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CO643 – Week 11
Web/Mobile Computing

Dr Özgür Kafalı

Lecturer

R.O.Kafali@kent.ac.uk

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Outline

- Web 2.0
- Targeted advertising
- Mobile computing
- Human intelligence

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Learning Outcomes

- After this lecture, you will be able to
  - Review ethical and professional issues regarding the modern Internet
  - Describe components of targeted advertising
  - Review security and privacy problems surrounding mobile applications
  - Describe how human intelligence helps with computing problems

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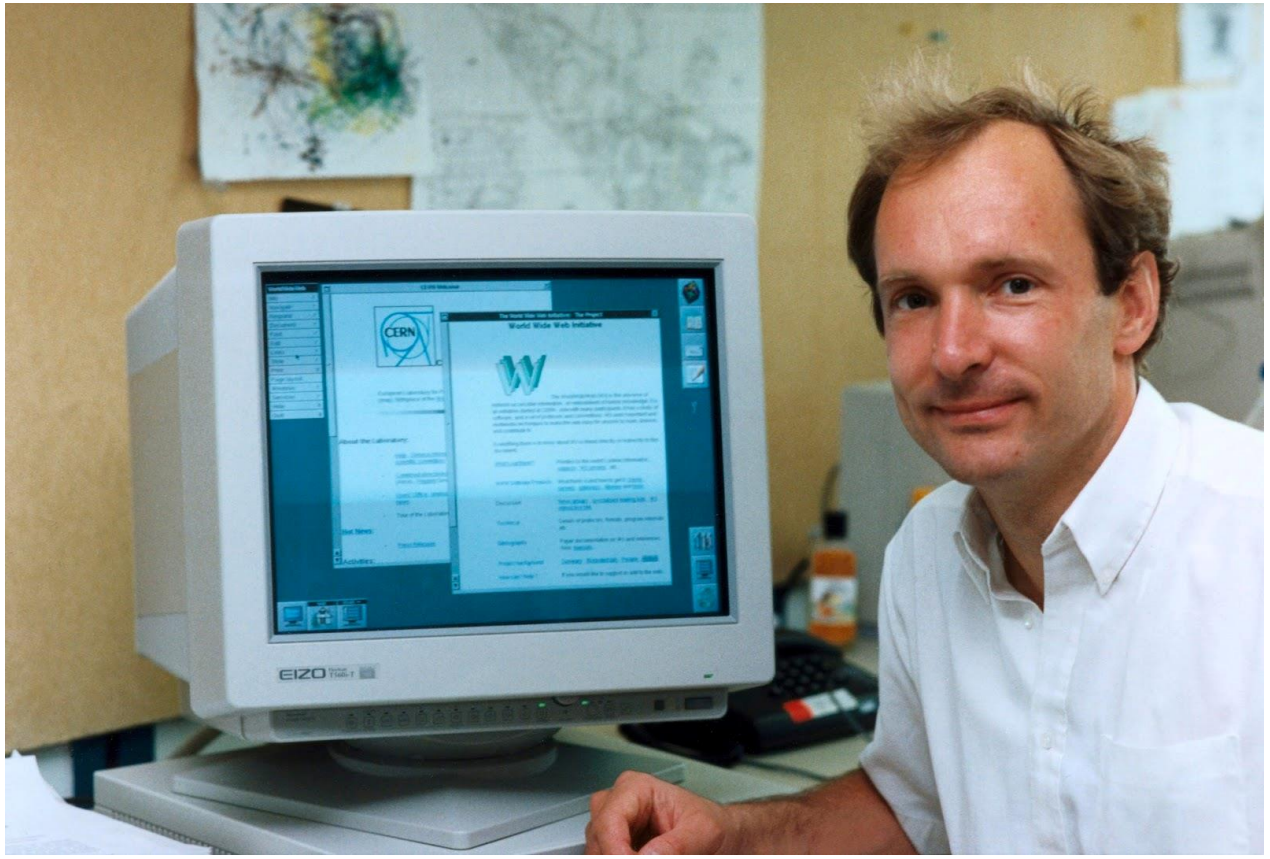
World Wide Web



https://en.wikipedia.org/wiki/World_Wide_Web

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Web 2.0 - Vision

- Social Web
- Active rather than passive
- Social networks, tagging
- Blogs, forums
- Communities

https://en.wikipedia.org/wiki/Web_2.0

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Semantic Web

- A web of data that can be processed by machines
- “I have a dream for the Web in which computers become capable of analyzing all the data on the Web – the content, links, and transactions between people and computers. A Semantic Web, which makes this possible, has yet to emerge, but when it does, the day-to-day mechanisms of trade, bureaucracy and our daily lives will be handled by machines talking to machines. The intelligent agents people have touted for ages will finally materialize”

