



An Overview of the History, Laws, and Technology Behind Opt-out Preference Signals

California Privacy Protection Agency

Informational Session

TOPICS & SPEAKERS

- I. **Background & Development of the Global Privacy Control**
Sebastian Zimmeck
- II. **Pseudonymous Profiles in the Ad-tech Ecosystem**
Daniel Goldberg
- III. **Timing Issues Associated with Opt-out Preference Signals**
Christo Wilson
- IV. **California Attorney General's Enforcement Work**
Stacey Schesser

BACKGROUND & DEVELOPMENT OF THE GLOBAL PRIVACY CONTROL

Sebastian Zimmeck

Sebastian Zimmeck
Associate Professor of Computer Science, Wesleyan University

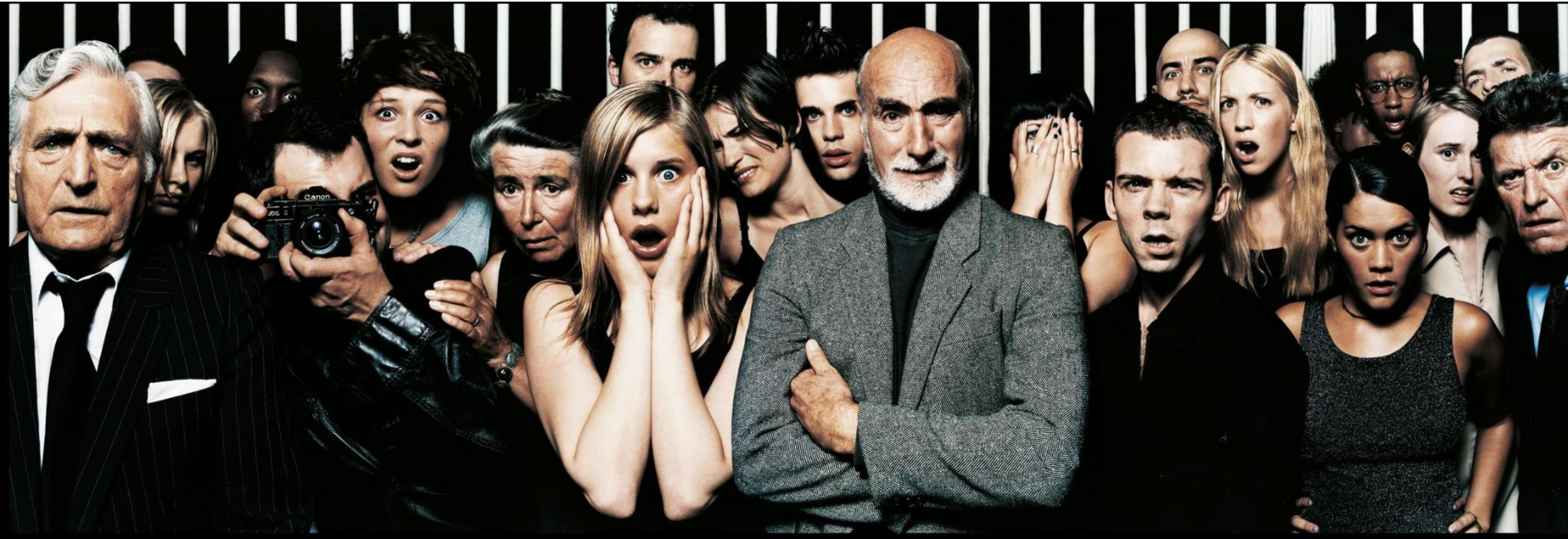
Background and Development of Global Privacy Control

What It Is, How It Works, and How It Has Evolved

CalPrivacy Board Hearing
An Overview of the History, Laws, and Technology Behind Opt-out Preference Signals

August 6, 2026

We have a problem with ...



Cassius 1999 / Rankin'. DR, <http://www.metamusique.fr/2015/03/hubert-boombass-confie-ses-cassius-cles.html>

... opting out!

Configure your Privacy Controls and Cookie Solution

GDPR ?

Manual configuration

Not configured according to the legal requirements across Europe

Applied to all users

EDIT

LGPD

The Lei Geral de Proteção de Dados Pessoais (LGPD) is the Brazilian data protection law aimed at enhancing Brazilian users' privacy rights. If LGPD is applicable to you — because you carry out operations in Brazil (for example, because your company is based in Brazil or you use servers based in the Brazilian territory), you target users in Brazil or you process personal data of an individual that was located in Brazil at the time of collection — you must comply with its requirements.

**Switzerland**

If LGPD or GDPR legislations are applied globally, they will override the Swiss data protection framework. Therefore, a consent-based approach (i.e., trackers are not placed until the user has given consent) rather than an opt-out approach will apply.

**US State Laws**

This option will help you comply with some privacy laws across the United States (currently the CCPA/CPRA, VCDPA, CPA, CTDPa and UCPA for California, Virginia, Colorado, Connecticut and Utah respectively). If you target users residing in the US, you may be required to comply with the privacy laws of the relevant US state.

Complete the configuration

Privacy Notice

We and our 1255 technology partners ask you to consent to the use of cookies to store and access personal data on your device. This can include the use of unique identifiers and information about your browsing patterns to create the best possible user experience on this website. The following description outlines how your data may be used by us, or by our partners.

Some of our [partners](#) process personal data on the basis of legitimate interest. You can object to such processing at any time. Please click “Options” below to view our list of partners and the purposes for which consent is required.

You don't have to consent in order to view the information on this site, but if you don't consent, some personalization of content and advertising won't be available. Your choices on this site will be applied only to this site. You can change your settings at any time by using the link at the bottom of the page to reopen the Privacy Preferences and managing the setting.

You can view our [privacy policy](#) for more information.

Store and/or access information on a device

Personalised advertising and content, advertising and content measurement, audience research and services development

Google Analytics Storage

Options

Reject All

Accept All

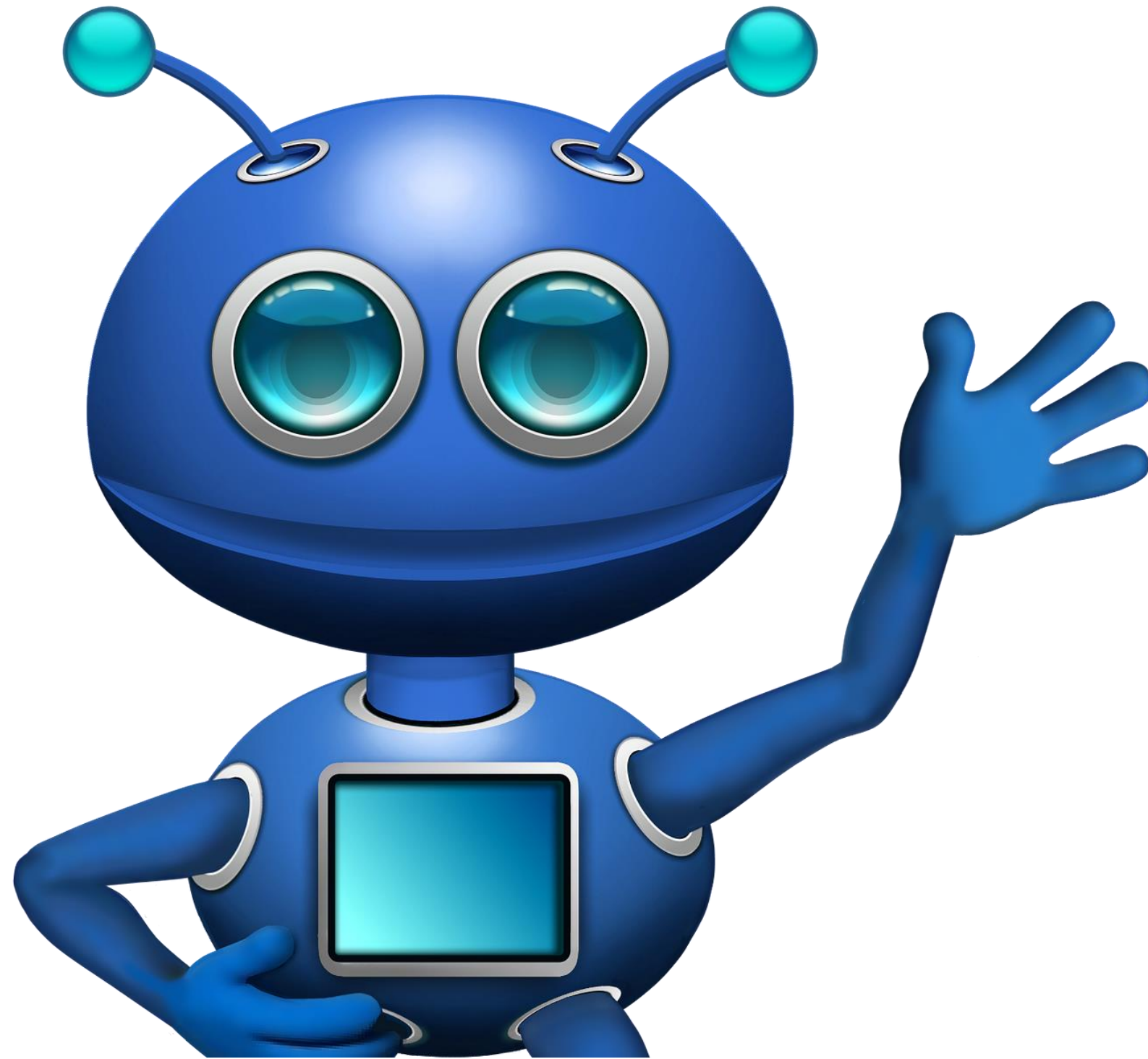
Take control of your privacy.

Online privacy should be accessible to everyone. It starts with a simpler way to exercise your rights.

