CSE 510
Web Data Engineering

Client-Side Programming

Ajax

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Interactive Applications Using Ajax

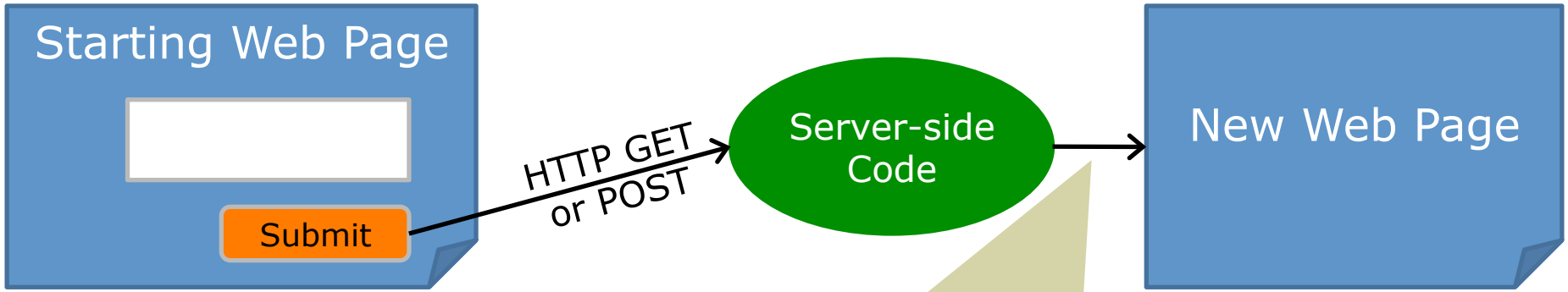
- Ajax is a set of technologies that collectively enable interactive applications
  - Hallmark: Part of a page changing asynchronously
- Ajax = Asynchronous JavaScript and XML
- Extensive use in Gmail, Yahoo! Finance, etc.

Only one really new primitive:

- JavaScript uses a (client side) **XMLHttpRequest** to asynchronously communicate with the server
- http://www.w3.org/TR/XMLHttpRequest/

So Far in Class…

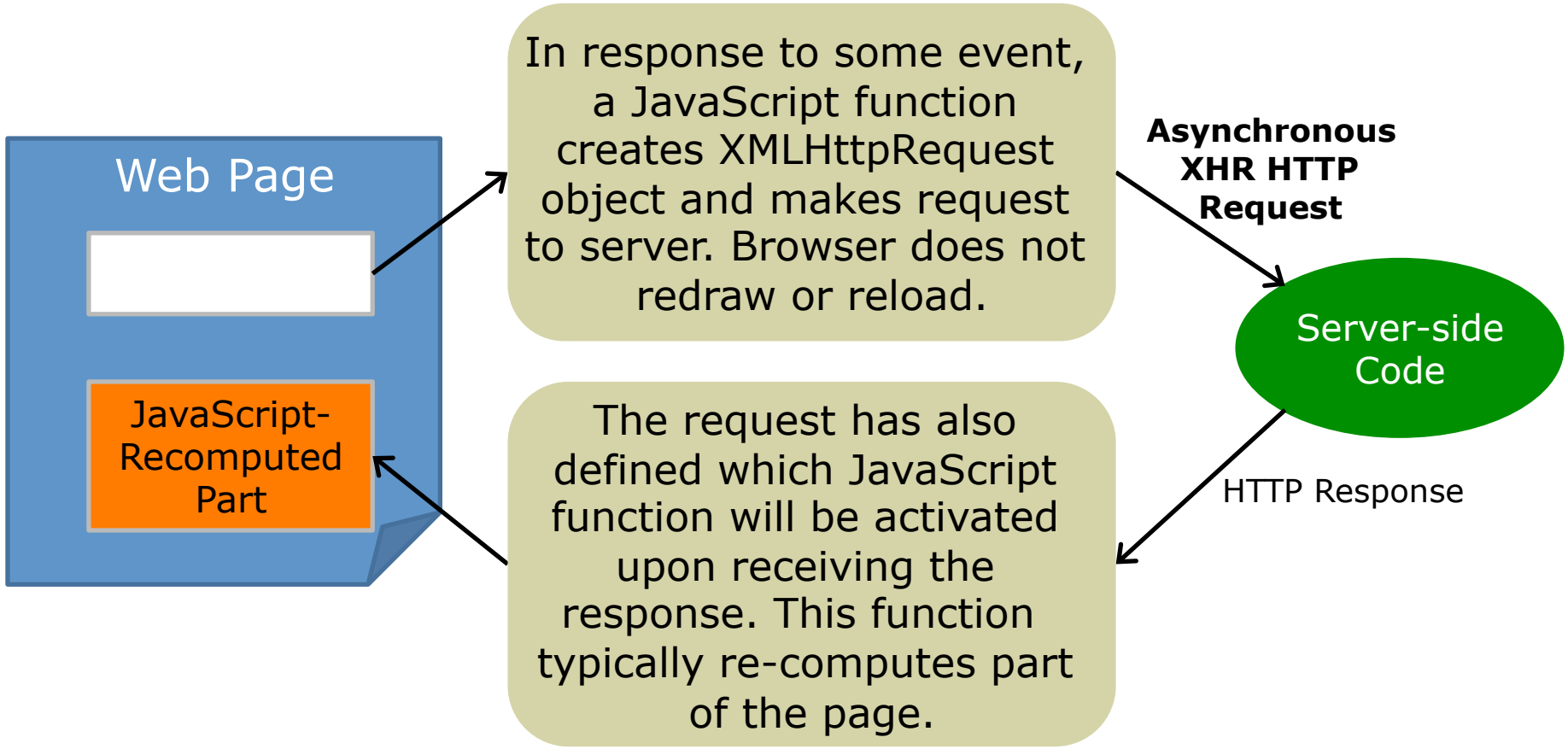
Client Communicates Synchronously with Server