Tim Berners-Lee

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Web 2.0 Features

- Blogging
- Wisdom of crowds
- Apps
- Multi-platform software
- Rich user experiences

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Legal Issues

- Placing social media in the legal context
- Social media and copyright
- Social media and brands
- Social media and privacy, confidentiality, defamation
- Social media and criminal law

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Misuse

- Intellectual property
- Criminal liability
- Deception
- Terrorism
- Illegal gaming

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Cyber Crime

- Fraud: Tampering with data integrity
- Cyberterrorism: Propaganda
- Online harassment: Cyber bullying
- Illegal online markets

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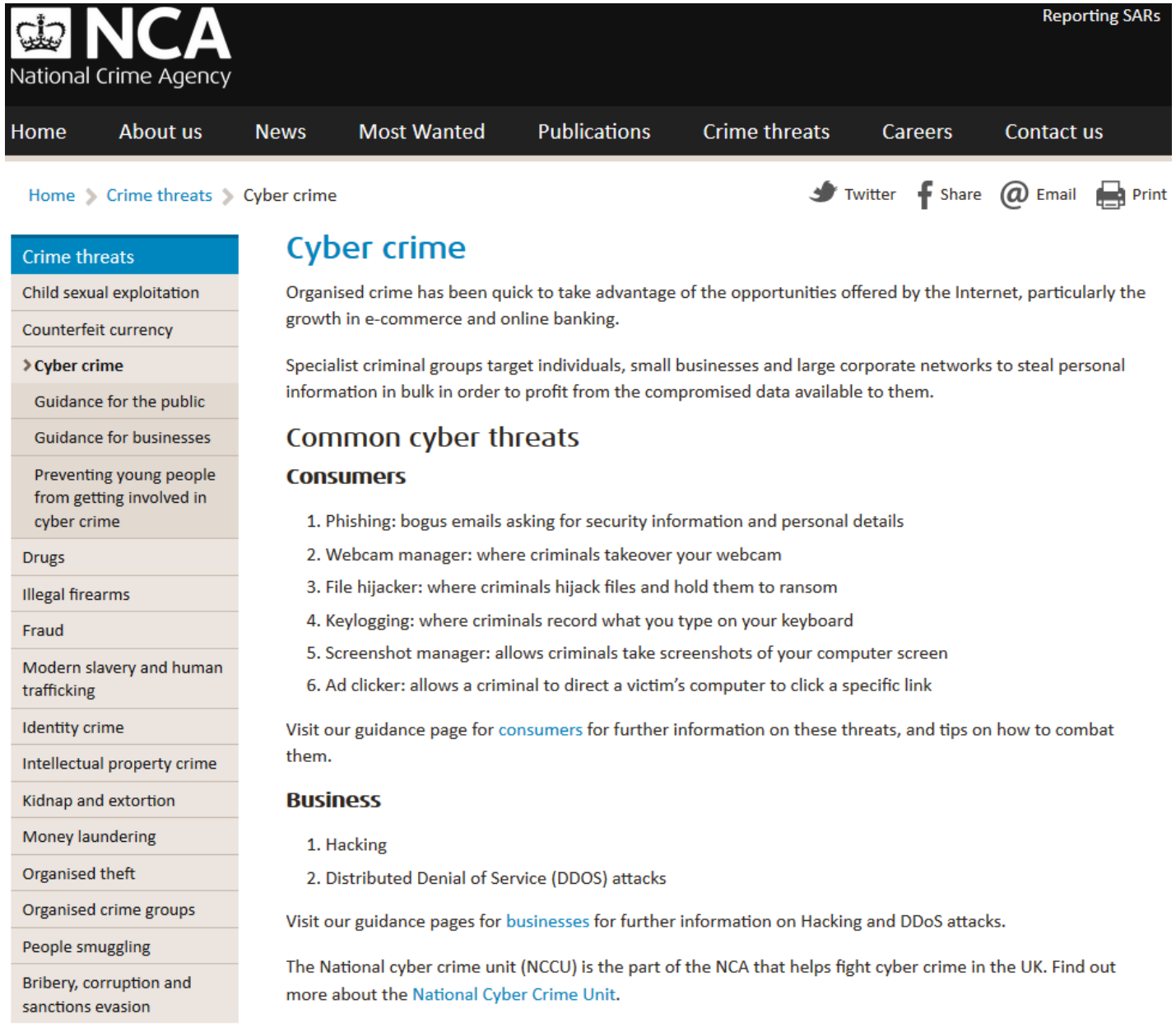
NCA



