

## Chapter 5.2

# Testing, Measuring, and Diagnosing Web Sites from the User's Perspective

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### ABSTRACT

Users perceive good Internet performance as characterized by low latency, high throughput and high availability. When browsing the Web, users are concerned with the performance of entire pages. Understanding and identifying the sources of the performance problems are very important issues, especially for e-business. Therefore, there is the need to have a service for testing and measuring e-business Web site performance from the perspective of the end-users. We present our contribution in this area, that is, the Wing free service that has been developed for the purpose of Web transaction visualization. Our Web client that probes a target Web site is a real Web browser (MS IE), so the user can observe how a particular browser uses the network. Such known tools use their own Web browsing methods. Therefore, the solutions can be different from that used by real browsers, and the results can be inadequate. Wing helps identify inefficient network usage by

the browser and helps to tune Web pages to use the network efficiently. Therefore, Wing can be a good analysis tool for Web page and network application developers.

### INTRODUCTION

In the past few years, the World Wide Web has grown from a speculative medium to a robust telecommunication infrastructure that handles several mission-critical business as well as research computing traffic. Web users perceive good Internet performance as low latency, high throughput and high availability. Web quality of service is extremely difficult to study in an integrated way. It has never been easy to determine whether slow responses are due to network problems or end-systems problems on both sides, that is, user and server sides. Moreover, because most of these performance problems are transient and very complex in the relationships between dif-

ferent factors that may influence each other, we, therefore, cannot precisely diagnose and isolate the issue key sources. Understanding and identifying the sources of the performance problems are very important issues for Internet designers.

There is the need to have a service for testing and measuring e-business Web site performance from the perspective of the end-users. This paper surveys and compares such services that are available on the Internet. Almost all are commercial. We may also obtain free access to their functions however limited in time or functionality. Here, we also present our contribution in this area, that is, the Wing free Internet service that has been developed for the purpose of Web probing, visualization and performance analysis from the user perspective. Wing can be used in instant and periodic measurements of Web sites, including e-commerce solutions.

The paper is organized as follows. The next section discusses related work and gives a background. The third section presents the Wing service. Different tools are compared and discussed to show how Wing relates to other developments. The fourth section gives an illustrative example of instant measurement of a Web page. The fifth and sixth sections show the application of the periodic measurements performed by Wing to throughput estimation and Web page “mortality” evaluation studies. Finally, the last section concludes the paper.

## **RELATED WORK AND BACKGROUND**

Network protocol visualization tools have been developed since the very beginning of computer networks. They are considered as tools for better understanding of computer network. They can help network administrators or end users in analysis of network reliability and performance. They can be general tools used for several network protocols or developed specifically to assist some chosen

protocol or a suite of protocols. Due to the rapid development of the Internet, there is the need to have such tools for the TCP/IP protocol suite. Nowadays, the most important visualization challenge is HTTP protocol and especially Web page downloading.

Internet uses IP network protocol, and all of the information is carried in packets. The data transfers are organized under control of TCP transport protocol that provides end-to-end reliable connectivity. Web clients communicate with Web servers using HTTP protocol.

The end users perceive good Internet performance through Web page downloading. Therefore both end users and Web site administrators are anxious for the knowledge found in how well the Web pages are downloaded.

To study Web page download time, we can consider the following components, as illustrated in Figure 1:

- DNS
- DNS2SYN
- CONNECT
- ACK2GET
- FIRST\_BYTE
- LEFT\_BYTES

In the first phase of Web transaction, there is the need to determine the IP address based on the symbolic server name. DNS is the time to translate the server name into the IP address. Sometimes, this operation may take much time, therefore we need to include this component in the measurements of Web page download. Next is the time period to open the TCP connection by the browser. The client downloading the Web page opens the TCP connection using an exchange of SYN packet that initiates the three-way handshake. DNS2SYN is the time spent by the client between DNS resolution event and this SYN packet exchange. The elapsed time between transmitting the SYN to the server and receiving the SYN response is the CONNECT time. The connection phase begins

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