

Lecture 25: Privacy

CS 181S

December 12, 2018

Confidentiality
Integrity
Availability

Privacy

Privacy concerns information about individuals (people, organizations, etc.)

- Often construed as legal right
- *Privacy* is not a synonym for confidentiality or for secrecy

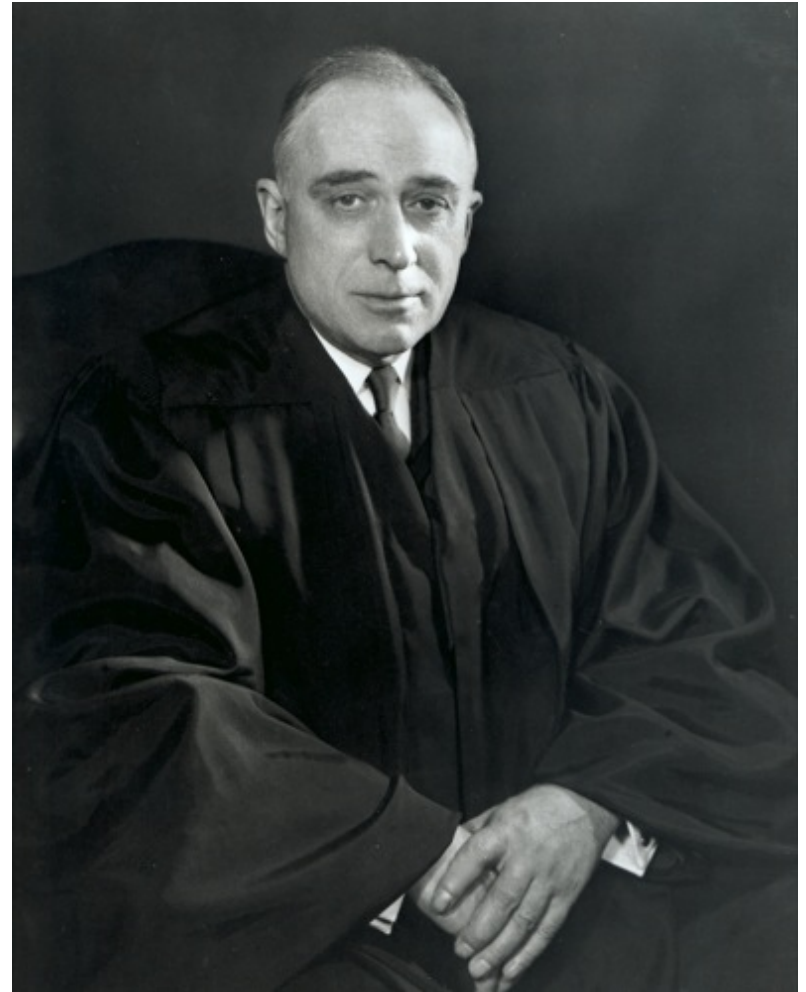
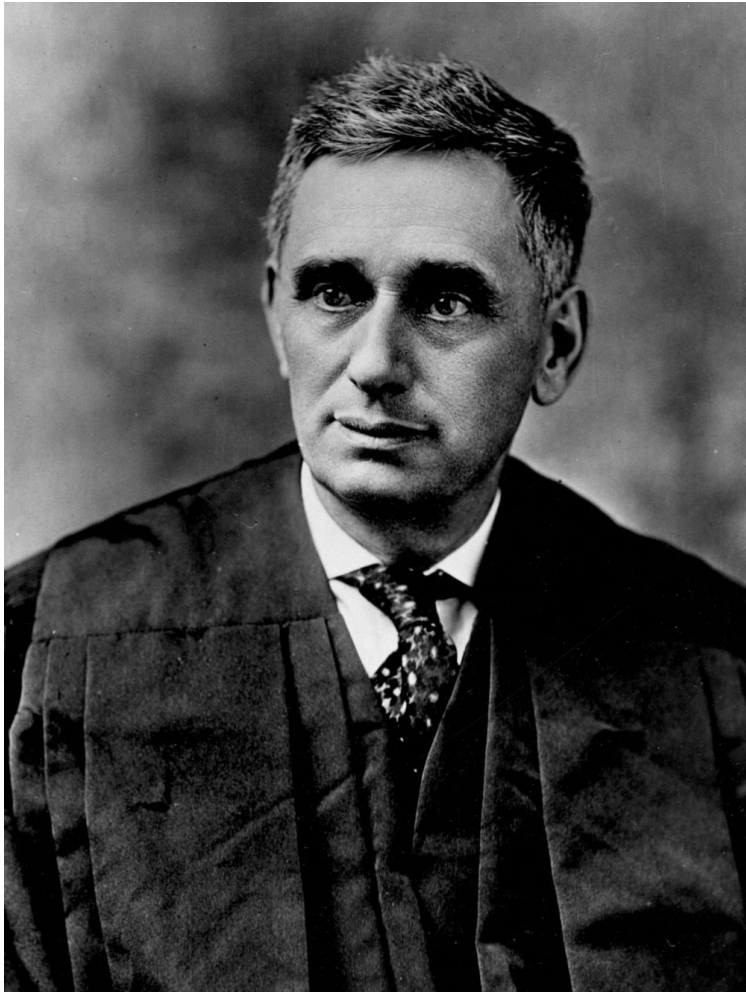
What is Privacy?



