Lecture 17: Tracking

CMSC 25900 / DATA 25900

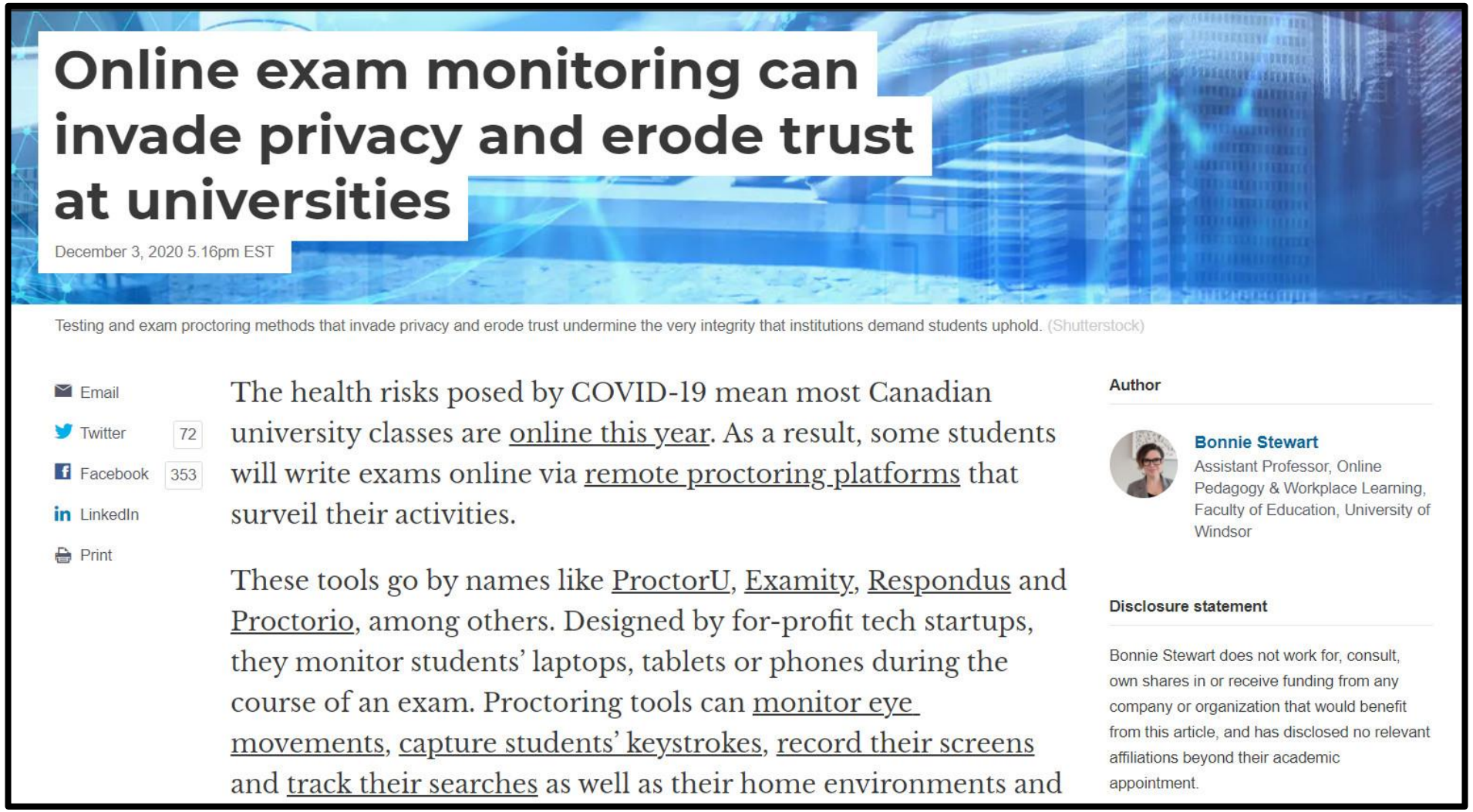
Spring 2021

The University of Chicago

THE UNIVERSITY OF CHICAGO

Surveillance of Students (Continued)

Exam-Proctoring Software



Online exam monitoring can invade privacy and erode trust at universities

December 3, 2020 5.16pm EST

Testing and exam proctoring methods that invade privacy and erode trust undermine the very integrity that institutions demand students uphold. (Shutterstock)

Email
Twitter 72
Facebook 353
LinkedIn
Print

The health risks posed by COVID-19 mean most Canadian university classes are online this year. As a result, some students will write exams online via remote proctoring platforms that surveil their activities.

These tools go by names like ProctorU, Examity, Respondus and Proctorio, among others. Designed by for-profit tech startups, they monitor students' laptops, tablets or phones during the course of an exam. Proctoring tools can monitor eye movements, capture students' keystrokes, record their screens and track their searches as well as their home environments and

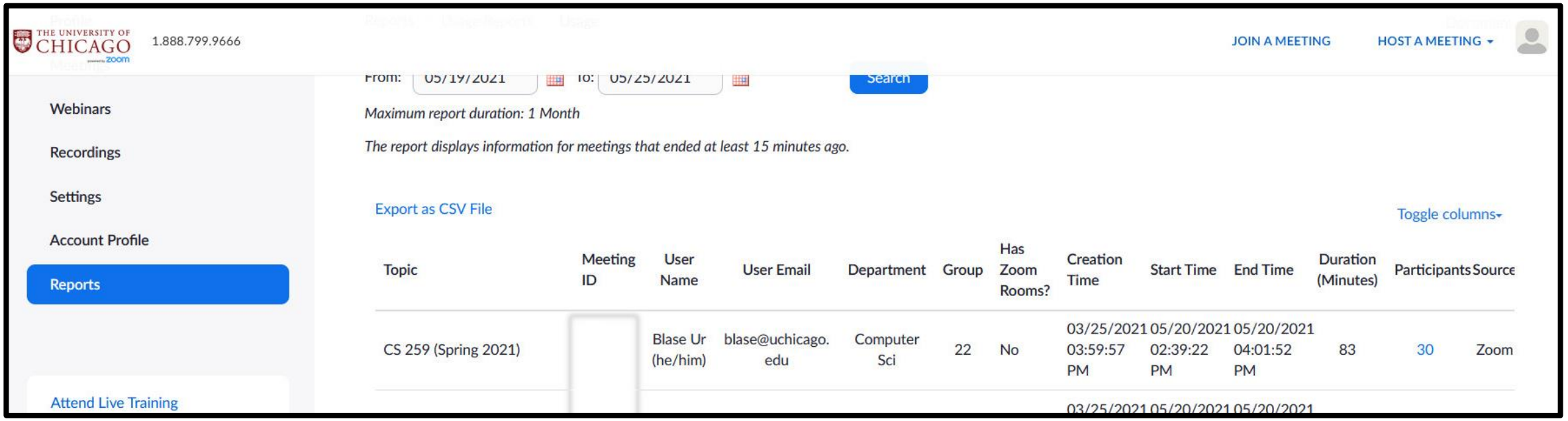
Author

Bonnie Stewart
Assistant Professor, Online Pedagogy & Workplace Learning, Faculty of Education, University of Windsor

Disclosure statement

Bonnie Stewart does not work for, consult, own shares in or receive funding from any company or organization that would benefit from this article, and has disclosed no relevant affiliations beyond their academic appointment.

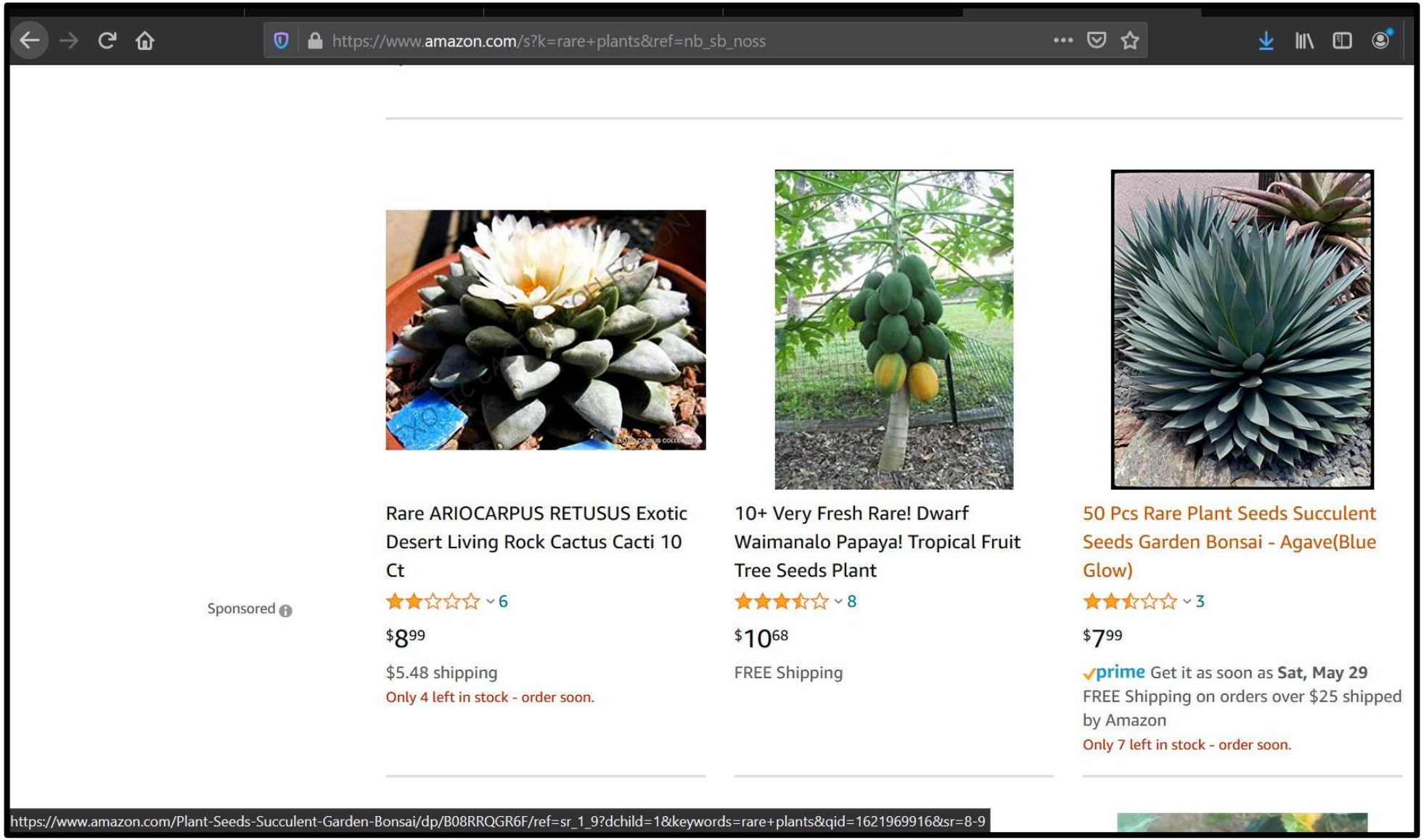
Virtual Meetings



Virtual Meetings

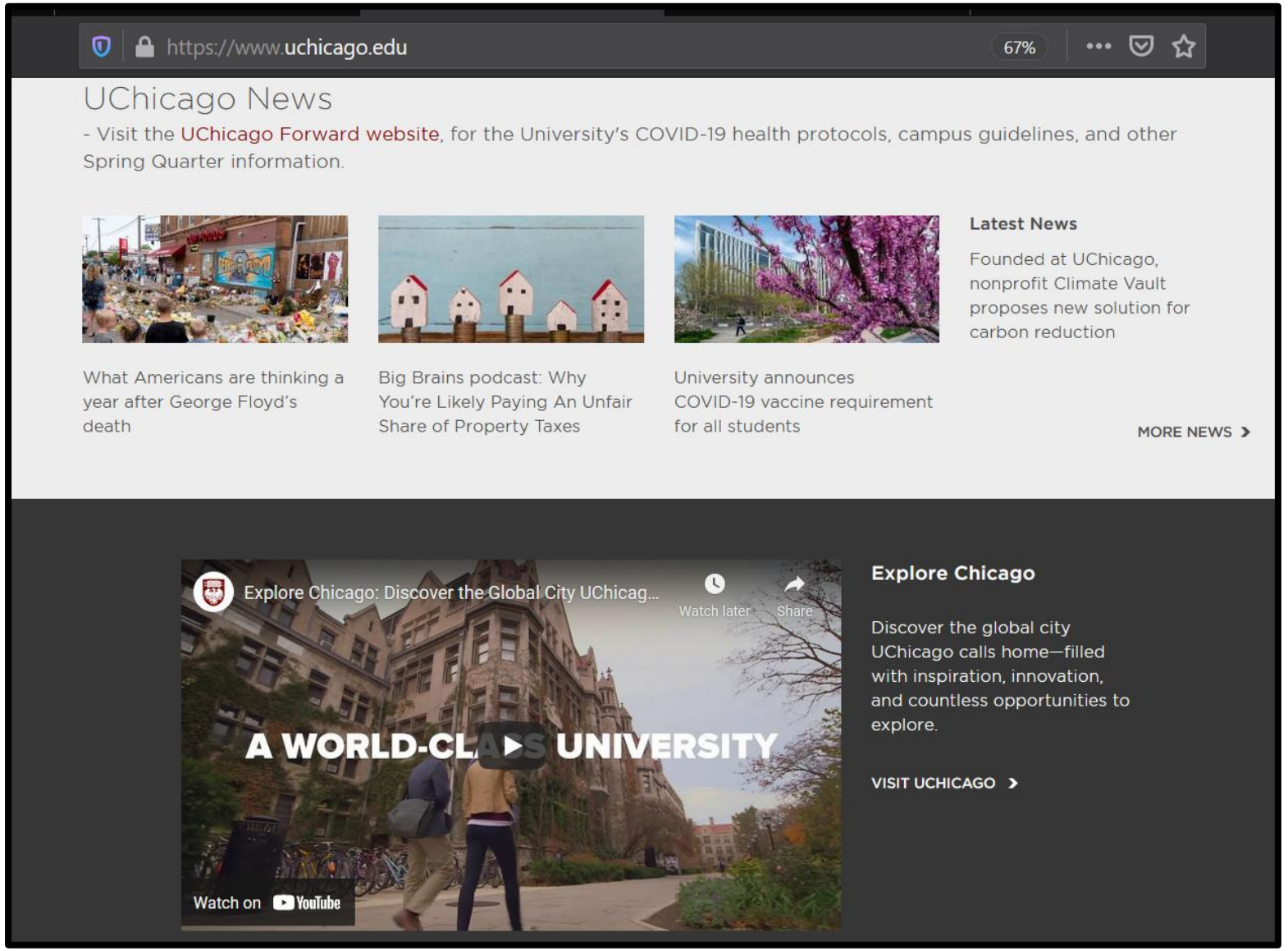
Tracking Website Visits

First-Party Tracking (The Website You Are Visiting)

