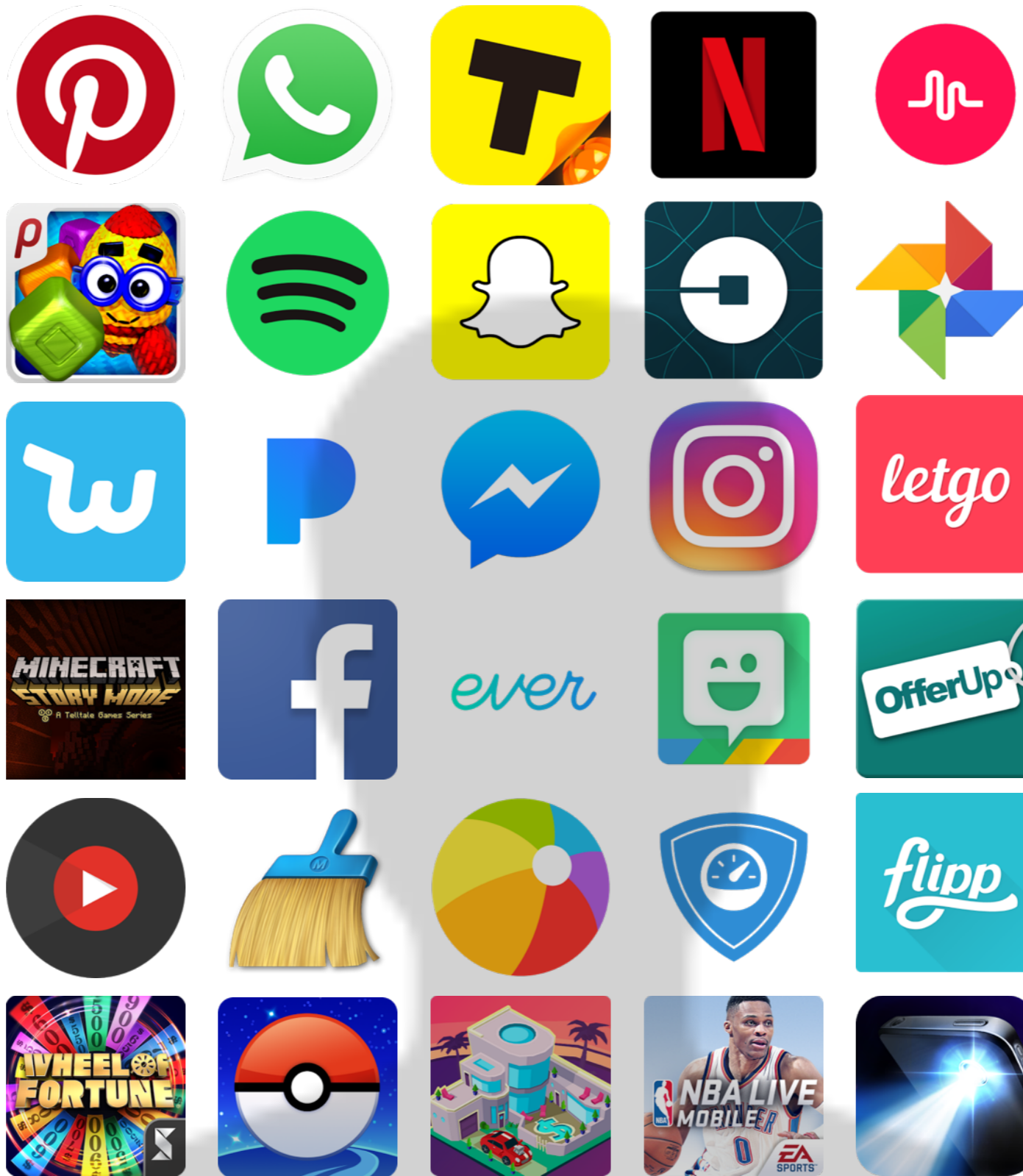
