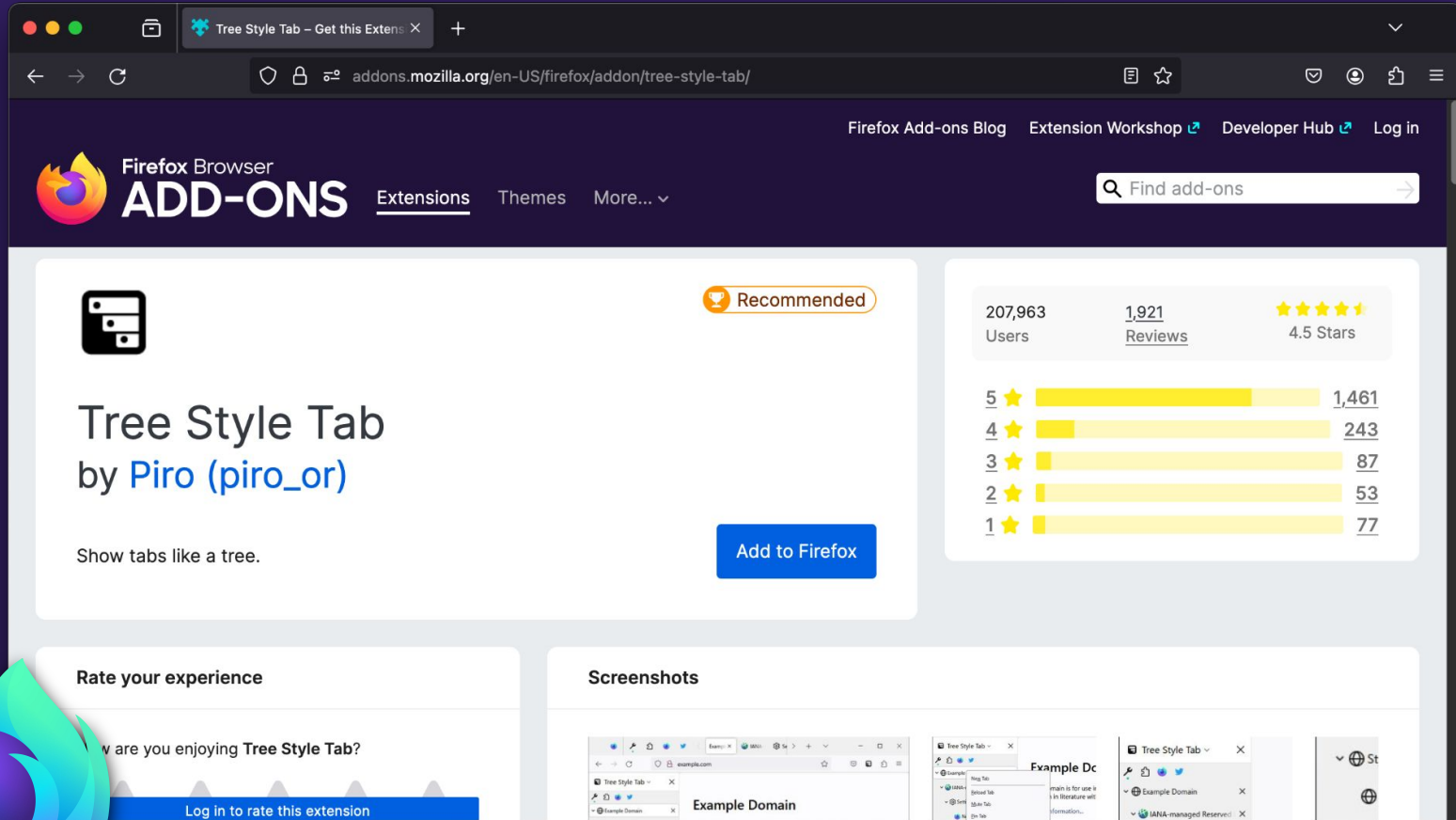




Firefox, Android, and Cross-browser WebExtensions in 2024

2024.03.14 Simeon Vincent — Developer Relations Engineer

What are extensions?



Tree Style Tab – Get this Extension

addons.mozilla.org/en-US/firefox/addon/tree-style-tab/

Firefox Add-ons Blog Extension Workshop Developer Hub Log in

Firefox Browser
ADD-ONS Extensions Themes More...

Find add-ons

 **Recommended**

Tree Style Tab
by [Piro \(piro_or\)](#)

Show tabs like a tree.

Add to Firefox

207,963 Users 1,921 Reviews 4.5 Stars

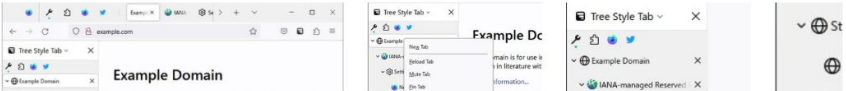
Rating	Count
5 Stars	1,461
4 Stars	243
3 Stars	87
2 Stars	53
1 Star	77

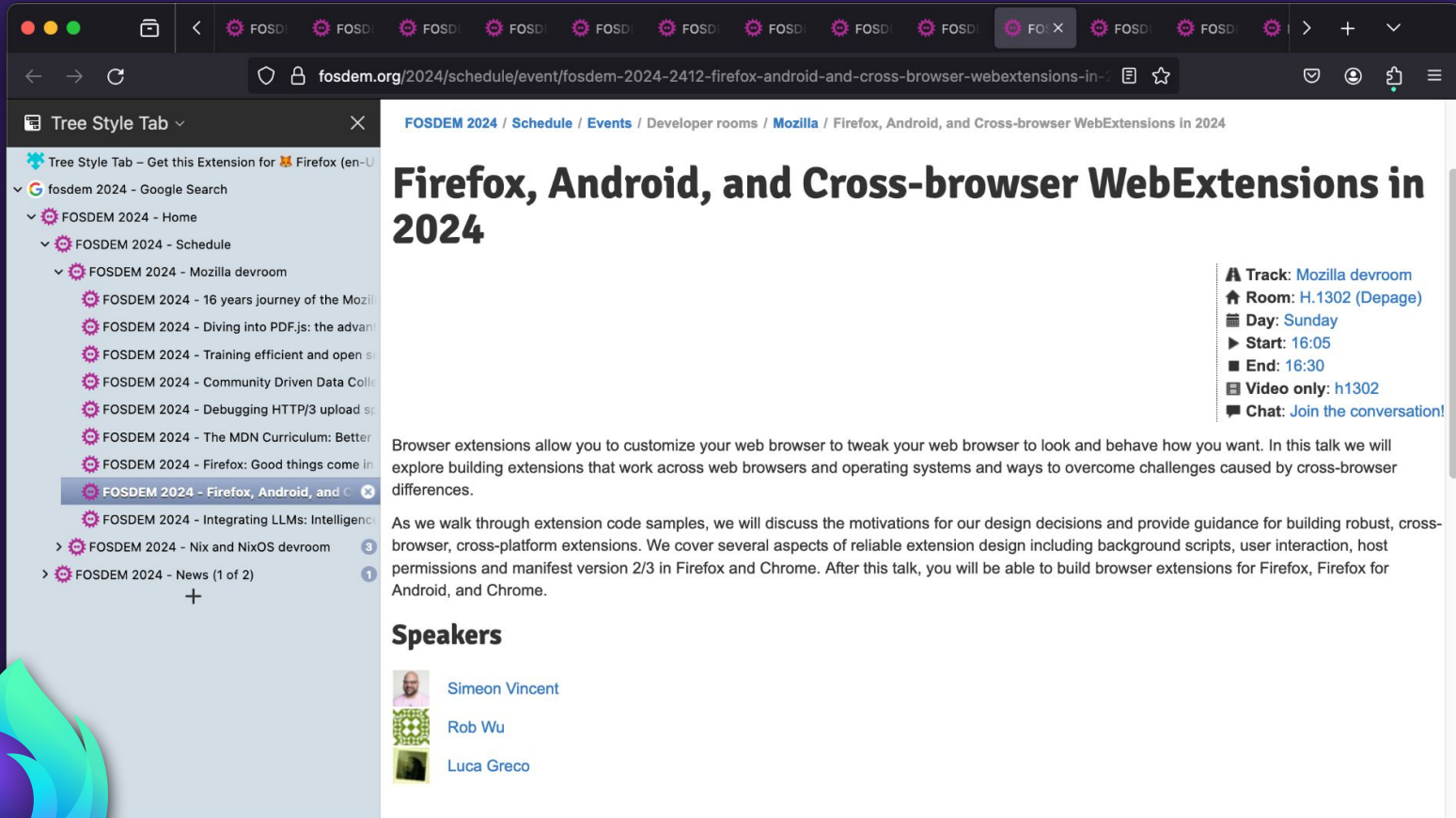
Rate your experience

How are you enjoying Tree Style Tab?

[Log in to rate this extension](#)

Screenshots





Firefox, Android, and Cross-browser WebExtensions in 2024

Track: [Mozilla devroom](#)
Room: [H.1302 \(Depage\)](#)
Day: [Sunday](#)
Start: [16:05](#)
End: [16:30](#)
Video only: [h1302](#)
Chat: [Join the conversation!](#)

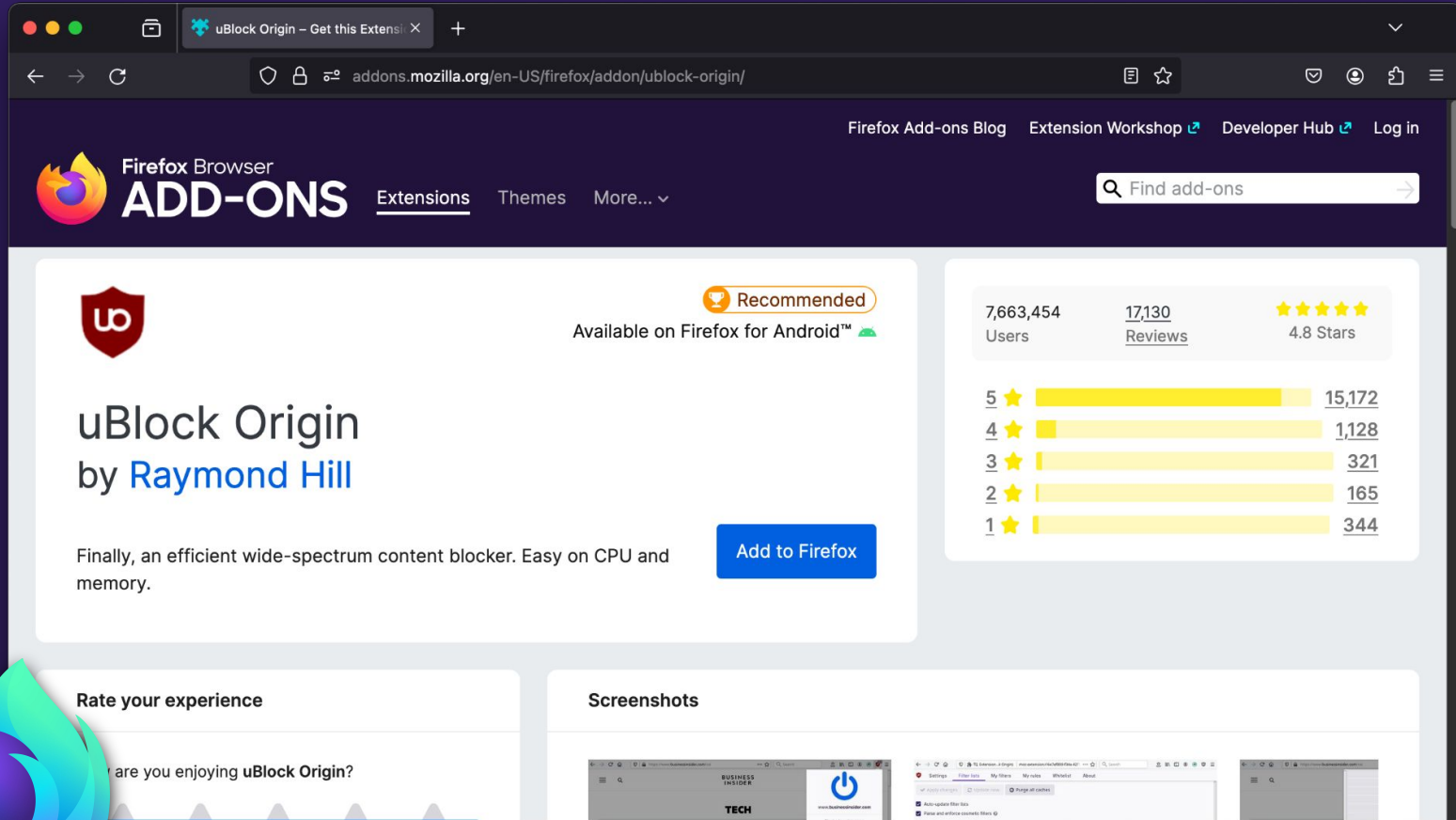
Browser extensions allow you to customize your web browser to tweak your web browser to look and behave how you want. In this talk we will explore building extensions that work across web browsers and operating systems and ways to overcome challenges caused by cross-browser differences.

As we walk through extension code samples, we will discuss the motivations for our design decisions and provide guidance for building robust, cross-browser, cross-platform extensions. We cover several aspects of reliable extension design including background scripts, user interaction, host permissions and manifest version 2/3 in Firefox and Chrome. After this talk, you will be able to build browser extensions for Firefox, Firefox for Android, and Chrome.

Speakers

-  [Simeon Vincent](#)
-  [Rob Wu](#)
-  [Luca Greco](#)



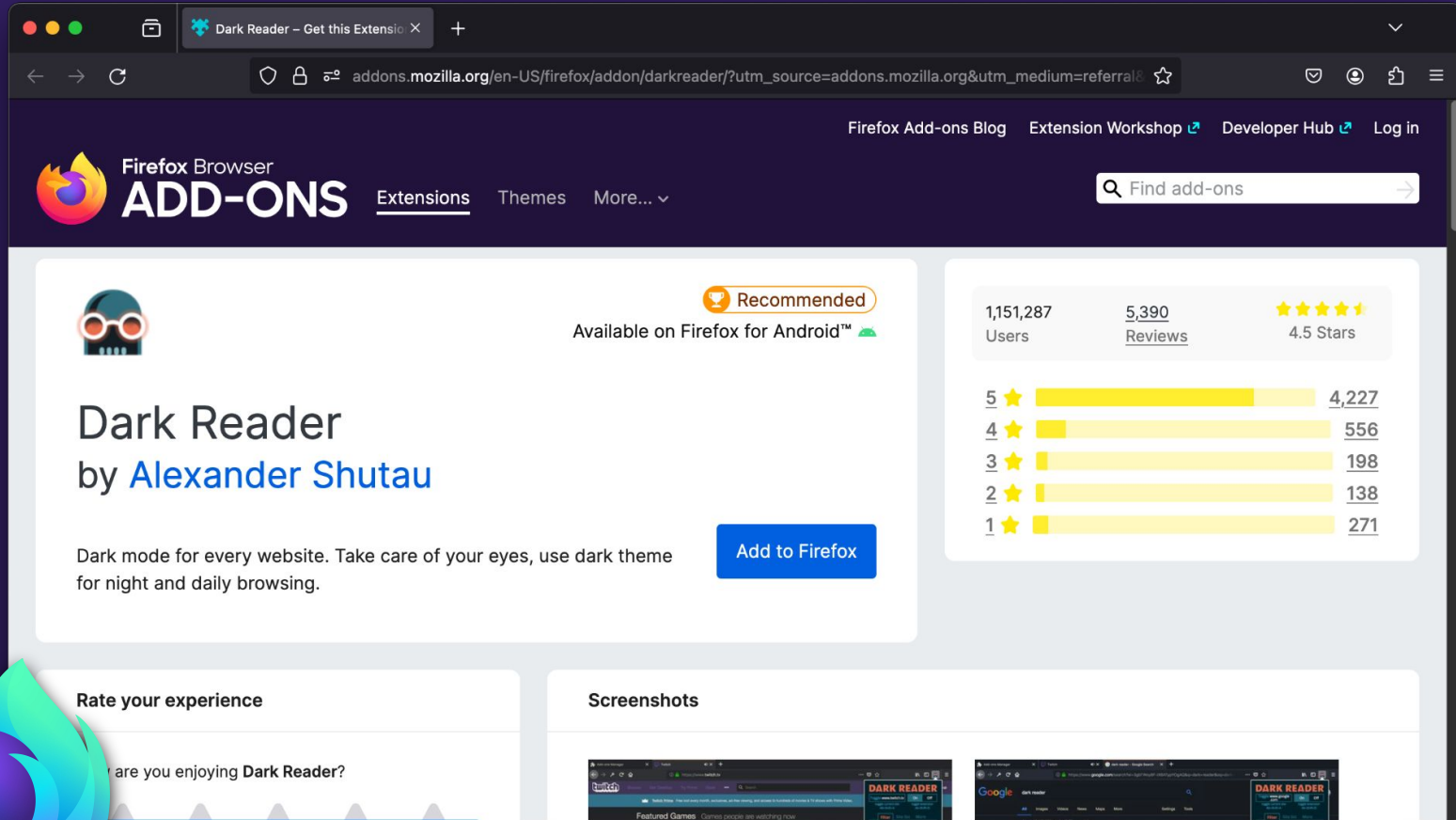


The screenshot shows the Firefox Add-ons page for uBlock Origin. The browser's address bar displays the URL `addons.mozilla.org/en-US/firefox/addon/ublock-origin/`. The page header includes the Firefox logo, the text "Firefox Browser ADD-ONS", and navigation links for "Extensions", "Themes", and "More...". A search bar with the placeholder "Find add-ons" is also present. The main content area features the uBlock Origin logo, a "Recommended" badge, and the text "Available on Firefox for Android™". The extension is titled "uBlock Origin by Raymond Hill". A description states: "Finally, an efficient wide-spectrum content blocker. Easy on CPU and memory." A blue "Add to Firefox" button is located below the description. To the right, statistics are shown: 7,663,454 Users, 17,130 Reviews, and a 4.8 Stars rating. A star distribution chart shows the following data:

Rating	Count
5 Stars	15,172
4 Stars	1,128
3 Stars	321
2 Stars	165
1 Star	344

Below the main content, there are sections for "Rate your experience" and "Screenshots". The "Rate your experience" section includes the text "are you enjoying uBlock Origin?". The "Screenshots" section displays three images of the extension in use.





The screenshot shows the Firefox Add-ons page for the Dark Reader extension. The browser's address bar displays the URL: `addons.mozilla.org/en-US/firefox/addon/darkreader/?utm_source=addons.mozilla.org&utm_medium=referral`. The page header includes the Firefox logo, the text "Firefox Browser ADD-ONS", and navigation links for "Extensions", "Themes", and "More...". A search bar labeled "Find add-ons" is also present.

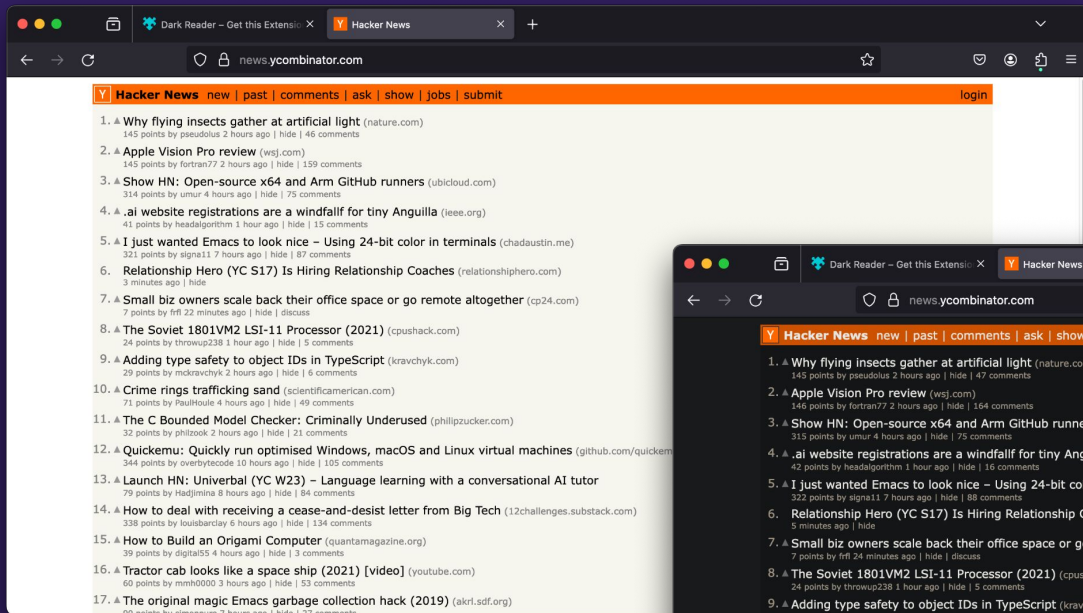
The main content area features the Dark Reader extension card. It includes the extension's icon (a stylized eye with glasses), a "Recommended" badge, and the text "Available on Firefox for Android™". The extension is titled "Dark Reader" by "Alexander Shutau". A description states: "Dark mode for every website. Take care of your eyes, use dark theme for night and daily browsing." A blue "Add to Firefox" button is located at the bottom right of the card.

To the right of the extension card, statistics are displayed: 1,151,287 Users, 5,390 Reviews, and a 4.5 Stars rating. Below these, a star rating breakdown is shown:

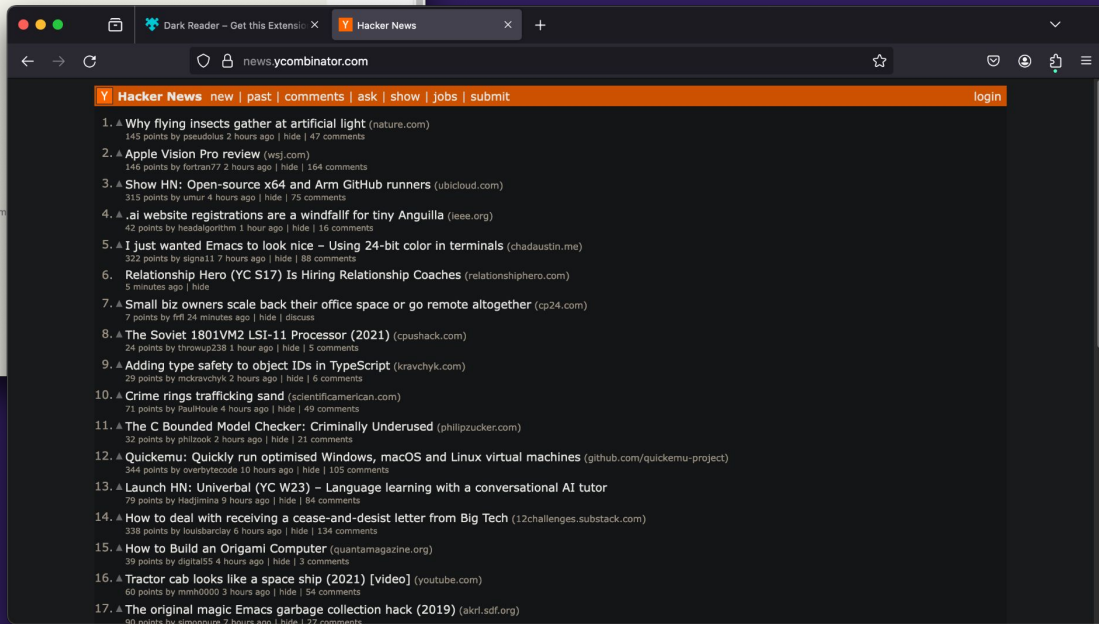
Star Rating	Count
5 Stars	4,227
4 Stars	556
3 Stars	198
2 Stars	138
1 Star	271

Below the extension card, there are two sections: "Rate your experience" and "Screenshots". The "Rate your experience" section asks "are you enjoying Dark Reader?" and features a series of five gray triangles representing a rating scale. The "Screenshots" section displays three screenshots of the Dark Reader extension in use on various websites, including Twitch and Google.

Before



After



WebExtensions

<https://github.com/w3c/webextensions>

WebExtensions



<https://github.com/w3c/webextensions>

Table of contents

Path towards full productivity

1. Modifying site content
2. Host permissions
3. Script on click
4. Short-lived background
5. Untrustworthy content
6. Resources

Modifying site content

- Content scripts
- Manifest Version 2 vs Manifest Version 3

./manifest.json

```
{
  "name": "Content script MV2 sample",
  "version": "1",
  "manifest_version": 2,
  "content_scripts": [
    {
      "js": ["contentscript.js"],
      "matches": ["*://*/*"]
    }
  ]
}
```

./contentscript.js

```
document.addEventListener("click", event => {
  alert("Got click at " + document.URL);
});
```

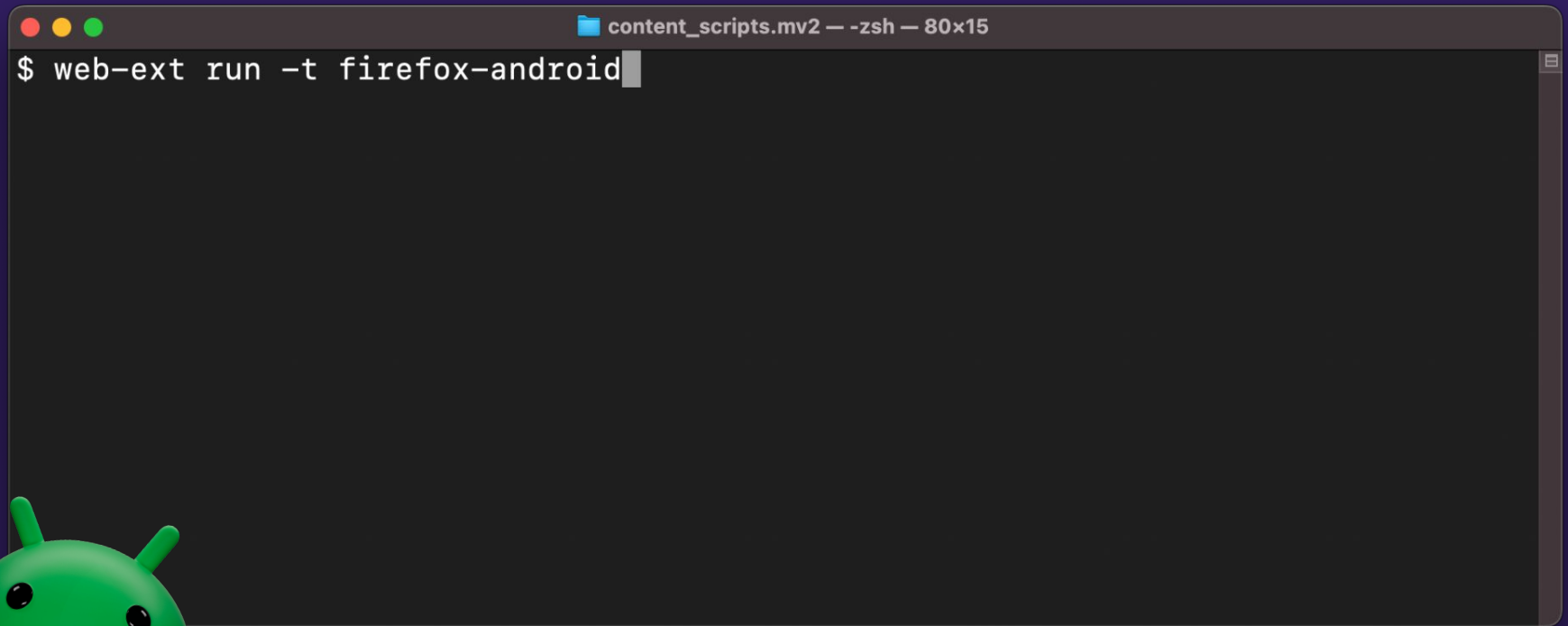

demo

**FAKE
LOGO**



**NO SUE
PLEASE**

Firefox Nightly for Android

A terminal window with a dark gray background and a light gray title bar. The title bar contains three colored window control buttons (red, yellow, green) on the left and a folder icon followed by the text "content_scripts.mv2 — -zsh — 80x15" on the right. The terminal text is white and shows a command prompt "\$" followed by the command "web-ext run -t firefox-android" with a white cursor at the end of the line.

```
content_scripts.mv2 — -zsh — 80x15
$ web-ext run -t firefox-android
```



```
content_scripts.mv2 — -zsh — 80x15  
$ web-ext run -t firefox-android  
Running web extension from /Users/svincent/dev/fosdem-2024-ext/code-samples/content_scripts.mv2  
  
Android devices found:  
- 9BCAY1J6VD  
  
UsageError: Select an android device using --android-device=<name>  
$ █
```



```
content_scripts.mv2 — -zsh — 80x15

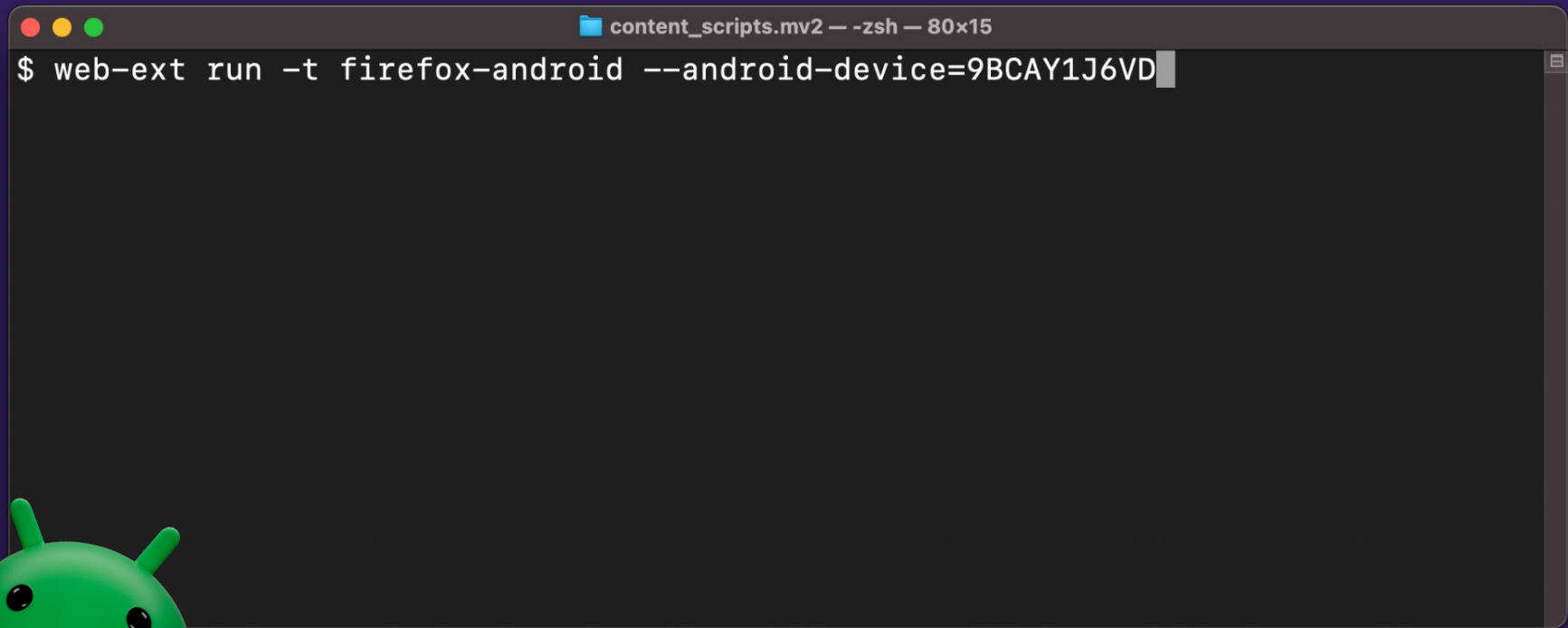
$ web-ext run -t firefox-android
Running web extension from /Users/svincent/dev/fosdem-2024-ext/code-samples/content_scripts.mv2

Android devices found:
- 9BCAY1J6VD

UsageError: Select an android device using --android-device=<name>

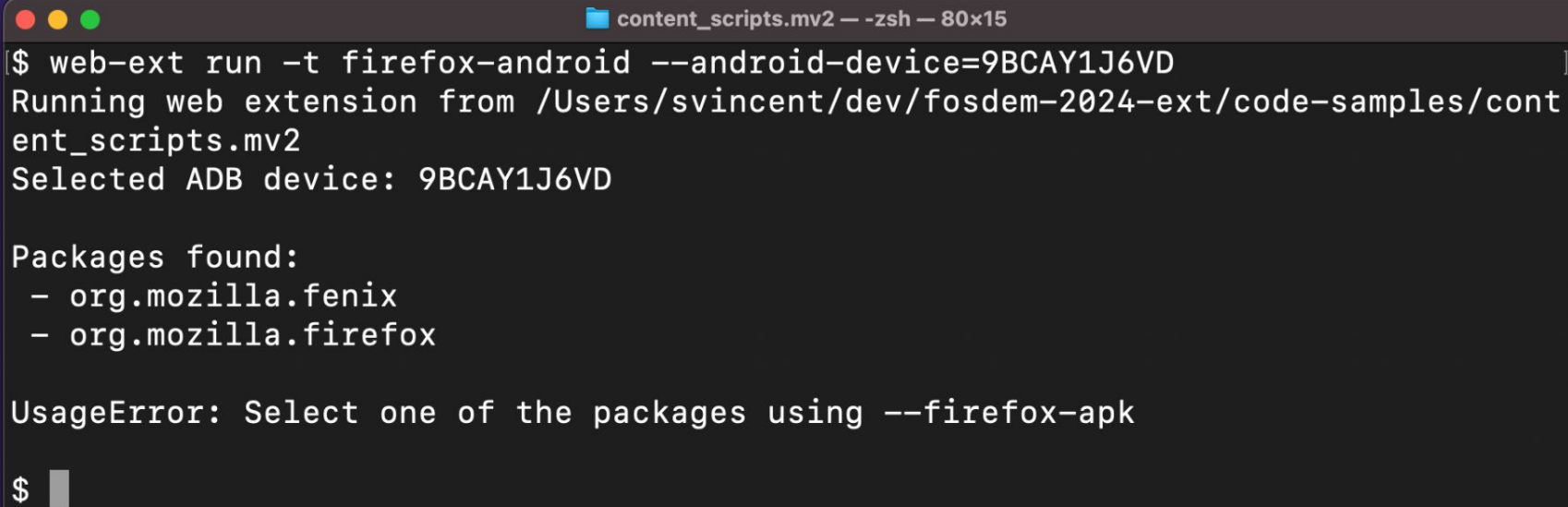
$ web-ext run -t firefox-android --android-device=9BCAY1J6VD
```





A terminal window titled "content_scripts.mv2 — -zsh — 80x15" is shown. The terminal has a dark background and displays the command: `$ web-ext run -t firefox-android --android-device=9BCAY1J6VD`. The cursor is at the end of the command line.



