

# How Adblockers Work

And Why Communities Make it all Possible.

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Rémi Berson

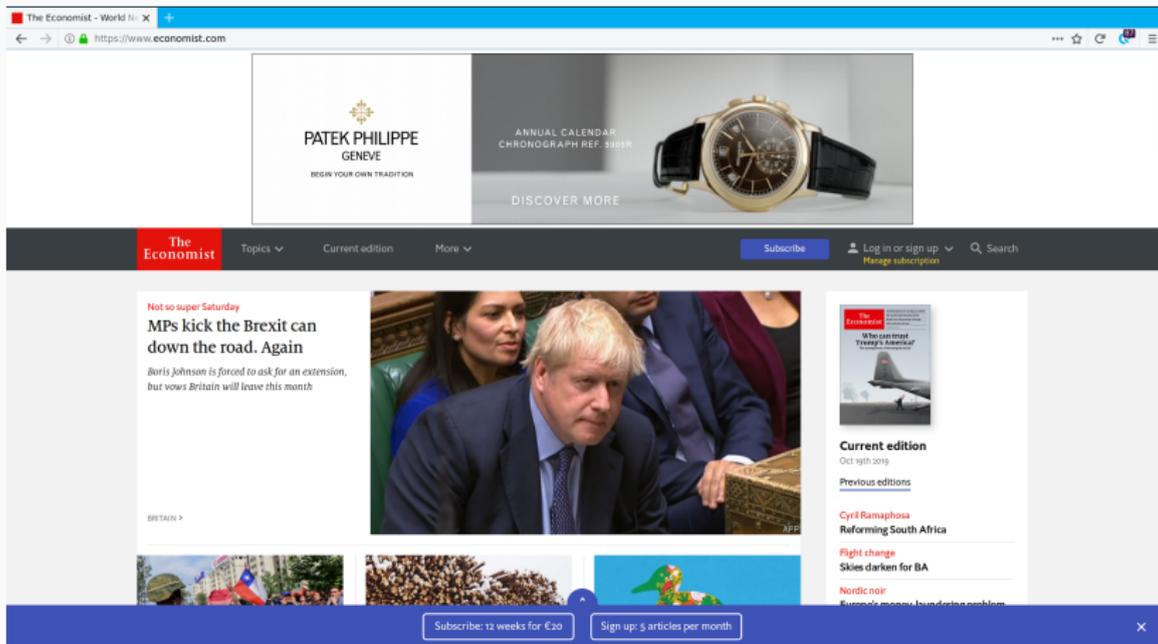
October 23th, 2019

Cliqz, Ghostery

## Adblockers, adblockers...



# What's a Website?



The screenshot shows the homepage of The Economist website. At the top, there is a navigation bar with the site's name, a search bar, and a 'Subscribe' button. Below this is a large banner for a Patek Philippe watch advertisement. The main content area features a large article titled 'MPs kick the Brexit can down the road. Again' with a sub-headline 'Boris Johnson is forced to ask for an extension, but vows Britain will leave this month'. To the right of the article is a smaller section for the 'Current edition' dated Oct 19th 2019, with a sub-headline 'Reforming South Africa'. At the bottom of the page, there are two buttons: 'Subscribe: 12 weeks for €20' and 'Sign up: 5 articles per month'.

The Economist - World N: X  
https://www.economist.com

PATEK PHILIPPE  
GENEVE  
BEGIN YOUR OWN TRADITION

ANNUAL CALENDAR  
CHRONOGRAPH REF. 5980R  
DISCOVER MORE

The Economist  
Topics  
Current edition  
More  
Subscribe  
Log in or sign up  
Manage subscription  
Search

Not so super Saturday  
**MPs kick the Brexit can down the road. Again**  
*Boris Johnson is forced to ask for an extension, but vows Britain will leave this month*

BRITAIN >

Current edition  
Oct 19th 2019  
Previous editions

Cyril Ramaphosa  
Reforming South Africa

Flight change  
Skies darken for BA

Nordic noir  
Europe's money laundering problem

Subscribe: 12 weeks for €20  
Sign up: 5 articles per month

More than meets the eye.

# What's an Ad?

The screenshot displays a web browser window with the URL `https://www.economist.com`. The main content area shows a Patek Philippe advertisement for the 'ANNUAL CALENDAR CHRONOGRAPH REF. 5955R'. The ad features the Patek Philippe logo, the text 'BEGIN YOUR OWN TRADITION', and a large image of the watch. Below the ad, the browser's developer tools are open, showing the DOM tree and the CSS styles for the selected advertisement element.

