

Firefox Conceptual Architecture

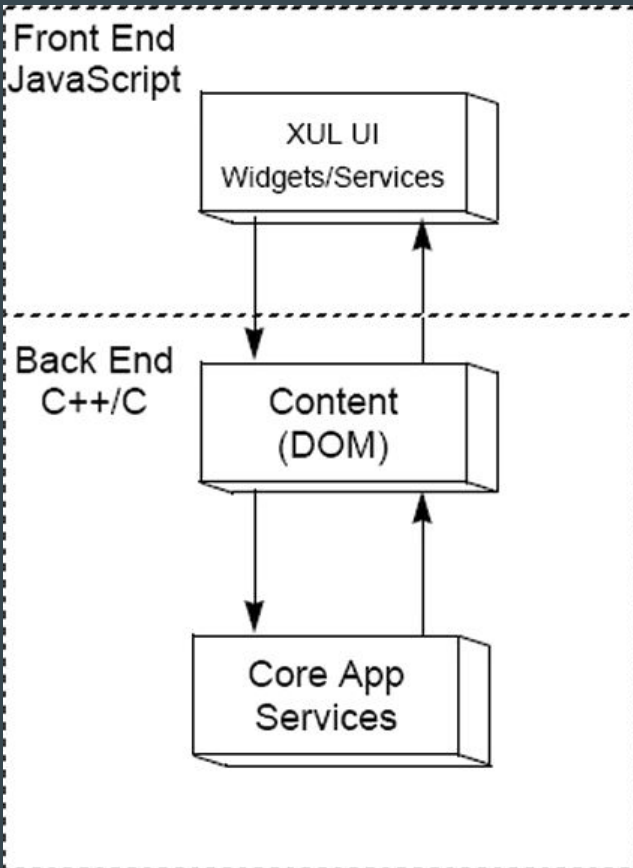
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By: The Other Group

Overview

Mozilla Firefox is a multi-platform browser supported by the Mozilla Foundation

- Started as a branch of the Mozilla Project by Netscape
- Based on the Mozilla Framework
 - Combination of technologies
 - XPFE (Cross-Platform Front End)
 - Uses a 'Layered' architectural style
 - Each layer has its own architecture