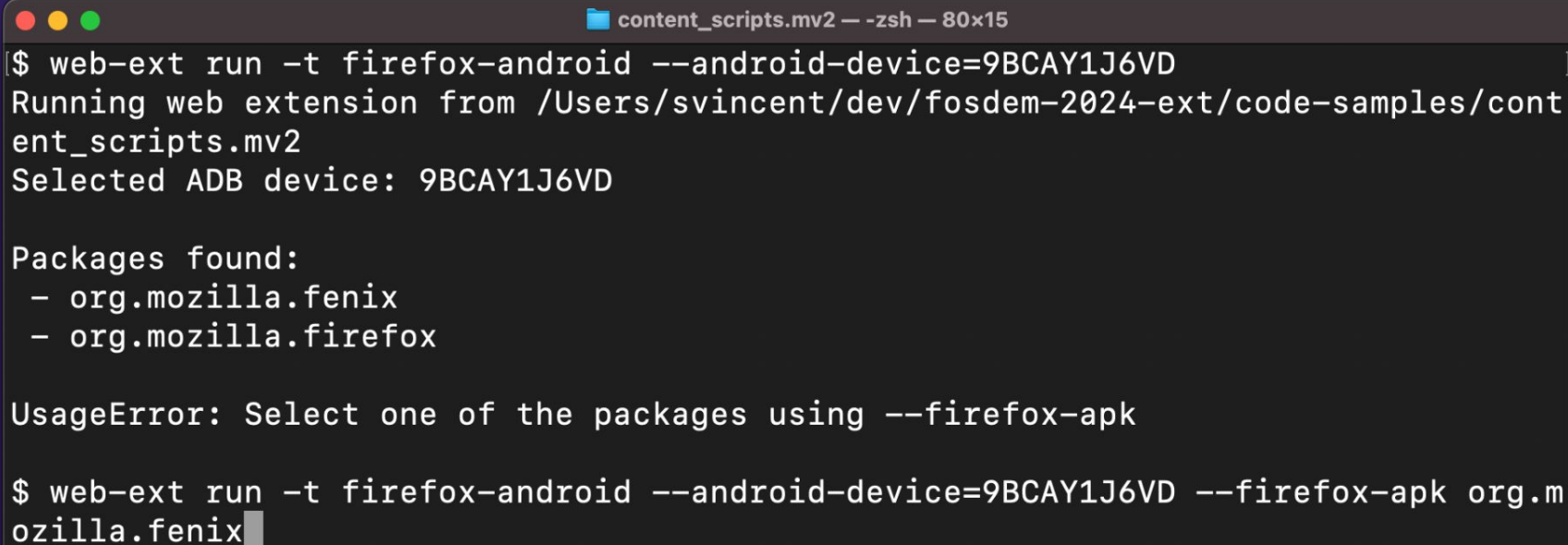


```
$ web-ext run -t firefox-android --android-device=9BCAY1J6VD
Running web extension from /Users/svincent/dev/fosdem-2024-ext/code-samples/content_scripts.mv2
Selected ADB device: 9BCAY1J6VD

Packages found:
- org.mozilla.fenix
- org.mozilla.firefox

UsageError: Select one of the packages using --firefox-apk
$
```





A terminal window titled "content_scripts.mv2 — zsh — 80x15" displays the following text:

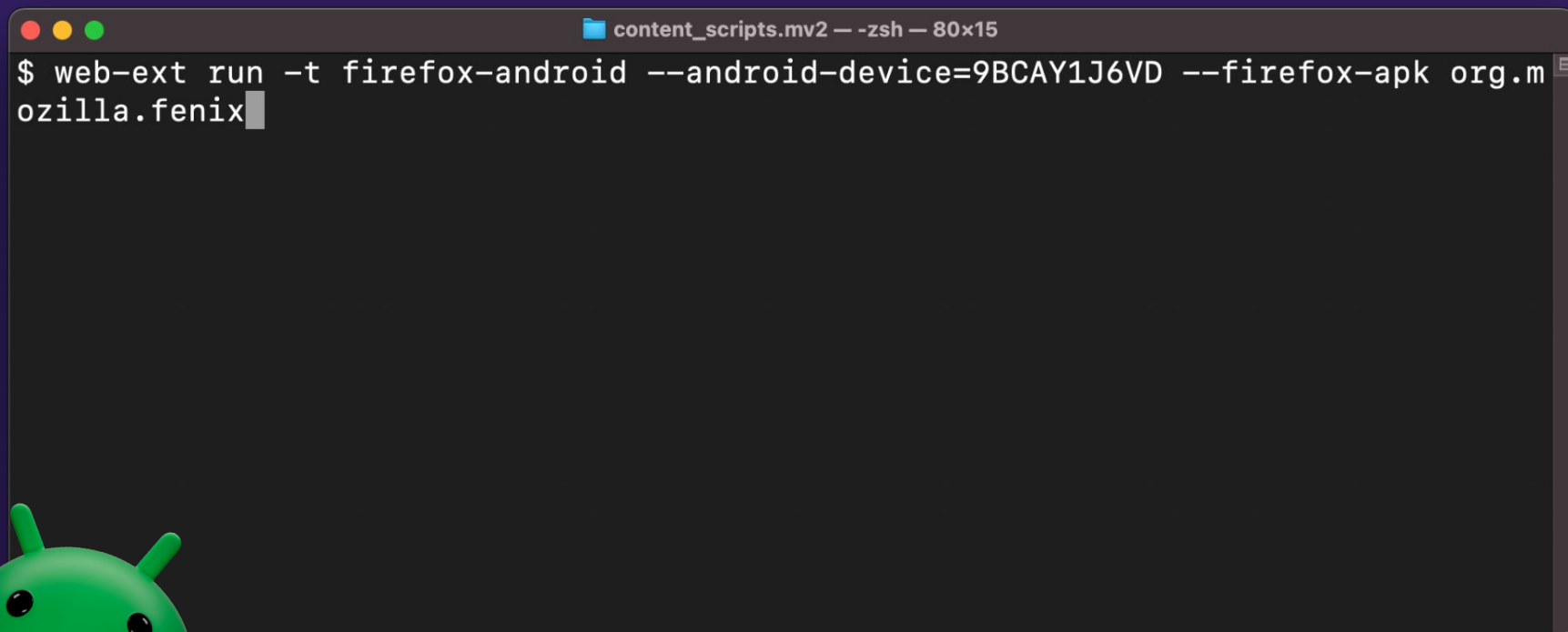
```
$ web-ext run -t firefox-android --android-device=9BCAY1J6VD
Running web extension from /Users/svincent/dev/fosdem-2024-ext/code-samples/content_scripts.mv2
Selected ADB device: 9BCAY1J6VD

Packages found:
- org.mozilla.fenix
- org.mozilla.firefox

UsageError: Select one of the packages using --firefox-apk

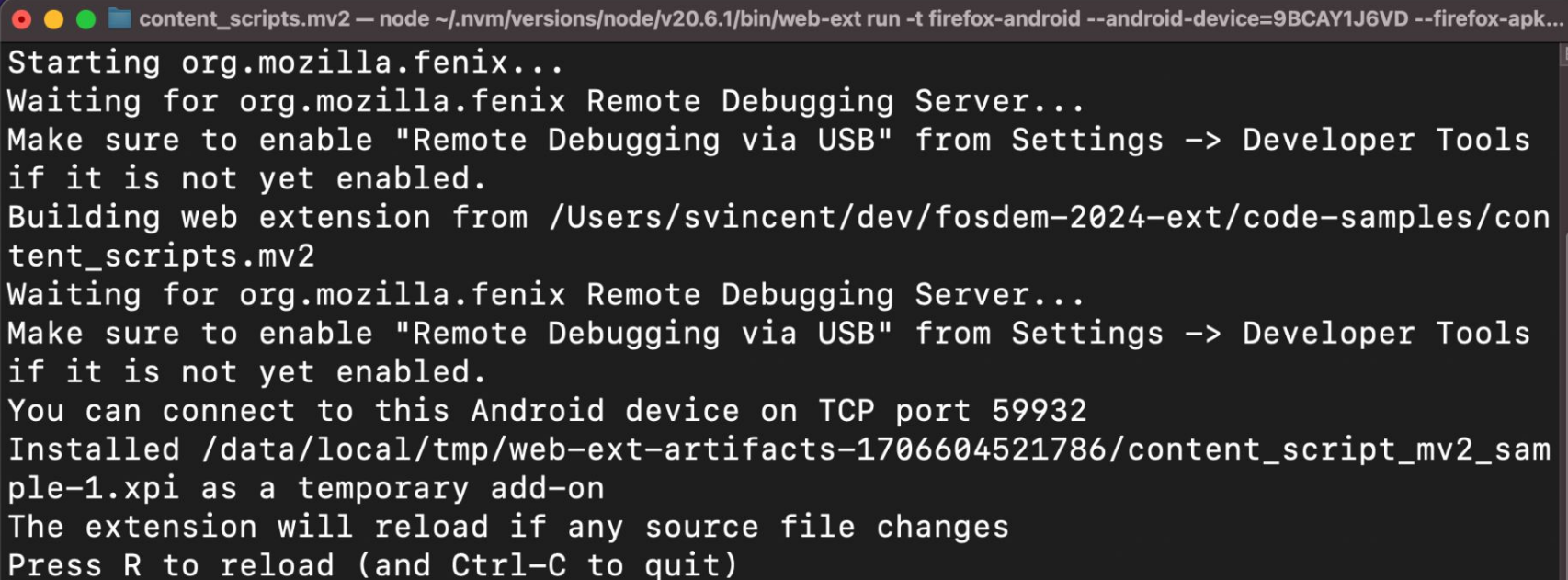
$ web-ext run -t firefox-android --android-device=9BCAY1J6VD --firefox-apk org.mozilla.fenix
```

A stylized Firefox logo is visible in the bottom-left corner of the image, partially overlapping the terminal window.



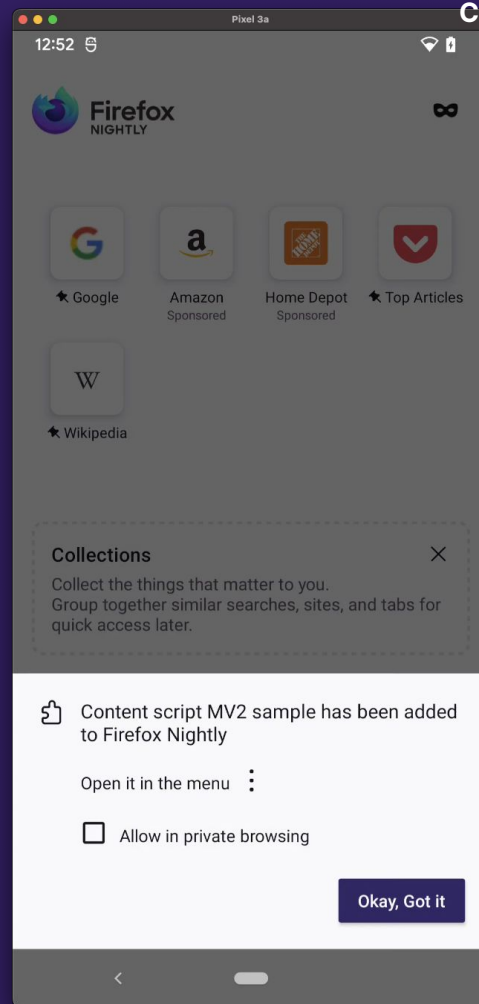
```
content_scripts.mv2 — -zsh — 80x15  
$ web-ext run -t firefox-android --android-device=9BCAY1J6VD --firefox-apk org.mozilla.fenix
```

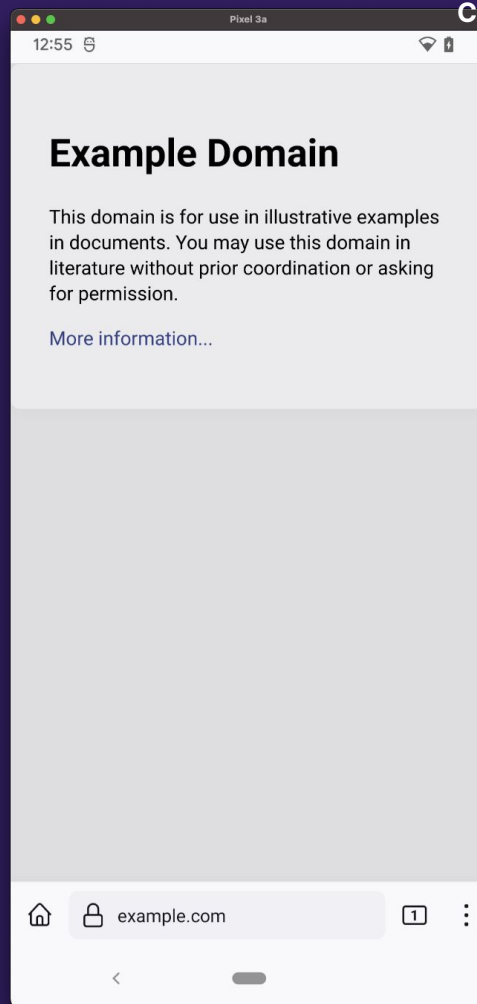


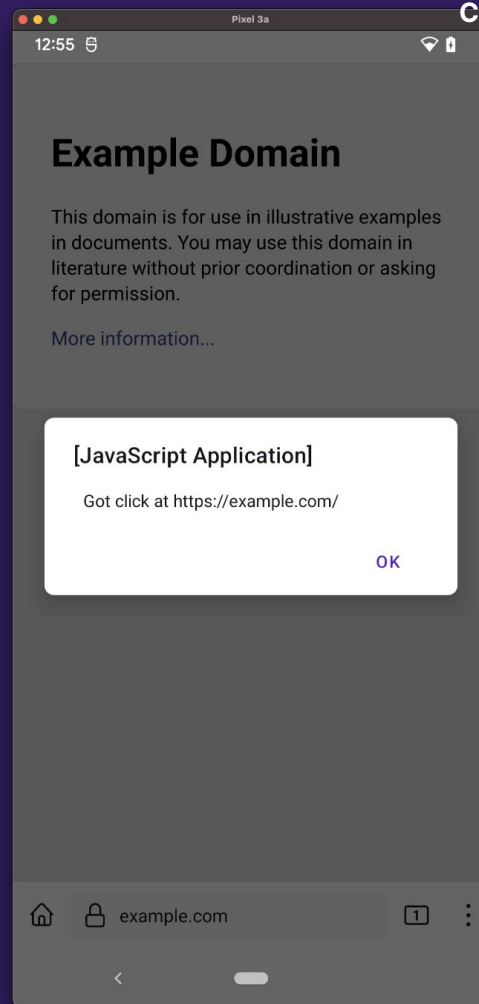


```
content_scripts.mv2 — node ~/.nvm/versions/node/v20.6.1/bin/web-ext run -t firefox-android --android-device=9BCAY1J6VD --firefox-apk...  
Starting org.mozilla.fenix...  
Waiting for org.mozilla.fenix Remote Debugging Server...  
Make sure to enable "Remote Debugging via USB" from Settings -> Developer Tools  
if it is not yet enabled.  
Building web extension from /Users/svincent/dev/fosdem-2024-ext/code-samples/content_scripts.mv2  
Waiting for org.mozilla.fenix Remote Debugging Server...  
Make sure to enable "Remote Debugging via USB" from Settings -> Developer Tools  
if it is not yet enabled.  
You can connect to this Android device on TCP port 59932  
Installed /data/local/tmp/web-ext-artifacts-1706604521786/content_script_mv2_sample-1.xpi as a temporary add-on  
The extension will reload if any source file changes  
Press R to reload (and Ctrl-C to quit)  
█
```





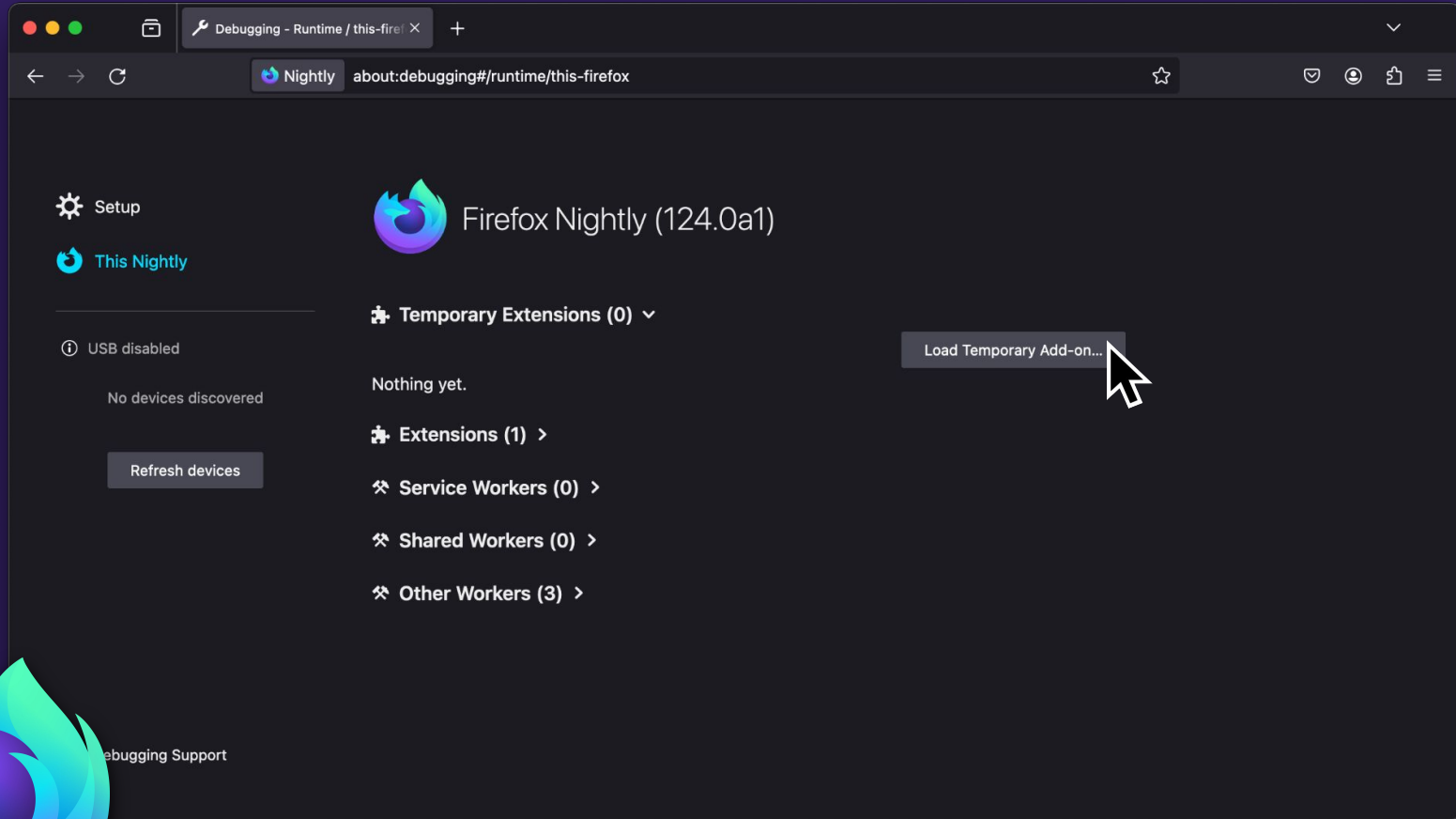


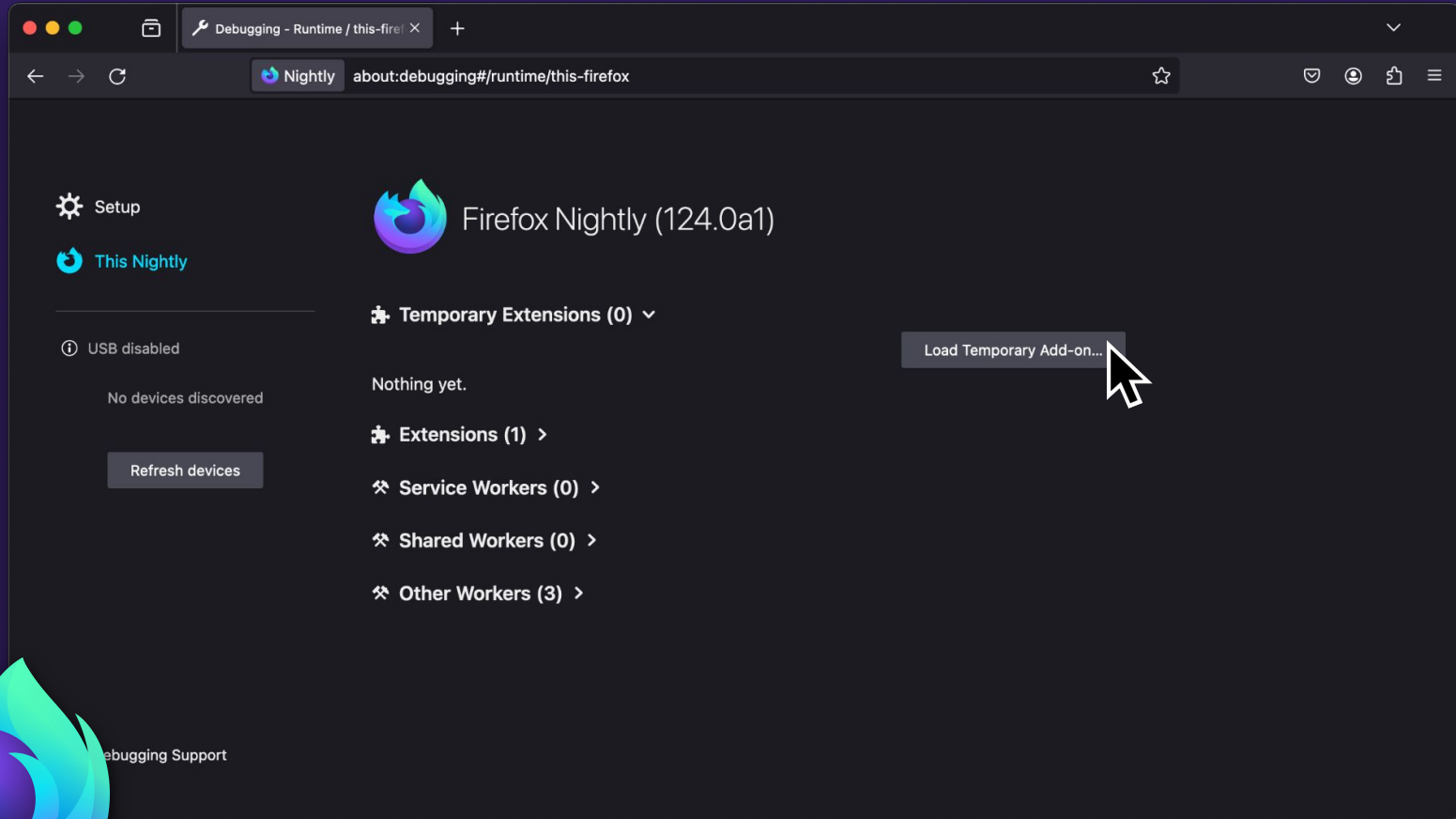


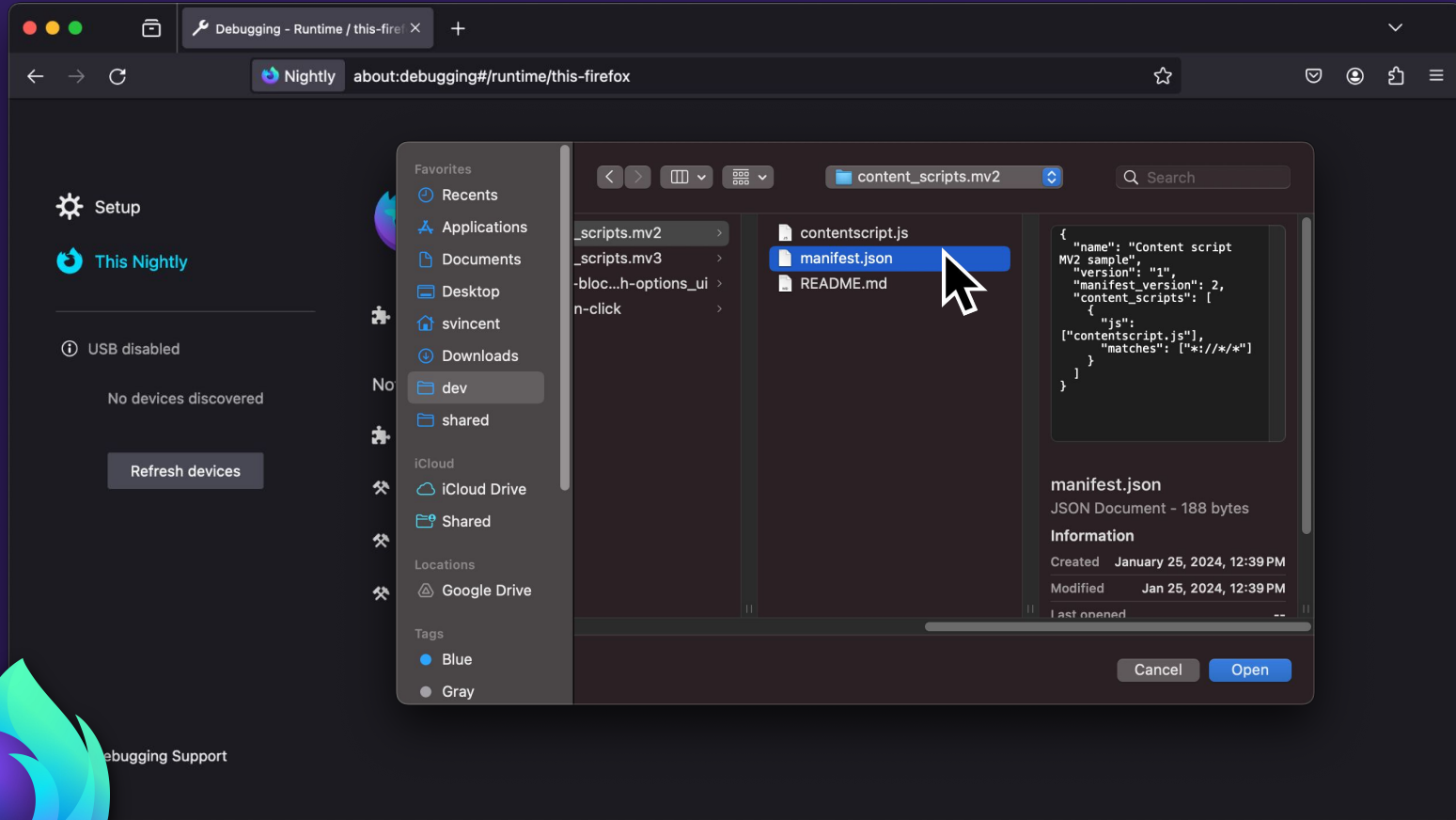


Firefox Nightly

demo









Debugging - Runtime / this-firefox

Nightly about:debugging#/runtime/this-firefox

Setup

This Nightly

USB disabled

No devices discovered

Refresh devices

Firefox Nightly (124.0a1)

Temporary Extensions (1) ▾

Load Temporary Add-on...

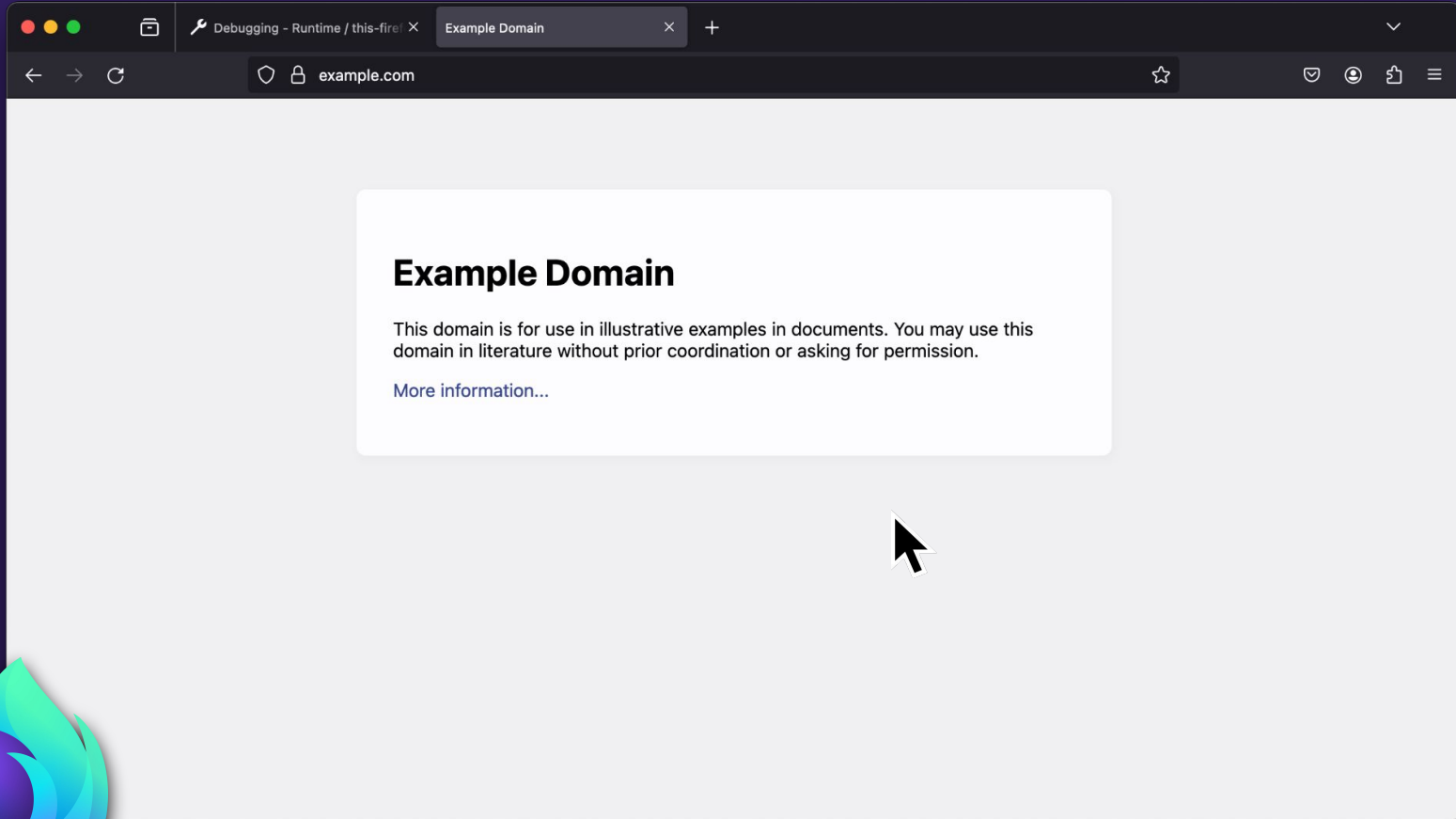
 Content script MV2 sample Inspect

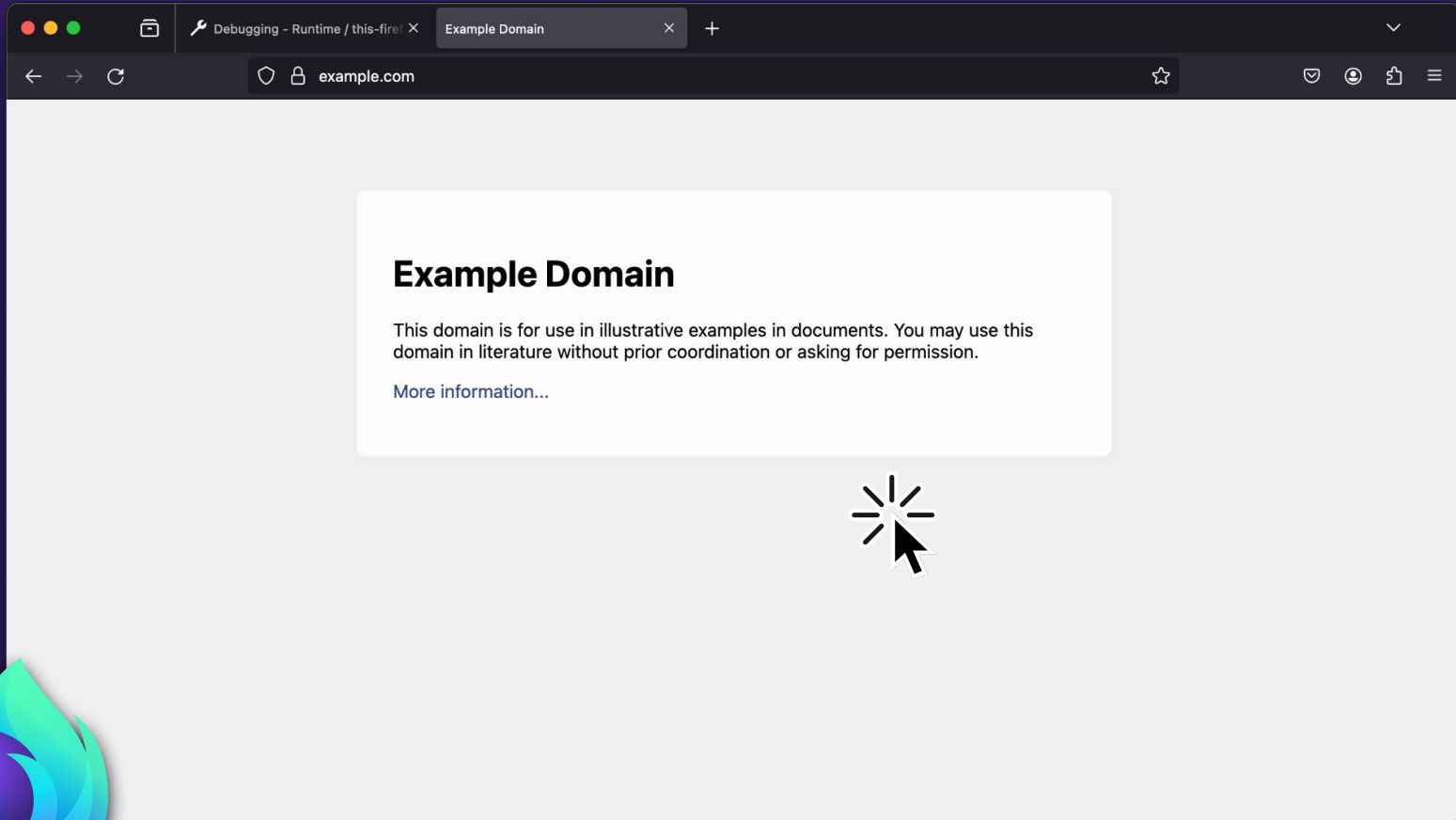
Location	/Users/svincent/dev/fosdem-2024-ext/code-samples/content_scripts.mv2/
Extension ID	c544a34126fa473821a28930014586c5cfdaf549@temporary-addon
Internal UUID	d6f9a863-026b-4a09-9c02-040397069f42
Manifest URL	moz-extension://d6f9a863-026b-4a09-9c02-040397069f42/manifest.json
This WebExtension has a temporary ID. Learn more	