The DOM tree shows the following structure for the advertisement:

```
<div class="sticky-scroller navigation-sticky-scroller navigation" style="top: -5px;">
  <div class="fe-blog_top-ad-wrapper fe-blog_top-ad-wrapper-billboard">
    <div class="fe-blog_top-ad fe-blog_top-ad-ad-panel_container" aria-label="Advertisement" role="complementary" (selected)
      <div id="ad-panel_0.6423031055152479" class="ad-panel_google" title="Advertisement" data-google-query-id="C73W4qg-UCF9W4odR712j">
        <div id="google_ads_iframe_5685/teq.FMS0/32EK_5_container_" style="border: 8pt none;">
          <iframe id="google_ads_iframe_5685/teq.FMS0/32EK_5" title="3rd party ad content" name="google_ads_iframe_5685/teq.FMS0/32EK_5"
            scrollable="no" marginwidth="0" marginheight="0" style="border: 8px none; vertical-align: bottom; arcsource="" data-google-container-
            id="1" data-lazy-complex="true" width="300" height="250" frameborder="0">
            </iframe>
          </div>
        </div>
      </div>
    </div>
  </div>
</div>
```

The CSS styles for the selected element are:

```
#clickthrough {
  width: 100%;
  height: 100%;
  z-index: 999;
  cursor: pointer;
}
div, video {
  position: absolute;
  background-repeat: no-repeat;
}
```

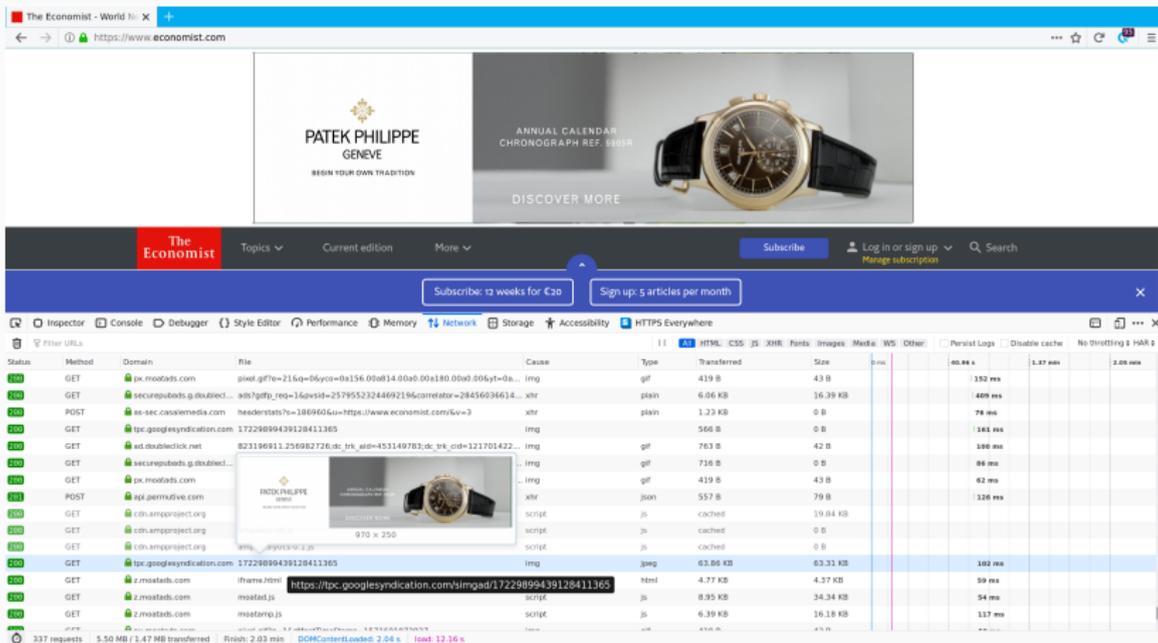
The *DOM*.

# Blocking: What Can Extensions Do?

**Adblockers** are **extensions**:

- They are JavaScript **programs** running inside the browser.
- They can *monitor*, *modify* or **block** network requests.
- They can **hide** elements from pages.

# Blocking: Network Filtering



The screenshot shows a web browser displaying a Patek Philippe advertisement. The ad features a gold watch and the text "ANNUAL CALENDAR CHRONOGRAPH REF. 5980R" and "DISCOVER MORE". Below the ad, there are navigation links for "Subscribe" and "Log in or sign up".

