of error, notify the Client.
  - Close the network connection properly.

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What Files are Executables?

- Server, not the browser has the control.
- The Server system administrator sets the policy.
- It varies from System to System.
  - In NCSA httpd for UNIX, the Scripts are always in a special directory (such as /cgibin/) and must have an UNIX execution permission on.
  - Some time they must have a special extension (such as *.cgi).
  - CERN httpd has a set of rules.
  - HTTPS for Windows NT can execute it from any directory but must have *.exe extension.

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Making The Script Run: CGI

- The proper communication between an HTTP server and the Script is ensured by a special protocol called Common Gateway Protocol (CGI).
- As long as both the Server and the Script adheres to these rules proper communication is ensured.
- The actual mechanism for interaction varies from system to system.
  - UNIX use stdin/stdout and environment variables.
  - MacOS passes data through Apple Events.
  - Windows NT us a set of temporary files.
- CGI is a collection of "standards"

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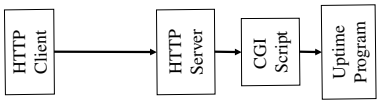
An Example

- A User want to know how busy is the UNIX server via Web.
- Unix program uptime() can provide the answer.
- We will write a gateway script which will connect the server with uptime.



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Demonstration

Run the How "busy" Script

See HTML Client Source

See The Source Code of "busy" Script

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Some body Clicks..

- Step-1 The httpd program waits for request
- Step-2 Request Arrives from a Client
  - some body clicks:
  - `Show current load on cgi.mcs.kent.edu.`
  - HTML form:
    - `<A HREF ="http://cgi.mcs.kent.edu/cgi-bin/javed/busy">`
    - `"Show current load on cgi.mcs.kent.edu"`
    - `</A>`
  - The client sends HTTP message to server:
    - `GET /cgi-bin/javed/busy HTTP/1.0`

Client can also use POST.

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Server Parses the Request

- Step 3: Server parses the request
  - Server parses the information to decide what to do. It checks the object location and finds out it is a script!
- Step 4: Server reads other information
  - Now server reads rest of the request. For example:
    - `User-agents: Mosaic for X Windows/2.4`
    - `Accept: text/plain`
    - `Accept:text/html`
    - `Accept */*`

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Step 5: Do the method requested.

- Step 5: Server does the method requested.
  - It prepares the Unix Environment
  - Sets the appropriate ENV variables
  - Starts a copy of Script
  - Sets STDIN/STDOUT
- Scripts Runs:
  - It reads the ENV variables, if needed. Starts the uptime. All output is directed to STDOUT, which is received by HTTPD.

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Send the Result

- If Every things goes well:
  - `HTTP:/1.0 200 Document follows`
  - `Server: NCSA /1.4`
  - `Date: Thu, 20 Jul 1998 17:35:00 GMT`
  - (then appends what Script has sent)
- Script Appends to it:
  - `Content-type: text/plain`
  - `11:35am up 7 days..`
- The response to user looks like this:
  - `1;29pm up 21 days, 4:35, 5 users, load average:0.0,0.09 0.00`

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If Anything Goes Wrong

- However, if anything goes wrong Server may send:
  - `HTTP:/1.0 403 Document Not Found`
  - `Server: NCSA /1.4`
  - `Date: Thu, 20 Jul 1998 17:35:00 GMT`
  - `Content-type: text/html`
  - `Content-length:0`

What if Script executes but uptime() fails?

- There are also other ways:
  - Script can append status code and Server notifies Client.
    - `HTTP:/1.0 500 Server Error`
    - `Server: NCSA /1.4`
    - `Date: Thu, 20 Jul 1998 17:35:00 GMT`
    - `Content-type: text/html`
    - `Content-length:0`
  - Sometime Script can append its own error code. (like the example)
  - Unexpected error message from script can baffle, Server, Browser or the User.

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Cost of Using Scripts

- Script Requires HTTP server to do lot more work.
- Many concurrent request can mean serious trouble.
-
- Generally every Server parses the Script output to check if it correct. This is also expensive.

Some server allows No Parse header NPH Scripts to run.

- How many programs run in this example?
- How many programs run if Scripts are written in C?

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Gathering Information From Client

CGI with Forms

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Example

- Vicinity Corporation has an Address Locator Database which can find any address in USA.
- Pizza Hut corporation wants to provide its customers an online tool through which any customer can locate the nearest Pizza Hut.
- The locator requires the address of the customer to find nearest Pizza Hut.
- We show a Form based system, where the user can submit his address to Pizza Huts web site. A CGI scripts redirects the information to Vicinity Corps database and finally the result comes Back.