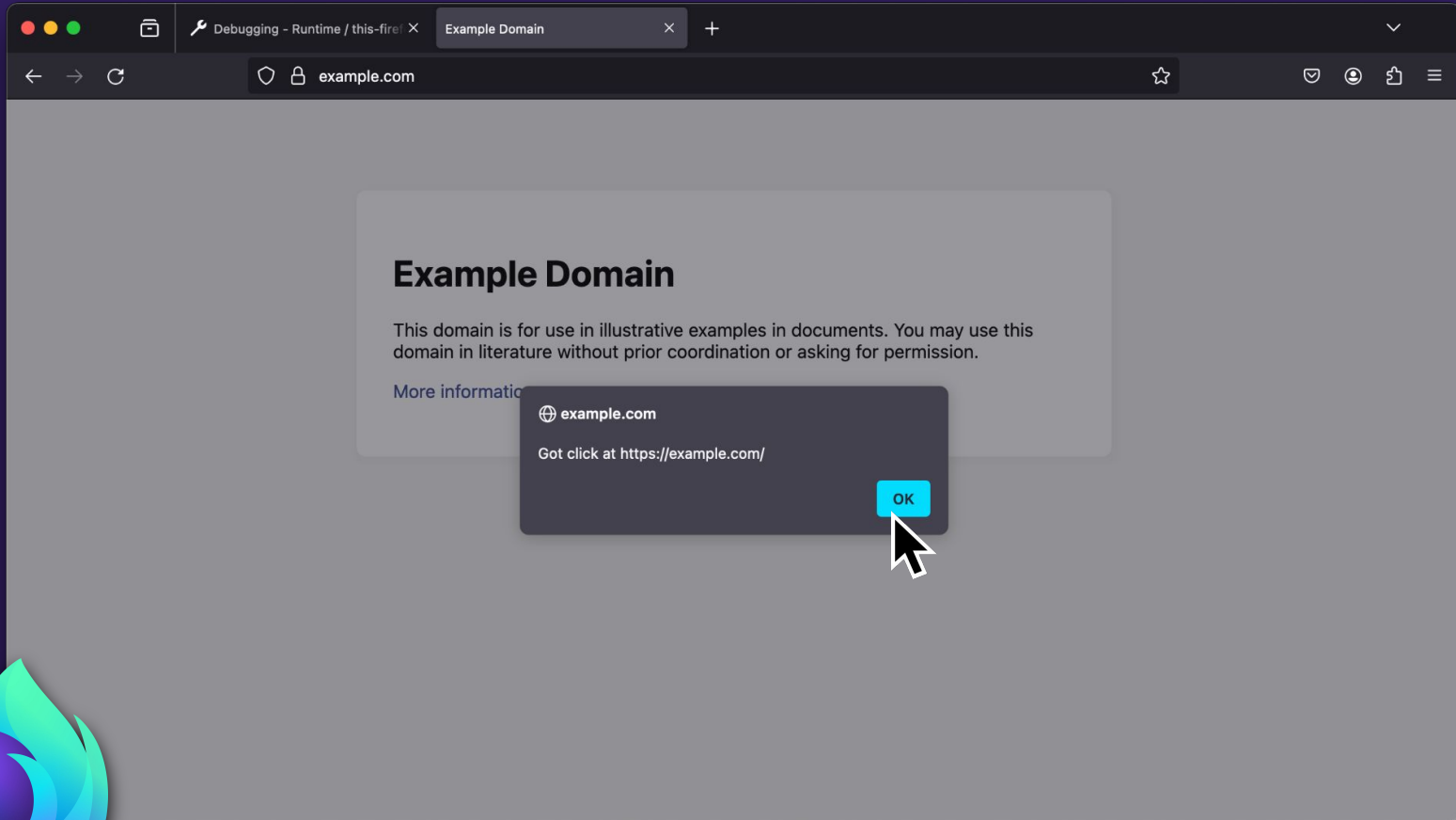
Reload Remove

Debugging Support

Extensions (1) >



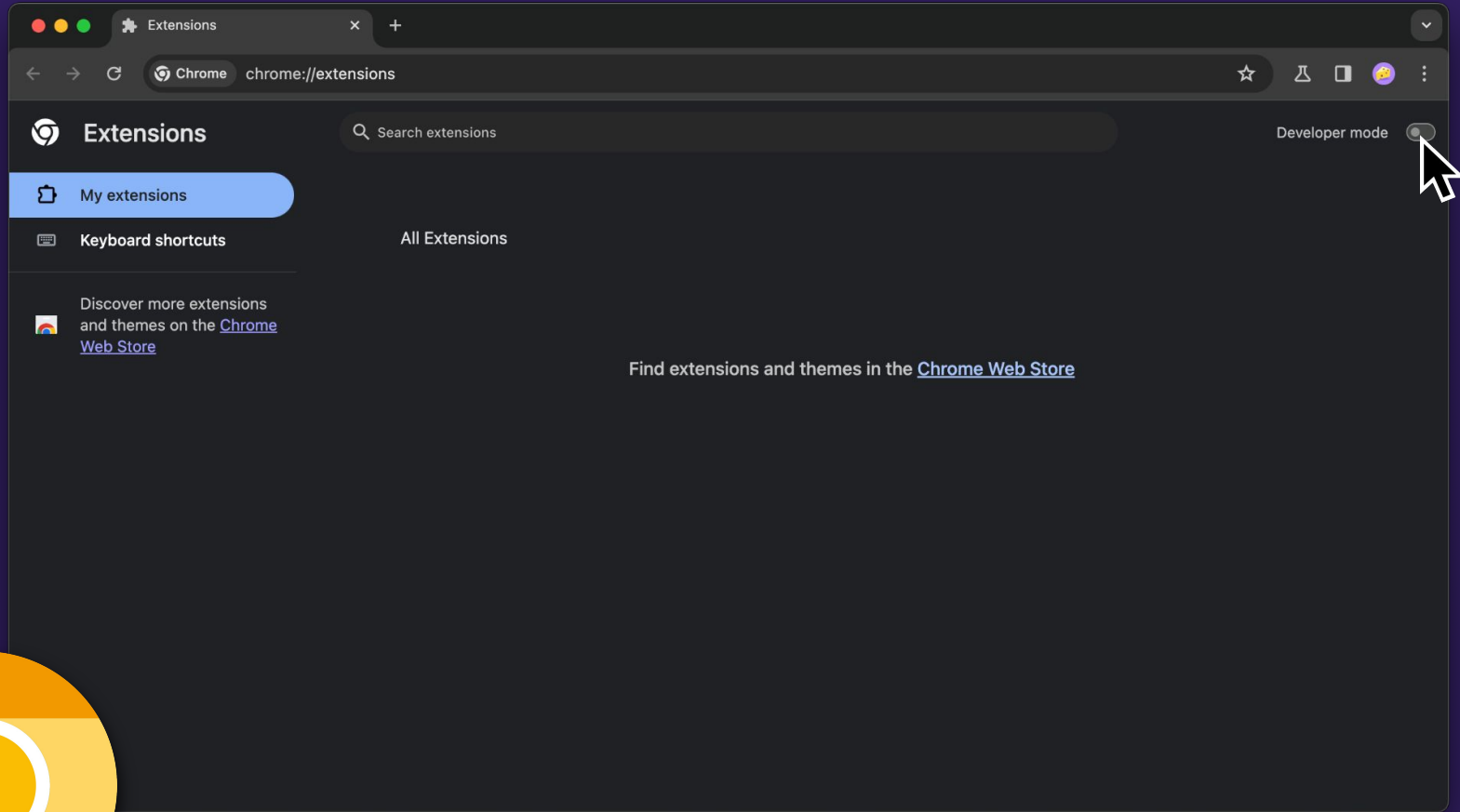


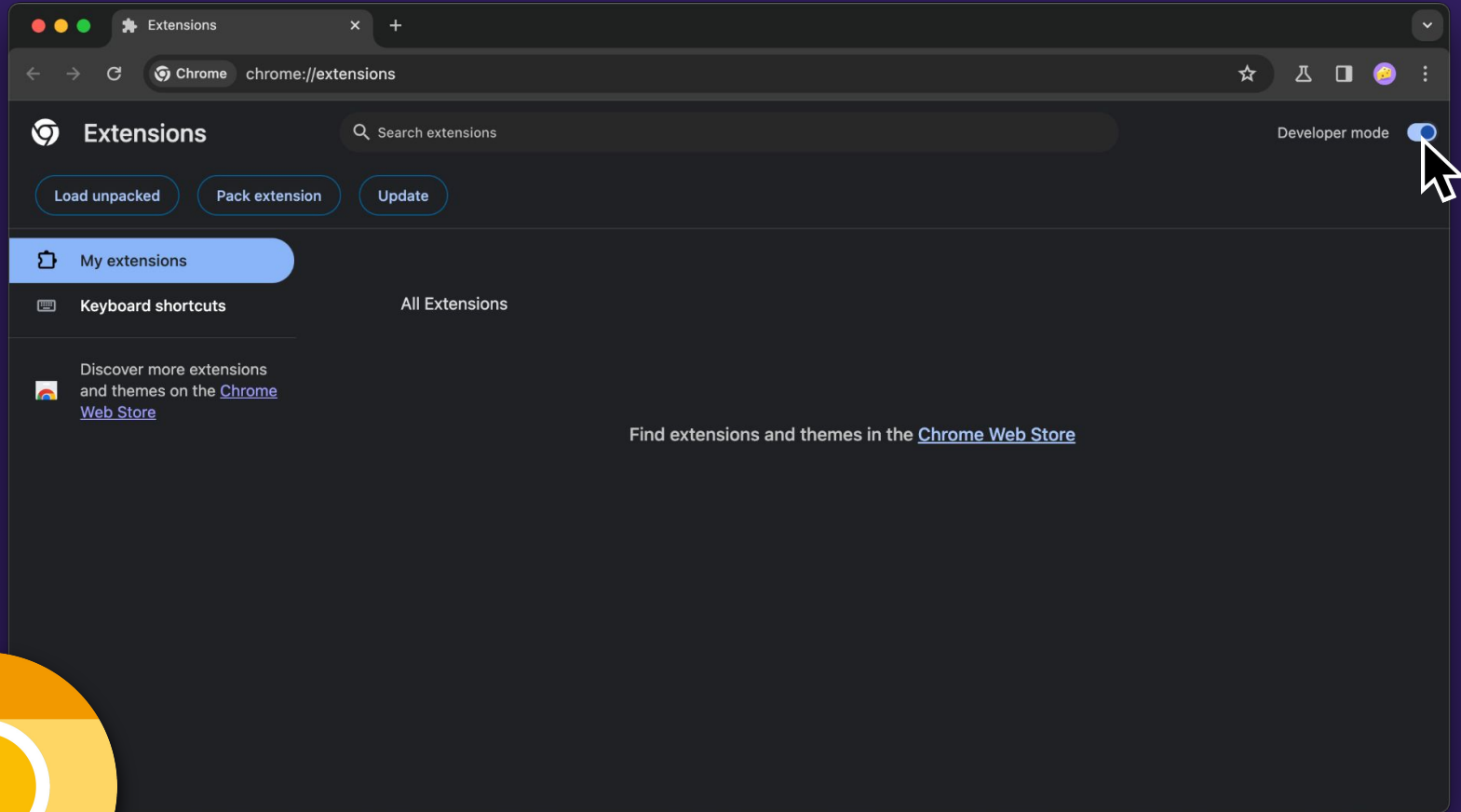


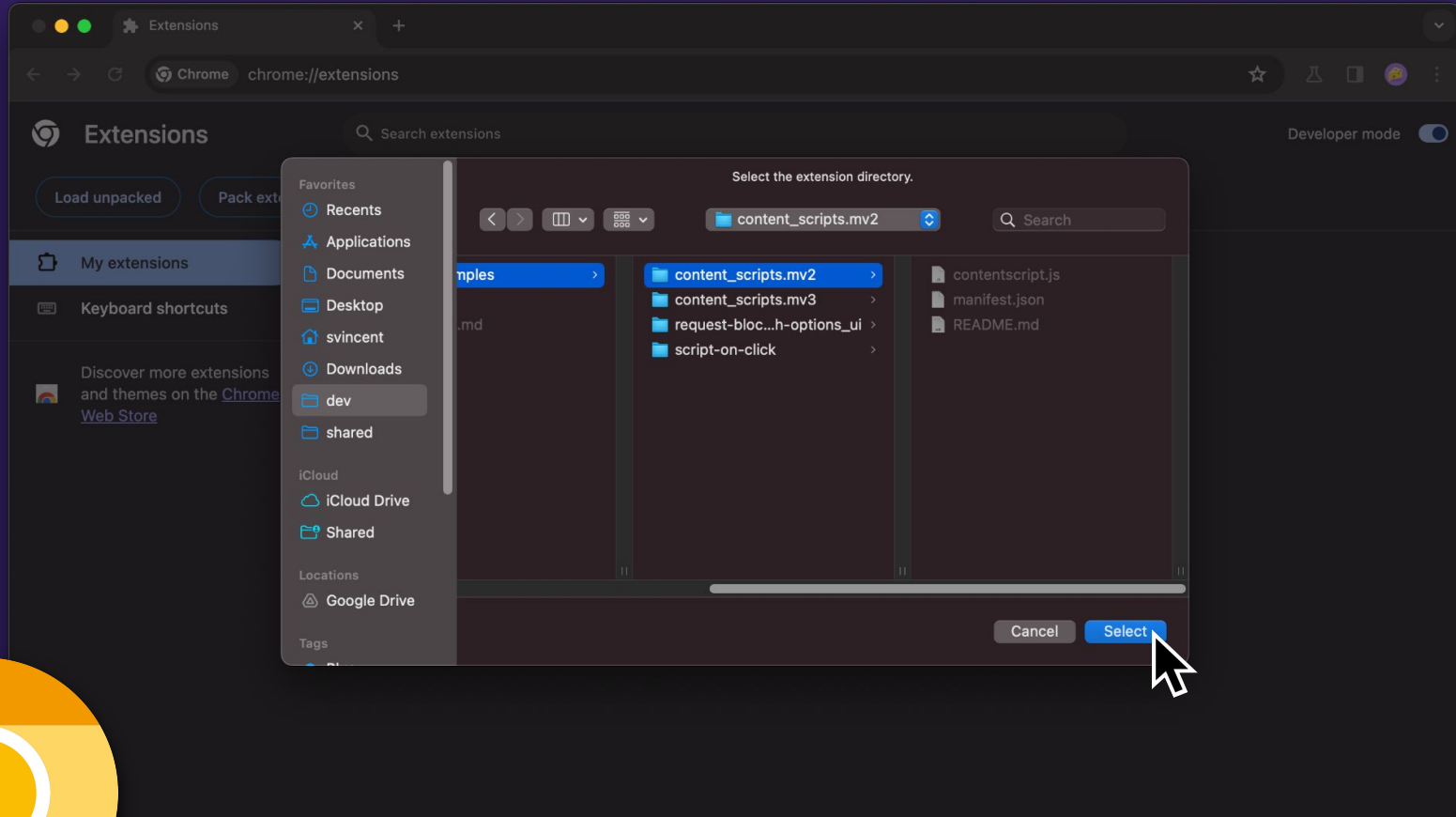


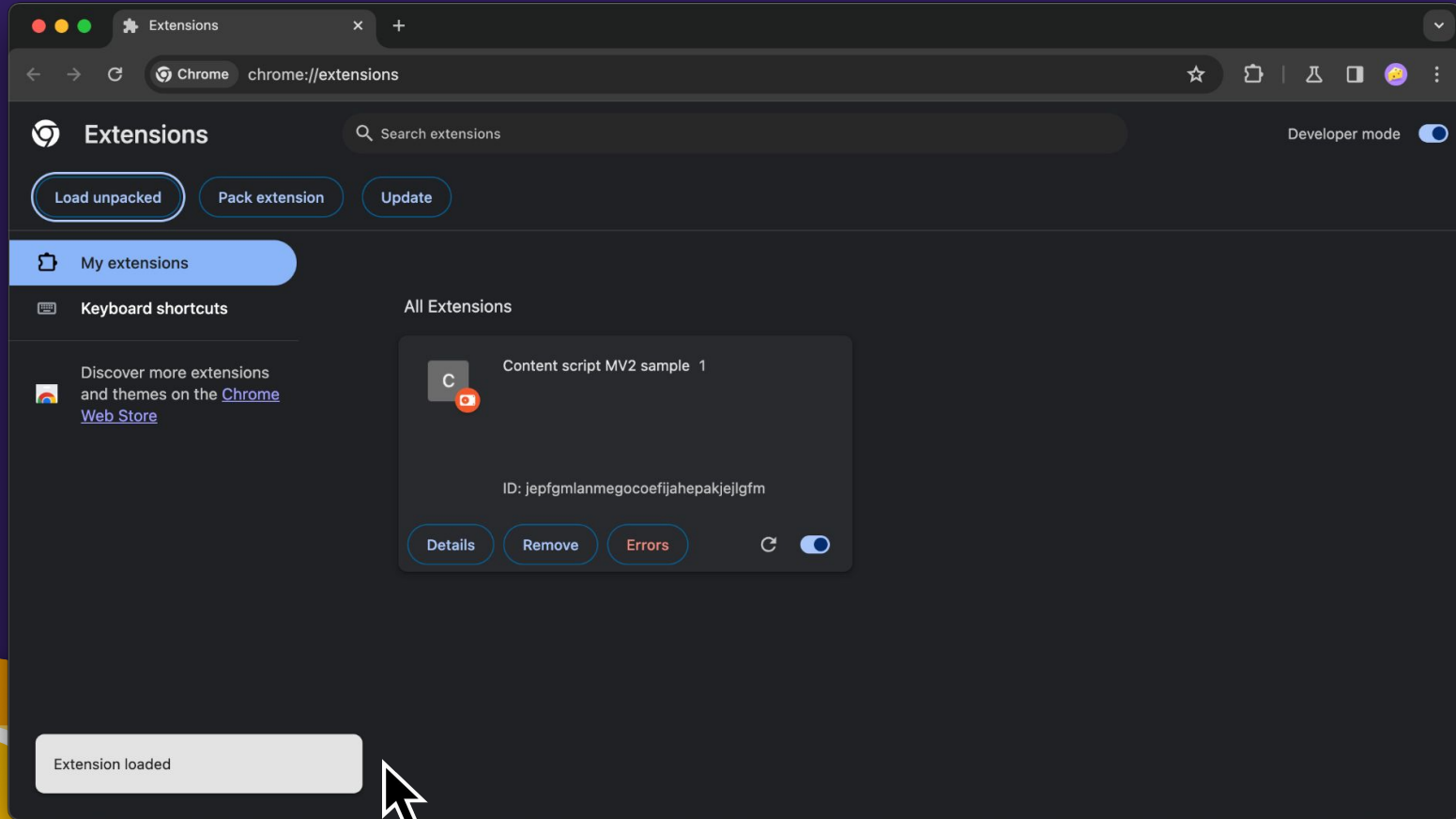
Chrome Canary

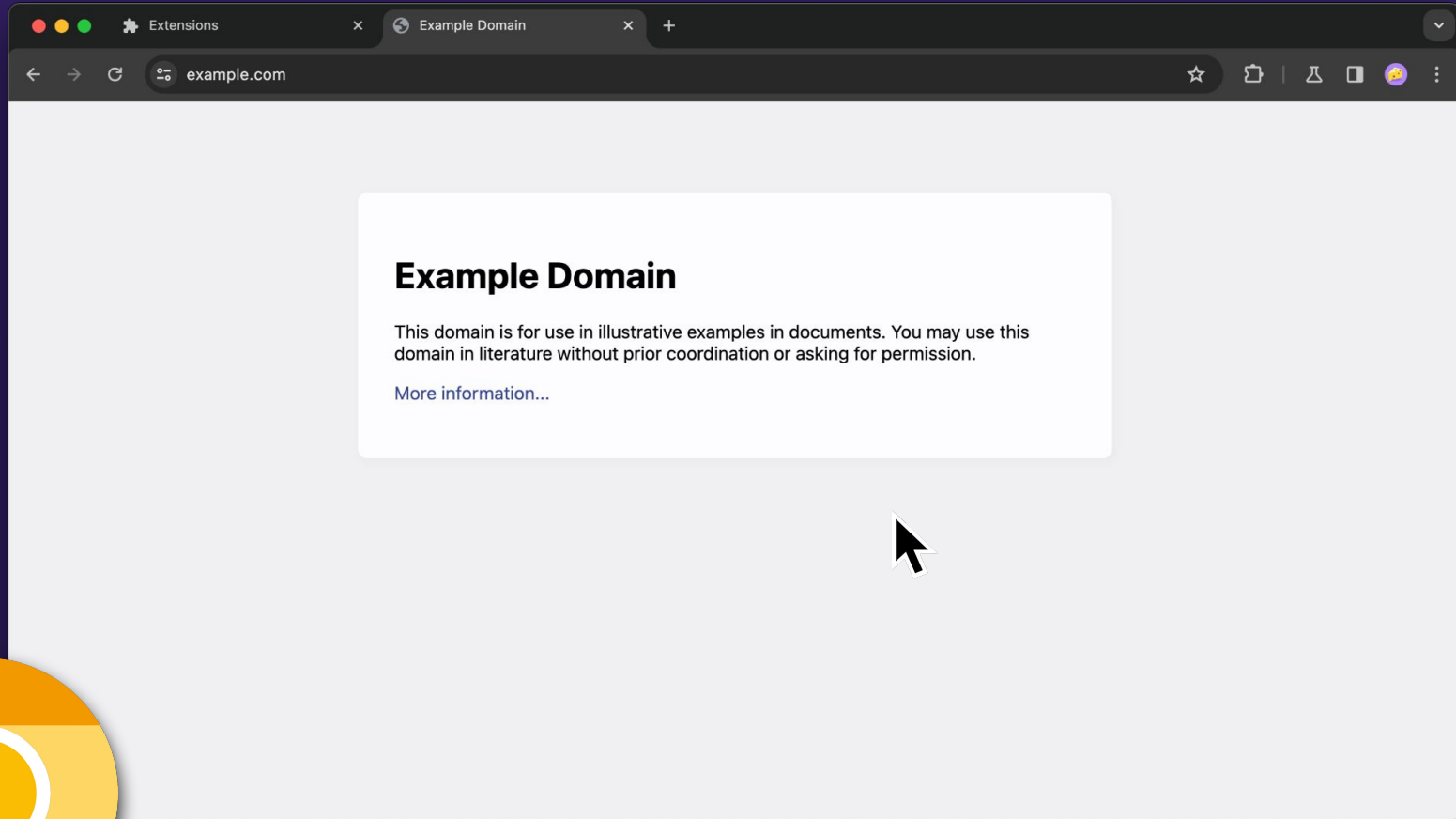
demo

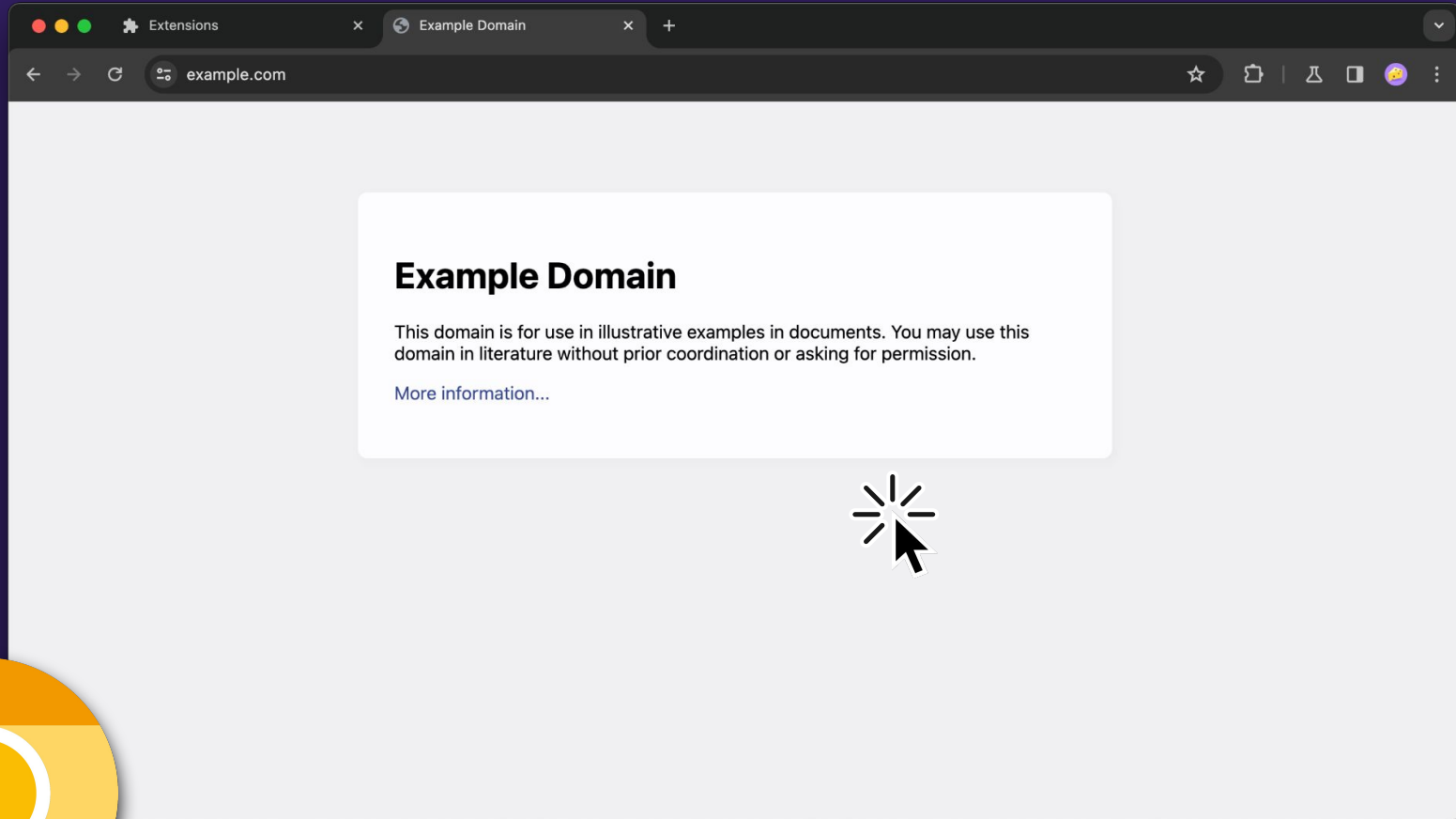


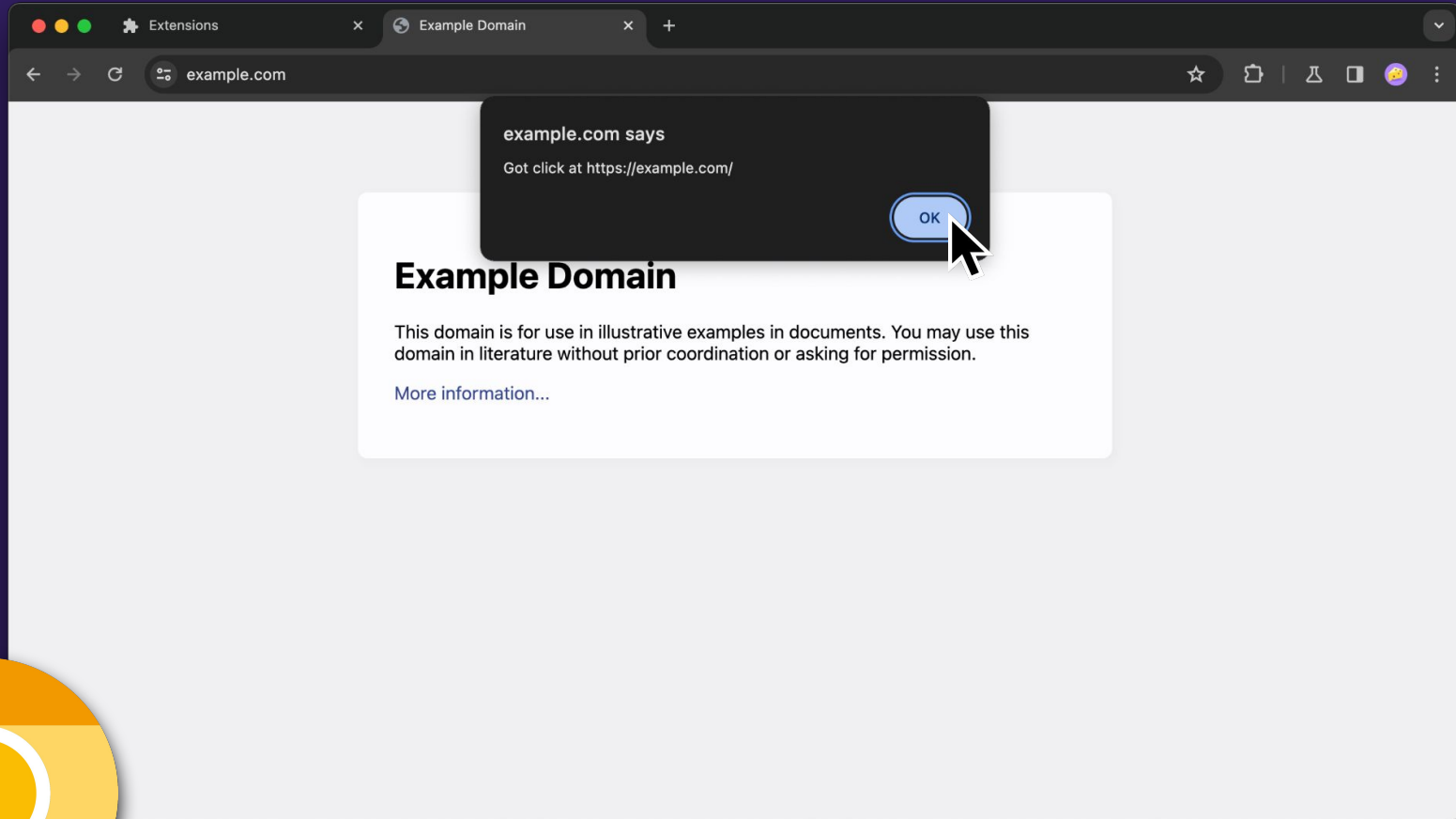




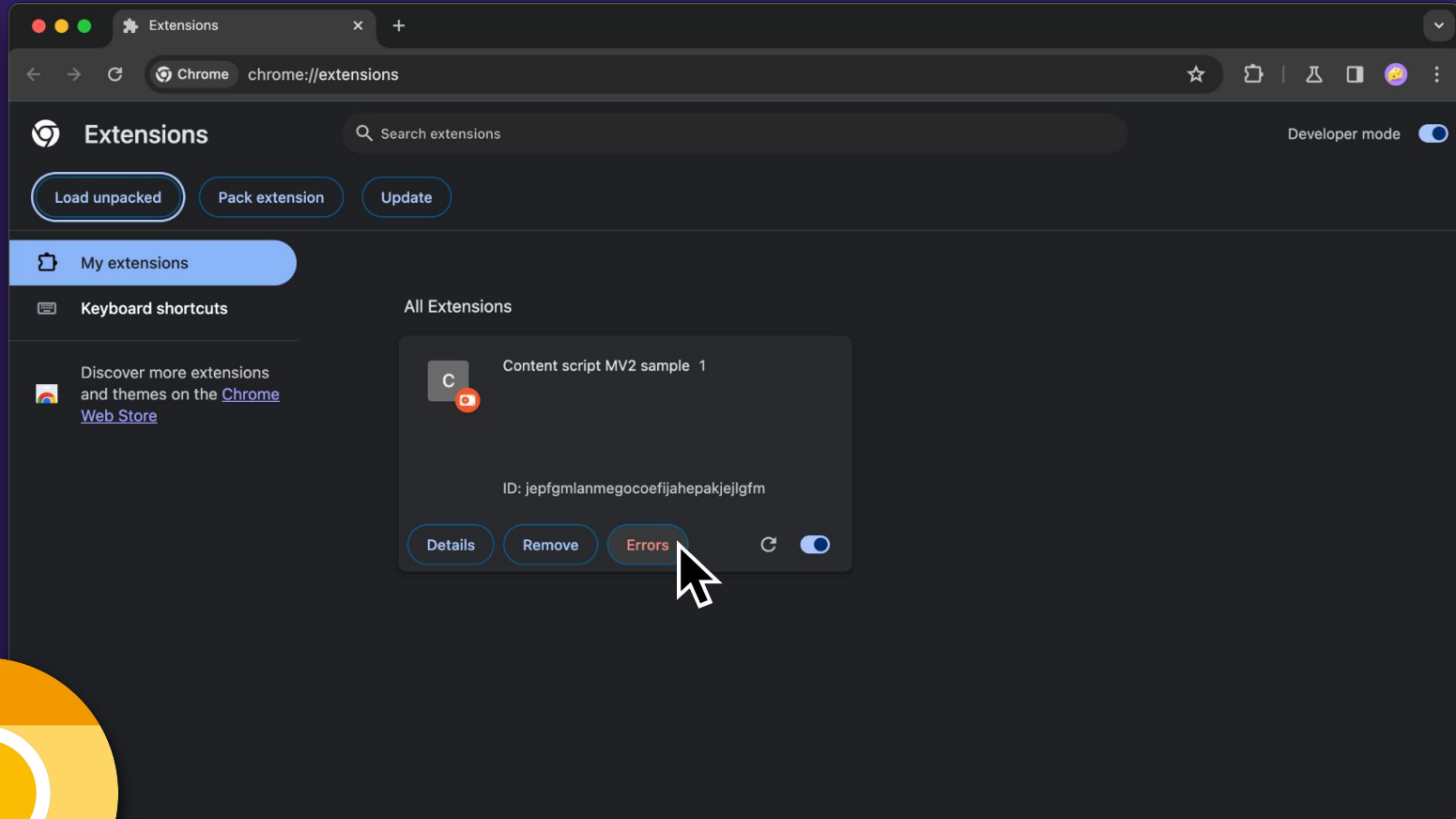


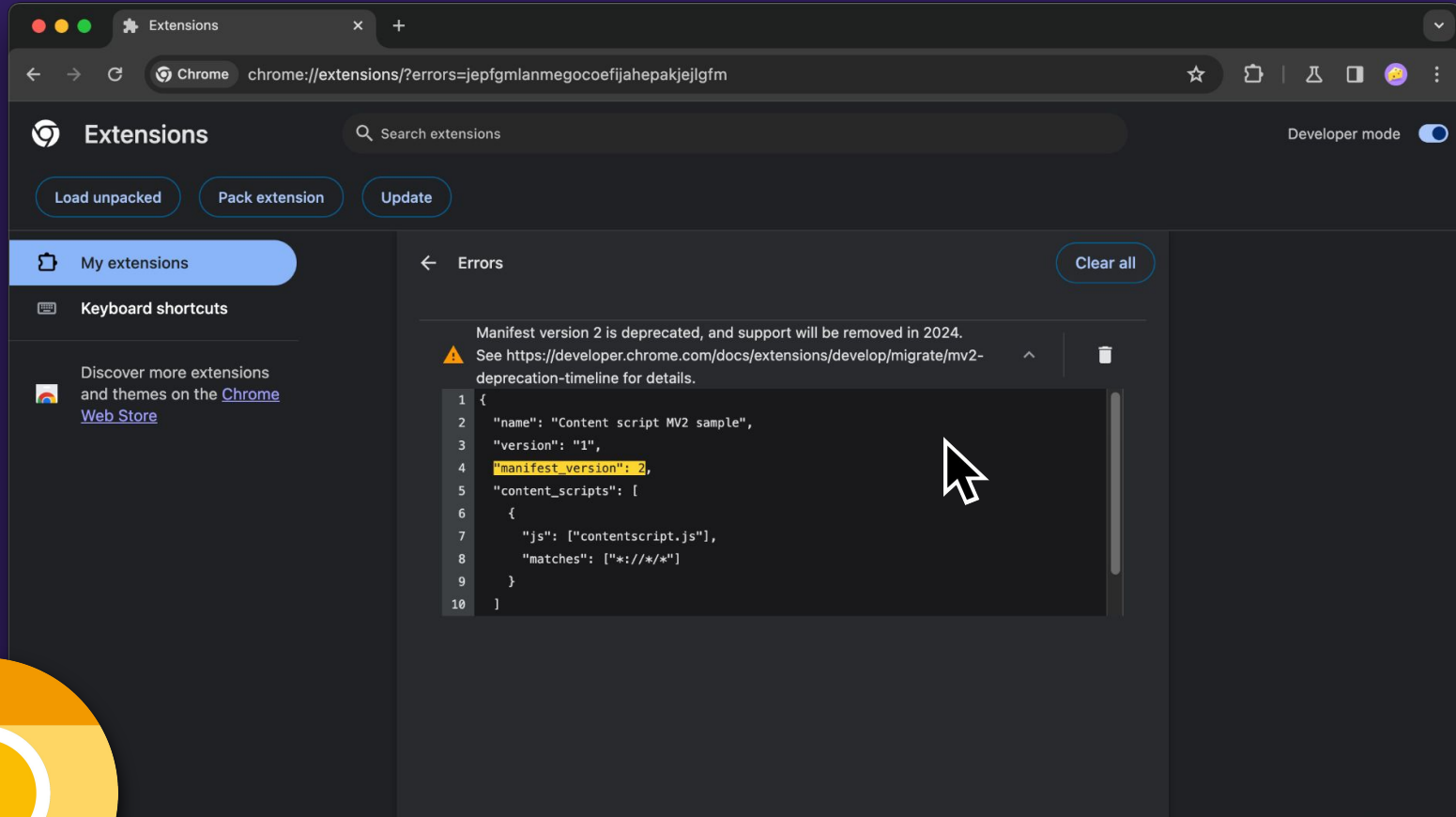






Manifest versions





The screenshot shows the Chrome Extensions page in a dark theme. The address bar displays the URL `chrome://extensions/?errors=jepfgmlanmegocoefijahepakjejlghm`. The page title is "Extensions". Below the title, there is a search bar and a "Developer mode" toggle which is turned on. Three buttons are visible: "Load unpacked", "Pack extension", and "Update". The left sidebar has two sections: "My extensions" (highlighted) and "Keyboard shortcuts". Under "My extensions", there is a link to "Discover more extensions and themes on the [Chrome Web Store](#)". The main content area is titled "Errors" and contains a warning message: "Manifest version 2 is deprecated, and support will be removed in 2024. See <https://developer.chrome.com/docs/extensions/develop/migrate/mv2-deprecation-timeline> for details." Below the message is a code editor showing a JSON manifest file. The code is as follows:

```
1 {
2   "name": "Content script MV2 sample",
3   "version": "1",
4   "manifest_version": 2,
5   "content_scripts": [
6     {
7       "js": ["contentscript.js"],
8       "matches": ["*://*/*"]
9     }
10  ]
```

A mouse cursor is pointing at the code editor. A "Clear all" button is located in the top right corner of the error section.



