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Evolving Web Applications with AJAX - A Review

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ABSTRACT: Ajax is short-form of asynchronous JavaScript and XML. It is bundle of technologies that combined together to create new, dynamic, responsive and powerful web applications. Most of the giant internet-based companies such as Google, Yahoo, Microsoft and Amazon etc. are started developing web application based on Ajax. Even though major internet based companies working with Ajax, there is still ignorance about this technology among many developers. Many developers find it difficult to handle those bundle of technologies to build Ajax application.

This paper present an overview about Ajax. The term Ajax and related technologies are discussed here. Also working of Ajax technologies and basic idea of Ajax based rich web applications is discussed.

KEYWORDS: HTML, CSS, Asynchronous JavaScript and XML, Java Script Object Notation.

I. INTRODUCTION

The term Ajax (Asynchronous JavaScript and XML) was introduced by Jesse James Garret in February 2005 [1], [2], [3]. The term Ajax triggered interest in web developers' community. In [3] discussion about Ajax technology, its expansion, capabilities and shortcomings has been done.

Many popular existing web applications such as Gmail, Yahoo Mail, Microsoft's Live Mail, Google Maps, Google Autocomplete and many more Google services and applications are being developed on Ajax based web technologies, demonstrating the capability and usefulness of Ajax technology in real world web applications [2].

Ajax based applications have certain benefits over the traditional desktop applications. The reason behind this advantages is independent nature of Ajax applications. Ajax applications are mainly independent of: operating systems, particular plug-ins in browsers, virtual machine and do not require any additionally installation of any supporting software programs. To run Ajax application, user needs a modern browser and an internet connection only. Ajax applications give faster, responsive and rich user interaction experience. Due to these features Ajax is gaining more popularity among the internet users around the globe.

Rich and interactive web applications are replacing desktop applications, Google Docs is a very good example of this fact. Google Docs provides facility of writing document files, editing it, making and editing of spreadsheets through browser. Though Ajax applications are gaining popularity between net users, term Ajax is not clear for some developers or there are misconception about it such as it is new product, a new technology or any new kind of framework. Some previous papers discuss about Ajax, but not in depth to clear all ideas about it.

This paper discuss term Ajax in more detail and also talks about its working inside any web application in detail. This paper is structured as follows: Section II is about term Ajax and explains basic concept behind the term. Section III gives introduction about synchronous communication and its application in classic web development, also talks about the asynchronous communication used in Ajax web applications. Section IV gives view about technology integration to produce Ajax applications. Section V sheds some light on features of Ajax applications. Finally Section VI present conclusion about Ajax and evolving web applications.

II. AJAX

Ajax is not new framework, new technology or new programming language. It is a new way of thinking, designing and developing web based applications.

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Ajax is bundle of technologies, technologies that are standard and open source which support cross-browser and cross-platform compatibility [4]. These technologies are not un-matured, new technologies, instead these technologies are well tested, stable and widely accepted and applied.

These technologies are cascaded at different levels with each other to provide some specific functionalities that help to build new powerful web applications [5]. Technologies, programming languages and protocols that are include in Ajax are as follows:

1. HTML, XHTML, XML.
2. CSS
3. W3C DOM (document object model)
4. JavaScript
5. XHR (XMLHttpRequest object)
6. XML, XSLT, HTML, JSON, Plain Text.
7. XML, XSLT, HTML, JSON, Plain Text.
8. Server-side languages: JSP, JSF, Perl, Ruby, PHP, Cold Fusion, ASP, and CGI applications.

These technologies, frameworks and programming languages are not unique or new, rather they are very generic, open source and popularly used, with some exception in server-side languages such as ASP, Asp.NET and Cold fusion. The Ajax application is made up of different web technologies applied at different levels. This is easy way to understand the structure of Ajax and not by considering it as whole new technology or specific programming language. In summary, Ajax does not contain any unique technology or technique, instead it makes use of established technologies in such a way that it makes whole Aja application unique [6].

Ajax applications need not require any high end expensive developing tools. A simple text editor is enough to develop a rich Ajax web application.

III. COMMUNICATION TECHNIQUES

A. Synchronous Communication

Old classic web uses synchronous communication in most of applications. Synchronous communication is good for the static web applications. Websites giving read-only information is a good example of static web. But for more interactive, dynamic and responsive web applications, synchronous communication is not suitable. Traditional web applications interactions are based on a page sequence paradigm [7] and applications are based on a multi-page interface model [8].

In classic web application, generally user needs to send a request to server through some link or form, in case of synchronous communication system. In such systems, user has to wait till the server side processing. In some scenario, as a result of user query to server, a dynamic creation of contain in web page is necessary [8]. In such cases, a full page refresh is done to update the user-desired results. In all this process, user has to suffer from very unpleasant experience of broken connection till page updating. This make-and-brake of connection continues whenever user asks for any new piece of information in synchronous communication [2].