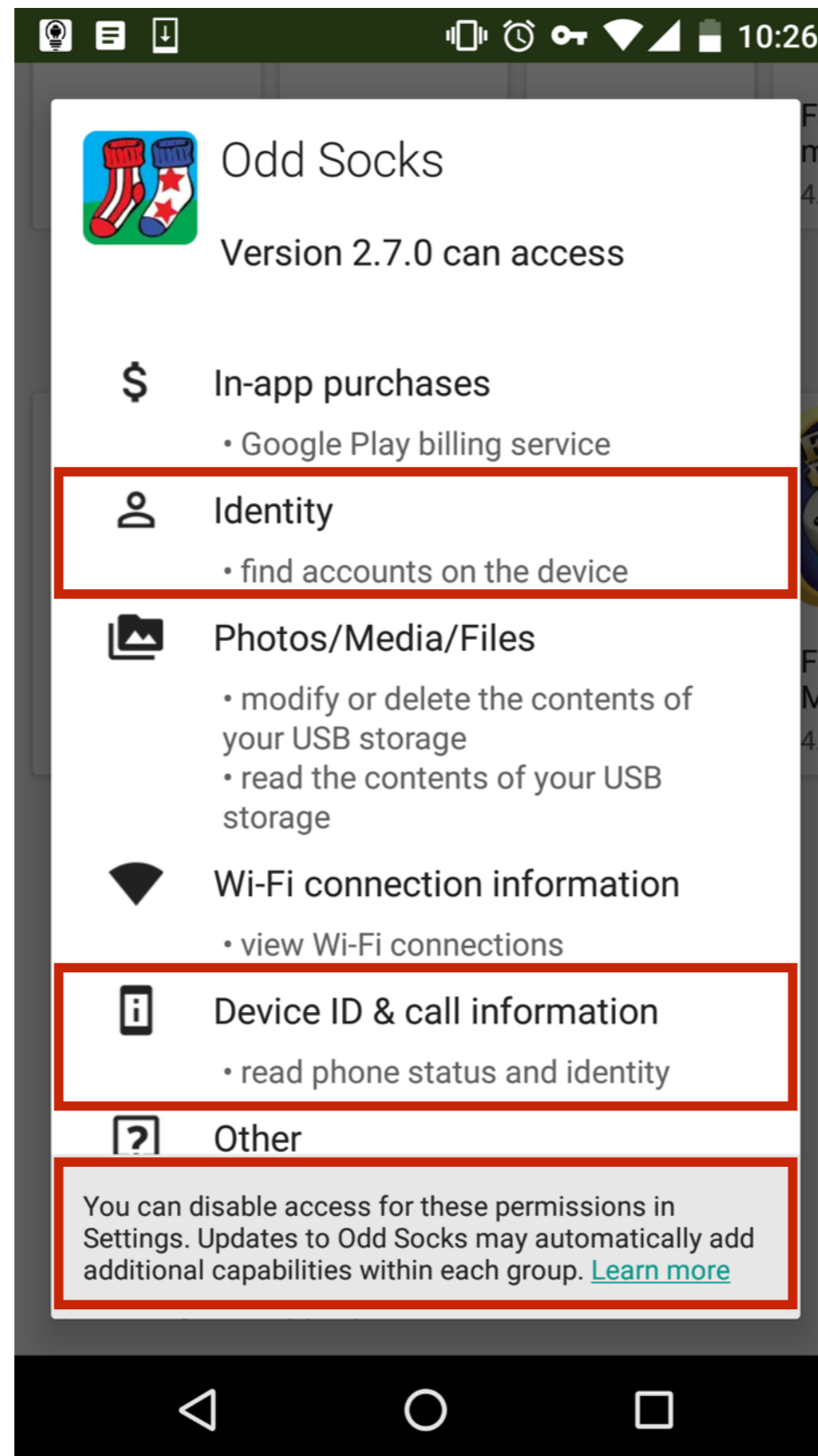