./manifest.json

```
{
  "name": "Content script MV2 sample",
  "version": "1",
  "manifest_version": 2,
  "content_scripts": [
    {
      "js": ["contentscript.js"],
      "matches": ["*://*/*"]
    }
  ]
}
```

./contentscript.js

```
document.addEventListener("click", event => {
  alert("Got click at " + document.URL);
});
```

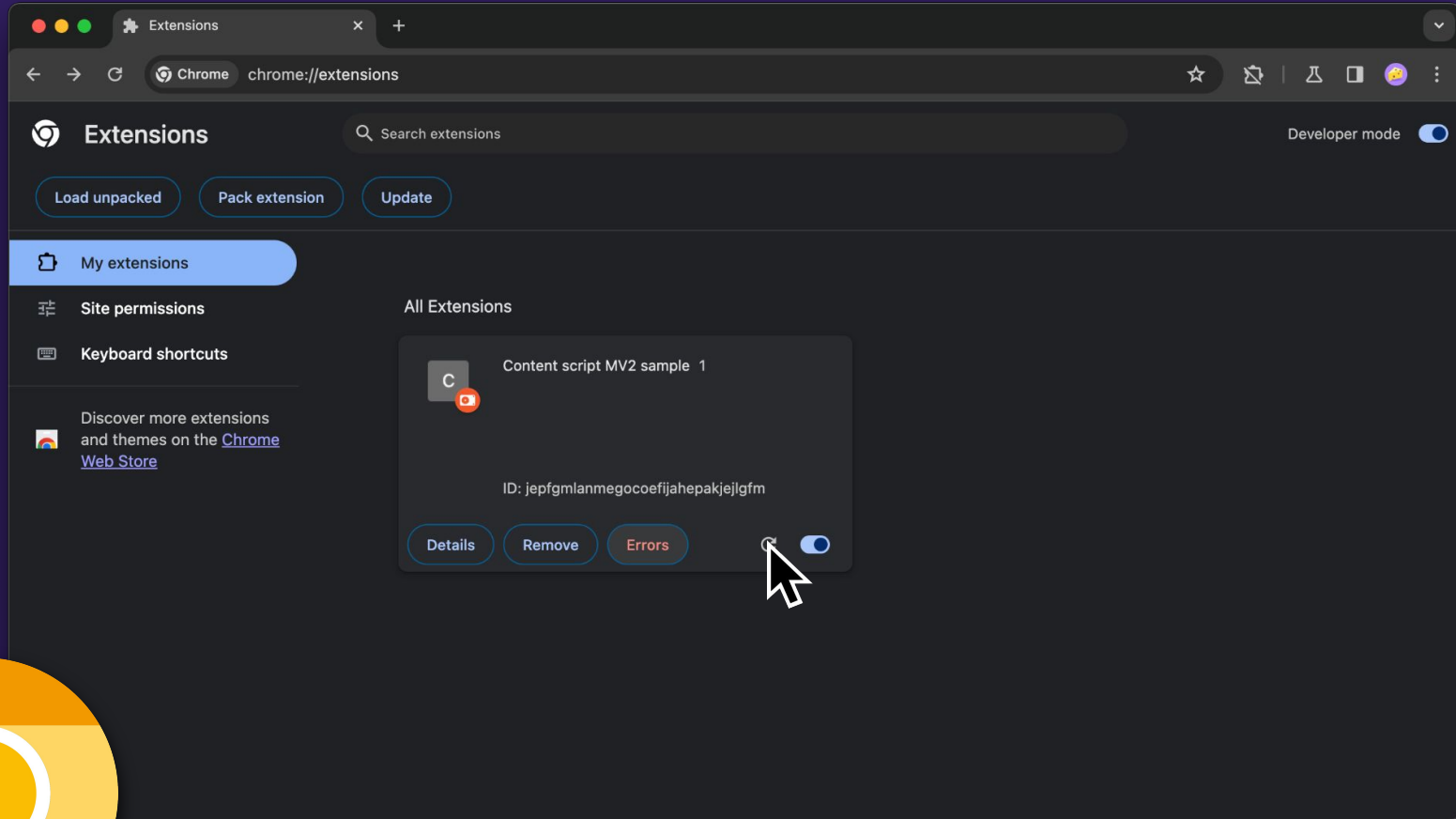
./manifest.json

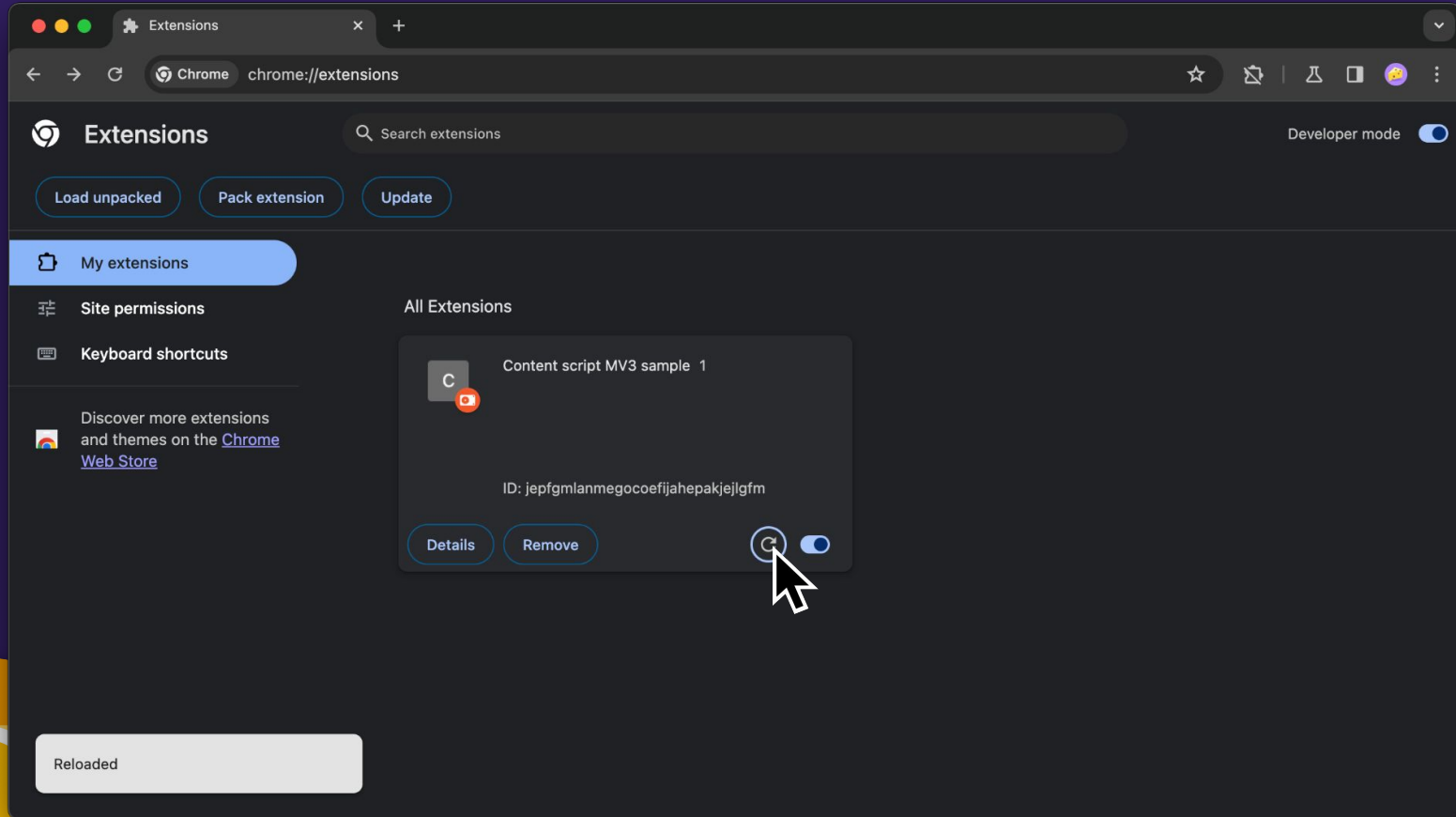
```
{
  "name": "Content script MV3 sample",
  "version": "1",
  "manifest_version": 3,
  "content_scripts": [
    {
      "js": ["contentscript.js"],
      "matches": ["*://*/*"]
    }
  ]
}
```

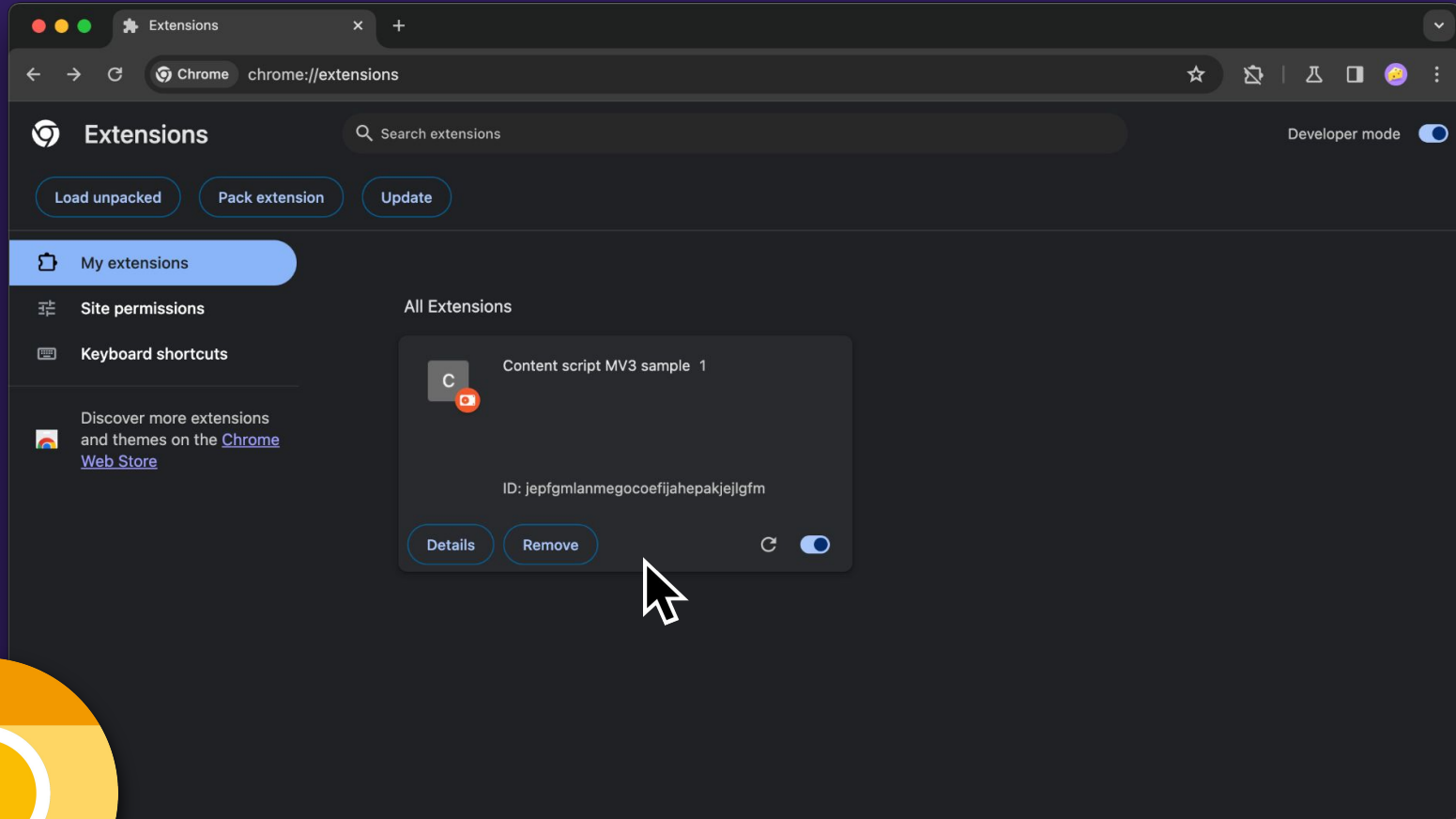
./contentscript.js

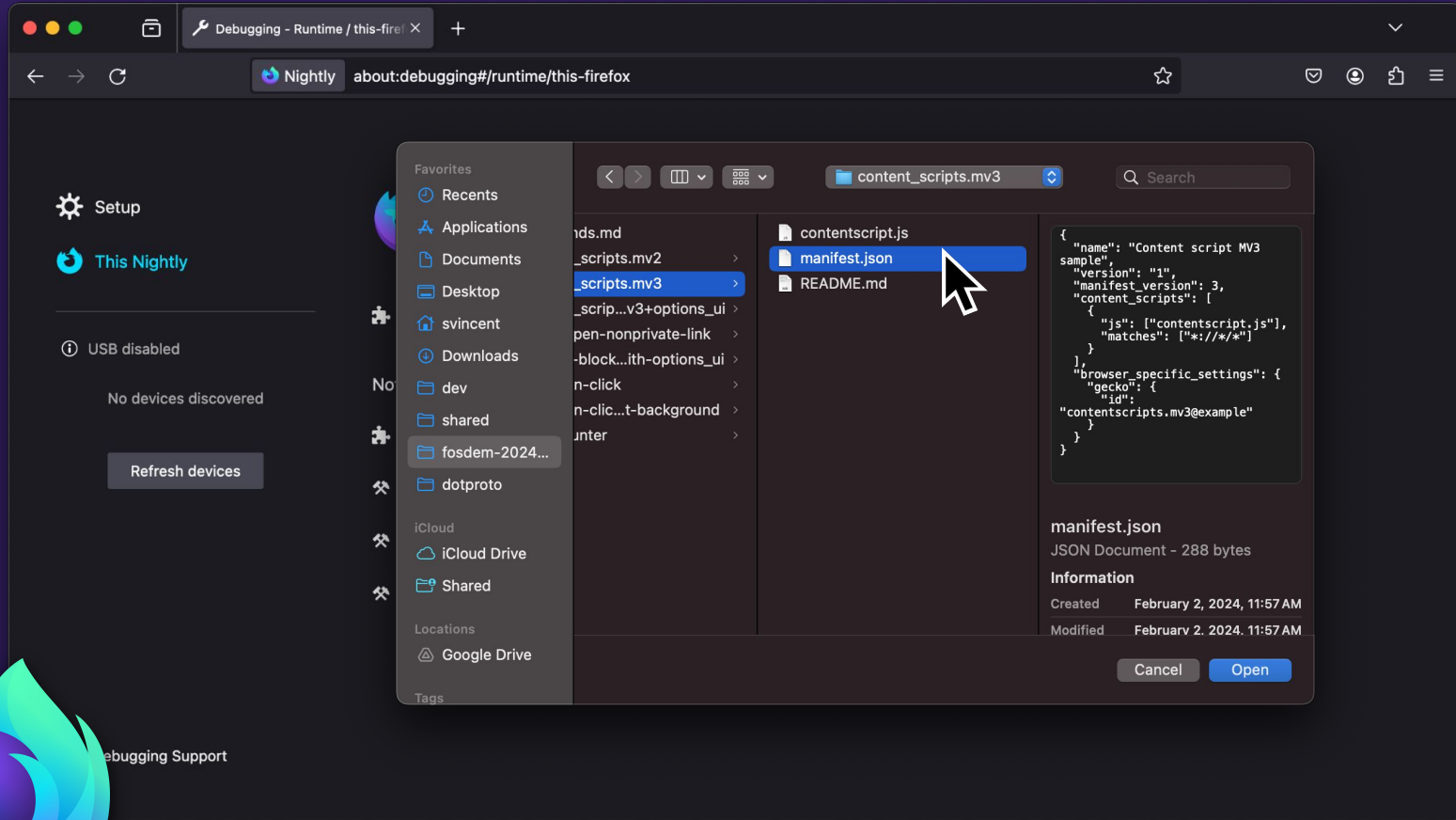
```
document.addEventListener("click", event => {
  alert("Got click at " + document.URL);
});
```

demo







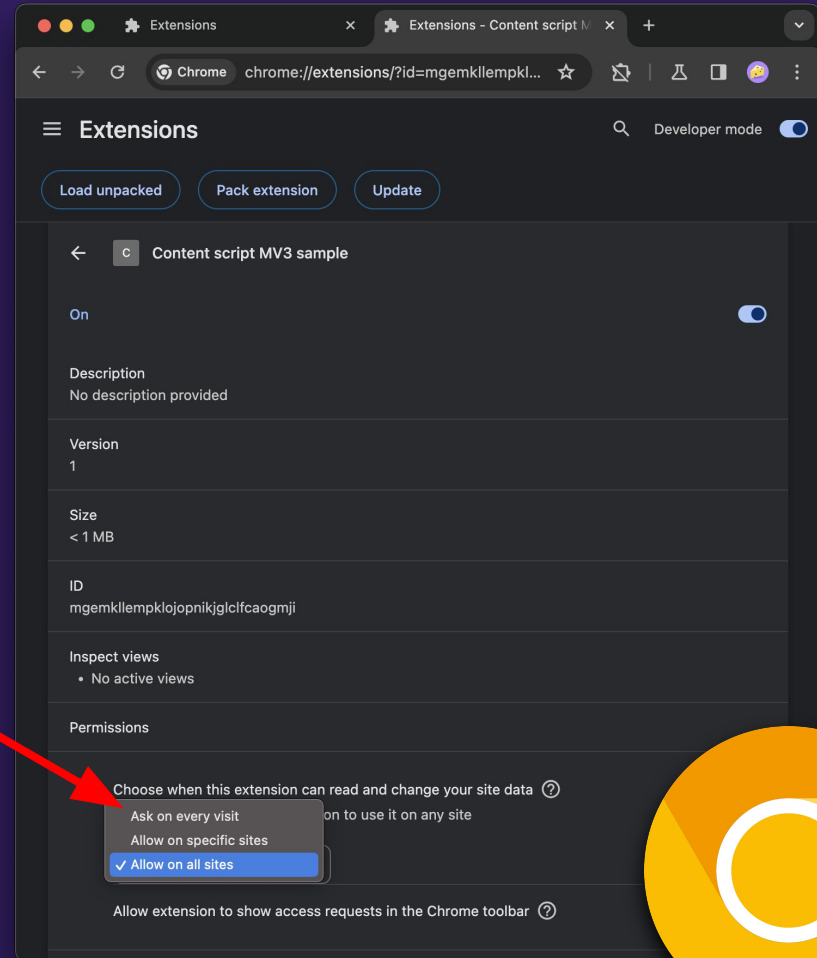
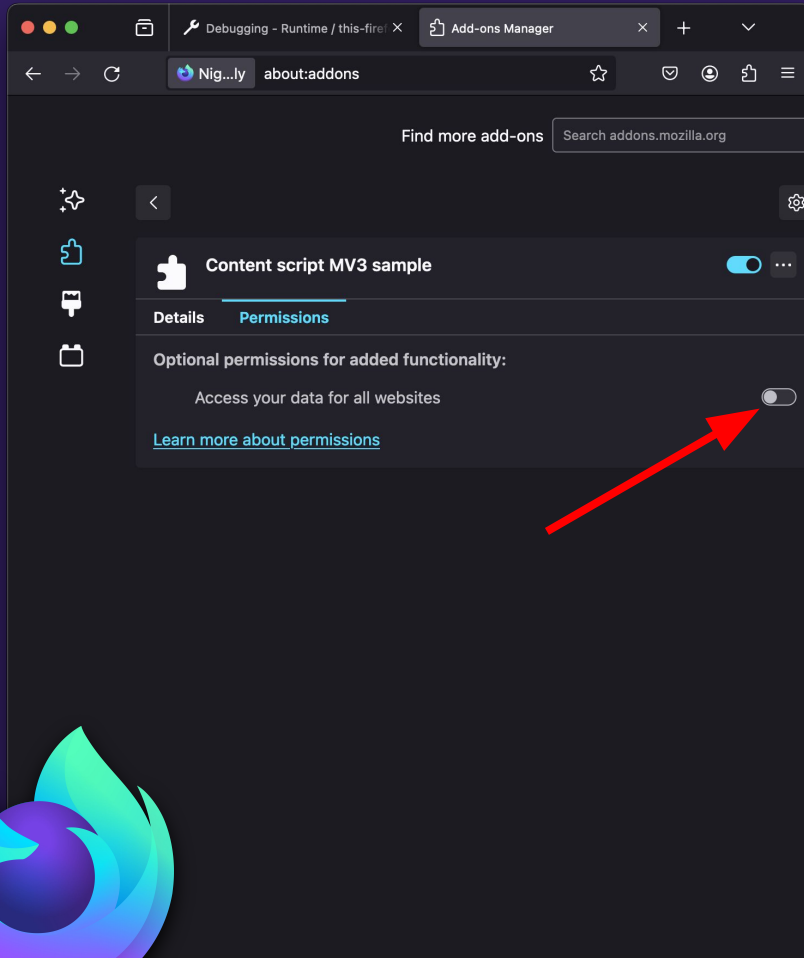


Host permissions

- Manifest Version 3 limitations
- User controls
- Requesting host permissions after install

**Users in control of host
permissions, by design**

Cross-browser WebExtensions — Host permissions



./manifest.json

```
"content_scripts": [{  
  "js": ["contentscript.js"],  
  "matches": ["*://*/*"]  
}],  
"options_ui": {  
  "page": "options.html"  
}  
}
```

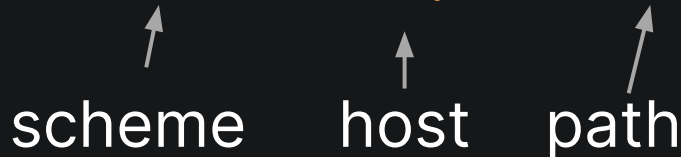
./options.html

Explanation here.

```
<label>  
  <input type="checkbox" id="permCheckbox">  
  Allow access to example.com  
</label>  
<script src="options.js"></script>
```

./options.js

```
const permissions = { origins: ["*://*.example.com/"] };
```



scheme

host

path

(path is ignored in permission requests)

"Match Patterns"

https://example.com/*

https://*.example.com/*

https://*.example.com/

://.example.com/sub/path.html

./options.js

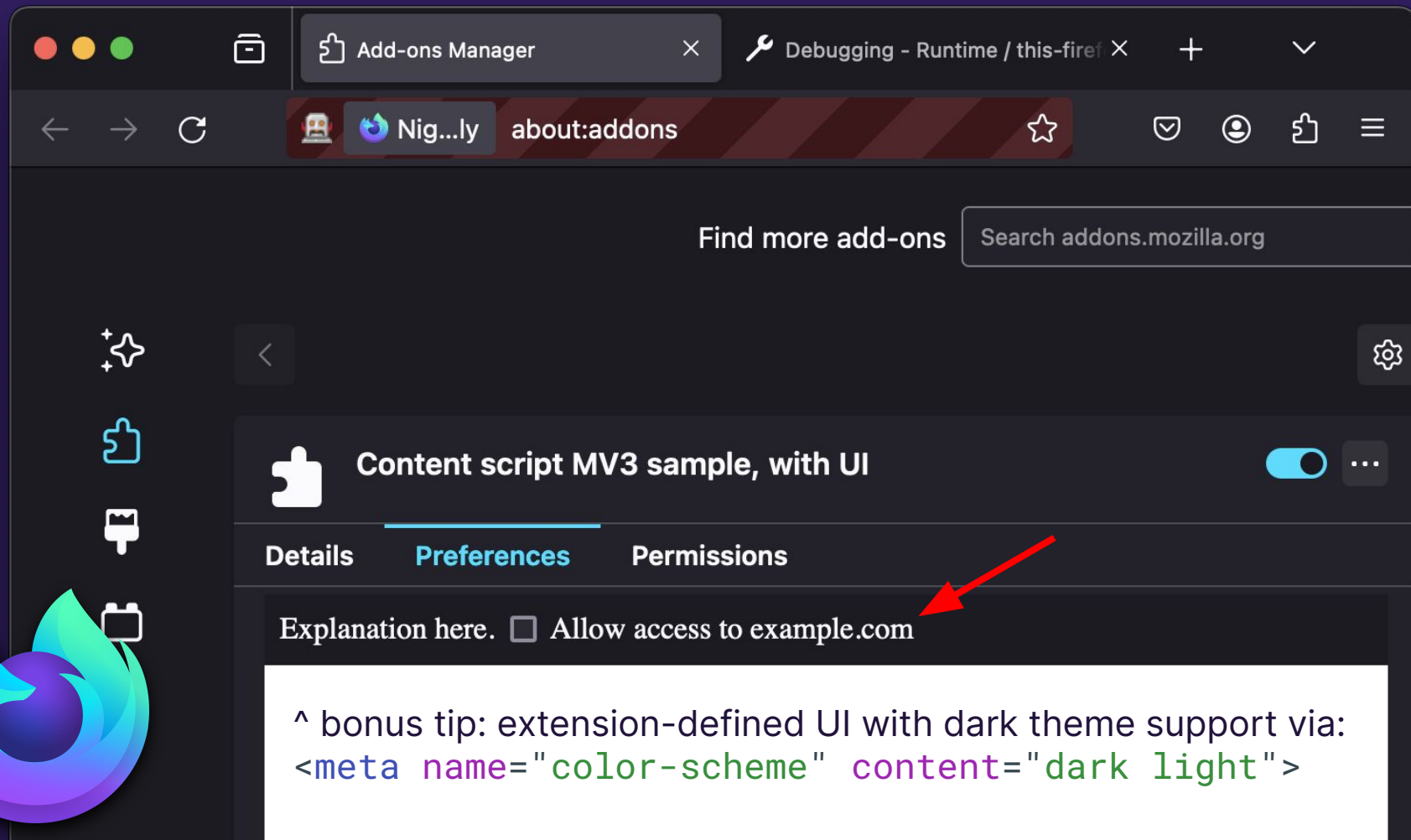
```
const permissions = { origins: ["*://*.example.com/"] };  
const checkbox = document.getElementById("permCheckbox");
```

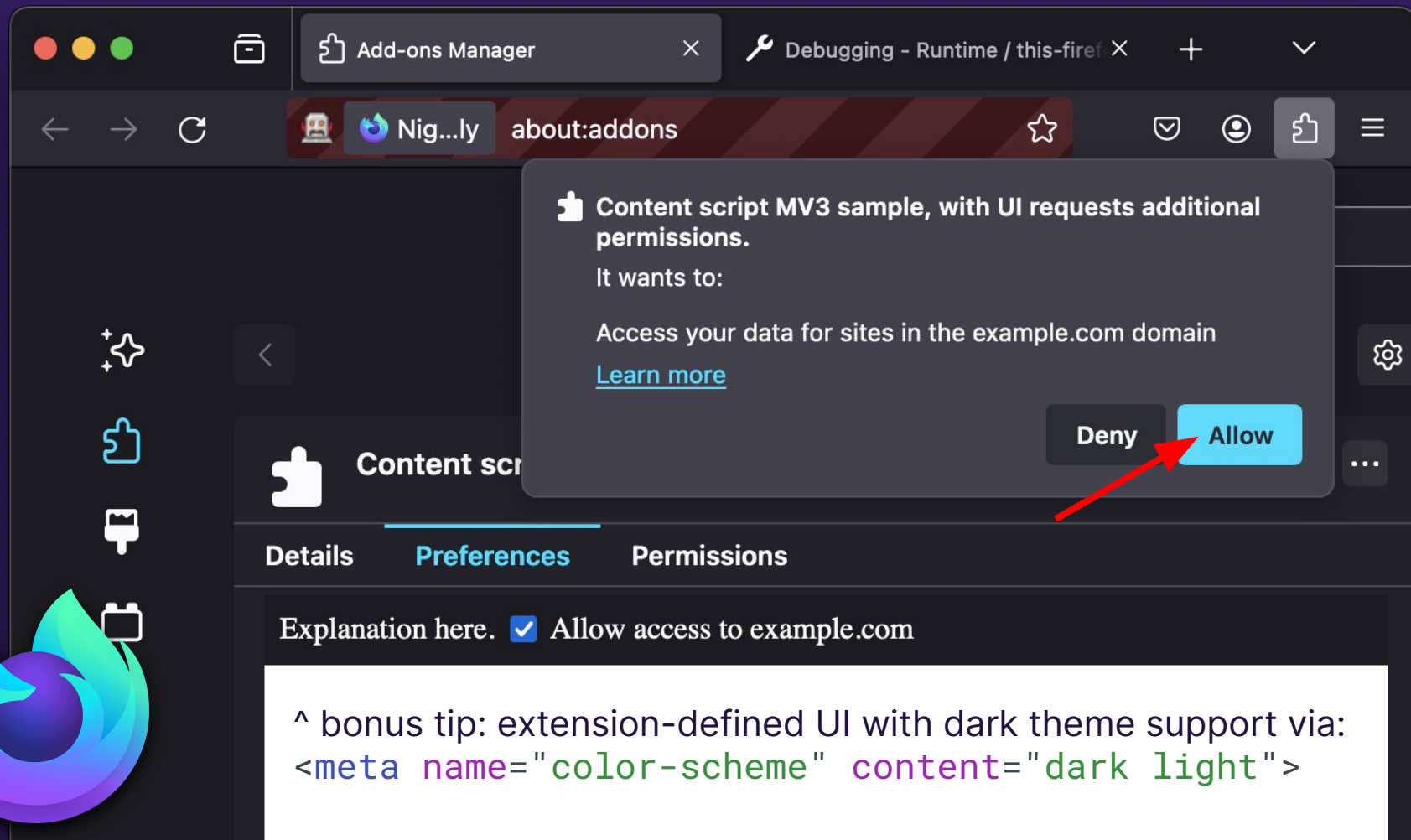
```
async function renderPermissions() {  
  checkbox.checked = await browser.permissions.contains(permissions);  
}
```

