

A Survey on E-Commerce Websites as Single Page Applications

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Abstract – The world of web technologies is complex and frequently changing. In the recent years, the rise of JavaScript has led to the growth of several frameworks which have changed the way web development is done. Single Page Applications are an important part of this trend. Single Page Applications are JavaScript based websites that are starting to appear everywhere on the internet. This has been possible because of the availability and constantly increasing capability of JavaScript frameworks. Single Page Applications are very different compared to traditional websites because they can update their content dynamically without requiring page refresh. This peculiarity helps modern web developers provide unique user experiences on the internet. This, along with powerful frameworks helps make their adoption easy. The increasing penetration of internet is now influencing every aspect of our lives. People now do almost all things online and this is why it is important to know about modern web development trends like these. This paper gives insights about Single Page Applications and their application to the field of E-Commerce.

Key-Words: Single Page Application, E-Commerce, JavaScript, Web Development, Multi Page Application.

1. INTRODUCTION

The world of web technologies is complex and ever changing. One such technology that is quite fascinating is Single Page Applications or SPA. Single Page Application is a website or a web application that changes its content based on user interaction, without requiring the browser to refresh. This is what differentiates them from other websites that require the browser to load a new page every time the user interacts with the website. Such sites are called Multi Page Applications, and it has been the go to approach for designing and developing websites for many years.

The reason why developers and businesses are leaning towards Single Page Applications nowadays is because of the rise of JavaScript on the web. The ever increasing popularity of JavaScript has led to the development of several JavaScript based frameworks and libraries whose primary aim is to make web development more efficient by allowing code reusability, streamlining the development process and also code maintainability.

1.1 Single Page Applications

It is possible for Single Page Applications to display required content without requiring the browser to reload the page because of JavaScript based frameworks and technologies like AJAX, Angular, React etc. and extensive use of client side processing[1]. JavaScript is the most popular programming language and there are many frameworks and libraries based on it. Because of this, developing Single Page Applications has become significantly easier for developers [2].

Single Page Applications allow the user interaction to stay uninterrupted and makes the website feel like a native application. There are many popular websites that are Single Page Applications like Google Maps, Gmail etc. Single Page Applications feel faster to the user and provide a great user experience.

Because SPAs make extensive use of JavaScript, they are dependent on client side processing. This would have been an issue in earlier years when the client side processing power was limited. Modern computers are powerful enough that they can easily perform extensive client side JavaScript processing. This helps the developers to reduce the load on the server and offload most of the processing to the client.

SPAs also require more time for initial load because the necessary components that drive the logic that displays the content has to be loaded. This is done only once, when the page is loaded the first time. In recent years, this would have been an issue but it is not so much now because of increased internet speeds.

The Single Page Application approach also helps when working in teams. The backend team can focus on the backend while the frontend team can focus on creating rich user experiences using the backend API. SPAs are also easy to convert into Progressive Web Applications which can then be deployed on any platform without much hassle thus saving time and resources for the development team [3].

All of these benefits must mean that every new website should be a Single Page Application right? But that has not been the case. Despite a good number of sites being Single Page Applications, there are a few areas where they are not being used as much.

1.2 Online Services and Single Page Applications

Nowadays, all the services that we use daily are being made available online like making payments, reading books, watching TV shows, etc. Even the applications that we have been using on our computers now have cloud based versions. This creates the need for developers to focus on delivering great user experiences along with delivering the necessary functionality. This means that the web applications that users interact with should feel as responsive as their native versions.

This is also true for E-Commerce, one of the most used and important part of the internet. E-Commerce sites need to focus on providing the best user experience on their websites and applications on mobile platforms. They have to make it easy for a customer to buy products hassle free without too many clicks or interactions. This is why being a Single Page Application would be a good way for an E-Commerce site. But it is not the case and we will see why.