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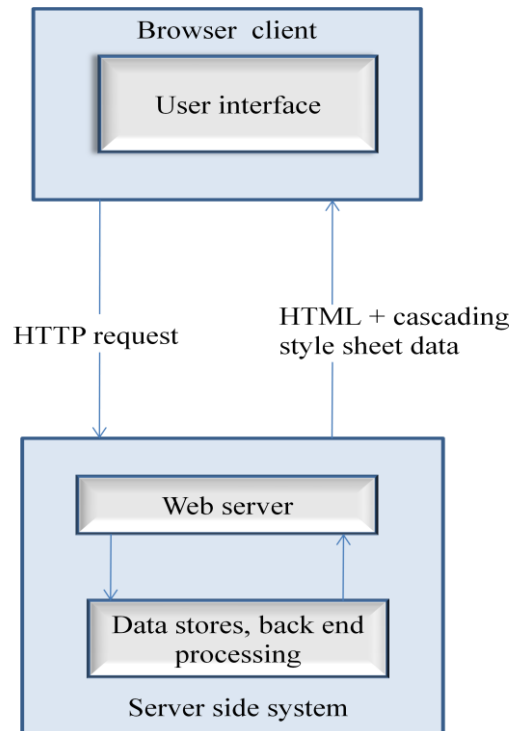


Fig 1: Working flow of traditional web application.

This pattern of request-wait-response pattern in classic web applications is extremely troublesome. It also lowers overall productivity [1]. The classic web application model has many drawbacks such as large response time that makes it sluggish, loss of states, usage of excessive bandwidth, less interactive nature of application and redundant data in transmission code which makes code heavy unnecessarily.

B. Asynchronous Communication

In asynchronous communication data can be transmitted intermittently instead of in a steady stream. The web application model in asynchronous communication is composed of independent and interactive web components, which can be created, updated, deleted and replaced independently [6]. Whenever user requested for new information, instead of loading complete web page or redirecting user to new web page, small updates has been done without interrupting user's interaction with website. These small updates are realized through small codes of XML driving through Ajax engine. There are four scenarios by which, an effect of asynchronous communication with Ajax engine can be seen. They are as follows:

1. User generates an even for Ajax engine:

In this case, direct request is sent to server. And while server is responding to query, user can experience some small updates. Unlike the traditional web applications, user does not need to wait for whole page to update, instead updates can be experienced in parts.

2. User generates a request and send indirectly to server:

In this case also, an even is triggered for Ajax engine and after that first scenario is followed.

3. User generates event, but does not send any request to server:

In this case, though event is generated by user, it is not necessary that it sends request to server. In such cases JS (JavaScript) can update component with the help of HTML, CSS and JS functions, with the help of data on the same page, without triggering any event for Ajax engine.

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4. Before user generating any even or request, Ajax engine sends a request to server:

In this case, Ajax engine sends request to server, prior to user triggered event. Because of this process, whenever user request for specific event, results load very quickly, giving very fast and uninterrupted user experience.

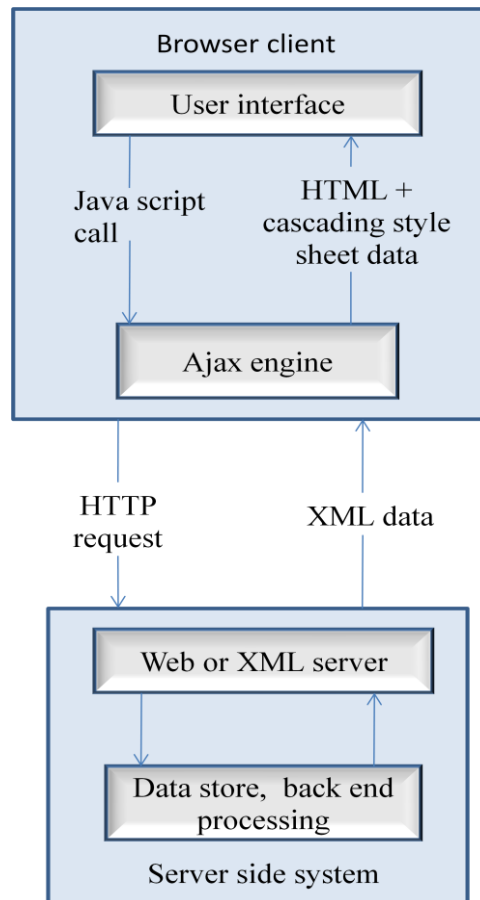


Fig 2: Working flow of web application using XML

Ajax engine adds asynchronous flair to the web application, by sending and receiving data from server side asynchronously. Due to this behaviour of Ajax engine, an undisrupted and fast responding web applications can be experienced. Even if, Ajax model adds extra level in web application module, it makes overall application more responsive and interactive, instead of slowing it down, like popular belief [3].

In seen in classic web applications, whole web page needs to be reloaded, on every user triggered event, Ajax eliminated this need-to-reload. Ajax also increases overall efficiency of web application, by providing updates of specific content that user asked for, rather than updating entire page. This process saves lots of data transmission, leading to saving of bandwidth usage. Due to this overall process becomes much faster and user experiences more responsive and richer interaction with web.

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IV. INSIGHT OF AJAX WEB APPLICATION

This section shed some light on working of Ajax inside in a web application. Client-side Ajax application is formed of three layers, first is user interface, second is JavaScript and third layer is of Ajax engine.