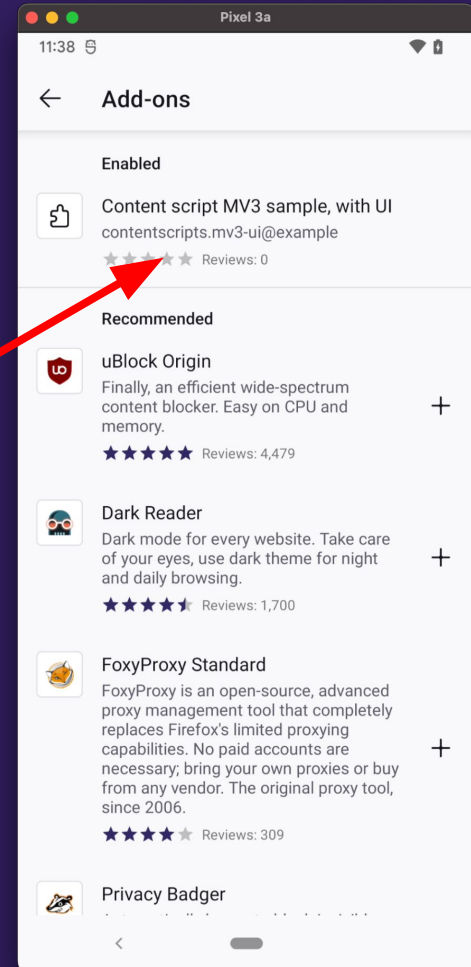
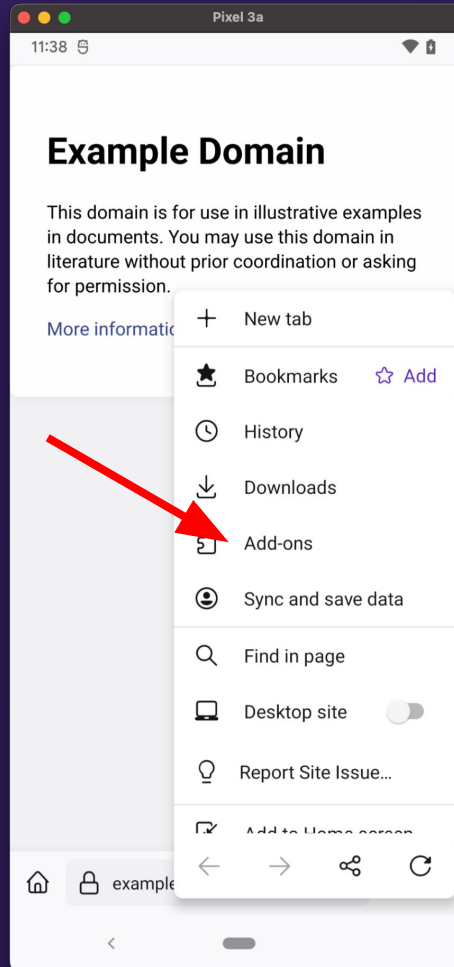
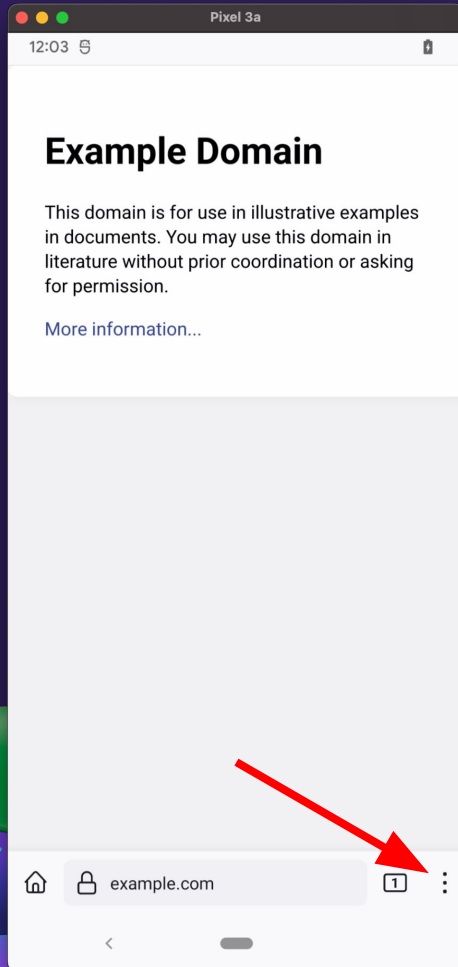
```
renderPermissions(); // Set initial checkbox state.
```

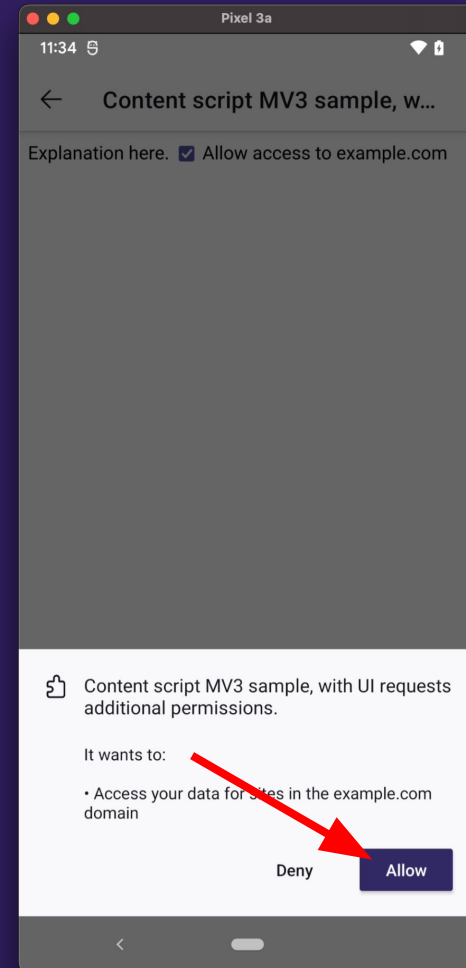
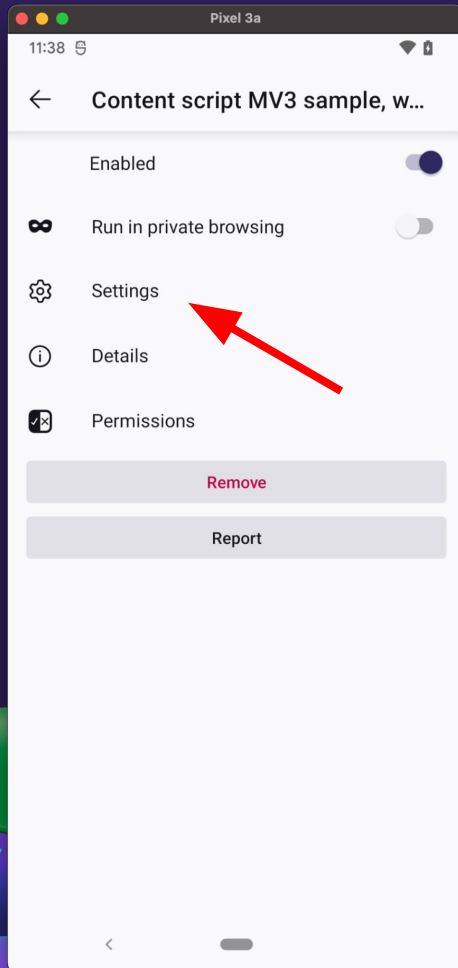
./options.js

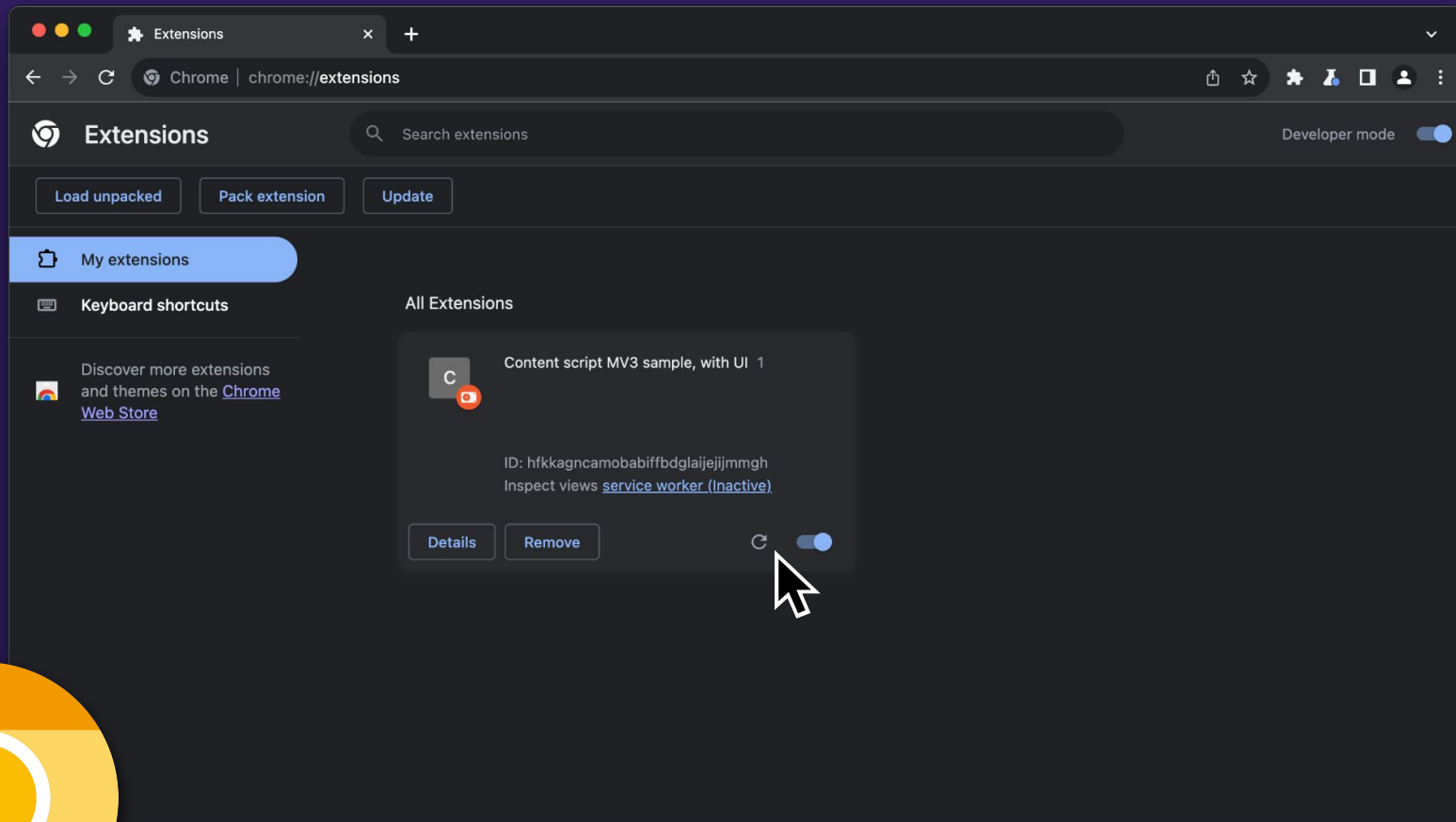
```
const permissions = { origins: ["*://*.example.com/"] };
const checkbox = document.getElementById("permCheckbox");
checkbox.onchange = async () => {
  if (checkbox.checked) {
    if (!(await browser.permissions.request(permissions)))
      checkbox.checked = false; // Denied by user.
  } else {
    try {
      await browser.permissions.remove(permissions);
    } catch (e) { checkbox.checked = true; } // Chrome refused removal.
  }
};
async function renderPermissions() {
  checkbox.checked = await browser.permissions.contains(permissions);
}
browser.permissions.onAdded.addListener(renderPermissions);
browser.permissions.onRemoved.addListener(renderPermissions);
renderPermissions(); // Set initial checkbox state.
```

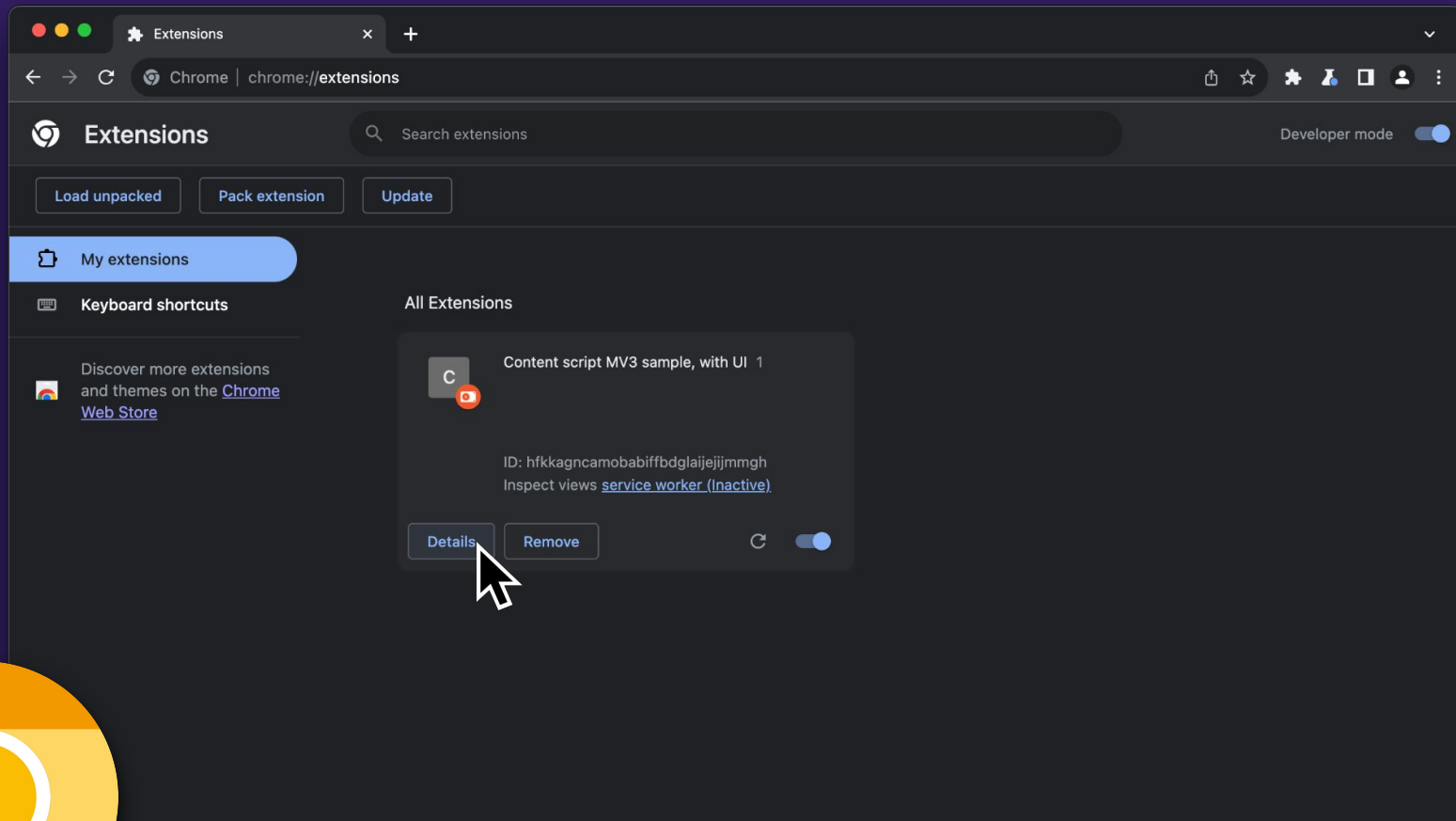



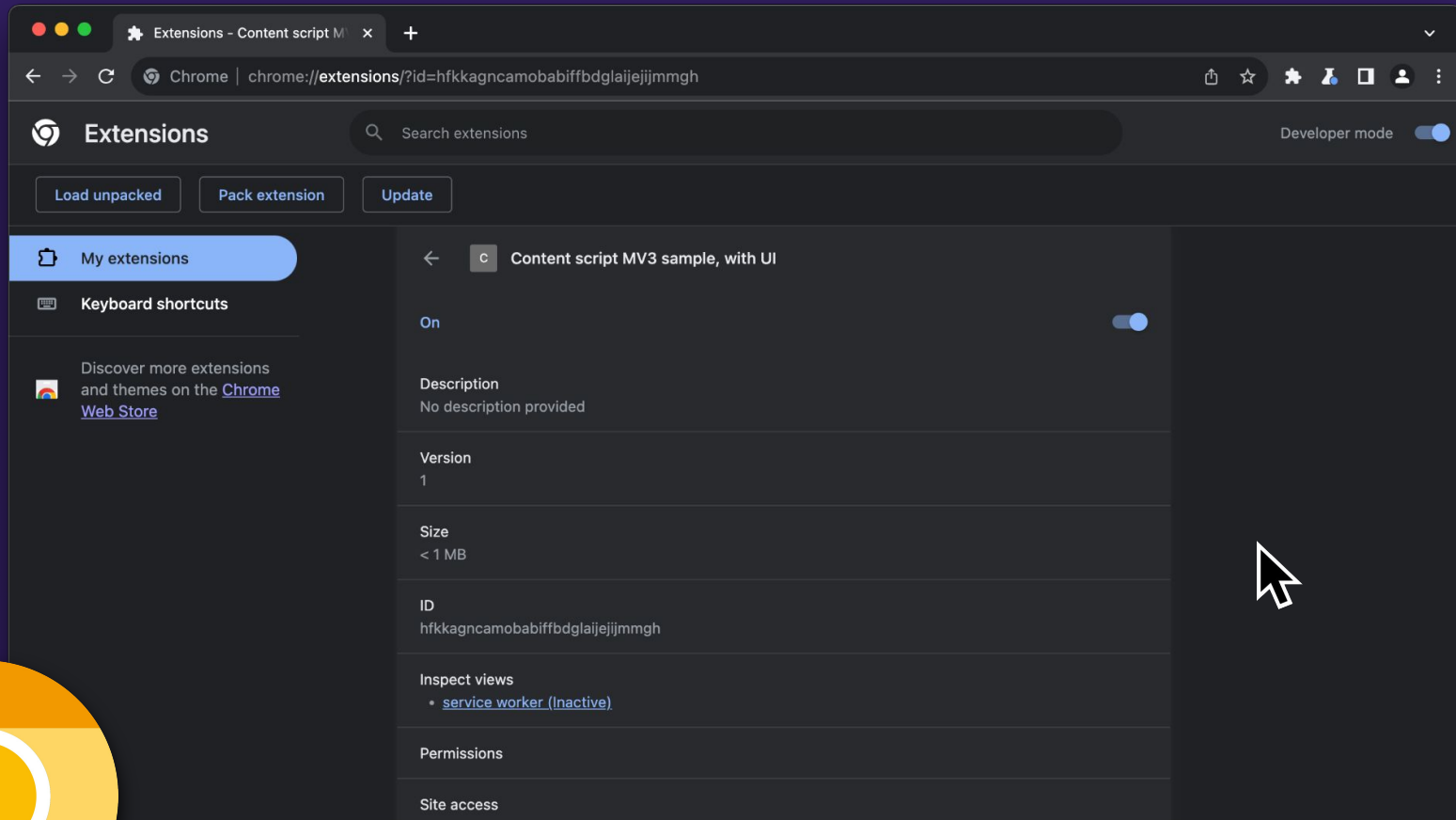












The screenshot shows the Chrome Extensions page in a dark theme. The browser's address bar displays the URL `chrome://extensions/?id=hfkkagncamobabiffbdglaijeijmmgh`. The page title is "Extensions". Below the title is a search bar labeled "Search extensions" and a "Developer mode" toggle switch which is turned on. There are three buttons: "Load unpacked", "Pack extension", and "Update". The left sidebar has a "My extensions" section with a folder icon, a "Keyboard shortcuts" section with a keyboard icon, and a link to "Discover more extensions and themes on the Chrome Web Store". The main content area shows a single extension: "Content script MV3 sample, with UI". It has a toggle switch set to "On". Below the toggle are fields for "Description" (No description provided), "Version" (1), "Size" (< 1 MB), "ID" (hfkkagncamobabiffbdglaijeijmmgh), "Inspect views" (service worker (Inactive)), "Permissions", and "Site access". A white mouse cursor is pointing at the extension details.

Extensions - Content script M x +

Chrome | `chrome://extensions/?id=hfkkagncamobabiffbdglaijeijmmgh`

Extensions

Search extensions

Developer mode

Load unpacked Pack extension Update

My extensions

Keyboard shortcuts

Discover more extensions and themes on the [Chrome Web Store](#)

Content script MV3 sample, with UI

On

Description
No description provided

Version
1

Size
< 1 MB

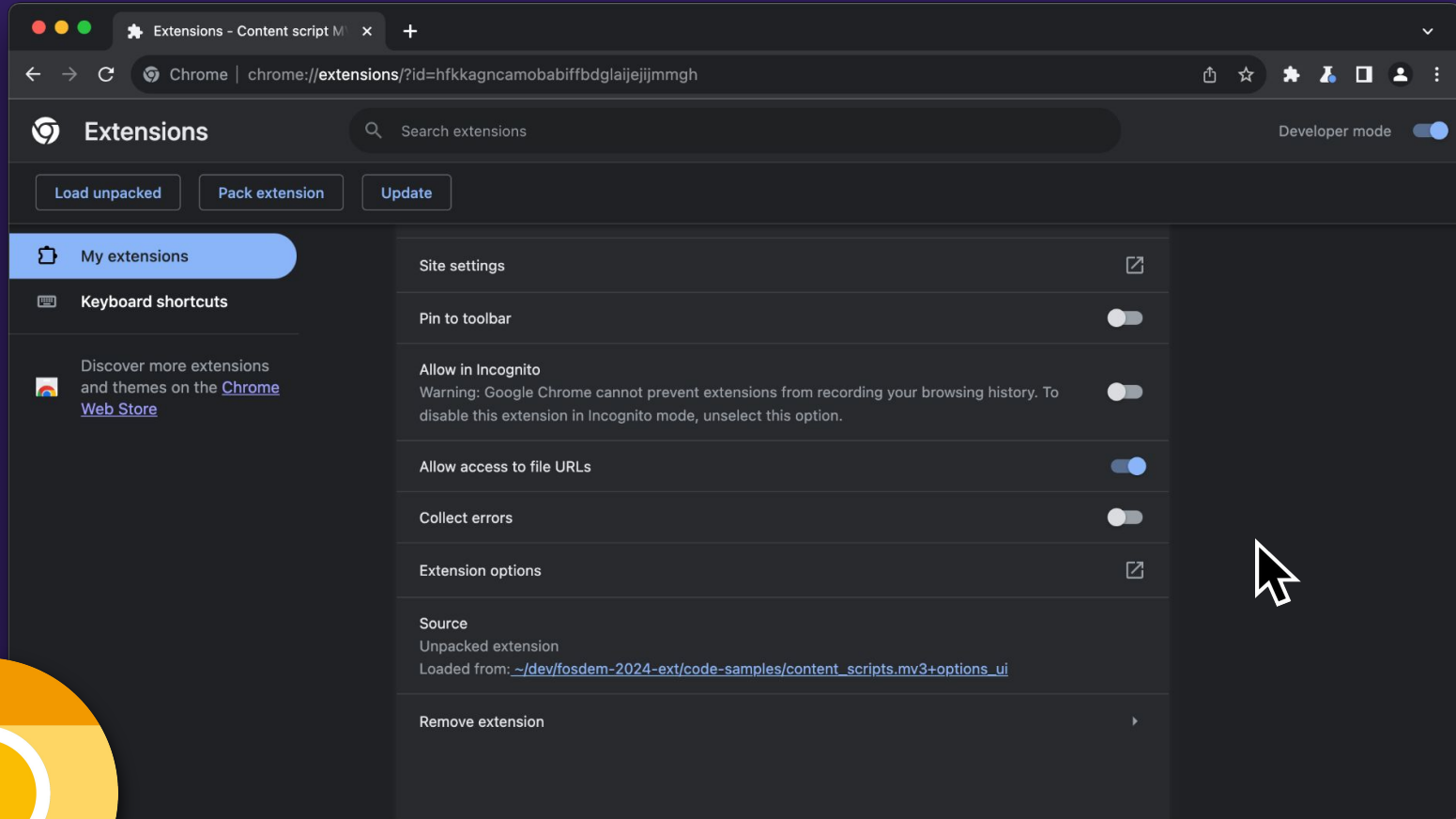
ID
hfkkagncamobabiffbdglaijeijmmgh

Inspect views
• [service worker \(Inactive\)](#)

Permissions

Site access



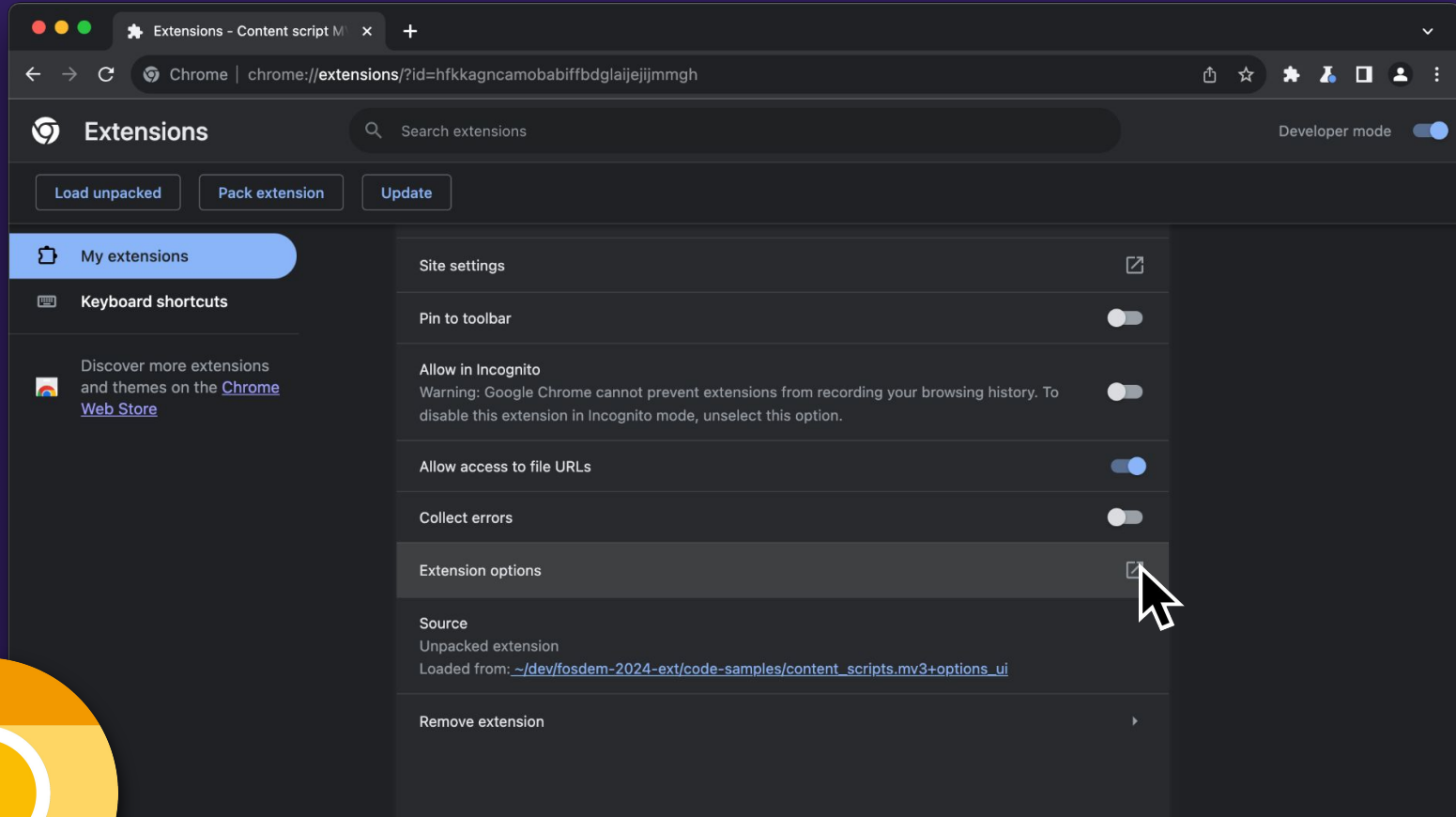


The screenshot shows the Chrome browser's Extensions page in Developer mode. The address bar displays the URL `chrome://extensions/?id=hfkkgagncamobabiffbdglajiejijmmgh`. The page title is "Extensions". Below the title, there is a search bar and a "Developer mode" toggle switch which is turned on. The main content area is divided into two columns. The left column contains a sidebar with "My extensions" (highlighted), "Keyboard shortcuts", and a link to "Discover more extensions and themes on the Chrome Web Store". The right column lists various settings for the selected extension:

- Site settings** (with an external link icon)
- Pin to toolbar** (toggle switch)
- Allow in Incognito** (toggle switch, with a warning: "Warning: Google Chrome cannot prevent extensions from recording your browsing history. To disable this extension in Incognito mode, unselect this option.")
- Allow access to file URLs** (toggle switch, currently turned on)
- Collect errors** (toggle switch)
- Extension options** (with an external link icon)
- Source**
 - Unpacked extension
 - Loaded from: `~/dev/fosdem-2024-ext/code-samples/content_scripts.mv3+options_ui`
- Remove extension** (with a right-pointing arrow)

A white mouse cursor is pointing at the right side of the settings panel.





The screenshot shows the Chrome browser's 'Extensions' page in Developer mode. The address bar displays the URL `chrome://extensions/?id=hfkkgagncamobabiffbdglajiejijmmgh`. The page title is 'Extensions'. On the left sidebar, there are links for 'My extensions', 'Keyboard shortcuts', and a link to 'Discover more extensions and themes on the Chrome Web Store'. The main content area shows settings for a specific extension. The 'Site settings' section includes options for 'Pin to toolbar', 'Allow in Incognito' (with a warning), 'Allow access to file URLs' (checked), and 'Collect errors'. The 'Extension options' section is highlighted, showing the 'Source' as 'Unpacked extension' and the 'Loaded from' path as `~/dev/fosdem-2024-ext/code-samples/content_scripts.mv3+options_ui`. A mouse cursor is pointing at the 'Extension options' section. The 'Remove extension' button is visible at the bottom of the extension details.

Extensions - Content script M x +

Chrome | `chrome://extensions/?id=hfkkgagncamobabiffbdglajiejijmmgh`

Extensions

Search extensions

Developer mode

Load unpacked Pack extension Update

My extensions

Keyboard shortcuts

Discover more extensions and themes on the [Chrome Web Store](#)

Site settings

Pin to toolbar

Allow in Incognito
Warning: Google Chrome cannot prevent extensions from recording your browsing history. To disable this extension in Incognito mode, unselect this option.

Allow access to file URLs

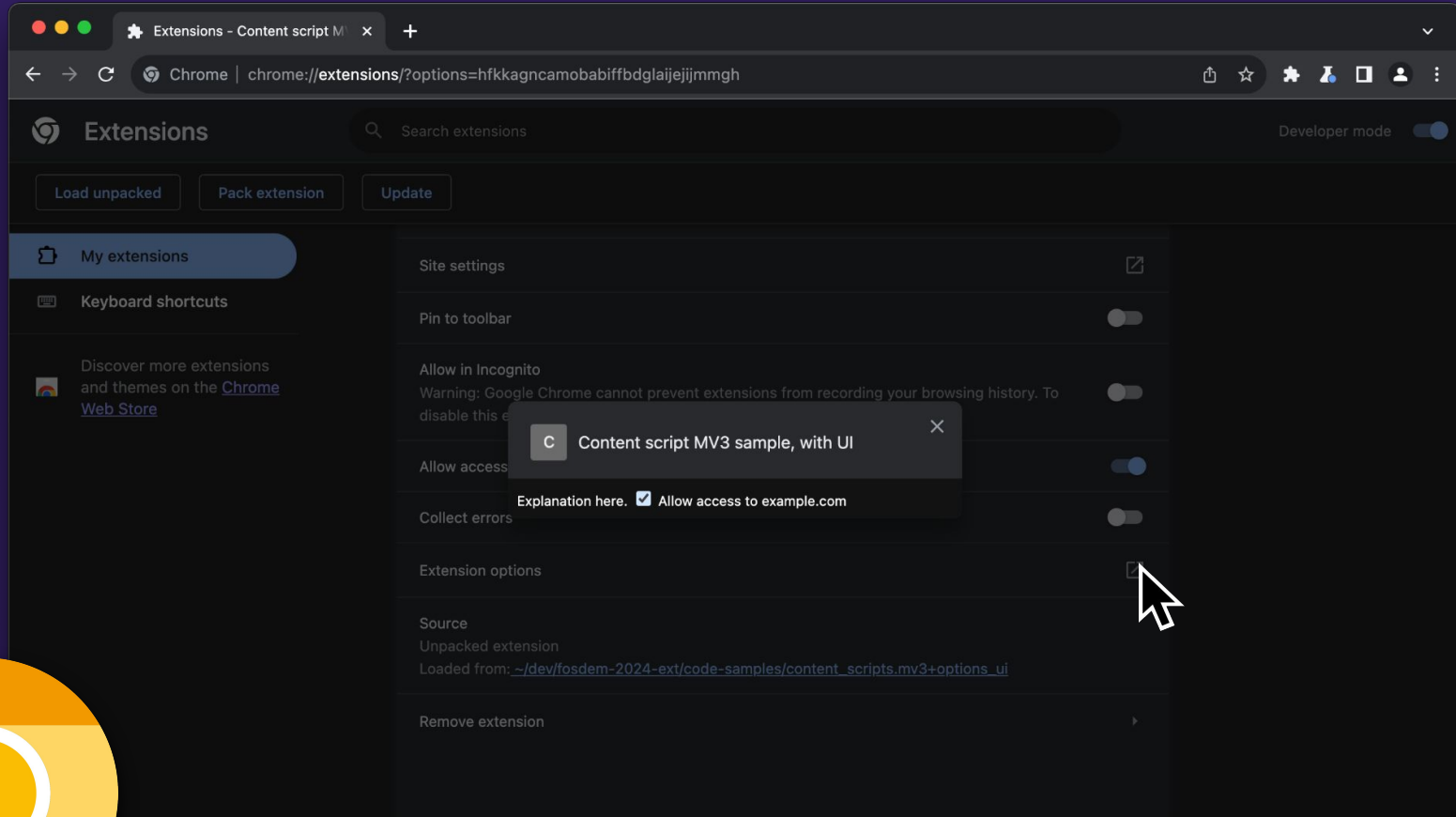
Collect errors

Extension options

Source
Unpacked extension
Loaded from: `~/dev/fosdem-2024-ext/code-samples/content_scripts.mv3+options_ui`

Remove extension





The screenshot shows the Chrome Extensions page for a content script. The browser address bar displays the URL `chrome://extensions/?options=hfkagncamobabiffbdglaijeijmmgh`. The page title is "Extensions". The left sidebar contains "My extensions", "Keyboard shortcuts", and a link to "Discover more extensions and themes on the Chrome Web Store". The main content area shows settings for the extension "Content script MV3 sample, with UI". The settings include "Site settings", "Pin to toolbar", "Allow in Incognito" (with a warning), "Allow access to example.com" (checked), "Collect errors", "Extension options" (with a link icon), "Source" (Unpacked extension, loaded from `~/dev/fosdem-2024-ext/code-samples/content_scripts.mv3+options_ui`), and "Remove extension". A mouse cursor is pointing at the "Extension options" link. A large Chrome logo is in the bottom left corner.

Extensions - Content script M x +

Chrome | `chrome://extensions/?options=hfkagncamobabiffbdglaijeijmmgh`

Extensions

Search extensions

Developer mode

Load unpacked Pack extension Update

My extensions

Keyboard shortcuts

Discover more extensions and themes on the [Chrome Web Store](#)

Content script MV3 sample, with UI

Site settings

Pin to toolbar

Allow in Incognito

Warning: Google Chrome cannot prevent extensions from recording your browsing history. To disable this extension, click here.

