CSE508 Network Security

11/30/2017 **Privacy**

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Privacy

"The right of an entity (normally a person), acting in its own behalf, to determine the degree to which it will interact with its environment, including the degree to which the entity is willing to share information about itself with others." [RFC2828]

Real-world Privacy

Large-scale data collection examples

> Credit cards, Metrocards, loyalty cards
>
> Street/public space cameras
>
> E-ZPass
>
> Named tickets
>
> …

Part of our everyday activities and personal information is (voluntarily or compulsorily) recorded

> Information from different sources can be **correlated**
>
> *Did you buy your Metrocard with your credit card?*

The same happens in the online world…

Third parties have access to…

Our email (Gmail, Yahoo, …)

Our files (Dropbox, Google Drive, …)

Our finances (e-banking, credit reporting, Mint, …)

Our communication (Skype, Facebook, …)

Our traffic (WiFi hotspots, ISPs, …)

Our location (3/4G, GPS, WiFi, …)

Our activities (browsing history, daily routine, …)

Our preferences ("Likes," Amazon, Netflix, …)

Our health (Fitbit, iWatch, 23andMe, …)

…

The New York Times

BUSINESS DAY

Millions of Anthem Customers Targeted in Cyberattack

By REED ABELSON and MATTHEW GOLDSTEIN   FEB. 5, 2015

Outside the Anthem facility in Indianapolis.   Anthem said it detected a data breach on Jan. 29, and that it was working with the Federal Bureau of Investigation. Aaron P. Bernstein/Getty Images

Anthem, one of the nation's largest health insurers, said late

Hacking of Government Computers Exposed 21.5 Million People

By JULIE HIRSCHFELD DAVIS   JULY 9, 2015

Katherine Archuleta, director of the Office of Personnel Management, right, at hearing before the House Oversight and Government Reform Committee last month. Mark Wilson/Getty Images

✉ Email

WASHINGTON — The Obama administration on Thursday revealed that 21.5 million people were swept up in a colossal breach of government computer systems that was far more damaging than

World's Biggest Data Breaches

Selected losses greater than 30,000 records

(updated 10th Sep 2017)

interesting story

YEAR

BUBBLE COLOUR YEAR METHOD OF LEAK

BUBBLE SIZE NO OF RECORDS STOLEN DATA SENSITIVITY

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2017

Brazzers X ebrite on Sense DaFont Instagram nterpark Lynda.com Netflix Twitter account 'ayAs Quest Diagnostics JCross Service ap Tesco Bank ee erly Wonga mate

Bell

Equifax
143000000

Swedish Transport Agency Telegram ran00 32000000

Dailymotion
85200000

Weebly
43000000

River City Media
1370000000

Wendy's

2016

uTorrent

Friend Finder Network
412, 000, 000

Turkish citizenship database

World Check

Minecraft ail. ru 25, 000, 000

Syrian government

Anthem
80, 000, 000

Linux Ubuntu forums Mossack Mutuelle Philippines'

Verizon

Egham, U.K., February 7, 2017

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Gartner Says 8.4 Billion Connected "Things" Will Be in Use in 2017, Up 31 Percent From 2016

Consumer Applications to Represent 63 Percent of Total IoT Applications in 2017

Gartner, Inc. forecasts that 8.4 billion connected things will be in use worldwide in 2017, up 31 percent from 2016, and will reach 20.4 billion by 2020. Total spending on endpoints and services will reach almost $2 trillion in 2017.

Regionally, Greater China, North America and Western Europe are driving the use of connected things and the three regions together will represent 67 percent of the overall Internet of Things (IoT) installed base in 2017.

Consumer Applications to Represent 63 Percent of Total IoT Applications in 2017

The consumer segment is the largest user of connected things with 5.2 billion units in 2017, which represents 63 percent of the overall number of applications in use (see Table 1). Businesses are on pace to employ 3.1 billion connected things in 2017. "Aside from automotive systems, the applications that will be most in use by consumers will be smart TVs and digital set-top boxes, while smart electric meters and commercial security cameras will be most in use

How A Coffee Machine Infected Factory Computers with Ransomware

By *Waqas* on July 28, 2017   ✉ *Email*   🐦 *@hackread*   🏷 **CYBER ATTACKS**   **HACKING NEWS**   **MALWARE**   **SECURITY**

2817
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It's no surprise that the Internet of Things (IoT) devices are highly vulnerable to cyber attacks but who would know a time would come when these devices will become a security threat to institutions?

