

A Study on the Speed factors for Websites

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ABSTRACT:

A website must be simple in navigation and structure, pleasant, functional and, most of all, fast. Everyone, even high-bandwidth users find some websites too slow. The reasons for this delay are associated with both the server end and client end. For server end, things like server load, page size are involved. Apart from speed, at client end, caching, web-browser are also entailed. This article discusses about the issues which make a website slow and gives some suggestions to overcome these situations.

KEYWORDS: *web speed, web browsing, download, web pages.*

1. INTRODUCTION

In today's world where time is everything; one who is surfing the internet and looking for some useful informative content, wants everything he/ she is looking for as quickly as possible. If the website takes any longer than the user's anticipated time, then it is most likely that the user will to push the "back" or "close" button, leaving the site nowhere. Slow loading websites always turn away the visitors and harm its credibility. It is one of the most crucial factors which decides the success or failure of websites. A fast loading website holds the attention and encourages visitors to explore every aspects of the website.

The most valuable measurement of web site performance from an end user's perspective is the amount of time needed to display a requested web page. The most important metric of page load time is Time to First Byte (TTFB). Defined as the amount of time it takes to deliver the first byte of the requested page to the end user, TTFB represents the visitor's initial confirmation that a web site or application is responding. Following TTFB is the metric of Throughput, or how many requests can be served by a Web site or application in a given time period. A user expects text, images, and other elements to load swiftly and methodically - failure in any of these metrics results in the perception of poor performance, which can very quickly lead to visitor frustration and abandonment of the site. Many factors contribute to Web site performance, most of which are at least partially outside the control of the

site designer. Web page download times depend on page design, on web server and client hardware and software configurations, and on the performance characteristics of the Internet route connecting a client to the site [1][2].

The objective of this article is to discuss about the factors which may be associated to the slowed down process of a website in an end user's viewpoint.

2. BACKGROUND LITERATURE

Before discuss why web download performance is slow, we include some background on the components that constitute web page download. On the Internet, all information is carried in packets. Network transfer times are not affected by the type of content being transmitted in those packets, but they are strongly influenced by the number of packets, and possibly even by their sizes. Also, the time required to set up a flow of packets is much larger than the amount of time between successive packets in a single connection. The basic performance principle is therefore to make fewer requests and transmit fewer packets. From this principle, we can derive two basic design rules for well performing Web pages. First, reduce the overall size of the page, thereby reducing the number of bytes (and packets) to be transferred over the Internet. Second, limit the number of embedded objects on the page, such as images, each of which must be requested and transferred separately from server to browser. The following steps like DNS Lookup (DNS), TCP Connection (TCP), Redirection, First Packet Download (FPD), Base Page Download (BPD), and Content Download (CD) are needed to be considered to download a webpage.

From Figure 1, the first five components together determine how long it takes to load the HTML for a base page. The First Packet Download is the time between the completion of the TCP connection with the destination server and the reception of the first HTML packet for the base page. It includes the client HTTP request and server HTTP response time. In addition to reflecting Internet latency, this measurement can also be an indicator of server performance and could differentiate between HTTP Performance and TCP stack speed.

COMPONENT	CLIENT	SERVER
DNS Lookup		
TCP Connection	Send SYN	
	Receive SYN+ACK Send ACK	Send SYN+ACK
Redirection	Send HTTP request	
		Send redirection response
First Packet Download	Send HTTP request	
		Perform server processing to locate or construct response
	Receive 1 st packet	Send HTTP response & first (or first two) HTML packets
Base Page Download		Send remaining HTML packet ...
	Receive last HTML packet	
Content Download	Send HTTP GET requests	
		TCP Connection, Redirection, First Packet Download, and Download phases for each

Figure 1. Web page response time components

The last component, called Content Download, is little different from the first five. It lumps into one number the cumulative time for downloading all the embedded objects (such as images) on the page. This process may actually include all five of the previous component types, for each of the embedded Web objects. For example, one of our test pages includes 64 images, so the Content Download component for that page includes the total time required for DNS Lookup, TCP Connection, First Packet Download, and download of additional packets for all 64 images. Although this description implies a huge overhead for each embedded element, in reality, many components of Content Download are either eliminated (by reusing cached DNS values and recycling existing TCP connections) or processed in parallel (by multithreading) [4].

3. REASONS FOR THE SLOWNESS

Slowness of a web site can be divided into two parts. They are the server end problems and the client end problems.

3.1 Server End Problems

Like all other systems, there are some limitations associated with a web server. These limitations can be occurred due to the hardware limitations, bandwidth limitations etc. Website response speed helps to assess the site's relevance because speed is one of the criteria recognized in a successful site. If a more powerful, faster server is used, the site loads more quickly and is rewarded by the end users [10].

3.1.1 Limited Recourses

As each server has limited recourses; there should be a maximum number of hits a server can handle per second. And if more requests come at a time, server needs to maintain long a queue which creates some latency. Sometimes in this kind of scenario, the server is considered as busy and consequently the speed will be slower.

3.1.2 Multiple Hosting

Many individual websites can be hosted in one server, which also sometimes leads us to latency problems. Then the server will not provide support optimally as many request will be occurred for different websites.

3.1.3 Bandwidth

For every website there is some allotted bandwidth. Insufficient bandwidth is another main issue for getting slow speed to browse a web site. If the system has limited amount of bandwidth, the system could not be able to operate at the required rate.