2. E-COMMERCE INDUSTRY

E-Commerce has seen a tremendous amount of growth in the recent years and because of this, many new businesses have also started selling goods online [4]. This is especially true in the case of countries like India. Some of the most popular websites like amazon.com, newegg.com etc. are Multi-Page Applications. Some websites like flipkart.com which is one of India's largest e-commerce site is a single page application. Amazon.in which is amazon Indian counterpart is a relatively new entrant to the Indian e-commerce market and it too is a Multi Page Application [5]. The following figure shows the growth of e-commerce websites over the years according to revenue:

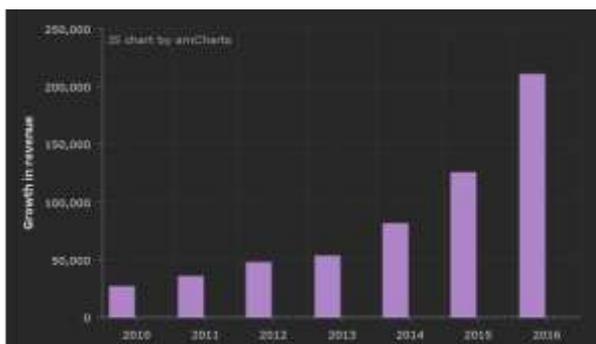


Chart -1: Growth of E-Commerce Industry in India

Based on the above graph, it is clear that the e-commerce industry in India is experiencing a boom. This creates a demand for E-Commerce websites and applications.

2.1 Technical Aspect of E-Commerce

E-Commerce websites rely on visibility and brand recognition for getting business. They gain visibility from advertisements via social media, newspapers, television

and SMS. A website with a higher level of visibility is likely to make more money than its competitors. When a person looks up a product online, it is possible that they may get an advertisement related to the product or they may get search results that link directly to the product on some e-commerce website. This is a very important way for e-commerce websites to get customers.

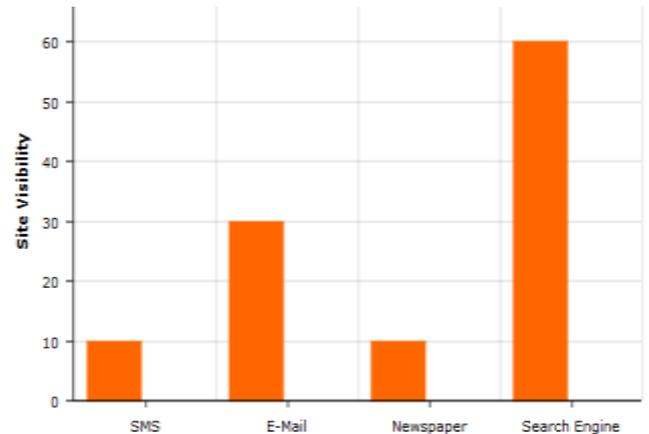


Chart -2: Effectiveness of SEO

This is possible because of Search Engine Optimization. Search Engine Optimization or SEO is the process which affects the online visibility of a website and it is a very important factor that e-commerce websites have to take into account. There are many factors which dictate how an e-commerce site will be ranked. Some factors that affect site visibility are the degree to which a web crawler can crawl through the site and the keywords used [7].

This is where Single Page Applications fall short. The reason behind it is that Single Page Applications are developed using JavaScript. When a search engine crawler indexes pages like this, it cannot index them correctly. This is actually the limitation of the crawler, not the webpage. But because a small number of websites are Single Page Applications, they cannot be held at fault.

Another area where Single Page Applications fall behind is initial loading times [6]. This is a very important thing for e-commerce websites because a user may get displeased that the site is not loading and may leave the site thus leading to a loss for the site. In Single Page Applications, the rendering logic is shifted from the server to the client. This is why SPAs take longer loading times because all the logic necessary to render the view is to be loaded first.

An example of Initial Loading times for a SPA can be seen as follows:

Website name: flipkart.com

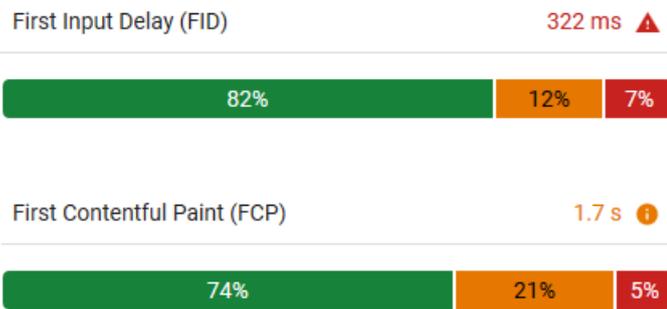


Fig -1: Analytics from Google Pagespeed

These results have been provided by Google Page speed Insights which is a tool that developers can use to find out how they can optimize their sites. These results show us that a significant time is used for loading the page while the user is not displayed anything.