GET STARTED

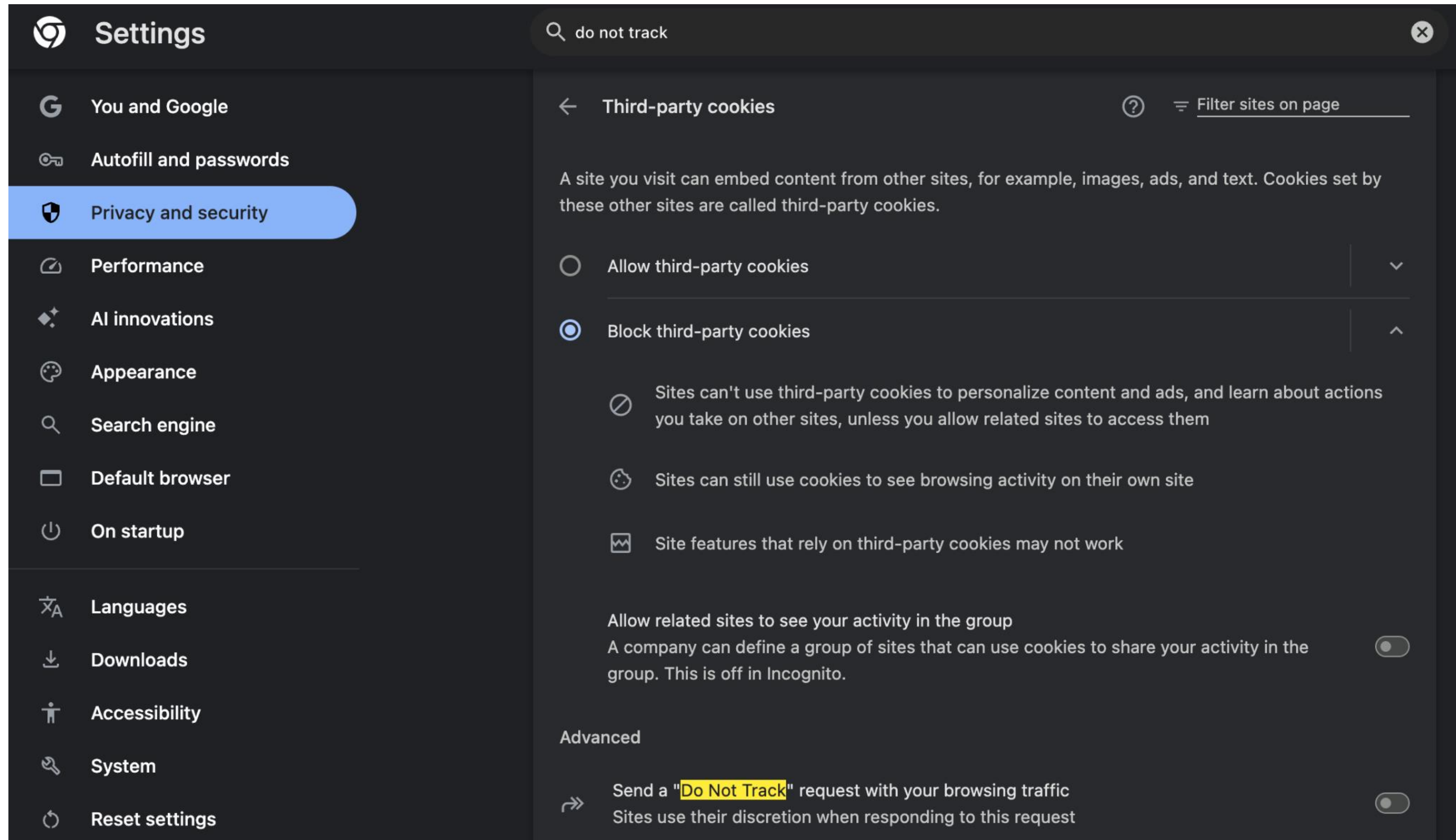
GET INVOLVED





- GPC is Like a Little Robot Pushing the Opt out Button When You Visit a Website
- Opt Out for All Sites or Some
- For Web, Mobile Apps, ...

Wait a minute, don't browsers have Do Not Track already?



The California Online Privacy Protection Act (CalOPPA)

22575 (a) An operator of a commercial Web site or online service that collects personally identifiable information through the Internet about individual consumers residing in California who use or visit its commercial Web site or online service shall conspicuously post its privacy policy on its Web site ...

(b) The privacy policy required by subdivision (a) shall do all of the following: ...

(5) Disclose how the operator responds to Web browser “do not track” signals or other mechanisms that provide consumers the ability to exercise choice regarding the collection of personally identifiable information about an individual consumer’s online activities over time and across third-party Web sites or online services, if the operator engages in that collection.

Standardizing Global Privacy Control (GPC) #10

✓ Closed



SebastianZimmeck opened on Apr 6, 2020

Last edited by SebastianZimmeck ▾

Member



Background

On January 1, 2020 the [California Consumer Privacy Act \(CCPA\)](#) went into effect and established new privacy rights for California consumers. Specifically, it covers the rights to:

1. Opt out from the sale of personal information (Do-Not-Sell),
2. Access personal information, and
3. Delete personal personal information.

A "sale" is understood broadly and likely covers, for example, a website making available or disclosing identifiers or location data to an ad network for purposes of monetization. The [most recent regulations to the CCPA](#) published by the California Attorney General specify that automatic signals communicating a user's decision to opt out must be respected. Here is the relevant language:

If a business collects personal information from consumers online, the business shall treat user-enabled global privacy controls, such as a browser plugin or privacy setting, device setting, or other mechanism, that communicate or signal the consumer's choice to opt-out of the sale of their personal information as a valid request

The CCPA appears to be a catalyst for implementing new privacy functionality in browsers and other clients. Other states beyond

<https://github.com/privacycg/proposals/issues/10>



Simple Search

Advanced Search

Popular Searches

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Award Details

Awards



- Search Awards
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- About Awards
- How to Manage Your Award
- Grant General Conditions
- Cooperative Agreement Conditions
- Special Conditions

Award Abstract # 2055196
SaTC: CORE: Small: Improving Internet Privacy with Global Privacy Control

NSF Org:	CNS Division Of Computer and Network Systems
Recipient:	WESLEYAN UNIVERSITY
Initial Amendment Date:	January 12, 2021
Latest Amendment Date:	May 21, 2021
Award Number:	2055196
Award Instrument:	Standard Grant
Program Manager:	Jason D. Borenstein jborenst@nsf.gov (703)292-4207



Archive – Attorney General Becerra

@AGBecerra

Replying to @AGBecerra



#CCPA requires businesses to treat a user-enabled global privacy control as a legally valid consumer request to opt out of the sale of their data.

CCPA opened the door to developing a technical standard, like the GPC, which satisfies this legal requirement & protects privacy.

5:56 PM · Jan 28, 2021



5



21



37



4



<https://x.com/AGBecerra/status/1354850758236102656>

§ 7025. Opt-out Preference Signals.

(a) The purpose of an opt-out preference signal is to provide consumers with a simple and easy-to-use method by which consumers interacting with businesses online can automatically exercise their right to opt-out of sale/sharing.

...

(c) When a business that collects personal information from consumers online receives or detects an opt-out preference signal ... :

(1) The business shall treat the opt-out preference signal as a valid request to opt-out of sale/sharing submitted pursuant to Civil Code section 1798.120

Attorney General Bonta Announces Settlement with Sephora as Part of Ongoing Enforcement of California Consumer Privacy Act

Press Release / Attorney General Bonta Announces Settlement with Sephora as ...



Wednesday, August 24, 2022

Contact: (916) 210-6000, agpressooffice@doj.ca.gov

Marks strong second year of CCPA enforcement with update on enforcement efforts and new investigative sweep of businesses failing to process opt-out request via a user-enabled global privacy control

OAKLAND – California Attorney General Rob Bonta today announced a settlement with Sephora, Inc. (Sephora), resolving allegations that the company violated the California Consumer Privacy Act (CCPA), California’s first-in-the-nation landmark privacy law. After conducting an enforcement sweep of online retailers, the Attorney General alleged that Sephora failed to disclose to consumers that it was selling their personal information, that it failed to process user requests to opt out of sale via user-enabled global privacy controls in violation of the CCPA, and that it did not cure these violations within the 30-day period currently allowed by the CCPA. Today's settlement is part of ongoing efforts by the Attorney General to enforce California's comprehensive consumer privacy law that allows consumers to tell businesses to stop selling their personal information to third parties, including those signaled by the Global Privacy Control (GPC).

<https://oag.ca.gov/news/press-releases/attorney-general-bonta-announces-settlement-sephora-part-ongoing-enforcement>

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Youth Sports Media Company to Pay \$1.10 Million Fine, Change Practices Over Privacy Violations

March 3, 2026

SACRAMENTO, CA — The California Privacy Protection Agency Board has [issued a decision](#) requiring PlayOn Sports to pay a \$1.10 million fine and change its practices following a settlement reached by CalPrivacy’s Enforcement Division. The Board’s decision is the first to address privacy violations involving students and California schools.

...

Instead, PlayOn Sports directed students and other users to opt-out through the Network Advertising Initiative and the Digital Advertising Alliance, violating the company’s responsibility to provide its own method for consumers to opt-out. PlayOn Sports also allegedly failed to recognize opt-out preference signals and did not provide Californians with sufficient notice of its privacy practices.



OFFICE OF THE ATTORNEY GENERAL
CONNECTICUT

09/09/2025

Connecticut, California and Colorado Announce Joint Investigative Privacy Sweep

States Investigating Businesses Refusing to Honor Consumers' Right to Opt-Out of the Sale of Their Personal Information

(Hartford, CT) — Connecticut Attorney General William Tong and the attorneys general of California and Colorado and the California Privacy Protection Agency today announced an investigative sweep involving potential noncompliance with Global Privacy Control, or GPC, an easy-to-use browser setting or extension that automatically signals to businesses a consumer's request to stop selling or sharing their personal information to third parties. As part of the sweep announced today, the coalition sent letters to businesses that do not appear to be processing consumer requests to opt out of the sale of their personal information submitted via the GPC as required by law and requested that those businesses come into immediate compliance. This sweep reinforces the three states' 2025 Data Privacy Day **educational efforts** on the GPC.