What is a privacy violation?

- Police read papers stored in your home
- Police read papers you threw in the trash
- Police read your medical records
- Your parents read your medical records
- Pomona uses your medical records in a research study
- Police read your texts/Facebook messages
- Police read your Facebook posts
- Police read your emails
- Google employee reads your emails
- Google uses your emails to target personalized ads
- Someone tracks your location for months (using phone)

Privacy in American Law



Contextual Integrity



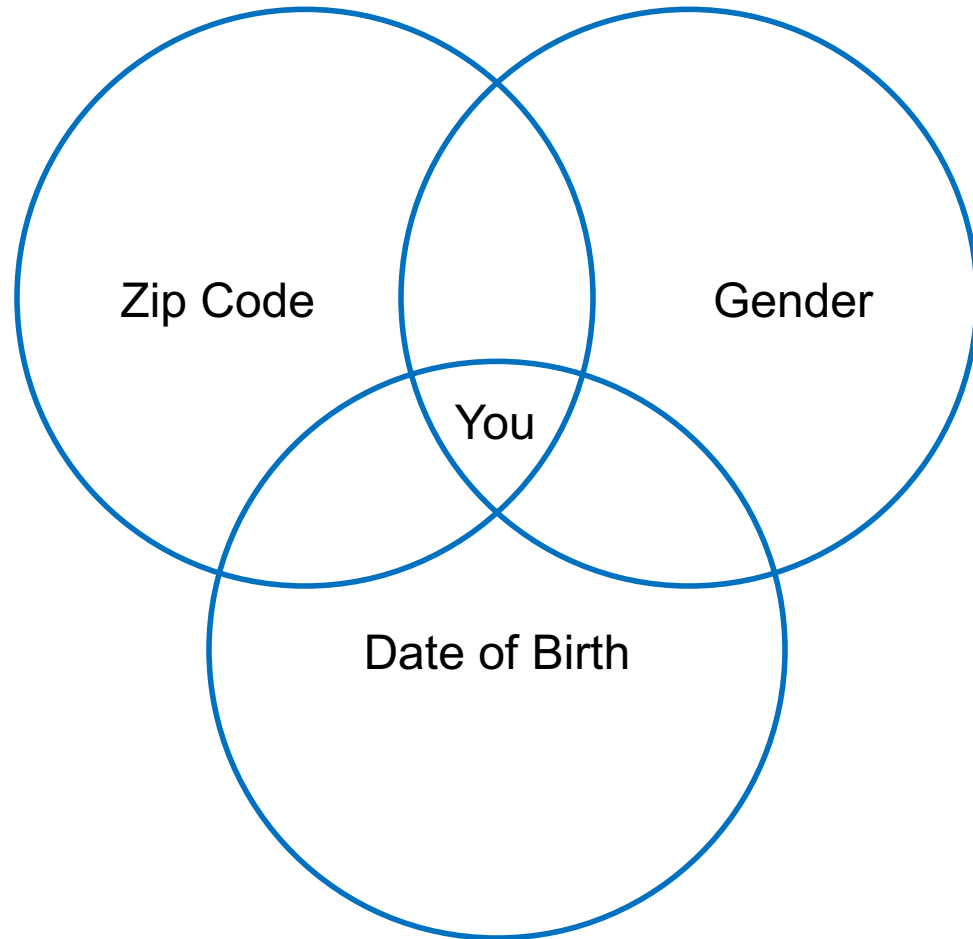
- defines privacy relative to appropriate context
- considers information type, time, location, purpose, principals involved (subject, sender, receiver)
- dependent on social norms
- norms can change over time

