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

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

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
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

Suggestions to Rules

Open Controller

Corporat e Controller

Anonymization

CrowdSurf Layer
CrowdSurf in a picture

Opinions + Traffic samples

Open Controller

Suggestions

Ruled Interaction

Rules

Traffic samples

Corporate Controller

Web Services

Opinions

Traffic samples

Suggestions

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**
     
     ```
     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

26 August 2016
CrowdSurf - Stefano Traverso
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
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

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

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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
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