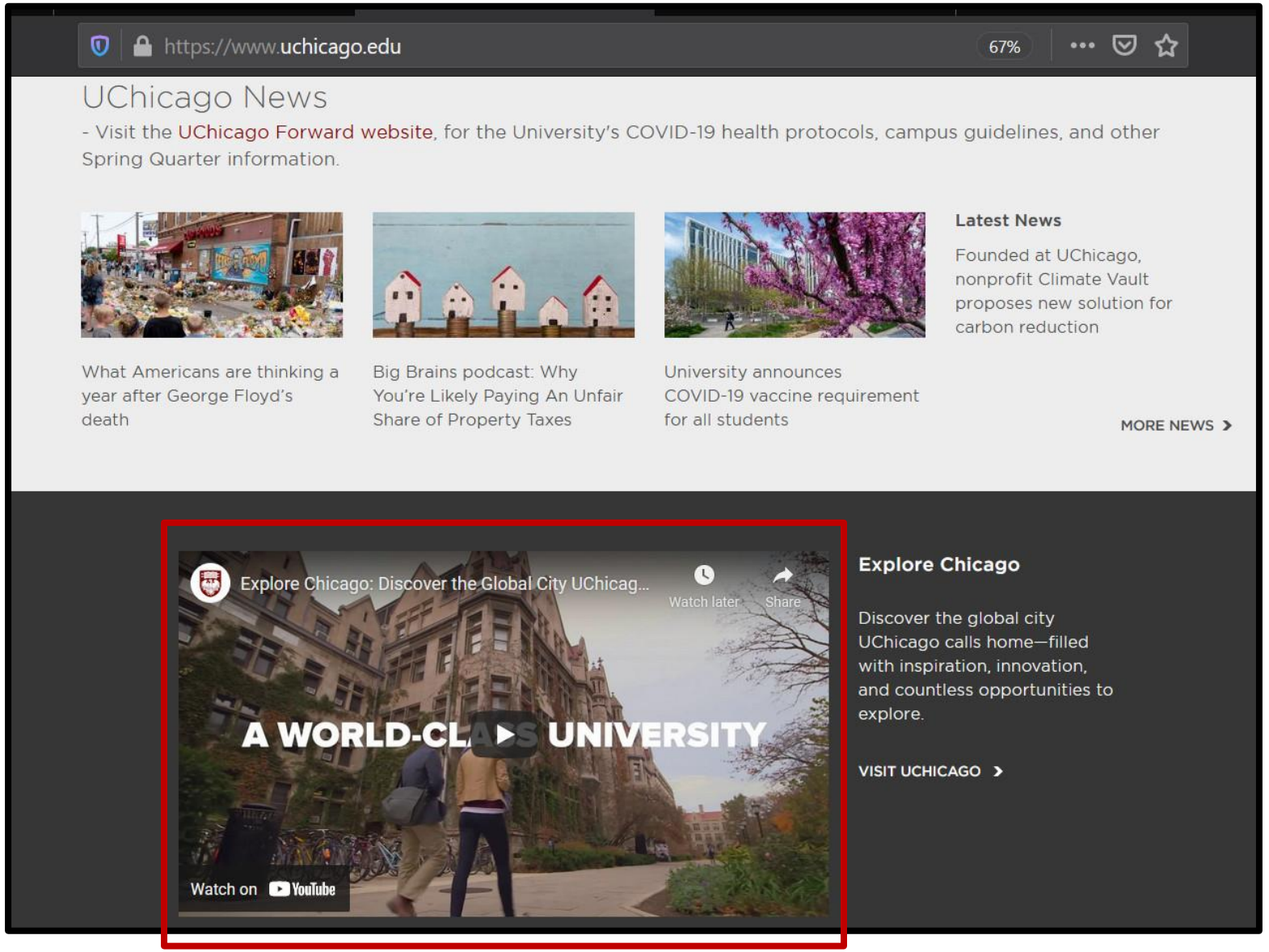


First-Party Tracking (The Website You Are Visiting)

Third-Party Tracking (***Not*** The Website You Are Visiting)

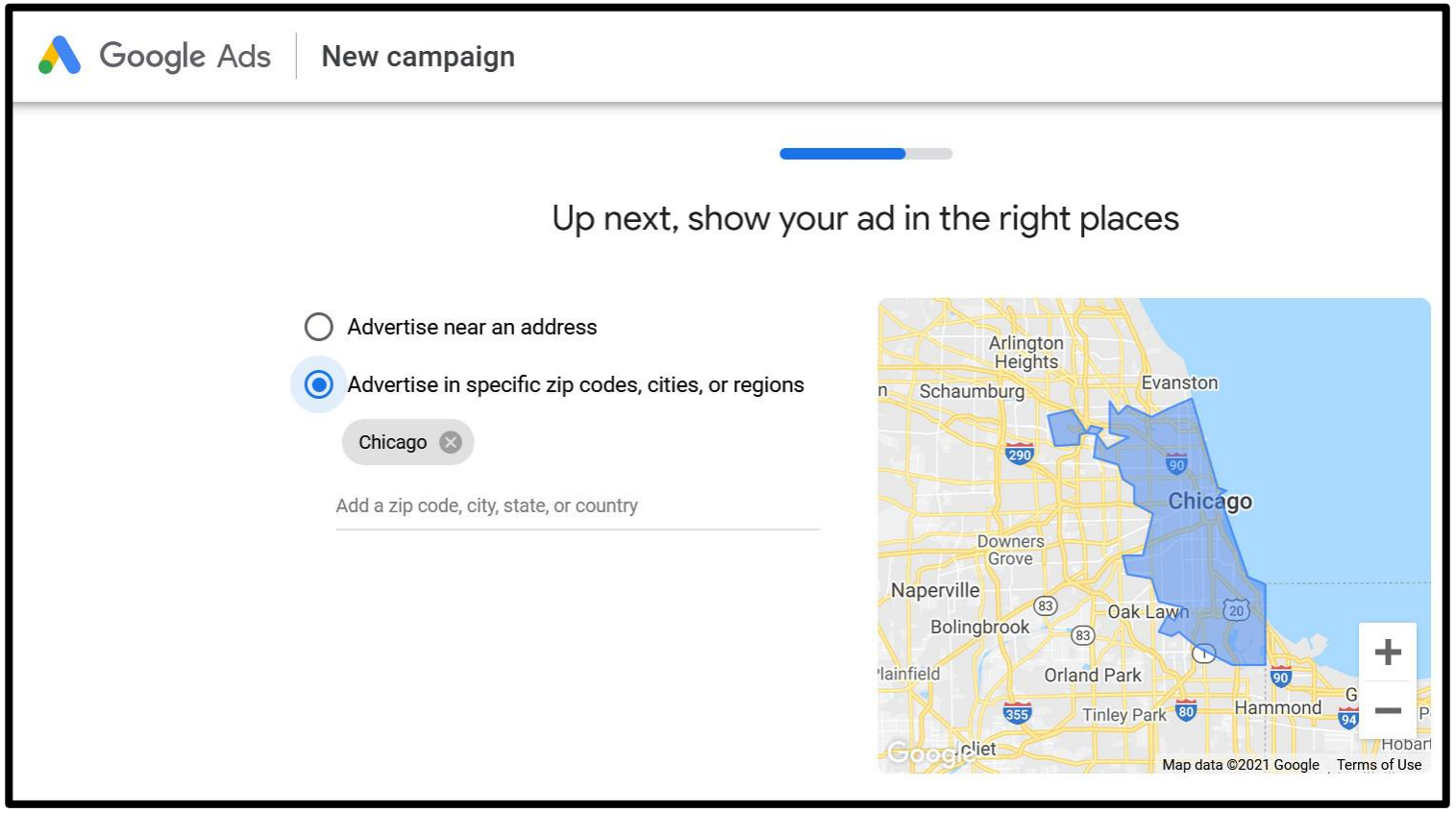


Third-Party Tracking (***Not*** The Website You Are Visiting)



Ad Targeting

- Goal: Target advertisements to particular users
  - Based on interests, demographics, past interactions (online/offline)



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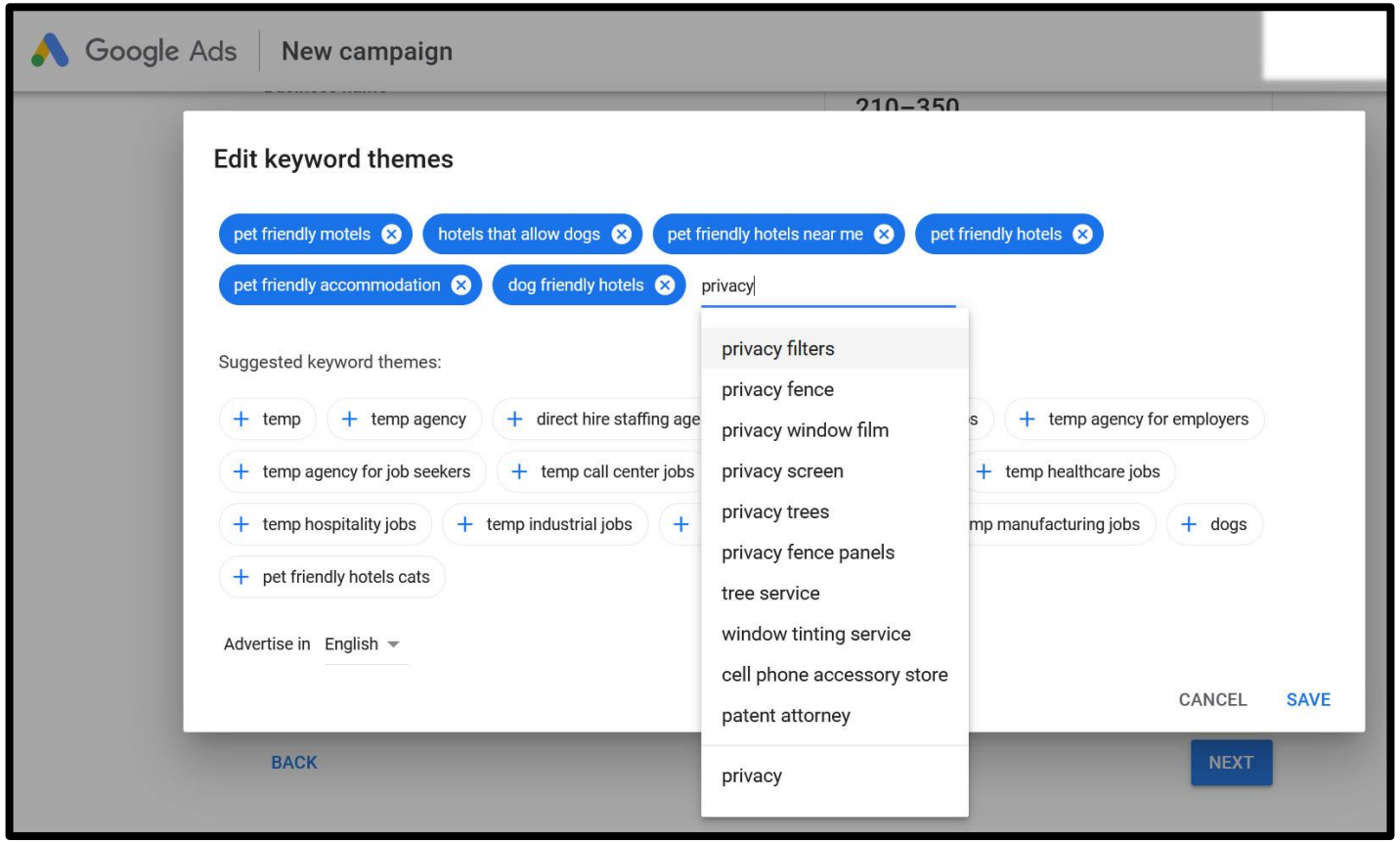

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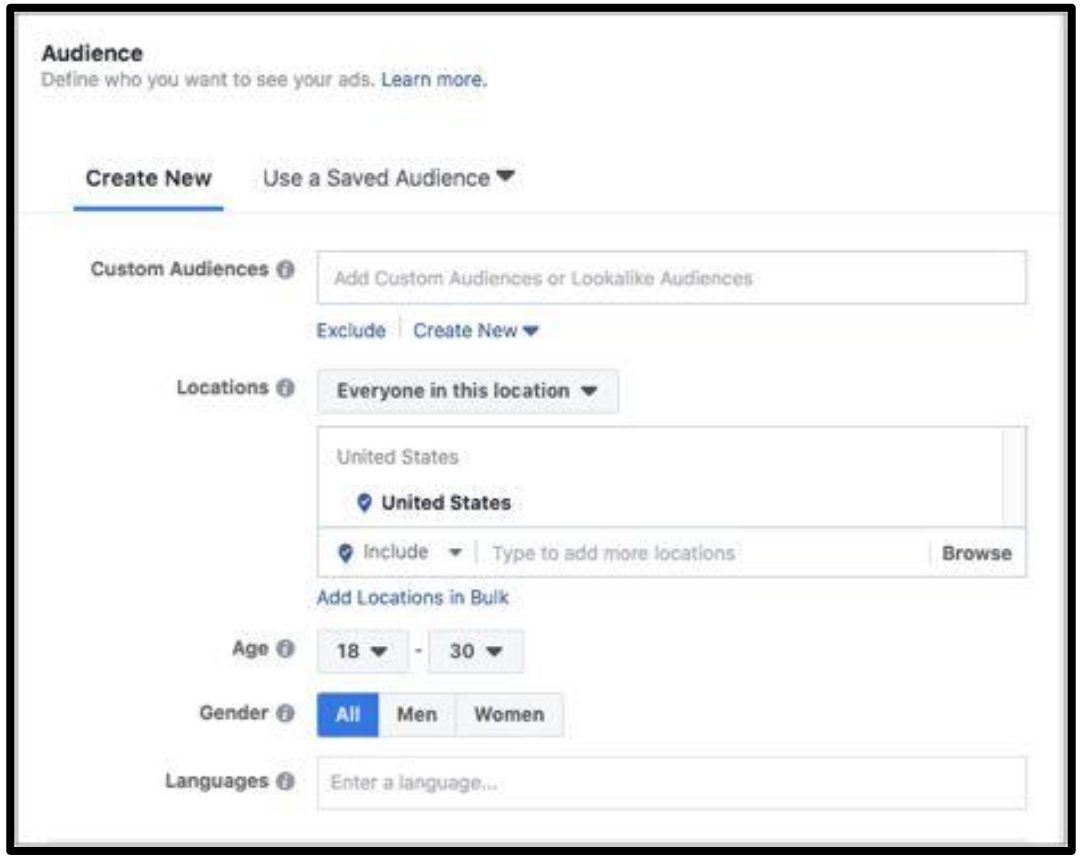
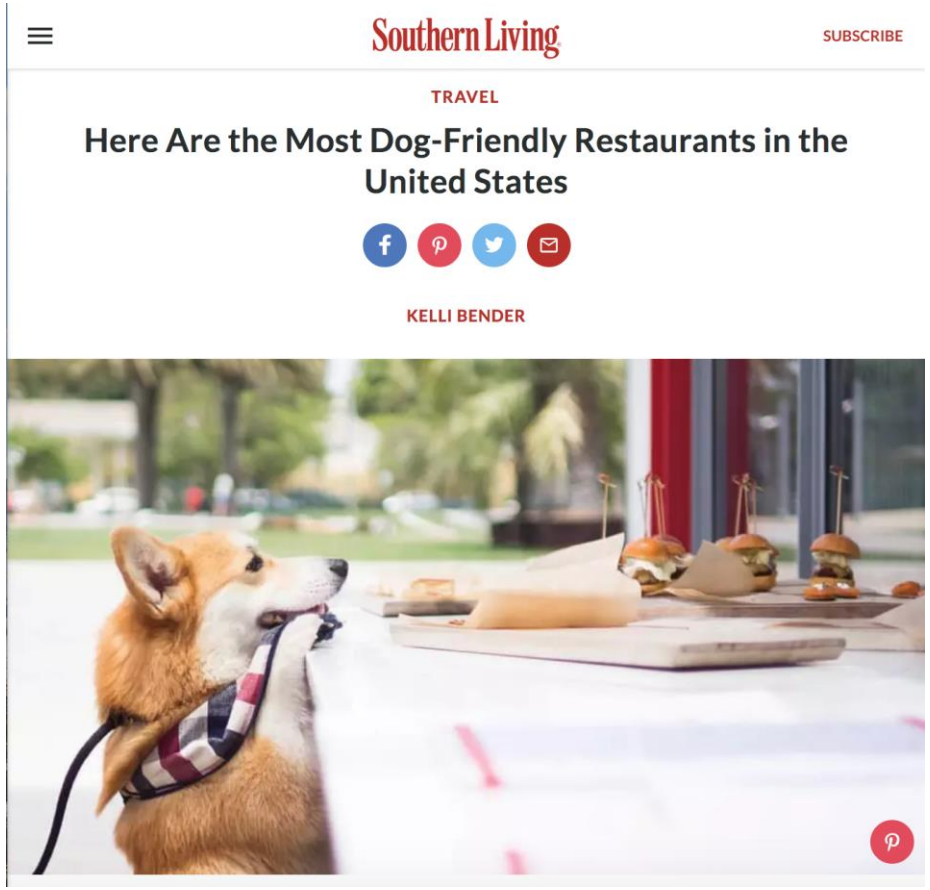
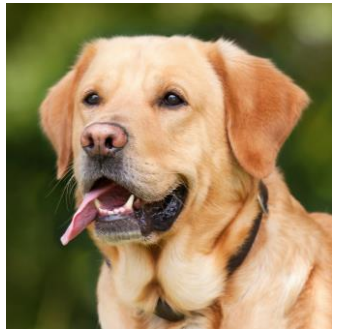


Data-Driven Inferences





You might like

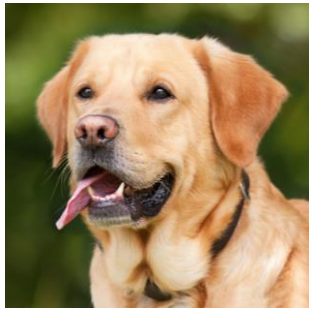
dogs!

