CrowdSurf: Empowering Informed Choices in the Web

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CrowdSurf
Empowering Transparency in the Web

25 Aug 2016, ACM SIGCOMM, Florianopolis

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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 [1]
- 71% of websites host at least one tracker [1]

The Open Question

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

- Network devices:
  - Firewalls and proxies
  - Fail in case of encrypted traffic (HTTPS)
  - Lack scalability
  - Managed by third parties

- On-client:
  - Browser plugins
  - Limited scope
  - No control on device traffic
  - Not transparent

---

Google, Microsoft, and Amazon are paying Adblock Plus huge fees to get their ads unblocked

Lara O'Reilly  
Feb. 3, 2015, 6:57 AM  
60,452  
22
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
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

Block Redirect Allow Modify Log and Report

Suggestions to Rules

Open Controller

Corporation Controller

Anonymization

TLS

TCP
CrowdSurf in a picture

- Suggestions
  - Opinions + Traffic samples
  - Open Controller

- Ruled Interaction

- Corporate Controller
  - Rules
  - Traffic samples
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 (key1, 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

<table>
<thead>
<tr>
<th>sid</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
<th>f</th>
<th>g</th>
<th>h</th>
<th>i</th>
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</thead>
<tbody>
<tr>
<td>tmp</td>
<td>m</td>
<td>m</td>
<td>m</td>
<td>n</td>
<td>n</td>
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<td>y</td>
<td>z</td>
<td>x</td>
<td>y</td>
<td>z</td>
</tr>
</tbody>
</table>
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

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

**Automatic Tracker Detector** vs **Dataset**
- HTTP trace from ISP running Tstat
  - 10 days of October 2014
  - ~19k monitored users
  - ~240k HTTP transactions per day

<table>
<thead>
<tr>
<th>Third-party Trackers</th>
<th>Found</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>News1</td>
<td>26</td>
<td>13</td>
</tr>
<tr>
<td>E-commerce1</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>E-commerce2</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>E-commerce3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Portal2</td>
<td>4</td>
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<tr>
<td>Porn</td>
<td>3</td>
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<tr>
<td>Sportnews</td>
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<td></td>
</tr>
<tr>
<td>SearchEngine</td>
<td>1</td>
<td></td>
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</tbody>
</table>

34 new third-party trackers found

<table>
<thead>
<tr>
<th>Third-party Trackers</th>
<th>Found</th>
</tr>
</thead>
<tbody>
<tr>
<td>atemda.com</td>
<td>1</td>
</tr>
<tr>
<td>x.bidswitch.net</td>
<td>1</td>
</tr>
<tr>
<td><a href="http://www.77tracking.com">www.77tracking.com</a></td>
<td>1</td>
</tr>
<tr>
<td>rack.movad.net</td>
<td>1</td>
</tr>
<tr>
<td>ovo01.webtrekk.net</td>
<td>1</td>
</tr>
<tr>
<td>dis.criteo.com</td>
<td>1</td>
</tr>
<tr>
<td>p.rfihub.com</td>
<td>1</td>
</tr>
<tr>
<td>ib.adnxs.com</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>34</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

Number of Visits vs. Service Rank

- Time to collect a dataset
- 26 August 2016
- CrowdSurf - Stefano Traverso
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

Data Analyzer

Corporate Device

Private User Device

Web Browsing

Suggestions

Traffic samples

Corporate Rules

Web Services