3.1.4 Designing Aspects

Research around the world has shown that if a website does not load in under 8 seconds on a dial-up connection (56k modem) then a large percentage of that website visitors will leave and go somewhere else. The speed of a website has a direct impact on the number of website visitors [8]. If the website is loaded with too much graphics, audio file types and especially if the graphic files are large in size, it will take more time. Unwanted line spacing in the code segment makes the file size larger. And last but not

the least, if the developer of the website doesn't follow some very common web programming schemes, there is a very high possibility that the webpage will be slowed down [7].

3.1.5 Proxy Server

HTTP supports proxy servers. A proxy server is a computer that keeps copies of responses to recent request. In the presence of proxy server, the HTTP client sends a request to proxy server. The proxy server checks its cache. If the response is not stored in the cache, the proxy server sends the request to the corresponding server. Incoming responses are to the proxy server and stored for future requests from other clients. So if the proxy server is not well configured or in other words don't have enough space for caching, latency can be occurred. The proxy server reduce the load on the reduce server, decrease traffic, and improves latency. However, to use the proxy server, the client must be configured to access the proxy instead of the target server.

3.2 Client End Problems

3.2.1 Web Browser

A variety of vendors offer commercial browser that interpret and display a web document, and all use nearly the same architecture. Each browser usually consists of three parts: a controller, client program, and interpreter. The controller receives input from the keyboard or the mouse and uses the client program to access the document. After the document has been accessed, the controller uses on of the interpreters to display the document on the screen. The architectures of different web browsers have some effects in downloading a webpage. Latency can also occur due to the cache memory varies among the web browsers.

3.2.2 Virus/ Spyware

If the client machine is infected by any virus or spyware, the infected client system might retrieve unwanted information from the internet which also leads to a performance limiting factor to access a website.

4. SUGGESTIONS

It is recommended to have in mind all the basic rules of web pages optimization. One should use speed optimization and testing tools as a comparison method in order to obtain the highest performance from a website [9].

4.1 Web Server Configuration

Better server performance involves system characteristics such as memory, I/O, bandwidth, and CPU speed; the OS; and the application implementation. To maintain throughput levels, the

server must be able to move data from the application buffers, through the kernel, and onto the network interface buffers at a speed to the network interface. So it is better to have well configured web server.

4.2 Optimize Website Development

Code optimization represents the first step in improving Web site and application performance by reducing the initial network payload that a server must deliver to the end user. Once that content has been optimized on the developer side, attention shifts to how that content can be delivered in its most optimized and efficient form. As a Web site or application acceleration strategy, its chief benefit is that the technique can provide substantial reductions in network payloads without requiring any additional processing on the origin server [5]. Different types of file format also give impact on latency of downloading any web page. As for example, a web designer should be concern about the downloading time of different types of image file format (i.e. jpg, bmp, gif) and should use those file format in the site which takes smallest time to others. Compression is one of those technologies where it seems like you get something for nothing. Compression saves bandwidth and speeds up web sites by removing redundancy to reduce the amount of data sent [6]. Master page concept, template concept is also an optimized way to develop web pages.

4.3 Bandwidth for the Web Server

Since bandwidth is a significant determinant of hosting plan prices, we should take time to determine just how much is right for the website. Almost all hosting plans have bandwidth requirements measured in months, so we need to estimate the amount of bandwidth that will be required by the site on a monthly basis. While calculating the bandwidth for web server things like number of average daily visitors, average page views, average page size, and average daily file downloads, average file size etc should be considered.

4.4 Impact of Session Caching

In secure web servers performance session caching substantially improves server throughput [3]. The main reason for this gain is a reduction in the number of RSA or MD5 operations as a result of session reuse. However, even in configurations where these operations are assumed to be infinitely fast, session caching is still beneficial, avoiding the extra network traffic and other computations.

5. CONCLUSION

The first and foremost criterion for a good web experience is fast and easy page loading. In order to achieve maximum website and application

performance, it is vital to view the complete chain - from source code development, server-side processes, and the connection between server and end user, all the way to the end user's web browser - and to examine each link in that chain for both potential pitfalls and opportunities for improvement. It is recommended to have in mind all the basic rules of web pages optimization. One should use speed optimization and testing tools as a comparison method in order to obtain the highest performance from a website

REFERENCES

- [1] J. Nielsen, "Designing Web Usability: The Practice of Simplicity", *New Riders Publishing*, 2000.
- [2] <http://httpd.apache.org/docs/1.3/misc/FAQ.html>.
- [3] A. Goldberg, R. Buff, and A. Schmitt, "Secure web server performance dramatically improved by caching SSL session keys", In *Proceedings of the Workshop on Internet Server Performance*, Madison, Wisconsin, June 1998.
- [4] J. Zhi, "Web Page Design and Download Time", *CMG Journal of Computer Resource Management*, no. 102 (2001): pp. 40-55.
- [5] "Fundamentals of Web Site Acceleration Performance Starts at the Web Server", Port80 Software.
- [6] <http://www.websiteoptimization.com/speed>
- [7] <http://www.webcredible.co.uk>
- [8] <http://www.zeald.com/Resources/Free+Tools/Website+Speed+Checker.html>
- [9] C. Bocanu, "The Fastest Loading Website - The major influences over page rendering speed", *Softpedia*.
- [10] "Server speed and SEO", *UKFast*, 2008.