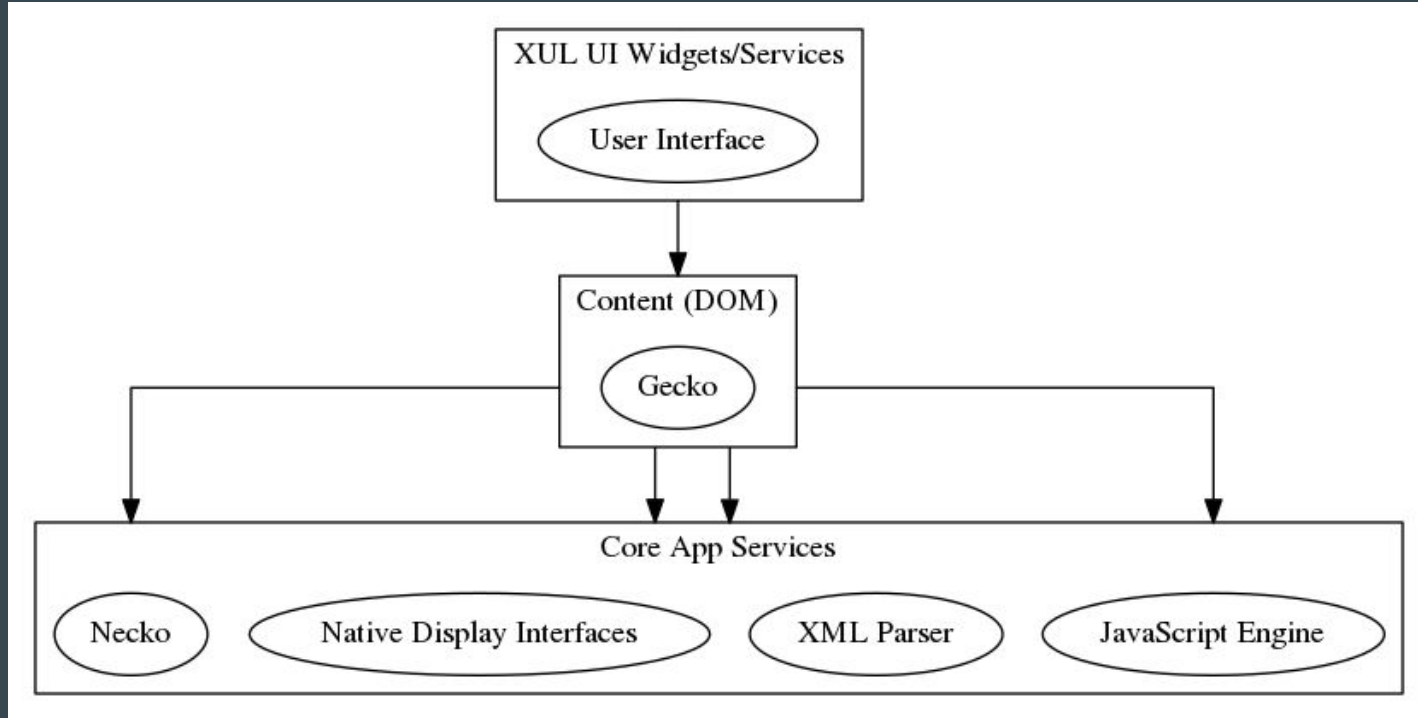


Mozilla Framework

Glossary

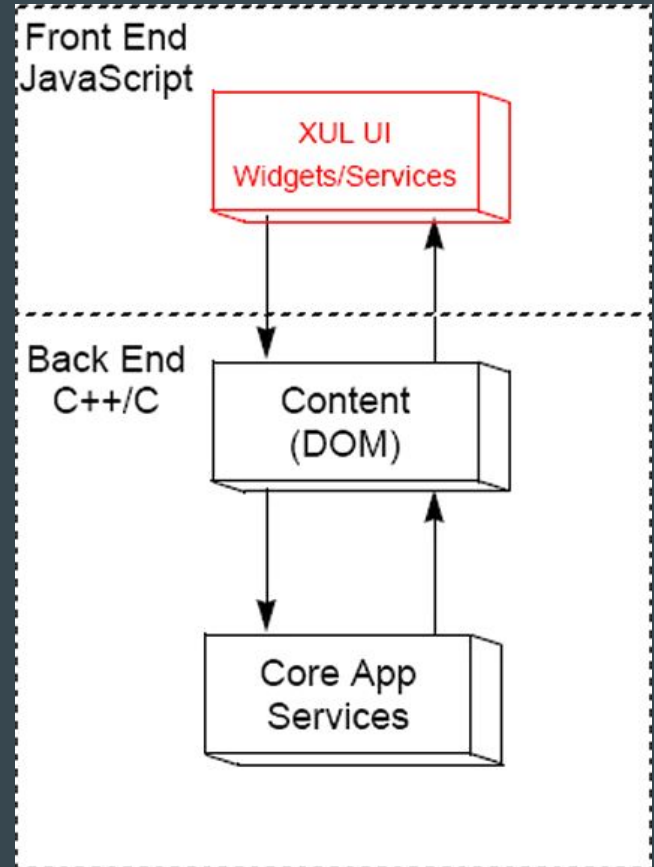
- XUL (XML User Language) / XBL (XML Binding Language)
 - Use XML/CSS/JS to make GUIs
- Gecko
 - Rendering engine, main force
- XPCOM (Cross-Platform Component Object Model)
 - COM implementation for development modules in language-agnostic environment
- XPConnect (NPAPI - Netscape Plugin Application Programming Interface)
 - XPCOM wrapper for JavaScript(add-ons)
- Necko
 - Network interactions

