



DATA
61

A First Look at Mobile Ad-Blocking Apps

Muhammad Ikram (UNSW, Data61-CSIRO)

Mohamed Ali (Dali) Kaafar (Macquarie University, Data61-CSIRO)



Ad-Blockers Use Case

What happens when a browser requests an HTML source from a web server (e.g., nytimes.com)?

https://www.nytimes.com

SEARCH

SECTION SEARCH

ENGLISH 中文 (CHINESE) ESPAÑOL

SUBSCRIBE NOW LOG IN

October 23–25, 2017 Dove Mountain, Arizona

The New York Times

Saturday, July 8, 2017 | Today's Paper | Video | 76°F | Dow +0.44% ↑

The New York Times Corner Office MASTER CLASS

<script async="" src="//cdn.krxd.net/ctjs/controltag.js.c3a35cae6beb84887ab6a83973d97fa9">

<script> Ward= "https://www.nytimes.com/crossword/puzzles?_format=json&category=Business" </script>

World Politics Opinion Tech Science Business Sports Arts Style Food Travel Magazine T Magazine Real Estate All

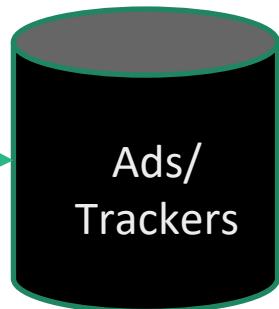
The Time to Switch Health Funds is Now.
Here's Why
HEALTHINSURANCECOMPARISON.COM.AU



<script async="" src="https://connect.facebook.net/en_US/fbevents.js">

Cookies DB

| | | |
|-------------|--|------------------|
| ► krux_segs | q6yvrtzf6 q8xmzq99j | .nytimes.com |
| ► idb | WET3iYNVWAAOi4xSWWGpSIKwryQ | .impdesk.com |
| ► id | 22ce55597d0b0045 t=1473...213fd480d0e6d98520841f8 | .doubleclick.net |
| ► et-a1 | %7B%22agentId%22%3A%2220...e%22%3A1499572551257%7D | .et.nytimes.com |



SECTIONS

SEARCH

ENGLISH 中文 (CHINESE) ESPAÑOL

SUBSCRIBE NOW

LOG IN

DATA
61October 23–25, 2017
Dove Mountain, Arizona

The New York Times

Saturday, July 8, 2017 | Today's Paper | Video | 76°F | Dow +0.44% ↑

The New York Times
Corner Office
MASTER CLASS

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

Ads and cookies (and social widgets) are enabled by JavaScript programs (JSes) to track users

Cookies DB

| | | |
|-------------|--|------------------|
| ▶ krux_segs | q6yvrtzf6 q8xmzq99j | .nytimes.com |
| ▶ idb | WET3iYNVWAQOj4xSWWGpSlKwryQ | .impdesk.com |
| ▶ id | 22ce55597d0b0045 t=1473...213fd480d0e6d98520841f8 | .doubleclick.net |
| ▶ et-a1 | %7B%22agentId%22%3A%2220...e%22%3A1499572551257%7D | .et.nytimes.com |



Privacy Preserving Tools (PP-Tools)



- Blacklist of URLs (or patterns of URLs) to block 3rd-party *tracking JSes*

The screenshot shows a news article from 9NEWS.com.au. The header includes tabs for NATIONAL, LOCAL, WORLD, 9RAW, and WEATHER. The main headline reads "Teen's balloon letter to dead dad inspires community 700km away". Below the headline is a byline "By Nicholas McCallum" with a small profile picture. The main text of the article is partially visible, mentioning a teenage girl in the US who wrote a balloon letter to her dead father. A red rectangular box highlights the word "Brightcove" in the text, which is part of a long list of tracking scripts at the bottom of the article.

A teenage girl in the US has written a balloon letter to her dead father on a hot air balloon. The balloon has recently been released into the air and has received responses from strangers living 700km away.