General Guidelines

The FTC's Fair Information Practice Principals (FIPPs) are the most broadly recognized guidelines for handling private data in information systems

- Seek consent
- Minimize data use
- Limit storage
- Avoid linking

Deanononymization



Deanononymization

AOL®



Deanonymization

The image shows the word "NETFLIX" in a bold, white, sans-serif font with a black drop shadow, centered on a solid red rectangular background. The letters are slightly shadowed to give a 3D effect.

NETFLIX

k-Anonymity

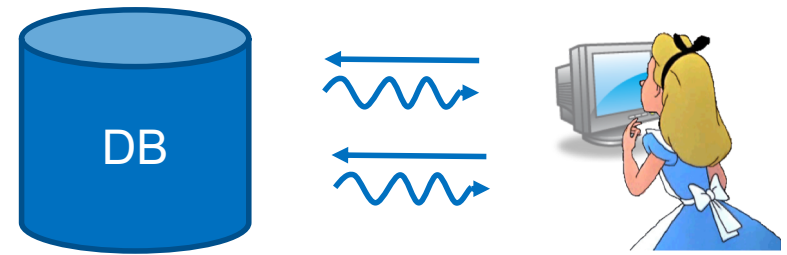
Name	Gender	Year	Grade
Alice	F	2018	95
Bob	M	2018	80
Charlie	M	2018	95
David	M	2018	60
Edward	M	2019	80
Flora	F	2019	99
Georgia	F	2019	60

Database Privacy

Offline Privacy



Online Privacy



Data Perturbation

Method	Accuracy	Runtime	Memory
Random	0.75	1.2s	100MB
Flip	0.75	1.2s	100MB
Swap	0.75	1.2s	100MB
Shift	0.75	1.2s	100MB
Rotate	0.75	1.2s	100MB
Scale	0.75	1.2s	100MB
Translate	0.75	1.2s	100MB

Differential Privacy



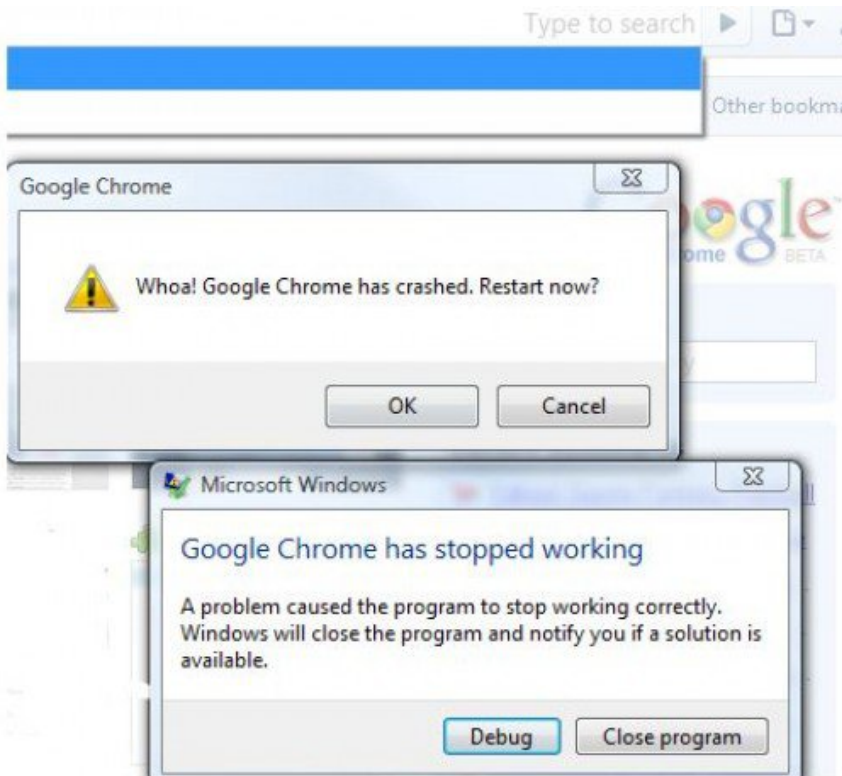
- absolute privacy is impossible
- goal should be to limit how much information can be learned
- A query Q is ϵ -differentially private if $\forall D, r \in D$,
$$\Pr[Q(D) = x] \leq e^\epsilon \cdot \Pr[Q(D - r) = x]$$

