Table of Contents

Introduction

People have recognized the value of the Internet for simplifying and enriching their lives, both personal and professional. As they rely on the Internet more frequently for more services, they want location-independent access, not just from their offices and homes, but from shopping malls, airport lounges, libraries and cafes.

This market for ever-richer services is driving major trends in both hardware and software design. Manufacturers are introducing a variety of new devices, from Internet-only appliances that provide a simple alternative to the desktop PC, to portable computers and other devices that provide Internet access from any location. And with the Web increasingly accessible, developers are creating software applications for the Web, replacing traditional desktop applications as well as providing entirely new capabilities.

SOFTWARE TREND: WEB APPLICATIONS

Web-based businesses have begun offering web applications as part of a portfolio of services designed to attract, satisfy and hold their customers. Portal-to-portal, site-to-site and service-to-service competition for user loyalty will guarantee the full exploitation of the browser's capability to enable rich content and applications.

Email and calendaring, applications that until recently had to be purchased and installed on a desktop computer, are now accessed through the browser, given away free by portals and other sites. These are only the first of many desktop applications that will be moved to the Web, as consumers recognize significant advantages.

> "Web browsers will become the access method of choice for applications, and the desktop environment will become much less critical."
> — Gordon Eubanks, CEO of Oblix Inc, former CEO of Symantec, "GUIs of Change — How The web IS Reshaping The Desktop," 5 October 99 MicroTimes

With web applications, a simple browser click runs the application, always using the latest version, without the download and installation effort required to update desktop applications. Applications and information are accessible anywhere via the Web, no longer tied to the location of the desktop PC.

However; web applications will not just replicate the functions of desktop applications. Web applications will provide highly targeted and personalized functionality not feasible in desktop applications that must satisfy a broad market. Developers will create a new category of web applications designed specifically to meet the evolving needs of consumers and professionals as they recognize the possibilities of mobile Internet access.

HARDWARE TREND: INTERNET-ENABLED DEVICES

The number one reason people buy personal computers is to access the Internet. [Source: Compaq Computer study, September 1998]. There are a growing number of alternatives to the PC, devices designed specifically for simple, low-cost Internet access, with less versatility but also less complexity than the PC.

> "The Internet appliance is about to arrive, in force. This is a simple, streamlined computer that handles only the Internet and e-mail, and does so very well. It may take the form of a desktop or laptop PC, or a box atop a TV, or a specialized phone, but it won't use Windows or any other obtrusive operating system. In an appliance, the operating system isn't king – it's just plumbing."
> —Walt Mossberg, "Using a PC Got Harder, But A New Age Is Dawning," 28 October 99 Wall Street Journal

Forrester Research estimates that by 2003, 30% of consumers will access the Internet with one of these information appliances [Net Devices Ascend, June 1999]. But these devices will not just provide easy web access at home. Because of their low cost, simple installation, and zero-maintenance design, devices will bring Internet access to public spaces such as airport waiting lounges. In addition, other portable wireless devices will provide complete mobility. These devices will take full advantage of the capabilities of web applications, providing personal web access, anytime, from any location.

CURRENT LIMITATIONS

Until now, there has not been a browser engine that supports and encourages the development of web applications across a diverse set of desktop platforms and other devices. The support for standards in the most recent generation of browsers was only sufficient for the most rudimentary web-based applications. Although ratified web standards have matured and now define rich functionality, implementations have not kept pace. Existing browsers do not have the standards support necessary to enable rich, native-application-like user interfaces or the performance improvements that result from more powerful client processing and fewer round trips to the server. These improvements are needed to make web applications attractive to users as viable alternatives to desktop applications.

Similarly, the adoption of Internet-enabled devices can be accelerated by a standards-based browser engine that can facilitate development of full-function browsers across many operating systems and hardware architectures. To get to the next-generation Internet we need next-generation browsers, that promote more rapid development of rich web applications and Internet-enabled devices that provide a consistent user experience of the Internet from any location.

NETSCAPE GECKO

At the heart of every browser is a layout engine that reads files and web pages, interprets the text and graphical elements, formats those elements for viewing and finally renders the result on the display screen. Netscape Gecko is Netscape's revolutionary new browser engine.

- Netscape Gecko is a small, fast, standards-compliant, free, open-source browser layout engine that can be embedded across multiple platforms and devices. The Gecko browser engine supports an accompanying array of Netscape Gecko Technologies:

- Industry-leading support of W3C standards—HTML 4.0, XML, XML Namespaces, RDF, CSS, DOM—and JavaScript

- Netscape cross-platform, cross-device interfaces—XUL and XP Widgets Library

- Gecko's extensible architecture—XPCOM and XPConnect

- Embedding technologies—web Shell APIs, ActiveX Control, and a JavaScript interpreter engine (also embeddable separately if desired)

- Other standards and features for full browser functionality—Data Transport Protocols, Multilingual Character Data, Image Data, Java Support and Plug-in APIs

The Gecko browser engine was previewed to developers in December 1998, delivering on its promise to be small, speedy, standards-compliant and open-source. Building on the Gecko core, Netscape has continued its innovation, developing Netscape Gecko Technologies to support the use of Gecko for an unprecedented range of applications. New since December 1998 are XUL, XPCOM, XPConnect, XP Widgets, the Necko networking library, and support for Java plug-ins. These and the other Technologies are described in detail in Section 3, beginning on page X.

Netscape is using the Gecko browser engine and Gecko Technologies for the design, development and deployment of its next-generation browser and its web-based services. Developers throughout the industry are embedding Gecko in browsers and web-enabled applications designed for a variety of devices and operating systems (see "Appendix C: Industry Case Studies—Netscape Gecko in Action" for examples from industry leaders such as Intel, Nokia, and Sun Microsystems).

Together, the Netscape Gecko browser engine and the Netscape Gecko Technologies it delivers provide a complete and standards-compliant set of resources for productive cross-platform, cross-device development of distributed, web-based applications. All participants in the Internet—users and developers alike—benefit greatly from Netscape Gecko.

For users, Gecko's size and the smaller software that results will make it easier to download upgrades or new applications. Gecko's industry-leading XML support will enable richer and more powerful web applications that are easier to maintain and more readily accessible via the Web than desktop applications. Gecko will also help ensure that users have a choice of devices as alternatives to the complex, desk-bound PC.