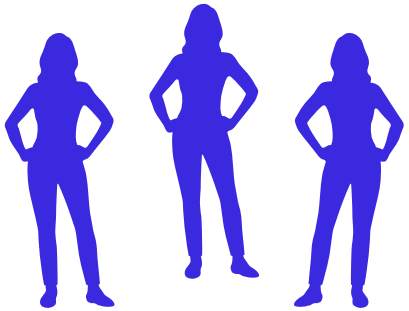
Targeted Advertising

Interests & remarketing

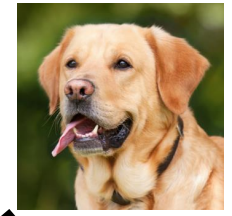
Affinity audiences

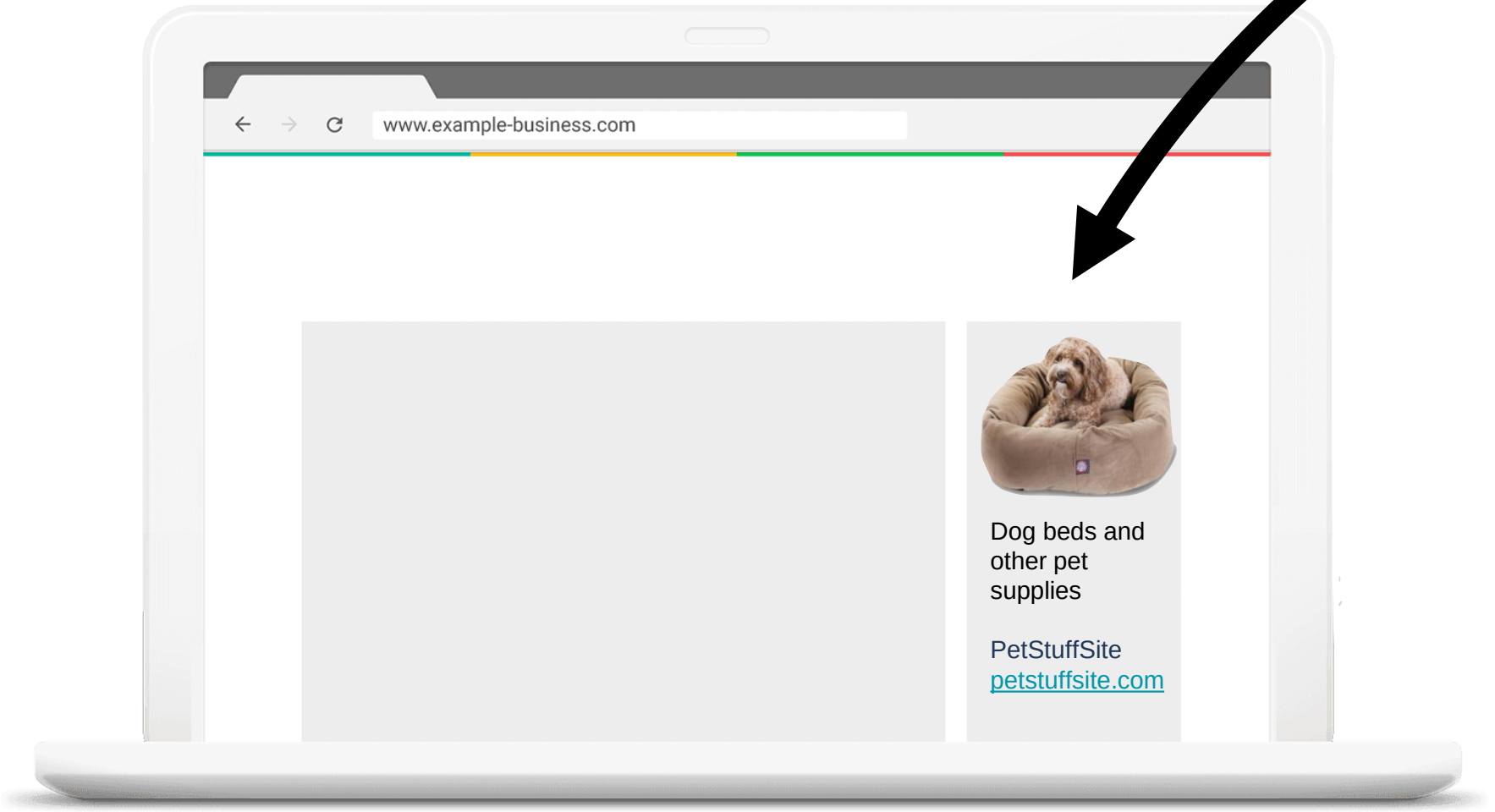
- Music Lovers »
- News Junkies »
- Nightlife Enthusiasts »
- Outdoor Enthusiasts »
- Pet Lovers »





Targeted Advertising





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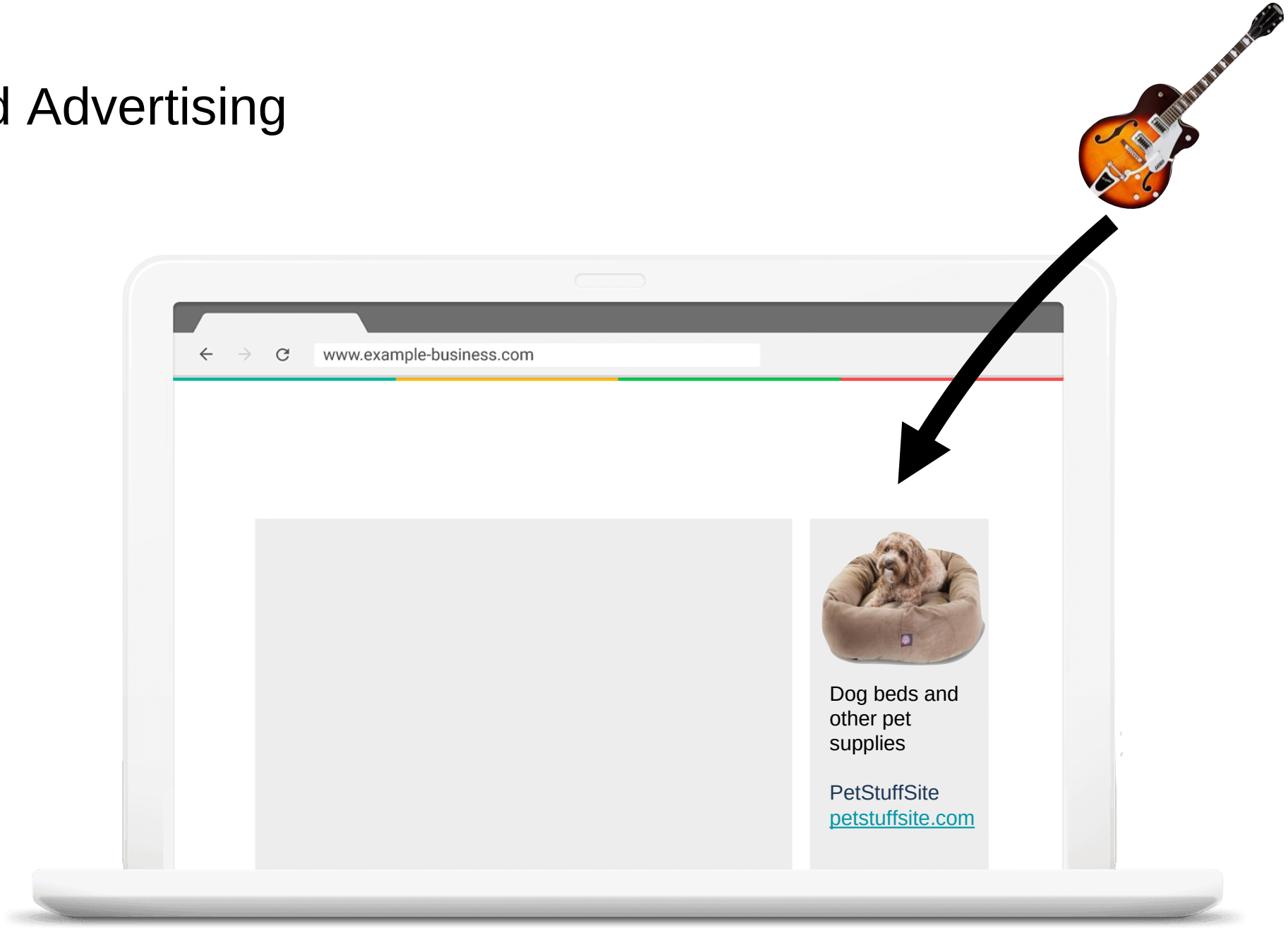


Mechanics of Tracking (Cookie Version)

HTTP Basics

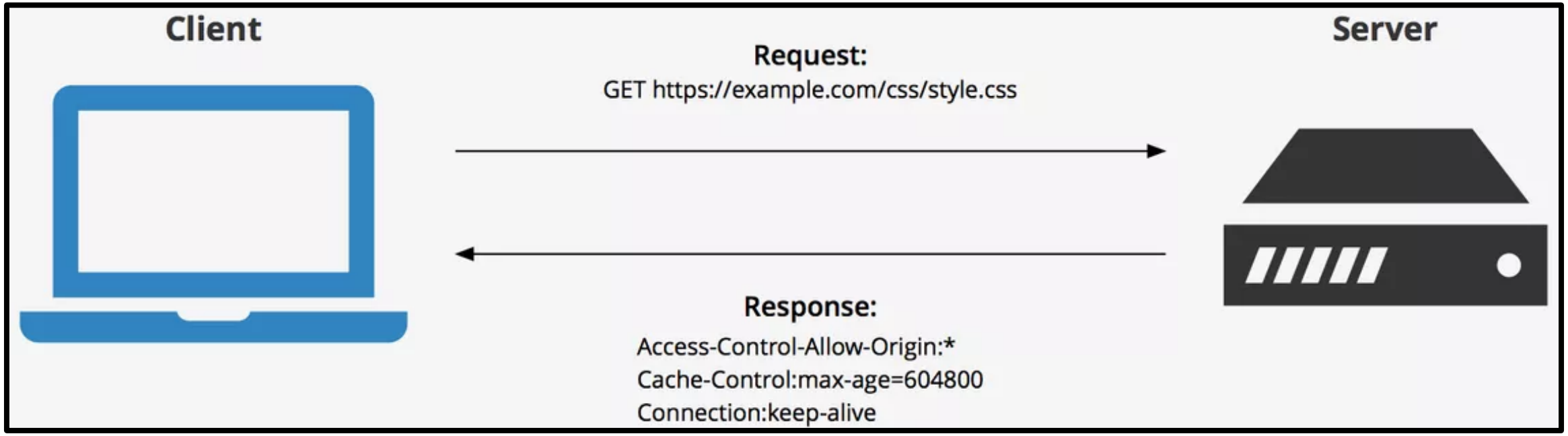
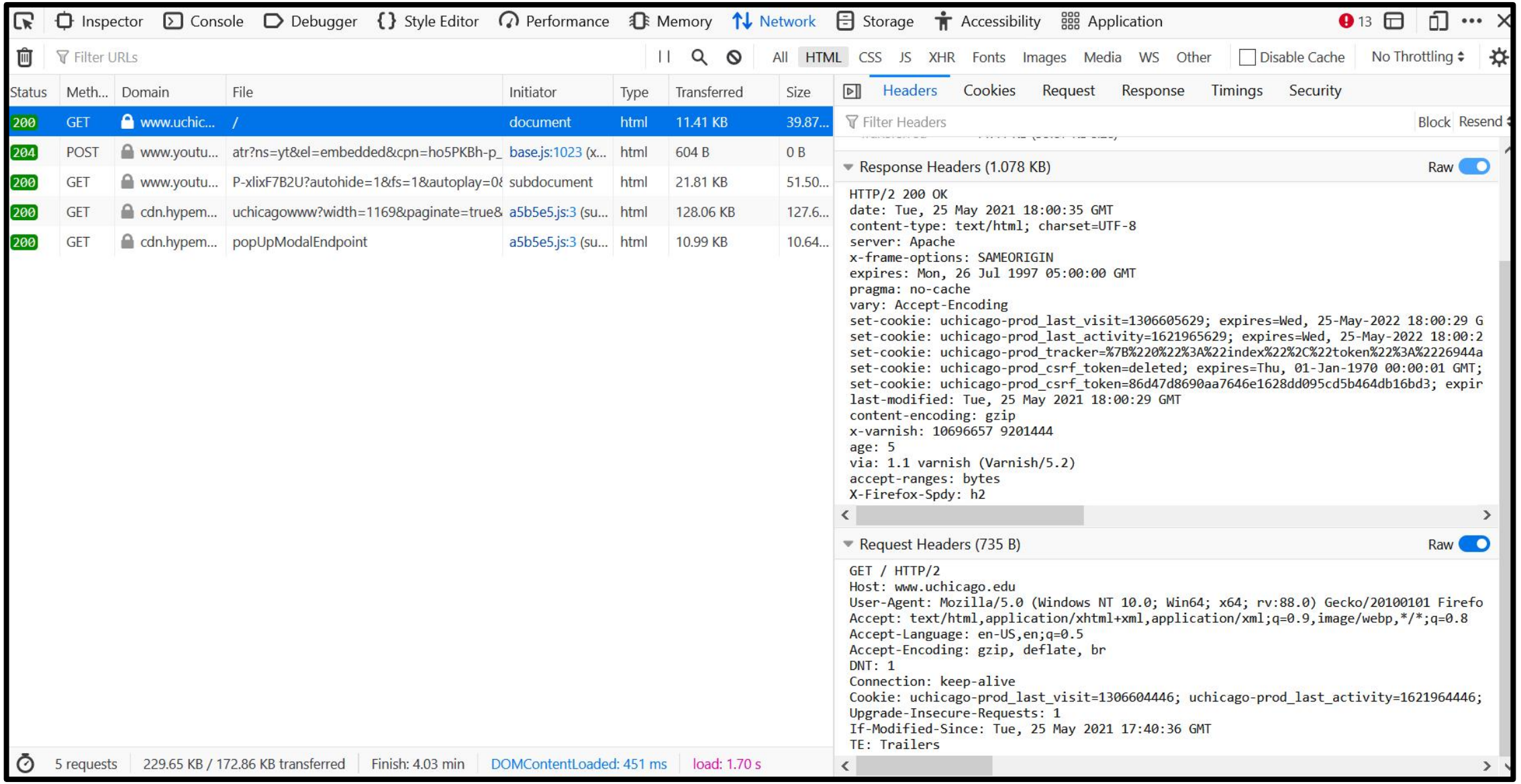
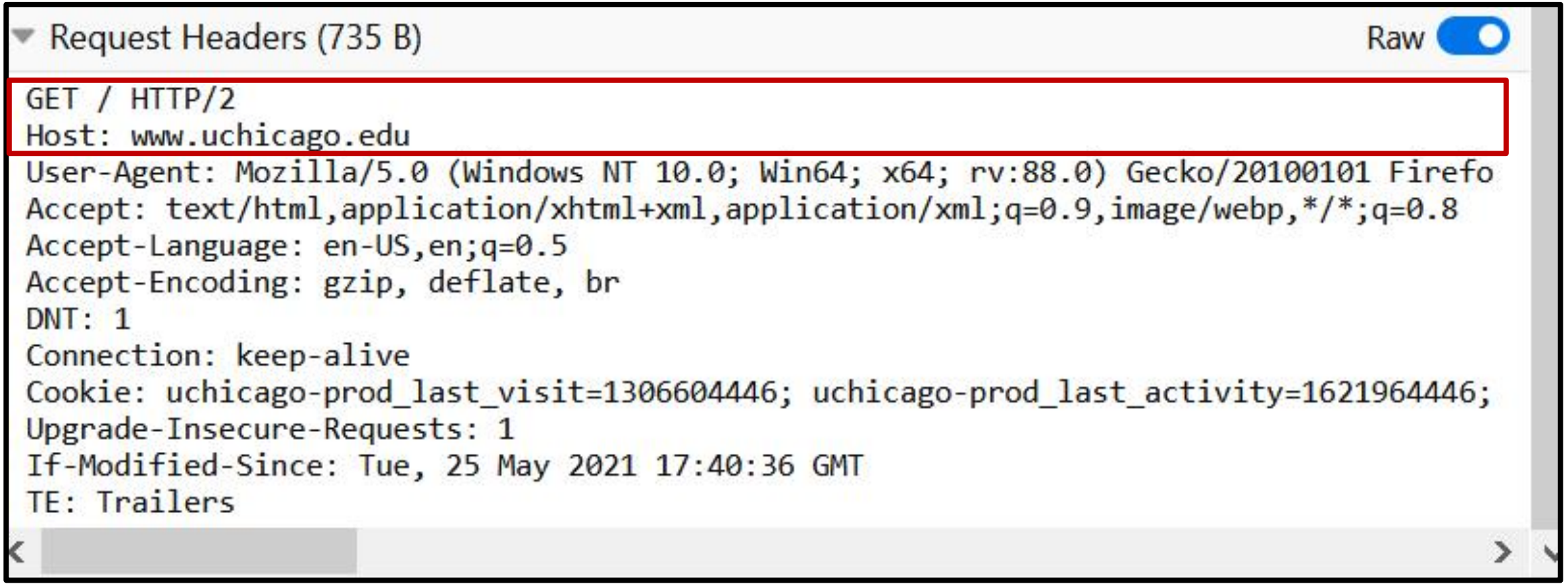