NCA National Crime Agency

Reporting SARs

Home | About us | News | Most Wanted | Publications | Crime threats | Careers | Contact us

Home > Crime threats > Cyber crime

Twitter | Share | Email | Print

Crime threats
- Child sexual exploitation
- Counterfeit currency
- Cyber crime
  - Guidance for the public
  - Guidance for businesses
  - Preventing young people from getting involved in cyber crime
- Drugs
- Illegal firearms
- Fraud
- Modern slavery and human trafficking
- Identity crime
- Intellectual property crime
- Kidnap and extortion
- Money laundering
- Organised theft
- Organised crime groups
- People smuggling
- Bribery, corruption and sanctions evasion

Cyber crime

Organised crime has been quick to take advantage of the opportunities offered by the Internet, particularly the growth in e-commerce and online banking.

Specialist criminal groups target individuals, small businesses and large corporate networks to steal personal information in bulk in order to profit from the compromised data available to them.

Common cyber threats

Consumers

1. Phishing: bogus emails asking for security information and personal details
2. Webcam manager: where criminals takeover your webcam
3. File hijacker: where criminals hijack files and hold them to ransom
4. Keylogging: where criminals record what you type on your keyboard
5. Screenshot manager: allows criminals take screenshots of your computer screen
6. Ad clicker: allows a criminal to direct a victim's computer to click a specific link

Visit our guidance page for consumers for further information on these threats, and tips on how to combat them.

Business

1. Hacking
2. Distributed Denial of Service (DDOS) attacks

Visit our guidance pages for businesses for further information on Hacking and DDoS attacks.

The National cyber crime unit (NCCU) is the part of the NCA that helps fight cyber crime in the UK. Find out more about the National Cyber Crime Unit.

http://www.nationalcrimeagency.gov.uk/crime-threats/cyber-crime

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Dark Web

- Botnets
- Virtual currency services
- Marketplaces
- Hacker hire

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Marketplaces

https://www.bbc.co.uk/news/technology-24526677

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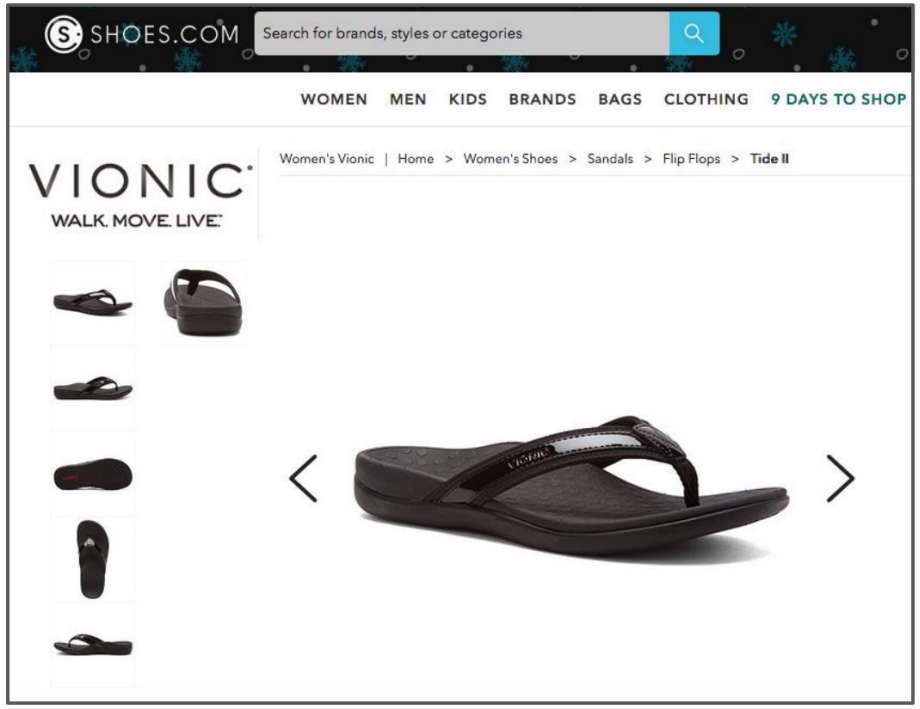
Targeted Advertising



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Stateful Web

https://en.wikipedia.org/wiki/Lou_Montulli

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Definition

- FTC defines “online behavioural advertising” (OBA) as:
- “The practice of tracking an individual’s online activities in order to deliver advertising tailored to the individual’s interests”