The network inspector tool at the bottom shows a list of requests. The following table summarizes the key requests related to the advertisement:

Status	Method	Domain	File	Cause	Type	Transformed	Size	Time	Perist	Logs	Disable cache	No throttling & HMR
200	GET	px.moatads.com	pixel.gif?e=216q=06yca=0a156.0ba014.0ba0.00a180.0ba0.006yt=0a...	img	gif		419 B	43 B	152 ms			
200	GET	securepubads.g.doubleclick.net	ads?gfpw=16dpsid=2579552324469219&correlator=28456036614...	xhr	plain		6.06 KB	16.39 KB	409 ms			
200	POST	ss-sec.casalemedia.com	headerstats?w=186&id=2579552324469219&www.economist.com/ev=3	xhr	plain		1.23 KB	0 B	78 ms			
200	GET	tpc.googleanalytics.com	1722989439128411365	img	img		566 B	0 B	181 ms			
200	GET	ad.doubleclick.net	823196911.356982726.dc.trk_aid=453149783.dc_trk_cid=123701422...	img	gif		763 B	42 B	100 ms			
200	GET	securepubads.g.doubleclick.net		img	gif		716 B	0 B	86 ms			
200	GET	px.moatads.com		img	gif		419 B	43 B	62 ms			
200	POST	api.perimwise.com		xhr	json		557 B	79 B	116 ms			
200	GET	cdn.ampproject.org		script	js	cached		19.04 KB				
200	GET	cdn.ampproject.org		script	js	cached		0 B				
200	GET	cdn.ampproject.org		script	js	cached		0 B				
200	GET	tpc.googleanalytics.com	1722989439128411365	img	jpg		63.86 KB	63.31 KB	102 ms			
200	GET	z.moatads.com	iframe.html	https://tpc.googleanalytics.com/algad/1722989439128411365	html		4.77 KB	4.37 KB	59 ms			
200	GET	z.moatads.com	moatad.js		script		8.95 KB	34.34 KB	54 ms			
200	GET	z.moatads.com	moatmp.js		script		6.39 KB	16.18 KB	117 ms			

Summary: 337 requests, 5.50 MB / 1.47 MB transferred, Finish: 2.03 min, DOMContentLoaded: 2.04 s, load: 12.16 s

The ads have to be *fetch*ed somehow.

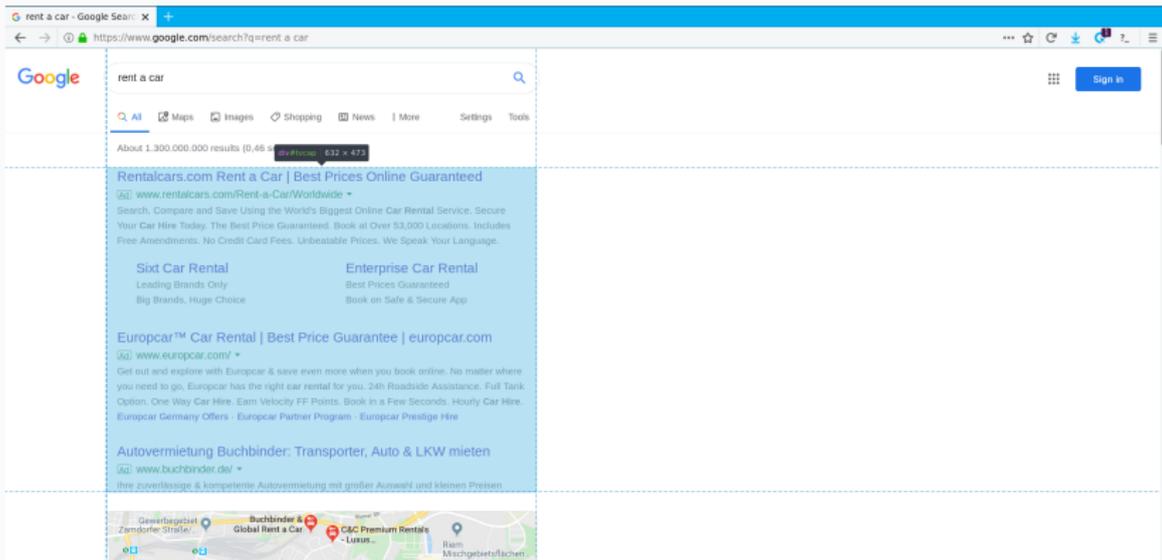
# Hiding: Cosmetics Filtering

The screenshot shows a Google search for "rent a car". The search results are as follows:

- Rentalcars.com Rent a Car | Best Prices Online Guaranteed**  
www.rentalcars.com/Rent-a-Car/Worldwide  
Rating for rentalcars.com: 4.0 - 148 reviews  
Search, Compare and Save Using the World's Biggest Online Car Rental Service. Secure Your Car Hire Today. The Best Price Guaranteed. Book at Over 53,000 Locations. We Speak Your Language. Includes Free Amendments. Unbeatable Prices. No Credit Card Fees.
- Sixt Car Rental**  
Leading Brands Only  
Big Brands, Huge Choice
- Enterprise Car Rental**  
Best Prices Guaranteed  
Book on Safe & Secure App
- Europcar™ Car Rental | Best Price Guarantee | europcar.com**  
www.europcar.com  
Get out and explore with Europcar & save even more when you book online. No matter where you need to go, Europcar has the right car rental for you. Europcar 24h Drive. 24h Roadside Assistance. Full Tank Option. No Hidden Fees. Monthly Car Hire, Risk Reduction Cover.
- Car Rental at Munich Airport | Hire at Buchbinder Rent-a-Car**  
www.buchbinder.de  
Large selection, from small cars to 9-seaters, low prices and can be cancelled at any time

When blocking network requests is not enough.

# Hiding: Cosmetics Filtering



We can remove or hide parts of the *DOM*.

How to decide **which network requests to block?**

```
||example.com$script,third-party  
/ads/$image
```

~**100k** by default.

## Filters: Cosmetic

How to decide **what to hide** in the page?

```
##.ad-element  
example.com##^script:has-text(loadAds)
```

~**50k** by default.

# What's an Adblocker?

- Big **rule engine**
- **Decide** what to block in real-time
- Store rules in **optimized** format
- Needs to be *really fast*

- *fast* decision time ( $\sim 0.01$  ms per request)
- *low memory* usage (5.6 MB to 7.7 MB for **170k** filters)
- zero-cost initialization (0.1-20 ms)

[whotracks.me/blog/adblockers\\_performance\\_study.html](https://whotracks.me/blog/adblockers_performance_study.html)

 [github.com/cliqz-oss/adblocker](https://github.com/cliqz-oss/adblocker)

-  — Hosted on *GitHub*
-  — Written in *TypeScript*
-  — Published on *NPM*
-  — Tested with *Jest*
-  — Managed with *Lerna*
-  — Bundled with *Rollup*
-  — Packaged with *Yarn*
-  — Formatted with *Prettier*

Run **everywhere** —     

# Open Source?

Sharing **knowledge**: performance, designs, data, benchmarks:

-  influential work on efficient designs and features.
-  performance study and open benchmarks.
-  proposed currently most efficient approach to adblocking.
-  translated Cliqz' adblocker into Rust.
-  Adblocker Dev Summit.
-  shared mobile trackers database with whotracks.me.

Adblocking is not possible without a *strong community!*

-  — [github.com/easylist/easylist](https://github.com/easylist/easylist)
-  — [github.com/uBlockOrigin/uAssets](https://github.com/uBlockOrigin/uAssets) 
-  — [github.com/AdguardTeam/AdguardFilters](https://github.com/AdguardTeam/AdguardFilters) 

**filterlists.com** counts more than **1700** subscriptions!

# Contributing?

So many ways to do *better together!*

- *report* site breakage or ads not blocked
- help *maintain* up-to-date rules
- open *issues*, ask *questions*, start *discussions*
- *talk* and *write* about projects
- *share* your knowledge!

