Evolution of the Single Page Application in the modern web application development

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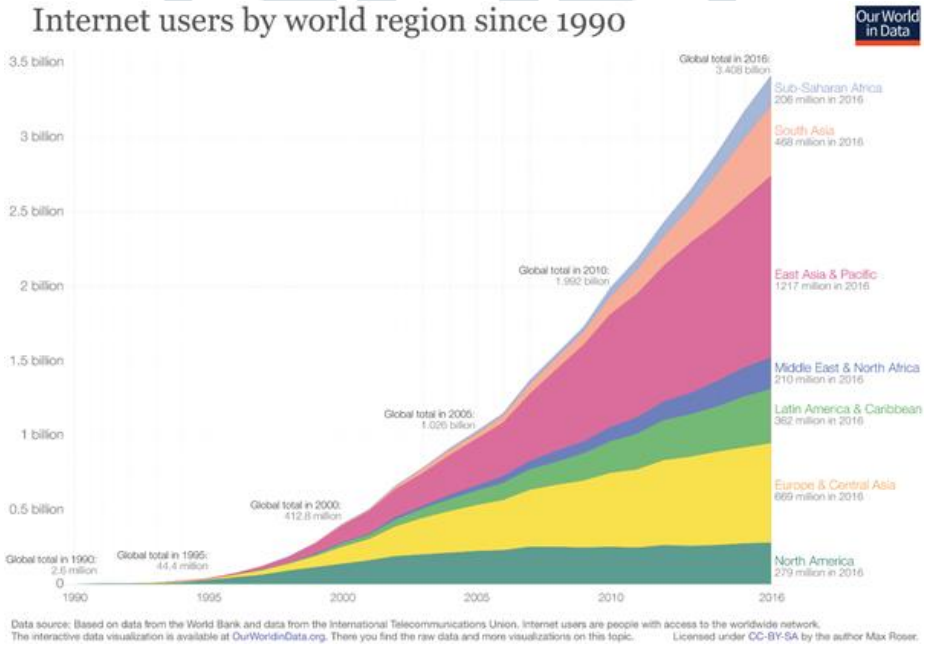
Abstract : The rise of cloud computing and availability of high-speed broadband internet connection helped lot reaching out people through websites and web applications. Cloud services like Platform as a service (PAAS), Infrastructure as a Service (IAAS) and Software as a Service (SAAS) are simplifies the software development easier. Because of the cloud, the web is available to be viewed from anywhere in the world, which makes the information collected through the website at any time. Nowadays modern applications are migrating towards Single Page Application (SPA) model. By adopting this approach the web applications can work like a desktop application, it works inside a browser and does not require reloading buffer time. The limitations and advantages of the Single Page Application (SPA) model and trends in modern web development are analyzed.

IndexTerms **- Single Page Application, SPA, Modern Web Development, Multi Page Application.**

I. INTRODUCTION

The history of web development began when Tim Berners-Lee proposed World Wide Web (WWW) in 1989. He had specified the three fundamental technologies that remains the foundation of web, which are Hypertext Markup Language (HTML) which is publishing format of the web, Uniform Resource Identifier (URI) which is kind of address that is unique to each web and Hypertext Transfer Protocol(HTTP) which is a protocol that allows retrieval of linked resources from across the web. Since then, the web has changed the world. Because unarguably it became the most powerful communication medium. Tim Berners-Lee and others realized to reach its full potential the underlying technologies must be global standards, else the proposal would have implemented into the web client specific. So, Tim Berners-Lee founded World Wide Web Consortium (W3C) whose vision is to standardize protocols and technologies used to build the web to be available to everyone. The Web foundation supports the work of W3C to ensure that the web technologies that underpin it remains free and open to all. Web Development was not a linear progression of technologies where one technology was unilaterally replaced with newer better technology.

