

¹P2PU Extension Development Course
Week One - Introduction to Web browsers and Web browser Reference
Architecture

World Wide Web (WWW) was first described in a proposal written by Tim Berners-Lee in 1990 at the European Nuclear Research Center (CERN) [1]. The following year, he wrote the first web browser, which was graphical and also served as a HyperText Markup Language (HTML) editor. Lynx, a well supported text-only browser, was adapted to support the web in 1993. At the same time, a graphical browser called Mosaic was released by the National Center for Supercomputing Applications (NCSA). Berners-Lee founded the World Wide Web Consortium (W3C) in 1994 to guide the evolution of the web and promote interoperability among web technologies. Microsoft released Internet Explorer in 1995, based on Mosaic, and Netscape released its browser in 1998 as open source under the name Mozilla.

Open source web browsers, such as Mozilla Firefox and Konqueror, have been reused into new ones [2]. Apple Computers has integrated Konqueror's core subsystems into its OS X web browser, Safari. Similarly, Mozilla Firefox has been reused into new ones, such as Flock web browser. Internet Explorer, a proprietary web browser, has also been reused into several new browsers like Maxthon, NetCaptor and Avant. These new web browsers are pushed to the market with numerous new features that are lacked in the old web browsers. On the other hand, the new web browsers may be refined to meet specific requirements of a group, community or set of people.

Although the 1990's was referred to as the "browser wars" period [2], the competition among web browsers has not ended. In general, today, features present in the web browsers in order to improve the web browsing experience include tabbed browsing, pop-up blocking, spell-check, page zooming and bookmarking. The capabilities of web browsers are also quickly increasing. The World Wide Web Consortium (W3C) has recently standardized new tags and features in web programming and how web browsers function. Taking the recently standardized HTML 5 [3] as an example, web browsers can play audio files embedded in the <audio> tag without specifying a plug-in in the HTML code.

1 The Extended Web Browser Architecture

A reference architecture for opened and closed source (proprietary) web browsers was described by Grosskurth and Godfrey in [2]. The development of web browsers often requires different standard libraries, and these variations have led to different architectures for the existing web browsers. They, however, share common building blocks. [2] identified the building blocks as User Interface, Browser Engine, Rendering Engine, Networking, JavaScript Interpreter, XML

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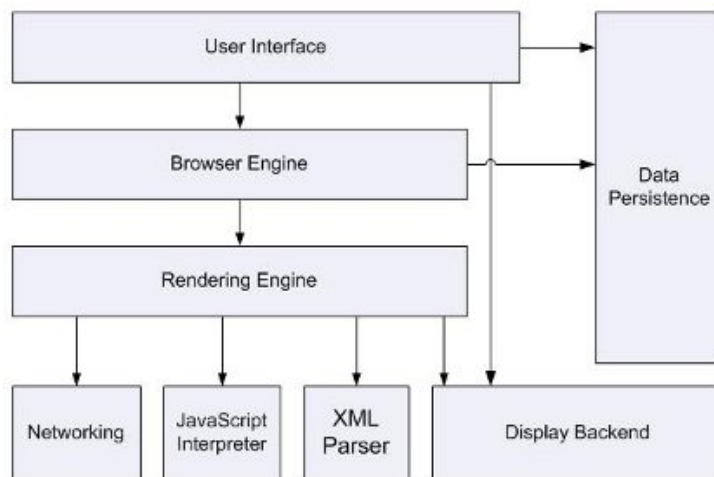


Figure 1: Web Browser Reference Architecture

Parser, Display Backend and Data Persistence. These building blocks, shown in Figure 1, are similar to the building blocks shown in Figure 2. While the HTML Manager in Figure 2 represents the XML Parser and the JavaScript Interpreter in Figure 1, the Input Manager in Figure 2 represents the Data Persistence in Figure 1.

Other building blocks, namely User Interface, Browser Engine, Rendering Engine, Networking and Display Backend in Figure 1, could be mapped into Final Presentation, Content Manager, HTML Manager, Networking Subsystem and Protocol Handler in Figure 2. Figure 2 further gives components of each building block that are not mentioned in [2]. Regarding the modification of existing web browsers' architecture to support a SIP stack, Figure 2 shows the proposed modifications to the web browsers' architecture. There are three forms of rectangles, namely normal, round-edge dashed-line and round-edge solid-line rectangles, in the figure (Figure 2). For clarity, the round-edge solid-line rectangles have wider border line than other rectangles. These round-edge solid-line rectangles and the SIP stack (in a normal rectangle) represent parts of the architecture that will be extended and a new feature that will be integrated, respectively.

The round-edge solid-line rectangle called "Extension," which is close to the HTML Manager, represents the User Interface (UI) that a user of the web browser would use to interact with the SIP stack. Extensions in web browsers often have interfaces for selecting one or more tasks. Extensions are different from plug-ins in web browsers. While a plug-in is a small runtime enhancement, an extension enables one to pass information and add functionality to existing interfaces. An example of a plug-in is the Adobe Flash Player. In this work, an extension called "TransferHTTP" is developed for the Mozilla Firefox web browser. Other notable extensions are Firebug [5] and FireFTP [6].