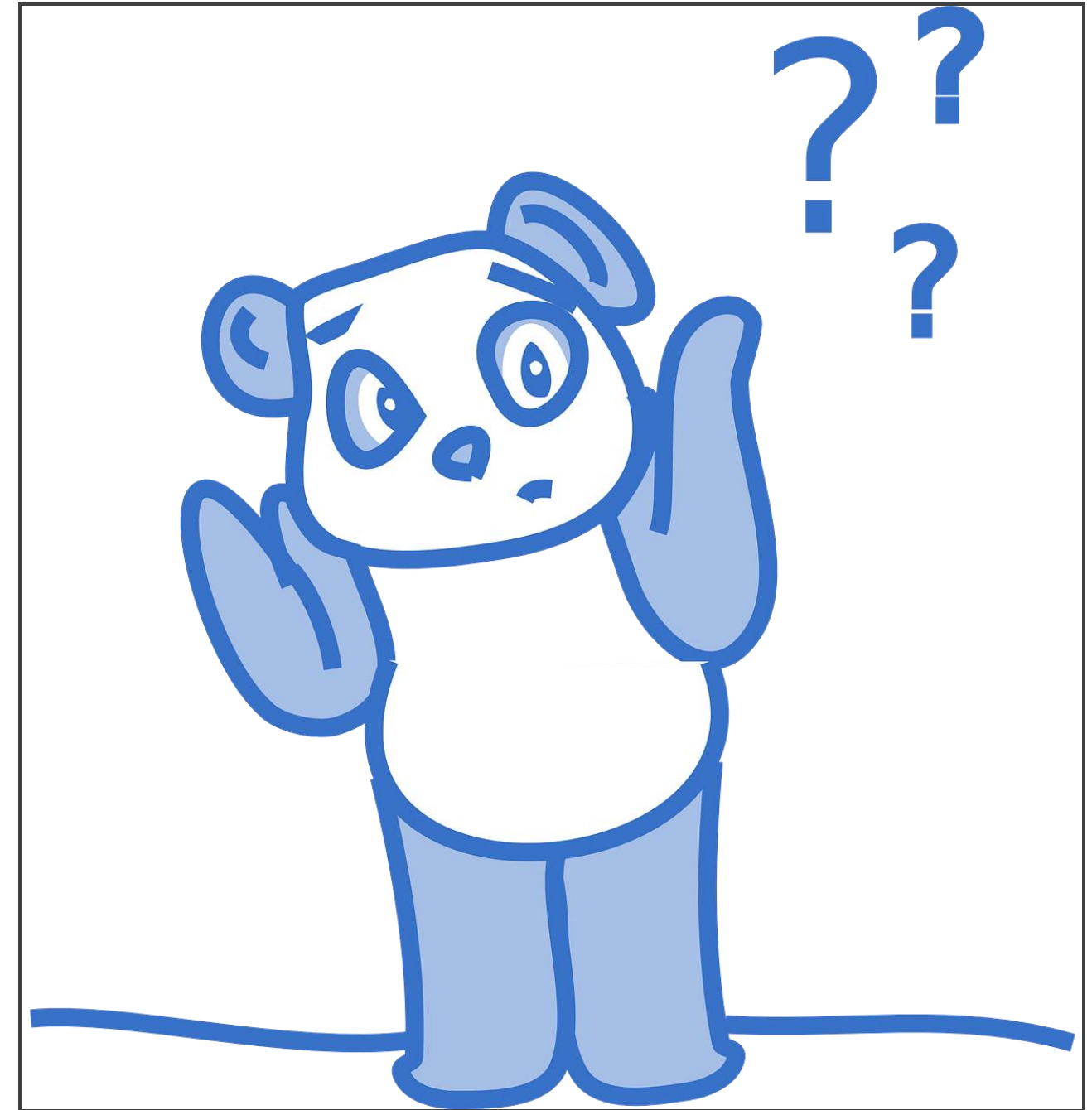


- California Consumer Privacy Act
- Colorado Privacy Act
- Connecticut Data Privacy Act
- New Jersey Privacy Act
- Oregon Consumer Privacy Act

Different States' Approaches

- California: Statute → Regulations
- Colorado: Statute → Regulations → Universal Opt-Out List
- Connecticut: Statute → Informal Guidance

Local Laws vs
Global Internet:
Who Determines
What the GPC Signal Means?



GPC in the EU

- Map GPC signal to withdrawing consent for behavioral advertising + object to processing if legal basis is consent ...
- Digital Omnibus is an opportunity!
- GDPR Article 88b supports privacy preference signals but its future is uncertain ...
- EU wants to solve cookie banner problem



Relationship to Cookies*



Do you want us to show you ads that are more relevant by using your activity information from ad partners?



A universal opt-out control has changed an ad setting that used to use information from **ad partners** to show you ads. You can change this setting on for all accounts in this Accounts Center.

-  This choice will continue to apply even if you change your account settings. You can change this choice in **Ad preferences** at any time.
-  We always use strict security standards to keep your information safe.
-  Some information may be anonymized and used to help us improve our services in our **Privacy Policy**, regardless of your choice.
-  This isn't the only kind of information from ad partners that we use. Learn more about **audience-based advertising**.
-  Learn more about **ad partners**.

Use this information

Don't use this information

* “Cookies” refer not only to HTTP cookies but also cover other tracking technologies on the web independently of how they are realized technically.

COOKIE PREFERENCES:



Your browser's Global Privacy Control is enabled. Non-essential cookies have been automatically disabled.

[Learn more about GPC](#)

☐ Optional Cookies

These are cookies to help us serve you better and ensure your experience online is optimized (ex. advertising & site usage analysis).

☒ Required Cookies

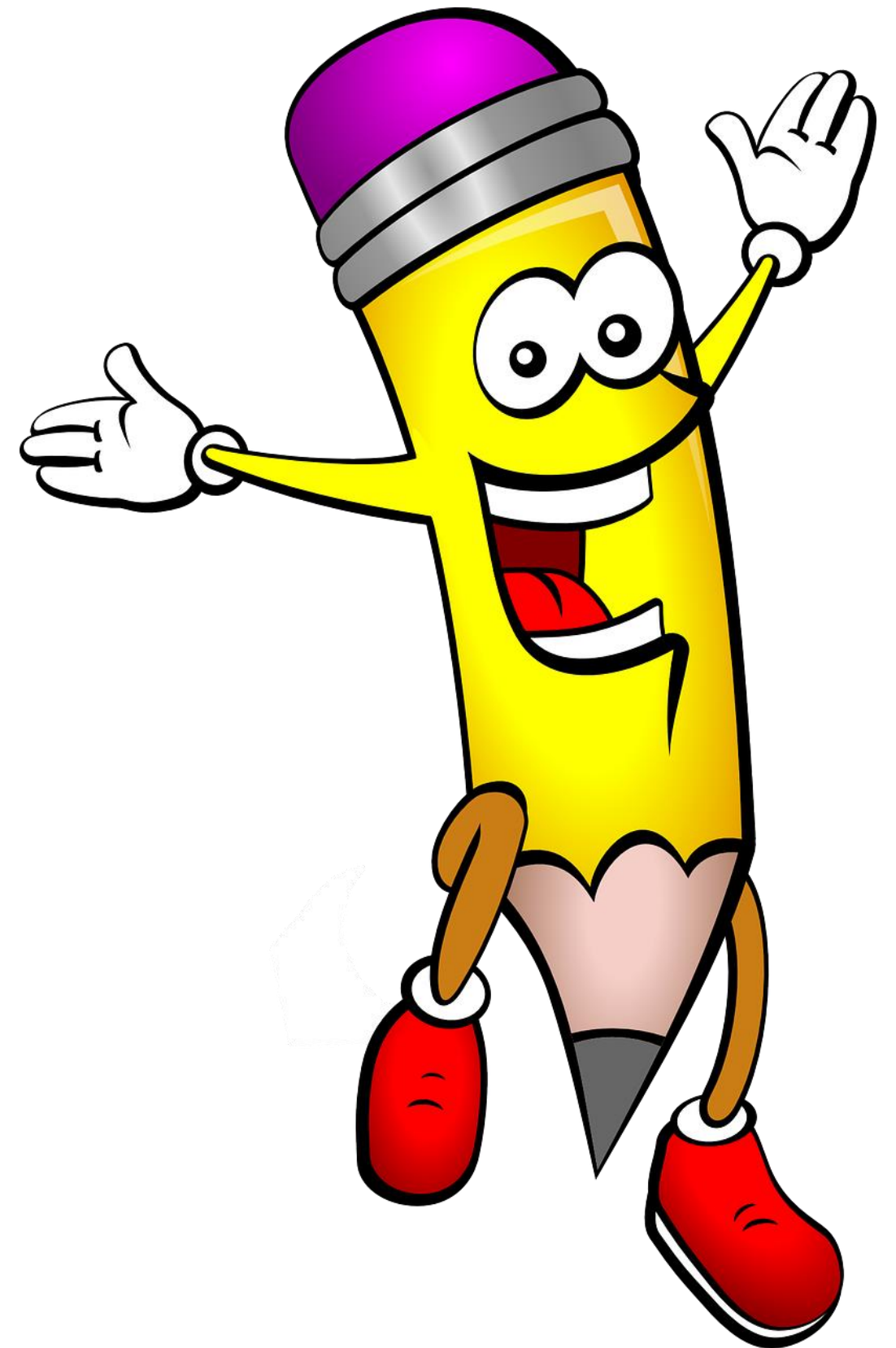
These are cookies necessary for the functionality of the site.

CONFIRM

Measurements

Enabling GPC initially reduces the number of intractable cookies by 30% on average, with a further 32% reduction possible on subsequent visits by rejecting the banners.

Rasaii et al., PETS 2025, <https://arxiv.org/abs/2506.11947>



Adoption

Browsers and Extensions



Firefox Browser



DuckDuckGo.