Image taken from https://www.keycdn.com/support/custom-http-headers

HTTP Headers (uchicago.edu)



HTTP Headers (uchicago.edu): **Request**



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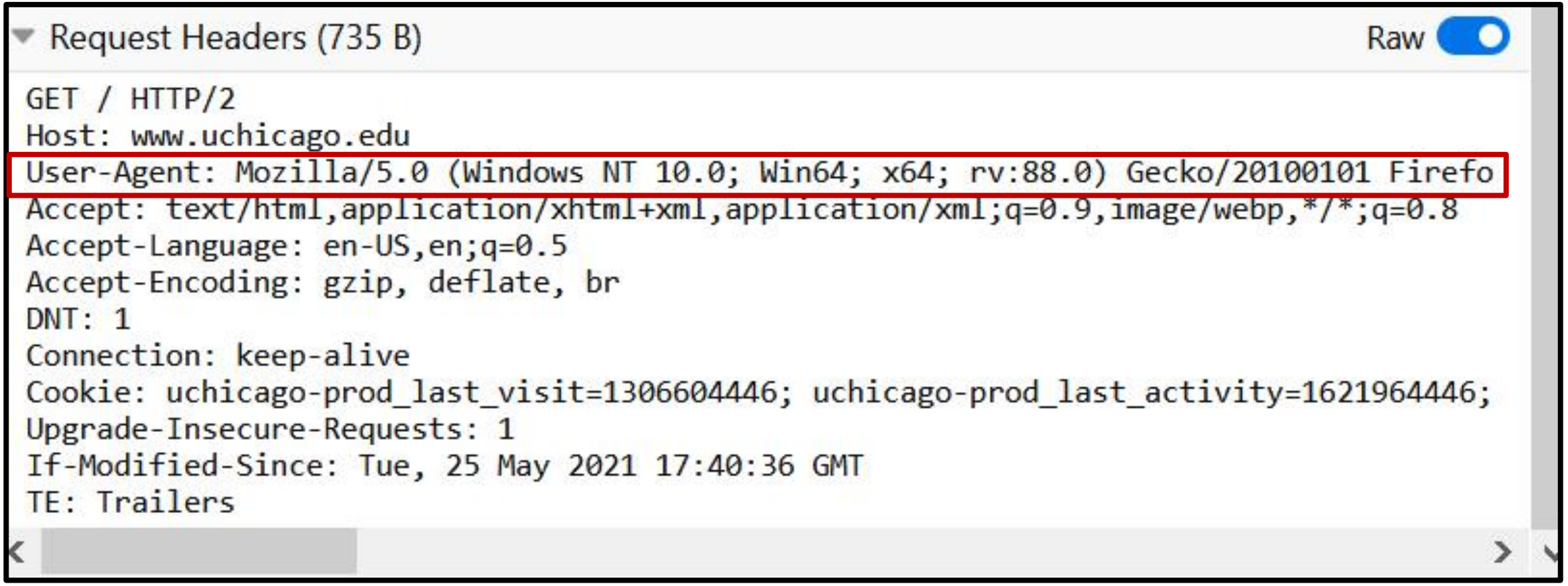

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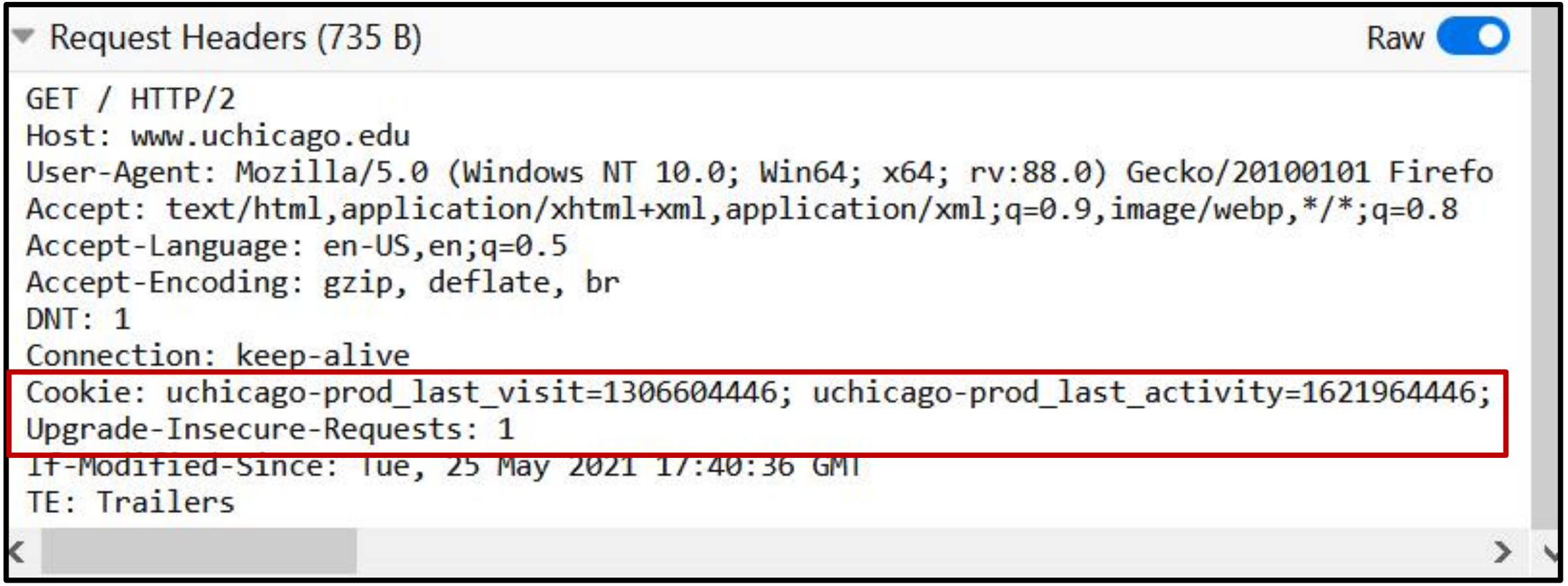

Detail: HTTP Cookies

Image taken from https://networkencyclopedia.com/http-cookie/

HTTP Headers (uchicago.edu): **Response**

Response Headers (1.078 KB) Raw

```
HTTP/2 200 OK
date: Tue, 25 May 2021 18:00:35 GMT
content-type: text/html; charset=UTF-8
server: Apache
x-frame-options: SAMEORIGIN
expires: Mon, 26 Jul 1997 05:00:00 GMT
pragma: no-cache
vary: Accept-Encoding
set-cookie: uchicago-prod_last_visit=1306605629; expires=Wed, 25-May-2022 18:00:29 G
set-cookie: uchicago-prod_last_activity=1621965629; expires=Wed, 25-May-2022 18:00:2
set-cookie: uchicago-prod_tracker=%7B%220%22%3A%22index%22%2C%22token%22%3A%2226944a
set-cookie: uchicago-prod_csrf_token=deleted; expires=Thu, 01-Jan-1970 00:00:01 GMT;
set-cookie: uchicago-prod_csrf_token=86d47d8690aa7646e1628dd095cd5b464db16bd3; expir
last-modified: Tue, 25 May 2021 18:00:29 GMT
content-encoding: gzip
x-varnish: 10696657 9201444
age: 5
via: 1.1 varnish (Varnish/5.2)
accept-ranges: bytes
X-Firefox-Spdy: h2
```

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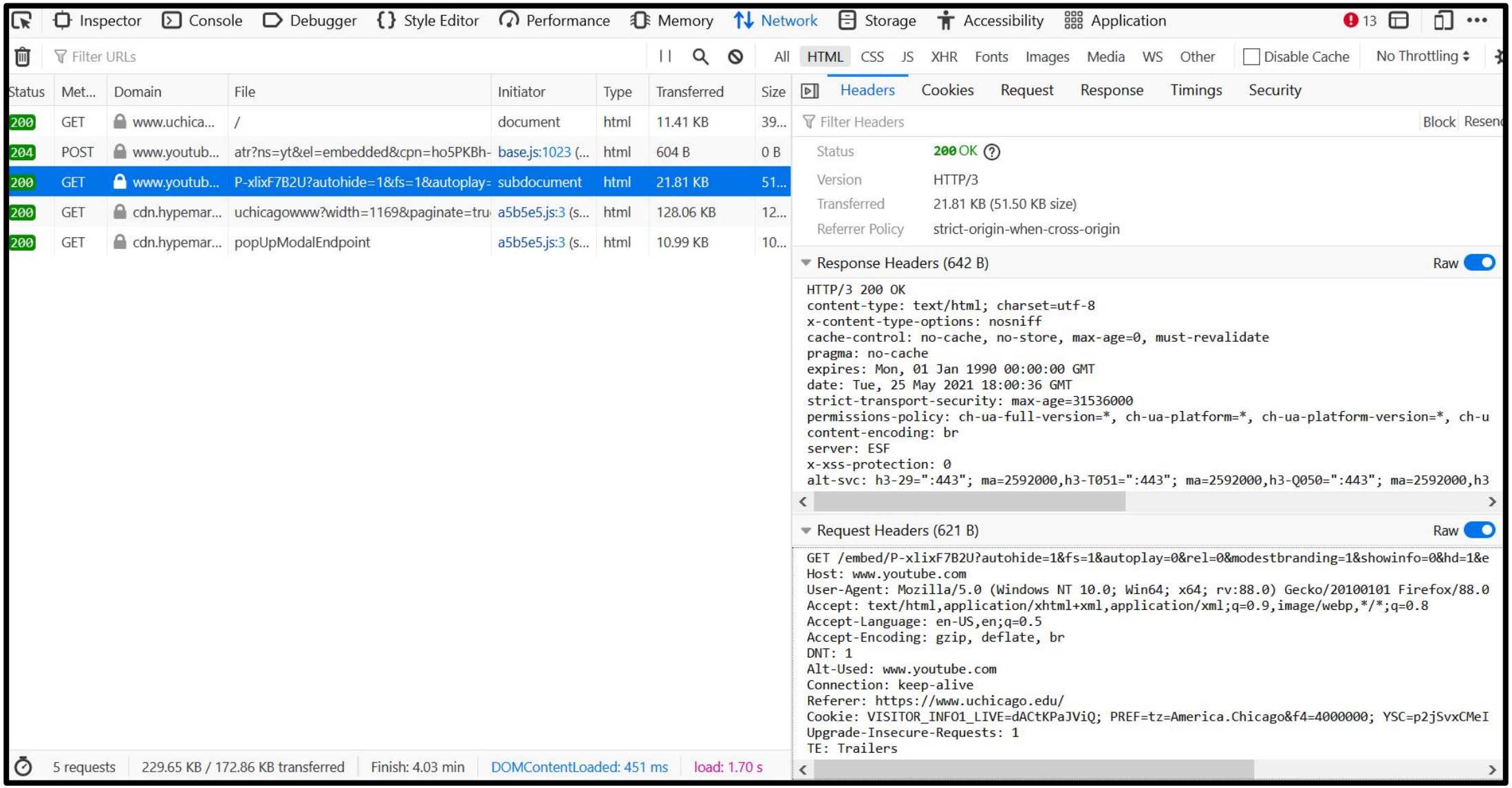
HTTP Headers (uchicago.edu → youtube.com)