For developers, Gecko makes it possible to deliver advanced content, applications and devices with minimal effort, increasing competitiveness and profitability and stimulating innovation. Desktop application and device vendors can offer their customers fast, full-power web browsing by embedding small, modular and standards-compliant Gecko. Developers of web content and web applications will reap the benefits of Gecko's W3C standards support in developing web applications with functionality, user interfaces and performance that approaches that of desktop applications.

Gecko will lower costs for developing browsers, web-enabled desktop applications and devices, as well as web applications and content that must be delivered across multiple platforms and devices. These development projects can leverage Netscape Gecko Technologies' highly modular, state-of-the-industry, standards-based components for distributed applications. With Gecko's support of open standards, developers can be confident of their investments in technology and human resources. Open standards provide a clear roadmap that encourages further investment and, in turn, further innovation.

GUIDING PRINCIPLES BEHIND NETSCAPE GECKO

Netscape Gecko has been designed and built for the next-generation Internet. The Gecko browser engine enables a new wave of web-based applications and devices because it is standards-compliant, high-performance, small and open source. Gecko Technologies supported by the Gecko browser engine greatly aid the use of Gecko across devices and platforms and the development and deployment of full-function, web-based applications.

The following principles have guided the creation of Netscape Gecko:

Small—Unlike existing browsers that have become bloated through successive releases, Gecko has been designed to be lean and modular. Because the Gecko browser engine is a fraction of the size of competing browser engines, applications that embed Gecko, such as full-function browsers will have minimal download sizes and use less disk space.

Fast—Gecko has been designed for speed. The Gecko browser engine retrieves and lays out content at high speed, and support for client-side scripting and data manipulation reduces the need for applications to do server round-trips. Applications, whether client- or web-based, will respond quickly to user commands and deliver an experience to rival that of applications written in native-platform code.

Standards-Compliant—Robust standards support boosts productivity by leveraging developers' existing knowledge and ensures a consistent quality of user experience across devices and applications. Gecko delivers what developers have been clamoring for. Because it fully supports the latest web standards, Gecko gives users access to all the power of the Web today, while freeing developers to innovate and create the web applications of tomorrow.

Cross-Platform, Cross-Device—Gecko has been designed from the ground up to be standards-compliant and easily portable to other platforms and devices. Nearly all of its code is cross-platform; the small amount of platform-dependent code is cleanly isolated and easy to port.

The existence of multiple platforms (MacOS, UNIX and Windows) and now the proliferation of devices complicates software development because there are so many configurations for which every application must be developed, tested and maintained. Netscape, along with other open-source developers, is developing Gecko and browsers that embed it on Windows, MacOS, and Linux in addition to other platforms including Solaris, HP/UX, AIX, IRIX, BeOS, OS/2 Warp, OpenVMS and Amiga. Gecko's clean cross-platform design minimizes the effort to deliver a browser on any platform, and the existence of Gecko-based browsers on target platforms enables application developers to write their applications once using cross-platform web standards instead of once for each platform using platform-specific technologies.

Modular, Embeddable—Leveraging a cross-platform, cross-device software component such as Gecko requires more than standards compliance and portable code. Gecko's modular architecture enables developers to add or remove modules with little effort, fitting the software to the available hardware and adjusting functionality to match product requirements. Gecko is implemented as a collection of pluggable XPCOM components that can be removed at will. Built-in programming interfaces (web Shell APIs and the ActiveX Control) make Gecko easily embeddable into applications and devices. Gecko is available in both source code and binary executable forms that can be directly embedded into applications, maximizing the flexibility and productivity of developers.

Open Source—Gecko is completely open source under the Mozilla Public License. An open source license guarantees adopters' rights, ensuring that developers have rights to access and modify source code.

No matter how carefully software is designed, there is always a small percentage of code that is platform-dependent. Access to the source code enables the inevitable modifications to that thin layer of platform-dependent code and ensures the ability to port Gecko to any platform or device. Open source also frees adopters from dependence on a particular vendor for information, bug fixes and enhancements. Joint development of the open source codebase enables adopters of the platform to cooperate and thus reduce their own product development costs.

Free—Netscape Gecko is free of charge. There is no charge for using the Gecko browser engine or Gecko Technologies in any way, including no charge to distribute Gecko inside another product. Furthermore, when embedding Gecko, developers are free to choose what modules to include. There is no requirement for distribution of any other software.

TECHNOLOGY OVERVIEW

Netscape Gecko is enabling revolutionary new web applications and easy-to-use devices. This section describes the Gecko browser engine and each of the Netscape Gecko Technologies. "Appendix A: Developing with Netscape Gecko" diagrams the relationships among the elements of Gecko.

NETSCAPE GECKO BROWSER ENGINE

The Netscape Gecko browser engine interprets web content and applications and presents them to the user on any platform or device. It is a powerful, standards-compliant, high-performance browser engine. Small, fast and modular, yet with complete support for web standards and with performance superior to all other rendering engines, it is perfectly suited for embedding into full-function applications such as desktop browsers, as well as easy-to-use web devices. Because of this unprecedented power, speed and standards support the Gecko browser engine represents a major advance for developers seeking to create a uniform, compelling experience of the Internet across platforms and devices.

NETSCAPE GECKO TECHNOLOGIES

The Netscape Gecko Technologies comprise a wide range of aids to developer productivity, including industry-leading web standards support, Netscape's cross-platform/cross-device interfaces, an extensible architecture and embedding technologies.

Industry-leading web standards support

Gecko leads the industry with support for these W3C standards and JavaScript, enabling the creation of user interfaces as rich as native user interfaces and web applications with the performance and interactivity of native applications. For the first time, using web standards alone, developers can re-create within a web application the entire user interface of a traditional desktop application, including menus, toolbars, icons and scroll bars.

HTML

Gecko provides a simple, universal model for web content and applications through its complete support for the latest HyperText Markup Language standard, HTML 4.0. HTML is the industry-standard language for presenting documents, applications and input requests to users and is accessible to web users. With version 4.0, HTML can deliver a significantly richer user experience, including better support for style sheets, richer tables, more user interface events, and internationalization of content.

XML

Gecko features complete and native support for the eXtensible Markup Language, XML 1.0. XML is a language for representing structured documents. It provides many advantages to developers and users. XML allows for structured data transfer between applications as well as between browser and server, enabling client-side data manipulation that avoids round-trips to the server – significantly enhancing the user's experience of web applications. Gecko's full XML support is the key to rich, powerful web applications with better performance and a superior user experience.