OptMeowt



Privacy and Consumer Orgs



Consent Management Platforms (CMPs)



Regulators

California, Colorado, Connecticut, ...

Publishers, Retailers, Companies



Adoption

GPC SUP

Check if a site supports
Global Privacy Control

Check Site

10,494,296 sites scanned

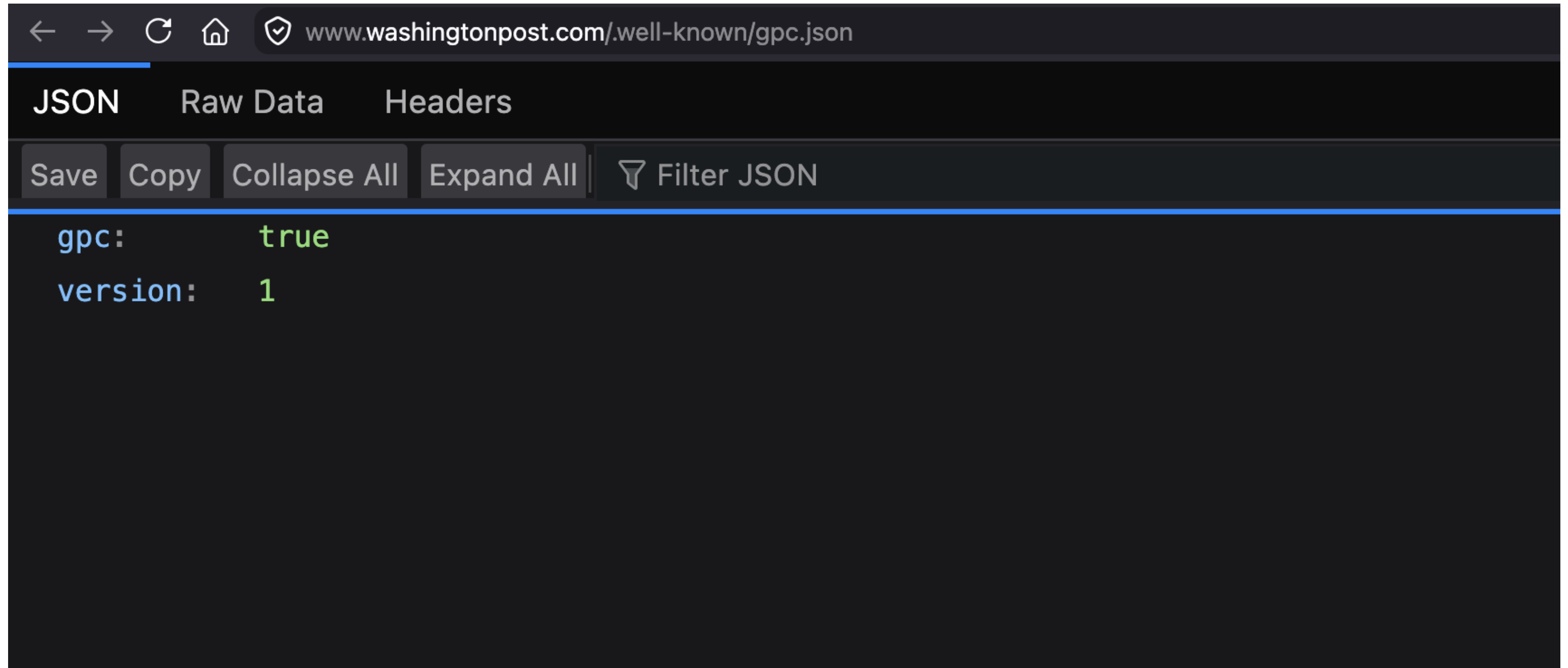
386,620 supporting sites found

Results 1 to 20 of 10,000+

Rank	Domain	Resource	Status
63	roblox.com	gpc.json	Ok
65	spotify.com	gpc.json	Ok
66	adobe.com	gpc.json	Ok
89	mozilla.org	gpc.json	Ok
136	intuit.com	gpc.json	Ok
153	nytimes.com	gpc.json	Ok
171	macromedia.com	gpc.json	Ok
238	stripe.com	gpc.json	Ok
246	roku.com	gpc.json	Ok
256	afternic.com	gpc.json	Ok
261	booking.com	gpc.json	Ok
285	mozilla.com	gpc.json	Ok
358	washingtonpost.com	gpc.json	Ok
381	adobe.net	gpc.json	Ok

<https://gpcsup.com/>

The GPC .well-known Resource



Building Privacy into the Structure of the Web

W3C Editor's Draft

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3.1	Expression Format
3.2	Preference Caching
3.3	The Sec-GPC Header Field for HTTP Requests
3.3.1	Extensibility of the Sec-GPC Field Value
3.4	JavaScript Property to Detect Preference
4.	GPC Support Resource
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5.	Legal Effects
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5.3	User Interface Language
6.	Privacy Considerations
7.	Security Considerations

Global Privacy Control (GPC)

W3C Editor's Draft 11 June 2026

▼ More details about this document

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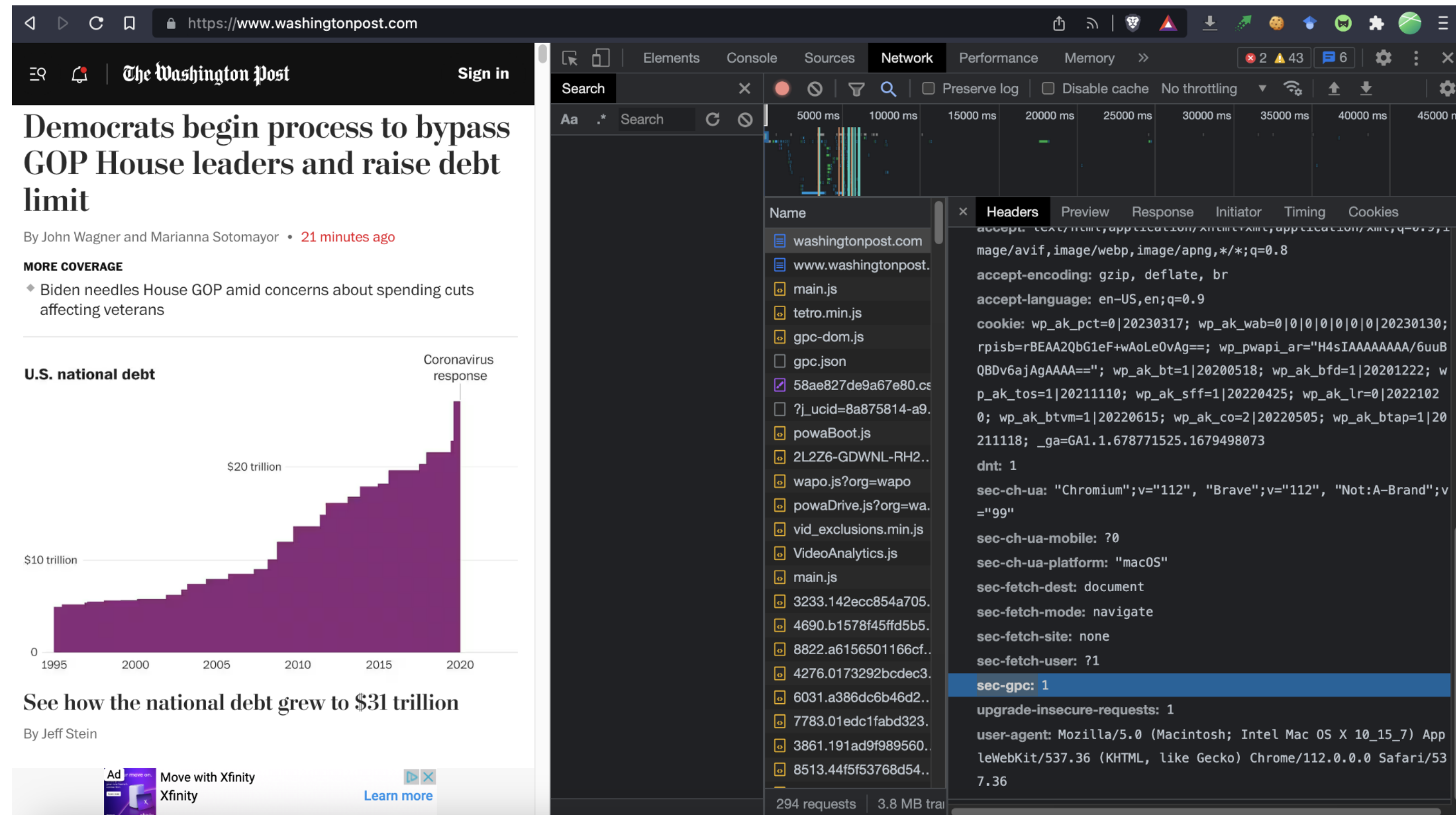


