XML and AJAX FUNDAMENTALS

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Lecture 6, Mid Section Exam Week

LAST TIME

- ❏ How to use JSON
- ❏ How to use Bootstrap

TODAY

- ❏ XML Fundamentals
- ❏ Ajax Fundamentals

XML Properties

- ❏ XML is designed to send, store, receive and display data. In simple words you can say that XML is used for storing and transporting data.
- ❏ Unlike HTML where most of the tags are predefined, XML doesn't have predefined tags, rather you have to create your own tags.
- ❏ XML stands for eXtensible Markup Language This means it lets you define your own tag
- ❏ XML is different from HTML. XML focuses on data while HTML focuses on how the data looks.
- ❏ XML was designed to be self-descriptive
- ❏ XML became a W3C (W3C stands for World Wide Web Consortium, the main international standards organization for the World Wide Web) recommendation on February 10, 1998.
- ❏ XML does not depend on software and hardware, it is platform and programming language independent.

What is XML?

XML is a markup language which is used for storing and transporting data. XML doesn't depend on the platform and the software(programming language). You can write a program in any language on any platform (Operating System) to send, receive or store data using XML.

XML Example

This is just to show you how a XML looks. You need not to give too much emphasis on this right now because we will learn this in detail later. For now, you can see it as a document that can be used for sending the sender's name (the value inside <from> tag), receiver's name (the value inside <to> tag) and the message (the value inside <msg> tag).

```
<?xml version="1.0" encoding="UTF-8"?>

<message>

 <to>MyReader</to>

 <from>Chaitanya</from>

 <msg>Welcome to beginnersbook.com</msg>

</message>
```

The top line <?xml version="1.0" encoding="UTF-8"?> is called **XML prolog**. For now just remember that it is an optional line, however if you mention it then it should be the first line in the **XML Document**.

Further Reading

https://www.w3schools.com/whatis/whatis_xml.asp
https://www.w3schools.com/xml/xml_whatis.asp
https://beginnersbook.com/2018/10/xml-tutorial-learn-xml/

Code Sample

https://github.com/juliettegodyere/Gbodo-ICT-Web-Development-Course/blob/dev/Lecture%206/xmlSample.xml

AJAX Fundamentals

The following tutorial will provide a short introduction to Ajax and its uses. Before understanding these terms see few practical examples to demonstrate the power of Ajax. Facebook, Instagram, Twitter etc for example, if someone posts a feed, another user clicks on the like button and likes the post the like count is added without refreshing the page. Now imagine the situation if one clicks on the like button and the whole page reloads again. Now the question is whether clicking on the like button for such a small task requires a complete reloading of a web page? Absolutely not. Ajax is very helpful as it prevents the reloading of the complete web page. It communicates only necessary information with the server and shows to the end user (in this case being the increase of like count). Consider another case when you visit google to search for anything. Usually, observe that when you start typing the desired keywords to search, observe that many suggestions are presented in the search bar. Now, where do they come from? Of course not from the client side. The results are again the power of communication with the server without reloading the page again.
Like this, there are dozens of examples which can be considered. The whole power working behind is nothing but Ajax. Let's discuss Ajax briefly and its implementation.

What is AJAX

Ajax is an acronym for Asynchronous Javascript and XML. It is used to communicate with the server without refreshing the web page and thus increasing the user experience and better performance. It is not a programming language. AJAX is a new technique for creating better, faster, and more interactive web applications with the help of XMLHttpRequest, XML, HTML, CSS, and Javascript.

Prerequisites:

There are no such pre-requisites required to understand the latter portion of the note. Only the basic knowledge of HTML, CSS, and Javascript are good to go.

AJAX - Technologies

AJAX cannot work independently. It is used in combination with other technologies like Javascript, CSS, DOM and XMLHttpRequest to create interactive web pages.

AJAX - Examples

Here is a list of some famous web applications that make use of AJAX.

- ❏ Google Maps
- ❏ Google Suggest
- ❏ Gmail
- ❏ Yahoo Maps (new)

AJAX - Browser Support

All the available browsers cannot support AJAX. Here is a list of major browsers that support AJAX.

- Mozilla Firefox 1.0 and above.
- Netscape version 7.1 and above.
- Apple Safari 1.2 and above.
- Microsoft Internet Explorer 5 and above.
- Konqueror.
- Opera 7.6 and above.

When you write your next application, do consider the browsers that do not support AJAX.

NOTE − When we say that a browser does not support AJAX, it simply means that the browser does not support the creation of Javascript object – XMLHttpRequest object

How does it work?

First, let us understand what does asynchronous actually mean. There are two types of requests synchronous as well as asynchronous. Synchronous requests are the one which follows sequentially i.e if one process is going on and in the same time another process wants to be executed, it will not be allowed that means the only one process at a time will be executed. This is not good because in this type most of the time the CPU remains idle such as during I/O operation in the process which is order of magnitude slower than the CPU processing the instructions. Thus to make the full utilization of the CPU and other resources use asynchronous calls. For more information visit this https://en.wikipedia.org/wiki/Asynchronous_I/O. Why the word javascript is present here. Actually, the requests are made through the use of javascript functions. Now the term XML which is used to create **XMLHttpRequest object.**

Thus the summary of the above explanation is that Ajax allows web pages to be updated asynchronously by exchanging small amounts of data with the server behind the scenes. Now discuss the important part and its implementation. For implementing Ajax, only be aware of XMLHttpRequest object. Now, what actually it is. It is an object used to exchange data with the server behind the scenes. Try to remember the paradigm of OOP which says that object communicates through calling methods (or in general sense message passing). The same case applied here as well. Usually, create this object and use it to call the methods which result in effective communication. All modern browsers support the XMLHttpRequest object.