Allow access to example.com

Collect errors

Extension options

Source

Unpacked extension

Loaded from: `~/dev/fosdem-2024-ext/code-samples/content_scripts.mv3+options_ui`

Remove extension

Script on click

- Content scripts on demand
- Cross-browser background script & service_worker
- Extension action and activeTab permission
- Extension action popups

./manifest.json

```
{  
  "name": "Script on click",  
  "version": "1",  
  "manifest_version": 3,  
  "permissions": ["activeTab", "scripting"],  
  "action": {  
    "default_title": "Execute script on click"  
  },  
  "background": {  
    "scripts": ["background.js"]  
  }  
}
```

./manifest.json

```
{  
  "name": "Script on click",  
  "version": "1",  
  "manifest_version": 3,  
  "permissions": ["activeTab", "scripting"],  
  "action": {  
    "default_title": "Execute script on click"  
  },  
  "background": {  
    "scripts": ["background.js"],  
  }  
}
```

./manifest.json

```
{  
  "name": "Script on click",  
  "version": "1",  
  "manifest_version": 3,  
  "permissions": ["activeTab", "scripting"],  
  "action": {  
    "default_title": "Execute script on click"  
  },  
  "background": {  
    "scripts": ["background.js"]  
  }  
}
```

Warning: demo works in Firefox but not Chrome

./background.js

```
// Polyfills "browser" in Chrome:  
if (typeof browser == "undefined") {  
  globalThis.browser = chrome;  
}
```

```
browser.action.onClicked.addListener((tab) => {  
  browser.scripting.executeScript({  
    target: { tabId: tab.id },  
    func: () => {  
      alert("Ran script at " + document.URL);  
    }  
  });  
});
```

./background.js

```
// Polyfills "browser" in Chrome:  
if (typeof browser == "undefined") {  
  globalThis.browser = chrome;  
}
```

To save screen space, subsequent sides use the below code snippet with the “nullish coalescing operator”:

```
globalThis.browser ??= chrome;
```

This polyfill is simple because **chrome** in MV3 supports Promises. In MV2, webextension-polyfill was needed.

./background.js

```
globalThis.browser ??= chrome;
```

```
browser.action.onClicked.addListener((tab) => {  
  browser.scripting.executeScript({  
    target: { tabId: tab.id },  
    func: () => {  
      alert("Ran script at " + document.URL);  
    }  
  });  
});
```

./background.js

```
globalThis.browser ??= chrome;
```

```
browser.action.onClicked.addListener((tab) => {  
  browser.scripting.executeScript({  
    target: { tabId: tab.id },  
    func: () => {  
      alert("Ran script at " + document.URL);  
    }  
  });  
});
```

`func` will be serialized and evaluated in the context of the target document.

⚠ Shorthand `func() { ... }` is not supported, instead use `func: function() { ... }` or `func: () => { ... }`

demo

./manifest.json

```
{  
  "name": "Script on click",  
  "version": "1",  
  "manifest_version": 3,  
  "permissions": ["activeTab", "scripting"],  
  "action": {  
    "default_title": "Execute script on click"  
  },  
  "background": {  
    "scripts": ["background.js"]  
  }  
}
```

./manifest.json

```
{  
  "name": "Script on click",  
  "version": "1",  
  "manifest_version": 3,  
  "permissions": ["activeTab", "scripting"],  
  "action": {  
    "default_title": "Execute script on click"  
  },  
  "background": {  
    "service_worker": "background.js"  
  }  
}
```

demo

Cross-browser background scripts

./manifest.json

```
{ // manifest.json for Firefox/Safari only.
  "name": "Script on click",
  "version": "1",
  "manifest_version": 3,
  "permissions": ["activeTab", "scripting"],
  "action": {
    "default_title": "Execute script on click"
  },
  "background": {
    "scripts": ["background.js"]
  }
}

{ // manifest.json for Chrome/Safari only.
  "name": "Script on click",
  "version": "1",
  "manifest_version": 3,
  "permissions": ["activeTab", "scripting"],
  "action": {
    "default_title": "Execute script on click"
  },
  "background": {
    "service_worker": "background.js"
  }
}
```


./manifest.json

```
{ // manifest.json for Firefox/Safari only.
  "name": "Script on click",
  "version": "1",
  "manifest_version": 3,
  "permissions": ["activeTab", "scripting"],
  "action": {
    "default_title": "Execute script on click"
  },
  "background": {
    "scripts": ["background.js"]
  }
}

{ // manifest.json for Chrome/Safari only.
  "name": "Script on click",
  "version": "1",
  "manifest_version": 3,
  "permissions": ["activeTab", "scripting"],
  "action": {
    "default_title": "Execute script on click"
  },
  "background": {
    "service_worker": "background.js"
  }
}
```

```
{ // manifest.json for all browsers
  "name": "Script on click",
  "version": "1",
  "manifest_version": 3,
  "permissions": ["activeTab", "scripting"],
  "action": {
    "default_title": "Execute script on click"
  },
  "background": {
    "scripts": ["background.js"],
    "service_worker": "background.js"
  }
}
```

./manifest.json

```
{ // manifest.json for Firefox/Safari only.  
  "name": "Script on click",  
  "version": "1",  
  "manifest_version": 3,  
  "permissions": ["activeTab", "scripting"],  
  "action": {  
    "default_title": "Execute script on click"  
  },  
  "background": {  
    "scripts": ["background.js"]  
  },  
}  
  
{ // manifest.json for Chrome/Safari only.  
  "name": "Script on click",  
  "version": "1",  
  "manifest_version": 3,  
  "permissions": ["activeTab", "scripting"],  
  "action": {  
    "default_title": "Execute script on click"  
  },  
  "background": {  
    "service_worker": "background.js"  
  },  
}
```

```
{ // manifest.json for all browsers  
  "name": "Script on click",  
  "version": "1",  
  "manifest_version": 3,  
  "permissions": ["activeTab", "scripting"],  
  "action": {  
    "default_title": "Execute script on click"  
  },  
  "background": {  
    "scripts": ["background.js"],  
    "service_worker": "background.js"  
  },  
  "browser_specific_settings": {  
    "gecko": {  
      "id": "script-on-click@example",  
      "strict_min_version": "121.0a1"  
    },  
    "gecko_android": {  
      "strict_min_version": "121.0a1"  
    }  
  },  
  "minimum_chrome_version": "121"  
}
```

**Loading multiple
background files**

./manifest.json

```
"manifest_version": 3,  
"permissions": ["activeTab", "scripting"],  
"action": {  
  "default_title": "Execute script on click"  
},  
"background": {  
  "scripts": ["mylib.js", "background.js"],  
  "service_worker": "background.js"  
},  
"browser_specific_settings": {  
  "gecko": {  
    "id": "script-on-click@example",  
    "strict_min_version": "101.0.1"
```

./manifest.json

```
"manifest_version": 3,  
"permissions": ["activeTab", "scripting"],  
"action": {  
  "default_title": "Execute script on click"  
},  
"background": {  
  "scripts": ["mylib.js", "background.js"],  
  "service_worker": "sw.js"  
},  
"browser_specific_settings": {  
  "gecko": {  
    "id": "script-on-click@example",  
    "strict_min_version": "101.0.1"
```

./manifest.json

```
"manifest_version": 3,  
"permissions": ["activeTab", "scripting"],  
"action": {  
  "default_title": "Execute script on click"  
},  
"background": {  
  "scripts": ["mylib.js", "background.js"],  
  "service_worker": "sw.js"  
},
```

```
// sw.js  
importScripts("mylib.js", "background.js");
```

Script on click via extension popup without background

./manifest.json

```
{  
  "name": "Script on click without background",  
  "version": "1",  
  "manifest_version": 3,  
  "permissions": ["activeTab", "scripting"],  
  "action": {  
    "default_title": "Execute script on click",  
    "default_popup": "action_popup.html"  
  }  
}
```

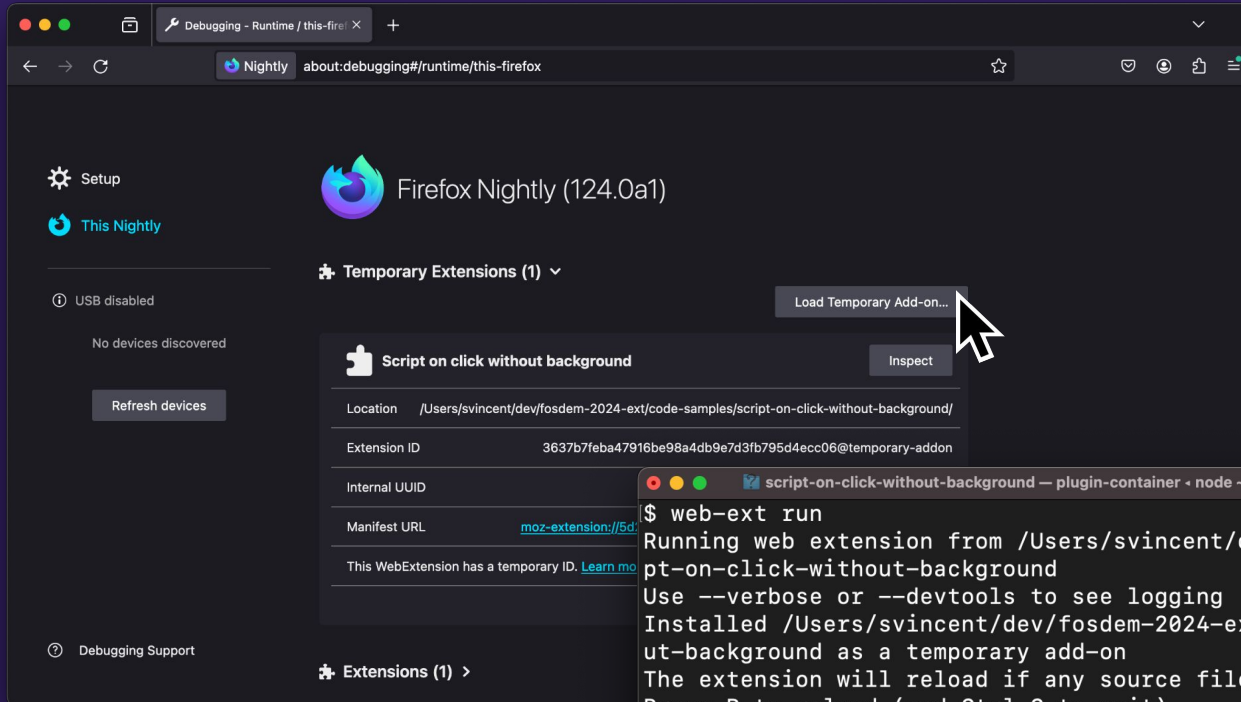

./action_popup.html

```
<!DOCTYPE html>
<script src="action_popup.js" type="module"></script>
```

./action_popup.js

```
try {
  let tabs = await browser.tabs.query({ active: true, currentWindow: true });
  await browser.scripting.executeScript({
    target: { tabId: tabs[0].id },
    func: () => { // ← func is serialized and run in the context of the tab.
      setTimeout(() => { // ← Queue task, so func returns before alert().
        alert("Clicked extension button and ran script at " + document.URL)
      }, 0);
    }
  });
} finally {
  window.close();
}
```

demo



Debugging - Runtime / this-firefox

Nightly about:debugging#/runtime/this-firefox

Setup

This Nightly

USB disabled

No devices discovered

Refresh devices

Firefox Nightly (124.0a1)

Temporary Extensions (1) ▾

Load Temporary Add-on...

Inspect

Script on click without background

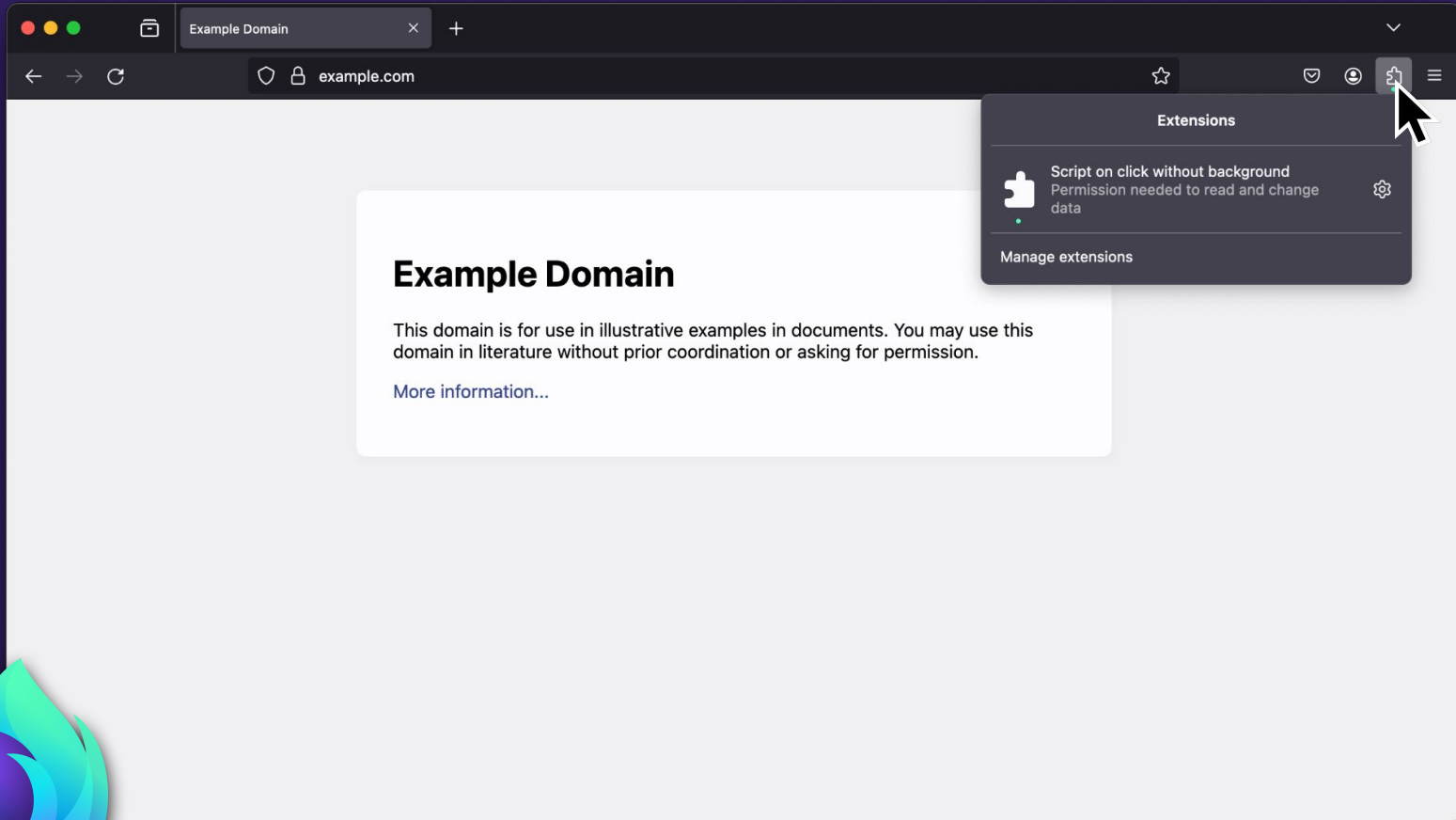
Location	/Users/svincent/dev/fosdem-2024-ext/code-samples/script-on-click-without-background/
Extension ID	3637b7feba47916be98a4db9e7d3fb795d4ecc06@temporary-addon
Internal UUID	
Manifest URL	moz-extension://5d...
This WebExtension has a temporary ID. Learn more	

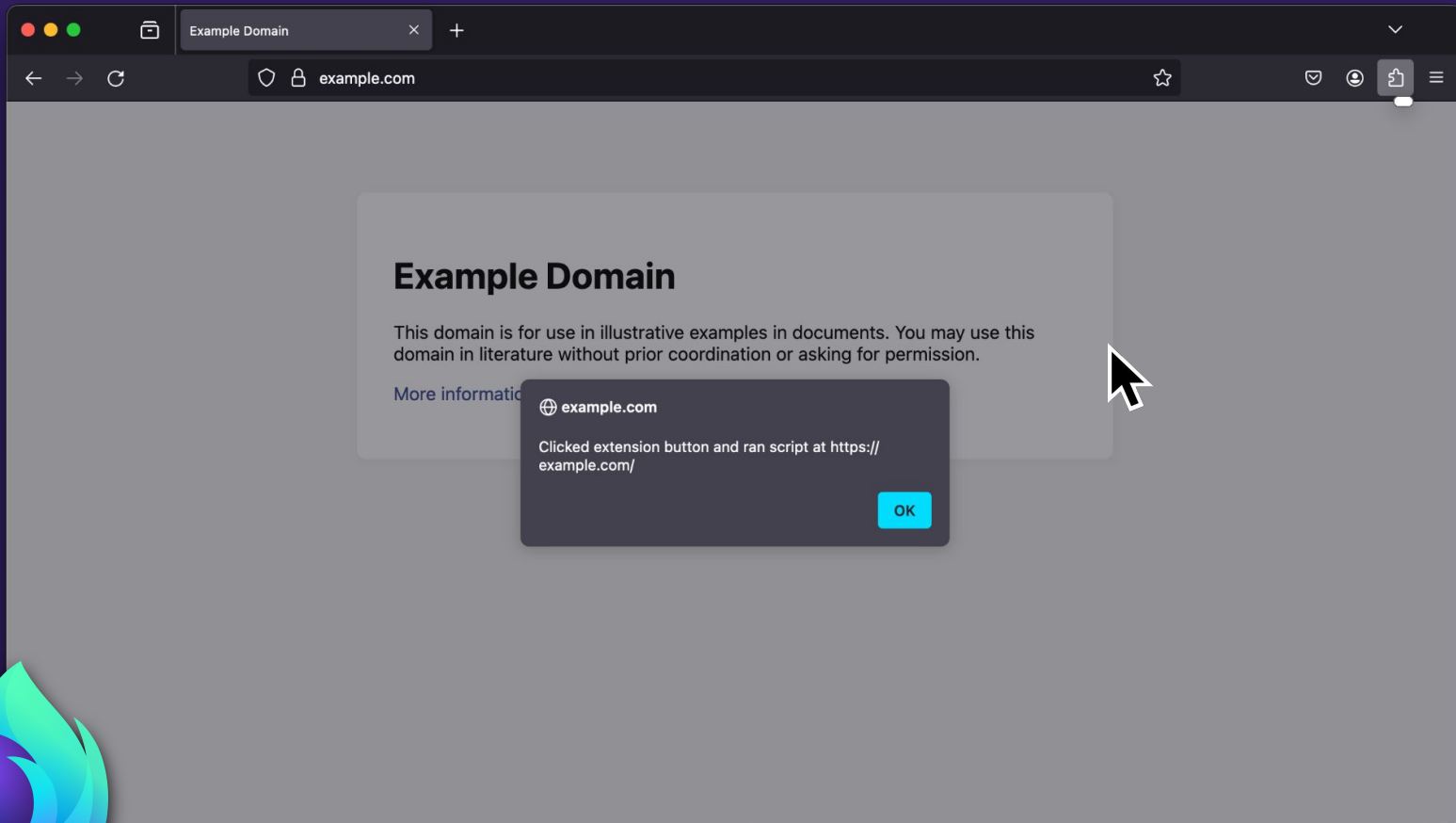
Debugging Support

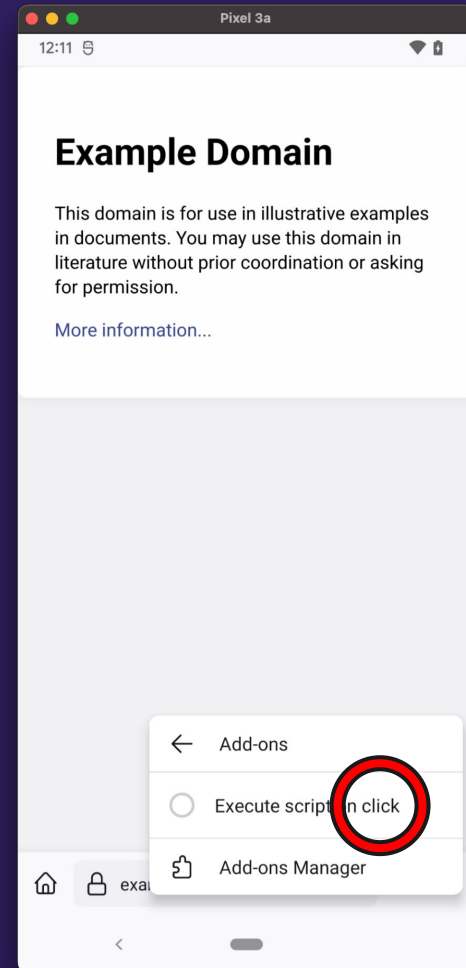
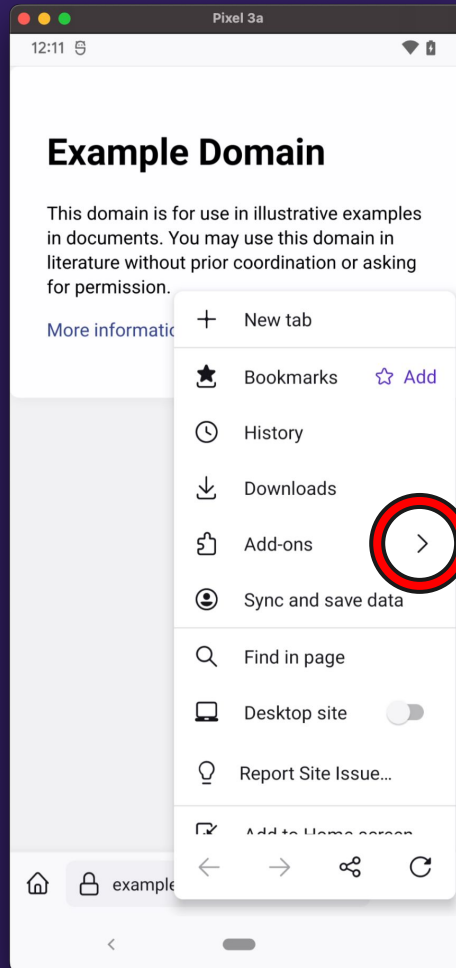
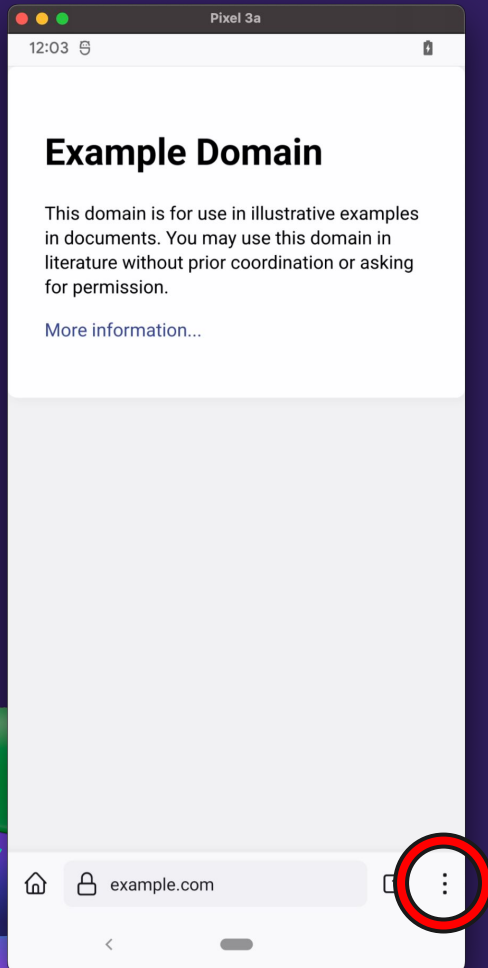
Extensions (1) >

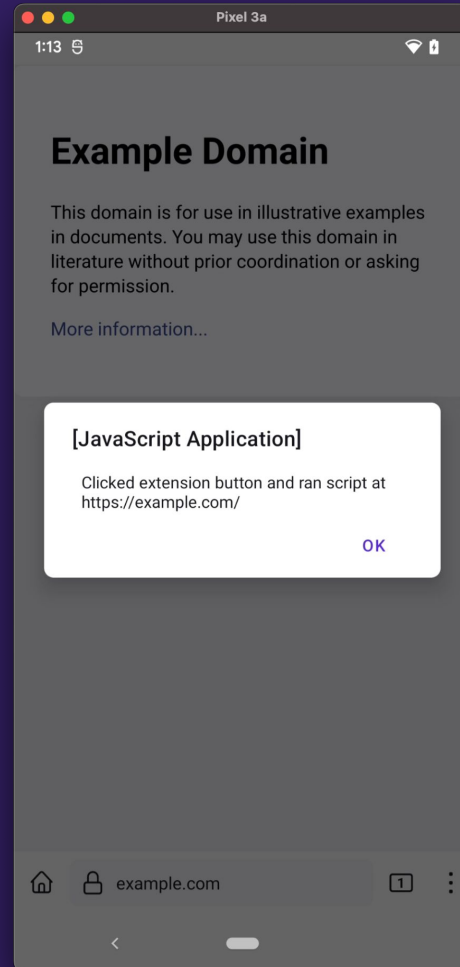
```
script-on-click-without-background — plugin-container • node ~/.nvm/versions/node/v20.6.1/bin/web-ext run — 80×15
$ web-ext run
Running web extension from /Users/svincent/dev/fosdem-2024-ext/code-samples/script-on-click-without-background
Use --verbose or --devtools to see logging
Installed /Users/svincent/dev/fosdem-2024-ext/code-samples/script-on-click-without-background as a temporary add-on
The extension will reload if any source file changes
Press R to reload (and Ctrl-C to quit)
```











Short-lived background

- Non-persistent background - what and why?
- Event-based execution context
- `storage.session`

./manifest.js

```
{
  "name": "Visit counter",
  "description": "Show number of visits to extensionworkshop.com on the extension button.",
  "version": "1",
  "manifest_version": 3,
  "permissions": ["webNavigation", "storage"],
  "action": {},
  "background": {
    "scripts": ["background.js"],
    "service_worker": "background.js"
  },
  "browser_specific_settings": {
    "gecko": {
      "id": "visit-counter@example",
      "strict_min_version": "121.0a1"
    },
    "gecko_android": {
      "strict_min_version": "121.0a1"
    }
  },
  "minimum_chrome_version": "121"
}
```

./manifest.js

```
name: "Visit Counter",  
"description": "Show number of visits to extensionworkshop.com",  
"version": "1",  
"manifest_version": 3,  
"permissions": ["webNavigation", "storage"],  
"action": {},  
"background": {  
  "scripts": ["background.js"],  
  "service_worker": "background.js"  
},  
"browser_specific_settings": {  
  "gecko": {  
    "id": "visit-counter@example",  
    "strict_min_version": "121.0a1"  
  },  
  "gecko_android": {  
    "strict_min_version": "121.0a1"
```

./background.js

```
globalThis.browser ??= chrome;
```

```
let count = 0;
```

```
browser.webNavigation.onCommitted.addListener(async (details) => {
```

```
  ++count;
```

```
  // The "text" parameter should be a string, so convert count to a string.
```

```
  browser.action.setBadgeText({ text: "" + count });
```

```
}, {
```

```
  url: [ { hostEquals: "extensionworkshop.com" } ],
```

```
});
```

./background.js

```
globalThis.browser ??= chrome;
```

```
let count = 0;
```

⚠ State is lost when background terminates

```
browser.webNavigation.onCommitted.addListener(async (details) => {
```

```
  ++count;
```

```
  // The "text" parameter should be a string, so convert count to a string.
```

```
  browser.action.setBadgeText({ text: "" + count });
```

```
}, {
```

```
  url: [ { hostEquals: "extensionworkshop.com" } ],
```

```
});
```

./background.js

```
globalThis.browser ??= chrome;

let count;

browser.webNavigation.onCommitted.addListener(async (details) => {
  if (!count) { // First run since wakeup, fetch the last known count.

    let items = await browser.storage.session.get({ count: 0 });
    count ??= items.count;

  }
  ++count;
  await browser.storage.session.set({ count });
  // The "text" parameter should be a string, so convert count to a string.
  browser.action.setBadgeText({ text: "" + count });
}, {
  url: [ { hostEquals: "extensionworkshop.com" } ],
});
```

./background.js

```
globalThis.browser ??= chrome;

let count;

browser.webNavigation.onCommitted.addListener(async (details) => {
  if (!count) { // First run since wakeup, fetch the last known count.

    let items = await browser.storage.session.get({ count: 0 });
    count ??= items[0].count;

  }
  ++count;
  await browser.storage.session.set({ count });
  // The "text" parameter should be a string, so convert count to a string.
  browser.action.setBadgeText({ text: "" + count });
}, {
  url: [ { hostEquals: "extensionworkshop.com" } ],
});
```

⚠ Multiple events can lead to parallel (re)initializations

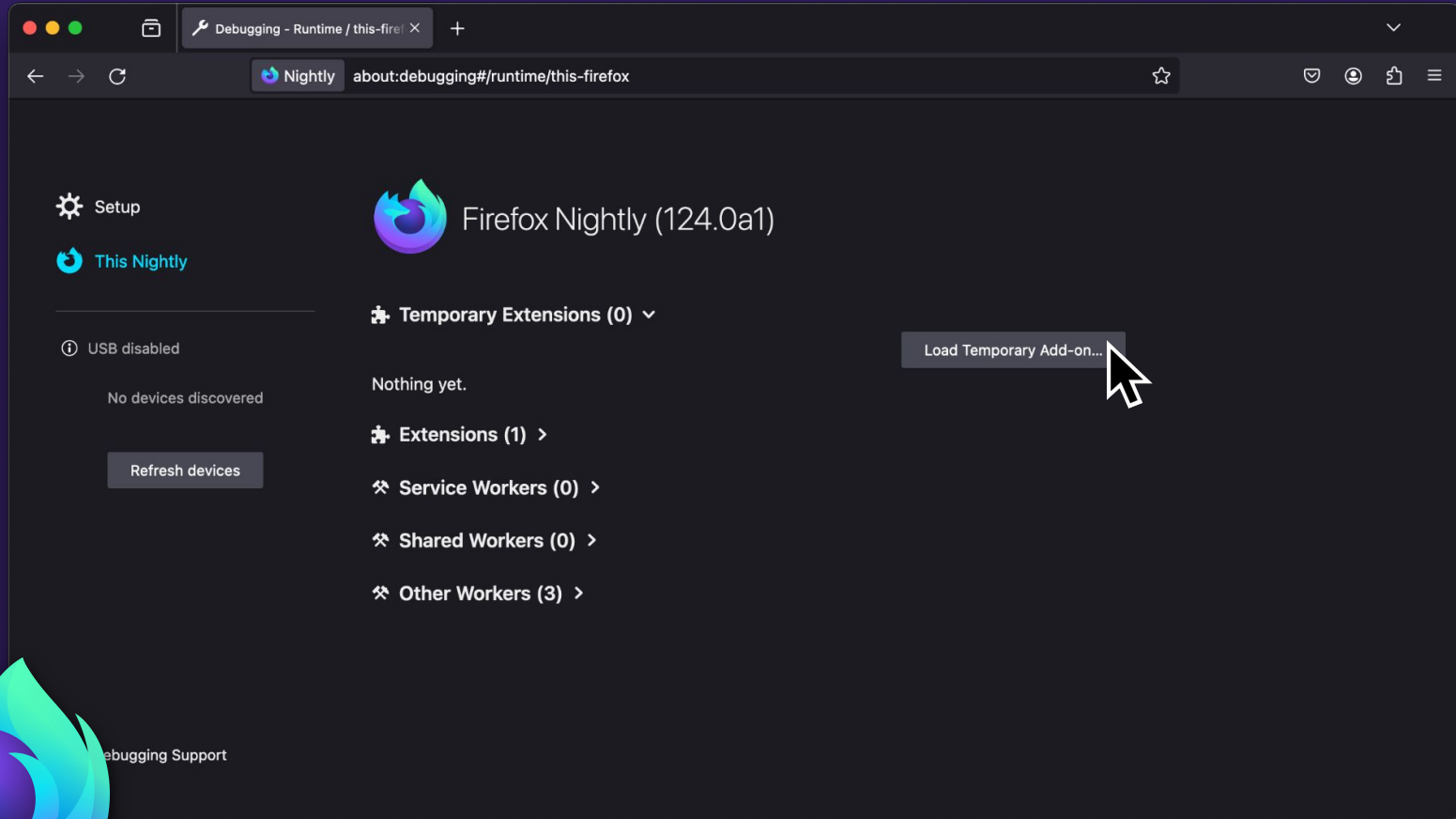
./background.js

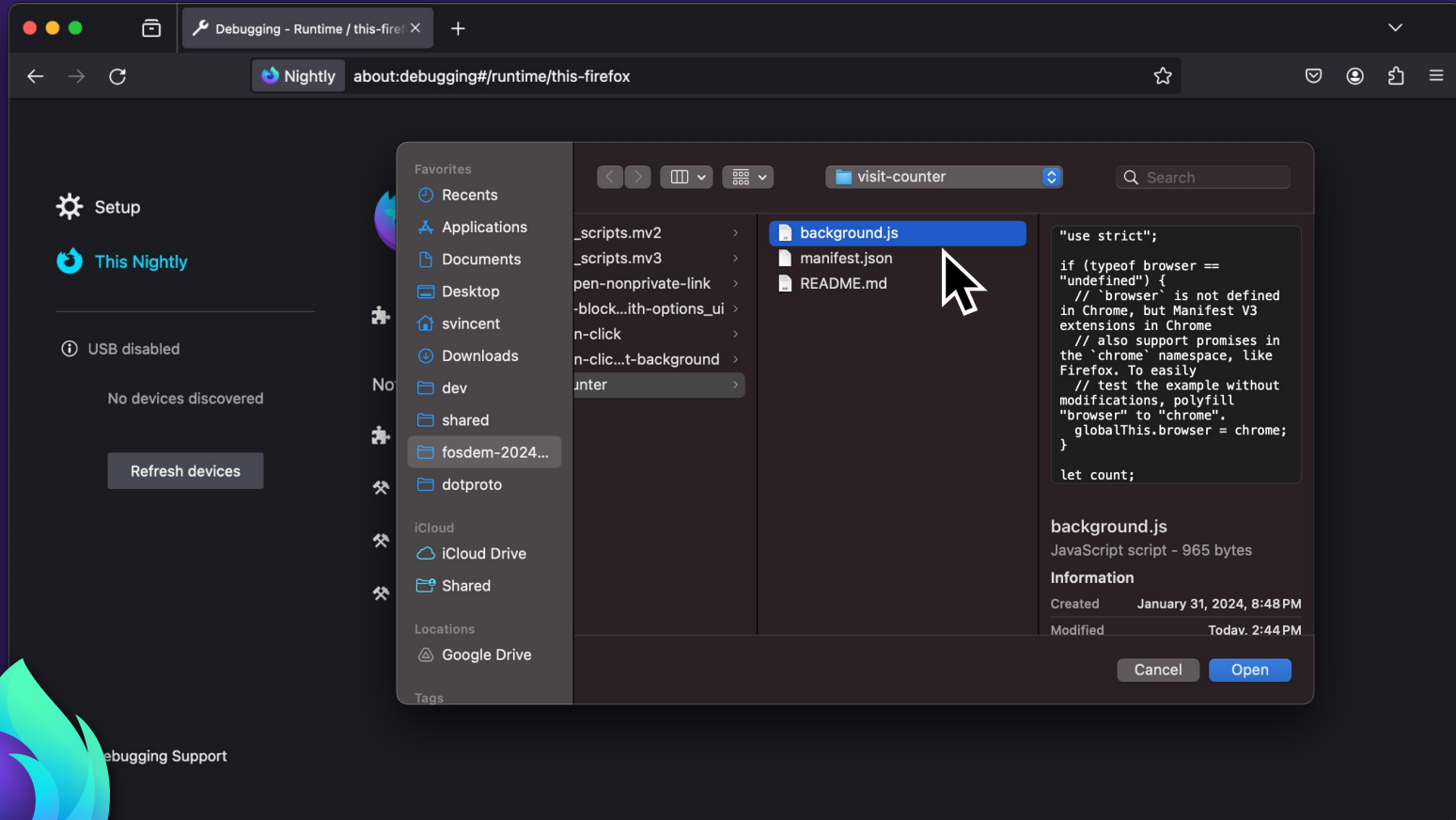
```
globalThis.browser ??= chrome;

let count;
let countPromise;

browser.webNavigation.onCommitted.addListener(async (details) => {
  if (!count) { // First run since wakeup, fetch the last known count.
    countPromise ??= browser.storage.session.get({ count: 0 });
    let items = await countPromise;
    count ??= items.count;
    countPromise = null;
  }
  ++count;
  await browser.storage.session.set({ count });
  // The "text" parameter should be a string, so convert count to a string.
  browser.action.setBadgeText({ text: "" + count });
}, {
  url: [ { hostEquals: "extensionworkshop.com" } ],
});
```

demo







Debugging - Runtime / this-firefox

Nightly about:debugging#/runtime/this-firefox

Setup

This Nightly

USB disabled

No devices discovered

Refresh devices

Firefox Nightly (124.0a1)

