[Proceeding] CrowdSurf: Empowering Informed Choices in the Web

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CrowdSurf
Empowering Transparency in the Web

25 Aug 2016,
ACM SIGCOMM,
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Introduction
Do you know what you HTTP?
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

The Open Question

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
- 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
CrowdSurf
CrowdSurf

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

Block Redirect Allow Modify Log and Report

TLS

TCP

Open Controller

Corporate Controller

Suggestions to Rules

Anonymization
CrowdSurf in a picture

Web Services

Opinions + Traffic samples

Suggestions

Open Controller

Ruled Interaction

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 (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
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

Takes actions

Under user’s control

Monitor the HTTP traffic before encryption takes place

Block/manipulate/report transactions to undesired services

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

<table>
<thead>
<tr>
<th>Third-party Trackers</th>
<th>Embedded Third-party Trackers</th>
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<tr>
<td>atemda.com</td>
<td>26</td>
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<td>x.bidswitch.net</td>
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<td>E-commerce2</td>
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<td>Sportnews</td>
</tr>
<tr>
<td>...</td>
<td>SearchEngine</td>
</tr>
</tbody>
</table>

34 new third-party trackers found

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

- Suggestions
- Corporate Rules
- Web Browsing
- Traffic samples

- Private User Device
- Corporate Device
- Data Analyzer