A few months ago researchers exposed life threatening vulnerabilities in IIoT (Industrial Internet of Things) devices specifically Industrial robots. In their findings, robots could be hacked, but in this case, we are about to discuss a smart coffee machine or an Internet connected coffee machine.

> **More:** San Francisco Railway' Fare System Hacked for 100 Bitcoin Ransom

The incident took place in June 2017 and was shared by a chemical engineer on Reddit who goes by the handle of "C10H15N1." He works as a PLC (Programmable Logic Controllers) expert in a company that has multiple petrochemical factories making chemicals in Europe.

Innovations

How a fish tank helped hack a casino

By **Alex Schiffer** July 21

Hackers stole data from a casino by hacking into an Internet-connected fish tank, according to a new report. (iStock)

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The New York Times

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By BRIAN X. CHEN   SEPTEMBER 4, 2014 11:32 PM   💬 21 Comments

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NEW YORKER | His name, writes Tim Wu, is Ted Sarandos. - *Natasha Singer*

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UBER BLOG | A new study released by the ride-hailing company claims it is having a "measurable impact on driving down alcohol-related crashes." - *Mike Isaac*

The Atlantic

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Armed With Facebook 'Likes' Alone, Researchers Can Tell Your Race, Gender, and Sexual Orientation

REBECCA J. ROSEN | MAR 12 2013, 2:59 PM ET

But the deeper aspects of your personality remain hard to detect.

VIDEO

How to Build a Tornado

A Canadian inventor believes his tornado machine could solve the world's energy crisis.

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Introducing the Supertweet
IAN BOGOST

My Parents' Facebook Will
JAKE SWEARINGEN

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GAY - A GREAT NATION DESERVES EQUALITY

f Like 6.6k   🐦 Follow @americabloggay 48.1K followers

Facebook knows you're gay before you do

3/20/13 4:29pm by Jon Green   39 Comments

f Like 2k   🐦 Tweet 761   ⬆ ⬇ 3 points   g+1 39

Am I the only one creeped out that Facebook is now guessing, sometimes correctly, if its users are gay?

In the world of Big Data, our private lives are increasingly becoming intermingled with the shadowy, yet public, world of cyberspace.

Whenever we go online we are providing data that can be used to market to us; from Google searches to Facebook likes to eBay purchases, we are inputting data into a series of mathematical models which make *incredibly* educated guesses about the kinds of people we are.

Facebook creepily offers help to a gay guy thinking of "coming out"

Enter Matt. As BuzzFeed notes, Matt was your typical Facebook user who suddenly found an ad in his news feed for help in coming out. The weird thing was that Matt "did" need help coming out, and understandably he was more than a bit curious as to how Facebook knew.

At first, Matt wondered if Facebook had accessed his text messages, as he had confided in a close friend the previous

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TECH   2/16/2012 @ 11:02AM | 2,698,356 views

How Target Figured Out A Teen Girl Was Pregnant Before Her Father Did

+ Comment Now   + Follow Comments

Every time you go shopping, you share intimate details about your consumption patterns with retailers. And many of those retailers are studying those details to figure out what you like, what you need, and which coupons are most likely to make you happy. Target, for example, has figured out how to data-mine its way into your womb, to figure out whether you have a baby on the way long before you need to start buying diapers.

