



Extending your browser

- Philip Roche – Karova
- philip@karova.com
- <http://www.philroche.net/downloads>

Introduction –

Today I'd like to discuss Mozilla as an application development framework, discussing the technologies used in that framework.

I'd also like to discuss the Firefox web browser and some of its features.

I will be talking about three Firefox extensions in particular.

I will then attempt to put all that together by showing you the code of an extension I have been developing

If you have any questions – don't hesitate to ask.



The slide is titled "Introduction" and features a list of four questions on the left side. On the right side, there are three graphical elements: the Mozilla logo (a colorful circle of dots), the mozilla.org logo (a red fox head), and the Firefox logo (two blue and orange fox heads). At the bottom of the slide, the date "06/02/2007" and the text "Extending your browser" are visible, along with a small number "2" in the bottom right corner.

Introduction

Who are Mozilla?

What is Firefox?

What is Mozilla Application Framework?

What is Gecko?

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Mozilla

The Mozilla Foundation is a free software/open source project that was founded in order to create the next-generation Internet suite for Netscape.

In 2005, the Mozilla Foundation announced the creation of Mozilla Corporation, a wholly owned for-profit taxable subsidiary of Mozilla Foundation, that will focus on delivering Firefox and Thunderbird to end users. It is because of the Mozilla Corporation's work that we have seen the increase in Firefox's user base to 31% (w3schools.com jan 2007 stats).

Firefox

Firefox is a freely available cross-platform browser.

Mozilla application framework

Also known as XPFE or XPToolkit.

A collection of cross-platform software components, One of which is the Gecko Layout engine.

Gecko

Gecko is a standard-based layout engine designed for performance and portability.

The terms Gecko and Mozilla Application Framework tend to be interchanged but Gecko is the layout engine that is part of the Mozilla Application Framework collection.



- Development began at Netscape in 1997
- Netscape 6 released
- AOL embed the Gecko engine
- In 2003, AOL lay off all Gecko Developers
- Mozilla foundation
- Currently developing Gecko 1.9

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Development began in 1997

Development of the Gecko engine began at Netscape in 1997, following the company's purchase of DigitalStyle.

The existing Netscape rendering engine, originally written for Netscape Navigator 1.0 was inferior to the one used in Microsoft Internet Explorer.

The new layout engine was developed in parallel with the old, with the intention being to integrate it into Netscape Communicator when it was mature and stable.

At least one more major revision of Netscape was expected to be released with the old layout engine before the switch.

After the launch of the Mozilla project in early 1998, the new layout engine code, then called NGLayout (Next Generation Layout) was released under an open-source license.

Netscape 6 released

In October 1998, Netscape announced that its next browser would use Gecko rather than the old layout engine, Netscape 6, the first Netscape release to incorporate Gecko, was released in November 2000.

AOL embed the Gecko engine

As Gecko development continued, other applications and embedders began to make use of it. America Online, adopted it for use in it's software instead of the Internet Explorer engine.

In 2003, AOL lay off all Gecko Developers - Mozilla foundation

In 2003, AOL (who owned Netscape) laid off the remaining Gecko developers and the Mozilla Foundation (formed on the same day) became the main steward of Gecko development. Today, Gecko is developed by employees of the Mozilla Corporation, employees of companies that contribute to the Mozilla project, and volunteers.

Currently developing Gecko 1.9

One of the main initiatives in 1.9 is an overhaul of the graphics infrastructure. Instead of using the platforms' API, Cairo will be used for all graphics outputs.