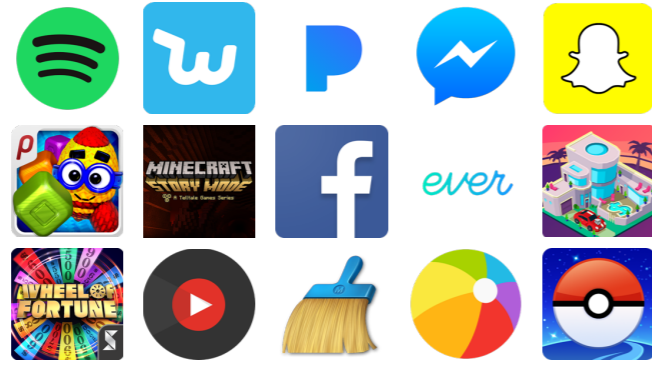
Characterizing Indirect Privacy Leaks in Mobile Apps with the Lumen Privacy Monitor

Narseo Vallina-Rodriguez



Protecting access to sensitive data

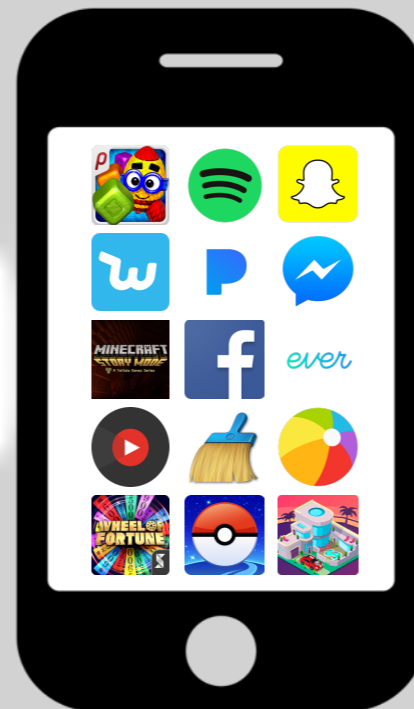




1st parties (Direct)



3rd parties (Indirect)



Project goals:

Identify 3rd-party advertising and tracking services on mobile apps

Evaluate their impact on user privacy

Promote mobile transparency and enable user control

How?