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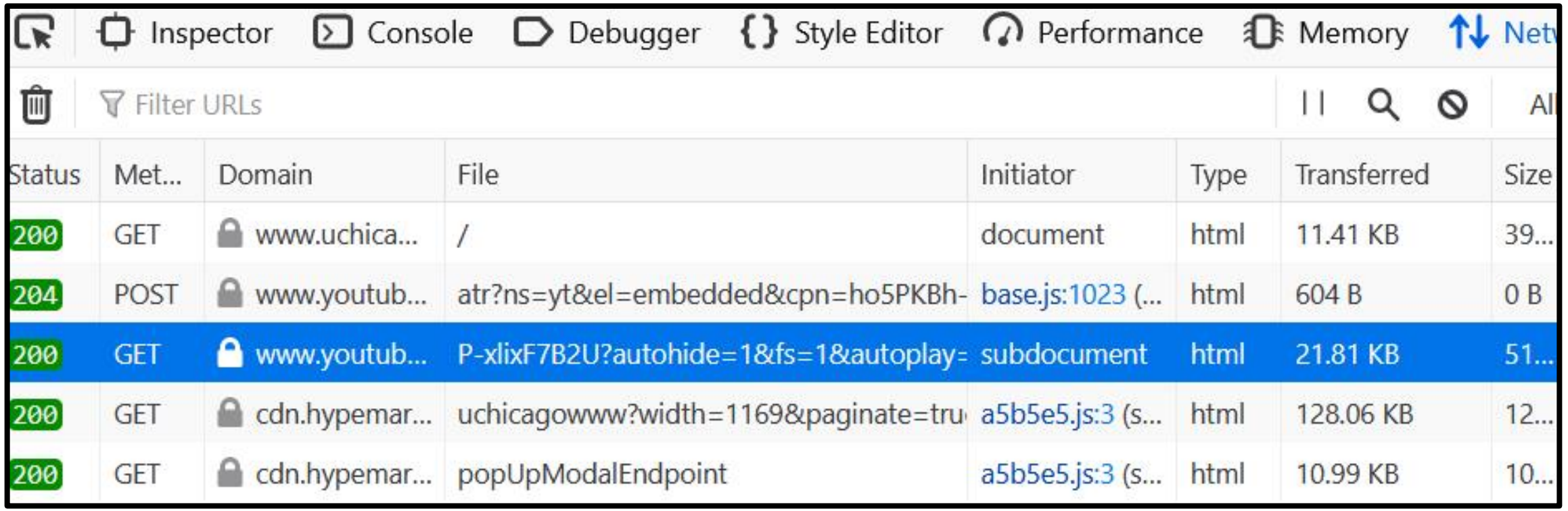
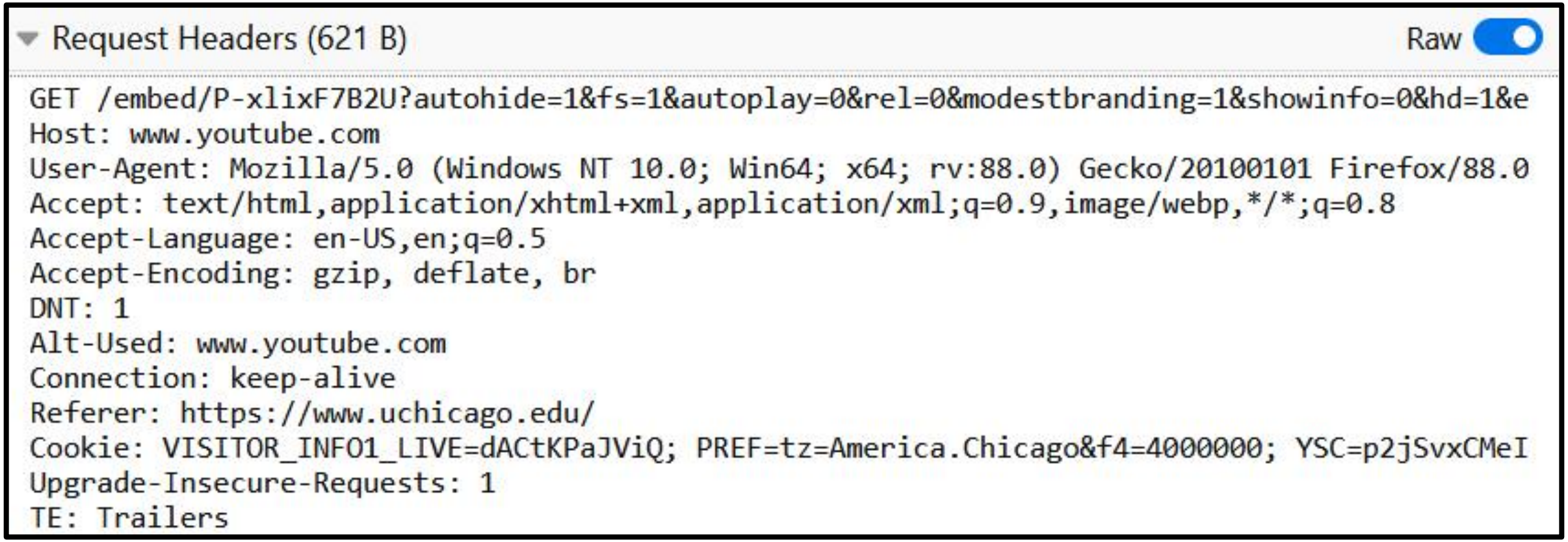


Status	Met...	Domain	File	Initiator	Type	Transferred	Size
200	GET	www.uchica...	/	document	html	11.41 KB	39...
204	POST	www.youtub...	atr?ns=yt&el=embedded&cpn=ho5PKBh-	base.js:1023 (...	html	604 B	0 B
200	GET	www.youtub...	P-xlixF7B2U?autohide=1&fs=1&autoplay=	subdocument	html	21.81 KB	51...
200	GET	cdn.hypemar...	uchicagowww?width=1169&paginate=tru	a5b5e5.js:3 (s...	html	128.06 KB	12...
200	GET	cdn.hypemar...	popUpModalEndpoint	a5b5e5.js:3 (s...	html	10.99 KB	10...

HTTP Headers (uchicago.edu → youtube.com)



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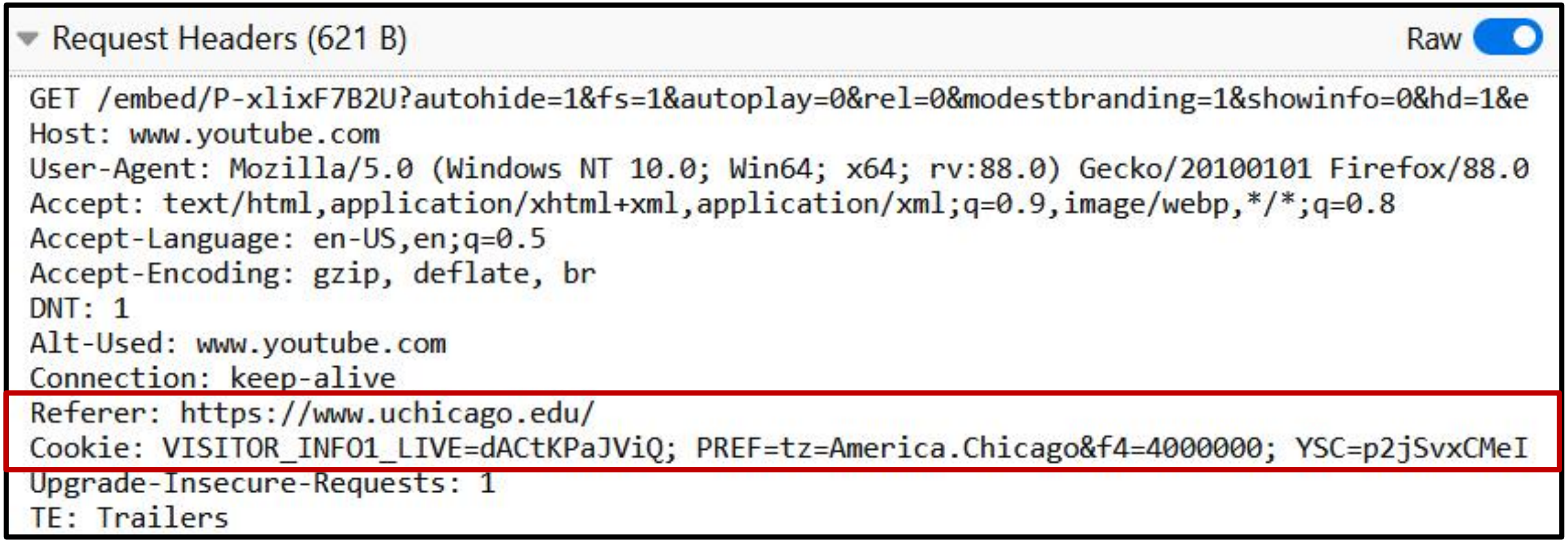
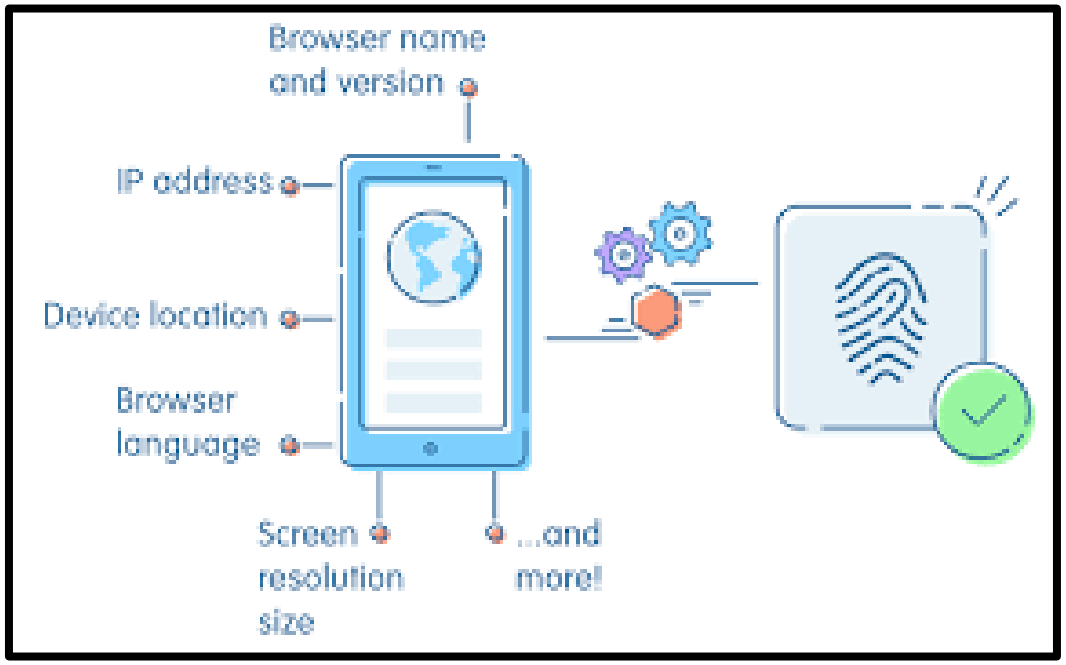


Mechanics of Tracking (Fingerprinting Version)

Browser Fingerprinting

- Use features of the browser that are relatively unique to your machine
  - Fonts
  - GPU model anti-aliasing (Canvas fingerprinting)
  - User-agent string
  - *(Often not)* IP address *(Why not?)*



See Fingerprinting Happening

The Ecosystem Underlying Targeted Ads

Ad Bidding Marketplaces

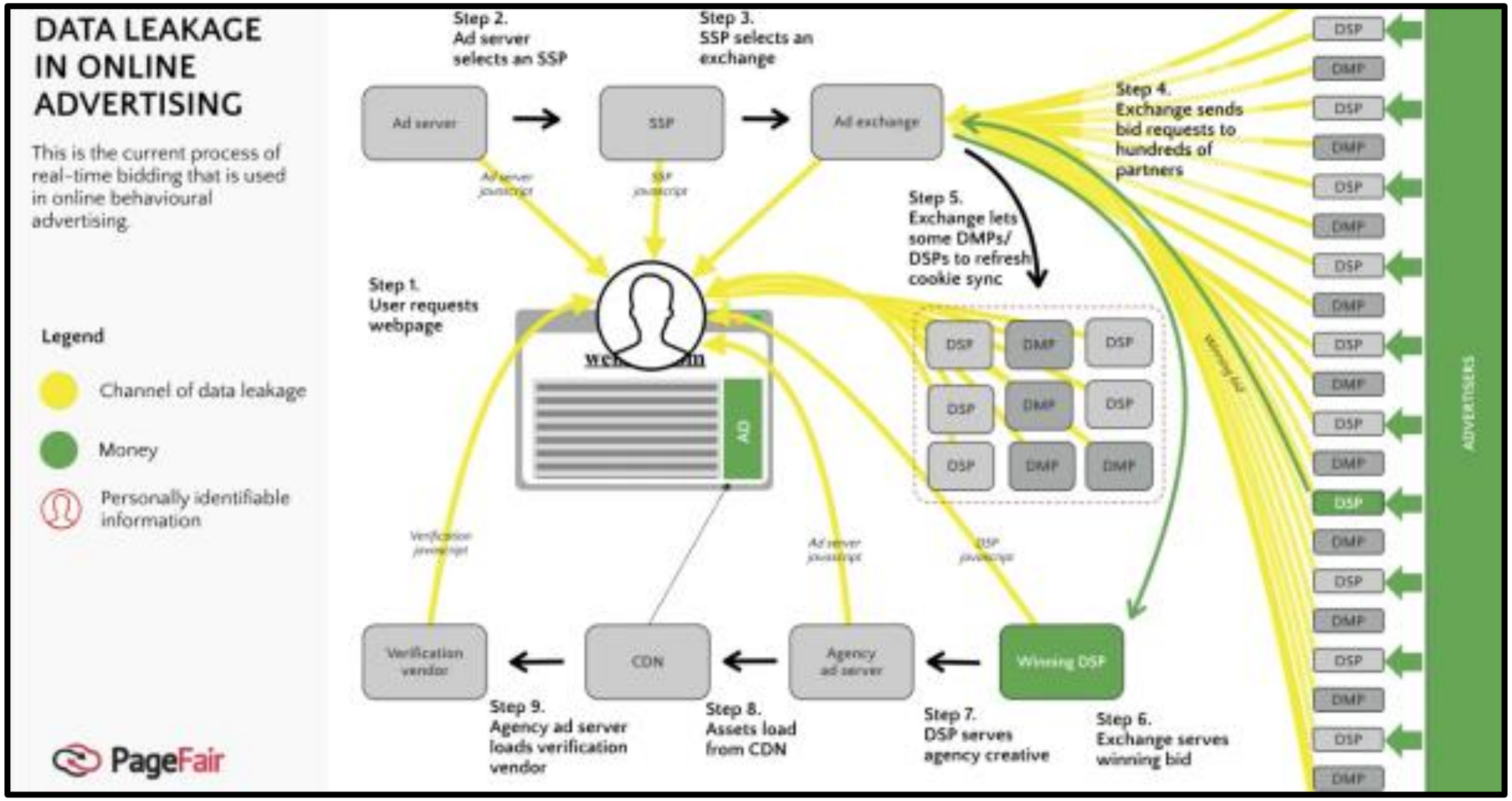
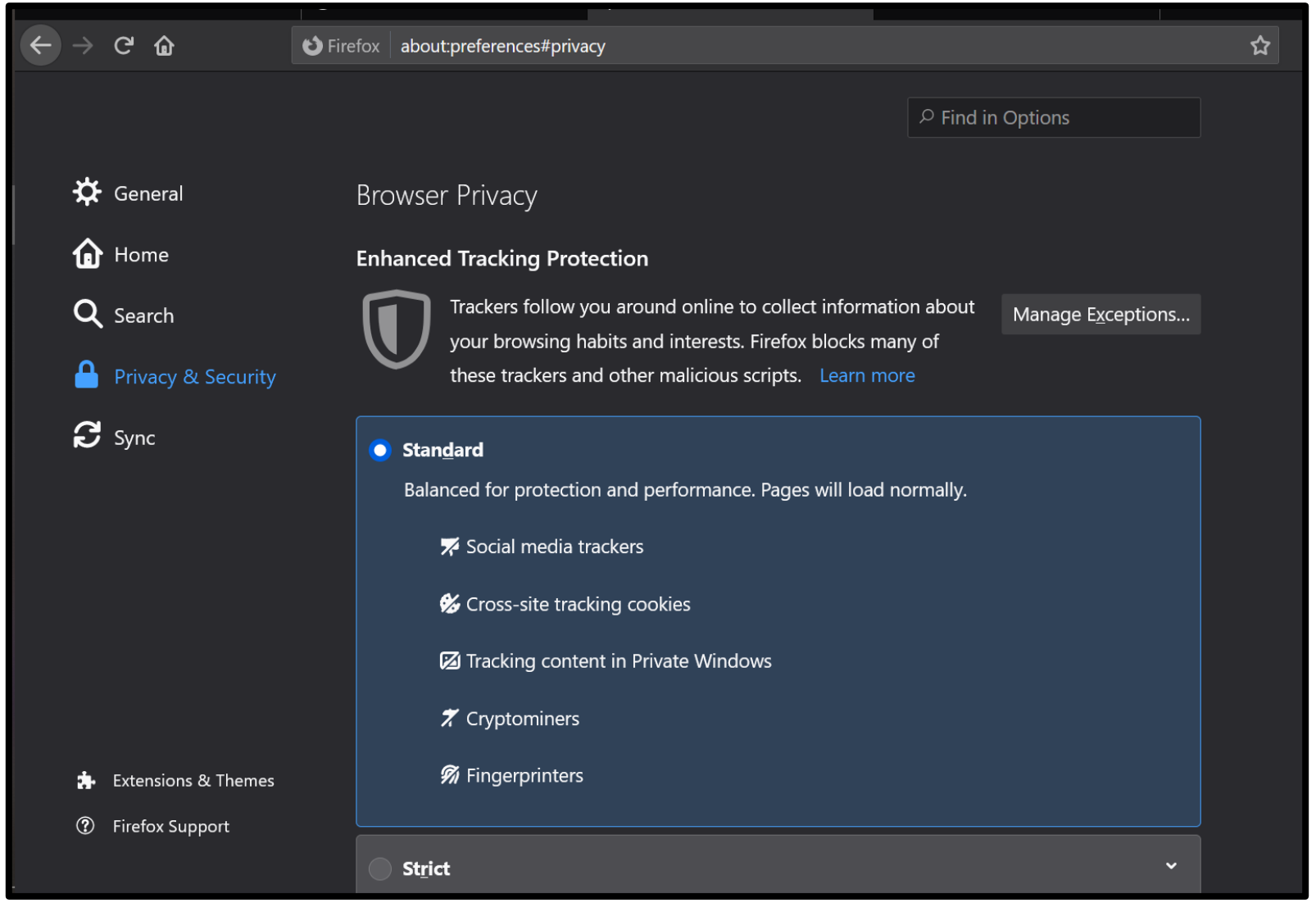