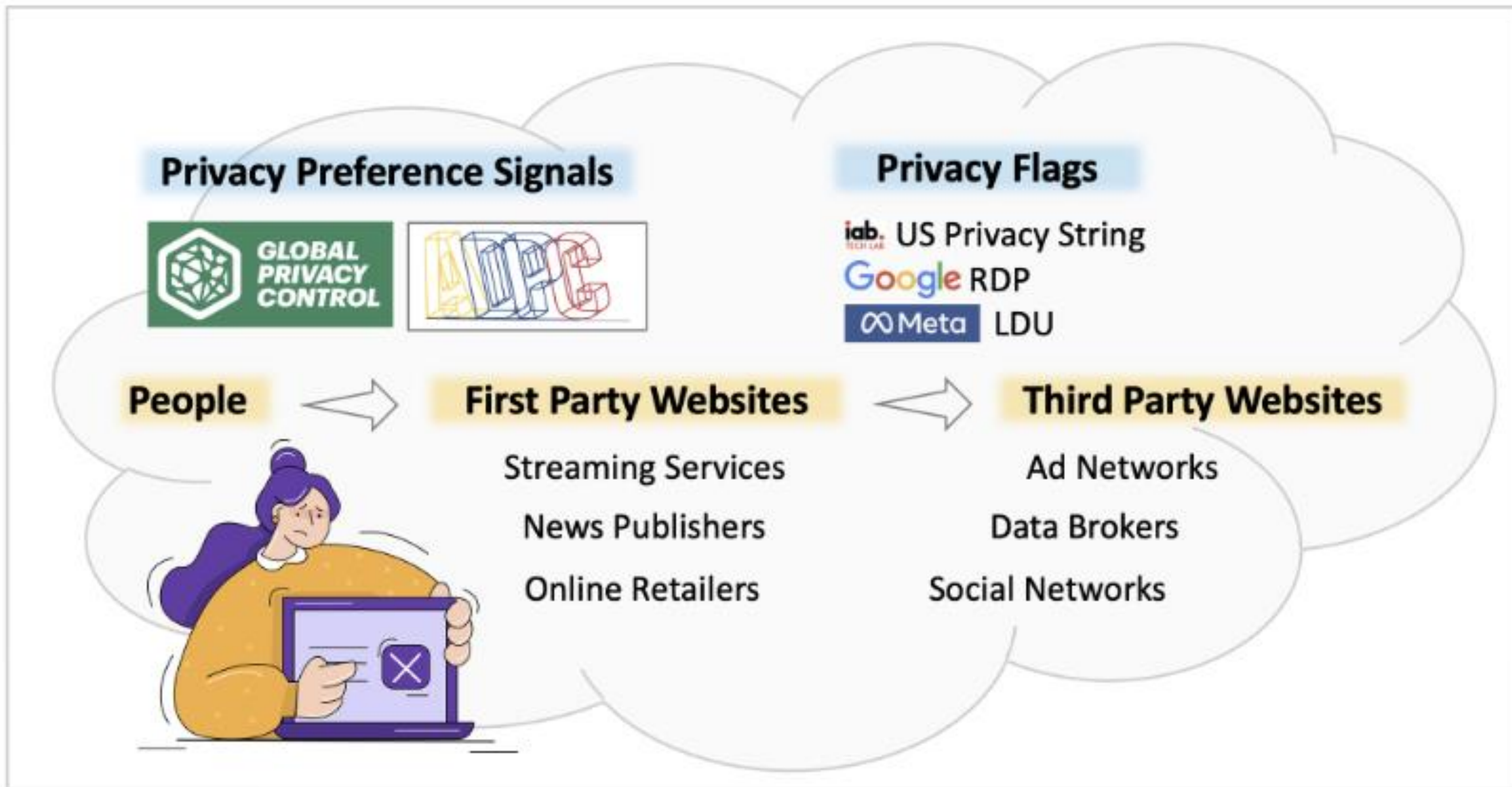
ReSpec

<https://w3c.github.io/gpc/>

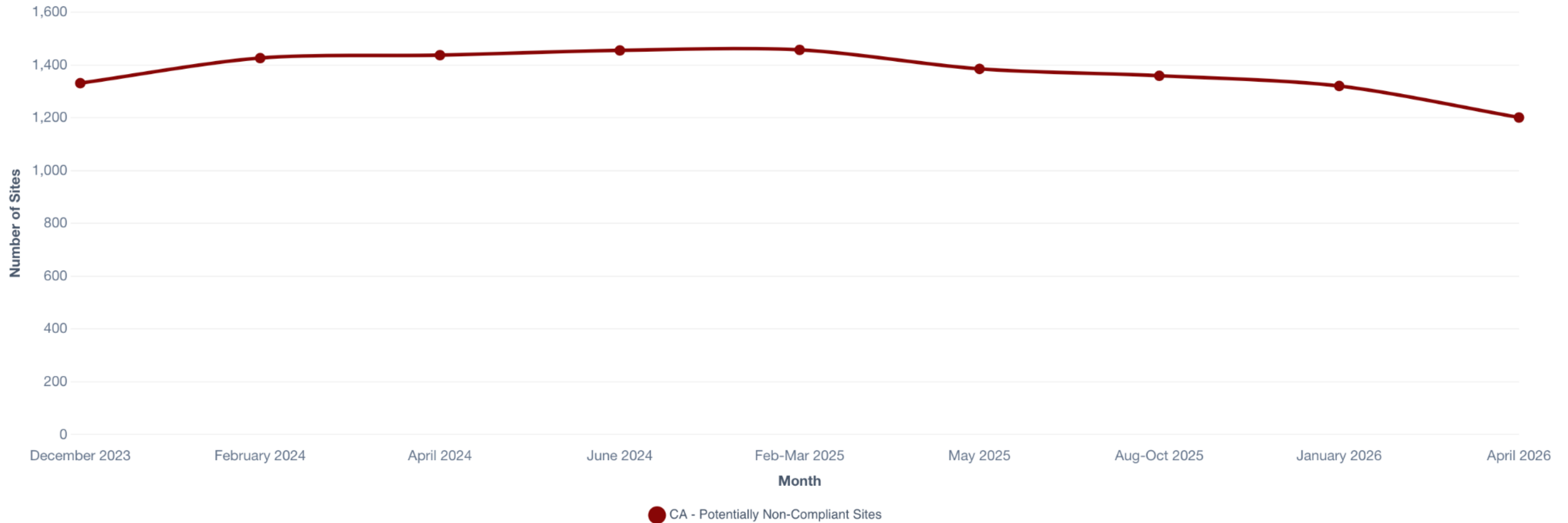
How Does GPC Work?

- HTTP Header
- DOM Property





Compliance Measurement Over Time



Statistical Ad Measurement

Retail
Website

Going fast! 247 added to bag in the last 24 hours



AE AirFlex+ Patched Athletic Skinny Jean
\$48.96 ~~\$69.95~~
Style: 0114-6872
Color: Shadow Patched Blues
Size: 28 X 28
Qty: 1

[Move to Favorites](#) [Edit](#) [Remove](#)

Going fast! 86 added to bag in the last 24 hours



AE Logo Graphic T-Shirt
\$13.46 ~~\$19.95~~
Style: 0181-4041
Color: Rose
Size: M
Qty: 1

Shipping: ~~\$7.95~~ **Free**
-~~\$7.95~~ Shipping Discount

Sub Total: ~~\$222.85~~ **\$187.42**
You're saving \$35.43!

or 4 interest-free installments of \$46.86 by **afterpay** ⓘ

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-30%



-50%



-30%



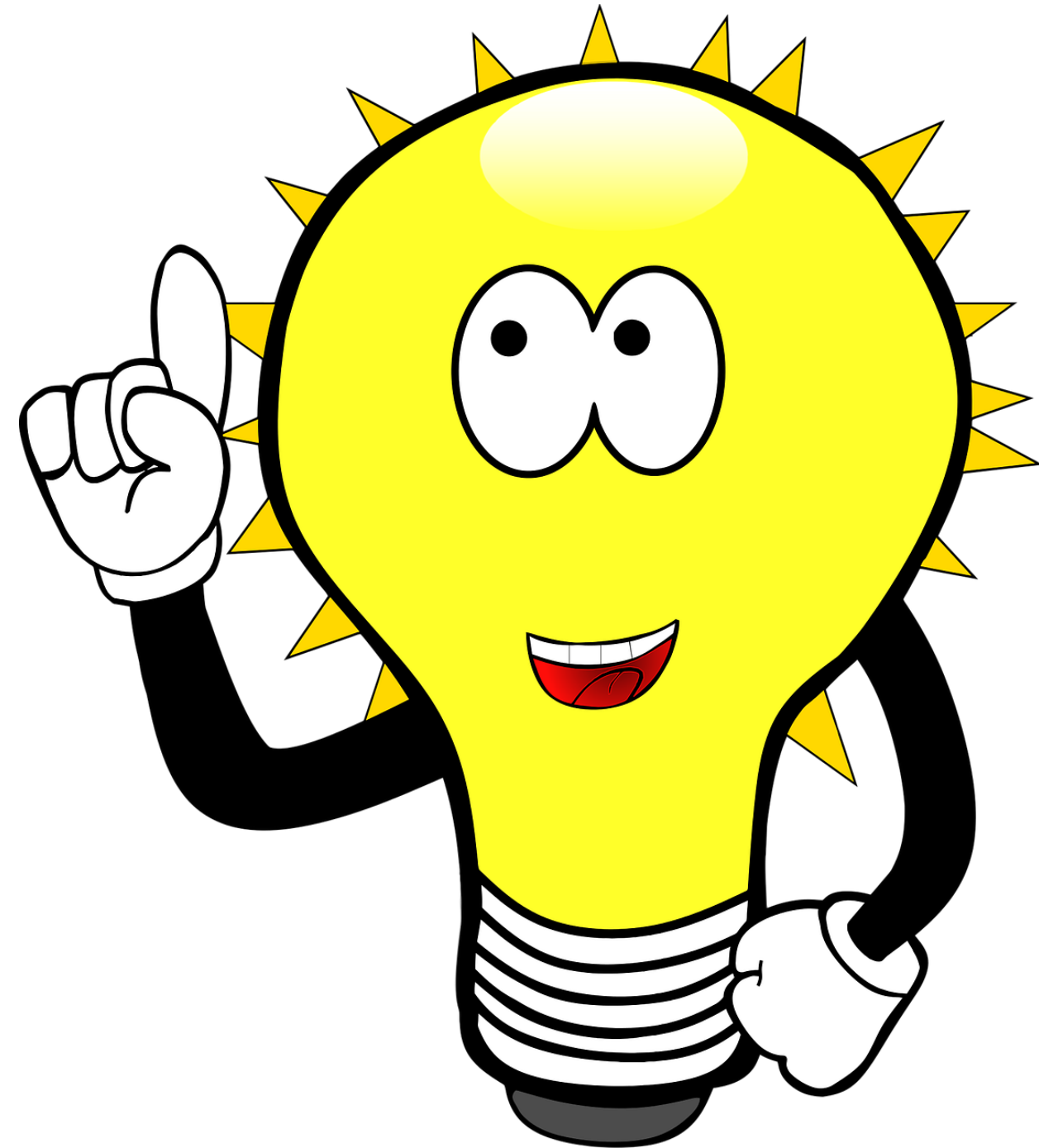
-30%



News
Website

The Future

- GPC in the Agentic Web
- Signal propagation vs stopping data flows



A Final Word

Keep it simple

Thank you!

