WEB222 - Web Programming Principles

Week 12: AJAX

Agenda

- AJAX
  - Simulating a call to a Web service
- JSON

What is AJAX

- AJAX stands for **A**synchronous **Ja**vaScript and **X**ML.
- Coined in 2005 by Jesse James Garrett.
- Not a technology , but a "new" way to use existing technologies.
- AJAX is a group of interrelated web techniques used on the client-side for creating fast and dynamic web pages.

Technologies used in AJAX

- HTML/CSS
- JavaScript
- The Document Object Model (DOM)
- XML/JSON, XSLT
- XMLHttpRequest object

AJAX Examples

- Google Maps

  http://maps.google.com/

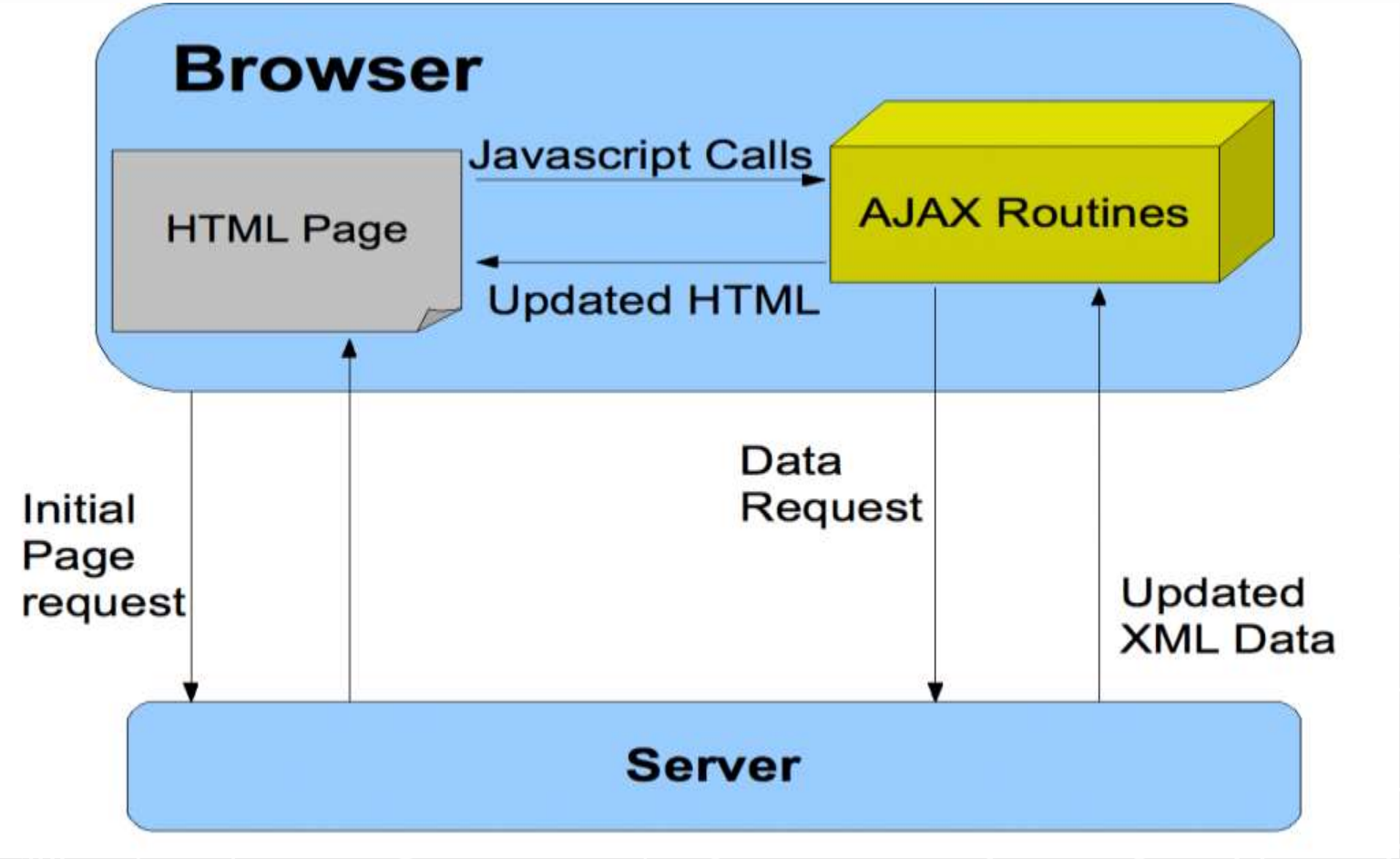
- Google Suggest

  http://www.google.com/

How does it works?

- AJAX allows web pages to be updated asynchronously by exchanging small amounts of data with the server behind the scenes. This means that it is possible to update parts of a web page, without reloading the whole page.

