UNIT III CLIENT SIDE TECHNOLOGIES

- XML
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- XML Schema
- Document Object Model
- Presenting XML
- Using XML Parsers: DOM and SAX
- JavaScript Fundamentals
- Evolution of AJAX
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- Web applications with AJAX
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Evolution of AJAX

Evolution of AJAX

- AJAX stands for **A**synchronous **Ja**vaScript and **X**ML.
- It is a **set of Web development techniques** using many Web technologies on the client side **to create asynchronous Web applications**.
- With Ajax, Web applications can send and retrieve data from a server asynchronously (in the background) without interfering with the display and behavior of the existing page.
- By decoupling the data interchange layer from the presentation layer, Ajax allows for Web pages, and by extension Web applications, to change content dynamically without the need to reload the entire page.
- In practice, modern implementations commonly utilize JSON instead of XML due to the advantages of JSON being native to JavaScript.

Evolution of AJAX Cont'd

- Before 2005, communication between client-side and server-side was harder to establish.
- Developers use **hidden iframes to populate the server data to the client-side**.
- But in 2005, **James Garrett** write an article named **AJAX: a new approach to Web applications**.
- The key technology is used in AJAX is XMLHttpRequest(XHR), firstly invented by **Microsoft** and then use by other browsers.
- XHR has capabilities to retrieve data from server-side and populate on client-side with the help of existing technologies.
- Before 2005, developers use different technologies for communication with server-side such as **Java Applets** or **Flash movies**.

AJAX

- **AJAX is not a technology but group of inter-related technologies**
- AJAX is a **web browser technology** independent of web server software
- AJAX technologies includes:
  - HTML/XHTML and CSS
  - DOM
  - XML or JSON (Javascript Object Notation) is like XML but short and faster than XML
  - **XMLHttpRequest**
  - JavaScript

AJAX technologies

- HTML/XHTML and CSS
  - These technologies are used for displaying content and style. It is mainly used for presentation.
- DOM
  - It is used for dynamic display and interaction with data.
- XML or JSON
  - For carrying data to and from server.
- XMLHttpRequest
  - **For asynchronous communication between client and server**
- JavaScript
  - It is used to bring above technologies together.

AJAX

- **AJAX allows to send only important information to the server not the entire page**. So only valuable data from the client side is routed to the server side. It makes the application interactive and faster.
- **Conventional web applications transmit information to and from the server using synchronous requests**. It means you fill out a form, hit submit, and get directed to a new page with new information from the server.
- With AJAX, when you hit submit, JavaScript will make a request to the server, interpret the results, and update the current screen. In the purest sense, the user would never know that anything was even transmitted to the server. **(Asynchronous requests)**
- There are too many web applications running on the web that are using ajax technology
  like **gmail**, **facebook**,**twitter**, **google map**, **youtube** etc.

