Student Data Privacy Consortium
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Evaluation and Testing

Looking Under the Hood Transparently, Safely, and Consistently

Presenters

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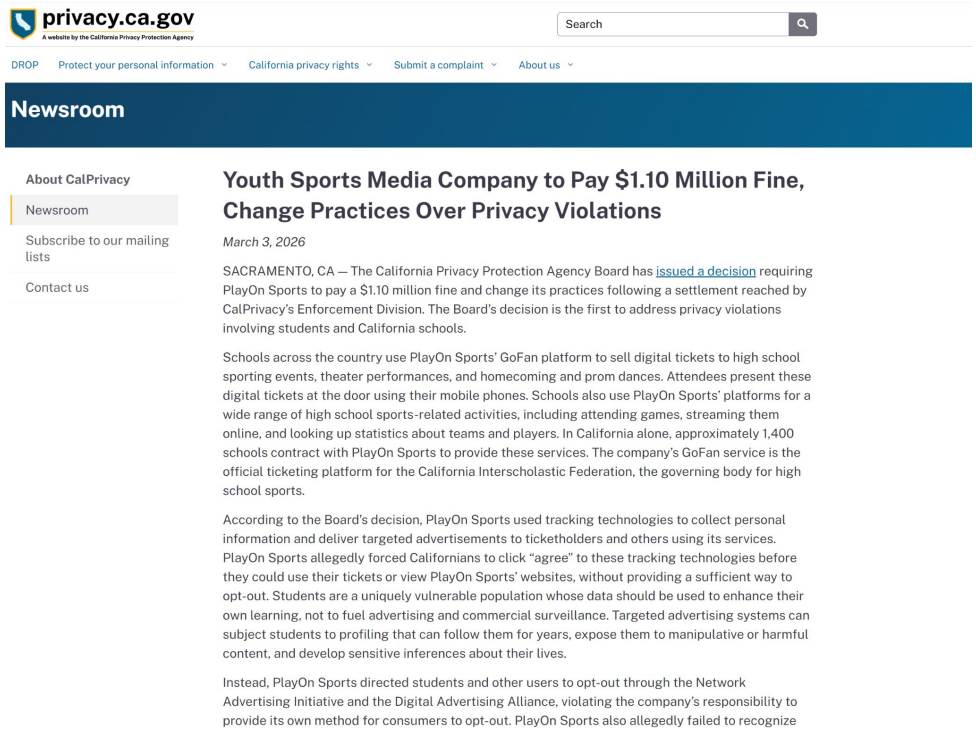
Privacy is Hard

EDTech's Trust Problem

- Consider the process of buying a house...
  - Home Inspection
  - Purchase Contract
- They are both risk management tools - but they are not interchangeable

EDtech Trust Violations in the News

California fined PlayOn Sports $1.1 million for privacy violations including tracking and targeted advertising.



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A website by the California Privacy Protection Agency

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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.

Schools across the country use PlayOn Sports' GoFan platform to sell digital tickets to high school sporting events, theater performances, and homecoming and prom dances. Attendees present these digital tickets at the door using their mobile phones. Schools also use PlayOn Sports' platforms for a wide range of high school sports-related activities, including attending games, streaming them online, and looking up statistics about teams and players. In California alone, approximately 1,400 schools contract with PlayOn Sports to provide these services. The company's GoFan service is the official ticketing platform for the California Interscholastic Federation, the governing body for high school sports.

According to the Board's decision, PlayOn Sports used tracking technologies to collect personal information and deliver targeted advertisements to ticketholders and others using its services. PlayOn Sports allegedly forced Californians to click "agree" to these tracking technologies before they could use their tickets or view PlayOn Sports' websites, without providing a sufficient way to opt-out. Students are a uniquely vulnerable population whose data should be used to enhance their own learning, not to fuel advertising and commercial surveillance. Targeted advertising systems can subject students to profiling that can follow them for years, expose them to manipulative or harmful content, and develop sensitive inferences about their lives.

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

Knock Knock: A Network Analysis Toolkit

- A suite of tools designed to test devices that connect to the internet
- Focused on observing and evaluating network traffic between the client/device and the service*
- Built to support both simple checks and deep technical analysis
- Designed for researchers, evaluators, and technologists
- All of the tools are freely available under an open source license.