Q&A

Please let me know if I can help:
szimmeck@wesleyan.edu

PSEUDONYMOUS PROFILES IN THE AD-TECH ECOSYSTEM

Daniel Goldberg

The Where and When of Consent, and the Importance of GPC for Californians

Christo Wilson

The Where and When of Consent, and the Importance of GPC for Californians

Christo Wilson

Professor of Computer Science

Northeastern University, Boston

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<https://cbw.sh/>



Who am I?

Christo Wilson, Professor, Computer Science

Member of the Cybersecurity and Privacy Institute

Previously: Director of Bachelors in Cybersecurity program

Currently: Associate Dean of Academic Programs and Student Experience

Faculty Associate at the Berkman Klein Center for Internet & Society at Harvard

Research Interests – Digital Consumer Protection

- Online tracking and privacy
- Dark patterns
- Algorithm auditing
- Fairness and bias in ML and AI

west elm

 track order

 account

 favorites



design & values | free design services ▾

tour this neutral oasis

new & notable ▾

in stock & ready to ship

friends & collaborators ▾

We're Here To Help

Customer Service

Track Your Order

Returns

Shipping Information

Buy Online Pick Up In Store

Monthly Payment Plan

Ship To: 

International Orders

Email Preferences

Our Cards & Rewards

The Key

View Credit Card Account

Pay Bill Online

west elm Credit Card

Gift Cards

Why West Elm?

Our Values

Responsible Retail Glossary

Your Local Store

 **WAYSIDE COMMONS**
6 Wayside Road
Space B
Burlington , MA 01803
[\(781\) 221-5626](tel:7812215626)

Stores

Find A Store

Design Crew

Do Not Sell My
Personal Information

- Covered websites are required to have a “Do Not Sell My Personal Information” link on their homepage
- Facilitates opting-out of data collection & activating data subject rights

Maggie Van Nortwick and Christo Wilson, [Setting the Bar Low: Are Websites Complying with the Minimum Requirements of the CCPA?](#), Proceedings of Privacy Enhancing Technologies, 2022.

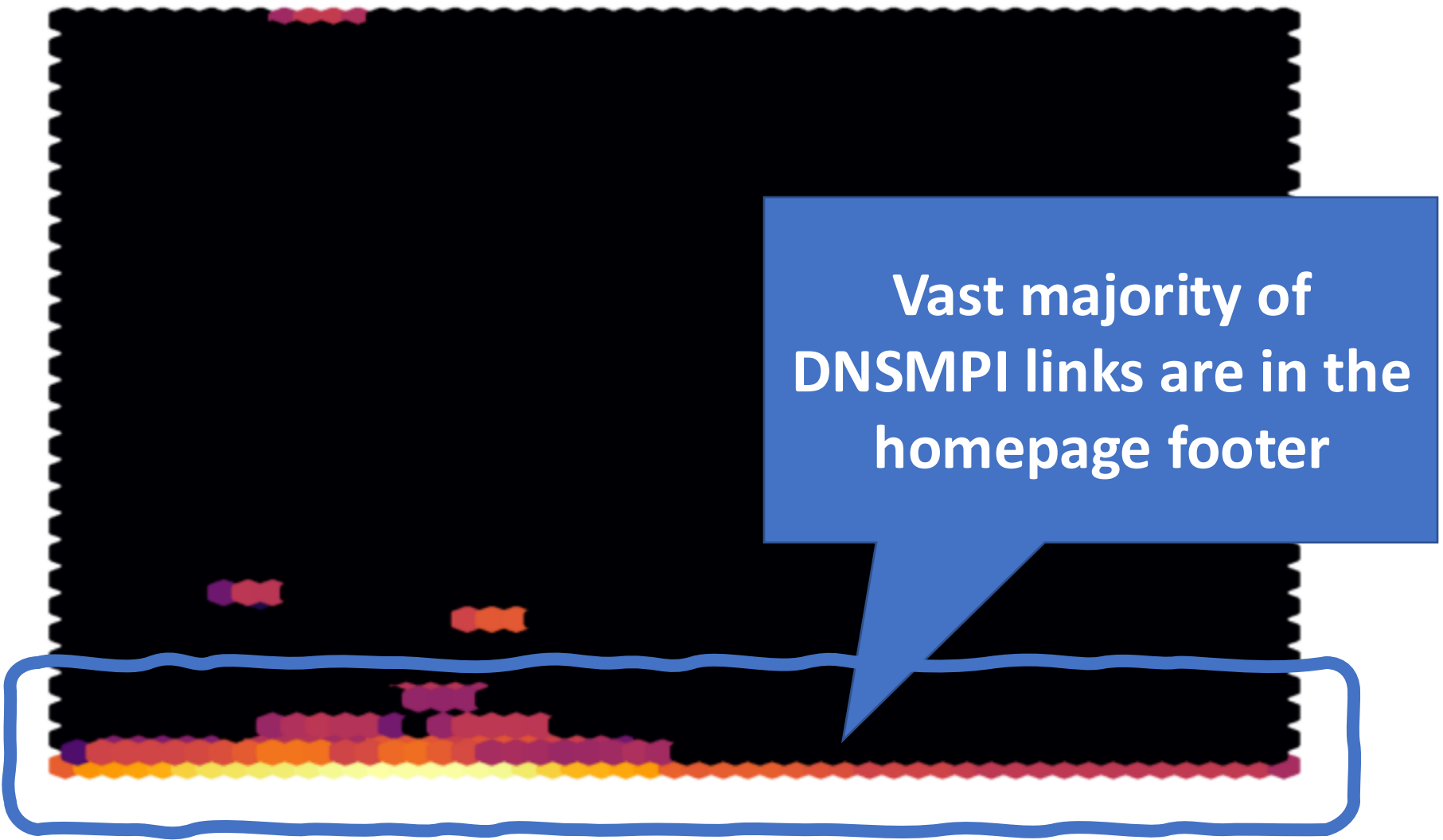
Are Links Clear and Conspicuous?

Contrast ratio of link, according to the WCAG accessibility guidelines

WCAG Level	Example	% of Websites
< AA	Do not sell my personal information	40%
AA— AAA	Do not sell my personal information	10%
> AAA	Do not sell my personal information	50%

Locations of DNSMPI links, normalized to a 1080P screen

Heatmap is log-scaled



Global Privacy Control



GPC solves many usability challenges

- No need to hunt for obscure links
- No need to be interrupted by or figure out complex banners
- No opportunities for dark patterns

Do Not Sell My
Personal Information

Before you start shopping

We use cookies to personalise content, analyse traffic and for advertising. Read our [Cookie Policy](#).

[MANAGE COOKIES](#)

ACCEPT ALL

GPC also solves timing and ambiguity problems!

Home - Penny Arcade

penny-arcade.com

Acq Inc PAX Child's Play Pinny Arcade About Contact

Login or Sign Up AA

COMIC NEWS VIDEO PODCASTS STORIES ARCHIVE STORE

Rex Ready Player

Publisher alters their practices regarding data selling and sharing to third parties

1. Don't do it at all
2. Contact third parties, but don't share/sell data (data minimization)
3. Contact third parties, share data, but put them into service provider mode (data use restriction)

One, Part One

By Tycho – July 6, 2026

Rex Ready



GET THE ANNE-CLAIRE PROMO!

COMIC REMIX

We use cookies to remember your display preferences for fonts and Day/Night mode, keep you logged into Club PA, and to protect forms from cross site scripting attacks. We use Google Analytics, which has its own cookie. Our ads may also use their own cookies.

Use Necessary Cookies Only

Allow All Cookies

https://www.penny-arcade.com/news/post/2026/07/08/rex-ready-player-one-part-two

Problems With Opt-out Compliance

Websites are composed of hundreds of objects that load one-by-one, in order

Many publishers rely on **Consent Management** software to handle opt-out compliance

- Present banners and choice screens to users
- Collect and store **consent signals**
- Implement compliance with users' opt-out choices

