What *Warp*TCP™ does for SPDY

WHITE PAPER

Turbcharge Web Performance

BADU networks

- Improving the way the world connects -

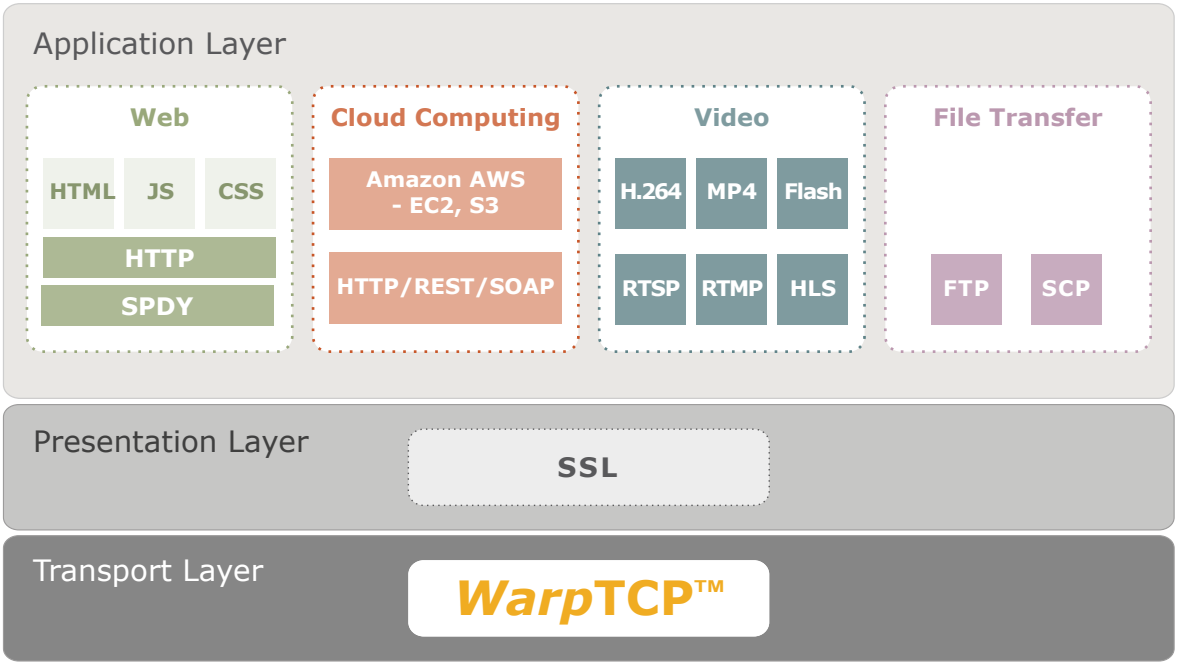
*Warp*TCP™ & *SPDY*

Web performance is increasingly becoming a key focal point for many web properties. There are several approaches to help deliver rich, dynamic content with significantly lower latencies and improved user experience. Google's "Make the Web Faster" initiative has proposed several techniques to improve web performance. These techniques are currently being evaluated for inclusion in future standards.

One among them is SPDY – a companion protocol to HTTP that is aimed at reducing *web page load latency* and improving web security among other things.

This document describes how SPDY and Badu technology can be combined to boost web performance. The approaches are different but complementary to each other and can be implemented individually or together for maximum benefit.

* The following diagram illustrates where SPDY and *Warp*TCP™ sit in the network protocol stack.



SPDY

SPDY operates at the Application/Session Layer. SPDY does not replace HTTP; it modifies the way HTTP requests and responses are sent over the Internet. This means that all the existing server-side applications can be used without modification if a SPDY-compatible translation layer is put in place. SPDY is similar to HTTP, with particular goals to reduce web page load latency and improve web security. SPDY achieves reduced latency through **compression**, **multiplexing**, and **prioritization**. In SPDY implementations servers may hint or even push content instead of awaiting individual requests for each resource of a web page. SPDY supports HTTPs with the Transport Layer Security (TLS) extension. TLS encryption is nearly ubiquitous in SPDY implementations, and transmissions are compressed by design (in contrast to HTTP, where the headers are not compressed).

- **SPDY** is currently supported in Google Chrome, FireFox, and Amazon Silk browsers.

- **SPDY** improves web performance several ways:

Utilizes fewer network connections.	Improves HTTP multiplexing.	Reduces bandwidth.
SPDY allows many HTTP requests to run concurrently across a single TCP connection. This reduces web page load time by reducing TCP connection overhead.	Browsers have practical limits on how many concurrent HTTP requests are allowed. SPDY improves overall page load time by multiplexing a larger number of concurrent HTTP requests over fewer connections.	SPDY compresses HTTP headers in order to reduce the amount of data sent.

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SPDY can provide significant improvements in page load time by reducing application latency. But since it runs over TCP it is still subject to the same network congestion, latency, and loss as standard HTTP. Thus, additional performance gains can be realized by combining SPDY with *Warp*TCP™.

Badu's patent pending *Warp*TCP™ technology operates at the **Transport Layer** of the protocol stack. It senses network conditions, receiver state, and implements state of the art auto-tuned congestion control. Depending on network conditions, *Warp*TCP™ can improve transport layer performance by up to 30%, and in some cases even up to 500% depending on latency and loss conditions. Badu *Warp*TCP™ improves Web Performance in several ways:

Dynamically adjusts the data transfer rate based on characteristics of the flow.	**Predicts loss** and recovers faster which reduces retransmissions and stabilizes the flows.	**Stabilizes video and audio streaming** by providing a consistent and steady data flow.
Dynamically sizes sending and receiving windows to eliminate static receiver window bottlenecks.	**Eliminates TCP "slow start"** by ramping the initial window size faster.	**Fills in data gaps** in a flow to use bandwidth more efficiently.
Optimizes SPDY over **wireless networks.**	Badu provides an additive performance benefit to SPDY as well as to the many other application-level web protocols used for cloud computing, video streaming, file transfer, mobile web and other common use cases.	

Conclusion & Summary

There is no overlap in the approaches to web optimization by SPDY and WarpTCP™ While the role of SPDY is to reduce web page load latency and make more efficient use of network connections, the role of WarpTCP™ is to transmit the data over those connections as quickly and efficiently as possible. Optimal web performance is thus achieved when both are implemented.

In summary, SPDY is focused on application latency and Badu is focused on Transport Latency. As the application latency is reduced then the bigger bottleneck becomes the Transport Layer which Badu addresses.

These two complementary technologies work hand in hand to ensure the best possible performance across the Internet for any application.

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ⓟ 949-310-5390 ⓕ 888-958-7697 ⓔ info@badunetworks.com ❖ 2640 Main Street Irvine CA 92614 USA