FTC: US Federal Trade Commission

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OBA Terminology

- Advertiser: A party with an online ad willing to embed the ad in websites (with payment)
- Publisher: A party with a website willing to place ads from advertisers
- Ad-network: A party that collects ads from advertisers and places them on publisher websites (also takes care of payments)

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Other Types of Advertising Models

- Contextual advertising: Based on the content of the page only
- Demographic targeting: Based on race, age, etc

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Collaborative Filtering

- User-based: If customers X and Y have a similar transaction history, then recommend items X has bought to Y
- Item-based: If item B is often bought by buyers of item A, then recommend B to a new buyer of A
- Recommendations shown to users based on either/both

http://starecat.com/customer-who-bought-this-item-also-bought-shopping-suggestions-at-groceries-drawing/

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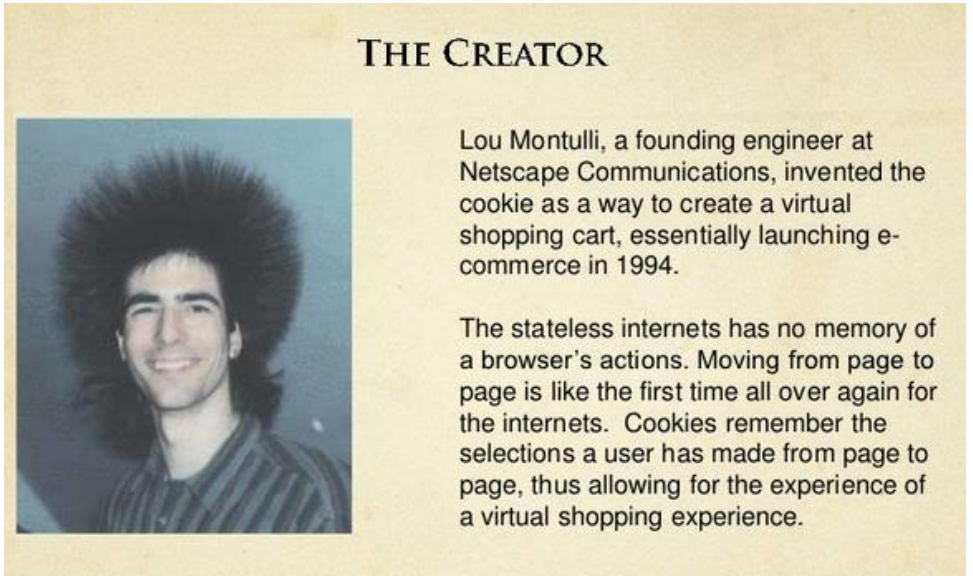
Cookies

- At the time, there was no way to store information about the state of the page
- Working on an e-commerce solution
- Implement shopping carts



https://www.slideshare.net/moxxycat/cookies-10097074

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Capabilities

- Collect information about your browsing activity
- Content you click on and other actions you take online
- Small files stored on your computer when you visit a website
- What can be inferred from cookies?
  - Age group (e.g. 18–25)
  - Gender
  - Purchase interests (e.g. shoes)

