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Research and Performance Analysis of HTML5 Web Socket for a Real-time Multimedia Data Communication Environment

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Abstract. Recently, with the advent HTML5, the performance of Web service has improved. It was difficult to configure the web services using only HTML. However, communication between the client and the server is now possible because of HTML5. HTML5 has many new features. One of the most powerful features is the WebSocket. The WebSocket aims to solve the problems of the conventional communication method, though it has several restrictions. Therefore, in this study, experiments were conducted to measure the performance analysis of WebSocket. We conclude by presenting the direction of future research in this field.

Keywords: HTML5, WebSocket, Multi-media Data, HTTP, Polling

1-INTRODUCTION

HTML5 has attracted significant attention in the recent years. HTML5 is the next-generation standard proposed in HTML [1]. It is not possible to configure the Web services using only HTML. However, with the advent of HTML5, it is possible for the clients and servers to communicate. Some features of HTML5 may be provided to Web services without using external modules. The browser manufacturers worldwide are cooperating in the development of HTML5. The most powerful feature is the ability of the WebSocket application programming interface (API). One of the early purposes of the Web was to link a document using hyperlinks and facilitate document transfer. The HTTP protocol for the network is a model that handles this purpose. However, with changing times and with developments in the environment, the purpose of the Web no longer focuses only on sharing longer documents. In the HTML5 initiative, many specifications have been developed under the banner of the Web application environment that are not standardized and are inconsistent with the available plug-ins, which was one of its main purposes. Among them is the specification for real-time two -way communication in a pure Web environment. Instead of evolving from HTTP communication, merely using an existing web socket shows significant improvements in properties [2]. In particular, in the event-based Web application, which is based on real-time communication, the effect is even greater. The HTML5 WebSocket technology may be able to receive information quickly via the push real time, and it may reduce the wait time for unnecessary network traffic. Therefore, in this paper, we conducted research on the HTML 5 WebSocket performance analysis by comparing the overhead depending on the number of concurrent users and the speed of the real-time multimedia communication.

2 HTML5 WebSocket Technology

As a Web application platform and a next-generation technology for productivity improvement of Web development, HTML5 is an open Web standard created to provide a better user experience. It has become possible through HTML5 to provide an excellent Web service rapidly [3], [4]. The function of the WebSocket technology was to improve performance. Two- way data communication in real time actually corresponds to numerous concurrent connections. In this case, the real-time aspects specifically, WebSocket technology is often used. If the WebSocket technology is used, the unnecessary HTTP header data must be removed first in order to quickly send and receive pure data [5]. This results in a reduction of the amount of data being transmitted and received; consequently, this reduces the load on the server and the network. Then, using the WebSocket Secure (WSS) protocol, security was enhanced with a unique algorithm for encryption / decryption of data. Figure 1 is a graph comparing the conventional communication method and new WebSocket system. Thus, with the use of the WebSocket technology, connection-oriented full-duplex communication, such as TCP sockets, is possible [6]. Using features such as these, we were able to implement more effectively the development of applications that allow chatting from the Web, real-time games, and multimedia delivery.

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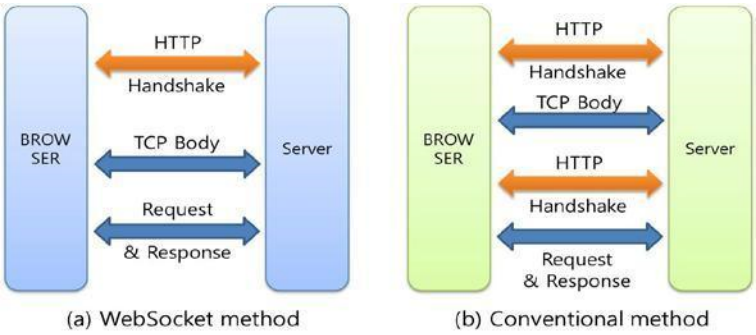


Fig. 1. Comparison of WebSocket and Conventional Polling Method

3 Design and Implementation of the Experiment

3.1 Design

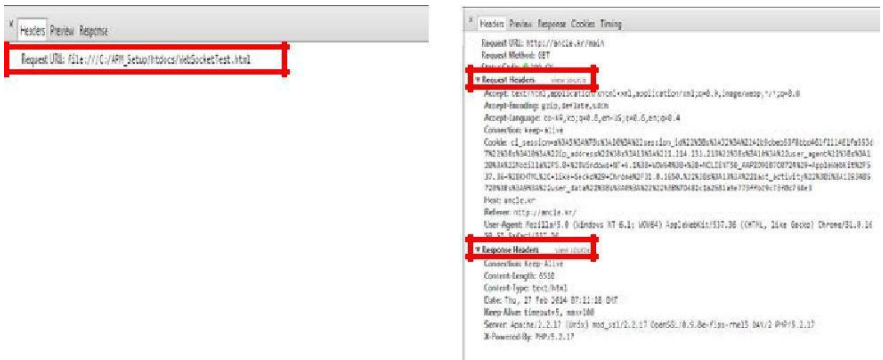
The following assumptions are made:

- •WebSocket technology is required.
- •Real-time two-way data communication is required.
- •There are many concurrent connections.
- •It is necessary to extend the TCP-based communication browser.
- •The developer is required to use the easy-to-use API net reason.
- •It is necessary to extend the SOA beyond environments such as the cloud, and Web.