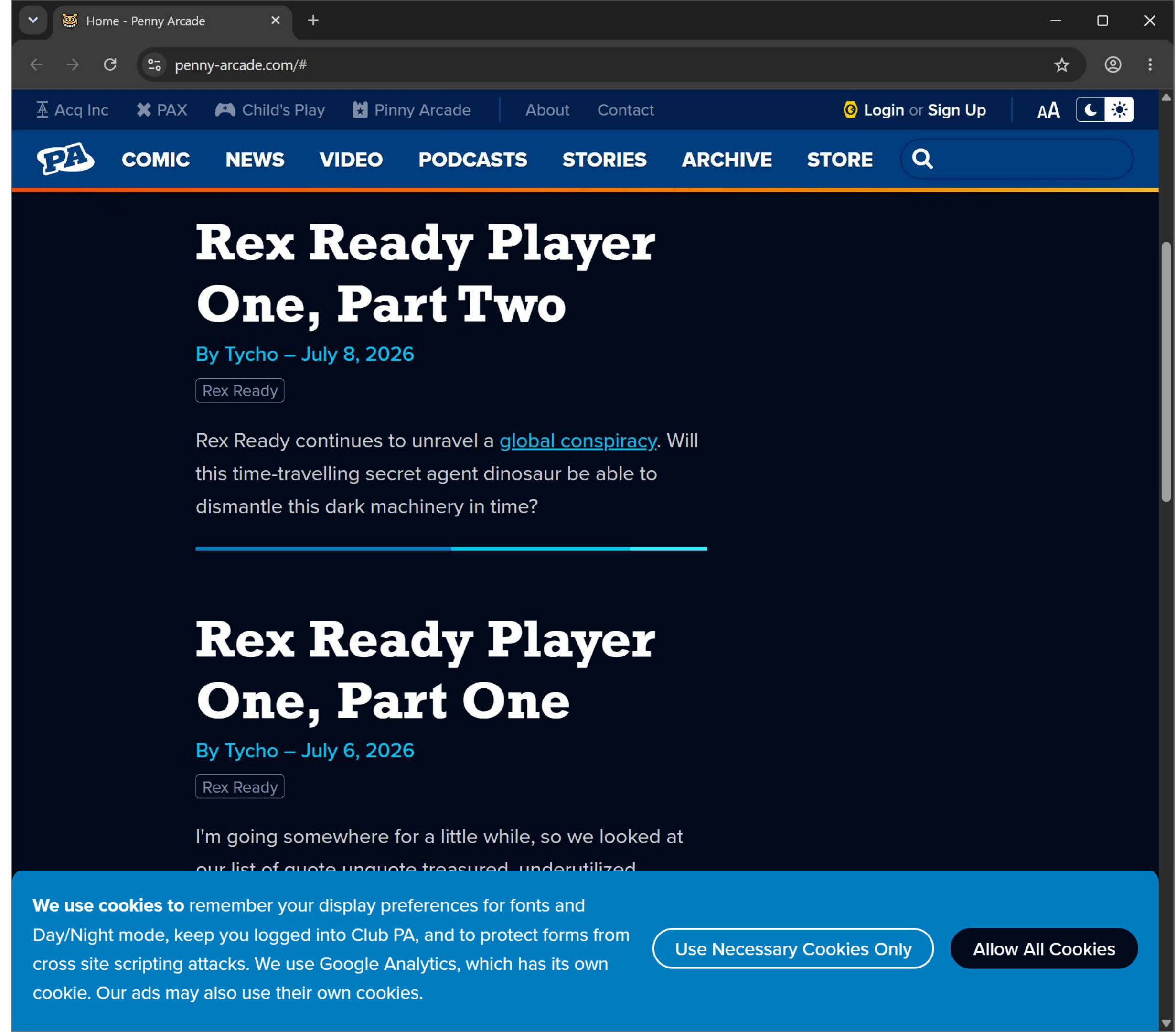
Problems:

1. When is the consent signal available?
2. Where is the consent signal located?

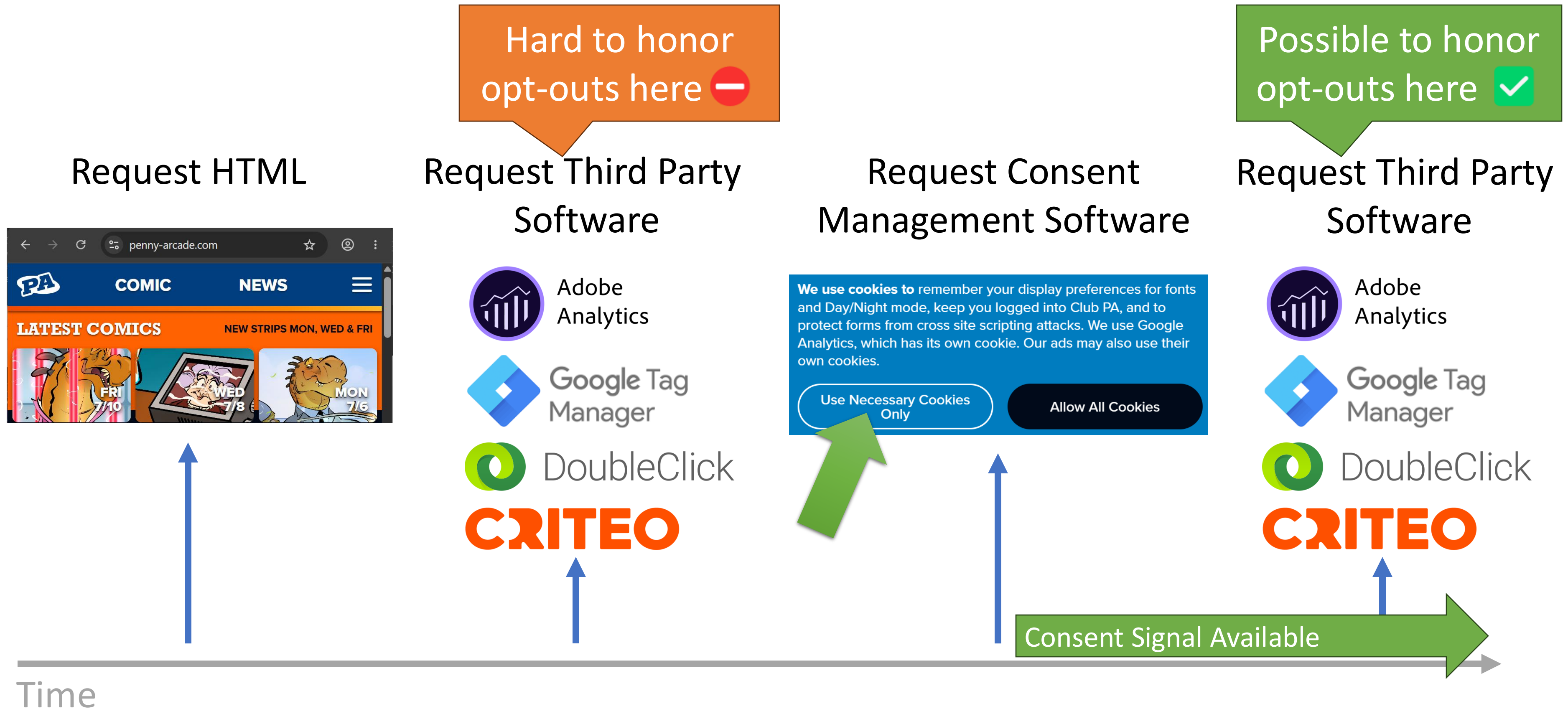
Websites are composed of many objects that load one-by-one, in order

Example: send HTTP requests for...

1. HTML
2. Images
3. Fonts
4. Third Party Analytics
5. Advertisement
6. Consent Manager



Problem: Consent Signal Timing



Mechanisms for Sharing and Selling Data

Hard to honor
opt-outs here 

Personal data may be shared and sold via many technical mechanisms

Once one third party is loaded, **all bets are off**

- HTTP requests may include tracking cookies and other personal data as parameters
- Read and set cookies
- Compute a browser fingerprint, i.e., probabilistic unique identifier
- Scrape personal data from the webpage, e.g., user's email address

Third parties often automatically share and sell data to other third parties

- Example: identifier matching/syncing

Request Third Party
Software



Adobe
Analytics



Google Tag
Manager



DoubleClick

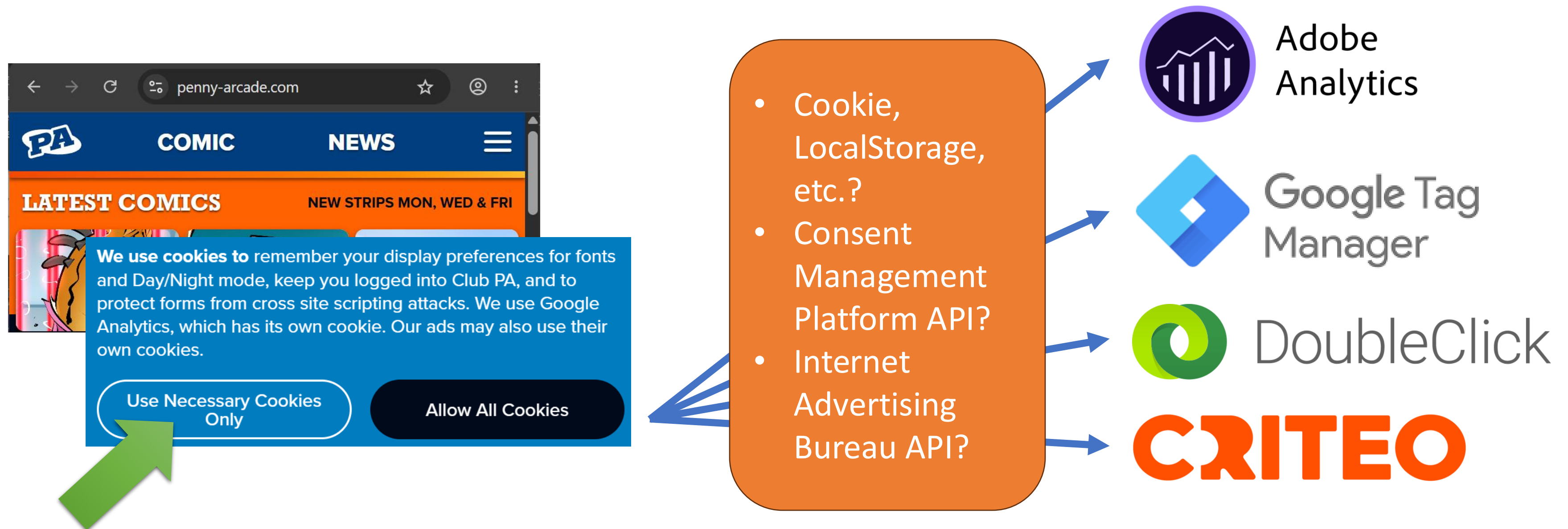
CRITEO



Time

Problem: Consent Signal Ambiguity

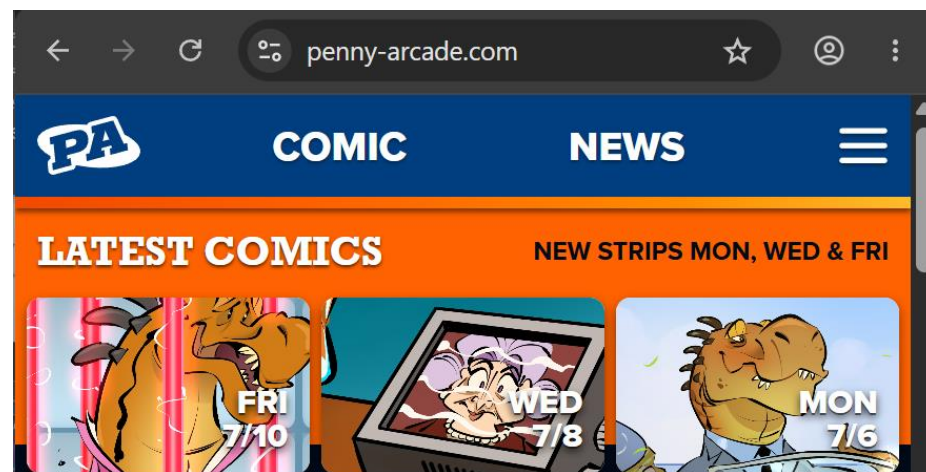
Consent Management software stores the consent signal... somewhere
Publishers assume third parties know where to find the consent signal



GPC Solves Timing Problems!