The AJAX model



Comparing with classic apps

- Conventional web application transmit information to and from the sever using synchronous requests.
- This means you fill out a form, hit submit, and get directed to a new page with new information from the server.
- Using AJAX – we are able to request data from the server & update the DOM with the result without leaving the page!

Packaging data in AJAX model

- XML was originally used as the format in AJA**X**.
- JSON is used more than XML nowadays .
  - Advantages of JSON: Concise, readable and a part of JavaScript.
- Other formats, e.g. plain text, can be used.

Features

- Make requests to the server without reloading the page
- Receive and work with data from the server
- AJAX is a web browser technology independent of web server software.
- A user can continue to use the application while the client program requests information from the server in the background
- Intuitive and natural user interaction. No clicking required only Mouse movement is a sufficient event trigger.
- Data-driven as opposed to page-driven

XMLHttpRequest object

- It is the most important part of AJAX.
- It is a JavaScript object
  - Designed by MS and adopted by Mozilla, Apple, …
- It provides an easy way to retrieve data from a URL without having to do a full page refresh.
- Creation:

```
var myRequest = new XMLHttpRequest();
```

XMLHttpRequest Methods

- abort()
- getResponseHeader()
- open() // Initializes a request.
- overrideMimeType()
- send() // Sends the request.
- …

XMLHttpRequest properties

- Onreadystatechange - event handler
- readyState
- responseText - used when receiving JSON or plain text
- responseXML - used when receiving XML
- responseType - set to change the response type

Writing AJAX

Step 1 – makes an HTTP request object

```
// creating a cross-browser instance
var httpRequest;

if (window.XMLHttpRequest) { // Mozilla, Safari, ...
    httpRequest = new XMLHttpRequest();
} else if (window.ActiveXObject) { // IE 8 and older
    httpRequest = new ActiveXObject("Microsoft.XMLHTTP");
}
```

Writing AJAX

- **Step 2 – register a request listener**

```
httpRequest.onreadystatechange = reqListener;

function reqListener () {
    // process the server response
};
```

- **Or:**

```
httpRequest.onreadystatechange = function(){
  // process the server response
};
```

Writing AJAX

- **Step 3 - make the request**

```
// Specifies the type of request
httpRequest.open('GET',
    'http://www.example.org/some.file', true);

// Sends the request off to the server.
httpRequest.send(null);
```

Parameters of open() and send()

- Parameters of the open(*method, url, async*) method:
  - 1st para: HTTP request method - GET, POST, …
  - 2nd para: the URL of the page this requesting
  - 3rd para: sets whether the request is asynchronous
- Parameters of the send(*string*) method:
  - The *"string"* para: Only used for POST requests.
    - any data you want to send to the server if using POST method. This can be as a query string, like:

name=value&anothername="+encodeURIComponent(myVar)+"&so=on"

Writing AJAX

- **Step 4 – handling the server response**

```
// check for the state of response
if (httpRequest.readyState === 4) {
  // everything is good, the response is received
  // do next process here

} else {
  // still not ready
}
```

  - the readyState values:
    - 0 (uninitialized), 1 (loading), 2 (loaded), 3 (interactive), 4 (complete)

Writing AJAX

- **Step 4 – handling the server response (cont')**

```
// check is the response code of the HTTP server response
if (httpRequest.status === 200) {
        // perfect!
        // do next process here

} else {
        // there was a problem with the request,
        // for example the response may contain a 404 (Not Found)
        // or 500 (Internal Server Error) response code
}
```

Writing AJAX

- Set the button to start

```
<button type="button"
        onclick="makeRequest();">Make a request</button>
```

Working with the XML response

- If the server response is in XML format, e.g.

```
<?xml version="1.0" ?>
<root>
    I'm a test.
</root>
```

- Parsing XML data

```
var xmldoc = httpRequest.responseXML;
var root_node = xmldoc.getElementsByTagName('root').item(0);
alert(root_node.firstChild.data);
```

Working with the JSON response

- If server response is in JSON format, e.g.

  {"name": "Kevin", "age": 22 }

- Parsing JSON data:

```
// function JSON.parse(): convert JSON object to JavaScript object
var jsonObj = http_request.responseText;
var jsObj = JSON.parse(jsonObj);
var name = jsObj.name;
var age = jsObj.age;
```

About JSON

- JSON stands for JavaScript Object Notation.
  - specified by Douglas Crockford.
  - a lightweight text based data-interchange format.
  - "self-describing" and easy to understand
  - smaller than XML, and faster and easier to parse
- JSON parsers and JSON libraries exists for many different programming languages.
  - e.g. C, C++, Java, Python, Perl, PHP etc.
- JSON filename extension is .json
- JSON Internet Media type is application/json

JSON Structures

- JSON is built on two structures:
  - JSON **object**: a collection of name/value pairs.

```
{ "firstName": "John",
  "lastName": "Smith", "age": 25,
  "address": { "street": "21 2nd Street",
               "city": "North York",
               "province": "ON",
               "postalCode": "M2M6T6" }
}
```

  - JSON **array**: an ordered list of values.

```
[
  {"name" : "Kevin", "age" : 22, "gender" : "m"},
  {"name" : "Kate", "age" : 22, "gender" : "f"},
  {"name" : "Steven", "age" : 25, "gender" : "m"},
  {"name" : "Bill", "age" : 22, "gender" : "m"}
]
```

JSON Objects vs JavaScript Objects

- JSON and JavaScript use the same syntax to describe data objects, including Arrays.