Target has got you in its aim

Charles Duhigg outlines in the New York Times how Target tries to hook parents-to-be at that crucial moment before they turn into rampant — and

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Web Browsing Tracking

Webpages are often mashups of content loaded from different sources

> Ads, images, videos, widgets, …

> IMG URLs, IFRAMEs, JavaScript, web fonts, Flash/applets, …

> Hosted on third-party servers: CDNs, cloud providers, ad networks, …

A third party involved in many different websites can track user visits across all those websites

> 2+ third parties may collude to expand their collective "view"

Need to learn two key pieces of information

> ***What webpage was visited***

> ***Who visited it***

Microsoft Announces Con ✕

techcrunch.com/2015/04/29/microsoft-announces-continuum-turning-windows-10-phones-into-desktop

68

News   Startups

DISCONNECT

Show list view

Apps   Microsoft   Window

Microsoft A
Phones Into

Posted 2 hours ago by Kyle

1,769
SHARES

Browse the web normally. As you do, the graph in this popup and the counter in the toolbar will update. Each circle in the graph represents a site that's been or would've been sent some of your personal info.
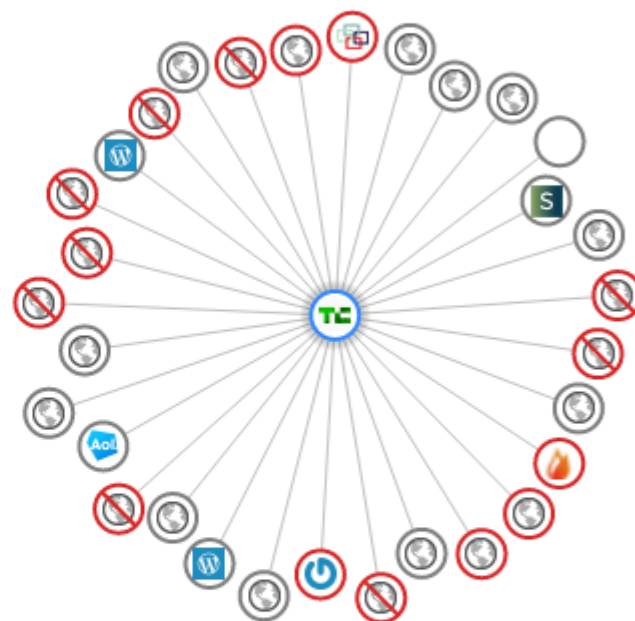
Circles with a halo are sites you've visited. Circles without a halo are sites you haven't.

Red circles are known tracking sites. Gray circles aren't but may still track you.

Mouse over a circle to view that site's tracking footprint. Click a red circle to block or unblock that site.

Unblock tracking sites

Hide sidebar

/b

Microsoft just demonstrated one of the intriguing possibilities from its single platform/multiple

What webpage was visited?

HTTP Referer [sic] header 💬

The URL of the webpage from which a link was followed

Useful for statistics/analytics, bad for privacy

Can be turned off trough browser options/extensions

HTML5 rel="noreferrer" anchor attribute to indicate to the user agent not to send a referrer when following the link

Page-specific, session-specific, user-specific URLs

Unique URL per page (even for the same resource) ➔ track what page was visited

Unique URL per session/user ➔ distinguish between visits from different users

Tracking URLs are also commonly used in promotional emails

Embedded image loading

This is an active email address!

Detect the time a user viewed a message

The request reveals much more: user agent, device, location, …

Embedded links

Learn which email addresses resulted in visits (click-through rate)

Default behavior of email clients varies

Gmail used to block images by default, now uses image proxy servers

Tracking through unique images still possible: senders can track the first time a message is opened (user's IP is not exposed though)

Twitter <info@twitter.com> Unsubscribe   Apr 26 (3 days ago)
to me

Images are not displayed. Display images below - Always display images from info@twitter.com
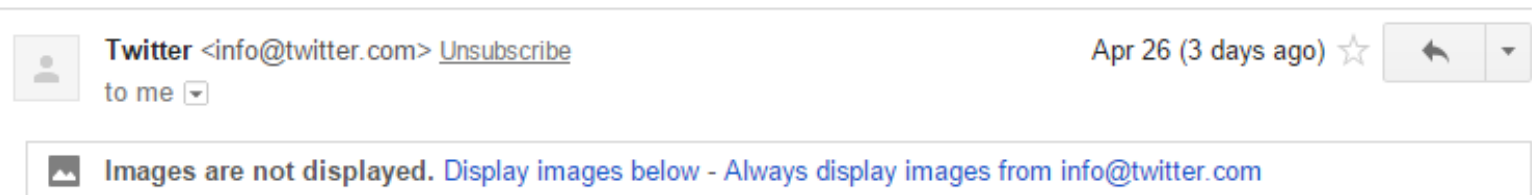
Who visited the page?