Differential Privacy

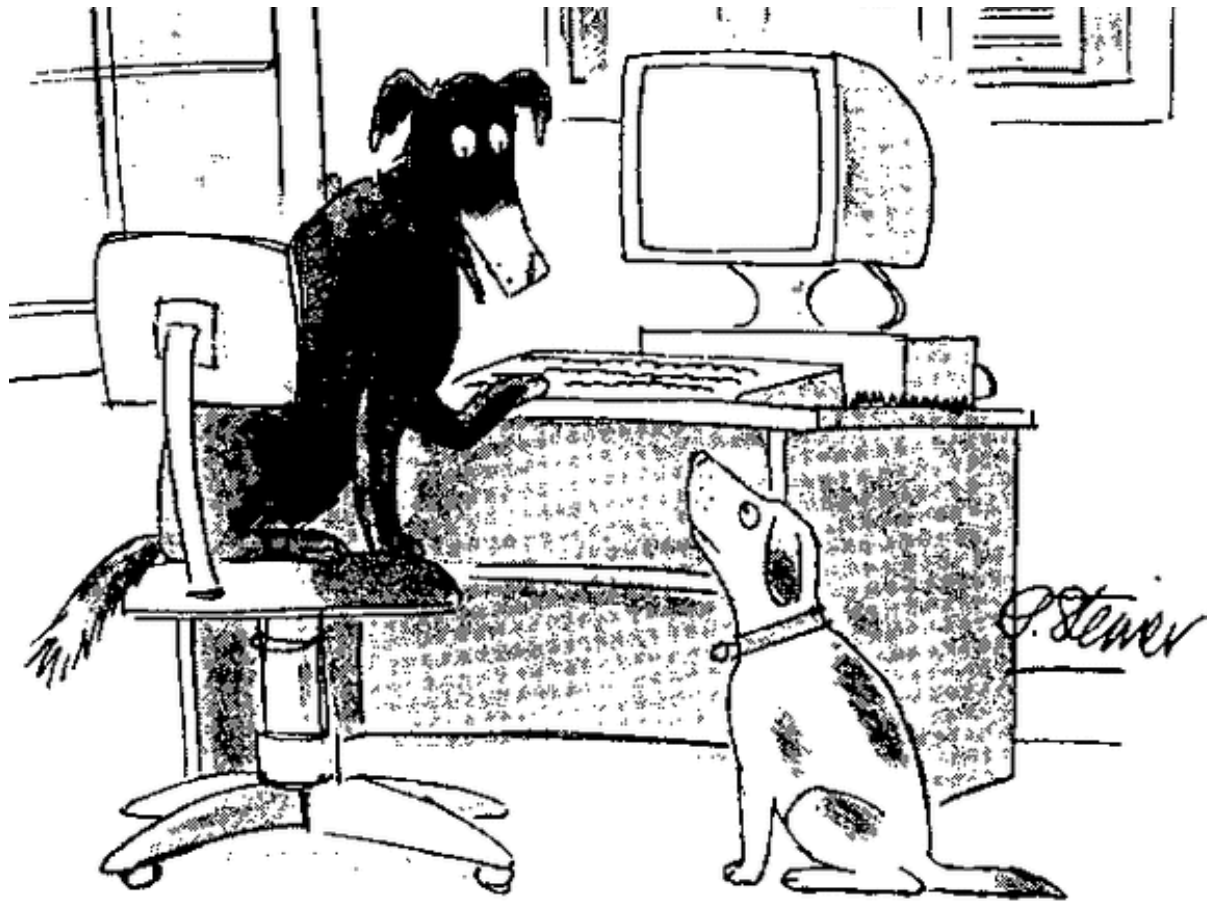
Key Idea: Changing a single user's record does not significantly affect the result of any analysis or query