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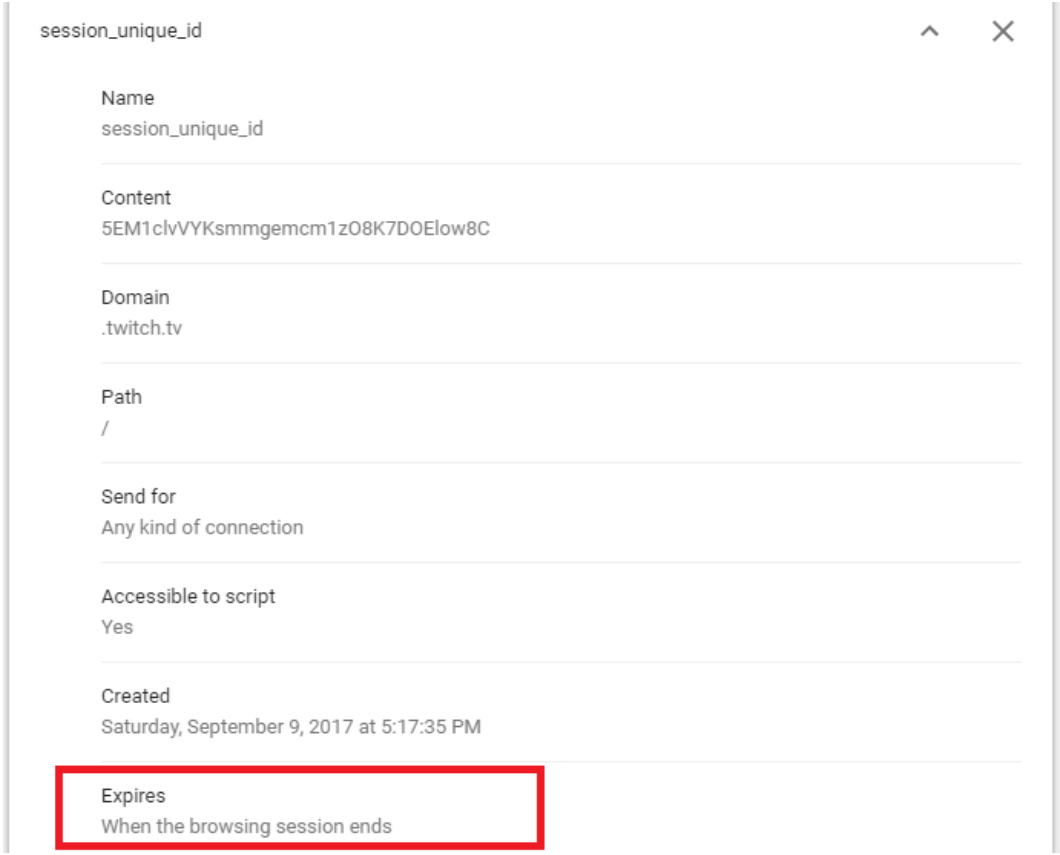
Types of Cookies

- Browser cookies
- Session cookies
- First-party cookies
- Third-party cookies



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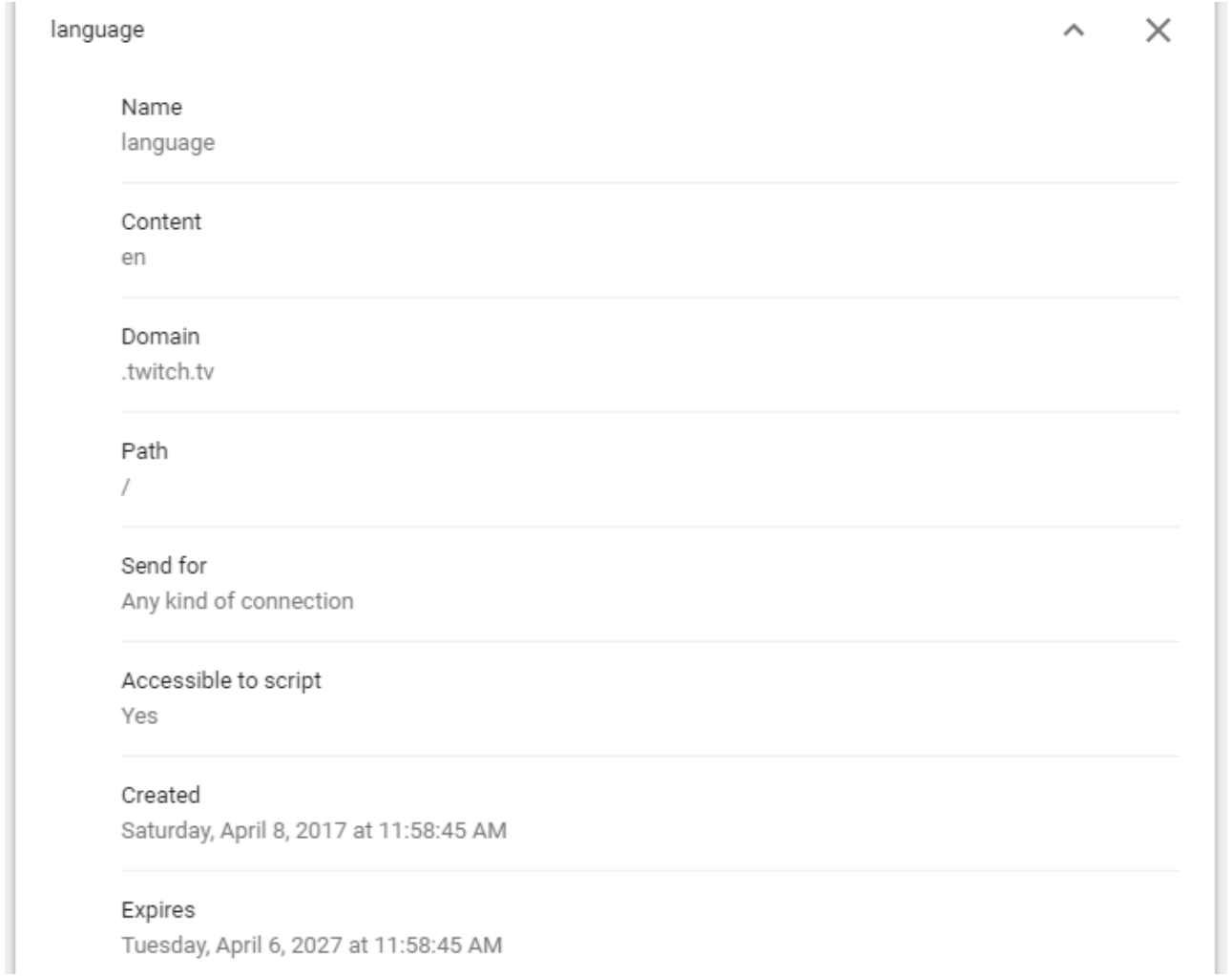
Cookie Attributes