Out of these three layers, user interface layer is made up of XHTML, CSS and DOM. XHTML contains the data in the page, in different tags. CSS eliminates redundancy in page, separate contain inside the page and make it presentable, through different CSS rules. These rules are defined in separate file. Dynamic access of contain, its structure, style and its updating is done by DOM. When first layer's all contain is loaded on the client side, EventListener and XHR are created and stay active in the web page. EventListener is nothing but a JavaScript function which logs user generated events in web page. This function catches events, and if any event is requested for extra code to be executed, this function triggers that code/ JavaScript function. EventListener updates web page in two ways. In first case EventListener updates function/s, that are in terms update the page content, structure or presentation through DOM and CSS. In this case, no external request is sent to server and changes can be observed quickly. In second case, data is sent to XHR object, by EventListener when user triggered an event. This XMR object is browser based. It is created differently for different browsers. For Mozilla-Firefox and Apple-Safari it create XMLHttpRequest object, while for Internet Explorer it uses special class called ActiveXObject. Although structure of these objects are little different from each other, their functionality is same. The function of XHR object is to send request to server through HTTP/HTTPs protocol.

The processing of HTTP/HTTPs request sent by XHR object is reflected in changes in ReadyState property. This property is made up of five states: uninitialized, loading, loaded, interactive and completed [9]. The XHR object indicate each change in the state with a ReadyStateChange event.

In case of sever-side processing of any user or Ajax generated request, data validation is necessary. Whenever an event requested to access database, it is important to validate that request. This validation is done in many different ways, some of commonly known techniques are User-id password combo, access permission definition for every user etc.

After successful communication with database, it returns new data to web application, which then presented in specific user desired web application format. When data is received by web application, it sends response to XHR object. After that readystate property changes to complete state. Now, the XHR returns the response to JavaScript functions for parsing the content.

The data transmitted from server side is incorporated according to specific page structure. The page is then updated through DOM and CSS rules. This model optimizes the code and can be separated out with small JavaScript files having specific functionality defined.

V. FEATURES

Ajax changes the way of development in Web applications. Google maps presents huge interest by web developers, because it shows that Ajax is practical for real world applications. Recently, there are several researches about Ajax, but the more interesting is the application to research as in [6], and [9]. Now, we show some advantages and disadvantages of Ajax Web applications.

This section talks about some features of Ajax, its advantages, disadvantages and security parameters. Ajax ignited huge interest in web developers. It changes the way of thinking about web developing. Ajax very much practical and real time is shown by Google Map. There are much interesting and rich Ajax based web applications, some of them are discussed in [6] and [9]. Now let's see some features of Ajax:

A. Advantages:

1. Cross-Browser and Cross-Platform Compatibility.
2. Open source: Ajax is a unique combination of existing open source technology.
3. Minimize cost of development: Ajax application can be developed with just simple notepad.
4. Optimization: Code can be easily separately optimized in small parts.
5. Enriches user experience: Ajax applications provide more interactive, optimized, and dynamic web contain.
6. Fast: Ajax applications are faster than traditional web applications.

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7. Compatibility: Very compatible with existing technologies.

B. Disadvantages:

1. Complexity: More complex than traditional web applications.
2. JavaScript: More use of JavaScript for interaction.
3. Old browsers: More bulky and separate code for old browsers.
4. Internet explorer: Different code for internet explorer.
5. Coding: Adding extra layer to existing web model needs more coding.

C. Security

Ajax is combination of many technologies, which makes its security an interesting topic for developers and researchers. Very common and generic risk in Ajax application development is not knowing all the technologies used in Ajax building. By not knowing them, there is always risk of creating loop-holes or generating any vulnerability in the application.

The security issues of Ajax based applications are discussed in [10], [11] and in [13] its integration with web services is studied. The heart of Ajax is object XHR. XHR is based on JavaScript and that can cause trouble. Because JavaScript is visible client side browser. A mal-intentional person can edit that code and can be used to validation process. One of the major problem is in server-side, if there is no validation on data. In such case, there is great risk of exposition of vulnerabilities like SQL injection. Another problem is mal-practicing of programming. Sometimes programmer writes code for client side and includes validation process for server side. This problem becomes grave danger, when web application access many different servers for information and validation code is written on the client side. In such scenario, validation code should be on the server side, or for more security, validation code should be written on one server and then from the central server, other server validation should be done, instead of user interacting directly with other servers. The validation request sent by XMR is same as in case of common web applications. Validation and analysis of request to server is very important to avoid in mishap in security.

VI. CONCLUSION

Ajax web applications are future of web applications. As seen from above discussion, it provides very rich user experienced and have very little disadvantages or security issues. In the age of internet, where internet is becoming necessity of life, Ajax is changing the face of web as we know it. Google Docs is a very good example that Ajax is as much as fast or even faster than the desktop applications. With cloud computing and Ajax, there is fair possibility that it can replace desktop applications. Ajax is relatively young technology and there is lots of possibilities to research. Unquestionably, there are more challenges to face, more research to be done and richer web to be build. This is only beginning of new web era.

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