$$\Pr[\mathcal{A}(D_1) \in \mathcal{S}] \leq e^\epsilon \times \Pr[\mathcal{A}(D_2) \in \mathcal{S}],$$

DP in action...



Internet Privacy



"On the Internet, nobody knows you're a dog."

Internet Privacy

The Joy of Tech™

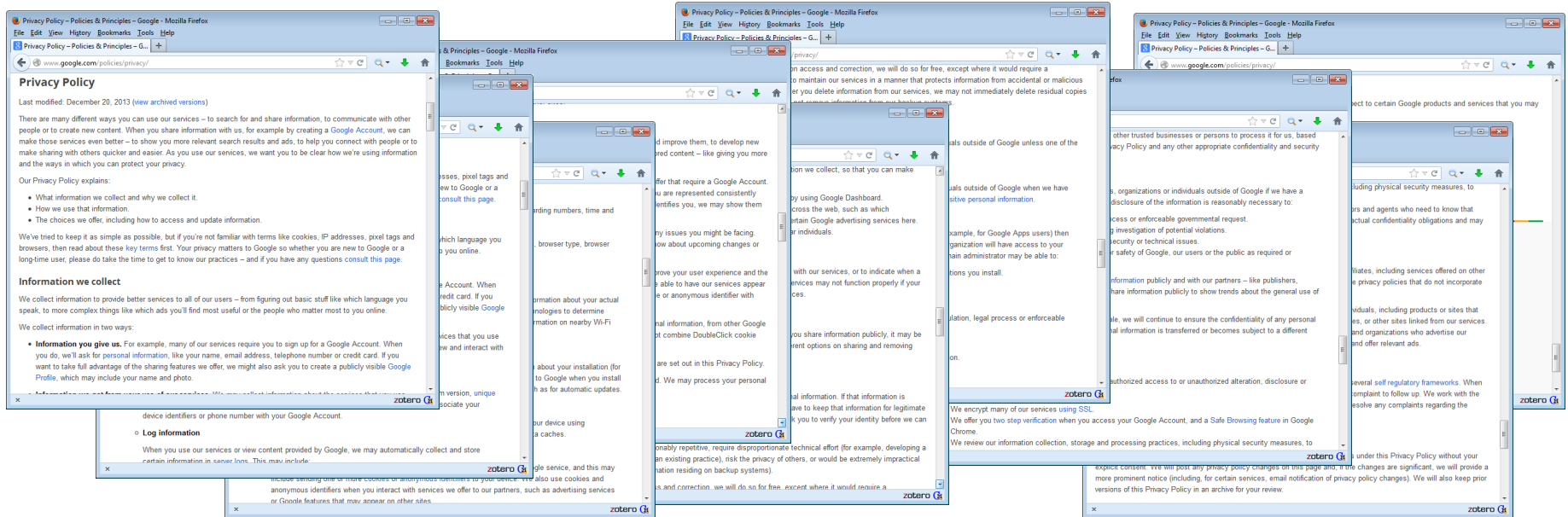
by Nitrozac & Snaggy



© 2013 Geek Culture

joyoftech.com

Notice & Consent



Browser Tracking



Personal Tech

US Senate votes to let broadband ISPs sell your browser histories

Hear that? That's the sound of ringing tills, sorry, freedom



23 Mar 2017 at 19:23, [Kieren McCarthy](#)



More like this

FCC

Isps

Congress

Privacy



阿里云国际站正式上线

美国、香港、新加坡、中国等
全球覆盖. 全球统一账号, 体

Browser Tracking



Browser Tracking

The image shows a screenshot of the New York Times website with the browser's developer tools open to the Network tab. The website header includes the title "The New York Times", the date "Thursday, March 23, 2017", and navigation links for "Today's Paper", "Video", and weather information "32°F | Hang Seng -0.09% ↓". A navigation menu lists various sections like World, U.S., Politics, etc. A large banner advertisement for pet food is visible. The developer tools show a list of network requests, including a blob from youtube.com and several JavaScript files from akamai.net, doubleclick.net, undertone.com, innovid.com, and twitter.com.