*We can see a lot, but not everything. We'll get into the details in a slide or two.

How it Works

Knock Knock uses simple, open source, mature components

- tshark (part of Wireshark) for capturing network traffic capture
- Python scripts for automated analysis and report generation
- bash scripts to connect components
- DuckDuckGo's Tracker Radar for attribution

There's nothing magical about it – just a lot of painfully earned experience on what can make good tests go bad.

What We Can't See

While we can see a lot, there are things we can't see.

- If a service does things with data *in their own infrastructure*
  - Cross reference traffic capture against legal docs and agreements
- Processes executed in the browser
  - While we can see javascript heading to the browser, we don't see how it's executed
  - We can make some inferences – and sometimes more.
- Anything we can't decrypt
  - When testing connected devices (streaming media players, connected speakers, etc) we generally don't try to decrypt the data
  - Bricking devices is often discouraged

Knock Knock Testing

For each test of a service or device, Knock Knock creates:

- A testing script that defines exactly what was tested
- A network traffic capture for the specific device/service that was tested
- For any web-based service, all cookies set during testing
- For any web-based service, encryption keys generated during testing allowing the decryption of network traffic.

A summary report that:

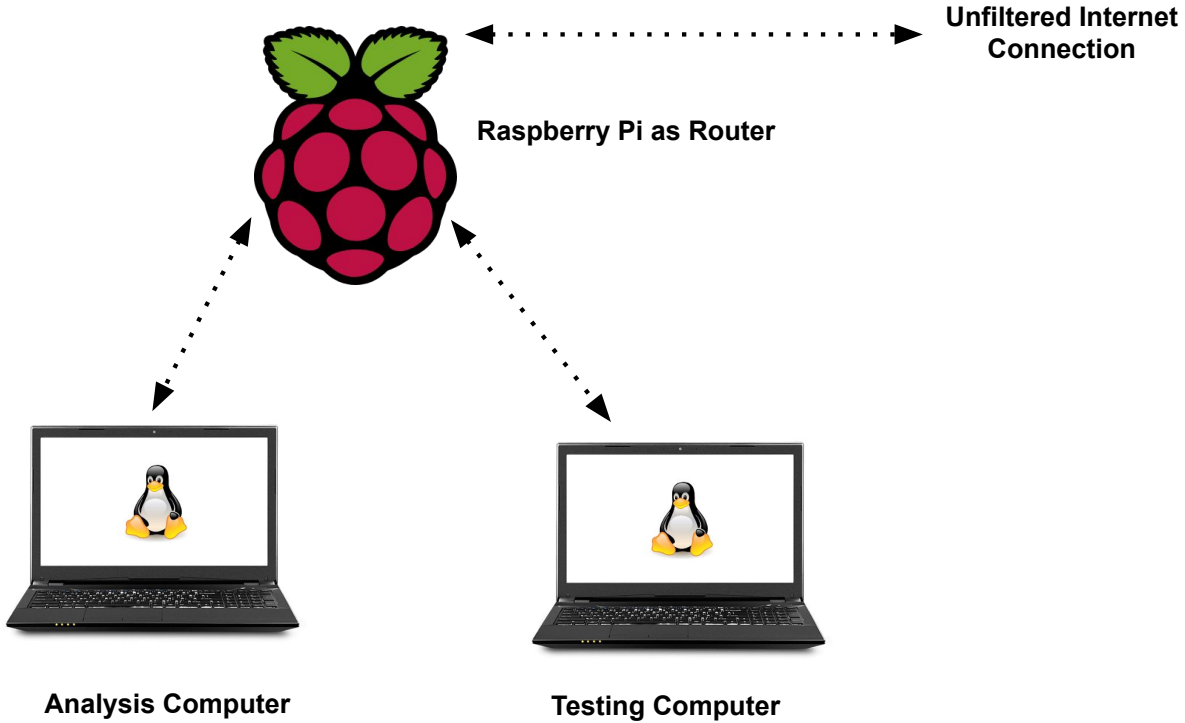
- shows what domains were contacted during testing
- calculates how much traffic was sent to and from each domain
- maps domains to their owners
- for web-based services, shows what domains set cookies
- for web-based services, a timeline graph showing cookies set at different urls