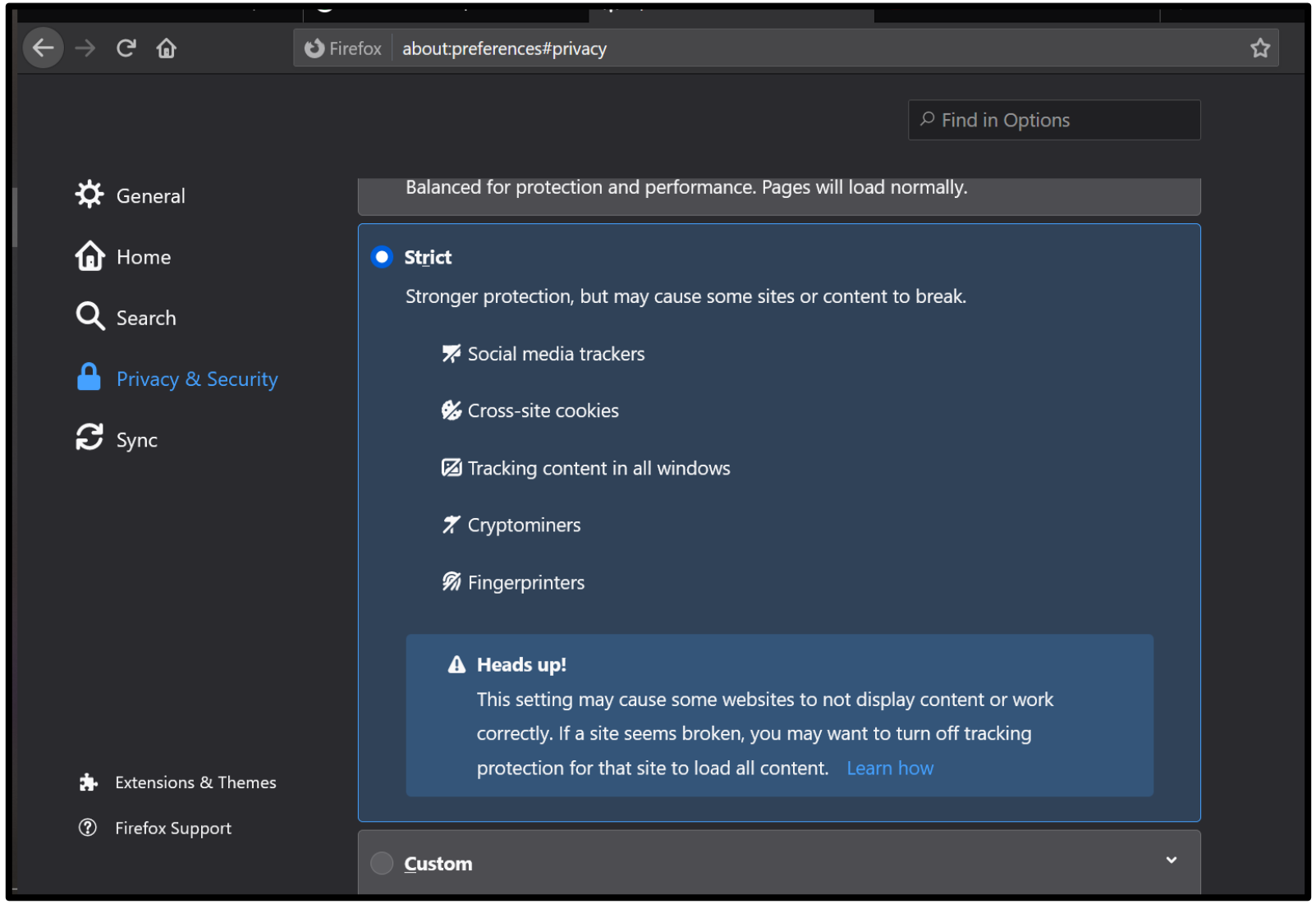
Image taken from https://vimeo.com/219820643

Anti-Tracking Mechanisms

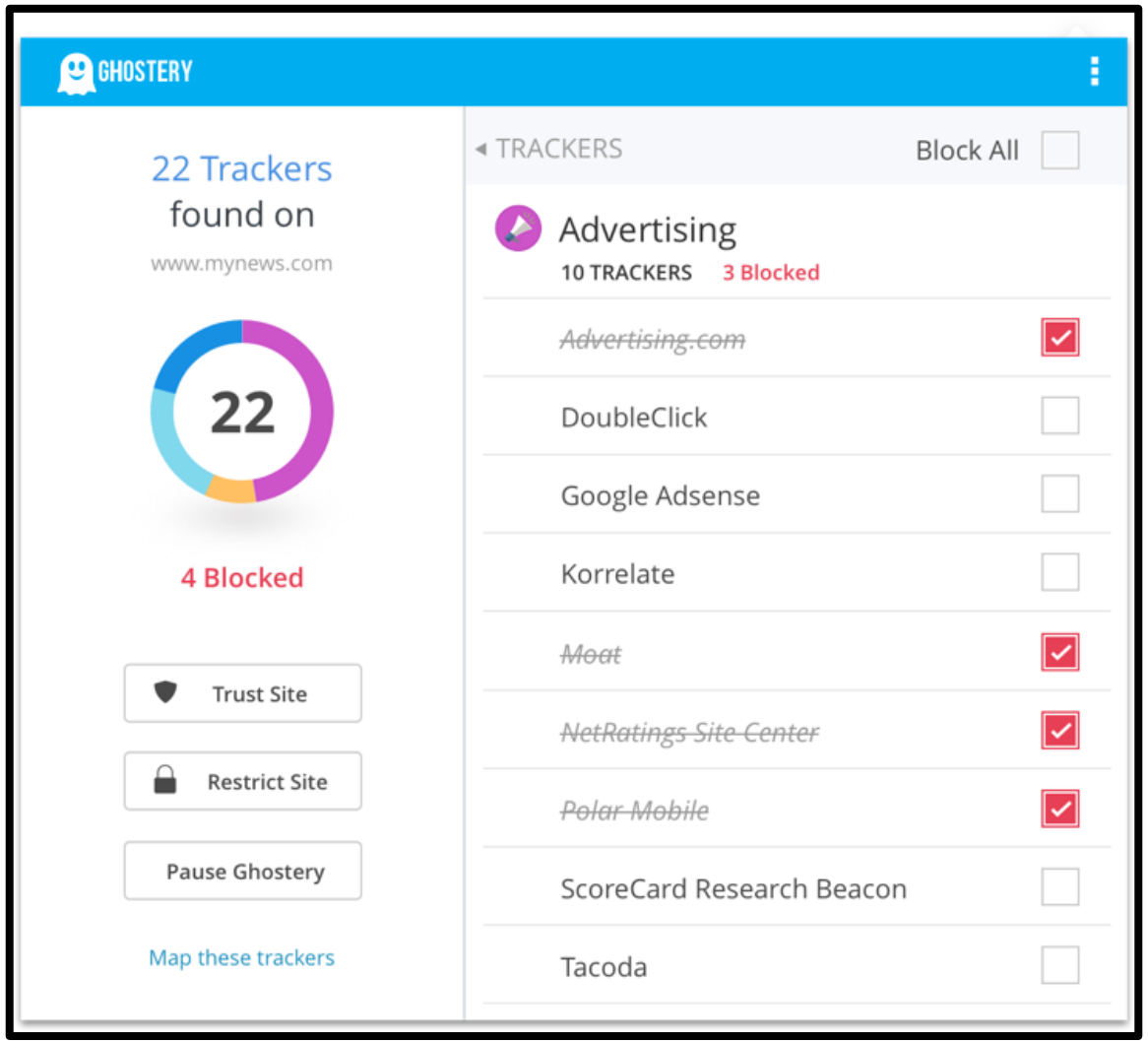
Firefox Browser (New-ish) Default Settings



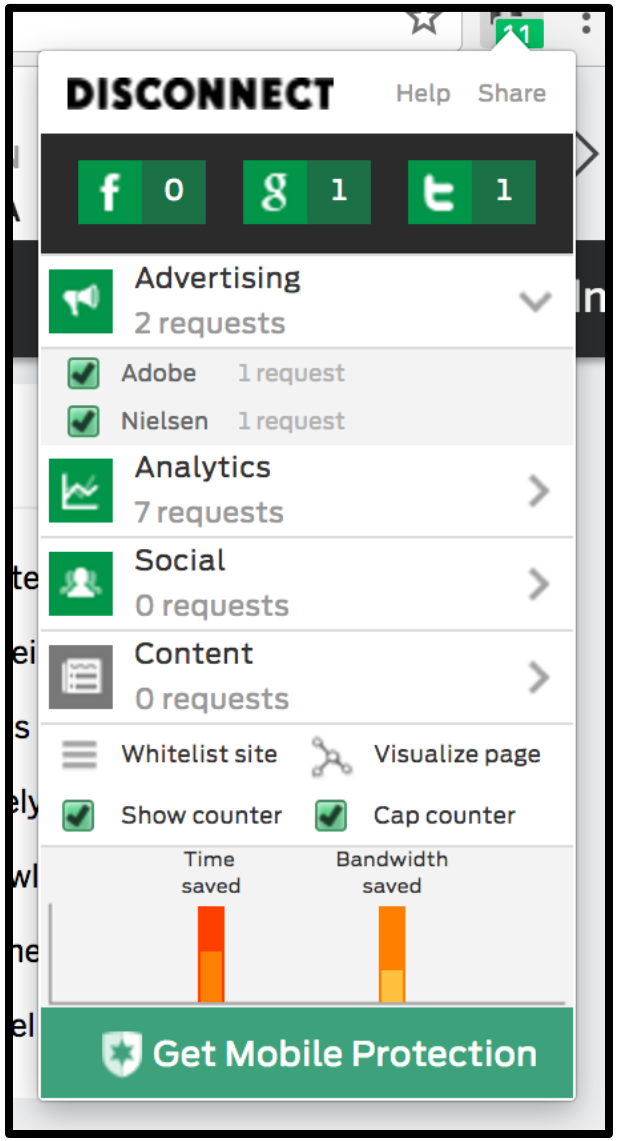
Firefox Browser Strict Settings

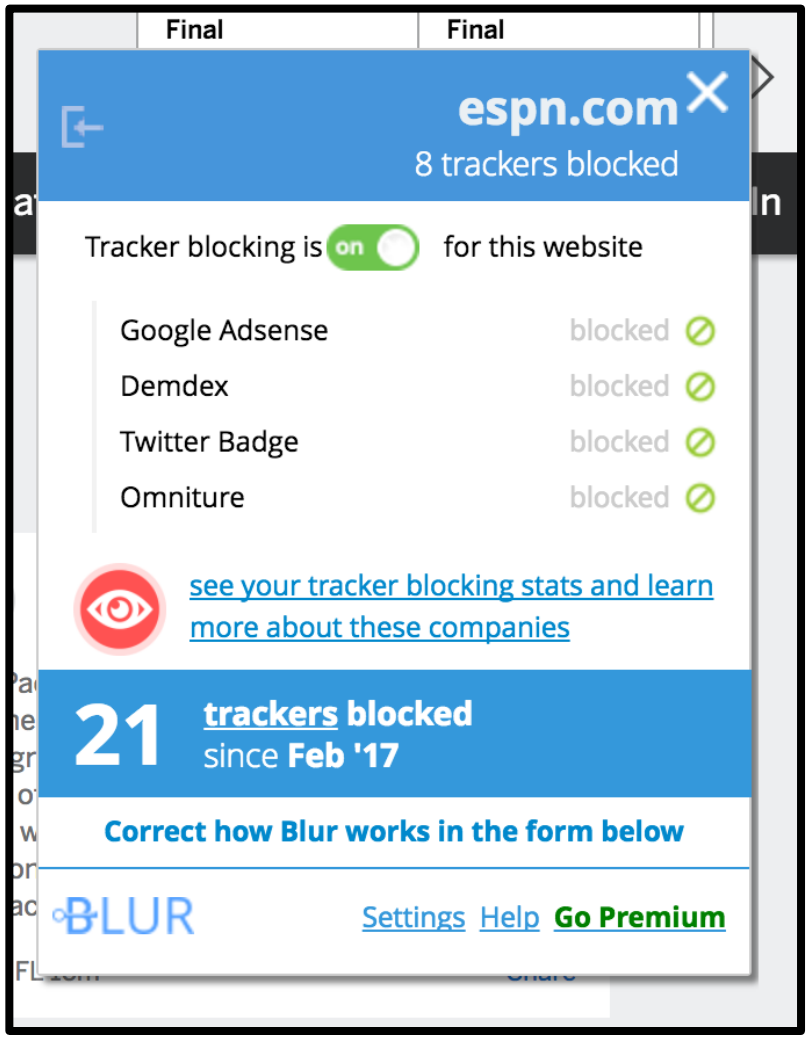


Ghostery

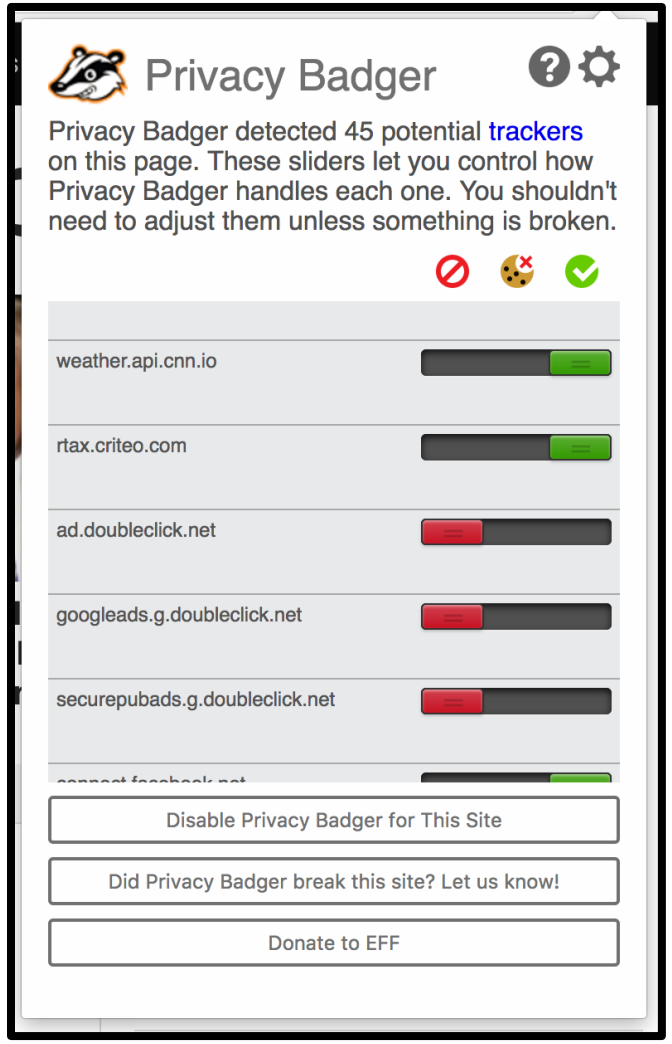

GHOSTERY
22 Trackers
found on
www.mynews.com
22
4 Blocked
Trust Site
Restrict Site
Pause Ghostery
Map these trackers
TRACKERS
Block All
Advertising
10 TRACKERS
3 Blocked
Advertising.com
DoubleClick
Google Adsense
Korrelate
Moat
NetRatings Site Center
Polar Mobile
ScoreCard Research Beacon
Tacoda