The chart below shows how the internet is changing the way we work, spend our leisure time and communicate with one another. According the data [2], it is estimated that the number of internet users worldwide reached 3.4 billion in 2016. World Bank data also confirms in the world's total population, internet user found per 100 members.



II. EMERGENCE OF WEB TECHNOLOGIES

The web is inherently a decentralized place with everybody each doing their own thing with their own mix of technology choices in order to improve the visualization and performance in mind. Early on many web pages were just static HTML pages edited by hand and served up by web servers without any real changes being made. During this time the web design began to incorporate background images, graphic elements, real-time visitor's counts and animated GIFs. Because of the addition of the graphic elements in the page, the performance issue arose and started the need for dynamic web in which the page contents to be updated instead of static contents.

2. 1. JavaScript and AJAX

JavaScript is a client-side scripting language which is influenced by Java Programming Language that lets web developers to design interactive sites. The source codes are executed by the client's web browser rather than the server. In 1999 Microsoft created AJAX to enhance the performance of the web browsers. In 2006, AJAX became Web Standard.

2.2. Cascading Style Sheet (CSS)

Cascading Style Sheet (CSS) is the language that is responsible to describe the presentation of the Web Pages, including colors, layouts and fonts while HTML contained the text. CSS ensured that the page loads faster and easy maintenance.

2.3. Responsive Design

In 2004, when google released Gmail, responsiveness got more attention. The responsiveness achieved through, AJAX, JavaScript.

2.4. jQuery

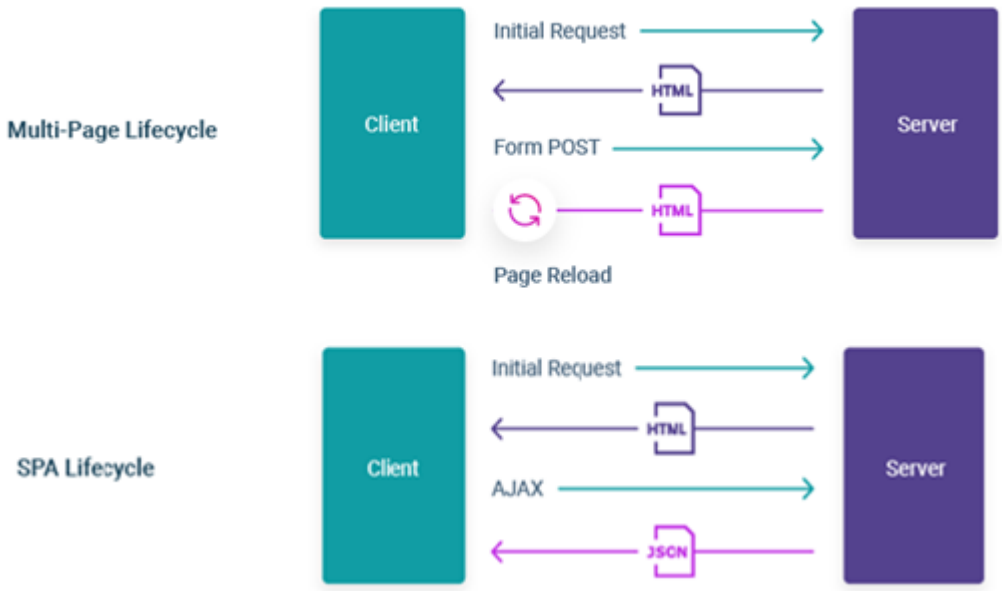
It is a light-weight JavaScript library which is created to easier the JavaScript code which the way of writing the JavaScript code.

2.5. Web Fonts

Web fonts is the technology that enables people to use fonts in the page without requiring installation in the local machine. Prior to this technologies, the recommended fonts needs to be downloaded in order to view the page.