Truth. It's more important now than ever.

The New York Times

Thursday, March 23, 2017 | Today's Paper | Video | 32°F | Hang Seng -0.09% ↓

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World U.S. Politics N.Y. Business Opinion Tech Science Health Sports Arts Style Food Travel Magazine T Magazine Real Estate ALL

When you buy any bag of dog or cat food, we give a meal to a pet in need.

BUY A BAG FOR THE

Name	Domain	Met...	Sch...	Status	Cac...	Size	Transfer...	Start Time	Latency	Duration
blob:https://www.youtube.com/8a5f55e3-99f3-...	a1.nyt.com	...	GET HTTPS	200	Yes	437.57 KB	0 B	311.1ms	19.79ms	149.2ms
tagx-simple.min.js	a248.e.akamai.net	...	GET HTTPS	200	Yes	32.56 KB	0 B	7.60s	24.03ms	0.154ms
sharetools-mixin.js	ad.doubleclick.net	...	GET HTTPS	200	No	42 B	559 B	18.93s	62.15ms	0.911ms
sharetools-config.js	ad.doubleclick.net	...	GET HTTPS	200	No	42 B	559 B	17.20s	244.0ms	0.839ms
showall.js	ad.doubleclick.net	...	GET HTTPS	200	No	42 B	559 B	5.23s	125.5ms	0.658ms
sharetools.js	ads.undertone.com	...	GET HTTPS	200	No	7 B	129 B	9.68s	1.09s	0.249ms
fonts.css	ag.innovoid.com	...	GET HTTPS	200	No	43 B	288 B	9.69s	996.8ms	1.076ms
ad-view-manager.js	analytics.twitter.com	...	GET HTTPS	200	No	604 B	604 B	7.17s	1.14s	0.425ms
1.6.0.js	beacon.krxid.net	...	GET HTTPS	204	No	-	491 B	9.62s	2.13s	5.757ms