Another area where SPAs fall behind is the bandwidth required for loading the content. Because all the processing logic has to be loaded on the client, they require faster connections which is not the case with Multi Page Applications where every page is rendered by the server.

Another important benefit that SPAs bring is client side rendering. Client side rendering reduces the load on the server by executing the logic on the client's hardware. This diagram shows this process:

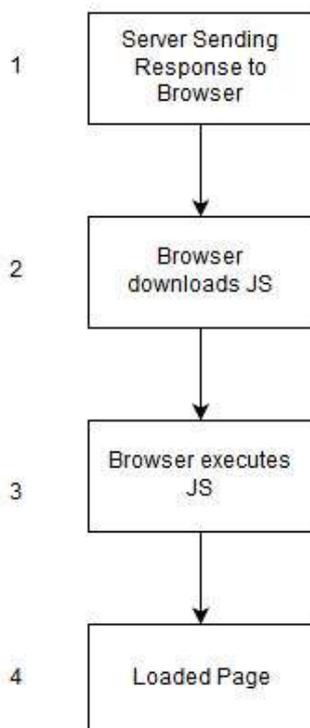


Fig -2: Client Side Rendering in SPA

The above diagram represents the client side rendering process in a Single Page Application. Although client side rendering helps to reduce the processing work a server has to do, it increases the client's work. This may prove to be a problem depending on the client. The client may be a computer with enough processing power available to render the website properly if it does not, then rendering the website may end up requiring more time and this affects the user experience negatively.

E-Commerce websites have to be lightweight enough that they can be provided on any platform and device. So, single page applications lose out here.

The solution to client side rendering is to implement server side rendering which does involve more work[8], but it allows the e-commerce site to reap other benefits of SPAs. The following diagram shows how server side processing works:

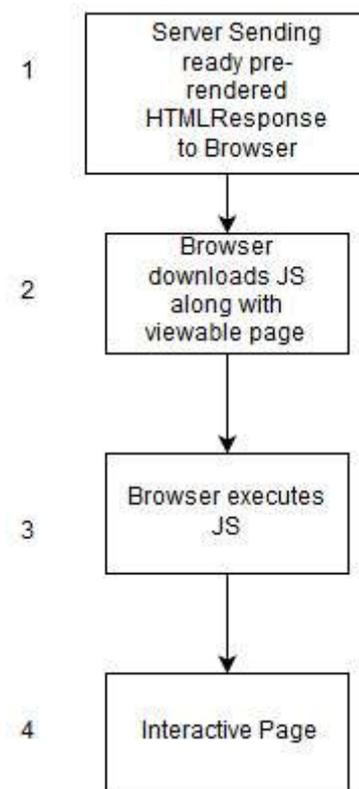


Fig -3: Server Side Rendering in SPA

Although solutions like these to the above mentioned problems do exist, they reduce the effectiveness of designing and deploying Single Page Applications. Some examples are to develop an HTML version of the site that is only for use by web crawlers. This would help boost the SEO for that site but it would increase development costs and efforts.

Regarding initial load times, Single Page Applications can be designed to cache data that would gradually speed up

the load time for the site. This is not that effective because if a user is not visiting the site because it loads slowly, chances are the user will not visit the site again.

These issues coupled with the costs of their solutions are what prevents companies from switching over to Single Page Applications. Benefits that the SPA approach brings like less server load, great user experience etc. are outweighed by the limitations like SEO which are necessary for e-commerce sites to conduct business.

However, there are e-commerce websites that are SPAs. They use different technological approaches like using a No-SQL(No Structured Query Language) database to provide content to the users and use SQL (Structured Query Language) databases for order processing.

Such approaches do exist, but they are not very common. It is because of the challenges involved in developing them.

3. CONCLUSION

We can conclude that based on the limitations put forth before, Single Page Applications are not frequently in use in E-Commerce scenarios. They are typically found in scenarios where search engine optimization is not necessary for the user to come to know about the site. However, their limited use does not mean that they are completely absent. They are used by some E-Commerce companies and there is a possibility that the rate of adoption may increase with time. Single Page Applications provide us with an new, powerful way to bring rich, engaging user experiences and the increasing popularity of JavaScript means that we will soon start to see more SPAs in the future.

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