XMLHttpRequest Object

The XMLHttpRequest object is the key to AJAX. It has been available ever since Internet Explorer 5.5 was released in July 2000, but was not fully discovered until AJAX and Web 2.0 in 2005 became popular.

XMLHttpRequest (XHR) is an API that can be used by JavaScript, JScript, VBScript, and other web browser scripting languages to transfer and manipulate XML data to and from a web server using HTTP, establishing an independent connection channel between a webpage's Client-Side and Server-Side.

The data returned from XMLHttpRequest calls will often be provided by back-end databases. Besides XML, XMLHttpRequest can be used to fetch data in other formats, e.g. JSON or even plain text.

Basic Syntax: The syntax of creating the object is given below

```
req = new XMLHttpRequest();
```

There are two types of methods open() and send(). Uses of these methods explained below.

```
req.open("GET", "abc.php", true);

req.send();
```

The above two lines described the two methods. **req** stands for the request, it is basically a reference variable. The **GET** parameter is as usual one of two types of methods to send the request. Use **POST** as well depending upon whether send the data through POST or GET method. The second parameter being the **name** of the file which actually handles the requests and processes them. The third parameter is **true**, it tells whether the requests are processed asynchronously or synchronously. It is by default true which means that requests are asynchronous. The open() method prepares the request before sending it to the server. The send method is used to send the request to the server.

```
req.send("name=johndoe&marks=99");
```

Use of setRequestHeader() method as shown below.

```
req.setRequestHeader("Content-type", "application/x-www-form-urlencoded");
```

Events and handling mechanism:

Any action performed on a web page, like clicking a button, hovering over elements, page loading etc all are termed as events. Also aware of the fact that javascript can detect events. So bind the code of a specific event with its action which can be implemented by javascript. These are basically event handlers.
Implementing event handlers which actually hold the events. Events handlers are basically functions written in javascript which act on or set into action when an event is fired by the user. When sending the request through the send method, they usually get the response from the server later. But getting response time is not usually known. So it's good you track it.
Therefore to keep a track of the response onreadystatechange event which is binding with the event handler(function) which will get executed when a response comes.
The onreadystatechange event is triggered every time the readyState changes. So what actually a ready state is and when will the onreadystate event actually occur and how many times it will occur between the request and response?
The XMLHttpRequest object has a property called as readyState whose value changes in the complete request-response journey i.e when a request is prepared, sent, resolved, processed and when the response comes. That's why it is called os onreadystatechange.
The onreadystatechange stores a function (or the name of the function)to be called automatically each time the readyState property changes.

The readyState holds different values ranging from 0 to 4. See details below

1. request not initialized

2. server connection established
3. request received
4. processing request
5. request finished and response is ready

XMLHttpRequest also has a property named status. The status has following values

- ❏ 200: “OK”
- ❏ 404: “Page not found”

Now remember it always that when readyState is 4 and status is 200, the response is ready. The whole thing described above is implemented in coding as given below

XMLHttpRequest Properties

- ❏ Onreadystatechange: An event handler for an event that fires at every state change.
- ❏ readyState: The readyState property defines the current state of the XMLHttpRequest object.
  The following table provides a list of the possible values for the readyState property

State	Description
0	The request is not initialized.
1	The request has been set up.
2	The request has been sent.
3	The request is in process.
4	The request is completed.

readyState = 0 After you have created the XMLHttpRequest object, but before you have called the open() method.

readyState = 1 After you have called the open() method, but before you have called send().

readyState = 2 After you have called send().

readyState = 3 After the browser has established a communication with the server, but before the server has completed the response.

readyState = 4 After the request has been completed, and the response data has been completely received from the server.

How to Use a Simple API Using AJAX ?

AJAX (Asynchronous JavaScript and XML) is a set of tools used to make calls to the server to fetch some data. In this article, we will see how to implement a simple API call using AJAX.

What are the basics?

We will be fetching employee's names from an employee object from a free API and displaying them inside a list. There are many API available for free on the internet. You can use any one of them.

HTML Code: We have a button and to fetch data and an empty unordered list inside which we will be adding our list-items dynamically using JavaScript.

Complete Code:
https://github.com/juliettegodyere/Gbodo-ICT-Web-Development-Course/blob/dev/Lecture%206/ajax.html

How to Use AJAX for Database Operations

AJAX can be used for interactive communication with a database.

Complete Code and step by step example: https://www.w3schools.com/xml/ajax_database.asp

Further Reading

https://www.w3schools.com/js/js_ajax_http.asp
https://www.w3schools.com/whatis/whatis_ajax.asp
https://www.tutorialspoint.com/ajax/ajax_quick_guide.htm

Code Sample

https://github.com/juliettegodyere/Gbodo-ICT-Web-Development-Course/tree/dev/Lecture%206