XML Namespaces

Gecko supports XML Namespaces, which makes the utilization of XML data across organizations and applications both simpler and more powerful. It does this by defining how XML tag names are to be resolved so that tags from different XML applications can be used together. Developers of content and applications using XML can use convenient, well-understood tags from HTML (such as form elements) within their XML pages via a straightforward syntax.

RDF

The Resource Description Framework is an XML application from the W3C for describing resources of all kinds, their properties and the relationships between them. Netscape Gecko's full support for RDF makes it easy for developers to create local data stores of resources (such as bookmarks, mail inboxes, etc.) and to display those resources visually to the user.

CSS

Gecko fully supports Cascading Style Sheets Level 1. CSS standards provide a mechanism for separating the content and presentation of web pages, so that the two can be changed and maintained separately. This makes it easy to reformat content for different devices or different users. CSS formatting is also necessary for XML-based content, for which no default look and feel is defined. Gecko also supports features of Cascading Style Sheets Level 2 such as content positioning.

W3C DOM

Gecko fully supports the W3C Document Object Model Level 1, and also supports W3C Document Object Model Level 2 working draft features such as event handling and the setting of style sheet properties. The DOM exposes all elements on the page so that they can be controlled from scripting languages such as JavaScript. Web applications gain complete control over the format and content of the page and the ability to change it dynamically. Gecko's rich DOM support enables the creation of rich, interactive user interfaces for an enhanced user experience.

JavaScript

Gecko implements JavaScript 1.5, which provides full support for ECMA-262 Version 3, the international language standard based on Netscape's JavaScript language. JavaScript is the most popular, widely used and easy-to-learn scripting language on the Internet today. JavaScript fulfills a variety of core needs for developers by making it easy to create small, fast and lightweight scripts for functions including validating user input; manipulating document objects and content; animating, adding, deleting or hiding elements or changing their contents; and intercepting and handling events such as user mouse-clicks and network activity.

Netscape Cross-Platform, Cross-Device User Interfaces

With Gecko, Netscape delivers breakthrough advances that support and simplify the process of developing cross-platform, cross-device applications and user interfaces.

XUL—XML-based User Interface Language

To make user interface development much easier, Netscape has invented XUL, the XML-based User Interface Language. XUL (pronounced "zool") is an XML application for representing the design, features, objects and layout of all user interfaces, whether client- or web-based, and whether on a desktop PC or device. Traditional software constructs the user interface with verbose, low-level, hard-wired application code that is platform- or device-dependent. XUL uses cross-platform, cross-device XML to define the user interface. User interface development becomes as easy as developing a web page, rather than as complex as developing and debugging program code. XUL lays out the pull-down menus, toolbars, icons, scrollbars, and other UI elements across all platforms by using HTML, XML, CSS, the W3C DOM, images, and JavaScript. (XUL also supports additional optional user interface features, such as box- and spring-based layout.) Because development of the user interface is often 50% or more of the development effort, XUL adds to developer productivity by allowing rapid evolution of the interface design with much shorter code/test/revision cycles.

The next-generation Netscape browser (under development and available for download from mozilla.org) is proof of XUL's power and robustness; its entire user interface is specified using XUL.

Developers are not required to use XUL to build web applications and user interfaces; they can build a user interface using the standards alone if they wish, just as they are free to mix elements of XUL with the standards. However, XUL is a convenient shorthand for those who wish to capitalize on it. XUL provides a cross-platform, cross-device, XML-based alternative to platform-specific technologies such as the Microsoft Foundation Classes and C++.

"Appendix B, XUL User Interface Example" details how XUL can quickly specify a cross-platform user interface for rendering via Gecko.

As Matt McKenzie, vice president of Content for Seybold Seminars, has observed, "Put XUL and Gecko together, and you get a web developer's dream machine—quick, highly modular and capable of supporting every web standard that matters. And because both components are part of Mozilla's open-source work, other developers will have carte blanche to create custom versions of Communicator for Intranets, front ends for hosted applications and other projects."

Developers are not required to use XUL to build web applications and user interfaces; they can build a user interface using the standards alone if they wish, just as they are free to mix elements of XUL with the standards. However, XUL is a convenient shorthand for those who wish to capitalize on it. XUL provides a cross-platform, cross-device, XML-based alternative to platform-specific technologies such as the Microsoft Foundation Classes and C++.

"Appendix B: XUL User Interface Example" details how XUL can quickly specify a cross-platform user interface for rendering via Gecko.

XP Widgets—User Interface "Widget" Library
When building applications, developers don't have to create all their own widgets and components from scratch. They can take advantage of the library of XP Widgets developed at mozilla.org while building the next version of Netscape Communicator. These widgets include common user interface objects such as menu bars, toolbars, tree widgets, tab widgets, progress bars and so on.

Gecko's Extensible Architecture

XPCOM—Cross-Platform Component Object Model
For implementing and extending the core features of the Gecko browser engine itself, Netscape adopted a subset of the well-known Component Object Model and made it cross-platform, resulting in XPCOM. To add functionality to Gecko, developers simply introduce a new XPCOM component. Conversely, to delete unneeded functionality to further reduce Gecko's footprint for devices or specialized applications, any of the default XPCOM components can simply be removed.

XPConnect—Controlling binary components from scripts
Just as applets and plug-ins must be scriptable, so must XPCOM components. To make this possible, Netscape created XPConnect, a cross-platform architecture supported by Gecko for exposing XPCOM components to script control. XPConnect is the glue between user interfaces created with XUL and binary application functionality.

Embedding Technologies
Gecko Technologies enable developers to easily embed Gecko and JavaScript in a variety of applications and devices.

Web Shell Embedding APIs
A key requirement for using Gecko to extend web functionality to other applications is the ability to embed it within an existing application. Gecko's Web Shell Embedding APIs make this easy.

ActiveX Control

Gecko is also available on Windows as an open-source, embeddable ActiveX Control (contributed to mozilla.org by Internet developer Adam Lock). NeoPlanet, Custombrowser.com and Bradbury Software are already embedding this Gecko ActiveX Control in their own products.

JavaScript Embeddability

The JavaScript interpreter engine that is part of Gecko is also available separately as an embeddable component that can be used to add JavaScript support to any software application or device. MetaCommunications has used this interpreter to add scripting support to its products.

