Proposal Draft - Impacts of the HTTP/2 protocol for large scale web environments

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1 Introduction

Recently, the specification for the new HTTP protocol HTTP/2 (and HPACK), the successor of the HTTP/1.1 protcocol has been formally approved by the IESG and will become an RFC standard soon. The main focus during the development period of the protocol was to improve the performance, and thus provide a better user experience. The performance improvement is mainly based on how the packets are sent over the wire within a HTTP/2 session. HTTP/2 data is sent in binary format and is based on a multiplexing mechanism that allows a single connection for parallelism. There are already web client and server implementations that support the final HTTP/2 specification.

2 Research Questions

How do the new features of the HTTP/2 protocol improve the performance for frequently visited webpages/webserver?

- Are there specific usecases where the new features of the HTTP/2 protocol will provide major enhancements compared to the HTTP/1 protcol in large scale environments?

- How can we measure such performance improvements that are proposed by the new protocol?

- What are possible drawbacks that can occur for large web service providers when switching from HTTP/1.1 to HTTP/2 ?

- What is the predictable impact that could be related to changes in the infrastructure of Web service providers?

3 Related work

The new HTTP2 protocol has been based on the SPDY protocol developed mainly by Google. As shown by Google [1], the SPDY protocol meets its expectations by reducing the loading time of web pages by 55%. Other people have tried to look into the protocol and one of the most interesting analysis has been done by Servy[2]. Servy evaluated the performance of the web servers implementing the SPDY protocol comparing it to HTTP1.1 and HTTPS. The load testing tool used for this benchmark was the NeoLoad 4.1.2. His results showed that the implementation of SPDY increases by a factor of 6 the number concurrent of users possible before errors start showing up in comparison to HTTP and HTTPS. The fact that SPDY uses a single connection for all requests induce that the clients are using one worker instead of multiple in HTTP and HTTPS. That makes the server able to handle more users with the same amount of worker. Servy also looked into the repercussions of the SPDY implementation in terms of CPU and memory consumption at the server side. Compared to HTTP, SPDY requests consume less memory but more CPU. However, compared to HTTPS, SPDY requests consume less memory and CPU usage. A contradictory study showing some boundaries of implementing SPDY has been done by Podjarny[3]. He shows that most of the websites use different domains and as SPDY works on a per-domain basis it does not necessarily help it to be faster. Finally, Wang et al.[4] have investigated the performance of SPDY for the improvements of the protocol compared to HTTP. This study highlights that SPDY is much faster since its benefits from the single TCP connection mechanism. However, they also mention that SPDY degrades under high packet loss compared to HTTP. Concerning the new standard HTTP/2 a few benchmarks have been performed by the creators of different client/server platforms. They reach the same conclusion for SPDY. However no study shows its impact on the infrastructure.

4 Requirements

In order to conduct this research we need multiple server instances that run a webserver instance which responds to both versions of HTTP, HTTP/2 and HTTP/1.1 [7]. Those instances will run on our student servers and on microinstances, using the Amazon Elastic Compute Cloud (EC2) [5] infrastructure to cover real life scenarios (e.g. RTT variances using different regions). Furthermore web client software that has already implemented HTTP/2 will be used [6].

5 Scope

This research will mainly focus on the major improvements of the HTTP/2 protocol compared to HTTP/1.1 and investigate the general user experience when visiting a website (e.g. page loading time) and possible impacts on the infrastructure under high load circumstances. In order to have consistent results the same configuration will be used on different platforms implementing HTTP/2 and HTTP/1.1.
The conducted measurements will focus on the new features of the protocol and are not intended to be a full benchmark of the protocol.

6 Method

First, several webserver instances will be implemented in order to have multiple HTTP/2 and HTTP/1.1 enabled environments. Secondly, those instances will serve Web sites that have different characteristics (number of files, size of files) and different geographical locations to cover e.g. different Round Trip Times (RTTs). Finally we will conduct benchmarking based on that infrastructure to outline the improvements or drawbacks HTTP/2 provides in comparison to HTTP/1.1.

7 Planning

Week	Tuesday	Friday
22-26 February	Research/Previous work	Research/Previous work
2-6 March	Configuration of servers	Deploy test environment
9-13 March	Testing	Result analysis + further testing
16-20 March	Report	Report and presentation

8 Ethical Concerns

Ethical issues are not expected during this project.

References

[1] A 2x Faster Web. (2009). [online] Chromium Blog. Available at: http://blog.chromium.org/2009/11/2x-faster-web.html [Accessed 20 Feb. 2015].

[2] Servy, H. (2015). Evaluating the Performance of SPDY-enabled Web Servers. [online] Neotys.com. Available at: http://www.neotys.com/blog/performance-of-spdy-enabled-web-servers/ [Accessed 20 Feb. 2015].

[3] Podiatry, G. (2015). Guy's Pod Blog Archive Not as SPDY as You Thought. [online] Guypo.com. Available at: http://www.guypo.com/not-as-spdy-as-you-thought/ [Accessed 20 Feb. 2015].

[4] Wang et al. (2014). How Speedy is SPDY?, 11th USENIX Symposium on Networked Systems Design and Implementation (NSDI 14). [online] usenix.org. Available at: https://www.usenix.org/system/files/conference/nsdi14/nsdi14-paper-wang_xiao_sophia.pdf [Accessed 20 Feb. 2015].

[5] Amazon Elastic Compute Cloud (Amazon EC2) (2015). Available at: http://aws.amazon.com/ec2/ [Accessed 20 Feb. 2015].

[6] Firefox Beta Notes (2015). Available at: https://www.mozilla.org/en-US/firefox/36.0beta/releasenotes/ [Accessed 20 Feb. 2015].

[7] HTTP/2 client/server implemenations (2015). Available at: https://github.com/http2/http2-spec/wiki/Implementations [Accessed 20 Feb. 2015].