Development of Web Applications
Principles and Practice

Vincent Simonet, 2014-2015
Université Pierre et Marie Curie, Master Informatique, Spécialité STL
Client Technologies

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Today’s agenda

- AJAX,
- JSONP,
- HTML5,
- WebSockets.
AJAX
AJAX  Asynchronous JavaScript and XML

With AJAX, a JavaScript script can send data to, and retrieve data from, a server asynchronously (in the background) without interfering with the display and behavior of the existing page.

Despite the name, the use of XML is not required. In fact, JSON is much more popular.
var xhr = new XMLHttpRequest();
xhr.open('get', 'http://example/method');

xhr.onreadystatechange = function() {
  // Ready state 4 means the request is done
  if (xhr.readyState === 4) {
    if (xhr.status === 200) {
      alert('Success: ' + xhr.responseText);
    } else {
      alert('Error: ' + xhr.status);
    }
  }
}

xhr.send(null);
AJAX: XML or JSON response

**XML response:**
```
xhr.responseType = "document";
xhr.responseXML.documentElement
```

**JSON response:**
```
xhr.responseType = "json";
eval(xhr.responseText)
(if you trust the response source!).
```
Same origin policy

AJAX requests can be made only to URLs of the same domain (host and port) as the page.

AJAX is hence useful for communication with the server of a web application, but not for doing calls to a third-party API.

For remote API calls, several workarounds are used:

- JSONP (by far the most popular),
- Using the application server as a proxy (costly),
- iframes / using the URL to communicate (tricky),
- Messages (the clean way, in HTML5).
W3C Specification

- Level 1 (1999)
- Level 2 (2008)
  - progress events,
  - support for cross-site requests,
  - handling of byte streams

http://www.w3.org/TR/XMLHttpRequest/
http://www.w3.org/TR/XMLHttpRequest2/
JSONP
JSONP JSON with Padding

An alternative to AJAX, for requesting data from a server in a different domain.

How it works?

- The client script generates the request by adding a `<script>` tag to the page:

```html
<script type="application/javascript" src="http://directory/?id=42">
```

- The server returns a JavaScript containing a JSON value, wrapped into a function call (the padding):

```javascript
callback({"id": 42,
          "name": "Vincent Simonet"});
```
The name of the padding is usually passed as an argument in the request:

```html
<script type="application/javascript"
src="...?id=42&jsonp=mycallback">
mycallback({"id": 42,
    "name": "Vincent Simonet"});
```

JavaScript frameworks provide helper functions for making this transparent. E.g. in jQuery:

```javascript
$.ajax({url : 'http://.../?id=42',
    dataType : 'jsonp',
   jsonp : 'jsonp',
    success : function(data){}
});
```
JSONP limitations

- Only GET (POST is doable, but tricky),
- No access to HTTP headers (in request and response), including cookies.
WebSockets
The problem

In HTTP and AJAX, all exchanges are initiated by client requests.

In some applications, it is useful to have the server pushing information to the client. E.g.:

- Notifications in a news website,
- Messages in a chat system,
- etc.
Workaround solutions

- The client can make periodic requests to the server,
- The client can make a request to the server, which will answer with an "infinite" response. Known as Comet.

Several implementations:
- Streaming (using iframe or special XmlHttpRequest),
- Long polling (using XmlHttpRequest or script tags).
The HTML5 solution: WebSockets

WebSocket is a protocol providing full-duplex communications channels over a single TCP connection.

Enables a stream of messages.

Its only relationship to HTTP are:

- its handshake is interpreted by HTTP servers as an Upgrade request,
- it is using port 80 as default port.
WebSocket protocol handshake

Request:
    ET /mychat HTTP/1.1
    Host: server.example.com
    Upgrade: websocket
    onnection: Upgrade
    ec-Web ocket-Key: x3JJHMbDL1EzLkh9 BhXDw==
    ec-Web ocket-Protocol: chat
    ec-Web ocket-Version: 13
    rigin: http://example.com

Response:
    HTTP/1.1 101 witching Protocols
    Upgrade: websocket
    onnection: Upgrade
    ec-Web ocket-Accept: H mrc0sM1YUkA mm5 Pp 2Ha Wk=
    ec-Web ocket-Protocol: chat
Client-side JavaScript API

```javascript
var connection = new WebSocket('ws://.../echo', ['soap', 'xmpp']);

connection.onopen = function () {
    connection.send('Ping');
};

connection.onerror = function (error) {
    console.log('WebSocket Error ' + error);
};

connection.onmessage = function (e) {
    console.log('Server: ' + e.data);
};
```
Server-side implementations

- Java: [Jetty](https://jetty.org)
- Node.js: [ws](https://github.com/websockets/ws), [WebSocket-Node](https://github.com/websockets/WebSocket-Node)
- Python: [pywebsocket](https://github.com/owTypeInfo/pywebsocket)
HTML5
What is HTML5?