Filter Resource List

Main Frame

Beyond Cookies

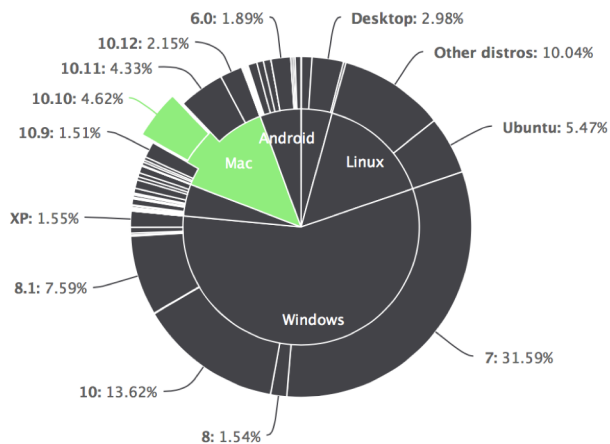
Zombie Cookies



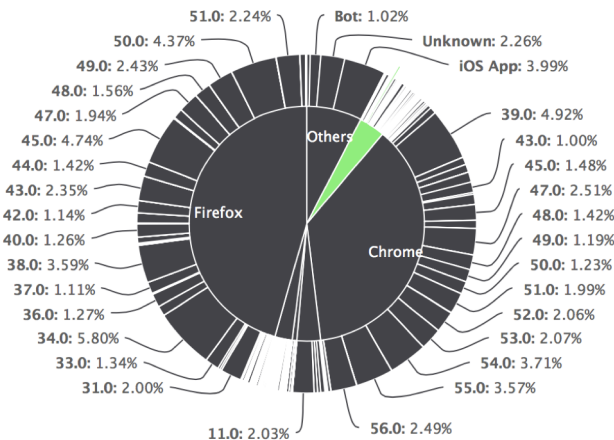
Browser Fingerprinting



Fingerprinting Works



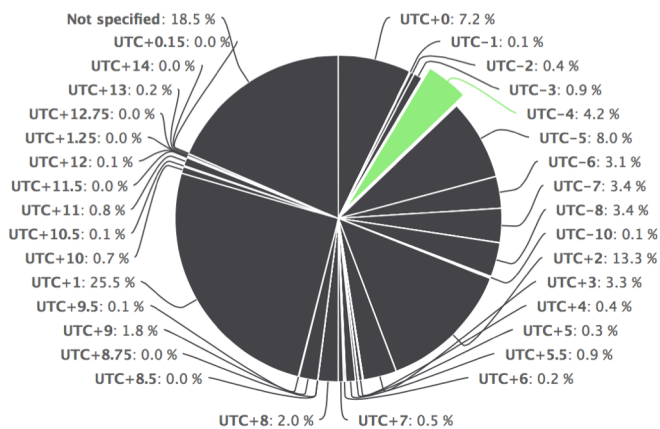
Operating System



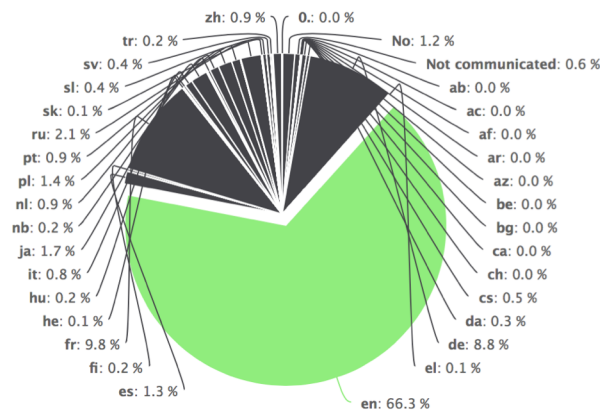
Browser

Cookies enabled ⓘ	77.92%	"yes"
Do Not Track ⓘ	30.91%	"yes"
Timezone ⓘ	4.23%	"240"
Screen resolution ⓘ	3.63%	"1280x800x24"
Use of local storage ⓘ	74.40%	"yes"
Use of session storage ⓘ	74.40%	"yes"

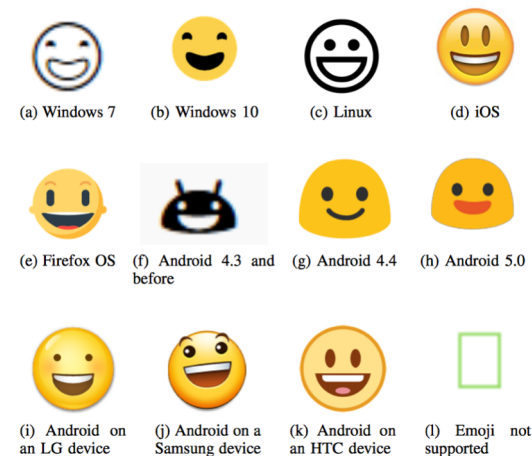
Settings



Time Zone



Language



Canvas

The result...

Your categories

Below you can review the interests and inferred demographics that Google has associated with your cookie. You can [remove](#) or [edit](#) these at any time.

Business & Industrial

Business & Industrial - Manufacturing

Computers & Electronics - Computer Hardware - Laptops & Notebooks - Tablet PCs

Computers & Electronics - Software - Multimedia Software - Photo & Video Software