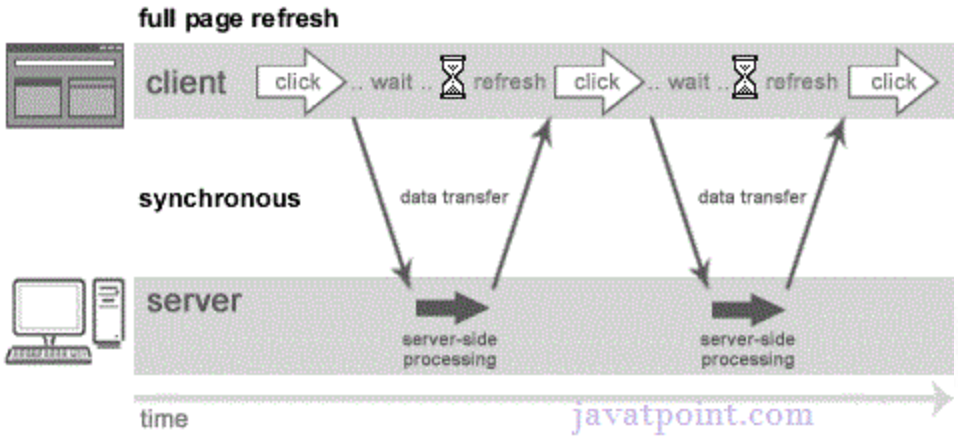
AJAX is Based on Open Standards

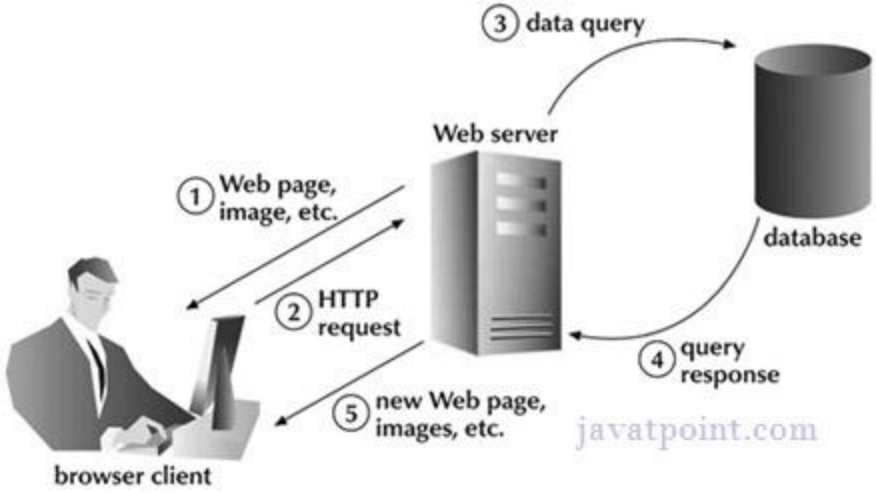
- AJAX is based on the following open standards:
  - Browser-based presentation using HTML and Cascading Style Sheets (CSS).
  - Data is stored in XML format and fetched from the server.
  - Behind-the-scenes data fetches using XMLHttpRequest objects in the browser.
  - JavaScript to make everything happen.

AJAX is the method of exchanging data with a server, and updating parts of a web page – without reloading the entire page

Synchronous (Classic Web-Application Model)

- A synchronous request blocks the client until operation completes i.e. browser is not responsive. In such case, javascript engine of the browser is blocked.