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Demonstration

PizzaHut Locator

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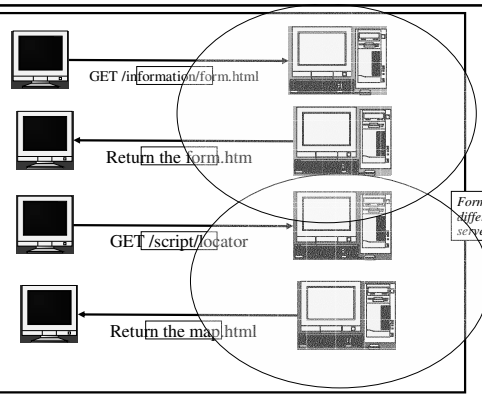

Technology Behind- 1:HTML Form

- Web Forms are Special kind of HTML documents defined by the rules of HTML.
- They are almost regular page, except that they have special fields where users can respond.
- Web Browsers must know how to interpret forms.

Special Fields of HTML Form

- The METHOD
  - by which user input has to be send (must)
- The ACTION
  - which specifies the URL (script) to which data will be sent.
- A set of INPUT objects.
  - Through which user types the data.
- A SUBMIT button
  - to initiate the sending.

Some Input Objects

- Text Boxes
  - <INPUT TYPE="text" NAME="address" SIZE=40 VALUE="default">
- Check boxes
  - <INPUT TYPE="checkbox" NAME="address" VALUE= cream>
- Radio Buttons
  - <INPUT TYPE="radio" NAME="valid" VALUE="yes">
- Option Selection Boxes
- Reset Button
- Text Area
- Password Box, etc.

Source Code of PizzaHut Form

Click Here

How It all works -1

- Step-1 User clicks the forms "submit" button
- Step-2 Browser collects all the inputs and creates a message for CGI script in the form of one long string.

```
GMX=1&FAM=pizzahut&
AD2=summit+street&AD3=kent,ohio
```

Field	Value	Type
GMX	1	Hidden Input
FAM	pizzahut	Another Hidden Input
AD2	summit	User Text Input
AD3	kent,oh	User Text Input

How It all works -2

- Step-3: Web Browser Invokes the GET HTTP method.

```
GET http://www.vicinity.com/yt.hm/
scripts/locator?GMX=1&FAM=pizzahut&
AD2=summit&AD3=kent,ohio HTTP/1.0
```

- Step-4: HTTP Server receives the method invocation via a socket connection.
- Step-5: HTTP Server parses the GET URL and realizes that it is a script, with data.

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GET it or POST it?

- GET
  - Retrieve the specified URL
  - Data is appended with Script URL with "?" mark inbetween.
- POST
  - Send this data to specified URL
  - Data/file is carried back to the server.
  - A better method if large data have to be carried.

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How It all Works -3

- Step-6: HTTP server sets up env variables (UNIX)
  - server_name, request_method, path_info, script_name, query_string, content_type, content_length, etc.
- Step-7: HTTP server starts the CGI program.
- Step-8: CGI program reads the environment variables and discovers that it is responding to GET or POST.
- Step-9: IF GET, the data is in query_string. IF POST, CGI program receives the actual message body via STDIN pipe. (it knows content_length!)

Cheer up, we are half way there!

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How It all Works -4

- Step-10: CGI scripts reads the arguments, and when necessary reformat them in the fashion appropriate for the locator database. Invokes it. Receives the input. Makes and HTML document.
- Step-11: CGI program returns the output results via STDOUT to HTTP server.
- Step-12: HTTP server receives the results on STDIN and concludes CGI interaction.
- Step-13: HTTP server returns the result to the Web Browser.

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Cost of Using Forms & CGI

- 2 contacts are necessary.
- Communication is stateless thus duplicate information have be be sent.
- Parsing needed.
- It is good idea to run Scripts on a different machine.

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CGI and STATE

- HTTP server is stateless.
- But CGI can maintain state, remember which Browser is contacting
- How?

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Image MAPS

- Components:
  - An Image.
  - A MAP file associating URLs with image regions.
  - HREF Anchor in the Main document with ISMAP tag.
- Steps:
  - Browser captures the location of the mouse and sends anchor:
  - `http://www.server.org/scripts/imagemap/firstfloor?40:150`
  - Web Server runs the Imagemap program, which looks into the image map and finds out the right URL and sends it HTTP server.
  - If It is local Web Server returns page otherwise returns the URL with code 302 (Moved temporarily), which makes Browser to automatically contact the new server.

Server Side Include

- Can create a web server signature, customized with current time, creation date etc. meta information.
- Example:
  - `Creation Date: <!-#echo var="LAST_MODIFIED"->`
  - will generate output:
  - Creation Date Thu 30 June 1998 22:00:00 GMT
- Very Expensive. Why?

Netscape Push-Pull Technology

- Server-Push:
  - It is based on MIME type multipart/mixed.The first part of the document is sent to Browser as a part of multipart document. Connection is kept open. As each new part is sent Browser replaces the last one with it.
- Client-Pull:
  - A Special tag inside the document tells client to refresh the document at a specified interval to get a updated version.
- Unique to Netscape only.