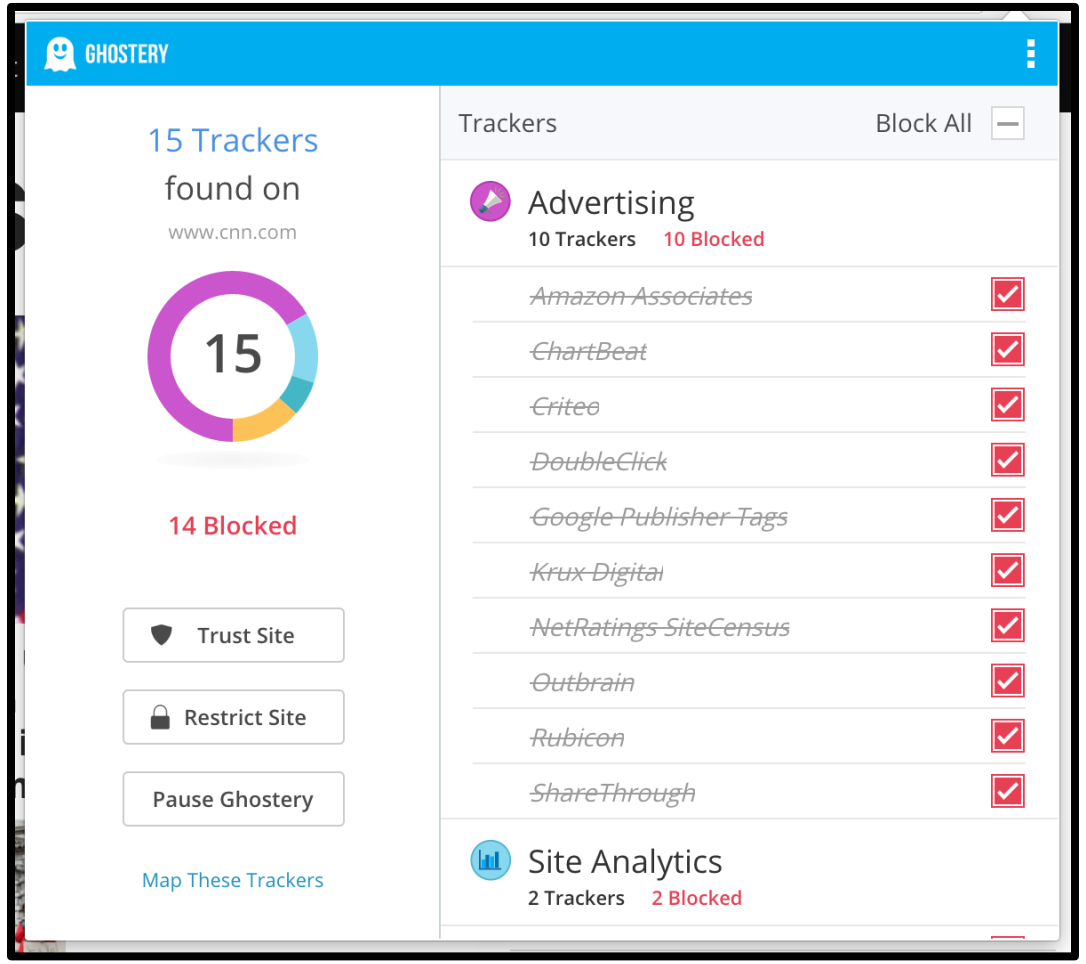
Existing Privacy Tools





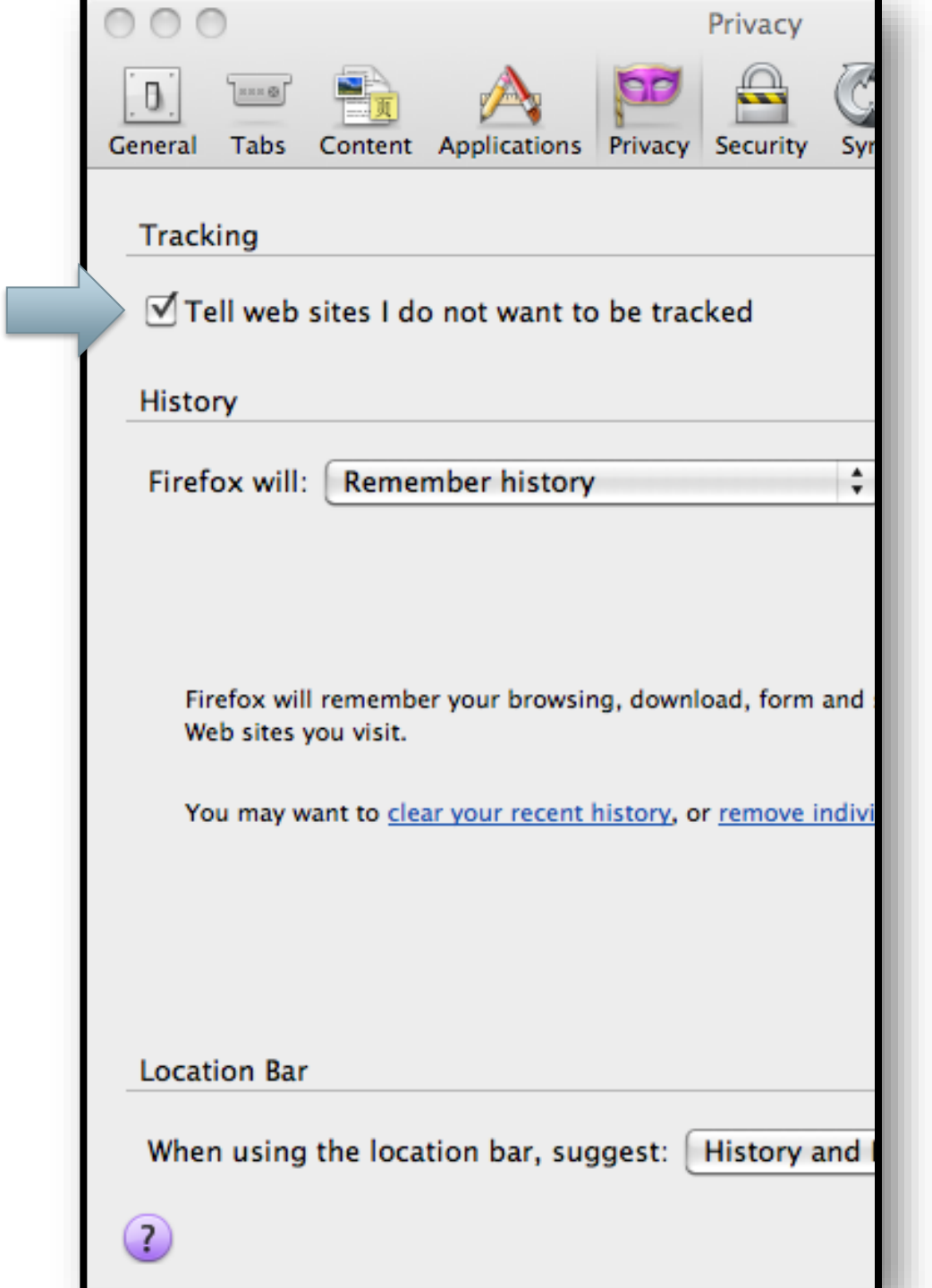
Existing Privacy Tools



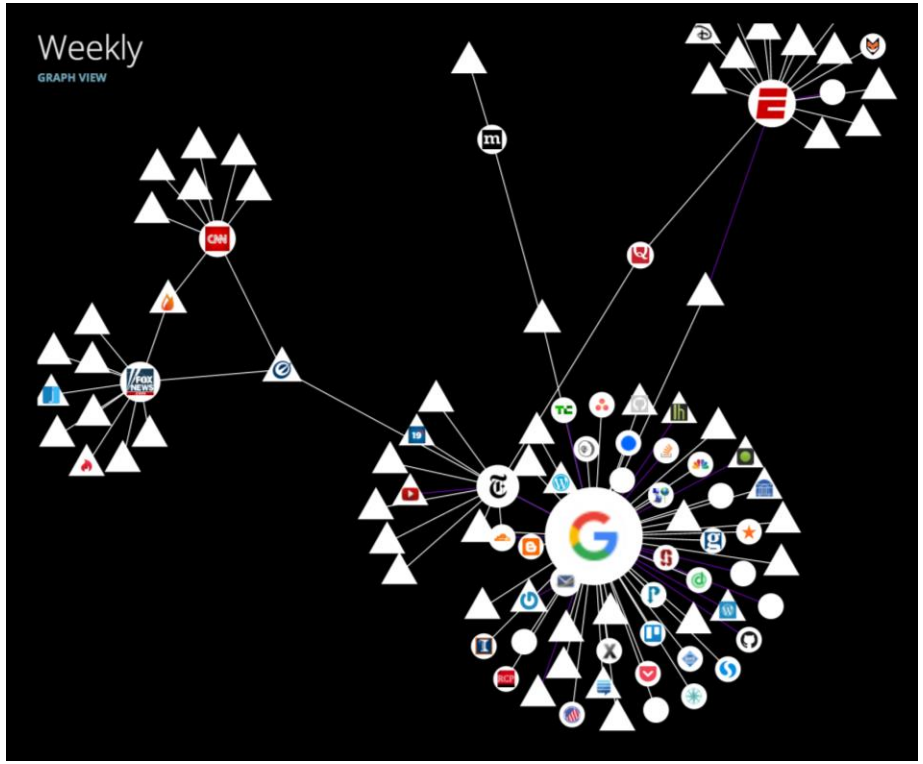


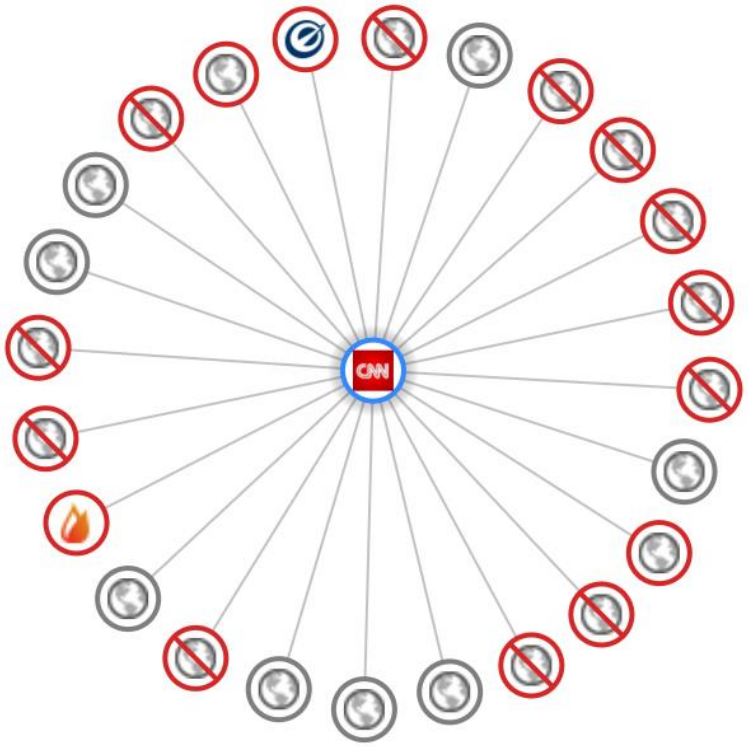
Do not track

- W3C standard
- User checks a box
- Browser sends a “do not track” header to website
- Website stops “tracking”
- W3C working group tried to define what “stopping tracking” meant



Visualization: Connection Graphs

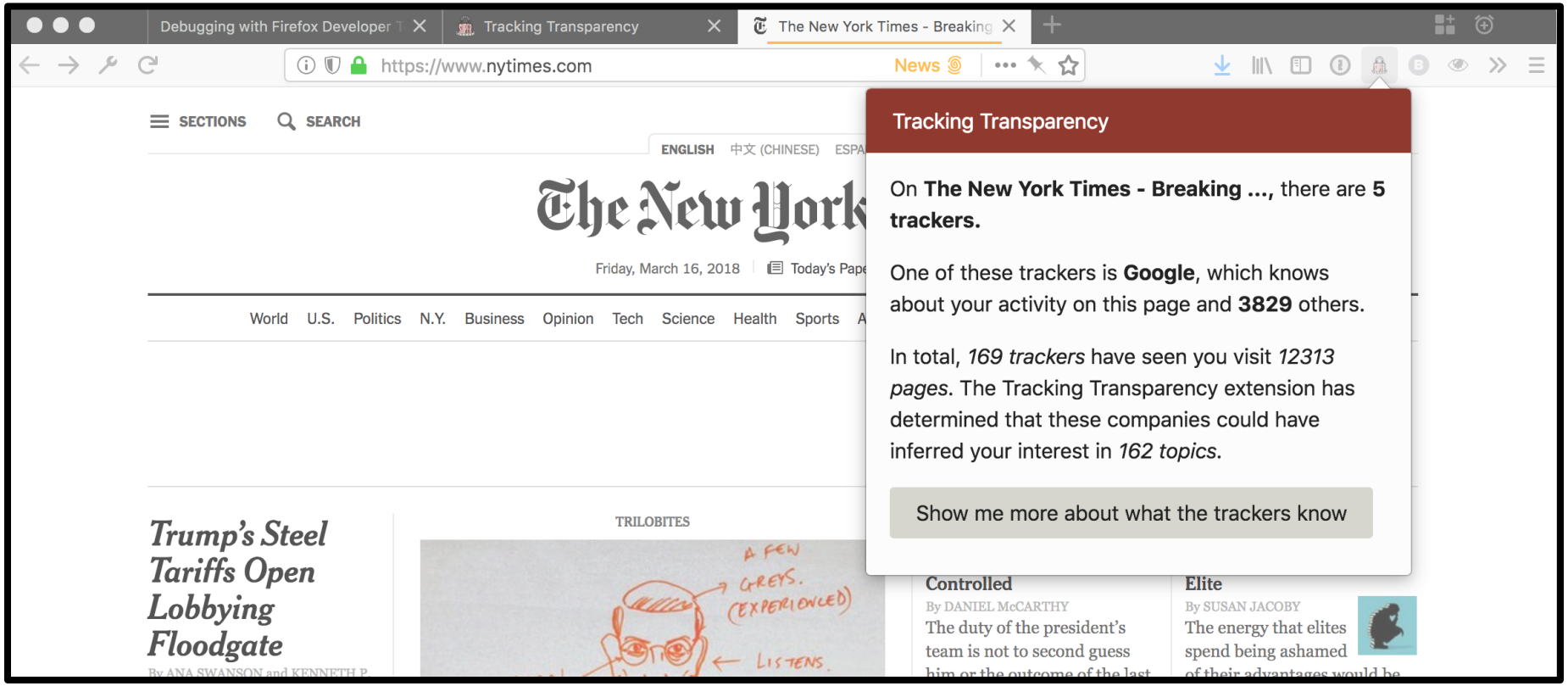




Tools to stop tracking, effective?