Testing Requirements

Every test requires:

- A device and/or service to test
- A method of capturing network traffic during the test
- A clear, written plan that outlines the steps taken during the test
- A device to analyze data created during testing

The Testing Environment



Main Components

- Python
- Wireshark
- Firefox/Chrome

Knock Knock can also be set up **to run on a single device** as capture, analysis and testing

Reasons Tests Get Messy

1. Noise on test machines
2. Browser cookies, cache, and history not cleared prior to testing
3. Additional devices connected to the router
4. Connected to a network with filtering

***Reference**: https://www.machinegobeep.com/posts/avoiding-messy-and-unreliable-results/*

Testing 101

1. Prepare to test
2. Test
3. Analyze results
4. Review results

This is testing at its most simple. 1 person, 1 service, 1 test.

Doing a Simple Thing 1000 times

Running one test is straightforward.

For something to age well, we need additional structure.

If we can't describe why we make a specific observation now, we haven't documented our work.

If we can't describe why we made a specific observation 12 months from now, our work is not adequately reliable

The Testing Process has Four Roles

In many cases, the same person can fill one or more or all of these roles.

1. **Manager** - The person (or people) managing the entire test process and ;
2. **Tester** - The person (or people) running the tests;
3. **Analyst** - The person (or people) analyzing results.
4. **Reviewer** - People in the reviewer role provide an additional set of eyes over each step of the process. Additional eyes are critical to ensure that each step has been followed accurately.

The Testing Process Flow

1. **The Manager creates Testing Kits and Analysis Kits.**
2. **Testing Kits are distributed to and set up by Testers.**
3. **The Manager starts the Network Traffic Capture device.**
4. **Testers connect to the Network Traffic Capture device, and run tests.**
5. **The Analyst collects and analyzes raw test data.**

Quizlet

Observed the week of **2025-12-14**

During testing, **692** cookies were set for **211** domains and subdomains.

Network Traffic

Cookies Set

00:00:00.000

No title provided
http://quizlet.com/

00:00:00.000

.quizlet.com: __cf_bm

HTTP->HTTPS Redirect

00:00:00.827

quizlet.com: qi5
quizlet.com: fs

00:00:00.830

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https://quizlet.com/

00:00:01.185

.quizlet.com: _sp_id.424b
.quizlet.com: _sp_ses.424b

00:00:01.483

.quizlet.com: sp

00:00:01.711

.quizlet.com: cf_clearance
quizlet.com: g_state
.quizlet.com: _gcl_au

00:00:01.800

.quizlet.com: _swb
.quizlet.com: _ga
.quizlet.com: _ga_BGGDEZ0S21
.quizlet.com: _ga_VG8TWT63ZN

00:00:02.013

.quizlet.com: _swb_consent_
.quizlet.com: _ketch_consent_v1_

Owned by Comscore-tracks user behavior across sites

00:00:02.459

.scorecardresearch.com: UID

00:00:02.537

.quizlet.com: _pxvid
.quizlet.com: _gid
.quizlet.com: _pxde

00:00:02.805

sc-static.net: X-AB
.quizlet.com: _scid
.quizlet.com: _scor_uid
.tiktok.com: _ttp

00:00:03.032

.snapchat.com: sc_at
.quizlet.com: _tt_enable_cookie
.quizlet.com: _ttp
.quizlet.com: ttcsid
.quizlet.com: ttcsid_C3E8DRI7V1C28HV6V6D0

00:00:03.379

.appsflyer.com: af_id
.quizlet.com: afUserId
.quizlet.com: _px3

00:00:03.577

.onelink.me: af_id
.quizlet.com: AF_SYNC
.tapad.com: TapAd_TS
.tapad.com: TapAd_DID
.tapad.com: TapAd_3WAY_SYNCS

User's email sent in URL request (redacted in report, but unredacted in network traffic)

00:00:03.788

.quizlet.com: _sctr
.quizlet.com: _fbp

00:01:47.690

www.google.com: _GRECAPTCHA

00:01:49.189

No title provided
https://quizlet.com/email-confirmation-required?email=REDACTED%40gmail.com&r...