Applications

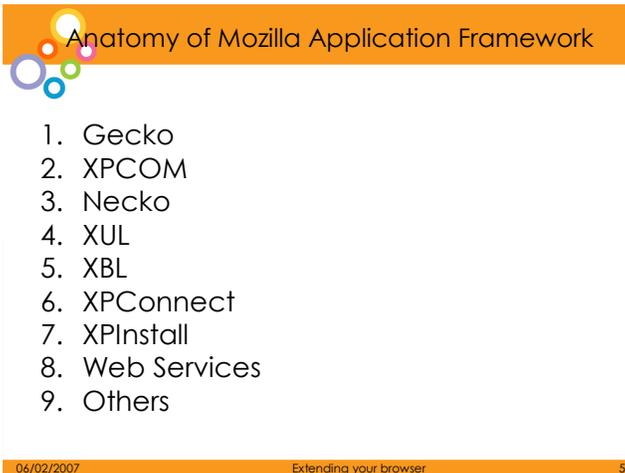
- Applications built using the Mozilla Application Framework or parts of.
 - Joost (The Venice Project)
 - XCube
 - Thunderbird
 - K-Meleon
 - eXe
 - Nvu
 - Flock
 - FireFTP
 - Swiftfox
 - XulRunner
 - Chatzilla
 - Camino
 - Democracy Player
 - Songbird
 - Epiphany
 - Galeon
 - SeaMonkey
 - MiniMo
 - Firefox

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To put this in context – there are many applications that are developed using the Mozilla Application Framework – some of which I have listed.



Anatomy of Mozilla Application Framework

1. Gecko
2. XPCOM
3. Necko
4. XUL
5. XBL
6. XPConnect
7. XPInstall
8. Web Services
9. Others

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Gecko

Gecko is a standard-based layout engine designed for performance and portability.

Necko

Necko provides an extensible API for several layers of networking from transport to presentation layers.

XUL

XUL is the basis of user interface. It is an application of XML that defines various user interfaces elements, mostly widgets, control elements, template, etc. It is similar in many ways to HTML. It is XUL that is used to build the chrome for most XPFE applications.

XBL

XBL allows one to define his/her own widget for use in XUL.

XPCOM

XPCOM is an object interface that allows interfacing between any programming language for which a binding has been developed

XPConnect

XPConnect is the binding between XPCOM and JavaScript.

XPInstall

XPInstall is a technology for installing small packages like extensions and themes into Mozilla applications in form of installation archives known as XPI.

Web services

Mozilla includes built-in support for popular web services standards XML-RPC, SOAP, and WSDL as well as a simple XMLHttpRequest object similar to the one in Internet Explorer.

Others

The framework supports a number of open or common standards, including DTD, RDF, XSLT/XPath, MathML, SVG, JavaScript, SQLite, LDAP, etc.



- Rich programming API
- Standards support
 - HTML 4.0
 - CSS Level 1 (partial support for CSS 2 and 3)
 - JavaScript 1.7 (ECMAScript)
 - DOM Level 1 and 2 (partial support for DOM 3)
 - XML 1.0
 - XHTML 1.1
 - MathML
 - XForms (via an official extension)
 - SVG (Partial SVG 1.1 support*)
 - RDF
 - Canvas

Rich programming API

Gecko offers a rich programming API makes it suitable for a wide variety of roles in Internet-enabled applications.

Standards support

Gecko was designed to support open Internet standards.

Some of the standards Gecko supports include:

- HTML 4.0
- CSS Level 1 (partial support for CSS 2 and 3, see Mozilla CSS support chart for details)
- JavaScript 1.7 (ECMAScript)
- DOM Level 1 and 2 (partial support for DOM 3)
- XML 1.0
- XHTML 1.1
- MathML
- XForms (via an official extension)
- SVG (Partial SVG 1.1 support*)
- RDF

Other browsers layout engine

Trident - Internet Explorer

WebCore – Safari

Presto - Opera



- Cross platform component object model, similar to Microsoft COM
- Multiple languages
- XPIDL interface
- Provides a set of core components and classes

XPCOM

XPCOM is a cross platform component object model, similar to Microsoft COM. It has multiple language bindings, letting the XPCOM components be used and implemented in JavaScript, Java, Perl, and Python in addition to C++.

Interfaces in XPCOM are defined in a dialect of IDL called XPIDL.

XPCOM itself provides a set of core components and classes, e.g. file and memory management, threads, basic data structures (strings, arrays, variants), etc.



- Necko is an extensible, scriptable API for client-side networking tasks built on XPCOM.

Necko

The network library (Necko) provides a platform-independent API for several layers of networking ranging from transport to presentation layers.

