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Performance Comparison and Evaluation of Traditional Web-Technologies with AngularJS

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Abstract - The World Wide Web (WWW) is currently evolving with tremendous speed due to the advancement of new technologies. Starting from a means of exchanging information in the form of static HTML pages, WWW has now come to a stage where complex computational tasks are being carried out by the websites or web applications. This journey of WWW comprised of important technological involvements of different web technologies at different stages. One of such important web technologies is JavaScript. JavaScript enabled interactive and computational features in websites and web applications. Since its beginning JavaScript has changed drastically with the introductions of different JS libraries. jQuery was one of these libraries that significantly improved the performance of a webpage. However, recent introduction of AngularJS claims many benefits over traditional JS libraries. This paper considers AngularJS as a case study and evaluates its performance with respect to certain criterions and compares it with traditional frameworks like jQuery..

Keywords **- SPA, DOM, CSS, JSON, User Experience**.

1. Introduction

World Wide Web is rapidly evolving through the advancement of advanced technologies that provide added computational capability to the traditional WebPages. At the time of its inception WWW was just intended to perform the task of information exchange in the form of static web pages written with the help of tags to assign syntactical meaning to the information being interchanged. Later, the concept of CSS was introduced to give a uniform styling to multiple webpages easily. With the use of CSS websites now became more attractive. However, they didn't have functionality that could provide its users a means to interact with it. This problem was solved by the introduction of the JavaScript. JavaScript is a higher-level language that is particularly used in order to provide computational capability to the static web-pages. Thus, due to the use of JavaScript in the static web-pages websites now became more alive.[2]

The functionality of interactivity stands on the notion of the Client-Server Model where client asks for something and server serves it. In WWW client asks for information and server serves the desired information to the client. With the help of JavaScript client became capable of sending information to the server. JavaScript also enabled clients to manipulate the information sent by the server to analyze it.

This feature of JavaScript led to the development of advanced web-applications which are capable of fetching and manipulating large amount of data over Internet. This feature requires manipulation of HTML DOM (Document Object Model). Right from the JavaScript there came various methods for DOM manipulation to change the style and content of a webpage. However, there are many issues that need to be considered in order to make DOM manipulation easy.

DOM manipulation is an extra overhead for the programmers as they need to keep track of every element of the DOM. jQuery improved the DOM manipulation to much larger extent.[2][4] However, recent technological framework of AngularJS which is developed by the search engine giant Google promises many new features that jQuery does not support. AngularJS is intended to build Single Page Applications (SPAs) or the websites that run on the notion of SPAs. AngularJS is much more than just a simple JS library. It can be rightly referred as a client-side JavaScript Framework used to build Single Page Web Applications.[4]

2. Single Page Applications

Single Page Applications differ from traditional applications in the way they work. In traditional web applications the flow of process takes place as follows.

1. Browser initiates a requests to server
2. Server sends a webpage along with the respective assets (HTML and JavaScript)
3. Browser loads the entire webpage
4. User clicks on a link (initiates a new request)
5. Server responds with new webpage and assets
6. Browser loads up entire webpage again

Obviously, the layouts like this are not quite efficient. To tackle this problem, the concept of SPA was introduced. SPAs work as follows.

1. Browser initiates a requests to server
2. Server sends a webpage along with the respective assets (HTML and JavaScript)
3. Browser loads the entire webpage
4. User clicks on a link (initiates a new request and asks for the information that is only going to need to update the webpage)
5. Server responds JSON data
6. Browser loads the JSON data into the existing webpage to update it.

This mode of working significantly makes the processing faster and efficient thereby improving the performance of the page.

The increasing number of applications these days are building their own APIs. They do this to interface with the mobile applications. They might also do this so that other developers can build applications that communicate with their application. They might also build APIs to communicate with front end applications. SPAs can get advantage of this notion and communicate with such applications at the backend.