Continue reading >

ADVERTISEMENTS

Brightcove DoubleClick Facebook-Social Plugins Google AdSense NetRatings SiteCensus Po.st ScoreCard Research Beacon Twitter Button

The screenshot shows the same news article from 9NEWS.com.au. The video player is visible, showing a close-up of a balloon with the letters "LOVE" written on it. To the right of the video is a sidebar with a byline "By Nicholas McCallum" and a profile picture. The sidebar also lists several tracking scripts: Brightcove, DoubleClick, Facebook-Social Plugins, Google AdSense, NetRatings SiteCensus, Po.st, ScoreCard Research Beacon, and Twitter Button. A red rectangular box highlights the word "Brightcove" in the sidebar text.

Teen's balloon letter to dead dad inspires community 700km away

By Nicholas McCallum

A teenage girl in the US has written a balloon letter to her dead father on a hot air balloon. The balloon has recently been released into the air and has received responses from strangers living 700km away.

Continue reading >

Brightcove DoubleClick Facebook-Social Plugins Google AdSense NetRatings SiteCensus Po.st ScoreCard Research Beacon Twitter Button

Privacy Preserving Tools (PP-Tools)



- Blacklist of URL (or patterns of URLs) to block 3rd-party *tracking JSes*

This may be contributing to PP-Tools poor uptake, 3 to 20%*

* Metwalley et al., The Online Tracking Horde: a View from Passive Measurements, TMA'15

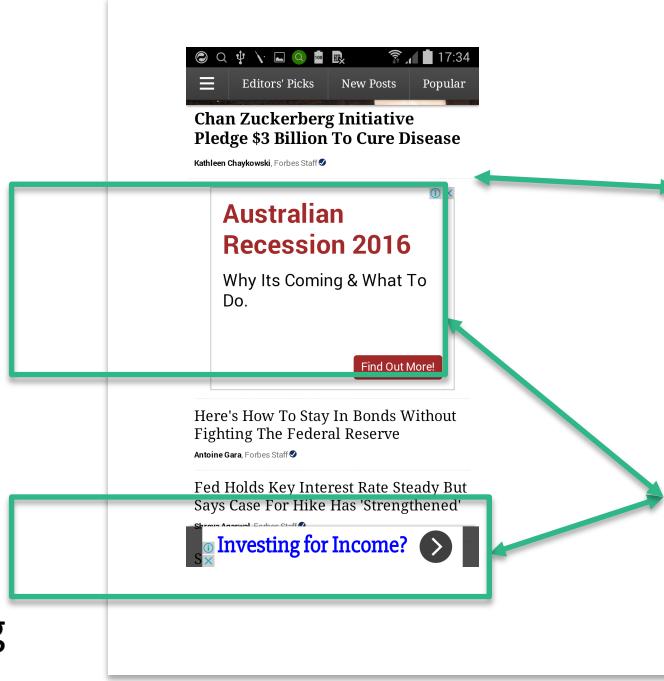
What about Ad-Blockers in Mobile Platforms?

They are not Explored Yet!