This API is used in the Mozilla client and can be used for writing other networking clients.

It provides:

- * generic and extensible framework for fetching URLs
- * generic cache service
- * async DNS resolution
- * implementations of common protocols (http, ftp, file, etc.)



- XML User Interface Language
- Uses many existing standards and technologies
- Localizable
- Can be run remotely
 - application/vnd.mozilla.xul+xml

XUL

XUL -pronounced zool ([zu:l]))

Stands for XML User Interface Language

Uses many existing standards and technologies

The XUL 1.0 specification is still in draft. It uses many existing standards and technologies, including CSS, JavaScript, DTD and RDF,

which makes it relatively easy to learn for people with a background in web programming and design.

Localizable

lets you build feature-rich cross platform user interfaces for applications that can run connected or disconnected from the Internet.

These applications are easily customized with alternative text, graphics and layout so they can be localized.

Can be run remotely

XUL applications or simple pages can be run remotely too, if the mime type application/vnd.mozilla.xul+xml is set for files with the xul extension.



- XML Binding Language is a language for describing bindings that can be attached to elements in other documents
- XML Syntax for describing those bindings
- Bound using CSS and the -moz-binding property.
- Nice way to template XUL

XBL

XML Binding Language (XBL, sometimes also called Extensible Bindings Language) is a language for describing bindings that can be attached to elements in other documents.

The element that the binding is attached to, called the bound element, acquires the new behavior specified by the binding.

XBL or XML Binding Language is used to declare the behavior and look of XUL widgets and XML elements.

In XUL you define the user interface layout of an application, and then (applying styles) can customize the look of elements.

The drawback is that XUL provides no means to change an element's function. For example, one might want to change how the pieces of a scroll bar work. This is where XBL comes in.



- XPConnect is a bridge between JavaScript and XPCOM.
- Security Issues

xpconnect

XPConnect is a bridge between JavaScript and XPCOM. With XPConnect, you can use XPCOM components from JavaScript code.

It allows JavaScript objects to transparently access and manipulate XPCOM objects

```
var Cc = Components.classes;
var Ci = Components.interfaces;
var rc = Cc["@mozilla.org/registry;1"];
var rs = rc.getService(Ci.nsIRegistry);
```

Security

Being able to call XPCOM components from Javascript is a security risk as the components have the ability to do a lot more than javascript.

To solve this, Full privileges are only granted by default to chrome scripts (cripts that are part of the application or of an extension).

There is a way to request privileges from the user to allow the remote script access to the local browsers components.



- Installing extensions or applications
- Format of an XPI
- Security



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xpInstall

XPInstall is a technology for installing Mozilla extensions that add functionality to the main application.

XPInstall consists of a single file that the browser installs

Format of an xpi

An XPI (pronounced zippy) is a ZIP file with a “xpi” extension that contains an install script or manifest (entitled install.js or install.rdf) at the root of the file.

In the xpi is also a directory or a jar archive containing all the javascript, XPCOM components, XUL, CSS images, localization files.

Security

After Firefox 1.0, XPI's from unauthorized sites were blocked from installation unless they were on the built in whitelist or the user had specifically add the site to their whitelist. This is to stop trojans or malicious extensions being installed.



- XML-RPC
- SOAP
- WSDL
- XMLHttpRequest

xml-rpc

The framework provides the ability to invoke remote procedure calls without having to write any networking code

Soap

The same goes for SOAP. Invoking a soap call is as simple as creating an instance of the SoapCall() class, populating it with your parameters and calling the invoke method, and waiting for the response.

WSDL

Use XBL to bind the result of a SOAP call using the WSDL description of that web service.

XMLHttpRequest

Allows the querying and parsing of remote XML document. It is this feature and the equivalent feature in other browsers that has seen AJAX development become so popular.



Other

- DTD
- RDF
- XSLT/XPATH
- MathML
- SVG
- Javascript
- SQLite
- LDAP
- Session Storage
- OpenSearch
- MicroSummaries
- Spell Check
- SAX Parser
- DOM Parser

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Other

Mozilla application development framework supports many other technologies besides those already mentioned.

