[Proceeding] CrowdSurf: Empowering Informed Choices in the Web

Original Citation:

Availability:
This version is available at: http://porto.polito.it/2656559/ since: November 2016

Publisher:
ACM

Published version:
DOI:10.1145/2831347.2831349

Terms of use:
This article is made available under terms and conditions applicable to Open Access Policy Article ("Public - All rights reserved"), as described at http://porto.polito.it/terms_and_conditions.html

Porto, the institutional repository of the Politecnico di Torino, is provided by the University Library and the IT-Services. The aim is to enable open access to all the world. Please share with us how this access benefits you. Your story matters.

(Article begins on next page)
CrowdSurf
Empowering Transparency in the Web

25 Aug 2016, ACM SIGCOMM, Florianopolis

Hassan Metwalley
Stefano Traverso
Marco Mellia
Stanislav Miskovic
Mario Baldi
Introduction
Do you know what you HTTP?
Example
Web tracking

Thousands of Web trackers collect our data

- Browsing histories
- Religious, sexual, and political preferences
- On average, the first tracker is met as soon as the browser starts
- Some trackers reach 96% of users
- 71% of websites host at least one tracker


26 August 2016
The Open Question

How to **know** and **choose** which **services our data is exchanged** with and how?
Partial solutions

I

In-network devices

Ø Firewalls and proxies

Ø Fail in case of encrypted traffic (HTTPS)

Ø Lack scalability

Ø Managed by third parties

On-client

Ø Browser plugins

Ø Limited scope

Ø No control on device traffic

Ø Not transparent
A New System

Goal
Let users re-gain visibility and control on the information they exchange with Web services

Design Principles

- Holistic
  working in any scenario
- Client-centric
  available on any kind of device
- Practical, not revolutionary
  use existing technology
- Crowd-sourced
  knowledge built on a community of users
- Automatic
  little engagement of the user
- Privacy-safe
  never compromise users’ privacy
Cloud
- A **controller** collects information about the services users visit
  - Explicit -> their opinion
  - Implicit -> traffic samples
- Users’ contributions processed by **data-analyzers** and the **advising community**
- Results = **suggestions** about the reputation of services

Client
- Users download the suggestions they like
- the **CrowdSurf Layer** translates them into **rules**
- Rules = **actions** on users’ traffic
  - Regexp + action
CrowdSurf Controllers

Open Controller
- Collaborative approach
- Users improve the wisdom of the system
  - Traffic samples and opinions
  - Build data analyzers and suggestions

Corporate Controller
- Builds directly rules for employees
- Employees can not customize rules
- All devices follow the same rules
The CrowdSurf Layer

HTTP

Regular Expression Matching

Action

Black
Redirect
Allow
Modify
Log and Report

Suggestions to Rules

Anonymization

Open Controller

Corporate Controller

CrowdSurf Layer

Rule Processor

TLS

TCP
CrowdSurf in a picture

Opinions + Traffic samples

Open Controller

Ruled Interaction

Suggestions

Web Services

Google

Facebook

Twitter

YouTube

Spotify

Rules

Traffic samples

Corporate Controller
Proof of Concept
Prototype

Controller
- Java-based web service
- Communicates with CrowdSurf devices
- Hosts a data analyzer for identification of tracking sites
- Collects traffic samples
- Distributes suggestions

Client
- Implemented as a Firefox plugin
- Supports block, redirect, log&report
Example of Data Analyzer: Automatic Tracker Detector

Unsupervised methodology to identify third-party trackers [2]

- Observation:
  - Trackers usually embed UIDs as URL parameters

- Procedure:
  1. Input: HTTP traffic samples provided by CS users
  2. Take all HTTP queries to third-party services
    http://acmetrack.com/query?key1=X&key2=Y
  3. Extract keys \((\text{key1}, \text{key2})\) and their values
  4. Check the presence of key values uniquely associated to the users

Example of Data Analyzer: Automatic Tracker Detector


34 new third-party trackers found
Performance Implications of running CrowdSurf

Different user profiles

Paranoid Profile
- Blocks
  - adv/tracking
  - JS code
- Does not report traffic samples

Kid Profile
- Activates child protection rules
- Reports traffic to trackers

Corporate Profile
- Redirects search.google.com to search.bing.com
- Blocks social networks, e-commerce sites, trackers
- Reports activity on DropBox
Impact on Web site loading time

Paranoid is **1.07 times faster** than baseline
Kid is **1.08 times slower**
Corporate is **1.18 times slower**
Conclusion
Open Problems

- Lot of details to consider
- Design/develop/standardize a new network layer
- Protecting users’ privacy
  - Anonymizing HTTP/S traffic
- Usability
- Involve users to join
- Protection from malicious biases
CrowdSurf

Holistic, crowd-sourced system for the auditing of the information we expose in the Web

[Image]

https://www.myermes.com
Thank you!
Need a new model that...

Enables transparency and visibility

Monitor the HTTP traffic before encryption takes place

Takes actions

Block/manipulate/report transactions to undesired services

Under user’s control

Automatic, but configurable
Example of Data Analyzer: Automatic Tracker Detector

<table>
<thead>
<tr>
<th>Dataset</th>
</tr>
</thead>
<tbody>
<tr>
<td>HTTP trace from ISP running Tstat</td>
</tr>
<tr>
<td>- 10 days of October 2014</td>
</tr>
<tr>
<td>- ~19k monitored users</td>
</tr>
<tr>
<td>- ~240k HTTP transactions per day</td>
</tr>
</tbody>
</table>

Automatic Tracker Detector vs

34 new third-party trackers found

<table>
<thead>
<tr>
<th>Third-party Trackers</th>
<th>Portal1</th>
<th>News1</th>
<th>Entertainment</th>
<th>Shopping</th>
<th>SearchEngine</th>
</tr>
</thead>
<tbody>
<tr>
<td>atemda.com</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x.bidswitch.net</td>
<td></td>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><a href="http://www.77tracking.com">www.77tracking.com</a></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rack.movad.net</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ovo01.webtrekk.net</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dis.criteo.com</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p.rfihub.com</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ib.adnxs.com</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cl.adform.net</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>atemda.com</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x.bidswitch.net</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><a href="http://www.77tracking.com">www.77tracking.com</a></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rack.movad.net</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ovo01.webtrekk.net</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dis.criteo.com</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p.rfihub.com</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ib.adnxs.com</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example
A growing business around our data

Loss of visibility and control

- HTTPS protects our privacy, but...
- ...prevents third parties to check what's going on under the hood of encryption
- ...and severely limits network functions

"Child protection through the use of Internet Watch Foundation blacklists has become ineffective, with just 5% of entries still being blocked when HTTPS is deployed" [2]

Time to collect a dataset

googleanalytics
Monitoring the Web

CrowdSurf Controllers

**Open Controller**
- Collaborative approach
- Users improve the wisdom of the system
  - Traffic samples and opinions
  - Build data analyzers and suggestions

**Third party Controller**
- Suggestions for **commercial purposes**
- Opens to a market of suggestions

**Corporate Controller**
- Builds directly rules for employees
- Employees can not customize rules
- All devices follow the same rules
CrowdSurf in a picture

Open controller

Third-party controller

Corporate controller

Web Services

Web Browsing

Traffic samples

Suggestions

Corporate Rules

Private User Device

Corporate Device

Data Analyzer