Ads/Tracking in Mobile Apps



In-Browser
Ads, JS API



In-App Ads,
Ads/Tracking
Libraries

First-party services
e.g., forbes.com



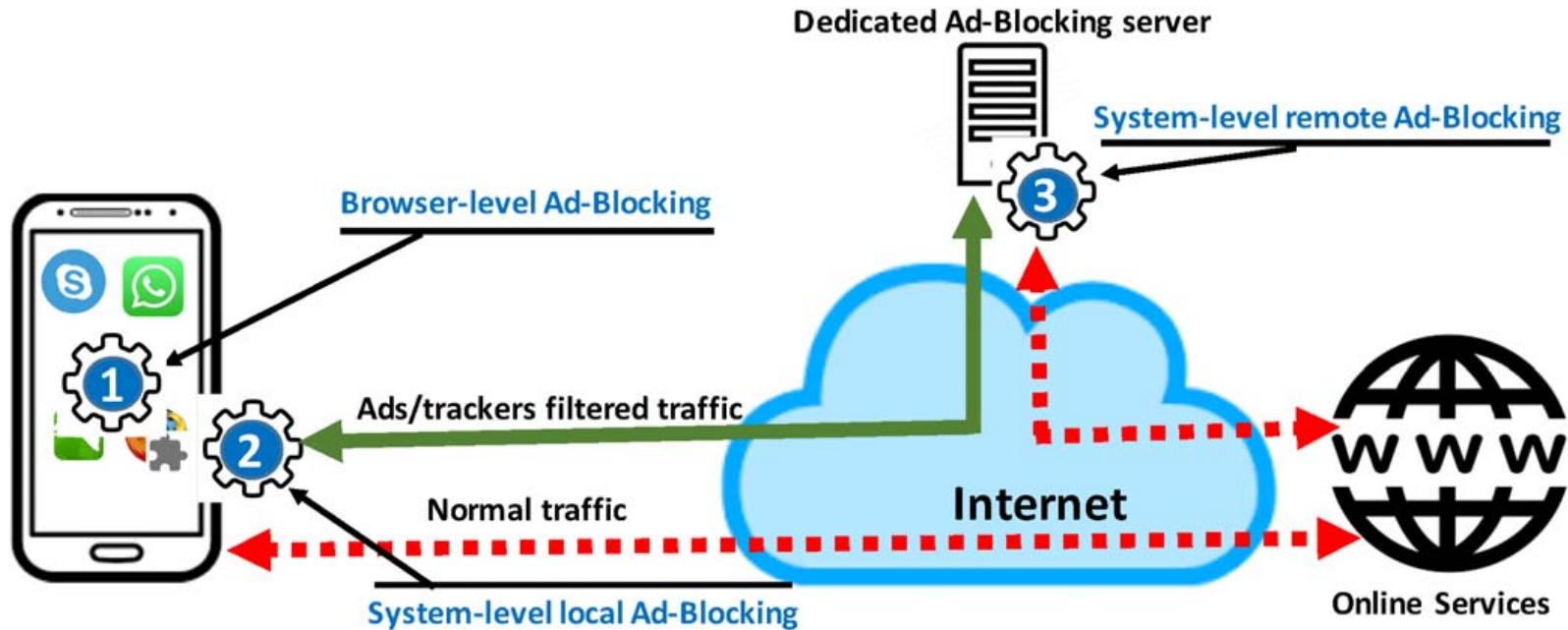
Third-party domains
(ad- and tracking-services)



1

2

Ad-Blocking Approaches





UC Browser - Fast Download Private & Secure

UCWeb Inc. Communication

★★★★★ 15,496,808

12+

Contains ads

This app is compatible with your device.



Add to Wishlist

Install



UC Web

Pr

12+

Con

i

Main Features

- ★ Upgraded Web Browsing Experience
- ★ Small Window Mode
- ★ Fast Download
- ★ Cricket Card Feature
- ★ Data Saving
- ★ Ad Block
- ★ Video for all tastes
- ★ Facebook Mode
- ★ Night Mode

15,496,808

Install



4.5

★★★★★

15,496,808 total

| ★ 5 | 11,199,393 |
|-----|------------|
| ★ 4 | 2,275,914 |
| ★ 3 | 975,142 |
| ★ 2 | 349,268 |
| ★ 1 | 697,091 |

Dejan Perović ★★★★★
I hate this headline, i wont to read news when i go into browser. I will on my own

Ji Ha ★★★★★
The last one was better! The newest version is not good, more like im gonna have

Lorris Simon ★★★★★
Uses too much RAM on my Lenovo K5 note and the phone starts to hang. The phone

Qays12_ ★★★★★
This would get 5 stars if there was a way where I could get rid of the news headline feed that

★ NIGHT MODE

Are Mobile Ad-Blocking apps effective?
Are they Trustworthy?

