COMP 4021

Internet Computing

AJAX

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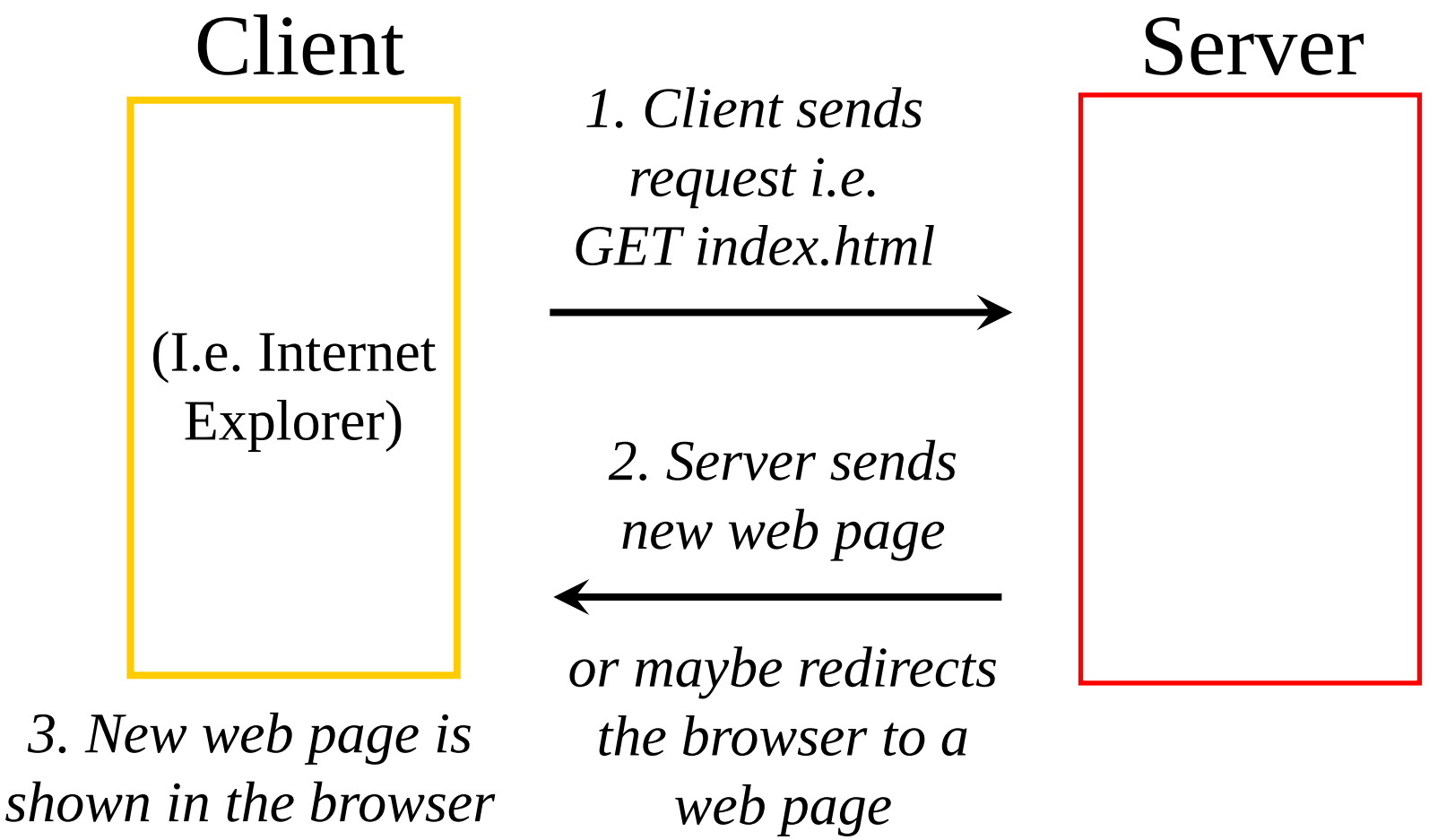
'Traditional' Communication

- You already know that the most common way to give information to a server is by using a form
- In response to the form request, the server sends back a complete web page to the browser

- With this method, the transaction (request – respond) happens 'once only'
- This is the 'traditional' style of "updating" a web page in Web 1.0