Apps

Categories

Home

Top charts

New releases



My apps

Shop

Games

Family

Editors' Choice

Account

Redeem

Send gift

Add credit

My wishlist

My Play activity

Parent guide



Lumen Privacy Monitor

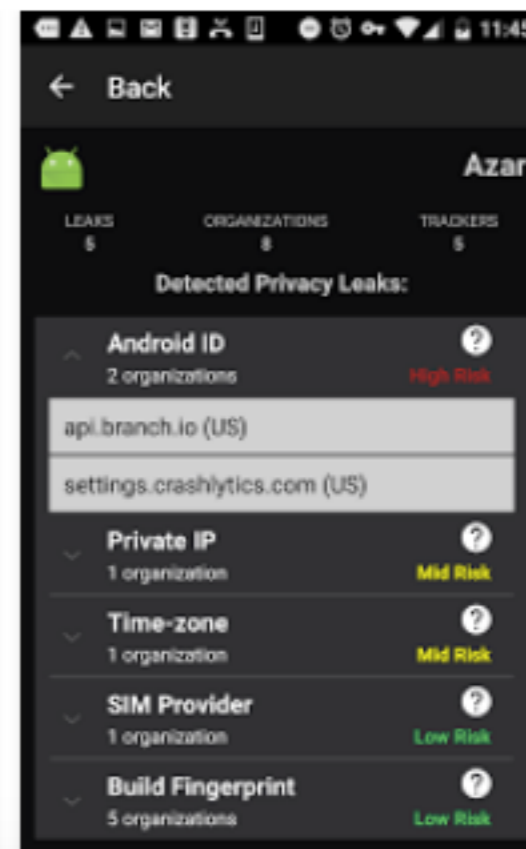
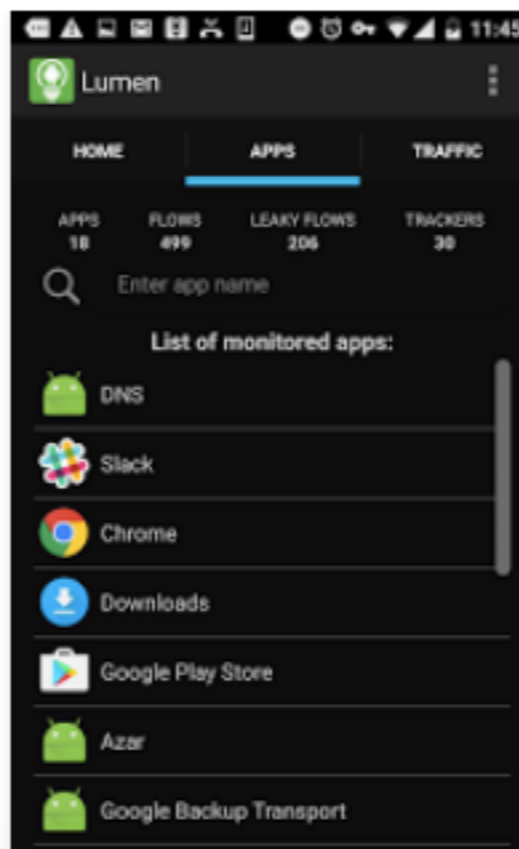
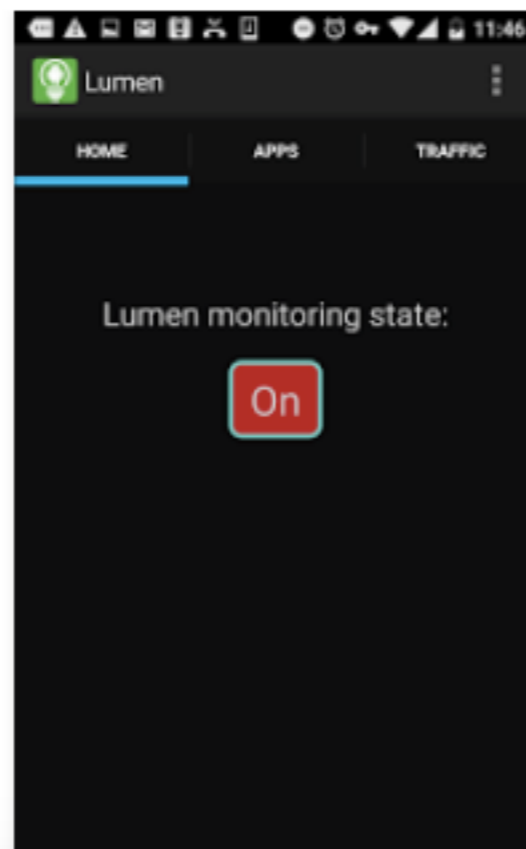
Int. Computer Science Institute-UC Berkeley Tools

★★★★★ 28

Everyone

This app is compatible with all of your devices.

Installed



Lumen monitoring state:

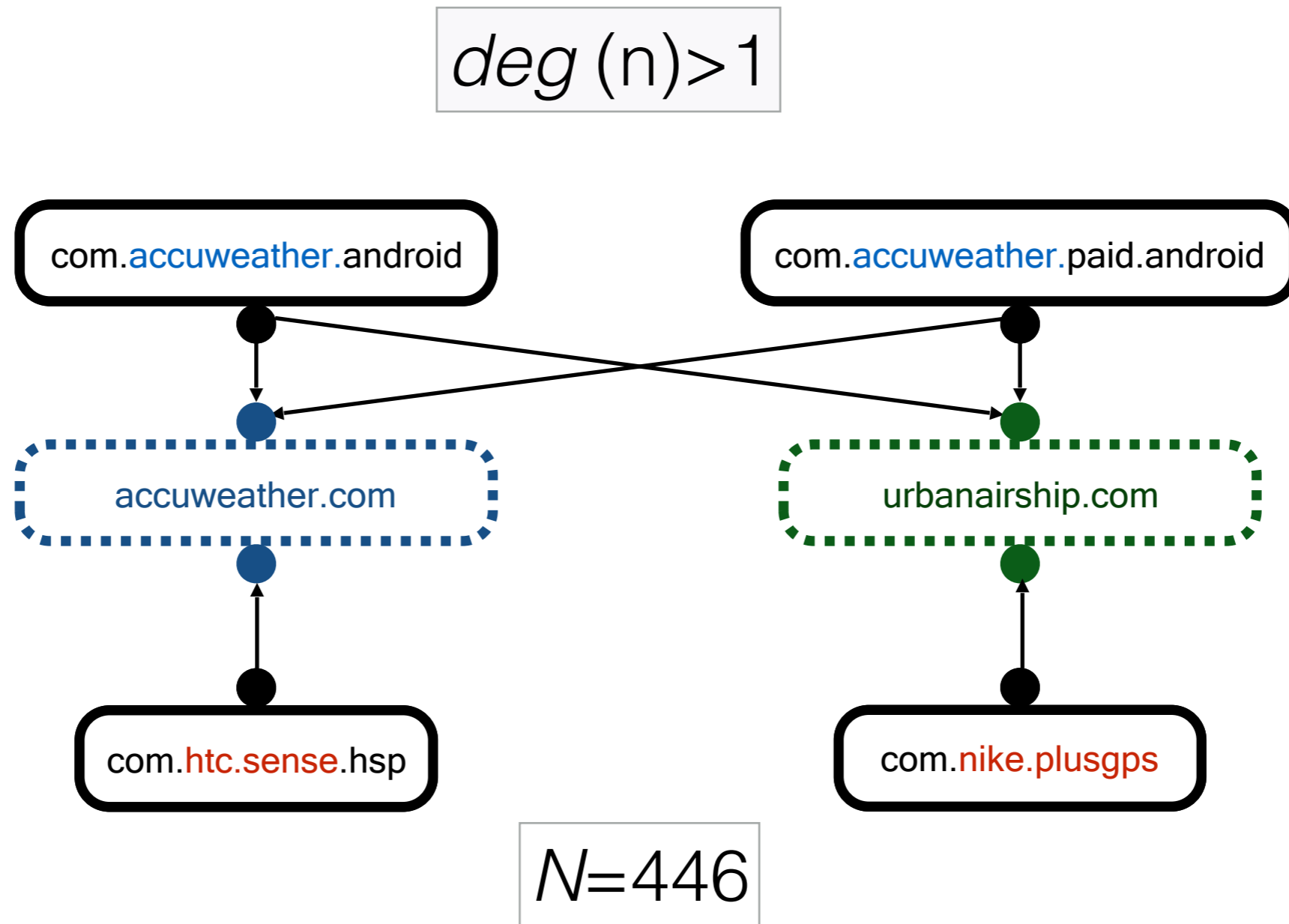
On

Research Efforts

900+ users

2500+ apps (paid and pre-installed ones)

1st-party vs. 3rd party services



How to distinguish ad networks and trackers (ATS) from CDNs?