DTD, RDF, XSLT/XPath, MathML, SVG, JavaScript, SQLite (MozStorage), LDAP, Session Storage, OpenSearch, MicroSummaries, Spell Check, SAX Parser, DOM Parser



Firefox - Not just a browser

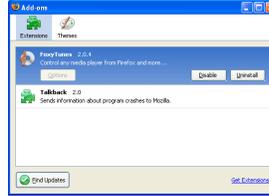
Firefox is not just a browser

- Add-ons (extensions)
- Plugins
- Themes
- Profiles



Add-ons

“Add-ons extend Firefox, letting you personalize your browsing experience. They can make a tiny tweak, or bring a whole new range of features to your favourite browser.”



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“Plugins help your browser perform specific functions like viewing special graphic formats or playing multimedia files. Plugins are slightly different from extensions, which modify or add to existing functionality. “



Plugins

Flash

Adobe PDF

SVG (Built in in Firefox 2.0)

Quicktime

Real player

Java

Shockwave

Windows media player

Search plugins – Open Search and MozSearch



Themes

"Themes are like new clothes for your Firefox. A theme can change only a few colors, or every piece of Firefox's appearance. It's another great way to personalize Firefox to your tastes."





- Personal Settings
- Bookmarks
- History
- Passwords
- Extensions
- Themes



Profiles

Mozilla Firefox stores all your personal settings, such as bookmarks, passwords and extensions, in a *profile*.

The profile is stored on your hard drive in a *profile folder*.



Anatomy of Firefox

- Viewing Code

- Code/Directory structure

- chrome
- components
- extensions
- plugins
- res
- searchplugins



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Viewing Code

As Firefox is built using the Mozilla Applications Framework, you can view and modify any part of Firefox's code. By extracting browser.jar, you have access to all of the javascript, XPCOM and XUL used to build the Firefox interface. In that way, in addition to the themes and extensions etc. It is very customizable.

Code Directory structure

The main directories of note in the Firefox install directory are

Chrome

Contains all of the xul and javascript used in the Firefox's interface

Components

Contains all of the XPCOM components, both javascript components and C++ ones, like the spell check, search suggestions or the content handler component

Extensions

Contains all the default extensions installed which in Firefox 2.0 consists of the default Firefox theme, the DOM inspector and the crash reporter.

Plugins

All the Flash, adobe reader plugins etc are stored here

Res

This is where the language files, the CSS and the images are stored.

Searchplugins

There are a number of default search plugins – amazon, yahoo and google.

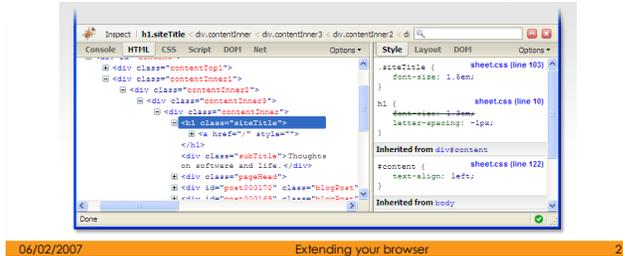
Firefox's main source of revenue is actually the search box you see there. For every Google search from Firefox that results in a click on a Google ad, the Mozilla Corporation receives a tiny amount of money. Last year they made \$72 million.



Extensions

Firebug (getfirebug.com)

"Firebug integrates with Firefox to put a wealth of development tools at your fingertips while you browse. You can edit, debug, and monitor CSS, HTML, and JavaScript live in any web page."



Firebug

Firebug is a truly great extension. It has everything a web developer could need to create and debug a web application.

Some of its features -

- Inspect and edit HTML
- Tweak CSS to perfection
- Visualize CSS metrics
- Monitor network activity – how long each item on your page is taking to load
- Debug and profile JavaScript – especially AJAX applications
- Quickly find errors
- Explore the DOM – there is the built in DOM inspector but Firebug's interface is much more intuitive
- Execute JavaScript on the fly -testing javascript without have to load it into a page
- Logging for JavaScript



Clipmarks (clipmarks.com)

"Clipmarks lets you clip and tag pieces of web pages. Whether it's a compelling paragraph in an article, interesting quotes, facts or tidbits, or a cool image, Clipmarks lets you save and share the best stuff you find on the web without having to bookmark the entire page."