‘Traditional’ Operation



Updating an Entire Web Page

- To periodically update information on a web page automatically, you can do either of these:
  - Method 1: Refresh the web page (or go to another web page) using an html 'meta' tag
  - Method 2: Use JavaScript to tell the browser to reload the web page (or go to another web page)
- With both methods, even if only small parts of the page need to be updated, the whole thing must be updated

Method 1 – Using a Meta Tag

- The HTML refresh meta tag can be used to redirect a web page after a certain time interval

  <META http-equiv="refresh" content="*<time>*;URL=*<url>*" />

- For example the following tag redirects the browser to the 303 main page 10 seconds after loading

  <META http-equiv="refresh"
  content="10;URL=http://course.cse.ust.hk/comp303" />

- If the URL field is empty the page will refresh itself after the specified time value, e.g.

  <META http-equiv="refresh" content="5" />

Refresh the same page after 5 seconds

Method 2 – Using JavaScript

- You can use JavaScript to refresh the page content
- The following example refreshes a web page after 5 seconds

```
<html>
 <body onload=
  "setTimeout('window.location.reload()', 5000)">
  Hello, I will be reloaded in 5 seconds.
 </body>
</html>
```

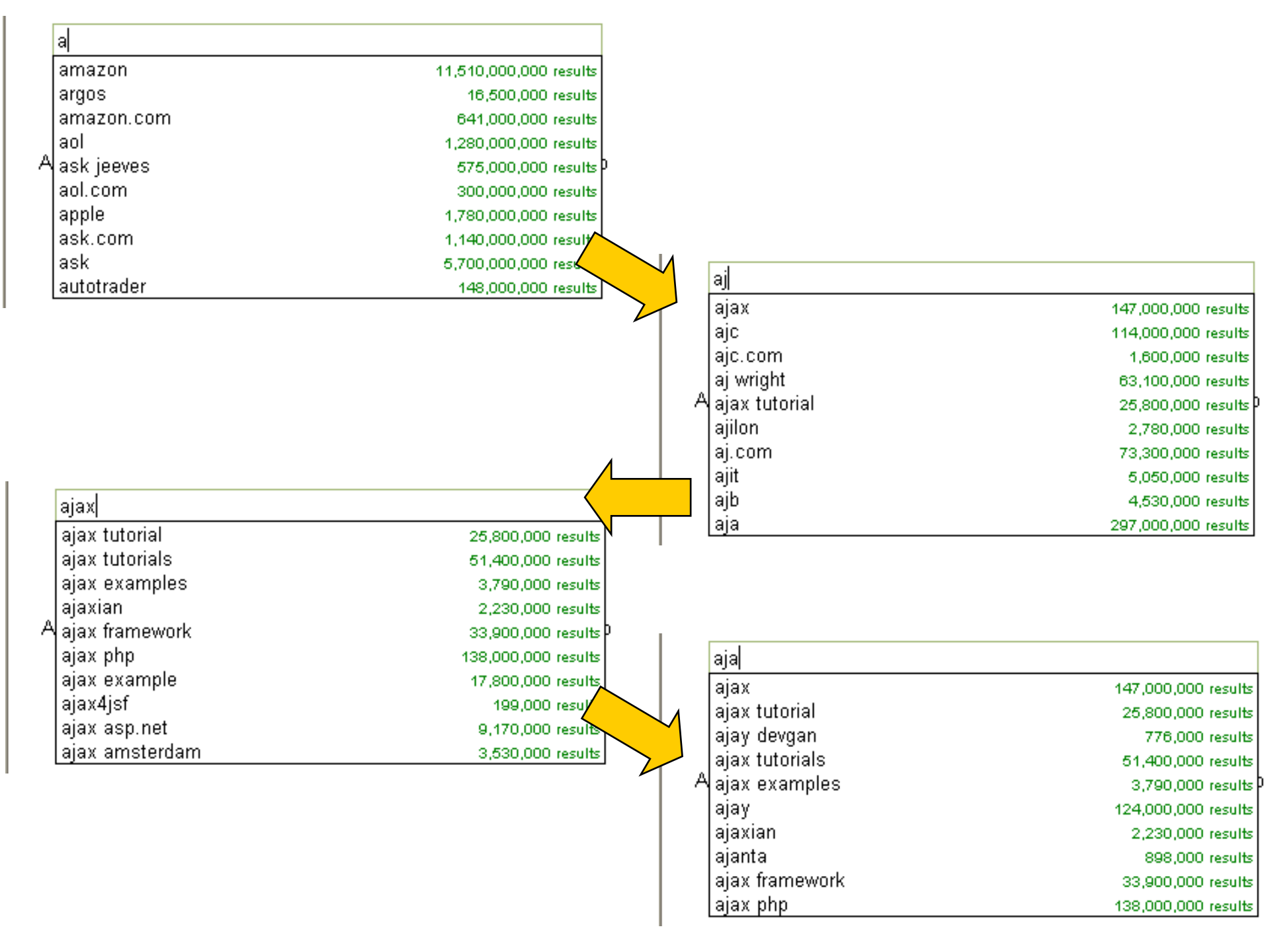
Get the URL of current page

AJAX

- Ajax uses a different style of communication to the ‘load a complete page’ style
- Ajax =Asynchronous JavaScript and XML
- It is a method for code in a web page to send a request to the server any time it wants to, without ‘leaving’ the current web page
- This is called ‘asynchronous communication’
- Typically a small message is sent back from the server to the browser (not a complete web page)

Example Use of Ajax - Google

- Example - interactive entering of search terms: http://www.google.com
- As soon as you enter a letter in the google search field, all the letters entered by the user so far are sent to the Google server
- Google immediately responds with a list of the most popular search terms that start with those letters (user can then use arrow keys to select one)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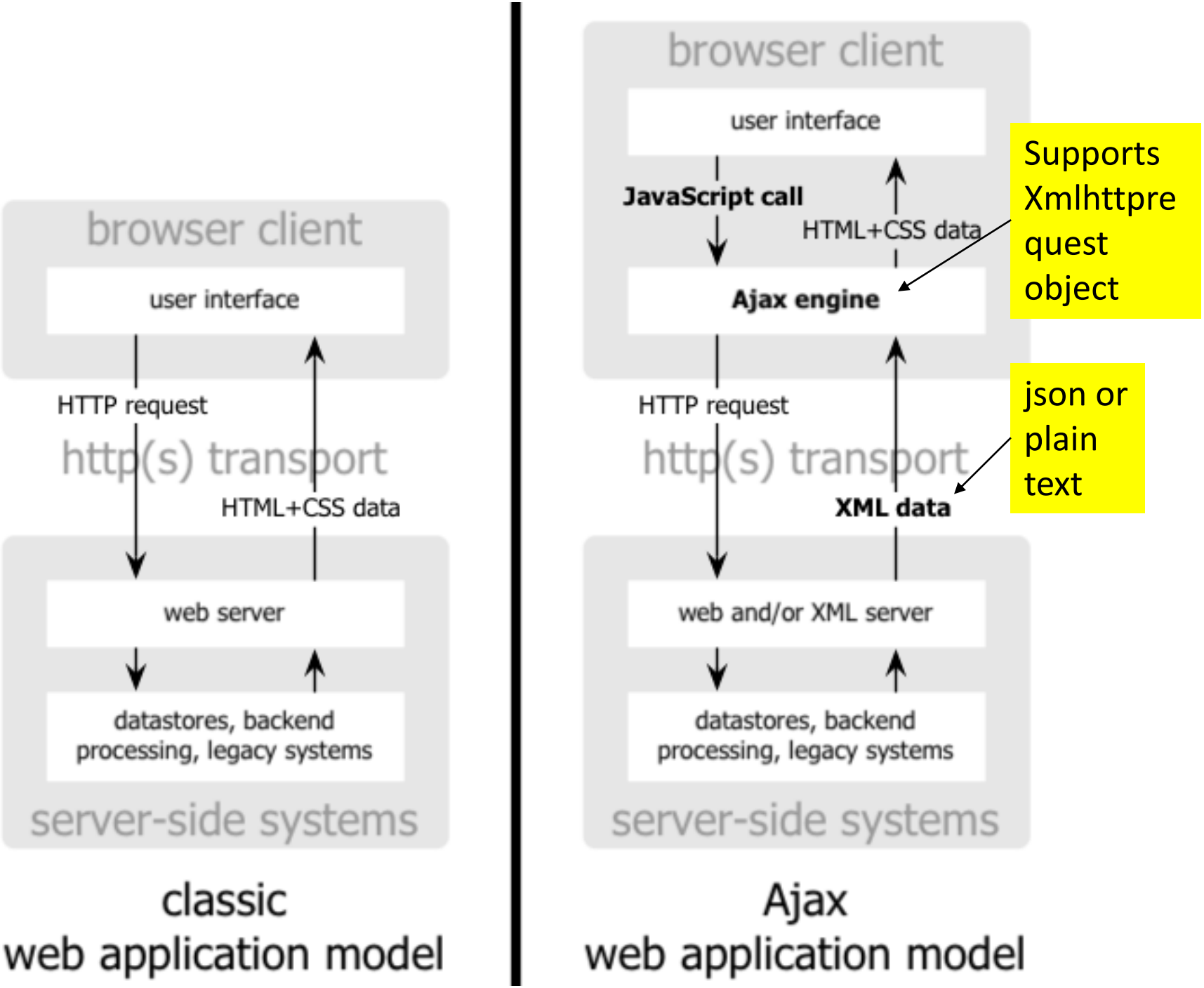
Speed Advantages of AJAX