Java Wrapper API

Embedding the Gecko layout engine in a Java application requires a Java Wrapper API for Gecko. This wrapper, under development on mozilla.org by Sun Microsystems and Internet developers, consists of high-level interfaces that encapsulate Gecko's layout engine and Web Shell APIs and present them to the developer as a JavaBeans component, making it easy to embed Gecko and control it from a Java application.

Full browser functionality

Gecko supports the following standards and features for complete browser functionality, allowing any desktop application and a new class of devices to be web-enabled.

Data Transport Protocols

To enable web content and applications to access all the resources on the Internet, Gecko supports HyperText Transport Protocol (HTTP), File Transport Protocol (FTP) and Secure Sockets Layer (SSL). Gecko's new networking library, Necko is designed to achieve higher-performance data transfer than any previous Netscape browser. It also supports HTTP 1.1 file compression to reduce the size and download time for each file.

Multilingual Character Data

Gecko delivers character data in all languages through its full support for Unicode, which enables the global distribution of content and applications.

Image Data

To display graphics, Gecko features full, native support for most widely used image formats: GIF, JPEG, PNG and XBM.

Java Support

Gecko's support for the Open JVM Interface (OJI) enables support for Java on platforms and devices through the use of any OJI-compliant JVM. This clean plug-in architecture decouples Gecko development from JVM development, allows Gecko users to upgrade to a new version of a JVM as soon as it is released and gives them the freedom to choose any OJI-compliant JVM on their platform or device. Gecko's support for LiveConnect enables scripts to start, stop and set the properties of applets. Together, OJI and LiveConnect enable web content and applications to make full use of the vast and growing library of existing Java applets, and provide seamless integration of Java into content and web applications running on Gecko.

Plug-in Support

The Mozilla Plug-in API supported by Gecko allows developers to offer identical plug-in functionality across all platforms and devices. There are a large number of browser plug-ins that users rely on every day, from streaming audio and video to companions that extend the browser's functionality. Existing plug-ins can be used with Gecko today and ported to new devices as they emerge. Netscape Gecko also adds support for Java Plug-ins, giving developers the option of implementing browser plug-ins as cross-platform Java code, easing and speeding cross-platform development.

BENEFITS OF NETSCAPE GECKO

Netscape Gecko provides a complete and standards-compliant foundation for productive cross-platform, cross-device development of distributed applications. All participants in the Internet—developers and users alike—benefit greatly from Gecko. Gecko's advantages make it the technology of choice.

FOR APPLICATION AND DEVICE VENDORS

Desktop application and device vendors can embed Gecko and offer their customers fast, full-power web browsing thanks to Gecko's industry-leading standards support. Because Gecko is small, adding Gecko doesn't bloat application download size or device footprint requirements. Because of Gecko's modular architecture, developers can easily add functionality for particular customers or applications, or subtract functionality to further reduce download size or device footprint. Because Gecko is open source, vendors are fully empowered and can leverage their industry colleagues for information, support, bug fixes or enhancements.

FOR WEB CONTENT AND APPLICATION DEVELOPERS

The W3C standards at the core of the Netscape Gecko Technologies provide a stable foundation for web content and applications and put confidence behind the investment of development dollars. Content and web application developers can write content and web applications once to run in all web standards-compliant applications and devices, thus reaching the broadest possible audience across platforms and devices while minimizing effort for development, testing and maintenance.

Because Gecko has the industry's best implementation of W3C standards, developers can leverage all the power these standards provide. Clean separation of content and presentation via CSS makes it easier and cheaper to maintain and update a site's look and feel over time. By building DOM-based applications with XML data exchange that do more processing on the client, developers can reduce the number of server round-trips per session. This provides better performance to the user while simultaneously reducing load on servers, and thus lowers resource costs for the content provider. XML is a critical enabling technology for the migration of functionality to fully featured web applications in a range of Internet-enabled devices. Deployment of XML also supports the industry trend toward openness and choice, and Netscape is committed to maintaining the platform-independent nature of XML.

Structuring software as web applications benefits both developers and users. Web applications and any databases they use are installed on the server side. Application logic can reside on the server side and/or be downloaded dynamically as needed to the desktop to provide interactivity. The user interface is downloaded dynamically in the form of web pages. Regardless of how a particular application mixes server-side and client-side code, bug fixes and enhancements can be rolled out to all users on a daily or hourly basis, improving the quality of the user experience on every visit. Users will be able to file bug reports online and get rapid resolution of their problems, improving the quality of the developer's information and the final application.

Enterprise developers will find that the Netscape Gecko Technologies provide a robust foundation for rapidly developing lightweight, high-performance web applications for deployment on the intranet or extranet. Web applications written for Gecko can be accessed "as is" from any platform, easing the integration of applications after merger or acquisition, as well as facilitating communication with partners over the extranet. Gecko's small size means it can easily be distributed and deployed. Plus, Gecko is distributed free and without licensing fees of any kind.

For the first time, the power of a web content and application development environment rivals that of proprietary platform APIs (such as the user interface and event handling supported by Windows), so web applications can offer the richness and power once possible only for platform-specific desktop applications.

	Room	Transportation	Entertainment	Total Francs	TOTAL DOLLARS
Mon	1700	600	1100	3400	$502.21
Tue	1700	600	900	3200	$472.67
Wed	1700	600	900	3200	$472.67
Thu	1950	800	1000	3750	$553.91
Fri	1950	800	1500	4250	$627.76
Total Required for Trip:					$2629.2

Netscape Gecko makes possible the deployment of a new class of web-based applications, such as this expense spreadsheet. Gecko's XML support enables data exchange so that more processing can be done on the client, resulting in better performance. Through its industry-leading support for W3C standards, Gecko delivers web applications with functionality and performance that rivals client-only native applications.

FOR USERS

First and foremost, users benefit because Gecko enables the creation of small, fast browsers that display rich content, run powerful web applications and can be used from PCs and devices alike.