Detailed Architecture



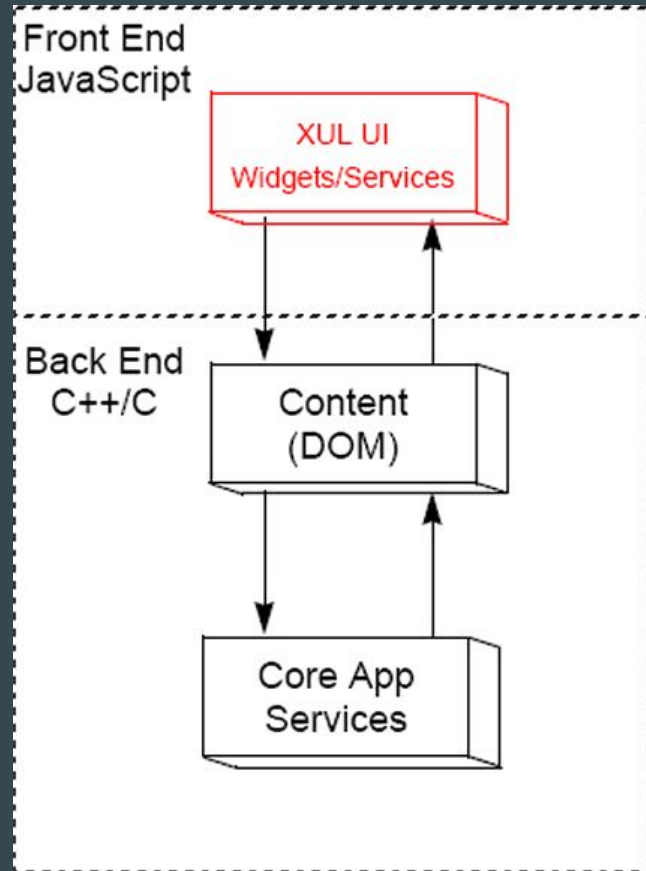
Front End: UI Toolkit

- Top layer of the Framework
 - Consists of services and widgets (pre-defined objects that encapsulate command actions and data associated with a GUI control)
 - Communicates with DOM level; Engine must paint the widgets
- Multiple Internal Architectures
 - Implicit Invocation - Event-Based event handling
 - Object-Model for XPCOM components
 - Adapter - XPConnect acts as an adapter for external components (extensions) in various languages



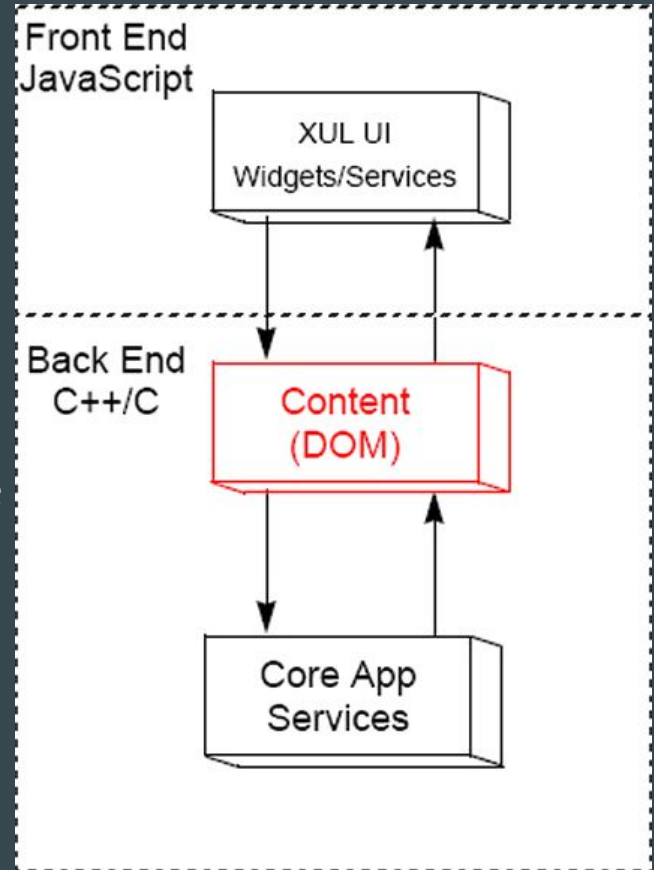
Front End: UI Toolkit

- Designed to be able to be written by web developers, using XUL/XBL
 - XUL (XML User Language)
 - Description of component
 - Used to design the user interface
 - Analogous to (and same syntax as) XML
 - XBL (XML Binding Language)
 - Used to control XUL components' look and behaviour
 - Analogous to (and same syntax as) CSS/JS