- The request sent to the server is small (i.e. <150 bytes) and the response from the server is small (maybe <200 bytes)
  - Only data for the updated parts of a page (e.g., DIVs) need to be fetched from server
- So these small sizes mean quick communication
- Another point is that usually when the data is received the JavaScript code only updates a small part of the web page, not the entire display
- This is much quicker than updating the entire web page display, which is the 'traditional' style

Ajax/Traditional Comparison

- The next slide shows a comparison between the 'traditional' method (left) and the Ajax method (right)
- Some things in the figure are slightly misleading i.e.
  - Both methods don't *have* to use a CSS file
  - Don't *have* to send XML data for the Ajax method, even simple text could be sent
  - Anything could be on the server, i.e. server may or may not have a database


browser client
user interface
HTTP request
http(s) transport
HTML+CSS data
web server
datastores, backend processing, legacy systems
server-side systems
classic web application model
browser client
user interface
JavaScript call
HTML+CSS data
Ajax engine
Supports Xmlhttpre quest object
HTTP request
http(s) transport
XML data
json or plain text
web and/or XML server
datastores, backend processing, legacy systems
server-side systems
Ajax web application model

Client Side Programming for Ajax

- Create an XMLHttpRequest object
- Send the request to the server
  - open() to initialize connection to the server
  - send() to send the data
- A client side event listener knows when the XMLHttpRequest object has finished retrieving data, and runs a callback function
- The callback function
  - Checks whether the data is successfully retrieved
  - Does something appropriate with the data

Why a callback function is needed?

Ajax: Set up and Send Request

```
function getUpdate() {
        request = new XMLHttpRequest();

        request.onreadystatechange = stateChange; // Define callback function
        request.open("POST", "server.php", true);
        request.send( null );
}
```

Here the request sent to the server doesn't pass any parameter

Specifies the type of request; last parameter is: async (true) or sync (false)

Server program to receive Ajax requests

No parameters are passed to the server program

- The AJAX request goes through several stages (see later slide)
- Whenever the state changes, the callback function will be executed

Ajax: Callback Function

```
function stateChange() {    // Callback function
      // This function is run when the server responds
      if (request.readyState == 4 && request.status == 200
            && request.responseText) {
            // suppose myDiv has been defined in html body
            document.getElementById("myDiv").innerHTML=
                        request.responseText;
      }
}
```

- '4' means a reply has been received from the server
- '200' means the reply was normal
- The third test is to check some actual data was returned by the server.