3. Mathematical Model

Let, Loading Time for the sample module developed in JavaScript, jQuery and AngularJS is L_{js}, L_{jq}, L_{ng}, respectively
Similarly,
Transition Time = $T_{js}\ T_{jq}\ T_{ng}$
Complexity of Code = $C_{js}\ C_{jq}\ C_{ng}$
Let, S_1, S_2, S_3 be the sets of criterions to measure performance of web technology.

$S_1 = \{ L_{js}, T_{js}, C_{js}\}$
$S_2 = \{ L_{jq}, T_{jq}, C_{jq}\}$
$S_3 = \{ L_{ng}, T_{ng}, C_{ng}\}$

The project finds out the result that,

$$S_1 > S_2 > S_3$$

4. jQuery vs AngularJS

This paper aims to compare the AngularJS with jQuery on the basis of certain criterions.

4.1 Size and Complexity of the code

The size of the code built using AngularJS is quite less than that of jQuery. This is due to the advance methods AngularJS incorporates to avoid the complexity of DOM manipulation. This is the thing where jQuery lags behind as it made it necessary for its user to keep track on DOM elements in order to manipulate it. AngularJS provide DOM manipulation through a new technique of Data Binding. For that purpose it uses its own concepts of Directives and Expressions. In this technique user need not keep track of DOM elements which was in the case of jQuery.[4][7]
Ex.

```
<!DOCTYPE html>
<html>
<head>
<script src="https://ajax.googleapis.com/ajax/libs/jquery/1.12.0/jquery.min.js"></script>
<script>
$(document).ready(function(){
    $("#btn1").click(function(){
        $("#test1").text("Hello world!");
    });
});
</script>
</head>
<body>
<p id="test1">This is a paragraph.</p>
<p>Input field: <input type="text" id="test3" value="Mickey Mouse"></p>
<button id="btn1">Set Text</button>
</body>
</html>
```

Fig 1.1 Code to Manipulate HTML elements in jQuery

```
<!DOCTYPE html>
<html>
<script src="http://ajax.googleapis.com/ajax/libs/angularjs/1.4.8/angular.min.js"></script>
<body>
<div ng-app="">
<p>Input something in the input box:</p>
<p>Name : <input type="text" ng-model="name" placeholder="Enter name here"></p>
<h1>Hello {{name}}</h1>
</div>
</body>
</html>
```

Fig 1.2 Code to Manipulate HTML elements in AngularJS

4.2 User Experience

User experience is the important criterion that determines the success of any technology. AngularJS clearly proves to this in case of Web Applications or the websites that run

on the notion of manipulation of information, typical example of which is an ecommerce portal (Paytm). .[4][7]

4.3 Loading Time

As AngularJS is not just a JavaScript library but a client-side JavaScript Framework it provides much more features than that of jQuery. It makes the transition from one link to another, over the webpage, easy. This reduces the loading time of the page. .[4][7]

4.4 Security

AngularJS hides the actual structure of URL of the page in the browser, so that the client gets no idea about the directory structure at the server where the data resides. This increases security of the data over the server. .[4][7]

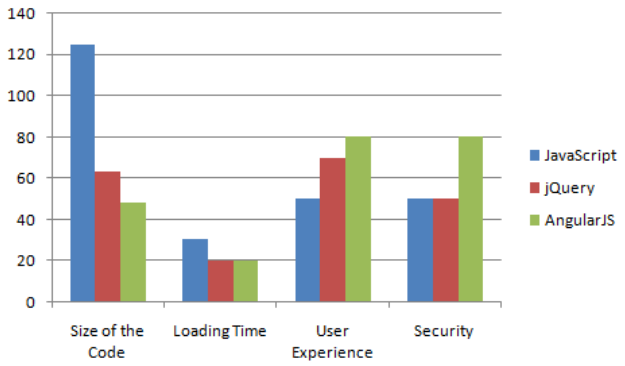

Fig 1.3 Performance Comparison of JavaScript, jQuery and AngularJS

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5. Conclusions

Thus it can be concluded that the AngularJS is more efficient than the existing client-side web technologies like JavaScript and jQuery. However, the area in which AngularJS gives the best performance is SPA (Single Page Applications) and not simple Websites.

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