Browsing to a web page reveals a wealth of information

Source IP address

Not very accurate (e.g., NAT, DHCP, on-the-go users) but still useful

Third-party cookies: precise user tracking

Easy to block (configurable in most browsers, defaults vary)

"Evercookies:" exploit alternative browser state mechanisms

Flash/Silverlight/other plugin-specific storage, ETags, HTML5 session/logal/global storage, caches, …

Browser/device fingerprinting: recognize unique system characteristics 💬

Browser user agent, capabilities, plugins, system fonts, screen resolution, time zone, and numerous other properties

What do web tracking techniques really track? 💬

Distinguish between different visitors

Track anonymous individuals

Actually: track the pages visited by a particular browser running on a particular device

Better: distinguish between different *persons*

Track named individuals

The transition is easy…

Personally identifiable information (PII) is often voluntarily provided to websites:

Social networks, cloud services, web sites requiring user registration, …

Cookies/sessions are associated with PII

Contamination: trackers may collude with services

Previously "anonymous" cookies/fingerprints can be associated with named individuals

ROBERT MCMILLAN   10.27.14   6:30 AM

VERIZON'S 'PERMA-COOKIE' IS A PRIVACY-KILLING MACHINE
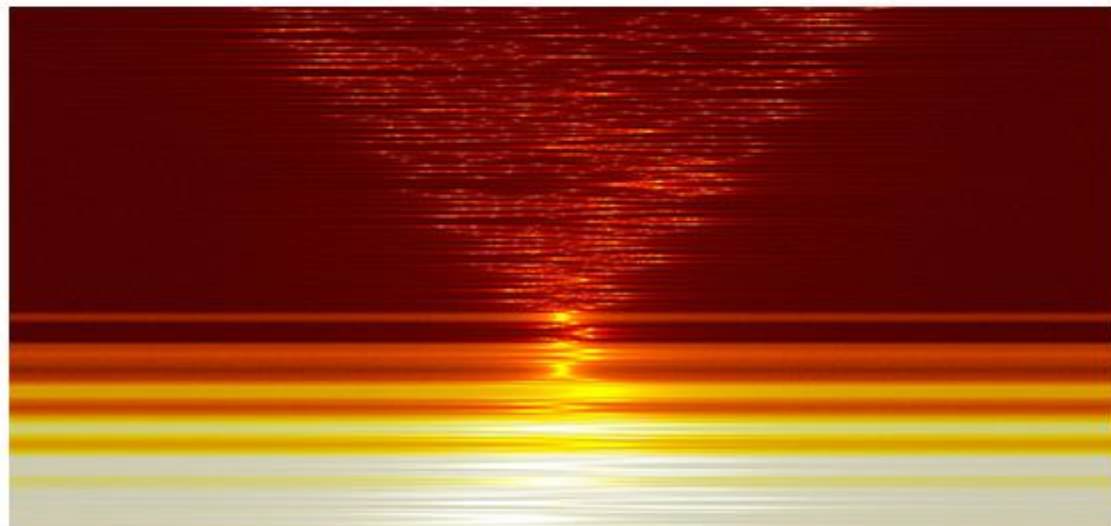
ars technica
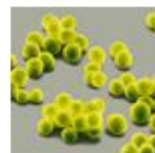
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MINISTRY OF INNOVATION / BUSINESS OF TECHNOLOGY

AT&T charges $29 more for gigabit fiber that doesn't watch your Web browsing

AT&T goes head to head against Google in KC on fiber and targeted ads.

by Jon Brodkin - Feb 16, 2015 12:38pm EST

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Awesome is here!
U-verse® with
AT&T GigaPower℠

📷 AT&T

AT&T's gigabit fiber-to-the-home service has just arrived in Kansas City, and the price is the same as Google Fiber—if you let AT&T track your Web browsing history.