ATS classifier (beta)

Goal: Automatically classify domains by their offered service:

1) Analytic services

2) Ad networks

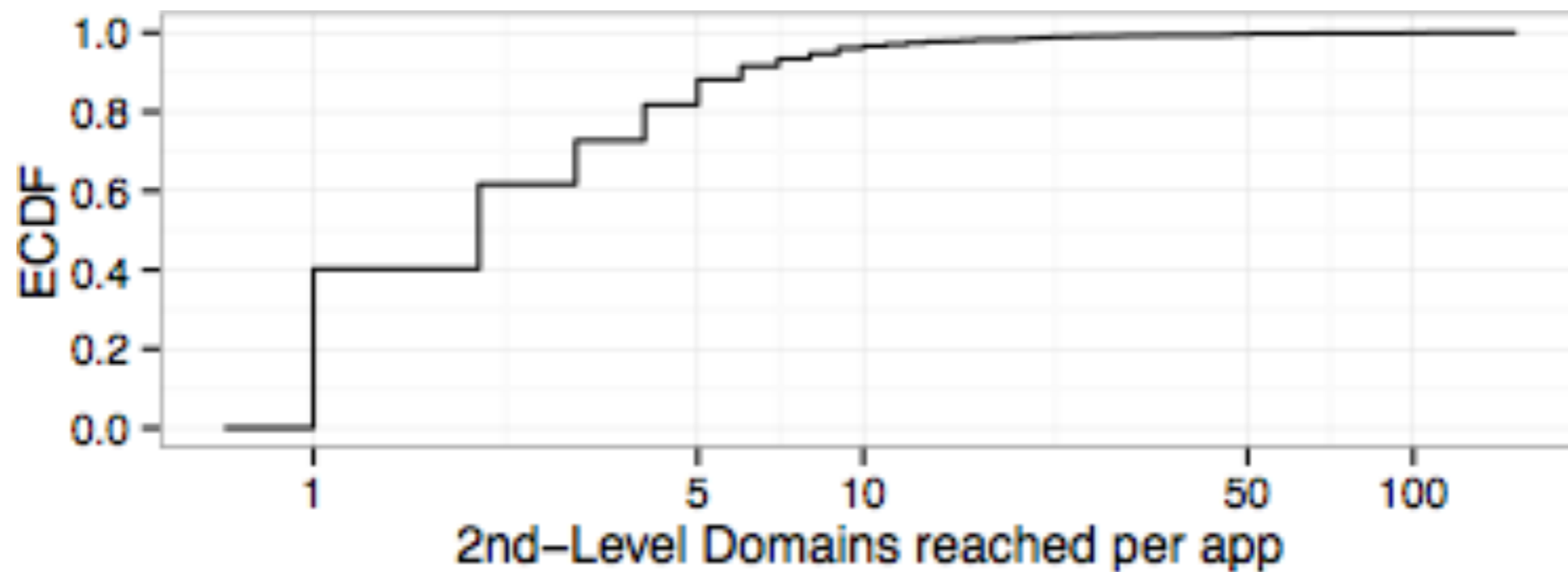
Problem: Existing URL classification services may be incomplete:

URL	Status	Categorization	Reputation
http://www.flurry.com	Categorized URL	- Internet Services	Minimal Risk

Solution: Analyse their behaviour and the content of the domain's landing page using NLP

Results

- 280 domains (N=446) ATS domains:
 - 4% FPR
 - 58 domains remained unreported by MalwareBytes and Easylist