00:01:50.096

.quizlet.com: _rdt_uuid

00:02:05.240

No title provided
http://mail.google.com/

00:02:05.460

No title provided
https://mail.google.com/

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Cookies placed while testing Quizlet

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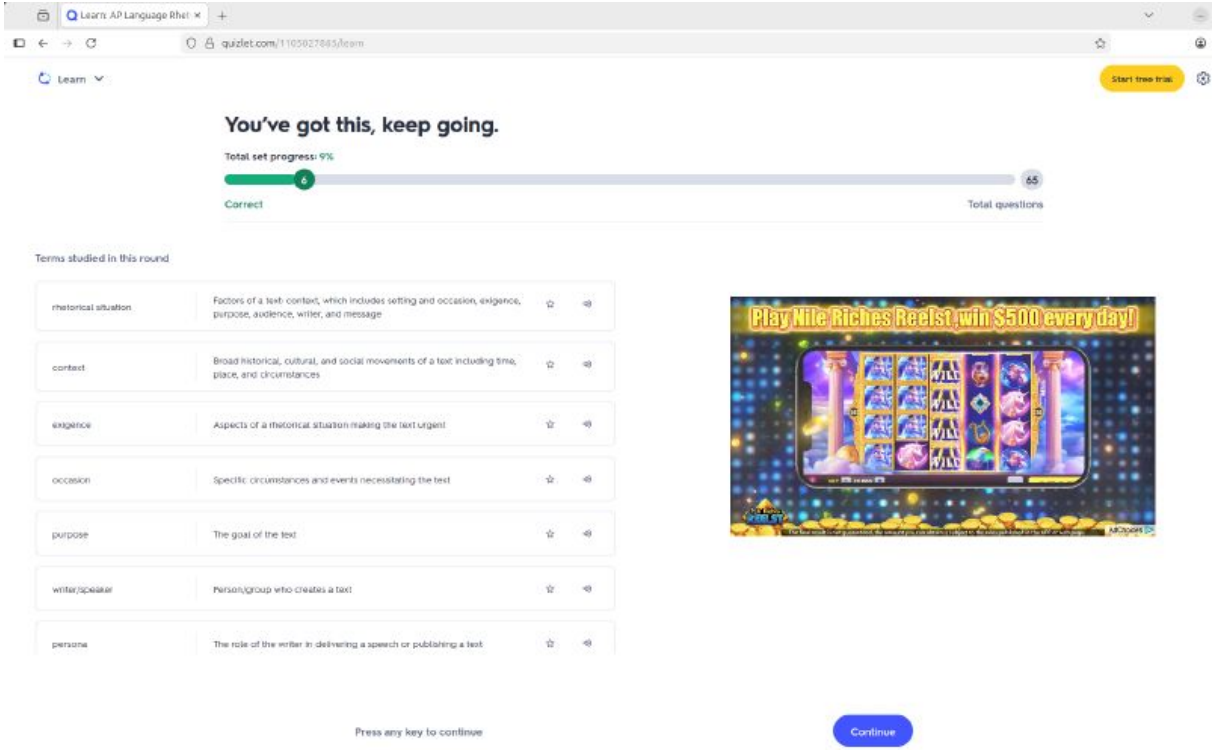
Analysis of Quizlet Traffic

1. **http://quizlet.com/** - redirect to https and loads the base HTML document and triggers resource loads such as scripts, fonts, bundled JS, CSS, endpoints and API calls typical of a React style front end app
2. **Cookies Placed**
   a. First Party Cookies Set: session identifiers, authentication / anonymous user ID, feature-flag cookies, event tracking, session measurement
   b. Third Party Cookies Set:
      i. Advertising / marketing trackers (often a pixel tracker)
      ii. Analytics / measurement services: e.g. Analytics, behavioral telemetry, conversion measurement, AB testing identifiers
      iii. Potential for cross-site tracking system, behavioral analytics, advertising attribution
3. **TL:DR**: Observed traffic from 3rd party behavior ad trackers would invalidate use of NDPA, and require FERPA and COPPA parental consent

Example of Ad Display in Quizlet

While reviewing a quiz on literary terms, the student account was shown an ad for what appears to be an online slot machine



Processing and Analysis

- Set up that test run's Python virtual environment and install all dependencies
- Collect the raw network traffic capture files (Actual App Testing)
- Merge network traffic capture files together into single source file.
- Collect all Testing Kits from different testers into a single location
- Filter single source file (network traffic capture data) into multiple individual files, moving filtered files back to respective Testing Kits
- Analyze the data in each individual Testing Kit

All of the processing and analysis occurs in the Analysis Kit.