Second, Gecko supports the evolution of computing from the desktop to the distributed application model of the Web. Delivery of computing via the Web avoids the messy and time-consuming activities of installing and maintaining applications on desktop machines. Because this process is fundamentally difficult and only a means to the end of delivering computing to users, software applications have grown larger and more generic so that the widest possible range of users and uses can be served by a single, monolithic application that can be installed once. As a result, this installed application is complex, is not frequently updated by the vendor, and, because of its sheer size as well as the installation hassles, is seldom upgraded by the user. In contrast, web-based application delivery is the simplest possible user experience: a simple browser click dynamically loads and runs the application. This provides the latest version of software, avoids any separate installation and configuration process, and immediately delivers what can be a highly specific, "vertical" application to a particular user and set of circumstances. Gecko enables the rapid evolution of software applications being delivered via the Web because it will encourage the development of simple applications tailored to specific uses, minimize application startup times, display complex content and user interfaces with high performance and deliver a rich user experience.

Third, because Gecko is cross-platform and cross-device, users will gain freedom of choice. Initially, a wider range of devices will make web content and email accessible from more locations. Over time, diverse platforms and devices will provide location-independent access to powerful web applications that bring simplicity, richness and consistency to the user's Internet experience.

ENABLING THE NEXT-GENERATION INTERNET

Netscape Gecko supports the continuing migration of client applications to the Web and of PC-bound applications to portable, always-connected devices. Gecko liberates the Web from desktop browsers, users from the PC, hardware from bloated application code, developers from cross-platform/cross-device porting headaches, and both users and the industry from proprietary solutions. Gecko also will enable a revolution in personalization, where ubiquitous computing is tailored to the needs of individuals.

Existing browsers are limited by the problems of the past. Netscape Gecko will enable the next generation of browsers, devices, and Web applications to meet and even lead marketplace demands for ever-richer services. Consumers and professionals will be assured of simple, convenient access, anytime, anywhere, to the personalized services they need, presented consistently yet flexibly, through the next-generation Internet.

GETTING INVOLVED

mozilla.org serves as a central point of contact and community for anyone interested in using or improving the Gecko source code. The development process at mozilla.org is open to all. Internet users, technical writers, editors, content and web application developers and software application developers can all participate in the design, development and testing of the Gecko browser engine and the Mozilla browser. By doing so, they can ensure that Netscape Gecko will meet their own needs. Anyone wishing to participate in mozilla.org should visit the "getting involved" page at http://www.mozilla.org/get-involved.html to learn about opportunities to make a difference. Those wishing to test the Mozilla browser can download the latest milestone builds from http://www.mozilla.org/projects/seamonkey/release-notes/.

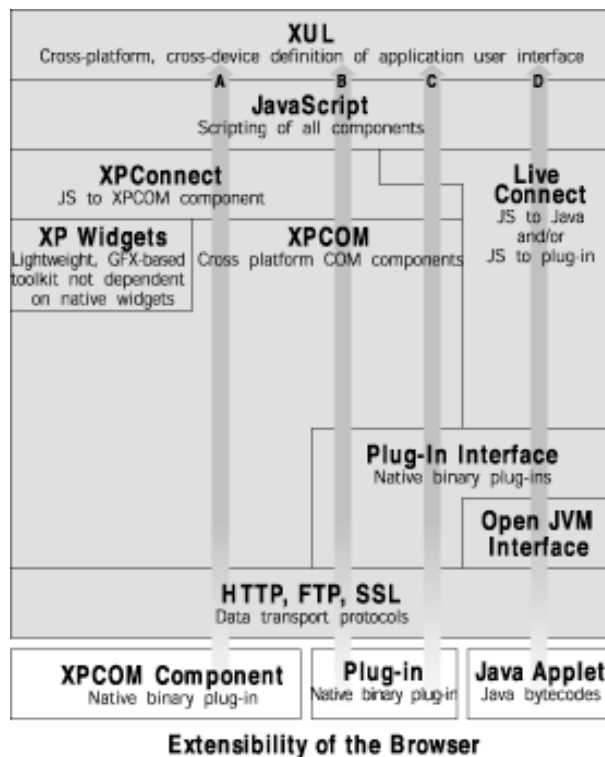Developers wishing to obtain the mozilla source code, including the Netscape Gecko browser engine can download it from http://www.mozilla.org/source.html. All source code at mozilla.org can be reused without charge under the Mozilla Public License. Netscape will be releasing its own branded binary build of Netscape Gecko for download in the future; watch http://developer.netscape.com/ for details.
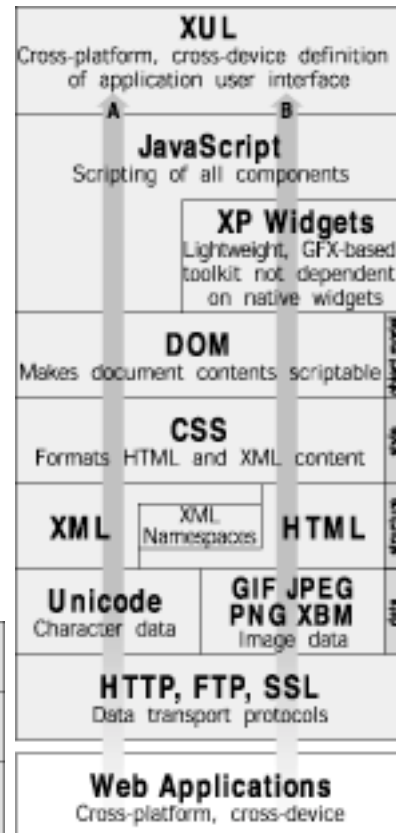
APPENDIX A: DEVELOPING WITH NETSCAPE GECKO

Netscape Gecko and the Netscape Gecko Technologies provide a robust platform for rapidly developing web content, web applications, browsers and other web-enabled applications and Internet browsing devices.

Netscape Gecko Technologies enable all elements on the web page and all browser components to be scripted from JavaScript, the Web's most popular scripting language. With the rich functionality provided by Gecko, along with XUL's power for constructing cross-platform, cross-device user interfaces, building a browser application is relatively simple. Moreover, the Java Wrapper API, Gecko ActiveX Control and web Shell Embedding APIs make it easy to web-enable other applications (such as web authoring tools or applications with web-based help) by embedding Gecko.