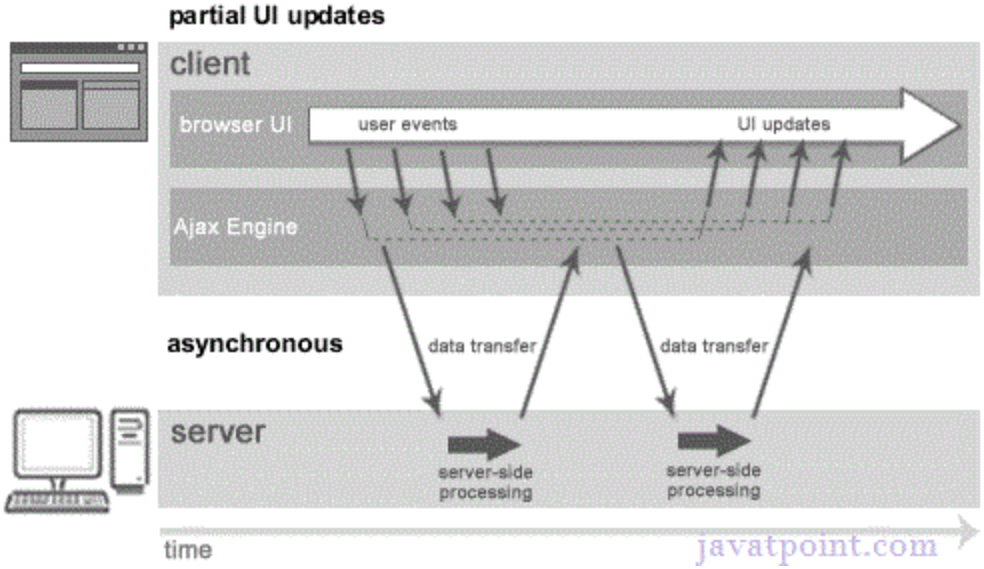


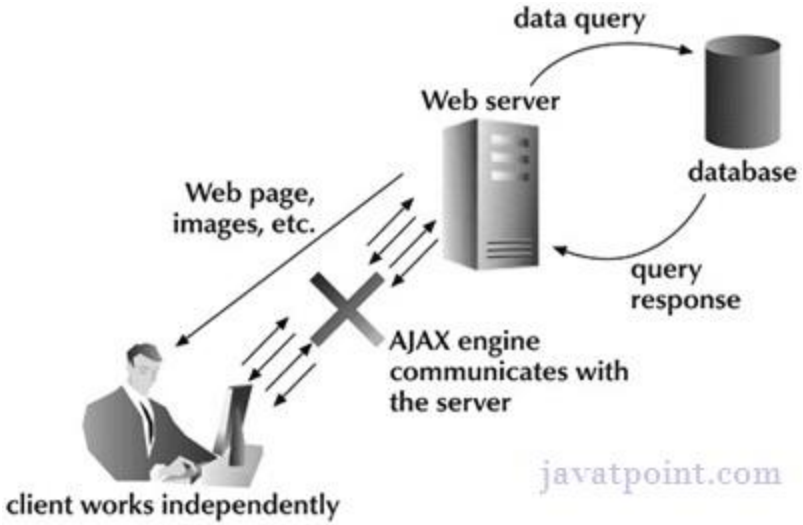


full page is refreshed at request time and user is blocked until request completes.

Asynchronous (AJAX Web-Application Model)

- An asynchronous request doesn't block the client i.e. browser is responsive. At that time, user can perform another operations also. In such case, javascript engine of the browser is not blocked.





full page is not refreshed at request time and user gets response from the ajax engine

Benefits of Ajax

Callbacks

→Ajax is used to perform a callback, making a quick round trip to and from the server to retrieve and/or save data without posting the entire page back to the server

→ By not performing a full postback and sending all form data to the server, network utilization is minimized and quicker operations occur

→ In sites and locations with restricted bandwidth, this can greatly improve network performance

→ Most of the time, the data being sent to and from the server is minimal. By using callbacks, the server is not required to process all form elements

→ By sending only the necessary data, there is limited processing on the server. There is no need to process all form elements, process the ViewState, send images back to the client, or send a full page back to the client.

Benefits of Ajax Cont'd

Making Asynchronous Calls

→Ajax allows to make asynchronous calls to a web server

→This allows the client browser to avoid waiting for all data to arrive before allowing the user to act once more.

User-Friendly

→ Because a page postback is being eliminated, Ajax enabled applications will always be more responsive, faster and more user-friendly

Increased Speed

→ The main purpose of Ajax is to improve the speed, performance and usability of a web application.

Technical Aspects of Ajax

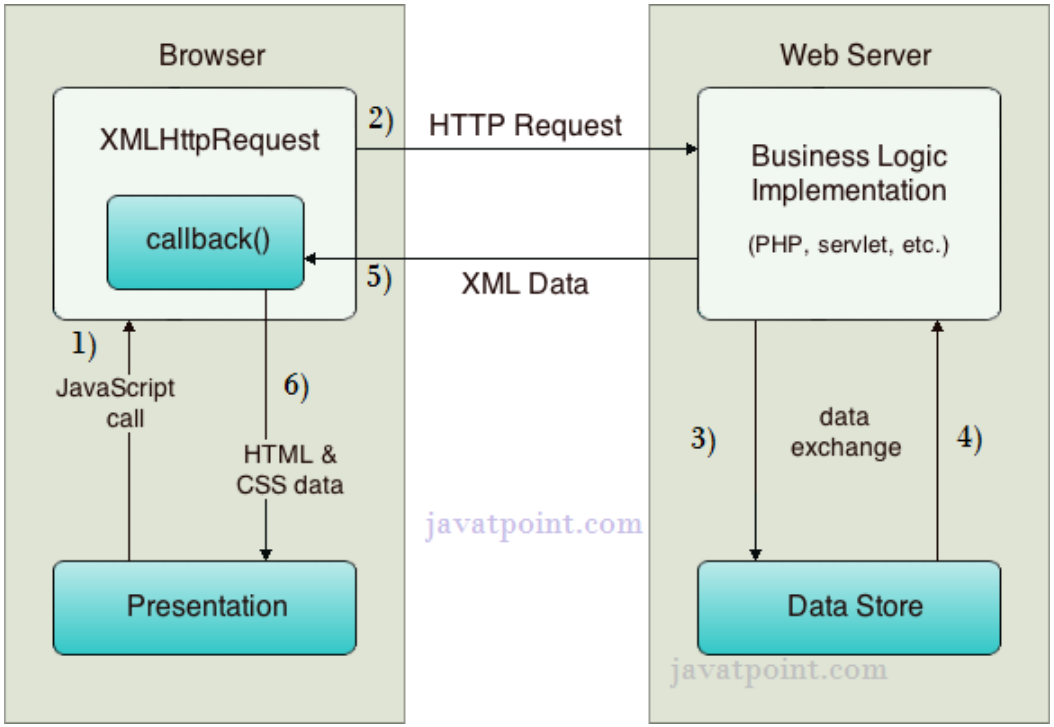
Ajax callbacks can be done by instantiating an **XMLHttpRequest** object in the client-side JavaScript