Temporary Extensions (1) ▾

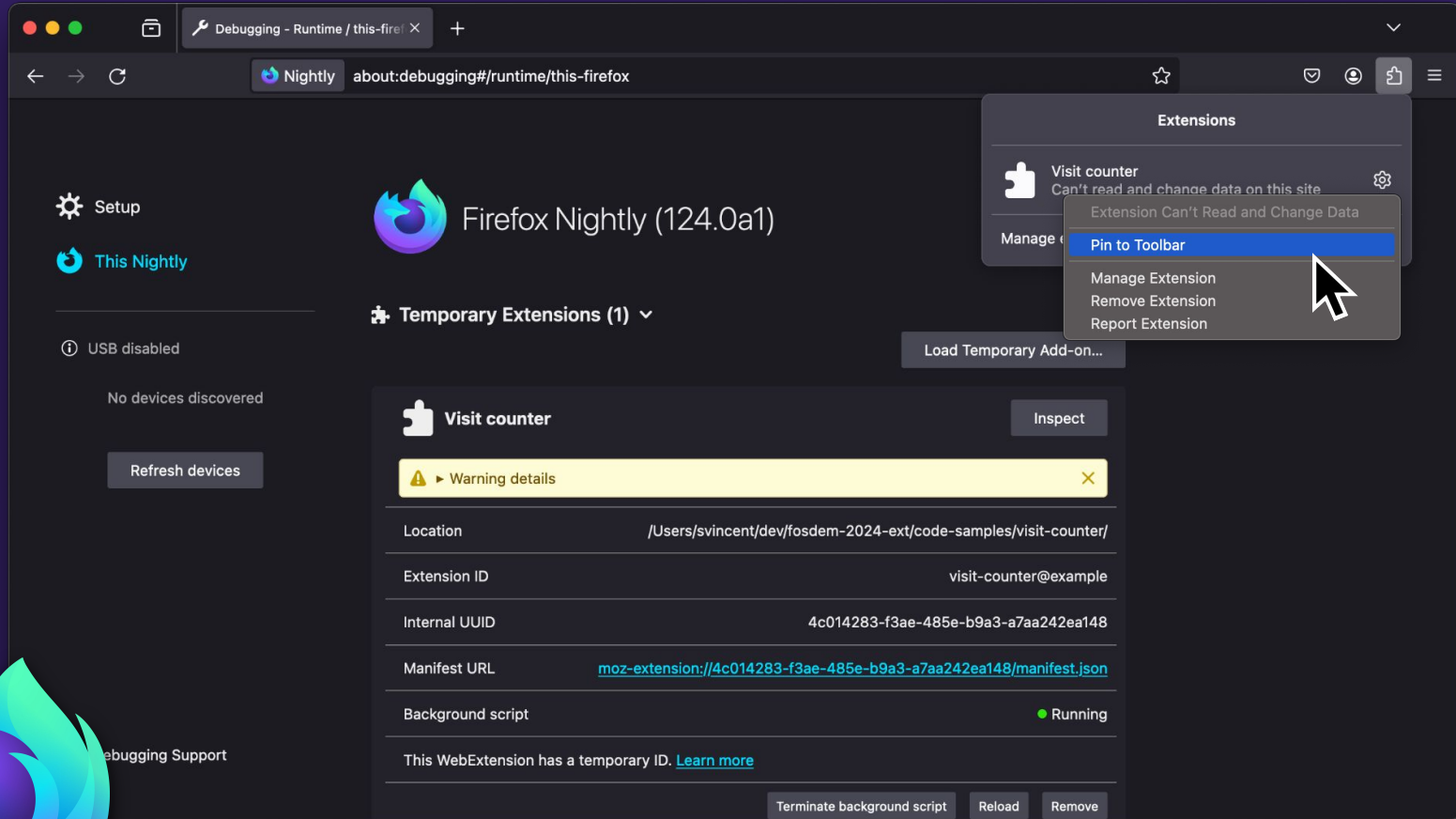
Load Temporary Add-on...

Inspect

Warning details

Location	/Users/svincent/dev/fosdem-2024-ext/code-samples/visit-counter/
Extension ID	visit-counter@example
Internal UUID	4c014283-f3ae-485e-b9a3-a7aa242ea148
Manifest URL	moz-extension://4c014283-f3ae-485e-b9a3-a7aa242ea148/manifest.json
Background script	Running
This WebExtension has a temporary ID. Learn more	

Terminate background script Reload Remove



Debugging - Runtime / this-firefox

Nightly about:debugging#/runtime/this-firefox

Setup

This Nightly

USB disabled

No devices discovered

Refresh devices

Firefox Nightly (124.0a1)

Temporary Extensions (1) ▾

Load Temporary Add-on...

Visit counter Inspect

Warning details

Location	/Users/svincent/dev/fosdem-2024-ext/code-samples/visit-counter/
Extension ID	visit-counter@example
Internal UUID	4c014283-f3ae-485e-b9a3-a7aa242ea148
Manifest URL	moz-extension://4c014283-f3ae-485e-b9a3-a7aa242ea148/manifest.json
Background script	Running
This WebExtension has a temporary ID. Learn more	

Terminate background script Reload Remove

Extensions

Visit counter Can't read and change data on this site

Extension Can't Read and Change Data

Pin to Toolbar

Manage Extension

Remove Extension

Report Extension



Debugging - Runtime / this-firefox

← → ↻ Nightly about:debugging#/runtime/this-firefox

Setup

This Nightly

USB disabled

No devices discovered

Refresh devices

Firefox Nightly (124.0a1)

Temporary Extensions (1) ▾

Load Temporary Add-on...

Visit counter Inspect

Warning details

Location	/Users/svincent/dev/fosdem-2024-ext/code-samples/visit-counter/
Extension ID	visit-counter@example
Internal UUID	4c014283-f3ae-485e-b9a3-a7aa242ea148
Manifest URL	moz-extension://4c014283-f3ae-485e-b9a3-a7aa242ea148/manifest.json
Background script	● Stopped
This WebExtension has a temporary ID. Learn more	

Terminate background script Reload Remove



Debugging - Runtime / this-firefox

extensionworkshop.com

http://extensionworkshop.com/ — Visit

extensionworkshop.com

This time, search with:         

Setup

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Temporary Extensions (1) ▾

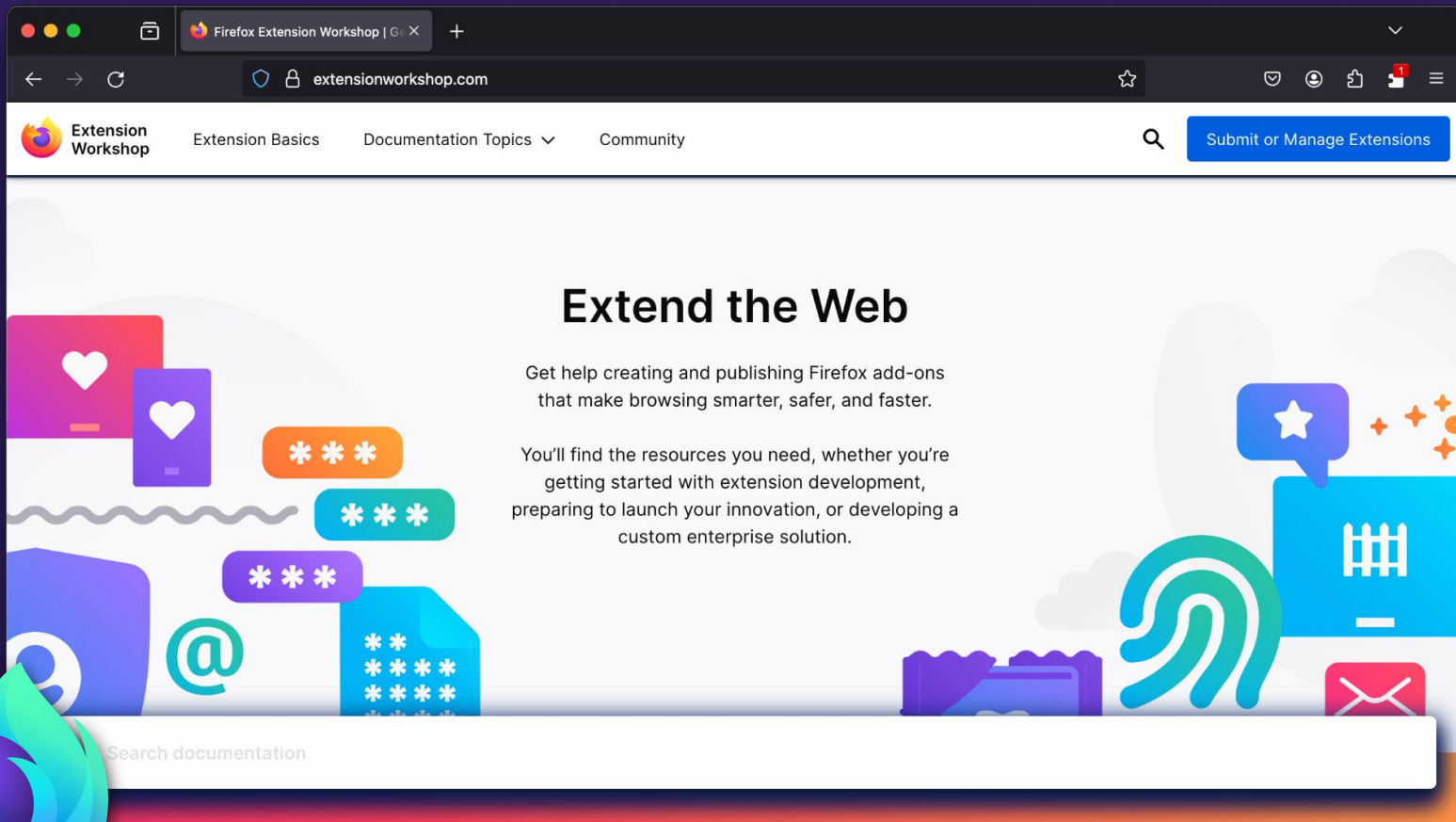
Load Temporary Add-on...

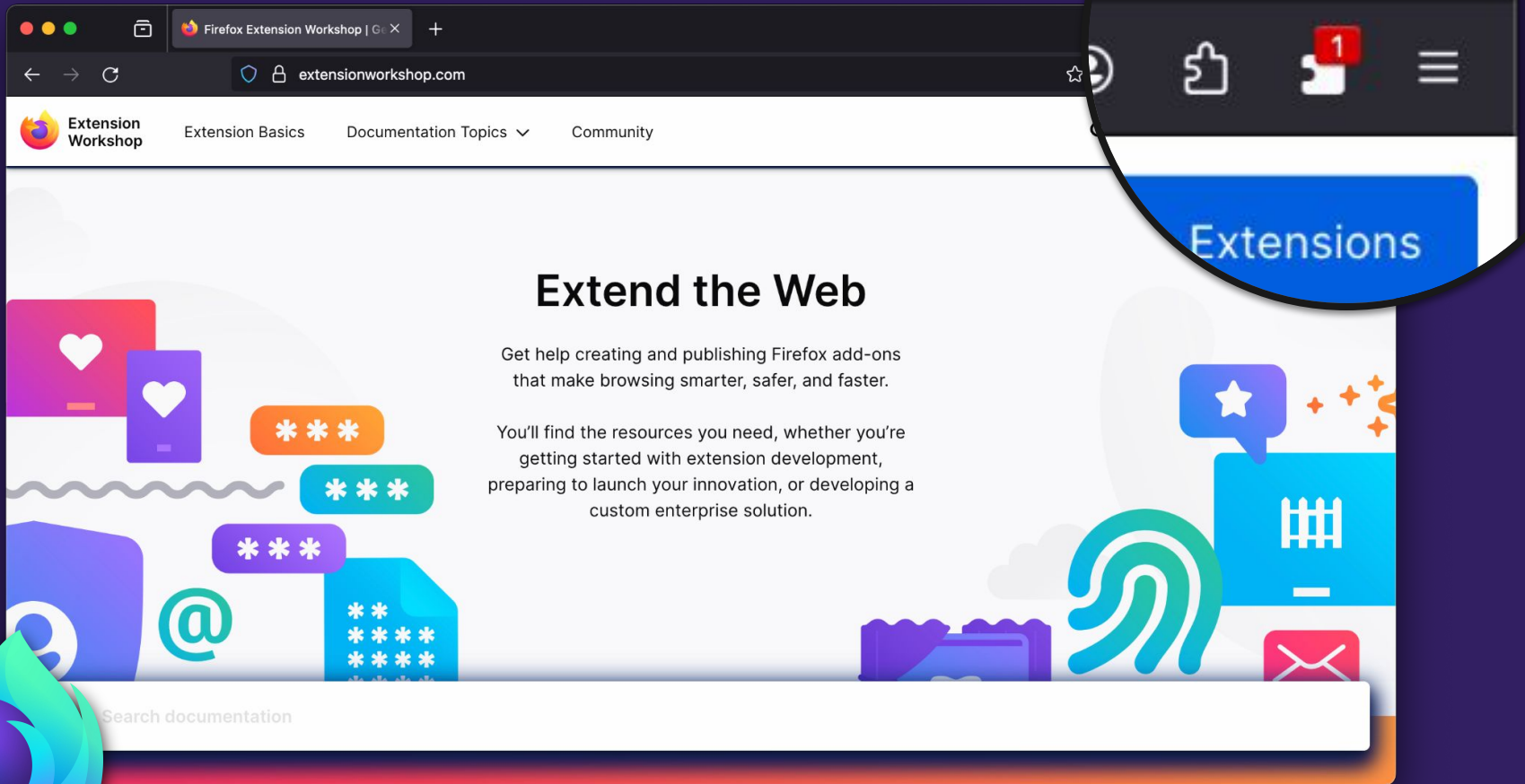
 Visit counter Inspect

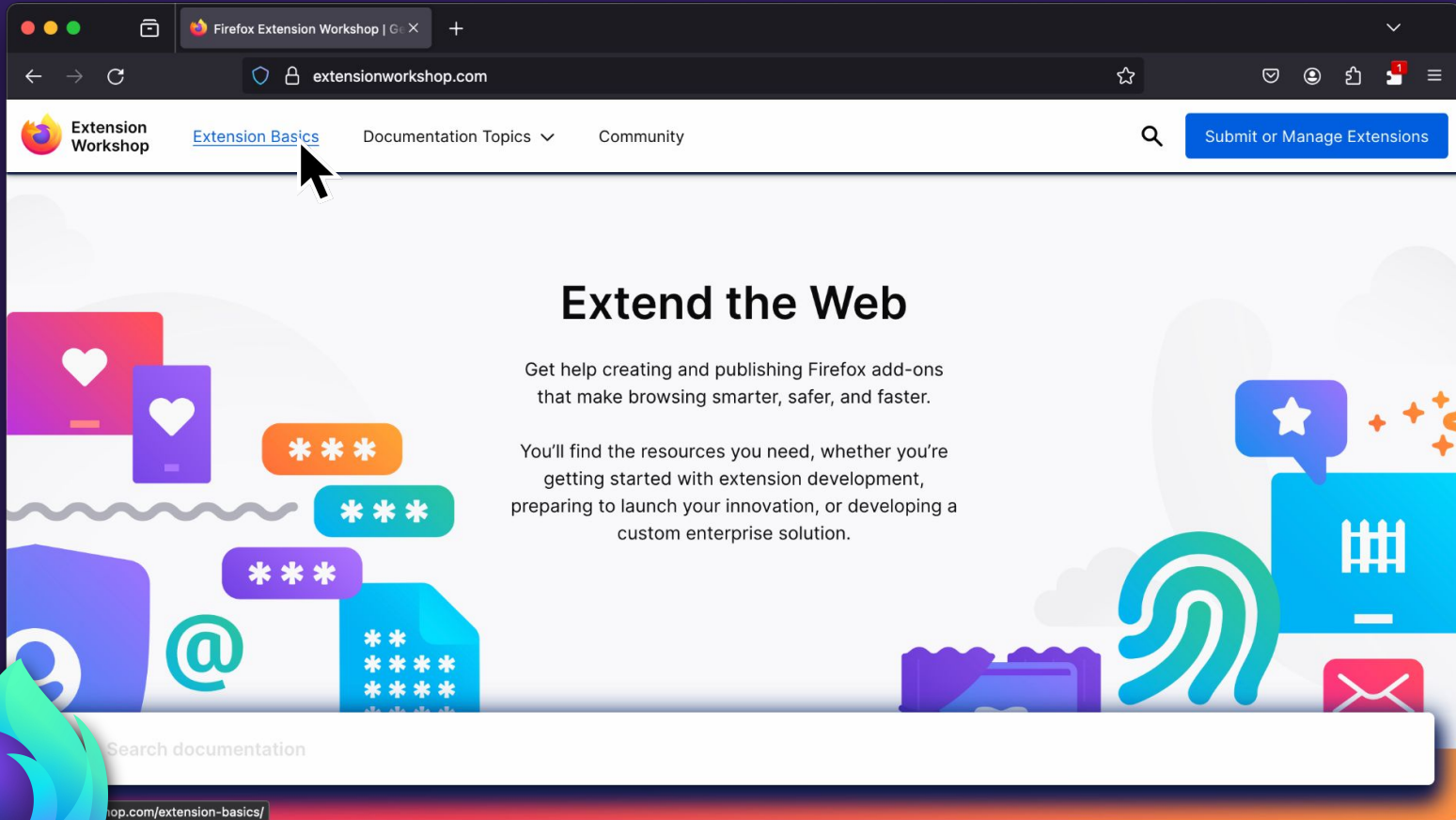
 ▶ Warning details ×

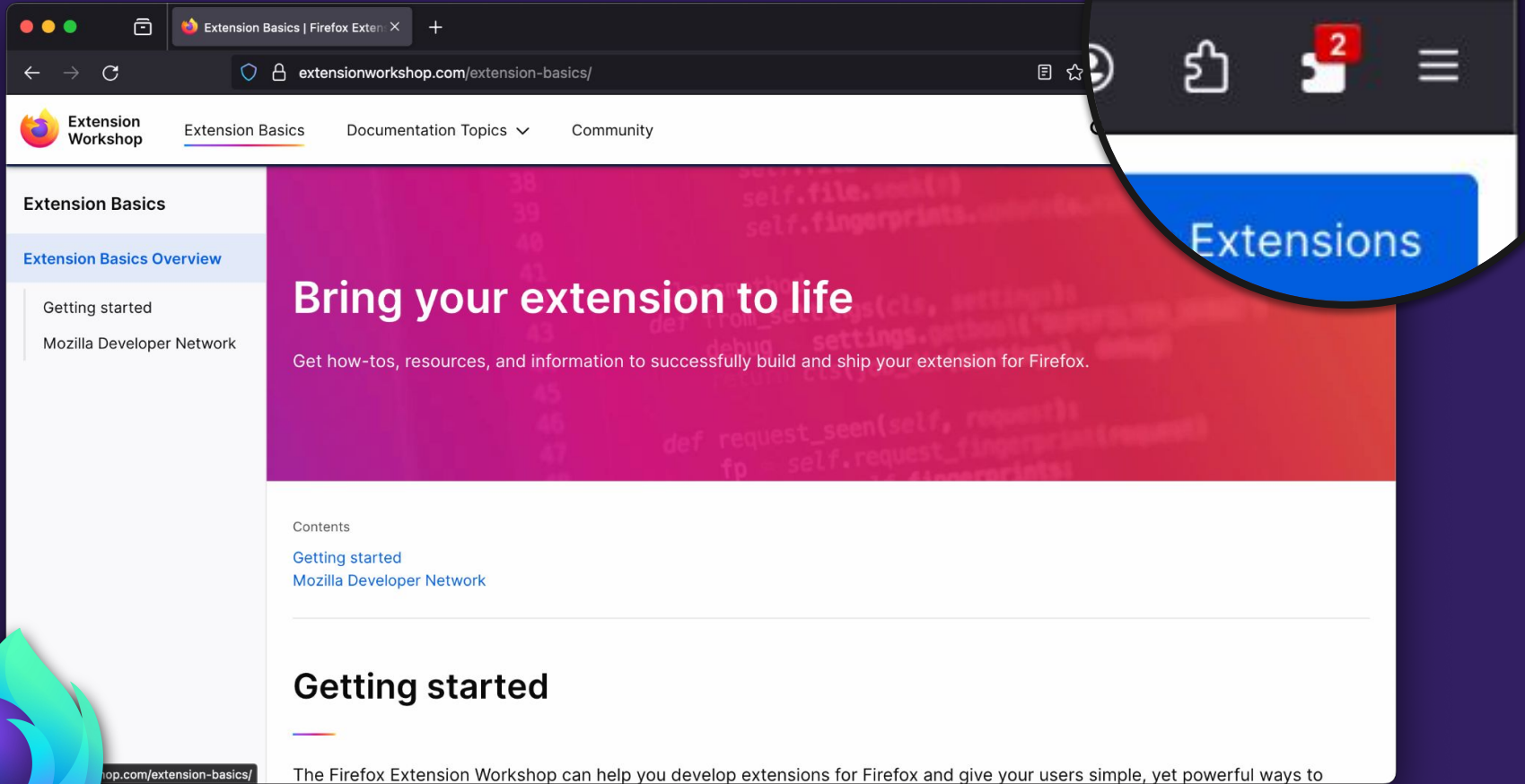
Location	/Users/svincent/dev/fosdem-2024-ext/code-samples/visit-counter/
Extension ID	visit-counter@example
Internal UUID	4c014283-f3ae-485e-b9a3-a7aa242ea148
Manifest URL	moz-extension://4c014283-f3ae-485e-b9a3-a7aa242ea148/manifest.json
Background script	☒ Stopped
This WebExtension has a temporary ID. Learn more	

Terminate background script Reload Remove









The screenshot shows the Firefox browser window with the address bar displaying `extensionworkshop.com/extension-basics/`. The page title is "Extension Basics | Firefox Extension Workshop". The main content area has a pink header with the text "Bring your extension to life" and a sub-header "Get how-tos, resources, and information to successfully build and ship your extension for Firefox." Below this, there is a "Contents" section with links to "Getting started" and "Mozilla Developer Network". A circular callout in the top right corner highlights the browser's extension menu, which shows a puzzle piece icon and a notification badge with the number "2".

Extension Basics | Firefox Extension Workshop

extensionworkshop.com/extension-basics/

Extension Basics

Documentation Topics Community

Extension Basics Overview

Getting started

Mozilla Developer Network

Bring your extension to life

Get how-tos, resources, and information to successfully build and ship your extension for Firefox.

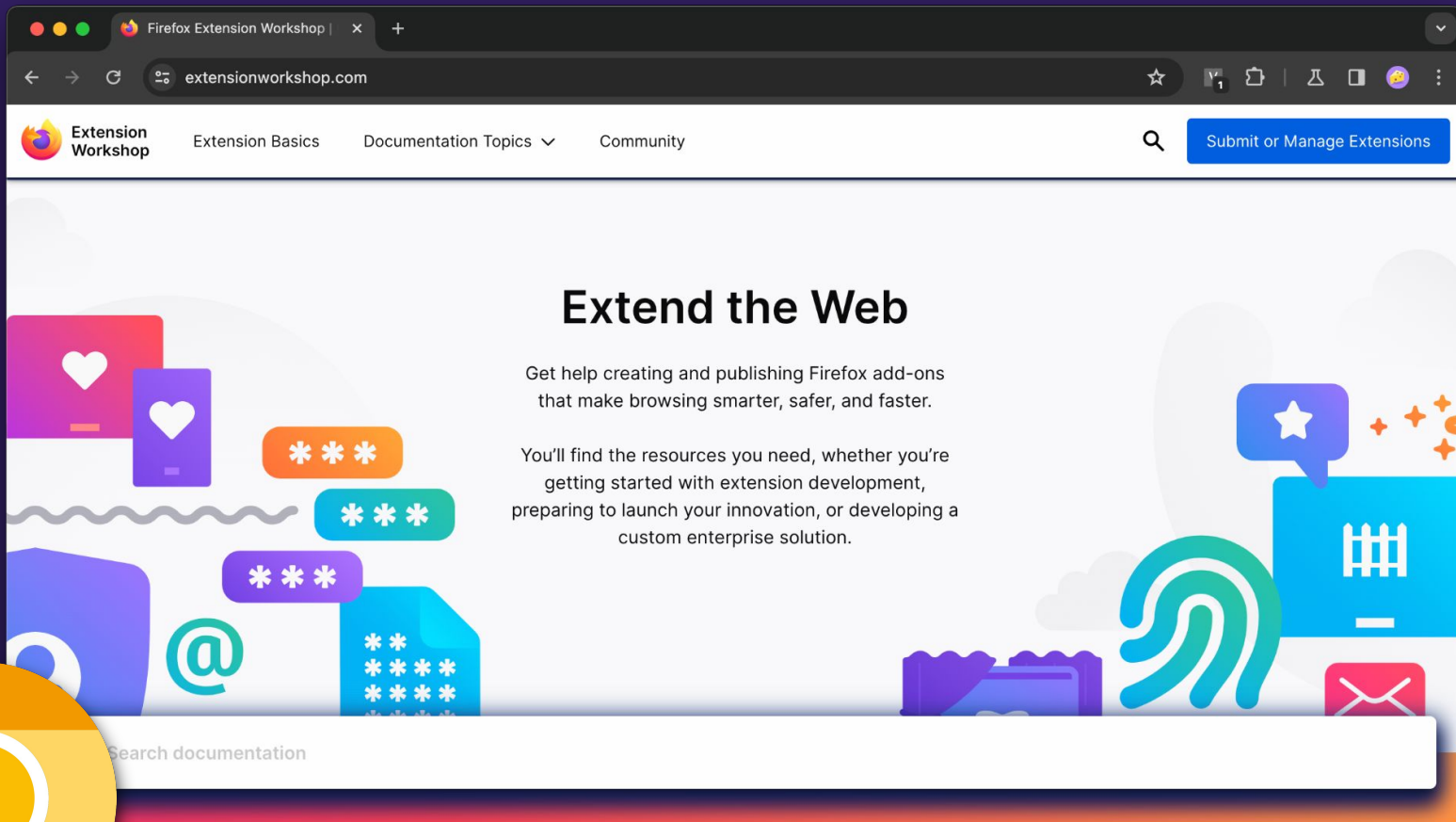
Contents

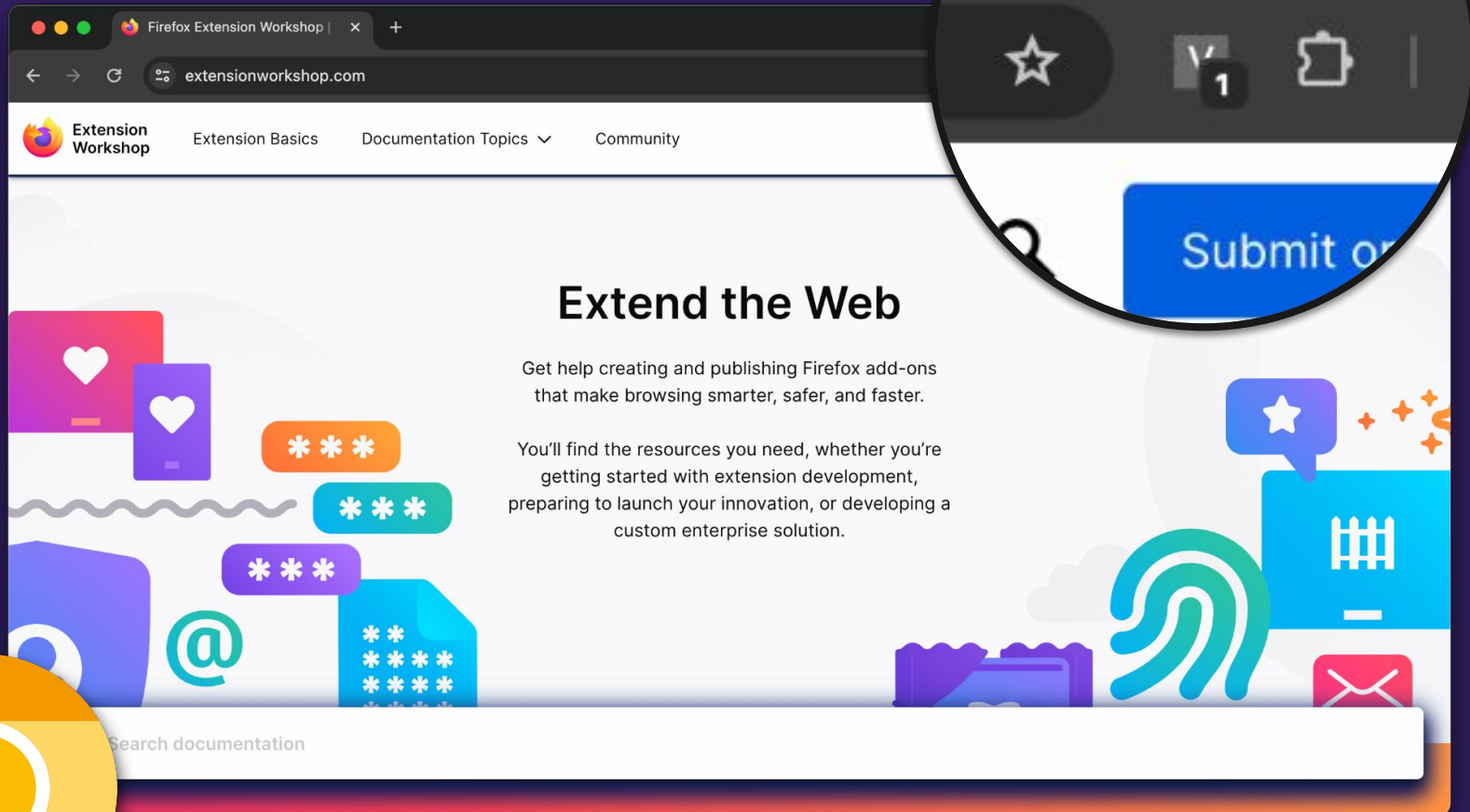
- [Getting started](#)
- [Mozilla Developer Network](#)

Getting started

The Firefox Extension Workshop can help you develop extensions for Firefox and give your users simple, yet powerful ways to







Untrustworthy content

- Soft content blocking
- `web_accessible_resources`
- Untrustworthy web pages
- Declarative Network Request handling

./manifest.json

```
{
  "name": "Soft content blocker",
  "version": "1",
  "manifest_version": 3,
  "content_scripts": [
    {
      "js": ["contentscript.js"],
      "matches": ["*://*/*"]
    }
  ],
  "web_accessible_resources": [
    {
      "resources": ["extStyle.css"],
      "matches": ["*://*/*"]
    }
  ]
}
```

./contentscript.js

```
globalThis.browser ??= chrome;
var div = document.createElement("div");
var shadow = div.attachShadow({ mode: "closed" });

var button = document.createElement("button");
button.textContent = "Click to reveal content";
button.onclick = () => div.remove();
shadow.append(button);

var style = document.createElement("link");
style.rel = "stylesheet";
style.href = browser.runtime.getURL("extStyle.css");
shadow.append(style);

document.body.append(div);
```

./extStyle.css

```
:host {  
  backdrop-filter: blur(9px) !important;  
  position: fixed;  
  top: 0;  
  left: 0;  
  right: 0;  
  bottom: 0;  
  z-index: 2147483647;  
}
```


./manifest.json

```
{  
  "name": "Request blocker, options UI only",  
  "description": "Request blocker with declarativeNetRequest,  
configurable through options UI. Does not require any other  
scripts.",  
  "version": "1",  
  "manifest_version": 3,  
  "permissions": ["declarativeNetRequest"],  
  "options_ui": {  
    "page": "options.html"  
  }  
}
```

./manifest.json

```
{
  "name": "Request blocker, options UI only",
  "description": "Request blocker with declarativeNetRequest,
configurable through options UI. Does not require any other
scripts.",
  "version": "1",
  "manifest_version": 3,
  "permissions": ["declarativeNetRequest"],
  "options_ui": {
    "page": "options.html"
  }
}
```

./options.html

```
<!DOCTYPE html>
<html>
<head>
<meta charset="utf-8">
<meta name="viewport" content="width=device-width"> <!-- mobile-friendly -->
</head>
<body>
  Specify the newline-separated list of URLs that you would like to block.
  Wildcards (*) are supported.
  <textarea id="inputField" style="width:100%;min-height:10em"></textarea>
  <button id="saveButton">Save changes</button>

  <script src="options.js"></script>
</body>
</html>
```



Debugging - Runtime / this-firefox

Nightly about:debugging#/runtime/this-firefox

Setup

This Nightly

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No devices discovered

Refresh devices

Firefox Nightly (124.0a1)

Temporary Extensions (1) ▾

Load Temporary Add-on...