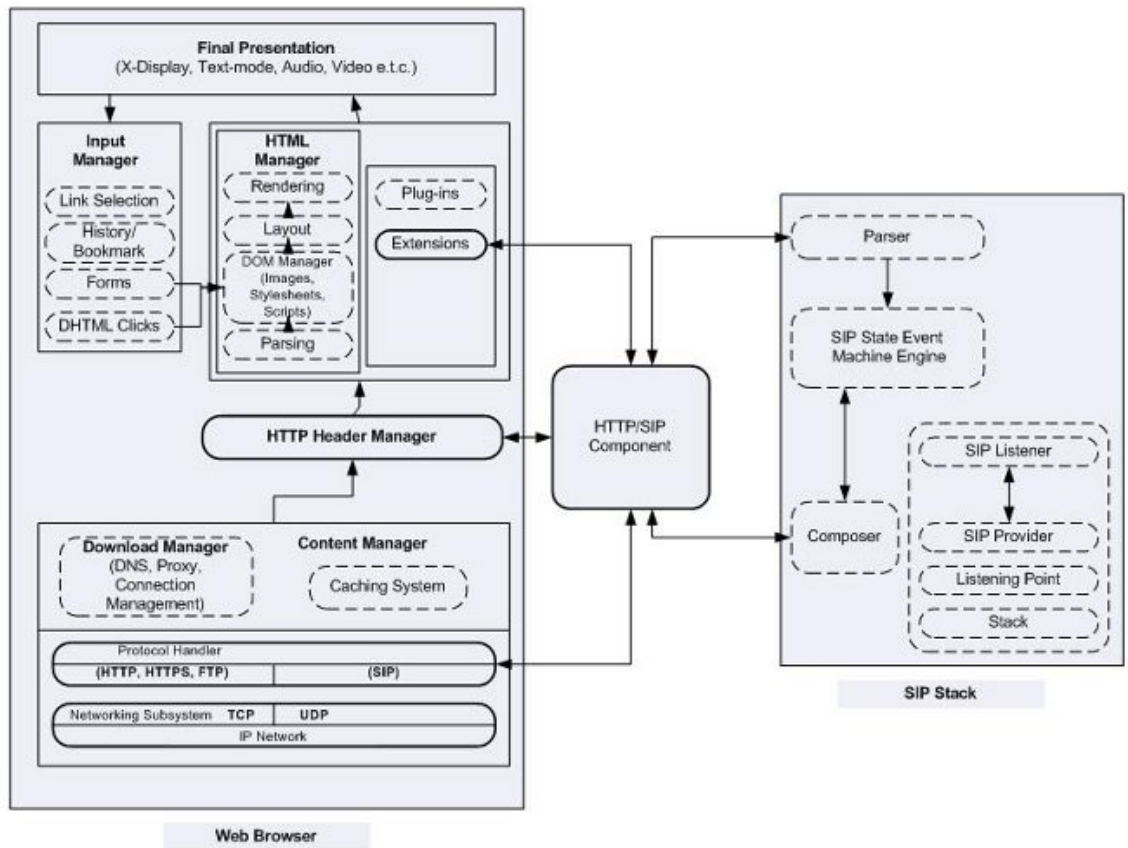


Figure 2: The Extended Web Browser Architecture

When buttons on the UI are clicked in this TransferHTTP extension, they trigger events, such as registering the client and sending excerpts of the HTTP Request/Response using the SIP MESSAGE method. Although SIP MESSAGE can be sent in a session mode or a pager mode [4], a pager mode was used in this implementation. Pager mode was chosen because the SIP stack used did not support Message Session Relay Protocol (MSRP) at the time of the implementation. In addition, session mode would have added unnecessary overheads to the solution.

Processes, such as triggering SIP register and deregister events and sending HTTP Request/Response excerpts using SIP MESSAGE, take place inside the HTTP/SIP Component block in Figure 2. SIP transactions are handled by the SIP stack and work seamlessly with the HTTP/SIP component, which helps in building the SIP messages. The HTTP Header Manager is required to interact with the HTTP/SIP Component by providing the HTTP Request/Response excerpts, such as Request-URI and Set-Cookie. The Protocol Handler implements the SIP protocol alongside the existing protocols, such as HTTP and HTTPS. In the same manner, the Networking Subsystem integrates User Datagram Protocol (UDP) and Transmission Control Protocol (TCP), which are required during the SIP transactions. The other blocks, such as Final Presentation, Input and Download Managers remain unmodified.

References

- [1] Berners-Lee T., Weaving the Web: The Original Design and Ultimate Destiny of the World Wide Web by its Inventor, Harper San Francisco, 1999.
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- [5] The Firebug Extension, <https://addons.mozilla.org/en-US/firefox/addon/1843>, June 16, 2008.
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