- But JSON objects are text-based or "string"s.

- The properties of JSON objects must to be quoted.

  e.g.

  ```
  {"name": "Kevin", "age": 22 }
  ```

JSON Objects vs JavaScript Objects

- JavaScript built-in object: JSON - used to convert data between JSON and JavaScript objects.
  - Serializing JavaScript object (converting JavaScript object to JSON object) :

```
var jsObject = { language: "Java", course: "JAC444" };
var JSONString = JSON.stringify(object1 );
```

  - Parsing JSON string (converting JSON object to JavaScript object) :

```
var JSONString2 =  '{ "language" : "C++", "course" : "OPP344" }';
var jsObject2 =  JSON.parse(JSONString2);
```

JSON vs XML

- A JSON object

```
{ "menu": {  "id": "file",
             "value": "File",
             "popup": {
                    "menuitem": [
                                {"value": "New", "onclick": "CreateDoc()"},
                                {"value": "Open", "onclick": "OpenDoc()"},
                                {"value": "Close", "onclick": "CloseDoc()"}      ]
          }          }
 }
```

- Equivalent XML document

```
<?xml version="1.0" ?>
<root>
<menu id="file" value="File">
    <popup>
        <menuitem value="New"  onclick="CreateDoc()" />
        <menuitem value="Open" onclick="OpenDoc()" />
        <menuitem value="Close" onclick="CloseDoc()" />
    </popup>
</menu>
</root>
```

JavaScript: simulating AJAX calls to Web Services

- Example 1: calling a web service with JSON object response
  - JSON data on Server("web service"):
    https://zenit.senecac.on.ca/~wei.song/web222/ajax/firstnation.json
  - Example Code:
    https://zenit.senecac.on.ca/~wei.song/web222/ajax/ajaxjson.html

- Example 2: calling a web service with JSON array response
  - JSON data on Server("web service"):
    https://zenit.senecac.on.ca/~wei.song/web222/ajax/nationArray.json
  - Example Code:
    https://zenit.senecac.on.ca/~wei.song/int222/ajax/ajaxjson2.html

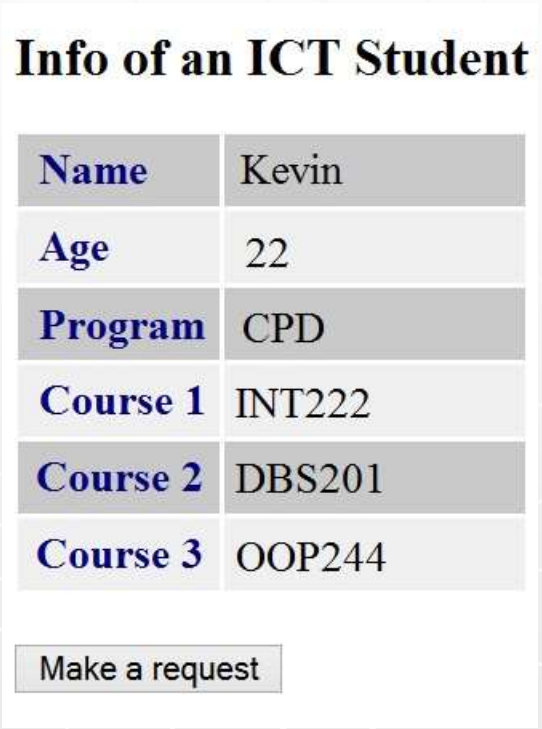
More about AJAX calls

- For security reason, web browsers do not allow cross-domain AJAX calls.
  - An Ajax call for web services from your PC/local web page will not work.
- The protocol used for the web page and the protocol for an Ajax call must match.
  - E.g.

use https://zenit.senecac.on.ca/~wei.song/web222/ajax/ajaxjson.html call http://zenit.senecac.on.ca/~wei.song/web222/ajax/nationArray.json will not work.

Exercise

- Download the JSON file: https://zenit.senecac.on.ca/~wei.song/web222/ajax/student.json
- Create an HTML5 file that loads data using an AJAX call to fetch the JSON data.
- Update the 2 files to the public_html folder of your Matrix or Zenit account, and make your app work.
- The HTML page is showed at right.



Resource & Reference

- MDN: AJAX - Getting_Started
  - https://developer.mozilla.org/en-US/docs/AJAX/Getting_Started

- JavaScript Object Notation (**JSON**)

- Browser Object Model - Wikipedia, the free encyclopedia

Thank You!