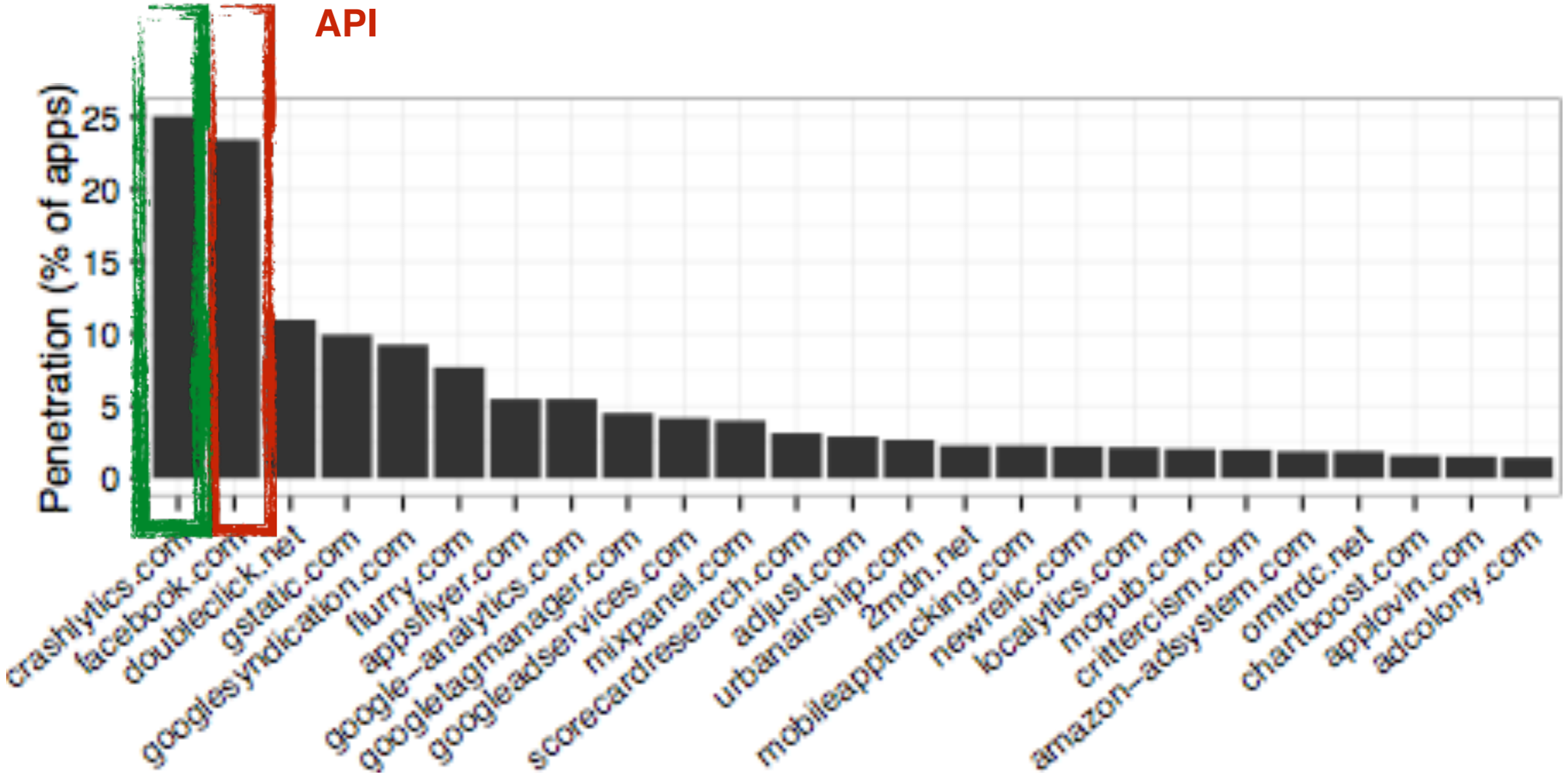


- 15% of apps connect to more than 5 trackers

ATS Penetration

Crashlytics

FB Graph
API



68.5% of identified ATS domains are cross-platform

Tracking users without consent

Unique identifiers are highly sensitive data

Examples:

- IMEI
- Google ID

Android permissions control access to sensitive resources

supposedly

```
Runtime.getRuntime().exec("getprop")
```

```
[dhcp.wlan0.domain]: [networks.imdea.org]  
[net.hostname]: [android-db216281e95dfab1]  
[persist.service.bdroid.bdaddr]: [40:B0:FA:5C:D0:80]  
[ro.boot.serialno]: [04efb34e55e22fcc]  
[ro.build.fingerprint]: [google/occam/mako:5.1.1/LMY48T/2237560:user/release-keys]
```