Users register on trackers!

Social plugins are prevalent

- 2+ billion Facebook users
- 33% of the top 10K websites have Like Buttons
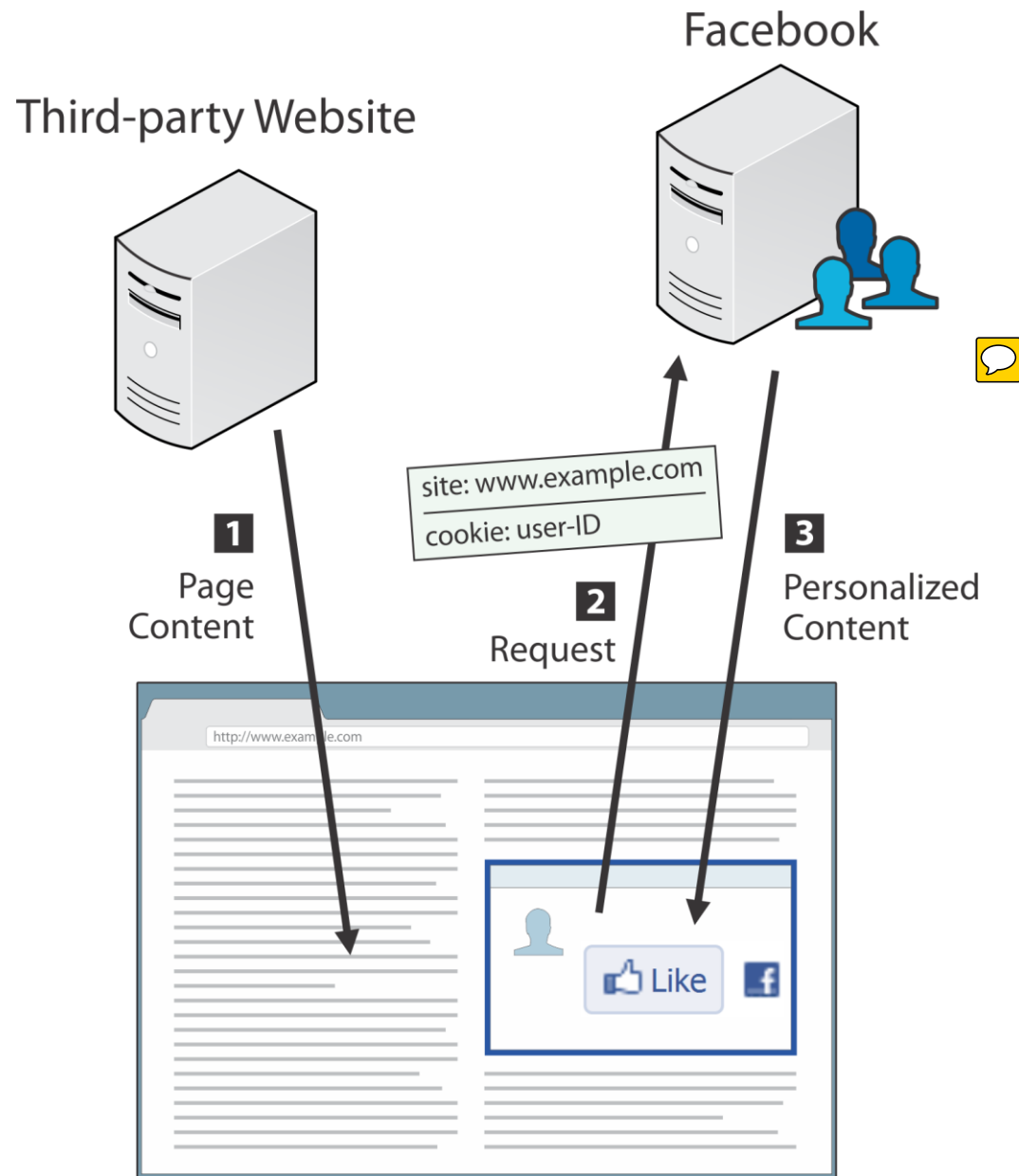- Twitter, Google+, LinkedIn, Pinterest, AddThis, …
- OS/app integration

