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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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

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

In-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
### A New System

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

#### Design Principles

<table>
<thead>
<tr>
<th>Holistic</th>
<th>Crowd-sourced knowledge built on a community of users</th>
</tr>
</thead>
<tbody>
<tr>
<td>working in any scenario</td>
<td></td>
</tr>
<tr>
<td>Client-centric</td>
<td>Automatic little engagement of the user</td>
</tr>
<tr>
<td>available on any kind of device</td>
<td>Privacy-safe never compromise users’ privacy</td>
</tr>
<tr>
<td>Practical, not revolutionary use existing technology</td>
<td></td>
</tr>
</tbody>
</table>

26 August 2016  CrowdSurf - Stefano Traverso
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

Regular Expression Matching

Action

Block Redirect Allow Modify Log and Report

Suggestions to Rules

Open Controller

Corporate Controller

Anonymization

HTTP

TLS

TCP

CrowdSurf Layer

Rule Processor
CrowdSurf in a picture

Open Controller

Opinions + Traffic samples

Suggestions

Rules

Traffic samples

Ruled Interaction

Web Services

Corporate Controller

CrowdSurf - Stefano Traverso
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


Visit 1  Visit 2  Visit 3

sid a b c d e f g h i

tmp m m m n n n p p p

uid x y z x y z x y z

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 time 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
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

34 new third-party trackers found

<table>
<thead>
<tr>
<th>Third-party Trackers</th>
<th>New Count</th>
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<tr>
<td>News1</td>
<td>13</td>
</tr>
<tr>
<td>E-commerce1</td>
<td>12</td>
</tr>
<tr>
<td>E-commerce2</td>
<td>9</td>
</tr>
<tr>
<td>E-commerce3</td>
<td>4</td>
</tr>
<tr>
<td>Portal2</td>
<td>4</td>
</tr>
<tr>
<td>Porn</td>
<td>3</td>
</tr>
<tr>
<td>Sportnews</td>
<td>1</td>
</tr>
<tr>
<td>SearchEngine</td>
<td>1</td>
</tr>
</tbody>
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Example trackers:
- atemda.com
- x.bidswitch.net
- www.77tracking.com
- rack.movad.net
- ovo01.webtrekk.net
- dis.criteo.com
- p.rfihub.com
- ib.adnxs.com
- bidderuid
- user_id
- rand
- us
- cs2
- uid
- bk-uuid
- xid
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

{% raw %}
\begin{center}
\includegraphics[width=\textwidth]{figure.png}
\end{center}

\text{googleanalytics}
{% endraw %}
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

- Suggestions
- Corporate Rules
- Web Browsing
- Traffic samples

Private User Device
Corporate Device
Data Analyzer