Abusive practices

11-02 13:26:14.077 9756 10171 I Haystack.Flow: Host: track.XXXX.com
11-02 13:26:14.077 9756 10171 I Haystack.Flow: Accept-Encoding: gzip
11-02 13:26:14.077 9756 10171 I Haystack.Flow:
11-02 13:26:14.077 9756 10171 I Haystack.Flow:
device=angler&installDate=2016-11-02_0126-0700&firstLaunchDate=2016-11-02_0126-0700&sdk=23&carrier=&date1=2016-11-02_0126-0700&af_preinstalled=false&**advertiserIdEnabled=false**&appsflyerKey=yZnL9BNtUzZLva6evLpUg5&lang=English&app_version_name=2.2.0&dkh=yZnL9BNt&android_id=84f942c74fffbdef&**advertiserId=fff3ca7e-61d7-4298-ab14-256033002de9**&deviceType=userdebug&af_v=da33e2cb0879238eb1dc9d93e0ce38b4564fbd9d&app_version_code=3&network=WIFI&operator=&brand=Android&date2=2016-11-02_0126-0700&af_timestamp=1478118372355&uid=1478118365655-1389078544330603868&isFirstCall=true&counter=1&product=aosp_angler&model=AOSP+on+angler

More details ...

The image is a screenshot of a web browser displaying an arXiv.org article page. The browser's address bar shows 'arxiv.org'. The page header includes the Cornell University Library logo and text, and a message of gratitude from the Simons Foundation. The breadcrumb trail is 'arXiv.org > cs > arXiv:1609.07190'. The article title is 'Tracking the Trackers: Towards Understanding the Mobile Advertising and Tracking Ecosystem'. The authors listed are Narseo Vallina-Rodriguez, Srikanth Sundaresan, Abbas Razaghpanah, Rishab Nithyanand, Mark Allman, Christian Kreibich, and Phillipa Gill. The submission date is noted as 22 Sep 2016 (v1), with a revision on 26 Oct 2016 (v2). The abstract discusses the role of third-party services in the mobile ecosystem and the paper's goal to provide a public catalog of these services. The page also features a 'Download' section with links for PDF and other formats, a 'Current browse context' section showing the category 'cs.CY', and a 'References & Citations' section with a link to 'NASA ADS'. A 'Bookmark' section includes icons for various services. At the bottom, there is a 'Submission history' section listing two versions of the paper and a footer with links to 'arXiv', 'form interface', and 'contact'.

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arXiv.org > cs > arXiv:1609.07190

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All papers Go!

Computer Science > Computers and Society

Tracking the Trackers: Towards Understanding the Mobile Advertising and Tracking Ecosystem

Narseo Vallina-Rodriguez, Srikanth Sundaresan, Abbas Razaghpanah, Rishab Nithyanand, Mark Allman, Christian Kreibich, Phillipa Gill

(Submitted on 22 Sep 2016 (v1), last revised 26 Oct 2016 (this version, v2))

Third-party services form an integral part of the mobile ecosystem: they allow app developers to add features such as performance analytics and social network integration, and to monetize their apps by enabling user tracking and targeted ad delivery. At present users, researchers, and regulators all have at best limited understanding of this third-party ecosystem. In this paper we seek to shrink this gap. Using data from users of our ICSI Haystack app we gain a rich view of the mobile ecosystem: we identify and characterize domains associated with mobile advertising and user tracking, thereby taking an important step towards greater transparency. We furthermore outline our steps towards a public catalog and census of analytics services, their behavior, their personal data collection processes, and their use across mobile apps.

Subjects: **Computers and Society (cs.CY)**

Cite as: **arXiv:1609.07190 [cs.CY]**
(or **arXiv:1609.07190v2 [cs.CY]** for this version)

Submission history

From: Rishab Nithyanand [view email]

[v1] Thu, 22 Sep 2016 23:45:20 GMT (163kb,D)

[v2] Wed, 26 Oct 2016 15:50:14 GMT (162kb,D)

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Takeaway

Method to identify and classify third-party tracking services

Anonymised data gathered with the **Lumen Privacy Monitor**

Promote user awareness and mobile transparency

Enable user control