Clipmarks



Greasemonkey (userscripts.org)

“Allows you to customize the way a webpage displays using small bits of JavaScript.”



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Greasemonkey

Greasemonkey allows you to completely customize a webpage, using CSS and JavaScript. There are hundreds if not thousands of scripts available that range from customizing the Google homepage, automated logins to customizing Amazon so the prices shown in different currencies.



Extension in detail

Aggreg8 (aggreg8.mozdev.org)

RSS feed aggregator built as a Firefox extension.



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Aggreg8

Aggreg8 is an open source project I have been working on for about 3 years (on and off).

I would like to use Aggreg8's source code to show you how all of the technologies I have discussed today have been used.

I'll briefly describe how each technology was used and then show some example code.



- RDF (Resource Description Framework)
- Firefox has built in support for querying RDF databases
- Aggreg8 uses RDF to store all the feed subscriptions



Javascript

- Javascript is used for all of Aggreg8's functionality
- Interfacing with built in components
- Writing new subscriptions to the RDF database
- Building up and displaying the parsed RSS feed

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Javascript

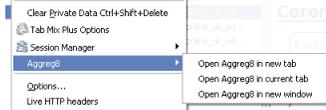
Aggreg8 uses the built in Feed Parser to parse the RSS feeds. It uses Javascript to interface with the feed processor and the XMLHttpRequest interface to retrieve the RSS feed from the web server.



- Aggreg8 uses CSS to style the parsed RSS feeds.
- Style sheet switcher to switch between multiple page styles.



- XUL is used to specify the user interface for Aggreg8, the feed tree, the display panel, the subscriptions form etc.
- Overlays – using the overlays feature we are able to add our extension to Firefox's existing chrome.



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Overlays

Overlays – using the overlays feature we are able to add our extension to Firefox's existing chrome.

This is how Aggreg8 adds itself to Firefox's tools menu.



- All Firefox extensions and themes can be localized.
- Localizing an XUL interface is achieved using DTD (Documents Type Definition) files.

DTD

Once you have specified your DTD with all your language specific text, you can reference any value in the DTD using it's entity name, just as you would reference Ascii entities in XSLT or XML.



Property strings

- javascript property strings are used for localization.
- Where the XUL could use the DTD for localized strings, the javascript uses, string property files to specify all the language specific content.

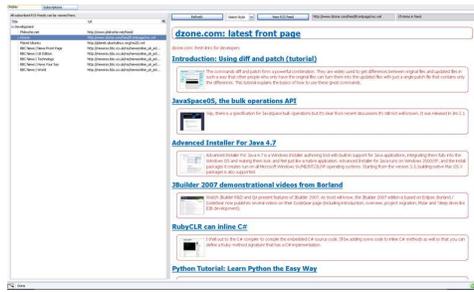


Build script

- creates the jar archive containing all the extensions code.
- Creates the XPI zip archive containing the jar archive, the install manifest and the install script.



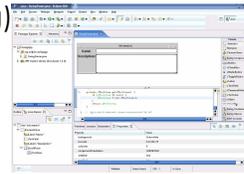
Finished product





Similar projects

- Eclipse (Eclipse.org)
– Aptana



- Internet Explorer 7 extensions
(ieaddons.com)



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Eclipse

Eclipse's Rich Client Platform is a platform for building and deploying rich client applications. Examples of these are – Aptana,

The Plug-in Development Environment (PDE) provides tools to create Eclipse plug-ins

Aptana

The Aptana IDE is a free, open-source, cross-platform, JavaScript-focused development environment

IE7 Addons

The recently released Internet explorer 7 also has the ability to install add-ons. Sadly, these tend to focus on toolbar development.

One very useful add-on is the Internet Explorer Web developer toolbar.





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