Comparison study of web browsers based on performances

Abstract*-- Everyone should have access to information in this age of globalization and modernity, and the Internet serves this purpose primarily. The entrance to the Internet is a web browser. Through the browser, you can experience the web. Web browsers serve as a conduit for accessing internet capabilities and assist us in browsing various websites for daily needs, making even the most challenging activities easier. Given the variety of choices, choosing a web browser can occasionally be challenging. Most consumers lack information while choosing a web browser. In this paper, we discuss developments in the web browser industry. We will talk about the importance and usefulness of well-known browsers like Google Chrome, Internet Explorer, Mozilla Firefox, Opera, etc. because they are so important in the world of the internet. Based on how well they function in various user environments, we will also assess the performance of web browsers. Over the previous ten years, we have observed numerous variations in various web browsers' versions, and we will also talk about how browsers have changed over time. This article will provide users with the necessary information and assist them in selecting a web browser.

Keywords—Internet, World Wide Web, web browser, gateway, web experience, CPU Utilization, Disk Usage, Users Response Time.

I. INTRODUCTION

Global internet usage has increased dramatically because of technological improvement. The World Wide Web serves as a platform for consumers to explore the almost infinite services now available on the Internet, which has proven popular. The Internet is a global network of interconnected networks, whereas the web is a service that runs on it. A software program called a web browser is used to access data on the Internet. A web browser is a piece of software that makes queries to a server to get the data it needs to show. It navigates between numerous web pages on the World Wide Web and displays texts, multimedia, and other content. The user can download useful info with its aid. It also caches the data and is then useful when opening the same web page again which makes browsers an integral part of web browsing.

Web browsers have significantly improved over the past ten years to provide users with the capabilities they need for effective information retrieval. A person can tell that a certain browser is different from the others while they are using it to access a website. Opera, Mozilla Firefox, Google Chrome, Safari, and Internet Explorer are the most popular browsers. To increase their quickness, security, and adaptability, browsers are updated frequently.

II. BACKGROUND

It's interesting to note that the number of key companies in the browser market has increased from just one in 1990 to at least ten in 2015. These consist of, among others, Mozilla, Opera, Safari, Google Chrome, and Microsoft Edge. Additionally, the number of internet users has multiplied at the same time, requiring the development of mobile versions of web browsing programs. As a result, several mobile browsers, including Mozilla Firefox, Opera Mini, Google Chrome, and Safari, have been developed.

The first graphical browser created in 1991 by Tim Lee, Worldwide Web—later called Nexus—started the history of web browsers. When Mosaic was introduced in 1993, it set the standard for GUI features for browsers that came after it. After being established in 1994, Netscape produced Netscape Navigator, the first commercial web browser. With the introduction of Internet Explorer, the technological behemoth Microsoft entered the browser market. Later in 1996, Telenor, the biggest telecom provider in Norway, made Opera available to customers to gain market share for mobile platforms. In the world of browsers, 1998 marked two significant turning points. On the one hand, Netscape went open source by disclosing the source code of Communicator, and on the other, the company launched a new project Mozilla. When IE attained a 95% market share in 2002, Microsoft's Internet Explorer put an end to the browser competition. Apple's entry into the browser market with Safari was a trend-following move. With the release of Firefox 1.0, which was used by 7.4% of browsers by year's end, the second browser war began in 2004. When IE 7 was introduced in 2006, it incorporated numerous features from Firefox, an open-source rival, including tabbed browsing. When Google released Chrome in 2008, it was a revolution that fueled the browser war. After a strong first year, Chrome had more than 50% of the user base by the end of five years.

III. ANALYSIS AND DISCUSION

Numerous tests were conducted on several browsers, which were taken into consideration. These various metrics produced a variety of findings that identified the top browser in each of the parts.

In this section, we will compare the three most widely used browsers, Google Chrome version 30, Mozilla Firefox version 18, and Internet Explorer version 11, on a computer running Windows 8.1 with an Intel i5 quad-core processor.

SECTION A. CPU Utilization

The percentage of the CPU cycle that is used by a certain process is known as the CPU usage rate. The amount of time the CPU spent waiting for an I/O operation can also be calculated from this time. This can be viewed as one effective way to monitor the load that browsers put on the CPU when running processes.

The CPU usage to open the web browser and the website is tested for all three browsers using http://www.google.com as the home page. No other primary processes were running during the

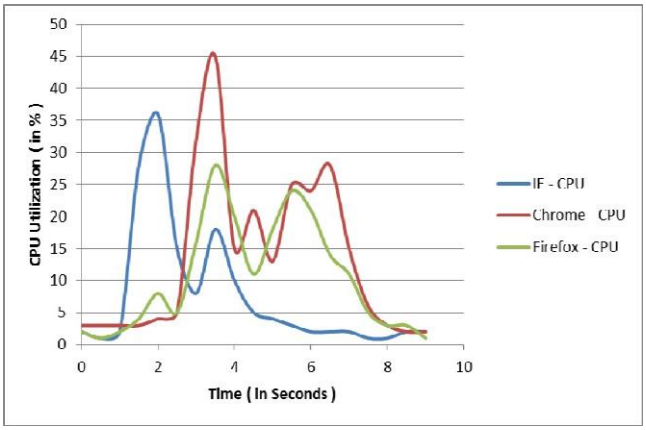
testing, and the observations were made after confirming that the CPU was stable with 1-2% CPU Utilization over a sizable period.

In the first example, using Chrome, we discovered that it first consumes a lot of CPU cycles and thereafter has multiple oscillations before being steady over an extended period of time.

The next browser is Firefox, which doesn't initially use up many cycles but does so as it begins to load the essential web page.