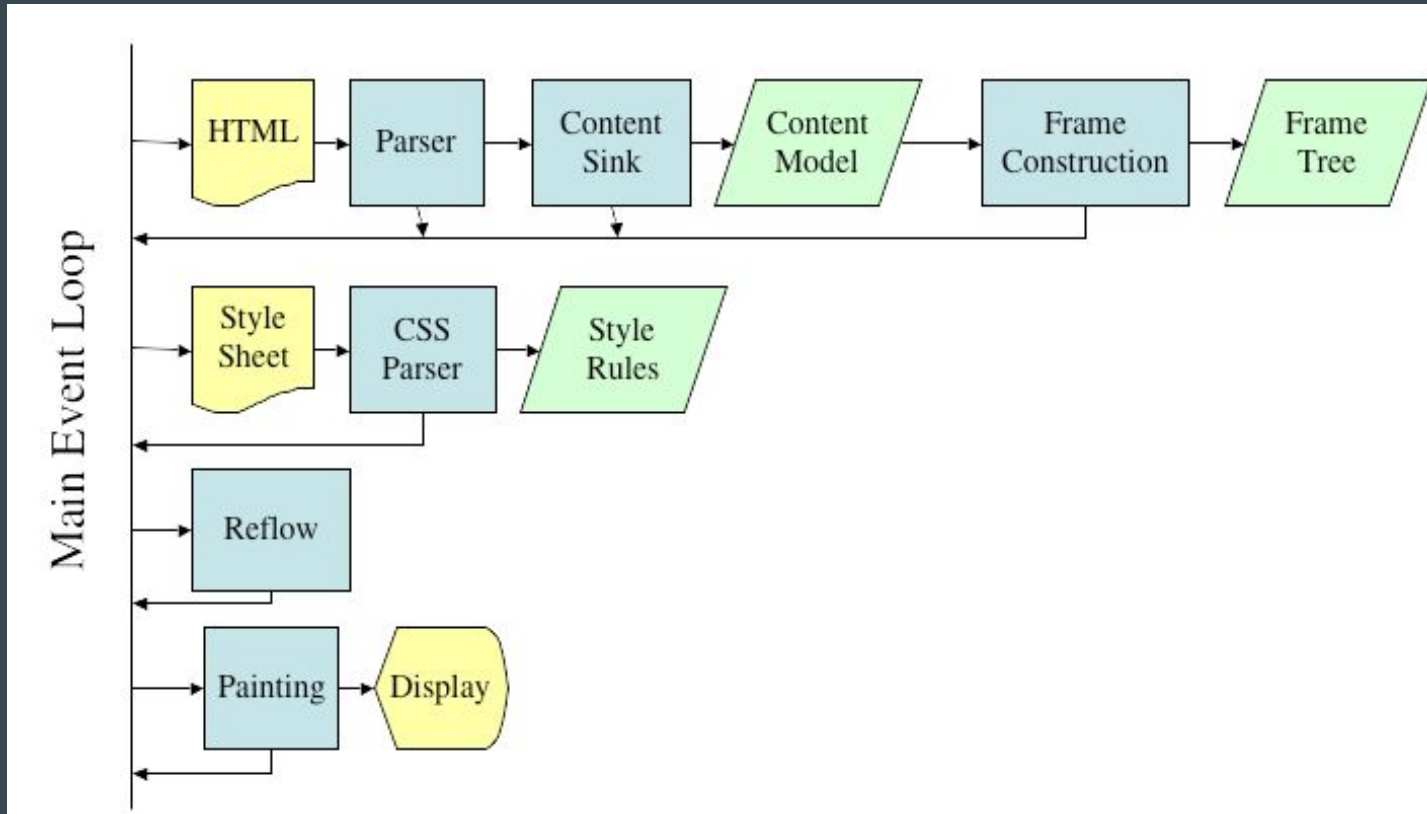


Backend: Content (DOM)²

- Middle Layer of the Framework
 - a. Receives widgets from the top layer³ and content/formatting information from the bottom layer
- Gecko is the engine which powers the browser
 - a. Takes content and formatting info and renders on screen
- Utilizes a Hybrid Pipeline-Repository⁴ architecture
 - a. Necko passes data from a web-server transaction
 - b. Parser converts the (X)HTML into a syntax tree
 - c. DOM content is traversed and Javascript is executed
 - d. Layout engine passes formatted DOM content to the GFX
 - e. GFX displays widgets, 2D/3D graphics are overlaid

