A Security analysis of Browser Extensions

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Presentation flow

Introduction to extensions.
Extension Security
Threat model
Methodology
Demos
Statistics
Solution and Conclusions
Browser Extensions

Add functionality to a browser

Written by a third party

Improve the browser experience
Extension security

Google Chrome uses a three step model:

- **Isolated worlds**: An extension’s content scripts cannot access the direct DOM (Document Object Model) of the current running page, but access a copy of it. The javascript execution of content-scripts is kept completely separate from the execution of the page’s actual javascript code, if any.

- **Privilege separation**: Core extension scripts have access to the chrome native APIs. Content scripts do not.

- **Permissions**: Extensions are required to pre-declare their needed privileges, and are limited to those by the browser.

Opera provides limited (common) privileges to all extensions.
Chrome Extension Model

Figure 1: The architecture of a Google Chrome extension.
Threats

Malicious Extensions: An attacker could install a malicious extension in the browser that could, theoretically, cause a lot of damage.

Extension Vulnerabilities: The extension could in itself be vulnerable.

- Insecure Coding practices
- Developer negligence or incompetence
Method of analysis

Silent extension installation

Source code analysis

Pre-install analysis of extensions
Silent Installation

Browsers allow third party application developers to *silently* install extensions in the browser. (Think Ask Toolbar)

Both Google Chrome & Firefox make the user confirm the installation by giving a UI prompt on next restart.

We work-around this prompt to prove that *complete silent installation* is possible.
Another program on your computer added an extension that may change the way Chrome works.

It can:
- Access your data on all websites
- Read and modify your bookmarks
- Access your tabs and browsing activity

Enable extension  Remove from Chrome
Another program on your computer would like to modify Firefox with the following add-on:

BlackSheep 1.7.2
By Julien Sobrier
Location: C:\Users\jsobrier\AppData\Roaming\Mozilla\Firefox\...

⚠️ Install add-ons only from authors whom you trust.

☐ Allow this installation
DEMO
Silent Extension Installation
Statistics: Content-Security Policy

Content-Security Policy is known to reduce extension vulnerabilities by enforcing stronger coding practices.

It is only available on a "setting" called Manifest Version=2 on Chrome, though.

It will get deployed to every extension on Chrome by September 2013.

We found 4079/9558 extensions using CSP
Statistics: Privilege abuse

Principle of least privileges

Match Permissions sought by an extension by those actually used

Almost 50% of analysed extensions asked for at least one extra permission

Very sensitive information, like browser cookies, were sought in multiple instances.
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<th>Number of violating extensions</th>
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Statistics: Network vulnerability

We found at-least 146 extensions making a network request to javascript files over HTTP.

HTTP requests can be attacked by a MitM attack and replaced with malicious javascript.

Furthermore extensions could be making XHR or other network requests over HTTP that we are not aware of.
Extension checker

Pre-checks the extension's API usage and reports it to the user.
Solution and Conclusion

- Our extensions checker provides information about the authenticity of an extension.
- Any extension with more than 6 permissions sought should be manually reviewed.
- Content-Security-Policy be made mandatory for all extensions.