In the beginning, Internet Explorer uses some CPU cycles, but this quickly becomes stable as the browser and the web page open quickly. As a result, Internet Explorer proves to be more efficient, using an average number of cycles in a single take and utilizing them effectively to complete the necessary tasks.

When we plotted all three browsers on a single graph, we saw that Chrome had the highest peak as it used the most CPU cycles, whereas Firefox used less CPU at any given time but had a higher average CPU usage than IE and Chrome. Compared to Internet Explorer, which first uses a typical CPU cycle before quickly stabilizing. Because IE completes all activities in fewer average CPU cycles and loads pages faster, it is more efficient when we look at average CPU utilization.



Hence, we can conclude our results as:

1) Internet Explorer
2) Firefox
3) Chrome.

SECTION B. Disk Usage

The browser consumes the hard drive for the duration of operation by using disk space when it first launches.

We see that at the initial setup, Chrome uses up a lot of disk space.

Firefox, on the other hand, uses far less space than Chrome and doesn't put the entire load on the disk at once, making it simpler for the system to allot disk space for the initial startup. In the third scenario, Internet Explorer utilizes a lot of disk space, but it does so in patches of small disk space requests and allocations, which reduces the overall load on the system but prolongs the time it takes for the disk utilization process to be completed.

It is clear from the fact that Firefox uses RAM effectively while Chrome and IE consume a lot of disk space.

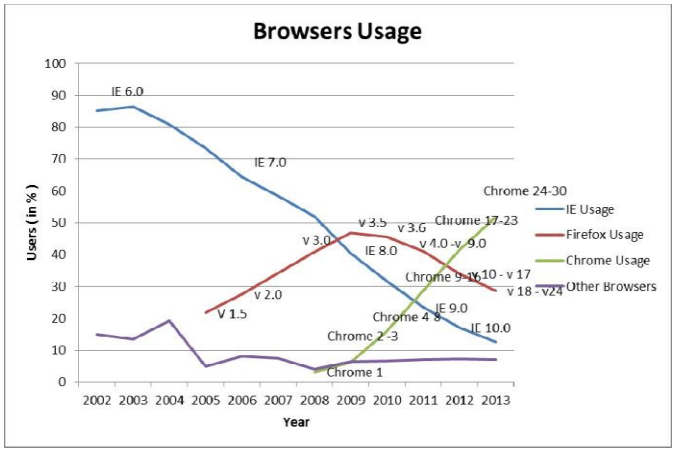
Hence, we can conclude our results as:

1) Firefox
2) Internet Explorer
3) Chrome

SECTION C. Browser Usage

The evaluated graph that shows the percentage usage of the various browsers is plotted. The year when various browser versions were introduced is also shown in the graph on the other side. When compared to its 2002 start, Internet Explorer saw a significant drop in usage percentage, while Google Chrome saw a sharp rise in usage as each new version added more functionality.

On the other hand, when Firefox was first released, it quickly surpassed Internet Explorer in terms of user base. However, once Chrome entered the fray, Firefox's user base also shrank.



Hence, we can conclude our results as:

1) Chrome
2) Firefox
3) Internet Explorer.

SECTION D. Multiple Tabs Performance

When a browser must manage several tabs, it is put to the actual test. Therefore, we employed a script that instantly launches browser instances of 20 of the most widely utilized websites. Every 1.5 seconds, a new tab with one page is automatically opened.

Because Firefox employs a single process to handle all data, unlike Chrome, which uses a multi-process paradigm where a new process is initiated for each open tab, Firefox has produced better results.

When there were more than 10 open tabs, Internet Explorer began to lag.

Hence, we can conclude our results as:

1) Firefox
2) Chrome
3) Internet Explorer.

SECTION E. HTML5 and CSS3 Support

Based on the features it offers and supports, Google Chrome receives 503/555 scores from html5test.com, compared to Mozilla Firefox's 447/555 and Internet Explorer's 377/555. The investigation reveals that Chrome receives the highest marks for form components because it offers practically all functionalities. When compared to the other accessible browsers, Chrome offers the most support for CSS selectors and other characteristics. On the other hand, because it builds data dictionaries, Firefox is renowned for its support for microdata.

Hence, we can conclude our results as:

1) Chrome
2) Firefox
3) Internet Explorer.

Because Chrome has an integrated email feature with Google services, it is evident that many users prefer it as their main web browser. It offers an easy-to-use UI. Internet Explorer and Mozilla Firefox are both inferior to Google Chrome. IE's interface features too many options and actions, which gives the impression that it is sophisticated. Chrome is the best option for benchmark tests. In terms of memory use, graphical user interface, ease of use, and diversity of functionality, it also performs quite well. The best browser is Google Chrome, which is followed by Mozilla Firefox and Opera. Their different market shares also show this. A browser gains favor with web users by offering more effective security features. We can get the conclusion that Firefox is the most private browser, whereas Chrome is the most secure. Opera is renowned for its privacy and security features. The most safe and private browser is Firefox, which is also available for all platforms and operating systems.

IV. CONCLUSION

We attempted to compare the performance of contemporary browsers in terms of speed, ping response time, compatibility with contemporary web technologies, and ease of use. We discovered that because the web is developing daily, browsers must be updated to function properly on the user's computer. Each browser shows both strengths and weaknesses in particular areas, and we are only able to compare each of them. Chrome provided the most support for HTML5, CSS3, and other web technologies; yet Firefox proved to be the most effective browser when using multiple tabs.

In summary, everything relies on the people and how they utilize their browsers. We discovered that Firefox is highly effective for web application developers. The analysis of Chrome's response time and problems demonstrates both its advantages and disadvantages. When a user is more concerned about making use of the system's resources, we can declare the relevant consumption of Internet Explorer in terms of CPU usage.

The best browser, however, will always depend on a user's specific requirements and priorities as they relate to internet navigation.

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