The 5th version of the HTML language, subsuming HTML 4.01 and XHTML 1.1

New/extended markup, and a galaxy of APIs.
Specification status at the beginning of 2013
## Implementation status

Source: [html5test.com](http://html5test.com)

<table>
<thead>
<tr>
<th>Browser</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chrome 29</td>
<td>463/500</td>
</tr>
<tr>
<td>Opera 16</td>
<td>442/500</td>
</tr>
<tr>
<td>Firefox 24</td>
<td>414/500</td>
</tr>
<tr>
<td>Safari 6.0</td>
<td>378/500</td>
</tr>
<tr>
<td>Internet Explorer 10</td>
<td>320/500</td>
</tr>
</tbody>
</table>
Main HTML5 features

- Semantic tags,
- Canvas,
- Video,
- Geo-localisation,
- Local storage,
- Offline,
- Improved forms,
- Microdata,
- History manipulation.
Tags in HTML5

- **Semantic replacements of** `<div>` or `<span>`:
  - `<nav>`  `<header>`  `<footer>`  `<section>`
  - `<hgroup>`  `<article>`  `<aside>`  `<time>`
  - `<mark>`

- **Replacements of** `<object>`:
  - `<audio>`  `<video>`

- **Removal of some style tags**:
  - `<font>`  `<center>`  `<strike>`  `<tt>`

(non-exhaustive list)
Canvas

**HTML:**

```html
<canvas id="c" width="500"
        height="375"></canvas>
```

**JavaScript:**

```javascript
var c_canvas = document.getElementById("c");
var context = c_canvas.getContext("2d");
for (var x = 0.5; x < 500; x += 10) {
    context.moveTo(x, 0);
    context.lineTo(x, 375);
}
```
navigator.geolocation.getCurrentPosition(
    handle_success, handle_error, options);

function handle_success(position) {
    var latitude = position.coords.latitude;
    var longitude = position.coords.longitude;
    // let's do something interesting!
}

function handle_error(error) {
    alert(error.code + ': ' + error.message);
}
# Geo-localisation

## POSITIONOPTIONS OBJECT

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Default</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>enableHighAccuracy</td>
<td>Boolean</td>
<td>false</td>
<td>true might be slower</td>
</tr>
<tr>
<td>timeout</td>
<td>long</td>
<td>(no default)</td>
<td>in milliseconds</td>
</tr>
<tr>
<td>maximumAge</td>
<td>long</td>
<td>0</td>
<td>in milliseconds</td>
</tr>
</tbody>
</table>

## POSITION OBJECT

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>coords.latitude</td>
<td>double</td>
<td>decimal degrees</td>
</tr>
<tr>
<td>coords.longitude</td>
<td>double</td>
<td>decimal degrees</td>
</tr>
<tr>
<td>coords.altitude</td>
<td>double or null</td>
<td>meters above the reference ellipsoid</td>
</tr>
<tr>
<td>coords.altitudeAccuracy</td>
<td>double</td>
<td>meters</td>
</tr>
<tr>
<td>coords.heading</td>
<td>double or null</td>
<td>degrees clockwise from true north</td>
</tr>
<tr>
<td>coords.speed</td>
<td>double or null</td>
<td>meters/second</td>
</tr>
<tr>
<td>timestamp</td>
<td>DateTimeOffset</td>
<td>like a Date() object</td>
</tr>
</tbody>
</table>
Improved forms

● **New input types**: color, date, datetime, datetime-local, email, month, number, range, search, tel, time, url, week
  
  <input type="color" name="favcolor">
  <input type="number" name="quantity" min="1" max="5">

● **New input attributes**: autocOMPlete, autofocus, multiple, min, max, pattern, required, etc.

● **New elements**: <datalist> <keygen> <output>

Use them!
Microdata
window.history.pushState("object or string", "Title", "/new-url");
window.history.replaceState("object or string", "Title", "/new-url");

window.addEventListener("popstate", function(e) {
    swapPhoto(location.pathname);
});