Computers & Electronics - Software - Operating Systems - Mac OS

Internet & Telecom - Mobile & Wireless - Mobile Phones

Internet & Telecom - Mobile & Wireless - Mobile Phones - Smart Phones

Online Communities - Social Networks

Reference - General Reference - Time & Calendars

Science - Mathematics

Personalized Content



Targeted Advertising



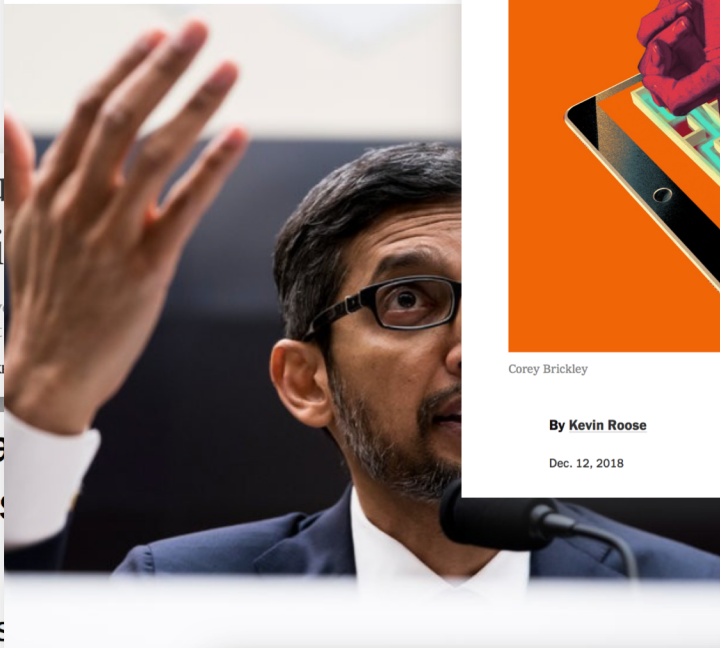
Data Collection is Here to Stay...



"Remember when, on the Internet, nobody knew who you were?"

Today

Google's Pichai Faces Privacy and Bias Questions in Congress



THE SHIFT

Is Tech Too Easy to Use?



Corey Brickley

By Kevin Roose

Dec. 12, 2018



Your Apps Know Where You Are at Night, and They're Not Keeping It Anonymous

Dozens of companies use smartphone locations to help advertisers and even track you, even if you claim to be anonymous, but the data shows how personal it is.

By JENNIFER VALENTINO-DeVRIES, NATASHA SINGER, MICHAEL H. KELLER and AARON K...

Privacy, security fears a UK.gov's digital bod has solution: 'Get over it'

Yeah, how about you work for us

By [Rebecca Hill](#) 10 Dec 2018 at 13:20



THE ZEN OF MOBILE

By [Evan Schuman](#), Contributing Columnist, Computerworld | DEC 12, 2018 3:00 AM PT

OPINION

Apple's App Store privacy efforts are backfiring big time

Although Apple is trying to position itself as the consumer-privacy-friendly company, some have complained that it is doing it in far too heavy-handed a way.



Over 70% of U.S. Consumers Favor National Data Privacy Law

MCM Staff

December 12, 2018

... and Cecilia Kang



Today

Czech yourself, Russia! Prague says its foreign ministry was hacked for more than a year

Report claims that from 2016-2017...

In case you're not already sick of Spectre... Boffins demo Speculator tool for sniffing out data-leaking CPU

proof-of-concept, SplitSpectre, requires fewer instructions in victim

Richard Chirgwin 7 Dec 2018 at 23:59

27 SHARE ▼

Latest Google+ flaw leads Chocolate Factory to shut down site early

52.5 million accounts at risk, tens of people are worried

By Shaun Nichols in San Francisco 11 Dec 2018 at 00:36

44 SHARE ▼

OPwned: Republicans fall victim to email hack

NRCC says it was hit in run-up to 2018 mid-term elections

Yet another mega-leak: 100 million Quora accounts compromised by system invaders

Passwords should be safe, but reset just in case

By Richard Chirgwin

Adobe Flash zero-day exploit... leveraging ActiveX... embedded in Office Doc... BINGO!

It's like a greatest hits album of terrible security policies

By Shaun Nichols in San Francisco 5 Dec 2018 at 19:34

48 SHARE ▼

Ticketmaster tells customer it's not at fault for site's Magecart malware pwnage

Uh, hello? Didn't you put third-party Javascript on a payment page?

By Gareth Corfield 12 Dec 2018 at 10:15

58 SHARE ▼