# Contributing: GitHub!

🔗 — github.com/cliqz-oss/adblocker

The screenshot shows the GitHub repository page for `cliqz-oss/adblocker`. At the top, the repository name is displayed with navigation icons for Code, Issues (6), Pull requests (0), Projects (0), Wiki, Security, Insights, and Settings. On the right, there are statistics: Used by 45, Unwatch 8, Star 111, and Fork 19. Below the repository name, a description reads "A fast, pure-JavaScript content-blocking library" with a link to `https://cliqz.com` and an Edit button. There are also topic tags: `content-blocking`, `javascript`, `adblocker`, and `easylist`, along with a "Manage topics" link. A progress bar shows the repository's activity with 322 commits, 1 branch, 53 releases, 9 contributors, and MPL-2.0 license. At the bottom, there are buttons for "Branch: master", "New pull request", "Create new file", "Upload files", "Find file", and "Clone or download".

cliqz-oss / **adblocker**

Used by 45 Unwatch 8 Star 111 Fork 19

Code Issues 6 Pull requests 0 Projects 0 Wiki Security Insights Settings

A fast, pure-JavaScript content-blocking library <https://cliqz.com> Edit

content-blocking javascript adblocker easylist Manage topics

322 commits 1 branch 53 releases 9 contributors MPL-2.0

Branch: master New pull request Create new file Upload files Find file Clone or download

# Contributing: GitHub!

🐙 — github.com/ghostery/ghostery-extension

ghostery / ghostery-extension

👁 Unwatch 48

★ Unstar 759

🍴 Fork 86

↔ Code

📄 Issues 20

🔗 Pull requests 4

🔧 Actions

🛡 Security

📊 Insights

Ghostery Browser Extension for Firefox, Chrome, Opera and Edge

firefox-extension

chrome-extension

opera-extension

edge-extension

ghostery

📄 805 commits

🌿 20 branches

📦 20 releases

👤 21 contributors

📄 MPL-2.0

Branch: master ▾

New pull request

Create new file

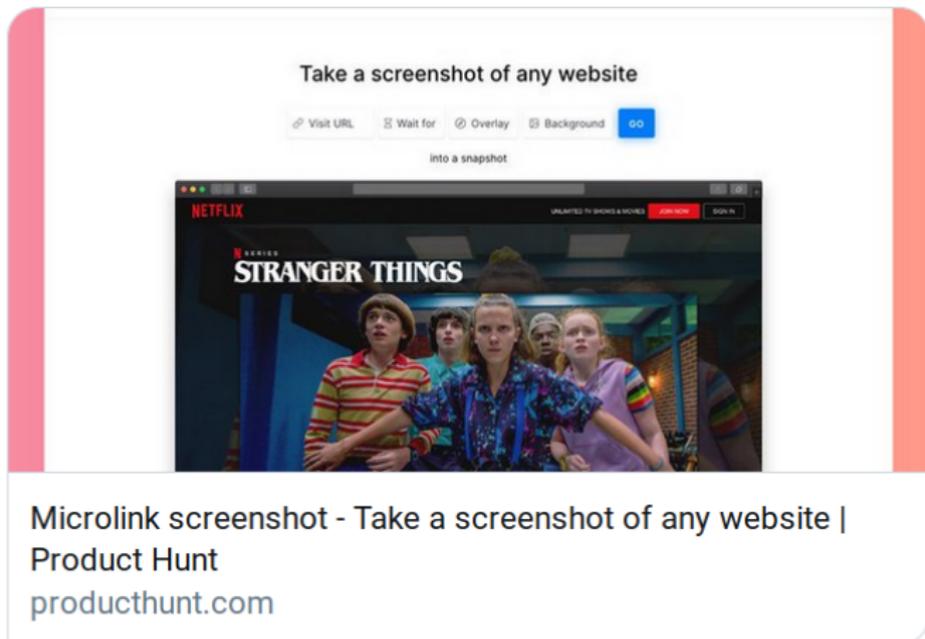
Upload files

Find file

Clone or download ▾

# Contributing: Twitter!

🐦 — [twitter.com/@pythux](https://twitter.com/pythux) or [twitter.com/@cliqz](https://twitter.com/cliqz)



Microlink screenshot - Take a screenshot of any website |  
Product Hunt  
[producthunt.com](https://producthunt.com)



Released using ghostery behind the hood 😊

Jul 18, 2019, 9:45 AM

# Questions?

- *jobs@cliqz.com* is **hiring!**
- Ping me: *remi@cliqz.com*
- Twitter: **@pythux**

 — [github.com/cliqz-oss/adblocker](https://github.com/cliqz-oss/adblocker)

-  [@cliqz/adblocker-webextension](https://www.npmjs.com/package/@cliqz/adblocker-webextension)
-  [@cliqz/adblocker-electron](https://www.npmjs.com/package/@cliqz/adblocker-electron)
-  [@cliqz/adblocker-puppeteer](https://www.npmjs.com/package/@cliqz/adblocker-puppeteer)