A growing part of our browsing history can be tracked by social networking services

- Not as merely anonymous visitors, but as **named persons**
- Just visiting the page is enough (no interaction needed)
- Cross-device tracking

Third-party Website

Facebook

1 Page Content

site: www.example.com

cookie: user-ID

2 Request

3 Personalized Content

http://www.example.com

Like

Existing Solutions

Log out

Some cookies persist

Block third-party cookies

Not always effective

Block social widgets completely

Incognito mode

All existing solutions disable content personalization

Privacy vs. functionality dilemma

(a) Like — 43 likes. Sign Up to see what your friends like.

(b) Like — 43 people like this.

(c) Like — Jane Doe, John Doe and 41 others like this.

Like — John Doe, Jane Doe and 69 others like this.

First Party Isolation (Firefox)

AKA Cross-Origin Identifier Unlinkability (Tor Browser)

All identifier sources and browser state are scoped (isolated) using the URL bar domain

Cookies, cache, HTTP Authentication, DOM Storage, Flash cookies, SSL and TLS session resumption, HSTS and HPKP supercookies, OCSP, …

Example: `tracker.com` sets/reads cookies in `bbc.com` and `cnn.com`

Before: `tracker.com` can track the same person on both sites

After: `tracker.com` will see two different cookies

Third party cookies are stored with a tag of the first party (e.g., `bbc.com.tracker.com` and `cnn.com.tracker.com`)
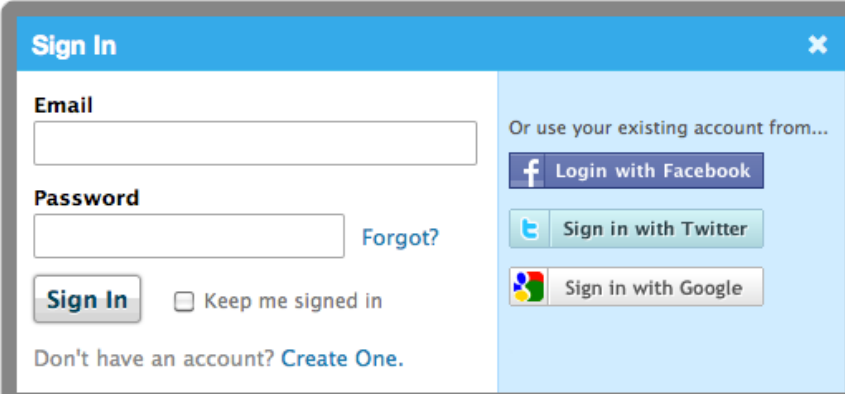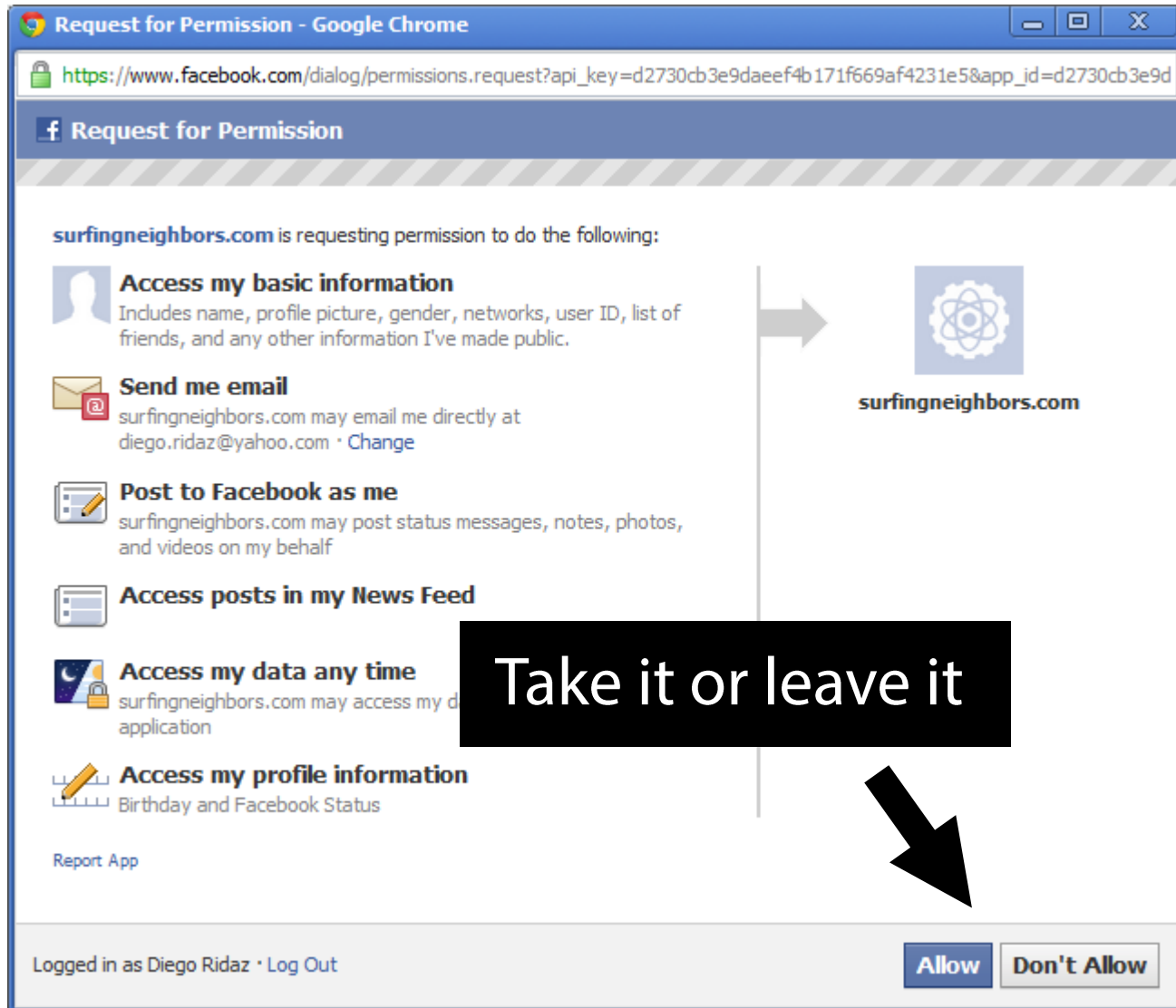
Single Sign-on/Social Login

