CrowdSurf
Empowering Transparency in the Web

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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

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
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
- Anonymization
- Open Controller
- Corporate Controller
- Suggestions to Rules
CrowdSurf in a picture

Opinions + Traffic samples

Suggestions

Ruled Interaction

Web Services

Rules

Traffic samples

Corporate Controller

Open 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 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
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

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<th>Third-party Trackers</th>
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<table>
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26 August 2016
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 the relationship between number of visits and service rank.](image-url)

*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