Ajax: Callback Function Status

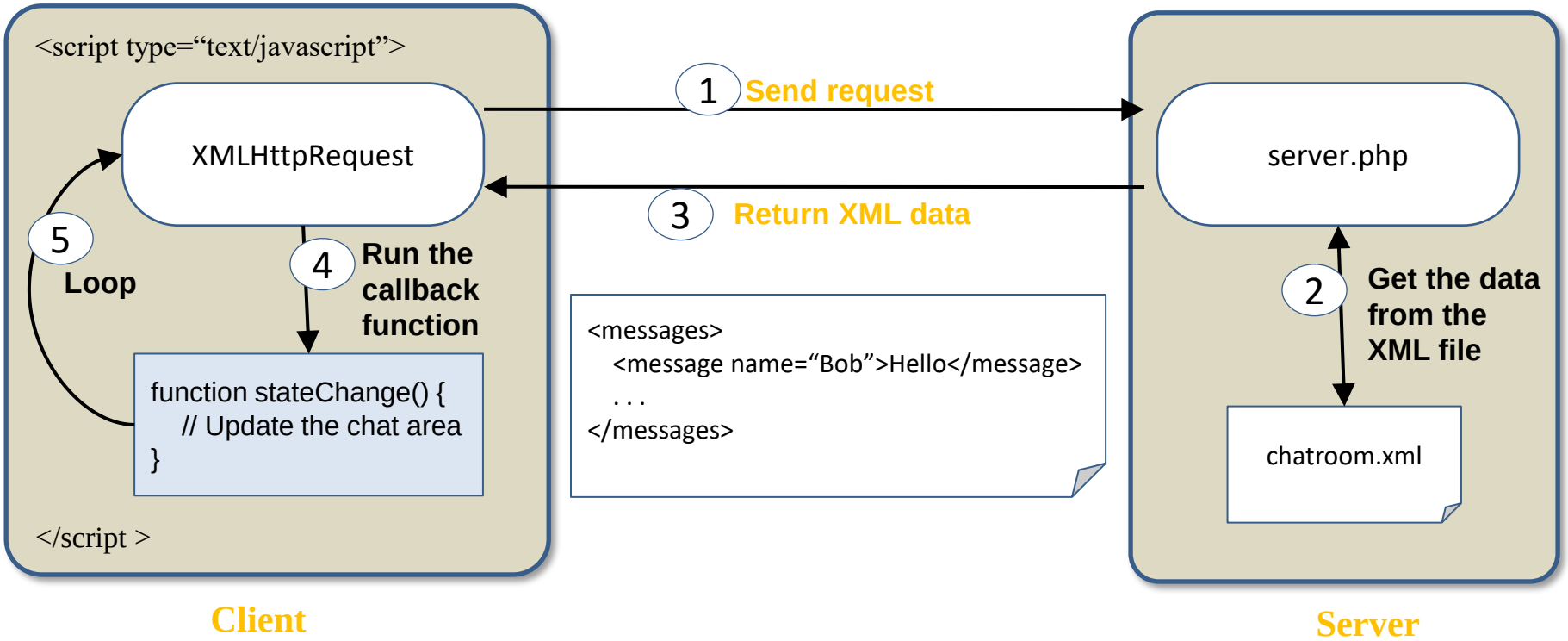
- **onreadystatechange** property defines a call-back function to be executed when the **readyState** changes
- **readyState** property holds the status of XMLHttpRequest:

  0: request not initialized
  1: server connection established
  2: request received
  3: processing request
  4: request finished and response is ready
- **status** property holds the HTTP return code (200, 404, etc) of the **XMLHttpRequest** object

Run Display Time Demo

Getting XML Data from Server

- In PHP project, the client uses AJAX to get XML data from the server
- A request is sent to the server; XML data is sent back
- When we send the request, we send the last known size of the XML data, so the server can compare it to the current size, and send all the XML chat room data if the size is not the same



PHP Project Code

- In the previous example code, we only needed to send the request once (in getUpdate())
- After that, whenever a response is received from server.php, stateChange() will be automatically executed
- For the PHP project, the situation is a bit different, because each time we need to tell the server the size of the chat room XML in the client
- So that means we have to repeatedly send the request

```
var datasize = 0;
```

The size of the XML data in the client is 0 when the chat room client side code starts

```
function getUpdate() {
    request = new XMLHttpRequest();
    request.onreadystatechange = stateChange;
    request.open("POST", "server.php", true);
    request.setRequestHeader("Content-type",
            "application/x-www-form-urlencoded");
    request.send("datasize=" + datasize);  }

function stateChange() {    // Callback function
    // This function is run when data is returned
    if (request.readyState == 4 && request.status == 200
        && request.responseText) {
        document.getElementById("myDiv").innerHTML=
                request.responseText;
        datasize = request.responseText.length;
        . . .    // XML received, update the chat display
        getUpdate();
    }   }
```

POST data in HTML form

Send the size of the XML file in the client to the server
server.php compares this value with the size of the current XML file to check if the client has the latest XML data, and send it if required

Update the current size of the XML data for sending later

Repeat the whole procedure again

Take Home Message

- Ajax has become a standard technology for modern websites
- Web 2.0 enables instantaneous interaction between user/system and user/user
- Data transfer from the server does not have to be XML; any format that the client can interpret is fine