III. SINGLE PAGE APPLICATION MODEL (SPA)

When Apple released its App Store in 2008 which offered third-party developer to create apps to be downloaded, was the game changer for JavaScript frameworks to evolve single page application approach in order to reduce the content and improve the performance. By this approach web application interacts with the users, dynamically rewriting the content in the same page instead of loading the new page. This moves the logic from the server to the client which is a web browser. SPAs are serving an outstanding UX Performance because, it doesn't require to reload, so content loading time is reduced. SPA model can be adopted by using JavaScript Frameworks like Angular, meteor.js, Knockout.js, ExtJS, Ember.js, Vue.js, React.



The architecture of Single-page application created such a way that, when you navigate to a new page, the content of the page alone get updated. So, the application can work likes a desktop application. It is also providing high-speed development because of the readily available libraries and frameworks. By adopting this approach, it makes front-end developer and back-end developers to work independently.

IV. DECISION TABLE – TRADITIONAL WEB OR SPA

The below table conveys the use cases for adopting the Single Page Application or Traditional Multi Page Application.

Traditional Multipage Approach	SPA Approach
• Client side requirements are simple and most of the contents are ready only.	• Application required to expose rich user interface with many features.
• Application needs to function in browsers without JavaScript support.	• Already available exposed APIs either internally or public. Because client is going to consume the content and rewrite the content.
• When the team is totally unware and unfamiliar with JavaScript or Typescript development techniques.	• When the team is really aware of the techniques and frameworks.
• Better Search Engine Optimization (SEO)	• Support of different platforms like mobile Apps, web App

Table1: Traditional Web vs SPA selection strategy.

Gmail, Facebook, Netflix, Instagram, LinkedIn are created using Single Page Application Approach.

V. DATA ANALYSIS

To validate and confirm the usage data of the Single-page Application Approach, I performed two types of validation and generated the report. One is getting google trends report is against the topic "Single-page application", the given Figure 3, shows about the trend. Another method is checking the tag trends in the popular Stack Overflow question and answer site. To search, I have used the SPA frameworks like Angular JS, Angular, React JS and jQuery for data benchmark. By this term, Figure 4 is generated. By these approaches and the data, we arrived shows very clearly that the developers are actively working in the SPA related code bases, because of which the search trend is popular still.