Other Testing Observations

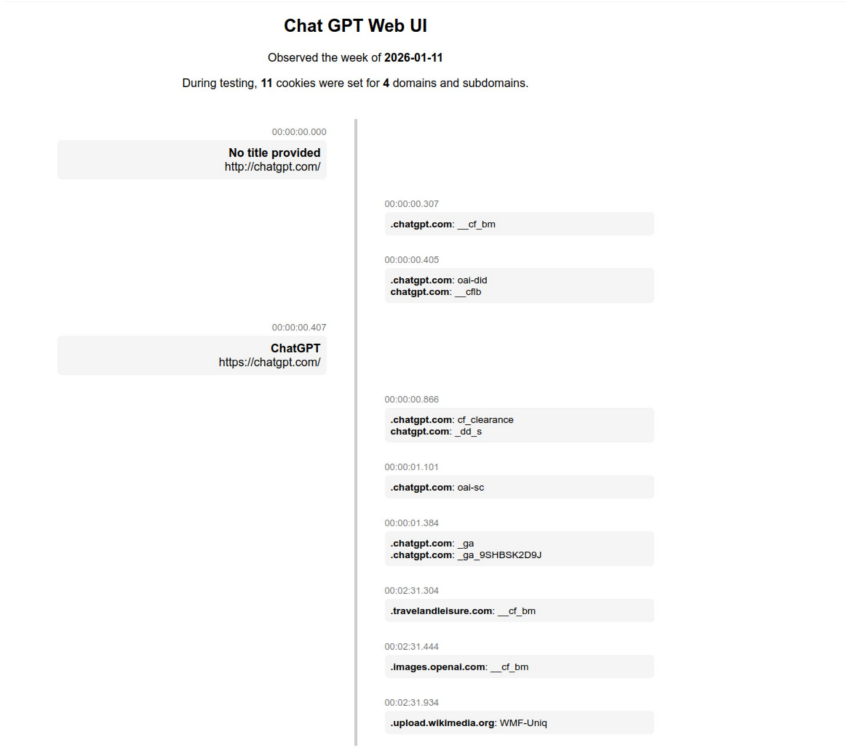
Knock Knock can reveal a lot about what happens behind the curtain.

For example, let's look at ChatGPT.

A straightforward question: let's plan a vacation!

What type of network traffic will that generate?

ChatGPT Cookies



ChatGPT Network Traffic

Let’s take a look.

It’s pretty funky.

I wasn’t expecting this.

ChatGPT Network Traffic – 2

Wireshark · Follow HTTP2 Stream (tcp.stream eq 29 and http2.streamid eq 3) · chatGPT_v2.pcapng

```
:method: GET
:path: /wikipedia/commons/4/45/Seillans_var_france.JPG
:authority: upload.wikimedia.org
:scheme: https
user-agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:147.0) Gecko/20100101 Firefox/147.0
accept: image/avif,image/webp,image/png,image/svg+xml,image/*;q=0.8,*/*;q=0.5
accept-language: en-US,en;q=0.9
accept-encoding: gzip, deflate, br, zstd
referer: https://chatgpt.com/
sec-fetch-dest: image
sec-fetch-mode: no-cors
sec-fetch-site: cross-site
priority: u=5, i
te: trailers
```

SDPC Next Steps and Discussion

Resources/Further Reading

- **Documentation** https://www.machinegobeep.com/knock-knock/
- **Repository** https://codeberg.org/funnymonkey/knock_knock
- **Streaming/IOT:** A Look at Apple TV Privacy Settings
- **One Person, One System, One Test**
- **Reasons Tests Get Messy**
- **Test Runs for Quizlet**
- **Checking AI Checkers**
- **The Security.txt File and EDTech Apps**