Netscape Gecko's broad and deep support for web standards provides a robust foundation for building compelling, high-performance web applications with rich user interfaces. In particular, Netscape Gecko features full support for HTML 4.0, XML, CSS1 and DOM1, as well as support for CSS2 content positioning and key features of DOM2 such as event handling and the style sheet interface.
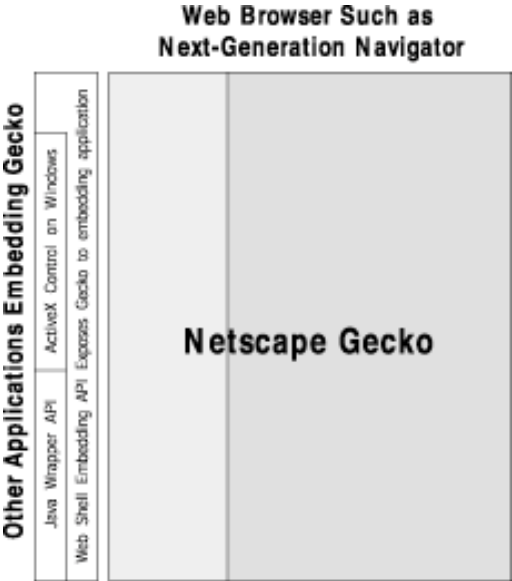

Extensibility of the Browser

Because of this rich standards support, all of the data, elements and style properties of the page can be scripted from JavaScript. Unicode character data and graphic images are given structure by HTML or XML, which can be used together when necessary via XML Namespaces. Cascading Style Sheets format the page and the W3C Document Object Model exposes all of the page's data, elements and style properties to JavaScript for manipulation and control. XUL leverages this rich standards support to provide a powerful shorthand that makes it easy to develop cross-platform, cross-device user interfaces for web applications and for client applications such as browsers. (Appendix B contains a detailed example of XUL.)

Developers can extend the browser's functionality through the use of native-binary XPCOM components, binary or Java-based plug-ins and Java applets. As shown by the diagram on the left, all of these components are scriptable from JavaScript:

A. Native binary XPCOM components are made scriptable by XPConnect.
B. Plug-ins can expose their functionality as XPCOM components and be scripted via XPConnect.
C. Plug-ins continue to support existing LiveConnect scripting APIs.
D. Java applets are supported by external Java Virtual Machines through the Open JVM Interface, and are made scriptable by LiveConnect.

Web Browser Such as Next-Generation Navigator

Other Applications Embedding Gecko

Java Wrapper API

ActiveX Control on Windows

Web Shell Embedding API Exposes Gecko to embedding application

Netscape Gecko

The Java Wrapper API, ActiveX Control and web Shell Embedding APIs make it easy to embed Gecko in Java applications, Windows applications and native C applications, respectively. As a result, Java applications and native applications on any platform are able to leverage Gecko's high performance and rich standards support to enable such features as integrated browsing, online help and file preview functionality.

APPENDIX B: XUL USER INTERFACE EXAMPLE

With the XML-based User interface Language (XUL), defining an application's user interface is as easy as editing a web page. Developing a cross-platform user interface once required intimate knowledge of platform-specific APIs and painstaking redevelopment on each platform. Now developers can use XUL to leverage the power of XML, XML Namespaces, HTML 4.0, CSS, the W3C DOM and JavaScript to build a lightweight user interface that runs on any platform or device with Gecko.

This simple example demonstrates how a few lines of XUL can create the browser toolbar in this graphic:

Here is the source code to create the toolbar, followed by an explanation of how it works:

```
<?xml-stylesheet href="chrome://global/skin/" type="text/css"?>
<?xml-stylesheet href="chrome://navigator/skin/" type="text/css"?>

<!DOCTYPE window>

<window align="vertical" xmlns:html="http://www.w3.org/TR/REC-html40"
xmlns="http://www.mozilla.org/keymaster/gatekeeper/there.is.only.xul">

<toolbox style="min-width: 10px"><toolbar>
  <titledbutton id="back-button"    align="top" value="Back"/>
  <titledbutton id="forward-button" align="top" value="Forward"/>
  <titledbutton id="reload-button"  align="top" value="Reload"/>
  <titledbutton id="stop-button"    align="top" value="Stop"/>

<box align="vertical" flex="100%"><spring flex="100%"/>
<html:input id="urlbar" type="text"/><spring flex="100%"/>
</box>

<titledbutton src="n.gif" align="right"/>
</toolbar></toolbox></window>
```

XML was intended for the creation of new markup languages in order to solve application-specific problems. Netscape has used XML to create the XUL markup language, whose elements represent familiar user interface objects such as windows, toolbars, buttons, menus, and menu items. Here is how each of the elements of the toolbar is specified in XUL:

- Cascading Style Sheets linked at the top of the file via xml-stylesheet define the appearance for all elements, so changing the user interface's look and feel is merely a matter of updating a style sheet file.

- The window element creates a new window.

- The toolbar element creates the toolbar; its enclosing toolbox provides the toolbar with "grippies," user-interface objects for opening and collapsing the toolbar.

- Inside the toolbar, titled button elements create individual buttons on the toolbar for "Back," "Forward," "Reload" and "Stop."

- Thanks to Gecko's support for XML Namespaces, familiar HTML elements can also be used in constructing a user interface. In this case, an HTML input element is used to create the Location Bar in which a user can enter a URL.

- Finally, a titled button with a GIF is used to create the familiar "throbber" image that animates when loading pages.

- User events such as clicks on the buttons are exposed by the W3C DOM and handled by JavaScript.

To create an equivalent toolbar without XUL that runs across Windows, MacOS and UNIX, a great deal more native code would be necessary on each individual platform than is needed here to develop across all platforms. Without XUL, development would require C language skills as well as knowledge of each individual platform, rather than just web markup and scripting skills. XUL is a powerful and productive shorthand that makes it easy to leverage the power of web standards to build an application user interface that runs across platforms and devices.

Appendix C: Industry Case Studies – Netscape Gecko in Action

The Netscape Gecko browser engine was previewed to developers in December 1998, delivering on its promise to be small, speedy, standards-compliant and open-source. Building on the Gecko core, Netscape and its partners in the open-source effort have continued their innovation, developing Netscape Gecko Technologies to support the efficient deployment of Gecko in an unprecedented range of applications.

Desktop application and device vendors can offer their customers fast, full-power web browsing by embedding small, modular and standards-compliant Gecko. Developers of web content and web applications will reap the benefits of Gecko's W3C standards support in developing web applications with functionality, user interfaces and performance that approaches that of desktop applications.

Netscape is using the Gecko browser engine and Gecko Technologies for the design, development and deployment of its next-generation browser and its web-based services. Developers throughout the industry are embedding Gecko in browsers and web applications designed for a variety of devices and operating systems.