XMLHttpRequest

- An object of XMLHttpRequest is used for asynchronous communication between client and server.
- It performs following operations:
  - Sends data from the client in the background
  - Receives the data from the server
  - Updates the webpage without reloading it

How AJAX works?

- AJAX communicates with the server using XMLHttpRequest object



1. User sends a request from the UI and a javascript call goes to XMLHttpRequest object.
2. HTTP Request is sent to the server by XMLHttpRequest object.
3. Server interacts with the database using JSP, PHP, Servlet, ASP.net etc.
4. Data is retrieved.
5. Server sends XML data or JSON data to the XMLHttpRequest callback function.
6. HTML and CSS data is displayed on the browser.

XMLHttpRequest Object Methods

Method	Description
new XMLHttpRequest()	Creates a new XMLHttpRequest object
abort()	Cancels the current request
getAllResponseHeaders()	Returns header information
getResponseHeader()	Returns specific header information
open(*method,url,async,user,psw*)	create a connection.Specifies the request *method*: the request type GET or POST *url*: the file location *async*: true (asynchronous) or false (synchronous) *user*: optional user name *psw*: optional password
send()	Sends the request to the server Used for GET requests
send(*string*)	Sends the request to the server. Used for POST requests
setRequestHeader()	Adds a label/value pair to the header to be sent

XMLHttpRequest Object Properties

Property	Description
onreadystatechange	Defines a function to be called when the readyState property changes
readyState	Holds the status of the XMLHttpRequest. 0: request not initialized 1: server connection established 2: request received 3: processing request 4: request finished and response is ready
responseText	Returns the response data as a string
responseXML	Returns the response data as XML data
status	Returns the status-number of a request 200: "OK" 403: "Forbidden" 404: "Not Found“
statusText	Returns the status-text (e.g. "OK" or "Not Found")

Create an XMLHttpRequest Object

- Syntax for creating an XMLHttpRequest object:
  - ***variable*** **= new XMLHttpRequest();**
- Old versions of Internet Explorer (IE5 and IE6) use an ActiveX Object:
  - ***variable*** **= new ActiveXObject("Microsoft.XMLHTTP");**
- To handle all browsers, including IE5 and IE6, check if the browser supports the XMLHttpRequest object. If it does, create an XMLHttpRequest object, if not, create an ActiveXObject

Send a Request To a Server

- To send a request to a server, we use the open() and send() methods of the XMLHttpRequest object:

```
xhttp.open("GET", "ajax_info.txt", true);
xhttp.send();
```

Method	Description
open(*method, url, async*)	Specifies the type of request *method*: the type of request: GET or POST *url*: the server (file) location *async*: true (asynchronous) or false (synchronous)
send()	Sends the request to the server (used for GET)
send(*string*)	Sends the request to the server (used for POST)

The url parameter of the open() method, is an address to a file on a server:The file can be any kind of file, like .txt and .xml, or server scripting files like .asp and .php (which can perform actions on the server before sending the response back).

