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- High Performance Browser Networking

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Preface

The web browser is the most widespread deployment platform available to developers today: it is installed on every smartphone, tablet, laptop, desktop, and every other form factor in between. In fact, current cumulative industry growth projections put us on track for 20 billion connected devices by 2020—each with a browser, and at the very least, WiFi or a cellular connection. The type of platform, manufacturer of the device, or the version of the operating system do not matter—each and every device will have a web browser, which by itself is getting more feature rich each day.

The browser of yesterday looks nothing like what we now have access to, thanks to all the recent innovations: HTML and CSS form the presentation layer, JavaScript is the new assembly language of the Web, and new HTML5 APIs are continuing to improve and expose new platform capabilities for delivering engaging, high-performance applications. There is simply no other technology, or platform, that has ever had the reach or the distribution that is made available to us today when we develop for the browser. And where there is big opportunity, innovation always follows.

In fact, there is no better example of the rapid progress and innovation than the networking infrastructure within the browser. Historically, we have been restricted to simple HTTP request-response interactions, and today we have mechanisms for efficient streaming, bidirectional and real-time communication, ability to deliver custom application protocols, and even peer-to-peer videoconferencing and data delivery directly between the peers—all with a few dozen lines of JavaScript.

The net result? Billions of connected devices, a swelling userbase for existing and new online services, and high demand for high-performance web applications. Speed is a feature, and in fact, for some applications it is *the feature*, and delivering a high-performance web application requires a solid foundation in how the browser and the network interact. That is the subject of this book.

About This Book

Our goal is to cover what every developer should know about the network: what protocols are being used and their inherent limitations, how to best optimize your applications for the underlying network, and what networking capabilities the browser offers and when to use them.

In the process, we will look at the internals of TCP, UDP, and TLS protocols, and how to optimize our applications and infrastructure for each one. Then we'll take a deep dive into how the wireless and mobile networks work under the hood—this radio thing, it's very different—and discuss its implications for how we design and architect our applications. Finally, we will dissect how the HTTP protocol works under the hood and investigate the many new and exciting networking capabilities in the browser:

- Upcoming HTTP/2 improvements
- New XHR features and capabilities
- Data streaming with Server-Sent Events
- Bidirectional communication with WebSocket
- Peer-to-peer video and audio communication with WebRTC
- Peer-to-peer data exchange with DataChannel

Understanding how the individual bits are delivered, and the properties of each transport and protocol in use are essential knowledge for delivering high-performance applications. After all, if our applications are blocked waiting on the network, then no amount of rendering, JavaScript, or any other form of optimization will help! Our goal is to eliminate this wait time by getting the best possible performance

from the network.

High-Performance Browser Networking will be of interest to anyone interested in optimizing the delivery and performance of her applications, and more generally, curious minds that are not satisfied with a simple checklist but want to know how the browser and the underlying protocols actually work under the hood. The "how" and the "why" go hand in hand: we'll cover practical advice about configuration and architecture, and we'll also explore the trade-offs and the underlying reasons for each optimization.

Our primary focus is on the protocols and their properties with respect to applications running in the browser. However, all the discussions on TCP, UDP, TLS, HTTP, and just about every other protocol we will cover are also directly applicable to native applications, regardless of the platform.

Conventions Used in This Book

The following typographical conventions are used in this book:

Italic
: Indicates new terms, URLs, email addresses, filenames, and file extensions.

`Constant width`
: Used for program listings, as well as within paragraphs to refer to program elements such as variable or function names, databases, data types, environment variables, statements, and keywords.

`Constant width bold`
: Shows commands or other text that should be typed literally by the user.

`Constant width italic`
: Shows text that should be replaced with user-supplied values or by values determined by context.

This icon signifies a tip, suggestion, or general note.

This icon indicates a warning or caution.

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Content Updates

May 23, 2014

1. Added new section on using TLS False Start to optimize TLS handshake.
2. Added new section on benefits of TLS Forward Secrecy.
3. Updated TLS record size optimization with recommendation to use dynamic record sizing.
4. Updated WebRTC code examples to use latest authentication and callback syntax.
5. Updated SPDY roadmap reference to 2014 timelines.
6. Fixed odd/even stream ID references in Chapter 12.
7. Fixed spelling mistakes in text and diagrams.

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