- Browser privacy settings
  - Cookie blocking
  - P3P
  - Tracking Protection Lists
  - Do Not Track
- Browser add-ons
- Opt-out cookies
- Digital Advertising Alliance (DAA) AdChoices icon and associated opt-out pages

(Our Group's) Tracking Transparency



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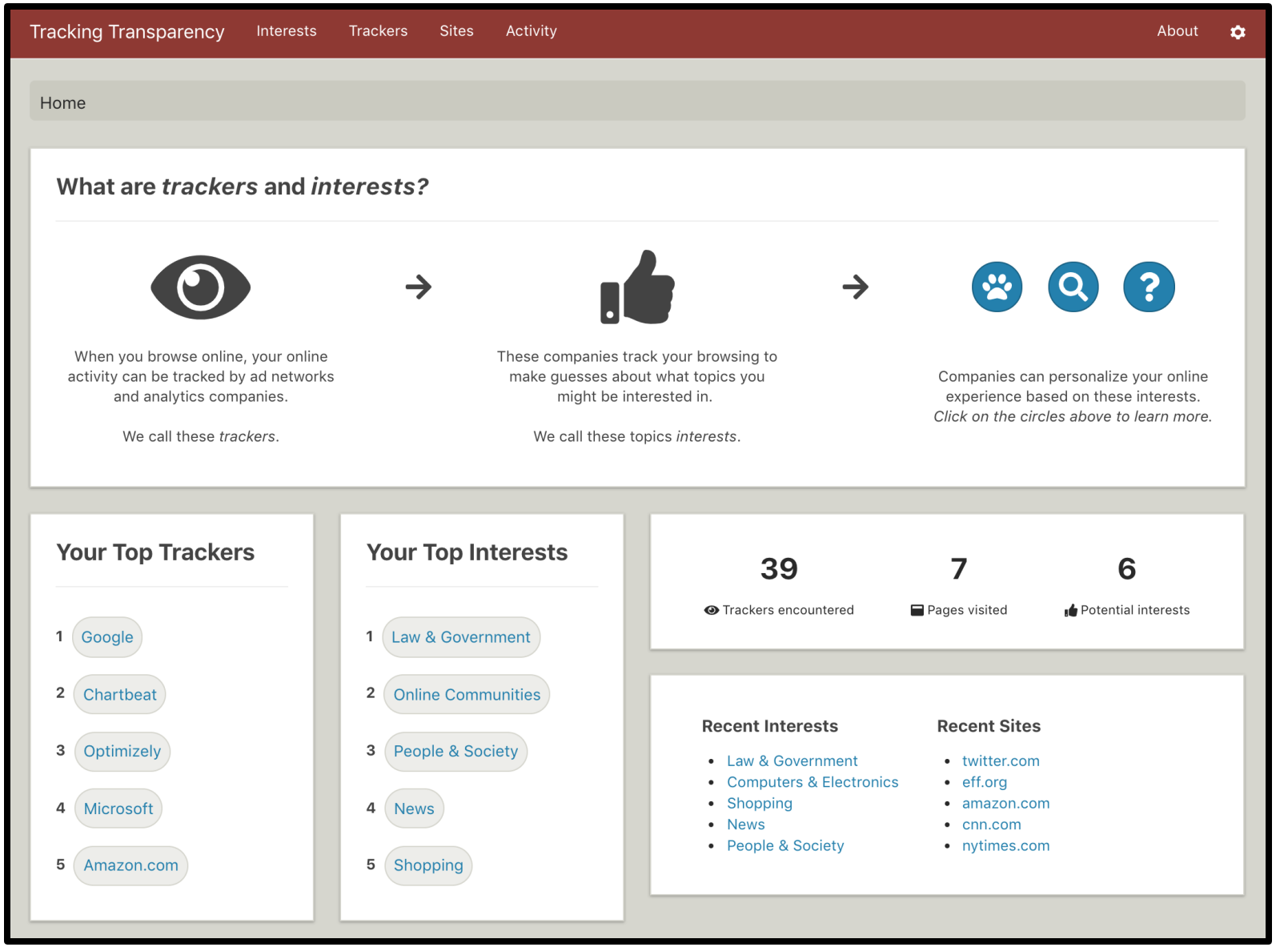

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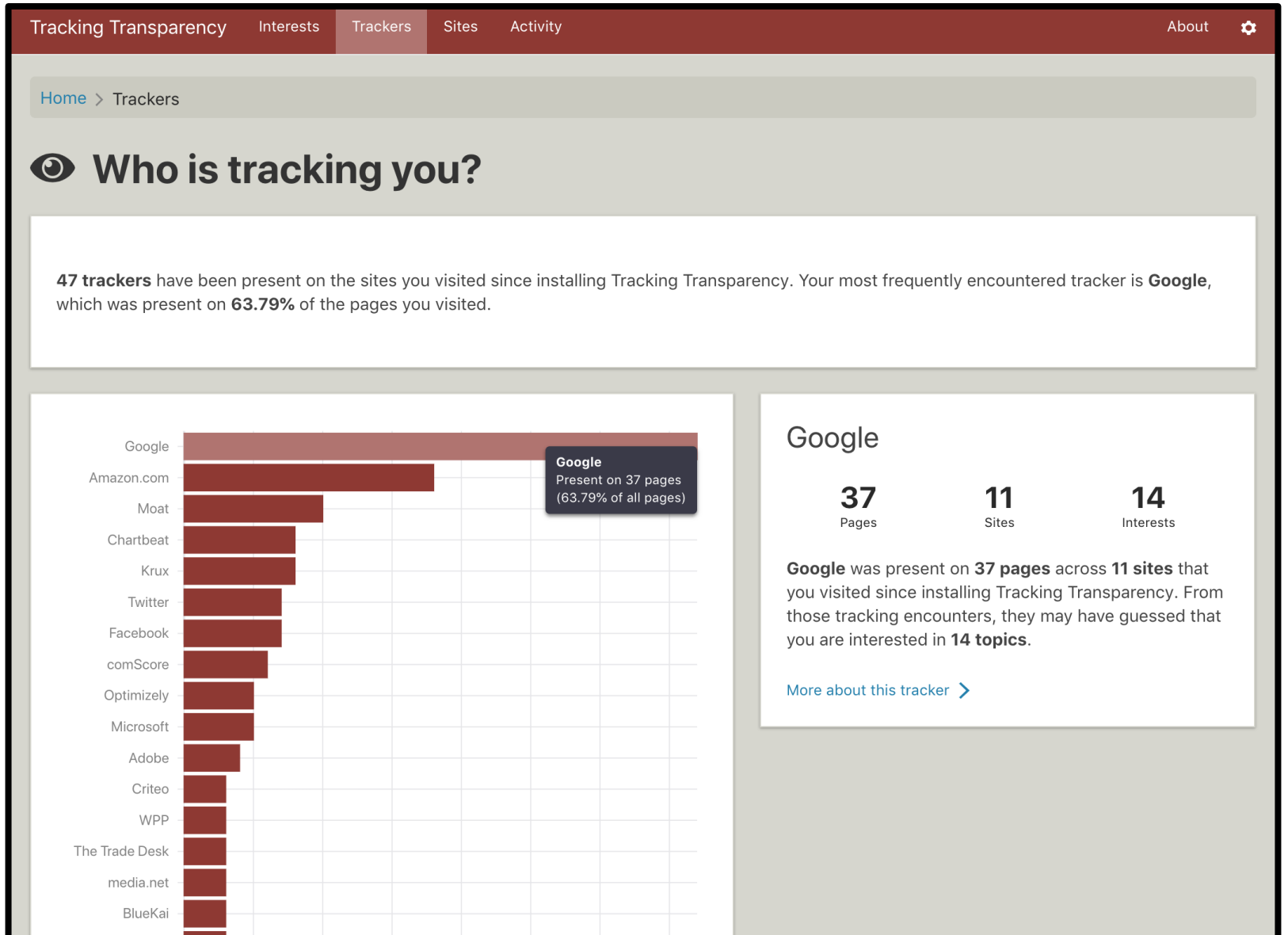

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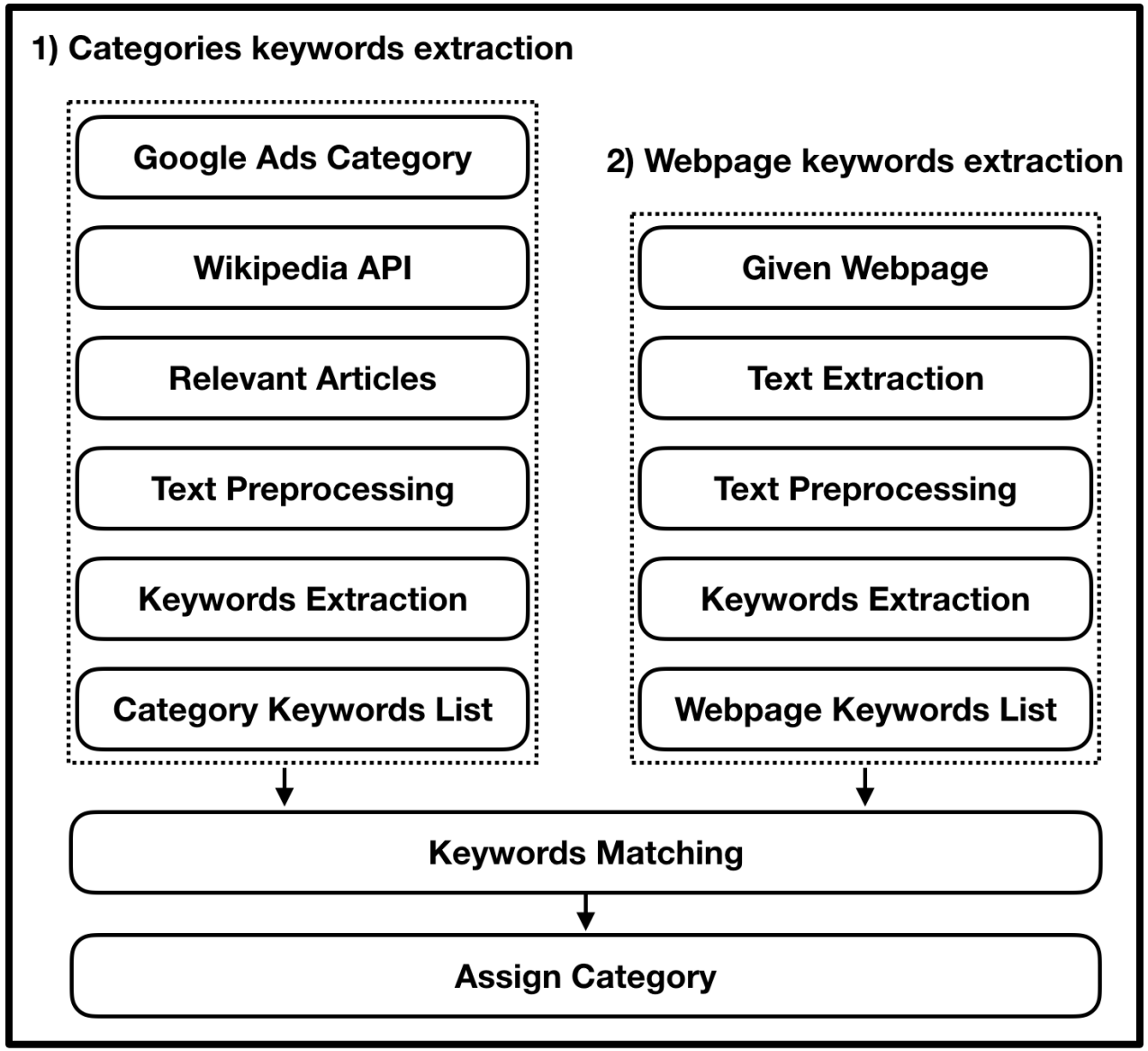
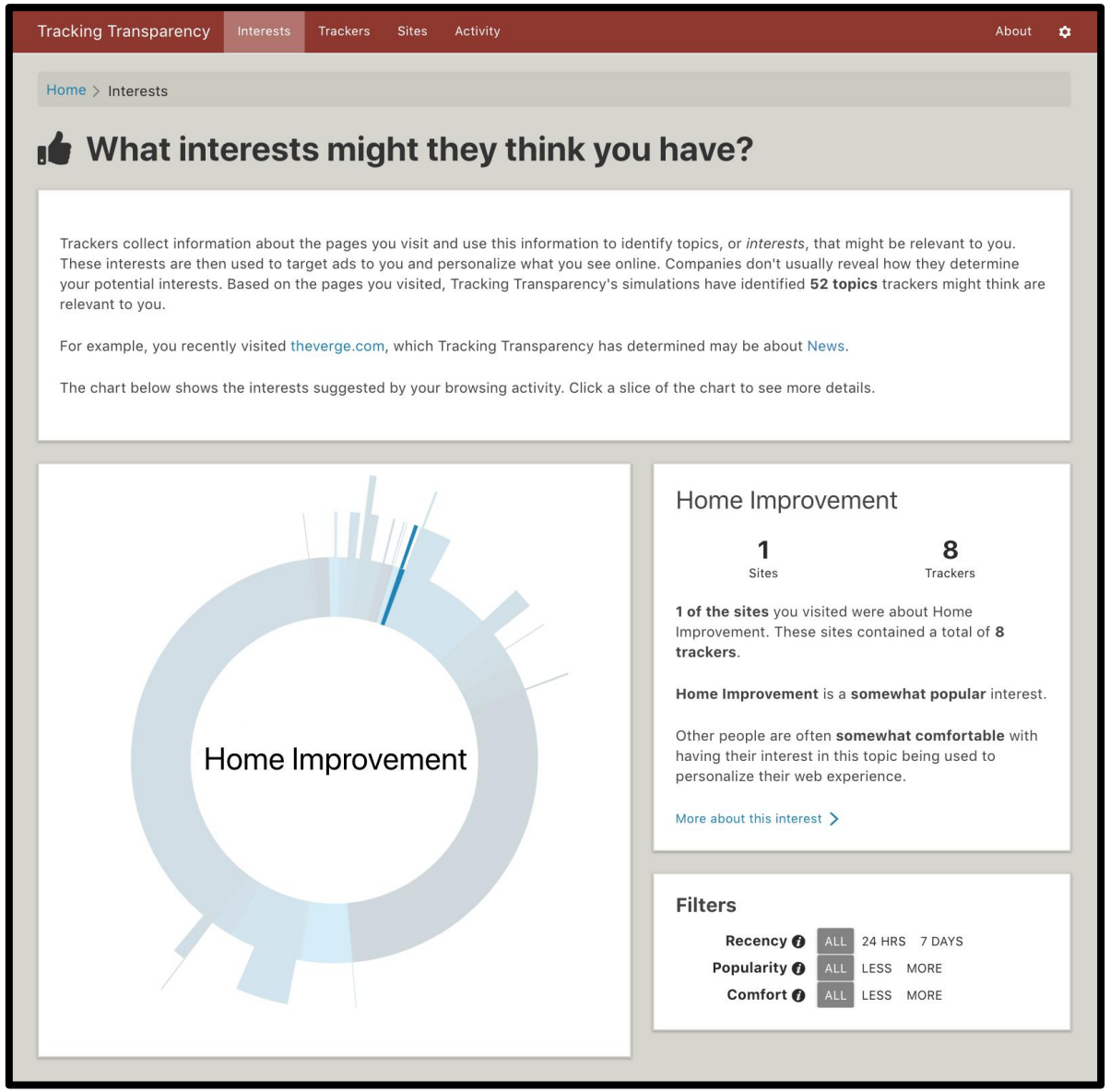


(Our Group's) Tracking Transparency



Mozilla Firefox Protections Dashboard