The onreadystatechange Property

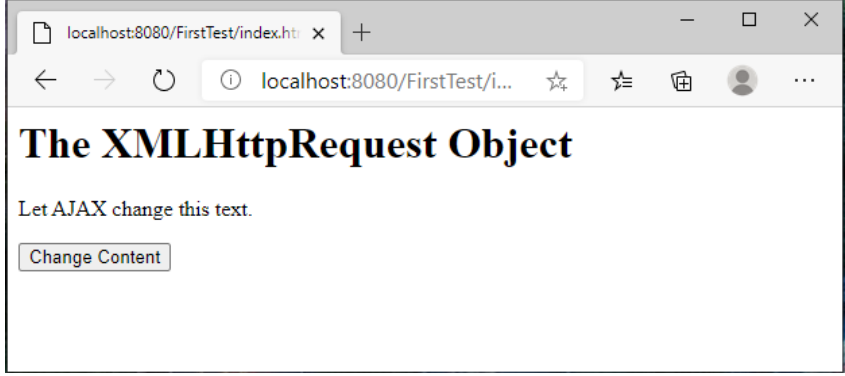
- The **readyState** property holds the status of the XMLHttpRequest.
- The **onreadystatechange** property defines a function to be executed when the readyState changes.
- The **status** property and the **statusText** property holds the status of the XMLHttpRequest object.

Property	Description
onreadystatechange	Defines a function to be called when the readyState property changes
readyState	Holds the status of the XMLHttpRequest. 0: request not initialized 1: server connection established 2: request received 3: processing request 4: request finished and response is ready
status	200: "OK" 403: "Forbidden" 404: "Page not found“
statusText	Returns the status-text (e.g. "OK" or "Not Found")

- The onreadystatechange function is called every time the readyState changes.
- **When readyState is 4 and status is 200, the response is ready**

Web applications with AJAX

AJAX Example




```
<html>
<body>
<h1>The XMLHttpRequest Object</h1>
<p id="disp">Let AJAX change this text.</p>
<button type="button" onclick="loadDoc()">Change Content</button>

<script>
function loadDoc()
{
 var xhttp;
 if (window.XMLHttpRequest)
  {
  // code for modern browsers
  xhttp = new XMLHttpRequest();
  }
  else
  {
  // code for IE6, IE5
  xhttp = new ActiveXObject("Microsoft.XMLHTTP");
  }
```

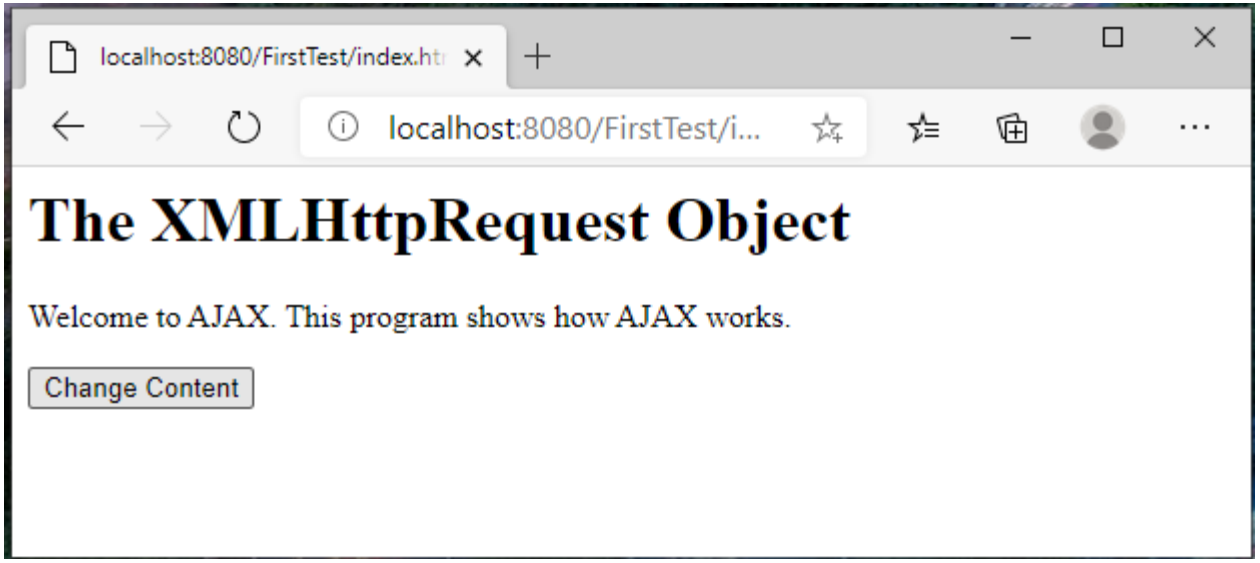
```
xhttp.onreadystatechange = function() {
    if (this.readyState === 4 && this.status === 200) {
      document.getElementById("disp").innerHTML = this.responseText;
    }
  };

xhttp.open("GET", "welcome.txt", true);
  xhttp.send();
}
</script>
</body>
</html>
```