Pros

Convenience – fewer passwords to remember

Rich experience through social features

Outsource user registration and management

Cons

Same credentials for multiple sites

User tracking

Access to user's profile

Take it or leave it

Location Tracking

IP addresses reveal approximate location information

MaxMind statistics: 99.8% accurate on a country level, 90% accurate on a state level in the US, and 81% accurate for cities in the US within a 50 kilometer radius
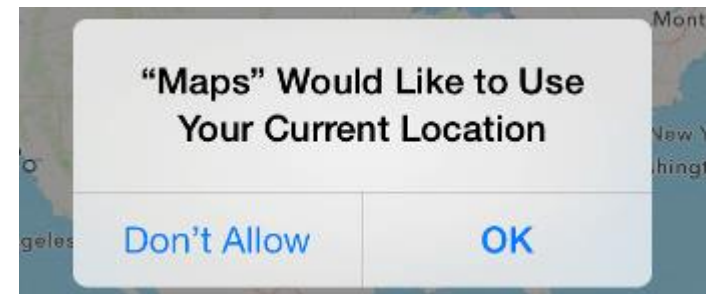
Mobile devices allow for precise location tracking

Cell tower triangulation/trilateration

GPS, GLONASS, …

WiFi access points in known locations

Per-app permissions

Android vs. iOS:
installation vs. usage time

SECTIONS   HOME   SEARCH

The New York Times

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BUSINESS DAY

💬 410 COMMENTS

Attention, Shoppers: Store Is Tracking Your Cell

By STEPHANIE CLIFFORD and QUENTIN HARDY   JULY 14, 2013

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Like dozens of other brick-and-mortar retailers, Nordstrom wanted to learn more about its customers — how many came through the doors, how many were repeat visitors — the kind of information that e-commerce sites like Amazon have in spades. So last fall the company started testing new technology that allowed it to track customers' movements by following the Wi-Fi signals from their smartphones.