Even if the new page is almost identical to starting web page, the server engages in total re-computation, creation and transmission of new response
POOR INTERACTION

Ajax

Client Communicates Asynchronously with Server



New JavaScript Material

- You can assign functions to variables and object properties
  - We will assign the function that handles the HTTP response to a property of XMLHttpRequest object

Ajax Example 1

```
<body>
  Write your story here:
  <form action="nowhere" method="GET">
    <p/>
    <textarea rows="10" cols="80" name="story"
              onkeyup="lastTimeFunction();”>
    </textarea>
    <p/>
    <span id="lastTime">
      You have not typed anything in the above box yet
    </span>
  </form>
</body>
```

Ajax Example 1 (cont'd)

```
function lastTimeFunction() {

  var xmlHttp = new XMLHttpReques

  var responseHandler = function() {
    if (xmlHttp.readyState == 4)
      document.getElementById("lastTi
        "You last typed on " + xml
  }
  xmlHttp.onreadystatechange = responseHandler;

  xmlHttp.open("GET","date.jsp",true)
  xmlHttp.send(null);
}
```

The value of the variable is a function and NOT the result of a function call (think of C++ function pointers)

Call the function stored in this property whenever the server produces the HTTP response

3rd argument is asynchronous communication flag (versions with user & pass also avail.)

Initiates request. If it was POST, argument would be body

XMLHttpRequest

The **readyState** Property of XMLHttpRequest

- 0 : request not initialized yet
- 1 : request is set up
- 2 : request has been sent
- 3 : request is in process
- **4 : request is complete**

XMLHttpRequest (cont'd)

// request

- **open**(DOMString method, DOMString url, boolean async,
  DOMString? user, DOMString? password);
- **setRequestHeader**(DOMString header, DOMString value);

// response

- unsigned short **status**; // holds the HTTP status code
- DOMString **statusText**; // holds the HTTP status text
- DOMString **responseText**; // DOMString
- Document **responseXML**; // Document

Browser Compatibility

```
var xmlHttp;
try {
  xmlHttp = new XMLHttpRequest(); // Firefox, Opera, Safari
} catch (e) {
  // Internet Explorer
  try {
    xmlHttp = new ActiveXObject("Msxml2.XMLHTTP");
  } catch (e) {
    try {
      xmlHttp = new ActiveXObject("Microsoft.XMLHTTP");
    } catch (e) {
      alert("Your browser does not support Ajax!");
      return false;
    }
  }
}
```

Enter XML: Auto-Completion of Contact Info

```
<html>
  <head><script src="selectCustomerXML.js"></script></head>
  <body>
    <form action="">
      Select a Customer:
      <select name="custs" onchange="showCust(this.value)">
        <option value="ALF">Alfred</option>
        <option value="JOH">John</option>
        <option value="WOL">Wolski</option>
      </select>
    </form>
    <b><span id="company"></span></b><br />
    <span id="contact"></span><br />
    <span id="address"></span>
    <span id="city"></span><br/>
    <span id="country"></span>
  </body>
</html>
```

Enter XML: Auto-Completion of Contact Info (cont'd)

```
function showCust(str) {
  var xmlHttp = new XMLHttpRequest();
  var url="getCustomerXML.jsp";
  url = url + "?q=" + str;
  url = url + "&sid=" + Math.random();
  xmlHttp.onreadystatechange = stateChanged;
  xmlHttp.open("GET", url, true);
  xmlHttp.send(null);
}
```

XML As Communication Mechanism

```
<?xml version='1.0' encoding='ISO-8859-1'?>
<company>
  <comp>Vandelay Industries</comp>
  <cont>Inc.</cont>
  <addr>201 Bell Hall</addr>
  <city>Buffalo</city>
  <cntr>USA</cntr>
</company>
```