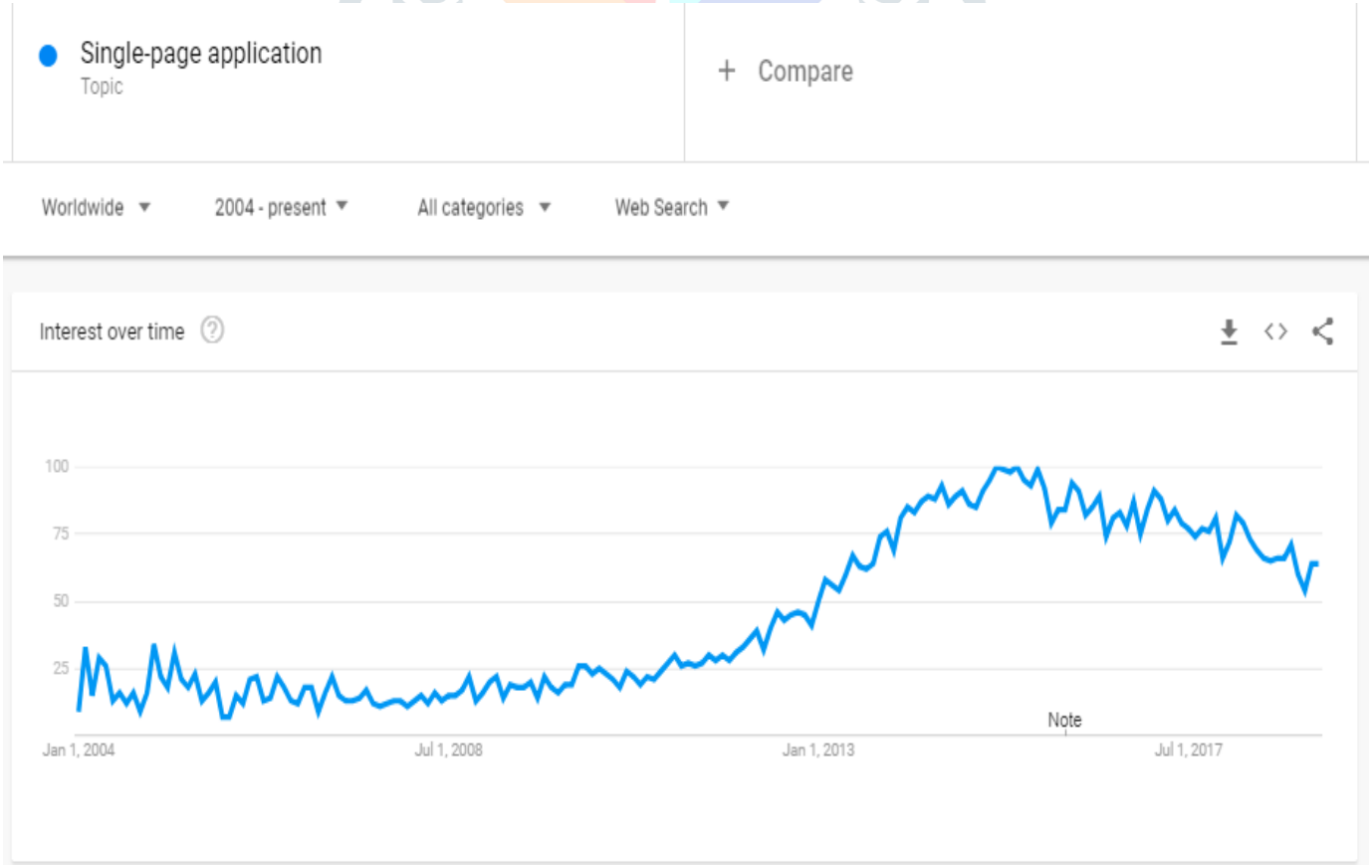


Figure 1 Google Trends for SPA Approach [4]