But when Nordstrom posted a sign telling customers it was tracking them, shoppers were unnerved.

"We did hear some complaints," said Tara Darrow, a spokeswoman for the store. Nordstrom ended the experiment in May, she said, in part because of the comments.

Nordstrom's experiment is part of a movement by retailers to gather data about in-store shoppers' behavior and moods, using video surveillance and signals from their cellphones and apps to learn
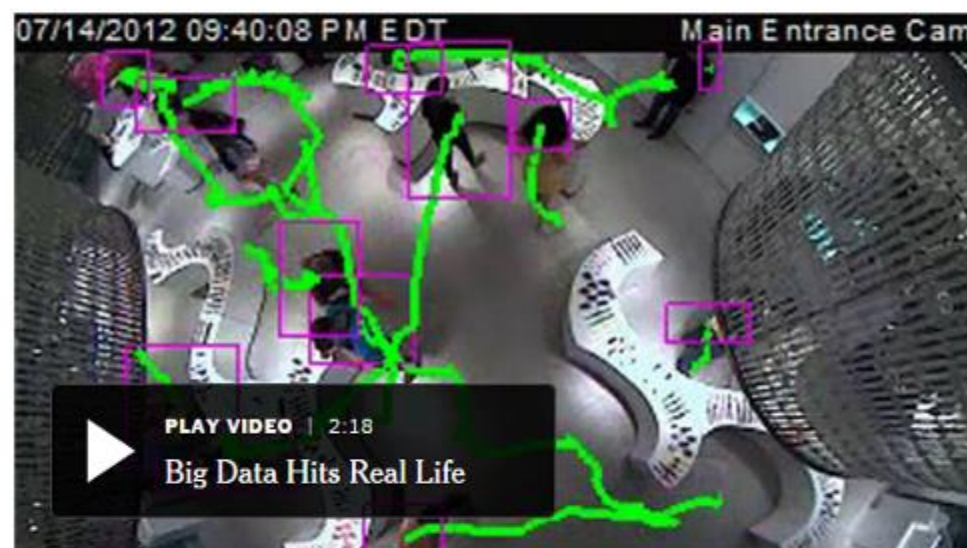
Brick-and-mortar stores are looking for a chance to catch up with their online competitors by using software that allows them to watch customers as they shop, and gather data about their behavior. Video by Erica Berenstein on July 14, 2013.

Once the stuff of science fiction, facial-scanning cameras are becoming a part of daily life in China, where they're used for marketing, surveillance and social control. Video: Paolo Bosonin. Photo: Qilai Shen/Bloomberg

WORLD | ASIA | CHINA

China's All-Seeing Surveillance State Is Reading Its Citizens' Faces

In vast social-engineering experiment, facial-recognition systems crunch data from ubiquitous cameras to monitor citizens

Online Behavioral Tracking

An increasing part of our daily activities are recorded

What we are interested in (Searches, Likes, …)

What we read (News, magazines, blogs, …)

What we buy (Amazon, Freshdirect, …)

What we watch (Netflix, Hulu, …)

What we eat (Seamless, GrubHub, …)

Where we eat (Opentable, Foursquare, …)

Where we go (online travel/hotel/event booking)

What we own/owe (e-banking, credit services, Mint, …)

Mobile apps make behavioral tracking easier and more accurate

Behavioral profiles have desirable and not so desirable uses

Recommendations, content personalization, insights, …

Targeted advertising, price discrimination (e.g., insurance premiums based on past behavior, higher prices for high-end device users), …

Health and Activity

Health records

How securely are they handled and stored?

Devices track our activities and health

Activity tracking devices

Health monitoring devices

Mobile phones

Many upload all data to the "cloud"…

Who can access them?

Doctor/hospital health portals managed by third parties