The following case studies represent a sample of the innovators who have recognized the value of Gecko. These leaders are contributing resources to the ongoing improvement of Gecko through the open source efforts of the mozilla.org community, as well as embedding Gecko in their next-generation Internet products.

Some of the industry leaders that are currently working with Netscape Gecko Technologies include:

- America Online
- IBM
- Intel/Nokia
- Liberate
- NetObjects
- Red Hat
- Sun Microsystems
- Netscape

America Online (AOL)

AOL is committed to using Netscape Gecko Technologies across its products and brands including its instant messaging services, Spinner, Winamp, AOL TV and Netcenter. Netscape Gecko Technologies will enable these brands to deliver rich Web applications and content across multiple platforms and devices.
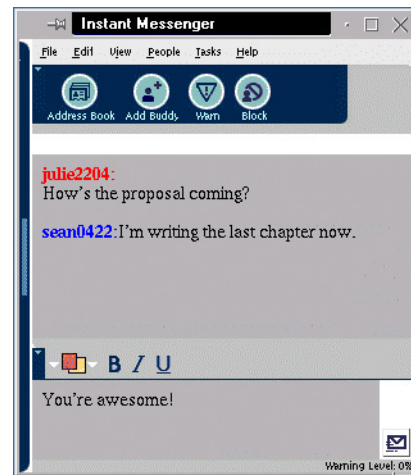
AOL is building Gecko support into future instant messenger clients so users will be able to experience the richest possible Web content when sending and receiving instant messages. These instant messenger clients will use Gecko to display Web content such as hyperlinks within instant messages, and will include a cross-platform and cross-device user interface via XUL, Netscape's XML-based User Interface Language. Using Netscape Gecko, these clients will run across multiple platforms, including device friendly operating systems such as Linux.

In the rapidly growing Internet music space, AOL's popular Winamp and Spinner clients will use Gecko to provide a Web browsing experience integrated with audio playback, linking content, such as artist profiles, with the music.

AOL will also use Netscape Gecko to bring Web browsing to television for millions of consumers. AOL TV uses Netscape Navigator today as the basis for its television-optimized TV Navigator services platform (provided by Liberate Technologies), allowing AOL TV to deliver a Web experience as rich as the one available on PCs. Ultimately, Netscape Gecko Technologies will enable AOL TV to provide next-generation Web applications and content, taking advantage of XML to deliver improved interfaces and better performance.

AOL Instant Messenger running on Linux with a XUL user interface enabled by Netscape Gecko.

Netscape Netcenter will deliver richer interactive services based on the Web standards that Gecko supports. For example, Netscape Netcenter will provide Web applications and content that use XML to provide greater responsiveness and user interfaces whose quality surpasses that available on the Web today.

Netscape Gecko will enable any AOL brand to deliver a consistently excellent Web experience and rich standards support across browsers, desktop applications, set-top boxes and other devices.

IBM

The mozilla.org community gives IBM a way to incorporate its customers' requirements directly into the source code of Mozilla, Gecko, and Mozilla-based browsers such as Netscape's. IBM will be contributing to the community in specific areas that concern its enterprise and e-business global customers. These areas will include internationalization support, accessibility, enterprise support and other areas to meet the needs of its customers.

"We at IBM are excited to see the innovative efforts of the Mozilla development community bearing fruit, such as the creation of the Gecko layout engine," said Scott Hebner, director of e-business Technology Marketing at IBM. "Our customers realize the importance of industry standards and the concepts of open-source communities, and IBM plans to participate accordingly in the Mozilla project. We hope to contribute technology and skills that will help this effort meet the needs of our customers."

IBM is the leader in the creation, development and manufacture of the industry's most advanced information technologies, including e-business solutions. IBM translates these advanced technologies into reliable and scalable solutions for its customers through its products and professional services worldwide. IBM customers require the support of many different hardware and software solutions to stay competitive in today's fast-paced business environment, and IBM works to support open industry standards that offer its customers the flexibility and choice they demand.

Intel and Nokia

Nokia and Intel share a vision for enabling the Internet on television. To fulfill this vision, Nokia and Intel are jointly developing standards-based, Internet-enhanced broadcasting solutions. These products will allow broadcasters to provide consumers with access to new, Internet-enhanced broadcasting services, as well as to an extensive range of services already available on the Internet.

"The Internet will change the nature of broadcasting, and we are excited to be working with our partners to make this vision a reality," said Claude Leglise, vice president and general manager of Intel's Home Products Group. "By using open source technologies such as the Mozilla browser with Netscape Gecko, along with Nokia's and Intel's technology, we are able to provide the broadcast industry with the platform to deliver to consumers new forms of Internet-enhanced programming."

Their jointly developed, Internet-enhanced broadcast products will help broadcasters offer consumers new types of programming that can fully utilize the power of the Internet. Based on technologies such as Netscape Gecko, with its industry-leading standards support, these devices will be able to evolve at the speed of the Internet and will allow for great innovation and flexibility.

Heikki Koskinen, president of Nokia Multimedia Terminals, comments, "By taking the lead and creating products that work with Internet-based technologies such as Netscape Gecko, we can give the broadcast industry a strong platform that will let it deliver new, exciting Internet-based services to viewers. This is why we are strongly promoting standards and environments open to all service providers and manufacturers."

Development of Internet-enhanced broadcast products is in progress and the first products are expected to be introduced in the second half of 2000.

Liberate Technologies

Liberate Technologies is a leading provider of a comprehensive software platform for delivering enhanced Internet content, services and applications to TV set-top boxes and other information appliances.

Liberate adopted the Netscape Gecko browser engine as a core component of its next-generation software platform for interactive TV. With Gecko's industry-leading standards support, Liberate can offer its customers immediate access to a robust array of web applications and content. Gecko's speed and size ensure that TV Navigator™ will run on low-cost set-top boxes.

Liberate's TV Navigator client software extends Netscape Gecko, adding numerous critical capabilities that make it possible to deliver Internet-based content and applications on television with the quality and reliability TV viewers have come to expect. Liberate's IQView™ automatically reformats standard web content to deliver crisp, easy-to-view web-based text and graphics on TV. Liberate software integrates broadcast standards, such as ATVEF, and further offers the capability to extract broadcast data from the MPEG stream used in digital TV. Liberate has also reduced the code footprint, enabling hardware OEMs to deliver the price point required for successful large-scale interactive TV deployments.