- Typical Internet cookie
- <Name, Value> pair



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Useful Cookies

- Remember your preferences and settings (e.g. opting in or out of marketing emails)
- Remember whether you filled in a survey
- Remember whether you have been to the site before (first-time user content might differ from a regular user)
- Show “related articles” according in a news site
- Remember a location you have entered (e.g. for weather forecasts)

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What is Tracked?

- Clickstream (all URLs user visited)
- Behavioural profile
  - Intent to purchase (e.g. request quotes, add item to shopping cart)
  - Influence over purchasing habits of others (e.g. time spent on latest news and current trends according to interests)
- Ad impression history (all ads displayed to the user)
- Ad click history (all ads user clicked)

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How to Mitigate?

- Goal: Support targeted advertising without compromising user privacy (not replace, but complement)
- Idea: Implement OBA as a browser extension
  - Use browser's history
  - Results reside inside browser
  - User information is not leaked to the outside world (only clicked ads are communicated)

Toubiana et al. Adnostic: Privacy Preserving Targeted Advertising
Network and Distributed System Security Symposium, 2010

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Usability of Mitigation Tools

- Tools for setting cookies to opt out of OBA, e.g. http://optout.aboutads.info/
- Privacy settings of browsers, e.g. Chrome, Firefox
- Browser plugins for blocking specific URLs, e.g. Adblock

Leon et al. Why Johnny Can't Opt Out: A Usability Evaluation of Tools to Limit Online Behavioral Advertising Conference on Human Factors in Computing Systems, pages 589-598, 2012

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Findings

- Serious usability flaws
- Difficult to configure
- Default settings not privacy protective
- Confusing interfaces

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Mobile Computing

- Smart mobile devices
- Security and privacy problems
- App store regulations
- App permissions

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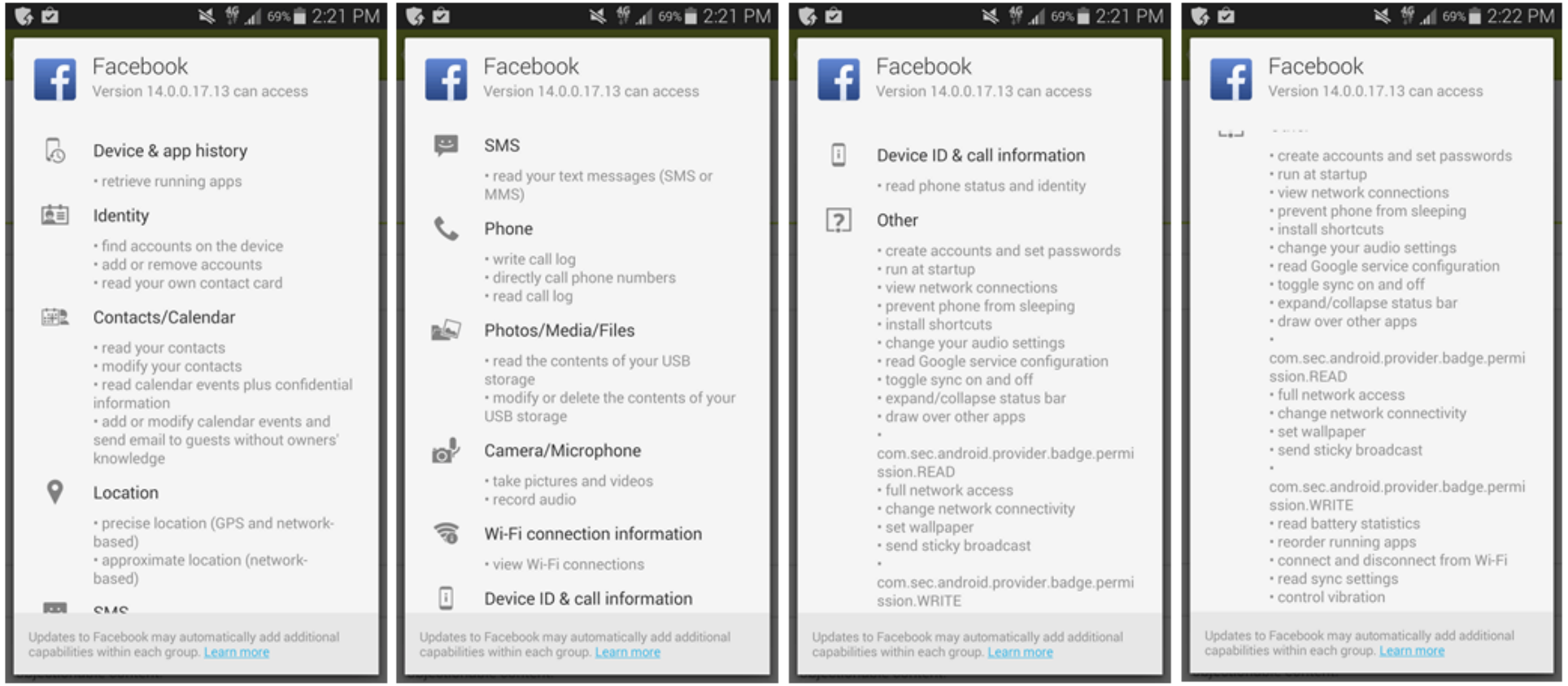
App Permissions