Available immediately on all webpages

Request HTML



Read and React to Consent 

```
if (navigator.globalPrivacyControl
    == true) {
  ...
  ...
}
```

Don't Load Third Parties 



Place Third Parties In Restricted Mode 



GPC Consent Signal Available

Time

&rdp=1

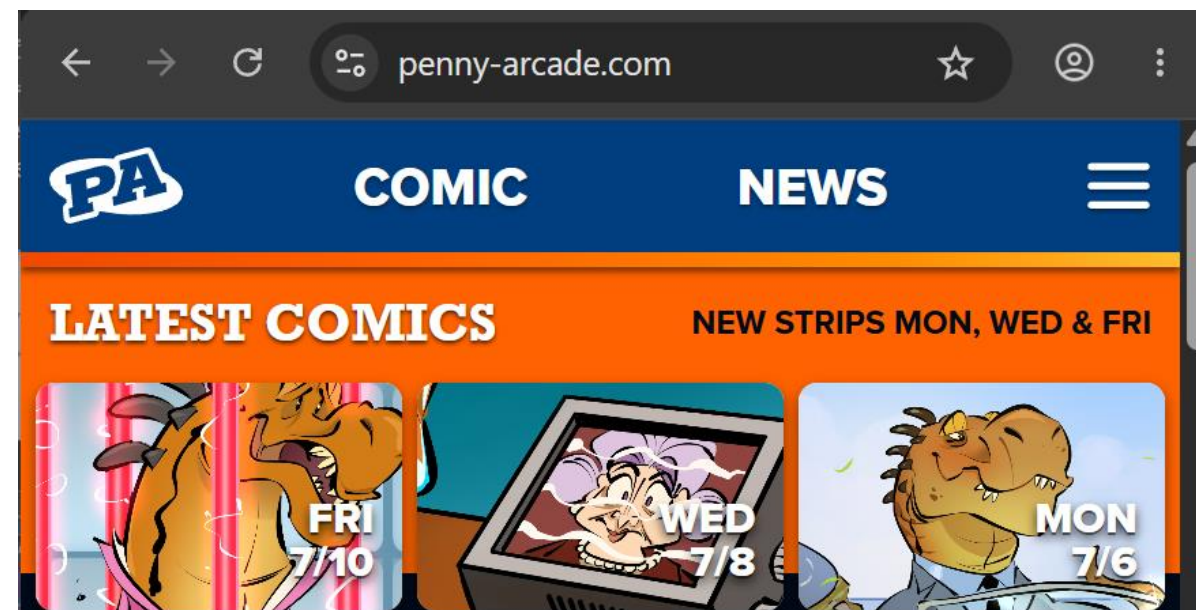
GPC Solves Consistency Problems!

One, simple, standard API

- Available via JavaScript API and in all HTTP requests

223 third-parties already rely on the GPC API

- 101 use GPC exclusively
- 122 use GPC and IAB APIs



Sec-GP

```
if (navi  
== t  
...  
}
```

- Cookie, LocalStorage, etc.?
- Consent Management Platform API?
- Internet Advertising Bureau API?

ntrol



Adobe Analytics



Google Tag Manager



DoubleClick

CRITEO

Conclusions



GPC is crucial for the success of the CCPA

Ameliorates many technical problems

- When is the signal available? → Immediately, on all webpages
- Where is the signal? → One, simple standard API

The browser is the right place for the consent user interface

- Permanent storage of choices; not ephemeral like cookies
- No need for per-website consent banners
- No dark patterns

Thanks! Questions?

Christo Wilson

c.wilson@northeastern.edu

<https://cbw.sh/>

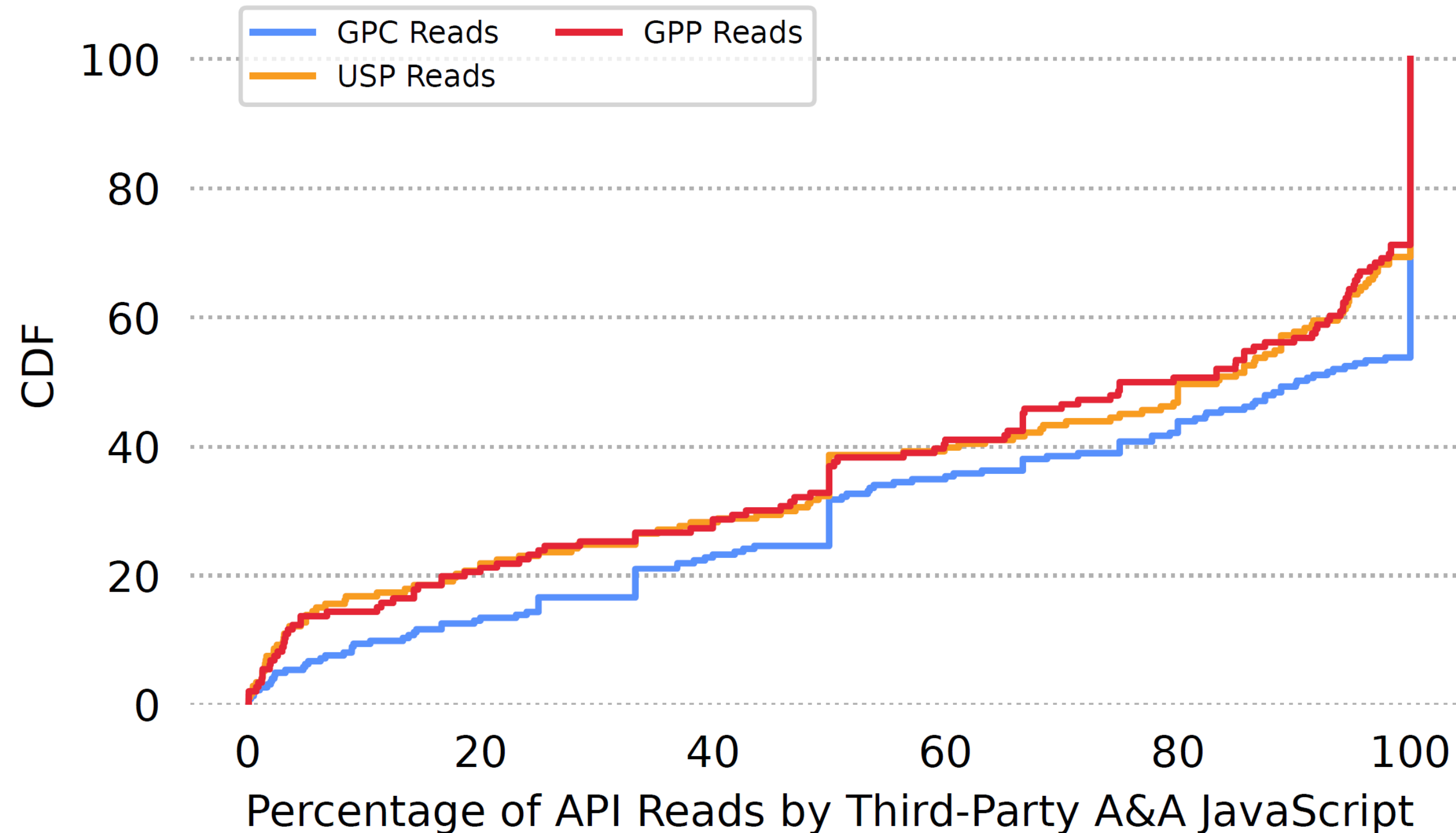
Further reading: Muhammad Abu Bakar Aziz and Christo Wilson, [*Johnny Still Can't Opt-out: Assessing the IAB CCPA Compliance Framework*](#), Proceedings on Privacy Enhancing Technologies, 2024.

Where is the Consent Signal?

Location	Problems	Examples
Cookie, LocalStorage, etc.	• No standard location • Browser state may expire or be erased, consent choice is lost	4 different cookies used to store IAB consent strings*
Consent Management Platform API	• At least a dozen competing platforms w/ different APIs • APIs produce ambiguous information	OneTrust (#1 CMP) produces numerical cookie category codes, not true/false consent data
Internet Advertising Bureau API	• Two competing standards • Voluntary standard, not well adopted • Overly complex, many bits	• ~16% of top publishers adopt the IAB standards • California section has 21 opt-out preference bits

*Muhammad Abu Bakar Aziz and Christo Wilson, *Johnny Still Can't Opt-out: Assessing the IAB CCPA Compliance Framework*, Proceedings on Privacy Enhancing Technologies, 2024.

Consistency of API Reads



ENFORCEMENT OF OPT-OUT PREFERENCE SIGNAL REQUIREMENTS

Stacey Schesser

EXAMPLES OF GPC ENFORCEMENT ACTIONS

Aug. 24, 2022

Sephora USA, Inc.

Jul. 28, 2025

Healthline Media, LLC

Sept. 25, 2025

Tractor Supply Company

March 3, 2026

2080 Media, Inc. D/B/A PlayOn Sports

Feb. 11, 2026

Disney DTC, LLC, ABC Enterprises, Inc.