"With Gecko, Netscape is once again leading the industry toward 100% compliance with open Internet standards," says Steve Weinstein, senior vice president of Strategic Technologies at Liberate. "Liberate believes standards are the driving force for any new content-based market such as interactive TV. Just as the TV market exploded upon adoption of common broadcast standards, such as NTSC and PAL, we believe integrating Gecko technologies into our interactive TV solution will help to spur a proliferation of interactive TV content and applications."

Liberate's software enables network operators (telecommunications companies, cable and sattelite television operators and ISPs) and information appliance manufacturers to deliver Internet-based service on TV.

NetObjects

With the introduction of NetObjects Authoring Server 2000 in September, NetObjects added an enterprise-quality web content management and collaborative site development package to its industry-leading desktop web-site creation tools. NetObjects is creating solutions that enable companies large and small to easily address the challenges of cost-effectively developing and deploying web-based applications that make their employees, partners and suppliers more efficient and productive.

Now NetObjects is creating an Integrated Application Environment (IAE) for the design, development and deployment of enterprise web applications. This will enable corporations to deploy integrated e-business applications that combine legacy and back-office applications with the power of web and Java technologies.

A key element of the IAE is an integrated application design and development client that is built on Netscape Gecko and the Mozilla codebase. Netscape's XUL makes it easy for NetObjects to create and extend the user interface of the IAE. Gecko's modularity and cross-platform component model (XPCOM) have enabled

NetObjects to extend the functionality available in Gecko. The ready availability of plug-in

WSIYWYG content using the Netscape Gecko-equipped Integrated Application Environment.

support was another key factor in NetObjects' decision to develop the IAE based on Netscape Gecko.

"Mozilla and Gecko provide NetObjects with the performance and flexibility we need to develop products that enable our customers to effectively integrate their enterprise applications and information infrastructure into a single web interface," says Martin Frid-Nielsen, vice president of Engineering at NetObjects. "We support Mozilla and Gecko because we have found its open, modular, standards-based approach gives us exactly the browsing engine we need to effectively integrate design with development."

Red Hat

Red Hat is the market leader in open-source operating system (OS) software with the multi-award winning Red Hat Linux OS. The open-source Netscape Gecko is a natural combination with Red Hat's Linux. Red Hat Linux is used as a desktop OS to meet the needs of a wide range of users, from professional software developers through EDA engineers to small office/home office users. All need reliable, fast and standards-based access to the Web.

Red Hat Linux plus Gecko meets this need by delivering rich web applications and content through support of leading web standards. As Bob Young, CEO of Red Hat, states, "The open-source Red Hat OS and Netscape Gecko Technologies will enable consumers to enjoy the same rich web experience on Linux desktops and Linux devices as is available on PCs."

Given the scalability of the Linux OS, there is great interest within the computer industry in using Linux as the OS for web appliances that will offer easy access to web content and web-based applications such as email and calendaring. Netscape Gecko provides an elegant rendering engine for such devices, with a remarkably small footprint.

Red Hat has also devoted engineering resources to work full time on the mozilla.org project as part of the Red Hat Advanced Development Labs (RHAD Labs). RHAD Labs is a significant contributor to the GNOME development effort. GNOME and Gecko share common technologies and both will benefit from close cooperation. A major part of the Red Hat effort will be to further increase the performance of the Gecko engine, to ensure that the user's browsing experience is limited only by the speed of connection to the Internet.

Finally, Red Hat will continue to include the Netscape browser along with Netscape Gecko in the future version of its award-winning OS.

Sun Microsystems

Sun Microsystems™ is using the Netscape Gecko Technologies to deliver a powerful enterprise desktop client solution across a variety of platforms, such as Windows and Solaris. By actively participating in the open-source development on mozilla.org, Sun is contributing key technologies to Netscape Gecko to ensure seamless integration with the Java™ platform.

Sun is working with mozilla.org to add technologies to Netscape Gecko that allow it to integrate with any pluggable Java runtime engine through the Open Java Interface. This will enable users to select the Java runtime engine that is best suited to their needs. Further, Sun has created a Java wrapper API that will make it easy to integrate the Netscape Gecko browser engine into any Java application and an API that will enable Netscape plug-ins to be written in the Java programming language. This addition of Java technologies to Netscape Gecko provides a powerful combination to deliver both web applications and Java applications across a variety of enterprise desktop platforms.

Netscape Gecko Technologies will enable StarOffice documents to display Web content.

Sun's StarOffice™ suite–the .COM office productivity suite that is free, cross-platform, and interoperable with Microsoft Office files–will also benefit from the industry-leading Netscape Gecko browser engine. Sun is embedding Gecko so users will be able to easily view and create web documents from within Star Office. Sun has chosen Gecko because it provides excellent HTML rendering, extensive support for industry standards such as XML, high performance and a small runtime memory footprint.

In addition, Sun will ship tools to enable management of the Gecko-based Netscape browser and other applications to provide a lower cost of management of the enterprise desktop.

Netscape Communications

Netscape's next-generation browser, based on Netscape Gecko, is currently being developed on an open-source model. Netscape Gecko enables Netscape to deliver a browser that is small, fast, standards-compliant and available on multiple platforms such as Windows, Linux, and Macintosh.

Gecko's small size means Netscape's browser download will be a fraction of the size of competing browsers. Because of the high performance of Gecko's network library and layout engine, this browser will retrieve and display pages faster than existing browsers. Gecko's component-based architecture extends to the browser and other applications, so users have the freedom to choose to install only the components they need.

Because Netscape's browser takes advantage of key Netscape Gecko Technologies such as XUL, customizing its user interface is as easy as modifying the content on a web page. This will enable corporate and ISP developers to easily adapt the browser, adding special-function buttons or branding, for example, to suit their own needs. XUL also enables the browser's user interface to be shared across multiple platforms.

Netscape browser and mail interfaces run across multiple platforms due to the innovative XML-based XUL technology found in Netscape Gecko

How to reach us:

Web: http://home.netscape.com
E-mail: info@netscape.com
           sales@netscape.com
Phone: 415.937.2555 (corporate customers)
           415.937.3777 (individuals)
Fax: 415.528.4140
Mail: Netscape Communications Corporation
           501 E. Middlefield Road
           Mountain View, CA 94043