welcome.txt

Welcome to AJAX. This program shows
how AJAX works.

Output


localhost:8080/FirstTest/index.ht
localhost:8080/FirstTest/i...
The XMLHttpRequest Object
Let AJAX change this text.
Change Content


localhost:8080/FirstTest/index.ht
localhost:8080/FirstTest/i...
The XMLHttpRequest Object
Welcome to AJAX. This program shows how AJAX works.
Change Content

AJAX with Databases

AJAX with Databases

- AJAX can be used for interactive communication with a database.
- Server side coding done using JSP.
- In client side, XMLHttpRequest object is used to send the request.

Example

Output


AJAX JDBC Example
localhost:8080/AJAX_JDBC_Ex/?txt=111
This is an example of ajax JDBC
Enter register number:
111
Click
111 Ajay 20 male 1996-02-17 no-7 Gandhi Street,porur,chennai

Index.html

```
<html>
<head>
   <title>AJAX JDBC Example</title>
<script>
var request;
function sendInfo()
{
        var v=document.form.txt.value;
        var url="searchResult.jsp?val="+v;
        if(window.XMLHttpRequest)
        {
                request=new XMLHttpRequest();
        }
        else if(window.ActiveXObject)
        {
                request=new ActiveXObject("Microsoft.XMLHTTP");
        }
        try
        {
                request.onreadystatechange=getInfo;
                request.open("GET",url,true);
                request.send();
        }catch(e){alert("Unable to connect to server");}
}
```

```
function getInfo()
{
        if(request.readyState===4)
        {
                var val=request.responseText;
                document.getElementById('res').innerHTML=val;
        }
}
</script>
</head>
<body>
   <h1>This is an example of ajax JDBC </h1>
   <form name="form">
   Enter register number:<input type="text" name="txt">
   <input type="button" value="Click" onclick="sendInfo()">
   </form>
   <span id="res"> </span>
 </body>
```

searchResult.jsp

```
<%@ page import="java.sql.*"%>
 <%
String s=request.getParameter("val");
if(s==null || s.trim().equals(""))
{
        out.print("Please enter Register Number");
}
else
{
        int rno=Integer.parseInt(s);
        try{
                Connection con =
DriverManager.getConnection("jdbc:derby://localhost:1527/student", "root", "12345");
 PreparedStatement ps=con.prepareStatement("select * from details where reg_no=?");
                ps.setInt(1,rno);
                ResultSet rs=ps.executeQuery();
                while(rs.next())
                {
                        out.print(rs.getString(1)+"    "+rs.getString(2)+"
"+rs.getString(3)+"    "+rs.getString(4)+"   "+rs.getString(5)+"   "+rs.getString(6));
                }
                con.close();
        }catch(Exception e){e.printStackTrace();}
}
%>
```

Ajax Frameworks

- The best technology to build dynamic web pages is **Ajax**.
- JavaScript code embedded into the HTML page is used to send requests to the server.
- At the server side, some processing is required to handle them, find the info or store the data.
- To do that, we need for a specialized framework.
- The framework has always a JavaScript part, and sometimes a server side part in another scripting language.
- A lot of them exist in various programming languages, in all environments around, but we retain here only the most widely used.