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Research Questions

- Attention switch and maintenance: Do users notice permissions?
- Comprehension and memory: Do users understand how permissions correspond to application risks?
- Attitudes and belief: Do users trust permissions to limit an app's abilities?
- Motivation: Do users care about their phones' privacy and security?
- Behaviour: Do users cancel installation due to permissions?

Felt et al. Android Permissions: User Attention, Comprehension, and Behavior Symposium on Usable Privacy and Security (SOUPS), pages 3:1-3:14, 2012

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Results

- Attention:
  - What portion pays attention? 17%
  - What portion is unaware? 42%
- Comprehension:
  - What portion of survey participants understand permissions correctly? 3%
  - What portion of lab study participants understand permissions correctly? 24%
- Behaviour: Majority claimed not installing app due to permissions at least once

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Human Computation

- Human intelligence
  - Crowdsourcing
  - Gamification
- Combine with machine intelligence (AI)

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Wisdom of the Crowd

Amazon mTurk

https://www.mturk.com/

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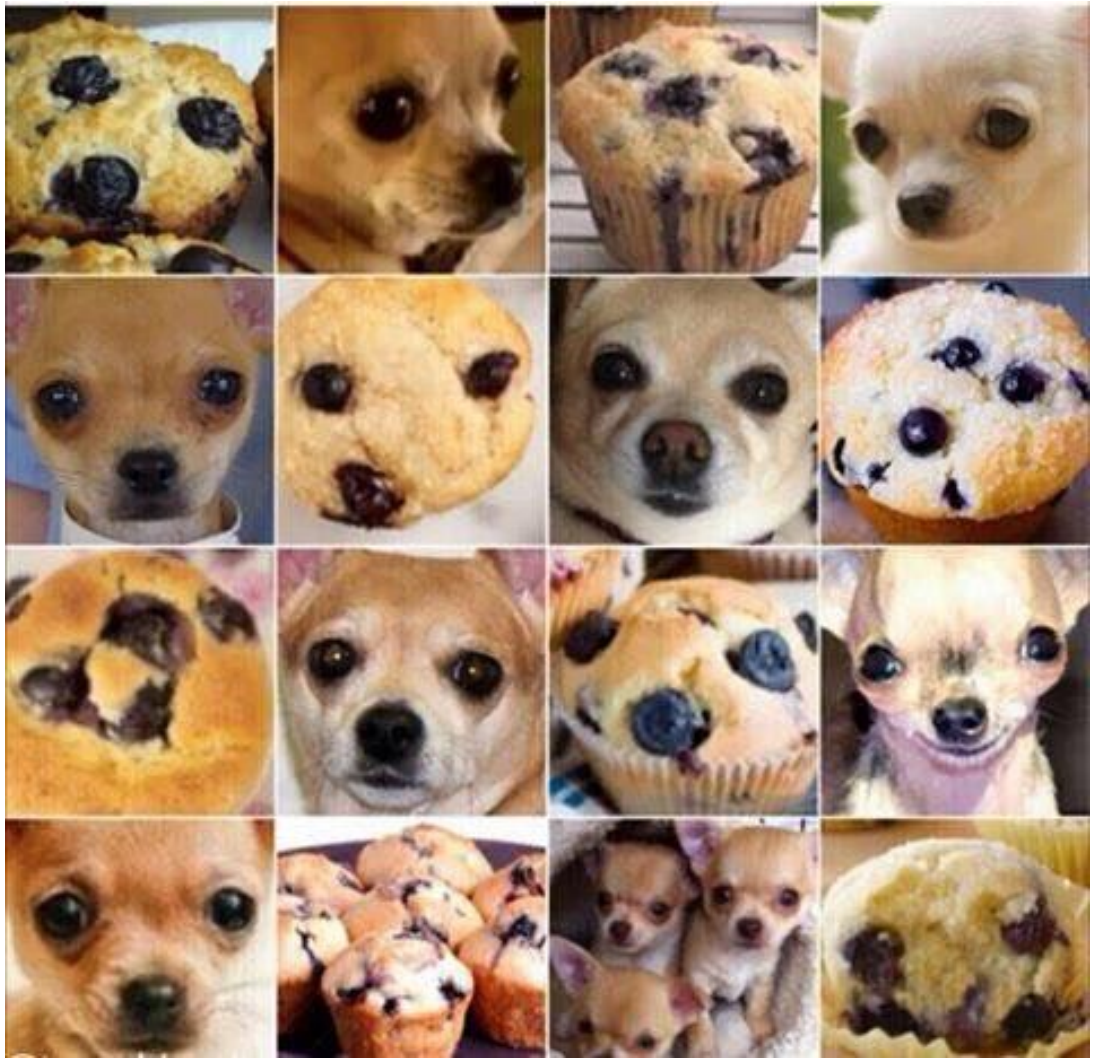
Sample HIT

- Classification
- Leverage human skills



https://imgur.com/gallery/TTpIGvo

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Challenges with Crowdsourcing

- Assessment of quality of work
- Estimation of fair wage
- Mitigation strategies:
  - Signaling to workers that their responses will be scrutinized
  - Multi-level review: A second group of workers evaluate initial group's responses
  - Competition: Multiple workers submit responses, only one is paid

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Policy Coding: Statement-level

- Collect: Any act by a first party to access, collect, obtain, receive or acquire data from another party
- Consent: Any act by a party to consent to, or control the use of, their personal information
- Use: Any act by a first party to use data in any way for their own purpose
- Retain: Any act by a first part to retain data for a particular period of time or in a particular location