Enter XML: Auto-Completion of Contact Info (cont'd)

Navigation into XML result using the XML Document Object Model (DOM)

```
function stateChanged() {
  if (xmlHttp.readyState==4) {
    var xmlDoc=xmlHttp.responseXML.documentElement;
    document.getElementById("company").innerHTML =
    xmlDoc.getElementsByTagName("comp")[0].childNodes[0].nodeValue;
    document.getElementById("contact").innerHTML =
    xmlDoc.getElementsByTagName("cont")[0].childNodes[0].nodeValue;
    document.getElementById("address").innerHTML =
    xmlDoc.getElementsByTagName("addr")[0].childNodes[0].nodeValue;
    document.getElementById("city").innerHTML =
    xmlDoc.getElementsByTagName("city")[0].childNodes[0].nodeValue;
    document.getElementById("country").innerHTML =
    xmlDoc.getElementsByTagName("cntr")[0].childNodes[0].nodeValue;
  }
}
```

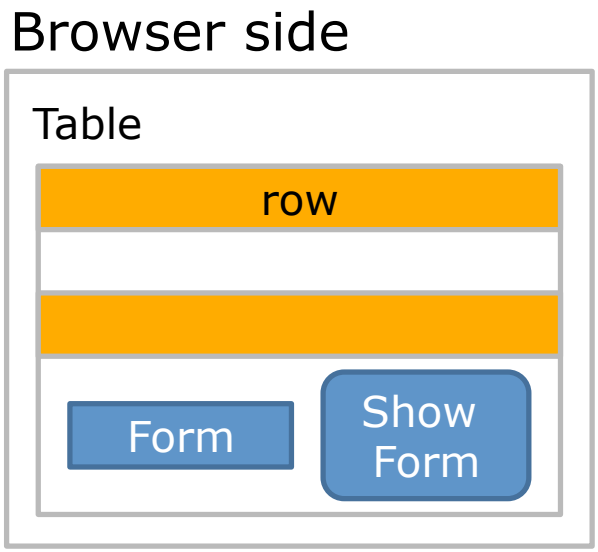
Common Use Cases of Ajax

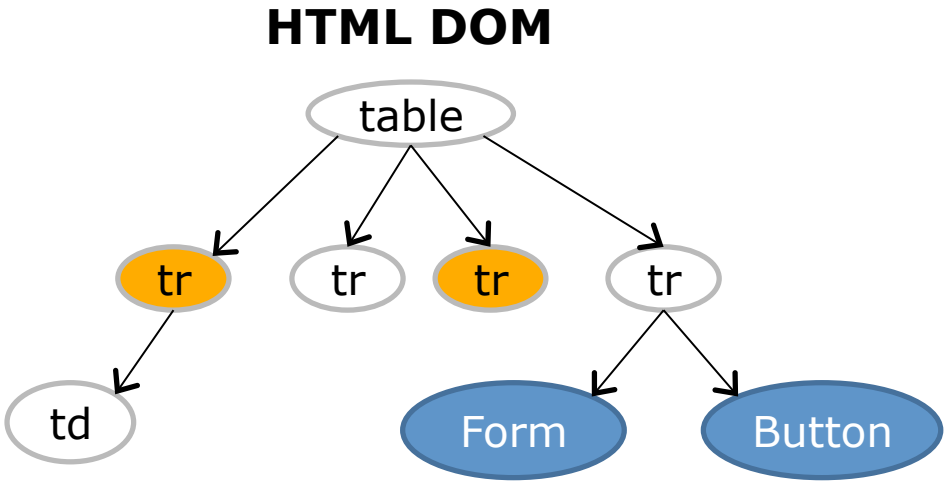
- Today's busy pages have multiple sections
- Reduce load by updating only the relevant part
- Quick response to inputs
  - "Illusion" that the page is faster even when it is not, simply because there is always something on screen

Common Ajax Downsides

- The "revisions" do not automatically register with browser's history
  - Back button behaves weirdly
- GET is good for bookmarking; Ajax is bad
  - Can be resolved with fragment identifier
- Non-crawlable web
- New opportunities for malicious hackers
- Complicates structure

In Previous Episodes of Client-Side Programming...





- Browser catches event **A** on element **E** of the page
- The HTML may dictate that JavaScript function **f** is executed upon event **A** on **E**
- The function **f** modifies the HTML DOM
- Browser refreshes and shows revised page
- Ajax/XHR further allow JavaScript function to contact server and obtain new data

What Should You Use When…

- Your application displays a table and you want the background of the rows of this table to turn red when you mouse over them
- Comment on pros and cons of:
  - Plain JavaScript
  - JavaScript communicating via XHR to the server which sends a revised "red row" and JavaScript changes old row with new row

What Should You Use When…

- Your application's page shows a table with today's College Basketball games with an update button next to each one of them
- Upon clicking the update button, new rows appear showing the latest events of the particular game