Therefore, in this paper, our experimental design functions through the polling conventional manner with real-time two-way data communication using the WebSocket methodology through the transfer delay time. We compare the overhead corresponding to the number of concurrent users, and analyze its performance. To ensure that the experiment is accurate, we implemented the Web to execute the polling method and the WebSocket technology to execute the multimedia data communication system. For the client polling method, we use the setInterVal() method, and transmit the HTTP requests at regular intervals through the browser.

3.2 Experimental Results

We compared the overhead of the network implemented via the server and the client. As shown in Fig. 2(a), the system is a WebSocket header data request and the response does not exist. On the other hand, as shown in Fig. 2(b), in the polling method, whenever there is a response to the HTTP request, the HTTP headers are passed, and the associated overhead occurs.



(a) Value of WebSocket header

Fig. 2. Comparison of the actual overhead of WebSocket and polling method

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In order to communicate multimedia data of one gigabyte, the polling method is used. The WebSocket system needs the capacity of the header data to be about 1,000 bytes; the header is not needed because of the low data capacity. It is assumed that when ten persons access the multimedia data of one gigabyte using the polling method, (that the header data capacity is 10,000 bytes, then when 100 people access the multimedia data of one gigabyte, that the header data capacity will be 100,000 bytes. On the other hand, with the WebSocket type, the additional capacity does not occur. These additional header data generate the overhead for a large number of users on the network.

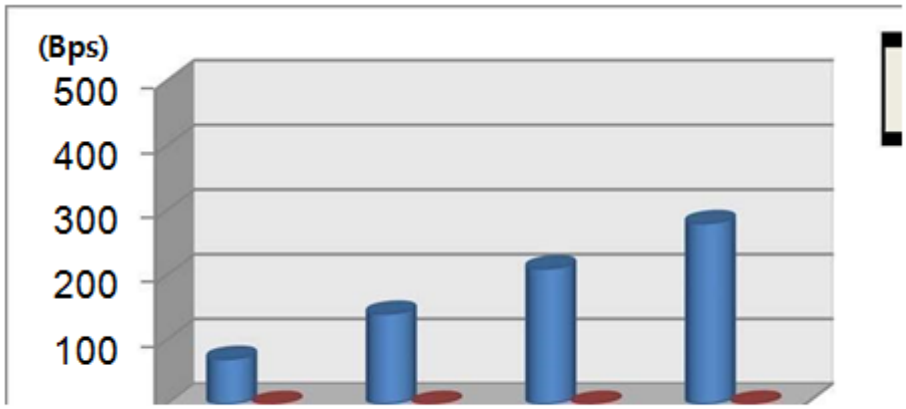

Fig. 3. Comparison of the overhead generated by the polling and WebSocket method based on the concurrent number of users

In addition, we also measured the transfer delay time and the overhead generated by increasing the number of concurrent connections. We compared the overhead generated by an increasing number of concurrent users. Figure 3 shows the results. As the concurrent number of users increase, the overhead of the polling method increases, while the overhead of WebSocket system was barely noticeable. In the polling method, starting from the client's req 60 ms consuming, and the time while waiting re-request, even if the response occurs after the response time from the server, all become overhead. However, using the WebSocket system, connections that occur after the first connection, resulted in the connection being maintained, with no additional latency. Figure 4 is a graph comparing the response times of the system using the polling and WebSocket methods. The x-axis represents the number of requests, and the y-axis represents the response time (ms).

4 Conclusion

With the advent of HTML5, we are able to provide better service, which is significantly faster than the existing Web services. HTML5 uses an open Web standard as a Web application platform and is a next- generation productivity improvement for Web development, which works together to create a better user experience. The function of WebSocket technology is to improve performance. This reduces the network load when compared to conventional methods. The WebSocket technology is often used when real-time two-way data communication is required. In particular, the positive effects of using the WebSocket technology are more pronounced while using web applications based on real-time two-way data communication. On the other hand, not many browsers that support HTML5 support web sockets. Further, if security is enabled while using a web socket, it proves to be disadvantageous. Currently, technical research is actively promoted for using WebSocket technology to improve its performance. In addition, future research can be conducted to study cross-browser compatibility with WebSocket technology, and reduction of its security vulnerability can be researched.

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