Approach

1. Static Analysis
2. Network Measurements [Future Work]

Some salient results

- Malware presence
- Third-party ads/tracking libraries embedding
- Not blocking, showing Ads

22 have malware presence

37 apps embed third-party ads/tracking libraries to track and show ads

24 apps shows ads and not blocking ads/tracking at all

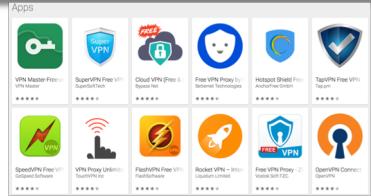
Agenda

- Ad-Blockers Detection and Methodology
- Passive Analysis
- Summary

Methodology



Google Play Crawl (1.5M+ Apps)



Executables and metadata
(apps description, reviews, etc)

Static Analysis

Network Measurements

Mobile Ad-blockers' Detection and Classification

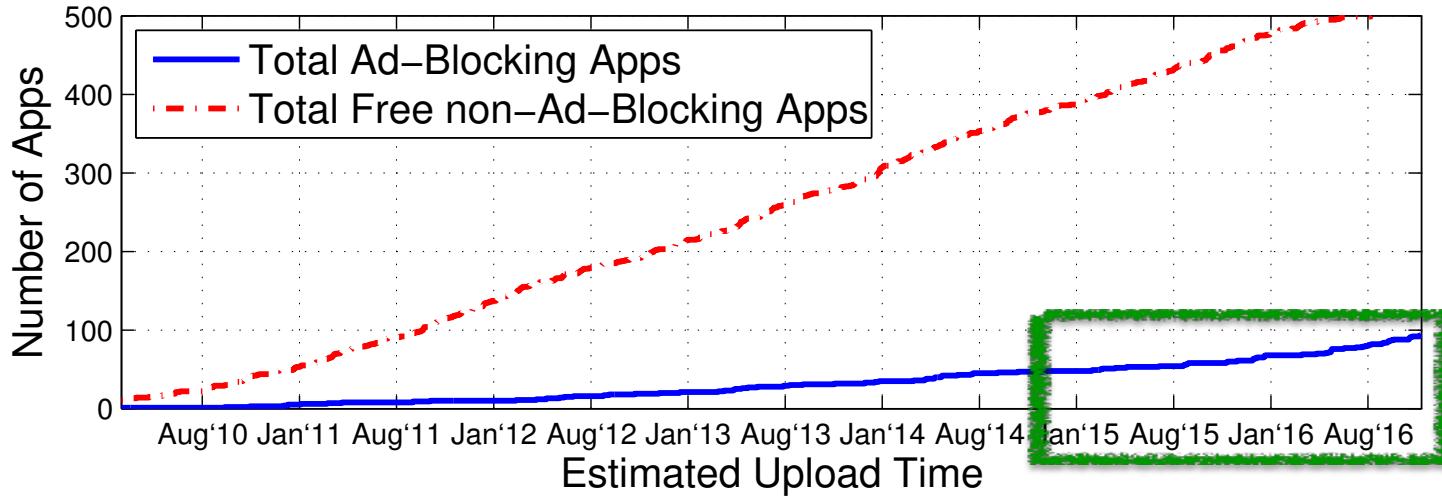
Identified VPN App



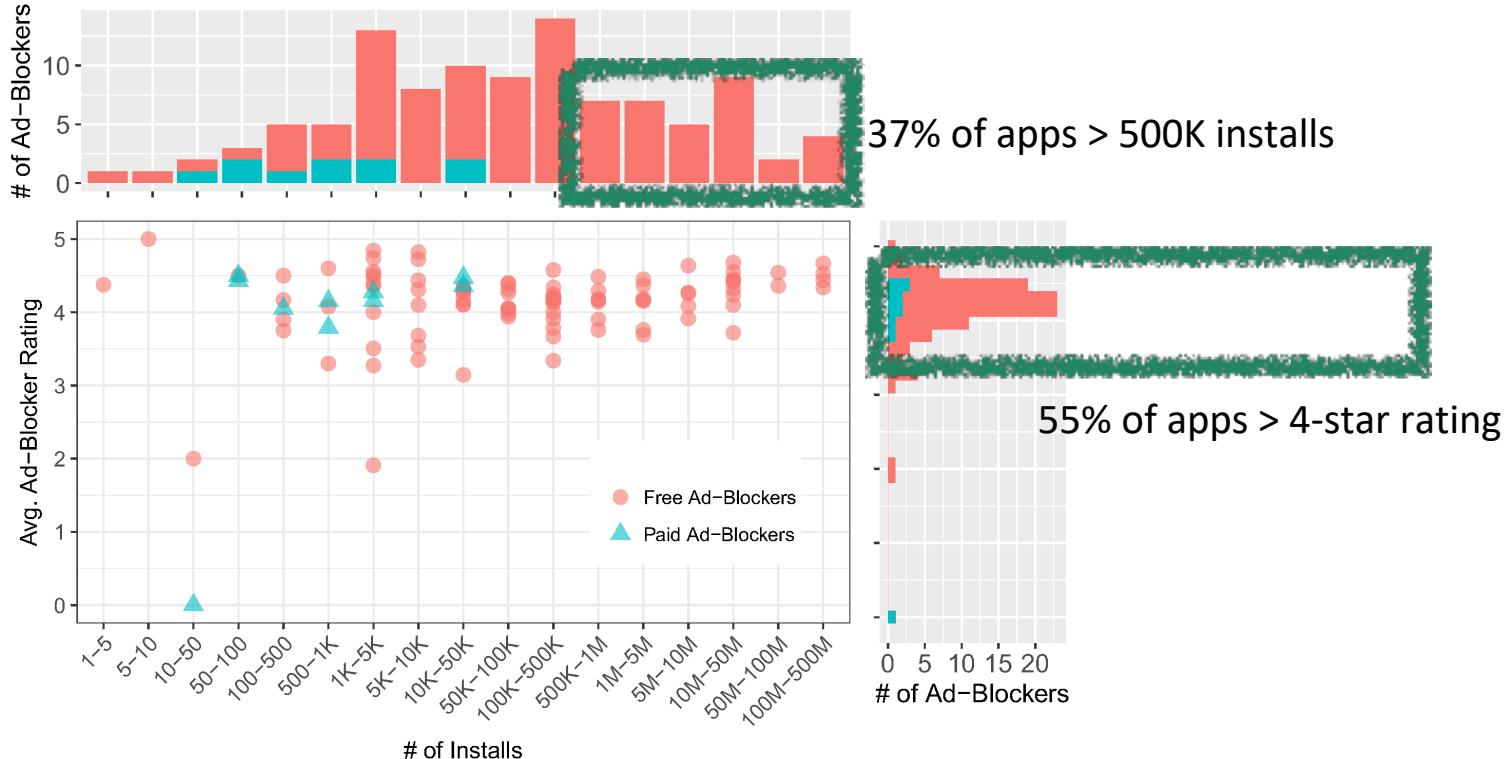
| App Category | # of apps found
(N = 97) |
|---------------------------|-----------------------------|
| Browser-level Ad-Blockers | 83 |
| System-Level Ad-Blockers | 14 |