Request blocker, options UI only

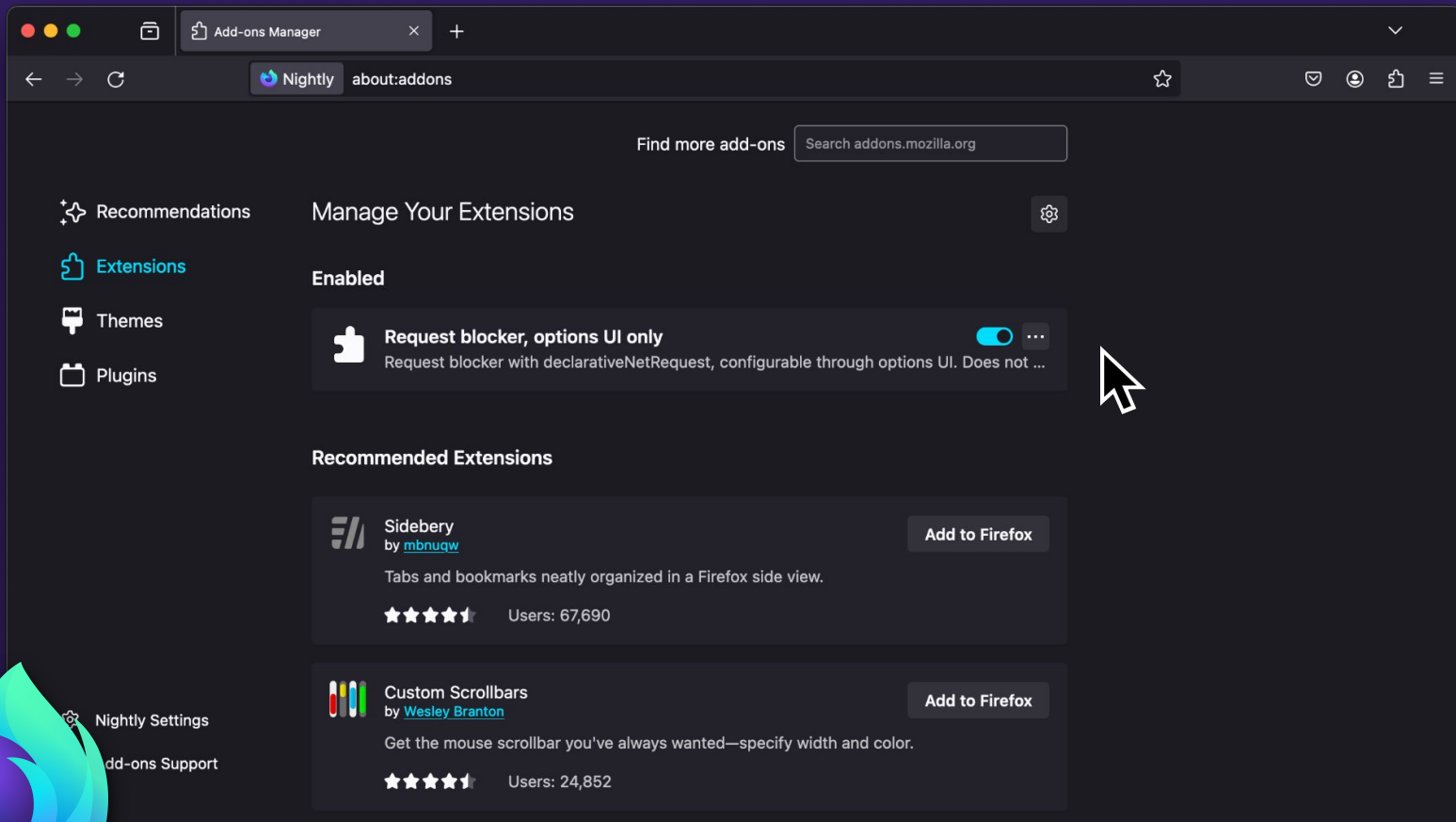
Inspect

Location	/Users/svincent/dev/fosdem-2024-ext/code-samples/request-blocker-with-options_ui/
Extension ID	e9d965581b7620961897a376ec513561c734ced9@temporary-addon
Internal UUID	a7abb3ca-7050-4f18-8424-886f774acacf
Manifest URL	moz-extension://a7abb3ca-7050-4f18-8424-886f774acacf/manifest.json
This WebExtension has a temporary ID. Learn more	

Reload Remove

Extensions (1) >

Debugging Support



The screenshot shows the Firefox Add-ons Manager window. The browser's address bar displays 'about:addons' with a 'Nightly' icon. The main content area is titled 'Manage Your Extensions' and includes a search bar labeled 'Find more add-ons' with the placeholder text 'Search addons.mozilla.org'. On the left sidebar, there are links for 'Recommendations', 'Extensions' (highlighted in blue), 'Themes', and 'Plugins'. The 'Enabled' section lists the 'Request blocker, options UI only' extension, which is currently active (toggle is on) and has a three-dot menu icon to its right. Below this, the 'Recommended Extensions' section features two cards: 'Sidebery' by mbnuqw, described as a tool for organizing tabs and bookmarks, and 'Custom Scrollbars' by Wesley Branton, described as a mouse scrollbar customization tool. Both recommended extensions have star ratings and user counts, and an 'Add to Firefox' button. At the bottom left of the window, there are links for 'Nightly Settings' and 'Add-ons Support'. A large white mouse cursor arrow is positioned over the three-dot menu icon of the 'Request blocker' extension.

Find more add-ons Search addons.mozilla.org

Recommendations

Extensions

Themes

Plugins

Manage Your Extensions

Enabled

Request blocker, options UI only  

Request blocker with declarativeNetRequest, configurable through options UI. Does not ...

Recommended Extensions

 **Sidebery**
by [mbnuqw](#) 

Tabs and bookmarks neatly organized in a Firefox side view.

★★★★☆ Users: 67,690

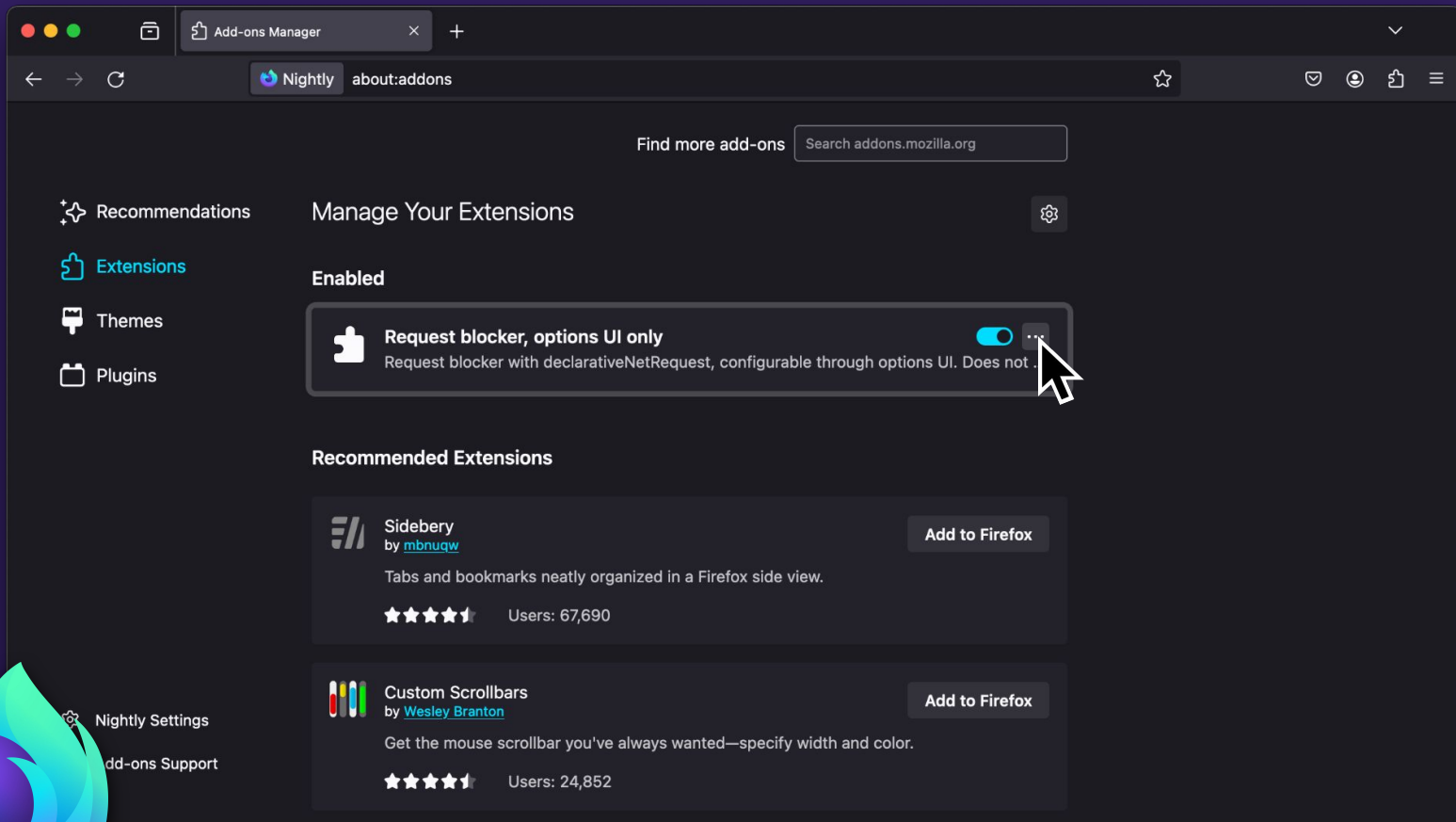
 **Custom Scrollbars**
by [Wesley Branton](#) 

Get the mouse scrollbar you've always wanted—specify width and color.

★★★★☆ Users: 24,852

Nightly Settings

Add-ons Support



The screenshot displays the Firefox Add-ons Manager window. The browser's address bar shows 'about:addons' with a 'Nightly' tab. The interface is divided into a left sidebar and a main content area. The sidebar includes links for 'Recommendations', 'Extensions' (highlighted), 'Themes', and 'Plugins'. The main content area is titled 'Manage Your Extensions' and features a search bar at the top. Below the search bar, there are sections for 'Enabled' and 'Recommended Extensions'. In the 'Enabled' section, the 'Request blocker, options UI only' extension is listed with a toggle switch and a menu icon. A mouse cursor is hovering over this menu icon. The 'Recommended Extensions' section lists 'Sidebery' and 'Custom Scrollbars' with their respective icons, descriptions, ratings, and user counts.

Find more add-ons

Manage Your Extensions 

Enabled

 **Request blocker, options UI only**  

Request blocker with declarativeNetRequest, configurable through options UI. Does not .

Recommended Extensions

 **Sidebery**
by [mbnuqw](#) 

Tabs and bookmarks neatly organized in a Firefox side view.

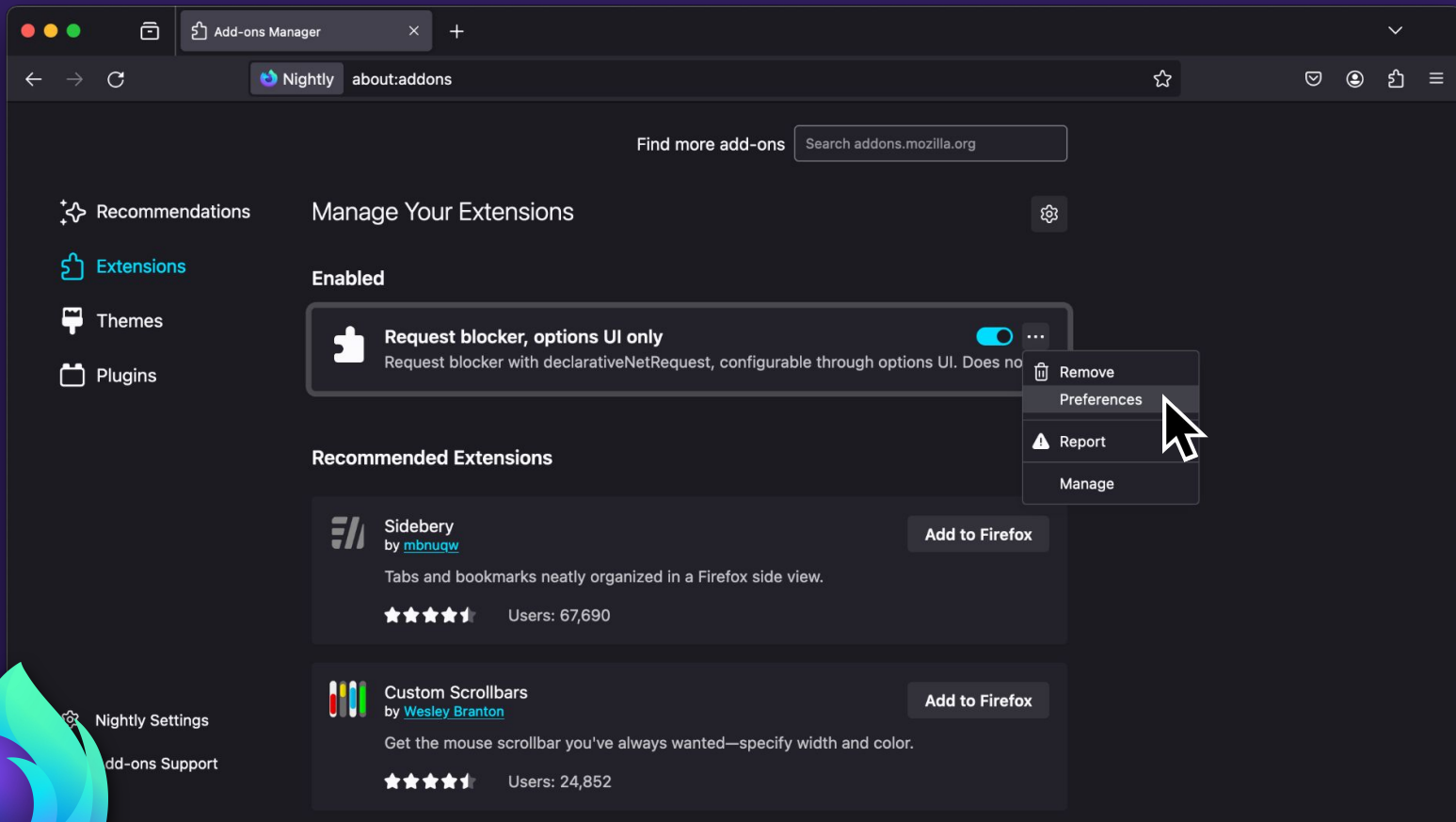
★★★★☆ Users: 67,690

 **Custom Scrollbars**
by [Wesley Branton](#) 

Get the mouse scrollbar you've always wanted—specify width and color.

★★★★☆ Users: 24,852

  Nightly Settings
 Add-ons Support



Find more add-ons

Recommendations

Extensions

Themes

Plugins

Manage Your Extensions

Enabled

 **Request blocker, options UI only** Request blocker with declarativeNetRequest, configurable through options UI. Does not

- Remove
- Preferences
- Report
- Manage

Recommended Extensions

 **Sidebery**
by [mbnuqw](#) Add to Firefox

Tabs and bookmarks neatly organized in a Firefox side view.

★★★★☆ Users: 67,690

 **Custom Scrollbars**
by [Wesley Branton](#) Add to Firefox

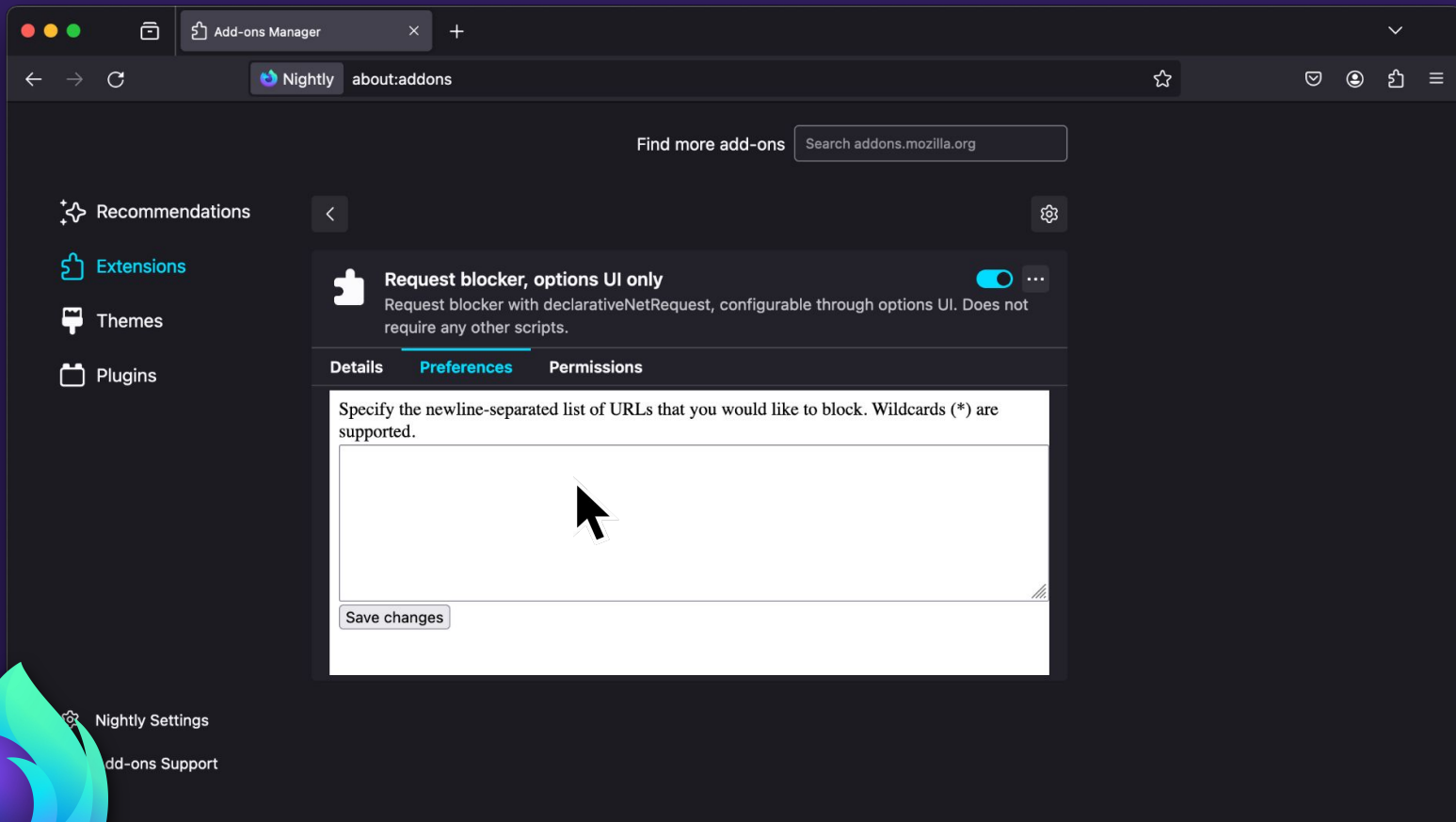
Get the mouse scrollbar you've always wanted—specify width and color.

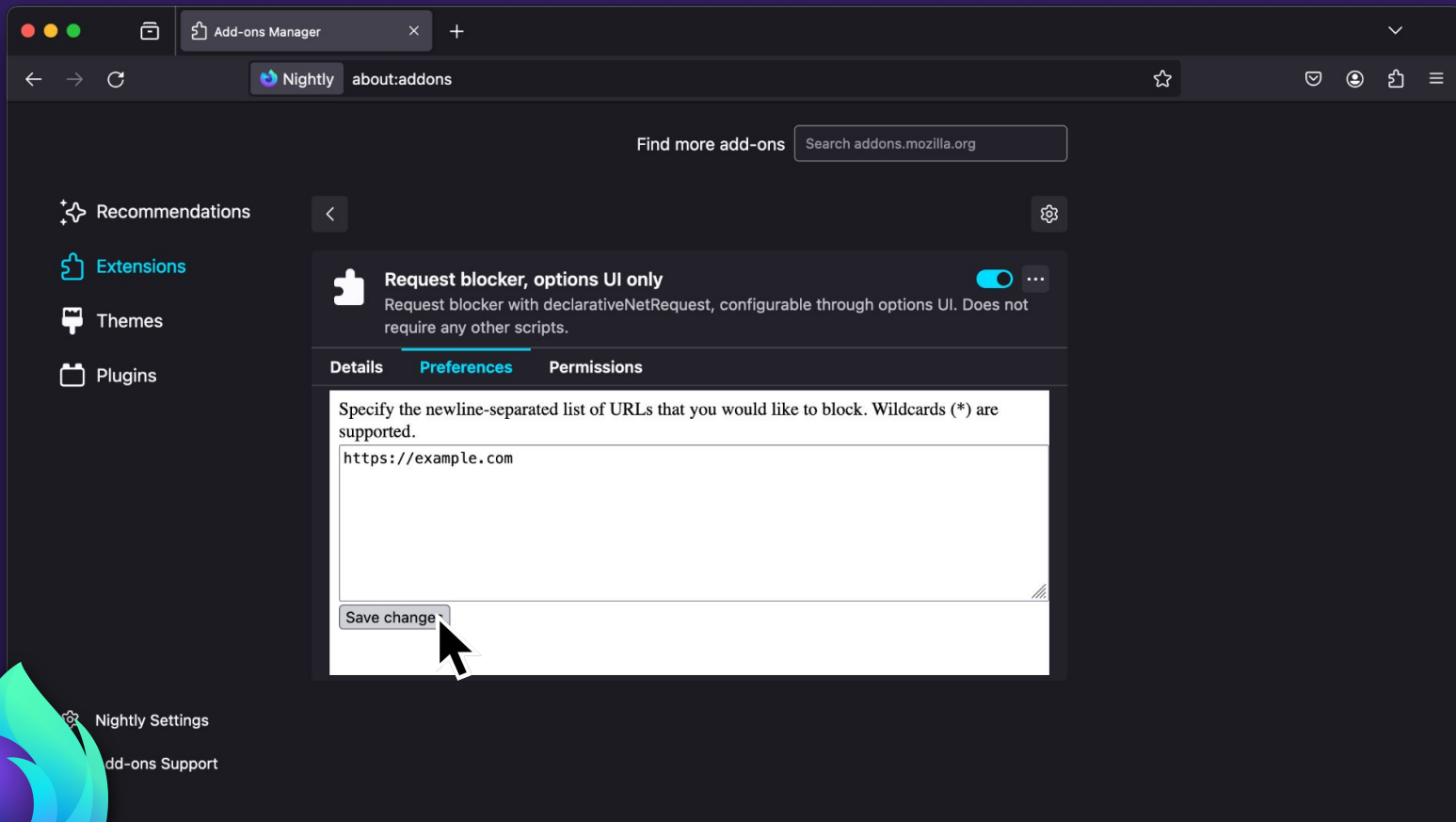
★★★★☆ Users: 24,852

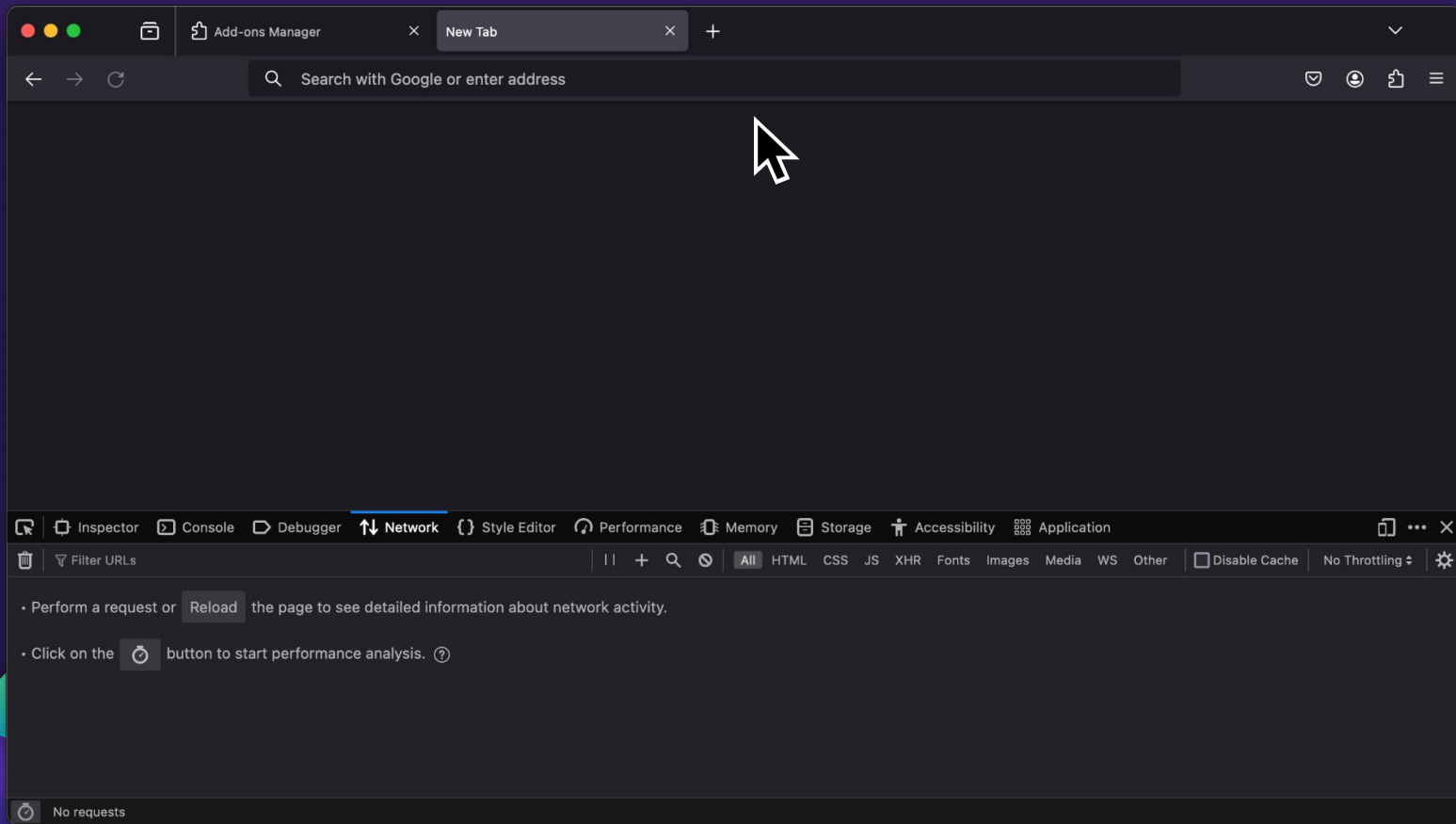
Nightly Settings

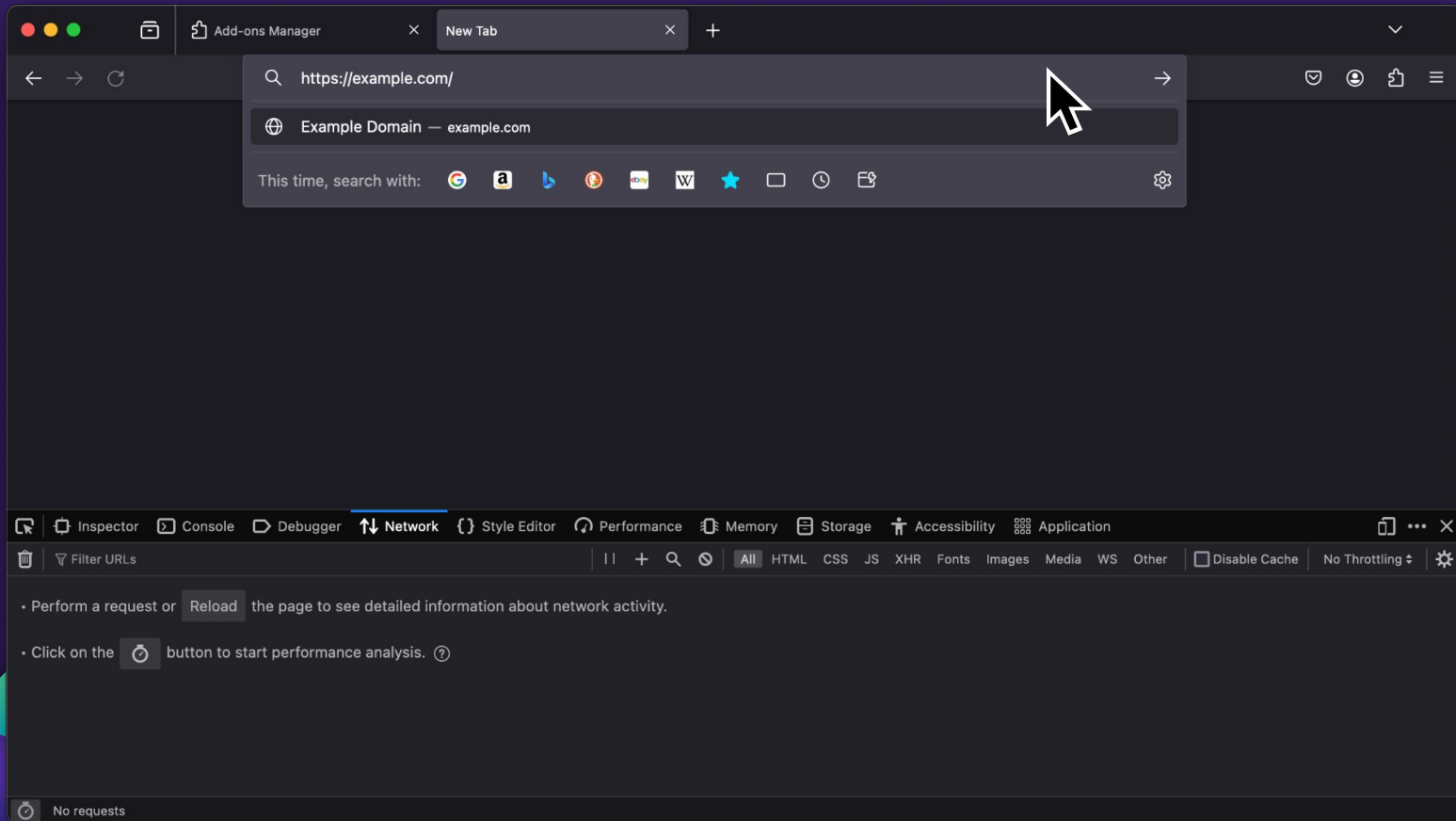
Add-ons Support

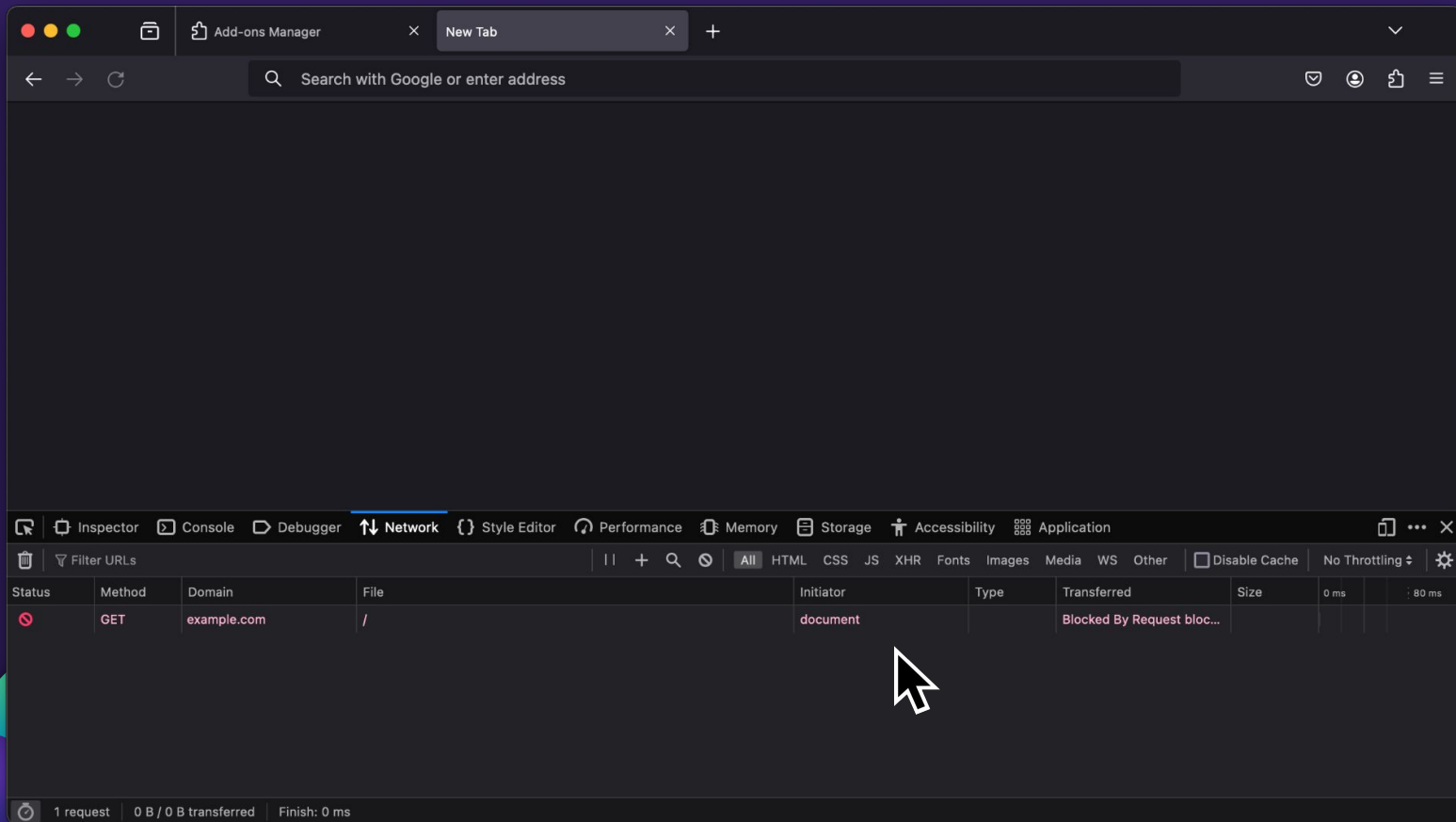












Resources

- <https://extensionworkshop.com>
- <https://github.com/mozilla/web-ext/>
- <https://discourse.mozilla.org/c/add-ons>
- <https://blog.mozilla.org/addons/>
- #addons at chat.mozilla.org: <https://matrix.to/#/#addons:mozilla.org/>

Contact

- Rob Wu
 - Email: rob@robwu.nl
- Simeon Vincent
 - Mastodon: [@dotproto@toot.cafe](https://toot.cafe/@dotproto)
 - Twitter: [@dotproto](https://twitter.com/dotproto)