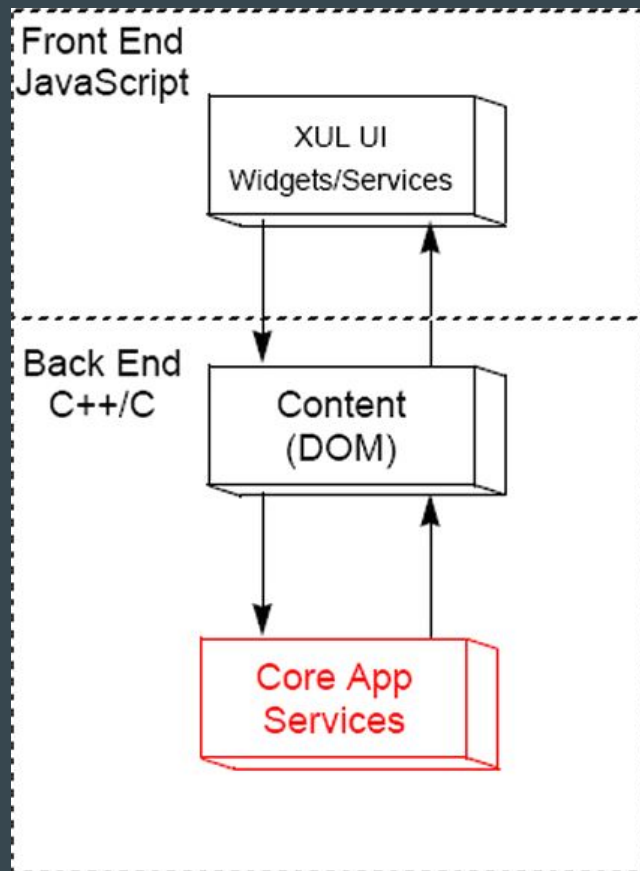


Document Rendering⁴



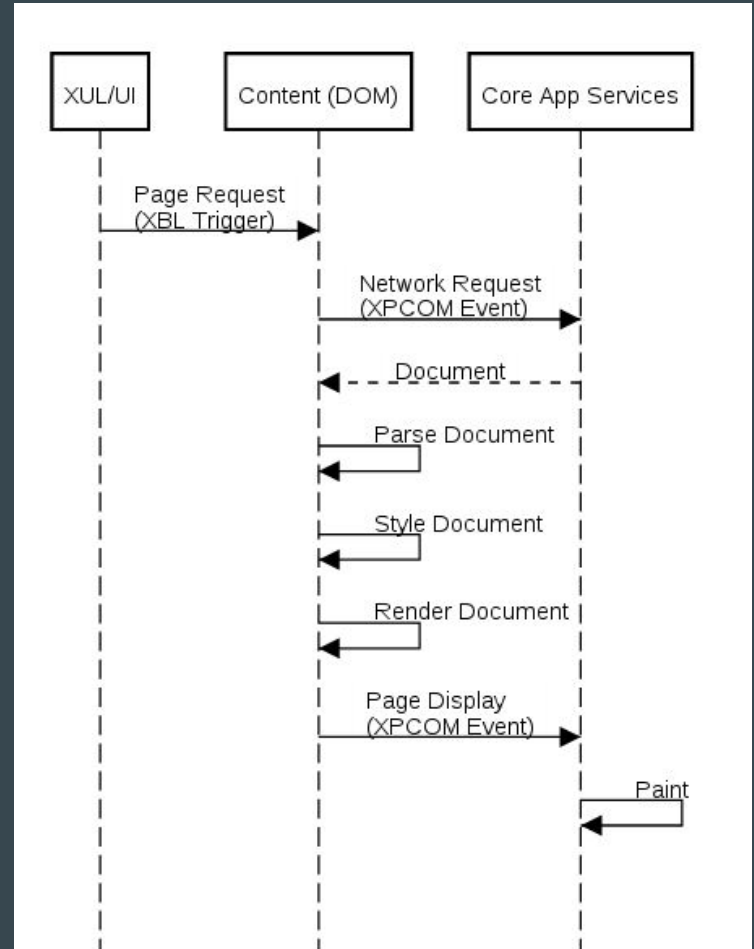
Backend: Core Services

- Bottom Layer of the Framework
 - Interface between Gecko engine and pluggable modules
 - Uses XPCOM to communicate with Gecko
 - Object-Oriented Style
- Core Services written as XPCOM objects in C++
 - Networking (Necko)
 - Javascript Interpreter (Spidermonkey)
 - Native graphics bindings (X11/GTK+/WINAPI etc)
 - WebRTC (Real Time Communications)



Sequence of Web Page Request

- Web page request for 'google.com'
 - The XBL binding fires off an event that a page has been requested
 - The browser engine (Gecko) receives the event, and requests page from Necko via XPCOM interface
 - Necko resolves DNS, performs network I/O and passes returned data back up to Gecko
 - Gecko parses DOM and renders content as well as XUL widgets



Brief Comments

The overall architecture of Firefox was derived using the [Mozilla Foundation's Developer site](#). Comments on derivation/structure:

- Single-threaded document rendering is problematic
- Documentation is usually vague, out of date, broken or non-existent
 - Example: [Necko](#)
 - Last updated 1999
 - Is it even still used? Can't figure out from documentation; have to check source code
 - This seems to have improved for newer projects - see [Firefox OS](#)

References

[1] [http://web.archive.org/web/20120509213313/https://developer.mozilla.org/en/Bird's Eye View of the Mozilla Framework](http://web.archive.org/web/20120509213313/https://developer.mozilla.org/en/Bird's_Eye_View_of_the_Mozilla_Framework)

[2] [https://web.archive.org/web/20150919100442/https://developer.mozilla.org/en-US/docs/Introduction to Layout in Mozilla](https://web.archive.org/web/20150919100442/https://developer.mozilla.org/en-US/docs/Introduction_to_Layout_in_Mozilla)

[3] <https://developer.mozilla.org/en-US/docs/Gecko/FAQ>

[4] <https://web.archive.org/web/20150909210358/https://wiki.mozilla.org/Gecko:Overview>

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