INT222 - Internet Fundamentals

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

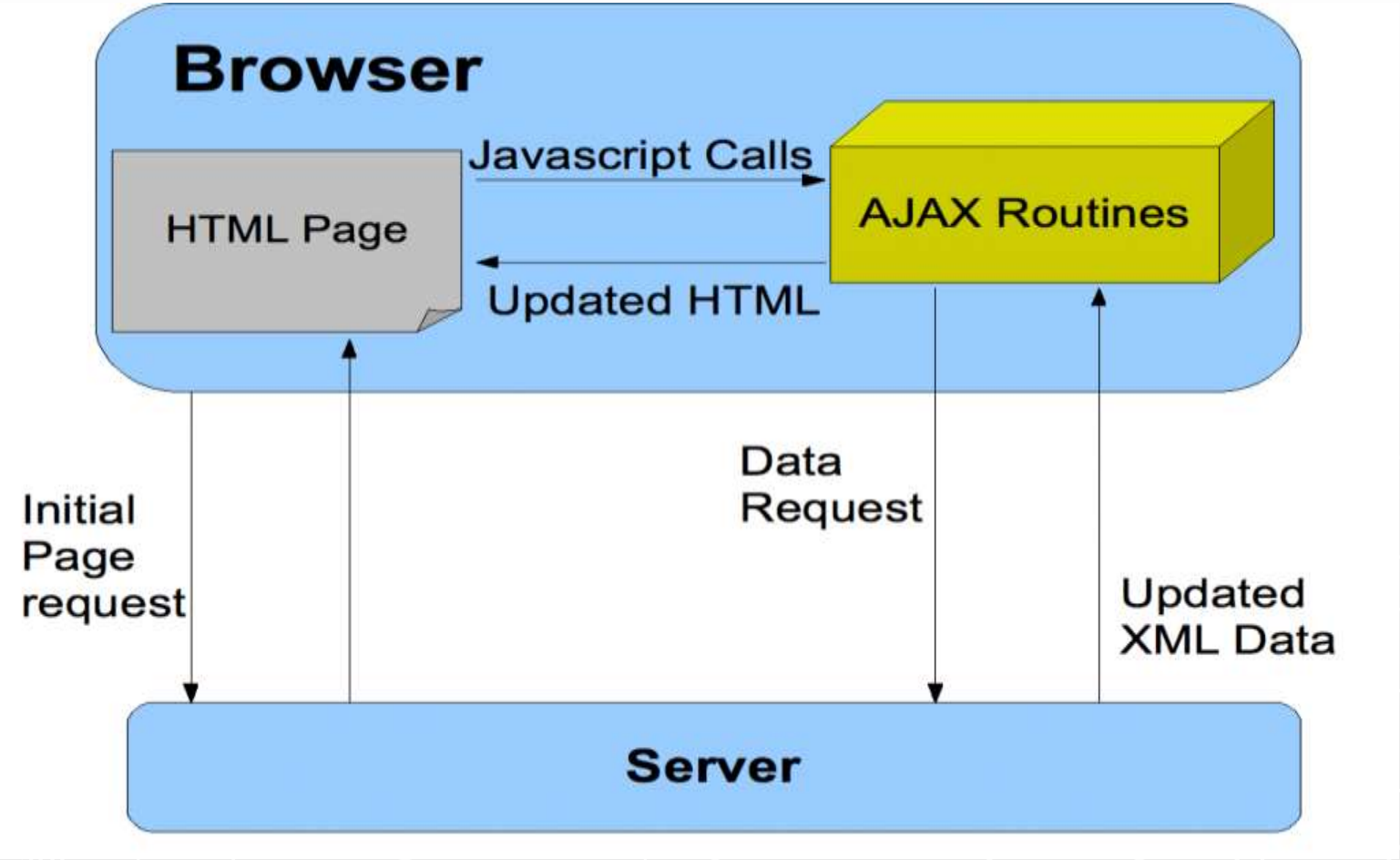
- Google Maps
  http://maps.google.com/

- Google Suggest
  http://www.google.com/webhp?complete=1&hl=en

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.

Packaging data in AJAX model

- XML was originally used as the format in AJA**X**.
- JSON is used more than XML nowadays .
  - Advantages to use JSON: being lighter and a part of JavaScript.
- Any format, including 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
- readyState
- responseText
- responseType // set to change the response type
- responseXML

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 pare: 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
} 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!
} 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

- Suppose server response is in XML format:

```
<?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

- Suppose server response is in JSON format:

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

- Parsing JSON data:

```
// Javascript function JSON.parse to parse JSON data
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 have to be qouted.

  e.g.

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

JSON Objects vs JavaScript Objects

- Conversion between JSON and JavaScript objects – using JS built-in object: JSON
  - 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

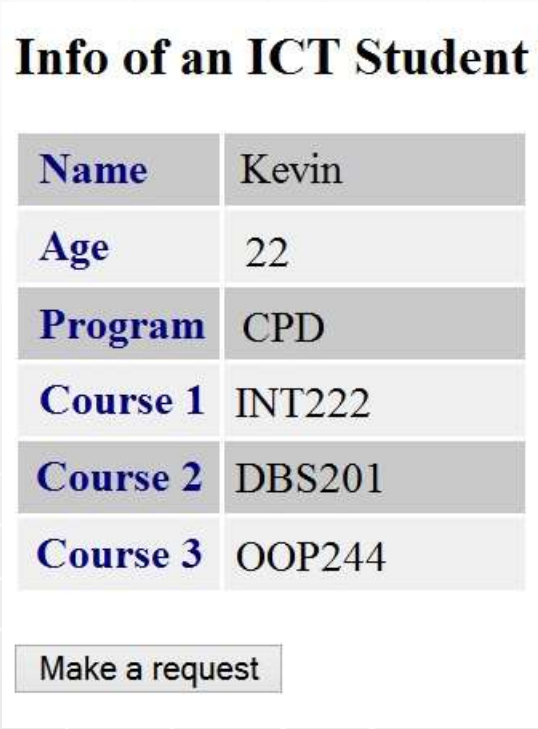
```
<?xml version="1.0" ?>
<root>
<menu id="file" value="File">
   <popup>
      <menuitem value="New"  onclick="CreateDoc()" />
      <menuitem value="Open" onclick="OpenDoc()" />
      <menuitem value="Close" onclick="CloseDoc()" />
   </popup>
</menu>
</root>
```

JavaScript: simulating AJAX calls to Web Services

- Example 1: calling a web service with JSON object response
  - Code: https://zenit.senecac.on.ca/~wei.song/int222/ajax/ajaxjson.html
- Example 2: calling a web service with JSON array response
  - Code: https://zenit.senecac.on.ca/~wei.song/int222/ajax/ajaxjson2.html

Exercise

- Create an HTML5 page that loads data with an AJAX call to a web service.
- The web service is simulated by a static JSON file: https://zenit.senecac.on.ca/~wei.song/int222/json/student.json
- You have to HTML page to the ZENIT server to make the AJAX code work.
  - ATTN: usually, Cross-Domain AJAX call is not allowed for security reason.
- 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!