87 Free and 10 Paid Ad-Blockers

Analyzed Ad-Blockers - Evolution



User installs and ratings



Static Analysis

67% of Android Ad-Blocking apps claim privacy and security enhancement features

3rd-party Tracking Libraries

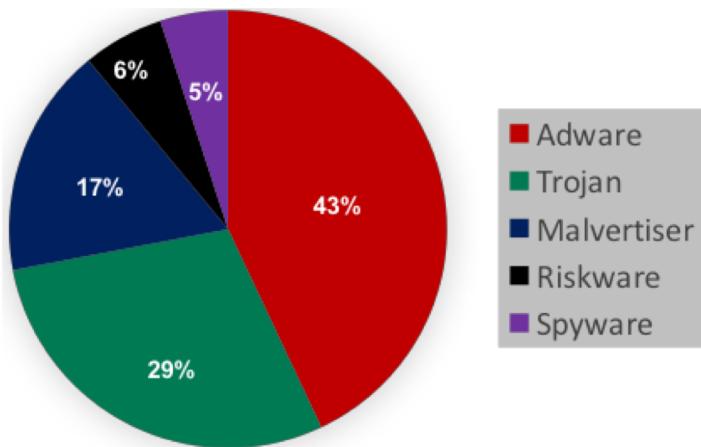


- 68% of Ad-Blockers include 3rd-party tracking libraries

| # Trackers | Ad-Blockers | | | Free
non-Ad-Blocking Apps |
|------------|-------------|------|-----|------------------------------|
| | Paid | Free | All | |
| 0 | 40% | 31% | 32% | 16% |
| 1 | 50% | 14% | 18% | 7% |
| 2 | 10% | 13% | 12% | 13% |
| 3 | 0% | 10% | 9% | 16% |
| 4 | 0% | 11% | 10% | 14% |
| >5 | 0% | 21% | 19% | 34% |

Malware Presence

- Scanner: VirusTotal aggregator
- **AV-rank:** number of AV tools reporting malware
- 21% of Ad-Blockers contain malware with 7% have AV-rank ≥ 3



| # | App ID | Price | Rating | Installs | AV-rank | DevLoc |
|---|----------------------|-------|--------|----------|---------|--------|
| 1 | Deep Search Browser | Free | 2.6 | 1K | 10 | PK |
| 2 | sFly Network Booster | Free | 4.3 | 1K | 10 | CN |
| 3 | Faster Browser Ever | Free | 4.0 | 1K | 6 | RU |
| 4 | FastCat | Free | 4.5 | 100 | 6 | AE |
| 5 | Magneto Browser | Free | 4.0 | 100 | 4 | IN |
| 6 | Adskip Browser | Free | 2.0 | 5K | 4 | CN |
| 7 | Maxthon Browser | Free | 4.4 | 10M | 3 | CN |

“And isn’t it ironic?”

- Do users care or know?
- Manually analysed negative reviews (20K) (1- and 2-Stars)
- 0.65% of the negative reviews raised privacy and security concerns
- 16% of the negative reviews raised inefficiency concerns (Allowing/not-blocking Ads)

A First Look at Mobile Ad-Blocking Apps

Muhammad Ikram^{1,2}, Mohamed Ali Kaafar^{1,3}

¹Data61, CSIRO

²UNSW

³Department of Computing, Macquarie University

Email: Muhammad.Ikram@data61.csiro.au and Dali.Kaafar@mq.edu.au

Abstract—Online advertisers, third party trackers and analytics services are constantly tracking user activities as they access web services through their web browsers or mobile apps. While, web browser plugins disabling and blocking Ads (often associated tracking/analytics scripts), e.g. AdBlock Plus[3] have been well studied and are relatively well understood, an emerging new category of apps in the tracking mobile eco-system, referred as the mobile Ad-Blocking apps, received very little to no attention. With the recent significant increase of the number of mobile Ad-Blockers and the exponential growth of mobile Ad-Blocking apps' popularity, this paper aims to fill in the gap and study this new category of players in the mobile ad/tracking eco-system.

This paper presents the first study of Android Ad-Blocking apps (or Ad-Blockers), analysing 97 Ad-Blocking mobile apps extracted from a corpus of more than 1.5 million Android apps on Google Play. While the main (declared) purpose of the apps is to block advertisements and mobile tracking services, our data analysis revealed the paradoxical presence of third-party tracking

of Ad-blocking¹ tools, packaged as mobile apps, in popular mobile app stores such as Google Play.

This paper presents the first characterisation study of Android mobile Ad-Blocking apps with a focus on security and privacy offered by these apps. In particular, we analyse the Android permissions mobile Ad-Blockers request and we perform static analysis of the code to investigate the presence of malware and third party tracking libraries.

We collect and extract from a corpus of more than 1.5 million Android apps, 97 mobile apps for which the name or the description suggest they enable to either block ads or to block trackers. We then manually check that the apps actually fall into the category of Ad-Blocking apps (cf. Section II).

We use a set of tools to decompile the Ad-Blocking apps and analyse the source code of each of the mobile Ad-Blockers. We then inspect the apps to reveal the presence of third



DATA
61

Thanks

Q&A

Muhammad Ikram

muhmmad.ikram@mq.edu.au