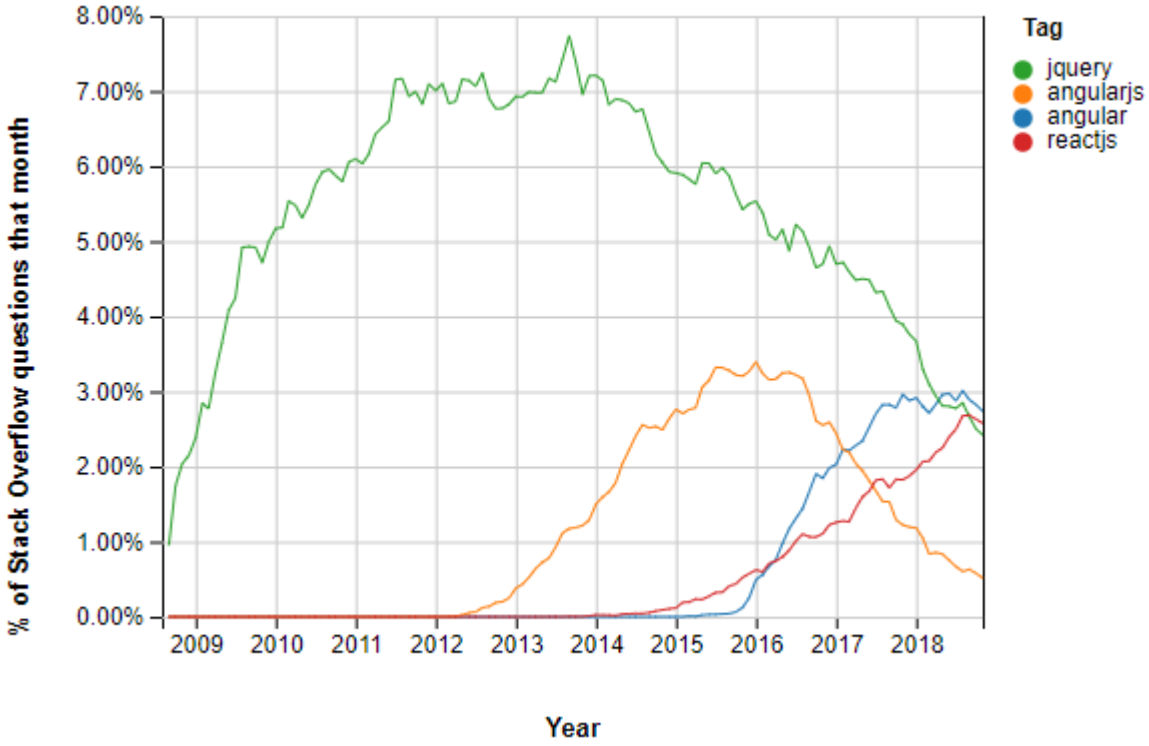


Figure 2 Stack overflow Tag Trends [3]

I have also searched in the job portal monsterindia.com to confirm the job demand for the technical skills like React, Angular, Ember, Vue.js, jQuery. To confirm the data, I paired searches with keyword "Software" along with the technical skill. To strengthen the chance of relevance, multiplied by approx. 1.5. Because this is the rough difference between the programming jobs listing that we used the word "Software". All the results were sorted by date. Thought the result may not be 100% accurate, it is ok to populate the approx. tends. Figure 5 image is generated against the data.

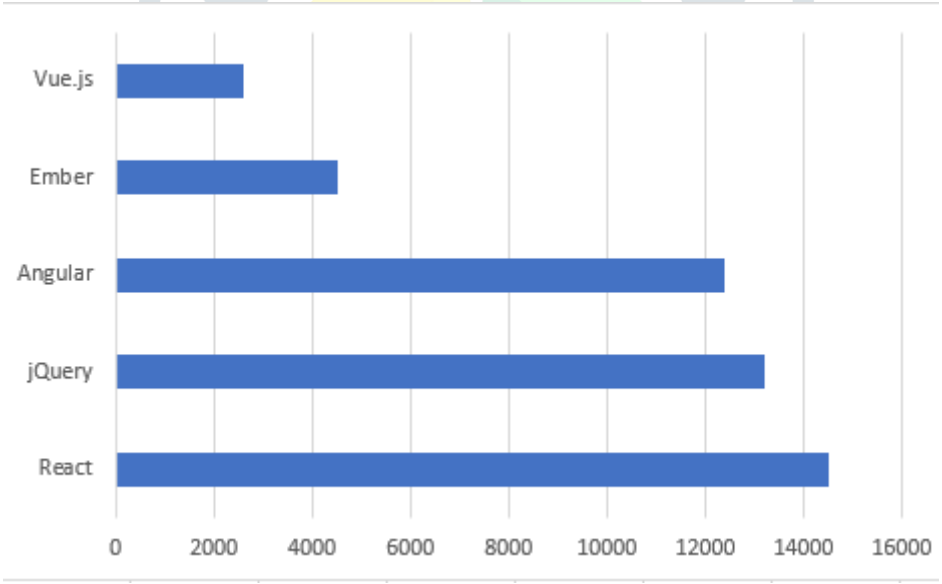


Figure 3 Technical Skill Trends in Job Portal monsterindia.com

VI. Conclusion

Analysis data confirms that the SPA is still topping the trend as well as in the job requirement portal. The study also confirms that because of the advantage over the traditional multipage applications in terms of performance and multi-app development support, Single page Application still ruling the web application development. Though the SPA approach is widely adopted, it lacks in the Search Engine Optimization (SEO). You cannot ignore the fact that indexing is not performed for the web pages, as it is rendered dynamically. So further studies can be performed in the SEO related area.

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