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 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

### Client
- **Browser plugins**
  - Limited scope
  - No control on device traffic
  - Not transparent

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*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 views  
22 comments
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
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
CrowdSurf in a picture

- Open Controller
  - Suggestions
  - Opinions + Traffic samples

- Corporate Controller
  - Rules
  - Traffic samples

Web Services:
- Google
- Amazon
- Twitter
- YouTube
- Spotify

Ruled Interaction
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
     
     \[
     \text{http://acmetrack.com/query?key1=X&key2=Y}
     \]
  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


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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
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
- 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

### Automatic Tracker Detector vs Dataset

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

#### New third-party trackers found

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<th>Portal1</th>
<th>E-commerce1</th>
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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

![Graph showing number of visits vs service rank]
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