- Transfer: Any act by a first party to transfer, move, send or relocate data to another party

Breaux and Schaub. Scaling requirements extraction to the crowd: Experiments with privacy policies Requirements Engineering Conference (RE), pages 163-172, 2014

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Policy Coding: Phrase-level

- Modality: Whether the action is a permission, obligation or prohibition
- Subject: The actor who performs the action on the datum
- Datum: The information on which the action is performed
- Purpose: The purpose for which the action is performed
- Source: The source from which information is collected
- Target: For transfer actions, the recipient to whom the information is transferred

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Coding Example

- “We receive and store the information you provide, including your telephone number, when you sign up to have SMS notifications sent directly to your mobile phone”
- “We do not actively share personal information with third party advertisers for their direct marketing purposes unless you give us your consent”
- Statement-level: Collect, consent, use, retain, transfer
- Phrase-level: Modality, subject, datum, purpose, source, target

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Serious Games

- Game theory
- Simulation
- Education & training

https://www.hazardoussoftware.com/products/cybersimulationsuite/

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Conclusions

- In this lecture, we have
  - Seen the ethical and professional implications of the new Web
  - Reviewed targeted advertising and how cookies are used for that
  - Seen how mobile applications can cause privacy problems
  - Reviewed applications of human intelligence complementing computing solutions

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Additional Material

- Wall Street Journal video on Targeted Ads: http://www.wsj.com/video/how-advertisers-use-internet-cookies-to-track-you/92E525EB-9E4A-4399-817D-8C4E6EF68F93.html
- Facebook incident: https://www.propublica.org/article/facebook-lets-advertisers-exclude-users-by-race
- TED talks:
  - https://www.ted.com/talks/tim_berners_lee_a_magna_carta_for_the_web#t-24904
  - https://www.youtube.com/watch?v=din2UVvRnGU