Why a framework?

- Framework is the Ajax engine described by J. J. Garrett and intended to suppress waiting for the user when accessing the server.
- The framework provides classical, cross-browser functions to use the XMLHttpRequest object.
- But a framework may goes beyond that, and allow to build "rich web applications", applications with a graphical user interface and other features of desktop software that run through a browser, while exchanging data with a remote server.

Features of an Ajax framework

- Any Ajax framework is able to communicate with the server, and thus, to read data or to send it data or commands. In the last case a server-side script is required.
- The frameworks often add components that make use of the asynchronous communication with the server.
- The classical examples are buttons, tabbed panels, grids, listboxs and other such widgets.
- Framework may be server-driven also, and in this case, component are created on the server with a scripting language such as PHP, and sent to the browser.
- Ajax is used to transmit user actions to the server part, and to handle the results.
- The ability to work offline as it is offered by HTML 5 is a complement to the Ajax framework as well.

List of Ajax frameworks

- There is a list of notable Ajax frameworks, used for creating web applications with a dynamic link between the client and the server.
- Some of the frameworks are JavaScript compilers, for generating JavaScript and Ajax that runs in the web browser client;
- some are pure JavaScript libraries; others are server-side frameworks that typically rely on JavaScript libraries.

JavaScript frameworks Framework	License
AngularJS	MIT
ASP.NET AJAX, a set of extensions to ASP.NET for implementing Ajax functionality.	Microsoft Public License
Backbone.js, loosely based on the Model-View-Controller application design paradigm	MIT[4]
Dojo Toolkit, an Open Source DHTML toolkit written in JavaScript.	modified BSD license or the Academic Free License
Ext JS, a library that extends Prototype, Jquery and YUI until version 1.0. Since version 1.1 a standalone Ajax framework.	GPLv3 or proprietary
j**Quer**y, a JavaScript library that provides an Ajax framework and other utilities, and jQuery UI, a plug-in that provides abstractions for low-level interaction and animation, advanced effects and high-level, themeable widgets.	GPL and MIT
MooTools, a compact and modular JavaScript framework best known for its visual effects and transitions.	MIT
Prototype, a JavaScript framework that provides Ajax and other utilities, and Script.aculo.us, a plug-in for animations and interface development.	MIT
Spry framework, an open source Ajax framework developed by Adobe which is used in the construction of Rich Internet applications. It is no longer maintained.	MIT
Unified.JS, a part of the JavaScript language framework.	BSD (component only) & commercial
YUI Library, a set of utilities and controls, for building richly interactive web applications using techniques such as DOM scripting, DHTML and Ajax.	BSD

Other frameworks that are more AJAX specific, and not among the list of general purpose frameworks:

- **AJAX.OOP**, an open source framework, it provides an OOP-style programming engine and Ajax requests-handling functionality to create web 2.0 components.
- **Ample SDK**, standards-based Ajax framework for Rich Internet application development
- **Bindows**, an enterprise Ajax framework, with Windows look and feel
- **DHTMLX**, a JavaScript library that includes a comprehensive set of user interface components and a special module for server-side integration.
- **qooxdoo**, is a comprehensive Ajax application framework. Leveraging object-oriented JavaScript allows developers to build cross-browser applications.
- **Smartclient**, provides a zero-install DHTML/Ajax client engine, user interface components and services, and client-server data-binding systems.
- **SproutCore**, designed to make desktop-like apps for the web
- **Wakanda Framework**, works on top of WakandaDB with Server-Side JavaScript, designed to build interfaces for desktop & mobile Web applications.
- **Webix**, an JavaScript framework for developing unique user interfaces with DataTable, SpreadSheet, Pivot, Kanban, File Manager, Scheduler widgets.

PHP

- PHP is an open-source, interpreted, and object-oriented scripting language that can be executed at the server-side.
- PHP stands for Hypertext Preprocessor.
- It is faster than other scripting languages, for example, ASP and JSP.
- PHP is a server-side scripting language, which is used to manage the dynamic content of the website.
- PHP can be embedded into HTML.